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Taxonomy and description of clionaid sponges (Hadromerida, Clionaidae) from the Pacific Ocean of Mexico

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A large collection of clionaid sponges collected in 58 different localities from the Pacific coast of Mexico was studied, and 15 species belonging to four genera were identified. Six species are new to science: in the genus *Cliona*, ***C. papillae* sp. nov.** and ***C. vallartense* sp. nov.**; in the genus *Thoosa*, ***T. calpulli* sp. nov.** and ***T. mismalolli* sp. nov.**; and in the genus *Spheciospongia*, ***S. ruetzleri* sp. nov.** and ***S. incrustans* sp. nov.** The new combinations *Cliona californiana* (de Laubenfels, 1932) **comb. nov.** and *Cliona raromicrosclera* (Dickinson, 1945) **comb. nov.** are also proposed. *Pseudosuberites pseudos* is considered to be synonymous to *Cliona californiana*. In addition, the validity of *Pione mazatlanensis* (Hancock, 1867) is also considered. Other *Cliona* species identified are *Cliona vermifera* Hancock, 1867, *Pione carpenteri* (Hancock, 1867 as *Cliona carpenteri*), *C. amplicavata* Rützler, 1974, *Cliona flavifodina* Rützler, 1974, and *Cliona euryphylla* Topsent, 1887. *Cliona amplicavata* and *C. flavifodina* are recorded for the first time in the Pacific Ocean and *C. euryphylla* for the east Pacific Ocean. The systematics, taxonomy and distribution of all these species are included and detailed species descriptions are provided based on newly collected material and previous descriptions from the literature. Discussions on problematic taxonomic issues are also presented, and the most useful parameters to differentiate species are highlighted. In addition, the morphology of the spirasters has been studied through SEM analysis, and the main characteristics have been evaluated from a taxonomic point of view in order to discriminate between species.

ADDITIONAL KEYWORDS: *Cliona* – distribution – excavating sponges – morphology – *Pione* – SEM – *Spheciospongia* – spirasters – *Thoosa*.

INTRODUCTION

The members of the family Clionaidae play an important role in the erosion of calcium carbonate substrates around the world, such as coral, shells and calcareous algae (Goreau & Hartman, 1963; Rosell & Uriz, 1997; Rosell, Uriz & Martin, 1999). Traditionally, the family only included sponge species with this limestone-excavating capability. However, a recent revision included other nonexcavating genera, such as Spheciospongia and massive species previously assigned to *Spirastrella* (Spirastrellidae), because they share a typical Clionaidae fatty acid (Vicente, Rützler & Carballeira, 1991). Later, a cladistic approach led to the reallocation of some *Cliona* species to different monophyletic genera (Rosell & Uriz, 1997). Thus, the Clionaidae [Clionidae was emended to Clionaidae owing to the homonymy with the family Clionidae (Mollusca, Pteropoda)] now harbours several massive or encrusting Hadromerida with tylostyles and delicate spirasters, which were traditionally included in the Spirastrellidae (Rützler, 2002a).

In this study, we accept the concept of the family Clionaidae considering those species with a well-differentiated ectosomal layer of spirasters (Ridley & Dendy, 1887) as part of Spirastrellidae (Rützler, 2002a).

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Clionaid sponges have been the subject of several studies in different parts of the world: the Atlantic–Mediterranean province (Volz, 1939; Rützler, 1973; Rützler & Bromley, 1981; Cruz & Bacallado, 1983; Carballo, Sánchez-Moyano & García Gómez, 1994; Rosel & Uriz, 2002), the Caribbean (Pang, 1973; Rützler, 1974; Rützler, 2002b), North America (Old, 1941; Wells, 1959), the Indian Ocean (Thomas, 1972), and the central Pacific (de Laubenfels, 1954; Schönberg, 2000). However, in spite of the high diversity of clionaid species described in various locations worldwide, no study has ever been devoted entirely to the systematics of burrowing sponges in any single area of the tropical eastern Pacific. In fact, there is a remarkable lack of registers of clionaid sponges for the east Pacific Ocean (see Lambe, 1893, 1894, 1900; and Austin, 1985), and even more so for the Pacific coast of Mexico, where only very few species have been cited. There are specific references to two *Pione* species for the Pacific coast of Mexico in one of Hancock's papers (Hancock, 1867; see also Rützler & Stone, 1986). Subsequently, there are only three or four more references to clionaids in this area: *Cliona californiana* (as *Pseudosuberites pseudos* Dickinson, 1945; see Results), *Cliona raromicrosclera* (as *Delaubenfelsia raromicrosclera* Dickinson, 1945; see Results), *Cliona celata* Grant 1826 (Green & Gómez, 1986) and *Cliona vermifera* Hancock, 1867 (Salcedo *et al*., 1988). At present, only five species of two genera have been described from the Pacific coast of Mexico.

The aim of this study is to contribute to the knowledge of all the possible Clionaidae from the eastern Pacific. Several goals where taken into account: first, to sample exhaustively along the coast of the Mexican Pacific Ocean to obtain a good representative collection of clionaids; after that, to review the material type of some species cited in the area, and to describe all the material collected.

MATERIAL AND METHODS

The specimens were collected by scuba diving, snorkelling and by trawling in deep waters at 58 locations along the Pacific coast of Mexico (Fig. 1). Spicule preparation followed the techniques described by Rützler (1974) for light and electron microscopy (SEM). The SEM pictures of microscleres were taken of clean spicules dried on a cover glass and coated with gold. Twenty-five or more spicules chosen at random were measured for each of the specimens studied. The number between brackets in some descriptions is the average.

The type of *Cliona celata* is assumed lost. Thus, the specimens from the Mexican Pacific coast considered as *C. celata* or close to it, were compared with typical specimens of *Cliona celata* at alpha growth stage from the coasts of the east Atlantic and Mediterranean Sea (six specimens for each). The material from European waters comes from the personal collection of the first author of this work (abbreviation used LEB, Laboratorio de Biología Marina of the Universidad de Sevilla, Spain). The specimens from Mexico were collected in widely separated locations along the Mexican Pacific coast. A morphometric study of the spicules was performed by measuring 25 tylostyles for each specimen. Length and width of the tylostyles (shaft and head) were measured under light microscope. The results were graphically represented by a box and whisker plot, and statistically tested using ANOVA.

The material has been deposited in the Colección de Esponjas del Pacífico (LEB-ICML-UNAM), of the Instituto de Ciencias del Mar y Limnología, UNAM, in Mazatlán (Mexico), and in the Colección Nacional del Phylum Porifera Gerardo Green of the Instituto de Ciencias del Mar y Limnología, UNAM, Mexico DF (CNPGG). The type material has been deposited in the Museo Nacional de Ciencias Naturales in Madrid (Spain) (MNCN), and in the British Museum of Natural History (BMNH) (London). We have added the most updated diagnosis of the genus and family to help anybody unfamiliar with sponge systematics to use this work. Sponge-specific terms are used according to Boury-Esnault & Rützler (1997).

SYSTEMATIC DESCRIPTIONS

FAMILY CLIONAIDAE D'ORBIGNY, 1851

Diagnosis: Hadromerida with limestone-excavating capability, having tylostyles as principal megascleres, in some specimens generally accompanied by oxeas or styloid modifications. Miroscleres may be absent entirely or in some specimens or populations. If present, they include spirasters, amphiasters, microxeas, microrhabds or rhaphides; some spirasters display secondary branching of spines, microrhabds may be smooth or microspined, straight, bent, or spiral (Rützler, 2002a).

GENUS *CLIONA* GRANT, 1826

Synonymy: see Rützler (2002a).

Type species: Cliona celata Grant, 1826.

Diagnosis: Sponges primarily in alpha growth form (excavating chambers, communicating through papillae), some species developing beta stage by merging of papillae, very few regularly outgrowing their substratum and occurring in gamma stage. Some gamma stage species attain a large, irregular massive or cup shape but do not develop specialized incurrent or excurrent features other than, the original pori- and

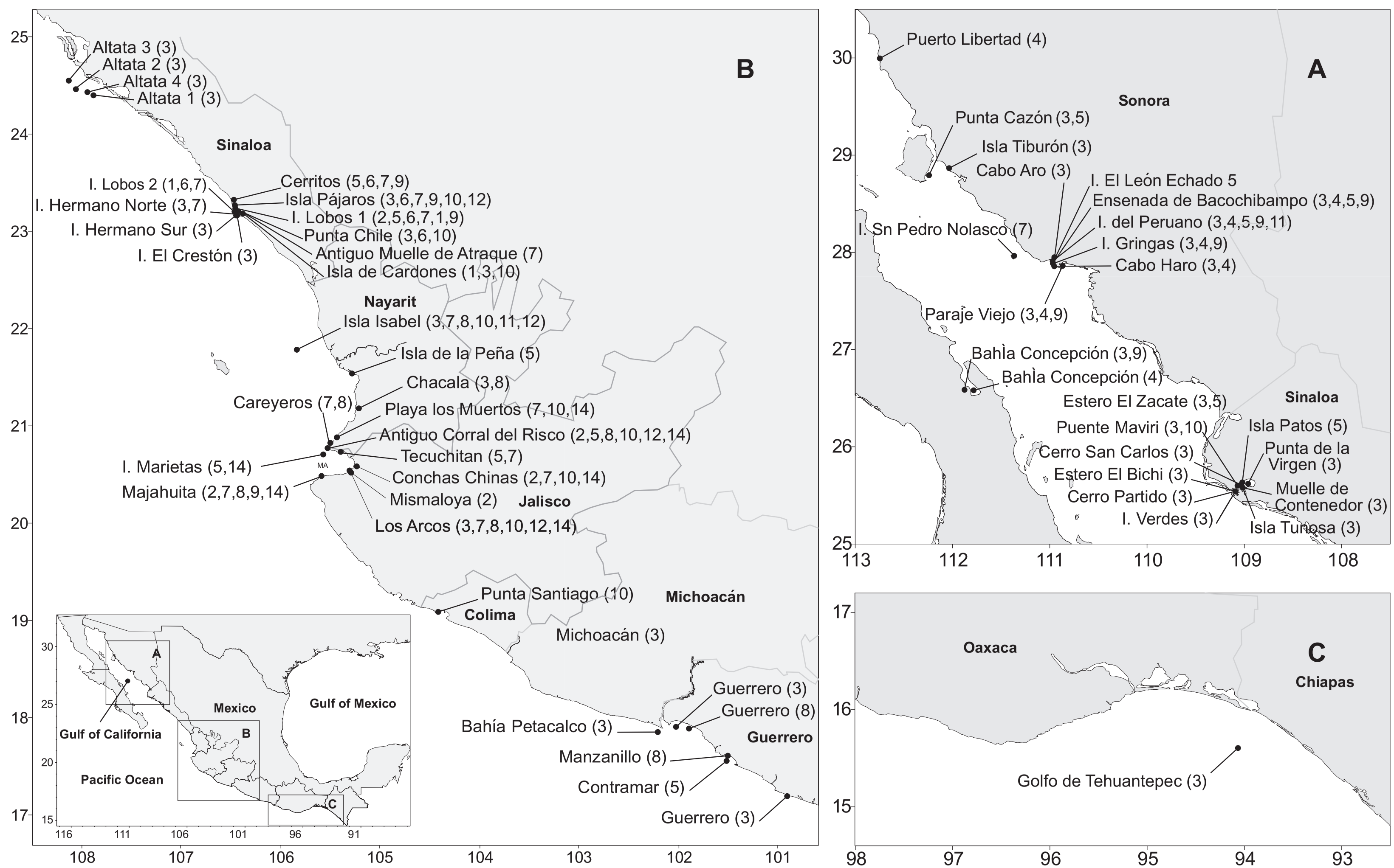

Figure 1. Location of the sampling stations along the coast of Mexico. The numbers show the distribution of the species: (1) ***Cliona papillae* sp. nov.**; (2) ***Cliona vallartense* sp. nov.**; (3) *Cliona californiana* **comb. nov.**; (4) *Cliona raromicrosclera* **comb. nov.**; (5) *Cliona amplicavata*; (6) *Cliona flavifodina*; (7) *Cliona euryphylla*; (8) *Cliona vermifera*; (9) *Pione carpenteri*; (10) *Pione mazatlanensis*; (11) ***Thoosa calpulli* sp. nov**.; (12) ***Thoosa mismalolli* sp. nov.**; (13) ***Spheciospongia ruetzleri* sp. nov.**; (14) ***Spheciospongia incrustans* sp. nov.**

oscula-bearing papillae in some forms. Spicules are tylostyles as megascleres, very thin oxeas (rhaphides) as accessory scleres but never of structural importance, and spiraster-like microscleres. Spirasters are straight, bent, kinked, spiralled, or undulated spiny rhabds, including amphiastrose forms clearly derived from true spirasters; extreme forms may be entirely smooth (Rützler, 2002a).

CLIONA PAPILLAE SP. NOV.
(FIGS 2, 3, 4)

Holotype: MNCN 1.01/234, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 09.v.2003.

Paratypes: BMNH: 2003.6.27.1, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 09.v.2003. LEB-ICML-UNAM-160, Isla de Cardones (Mazatlán, Sinaloa), 23°11′05″N–106°24′07″W, 8 m depth, 15.iii.2000, on rocks. LEB-ICML-UNAM-316, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 20.ii.2000. LEB-ICML-UNAM-913, Isla Lobos 2 (Mazatlán, Sinaloa) 23°13′27.7″N, 106°28′01.6″W, 7 m depth, 03.x.2003, on rocks.

Description: Boring sponge growing always in alpha stage (Fig. 2A). The sponge can reach up to 12 × 10 cm in coverage. One of the most typical features of this species is the presence of elevated papillae that can protrude up to 8 mm on the substrate when alive. The

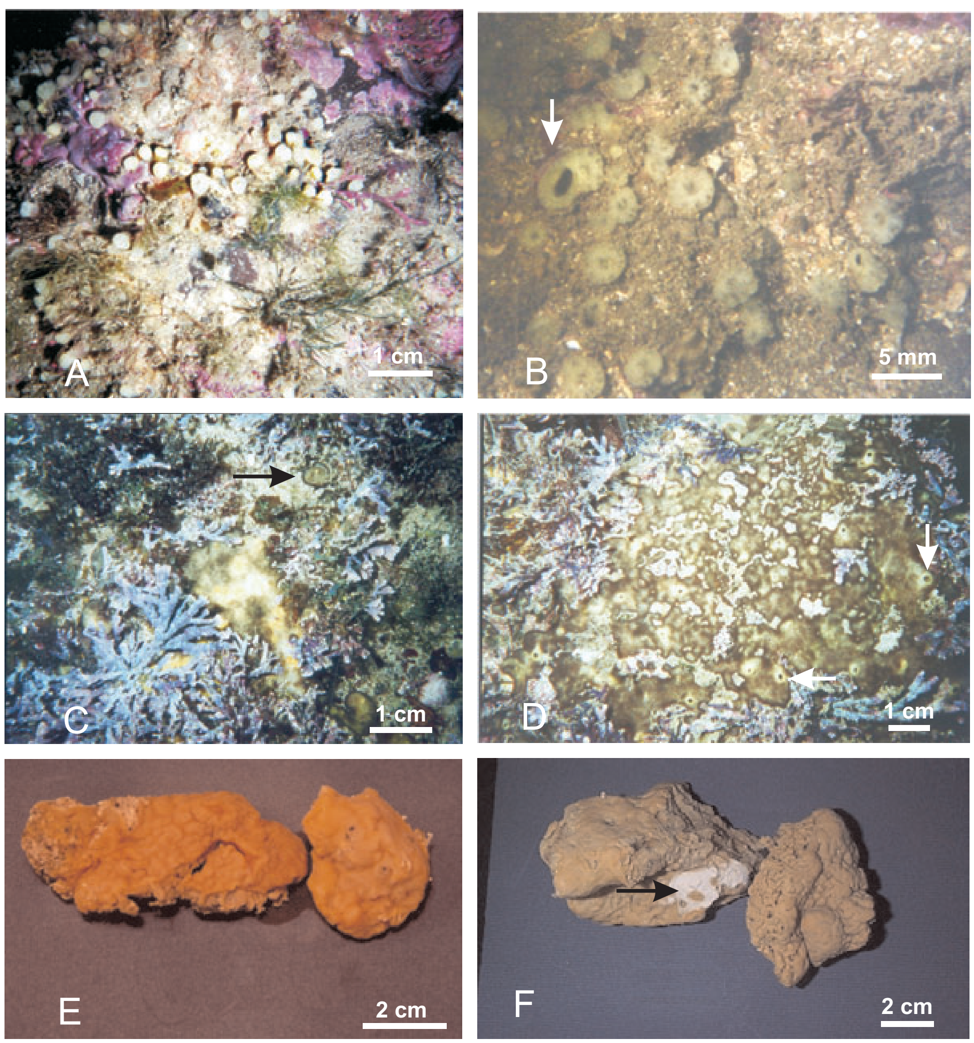

Figure 2. External morphologies. A, ***Cliona papillae* sp. nov.**, boring into rock and calcareous algae at 5 m depth. B, Detail of the papillae of ***Cliona papillae* sp. nov.** The arrow shows the fusion of oscular and ostial papillae. The typical sieve-like ostial papillae are visible to the eye underwater. C, ***Cliona vallartense* sp. nov.** growing in beta stage with scattered oscular papillae (arrow) at 4 m depth. D, ***Cliona vallartense* sp. nov.** growing in beta stage with numerous oscula (arrow) at 7 m depth. E and F, *Cliona raromicrosclera* **comb. nov.** massive orange and beige specimens.

papillae bear either grouped ostia (visible to the eye underwater) or oscula (Fig. 2B). The ostial papillae are regularly scattered on the surface, and they are usually spaced 1.3–10 mm from each other. Ostial papillae bear many ostia, sieve-like. They are circular or oval in section, and characteristically distally widened; the diameter in the centre is 1.8–3.5 mm, and at the end 2–6.8 mm. The oscular papillae are circular or oval-shaped, from 1 to 4.3 mm in diameter. Papillae fusion is not common. The species has a very distinctive very pale yellow colour when alive. Upon preservation in alcohol, colour changes to light brown.

Skeletal characters: Tylostyles are mostly straight or only slightly curved, with generally well-formed spherical or oval head (Fig. 3A). Tylostyles measures 304×9.5 µm on average (13 µm of head width) (Table 1). Tylostrongyles occasionally appear. The spirasters are very delicate, slender, with about 2–5 bends (21 µm length in average) (Fig. 3B). The shaft surface is characteristically very finely spined, with nonbifurcated spines. In the periphery of the papillae there is a dense palisade of tylostyles, with tylostyle heads anchored in tissue and pointed ends piercing the surface (Fig. 4). In the inner part of the papillae the tylostyles are irregularly scattered, there are occasional tracts of spicule bundles in the central canal. The spirasters are very scarce in the papillae. They are only abundant in the choanosome.

Etymology: The species name selected means 'nipple' in Latin to emphasize the characteristic papillae of this species.

Distribution: Bahía de Mazatlán (Mazatlán, Sinaloa) (present study).

Remarks: The closest species seems to be *Cliona lobata sensu* de Laubenfels (1954), which assigns to this species a bright yellow specimen with very slender spirasters ($27–40 \times 0.3$ µm), and tylostyles ($220–240 \times 5–12$ µm) with a marked neck and a very well-developed head (8–15 µm in diameter). These characteristics in part agree with our specimen; however, *C. lobata* Hancock, 1849, in addition to slender and longer spirasters, has additional thicker and shorter spirasters (Topsent, 1887; Volz, 1939). Other close species seem to be *Cliona caribbea* Carter, 1882 (redescribed in Rützler, 1974), and *Cliona paucispina* Rützler (1974). *Cliona caribbea* is a greenish or dark brown sponge, which has only slender spirasters similar to the *C. papillae* spirasters. However, important differences exist between them, like the size (32.8×0.8 µm in average), and the distribution and form of the spines in the spirasters of *Cliona caribbea*, which has singular or bifurcated actins (Rützler, 1974; Schönberg, 2000). *Cliona paucispina* (Rützler, 1974) has shorter spirasters ($12.8–43.2 \times 0.8–3$ µm), with much smaller spines, and fewer spines and bends than *C. papillae*. The presence of tylostrongyles, and the morphology of the papillae are other distinguishing characteristics of *C. papillae*, which do not appear in the related species commented upon above.

CLIONA VALLARTENSE SP. NOV.
(FIGS 2, 5)

Holotype: MNCN-1.01/235, Mismaloya (Bahía de Banderas, Jalisco), 20°31′56″N–105°17′42″W. 3 m depth, 06.ix.2003.

Paratypes: BMNH-2003.6.27.2, Mismaloya (Bahía de Banderas, Jalisco), 20°31′56″N–105°17′42″W, 3 m depth, 06.ix.2003. LEB-ICML-UNAM-633, Conchas Chinas (Puerto Vallarta, Jalisco), 20°35′16″N–105°14′42″W. 2 m depth, 08.x.2002. LEB-ICML-UNAM-788, Mismaloya (Bahía de Banderas, Jalisco), 20°31′56″N–105°17′42″W, 3 m depth 06.ix.2003. LEB-ICML-UNAM-821, Antiguo Corral del Risco (Punta Mita, Nayarit), 20°46′20″N–105°32′49″W, 2 m depth, 11.vi.2003. LEB-ICML-UNAM-848, Majahuita (Bahía de Banderas, Jalisco), 20°29′06″N–105°17′42″W, 10 m depth 06.viii.2003.

Description: This species grows in alpha and beta stage, overgrowing the substrate completely and covering it with a thin (0.9–2.8 mm) layer of tissue in the beta stage (Fig. 2C, D). In some specimens the papillae are surrounded by patches of ectosomal tissue over-

Table 1. Comparative data for the dimensions of the spicules (in µm) of ***Cliona papillae* sp. nov.** specimens. Values between brackets are means

	Tylostyles	Tylostrongyles	Spirasters
Specimens	Length × width shaft; head width	Length × width shaft; head width	Length
LEB-ICML-UNAM-160	185–(301)–455 × 5–(11.2)–16.3; 10–(14.5)–18	185–(349)–425 × 8.8–(10.5)–12.5; 11.3–(14.6)–15.5	15–(23.3)–32.5
LEB-ICML-UNAM-316	175.5–(307.8)–400 × 6–(7.8)–10; 8.8–(10.8)–12.5	252–(346.3)–382 × 8.8–(10.8)–15; 11.3–(14.5)–17.5	12.5–(19.5)–32

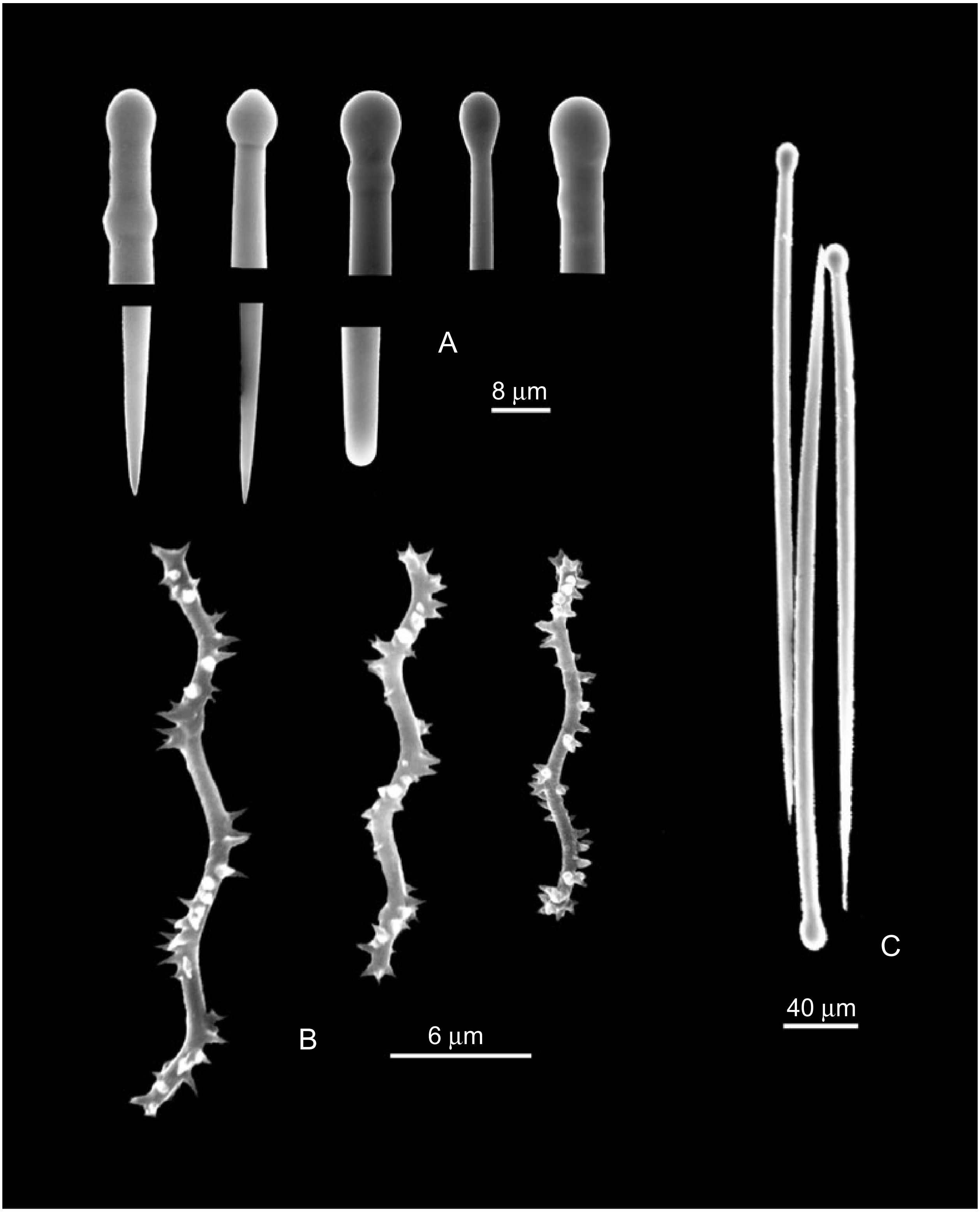

Figure 3. ***Cliona papillae* sp. nov.**: A, heads and tips of the tylostyles, some showing annular swelling and a rounded end; B, different forms of spirasters; C, tylostyles.

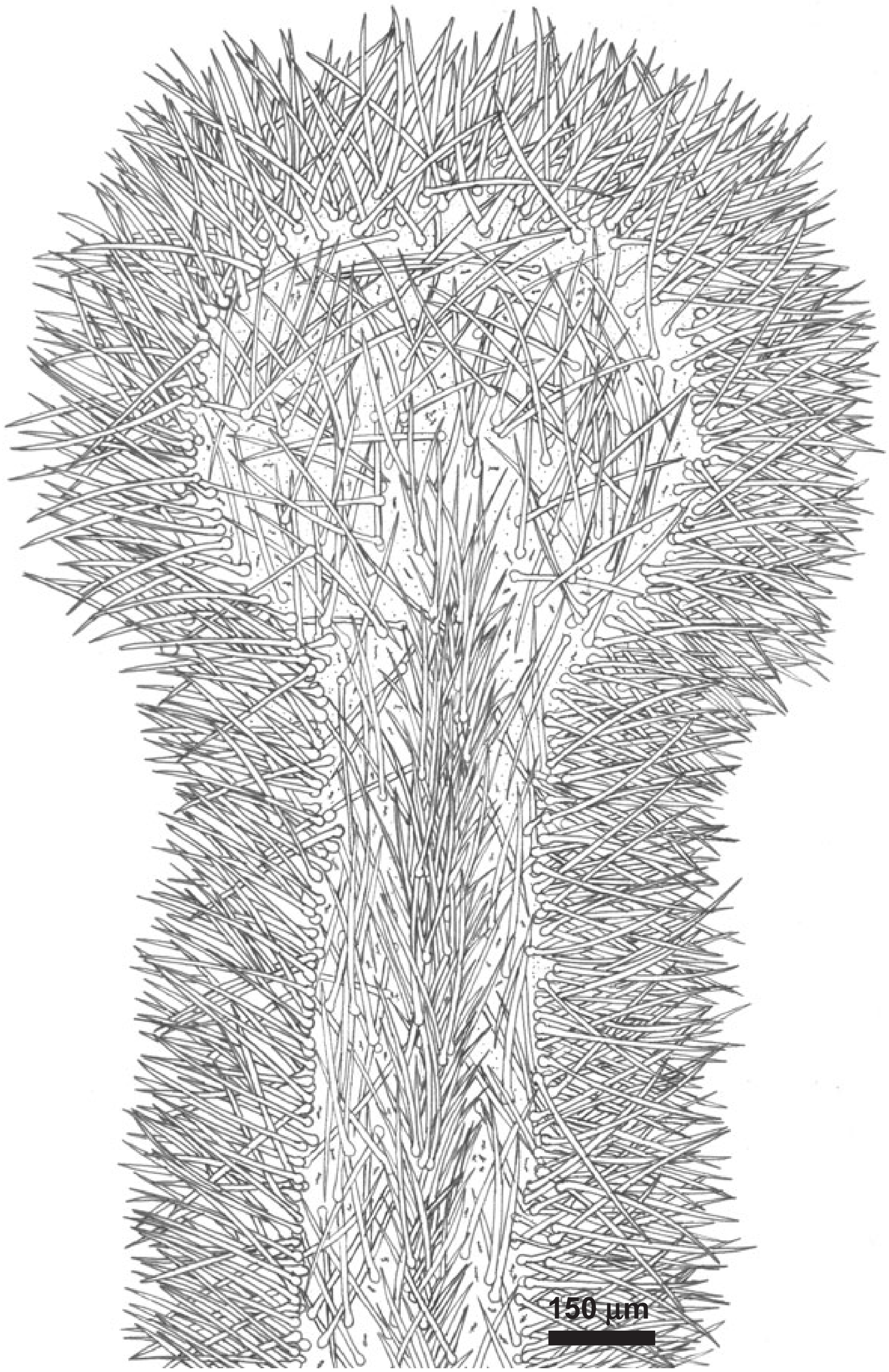

Figure 4. ***Cliona papillae* sp. nov.**: skeletal arrangement in papillae.

growing the substrate. The specimens can reach a maximum surface area of 20×10 cm. Papillae are variable in size (0.2–1.3 cm) and form (from circular to elongated), and scarce in the alpha form. Oscules and ostia frequently flush with the surface. Preserved, the sponge shrinks and mirrors the contour of the substrate beneath. Colour is green olive to pale yellow. The tissue surrounding papillae is light olive or yellow. The choanosome is ochre. This species penetrates deeper into carbonate structures (up to 9 cm depth in

Table 2. Comparative data for the dimensions of the spicules (in μm) of ***Cliona vallartense* sp. nov.** specimens. Values in parentheses are means

	Tylostyles	Spirasters
Specimens	Length × width shaft; head width	Length
LEB-ICML-UNAM-633	237.5–(294)–347.5 × 1.3–(4.7)–7.5; 3.8–(7.5)–10	18.0–(24.3)–32.5
LEB-ICML-UNAM-788	137–(258)–337.5 × 3–(4.7)–6.3; 5–(7.6)–10	12–(18.5)–25.5

the holotype) than the others *Cliona* species in the same area.

Skeletal characters: The species presents tylostyles and spirasters (Fig. 5). The tylostyles are slender, slightly curved, and gradually tapering from the middle of the spicule. The heads are characteristically narrow and elongate, sometimes ovoid, with annular swellings. Deformations are also common, and the head region of the spicule may exhibit a rather wide variety of shapes. They measure 294 × 4.7 μm on average (7.5 μm of head width) (Table 2). Spirasters have a thick shaft, with narrowly spaced small conic spines surrounding the entire axis of the spirasters. Sometimes the spines are not pointed but branching two, three or even more times. They may be spiral with two or more bends with almost straight shafts (24 μm length on average). The spirasters are very scarce in the ectosome and in the papillae, but they are abundant in the choanosome around the excavating chambers.

Etymology: The specific epithet refers to the village of Puerto Vallarta from the Bahía de Banderas (Jalisco, Mexico).

Distribution: Bahía de Banderas (Puerto Vallarta, Jalisco) (present study).

Remarks: Cliona vallartense sp. nov. is a greenish sponge characterized mainly by skeletal details of the megascleres and by the form and spination of the spirasters. *Cliona orientalis* Thiele, 1900 seems to be the most similar species. However, spines on their spirasters are usually arranged at the convex side of the spicule parts (Thomas, 1979; Calcinai *et al*., 2000), forming little bouquets along the shaft (Schönberg, 2000). Our specimens have spirasters with spines arranged around the shaft, and they are commonly bifurcated. *Cliona caribbea* is another greenish or dark brown sponge, which has only slender spirasters with singular or bifurcated actins (Rützler, 1974). Another close species seems to be *Cliona paucispina* Rützler, 1974, which is clearly different from our specimens because its spirasters have reduced spination and nonbifurcated spines (Rützler, 1974).

CLIONA CALIFORNIANA (DE LAUBENFELS, 1932) **COMB. NOV.** (FIGS 6, 7, 8, 9)

Synonymy: Cliona celata var. *californiana* de Laubenfels, 1932: 47; *Pseudosuberites pseudos* Dickinson, 1945: 38; **syn. nov.**

Paratype: Cliona celata var. *californiana* de Laubenfels, 1932. BMNH-29.8.22.52a (microscope slide), BMNH-29.8.22.50 (specimen in spirit).

Holotype: Pseudosuberites pseudos Dickinson, 1945. Allan Hancock Foundation, Sta. No. velero 553-36. MNCN-1.01/237, Estero el Bichi (Topolobampo, Sinaloa), 25°32′27″N–109°05′29″W, 1 m depth, 13.xi. 2002. LEB-ICML-UNAM-141, Chacala (Nayarit), 21°09′57″N–105°13′38″W, 4 m depth, 20.ii.2000, on sand bottoms. LEB-ICML-UNAM-224, Puente Maviri (Los Mochis, Sinaloa), 25°34′55″N–109°06′52″W, 2 m depth, 21.vi.2000. LEB-ICML-UNAM-285, Ensenada de Bacochibampo (Guaymas, Sonora), 27°54′37″N–110°57′12″W, 5 m depth, 06.xi.2000. LEB-ICML-UNAM-295, Punta Cazón (Kino, Sonora), 28°52′20″N–112°02′01″W, 3 m depth, 08.xi.2000. LEB-ICML-UNAM-300, Isla del Peruano (Guaymas, Sonora), 27°54′35″N–110°58′17″W, 15 m depth, 03.xi.2000. LEB-ICML-UNAM-319, Isla del Peruano (Guaymas, Sonora), 27°54′35″N–110°58′17″W, 12 m depth, 03.xi.2000. LEB-ICML-UNAM-336, Isla Tiburón (Kino, Sonora), 27°54′35″N–110°58′17″W, 15 m depth, 27.iv.2001. LEB-ICML-UNAM-337, Isla Tiburón (Kino, Sonora), 28°47′12″N–112°15′6″W, 15 m depth, 27.iv.2001. LEB-ICML-UNAM-338, Isla Tiburón (Kino, Sonora), 28°47′12″N–112°15′6″W, 15 m depth, 27.iv.2001. LEB-ICML-UNAM-369, Punta Chile (Mazatlán, Sinaloa), 23°12′29″N–106°25′40″W, 1.5 m depth, 08.x.2001. LEB-ICML-UNAM-444, Isla Pájaros 1 (Mazatlán, Sinaloa), 23°15′29″N–106°28′25″W, 3 m depth, 26.ii.2002. LEB-ICML-UNAM-494, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 5 m depth, 08.iv.2002. LEB-ICML-UNAM-667, Cerro San Carlos (Topolobampo, Sinaloa), 25°35′33″N–109°02′39″W, 4 m depth, 12.xi.2002. LEB-ICML-UNAM-672, Muelle de Contenedor (Topolobampo, Sinaloa), 25°34′55″N–109°03′32″W, 5 m depth,

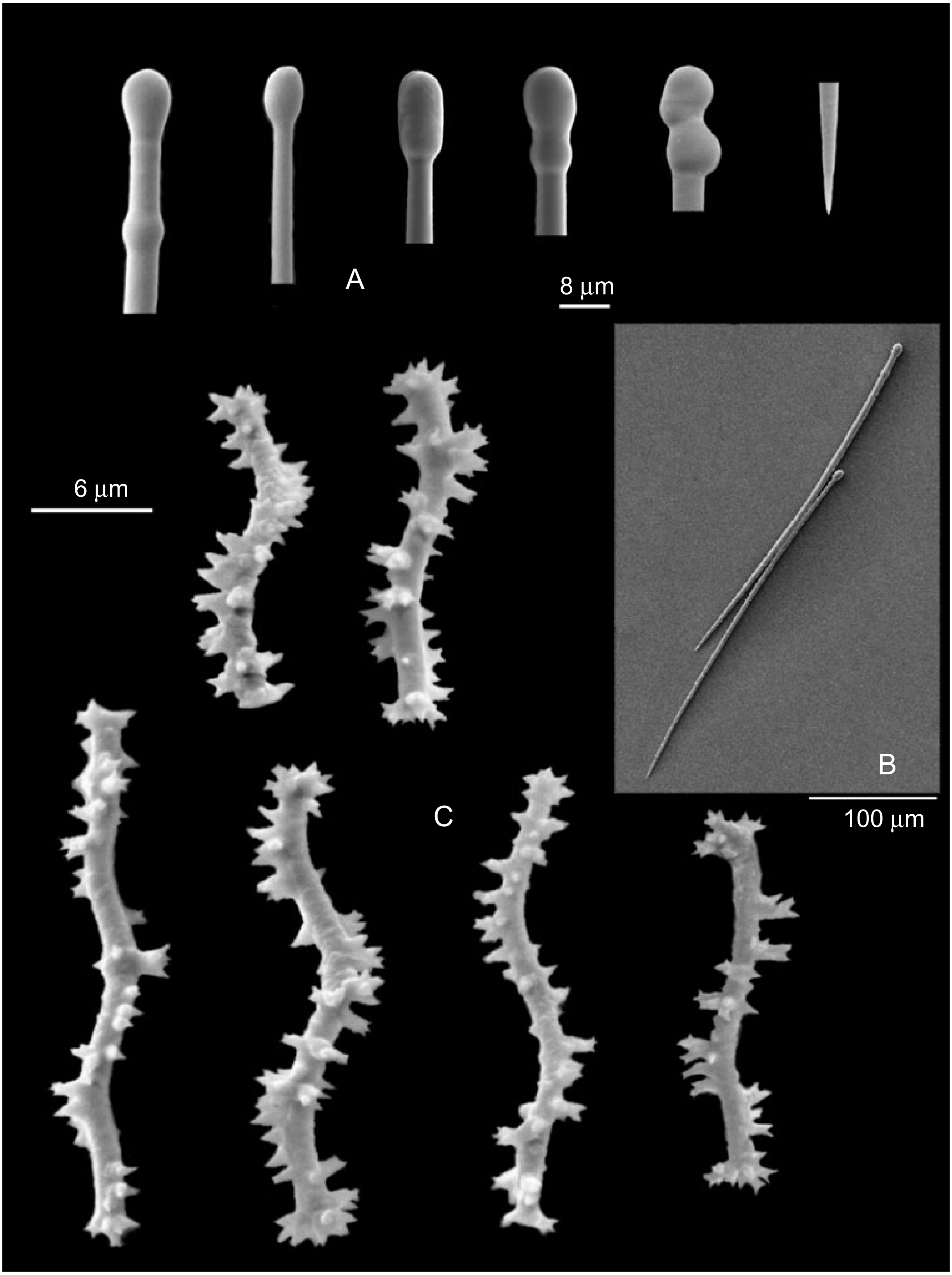

Figure 5. ***Cliona vallartense*** **sp. nov.**: A, heads and tip of the tylostyles showing different modifications and secondary annular swelling; B, tylostyles; C, different forms of spirasters.

12.xi.2002. LEB-ICML-UNAM-676, Punta de la Virgen (Topolobampo, Sinaloa), 25°36′58″N–108°58′12″W, 1 m depth, 12.xi.2002. LEB-ICML-UNAM-681, Isla Tunosa (Topolobampo, Sinaloa), 25°34′58″N–109°00′51″W, 2 m depth, 12.xi.2002. LEB-ICML-UNAM-692, Islas Verdes (Topolobampo, Sinaloa), 25°31′47″N–109°05′27″W, 2 m depth, 13.xi.2002. LEB-ICML-UNAM-701, Estero el Bichi (Topolobampo, Sinaloa), 25°32′27″N 109°05′29″W, 1 m depth, 13.xi.2002. LEB-ICML-UNAM-704, Cerro Partido (Topolobampo Sinaloa), 25°32′7″N–109°05′33″W, 1 m depth, 13.xi.2002. LEB-ICML-UNAM-711, Estero el Zacate (Los Mochis, Sinaloa), 25°36′25″N–109°04′33″W, 2 m depth, 14.xi.2002. LEB-ICML-UNAM-726, Puente el Maviri (Los Mochis, Sinaloa) 25°34′55″N–109°06′52″W, 6 m depth, 14.xi.2002. LEB-ICML-UNAM-738, Paraje Viejo (Guaymas, Sonora), 27°52′20″N–110°52′08″W, 8 m depth, 26.xi.2002. LEB-ICML-UNAM-741, Paraje Viejo (Guaymas, Sonora), 27°52′20″N–110°52′08″W, 5 m depth, 11/26/02. LEB-ICML-UNAM-753, Islas Gringas (Guaymas, Sonora), 27°53′5″N–110°57′55″W, 10 m depth, 27.xi.2002. LEB-ICML-UNAM-766, Islas Gringas (Guaymas, Sonora), 27°53′05″N–110°57′55″W, 10 m depth, 27.xi.2002. LEB-ICML-UNAM-767, Cabo Haro (Guaymas, Sonora), 27°52′5″N–110°57′2″W, 12 m depth, 27.xi.2002. LEB-ICML-UNAM-773, Cabo Haro (Guaymas, Sonora), 27°52′04′N–110°57′01″W, 12 m depth, 27.xi.2002. LEB-ICML-UNAM-784, Estero ‘El Bichi’ (Topolobampo, Sinaloa), 25°32′27″N–109°05′29″W, 1 m depth, 13.xi.2002. LEB-ICML-UNAM-785 Estero ‘El Bichi’ (Topolobampo, Sinaloa), 25°32′27″N–109°05′29″W, 1 m depth, 13.xi.2002. LEB-ICML-UNAM-833 Altata 3 (by trawling, Sinaloa), 24°32′42.9′N–108°07′41.58′W, 53 m depth, 18.xi.2002. LEB-ICML-UNAM-838, Altata 2 (by trawling, Sinaloa), 24°27′58.8″N–108°03′37.2″W, 42 m depth, 20.xi.2002. LEB-ICML-UNAM-841, Altata 4 (by trawling, Sinaloa), 24°26′20.4″N–107°56′32.64″W, 32 m depth, 16.xi.2002. LEB-ICML-UNAM-843, Altata 1 (by trawling, Sinaloa), 24°24′19.92″N–107°53′17.58″W, 31 m depth, 25.xi.2002. LEB-ICML-UNAM-933, Isla Hermano Sur (Mazatlán, Sinaloa), 23°10′59″N–106°26′24.1″W, 8 m depth, 22.x.2003. LEB-ICML-UNAM-895, Isla el Crestón (Mazatlán, Sinaloa), 23°11′02″N–106°25′37″W, 7 m depth, 12.ix.2003. LEB-ICML-UNAM-958, Isla Hermano Norte (Mazatlán, Sinaloa), 23°11′16.2″N–106°25′11.5″W, 8 m depth, 24.x.2003. LEB-ICML-UNAM-995, Isla Cardones (Mazatlán, Sinaloa), 23°11′05″N–106°24′07″W, 6 m depth, 26.xi.2003. LEB-ICML-UNAM-1008, Cerro Pelón (Isla Isabel), 21°51′21″N–105°53′33″W, 20 m depth, 10.xii.2003. LEB-ICML-UNAM-1014, Cerro de la Cruz (Isla Isabel), 21°50′32″N–105°52′58″W, 13 m depth, 11.xii.2003. CNPGG-93, Golfo de Tehuantepec, 15°36′0″N–94°04′0″W, i.1989. CNPGG-579, Bahía Petacalco (Guerrero), 17°52′12″N–102°12′48″W, 37 m depth, 11.ii.1982. CNPGG-642, Bahía de los Ángeles (Baja California), 19.ii.1999. CNPGG-682, Isla Coronado (Baja California), 19.ii.1999. CNPGG 698 (Michoacán), 18°40′12″N–103°46′12″W, 30 m depth, 10.i.1983. CNPGG-699, Bahía Concepción (Baja California Sur), 26°35′0″N–111°47′0″W, 10.ii.1999. CNPGG-700 (Guerrero), 17°12′30″N–100°55′12″W, 20 m depth, 20.iv.1982. CNPGG-701, La Bufadora (Ensenada, Baja California), 11.v.2001. CNPGG-702 (Guerrero), 16°35′18″N–99°07′0″W, 25 m depth 15.ii.1982. CNPGG-703 (Guerrero), 17°55′30″N–102°01′12″W, 46 m depth, 23.iv.1982.

Description: Three typical growth stages of *C. californiana* (alpha, beta and gamma) have been found (Fig. 6). The alpha stages (papillae) are pale yellow (dark brown or pale yellow in alcohol) (Fig. 6A). Their ostial papillae are more frequently circular, 0.2–3.4 mm in diameter, and 0.5–(0.9)–1.8 mm apart. They protrude 1–5 mm above the sponge surface. Oscular papillae are less abundant than ostial papillae; they are also circular, slightly elevated, and open to 0.7–2.3 mm in diameter. Fusions of papillae have not been observed. The alpha stage is frequently boring into bivalve shells and rocks, reaching sizes up to 8.5 × 14 cm. The beta stage overgrows the surface of the substrate reaching a maximum coverage of 9 × 12 cm, and the specimens exhibited no tendency to undergo papillary fusion (Fig. 6B). The gamma stage has a characteristic mammillate surface with mainly circular papillae, uniformly distributed, about 1–2 mm apart. They protrude above the substratum surface. Gamma specimens can grow up to 1 m in length, 33 cm high, and 55 cm wide (at the base). In this case, oscular papillae are frequently at the top of the sponge, and the ostial papillae are scattered on the lateral sides. Specimens are globular or semiglobular (4.8 × 4.4 × 1.5 cm), and volcano-shaped specimens are also common (22 × 25 × 13 cm) with an inner diameter of 8 cm. In the latter form, the ostial papillae are mainly located on the external surface and the oscular papillae are in the interior of the volcano. The ostial papillae are more frequently circular, very homogeneous in size, 0.75–(2)–4.5 mm in diameter, and they are spaced 5–(1.4)–2.2 mm from each other, without a tendency to fuse. The edges of the papillae are raised to about 5–(1.47)–2.5 mm above the substratum. In preserved specimens papillae protrude from the body of the sponge, but in some specimens preserved by freezing the papillae are very often sinking, forming openings of 0.75–(2.3)–4.5 mm in diameter. The oscular papillae are less abundant than ostial ones, they are also circular-shaped, and they can reach

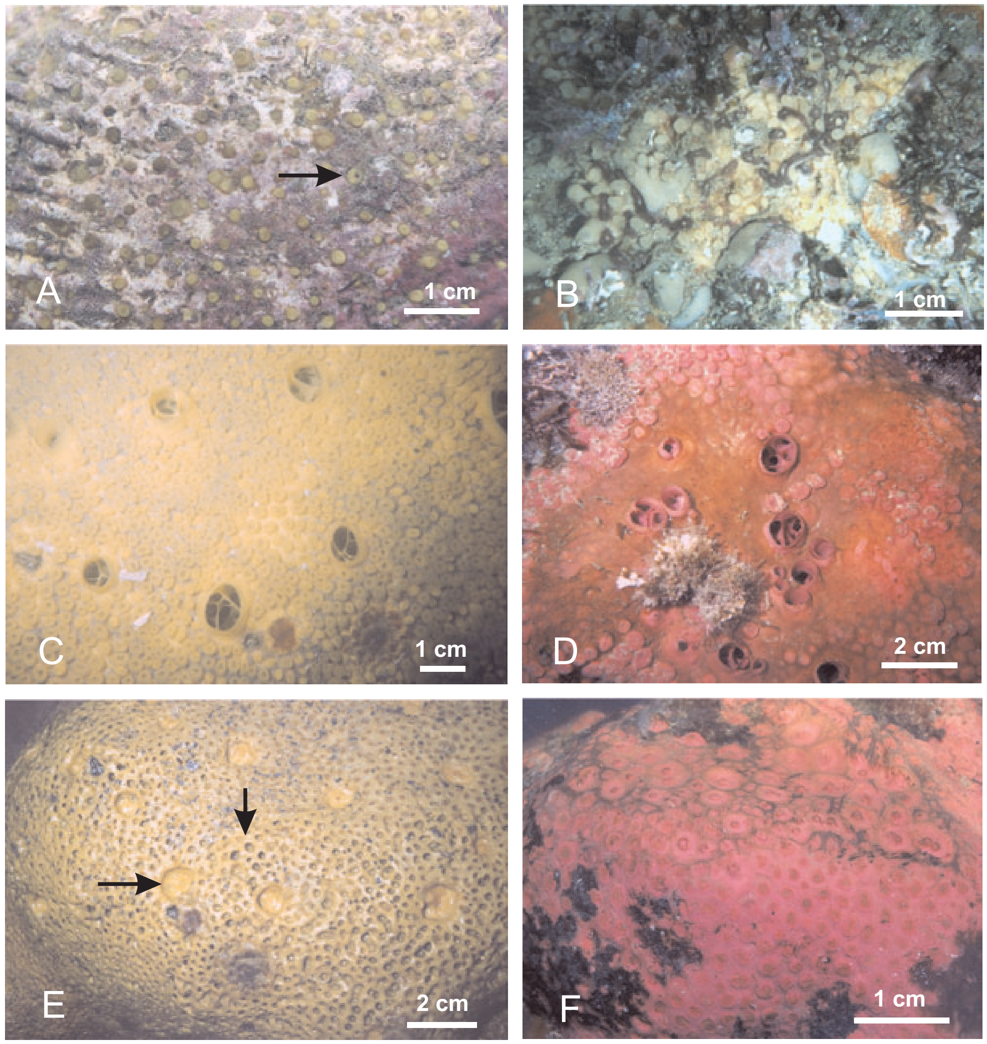

Figure 6. External morphology at different growth stages of *Cliona californiana* **comb. nov.** A, Specimen in alpha stage boring into a bivalve shell at 15 m depth. The arrow shows oscular papillae. B, Specimen in beta stage growing on rocks and calcareous algae, 5 m depth. C, Large, massive yellow specimen (gamma stage) at 1 m depth. D, Pink specimen growing in gamma stage, at 10 m depth. E, Specimen (C) out of the water. The arrows show collapsed papillae. F, Pink gamma stage with closed papillae.

up to 10 mm in diameter. The surface is smooth, but the spicules protrude the surface by up to 70 μm. The ectosome is not detachable, from 0.9 to 1.5 mm thick. In the choanosome there are canals from 0.3 to 1 cm wide. The consistency is firm, slightly compressible. The colour in the alpha and beta stages is golden yellow. In the gamma stage it is golden yellow, light pink, reddish brown and ochre (Fig. 6C, D). In some specimens the colour is not uniformly distributed, presenting both yellow and light pink areas. Alcohol turns them very dark brown.

Skeletal characters. The spiculation is formed exclusively by slightly curved tylostyles (Fig. 7), with a well-differentiated globular head, mucronate or ovoid, sometimes with an apical knob. The pointed end is thin. The tylostyles in the gamma stage are characterized by having a shaft that is thinner in the middle part than at the extremes. They are straight or slightly curved with a well differentiated head, sometimes they are also mucronate. They measure 256×7.8 μm on average (8.3 μm head width). Styles appear very occasionally (Table 3). The ectosome has the typical clionaid tylostyle palisade that is 0.75–1.57 mm wide. The choanosomal skeleton is made of ascending tracts of tylostyles (120–210 μm thick), branching and anastomosing towards the ectosome from the base of the sponge (Fig. 8).

Distribution: Sea of Cortez (Dickinson, 1945; Hofknecht, 1978; as *Pseudosuberites pseudos*, and

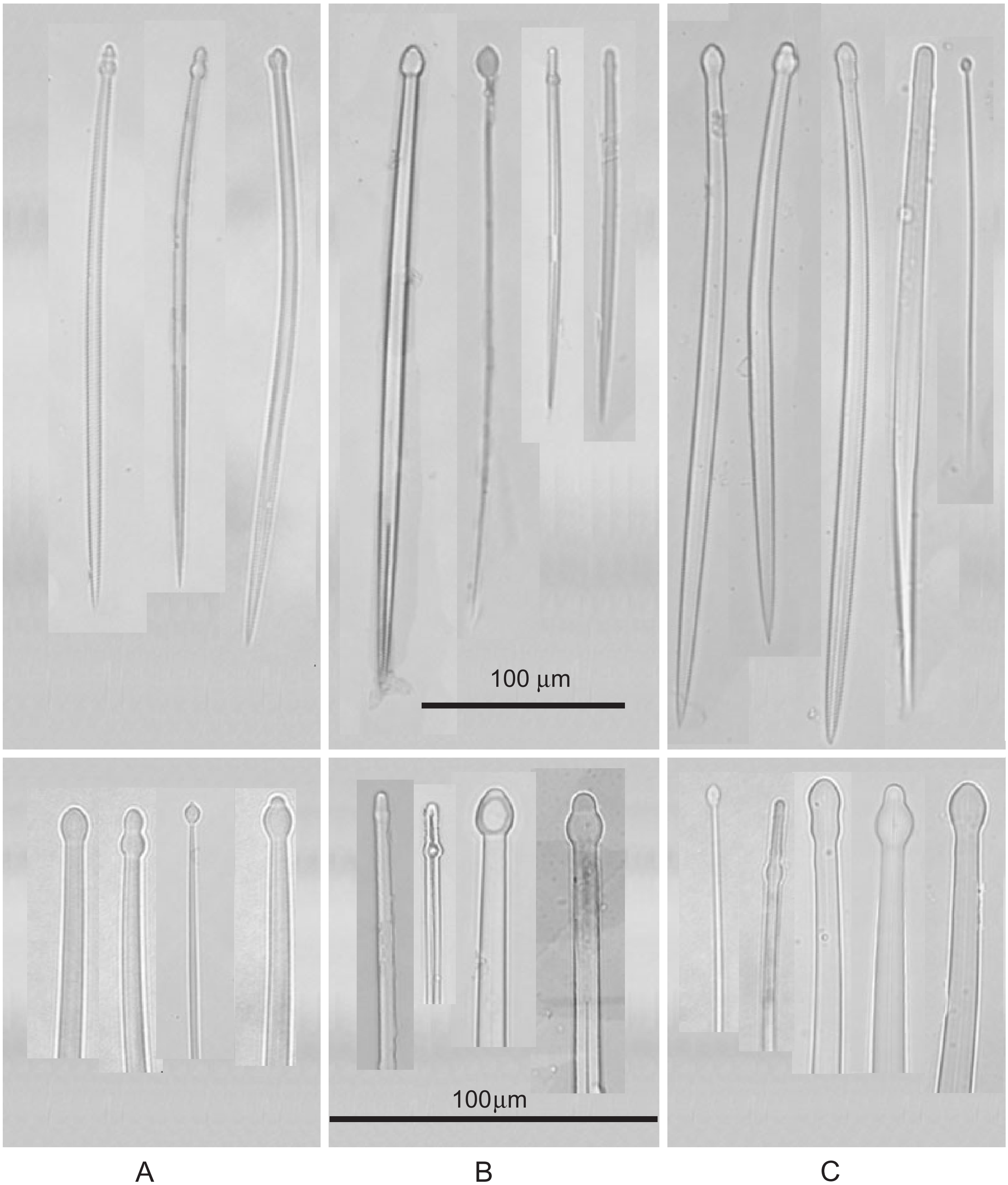

Figure 7. *Cliona californiana* **comb. nov.**: tylostyles and detail of the heads in (A) alpha stage, (B) beta stage and (C) gamma stage. Same scale bar for tylostyles (in the centre) and for the heads (below).

Table 3. Comparative data for the spicule dimensions (in μm) of *Cliona californiana* specimens. Values in parentheses are means

			Tylostyles	Styles/subtylostyles
Specimens	Stage	Colour	Length × width shaft; width head	Length × width shaft
Paratype *C. celata* var. *californiana*			202.5–(257.3)–300 × 1.3–(5.5)–10; 3.8–(7.1)–10	–
Holotype *P. pseudos* MNCN 1.01/237			205–(285.8)–350 × 1.3–(7.4)–10; 3.8–(8.3)11.3	–
LEB-ICML-UNAM-141	Gamma	Yellow	175–(294)–400 × 5.5–(10)–12.5; 5–(8)–12.5	–
LEB-ICML-UNAM-224	Alpha	Yellow	127.5–(281)–312.5 × 1.3–(6.6)–10; 3.8–(8.8)–12.5	–
LEB-ICML-UNAM-285	Gamma	Light pink	155–(267)–325 × 1.3–(6.6)–10; 2.5–(8)–10	–
LEB-ICML-UNAM-295	Gamma	Pink	175–(247.8)–287–5 × 1.3–(6.6)–10; 3–(7.7)–10.5	–
LEB-ICML-UNAM-300	Gamma	Pink	175–(245.3)–312.5 × 2–(6.7)–10; 3–(8.5)–12.5	–
LEB-ICML-UNAM-336	Gamma	Reddish	225–(267)–305 × 2.5–(8)–11.3; 5–(9.4)–12.5	–
LEB-ICML-UNAM-337	Gamma	Yellow	152–(253)–300 × 3–(7.3)–10; 5–(8.7)–10.5	–
LEB-ICML-UNAM-338	Gamma	Light pink	155–(245)–307.5 × 1.3–(5.9)–11.3; 2.5–(7.7)–11.3	–
LEB-ICML-UNAM-369	Alpha	Yellow	150–(247.3)–295 × 2.5–(6)–8.8 × 5–(7.9)–10	–
LEB-ICML-UNAM-494	Alpha	Yellow	205–(255.8)–302.5 × 2.5–(5.4)–7.5; 5–(8.6)–12.5	–
LEB-ICML-UNAM-667	Alpha	Yellow	175–(269.8)–332.5 × 7.5–(10.8)–13.8; 8.8–(12)–13.8	–
LEB-ICML-UNAM-672	Alpha	Yellow	200–(255.3)–295 × 5–(6.6)–8.8; 6.3–(7.8)–8.8	–
LEB-ICML-UNAM-676	Alpha	Yellow	177–(258.8)–300 × 5–(8)–10; 7.5–(9.9)–12.5	–
LEB-ICML-UNAM-681	Alpha	Yellow	175–(241.5)–290 × 1.3–(5.8)–7.5; 3.8–(7.4)–10	–
LEB-ICML-UNAM-692	Alpha	Yellow	162.5–(243.8)–287.5 × 5–(6.9)–7.5; 6.3–(8).8.8	–
LEB-ICML-UNAM-701	Gamma	Yellow	185–(288.3)–355 × 2.5–(7.9)–10; 5–(9.5)–12.5	177.5–(191.8)–205 × 3.8–(4.3)–5
LEB-ICML-UNAM-711	Alpha	Yellow	207–(269.8)–317.5 × 5–(6.8)–8.8; 7.5–(8.6)–10	–
LEB-ICML-UNAM-726	Alpha	Yellow	187–(252.5)–290 × 5–(7)–7.5; 6.3–(8.4)–10	–
LEB-ICML-UNAM-741	Gamma	Reddish brown	225–(257)–307.5 × 1.3–(6.1)–10; 2.5–(7.9)–10	212.5–(234.4)–260 × 2.5–(4.2)–6.3
LEB-ICML-UNAM-753	Alpha	Yellow	190–(259.8)–312.5 × 3.8–(8.3)–12.5; 6.3–(9.5)–12.5	–
LEB-ICML-UNAM-766	Gamma	Light pink/yellow	225–(274.8)–320 × 1.3–(6.6)–10; 3.8–(8.8)–10	185–(225.5)–250 × 3.8–(4)–5
LEB-ICML-UNAM-773	Gamma	Light pink/yellow	172.5–(253.3)–325 × 1.3–(5.8)–10; 3.8–(7.6)–10	195–(213.5)–240 × 2.5–(7.6)–10
LEB-ICML-UNAM-783	Alpha	Yellow	177.5–(264.3)–317.5 × 2.5–(7.8)–10; 5–(9.4)–11.3	157–(166.8)–175 × 3.8–(4.1)–5
LEB-ICML-UNAM-784	Alpha	Yellow	242.5–(279.5)–320 × 2–(6.2)–7.5; 3.8–(7.6)–10	–
LEB-ICML-UNAM-785	Beta	Yellow	175–(270.4)–335 × 1.25–(6.75)–10; 5–(8.5)–11.3	167.5 (176.6)–187.5 × 3.8–(4.6)–5
CNPGG-93	Gamma	Yellow	179–(256)–300 × 2.5–(9)–12.5; 2.5–(9)–12.5	–
CNPGG-579	Gamma	Red–orange	184–(314)–412 × 2.5–(9.5)–13.8; 6–(9)–12	–
CNPGG-698	Alpha	Yellow	169–(253)–305 × 4–(8)–11.5; 3–(10)–13	157.5–169–173 × 3.5–(3.7)–5
CNPGG-699	Gamma	Yellow	173–(275.7)–309 × 3–(8.8)–11; 6–(9)–12	145–(166)–176 × 3.5–(3.8)–5

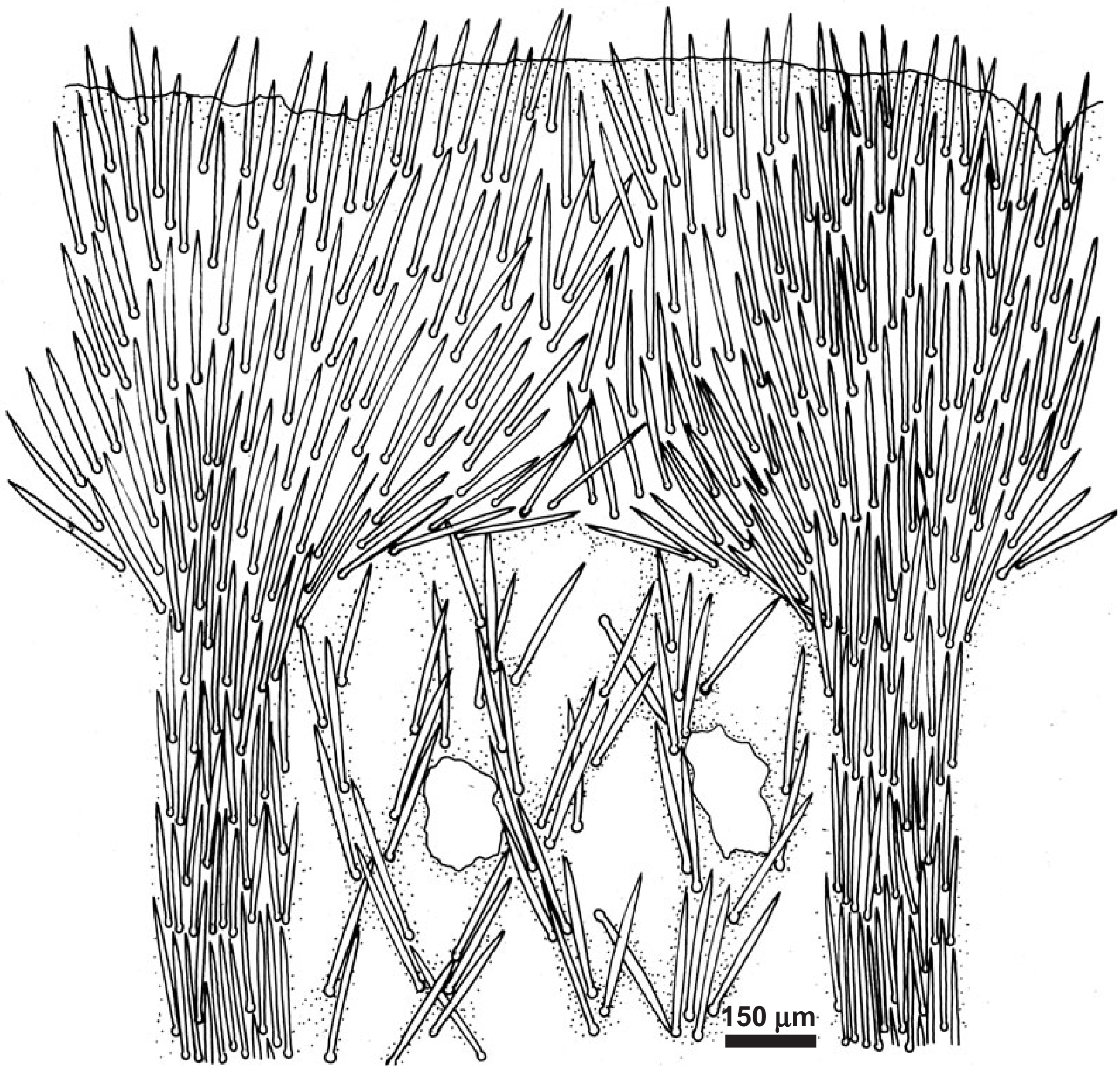

Figure 8. *Cliona californiana* **comb. nov.**: skeletal arrangement close to the surface of a gamma stage.

Green & Gómez, 1986 as *Cliona celata*) (Fig. 1). California (de Laubenfels, 1932 as *C. celata* var. *californiana*). Baja California, Sonora, Sinaloa, Nayarit, Jalisco, Guerrero and the Gulf of Tehuantepec. This is the most typical sponge species in the north of the Sea of Cortez due to its abundance and its large size.

Remarks: A lot of specimens of a *Cliona* species very close to *C. celata* in form and colour were collected along the Mexican Pacific coast. In the north-east Pacific coast these specimens are commonly assigned to *C. celata* var. *californiana* de Laubenfels 1935 (Sim & Bakus, 1986) or to *C. celata* (Green & Gómez, 1986). We compared our specimens with those from localities of *Cliona celata* along the east Atlantic and Mediterranean Sea coasts (Rützler, 1973; Carballo *et al*., 1994; Carballo, 1994; Bavestrello, Calcinai & Sarà, 1995), and found important differences between them, mainly in the size of the megascleres (Fig. 9). The tylostyles from Pacific specimens are significantly shorter ($P < 0.0001$, F-ratio 30.04) and wider ($P < 0.0001$, F-ratio 66.98), than those from the Mediterranean. Moreover, Pacific specimens have better formed termi-

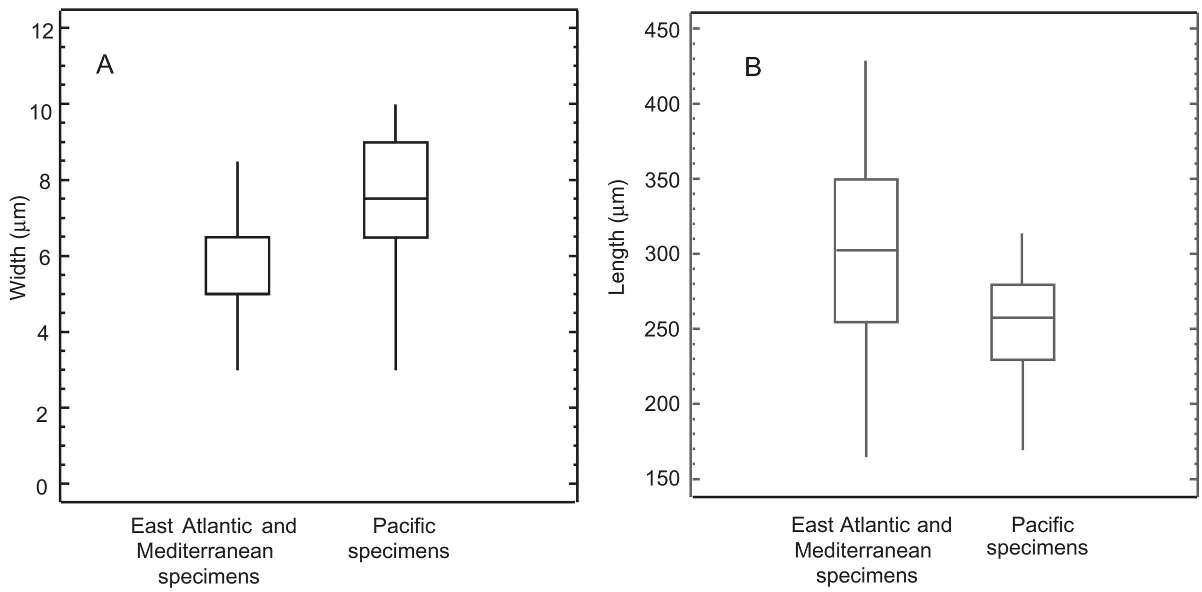

Figure 9. Multiple 'Box-and-Whisker' plot for tylostyle shaft width (A), and length (B) for Mediterranean and Pacific specimens.

nal heads, although small styles/subtylostyles with a slight swelling or knob that can be displaced along the shaft, are present in some specimens. On the basis of our results, we propose that *Cliona celata* var. *californiana* be considered as a valid species different from *Cliona celata*. Specimens at gamma stage are generally found in deeper waters than those at alpha stage (Carballo, 1994), but we have found important populations of *Cliona californiana* in small coastal lagoons where the alpha, beta and enormous gamma specimens appear simultaneously in shallow waters (from 0.5 to 1.5 m depth). This feature is very interesting and led us to clearly determine and compare the characteristics of the three growth forms in this species. A similar situation has been described along the northern coast of Spain (Rodriguez-Solórzano, 1990). The specimens largely considered as *Pseudosuberites pseudos* Dickinson, 1945 in the Gulf of California matched perfectly with the gamma stage of the *Cliona californiana*. In areas where this species is very abundant we have observed massive golden yellow, brown, pink and salmon-coloured specimens growing together with yellow and pinkish brown specimens. The spiculation (size and form of the tylostyles) of all these specimens was similar and of the same characteristics as the holotype of *Pseudosuberites pseudos*. In fact, dark brown and dark yellow specimens of *C. celata* var. *californiana* have been described from the central California coast (Hartman, 1975). Consequently, on the basis of both external and skeletal features, *P. pseudos* is here considered synonymous with *C. californiana*. The species *Pseudosuberites pseudos* was considered a synonym of *Pseudosuberites melanos* de Laubenfels 1934 by Desqueyroux-Faúndez (1972), and more recently of *Cliona chilensis* Thiele, 1905 by Desqueyroux-Faúndez & Soest (1997). *Cliona chilensis* has spirasters (Thiele, 1905; Burton, 1932; Bergquist, 1968; among others), a characteristic missing from our specimens and the holotype. Moreover, other differences exist between the specimens assigned previously to *C. pseudos* and *C. chilensis*, in colour, surface, tylostyle measurements, geographical location and habitat.

CLIONA RAROMICROSCLERA DICKINSON, 1945 COMB. NOV. (FIGS 2, 10)

Synonymy: Delaubenfelsia raromicrosclera Dickinson, 1945: 34.

Material examined: MNCN-1.01/238, Ensenada de Bacochibampo (Guaymas, Sonora), 27°54′37″N–110°57′12″W, 5 m depth, 06.xi.2000. LEB-ICML-UNAM-284, Ensenada de Bacochibampo (Guaymas, Sonora), 27°54′37″N–110°57′12″W, 5 m depth, 06.xi.2000. LEB-ICML-UNAM-302, Isla del Peruano (Guaymas, Sonora), 27°54′35″N–110°58′17″W, 15 m depth, 03.xi.2000. LEB-ICML-UNAM-734, Paraje Viejo (Guaymas, Sonora), 27°52′20″N–110°52′08″W, 5 m depth, 26.xi.2002. LEB-ICML-UNAM-746, Paraje Viejo (Guaymas, Sonora), 27°52′20″N–110°52′08″W, 5 m depth, 26.xi.2002. LEB-ICML-UNAM-755, Islas Gringas (Guaymas, Sonora), 27°53′05″N–110°57′55″W, 10 m depth, 27.xi.2002. CNPGG-63, Bahía Concepción (Baja California Sur), 26°35′N–111°47′W, 30.x.1998. CNPGG-237, Puerto Libertad (Sonora), 29°59′N–112°45′W, intertidal 11.x.1985. CNPGG-400, Santispac (Bahía Concepción, Baja California), 26°35′N–111°52′W. 30.x.1998. CNPGG-640, La Silica (Bahía de los Ángeles, Baja California), intertidal.

Description: Thickly encrusting to massive sponge (0.5–4 cm thick), covering a maximum area of 10 × 15 cm (Fig. 2E, F). The surface is smooth or wrinkled in some parts, but it can be irregularly tuberculate or verrucose. The oscules are circular or oval, from 2 to 5 mm in diameter. These are elevated up to one millimetre from the surface. The choanosome presents abundant calcareous debris (mollusc shells, tubes of polychaetes, barnacles) and sand. The consistency is slightly compressible but firm. Colour in life is orange and olive green, and pale orange, beige or pink in alcohol.

Skeletal characters: The species has tylostyles and spirasters (Fig. 10). The tylostyles are straight or slightly curved, with a generally round, oval or malformed head with annular swellings. They are usually bent in the upper third of their length. They measure 341 × 9 μm on average (12.2 μm of head width) (Table 4). Reduced tylostrongyles are also common in some specimens; they are straight, thick and with a round head, sometimes with incipient heads in the distal extreme (Fig. 10B). Tylostrongyles measurements are (as length × width shaft; head width): 80–(126)–181 × 16.5–(20.7)–24 μm; 19.5–(25)–30 μm. The spirasters are sinuous or straight, and some are like anthosigmas (20 μm average length). The spines are not pointed, but branching to two, three or even more spines. In the choanosome the tylostyles are arranged in vague tracts or in ascending bundles 130–(232)–350 μm in diameter, which brush (325–425 μm wide) out toward the surface in a palisade (Fig. 11). The spirasters are scattered throughout the choanosome, and absent in the ectosome.

Distribution: Gulf of California (Dickinson, 1945). Baja California, Baja California Sur and Sonora (present study).

Remarks: There is no other species similar to *C. raromicrosclera*. *Anthosigmella vagabunda* Ridley *sensu* de Laubenfels, 1954 from the Central Pacific, has ramose processes, it is spongy, and has different spicule sizes: tylostyles 500–600 × 8–27 μm, 'C' shape spirasters measure 13–20 μm. We found three species with reduced tylostrongyles: *C. desimoni* Bavestrello *et al*. (1995), *C. argus* var. *laevicollis* Thiele 1898, and *C. ensifera* Sollas, 1878. In *C. desimoni* megascleres are smaller in size, tylostyles are 110–(165)–225 × 5–(7.8)–11 μm, reduced tylostrongyles are 45–145 × 7–19 μm, but the spiraster is a straight microrhabd (13–25 μm). In *C. argus* var. *laevicollis* the spiculation is larger; tylostyles measure 400–500 × 18 μm, tylostrongyles measure 240 × 5 μm, and the spiraster type has a verrucose surface instead of slender spines. *C. ensifera* has several malformations on the tylostyles different from the reductions of our species, besides smaller measurements and a different spiraster shape. These characteristics support the separation between them.

Cliona raromicrosclera has been also cited in Japan (Hoshino, 1981). The spicule complements, the measurements and the morphological characteristics of the Japan specimens match the Mexican material closely. However, we do not consider those registers valid; the reduced tylostrongyles were not found in Japan specimens, and moreover, *C. raromicrosclera* has a typical distribution in the inner part of the Gulf. In spite of having sampled in

Table 4. Comparative data for the dimensions of the spicules (in μm) of *Cliona raromicrosclera* specimens. Values in parentheses are means

	Tylostyles	Spirasters
Specimens	Length × width shaft; head width	Length
LEB-ICML-UNAM-284	175–(367)–470 × 2.5–(8.8)–12.5; 4–(15.8)–17.5	15–(18.7)–22.5
LEB-ICML-UNAM-302	187–(331)–450 × 1.3–(8.3)–15; 5–(11.9)–20	12.5–(16)–21.3
LEB-ICML-UNAM-734	207.5–(349.5)–437 5 × 2.5–(8.4)–15; 5–(12)–17.5	12.5–(19.2)–28.8
LEB-ICML-UNAM-746	232.5–(353)–232.5 × 2.5–(7.4)–15; 5–(11)–18.8	13.8–(19.5)25
LEB-ICML-UNAM-755	132–(340)–450 × 2.5–(8.4)–15; 5.5–(11.9)–17.5	16.3–(20.8)–25
CNPGG-63	207–(340)–435 × 2.5–(9)–14;	12.5–(22)–30
CNPGG-237	180–(351)–440 × 5–(10)–14; 6.7–(13)–16	10–(24)–39.5
CNPGG-400	124–(301)–427 × 5–(10)–15; 9–(13)–18	10–(18.7)–28.5

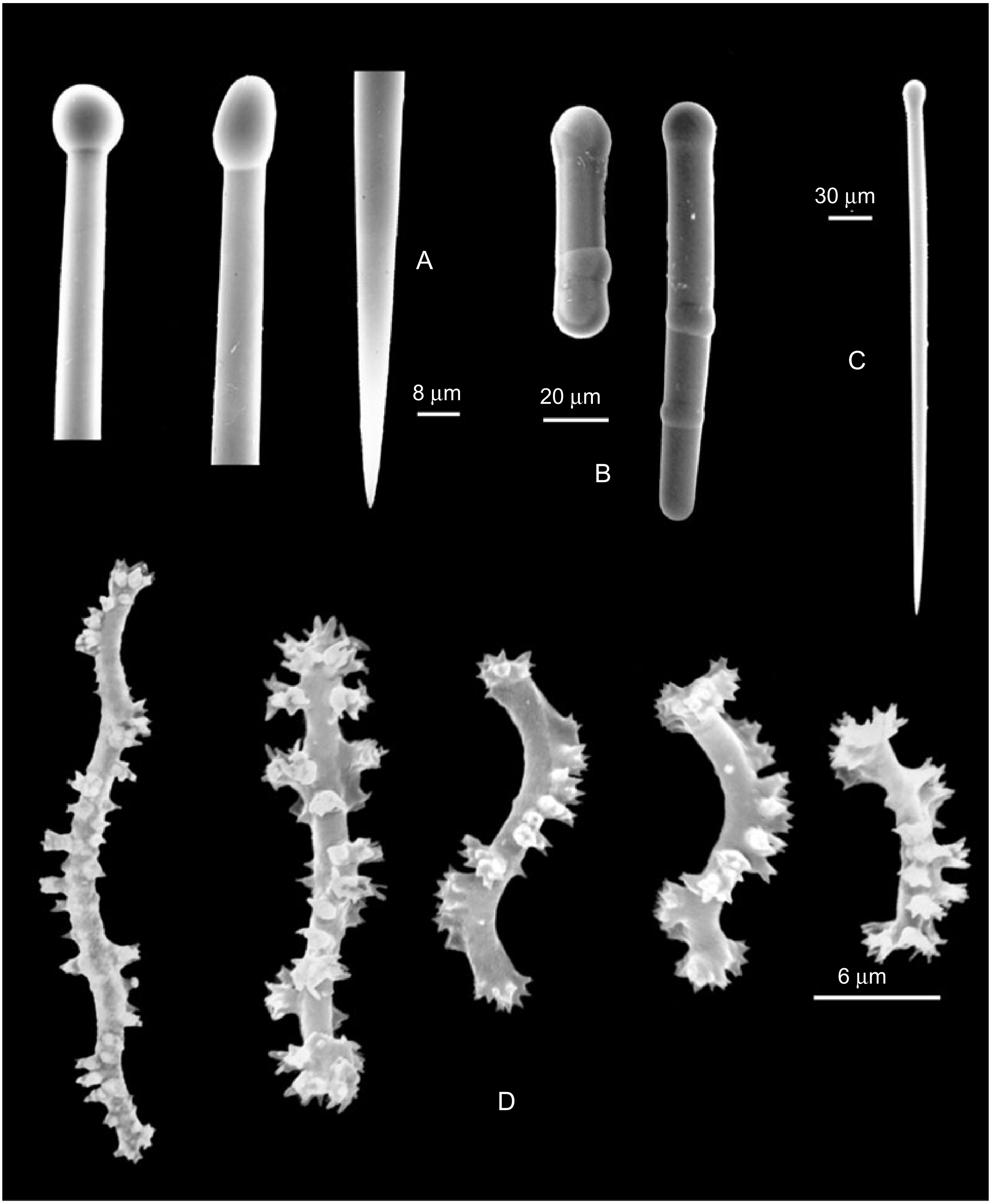

Figure 10. *Cliona raromicrosclera* **comb. nov.**: A, heads and tip of the tylostyles; B, small tylostrongyles with secondary swelling; C, tylostyle; D, different forms of spirasters.

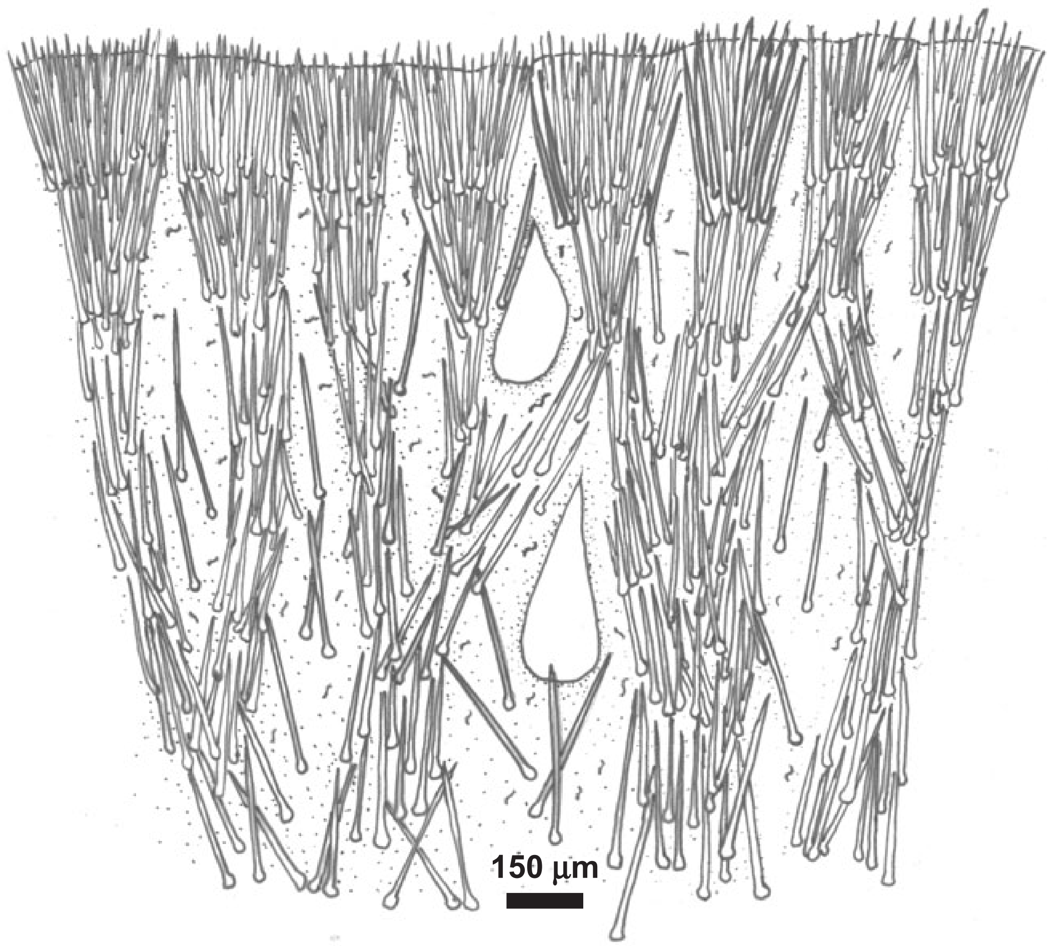

Figure 11. *Cliona raromicrosclera* **comb. nov.**: cross section of the body close to the surface.

a lot of localities along the Mexican Pacific Ocean, we have not found that species out of their typical area of distribution.

CLIONA AMPLICAVATA RÜTZLER, 1974 (FIGS 12, 13)

Synonymy: Cliona amplicavata Rützler, 1974: 26; *Cliona amplicavata* Rosell & Uriz, 2002: 68.

Material examined: MNCN-1.01/308, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 5 m depth, 19.ix.2001, boring into a bivalve shell (Arcidae). LEB-ICML-UNAM-89, Isla de la Peña (Guayabitos, Nayarit), 21°32′53″N–105°17′59″W, 14 m depth, 23.xi.1999. LEB-ICML-UNAM-103, Isla de la Peña (Guayabitos, Nayarit), 21°32′53″N–105°17′59″W, 14 m depth, 11.xi.1999. LEB-ICML-UNAM-201, Estero El Zacate (Los Mochis, Sinaloa), 25°36′25″N–109°04′33″W, 2 m depth, 21.vi.2000. LEB-ICML-UNAM-240, Isla Patos (Bahía de Ouhira, Topolobampo, Sinaloa), 25°37′12″N–109°00′56″W, 2 m depth, 22.vii.1999, on mollusc shell. LEB-ICML-UNAM-254, Isla de la Peña (Guayabitos, Nayarit), 21°32′53″N–105°17′59″W, 14 m depth, 23.vii.2000. LEB-ICML-UNAM-286, Ensenada de Bacochibampo (Guaymas, Sonora), 27°54′37″N–110°57′12″W, 5 m depth, 06.xi.2000, boring into a bivalve shell. LEB-ICML-UNAM-290, Isla El León Echado (Guaymas, Sonora), 27°55′34″N–110°57′12″W, 17 m depth, 06.xi.2000. LEB-ICML-UNAM-319, Isla Peruano (Guaymas, Sonora), 27°54′35″N–110°58′17″W, 15 m depth, 03.xi.2000. LEB-ICML-UNAM-348, Punta Cazón (Kino, Sonora), 28°52′20″N–112°02′01″W, 2 m depth, 28.iv.2001. LEB-ICML-UNAM-365, Isla Lobos 1 (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 5 m depth, 19.ix.2001, boring into an Arcidae bivalve shell. LEB-ICML-UNAM-461, Isla Redonda (Islas Marietas, Nayarit), 20°42′04″N–105°33′89″W, 10 m depth, 05.iv.2002. LEB-ICML-UNAM-484, Antiguo Corral del Risco (Punta de Mita, Nayarit), 20°46′20″N–105°32′49″W, 4 m depth, 06.iv.2002. LEB-ICML-UNAM-582, Tecuchitan (Bahía de Banderas, Nayarit), 20°43′54″N–105°24′44″W, 10 m depth, 05.x.2002.

LEB-ICML-UNAM-598, Isla redonda (Islas Marietas, Nayarit), 20°42′04″N–105°33′89″W, 9 m depth, 05.iv.2002, near the entrance of a small cave.

Description: Species found growing in alpha stage (Fig. 12A). Papillae are regularly distributed on the surface, circular in form, and protruding 0.1–0.5 mm from the substrate. Papillary fusion is not frequent. The ostial papillae are 1.45–3.5 mm in diameter, and are more abundant than oscular papillae (0.2–0.7 mm in diameter). Colour alive is bright yellow.

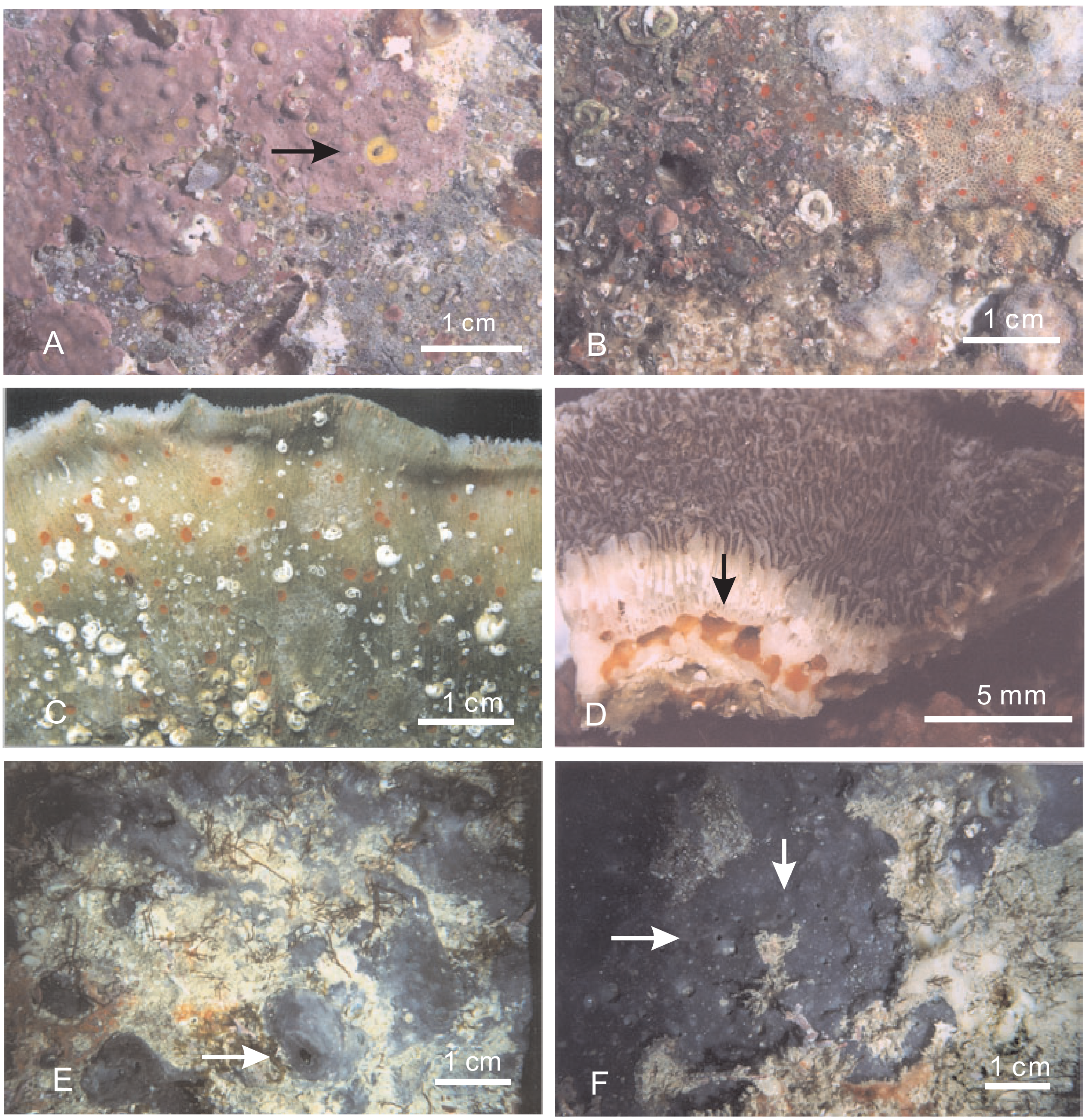

Figure 12. External morphology of A, *Cliona amplicavata*. The arrow shows an oscule. B, *Pione mazatlanensis* boring into different calcareous material. C, *Cliona vermifera* boring into the coral *Pavona gigantea*. The papillae are only visible in the base of the coral. D, Excavating pattern of the papillae can be observed after breaking a fragment of the coral. E, ***Spheciospongia incrustans* sp. nov.** at 5 m depth; the arrow shows an oscule. F, ***Spheciospongia incrustans* sp. nov.**; the arrows show the pore sieves.

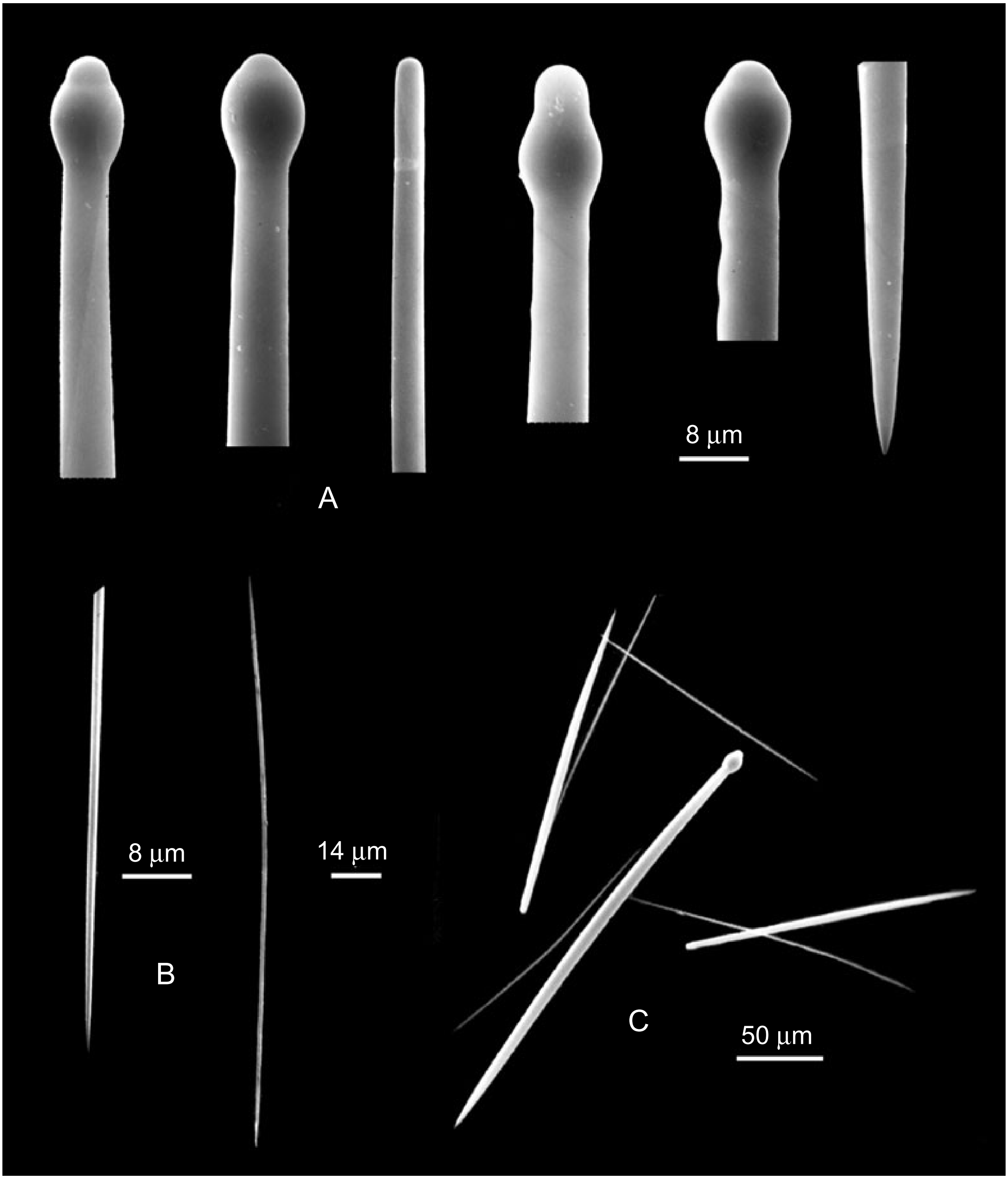

Figure 13. *Cliona amplicavata*: A, mucronated heads and tip of the tylostyles – in some specimens there is a small percentage of styles; B, rhaphide and its magnification; C, tylostyles, styles and rhaphides.

Skeletal characters: The species presents tylostyles and rhaphides (Fig. 13). The tylostyles are usually curved, with the shaft slightly bent in the upper third. They measured 266 × 7 μm on average. The heads are typically mucronated (8.5 μm in average). In some specimens there is a small percentage of styles. The rhaphides are slender and slightly curved in the middle (Table 5).

Table 5. Comparative data for the spicule dimensions (in μm) of *Cliona amplicavata* specimens. Values in parentheses are means

Specimens	Tylostyles	Styles	Rhaphides
	Length × width shaft; width head	Length × width shaft	Length
LEB-ICML-UNAM-89	165–(251.5)–285 × 3.8–(7)–10; 3.8–(8.8)–12.5		80–(95)–110
LEB-ICML-UNAM-103	140–(257)–305 × 3.8–(7.3)–10; 5–(9.6)–12.5		85–(93)–100
LEB-ICML-UNAM-201	200–(273)–315 × 3–(7)–9; 6–(8.7)–10.5		120–(133.3)–142.5
LEB-ICML-UNAM-240	160–(240)–300 × 2.5–(6)–7.5; 5–(8)–10		112.5–(125)–142.5
LEB-ICML-UNAM-254	180–(249.8)–322.5 × 2.5–(7)–8.8; 5–(7.8)–10		80–(95.8)–132.5
LEB-ICML-UNAM-286	131.3–(248.6)–307.5 × 1.3–(6.7)–10; 2.5–(7.4)–12.5	162–(172.6)–197.5 × 3.8–(4.1)–5	80–(92)–112.5
LEB-ICML-UNAM-290	150–(268)–350 × 3.8–(9.2)–12.5; 3.8–(9.9)–12.5		80–(93)–105
LEB-ICML-UNAM-319	165–(258.8)–325 × 2.5–(8.5)–12.5; 6.3–(9)–12.5		90–(106)–117.5
LEB-ICML-UNAM-348	155–(271.3)–357 × 2.5–(7.3)–10; 3.8–(8)–12.5	150–(169)–185 × 3.8–(4.1)–5	92–(101.8)–110
LEB-ICML-UNAM-365	152.5–(257.3)–342.5 × 3.8–(7.4)–10; 3.8–(9.9)–15	140–(154.5)–162.5 × 3–(4)–5	137.5–(154.3)–182.5
LEB-ICML-UNAM-461	172–(253.3)–295 × 2–(5.8)–7.5; 3–(7)–10		82.5–(112.5)–137.5
LEB-ICML-UNAM-484	145–(197.3)–245 × 1.3–(4.4)–5; 3.8–(6.5)–7.5		87.5–(120.3)–140
LEB-ICML-UNAM-582	240–(271.5)–290 × 5–(6.5)–7.5; 6.3–(7.5)–8.8		97.5–(117.5)–147.5
LEB-ICML-UNAM-598	180–(216)–302.5 × 5–(7.1)–10; 5–(8.4)–10	130–(164.8)–180 × 2.5–(4.1)–5	87.5–(96.8)–110

Distribution: Caribbean (Rützler, 1974), Mediterranean Sea (Rosel & Uriz, 2002), and east Pacific Ocean (present study).

Remarks: Four *Cliona* species with rhaphides are currently known: *C. radiata* Hancock, 1849; *C. linearis* Sollas, 1878, *C. raphida* Boury-Esnault, 1973, and *C. amplicavata* Rützler, 1974. *Cliona radiata* Hancock, 1849 (originally described without rhaphides), and *C. linearis* Sollas, 1878 were synonymized with *C. celata* by Topsent (1900). However, Rützler & Stone (1986) found rhaphides in *C. radiata* after revision of the type material and considered it a good species. In the same way, Dendy (1921) suggests the possibility that *C. linearis* is a species different from *C. celata*. The other species with rhaphides, *C. raphida* Boury-Esnaut, 1973, was described from a unique specimen in the Atlantic coast of South America, and we do not know of any record after that. However, *Cliona raphida* has tylostyles similar in size (260–355 × 6–9 μm), but smaller rhaphides (32–62 × 0.5 μm) than *C. amplicavata. Cliona amplicavata* was described in the Caribbean by Rützler (1974), and later cited in the Mediterranean Sea by Rosell & Uriz (2002), who considered this species to be a synonym of *C. linearis*. However, these authors considered *C. linearis* as a *nomen dubium*, giving validity to *C. amplicavata*. Our specimens are in perfect agreement with the Caribbean specimens in form, size of the tylostyles (190–290 μm in length and 5–8 μm in width) and rhaphides (117–150 μm), and in the sporadic presence of small styles (Rützler, 1974). In contrast, the Mediterranean specimens have larger tylostyles (230–460 in length and 6–12 μm in width) and rhaphides (125–250 μm), and the small styles are not present.

Besides these species, specimens with rhaphides assigned to *C. celata* are known in the Indian Ocean (Dendy, 1921; Topsent, 1932; Thomas, 1973), Gulf of Mexico (Topsent, 1887), and off Australia (Schönberg, 2000); these would need to be reviewed to clarify their taxonomic status.

CLIONA FLAVIFODINA RÜTZLER, 1974
(FIGS 14, 15)

Synonymy: Cliona flavifodina Rützler, 1974: 9.

Material examined: MNCN-1.01/309, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 5 m depth, 24.iv.2003. LEB-ICML-UNAM-373, Punta Chile (Mazatlán, Sinaloa), 23°12′29″N–106°25′40″W, intertidal, 08.x.2001. LEB-ICML-UNAM-376, Cerritos 2 (Mazatlán, Sinaloa), 23°18′51′N–106°29′31′W, 1.5 m depth, 10/15/01. LEB-ICML-UNAM-555, Isla Lobos 1 (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 5 m depth, 24.iv.2003. LEB-ICML-UNAM-654, Isla Pájaros (Mazatlán, Sinaloa), 23°15′29″N–106°28′25″W, 5 m depth, 31.x.2002. LEB-ICML-UNAM-912, Isla Lobos 2 (Mazatlán, Sinaloa), 23°13′27.7″N, 106°28′01.6″W, 7 m depth, 03.x.2003.

Description: This species tends to overgrow the substrate, covering a maximum surface of 8 × 14 cm (Fig. 14A, B). The papillae (oscular and inhalant) are scarce and irregularly distributed over the surface. They are well-spaced (from 0.25 to 1.6 cm apart), measuring from 1.4 to 5 mm in diameter, and without a tendency to fuse. They are mainly circular, and when the sponge is alive the papillae protrude on the substrate from 1.5 to 5 mm. The colour is commonly purple brown, although golden-yellow specimens also appear. The choanosome is yellowish brown; after fixation the surface and choanosome turn brownish.

Skeletal characters: Species having tylostyles and spirasters (Fig. 15). The tylostyles are mostly straight or slightly bent, with the shaft characteristically widest near the midregion. The point is sharp. They measure 295 × 7.5 μm on average. The heads are well set off and usually spheroid (average 10.8 μm) (Table 6). The spirasters (average 35 μm) are very characteristic, with three or four bends and with few and slender prominent spines. The actins are robust, single or bifurcated, and end in a sharp point. Tylostyles are in loose bundles in the choanosome. In the ectosome, the tylostyles form a compact palisade.

Distribution: The species was described from Bermuda (Caribbean Sea) (Rützler, 1974). This constitutes the first record from the Pacific Ocean, and it is the second time that the species has been found. It is distributed from the intertidal zone to 12 m depth, on dead corals, pelecypod shell and rocks. The species has been found alive in the intertidal zone during low tide.

Remarks: Our specimens agree with the description of *Cliona flavifodina* in Bermuda by Rützler (1974). However, they differ in the shape of the tylostyle heads, which are mainly rounded in the Pacific specimens and droplet-shaped or ovoid in the Caribbean, sometimes with secondary swellings. Moreover, the

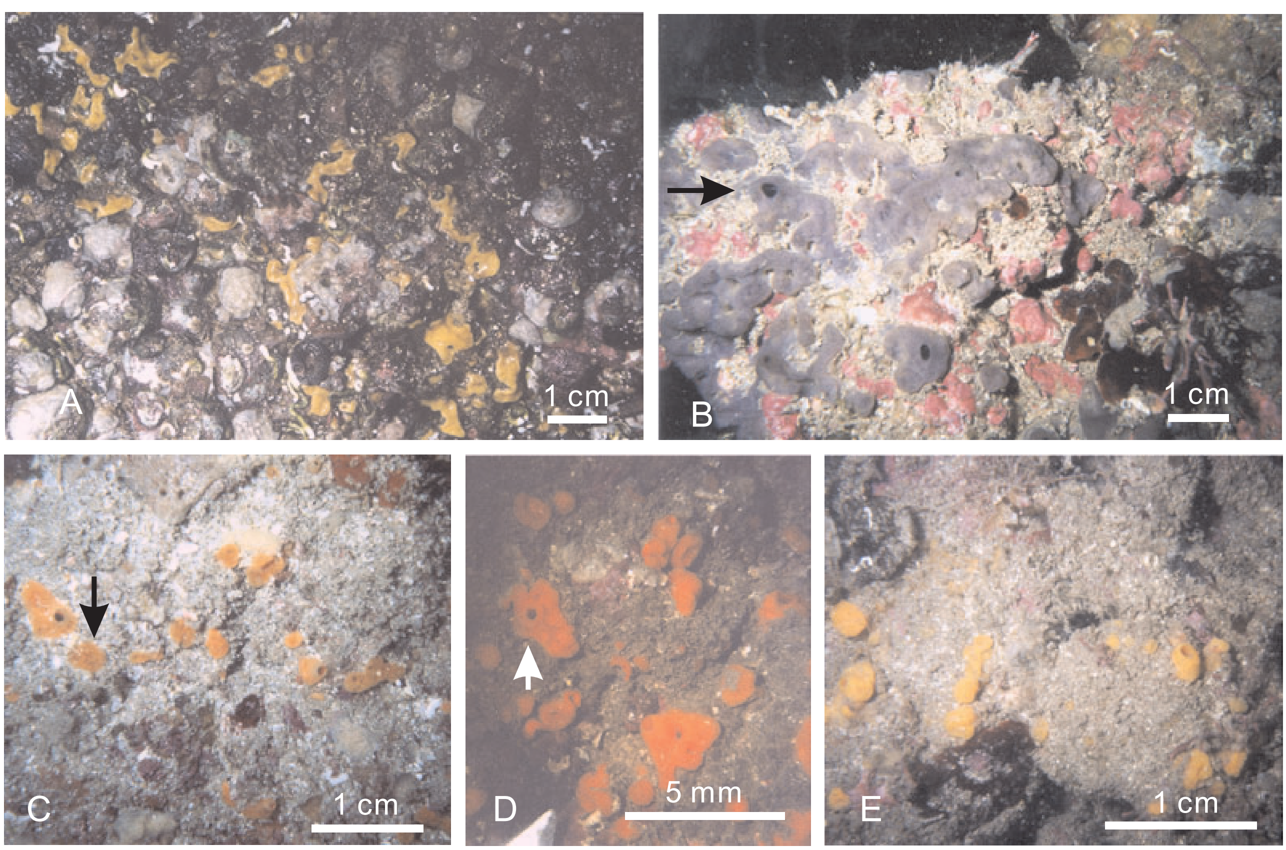

Figure 14. External morphology of A, *Cliona flavifodina*; yellow specimen living in a small intertidal cornice. B, *Cliona flavifodina* at 5 m depth; arrow shows an oscule. C, *Cliona euryphylla*; Light orange specimen growing in alpha stage. Arrow shows ostial papillae. D, Orange *Cliona euryphylla* specimen; the arrow shows an ostial papillae surrounded by a patch of ectosomal tissue. E, *Cliona euryphylla*; light orange specimen growing in alpha stage at 6 m depth. Arrow shows an ostial papillae.

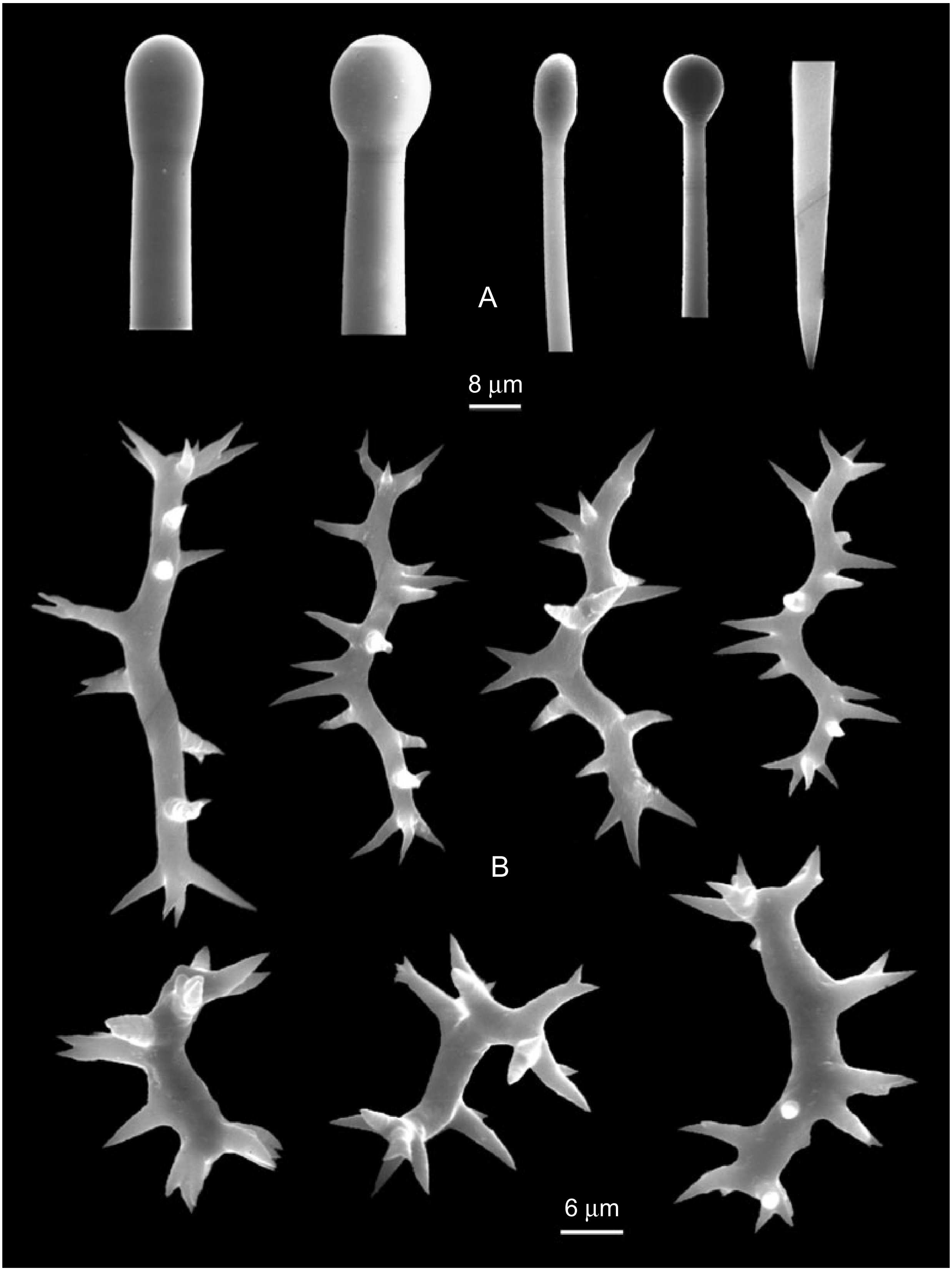

Figure 15. *Cliona flavifodina*: A, heads and tip of the tylostyles; B, different forms of spirasters.

Table 6. Comparative data for the spicule dimensions (in µm) of *Cliona flavifodina* specimens. Values in parentheses are means

	Tylostyles	Spirasters
Specimens	Length × width shaft; width head	Length
LEB-ICML-UNAM-373	207.5–(247)–367 × 5–(7.8)–10; 5–(10.8)–15	17.5–(28.9)–65
LEB-ICML-UNAM-376	175–(268)–360 × 5–(7.2)–10; 7.5–(10.7)–12.5	27.5–(47.3)–75
LEB-ICML-UNAM-555	175–(321.5)–415 × 1.3–(8.8)–12.5; 3.8–(11)–15	22.4–(31.3)–42.5
LEB-ICML-UNAM-654	200–(341.3)–417 × 2.5–(5.9)10; 5–(10.4)–12.5	20–(29.5)–40

spirasters have singular spines in the Caribbean but they can bifurcate in the Pacific specimens. *Cliona aprica* Pang, 1973 from Jamaica is another similar brown-black sponge with a tendency to overgrow the substrate. However, the spirasters in this species possess shorter spines (1–2 µm in length), and they are located mainly in the convex side of the axis of the spiraster. *Cliona langae* Pang, 1973 has spirasters with rather widely spaced spines like *C. flavifodina*, and they also tend to overgrow the substrate completely (Pang, 1973). However, this species differs from *Cliona flavifodina* in spicular dimensions and in the form and spination of the spirasters. Recently, *C. langae* and *C. aprica* have been synonymized with *C. caribbaea* by Rützler (2002b).

Cliona euryphylla Topsent, 1887 (Figs 14, 16, 17)

Synonymy: Cliona euryphylla Topsent, 1887: 82; *Cliona euryphylla* de Laubenfels, 1954: 218; *Cliona euryphylla* Bergquist, 1968: 30.

Material examined: MNCN-1.01/310, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 09.v.2003. LEB-ICML-UNAM-123, Cerritos (Mazatlán, Sinaloa), 23°18′27″N–106°29′25″W, Intermareal, 18.ii.2000, on rocks. LEB-ICML-UNAM-276, Isla San Pedro Nolasco (Sonora), 27°57′24″N–111°22′34″W, 20 m depth, 15.xi.2000. LEB-ICML-UNAM-313, 02/20/01, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 20.ii.2001. LEB-ICML-UNAM-323, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 20.ii.2001. LEB-ICML-UNAM-355, Cerritos 2 (Mazatlán, Sinaloa), 23°18′51′N–106°29′31′W, 1.5 m depth, 28.v.2001. LEB-ICML-UNAM-366, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 6 m depth, 18.ix.2001. LEB-ICML-UNAM-431, Isla Pájaros (Mazatlán, Sinaloa), 23°15′29″N–106°28′25″W, 4 m depth, 15.ii.2002. LEB-ICML-UNAM-443, Antiguo muelle de atraque (Mazatlán, Sinaloa), 23°11′57″N–106°25′15″W, 4 m depth, 24.i.2002. LEB-ICML-UNAM-445, Isla Pájaros (Mazatlán, Sinaloa), 23°15′29″N–106°28′25″W, 4 m depth, 26.ii.2002. LEB-ICML-UNAM-481, Careyeros (Punta Mita, Nayarit), 20°47′13″N–105°71′13″W, 4 m depth, 6.iv.2002. LEB-ICML-UNAM-498, Los arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 4 m depth, 04.viii.2002. LEB-ICML-UNAM-521 Playa los Muertos (Sayulita, Nayarit), 20°52′29 N-105°26′72″, 5 m depth, 04.ix.2002. LEB-ICML-UNAM-522, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 2 m depth, 10.iv.2002. LEB-ICML-UNAM-592, Tecuchitan (Bahía de Banderas, Nayarit), 20°43′54″N–105 24′44″W, 10 m depth, 05.x.2002. LEB-ICML-UNAM-625, Conchas Chinas (Puerto Vallarta, Jalisco), 20°35′16″N–105°14′42″W. 2 m depth, 08.x.2002. LEB-ICML-UNAM-641, Playa los Muertos (Sayulita, Nayarit), 20°52′29 N-105°26′72″, 8 m depth, 09.x.2002. LEB-ICML-UNAM-433, Isla Pájaros 1(Mazatlán, Sinaloa), 23°15′29″N, 106°28′25″W, 10 m depth, 15.ii.2002. LEB-ICML-UNAM-854, Majahuita (Jalisco), 20°29′6.66″N, 105°35′3.42″W, 7 m depth, 08.vi.2003. LEB-ICML-UNAM-914, Isla Lobos 2 (Mazatlán, Sinaloa), 23°13′27.7″N, 106°28′01.6″W, 7 m depth, 03.x.2003. LEB-ICML-UNAM-959, Isla Hermano Norte (Mazatlán, Sinaloa), 23°10′59″N, 106°26′24.1″W, 8 m depth, 24.x.2003. LEB-ICML-UNAM-1010, Cerro de la Cruz (Isla Isabel), 21°50′32″N–105°52′58″W, 13 m depth, 11.xii.2003.

Description: The most characteristic trait of this species is that papillae are surrounded by and connected with patches of ectosomal tissue. The sponge typically grows in alpha stage, but it is able to spread over the substratum by lateral growth of the ectosome next to the papillae, reaching a beta stage (from 1 to 3 mm thick) (Fig. 14C, D, E). The size of the specimens reaches up to 12 × 23 cm coverage. Specimens growing in beta stage are very irregular in form. Fusions between papillae are not common. The papillae can be circular and oval, from 3 to 6 mm in diameter, and they can protrude over the substrate up to 3 mm in a live sponge. They are very irregularly distributed, and can be spaced up to 12 mm. Oscules are usually circular, up to 2 mm in diameter, and can protrude over the substrate up to 5 mm. The consistency is firm. The papillae range from yellow to light orange in life, and turn pale in alcohol. The orange colour is more typical in the beta specimens.

Skeletal characters: The megascleres are tylostyles, each with well-formed rounded head (Fig. 16A, D). They measure 249 × 7.3 μm on average (9.7 μm head width) (Table 7). The microscleres are short, stout spirasters, with many heavy spines uniformly distributed along the shaft (Fig. 16B, E). Short amphiasters sometimes appear. The mean length of the spirasters is 18 μm. The skeleton has the typical arrangement of *Cliona* species, with a palisade of tylostyles in the periphery of the sponge, and tylostyles in disorganized bundles in the choanosome (Fig. 17). Sometimes tylostyles are disposed in tangential form in the ectosome. Differences in the skeletal characters were not found between the orange and yellowish specimens.

Distribution: Gulf of Mexico (Atlantic Ocean) (Topsent, 1887), New Zealand (Bergquist, 1968), central Pacific (de Laubenfels, 1954). On rocks, boring into shells of bivalves, etc. These are the first records in the east Pacific.

Remarks: Cliona euryphylla is included in the group of *Cliona* species with thick and short spirasters like the species *C. chilensis* Thiele, 1905, *C. burtoni* Topsent, 1932 and *C. aethiopicus* Burton, 1932; which are considered conspecific species by de Laubenfels (1954). We agree with Bergquist (1968) and consider the four species valid on the basis of different characteristics, mainly the spiraster sizes (Thiele, 1905; Burton, 1932). *Cliona euryphylla* Topsent (1887) was described in Campeche (Gulf de Mexico) in the Atlantic coast, and later was cited by de Laubenfels (1954) in the central Pacific, and by Bergquist (1968) in New Zealand. De Laubenfels (1954) and Bergquist (1968) mistakenly thought that Topsent (1887) had described this species in the eastern Pacific Ocean. However the measurements given by Bergquist (1968) are larger (344 × 12.5 μm) than our specimens which match very well with the tylostyle measurements given by Topsent (300 × 5 μm), and by de Laubenfels (300 × 7 μm). The spirasters of our specimens are also smaller than those from Bergquist (24 × 6.3 μm) and Topsent (35 × 5 μm). The closest species is *Cliona dioryssa* (de Laubenfels, 1950), which has two types of spirasters: stout spirasters with a thick shaft densely set with large, strong spines, most of which are joined at the base, and more delicate spirasters with a long, slender shaft and small spines, which are usually well spaced (Rützler, 1974). However, the SEM shows different fine details in the spiraster types, and in the size, which is slightly smaller in *C. euryphylla*.

Two different expressions of colour are found in *C. euryphylla*; however, the morphology and size of the spicules are very similar in the two forms.

Table 7. Comparative data for the spicular dimensions (in μm) of *Cliona euryphylla* specimens. Values in parentheses are means

	Tylostyles	Spirasters
Specimens	Length × width shaft; head width	Length
Orange specimens		
LEB-ICML-UNAM-123	180–(277)–367.5 × 2.5–(5.5)–10; 5–(9.1)–15	10–(15)–29
LEB-ICML-UNAM-276	115–(240.5)–325 × 3.8–(8.1)–11.3; 5–(10.8)–15	10.5–(18.4)–25
LEB-ICML-UNAM-313	130–(293)–317.5 × 5–(7.6)–10; 7.5–(11.2)–13.8	8.8–(20)–27.5
LEB-ICML-UNAM-431	135–(243)–325 × 2.5–(6.7)–8.8; 5–(9)–13	10–(21.5)–30
LEB-ICML-UNAM-498	137.5–(225)–307.5 × 3.8–(7)–10; 5.5–(9)–12.5	15–(22.3)–27.5
LEB-ICML-UNAM-521	130–(214.8)–320 × 3.8–(6.8)–10 × 5–(9.5)–12.5	15–(21)–27.5
LEB-ICML-UNAM-522	150–(243.8)–317.5 × 2.5–(5.9)–10; 5–(8.4)–12	10–(14.8)–20
LEB-ICML-UNAM-592	150–(274.5)–317.5 × 3.8–(7.6)–10; 5–(10.5)–12.5	10–(15.4)–27.5
LEB-ICML-UNAM-625	145–(218.8)–295 × 3.8–(5.6)–10; 5–(7.9)–12.5	10–(16.1)–23
LEB-ICML-UNAM-641	137.5–(248.8)–332.5 × 2.5–(6.4)–8.8; 5–(9.9)–11.3	10–(16.6)–22.5
Yellow specimens		
LEB-ICML-UNAM-323	157–(252.3)–320 × 1.3–(6.8)–10; 5–(10.8)–12.5	10–(18.9)–27.5
LEB-ICML-UNAM-355	152.5–(268)–365.5 × 5–(7.8)–10; 7.5–(10)–12.5	10–(18.4)–26.3
LEB-ICML-UNAM-366	142–(244)–347.5 × 3.8–(7.8)–10; 6.3–(10.1)–16.3	4.5–(19.8)–30
LEB-ICML-UNAM-443	125–(241.8)–317.5 × 3–(6.6)–10; 5–(9)–12.5	10–(19.3)–25
LEB-ICML-UNAM-445	145–(250)–360 × 3.8–(6.6)–8; 5–(10)–12.5	13–(17)–25
LEB-ICML-UNAM-481	137.5–(244.5)–325 × 5–(6.3)–7.5; 7.5–(9.6)–12.5	10–(16.6)–22.5

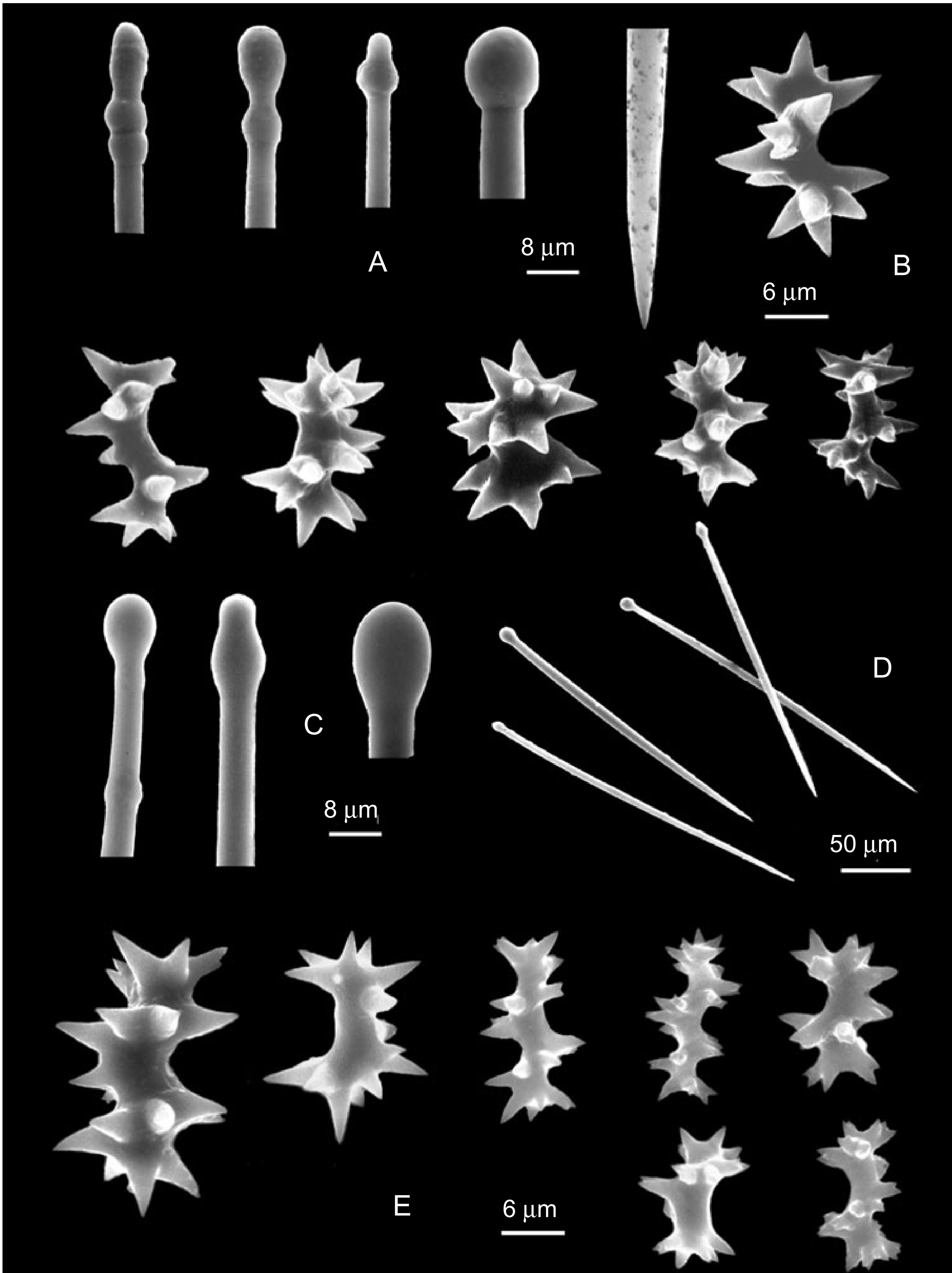

Figure 16. *Cliona euryphylla*: A, heads and tip of the tylostyles; B, spirasters and D, tylostyles from orange specimens; C, heads and E, spirasters from yellow specimens.

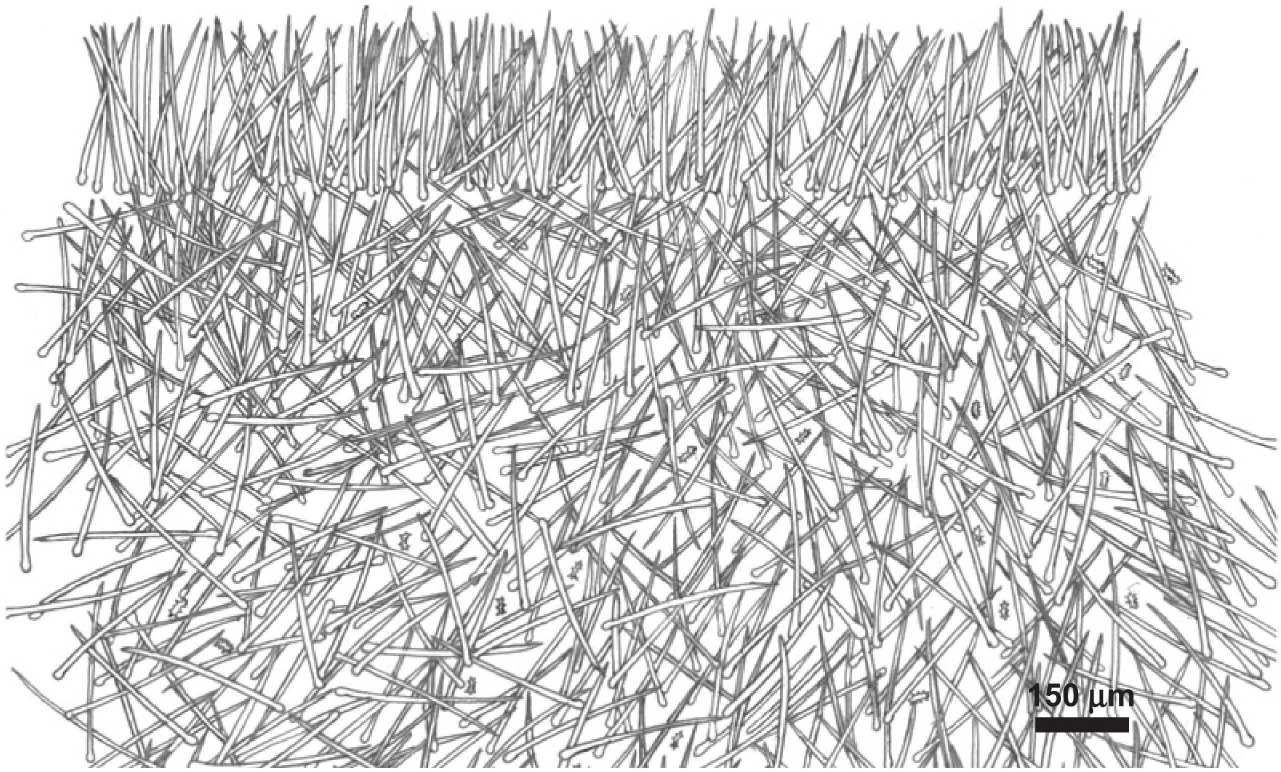

Figure 17. *Cliona euryphylla*: Cross section of the body close to the surface.

CLIONA VERMIFERA HANCOCK, 1867 (FIGS 12, 18)

Synonymy: Cliona vermifera Hancock, 1867: 239; *Bernatia vermifera* Rosell & Uriz, 1997: 352.

Material examined: MNCN-1.01.311 Antiguo Corral del Risco (Punta de Mita, Nayarit), 20°46′20″N–105°32′49″W, 4 m depth, 06.iv.2002, on dead coral. LEB-ICML-UNAM-364, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 2 m depth, 23.i.2001, on dead coral. LEB-ICML-UNAM-470, Careyeros (Punta Mita, Nayarit), 20°47′13″N–105°71′13″W, 4 m depth, 06.iv.2002, on dead coral. LEB-ICML-UNAM-477, Antiguo Corral del Risco (Punta de Mita, Nayarit), 20°46′20″N–105°32′49″W, 4 m depth, 06.iv.2002, boring into dead coral. LEB-ICML-UNAM-800, Isla Redonda (Islas Marietas, Nayarit), 20°42′04″N–105°33′89″W, 14 m depth, 10.vi.2003, boring into coral *Pavona gigantea*. LEB-ICML-UNAM-807, Isla Redonda (Marietas, Nayarit), 20°42′04″N, 105°33′89″W, 12 m depth, 10.iv.2003, boring into dead coral. LEB-ICML-UNAM-847, Majahuita (Jalisco), 20°29′6.66″N, 105°35′3.42″W, 10 m depth 08.vi.2003. LEB-ICML-UNAM-857, Antiguo Corral del Risco (Punta Mita, Nayarit), 20°46′20″N–105°32′49″W, 3 m depth 06/08/03. LEB-ICML-UNAM-865, Chacala (Nayarit), 21°09′57″N–105°13′38″W, 4 m depth, 12.vi.2003. LEB-ICML-UNAM-1016, Cerro de la Cruz (Isla Isabel), 21°50′32″N–105°52′58″W, 13 m depth, 11.xii.2003. LEB-ICML-UNAM-1040, Las Monas (Isla Isabel), 21°50′58″N–105°52′46″W, 6 m depth, 10.xii.2003. LEB-ICML-UNAM-1049, Punta Bobo (Isla Isabel), 21°50′35″N–105°52′44″W, 12 m depth, 9.xii.2003. CNPGG-666, Manzanillo (Zihuatanejo, Guerrero), 17°37′0″N–101°31′0″W, 3.5 m depth, 05.iii.1982. CNPGG-667, Contramar (Zihuatanejo, Guerrero), 17°35′0″N–101°32′0″W, 6 m depth, 17.viii.1982. CNPGG-672 (Guerrero), 17°54′24″N–101°53′42″W, 10 m depth, 13.ii.1982.

Description: Boring sponge in alpha stage, covering a maximum surface of 8 × 11 × 6 cm. Papillae are very small (Fig. 12C, D). Their shape is circular, from 0.3 to 1.2 mm, or oval, from 0.6 to 1.5 mm in diameter. They are regularly distributed, lying 0.1–6.5 mm apart. No fusion tendency was observed. Oscules have not been observed. Colour is orange in life, beige in alcohol.

Skeletal characters: The species have tylostyles and 'smooth spirasters' (Fig. 18). The tylostyles are mostly straight with spheroid heads, sometimes mucronated, with hastate or acerate ends. They measure 201 × 6 μm on average (8.8 μm head width) (Table 8). The microscleres are smooth, spiral or

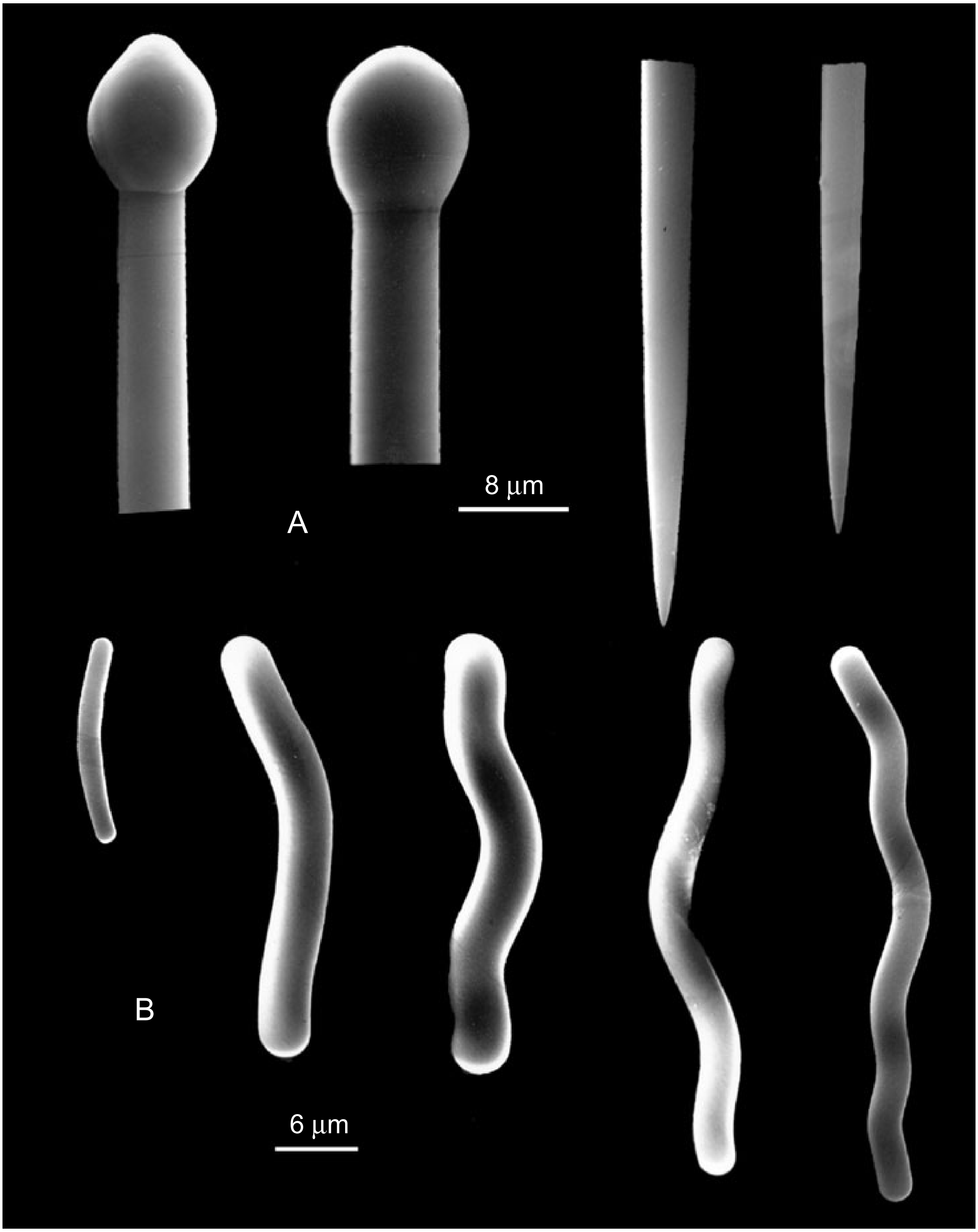

Figure 18. *Cliona vermifera*: A, heads and tips of the tylostyles; B, smooth spirasters.

undulated rods, with 2–4 bends and obtuse extremities. Ectosomal arrangement of tylostyles in a palisade, accompanied along the shafts by intermingled spirasters.

Distribution: Mediterranean Sea (Vosmaer, 1933; Volz, 1939), east Atlantic Ocean (Carballo *et al*., 1994), Caribbean (Topsent, 1889; Hechtel, 1965; Rützler, 1974), east Pacific Ocean (Salcedo *et al*., 1988), Indian

Table 8. Comparative data for the spicular dimensions (in μm) of *Cliona vermifera* specimens. Values in parentheses are means

Specimens	Tylostyles	Spirasters
	Length × width shaft; head width	Length × width
LEB-ICML-UNAM-364	135–(219)–275 × 1.3–(5.8)–8.8; 5–(8.3)–12.5	30–(48)–70 × 2.5–(5.4)–7.5
LEB-ICML-UNAM-470	107.5–(166.3)–225 × 2–(3.4)–5; 5–(6.1)–7.5	20–(45.5)–57.5 × 1.3–(2)–2.5
LEB-ICML-UNAM-477	160–(223)–265 × 6.3–(7)–10; 10–(10.8)–12.5	37.5–(50.3)–65 × 2.5–(5.7)–9
CNPGG-666	105–(216)–258 × 4.5–(5.9)–6.75; 4.9–(9)–10.5	19.5–(42)–48 × 3–(4.5)–6
CNPGG-672	157–(184)–280 × 5–(8.2)–9; 7.5–12	27–(31.8)–52 × 3–(4.5)–6

Ocean (Topsent, 1932). Mexican Pacific: Nayarit, Jalisco and Guerrero State (present study). There is a high incidence of the species in corals of the species *Pavona gigantea*. More than 70% of the specimens of this coral were found with *C. vermifera* (Fig. 12D).

Remarks: Volz (1939) and later Carballo *et al*. (1994) mistakenly thought that Carter (1882) had cited the species *C. vermifera* in Acapulco (México) in the eastern Pacific Ocean. However, the only previous register of *C. vermifera* in the eastern Pacific Ocean is from Salcedo *et al*. (1988) in Guerrero (Mexico).

Rosell & Uriz (1997) erected the genus *Bernatia* to harbour *Cliona* species with two size classes of tylostyles. However, this character could be insufficient to justify the formation of a new genus, because the presence of two size classes of tylostyles seems to appear in different boring sponge genera (Schönberg, 2000). We accept the concept of the genus *Cliona sensu* Rützler (2002a) considering *Bernatia* a synonym of *Cliona* until the true importance of this character can be conveniently evaluated.

PIONE GRAY, 1867

Synonymy: see Rützler (2002a)

Type species: *Cliona northumbrica* Hancock, 1849

Diagnosis: Sponges in alpha and beta forms. Delicate tylostyles as megascleres accompanied by microspined (rarely smooth) microxea and microspined microrhabds as microscleres. Microrhabds are usually straight or bent but may also be centrotylote and sinuose. Microxeas do not have a particular location or orientation in the tissue (Rützler, 2002a).

PIONE CARPENTERI (HANCOCK, 1867) (FIG. 19)

Synonymy: Cliona carpenteri Hancock, 1867: 241; *Cliona bacillifera* Carter 1887: 76; *Pione carpenteri* Rosell & Uriz, 1997: 362.

Material examined: MNCN-1.01/306, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 5 m depth, 17.x.2001, boring into a shell of the bivalve *Crassostrea* sp. LEB-ICML-UNAM-375, Cerritos 2 (Mazatlán, Sinaloa), 23°18′51′N–106°29′31′W, 1.5 m depth, 15.x.2001, boring into a shell of *Crassostrea* sp. LEB-ICML-UNAM-379, Isla Pájaros (Mazatlán, Sinaloa), 23°15′29″N–106°28′25″W, 4 m depth, 18.x.2001, boring into a bivalve shell. LEB-ICML-UNAM-381, Isla Lobos (Mazatlán, Sinaloa), 23°13′49″N–106°27′43″W, 5 m depth, 17.x.2001, boring into a shell of *Crassostrea* sp. LEB-ICML-UNAM-856, Majahuita (Jalisco), 20°29′6.66″N, 105°35′3.42″W, 5 m depth, 08.vi.2003. LEB-ICML-UNAM-786, Antiguo muelle de atraque (Estero de Urías, Mazatlán, Sinaloa), 23°11′57″N, 106°25′15″W, 2 m depth, 09.v.2003.

Description: Boring sponge always growing in alpha stage. The species reaches a maximum surface of 3.3–5.5 cm^2. The inhalant papillae are circular, and very small in diameter (from 83 to 800 μm), making them very difficult to see *in situ*. They are 0.1–2.4 mm apart and evenly scattered on the entire surface. Oscules are circular, very small in size, from 33.2 to 132.8 μm in diameter. Papillae are never fused, and do not protrude. Sponge is very light orange in life, pale yellow in alcohol.

Skeletal characters: There are three types of spicules. (i) Straight tylostyles, with well-formed globular heads, sometimes with a small terminal knob, and gradually tapering to the end (Fig. 19A). They measure 171 × 4 μm on average (9.5 μm head width) (Table 9). (ii) Stout fusiform oxeas, finely microspined, straight or bent in the centre, where a nodule sometimes appears (on average 84 × 4 μm) (Fig. 19B, D). (iii) Straight microspined microrhabds, slightly fusiform, and characteristically with obtuse ends (average 12.6 μm) (Fig. 19C).

Distribution: Mazatlán (Sinaloa, México, east Pacific Ocean) (Hancock, 1867), Indian Ocean (Calcinai *et al*., 2000).

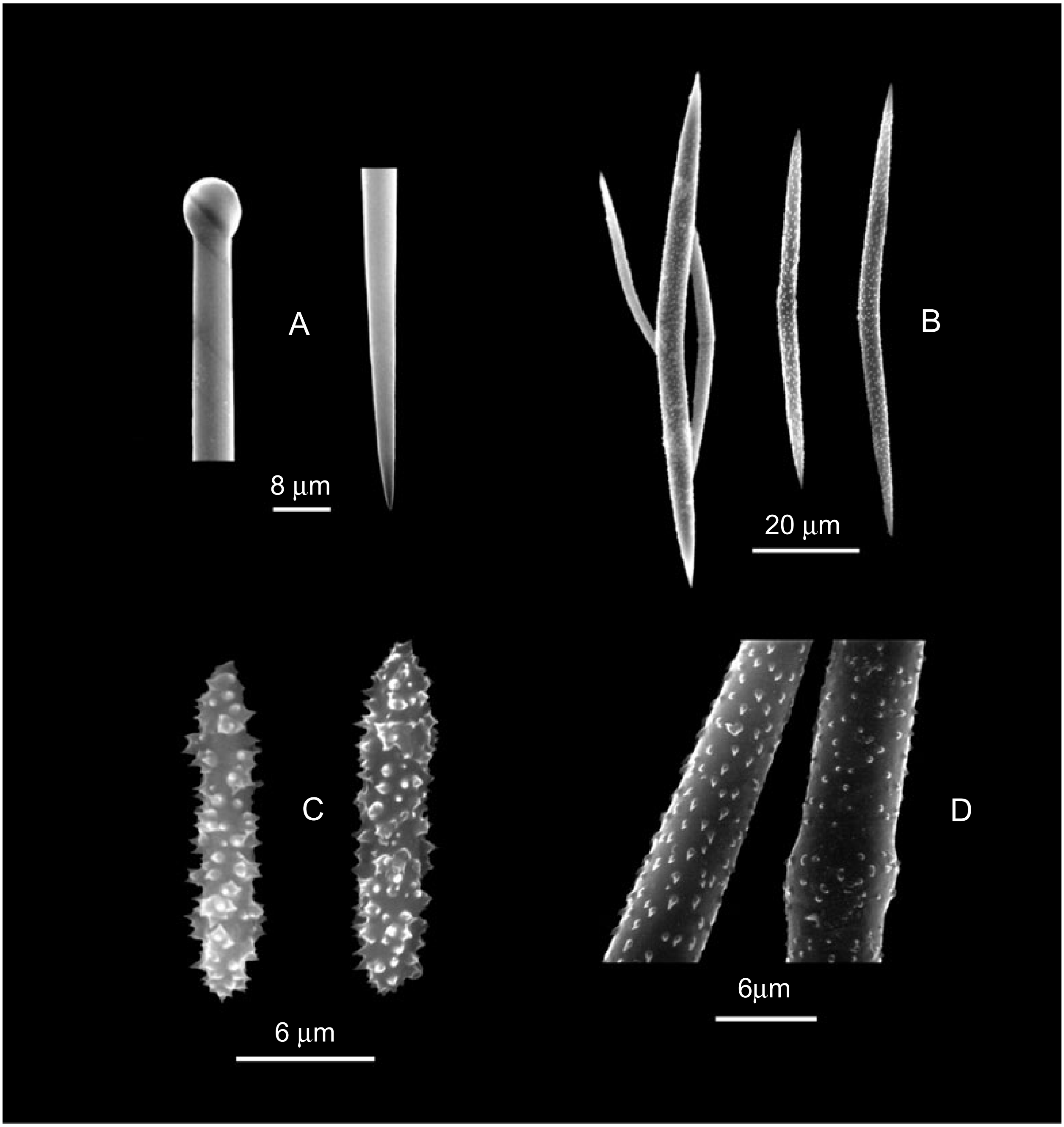

Figure 19. *Pione carpenteri*: A, head and tip of a tylostyle; B, oxeas with minute spines; C, straight microrhabds; D, detail of the ornamentation of the oxea.

Remarks: This is the second record in the east Pacific Ocean after its original description. Our specimens were collected in the type locality of Mazatlán (Sinaloa, Mexico), and they perfectly match with the original Hancock description. Along the Atlantic coast of South America specimens without microrhabds and with a violet colour have been cited, which must not be considered *Pione carpenteri* (Boury-Esnault, 1973 as *Cliona carpenteri*).

PIONE MAZATLANENSIS (HANCOCK, 1867)(FIG. 20)

Synonymy: Cliona mazatlanensis Hancock, 1867: 240.

Material examined: MNCN-1.01/307, Sta. Cruz

Table 9. Comparative data for the dimensions of the spicules (in μm) of *Pione carpenteri* specimens. Values in parentheses are means

	Tylostyles	Microspined oxeas	Spirasters
Specimens	Length × width shaft; head width	Length × width	Length
LEB-ICML-UNAM-375	177–(201)–227.5 × 2–(5)–7.5; 4.5–(7.5)–10	57.5–(86)–132.5 × 2–(5)–8.8	8–(11)–13
LEB-ICML-UNAM-379	115–(127)–145 × 1.3–(2.5)–3; 3.8–(4.3)–5	45–(65)–80 × 1.3–(3.6)–5	11.3–(14)–16.3
LEB-ICML-UNAM-381	105–(186)–267.5 × 2.5–(4.4)–5; 3.8–(6.5)–7.5	62.5–(102)–125 × 2.5–(4)–5	9.5–(13)–17.5

Table 10. Comparative data for the dimensions of the spicules (in μm) of *Pione mazatlanensis* specimens. Values in parentheses are means

	Tylostyles	Microspined oxeas	Microrhabds
Specimens	Length × width shaft; head width	Length × width	Length
LEB-ICML-UNAM-278	182.5–(212)–240 × 3.4–(4.8)–6.3 × 5–(7.1)–10	50–(92)–126.3 × 2.5–(5.1)–8.8	10–(12)–13.8
LEB-ICML-UNAM-370	180–(206)–215 × 2–(4.7)–5.6; 5.5–(7)–7.5	52–(74.6)–100 × 2.5–(4)–5	10–(14)–17
LEB-ICML-UNAM-372	145–(177)–215 × 2.5–(3.3)–4.5; 4.5–(5.5)–6.3	51.3–(81.9)–97.5 × 2.5–(3.5)–5	12.3–(13)17.5
LEB-ICML-UNAM-378	140–(215)–262.5 × 3.8–(4.8)–5.5; 5–(7.3)–10	62.5–(80.3)–92.5 × 3.8–(5.8)–8	10.5–(13)–15
LEB-ICML-UNAM-395	182.5–(203)–22.5 × 32.5–(3.1)–4.5; 3.8–(4.9)–5.5	72.5–(91.5)–110 × 2.5–(3)–3.8	8.8–(11)–12.5
LEB-ICML-UNAM-553	175–(200)–237.5 × 3.8–(4.6)–5; 5.3–(6.2)–7.5	62.5–(98)–115 × 2.5–(4.2)–5	10–(12)–13.8

Ensenada del Pabellon (Culiacán, Sinaloa), 22°7′33″N–107°18′37″W, 3 m depth, 06.vii.2002, boring into a bivalve shell (Veneridae). LEB-ICML-UNAM-278, Isla del Peruano (Bahía de Guaymas, Sonora), 27°54′35″N–110°58′17″W, 15 m depth, 03.xi.2000, boring into a bivalve shell (*Pinctada mazatlanica*). LEB-ICML-UNAM-370, Punta Chile (Mazatlán, Sinaloa), 23°12′29″N–106°25′40″W, 1.5 m depth, 08.viii.2001, boring into a bivalve shell (*Crassostrea* sp.). LEB-ICML-UNAM-372, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 1 m depth, 23.i.2001, boring into a serpulid polychaete. LEB-ICML-UNAM-378, Isla Pájaros (Mazatlán, Sinaloa), 23°15′29″N–106°28′25″W, 4 m depth, 18.x.2001, boring into a serpulid polychaete. LEB-ICML-UNAM-395, Punta Santiago (Manzanillo, Colima), 19°5′41″N–104°25′22″W 1.5 m, depth 16.xi.2001, boring into a bivalve shell (*Crassostrea* sp.). LEB-ICML-UNAM-553, Sta. Cruz Ensenada del Pabellón (Culiacán, Sinaloa), 22°7′33″N–107°18′37″W, 3 m depth, 06.vii.2002, boring into a bivalve shell (Veneridae). LEB-ICML-UNAM-477, Antiguo Corral del Risco (Punta de Mita, Nayarit), 20°46′20″N–105°32′49″W, 2 m depth, 11.vi.2003, boring into dead coral.

Description: Specimens always growing in alpha stage, covering a maximum surface diameter of 12.5 cm. The species has very small circular papillae (0.1–1.4 mm in diameter) that are level with the surface of the substratum (Fig. 12B). They are from 0.1 to 2.9 mm apart and very evenly scattered on the surface. Fusion of papillae has not been observed. Oscules are also very small; ranging from 0.1 mm to 0.8 mm in diameter (average 0.41 mm). The colour is red when alive and light red in alcohol.

Skeletal characters: There are three types of spicules: straight tylostyles which are gradually tapering to a sharp point, with heads mainly spherical or oval, although terminal knobs have been observed (Fig. 20A); they measure 202 × 4.2 μm on average (6.3 μm head width); acanthoxea with minute spines over the entire surface, which are bent at the centre and with both ends sharply pointed (average 86 × 4 μm) (Fig. 20B); and microrhabds densely covered by robust spines, with 2–4 bends, and mostly with rounded ends (average 10.8 μm) (Fig. 20C, D). The microrhabds can be straight, curved, or 'S'-shaped (Table 10) (Fig. 20C).

Distribution: de Laubenfels (1954) described a similar red specimen of *C. vastifica*. Perhaps some registers of *P. vastifica* from the Pacific Ocean may be considered as *P. mazatlanensis*. Mexican Pacific Ocean: Sonora, Sinaloa and Colima.

Remarks: The species *Cliona mazatlanensis* was synonymized with *C. vastifica* by Topsent (1891); without

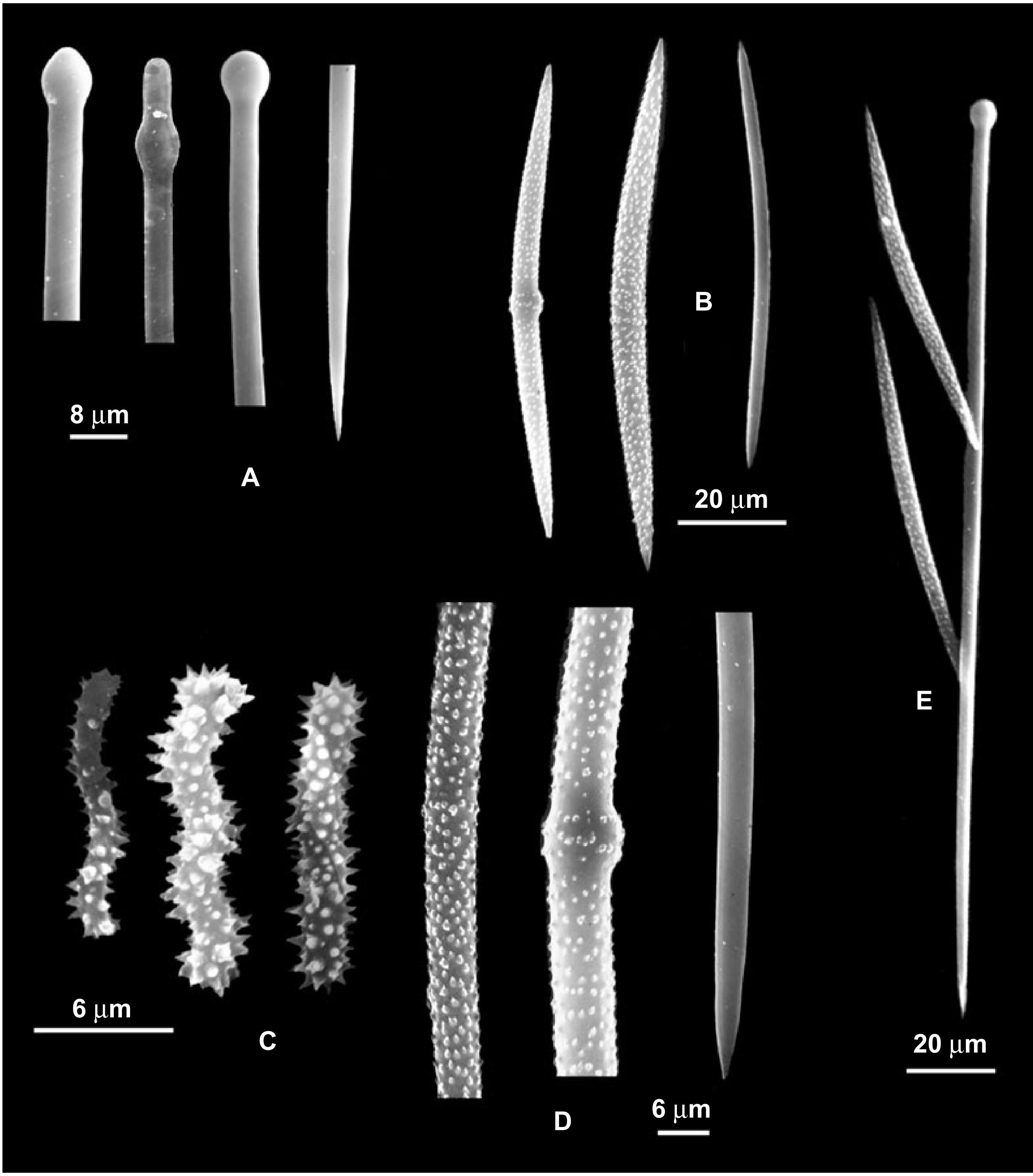

Figure 20. *Pione mazatlanensis*: A, heads and tip of the tylostyles; B, acanthoxeas; C, microrhabds; D, detail of the spines.

providing important arguments for that decision. Rützler & Stone (1986) comment about the great difficulty that exists in the *Cliona vastifica* complex (specimens containing three spicule types: tylostyles, microspined oxeas, and microspined microrhabds), due to the great variability among all types. In many cases this has led others to synonymize species with these three types of spicules with *C. vastifica* without a clear justification.

One of the most important features that easily distinguishes *P. mazatlanensis* from *P. vastifica* is the small size of its papillae, and its red colour in life. The typical *P. vastifica* from the Mediterranean and West Atlantic coasts has characteristically bigger papillae, and a different orange or bright orange colour (Carballo *et al*., 1994; Carballo, 1994; Rosell & Uriz, 2002; among others). Moreover, the size of the microrhabds is another distinguishing feature, longer on average in the Mediterranean and Atlantic coast specimens (19 µm in Rützler, 1973; 23 µm in Old, 1941; 25 µm in Rosell, 1994). We think that *P. mazatlanensis* has important characteristics such as colour and papillae size to maintain it as a valid and different species from *Pione vastifica*.

THOOSA HANCOCK, 1849

Synonymy: see Rützler (2002a)

Type species: Thoosa cactoides Hancock, 1849

Diagnosis: Sponges are always papillate. Tylostyles may be missing in some specimens, populations or species. There are many types and variations of microscleres, but most commonly there are amphiasters and oxyasters. Amphiasters are mostly tylote, with microspination on the terminal bulbs, yet variations in different species include smooth oxeote rays. Oxyasters have a very small centre with slender projecting rays 1–6 µm long. The common reduction of rays can lead to centrotylote sigmoid or tylostylote forms. Because rays tend to be curved, biradiate forms often appear like bird wings. Accessory microscleres in some species may include microxeas and pseudosterrasters (microspined spheres or rhabds) (Rützler, 2002a).

***THOOSA CALPULLI* SP. NOV.**
(FIG. 21)

Material examined: MNCN-1.01/239, Islas Isabeles (Nayarit), 21°46′35″N–105°51′42″W, 20 m depth, 21.xi.1999, boring into dead corals. LEB-ICML-UNAM-417, Islas Isabeles (Nayarit), 21°46′35″N–105°51′42″W, 20 m depth, 21.xi.1999, boring into dead corals.

Description: Sponge growing in alpha stage, with small papillae from 0.5 to 0.9 mm in diameter, very regularly formed. They are rarely visible externally and never fused. The species excavates coral substrates, forming irregular or regular cavities that are 0.8–1.3 mm. Colour is pale yellow in alcohol.

Skeletal characters: (i) Amphiasters with seven microspined rays at each side of the shaft (Fig. 21A). Two shape categories exist but measurements overlap. One category has thick actins ending in spiny knobs with a sharp point (18.7–21 by 13–13.5 µm), and the other has more slender amphiasters, bearing small conical spines at the ends (10.5–23 by 7.5–16.5 µm). (ii) Smooth oxyasters have a small centrum. They are biradiate like bird wings, triradiate, tetraradiate or symmetric with six rays (Fig. 21B). Rays measure 16–49.5 by 2–2.5 µm; (iii) Centrotylote oxea are slightly spined (Fig. 21C, D), in two size categories: (a) 30–46.5 by 3 µm; (b) 133.5–270 by 5–6.7 µm. (iv) Smooth oxeas.

Etymology: The word *calpulli* comes from the Nahuatl which meant the joining in marriage during the Mexica era in Tenochtitlan; referring to the joining of the sponge with the coral substrate.

Remarks: see below.

Distribution: Islas Isabeles (Pacific Ocean, Mexico).

***THOOSA MISMALOLLI* SP. NOV.**
(FIGS 22, 23)

Material examined: MNCN-1.01/240, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, intertidal, 23.i.2001, boring into dead corals. LEB-ICML-UNAM-361, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, intertidal, 23.1.2001, dead corals. LEB-ICML-UNAM-483, Antiguo Corral del Risco (Punta de Mita, Nayarit), 20°46′20″N–105°32′49″W, 4 m depth, 06.iv.2002, boring into dead corals. LEB-ICML-UNAM-524, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 4 m depth, 10.iv.2002, boring into shells of *Crassostrea* sp.

Description: Excavating sponge on coral substrate found only in alpha stage. Papillae are small, from 1.3 to 3.5 mm in diameter, most frequently circular in form, and 0.5–2 mm apart. Fusion of papillae has not been observed. The species is very difficult to observe '*in situ*' due to the small size of its papillae. However, if the coral is fragmented, the bright orange tissue of the sponge is visible to the naked eye.

Skeletal characters: The spiculation is typical of the genus. (i) Amphiasters have 14 tylote nodules, seven at each side of the shaft. They can be separated in two shape categories: thick tylote amphiasters, with very reduced spines or with very short spines (19.5–24 µm long × 10.5–18 µm wide) (Fig. 22). In some cases the amphiasters look like nodules with a verrucose surface (9–18 µm long × 6–10.5 µm wide), and slender amphiasters, with a verrucose surface. (ii) Oxyasters in two categories (Fig. 23A): (a) the reduced type; with smooth and microspined rays which have an elongated or irregular centre at the junction, these are biradiate, triradiate, tetraradiate forms, rays measure 21–30 × 1.5–3 µm; (b) oxyasters in symmetric forms with

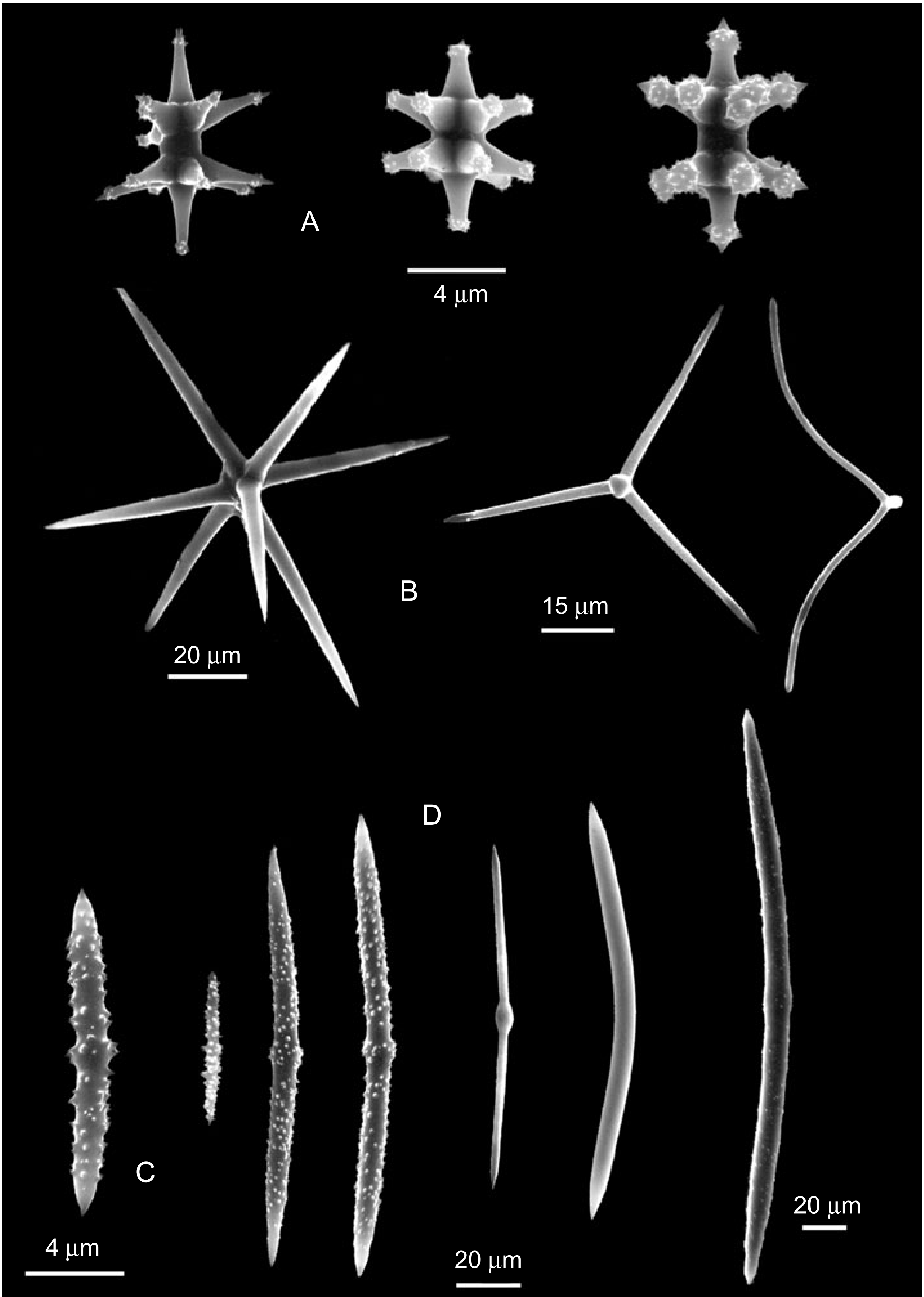

Figure 21. ***Thoosa calpulli* sp. nov.**: A, amphiasters with microspined rays; B, different forms of smooth oxyasters; C, small spined oxea; D, smooth and spined centrotylote oxeas.

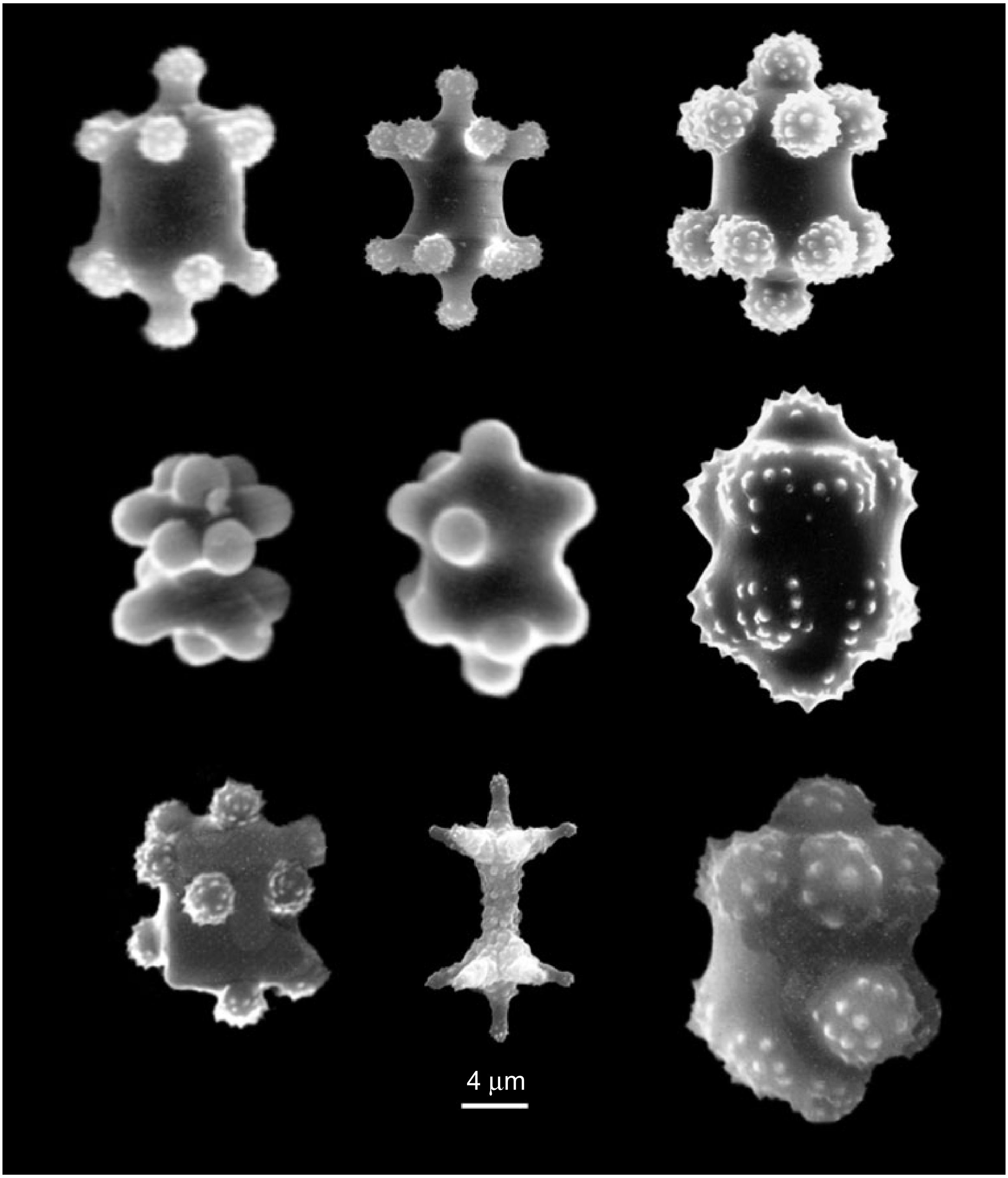

Figure 22. ***Thoosa mismalolli*** **sp. nov.**: different forms of nodulose amphiasters.

six rays, each ray 13.5–15 × 2.5 µm. Some oxyasters have microspined rays, and swollen tips. (iii) Centrotylote oxea are smooth and/or spined, these are like an oxyaster ray in appearance, total longitude is 69–70.5 × 1.5–3 µm. The oxeas can end in a sharp or blunt point (Table 11). A low proportion of slender tylostyles were found. They measure 254 × 4 µm on average (7 µm head width) (Fig. 23B).

Etymology: The specific epithet refers to the village of Mismaloya from the Bahía de Banderas (Jalisco, Mexico).

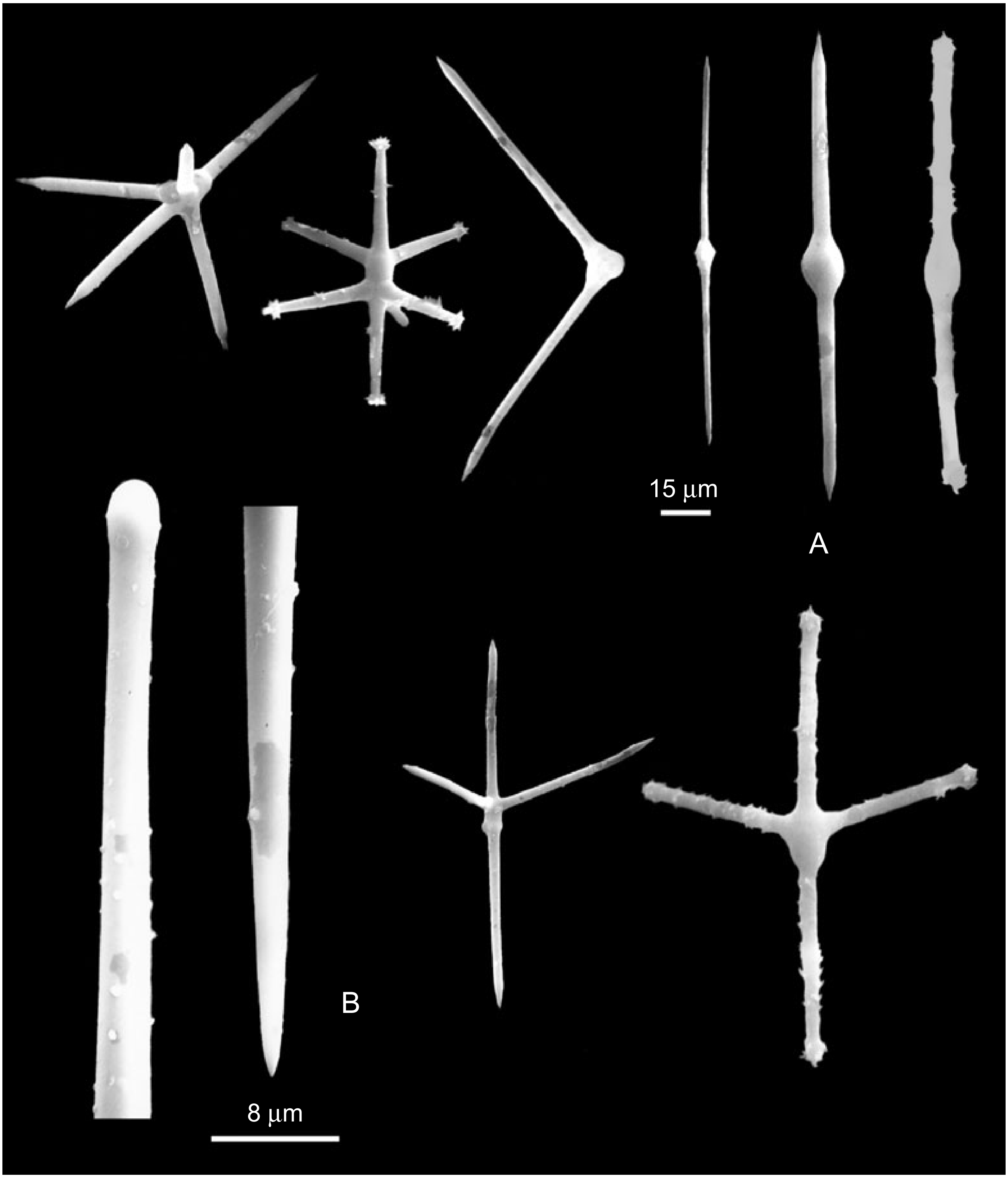

Figure 23. ***Thoosa mismalolli* sp. nov.**: A, different forms of oxyasters and oxeas; B, head and tip of tylostyles.

Distribution: Bahía de Banderas (Jalisco, Mexico). east Pacific Ocean.

Remarks: There have been very little reports of the genus *Thoosa* around the world, e.g. *T. mollis, T. armata, T. cactoides, T. bulbosa, T. fisheri* Topsent, 1891, *T. amphiasterina*, without mentioning the erroneous allocation names, like *T. hancocki* (= *Cliothosa hancocki*) (Topsent, 1887), as well as other *Thoosa* species which have a different spiculation not proper to

Table 11. Comparative data for the dimensions of the spicules (in μm) of ***Thoosa mismalolli*** **sp. nov.** specimens. Values in parentheses are means

	Tylostyles	Centrotylote oxea	Oxyasters	Amphiasters
Specimens	Length × width shaft; head width	Length × width shaft; width	Length	Length
LEB-ICML-UNAM-361	272.5–(300)–337.5 × 2.5–(4.7)–7.5; 5–(6.5)–10	62.5–(80.6)–105 × 2.5–(2.7)–3.8; 3.8–(5)–6.3	37.5–(50)–67	12.5–(18.3)–25
LEB-ICML-UNAM-483	247–(262)–290 × 5–(3.8)–10; 6.3–(8.6)11.3	72.5–(79)–87.5 × 2.5; 3.8–(4.5)–5	37.5–(54.3)–75	10–(18.8)–30.5
LEB-ICML-UNAM-524	180–(200)–220 × 3.8–(4)–5; 6.3–(6.8)–7.5	71.3–(81)–100 × 2.5–(2.9)–3.8; 3.8–(4)–6.3	45–(56)–62.5	10–(21)–26.3

the genus, which is probably the case of *Thoosa socialis* (Carter, 1880) with rough microspined circular discs. Moreover, all of them are located in an unclearly stated geographical area, far distant from the present Pacific location. It is difficult to attempt a comparison of the different species because collections are too old or are lost (Rützler & Stone, 1986). A species similar to *T. calpulli* sp. nov. is *T. armata* Topsent, 1891, which has tylostyles (lacking in *T. calpulli*), and a very different ornamentation of the amphiasters. *Thoosa calpulli* presents small, conical spines; in contrast, *T. armata* has larger curved spines. Another close species could be *Thoosa amphiasterina* Topsent, 1920, which has very similar amphiasters. However, *T. amphiasterina* has no oxyasters nor centrotylotes oxeas. The closest species to *T. mismalolli* sp. nov. seems to be *T. bulbosa* Hancock, 1849 from the Indo-Pacific, but this species has oxyasters of the reduced type with oversized rays (70 μm), and no centrotylote oxeas. *Thoosa mismalolli* and *T. calpulli* are the first records of *Thoosa* for the east Pacific. These two are excavating sponges on calcareous substrates, appearing in small papillae, and only present in the alpha stage of growth. Larger growth forms have not been found over a period of 25 years of observing different sponges along the Mexican Pacific coast.

Spheciospongia Marshall, 1892

Synonymy: Heterocliona Verrill, 1907

Type species: Alcyonium vesparium Lamarck, 1814

Diagnosis: Large-growing sponges with cribiporal chones (pore sieves) and simple, multiple or septate oscula. In the ectosome, there are numerous robust tylostyles forming a dense tangential network, and rare, minute spirasters and spiraster-derived amphiasters; the latter are also located in the canal linings. In the choanosome, tylostyles occur densely scattered and in strands. Tylostyles may be modified to styles, tylostrongyles and strongyles. The sponges excavated limestone in the early growth stage, forming large, tissue-filled cavities, not a series of distinct chambers as do other clionaids (Rützler, 2002a).

Spheciospongia ruetzleri sp. nov.
(Fig. 24)

Holotype: MNCN-1.01/241, Peña de La Virgen (San Blas, Nayarit), 4.5 m depth, on rocks in sand bottoms. 22.xi.1999.

Paratype: LEB-ICML-UNAM-69, Peña de La Virgen (San Blas, Nayarit), 4.5 m depth, on rocks in sand bottoms, 22.xi.1999. *Spheciospongia confoederata* holotype USNM-21487, *Spheciospongia confoederata* paratype BMNH-28.8.22.50.

Description: Very large, massive sponge up to 8 cm thick, covering a maximum surface area of 50 × 18 cm. The oscula are scarce but large, up to 15 mm in diameter, and they are characteristically situated in elevations (2–3.5 cm high) that seem like small volcanoes. They are often septate, and up to 12 exhalant canals are confluent in each. The inhalant pore sieve area is formed by 9–16 small circular not contractile pores from 2 to 3 mm in diameter. These areas are scattered, and extend over a surface from 2.5 to 6 cm^2. The choanosome is cavernous, with canals of 0.3–1.7 cm in diameter, and up to 6 cm in length. The consistency is very firm. The surface is smooth. The ectosome is purplish in life, and the choanosome is ochraceous. Dark brown in alcohol.

Skeletal characters: The tylostyles are thick, mostly gently curved, sometimes double curved, with a well differentiated head (Fig. 24A, B). Tylostyles mean measurements (length × width shaft; head width): 105-(283)-437.5 × 2.5-(12.9)-17.5 μm; 5-(13.7)-18.8 μm. Despite the ample range in the length of the tylostyles the frequency histogram showed only one size class. The spirasters are short and thick from 10 to 20 μm in length (average 13 μm), with few waves, some almost

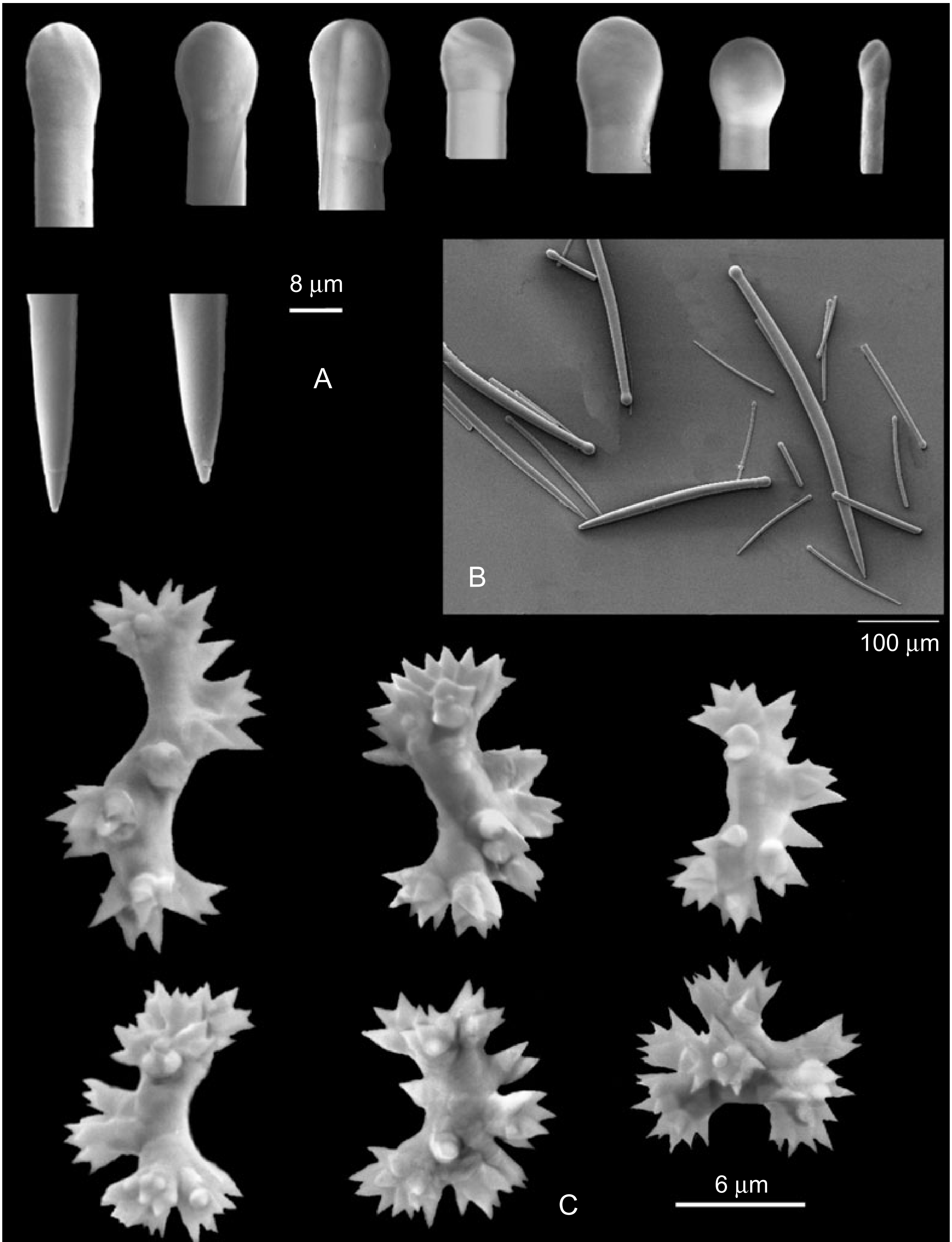

Figure 24. ***Spheciospongia ruetzleri* sp. nov.**: A, heads and tips of the tylostyles; B, tylostyles; C, spirasters.

straight (Fig. 24C). They are very scarce, and it is necessary to use a huge amount of sponge to find them.

Etymology: The species is named after Dr Klaus Rützler for his contribution to the study of the clionaid sponge fauna.

Distribution: Peña de La Virgen (San Blas, Nayarit).

Remarks: See below.

SPHECIOSPONGIA INCRUSTANS SP. NOV. (FIG. 25)

Holotype: MNCN-1.01/305, Conchas Chinas (Puerto Vallarta, Jalisco), 20 35′16″N–105 14′42″W, 4 m depth, 08.x.2002.

Paratype: BMNH-2003.6.27.3, Conchas Chinas (Puerto Vallarta, Jalisco), 20°35′16″N–105 14′42″W, 4 m depth, 08.x.2002. *Spheciospongia confoederata* holotype USNM-21487, *Spheciospongia confoederata* paratype BMNH-28.8.22.50. LEB-ICML-UNAM-360, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 2 m depth, 23.i.2001. LEB-ICML-UNAM-475, Antiguo Corral del Risco (Punta de Mita, Nayarit), 20°46′20″N–105°32′49″W, 4 m depth, 06.iv.2002. LEB-ICML-UNAM-499, Los Arcos (Puerto Vallarta, Jalisco), 20°32′73″N–105°18′47′W, 2 m depth, 08.iv.2002. LEB-ICML-UNAM-514, Playa los Muertos (Sayulita, Nayarit), 20°52′29 N-105°26′72″, 8 m depth, 09.iv.2002. LEB-ICML-UNAM-574, Isla Redonda (Islas Marietas, Nayarit), 20°42′04″N–105°33′89″W, 3 m depth, 04.x.2002. LEB-ICML-UNAM-602, Isla Redonda (Islas Marietas, Nayarit), 20°42′04″N–105°33′89″W, 10 m depth, 04.x.2002. LEB-ICML-UNAM-614, Isla Redonda (Islas Marietas, Nayarit), 20°42′04″N–105°33′89″W, 8 m depth, 04c.2002, in cave. LEB-ICML-UNAM-622, Conchas Chinas (Puerto Vallarta, Jalisco), 20 35′16″N–105 14′42″W, 4 m depth, 08.x.2002. LEB-ICML-UNAM-639, Playa los Muertos (Sayulita, Nayarit), 20°52′29 N-105°26′72″, 8 m depth, 09.x.2002.

Description: Encrusting sponge from 1 to 4.5 cm thick, with an endolithic portion that inhabits large hollows and cavities of dead coral (Fig. 12E, F). The species is also able to spread over the substratum reaching a coverage up to 20 × 14 cm. The pore sieves (1–4 mm in diameter) are clustered in small areas of 3.2 cm^2 (from three to nine pores). They are present even in the smallest specimens. Colour is purplish when alive.

Skeletal characters: The megascleres are robust, curved tylostyles, with small heads, most frequently ovoid, and in some cases almost undifferentiated from the shaft (Fig. 25). They measure 286 × 7.9 μm on average (Table 12). The heads are typically mucronated (average 9.4 μm). The shaft is bent in the middle; ensiform tylostyles with a short and sharp tip frequently appear. The microscleres are of two types: slender spirasters (13.8 μm average length), with many spines uniformly distributed along the shaft, with 2–5 turns; and straight short, stout amphiasters with long, irregular, smooth rays which have pointed, often bifid tips (Fig. 25B). Tylostyles run in strands that branch toward the surface, where the spicules protrude in tufts.

Etymology: The specific name refers to its typical growth form.

Distribution: Bahía de Banderas (Jalisco), Sayulita (Nayarit). east Pacific Ocean.

Remarks: The closest related species to *S. rueztleri* sp. nov. seems to be *S. vesparium* (Lamarck). However, *S. rueztleri* sp. nov. has shorter and thicker tylostyles (283 × 13 μm average) than *S. vesparium* (368 × 9.2 μm average) (Vicente *et al.,* 1991); in addition, the types and the morphology of the spirasters are quite

Table 12. Comparative data for the dimensions of the spicules (in μm) of ***Spheciospongia incrustans* sp. nov.** specimens. Values in parentheses are means

	Tylostyles	Spirasters
Specimens	Length × width shaft; head width	Length
LEB-ICML-UNAM-360	150–(299)–437.5 × 5–(11)–17.5; 7.5–(11.2)–16.3	7.5–(12.4)–17.5
LEB-ICML-UNAM-475	117–(278.8)–387.5 × 5–(8)13.8; 6.3–(9.6)–15	11.3–(16)–25
LEB-ICML-UNAM-499	105–(263)–350 × 1.3–(7)–15; 5–(9)–16.3	10–(14.8)–22.5
LEB-ICML-UNAM-514	162.5–(296.3)–435 × 3.8–(9.3)–17.5; 6.3–(10.4)–17.5	10–(13.3)–17.5
LEB-ICML-UNAM-574	140–(296)–382.5 × 2.5–(7.6)–12.5; 5–(10)–16.3	6.3–(12.3)–17.5
LEB-ICML-UNAM-602	132–(290.5)–400 × 2.5–(7.5)–12.5; 5–(8.75)–12.5	10–(14.9)–23.8
LEB-ICML-UNAM-614	125–(298)–400 × 2.5–(7)–11.3; 5–(9.6)–12.5	8.8–(13.1)–18.8
LEB-ICML-UNAM-622	112.5–(285.3)–432.5 × 3.8–(7.5)–12.5; 5–(8.5)–13	11.3–(15.5)–17.5
LEB-ICML-UNAM-639	135–(265.8)–395.5 × 2.5–(6.5)–11.3; 5–(7.8)–11.3	7.5–(12)–16.3

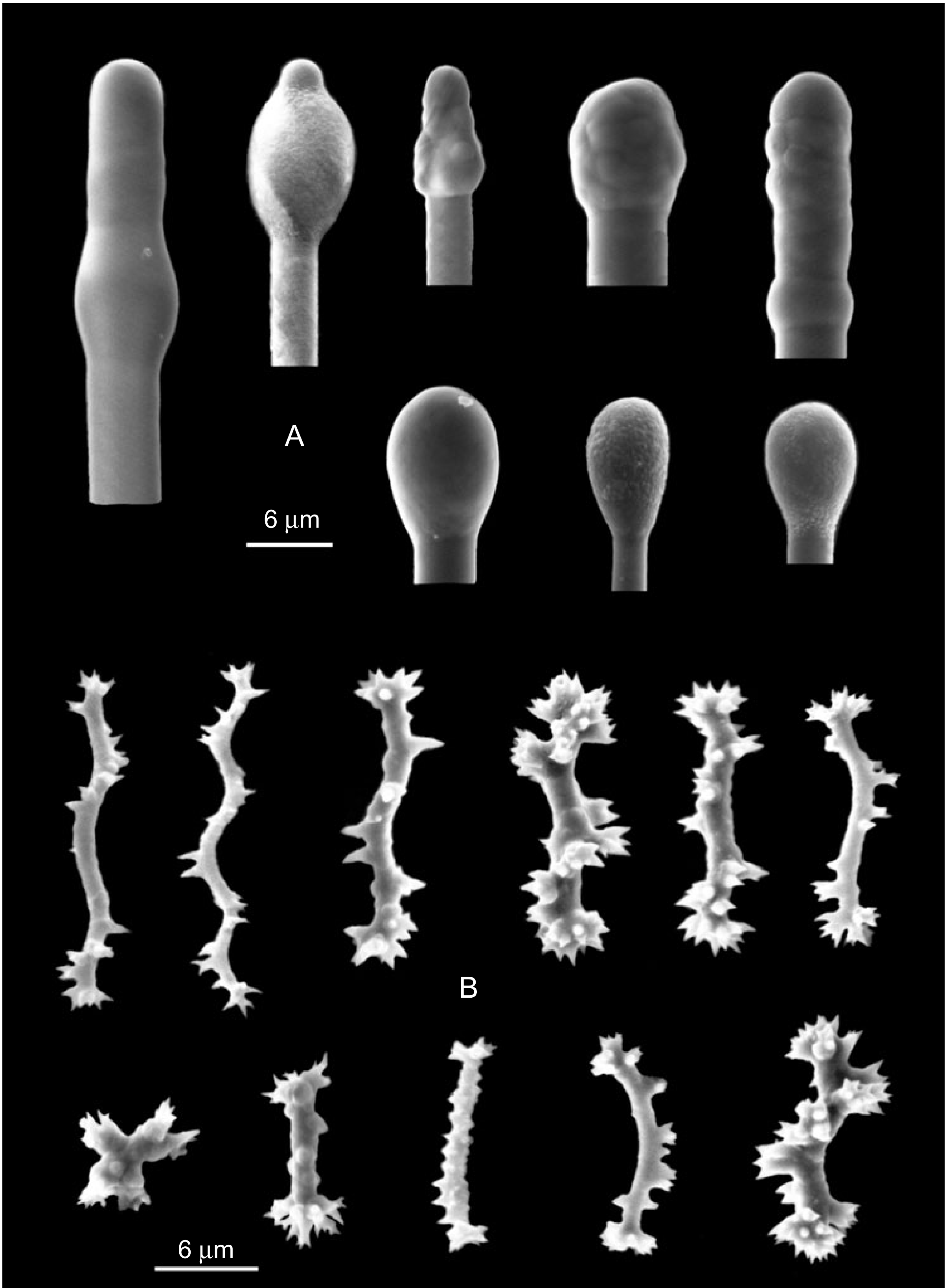

Figure 25. ***Spheciospongia incrustans* sp. nov.**: A, heads of the tylostyles; B, spirasters and amphiasters.

different between the two species. *S. rueztleri* sp. nov. only presents short and thick spirasters that are almost straight or with very few waves, and the main spirasters of *S. vesparium* are slender with several turns (see Vicente *et al.,* 1991). Another closely related species seems to be *Spheciospongia confoederata* de Laubenfels (1932), which is similar in form, and in the morphology and size of the tylostyles, which measure: length from 222.5 to 320 µm (282.5 µm average), width from 3.8 to 12.5 µm (8.9 µm average); head from 5 to 10 µm (12.5 µm average). However, the presence of spirasters in *S. ruetzleri* (absent in *S. confoederata*) clearly separates both species. We first thought that due to their scarcity in the sponge flesh, and their small size, they could be overlooked by de Laubenfels. However, the holotype and paratype of this species were examined in detail and we didn't find spirasters. *Spheciospongia incrustans* sp. nov. is different from *S. rueztleri* in the form, and in the morphology of its spirasters. A species close to *S. incrustans* could be *S. cuspidifera* (originally described as *Alcyonium cuspidiferum* Lamarck, 1815), which has similar spirasters. However, this species has a very different external morphology, growing in the form of single erect or staghorn-like hollow cylinders without conspicuous aquiferous openings and with a specialized inhalant complex (Vicente *et al*., 1991), and it was recently accommodated in the new genus *Cervicornia* (Rützler & Hooper, 2000).

DISCUSSION

The sponge fauna of the east Pacific Ocean is one of the least known in the world if we compare it with other areas such as the Caribbean Sea, Mediterranean Sea or the north-eastern Atlantic Ocean. Among the different sponge groups are the excavating or bioeroding sponges, which can cause severe damage to submerged calcareous substrates (Goreau & Hartman, 1963). In recent years, the sponges of the Pacific Mexican coast have been widely studied, and the preliminary results show a high number of undescribed species (Gómez & Bakus, 1992; Gómez, 1998; Carballo *et al.,* 2003), or species only known in distant areas (Gómez *et al.,* 2002). However, the fauna of boring sponges of the Mexican Pacific coast is very scarce, and its incidence in different ecosystems (including coral reefs) had not been addressed until now. A total of five species are known from the Mexican Pacific coast: *Pione carpenteri* (Hancock, 1867), *P. mazatlanensis* (Hancock, 1867), *Cliona vermifera* (Hancock, 1867), *C. raromicrosclera* (Dickinson, 1945 as *Delaubenfelsia*) and *C. celata* (Green & Gómez, 1986). Another four species can be found along the north-east Pacific coast: *Cliona lobata* Hancock, 1849; *C. celata* var. *californiana* de Laubenfels, 1932, *Cliona* cf. *argus* Thiele, 1898, and *Spheciospongia confoederata* de Laubenfels 1930 (Austin, 1985; Bakus & Green, 1987). Other species in the area such as *Cliona viridis* cited by Sim & Bakus (1986) have no description and cannot be considered as valid registers of the species. After the present study, the number of clionaid species along the north-east Pacific coast has increased to 18 species, which constitute a high number if we compare it with other profusely studied areas like the Caribbean (Pang, 1973; Rützler, 1974), the Mediterranean (Rosell & Uriz, 2002), or the east Atlantic coast (mainly the works of Topsent).

Sponges are organisms with many overlapping characteristics and transition species, and therefore the use of numerous characteristics should be employed in identification instead of only a few well-established characters like spicule types and sizes (Schönberg, 2000). We think that the micromorphology of the spirasters could be a very good additional diagnostic character as has been shown for other genera such as *Guitarra* (Carballo & Uriz, 1998) and *Mycale* (Carballo & Hajdu, 1998). In this sense, the morphological variability of the spirasters across the *Cliona* species has been analysed and the main parameters that are useful to differentiate species are highlighted. According to our SEM studies, these could be the main distinguishing features to consider when describing the spirasters in *Cliona* species (Fig. 26).

The form of the spirasters can be grouped in three main types: (i) spiral or sinuous with different number of bends (cf. those of *Cliona vallartese* sp. nov.) (Fig. 26G); (ii) with almost straight shafts (amphiasters) (cf. some of *Speciospongia incrustans* sp. nov.) (Fig. 26J); and (iii) 'C'-shaped spirasters like anthosigmas (cf. Those in *C. raromicrosclera*) (Fig. 26D). Two main types of shafts have been found: slender and longer spirasters (*Cliona papillae* sp. nov.) (Fig. 26C), and thick and short spirasters (cf. those of *Cliona euryphylla*) (Fig. 26H).

The form of the spines displays completely different morphologies that characterize several species of *Cliona*. The spines can be sharply pointed (*Cliona flavifodina*), or blunt, conical and robust, and spines can be stout or slender; and singular, bifurcated, or branching to two, three or even more spines (cf. those of *Cliona raromicrosclera* and *Cliona vallartese* sp. nov. (Fig. 26D, G). The number and distribution of the spines are other important characters to take into account. The spines can be arranged on one side of the spicule (*Cliona papillae*), or arranged around the entire axis of the spirasters (*Cliona vallartese*); the spines can be narrowly (*Cliona vallartense*) or widely spaced (*Cliona flavifodina*); scattered or clustered uniformly along the shaft. Sizes of the spines fall into the next categories: prominent (*Cliona flavifodina*), small

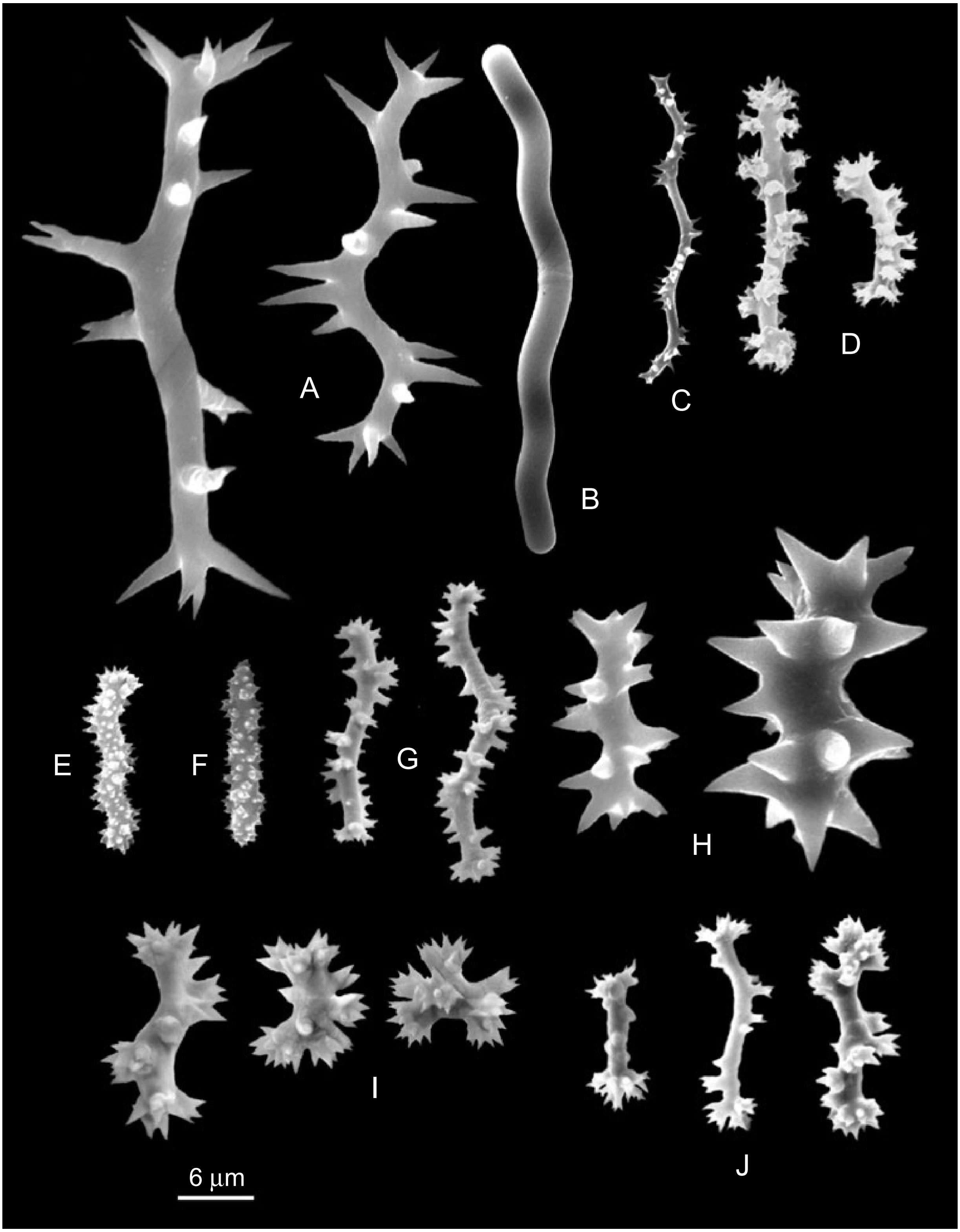

Figure 26. Different morphologies of the spirasters and microrhabdes of the clionaid species from the Pacific coast of Mexico. All are shown at the same scale.

(*Cliona papillae* sp. nov.), reduced spination (cf. some amphiasters of *Spheciospongia incrustans*), or absent, cf. the smooth spirasters of *Cliona vermifera* (Fig. 26B).

Moreover, additional 'in situ' characteristics such as colour, size and distribution of the papillae (regularly or irregularly distributed), and fusion of the papillae, may help an underwater identification at least in areas where the specific composition of clionaids is known.

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