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RECENT ADVANCES IN ECOLOGY AND SYSTEMATICS OF SPONGES. *M.J. URIZ and K. RÜTZLER (eds.)*.

Cosmopolitism in sponges: The "complex" *Guitarra fimbriata* with description of a new species of *Guitarra* from the northeast Atlantic*

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SUMMARY: A new species of the genus *Guitarra* (*G. laplani*) is described from the Gibraltar region (Northeast Atlantic). The type material of the species *G. fimbriata* Carter and *G. voluta* Topsent was revised by scanning electron microscopy, and the results compared with descriptions from the literature.The results suggest *G. voluta* is a valid species and provide grounds for distinguishing two groups of specimens among those described under the name *G. fimbriata*. The first group is formed by North Atlantic deep specimens matching the holotype of *G. fimbriata* and is mainly characterized by tornostrongyloid megascleres, the presence of two categories of placochelae, and microspined pseudoisochelae. The second group, with an Indo-Pacific littoral distribution, would correspond to *G. bipocillifera* Brønsted, characterized by oxeas tapering to long points as megascleres, one category of placochelae, and distinctive spiny isochelae. These results illustrate a new example of what was previously believed to be a cosmopolite species, that a thorough reexamination has shown to be a species complex, thus restricting the distribution of *G. fimbriata* s.s. to the North Atlantic.

Key words: sponges, Poecilosclerida, taxonomy, *Guitarra laplani*, Gibraltar region, cosmopolitism.

INTRODUCTION

Sponge dispersion is still poorly understood in nature. The behavior of marine sponge larvae has only been studied under laboratory conditions (e.g., WARBURTON, 1966; BERGQUIST and SINCLAIR, 1968; FRY, 1971; URIZ, 1982a, 1982b). Under these experimental conditions, larvae generally display short periods of free locomotion. Although these periods should be longer under natural conditions since water movement induces larvae to continue swimming (FRY, 1971; URIZ, 1982a, 1982b), their extremely limited capacity for movement (URIZ 1982a) makes them dependent on currents for their dispersal. Moreover, the limited nutrient reservoir of sponge larvae (SIMPSON, 1984) prevents them from surviving for long without fixing. Furthermore, several experiments on the colonization of new substrata conducted *in situ* suggest that it takes larvae long periods of time to cover relatively short distances, especially in the case of Demospongiae (VACELET, 1981; PANSINI and PRONZATO, 1981).

Despite these various indications of a weak dispersion ability, some species of sponges (e.g., *Pachastrella monilifera*, *Dysidea fragilis*, *Clathrina clathrus, Chondrosia reniformis*) are thought to be widespread throughout the oceans. This is mainly because small but significant variations in the skeletal characteristics that would signify species-specific differences are impossible to find among specimens

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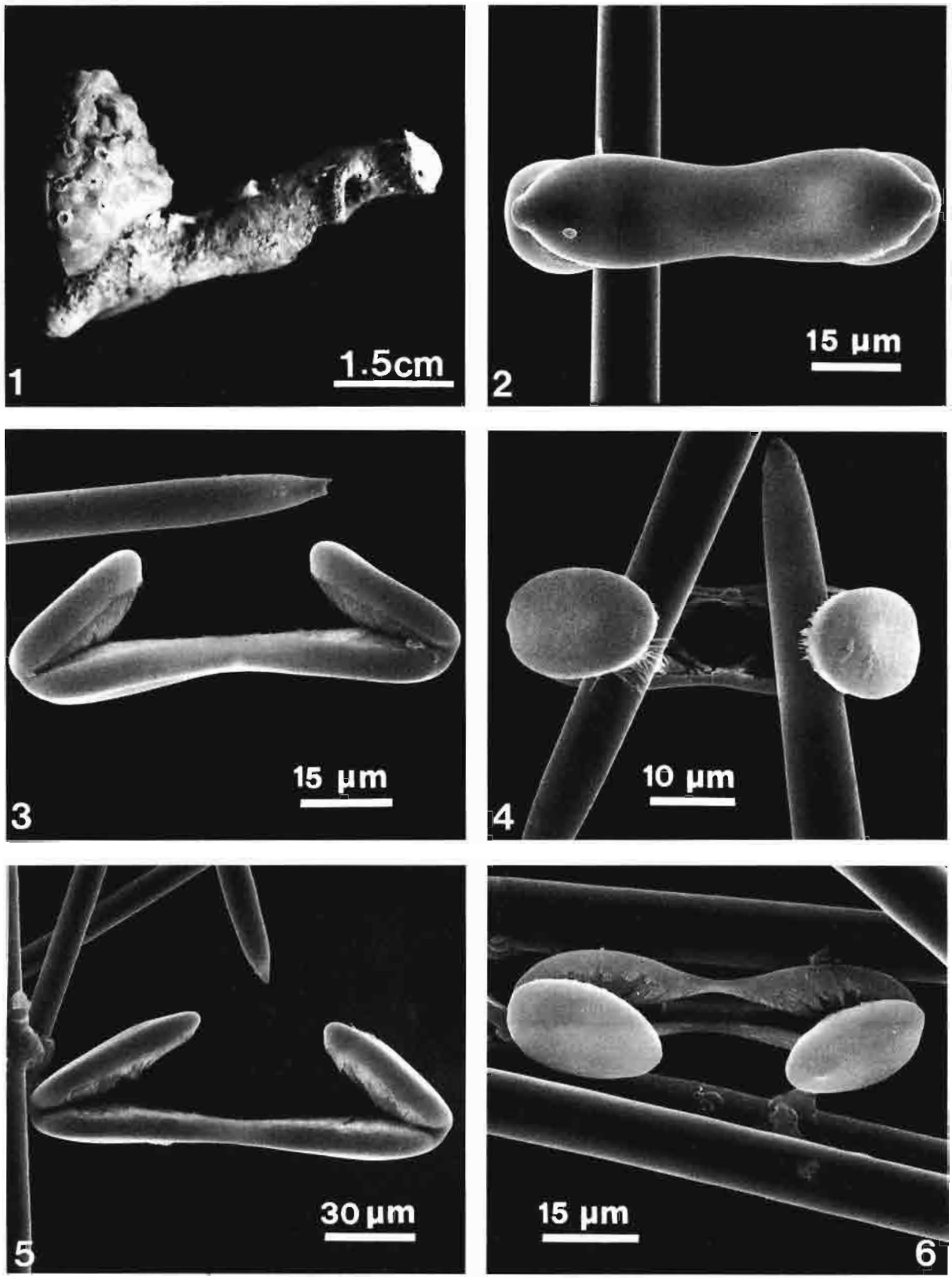
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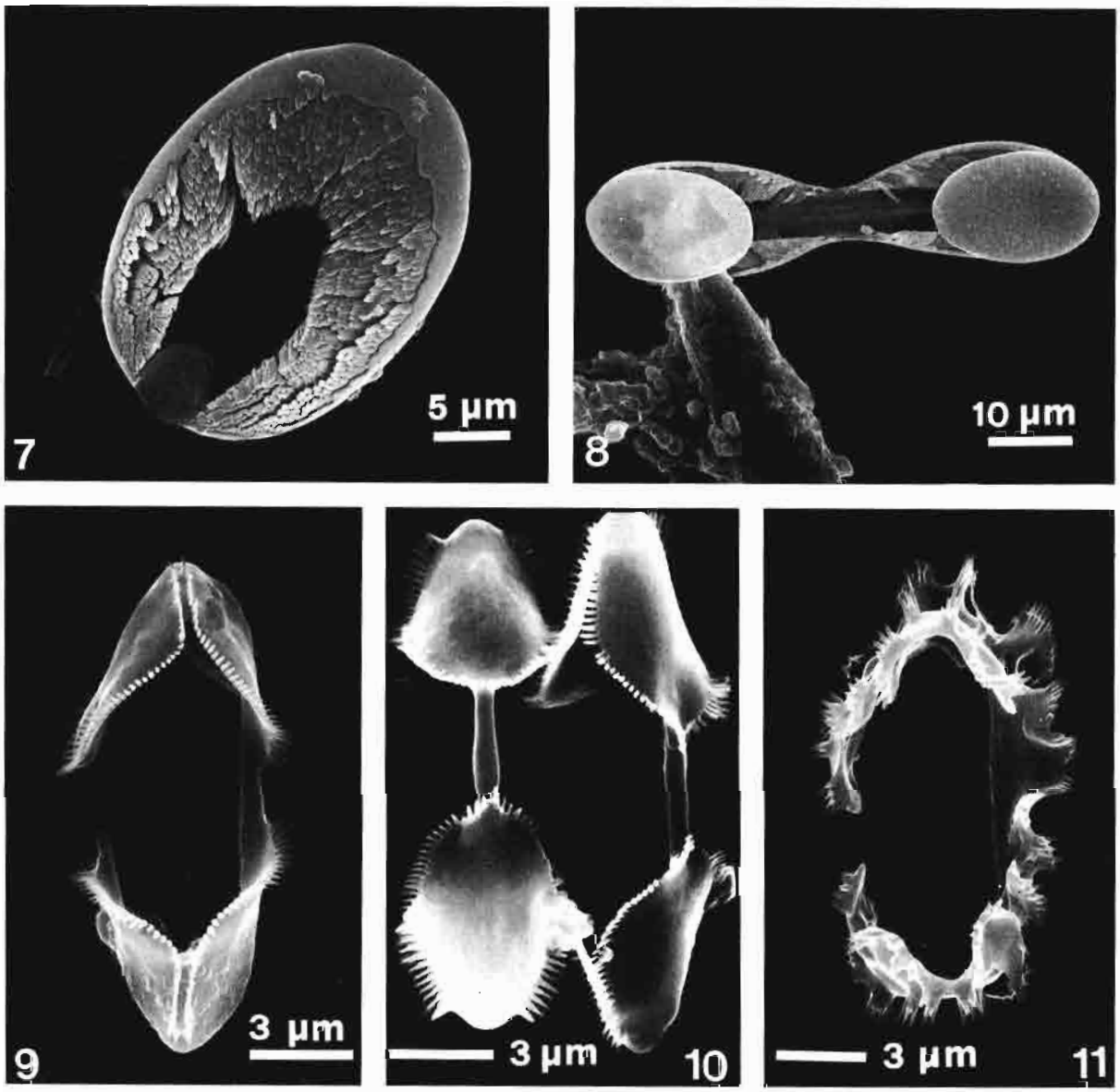

FIG. 1. — *Guitarra laplani*: 1, holotype; 2, 3, and 4, placochelae, different views; 5 and 6, *Guitarra voluta*: placochelae, different views; 7 and 8, *Guitarra fimbriata*, placochela of the holotype, different views; 9, *G. laplani*, isochela, lateral view; 10, *G. laplani*, isochelae, lateral and dorsal views; 11, *Guitarra fimbriata*, spiny isochela of the holotype (scanning micrographs).

from different localities if examined through the light microscope exclusively.

However, when new taxonomic techniques (e.g., genetic divergence and cytological criteria) are applied to some of these so-called cosmopolite species, at least two species emerge from a complex previously known under a sole specific name (see, e.g., SOLÉ-CAVA and THORPE, 1986; SOLÉ-CAVA *et al.*, 1991; SARÀ *et al.*, 1989; HOOPER *et al.*, 1990; BOURY-ESNAULT *et al.*, 1992). Reinterpretations may also be necessary when more accurate information is obtained on morphological characteristics (e.g., spicule shape) through the scanning electron microscope. It often makes clear different morphologies, sometimes indicating different spicular origin, among forms interpreted as the same spicule type (FROMONT and BERGQUIST, 1990). A case in point concerns specimens of *Guitarra* from relatively distant localities -the North Atlantic (CARTER, 1874; CABIOCH, 1968), Antarctic (BURTON, 1929), South Atlantic (LÉVI, 1963), Indo-Pacific (BERGQUIST and FROMONT, 1988), and Mediterranean (MARTÍNEZ-INGLÉS and ROS, 1988)- which have all been assigned to a sole cosmopolite species (BURTON, 1929), mainly because

the spicule shape of the small microscleres was misinterpreted. The finding of a new species of *Guitarra*, and scanning microscope observations of the type species of *G. fimbriata* and *G. voluta* led us to revise all the extant descriptions in the literature under the name *G. fimbriata*.

MATERIAL AND METHODS

Samples for this study were collected from both sides of the Gibraltar Strait by dredging off the R.V. *Cryos* during the Balgim cruise (May 25-June 22, 1984) conducted by PIROCEAN (CNRS) under the direction of P. Bouchet. The holotypes of *G. voluta* Topsent, 1904 (Muséum Océanographique of Monaco), and *G. fimbriata* Carter, 1874 (BMNH 1954.3.9.319), were also studied for purposes of comparison.

Micrographs of clean dehydrated spicules coated with gold-palladium were taken through a Hitachi S570 scanning electron microscope.

Type material has been deposited in the Porifera collection of the Muséum National d'Histoire Naturelle de Paris under the reference number: LBIM-NBE.MP.MU-13.

RESULTS

Order Poecilosclerida
Family Desmacididae Gray, 1972

Genus *Guitarra* Carter, 1874

Desmacididae in which the choanosomal skeleton is a reticulation of oxeas or styles. Brushes of megascleres are present at the surface. Megascleres of one size category only. The characteristic microscleres are placochelae, sometimes together with biplacochelae, which may be accompanied by spiny isochelae or isochelae-like spicules, and sigmata (*sensu* BERGQUIST and FROMONT, 1988, modified to include the microscleres derived from isochelae and the biplacochelae of Lee's species —LEE, 1987—).

Guitarra laplani n. sp

Material examined: Ibero-Moroccan Gulf, Station DW157, 36°21'N, 7°55'8"W, 1108 m, detritic bottom with Foraminifera and Pteropoda, 3 specimens; Station CP-21, 36°38'N, 7°24'W, depth of 478-491 m, 2 specimens. Both stations are located within the Mediterranean water vein in the Atlantic.
Derivatio nominis: the species is dedicated to Joël Laplane, for his creative contribution to guitar making, (the equivalent in the music world of the placochela in the spicule world!).

Description

Five globular specimens, the largest of which was 2.5 cm high and 1.5 cm across (holotype, Fig. 1.1), were examined. Only two of these were in a good state of preservation. Surface even, raised by several crateriform protuberances, 0.5 mm high and 1.5 mm in diameter (Fig. 1.1). A thin membrane perforated by inhalant ostia covers the apical zone of these protuberances. Such inhalant structures are comparable to the cribiform formations of other Poecilosclerida sponges (e.g., genera *Hamigera, Anchinoe*, and *Hymedesmia*) (BOURY-ESNAULT, 1972). The oscule is apical.

The skeletal arrangement consists of spicule tracts (30-70 μm wide, corresponding to 6-10 spicules) forming a confuse reticulation. Microscleres widespread throughout the sponge.

Spicules

Styles, straight or slightly flexuous, occasionally with a subproximal tyle (Fig. 2). One extremity is acerate, the other one is generally rounded but sometimes also pointed; in the latter case the spicule shows the shape of an asymmetrical oxea or styloxea: 436-514 μm × 5-11 μm. Some juvenile spicules are always present: 360-400 μm × 2-3 μm.

Placochelae (Figs. 1.2-4), in the typical shape, of only one size class, corresponding to the small category of *G. fimbriata*: 40-65 μm × 13-18 μm.

Palmate isochelae (Figs. 1.9-10) with a fringe of delicate spines around the alae: 11-15 μm in length.

DISCUSSION

This new species is quite different from those previously described for the genus. Its megascleres are longer than those of the remaining species of *Guitarra* except for *G. voluta*. It clearly differs from the type *G. fimbriata* (Figs. 1.8 and 1.11) in the presence of only one category of placochelae and the shape of the isochelae, which are true palmate isochelae with a fringe of delicate spines. This fringe of spines is also present on the isochelae of *G. bipocillifera* Brønsted, 1924, but the alae of these isochelae have a characteristic spoonlike shape. The isochelae of *G. abbotti* Lee, 1987, are noticeably more spiny than those of *G. laplani* and *G. bipocillifera*. Their equivalent in *G. fimbriata* are also very spiny, but they are atypical in form and can be interpreted as isochelae-like spicules with greatly reduced alae. Other differences from *G. abbotti* are the absence of biplacochelae and the pre-

sence of only one category of placochelae. The placochelae of the new species are small, like those of *G. indica* Dendy, 1916, but their central constriction is less marked. The main differences from *G. voluta* (Figs. 1.5-7) are the smaller size of the megascleres and placochelae, and the spiny isochelae.

BURTON (1929), after the revision in which he synonymized all the extant species of the genus, considered *Guitarra fimbriata* a cosmopolite species. His decision was accepted without discussion by most of the authors who ascribed the observed differences to local variability (e.g., LÉVI, 1963).

BERGQUIST and FROMONT (1988) recently recorded *G. fimbriata* from New Zealand and provided-scanning photographs of the microscleres. This material, together with an examination of the holotype spicules under the scanning microscope, allowed us to detect the mistaken synonymy ascribed by BURTON (1929) to *G. fimbriata* and *G. bipocillifera*.In fact, the isochelae of *G. fimbriata* (Fig. 1.11) have nothing to do with those of the specimens described by BERGQUIST and FROMONT (1988), which perfectly match the species *G. bipocillifera*.

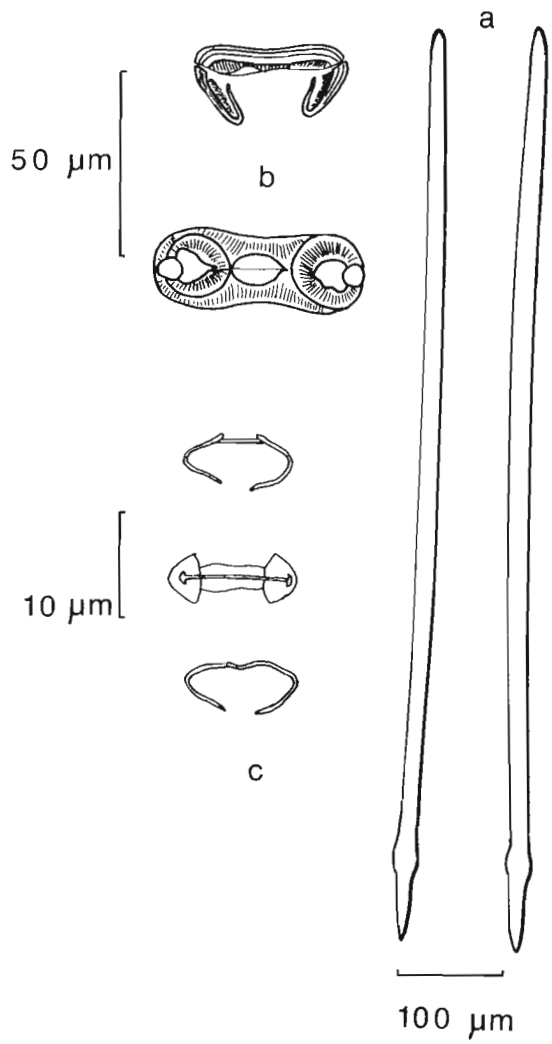

FIG. 2. — *Guitarra laplani*: spicules shown under the optical microscope: a, styles, b, placochelae, c, isochelae.

G. fimbriata is also clearly different from the species described by LÉVI (1963) from the South Atlantic as *G. fimbriata* var. *indica*, which actually corresponds to the type description of *G. indica* Dendy, characterized by the small placochelae with a strong central constriction.

In addition, reexamination of the type confirms that *G. voluta* is a valid species. The large size of the megascleres described by TOPSENT (1904) and the absence of isochelae clearly differentiate this species from the remaining known species of the genus.

The type *G. antarctica* Hentschel 1914 and *G. sigmatifera* Topsent, 1916, were examined by LEE (1987), who considered them valid species different from *G. fimbriata*.

To summarize, a total of 9 species can actually be recognized among the *Guitarra* known up to now (Table 1).

TABLE 1. — Key for the species identification.

1	— Biplacochelae present	2
	— Biplacochelae absent	3
2	— Small microscleres are isochelae	*G. abotti*
	— Small microscleres are sigmata	*G. isabellae*
3	— Only with placochelae as microscleres	*G. voluta*
	— Other microscleres present	4
4	— Placochelae of one size class	5
	— Placochelae of two size classes	6
5	— Supplementary microscleres are sigmata	*G. sigmatifera*
	— Supplementary microscleres are isochelae palmate with a spiny outline	*G. laplani*
6	— Sigmata of two size classes	*G. antarctica*
	— Without sigmata	7
7	— Placochelae with a deep central constriction	*G. indica*
	— Placochelae with a smooth central constriction	8
8	— Supplementary microscleres are irregularly spiny isochela-like spicules	*G. fimbriata*
	— Supplementary microscleres are isochelae with spoon-like alae and a spiny outline	*G. bipocillifera*

Three of them show a North-Atlantic distribution:

G. fimbriata Carter, 1874 (= *G. fimbriata* Cabioch, 1968) from the deep North Atlantic region, characterized by two size classes of placochelae, tornostrongyles, and spiny isochela-like spicules.

G. voluta Topsent 1904, known from deep bottoms of the Azores, characterized by the large size of the megascleres, the presence of only one category of placochelae, and the absence of isochelae.

G. laplani n. sp., known from deep bottoms of the

Ibero-Moroccan Gulf (Spanish Bay), characterized by its small placochelae of only one size category, and its particular spiny isochelae.

Four species exhibit an Indo-Pacific distribution:

G. bipocillifera Brøndsted 1924 (= *G. fimbriata* in BERGQUIST and FROMONT, 1988), from littoral bottoms (in depths up to 110 m), characterized by oxeas with long points and particular isochelae derived microscleres.

G. indica Dendy 1916 (= *G. fimbriata* var. *indica* Lévi, 1963 = ? *G. antarctica* var. *novae zealandae*), from medium bottoms, characterized by small placochelae that show a deep central constriction.

G. abbotti Lee, 1987, from littoral bottoms, characterized by the presence of biplacochelae and typically spined isochelae.

G. isabellae, Lee, 1987, from littoral bottoms, characterized by the presence of biplacochelae and sigmata.

Two species are known from the Antarctic:

G. antarctica Hentschel, 1914, characterized by placochelae and sigmata of two size classes.

G. sigmatifera Topsent, 1916, characterized by placochelae and sigmata of one size class.

In conclusion, *G. fimbriata* is not a cosmopolite species but is restricted to deep bottoms of the North Atlantic region. The description supplied for a specimen from the Mediterranean (MARTINEZ-INGLÉS and ROS, 1988) is too poor to confirm this record. Once again, the accurate observation of a species traditionally considered to be cosmopolite has allowed us to discover the presence of different species.

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REFERENCES

BERGQUIST, P. R. and J. FROMONT. — 1988. The marine fauna of New Zelanda. Porifera, Demospongiae. Part 4 Poecilosclerida. *N. Z. Oceanogr. Inst. Mem.* 96: 3-197.

BERGQUIST, P. R. and M. E. SINCLAIR. — 1968. The morphology and behaviour of larvae of some intertidal sponges. *N.Z. Journ. Mar. & Fresh. Res.*, 2(3): 426-437.

BOURY-ESNAULT, N. 1972. Une structure inhalante remarquable des Spongiaires: le crible. Etude morphologique et cytologique. *Arch. Zool. exp. gén.* 113(1): 7-23.

BOURY-ESNAULT, — N., A. M. SOLÉ-CAVA and J. P. THORPE. 1992. Genetic divergence between morphs of the Mediterranean sponge *Oscarella lobularis* Schmidt (Porifera, Demospongiae). *J. Nat. Hist.*, 26: 271-284.

BRØNDSTED, H. V. — 1924. XXIII Sponges from New Zealand. Part I. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-16, pp. 453-483.

BURTON, M. — 1929. Porifera, part 2. Antarctic Sponges. British Antarctic "Terra Nova" expedition 1910. *Nat. Hist. Rep., Zool.* 6(4): 393-458.

CABIOCH, L. — 1968. Contribution à la connaissance de la faune des Spongiaires de la Manche occidentale. Démosponges de la région de Roscoff. *Cah. Biol. Mar.*, 9: 211-246.

CARTER, H. J. — 1874. Descriptions and Figures of Deep-Sea Sponges and their Spicules from the Atlantic Ocean, dredged up on board H.M.S. "Porcupine", chiefly in 1869; with Figures and Descriptions of some remarkable Spicules from the Agulhas Shoal and Colon, Panama. *Ann. Mag. nat. Hist.*, serie 4, 14: 207-258.

FROMONT, J. and P. R. BERGQUIST. 1990. Structural characters and their use in sponge taxonomy. When is a sigma not a sigma? *In*: K. Rützler (ed.), pp. 273-283. *New perspectives in sponge biology*. Smithsonian Institution Press, Washington, D.C.

FRY, W. G. — 1971. The biology of larvae of *Ophlitaspongia seriata* from two North Wales populations. *In*: D.J. Crisp (ed.), pp. 155-178. *Fourth European Marine Biology Symposium*. Cambridge University Press.

HOOPER, J. N. A., R. J. CAPON, C. P. KEENAN and D. E. PARRY. — 1990. Biochemical and morphometric differences of two sympatric sibling species of *Clathria* (Porifera: Demospongiae: Microcionidae) from northern Australia. *Invert. Taxon.* 4(1): 123-148.

LEE, W. L. — 1987. *Guitarra abbotti* and *G. isabellae*, new sponges from the Eastern Pacific. *Proc. Biol. Soc. Wash.*, 100(3): 465-479.

LÉVI, C. — 1963. Spongiaires d'Afrique du Sud. (1) Poecilosclerides. *Trans. roy. Soc. S. Afr.*, 37(1): 1-71.

MARTINEZ-INGLÉS, A. M. and J. ROS. — 1988. Catálogo de las esponjas asociadas a los caladeros de arrastre de la costa murciana. *Actas VI Simp. Iber. Est. Bentos Marino*, 1: 37-42.

PANSINI, M. and R. PRONZATO. — 1981. Etude des spongiaires de substrats artificiels immergés durant quatre ans. *Vie Milieu*, 31(1):77-82.

SARÀ, M., P. MENSI, R. MANCONI, G. BAVESTRELLO and E. BALLETTO. — 1989. Genetic variability in a Mediterranean population of *Tethya* (Porifera, Demospongiae). *In*: J. S. Ryland and P. A. Tyler (eds.), pp. 293-298. *Reproduction, Genetics and Distributions of Marine Organisms*. Olsen and Olsen, Fredensborg.

SIMPSON, T. L. — 1984. *The Cell Biology of Sponges*. Springer-Verlag, New York, 662 pp.

SOLÉ-CAVA, A. M. and J. P. THORPE. — 1986. Genetic differentiation between morphotypes of the marine sponge *Suberites ficus* (Demospongiae: Hadromerida). *Mar. Biol.*, 93: 247-253.

SOLÉ-CAVA, A. M., M. KLAUTAU, N. BOURY-ESNAULT, R. BOROJEVIC, and J.P. THORPE. — 1991. Genetic evidence for cryptic speciation in allopatric populations of two cosmopolite species of the calcareous sponge genus *Clathrina*. *Mar. Biol.*, 11: 381-386.

TOPSENT, E. — 1904. Spongiaires des Açores. *Res. Camp. Scient. Prince Albert I Monaco*, 15:3-280.

URIZ M. J. — 1982a. Reproducción en *Hymeniacidon sanguinea* (Grant, 1826): biología de la larva y primeros estadios postlarvarios. *Inv. Pesq.*, 46(1): 29-39.

— 1982b. Morfología y comportamiento de la larva parenquimel-

la de *Scopalina lophyropoda* Schmidt, 1862 (Demospongia, Halichondrida) y formación del rhagon. *Inv. Pesq.*, 46(2): 313-322.

VACELET, J. — 1981. Etude qualitative et quantitative des salissures biologiques de plaques expérimentales immergées en pleine eau. 6. — Les éponges. *Tethys*, 10(2):165-172.

WARBURTON, F. E. — 1966. The behaviour of the sponge larvae. *Ecology*, 47(4): 672-674.