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The genus *Hymerhabdia* Topsent, 1892 (Porifera: Halichondrida: Axinellidae) with some remarks on related genera

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Abstract.—The genus *Hymerhabdia* hitherto contained the species *H. typica*, *H. oxytrunca*, *H. intermedia*, *H. contracta*, *H. papillosa* and *H. topsenti*. Based on our material, a new species is described, *Hymerhabdia diversicolor*, and *H. typica* and *H. papillosa* are redescribed. Moreover, it is proposed to synonymize *H. oxytrunca* and *H. typica*, and to assign *H. topsenti* to the genus *Bubaris*. The new species, *H. diversicolor*, is distinguished by having very particular anisodiametric oxeas, that is, one half tapering to a sharp lanceolate point, the other half uniformly thick and abruptly ending in a tip. This feature clearly distinguishes the species from other known species. The affinity of *Hymerhabdia* to other closely related genera such as *Axinysa*, *Collocalypta* and *Bubaris* is discussed based mainly on their different types of spicules and choanosomal skeletons. *Hymerhabdia* and *Collocalypta* have a clearly plumose choanosomic skeleton, which consists of erect plumose columns of spicules in *Hymerhabdia*, from which spicule tracts in *Collocalypta* diverge. In the other genera the choanosomal skeleton is disorganised with spicules strewn in confusion and/or composed of vaguely ascending tracts in *Axinyssa,* and with a condensed reticulation of flexuous or vermiform strongyles, with projecting bundles or individual styles ascending to the surface in *Bubaris*.

Hymerhabdia is a small genus with species with a typically littoral Atlanto-Mediterranean distribution (Sarà & Siribelli 1962, Pouliquen 1972, Juan 1987). The genus was erected by Topsent (1892) to include encrusting sponges with a choanosomal skeleton that consists of erect plumose columns of spicules, with centrotylote oxeas sharply curved at the middle and rhabdostyles (Topsent 1904), although the most typical spiculation is formed by long styles that are sometimes sinuous and shorter oxeas (Bergquist 1970). The diagnosis of the genus has been expanded a few times to include a new external morphological characteristic (with vertically ascending projections) (Sarà & Siribelli 1962), or some spicular type previously not found (rhabdostrongyles, strongyles) (Sarà & Siribelli 1960, 1962). In material from the Strait of Gibraltar (Southern Iberian Peninsula), we found a new species for the genus characterized by having anisodiametric oxeas which have one-half their length of the same width, and the other half progressively decreasing in width towards a fine or lanceolated point. Besides the new species, there are six others: *H. typica* (Topsent 1892), *H. oxytrunca* (Topsent 1904), *H. topsenti* (Lévi 1952), *H. intermedia* (Sarà & Siribelly 1960), *H. contracta* and *H. papillosa* (Sarà & Siribelli 1962), which share many characteristics with the family Axinellidae, in this work considered to be part of the order Halichondrida (van Soest et al. 1990). Moreover, some species of *Bubaris*,

such as *Bubaris salomonensis* (Dendy 1921) and *B. oxeata* Dendy (1924), were transferred to the genus *Hymerhabdia* by Topsent (1928).

This study seeks to clarify the differences between the known species of *Hymerhabdia*, which allowed a new species to be recognized, and the relation of this genus to related genera such as *Axinysa*, *Collocalypta* and *Bubaris*.

Material and Methods

The specimens were collected by scuba diving off the Iberian coast of the Strait of Gibraltar and preserved in 70% alcohol. Spicule preparation followed the techniques described by Carballo (1994). The new species has been deposited in the Museo Nacional de Ciencias Naturales in Madrid (Spain) (MNCN). Paratype and spicule slides have been deposited in the Laboratorio de Biología Marina (LBM) of the Universidad de Sevilla (Spain). Specimens of other species and genera studied include material collected by the author and material from the museum. The holotype of *Collocalypta digitata* (type-BMNH 1907:2:1: 89) has been examined.

Results

Familia Axinellidae Ridley & Dendy, 1887

Hymerhabdia Topsent, 1892

Diagnosis.—Encrusting Axinellidae, sometimes with vertically ascending projections. The spiculation is formed by styles, oxeas, which are frequently centrotylotes or widely curved, rhabdostyles and/or rhabdostrongyles. Modifications of some spicules, such as tylostyles and strongyles also can appear. Without microscleres. There is no ectosomic skeleton. The choanosomic skeleton consists of erect plumose columns of spicules which are continued through the ectosome as loose tufts, which may project beyond the surface.

Hymerhabdia diversicolor, new species

Figs. 1, 2, 5, 6; Table 1

Diagnosis.—*Hymerhabdia* with erect projections. The skeleton in the base consists of tylostyles with the heads on the substratum, from which arise erect plumose columns of spicular bundles (oxeas and styles) that protrude through the surface as small tufts. The spicules are anisodiametric oxeas almost evenly wide for one-half their length, and progressively narrower, ending with a fine or lanceolated point.

Material examined.—Two specimens from Isla de Tarifa (Tarifa), 36°01′8″N, 5°36′22″W, 13 Jul 1995, depth between 10 and 12 m, in small caves. Holotype and spicule slides ref. n° MNCN 1.01/183, Paratype and spicule slides ref. n°s LBM-641 and LBM-642. Type locality. Isla de Tarifa (Strait of Gibraltar, Spain). Coll. J. L. Carballo.

Description.—Sponge consisting of a flat, wide-spreading, encrusting base, about 2–6 mm thick, with a maximum extension of 2.2 by 4.6 cm in the holotype and 2.1 by 4.1 in the paratype, from which erect processes arise. These processes have a length between 0.5 and 2.2 cm, and measure 0.4 cm in diameter at the middle. They usually taper to a sharp apex and are unbranched. The surface of the basal crust is smooth between the processes, but spicule bundles protrude through the surface as small tufts giving it a hispid appearance, without conules. Ectosome conspicuous, translucent, easily detachable from the choanosome. The digitiform processes have a slightly conulose surface with spicule bundles that protrude through the surface. Oscules inconspicuous. The colour in life is white in the holotype and orange in the paratype, and whitish in alcohol (both).

Spicules: The most abundant are anisodiametric oxeas, with one half of constant width and abrupt point, and the other half tapering toward a fine or lanceolated point (Fig. 1A). Oxeas can be straight, slightly curved or even flexuous; at the wider end

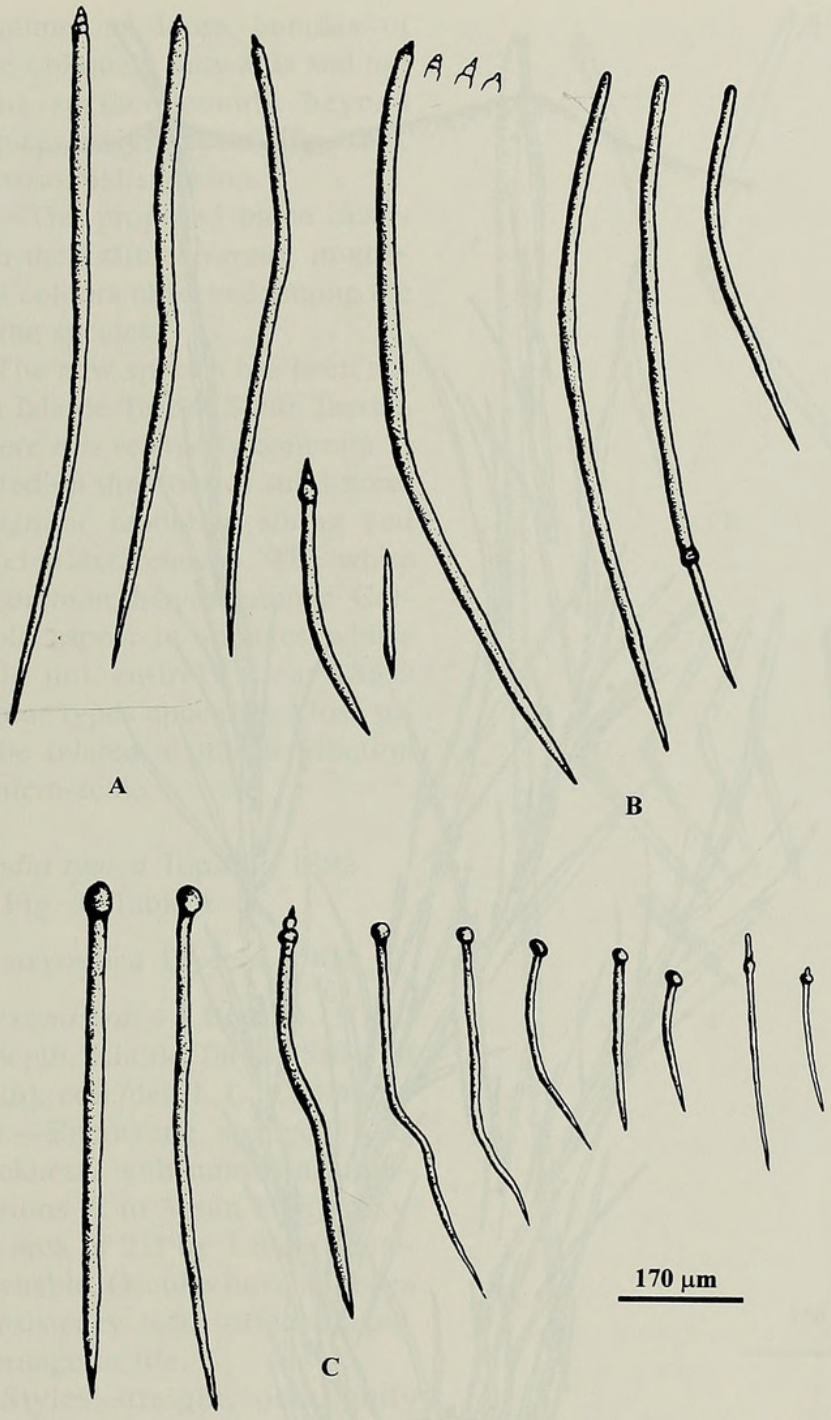

Fig. 1. Spicules of *Hymerhabdia diversicolor*. A) Anisodiametric oxeas. B) Styles. C) Tylostyles.

a series of modifications may appear, most frequently ribbing or successive swelling. Styles are also very frequent, slightly curved (Fig. 1B). Tylostyles are less abundant, with a well formed tyle, straight or curved stem, sometimes at different angles (Fig. 1C).

Skeleton: The skeleton in the basal crust consists of erect plumose columns of oxeas and styles (Fig. 2), which are continued through the ectosome as a loose tuft, and the apices of these spicules (1–4 spicules) project beyond the surface (Fig. 5F). Sometimes only the basal layer of spicules, which are in bundles, can be observed, from which thin columns of spicules rise to the exterior (Fig. 5E). In the digitiform processes, we find an axial core of spicules,

Fig. 2. Cross section of body of *Hymerhabdia diversicolor*.

from which numerous loose bundles of spicules radiate obliquely outwards and upwards into the surface conuli, beyond which their apices may project (Fig. 6D). There is no ectosomial skeleton.

Etymology.—The proposed name *diversicolor* is from the Latin, *diversus*, in allusion to the two colours observed among the specimens of the species.

Ecology.—The new species has been observed only in Isla de Tarifa (South Iberian Peninsula) where it is relatively common. It is always located on the floor of sub littoral caves with high or moderate silting and with very good water renewal. The white form is more common than the orange. Color is a variable aspect in sponges whose significance is not entirely clear (Sarà 1993); both color types appearing close together could be related to the distribution of light at a micro-scale.

Hymerhabdia typica Topsent, 1892
Fig. 3; Table 1

Hymerhabdia oxytrunca Topsent, 1904

Material examined.—LBM-14, 9 Jul 1990, 15 m, depth, Isla de Tarifa (Strait of Gibraltar, Spain), coll./det. J. L. Carballo.

Description.—Encrusting sponge 1 cm maximum thickness, with numerous cone-shaped projections (2 to 3 mm high), maximum surface area of 2.3 by 1.4 cm. Ectosome not detachable. Oscules have not been observed. Consistency soft, surface hispid. Colour dark orange in life.

Spicules: Styles straight, or slightly curved, sometimes modified to subtylostyles or tylostyles (Fig. 3H). Rabdostyles sharply curved, frequently thickly ribbed and spiny at one end (Fig. 3G). Centrotylote oxeas, some sharply curved, even V-shaped, sometimes with distal microspines (Fig. 3E, 3F).

Skeleton: Vertically-ascending plumose bundles of styles and rabdostyles, giving it a hispid exterior aspect.

Remarks.—By studying *H. typica* material from the Strait of Gibraltar and reviewing the bibliography on the dimensions and spicule types of *H. typica* and *H. oxytrunca*, an overlap between the species is observed. Both species bear the same spicule types (rhabdostyles, oxeas and styles/subtylostyles), have the same particular characteristics (sharply curved oxeas and rhabdostyles)

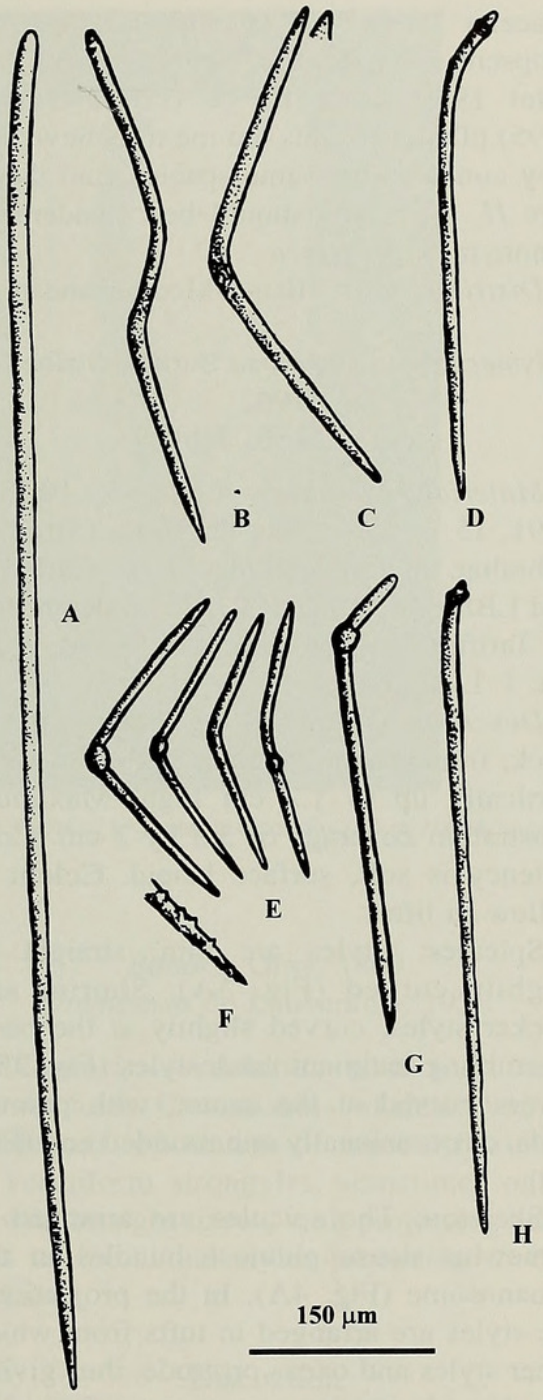

Fig. 3. Spicules of *H. papillosa* (A–D) and *H. typica* (E–H). A–B) Style. C) Oxea. D) Rhabdostyle. E) V-Oxeas. F) microspinulated oxea. G) Rhabdostyle. H) Style.

(Vacelet 1969), and spicule sizes overlap (Topsent 1904, Sarà & Siribelli 1960, Vacelet 1969, Carballo & García-Gómez 1995) (Table 1). This led me to believe that they could be the same species, and therefore *H. oxytrunca* should be considered a synonym of *H. typica*.

Distribution.—Atlanto-Mediterranean

Hymerhabdia papillosa Sarà & Siribelli, 1962

Fig. 3, 4, 6; Table 1

Material examined.—LBM-45, 10 Feb 1991, 15 m depth, Isla de Tarifa (Strait of Gibraltar, Spain), coll./det. J. L. Carballo, and LBM-Q6, 8 Jan 1993, 15 m depth, Isla de Tarifa (Strait of Gibraltar, Spain), coll./det. J. L. Carballo.

Description.—Encrusting body 0.9 cm thick, from which irregular projections rise vertically up to 1.2 cm high. Maximum substratum coverage of 3.3 by 2 cm. Consistency is soft, surface hispid. Colour is yellow in life.

Spicules: Styles are thin, straight or slightly curved (Fig. 3A). Shorter and thicker styles, curved slightly at the base, resembling incipient rabdostyles (Fig. 3D). Oxeas curved at the center, with pointed ends, or occasionally one rounded end (Fig. 3B).

Skeleton: The spicules are arranged in somewhat dense plumose bundles in the choanosome (Fig. 4A). In the projections, the styles are arranged in tufts from which other styles and oxeas protrude, thus giving it a hispid exterior appearance (Figs. 3B, 6C).

Distribution.—Mediterranean Sea, between 15 to 70 m depth, floor of small littoral caves, and detrital bottoms.

Genera Associated with *Hymerhabdia*

Axinyssa Lendenfeld, 1897
Pseudaxinyssa Burton, 1931; *Axinomimus* de Laubenfels, 1936

Diagnosis.—Massive-amorphous or encrusting Axinellidae. Without ectosomal

Table 1.—Main spicular characteristics of species of *Hymerhabdia* close to *Hymerhabdia diversicolor*. The spicule ranges are the combined measurements of all authors (all spicule sizes in µm; n.p. = not present).

	Tylostyles	Rhabdostyles	Rhabdostrongyles	Oxeas	Styles/substylostyles	Distribution
H. typica	n.p.	120–350 × 4–15[1,2,4,7]	n.p.	Centrotylote, V-shaped 136–185 × 5[1,2].	275–1000 × 8–40[1,2,3,4]	Atlanto-Mediterranean
H. intermedia	n.p.	n.p.	n.p.	Sharply Centrotylote, some modified in strongyles	130–1480 × 3.5–17[5]	Mediterranean
H. contracta	512–1600 × 6.2–10[6]	102.5–152 × 5–7.5[6]	37.5–55 × 7.5–10[6]	n.p.	n.p.	Mediterranean
H. papillosa	n.p.	90–350 × 3.7–6[6,7]	n.p.	130–399 × 2,5–7[6,7]	560–1920 × 4–12.5[6,7]	Mediterranean
H. diversicolor	145–500 × 7–13	n.p.	n.p.	anisodiametric, 745–1130 × 8–19	300–1040 × 7–18	Mediterranean

[1] Topsent 1892, [2] Carballo & García-Gómez 1995, [3] Topsent 1904, [4] Vacelet 1969, [5] Sará & Siribelli 1960, [6] Sará & Siribelli 1962, [7] This work.

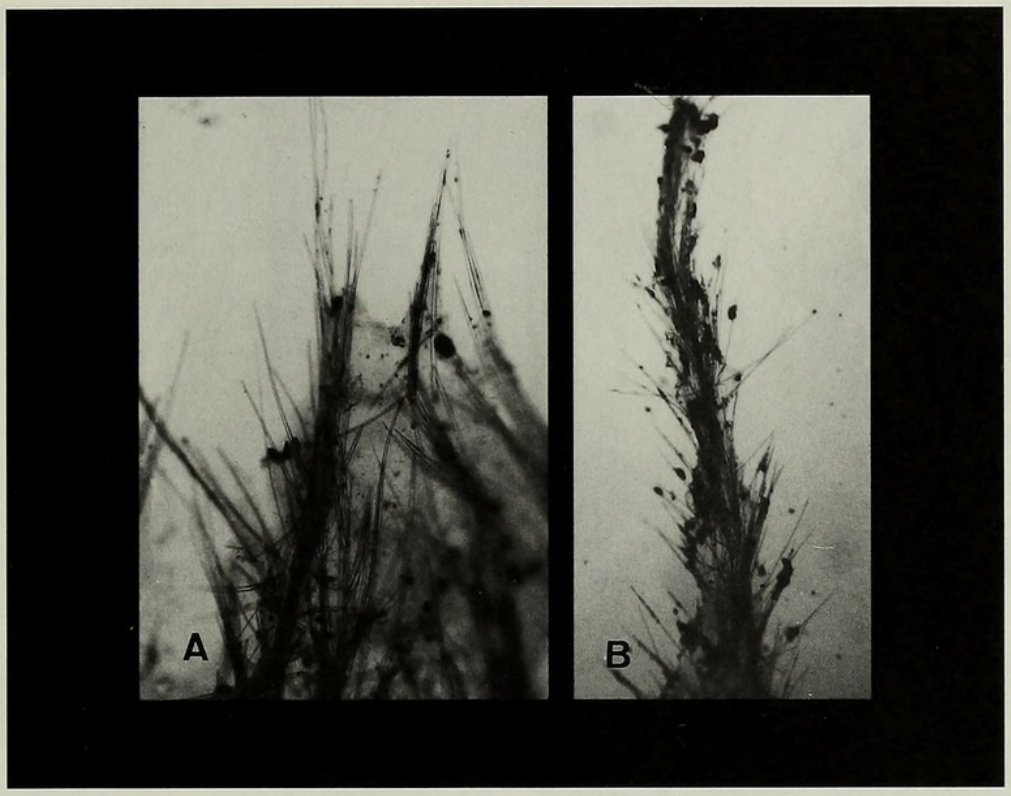

Fig. 4. Skeletal arrangement in choanosome (close to the surface) (A), and projections (B) in *Hymerhabdia papillosa*.

skeleton or with sparsely scattered spicules. Choanosomal skeleton disorganized with spicules strewn in confusion and/or composed of vaguely ascending, widely spaced vertical tracts of large oxeas, forming loose bundles, with spicule tracts protruding through surface to produce conules. Choanosome with poor or moderate spongin fibres but heavy collagen. Spicules oxeas, strongyloxeas or styles usually of only one size class (Soest et al. 1990, Carballo et al. 1996).

Collocalypta Dendy 1905
Figs. 5, 6

Diagnosis.—Axinellidae with fistulose habit and architecture. Ectosomal skeleton absent. Choanosomal skeleton highly collagenous, with a central column of spicules and diverging spicule tracts ascending to the surface, protruding slightly beyond the ectosome, and producing a finely conulose surface pattern. Spicules are oxeas (slightly modified from Soest et al. 1990).

Bubaris Gray, 1867
Ommatosa de Laubenfels, 1936

Diagnosis.—Axinellida with encrusting growth form. Choanosomal skeleton with a condensed reticulation of smooth flexuous or vermiform strongyles, sometimes only, or with straight oxeas, with projecting bundles or individual styles ascending to the surface.

Discussion

The new species, *H. diversicolor*, is mainly characterized by vertical projections from the body of the sponge and by the presence of the anisodiametric oxeas that have one-half of their length different from the other half. The most similar species in external morphology seems to be *H. papillosa* Sarà & Siribelli, 1962. However, its spicular characteristics are clearly different from *H. diversicolor*, as are all the known species of *Hymerhabdia*. Another species found in the Strait of Gibraltar is *H. typica*,

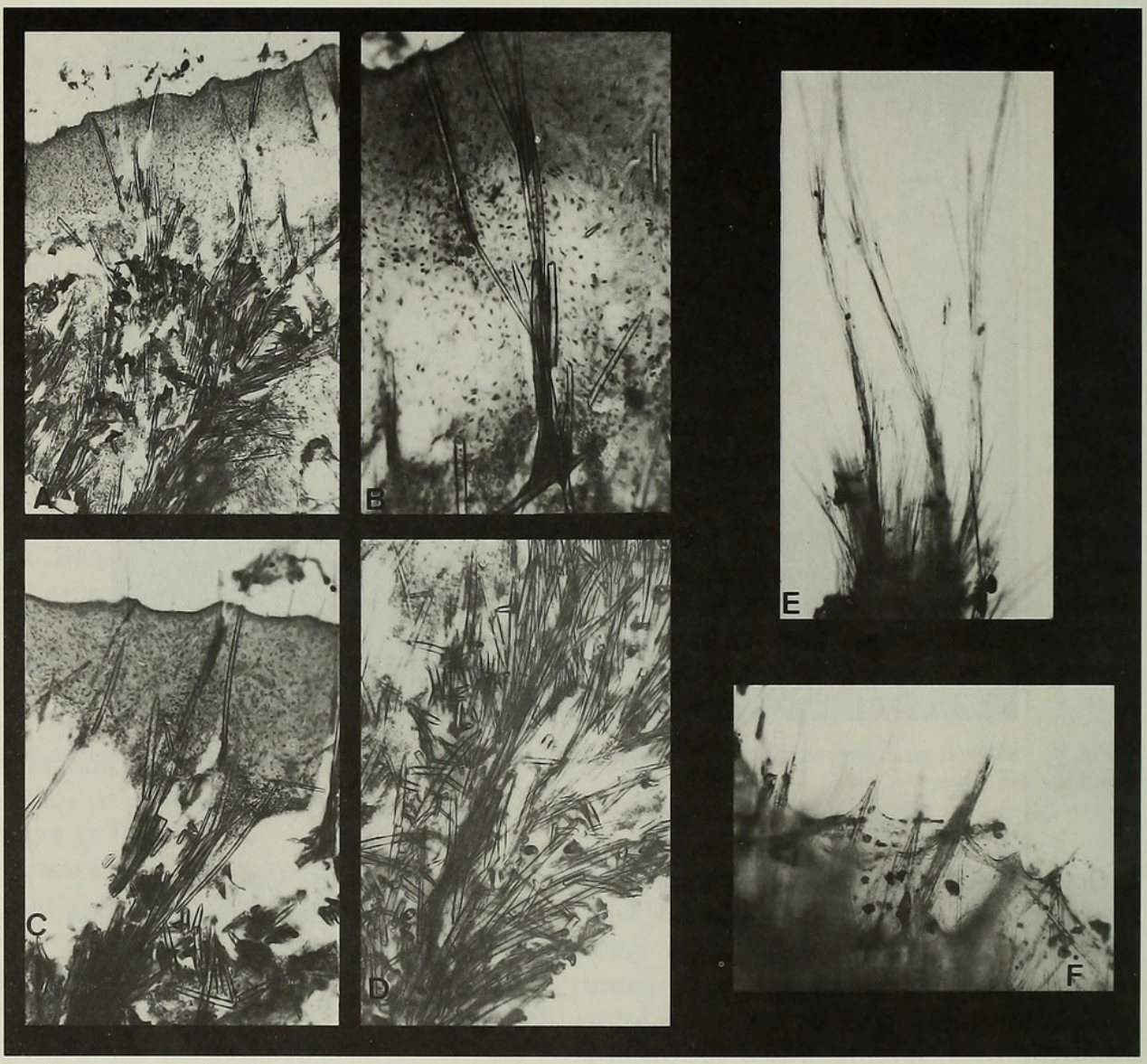

Fig. 5. *Collocalypta digitata* A) Cross section of choanosome. B) Detail of terminal spicule tuft. C) Terminal spicule tuft. D) Detail of erect plumose columns in the choanosome. *Hymerhabdia diversicolor* E) Cross section of choanosomal skeleton. F) Terminal spicule tuft.

which is clearly different from the previous species by having U and V-shaped centrotylote oxeas. The other two species, considered as valid for the genus, have exclusive spicular characteristics, strongyles that are not centrotylote in *H. intermedia* (Sarà & Siribelli 1960), and rabdostrongyles derived from rabdostyles in *H. contracta* (Sarà & Siribelli 1962). Others species described in the genus *Hymerhabdia* such as *H. topsenti* Lévi 1952, or transferred to the genus *Hymerhabdia* by Topsent (1928), such as the species *H. salomonensis* (Dendy, 1921 as *Bubaris salomonensis*) and *H. oxeata* (Dendy, 1924 as *Bubaris oxeata*), can not be considered as valid species of *Hymerhabdia* because they lack erect plumose columns of spicules in the choanosomic skeleton. *Bubaris salomonensis* (Dendy, 1921) and *B. oxeata* Dendy (1924) have a skeleton consisting of a basal crust of short, interlacing oxea or strongyles, for the most part disposed horizontally, in which are inserted the bases of very numerous, rather close-set styles of various sizes, which project from the basal crust more or less perpendicularly, and match with the genus *Bubaris*. However, these species do not have flexuous or

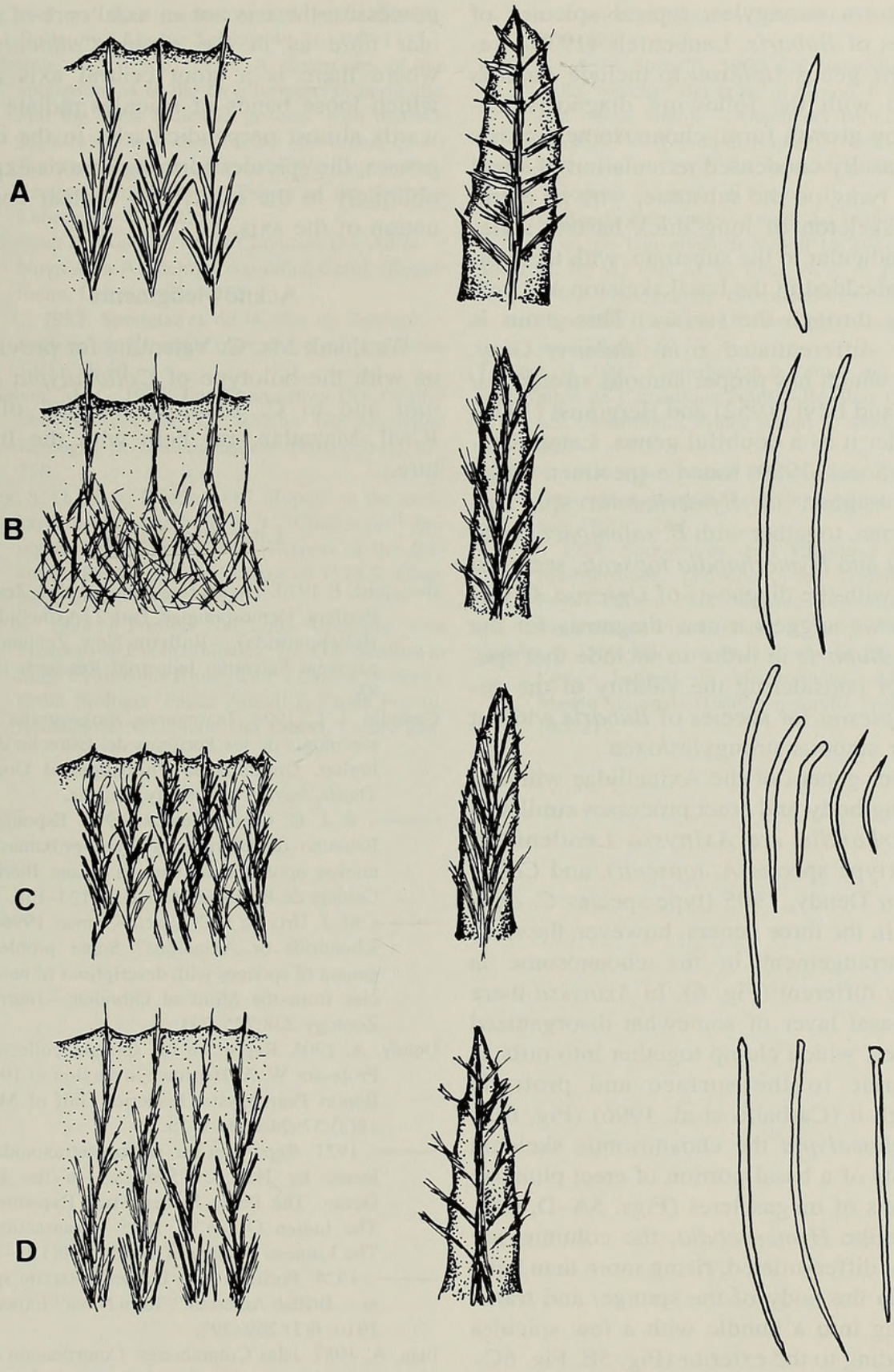

Fig. 6. Skeletal arrangement in choanosome, skeletal arrangement in the projections, and spicules in A) *Collocalypta digitata*, B) *Axynissa digitata*, C) *Hymerhabdia papillosa* and D) *Hymerhabdia diversicolor*.

vermiform strongyles, typical spicules of species of *Bubaris*. Laubenfels (1936) created the genus *Uplexoa* to include *Bubaris oxeata* with the following diagnosis: encrusting growth form; choanosome consists of a basally condensed reticulation of small oxeas lying on the substrate, with an extra-axial skeleton of long thick hastate styles perpendicular to the substrate, with their bases embedded in the basal skeleton and projecting through the surface. This genus is barely differentiated from *Bubaris* Gray, 1867, which has proper sinuous strongyles/oxea, and Lévi (1952) and Bergquist (1970) consider it as a doubtful genus. Later, Kobluk & Soest (1989) found a specimen which was assigned to *Hymerhabdia* sp. This specimen, together with *B. salomonensis*, *B. oxeata* and *Hymerhabdia topsenti*, seems to agree with the diagnosis of *Uplexoa*. In this sense, we suggest a new diagnosis for the genus *Bubaris* in order to include that species, or considering the validity of the genus *Uplexoa* for species of *Bubaris* without proper sinuous strongyles/oxea.

Other genera of the Axinellidae with encrusting body and erect processes similar to *Hymerhabdia* are *Axinyssa* Lendenfeld, 1897 (type species *A. topsenti*), and *Collocalypta* Dendy, 1905 (type species *C. digitata*). In the three genera, however, the skeletal arrangement in the choanosome is clearly different (Fig. 6). In *Axinyssa* there is a basal layer of somewhat disorganized spicules, which clump together into tufts as they rise to the surface and protrude through it (Carballo et al. 1996) (Fig. 6B). In *Collocalypta* the choanosomic skeleton consists of a basal portion of erect plumose columns of megascleres (Figs. 5A–D, 6A), but unlike *Hymerhabdia*, the columns are clearly differentiated, rising more than halfway up the body of the sponge, and transforming into a bundle with a few spicules protruding to the exterior (Fig. 5E, Fig. 6C–D).

On the other hand, the skeleton in the projections is similar in the genera *Axinyssa* and *Hymerhabdia* (Fig. 6). In the digitiform processes, there is not an axial core of spicular fibre as in the genus *Collocalypta*, where there is a stout central axis from which loose bands of spicules radiate outwards almost perpendicularly. In the other genera, the spicules forming an axis expand obliquely to the exterior as a clear continuation of the axis.

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