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Proceedings of the Biological Society of Washington.

Washington, Biological Society of Washington

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v. 113 Apr-July 2000: <http://www.biodiversitylibrary.org/item/109909>

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A new species of *Heterotella* (Porifera: Hexactinellida: Euplectellidae) from the West Indies

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Abstract.—*Heterotella pomponae*, a new species, is reported from near S. Caicos Is., West Indies. This is only the second described species of the genus and the first from the Atlantic Basin. *Heterotella* was erected by Gray to accommodate *Alcyoncellum corbicula* Bowerbank from Isle de Bourbon (Reunion), southwest Indian Ocean. The genus is distinguished from other Corbitellinae by a microsclere which has controversial interpretation, as either a oxyhexactin with long spines or an oxyhexaster with irregularly originating terminal rays. The two species are distinguished by presence of sigmatocomes in *H. pomponae* and their absence in *H. corbicula*.

The first taxonomically acceptable reference to a sponge now included in the genus *Heterotella* was made by Bowerbank (1867:358), where he clearly referred the earlier published figure of a distinctive microsclere (Bowerbank 1858, 1864) to a specimen labelled *Alcyoncellum corbicula* from Isle de Bourbon in the Paris Museum. The genus *Alcyoncellum* had a very convoluted early history, originally attributed to a calcareous sponge and later considered to be an uncertain synonym of the hexactinellid genera *Euplectella* and *Corbitella*. The status of many of these previously confounded generic names was clarified by Gray (1967), where he erected the genus *Heterotella* to contain only Bowerbank's *A. corbicula*. The two closely related genera, *Corbitella* and *Heterotella*, were later reviewed by Ijima (1902), who described the three then existing specimens of *H. corbicula* from Isle de Bourbon (Reunion) in the Museum National d'Histoire Naturelle, Paris. The earlier figured and still diagnostic microsclere of the genus was considered in some detail. Ijima interpreted the oxy-tipped spicule to be a hexactin with long, irregular spines, but noted that this could alternately be accepted as a oxyhexaster

with irregularly arising terminal rays. Kirkpatrick (1910) reviewed the spicule in his attempt to systematize spicule nomenclature, and decided that it was an oxyhexaster since the axial canal did not extend to the ray tip. These distinctions remain arbitrary since there is no method of objectively differentiating spines from terminal rays.

No other *Heterotella* specimens have been added to that type series collected from Reunion in 1819 and 1857. Here I describe the first recent specimen of this genus, collected in 1994 from S. Caicos Island, West Indies. The specimen represents a new species of *Heterotella* and the first member of the genus from a location other than Reunion, Indian Ocean.

Materials and Methods

The specimen of an unidentified lyssacine hexactinellid (the new species described herein) was obtained on loan from Harbor Branch Oceanographic Museum, Fort Pierce, Florida (HBOM). The type series of *H. corbicula* was reviewed during a 1997 visit to the Museum National d'Histoire Naturelle, Paris (MNHN). Fragments of two of the MNHN specimens were

returned to Montreal where skeletal preparations were made. Small pieces of dermal and gastral surfaces were either whole-mounted in balsam for light microscopy (LM) or digested in hot nitric acid. Large spicules in the resulting spicule suspensions were rinsed, spread on microscope slides and mounted in balsam. Smaller spicules were dispersed on 25 mm diameter, 0.2 μm pore-size, nitrocellulose filters by filtration; the filters were rinsed, dried and mounted in balsam. Spicules were measured by computer via a microscope-coupled digitizer. Data are reported as: mean \pm st. dev._(number) (range). Spicule drawings were prepared from video-captured microscope images imported into a computer drawing program and traced on-screen. Samples for scanning electron microscopy (SEM) were nitric-acid-cleaned and mounted on stubs with epoxy. Following gold-palladium coating, specimens were viewed and photographed with a JEOL JSM-840 SEM.

Systematics

Subphylum Symplasma Reiswig & Mackie, 1983

Class Hexactinellida Schmidt, 1870

Subclass Hexasterophora Schulze, 1886

Order Lyssacinosa Zittel, 1877

Family Euplectellidae Gray, 1867

Subfamily Corbitellinae Ijima, 1902

Genus *Heterotella* Gray, 1867

Type species.—*Heterotella corbicula* (Bowerbank, 1867).

Diagnosis.—(from Ijima 1902:32 for *H. corbicula*, emended here). Corbitellinae of saccular shape, the lateral walls constricting distally to the margins of a terminal sieve-plate. With numerous, round, irregularly arranged parietal oscula. Skeletal beams unfused or totally fused by synaptacula. Principalia parenchymalia as diactins; accessoria as diactins and hexactins. With distinctive microxyhexasters in which the slender terminal rays are irregularly undulating and do not all originate from a single point (often interpreted as microxyhexac-

tins with irregular spines). Floricome and graphiome present, with or without sigmatocome; discohexaster lacking.

Remarks.—A holotype has not been designated for *H. corbicula* from among the original three specimens in the collections at MNHN. A lectotype is here designated as MNHN HX 23, Ijima's specimen A, the specimen upon which he based his extensive spicule description. The specimen can be identified as consisting of only the top portion of a sponge from Isle de Bourbon donated by Mr. Leschinault, 1819. The two remaining specimens, MNHN HX 24 & 25, Ijima's B and C, thus become paralectotypes. Lectotype designations are made here with the purpose of clarifying the application of the name to a taxon.

Heterotella pomponae, new species

Figs. 1–10, Table 1

Material examined.—Holotype: HBOM 002:00019; 1 km S of S. Caicos Is., 21°28.84'N, 71°29.985'W, 467 m; col. A. Wright via RMS *Johnson SeaLink I*, dive 3788, 31 Oct 1994; in alcohol.

Shape.—Entire specimen with basal disc retrieved; broken during handling. Thin-wall, sac-shaped sponge (Fig. 1), 13 cm tall by 5.5 cm diam, attached to hard substrata by short basal disk supporting a short, rigid basal cup. Wall, 2.3 mm in maximum thickness, perforated by numerous primary parietal oscula passing directly through the wall, diameter $1.7 \pm 0.3_{25}$ mm (1.1–2.1 mm), spaced at $6.4 \pm 1.4_{25}$ mm (3.1–9.0 mm); smaller openings passing obliquely or tortuously through the wall (secondary parietal oscula) have diameter on the dermal side of $1.5 \pm 0.7_{30}$ mm (0.4–2.7 mm, Fig. 2) and on the atrial side $1.0 \pm 0.3_{76}$ mm (0.5–2.0 mm, Fig. 3). Parietal oscula are arranged without apparent pattern. The terminal osculum, 2.3 cm diam is covered by a sieve plate and bordered by a vertical marginal collar.

Surface texture.—Dermal tissue is delicate and subject to detachment by gentle

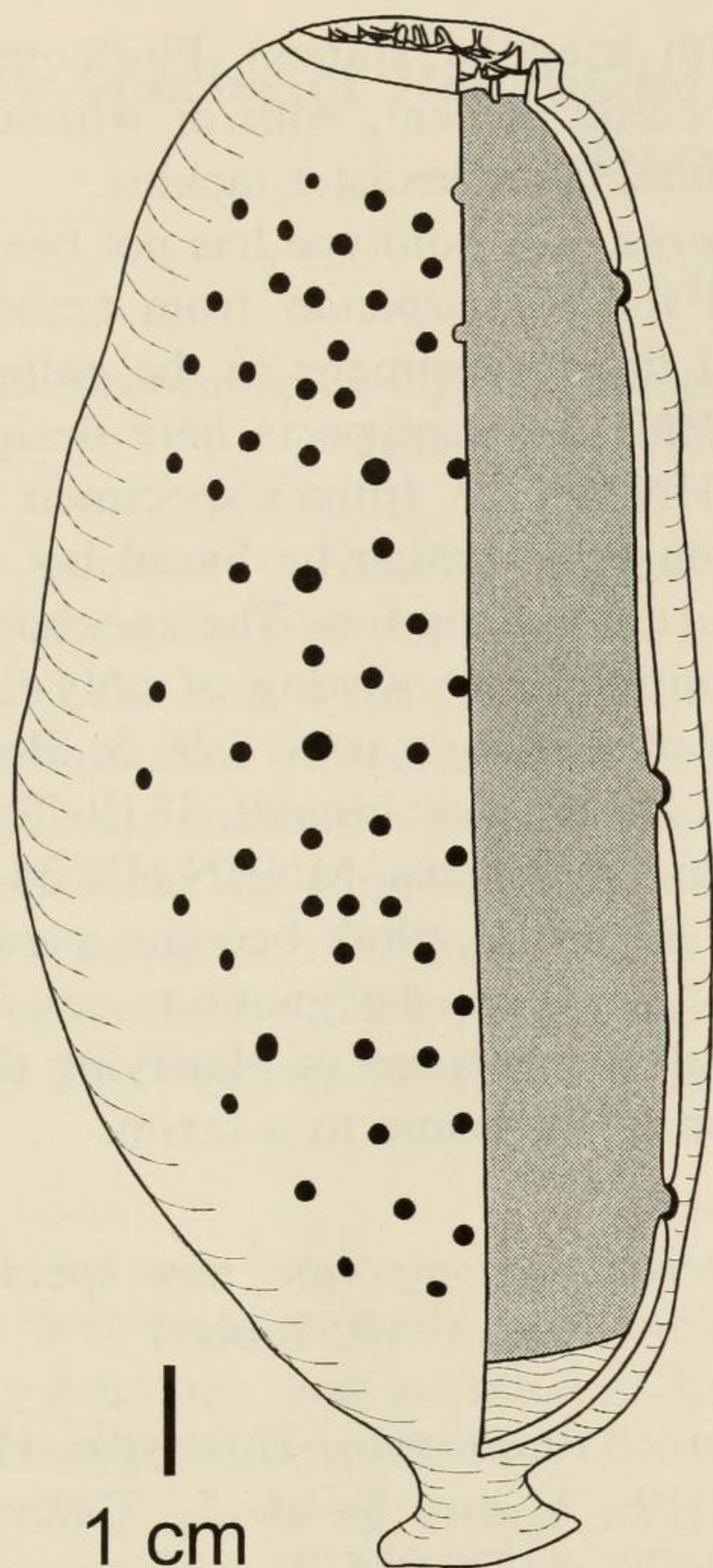


Fig. 1. *Heterotella pomponae* n. sp. (holotype) cut-away diagram reconstructed from photographs, showing distribution of main parietal oscula, terminal sieve plate and location of sinuous diactins in the base of the atrium (wavy filled area).

water currents; gastral tissue is firmer and more adherent to the skeletal framework. Both surfaces are smooth to eye but irregularly lumpy under a dissecting microscope. Prostalia are lacking; the fine tips of sword hexactins projecting from the cushion-like white tissues can be perceived only with aid of a microscope; no regular grid arrangement is detectable on either surface. Living tissues with spicules are not present in the sieve plate or marginal collar; marginalia absent, but may have existed in younger stage.

Color.—White in life and preserved in ethanol.

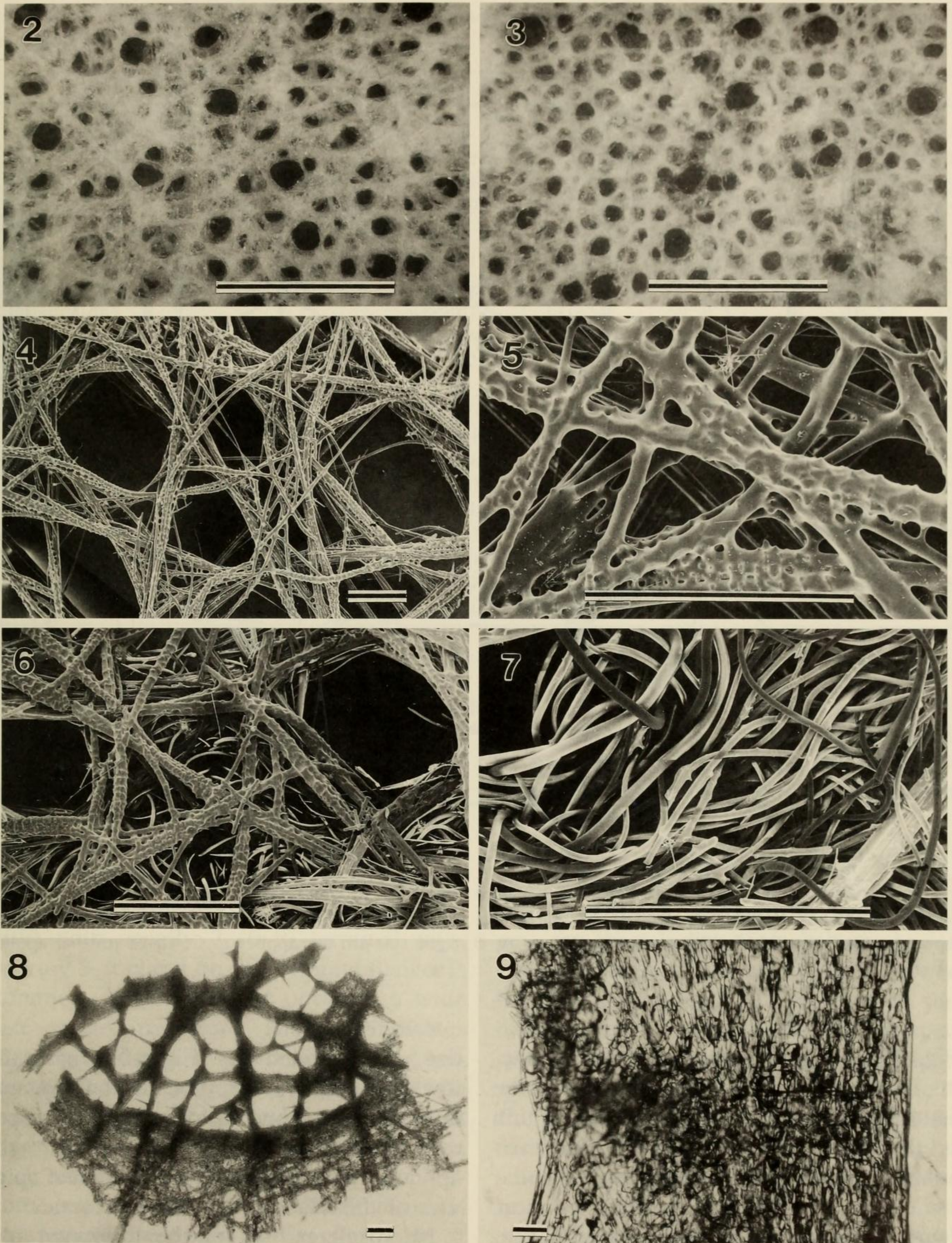
Skeleton.—The entire framework of the holotype (basal cup, lateral walls, sieve plate) has been solidified into a rigid struc-

ture by siliceous synapticalae so profuse as to obscure the nature of the primary framework-forming megascleres (Figs. 4–8). These are presumed to be diactins since hexactin nodes have not been found in this structure and diactins are known to be principalia of *H. corbicula*. Major siliceous elements of most of the framework appear randomly oriented (Fig. 4), but the outer layer contains major longitudinal bundles and the inner-most atrial bundles are transversely oriented. The outer-most strands of the framework are nodulated by secondary silicification (Fig. 5) while the middle and internal strands are smooth. Thickness of the framework is $1.6 \pm 0.2_{13}$ mm (1.2–1.9 mm). In the basal region of the body (Fig. 1), a dense matt of sinuous diactins joined by very short synapticalae or point cementation, is deposited on the internal surface of the framework (Fig. 6); this matt nearly fills the mesh spaces (Fig. 7), occludes some parietal oscula and strengthens the basal framework.

Elements of the sieve plate and marginal collar are rigidified and nearly filled to solid sheets by dense synapticalation (Figs. 8, 9). The marginal collar extends up from the body surface $1.9 \pm 0.4_{13}$ mm (1.4–2.4 mm), as a nearly solid sheet of fused, transversely-oriented, siliceous spicules. Major strands of the body framework extend up the inner side of the collar and project out into the oscular plane as sieve beams (Fig. 8). The sieve beams are unusual in their vertical sheet-like form, being taller than wide (septa-like), with beam height: $0.78 \pm 0.4_{25}$ mm (0.2–1.9 mm), width: $0.25 \pm 0.10_{25}$ mm (0.11–0.53 mm). Sieve pores are variable in shape and size (Fig. 9), but are mainly subtriangular with sides $1.5 \pm 0.4_{25}$ mm (0.6–2.3 mm).

Loose spicules.—Diagrams of spicule form and dimensions are summarized in Figure 10 and Table 1.

Megascleres: The major surface spicules of both dermal and gastral surfaces are smooth, sword-shaped hexactins with the short ray projecting from the tissue surface



Figs. 2-9. *Heterotella pomponae* n. sp. (holotype). 2-3. Photographs of dermal (2) and gastral (3) surfaces with tissues, showing differences in aperture distributions; scale equals 1 cm (LM). 4-5. External surface of acid-cleaned, fused framework of upper body wall; scale equals 1 mm (SEM). 6. External surface of basal region with meshes filled with sinuous diactins; scale equals 1 mm (SEM). 7. Internal surface of the cup base covered with dense pad of sinuous diactins; scale equals 1 mm (SEM). 8. Oblique view of a fragment of the fused marginal collar and sieve plate showing continuity of sieve beams with wall bundles; scale equals 1 mm (LM). 9. Side view of a major sieve plate beam, top surface to left, showing complete fusion of constituent diactins; scale 0.1 mm (LM).

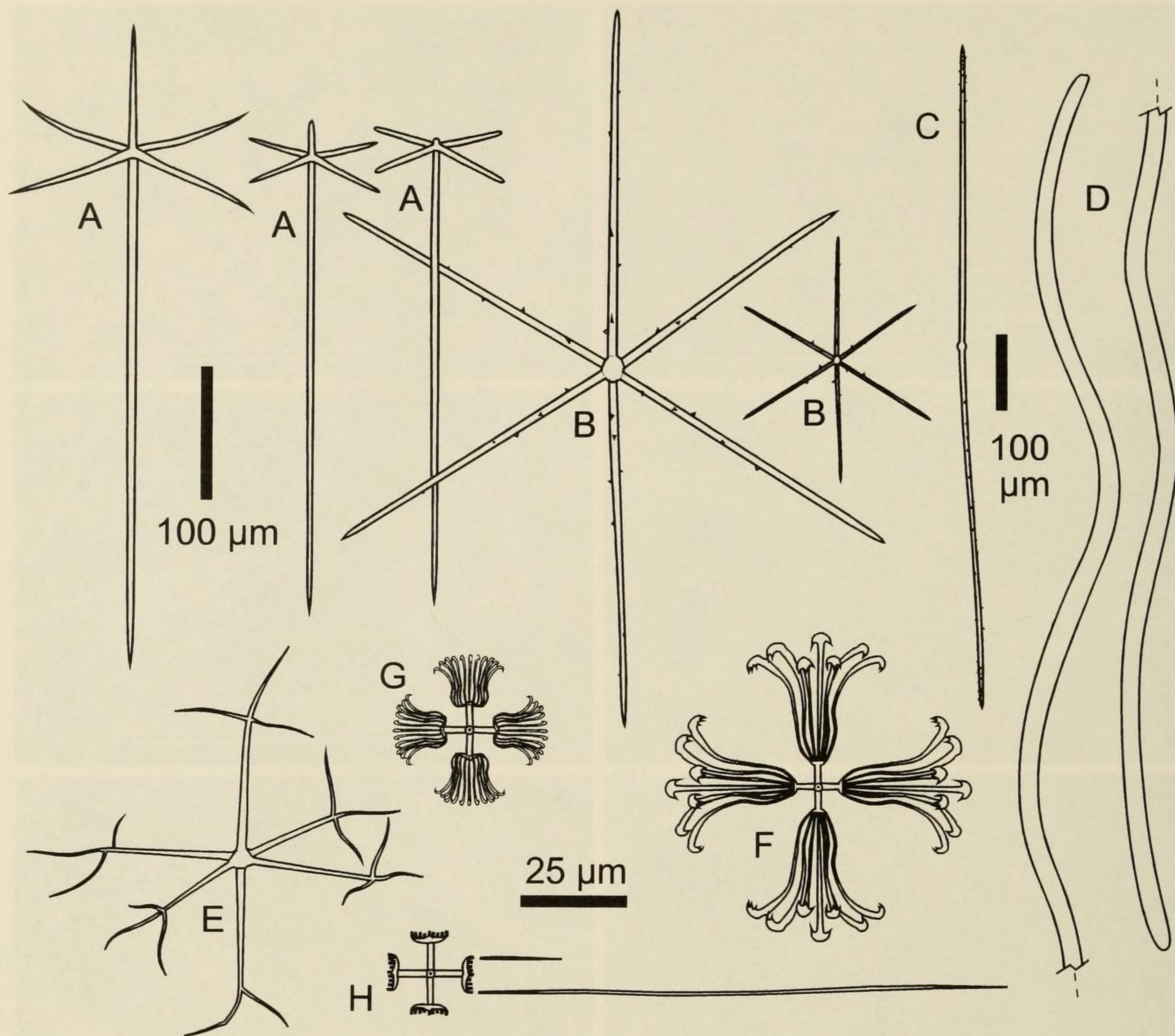


Fig. 10. Loose spicules of *Heterotella pomponae* n. sp. (holotype). A. Superficial dermal and gastral sword hexactins grading to pentactin. B. Choanosomal regular hexactins. C. Centrotylote diactin. D. Ends of sinuous diactins. E. Oxyhexaster. F. Floricome. G. Sigmatocome. H. Graphiocome centrum with long and short terminals (raphides). Scale bars: Left 100 μm bar applies to A, B; right 100 μm bar applies to C, D; 25 μm bar applies to E-H.

(Fig. 10A); a moderate number of pentactins (11%) may result by reduction of the distal ray. These occur in mixtures of thin and thick forms on both surfaces. True marginalia were not found—the marginal collar was devoid of tissues or loose spiculation. Nearly equal-rayed, sparsely-spined hexactins (Fig. 10B) occur throughout the choanosome in small numbers; they vary greatly in size and may consist of two classes, but frequency analysis was not performed. Sparsely-spined, centrotylote diactins with acute tips (Fig. 10C) are abundant throughout the choanosome. Smooth, sinuous diac-

tins with rounded tips (Fig. 10D) pack the lower framework. They occur as fragments up to 6+ mm long in loose spicule preparations, presumably broken from their synapticular connections; loose complete spicules of this class have not been found.

Microscleres: All of the following microscleres, with exception of the short-rayed graphiocome noted below, are found in samples from both surfaces and the choanosome. The most common microsclere is a smooth, sharp-tipped form (Fig. 10E) which can be regarded either as an oxyhexaster with very irregular secondary

Table 1.—Spicule dimensions of *Heterotella pomponae* holotype in μm ; SD = standard deviation; n = number of measurements.

Spicule type	Length ^a \pm SD	Range	N	Width \pm SD	Range	n
Hexactin, thick sword						
distal ray	43 \pm 24	8–101	50	5.4 \pm 0.8	4.2–6.7	25
tangential ray	88 \pm 15	52–121	50	5.1 \pm 0.7	3.9–6.4	25
proximal ray	507 \pm 96	335–730	50	5.3 \pm 0.7	4.3–6.7	25
Hexactin, thin sword						
distal ray	90 \pm 17	35–118	50	3.5 \pm 0.9	2.0–5.6	25
tangential ray	106 \pm 18	67–141	50	3.3 \pm 0.6	2.7–4.8	25
proximal ray	306 \pm 77	171–541	50	3.5 \pm 0.7	2.6–5.6	25
Hexactin, regular ray	151 \pm 81	64–318	50	3.7 \pm 0.9	2.0–5.9	50
Diactin, centrotylote	869 \pm 257	320–1963	50	7.2 \pm 2.1	3.8–12.3	50
Diactin, sinuous	—	—	—	23.1 \pm 6.3	9.1–40.2	50
Oxyhexaster radius	50.5 \pm 6.8	37.3–71.5	100	2.0 \pm 0.4	1.1–2.7	25
oxyhexaster secondary ray	18.8 \pm 4.5	5.8–28.7	100	1.2 \pm 0.3	0.6–1.7	25
Floricome radius	35.1 \pm 4.1	21.6–44.6	357	5.4 \pm 1.0 ^b	3.4–7.4	25
floricome centrum radius	7.2 \pm 0.8	5.4–9.0	100	1.7 \pm 0.3	1.1–2.5	25
Sigmatocome radius	17.1 \pm 1.5	13.3–20.5	100	0.6 \pm 0.2 ^b	0.2–1.0	25
sigmatocome centrum radius	6.8 \pm 0.8	5.1–9.5	100	1.1 \pm 0.3	0.6–1.6	25
Graphiocome centrum radius	8.2 \pm 0.9	6.3–11.1	100	1.3 \pm 0.3	0.9–1.9	25
graphiocome long secondary ray	86 \pm 9	63–151	100	0.9 \pm 0.2	0.6–1.2	25
graphiocome short secondary ray	14.9 \pm 1.8	11.6–21.9	100	0.6 \pm 0.1	0.4–0.9	25

^a Radius for microscleres, ^b Width of terminal flange.

rays (preferred here) or an oxyhexactin with long spines. The secondary rays (or spines) number 1–4, most commonly 3, and emanate from an elongate swelling at their junction. About 10% of these are without secondary rays but bear the swelling seen in the astrose form. A typical floricome (Fig. 10F) with usually 7 (6–9) terminal rays, bearing 3–5 claws on the terminal flange, is common. Although these occur in a wide size range, frequency analysis indicates these compose a single class. An uncommonly occurring sigmatocome (Fig. 10G) bears 25–35 sigmoid terminals, uniform in length, from a single marginal whorl on each recurved primary capitulum. Graphiocome centra, with stumps of 30–50 terminal attachments scattered across the face of each discoid capitulum, (Fig. 10H) are uncommon. The presumed raphide-like, long terminal rays are common on filters from all tissues, but the short versions are found only in gastral tissues. Intact graphiocomes have not been encountered.

Etymology.—This species is named to

honour Dr. Shirley Pomponi in recognition of her many years of invaluable contributions to the knowledge of tropical marine biodiversity.

Remarks.—The vary large number of shared characters between the new species and *H. corbicula* leaves little doubt that the new the West Indian form belongs to *Heterotella*. Most of the differences between the two species can be attributed to their different stages of maturation. Only specimen B of *H. corbicula* exhibits incipient spicule fusion in its lower portion, while the *H. pomponae* specimen has completely fused its lyssacine net into a rigid framework. The absence of free large choanosomal diactins and marginalia in *H. pomponae* are attributable to this terminal growth stage, where further body extension (growth) has ceased. Surface megascleres and microscleres are almost identical in form and size in both species. The dermalia are thicker (to 30 μm) and the accessory diactins longer (to 5 mm) in *H. corbicula* than in *H. pomponae* (to 6.7 μm and 2 mm

respectively). The distinctive oxyhexasters (oxyhexactins) are virtually identical in the two species. The most unambiguous difference between the two is the presence of sigmatocomes in *H. pomponae* and their absence in *H. corbicula*, confirmed by examination of new spicule preparations of Ijima's specimen A (the lectotype) and B (the nearly intact paralectotype) using filter techniques. Photographic records at HBOM suggest that *H. pomponae* is moderately common in the West Indian area. Younger specimens with incompletely fused skeletal networks are expected to be found in future collections.

Acknowledgments

I thank C. Adams for bringing the specimen to my attention, S. Pomponi and J. Reed for providing access to the specimen, photographs and data sheets, M. Kelly for providing transparencies and motivation, C. Lévi and K. Tabachnick for assisting in review of the Paris material, and the latter for his valuable comments on improving the manuscript. This study was supported by an operating grant from the Natural Sciences and Engineering Research Council of Canada.

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