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The genus *Timea* (Porifera: Timeidae) in the Eastern Pacific Ocean: revision of type material, new species and intraspecific variability

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Abstract: *Timea* species are small encrusting sponges living in cryptic habitats. The only species known from the East Pacific Ocean to date is *T. authia* de Laubenfels, 1930. An extensive survey carried out during the last five years along the coast of the Sea of Cortez (tropical East Pacific Ocean, Mexico) resulted in 25 *Timea* specimens found mainly under stones from 12 localities. *T. authia* de Laubenfels, 1930 and four species new to science, *T. chiasterina*, *T. floridusa*, *T. juantotoi* and *T. ohuirae,* were identified in the collected material. A revision of the type material of *T. authia* and the specimens collected in the East Pacific Ocean showed that the five *Timea* species are distinguished mainly by details in the micromorphology of the euasters. The significance of certain additional characteristics of live populations was noticed, such as color and surface structure. The intraspecific variability of *Timea* species is not well known because most species were described on the basis of a single specimen. However, the relatively high number of specimens of *Timea* collected during the present work allowed an analysis of the morphological variability of the euasters. The genus *Timeopsis* Lévi, 1958 was herein placed in synonymy with *Timea*.

Résumé : *Le genre* Timea *dans l'Océan Pacifique oriental : révision du matériel type, nouvelles espèces et variabilité intraspécifique.* Les espèces de *Timea* sont de petites éponges encroûtantes vivant dans les habitats cryptiques. La seule espèce connue de l'océan Pacifique est *Timea authia* de Laubenfels, 1930. Une étude extensive effectuée pendant les cinq dernières années dans 105 localités le long de la côte de la mer de Cortez (océan Pacifique est tropical du Mexique) a permis la récolte de 25 spécimens de *Timea* trouvés principalement sous des pierres de 12 localités. *Timea authia* de Laubenfels, 1930 et quatre espèces nouvelles pour la science ont été identifiées dans le matériel rassemblé: *T. chiasterina*, *T. floridusa*, *T. juantotoi* et *T. ohuirae*. Nous avons révisé le matériel type de *Timea authia* et les spécimens rassemblés dans l'océan Pacifique est. Les cinq espèces de *Timea* sont distinctes principalement par des détails micromorphologiques des euasters. L'importance des caractéristiques additionnelles des populations vivantes est notée, comme la couleur et la structure de la surface. La variabilité intraspécifique des espèces de *Timea* n'est pas bien connue car la plupart des nouvelles espèces ont été décrites sur la base d'un spécimen. Cependant, le nombre relativement élevé de spécimens de *Timea* rassemblés en ce travail nous a permis d'étudier la variabilité morphologique des euasters. Le genre *Timeopsis* Lévi, 1958 est ici considéré comme synonyme de *Timea*.

Keywords: *Timea* • Taxonomy • Cryptic habitat • SEM • Micromorphology • Gulf of California

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Introduction

The genus *Timea* was erected by Gray (1867) for the type species *Hymedesmia stellata* Bowerbank, 1866. Later, Topsent (1928) moved several species, originally placed in *Hymedesmia,* to *Timea* and proposed the new family Timeidae Topsent, 1928. By the end of the 20th century, the family contained the genera *Timea* Gray, 1867, *Diplastrella* Topsent, 1918, *Kotimea* de Laubenfels, 1936, and *Willardia* Willenz and Pomponi, 1996. In a recent revision, *Diplastrella* was moved to Spirastrellidae, *Kotimea* was synonymized with *Timea*, and *Willardia* - a coralline sponge - was moved to Acanthochaetetidae (Rützler, 2002; Rützler & Vacelet, 2002), leaving only the genus *Timea* in the Timeidae (Rützler, 2002).

There are not many *Timea* records in the literature. The most recent papers report 22 species for Mediterranean and Atlantic waters (Lehnert & Heimler, 2001; Mothes et al., 2004) and 21 species from the Indo Pacific Ocean (see Table 1). The only species known along the coast of the east Pacific is *Timea authia* de Laubenfels 1930.

Up to date, the distinction of *Timea* species has been mostly based upon the form of the euaster and the spination of their rays (see for example, Bergquist, 1965 & 1968; Hooper & Wiedenmayer; 1994; Lehnert & Heimler, 2001; Mothes et al., 2004), and in most cases the species were described on the basis of a single specimen (Hooper, 1986; Lehnert & Heimler, 2001; Mothes et al., 2004, to name a few).

In the present paper a collection of *Timea* specimens along the Mexican Pacific coast was examined, allowing four new species to be recognized. Moreover, a revision of *T. authia* type material and other specimens collected along the Mexican Pacific coast was carried out. Finally, the number of specimens collected in this work allowed, for the first time, a detailed study of the intraspecific variability of the euasters' micromorphology by SEM analysis.

Material and methods

Sponge specimens were collected by scuba diving and snorkeling along the coast of Sea of Cortez. Even though a total of 105 localities were sampled, *Timea* specimens were only found at 12 of them (Fig. 1).

Spicule preparation followed the techniques described by Rützler (1974) for light and for electron microscopy (SEM). Photographs of microscleres were taken by means of a scanning electron microscope for which clean spicules were dried on a cover glass and coated with gold. Twenty-five or more spicules chosen randomly were measured for each of the specimens studied. Tylostyle measurements were given as length x width of shaft; head width. In each description the number between brackets is the average.

The material has been deposited in the sponge collection of the Instituto de Ciencias del Mar y Limnología, UNAM (LEB-ICML-UNAM), in Mazatlán (México), in the Museo Nacional de Ciencias Naturales in Madrid (Spain) (MNCN), and in the British Museum of Natural History (BMNH) (London). Sponge-specific terms are used according to Boury-Esnault and Rützler (1997).

We have also reviewed the type material of *T. authia* de Laubenfels 1930 from Smithsonian Institution (USNM), and material of the same species deposited in the Museo de Zoología de la Universidad Católica de Chile (MZUC).

Results

Family Timeidae Topsent, 1928

Diagnosis

Sponges form very thin crusts on shells or under rock. Spicules include tylostyles and euasters. Tylostyles are arranged in tracts ending as bouquets at the surface, where they cause a hispid appearance. Additional tylostyles occur in criss-cross fashion between the tracts. Microscleres are dispersed throughout the tissue, denser at the substrate and toward the surface, and forming an ectosomal crust (Rützler, 2002).

Timea Gray, 1867
Type species: *Hymedesmia stellata* Bowerbank, 1866 (by monotypy)
Syn*: Hymedesmia* in part, Bowerbank, 1866: 149; 1874b: 71. *Timea* Gray, 1867a: 544. *Kotimea* de Laubenfels, 1936; 147. *Halicometes* sensu de Laubenfels, 1950a: 99. Not *Halicometes* Topsent 1898: 112. *Timeopsis* Lévi, 1958: 22. **new. syn.**

Diagnosis

Same as family (Rützler, 2002).

Timea authia de Laubenfels, 1930
(Figs 2 & 3)

Material examined

LEB-ICML-UNAM-424, Isla Lobos (Mazatlán, Sinaloa), 23º13'49''N-106º27'43''W, 01/15/02, 4 m depth, on rocks. Holotype of *Timea authia* de Laubenfels, 1930; specimen USNM No. 21499, intertidal, Laguna Beach, California, United States. *Timea authia* de Laubenfels, 1930; MZUC No. 4036, intertidal, Antofagasta, Chile.

Table 1. Characteristics and distribution of *Timea* species in the Indo Pacific Ocean. Shaft length x width; head diameter are given for megascleres and diameter for euasters. Values between brackets are means.

Tableau 1. Caractéristiques et distribution des espèces du genre *Timea* de l'Océan Indo Pacifique. Longueur x largeur ; diamètre de la tête des mégasclères et diamètre des euasters. Les valeurs moyennes sont données entre parenthèses.

Species of *Timea*	Reference	Color	Megascleres (in μm)	Euasters (in μm)	Distribution
Timea chiasterina Holotype MNCN 1.01/348	Present study	dark yellowish to orange	92.5-(426)-750 x 5-(8.5)-13; 6-(10)-15	8.5-(11.3)-15	Sinaloa & Nayarit Mexico
Timea floridusa Holotype MNCN 1.01/347	Present study	light brown or light Orange	140-(390)-925 x 2.5-(5.5)-11; 2.5-(9)-12.5	8-(12.2)-16.3	Sinaloa & Nayarit Mexico
Timea juantotoi Holotype MNCN 1.01/349,	Present study	pale orange	235-(397.5)-675 x 2.5-(5)-10; 5-(7.5)-12.5	7-(11)-15	Sinaloa & Nayarit Mexico
Timea ohiri Holotype MNCN 1.01/350	Present study	pale orange or orange	250-(550)-925 x 3-(5.4)-17.5; 5-(10)-20	22-(30)-39 (Type I) 15-(19)-25 (Type 2) 5-(6.2)-8 (Type 3)	Sinaloa & Nayarit Mexico
T. alba Bergquist, 1968	Bergquist, 1968	White (in alcohol)	2970-(3659)-4018 x 15.8-(18.2)-20.6; 22-30.8 tylostyles	34.8-(44.6)-49.2 strongylospheraster s	New Zealand
T. anthastra Lévi, 1961	Lévi, 1961	Purple-pink	350-400 x 8-9 tylostyles	12-14 anthasters	Aldabra.
T. aurantiaca Bergquist, 1968	Bergquist, 1968	Bright orange	193-(360)-677 x 2.3-(4.3)-6 tylostyles	4.6-(12.7)-22.2 spherasters	New Zealand.
T. authia de Laubenfels, 1930	De Laubenfels, 1930	Orange	777x 10 tylostyles 200-840 x 4-11 styles	6-23 tylasters	California (USA)
	Desqueyroux-Faúndez, 1972	White-yellowish (in alcohol)	500-780 x 9-10 tylostyles 200-800 x 4-10 styles	3-23 tylasters	Antofagasta (Chile)
	Present study	orange yellowish	207.5-(477.5)-915 x 3.75-(6.4)-15; 3-(8.2)-15 tylostyles 187-(289.4)-800 μm x 2.5-(3.8)-5 styles	3-(14.7)-24	Sinaloa, Mexico
T. capitatostellifera (Carter 1880)	Carter, 1880 Burton, 1959	White	1128 tylostyles	50 asters	Gulf of Manaar
T. centrifera (Hentschel, 1909)	Hentschel, 1909	Yellow	217-376 x 4-6 tylostyles	10-18 strongylasters	Australia
T. curvistellifera (Dendy, 1905)	Dendy, 1905	Light brown	380 x 6 tylostyles	32 asters	Gulf of Manaar,
	Lévi, 1961	Gray.	375-425 x 13 tylostyles	20-60 spherasters	Madagascar, Ceylan,
	Vacelet and Vasseur, 1965	Red or orange	260-520 x 6-13 tylostyles	15-50 spherasters	Aldabra, Tuléar.
T. granulata Bergquist, 1965	Bergquist, 1965	Pale brown (in alcohol)	170-687 x 1.5-8 tylostyles	13-(14.8)-16.5 chiasters 4- (4.8)-5.8 chiasters.	Palau
T. lophastraea (Hentschel, 1909)	Hentschel, 1909	Gray-yellow (in alcohol)	336-696 x 2-7 styles 68-155 x 1-2.5 amphioxe	(2-6) (11-14) Lophaster	Australia
T. lowchoyi Hooper, 1986	Hooper, 1986	Red-brown	332-(432.4)-547 x 4-(7.4)-10 tylostyles	12-(19.52)-28 oxyasters-strongylasters	Australia
T. moorei (Carter, 1880)	Carter, 1880	Glistening white	1749 tylostyles	21 asters	Gulf of Manaar
T. ornata Lévi and Lévi, 1989	Lévi and Lévi, 1989	--	330-600 x 5-9 tylostyles	40-45 spheroxyasters	Polynesia
T. spherastraea Burton, 1959	Burton, 1959	Greyish	1100 x 12 tylostyles	20-35 spherasters	Zanzibar area (Indian Ocean)
T. spinatostellifera (Carter, 1880)	Carter, 1880	Salmon-colour	1834 Tylostyles	42 asters	Gulf of Manaar
T. stellata (Bowerbank, 1866)	Burton, 1937	Yellow	170-1000 x 1-15 tylostyles	14 chiasters	Mediterranean sea, North Atlantic, the
	Thomas, 1973	Pale yellow	191-(711)-1553 x 2-(11)-14 tylostyles	12-(16)-29 strongylasters	West Indies, Australia, Indian Ocean
T. stelligera (Carter, 1882)	Thomas, 1973	Pale yellow	193-(711)-1370 x 2-(6)-14 tylostyles	8-12 chiasters	Atlantic Ocean, Indian Ocean.
T. stellivarians (Carter, 1880)	Carter, 1880	Yellow	352 tylostyles	12 asters	Gulf of Manaar
	Thomas, 1973	Pale white	377-566 x 10 tylostyles	(29) (12-21) (8) oxyasters	
	Dendy, 1905	Yellowish	470 x 10 tylostyles	(20) (12) (8) spherasters	
T. tethyoides Burton, 1959	Burton, 1959	Light greysh-brown	400-800 x 22 tylostyles	(20) (80) spherasters	Zanzibar area (Indian Ocean).
T. tetractis Hentschel, 1912	Hentschel, 1912	--	184-520 tylostyles	7-12 strongylasters 15-31 caltrop-like aster	Indonesia
T. trigonostellata (Carter, 1880)	Carter, 1880	White	356 tylostyles	--	Gulf of Manaar
T. unistellata (Topsent, 1882)	Dendy, 1922	Brown	225 x 4 tylostyles	29 asters	Mediterranean Atlantic N- E,
	Vacelet and Vasseur, 1965	Brown	200-320 x 4-6	9-40 asters	Indian Ocean

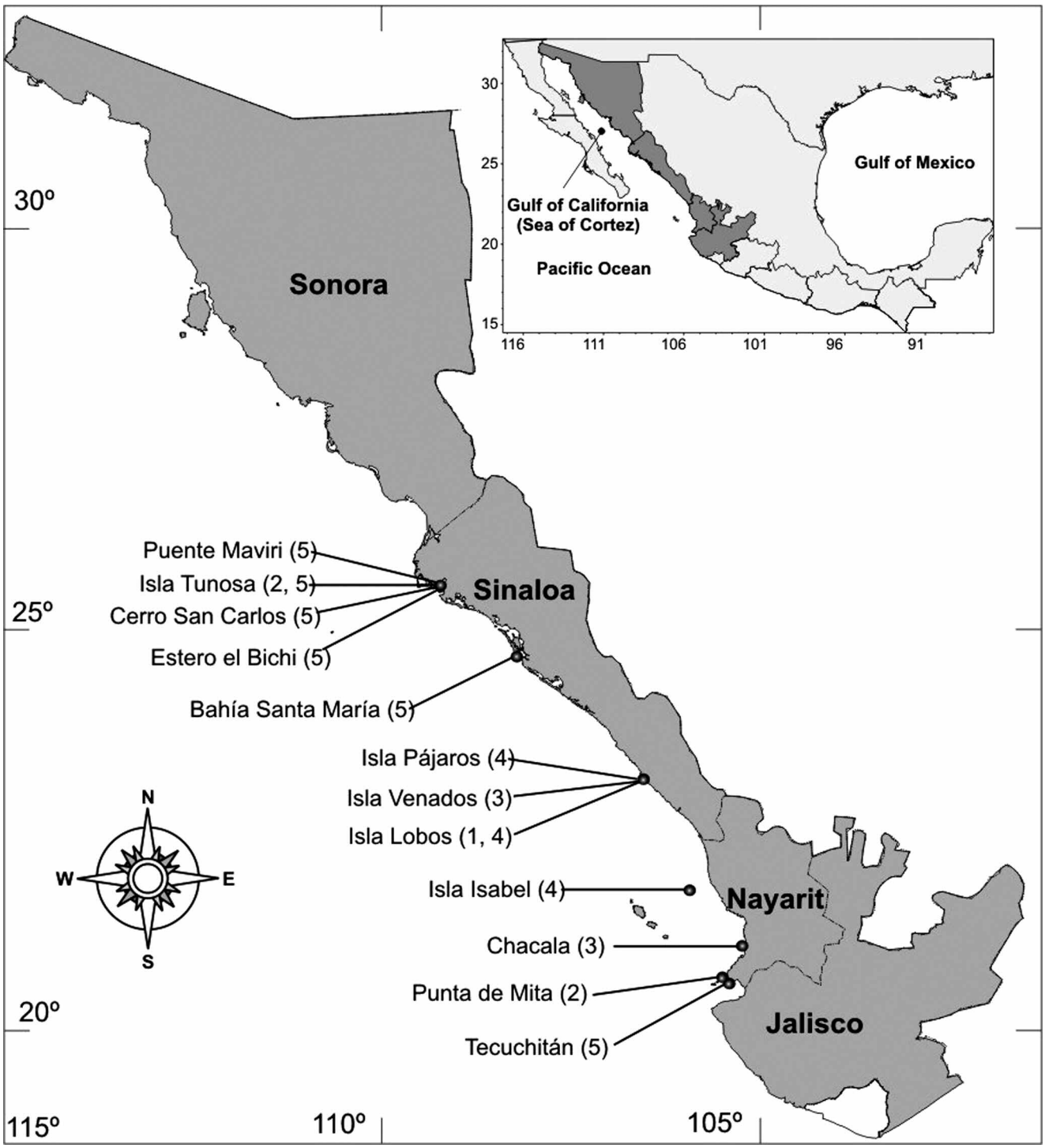

Figure 1. Finding locations of the *Timea* species along the coast of Mexico. Numbers correspond to the different species: (1) *Timea authia*, (2) *Timea chiasterina* sp. nov., (3) *Timea floridusa* sp. nov., (4) *Timea juantotoi* sp. nov., (5) *Timea ohuirae* sp. nov.

Figure 1. Localisation des récoltes d'espèces du genre *Timea* sur les côtes du Mexique. Les nombres correspondent aux différentes espèces : (1) *Timea authia*, (2) *Timea chiasterina* sp. nov., (3) *Timea floridusa* sp. nov., (4) *Timea juantotoi* sp. nov., (5) *Timea ohuirae* sp. nov.

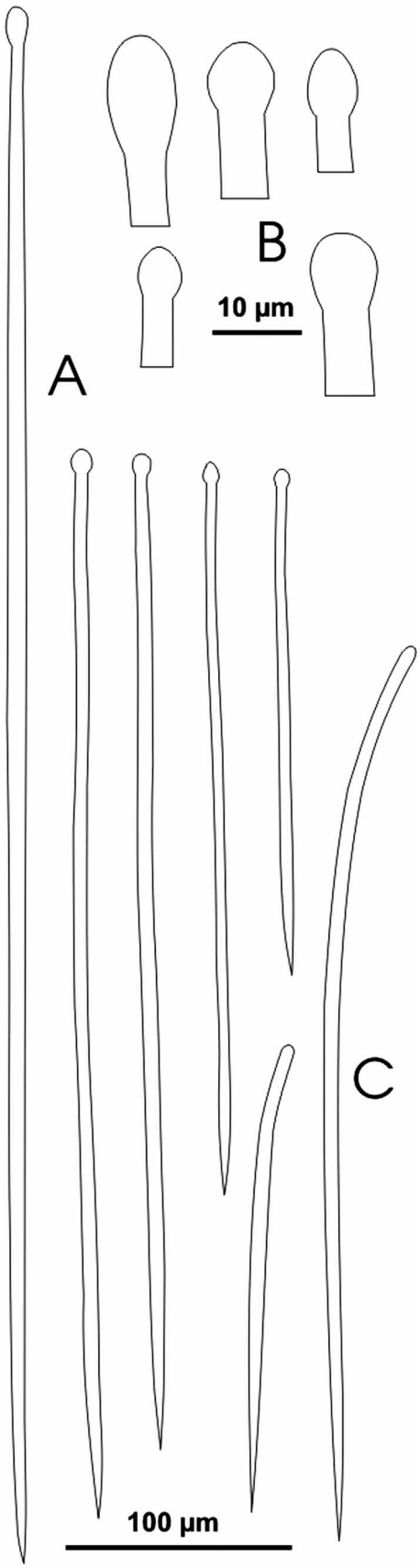

Figure 2. *Timea authia* de Laubenfels, 1932. **A.** Subtylostyles. **B.** Head of the subtylostyles. **C.** Styles.

Figure 2. *Timea authia* de Laubenfels, 1932. **A.** Subtylostyles. **B.** Tête des subtylostyles. **C.** Styles.

Description (Mexican material)

Encrusting sponge 2 mm thick in average, spreading on a surface with a maximum diameter of 19 cm. The color in life is orange yellowish, and beige in alcohol. The surface is hispid with the tip of the subtylostyles protruding by 132 to 190 µm, and sculptured by subectosomic canals 0.6 to 0.9 mm in diameter. Oscules are 0.4 to 1 mm in diameter.

Skeletal characters

The species bears subtylostyles and styles as megascleres. The tylostyles are long and straight with the pointed end hastate (Fig. 2A) and with a generally well-formed spherical oval head; sometimes with a malformed head (Figs 2B, 3A). Tylostyle size: 207.5-(477.5)-915 x 3.75-(6.4)-15 µm; tyle diameter: 3-(8.2)-15 µm. The species also presents slender styles, with the shaft slightly bent in the upper third (Fig. 2C) measuring 187-(289.4)-800 µm x 2.5-(3.8)-5 µm. The euasters have characteristically thick rays with rounded ends. Each actine ends in small spines, but smooth rays are also found. In this case the rays end in an acute point (Fig. 3B). Euaster diameter: 3-(14.7)-24 µm. The euasters form the typical cortex of the genus on the surface of the sponge (Tables 1 & 2).

Distribution and habitat

East Pacific Ocean, from USA (de Laubenfels, 1930) to Chile (Desqueyroux-Faúndez, 1972). *Timea authia* is the only species known along the east Pacific coast, which was originally described in California (de Laubenfels, 1930), and later found in Chile (Desqueroux-Faúndez, 1972). This species was also reported by de Laubenfels (1956) from Brazil (São Paulo); however the conspecifity of the latter record is doubtful and it has not been included as a distributional record of *T. authia*, which is considered to have an eastern Pacific distribution.

Remarks

The type material of *T. authia* is an encrusting sponge, similar to the material from Chile and our own material. Thus, even though de Laubenfels (1930) described it as a "massive, encrusting sponge 2.5 mm thick" we consider *T. authia* an encrusting sponge. *T. authia* is a species well characterized by the presence of tylostyles and styles and by having euasters with thick rays with rounded ends. Size

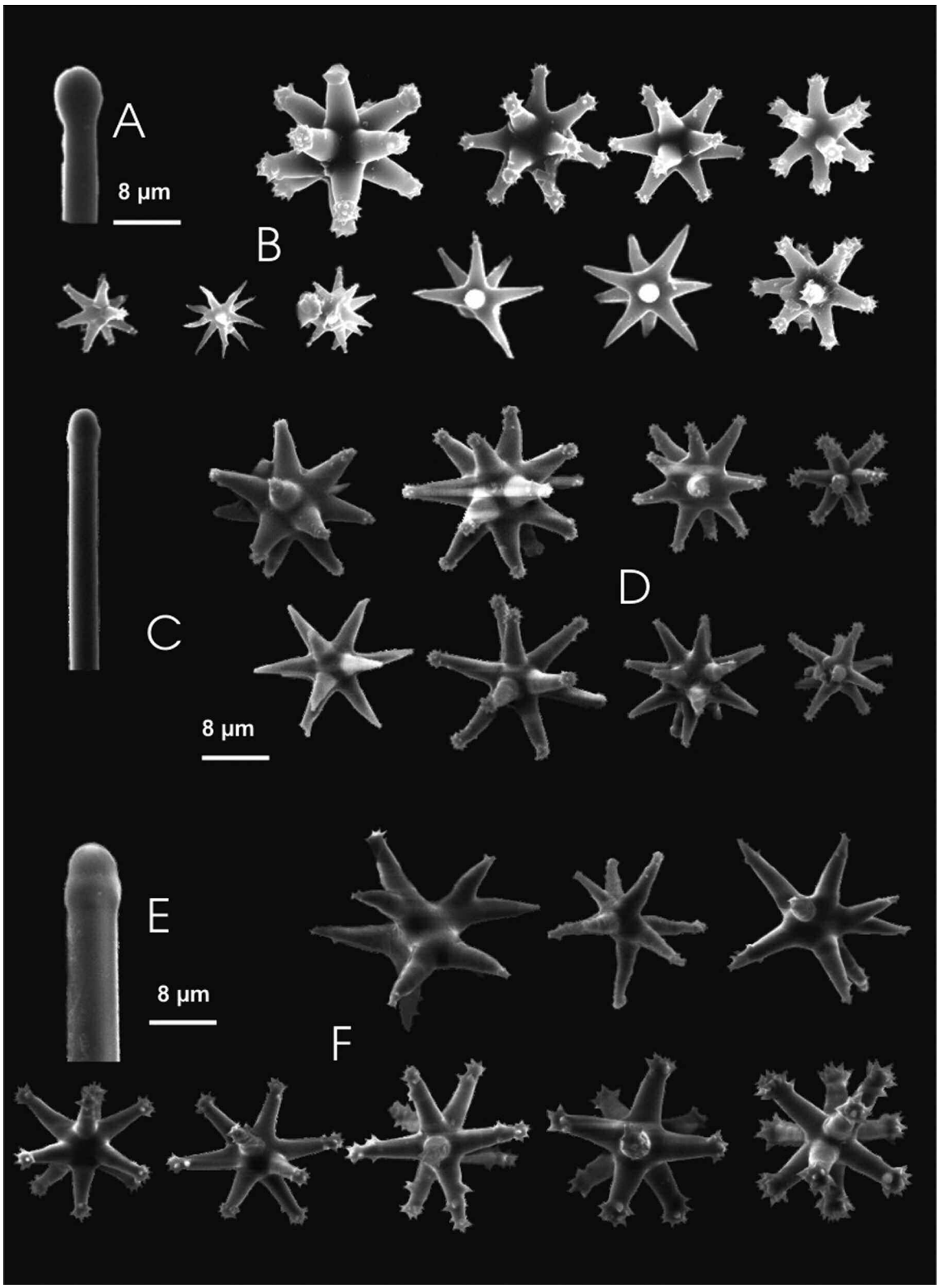

Figure 3. *Timea authia* de Laubenfels, 1932. **A & B.** Mexican specimens. **C & D.** Holotype USNM No. 21499 (Laguna Beach, California). **E & F.** Specimen MZUC No. 4036 (Antofagasta, Chile). **A, C & E.** Head of the subtylostyles. **B, D & F.** Euasters.

Figure 3. *Timea authia* de Laubenfels, 1932. **A & B.** Spécimens mexicains. **C & D.** Holotype USNM No. 21499 (Laguna Beach, California). **E & F.** Spécimen MZUC No. 4036 (Antofagasta, Chili). **A, C & E.** Tête des subtylostyles. **B, D & F.** Euasters.

Table 2. Comparative data for the dimensions of the spicules (in µm) of the new species. Values between brackets are means.
Tableau 2. Données comparatives des tailles de spicules (en µm) des nouvelles espèces. Les valeurs moyennes sont données entre parenthèses.

New-Species	Specimens	Tylostyles	Euasters 1	Euasters 2	Euasters 3
Timea chiasterina		**Length x width shaft; width head**	**Diameter**	**Diameter**	**Diameter**
Holotype	MNCN 1.01/348	92.5-(426)-750 x 5-(8.5)-13; 6-(10)-15	8.5-(11.3)-15		
Paratypes	LEB-ICML-UNAM-244	100-(360)-615 x 3-(6.2)10; 5-(8)12.5	8-(12)-15		
	LEB-ICML-UNAM-1174	152-(246)-350 x 2.5-(2.7)-4.5; 3.8-(5)-8	10-(12.5)-15		
	LEB-ICML-UNAM-1175	155-(313)-545 x 2.5-(4)-5.5; 3-(6.4)-10	8-(12)-15		
Timea floridusa					
Holotype	MNCN 1.01/347	140-(390)-925 x 2.5-(5.5)-11; 2.5-(9)-12.5	8-(12.2)-16.3		
Paratypes	LEB-ICML-UNAM-36	130-(392)-750 x 2.5-(7.2)-15; 2.5-(8.4)-16.3	8-(12)-17		
	LEB-ICML-UNAM-873	162.5-(360)-725 x 2.5-(4)-7; 2.5-(4.5)-10	8.5-(12)-17		
	LEB-ICML-UNAM-1225	150-(510)-1120 x 2.5-(5.6)-10; 3-(7.3)-15	8-(11.8)-17		
Timea juantotoi					
Holotype	MNCN 1.01/349	235-(397.5)-675 x 2.5-(5)-10; 5-(7.5)-12.5	7-(11)-15		
Paratypes	LEB-ICML-UNAM-423	300-(478)-660 x 2.5-(5.3)-10; 5-(8)-15	7-(11.5)-14		
	LEB-ICML-UNAM-858	162-(317)-700 x 2.5-(5)-10; 3-(7.3)-15	7-(12)-17		
	LEB-ICML-UNAM-1080	250-(348)-590 x 2.5-(4.5)-8; 3-(7)-12.5	9-(12.4)-17.2		
	LEB-ICML-UNAM-1184	205-(300)-525 x 2.5-(4.3)-7.5; 5-(6.3)-10	8-(10.5)-15		
Timea ohuirae					
Holotype	MNCN 1.01/350.	250-(550)-925 x 3-(5.4)-17.5; 5-(10)-20	22-(30)-39	15-(19)-25	5-(6.2)-8
Paratypes	BMNH: 2004.8.18.1.	250-(471)-725 x 2.5-(7)-10 x 4-(8.2)-12	22.5-(30)-42	17.5-(19.6)-22.5	5-(6.5)-7.5
	LEB-ICML-UNAM-426	185-(486.7)-990 x 3-(7.2)-15 x 3.8-(9)-16	19-(29)-40	16-(18.4)-20	5-(6.3)-7
	LEB-ICML-UNAM-615	175-(465)-765 x 2.5-(5.2)-7.5; 2.5-(7.3)-13	17-(27)-32.5	15-(18.1)-23	5-(6.2)-8
	LEB-ICML-UNAM-665	192-(358.8)-855 x 3-(6.3)-17.5; 4.5-(8)-20	18.8-(27.5)-37.5	15-(19)-24	5-(6.3)-7.5
	LEB-ICML-UNAM-678	240-(415)-925 x 2.5-(5)-15; 3.8-(6.8)-17.5	17.5-(22)-29	15-(18.3)-25	6-(7)-8
	LEB-ICML-UNAM-698	167.5-(514)-880 x 2.5-(7)-15; 3.8-(9)-16	20-(29)-37.5	17.5-(20.3)-22.2	5-(6.1)-7.5
	LEB-ICML-UNAM-1079	250-(443)-850 x 3-(6.3)-12.5; 3.8-(7.8)-17.5	16-(25)-35	16.5-(18)-25	5-(6.7)-8

of the spicules are in accordance with the measurements of the Mexican material. Size of the tylostyles: 777 x 10 µm in the holotype (Fig. 3C); 500-780 x 9-10 µm in Chile's material (Fig. 3E). Size of the styles: 200-840 x 4-11 µm in the holotype and 200-800 x 4-10 µm in Chile's material. Size of the euasters: 6-23 µm in the holotype (Fig. 2D) and 3-23 µm in Chile's material (Fig. 3F).

Timea chiasterina sp. nov.
(Figs 4 & 5)

Material examined

Holotype. MNCN 1.01/348; Isla Tunosa (Topolobampo, Sinaloa), 25º34'58''N-109º00'51''W, 06/22/00, 1.5 m depth, under rocks. Schizotype. BMNH: 2004.8.18.2; Isla Tunosa (Topolobampo, Sinaloa), 25º34'58''N-109º00'51''W, 06/22/00, 1.5 m depth, under rocks. Paratypes. LEB-ICML-UNAM-244, Isla Tunosa (Topolobampo, Sinaloa), 25º34'58''N-109º00'51''W, 06/22/00, 1.5 m depth, under rocks. LEB-ICML-UNAM-1174, Antiguo Corral del Risco (Punta Mita, Nayarit), 20°46'20''N-105°32'49''W, 07/18/2005, 2 m depth, on rocks. LEB-ICML-UNAM-1175, Antiguo Corral del Risco (Punta Mita, Nayarit), 20°46'20''N-105°32'49''W, 07/18/2005, 2 m depth, on rocks.

Description

Thinly encrusting sponge, 1-2 mm thick. The biggest specimen is 4 x 5 cm. Colour in life is dark yellowish to orange; in alcohol it is pale beige. The surface is microhispid, because the tip of the spicules protrudes by 31 to 50 µm. The surface is sculptured by meandering and bifurcating subectosomic canals from 175 to 374 µm in diameter. Oscules are from 0.4 to 0.7 mm in diameter.

Skeletal characters

The species presents straight or slightly curved subtylostyle/tylostyles (Fig. 4A), with a rounded heads (Figs 4B, 5A). Tylostyle size: 92.5-(328)-750 x 2.5-(8.5)-15 µm; head diameter: 6-(10)-16.5 µm. Tylostyles are arranged in tracts ending as bouquets at the sponge surface which giving a hispid appearance to it. The microscleres are morphologically euasters, measuring: 8-(12)-15 µm, with 6-9 stout rays diverging from a small centrum which can be variable in size. The rays (6-10) end in small bouquets of

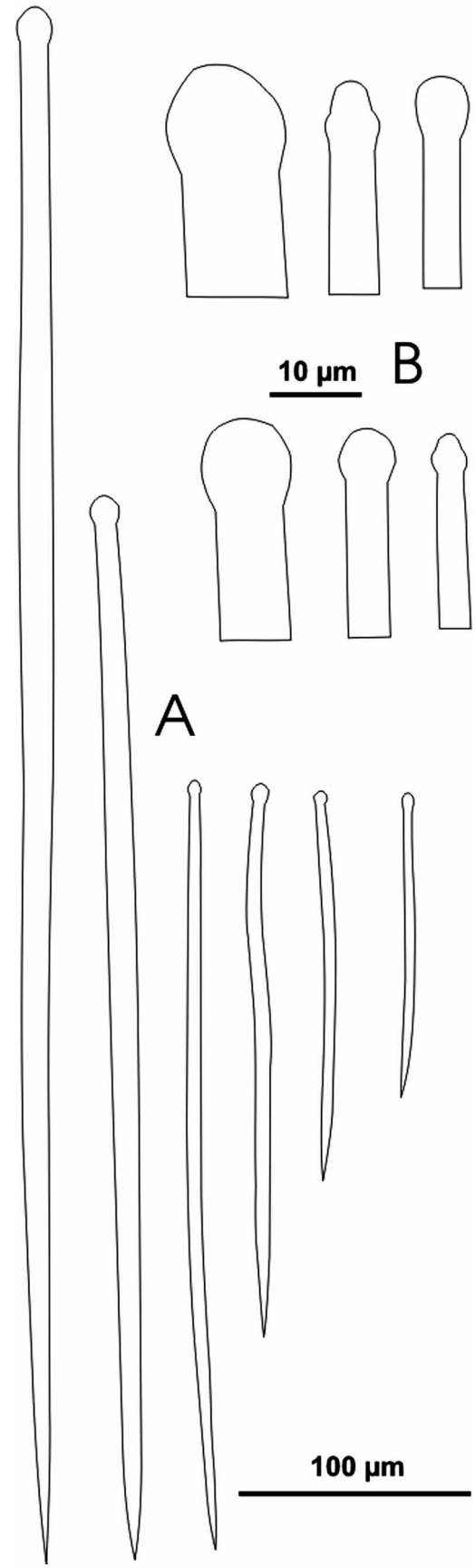

Figure 4. *Timea chiasterina* sp. nov. **A.** Subtylostyles. **B.** Head of the subtylostyles.

Figure 4. *Timea chiasterina* sp. nov. **A.** Subtylostyles. **B.** Tête des subtylostyles.

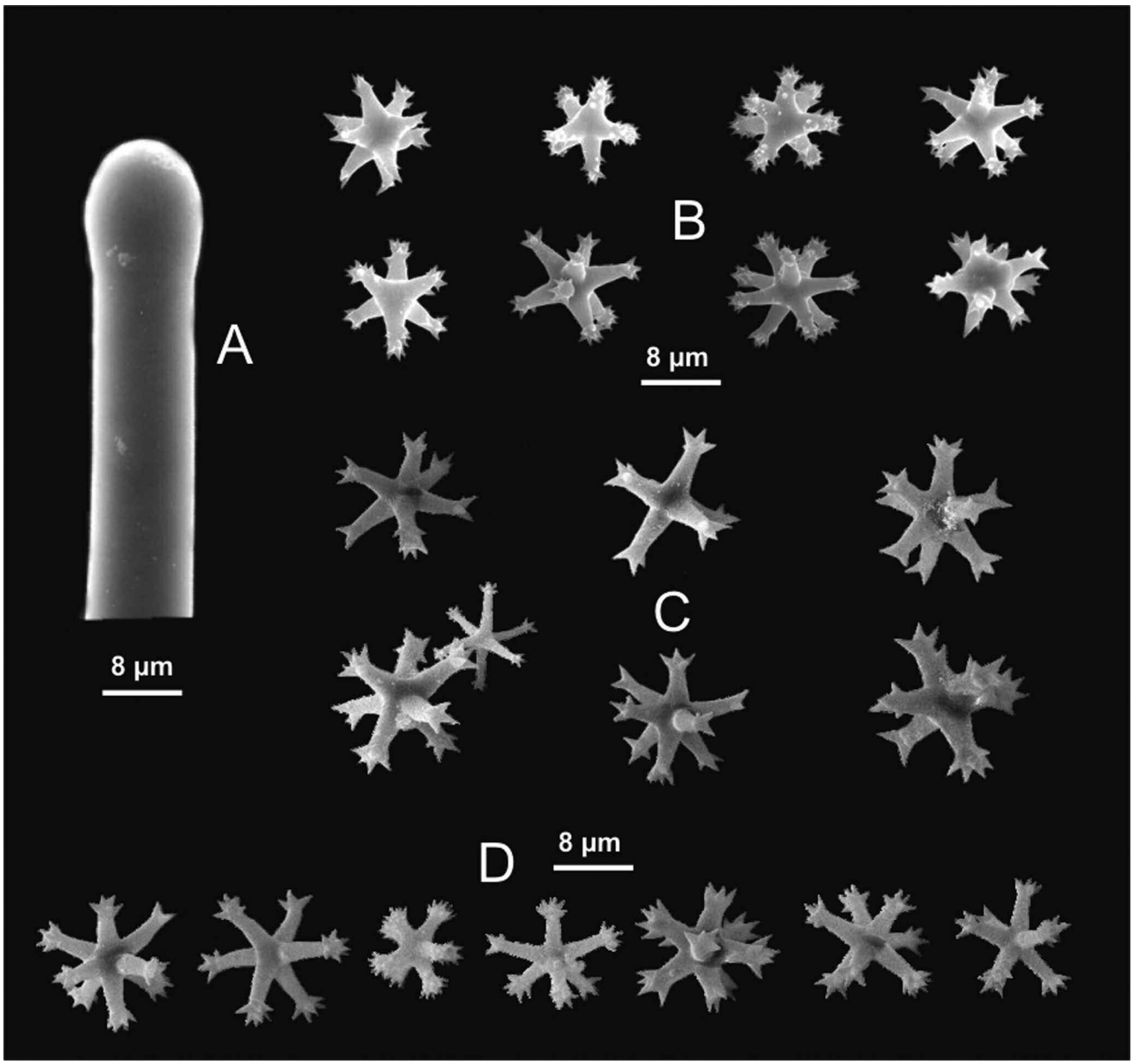

Figure 5. *Timea chiasterina* sp. nov. **A.** Head of subtylostyles. **B.** Euasters of the holotype MNCN1.01/348. **C.** Euasters of the specimen LEB-ICML-UNAM-1174. **D.** Euasters of the specimen LEB-ICML-UNAM-1175.

Figure 5. *Timea chiasterina* sp. nov. **A.** Tête des subtylostyles. **B.** Euasters de l'holotype MNCN1.01/348. **C.** Euasters du spécimen LEB-ICML-UNAM-1174. **D.** Euasters du spécimen LEB-ICML-UNAM-1175.

diverging conical spines; very rarely the spines appear from the middle of the shaft (Fig. 5B, C and D). They form a cortex on the surface of the sponge (Tables 1 & 2).

Etymology

The proposed name *chiasterina* alludes to the form of the euasters ("chiasters").

Distribution and habitat

Mexican Pacific Ocean (from Sinaloa to Nayarit), always found under rocks in shallow water.

Remarks

T. chiasterina sp. nov. can be compared to *T. granulata* Berguist, 1965 from the Gulf of Manaar (Indian Ocean),

from which it mainly differs in the surface texture (smooth vs. finely granular in *T. granulata*), the width of the tylostyles (5-15 µm vs. 1.5-8 µm in *T. granulata*) and form of the euasters (*T. granulata* also presents euasters with one or two rays). Another close species is *T. intermedia* described by Lévi (1958) as *Timeopsis*. This is a yellow sponge from the Red sea that is 2-3 mm thick, with asters (9-11 µm, 6 rays in average) ending in spiny knobs (4-6 spines) which Lévi named acanthotylasters. However, the spination of the euasters and the very different geographical distribution clearly separates the two species. *T. anthastra* Lévi, 1961 from the Indian Ocean is a pink sponge with shorter tylostyles (350-400 x 8-9 µm) and a well-formed head (13-15 µm), with euasters ("anthasters") (12-14 µm) bearing very slender rays, all characteristics which are clearly different to those of *Timea chiasterina* sp. nov.

Timea floridusa sp. nov.
(Figs 6 & 7)

Material examined

Holotype. MNCN 1.01/347; Isla Venados (Mazatlán, Sinaloa), 23º10'75''N-106º26'42''W, 10/25/99, intertidal, on the sponge *Geodia mesotriaena*. Schizotype. BMNH: 2004.8.18.3; Isla Venados (Mazatlán, Sinaloa), 23º10'75''N-106º26'42''W, 10/25/99, intertidal, on the sponge *Geodia mesotriaena*. Paratypes. LEB-ICML-UNAM-36, Isla Venados (Mazatlán, Sinaloa), 23º10'75''N-106º26'42''W, 10/25/99, intertidal, on the sponge *Geodia mesotriaena*. LEB-ICML-UNAM-873, Chacala (Nayarit), 21º09'57''N-105º13'38''W, 10/25/99, 3 m depth, on the sponge *Geodia mesotriaena*. LEB-ICML-UNAM-1225, Isla Venados (Mazatlán, Sinaloa), 23º10'75''N-106º26'42''W, 07/28/05, 1 m depth, on rocks.

Description

Very thinly encrusting sponge, 0.2-0.8 mm thick. The sponge reaches a maximum surface of 6 x 3 cm and it lives characteristically on the surface of *Geodia mesotriaena* (Lendenfeld, 1910). The specimens are ochre, light brown or light orange in life, and pale brown in alcohol. The surface is smooth to the naked eye, but under the microscope is unevenly hispid with the tips of the subtylostyles protruding from the surface by 350 to 500 µm. Subectosomic canals, grooves or oscula have not been observed. Sponge consis-

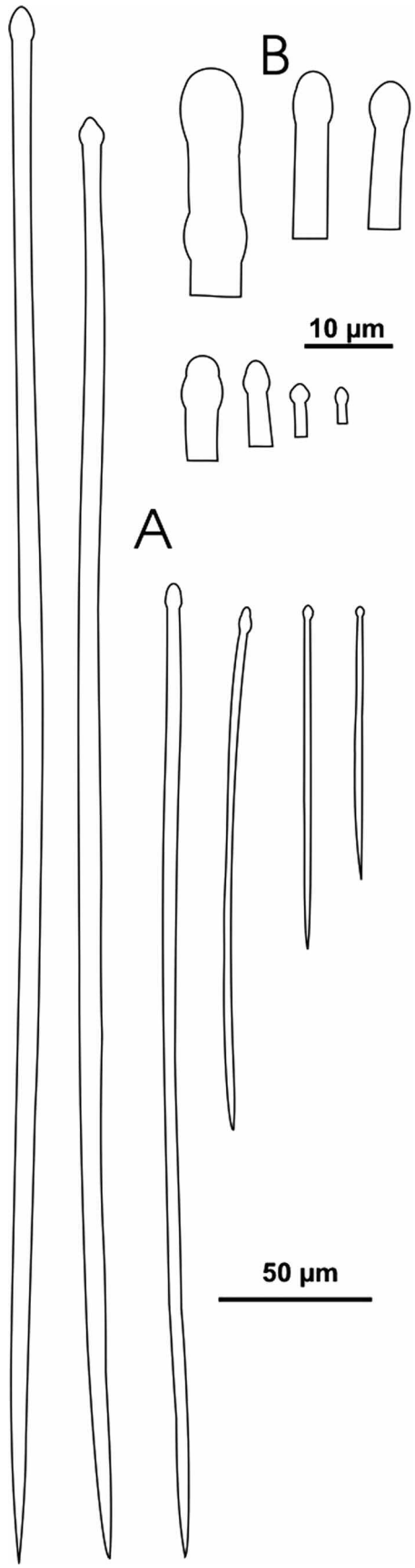

Figure 6. *Timea floridusa* sp. nov. **A.** Subtylostyles. **B.** Head of the subtylostyles.

Figure 6. *Timea floridusa* sp. nov. **A.** Subtylostyles. **B.** Tête des subtylostyles.

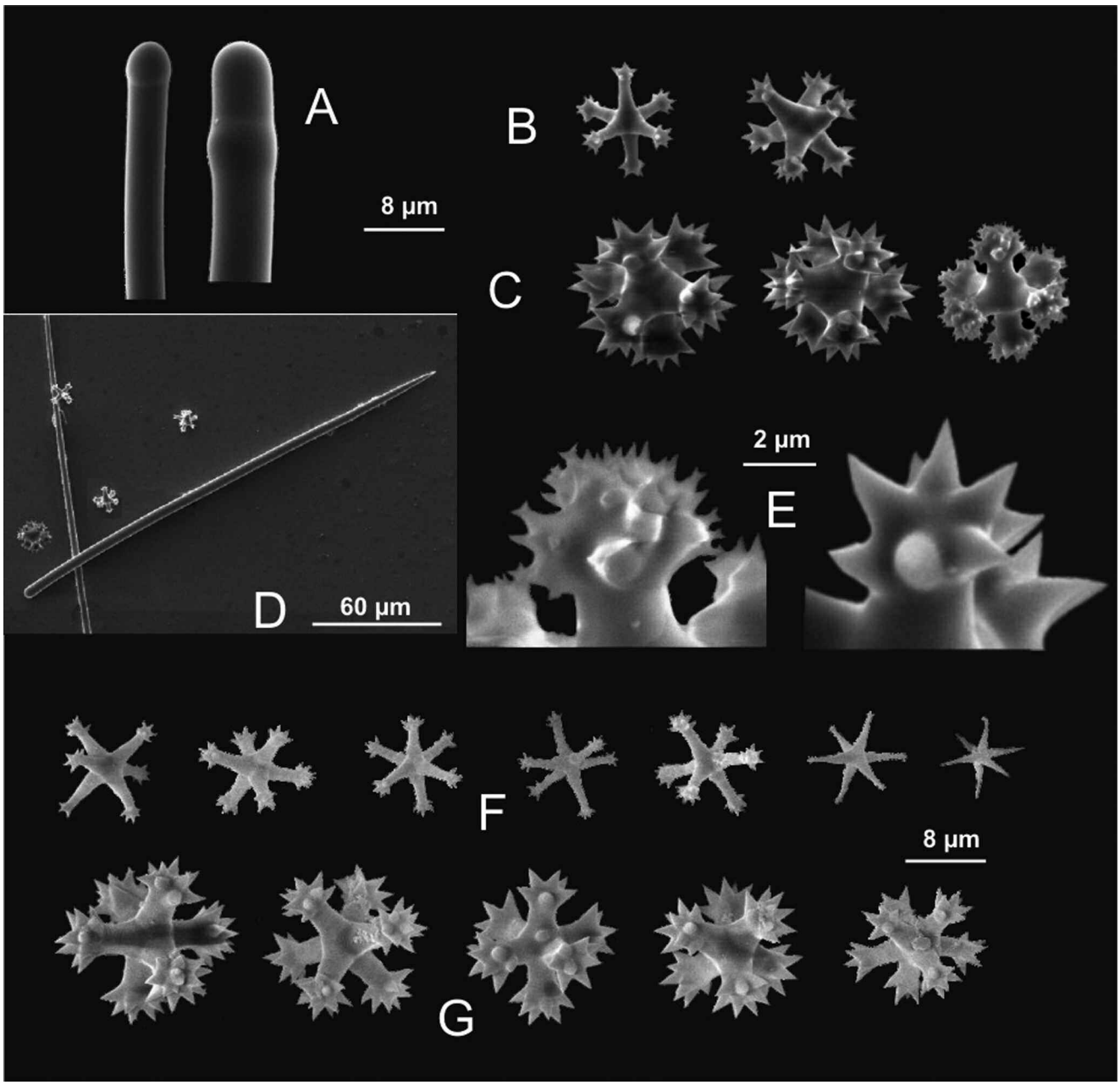

Figure 7. *Timea floridusa* sp. nov. **A.** Heads of the subtylostyles. **B & F.** Euasters with slender rays terminating in small spiny knobs. **C & G.** Robust euasters, with stout rays diverging from a large centrum and terminating in an ample bouquet of spines. **D.** Subtylostyles and euasters. **E.** Detail of the terminal rays. **A-E.** Holotype MNCN 1.01/347. **F-G.** Specimen LEB-ICML-UNAM-873.

Figure 7. *Timea floridusa* sp. nov. **A.** Tête des subtylostyles. **B & F.** Euasters pourvus de rayons étroits terminés par des petites boules épineuses. **C & G.** Euasters robustes, pourvus de rayons épais partant d'un large centre et terminés par un ample bouquet d'épines. **D.** Subtylostyles et euasters. **E.** Détail des extrémités des rayons. **A-E.** Holotype MNCN 1.01/347. **F-G.** Spécimen LEB-ICML-UNAM-873.

tence is very delicate, and soft, very difficult to detach from the surface of the sponge *Geodia mesotriaena*.

Skeletal characters

The megascleres are subtylostyles with a very incipient head, sometimes with a slight subterminal swelling (Figs 6B & 7A). They are straight, or curved in the upper third (Figs 6A & 7D). Measurements: 130-(420)-1120 x 2.5-(5.6)-15 µm, head measurements: 2.5-(6.7)-16.3 µm. The subtylostyles are anchored with their heads in the tissue and form erect tracts (75 to a 217 µm in diameter) These branch towards the surface protruding it up to 166 µm. The species

presents two morphological categories of euasters: 1) Euasters with a very constant number of slender rays (6 rays), ending in small spiny knobs with 4-8 short conical spines (Fig. 7B, F). 2) Euasters more robust, with stout rays diverging from a large centrum and ending in an ample bouquet of spines (Fig. 7C, G). In other stage of development the rays are so short that the terminal bouquets almost diverge directly from the centrum of the spicule. Occasionally some spicules have the terminal spines reduced to irregular protuberances (Fig. 7E). Measurements: 8-(12)-17 µm. The euasters are irregularly scattered in the choanosome, but they form a cortex in the surface of the sponge (Tables 1 & 2).

Etymology

The specific name is derived from the Latin *floridusa*, it refers to the flowery aspect of the large euasters.

Distribution and habitat

Mexican Pacific Ocean (from Sinaloa to Nayarit), from the intertidal to 3 m depth. It has always been found living under rocks attached over sponges of the genus *Geodia*.

Remarks

T. fasciata Topsent, 1934 from the Mediterranean Sea (Monaco) seems to be the closest species to *T. floridusa* sp. nov. Common characteristics of the two species are the similar size of tylostyles, and the euasters with the very small center and rays ending in spiny bouquets. However, in the former, these euasters named by Topsent "strongylasteres", strongylotriplaster" and "strongyamphiasters" are highly variable in the number of rays, and the bouquets terminate in small rounded warts. *T. granulata* Bergquist, 1965 is a thinly encrusting sponge up to 0.5 mm thick with euasters ("chiasters") having six to nine rays diverging from a centrum and ending in four to six short conical spines. It presents important differences with our new species. The surface of *T. granulata* is finely granular, due to the concentration of microscleres in the dermal region; in contrast, the surface of *T. floridusa* sp. nov. is smooth. Megascleres are similar in size in both species, but in *T. granulata* they are tylostyles (170-687 x 1.5-8 µm) with rounded terminal or ovate subterminal heads, tapering evenly to sharp points, and in *T. floridusa* sp. nov. they are mainly subtylostyles with a very incipient head. The size of the euasters (smaller in *T. granulata*), and most of all, the absence of the better developed euasters of *T. floridusa* sp. nov. clearly separate the two species as well. The new species could also be compared to *T. chiasterina* sp. nov. because both share a similar form of euasters (category I), with rays diverging from a small centrum and ending in small bouquets of divergent spines (Table 1). However, *T. floridusa* sp. nov. additionally bears more robust euasters, with stout rays diverging from a large centrum and ending in an ample bouquet of spines. The size of the subtylostyles (up to 1120 µm in *T. floridusa* and up to 750 µm in *T. chiasterina*) also separates the two species.

Timea juantotoi sp. nov.
(Figs 8 & 9)

Material examined

Holotype: MNCN 1.01/349 Isla Lobos (Mazatlán, Sinaloa), 23º13'49''N-106º27'43''W, 6/20/03, 2 m depth, on the sponge *Geodia mesotriaena*. Schizotype BMNH: 2004.8.18.4; Isla Lobos (Mazatlán, Sinaloa), 23º13'49''N-106º27'43''W, 6/20/03, 2 m depth, on the sponge *Geodia mesotriaena*. Paratypes: LEB-ICML-UNAM-423, Isla Isabel (Nayarit), 21º46'35''N-105º51'42''W, 20 m depth, 11/21/99, on dead coral. LEB-ICML-UNAM-858, Isla Lobos (Mazatlán, Sinaloa), 23º13'49''N-106º27'43''W, 6/20/03, 2 m depth, on the sponge *Geodia mesotriaena*. LEB-ICML-UNAM-1080, Isla Pájaros (Mazatlán, Sinaloa), 23º15'29''N-106º28'25''W, 4 m depth, 02/15/02, 5 m depth, on the sponge *Geodia mesotriaena*. LEB-ICML-UNAM-1184, Isla Isabel (Nayarit), 21º46'35''N-105º51'42''W, 10 m depth, 08/02/05, on dead coral.

Description

A thinly encrusting sponge from 0.4 to 1.2 mm in thickness, covering a maximum surface of 2 x 3 cm. The color is pale orange in life, almost ochre or dark beige in alcohol. The surface is smooth to the naked eye, while under the stereoscope it is unevenly hispid, with spicules protruding by 63 to 200 µm. Neither oscules nor subectosomic canals were observed.

Skeletal characters

Subtylostyles are mostly straight or only slightly curved (Fig. 8A), with an oval head (Figs 8B & 9A), measuring 162-(317)-700 x 2.5-(5)-10 µm; head diameter: 3-(7.3)-15 µm. Microscleres are very characteristic euasters measuring 7-(12)-17 µm, with a large number of rays (up to 16 rays) frequently ending in an acute point. The rays have small spines which are distributed from the middle to the distal end of the shaft, or appearing only at the end of the shaft (Fig. 9B, C). Rarely, the rays are completely smooth.

Etymology

The species is named after Mr. Juan Toto Fiscal, the captain of the boat "Espumita", for his altruism and help at different stages of our work.

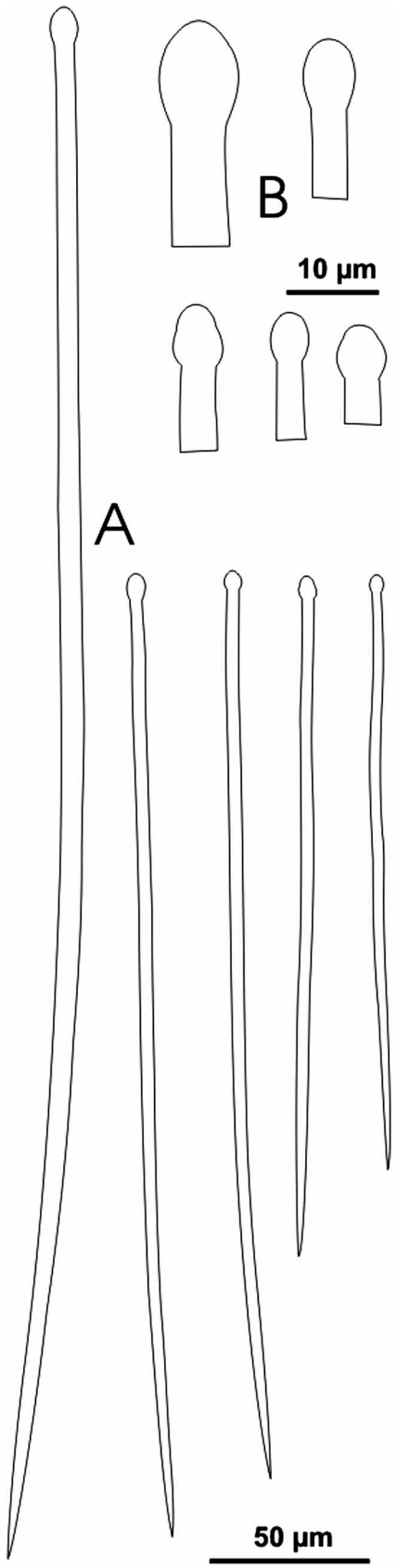

Figure 8. *Timea juantotoi* sp. nov. **A.** Subtylostyles. **B.** Head of the subtylostyles.

Figure 8. *Timea juantotoi* sp. nov. **A.** Subtylostyles. **B.** Tête des subtylostyles.

Distribution and habitat

Mexican Pacific Ocean (from Sinaloa to Nayarit). The species has always been found living from 2 to 20 m depth, on corals, under rocks and on sponges of the genus *Geodia*.

Remarks

The new species *T. juantotoi* sp. nov. is mainly characterized by the homogeneity in the morphology of the euasters, which present a high number of rays with small spines. The closest species seems to be *T. ornata* Lévi & Lévi, 1989 from the Indian Ocean, which has euasters similar in form and in number of rays. However, the size of the euasters (40-55 µm) clearly separates it from *T. juantotoi* sp. nov. *T. lowchoyi* described by Hooper (1986) from Australia is comparable to *Timea juantotoi* sp. nov. in size and morphology of the spicules, but *T. lowchoyi* is a dark red-brown sponge, with radially grooved canals draining into small oscules (not observed in *T. juantotoi* sp. nov.) (Table 1). The thickness of the sponge (1-3 µm vs. 0.3-1.2 of *T. juantotoi* sp. nov.) is another characteristic that differentiates the two species. The new species could be also compared to *T. unistellata* (Topsent, 1892). Both share a similar form of euasters although the rays are frequently smooth in *T. unistellata* (Carballo, 1994). The tylostyles are also much shorter in *T. unistellata* (280-360 µm) (Carballo, 1994) than in *T. juantotoi* sp. nov. (162-700 µm).

Timea ohuirae sp. nov.
(Figs 10-12)

Material examined

Holotype: MNCN 1.01/350. Estero el Bichi (Topolobampo, Sinaloa), 25°32'27''N-109°05'29''W, 08/26/05, 2 m depth on rocks. Paratypes: BMNH: 2004.8.18.1. Estero el Bichi (Topolobampo, Sinaloa), 25°32'27''N-109°05'29''W, 08/26/05, 2 m depth, on rocks. LEB-ICML-UNAM-426, Bahía Sta. Maria (La Reforma, Sinaloa), 24°47'30''N-108°04'13''W, 12/12/01, 2 m depth, on rocks. LEB-ICML-UNAM-615, Tecuchitan (Punta Mita, Nayarit), 20 43'54''N-105 24'44''W, 10/05/02, 10 m depth, on shell of a bivalve. LEB-ICML-UNAM-678, Isla Tunosa (Topolobampo, Sinaloa), 25º34'58''N 109º00'51''W, 11/12/02, 2 m depth, on rocks. LEB-ICML-UNAM-698, Estero el Bichi (Topolobampo, Sinaloa), 25°32'27''N-

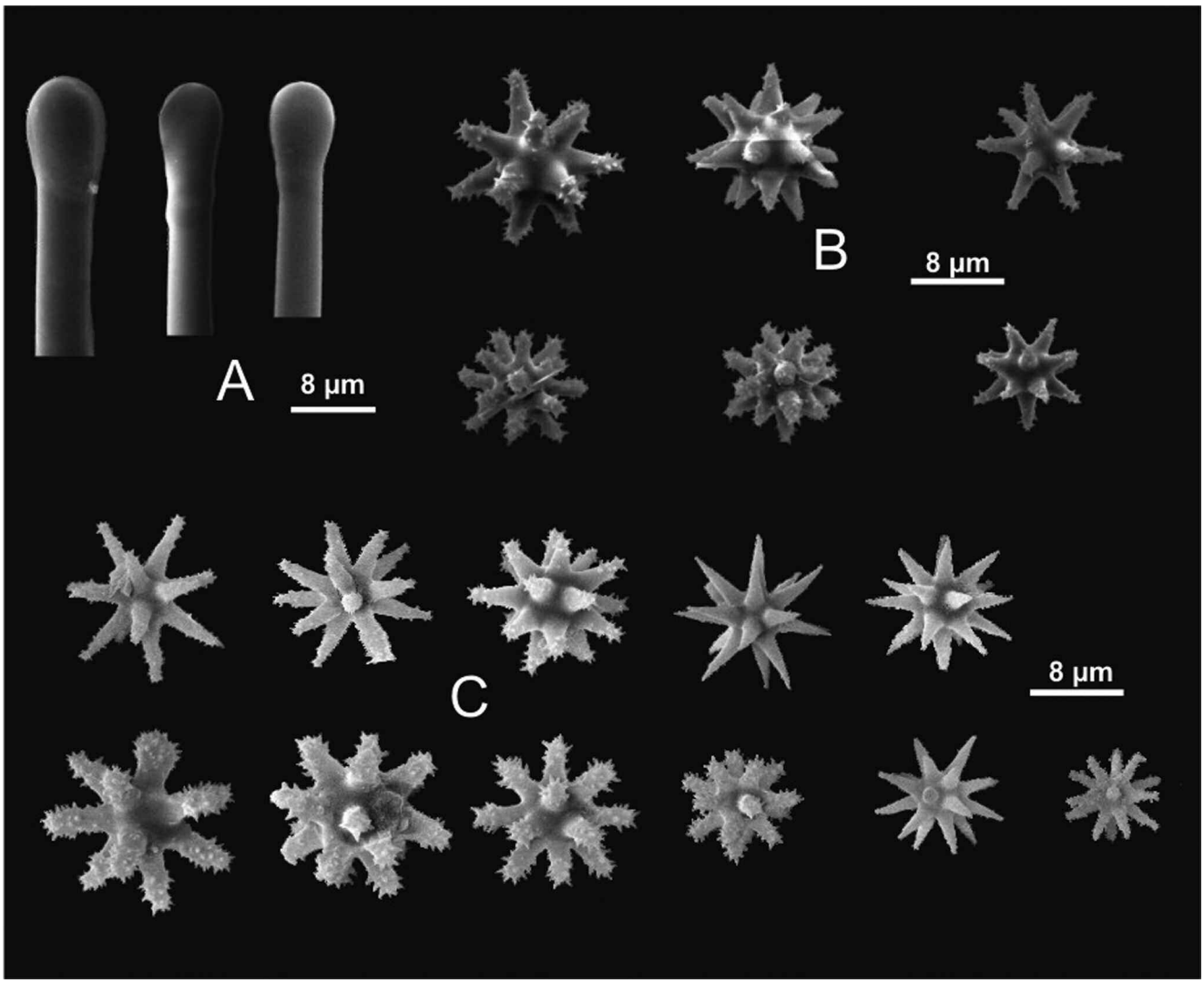

Figure 9. *Timea juantotoi* sp. nov. **A.** Heads of the subtylostyles. **B.** Euasters of the holotype MNCN 1.01/349. **C.** Euasters of the specimen LEB-ICML-UNAM-1184.

Figure 9. *Timea juantotoi* sp. nov. **A.** Tête des subtylostyles. **B.** Euasters de l'holotype MNCN 1.01/349. **C.** Euasters du spécimen LEB-ICML-UNAM-1184.

109°05'29''W, 11/13/02, 1 m depth, on rocks. LEB-ICML-UNAM-731, Puente Maviri (Los Mochis, Sinaloa), 25º34'55''N-109º06'52''W, 11/14/02, 8 m depth, on rocks. LEB-ICML-UNAM-1079, Estero el Bichi (Topolobampo, Sinaloa), 25°32'27''N-109°05'29''W, 04/22/04, 1 m depth.

Description

A very thinly encrusting sponge from 0.4 to 2 mm thick. The holotype extends over a surface of 12 cm in diameter, but some of the paratypes were spreading simultaneously over two rocks; 11 x 9.5 cm (first rock) and 11 x 2.5 cm (second rock). The color in life is pale orange or orange, and beige or light yellow in alcohol. The surface is hispid with the tylostyle tips protruding from the surface as small bouquets having a length of 50-332 µm. The presence of minute warties (150-900 µm in diameter) formed by the accumulation of euasters on the surface of the sponge is also frequent. Sponge surface is also sculptured by long meandering subectosomic canals (100-200 µm) and spaces (166-332 µm) radiating from circular or oval shaped oscules, 0.3 to 0.5 mm in diameter (Fig. 11A, B). Oscula rose slightly in thicker areas of the sponge, or flush with the surface. The texture is slightly compressible and elastic.

Skeletal characters

Subtylostyle/tylostyles are mostly straight or slightly curved (Fig. 10 A), with a generally well-formed spherical or oval head. Some subtylostyle/tylostyles have malformed

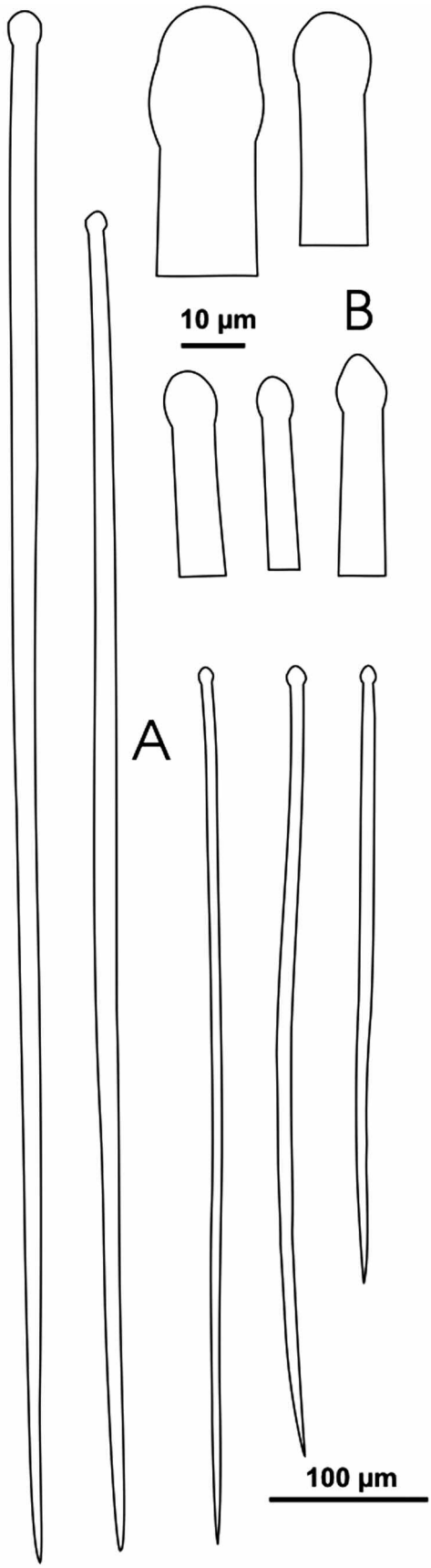

Figure 10. *Timea ohuirae* sp. nov. **A.** Subtylostyles. **B.** Head of the subtylostyles.

Figure 10. *Timea ohuirae* sp. nov. **A.** Subtylostyles. **B.** Tête des subtylostyles.

heads and annular swellings (Figs 10B, 11A, E & I). Length: 167-(462)-990 x 2.5-(6)-17.5 µm; head diameter: 3.8-(8.2)-20 µm (Tables 1 & 2). The new species has three morphological categories of euasters. 1) Large euasters with 8 to 14 long robust and conic rays ending in a sharp point, with variable spination pattern. They varied from smooth, or with short conic spines distributed mainly in the distal part of the actine or from the middle of the shaft, to more robust euasters, with prominent centrum, shorter rays and heavily spined rays. These are irregular in shape, sometimes forming proto-bouquets (Fig. 12A, D & G). Measurements: 16-(27.4)-42 µm. 2) Medium euasters with 8 to 13 rays ending in a blunt point, with spines distributed only in the end of the actine (Fig. 12B, E & F). Measurements: 15-(18.8)-25 µm. 3) Small euasters with 6 to 9 short stout rays diverging from a small centrum which vary in size. The rays are terminated in small bouquets of divergent conical spines. Measurements: 5-(6.4)-8 µm (Tables 1 & 2) (see Fig. 12C, F & I).

Etymology

The specific epithet refers to the village of Ohuira bay from the northern of Sinaloa State.

Distribution and habitat

Mexican Pacific Ocean. Bahía de Topolobampo, Bahía de Ohuira and Santa María de la Reforma (Sinaloa), Bahía Banderas (Jalisco). Under rocks, in shallow water.

Remarks

The new species is mainly characterized by skeletal details such as the three morphological categories of the euasters. Two species are found in the literature close to *T. ohuirae* sp. nov. The closest one seems to be *T. mixta* (Topsent, 1896) *sensu* Wiedenmayer (1977) bearing two classes of euasters which the author names oxyasters (probably similar to category 1 of *T. ohuirae* sp. nov.), and chiasters, anthasters and anthospherasters (probably similar to category 2 in *T. ohuirae*). However, there are significant differences between the two species. (besides the very different geographical distribution). In *T. mixta* the ectosome has tangential spicules in confusion, and *T. ohuirae* sp. nov., it characteristically bears a cortex of densely packed euasters. This species can also be compared to *T. aurantiaca* Bergquist, 1968 from New Zealand, a thinly

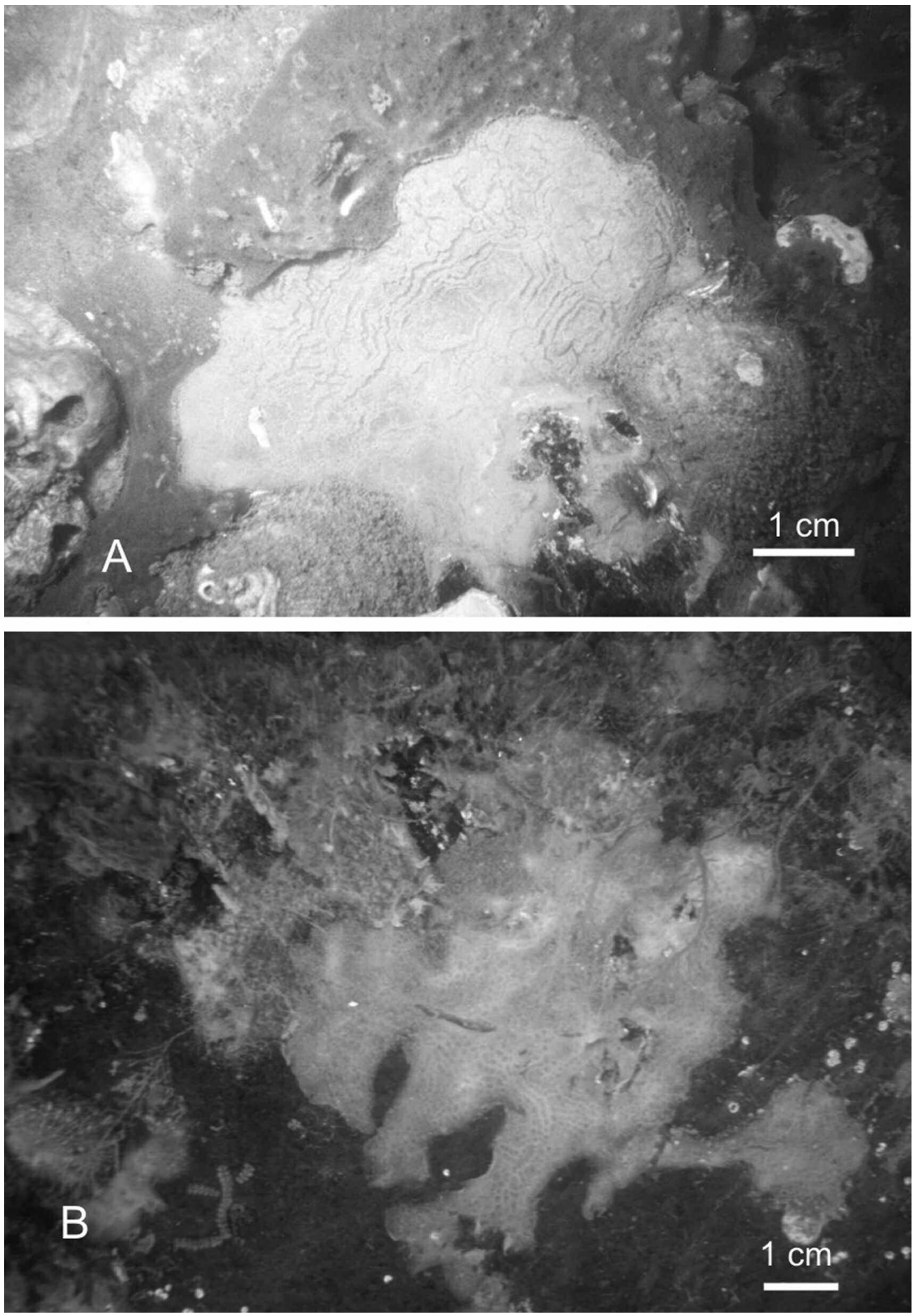

Figure 11. External morphology of *Timea ohuirae* sp. nov. in bahía de Ohuira. **A.** Holotype MNCN 1.01/350, at 1 m depth. **B.** Specimen LEB-ICML-UNAM-725, at 5 m depth.

Figure 11. Morphologie externe de *Timea ohuirae* sp. nov. à Bahía de Ohuira. **A.** Holotype MNCN 1.01/350, à 1 m de profondeur. **B.** Spécimen LEB-ICML-UNAM-725, à 5 m de prodondeur.

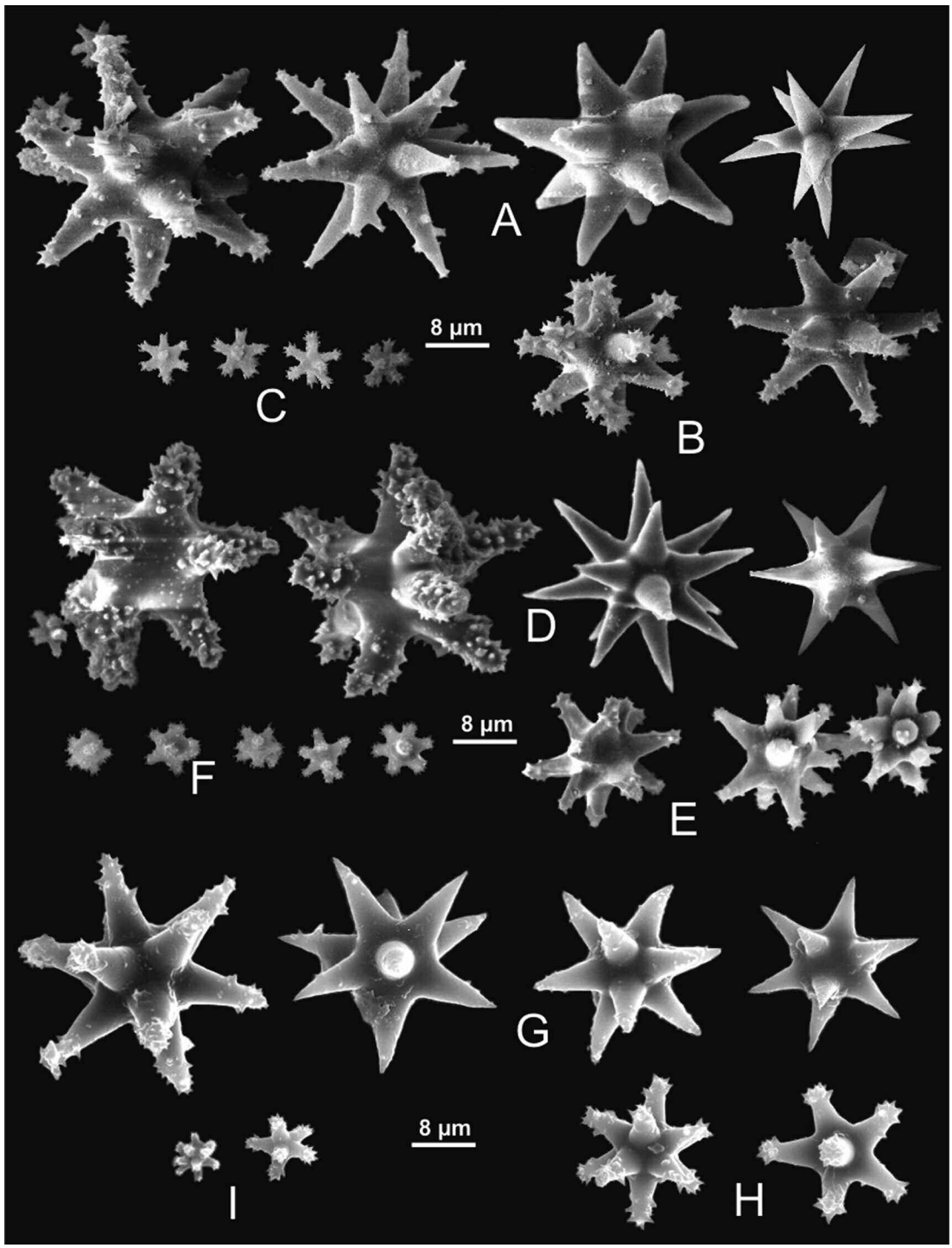

Figure 12. *Timea ohuirae* sp. nov. **A, B & C.** Holotype MNCN 1.01/350. **D, E & F.** Specimen LEB-ICML-UNAM-665. **G, H & I.** Specimen LEB-ICML-UNAM-426. **A, D & G.** Large euasters with long robust and conic rays ending in a sharp point, with variable stoutness and spination pattern. **B, E & H.** Medium euasters with rays ending in a blunt point, bearing spines distributed only in the end of the actine. **C, F & I.** Small euasters with short stout rays diverging from a small centrum which vary in size.

Figure 12. *Timea ohuirae* sp. nov. **A, B & C.** Holotype MNCN 1.01/350. **D, E & F.** Spécimen LEB-ICML-UNAM-665. **G, H & I.** Spécimen LEB-ICML-UNAM-426. **A, D & G.** Grands euasters pourvus de rayons coniques longs et robustes terminés en pointe, d'épaisseur variable et avec différentes ornementations épineuses. **B, E & H.** Euasters moyens pourvus de rayons terminés par une pointe émoussée, portent des épines seulement vers l'extrémité de l'actine. **C, F & I.** Petits euasters portant des rayons épais courts partant d'un noyau petit de taille variable.

encrusting, bright orange sponge which presents a granular surface because of the dense dermal layer of spherasters, similar to that of *T. ohuirae* sp. nov. However, *T. aurantiaca* can be distinguished from the new species by having two distinct forms of euasters (tylospherasters to strongylospherasters) as well as megascleres of a different size (193-677 x 2.3-6 µm in *T. aurantiaca*).

Discussion

Differentiation of *Timea* species relies largely upon the form and spination of the euasters (see for example, Bergquist, 1965 & 1968; Hooper & Wiedenmayer, 1994; Lehnert & Heimler, 2001; Mothes et al., 2004). These euasters have been named in the literature following a complicated terminology (acanthotylaster, amphiaster, anthaster, anthispheraster, calthrops-like aster, chiaster, lophaster, oxyaster, oxyspheraster, pseudoaster, spheroxyaster, spherotylaster, strongylamphiaster, strongylaster, strongylotriplaster, tylaster strongylospheraster and tylospheraster) that sometimes makes it very difficult to attempt an inter-species comparison when a detailled micromorphological description of them is lacking. Even though some of the euasters definitions have been revised by Boury-Esnault & Rützler (1997), and most terms are very useful to recognize species, we recommend describing them by SEM analysis in detail to permit a clear understanding of their morphology.

Moreover, additional characteristics from live specimens, particularly colour and surface ornamentation, are certainly useful to separate species. *Timea* species have encrusting growth forms, with the surface frequently sculptured by subectosomal drainage canals running to oscula (Hooper, 1986), or with the surface smooth or finely granular due to the concentration of microscleres in the dermal region (Bergquist, 1965). The *Timea* species from the Mexican Pacific coast are clearly different from each other in the form and spination of the microscleres, and the detail of the form and size of the megascleres. However, the color and ornamentation of the surface are significant distinguishing characteristics.

The low number of records of the species belonging to the family Timeidae in the East Pacific Ocean (only two records before this contribution) is not surprising, since we also observed very low frequency of appearance of *Timea* specimens in our samples. We have sampled in more than 105 localities during the last 5 years (Gómez et al., 2002; Carballo et al., 2003 & 2004; Cruz-Barraza & Carballo, 2005, among others), and more than 2000 sponge specimens have been deposited in the sponge collection of the ICML-UNAM. *Timea* species are usually very small cryptic encrusting sponges. Still, despite having sampled extensively small caves, as well as overhangs and lower rock surfaces, only 25 specimens of *Timea* were found. The same seems true in other areas, given the low number of *Timea* species described in recent years (only three species) (Hooper, 1986; Lehnert & Heimler, 2001; Mothes et al., 2004).

A comparison of our new material with other *Timea* species was difficult because of the lack of detailed depictions of euasters by SEM technique, in most cases, but each new species was compared with its closest and others related species, mainly from the Indo Pacific area. Some species such as *T. ohuirae* sp. nov. are difficult to be separated morphologically from species of the Atlanto-Mediterranean province, such as *T. mixta* or *T. stellata*. *T. stellata* was recorded from extra-European waters for the first time by Burton (1937) in Papuan Pass (Indian Ocean), without a description of the spicules or their arrangement. This species was recorded later by several authors in areas very far from its typical distribution area, but the validity of this record was questioned by Hooper and Wiedenmayer (1994). The same is true for other *Timea* species described in certain places, and later recorded from very distant areas. Most of the species described in this paper have a very restricted distribution, and only one of them (*T. ohuirae*) is relatively common in a locality. We have accepted the recent tendency which considers that most sponge species are not cosmopolitan. Recent research has demonstrated that Poriferan diversity measured by genetic divergence among sympatric morphotypes may be greater than indicated by current classifications. These considerations indicate that the cosmopolitanism of most sponge species is the result of over-conservative systematics. This also has been the conclusion of a lot of recent studies on sympatric and allopathic sponges (Solé-Cava et al., 1991 & 1992; Boury-Esnault et al., 1992, 1993, 1994 & 1995; Klautau et al., 1994 & 1999; Soest & Hooper, 1993; Carballo et al., 2003).

The new species described in this paper are easy to separate regarding their morphological characteristics. *T. floridusa* sp. nov. could be compared to *T. chiasterina* sp. nov. because both share a similar form of euasters (category I), with rays diverging from a small centrum and ending in small bouquets of divergent spines. However, *T. floridusa* sp. nov. additionally bears more robust euasters, with stout rays diverging from a large centrum and ending in an ample bouquet of spines. *T. juantotoi* sp. nov. is clearly different to the other species from the East Pacific Ocean by the homogeneity in the morphology of the euasters, and *T. ohuirae* sp. nov. by having three morphological categories of the euasters. *T. authia* is characterized by the presence of tylostyles and styles and by having euasters with thick rays with rounded ends, characteristics that are clearly different to those in the new species described in this paper.

Moreover, intraspecific variability of *Timea* species is not well known (Hooper, 1986), because in most cases new

species were described on the basis of a single specimen or fragment. To give only some examples, see the most recent papers where *Timea* species have been described (Hooper, 1986; Lehnert & Heimler, 2001; Mothes et al., 2004). Some of the species described in this paper are relatively common, and for the first time it was made possible to study the stability of certain taxonomic characters in the genus, such as the micromorphology of the asters.

The Mexican and Californian specimens of *T. authia* are quite similar (Fig 3B, D). However, the larger and nearly smooth euasters from Chile sometimes have rays of secondary order (ramified) (Fig. 3 F); additionally, they may be much more robust and bear much stouter spines, which could suggest that the Chilean record may belong to a different species. *T. chiasterina* sp. nov. presents very low intra- and inter-specimen variation. The microscleres are morphologically even euasters with rays diverging from a small centrum. However, we can find euasters without center. The rays end in small bouquets of divergent conical spines, but they spring from the middle of the shaft in a few euasters of a unique specimen (Fig. 5B, C & D). *T. floridusa* sp. nov. is another species with a very stable aster morphology. It presents euasters with slender rays, ending in small spiny knobs with short conical spines (Fig. 7B & F), and more robust euasters, with stout rays diverging from a large centrum and ending in an ample bouquet of spines (Fig. 7C & G). These two categories are quite similar in all the specimens studied, but the rays of the robust euasters are so short in some cases that the terminal bouquets diverge almost directly from the centrum of the spicules. This variation appears in all the specimens studied. In *T. juantotoi* sp. nov. the euasters varied from completely smooth to spined with small spines distributed from the middle to the distal end of the actine, and with rays ending frequently in a sharp point (Fig. 9B & C). However, in one single specimen one can find euasteres with sharp and blunt points, and the spines appearing only at the end of the shaft. Despite this intra specific variation, the euasters of this species are very stable in form and size. Of the three categories of euasters in *Timea ohuirae*, the large ones seem to be the most variable in form, which have smooth or spined rays, or they are more robust euasters, with a prominent centrum, and shorter and heavily spined rays (Fig. 12A, D & G). The second category of euasters presents low both intra- and inter-specimen variation. They are very constant in size and form, ending in a blunt point (Fig. 12B, E & H). The smaller euasters are always present in all the specimens studied, but there is an intra-specimen variation regarding the size of the centrum from which the rays diverge (Fig. 12C, F & I).

The genus *Timeopsis* Lévi, 1958 was not included in the recent revision of the family Timeidade (Rützler, 2002). The description of the type species *Timeopsis intermedia* "Timeidae caractérisés par leur structure compacte, suberitoïde et par leurs euasters, en nombre restraint" (Lévi, 1958) agrees well with the diagnosis of *Timea*, and hence it is considered as its synonym.

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