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THELOGORGIA, A NEW GENUS OF GORGONACEAN OCTOCORALS, WITH DESCRIPTIONS OF FOUR NEW SPECIES FROM THE WESTERN ATLANTIC

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ABSTRACT

The identity of the Antillean gorgonian *Gorgonia richardii* Lamouroux, 1816, is reconsidered and the interpretations proposed by Deichmann (1936) and Bayer (1961) are shown to be incorrect. Verrill's unpublished genus *Thelogorgia,* intended for material obtained by the U.S. Coast Survey steamer BLAKE, is now validated for western Atlantic gorgonians incorrectly identified as *Keroeides richardii* (Lamouroux) by Deichmann (1936) and *Lignella richardii* (Lamouroux) by Bayer (1961). Four new species, *T. stellata, studeri, longiflora* and *vossi* are described and illustrated by photographs, drawings and scanning electron micrographs.

The enigmatic octocoral *Gorgonia richardii* Lamouroux, 1816, remained a mystery until Deichmann (1936: 89) reported it under the combination *Keroeides richardii* in the family Subergorgiidae from three stations of the U.S. Coast Survey steamer BLAKE off St. Vincent, Guadeloupe, and Barbados. She described it briefly but gave no illustrations. Duchassaing and Michelotti (1860: 29) reported *Gorgonia richardii* as common in the waters of the Antilles and illustrated it for the first time (1860: pl. 4, fig. 1) but did not describe their material and the illustration cannot plausibly be associated with any known species. Verrill (1869: 429) interpreted their figure as possibly representing a species of *Thesea,* which is not at all convincing. J. E. Gray (1870: 408) established the genus *Lignella* on the basis of Lamouroux's description of *Gorgonia richardii* but apparently had no specimens for study, as he merely paraphrased the original description given by Lamouroux and added some features illustrated by Duchassaing and Michelotti.

Verrill, in studying the collection of gorgonians obtained by the U.S. Coast Survey steamer BLAKE recognized three species of a new genus that he intended to name *Thelogorgia.* Although his descriptions no longer exist, his illustrations of two species were actually printed for inclusion in the projected report, and those of the third still survive as original artwork for plate 148. This is the material interpreted by Deichmann (1936) as *Keroeides richardii* (Lamouroux).

As the western Atlantic specimens show significant differences from Indo-Pacific *Keroeides,* Bayer (1961: 83) uncritically accepted Deichmann's identification of the BLAKE specimens as *Gorgonia richardii* Lamouroux but recognized Gray's genus *Lignella* because of significant differences from *Keroeides.* The sclerites and polyps of *L. richardii* (sensu Deichmann) were first illustrated by Bayer (1961: fig. 18) based upon an incomplete specimen obtained at Barbados by the Barbados-Antigua Expedition of the State University of Iowa (1918), but the description provided by Deichmann (1936) was not enlarged upon so details were inadequate.

Reevaluation of the information about *Gorgonia richardii* provided by Lamouroux shows beyond any doubt that the specimens from the BLAKE collection identified as *Keroeides richardii* by Deichmann cannot be the species called *Gorgonia richardii* by Lamouroux. The original description of this species given by Lamouroux (1816: 407) reads as follows:

> 562. G. DE RICHARD; rameaux épars ou presque latéraux et un peu flabellés; axe cylin[dri]que d'une grosseur irrégulière, quelquefois comprimé, d'une consistance molle semblable à celle des bois blancs les plus tendres, et de couleur blanchâtre; écorce mince, friable, d'une couleur fauve-terne, parsemée de cellules polypeuses; polypes externes à huit tentacules, formant une pustule conique et saillante de 2 millimètres; grandeur 6 à 8 décimètres.

G. RICHARDII; ramosissima, ramis sparsis vel sublateralibus paululum flabellatis; polypis exsertis octotentaculatis conoideïs.

Antilles. Ded. Richard.

Nota. Cette Gorgone, une des plus remarquables par sa grandeur et ses caractères, m'a été donnée par M. Richard, professeur à l'école de médecine de Paris, un de nos plus savants botanistes, à qui je l'ai dédiée en témoignage de reconnaissance, de considération et d'amitié.

Because the type material is no longer extant and the original description is inadequate and unillustrated, the identity of the true *Gorgonia richardii* can only be deduced from the evidence now available. On a strict interpretation of Lamouroux's words in the light of the known gorgonians of the western Atlantic, the description of *Gorgonia richardii* could apply to only two species. He described (1816: 407) the axis as having a soft consistency like that of very soft white wood ("d'une consistance molle semblable à celle de bois blanc les plus tendres, et de couleur blanchâtre"). In writing of the axis of *Gorgonia* species in general, he described it (1816: 387) as horny and very hard, but sometimes brittle with the consistency of sapwood ("cornée et très-dure, ou bien, semblable par son consistance à l'aubier mou et cassant de certains arbres"). As he described the axis of *Gorgonia richardii* specifically as having the consistency of soft wood (rather than horny), the various species of *Eunicea* and *Plexaura,* established by Lamouroux himself in the same publication, can be excluded because of their hard, dark, horny axis. Although there is no internal evidence that the axis of *Gorgonia richardii* is spicular (i.e., calcareous; Lamouroux was familiar with the acid test and did not mention it in this context), that of only two gorgonian species of the Antillean region could be described as being like soft, white wood. These are *Keroeides richardii* (sensu Deichmann, 1936) and *Iciligorgia schrammi* Duchassaing, 1870. Both of those species agree in general with Lamouroux's words, but both have features inconsistent with the original description of *Gorgonia richardii.*

There is no objective way to determine whether *Iciligorgia schrammi* Duchassaing or *Keroeides richardii* (sensu Deichmann) fits Lamouroux's original description more closely. The axis of both species bears a resemblance to soft wood. Duchassaing described the medullar part of *Iciligorgia* as approaching the consistency of elder pith ("la partie médullaire se rapproche par sa consistance de la moelle de sureau"), while Lamouroux said that *G. richardii* is like soft, white wood. Color of the coenenchyme is the most obvious difference between *G. richardii* ("fauve-terne") and *Iciligorgia schrammi* ("in sicco nigro"). The calcyes of *K. richardii* (sensu Deichmann) are indeed about 2 mm high, but conical only in an inverted position: they are obconic. The calcyes of undisputed specimens of *I. schrammi* in dry condition have low, rounded mammiform calyces ("calycibus mammaeformibus, obtusis in utroque latere ramorum"), which project only slightly but are topped by the contracted anthocodiae, which distinctly form blunt cones.

Lamouroux's note following his formal description provides evidence that permits an irrefutable decision. His statement that "Cette Gorgone, une des plus remarquables par sa grandeur" readily applies to *I. schrammi,* which commonly reaches "6 à 8 décimètres," often even more, but hardly to *K. richardii* (sensu Deichmann). Colonies of the latter may reach about 0.5 m in height but are so delicate and finely branched that even experienced collectors have identified them in the field as hydroids rather than gorgonians. When preserved dry, specimens are so fragile that they fall to bits even when handled with great care. As Lamouroux recognized as "fragile" the much more robust *Gorgonia granulata* Esper (an ellisellid), he certainly would have commented on the excessive fragility of the present species if he had it, rather than *I. schrammi,* before him.

From the evidence now available it can only be said that the identity of *Gorgonia*

richardii, and therefore of the genus *Lignella* Gray, 1870, based upon it, cannot be determined with any degree of certainty. It may be *Iciligorgia schrammi* but it cannot be *Keroeides richardii* (sensu Deichmann) = *Lignella richardii* (sensu Bayer). Consequently, that species, designated by Verrill in manuscript as *Thelogorgia studeri* represents a new genus. Verrill's original opinion was correct and thus remains valid after nearly a century. A large amount of new material collected throughout the Caribbean region makes it possible to confirm Verrill's taxonomic insight. The names he proposed for the genus and one of the species are validated in the following pages, and three other species are added to the genus.

Materials and Methods

Many specimens referable to Verrill's unpublished genus *Thelogorgia* have been collected by trawling and by SCUBA divers at many localities from Florida and the Bahamas south through the Caribbean, the Greater and Lesser Antilles, to Surinam. Several lots were collected at localities along the north coast of Jamaica by Roma and Paul Chapman, the late Thomas F. Goreau and R. A. Kinzie. R/V John Elliott Pillsbury also obtained numerous samples in the course of the University of Miami Deep-Sea Biology Program directed by the late Dr. Gilbert L. Voss. Thanks to these efforts, more than 50 lots are now available for study.

Samples were prepared for SEM following the procedures outlined by Bayer and Stefani (1989: 450–451). However, colonies are so fragile and sclerites so weakly held in place by mesogloea that preparations of branch fragments for examination of intact polyps can withstand only brief treatment with sodium hypochlorite and hydrogen peroxide solutions for removal of superficial organic material and attached debris. Unduly prolonged treatment must be avoided to preclude dissociation of sclerites and disruption of their normal arrangement. Individual polyps selected for drawing were cleared in carbol-xylol and drawn with the aid of the Wild drawing attachment of the M-8 stereomicroscope. Scanning electron micrographs were made with a Hitachi SEM model S-570.

Taxonomic Characters

As usual in the study of gorgonians, growth form of colonies, axial structure, size and arrangement of polyps, size, shape and arrangement of sclerites must be considered together in establishing taxonomic boundaries of species. The most conspicuous differences among the present specimens are size of the contracted polyps, size of the calicular sclerites, and size of the tentacular sclerites. They can be divided into two groups on the basis of the height of mature polyps. In one group the fully developed polyps are from 1 mm to about 4 mm tall; some colonies are exceedingly delicate, appearing more like hydroids than gorgonians. In the second group, the polyps are 4–6 mm tall and the colonies have a more distinctly gorgonian aspect although still not large.

As the application of these characters often is a matter of subjective judgement, discrimination of species in some cases can be questionable. Too little material is available for wholly reliable delineation of species, and much of that is in poor condition. Larger suites of specimens are needed from more localities to provide information about individual, ecological, and geographical variation, and biochemical data are urgently needed to supplement morphological characters. Until a more comprehensive study can be done, the status of all these species may be subject to reevaluation.

Order Gorgonacea Lamouroux, 1816
Family Keroeididae Kinoshita, 1910

Thelogorgia new genus

Thelogorgia Verrill MS.
Lignella.—Bayer, 1961: 82 (not Gray, 1870: 408).

Diagnosis.—Arborescent Gorgonacea having supporting axis composed of an uncalcified, cross-chambered central core surrounded by concentric layers of smooth,

slender, flattened, irregularly fusiform calcareous sclerites embedded in gorgonin and elaborately interconnected by longitudinal and transverse processes to form delicate, lattice-like concentric tubes. Polyps prominently projecting, cylindrical or trumpet-shaped, not retractable into very thin coenenchyme. Body wall of polyps filled with elongate spindles ornamented with simple, sharp prickles, arranged in longitudinal interseptal double rows converging toward base of tentacles, becoming acutely *en chevron* to form eight points on the bases of tentacles; backs of tentacles armed with blunt rods usually bent near one end, arranged in a double row *en chevron* diverging distad. Coenenchyme filled with spindles similar to those of polyps, on larger branches and main stem becoming coarse and irregular, with compound rather than simple tubercles.

Type Species.—*Thelogorgia stellata* new species.

Discussion.—In the course of describing the alcyonarians collected by the U.S. Coast Survey steamer BLAKE, Verrill recognized three species referable to this genus. His report, obviously intended to be a major monographic revision, was in preparation for many years. Unfortunately, Verrill's manuscript was not in satisfactory condition for publication at the time of his death in 1926, even though over a hundred lithographic plates, some in color, had already been printed. The unenviable task of preparing the report for publication fell to Dr. Elisabeth Deichmann, who found it necessary to rewrite the paper as a whole and scrap all but 11 of the printed plates.

Pictorial evidence of Verrill's intended species of his new genus *Thelogorgia* still exists on the unpublished plates and original artwork but, owing to their extreme fragility the actual specimens had been reduced to fragments from three BLAKE stations by the time Deichmann studied the collection. She referred these to a single species interpreted as referable to *Gorgonia richardii* Lamouroux, 1816, which she assigned to the Indo-Pacific genus *Keroeides.* Deichmann correctly described the peculiar axial structure, which agrees in all essentials with that of *Keroeides* but not with that of the family Subergorgiidae, to which she assigned it.

In preservation both wet and dry, the polyps of *Thelogorgia* resemble those of acanthogorgiids in several respects. In particular, the spindles conspicuously projecting from the base of the tentacles give the polyps of *T. stellata* and *T. studeri* the aspect of some delicate *Acanthogorgia.*

Etymology.—Thelo–, from Greek θηλή = nipple + gorgia, combining form derived from Greek Γοργώ, one of the frightful phantoms in Hades, with snakes for hair; source word for the generic name *Gorgonia,* in allusion to the sinuous branches of some species. Gender, feminine.

It is today amusing to note that A. E. Verrill (1914) who, in a fit of prudery, took his contemporary J. P. McMurrich (1914) to task for using some of Linnaeus's "obviously obscene names" for various invertebrates, himself coined *Thelogorgia, Anthothela,* and *Anthomastus.* Possibly he considered words applying to anatomical features above the waist to be acceptable.

KEY TO SPECIES OF *THELOGORGIA*

1(4). Height of fully developed polyps contracted in preservation less than 4 mm. Spindles of body wall converging in 8 calicular points that usually flare outward to form a distinct stellate figure around the contracted tentacles.

2(3). Sclerites of tentacle backs are stout, blunt, prickly rods bent near one end; polyps 2.5–3.5 mm tall ..... *stellata*

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[1] "Blake" exp. Alcyonaria. "Proofs" of plates on file with Verrill papers in archives of the Museum of Comparative Zoology, Cambridge, Massachusetts. Unpublished.

3(2). Sclerites of tentacle backs are slender prickly rods bent near one end; polyps 1–2 mm tall ..... *studeri*

4(1). Height of fully developed polyps contracted in preservation 4–6 mm. Spindles of body wall converging in 8 calicular points with little or no tendency to flare outward, calices not stellate.

5(6). Polyps slender, about 0.5 mm in diameter, and up to 5 mm tall; spindles of body wall longitudinally oriented ..... *longiflora*

6(5). Polyps stouter, 1–1.5 mm in diameter, and 5–6 mm tall; zone of transverse and obliquely directed spindles encircles middle part of body ..... *vossi*

Thelogorgia stellata new species
Figures 1–7

Material Examined.—BAHAMAS: Off Pinder Point, Freeport, Grand Bahama, 61–92 m, coll. John Hines, R/V CALANUS, 17 Aug 1972; two nearly complete colonies, HOLOTYPE, USNM 54823 and PARATYPE USNM uncatalogued (SEM 1672, 1673, 1867, 1868, 1878).—Andros Island, coll. Timothy Turnbull; 2 branches in excellent condition, USNM 73926 (SEM 1877, 1882, 1890).

HISPANIOLA: Off Cape San Rafael, north coast of Dominican Republic, 19°03′N, 68°47′W, 84–266 m, R/V PILLSBURY sta. P-1158, 16 Jan 1970; two incomplete colonies, somewhat broken, USNM 55443 (SEM 1873–75, 1881, 1885, 1886, 1890).

LESSER ANTILLES: Off Grenada, 12°02′N, 61°35.7′W, 66–84 m, R/V PILLSBURY sta. P-854, 3 Jul 1969; small fragments, USNM 55437.—Barbados, off Pelican Island, 146 m, University of Iowa Barbados-Antigua Exped. sta. 49, 27 May 1918; small fragments, USNM 57405.

CARIBBEAN SEA: Off Los Roques Islands, Venezuela, 11°57.9′N, 66°50′W, 64–66 m, R/V PILLSBURY sta. P-745, 24 Jul 1968; broken branchlets, USNM 55435.—Off Peninsula de Paria, Venezuela, 10°45′N, 62°00′W, 77–86 m, R/V PILLSBURY sta. P-705, 18 Jul 1968; broken distal branches, USNM 55432.

Diagnosis.—*Thelogorgia* with polyps 2.5–3.5 mm tall; calicular points forming prominent stellate figure; sclerites of tentacle backs blunt, stout, prickly rods bent near one end, up to 0.35 mm long and 0.08 mm in diameter.

Description.—Colonies (Fig. 1) branched generally in one plane, loosely pinnate to the third or fourth order, borne on a tall, irregularly bending main stem without side branches and devoid of polyps occupying as much as half the height of the entire colony. Side branches arise from the main stem at intervals of about 1 cm but may be somewhat more or less. Undivided lateral branchlets up to 6 cm in length, usually less. The largest specimen is about 32 cm tall, with a main stem without branches for 23 cm and measuring 3 mm in diameter just above the holdfast.

Polyps are arranged biserially along the branches, 2–3 mm apart, sometimes a little more and sometimes less, usually alternating except at the twig tips where ordinarily two polyps are opposed, with the short apex of the growing branch between them (Fig. 2). In contracted state, the polyps of preserved specimens are trumpet-shaped (Fig. 3), narrower at the base and flaring outward toward the tentacles, originating from the axis at about 45° and more or less distinctly directed toward one face of the colony, from 2 mm to 3.5 mm tall and about 0.5 mm in diameter proximally, conspicuously flaring distally to as much as 1.5 mm across the base of the tentacles. Often the tallest polyps are those at the twig tips. Narrow longitudinal grooves corresponding to the mesenteries are scarcely perceptible in preserved specimens. The tentacles are folded over the mouth, their backs covered by stout, prickly rods (Figs. 5a, 7a) bent near one end, about 0.35 mm in length and 0.08 mm in width, in a double row converging proximad (Figs. 4, 6); smaller, narrow, curved rodlets about 0.12 mm long are vertically aligned along the sides of the tentacles, the smallest extending into the pinnules (Figs. 5b, 7b). The distalmost large sclerites of the polyp body are thorny spindles reaching a length of 1 mm or a little more and up to 0.1 mm in width, exclusive of thorns (Figs. 5d, 7e), converging to form eight distinct calicular points that project strongly from the bases of the infolded tentacles, giving the contracted polyps a conspic-

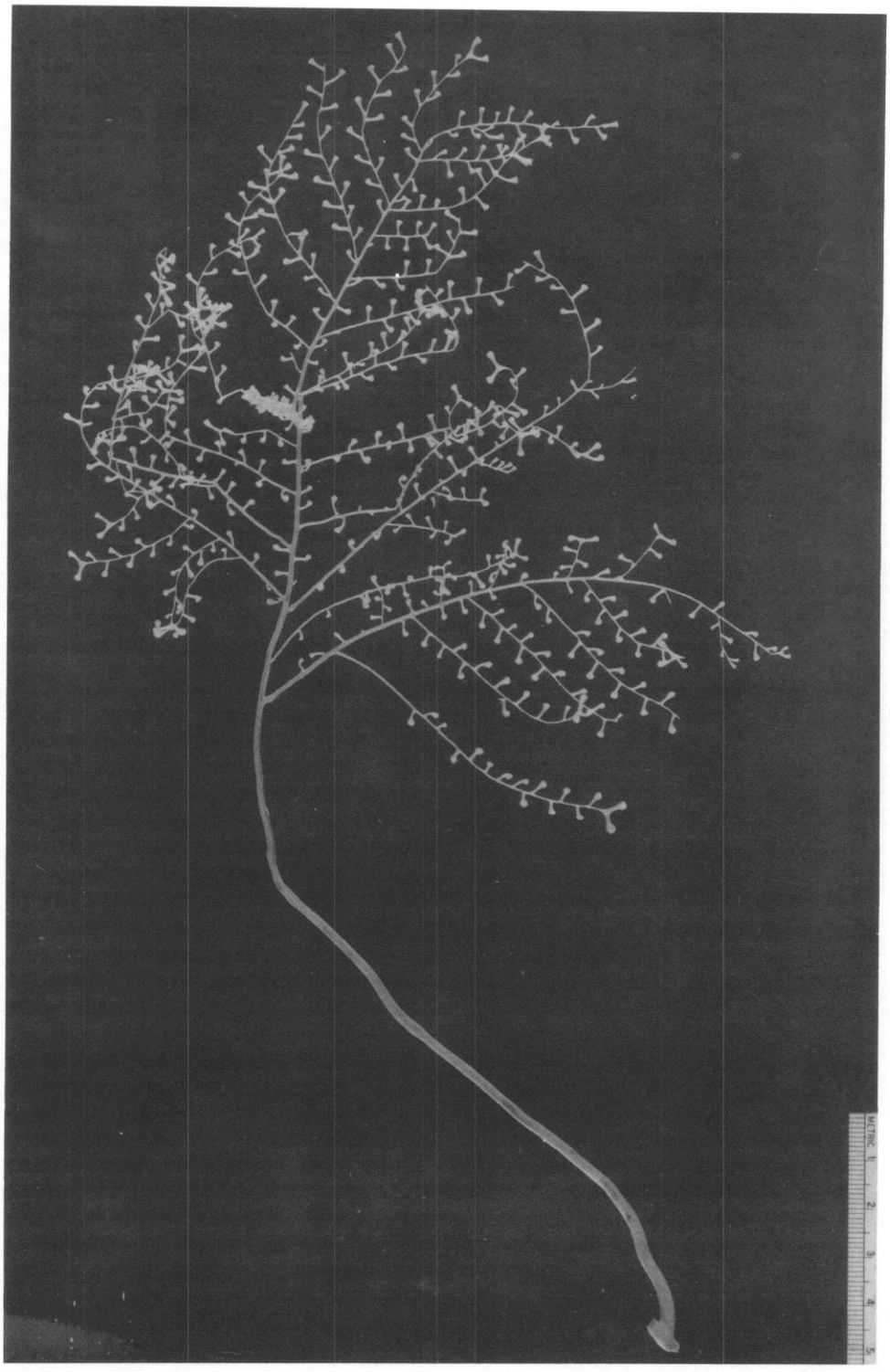

Figure 1. *Thelogorgia stellata* new species. Colonies: a, holotype from Grand Bahama, USNM 54823.

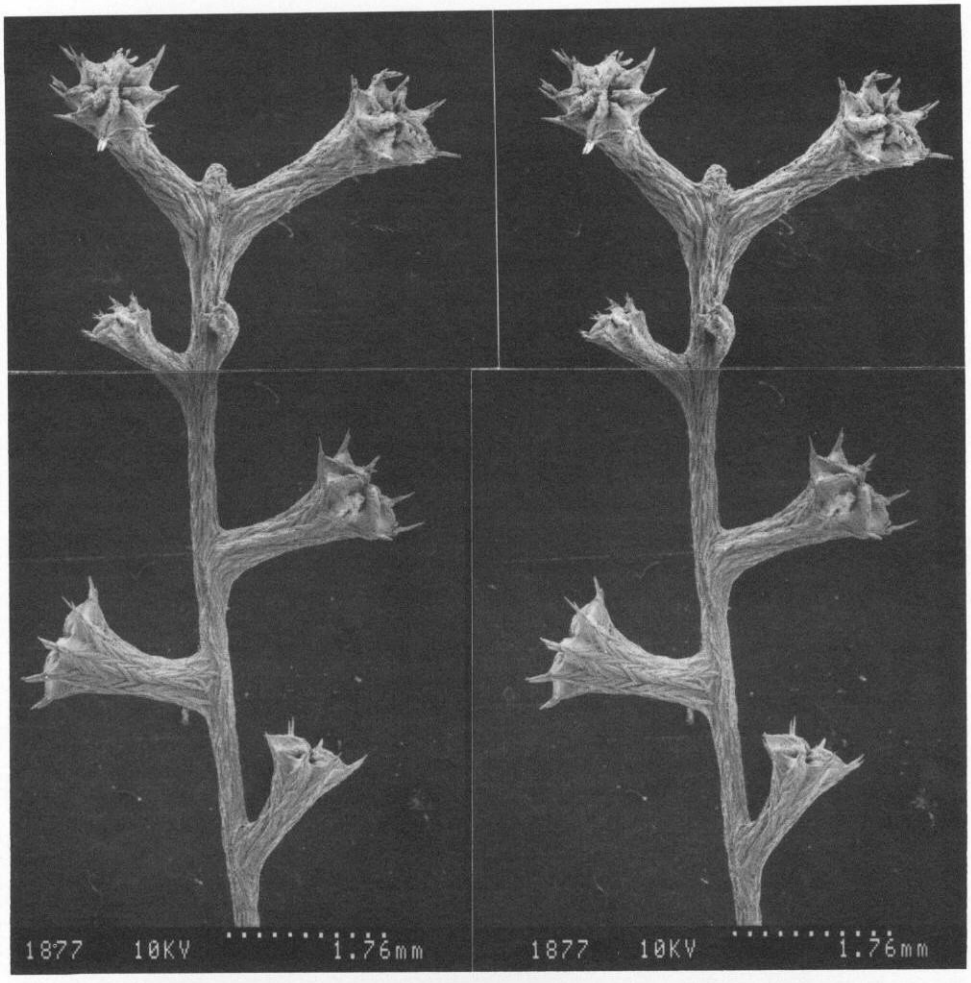

Figure 2. *Thelogorgia stellata* new species, USNM 73926. Terminal part of branchlet showing arrangement of polyps. Stereoscopic scanning electron micrographs.

uously stellate appearance (Figs. 3, 4). Below the sub-tentacular points, the spindles of the body wall are arranged longitudinally, often more or less distinctly converging in the eight interseptal tracts. The wall of the long pharynx contains numerous, thickly scattered minute rods 0.05–0.08 mm long, sculptured by prominent, blunt projections (Figs. 5c, 7c). The sclerites of the coenenchymal cortex on the terminal branches are similar to those of the polyps, but on the largest branches or main stems they are shorter, blunt and coarsely sculptured (Fig. 7f), interspersed with numerous irregular warty forms, some of which are typical crosses (Fig. 7g). The anastomosing sclerites of the axis (Figs. 5f, 7h) are smooth, slender, flattened, tapered spindles irregularly fused together and rarely found isolated.

Etymology.—Latin *stellatus* = starry, in allusion to the starlike aspect of the polyps. Adjective.

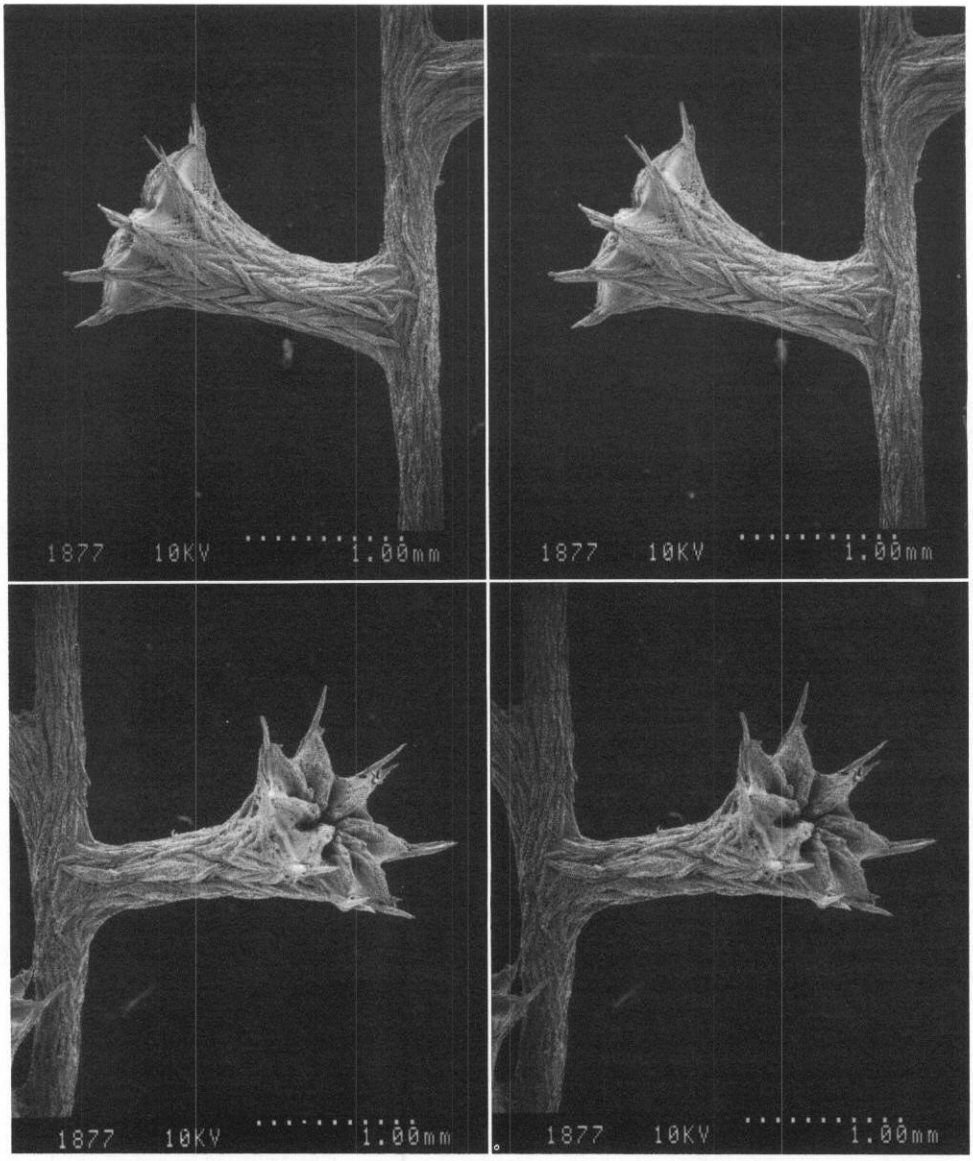

Figure 3. *Thelogorgia stellata* new species, USNM 73926. Contracted polyps. Stereoscopic scanning electron micrographs.

Distribution.—Bahamas, Greater and Lesser Antilles, and northern coast of South America. About 60–90 m. Less frequently collected than *T. studeri* perhaps owing to a preference for cavernous habitats.

Comparisons.—The polyps of this species form conspicuously stellate calices noticeably larger than those of *T. studeri,* and the tentacular rods are stouter. The colonies are much coarser and more "gorgonian-like" than those of *studeri.*

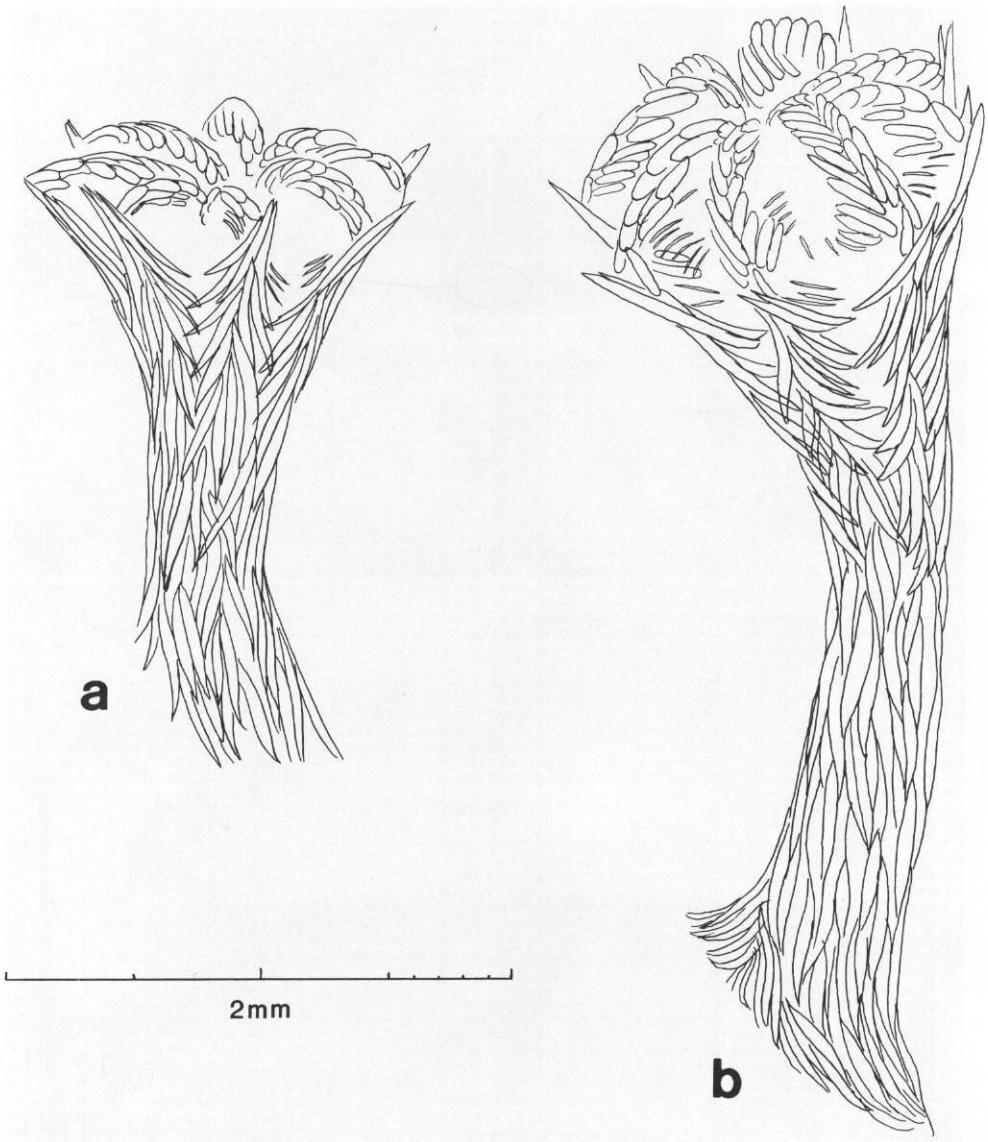

Figure 4. *Thelogorgia stellata* new species. Contracted polyps: a, USNM 73926 from Andros Islands; b, USNM 54823, holotype from Grand Bahama. Camera lucida drawings.

Remarks.—Two colonies, one from Grenada (USNM 55437) and one from Venezuela (USNM 55435) are tentatively included here because of their stout tentacular rods and appropriate size of contracted polyps. Their unusually short calicular spindles throw some doubt upon their inclusion in *stellata,* but these are stouter in proportion to length than is the case in *studeri.* As the specimens in question are fragmentary and in poor condition, their identification is ambiguous.

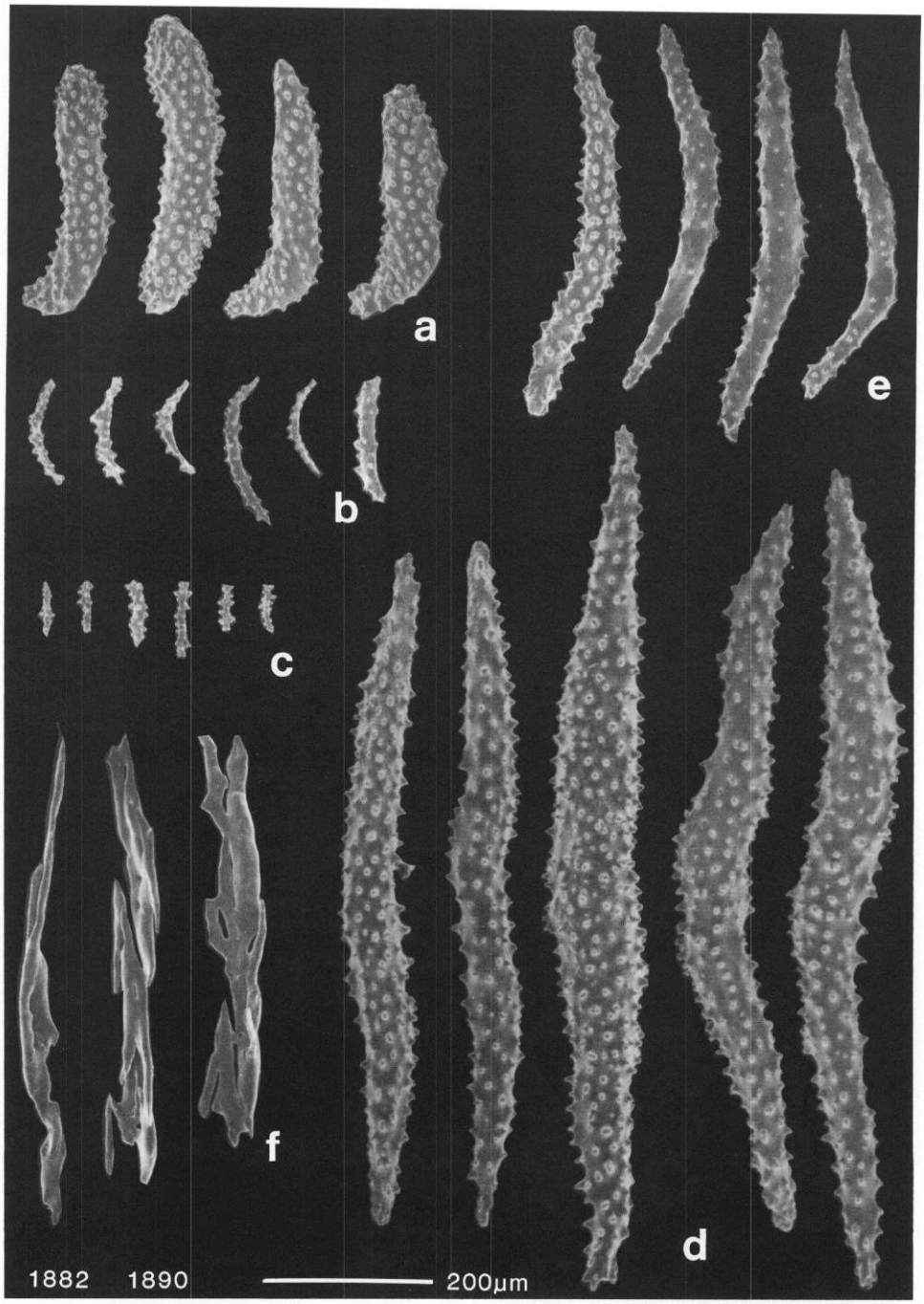

Figure 5. *Thelogorgia stellata* new species. Sclerites of USNM 73926: a, bent rods from back of tentacle; b, small, curved spindles from tentacle rachis and pinnules; c, flattened rodlets from pharyngeal wall; d, large spindles from body wall of polyp; e, curved spindles from calicular points; f, anastomosing flattened spindles from axis.

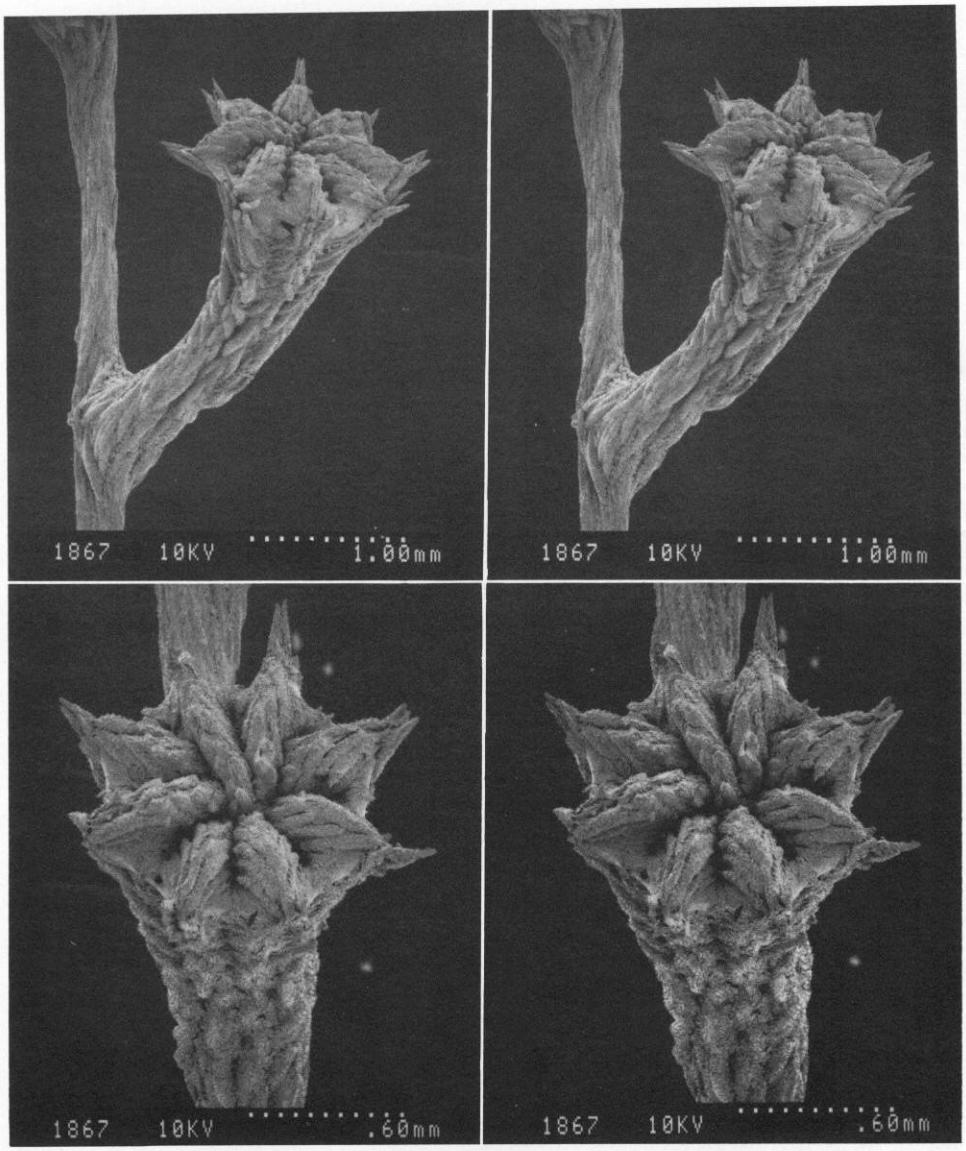

Figure 6. *Thelogorgia stellata* new species. Contracted polyps of holotype, USNM 54823. Stereoscopic scanning electron micrographs.

Thelogorgia studeri new species
Figures 8–14

"Thelogorgia studeri" Verrill MS, pls. 19, figs. 4, 4a–b; 40, fig. 2a–v; 45, fig. 2a–j.
Keroeides richardii.—Deichmann, 1936: 89.
?*Lignella richardii.*—Bayer, 1961: 83, fig. 18.
Lignella richardii.—Kinzie, 1973: 113, 130.
not *Gorgonia Richardii* Lamouroux, 1816: 407; 1824: 205.—Lamouroux, Bory de Saint-Vincent and Deslongchamps, 1824: 443.
not *Gorgonia Richardi.*—Duchassaing and Michelotti, 1860: 29, pl. 4, fig. 1.
not *Lignella Richardi.*—Gray, 1870: 408.

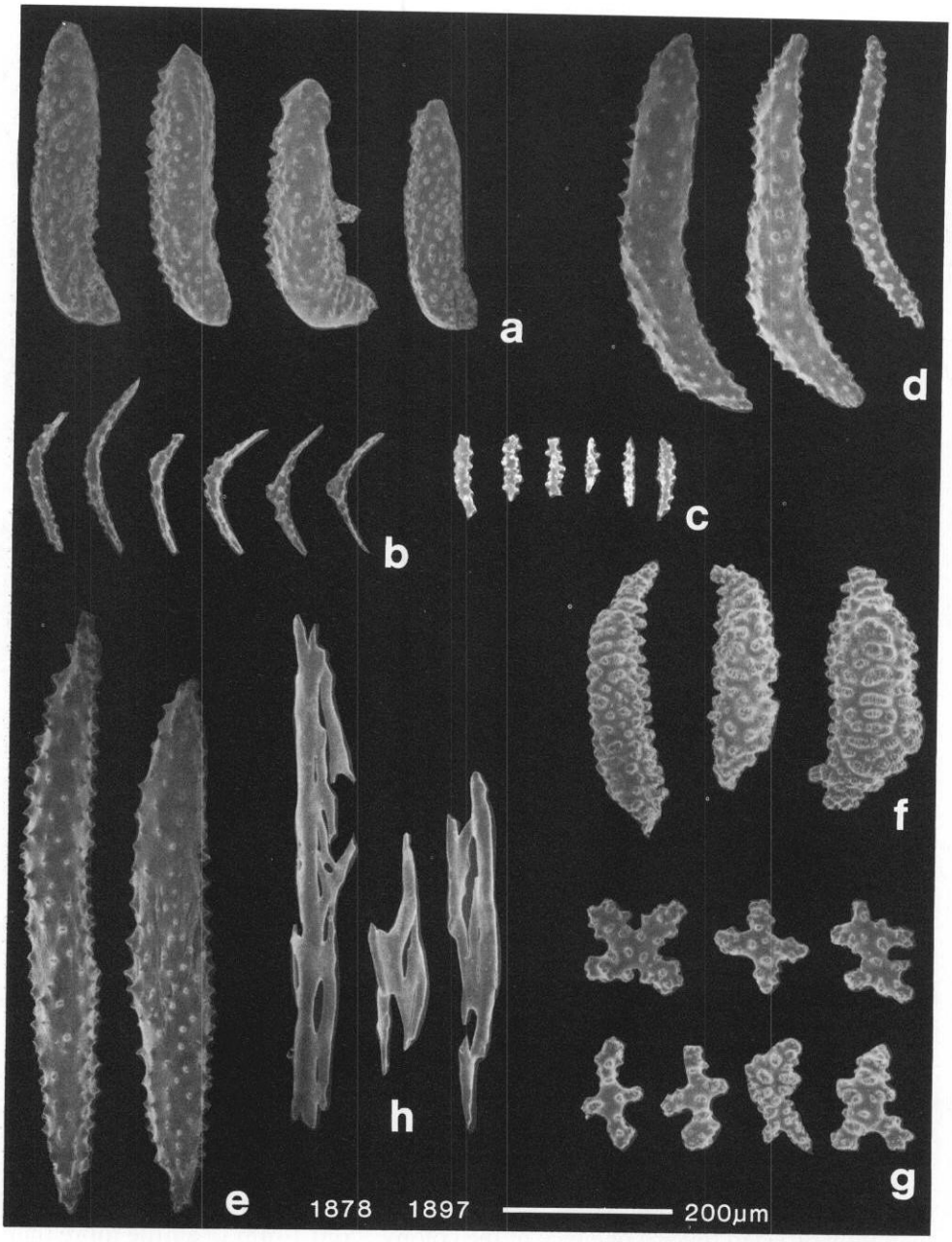

Figure 7. *Thelogorgia stellata* new species. Sclerites of holotype, USNM 54823: a, bent rods from back of tentacle; b, small, curved spindles from tentacle rachis and pinnules; c, flattened rodlets from pharyngeal wall; d, curved spindles from calicular points; e, large spindles from body wall of polyp; f, blunt spindles from cortex of main stem; g, crosses and irregular bodies from cortex of main stem; h, anastomosing flattened spindles from axis.

Material Examined.—BAHAMAS: Northwest Providence Channel, depth and exact location not recorded, coll. W. A. Starck, Nov 1964; one profusely branched colony broken off just above holdfast, USNM 55426.—Dotum Bay, Acklins Island, 22°10.25′N, 74°18.25′W, 61 m, coll. Bruce Chalker, R/V CALANUS 23 Jan 1978; one incomplete colony, USNM 59456.

FLORIDA: South of Marquesas Key, 37–40 m, coll. Bruce Chalker and Patrick L. Colin, 19 Jun 1973; two nearly complete colonies, USNM 55088 (SEM 1870, 1880).

GULF OF MEXICO: Northwest of Dry Tortugas, 24°47′31″N, 83°41′11″W, 62.5 m, Continental Shelf Associates sta. 29 for Bureau of Land Management, 24 April 1981; two lots of fragments much damaged, USNM 74765, 74766.

HISPANIOLA: East end of Monte Cristi Bank, north coast of Dominican Republic, 19°57′N, 71°20.6′W, 37–695 m, R/V PILLSBURY sta. P-1151, 15 Jan 1970; one large much damaged colony, main trunk broken in several pieces, USNM 55087 (SEM 1869, 1879, 1896).—East end of Monte Cristi Bank, 19°57′N, 71°22′W, 22–229 m R/V PILLSBURY sta. P-1150, 15 Jan 1970; one colony with part of holdfast, USNM 55442 (SEM 1674).

JAMAICA: Discovery Bay, 58 m, coll. Eileen A. Graham, 25 Oct 1964; one colony almost completely overgrown by hydroids, USNM 55418.—Depth not recorded, coll. R. A. Kinzie, 1 May 1969; one damaged colony with membranous holdfast, USNM 55419 (SEM 1887).—66 m, coll. Eileen A. Graham, 25 Oct 1964; one badly damaged colony, USNM 55420.—79 m, coll. Roma Chapman, 25 Oct 1964; one nearly complete small colony, USNM 55421.—79 m, coll. Roma Chapman, 30 Oct 1964; one abundantly branched colony now somewhat broken, HOLOTYPE, USNM 55424 (SEM 1682–1684, 1686, 1889, 1890, 1896).—60–70 m, coll. Roma Chapman, 23 Dec 1964; two colonies, one with holdfast, now much broken, USNM 55427.—70 m, coll. Eileen A. Graham, no date; one damaged colony, USNM 59282 (SEM 1876).

HONDURAS: Off Punta Sal, Gulf of Honduras, 15°58.2′N, 87°34′W, 18–64 m, R/V PILLSBURY sta. P-619, 20 Mar 1968; one colony in poor condition, USNM 55431.

COLOMBIA: Isla Morro Grande at entrance to Santa Marta Bay, 12 m, coll. Harry Ehrhardt, 2 Sep 1975; one nearly white colony 13 cm tall, Senckenberg Museum Frankfurt No. 6342.—30 m, one yellow colony 26 cm tall, Senckenberg Museum Frankfurt No. 6340, and one colony 25 cm tall broken in three pieces, Senckenberg Museum Frankfurt No. 6361, both coll. M. Grasshoff, 16 Sep 1974.

Diagnosis.—*Thelogorgia* with polyps 1–2 mm tall; calicular points forming prominent stellate figure; sclerites of tentacle backs slender prickly rods bent near one end, up to 0.3 mm long and 0.06 mm in diameter.

Description.—Colonies (Figs. 8, 9) abundantly and finely branched in one plane but extremely delicate and brittle, openly pinnate, with a slender main stem that often is without branches for several cm and usually is devoid of polyps. Side branches arise from the main stem and major branches at intervals of about 1 cm, but this varies considerably and may be more or less; because of this irregularity, the colonies do not have a regular plumose aspect. Undivided lateral branchlets may be as much as 5 cm in length, but usually are no more than about 3 cm. The largest specimen is about 45 cm tall, with a main stem devoid of branches for 16 cm and measuring 3.5 mm in diameter just above the holdfast.

Polyps are arranged biserially along the branches (Fig. 9), 1.5–3 mm apart but sometimes as much as 4 mm, rarely almost opposite but usually alternating except at the twig tips where ordinarily two polyps are opposed, with the short apex of the growing branch between them. In contracted state, the polyps of preserved specimens (Fig. 11) are trumpet-shaped, narrower at the base and flaring outward toward the tentacles, originating from the axis at about 45° and more or less distinctly directed toward one face of the colony, from 1 mm to a little more than 2 mm tall and 0.2–0.4 mm in diameter proximally, widening to as much as 1 mm distally. Even on a single colony, fully developed contracted polyps can vary from 0.9 to 2 mm in height (Fig. 11a, b); often the tallest are those at the twig tips, and young individuals may be much smaller. The tentacles are folded over the mouth, their backs covered by slender, bent rods in a double row converging proximad (Fig. 11f); very delicate, narrow bent rodlets extend along toward the pinnules, the smallest, slender needles extending into the pinnules. Immediately beneath the tentacles, the distalmost large spindles of the polyp body converge

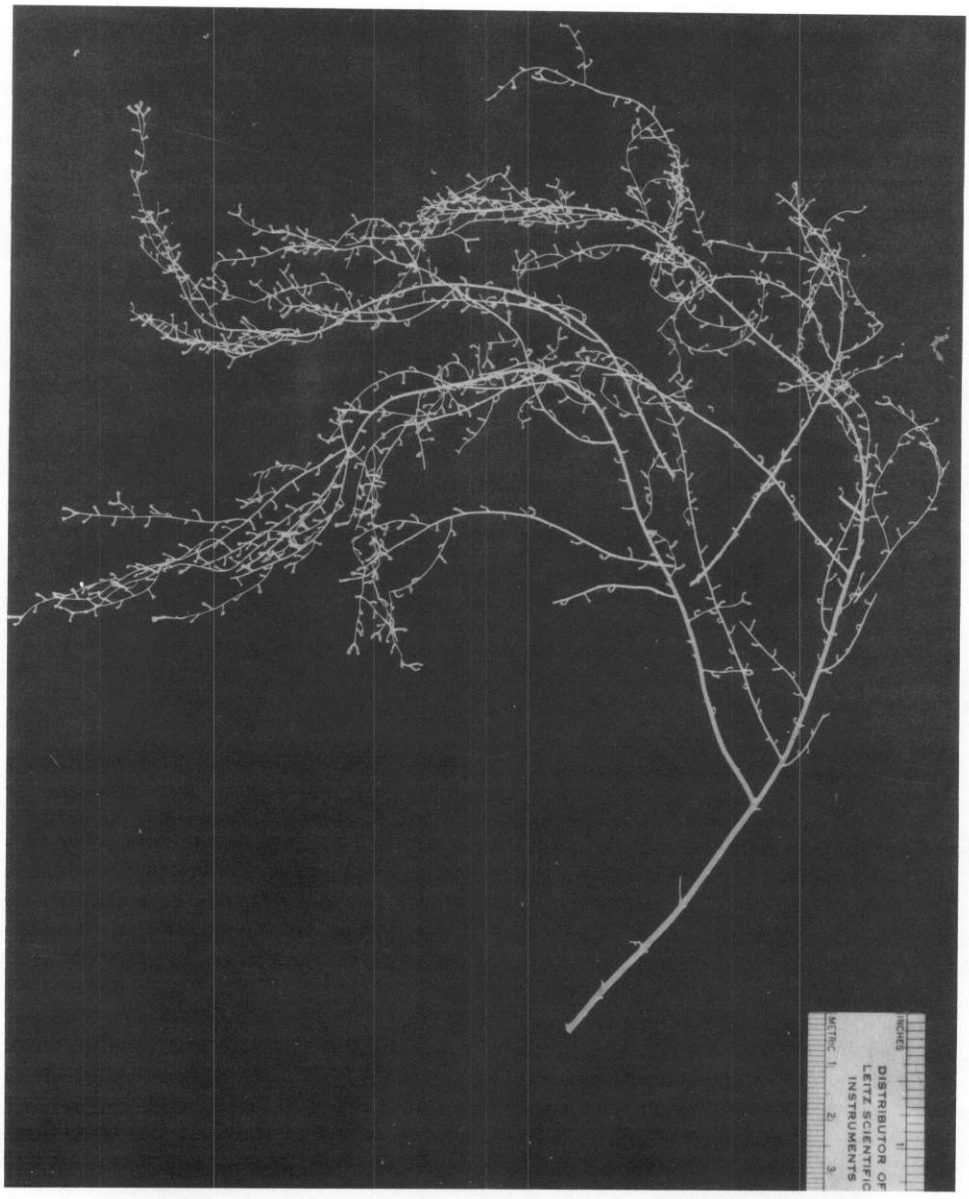

Figure 8. *Thelogorgia studeri* new species, holotype colony from Jamaica, USNM 55424, colony in alcohol, distorted by crowding in container.

to form eight distinct calicular points that project more or less strongly from the base of the infolded tentacles as marginal projections. Below the sub-tentacular points, the spindles of the body wall are arranged longitudinally, converging weakly if at all in eight interseptal tracts separated by narrow grooves corresponding to the mesenteries.

The largest tentacular rods are slender, 0.2–0.3 mm in length, curved near one end and ornamented with low, sharp thorns (Figs. 12a, 14a); the smallest tentacular

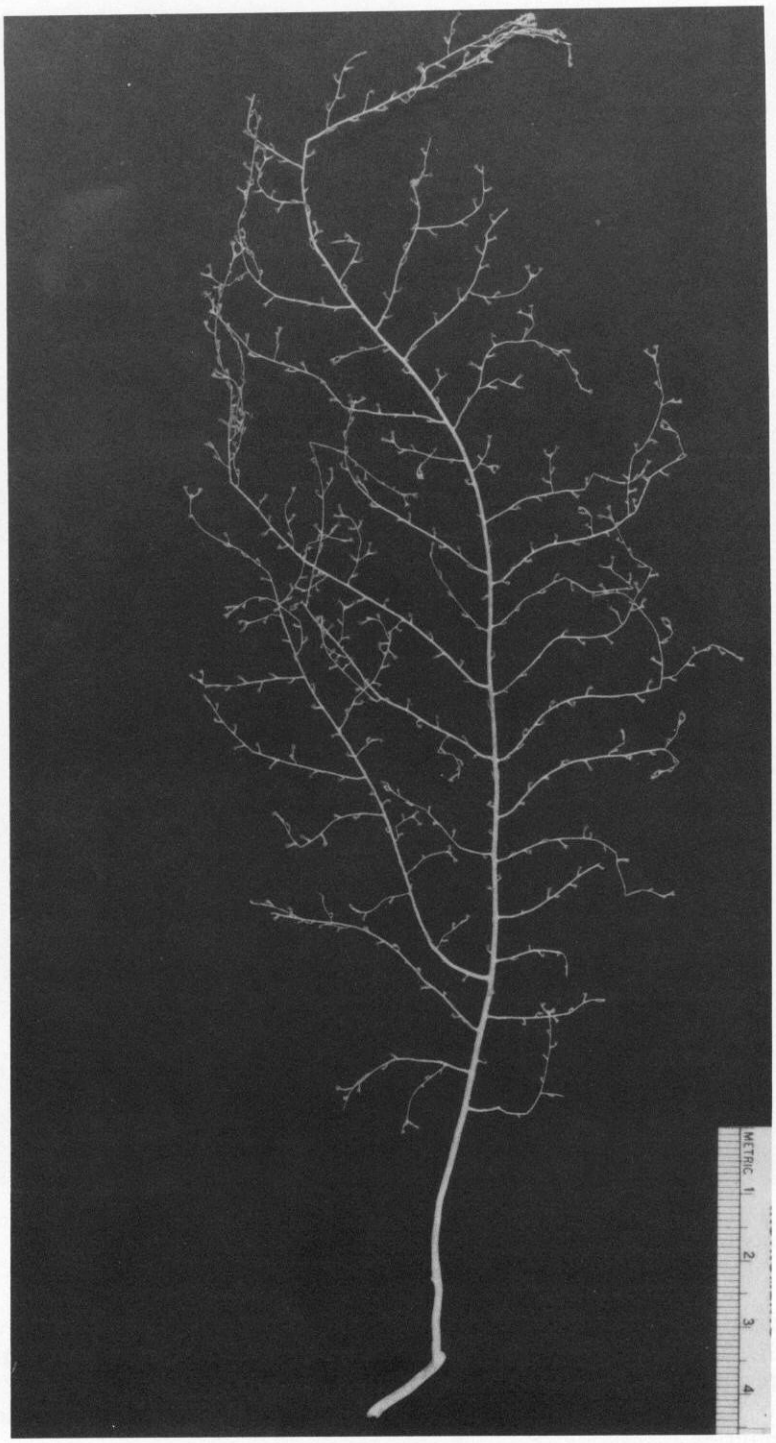

Figure 9. *Thelogorgia studeri* new species, USNM uncatalogued, colony from Jamaica, dried immediately after collection.

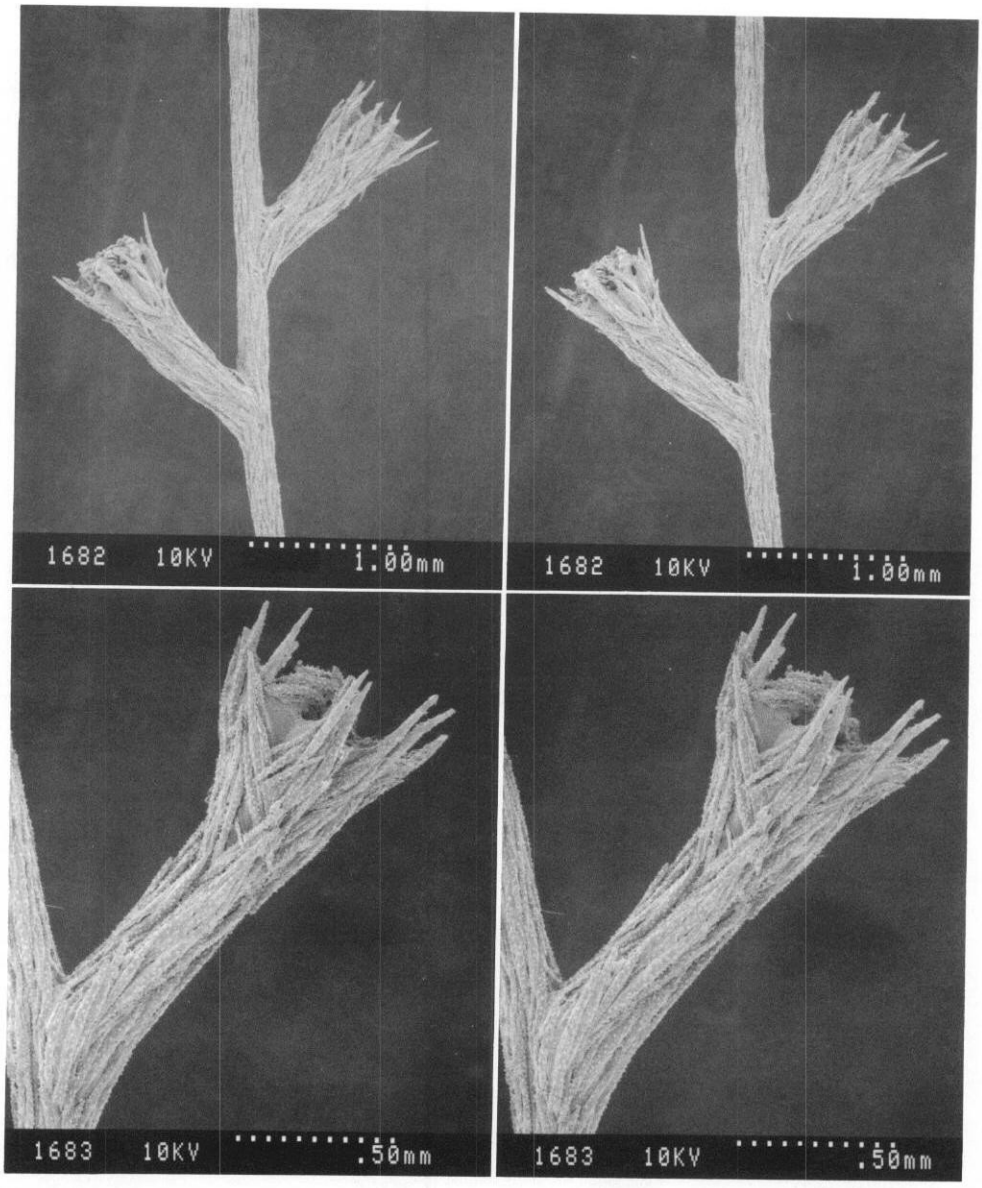

Figure 10. *Thelogorgia studeri* new species. Contracted polyps of holotype, USNM 55424. Stereoscopic scanning electron micrographs.

sclerites (Figs. 12b, 14b) are very delicate, slender, flattened rodlets straight or slightly curved and up to about 0.13 mm long. The pharyngeal walls contain small, flattened, narrow rodlets with marginal tubercles (Figs. 12c, 14c), the largest about 0.08 mm long. The sclerites of the polyp body are slender, thorny spindles reaching lengths of 0.35–0.65 mm and 0.03–0.05 mm in width, exclusive of thorns (Figs. 12d, 14d); those converging in the calicular points are correspondingly curved (Figs. 12e, 14e). The sclerites of the coenenchymal cortex on the terminal

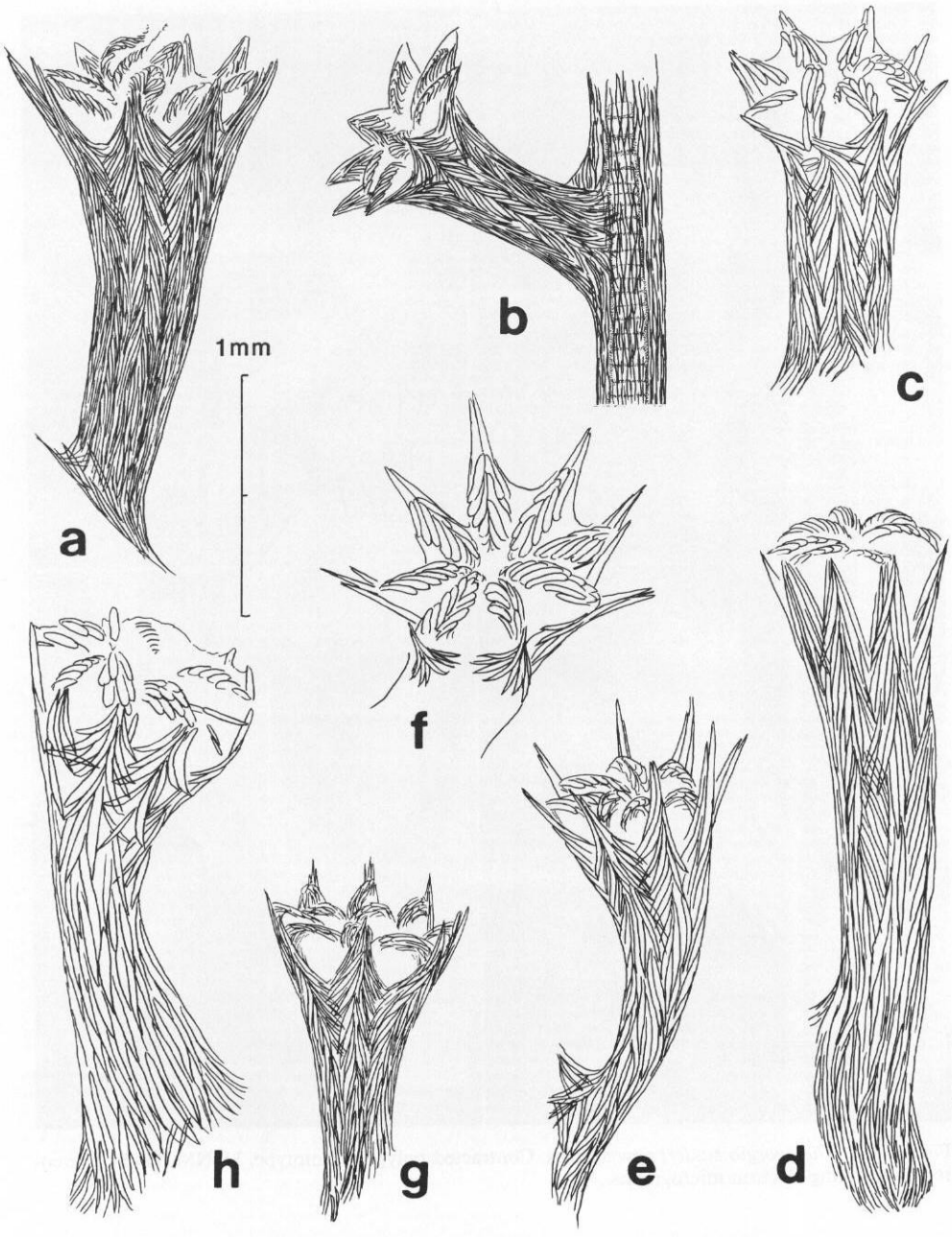

Figure 11. *Thelogorgia studeri* new species. Contracted polyps: a, b, USNM uncatalogued, from Jamaica; c, USNM 55419 from Jamaica; d, USNM 74765 from northwest of Dry Tortugas; e, f, USNM 55088 from south of Marquesas Key; g, USNM 59456 from Acklins Island; h, USNM 55443 from Dominican Republic. Camera lucida drawings to same scale.

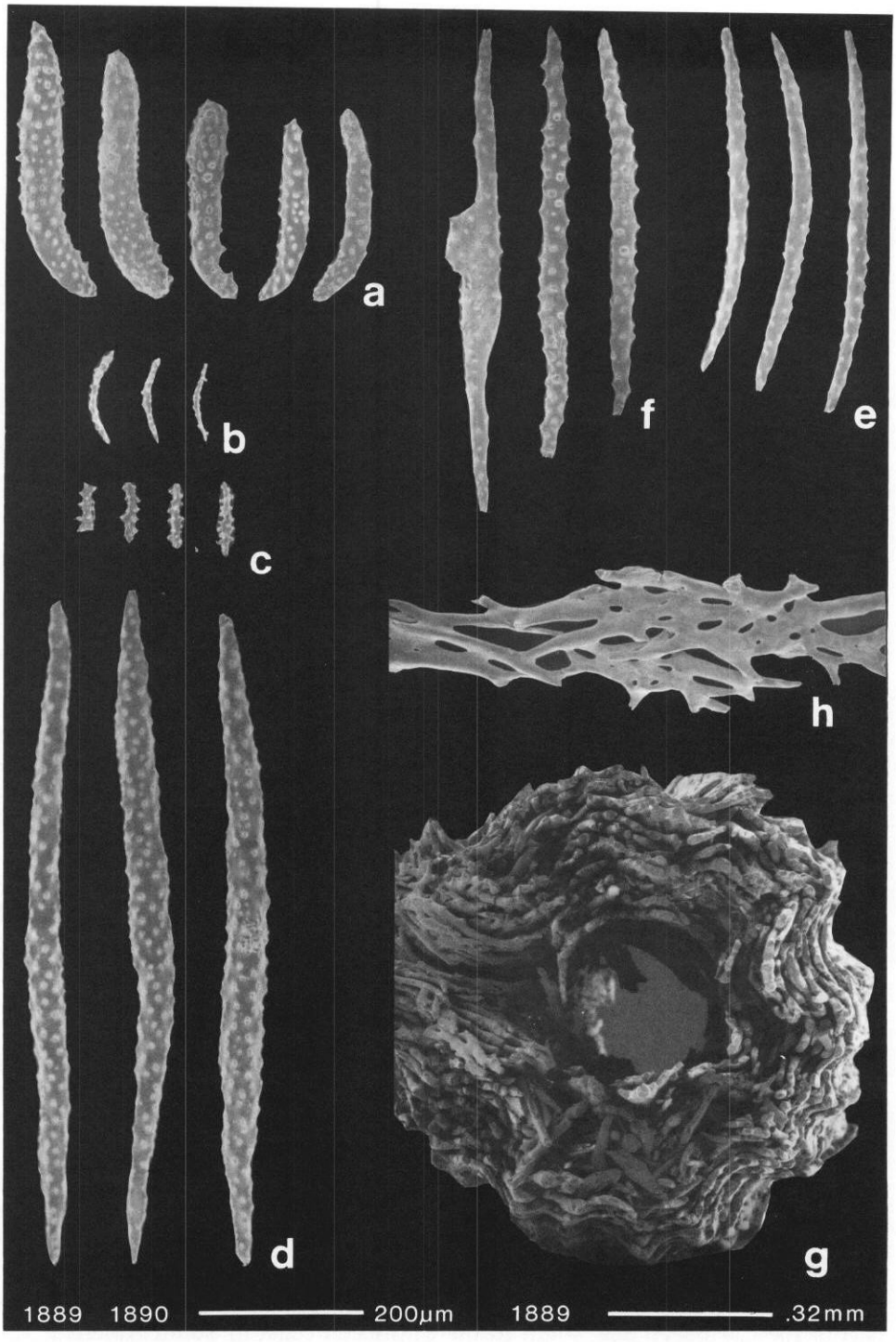

Figure 12. *Thelogorgia studeri* new species. Sclerites of holotype, USNM 55424: a, bent rods from back of tentacle; b, small, curved spindles from tentacle rachis and pinnules; c, flattened rodlets from pharyngeal wall; d, large spindles from body wall of polyp; e, curved spindles from calicular points; f, spindles from cortex of main stem; g, cross section of axis showing central core surrounded by concentric layers of sclerites; h, anastomosing flattened spindles from axis.

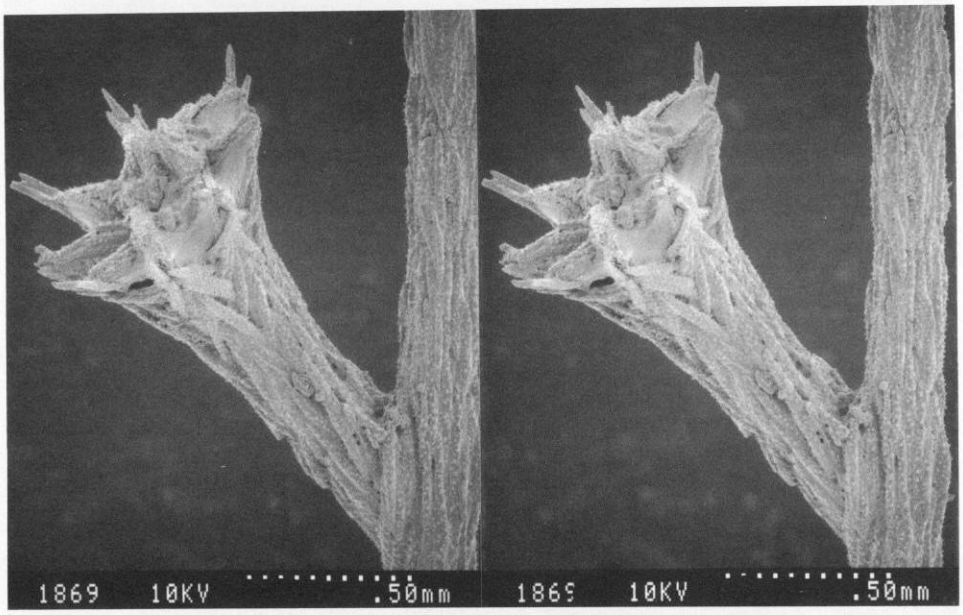

Figure 13. *Thelogorgia studeri* new species. Contracted polyp of USNM 55087 from Dominican Republic. Stereoscopic scanning electron micgrographs.

twigs and small branches are similar to those of the polyps, but on the largest branches and main stems of some colonies they become blunt and coarsely sculptured (Fig. 14f). As in all species of *Thelogorgia,* the sclerites of the axis (Figs. 12g, h; 14e, g, h) are smooth, flattened, tapered spindles elaborately anastomosed to form concentric, lattice-like tubes surrounding the chambered core.

Color.—Observations of the color of colonies in life were made by the collector in four cases: USNM 55424, "pale brownish yellow," Roma Chapman; USNM 55421, "brownish white, polyps dark," Roma Chapman; USNM 59282, "orange red," Eileen A. Graham; and Senckenberg Museum Frankfurt No. 6361, "yellow," M. Grasshoff. In preserved condition, the coenenchyme is usually light brown, pale tan or fawn color, sometimes nearly white, and the supporting axis is white.

Etymology.—In recognition of A. E. Verrill's contributions to our knowledge of the Octocorallia, the name honoring Théophile Studer that he proposed for this species when he recognized it nearly a century ago is hereby validated.

Comparisons.—This species has the smallest polyps in the genus *Thelogorgia.* The calicular points tend to flare widely, but this feature may be related to the degree of contraction of individual polyps as in some cases they do not project noticeably. Branching is much finer than in *T. stellata,* giving the colonies a delicate, almost lacy aspect readily mistaken for hydroids.

Distribution.—Bahamas southward through the Greater Antilles and northwestern part of the Caribbean Sea, south to the Caribbean coast of South America; 12–82 m. In Jamaica, on the deep fore-reef slope below 66 m (Kinzie, 1973: 113, 130).

Remarks.—The material in the present collection is not consistent with Lamouroux's note that *G. richardii* is one of the most remarkable gorgonians because

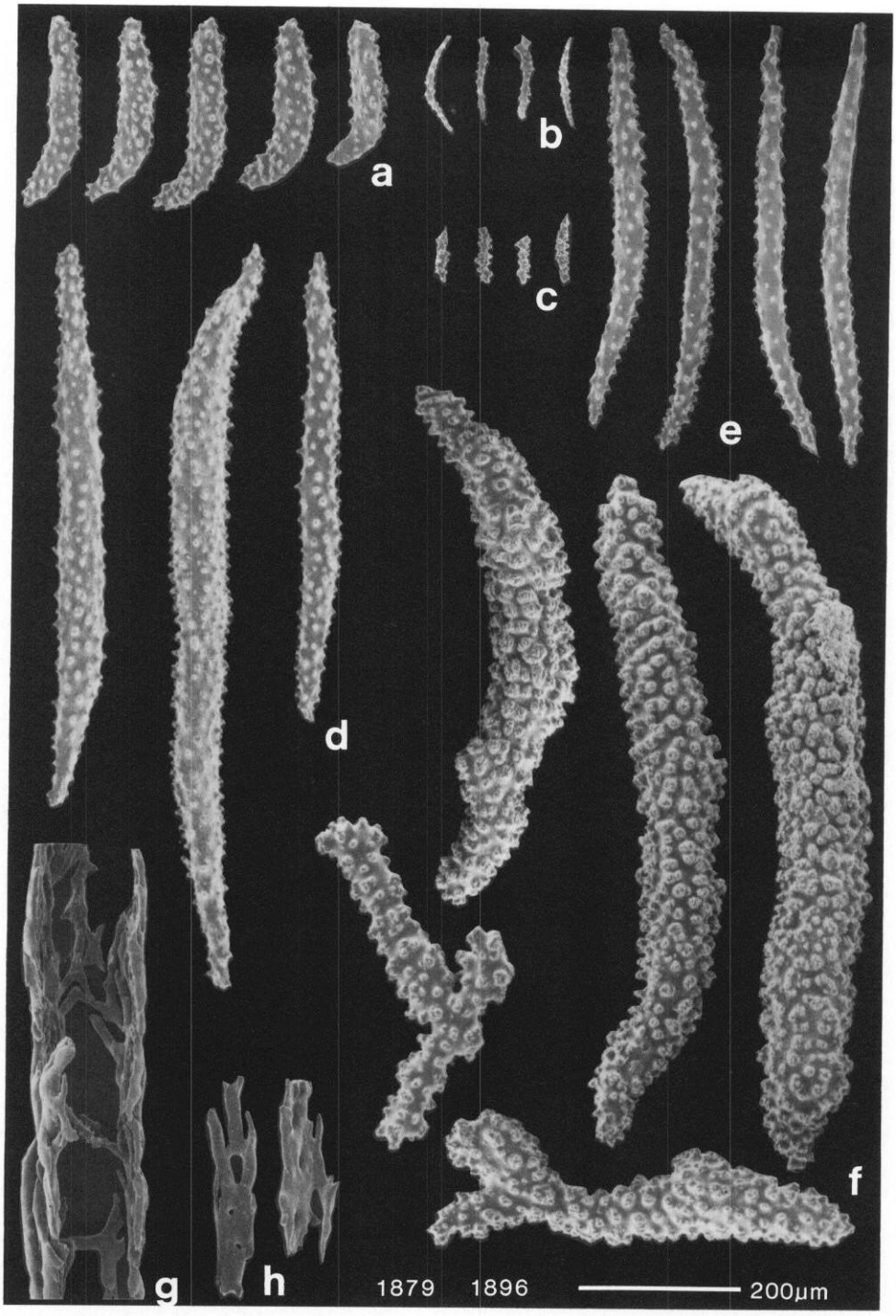

Figure 14. *Thelogorgia studeri* new species. Sclerites of USNM 55087 from Domincan Republic: a, bent rods from back of tentacle; b, small, curved spindles from tentacle rachis and pinnules; c, flattened rodlets from pharyngeal wall; d, large spindles from body wall of polyp; e, curved spindles from calicular points; f, large, coarse spindles from cortex of main stem; g, h, anastomosed sclerites of axis. Scanning electron micrographs.

of its size (6 à 8 décimètres), as the largest specimen is only about 50 cm tall (i.e., 5 décimètres) and the colonies—especially if preserved in dry condition—are extremely delicate and brittle. As reasoned above, this species cannot represent *Gorgonia richardii* Lamouroux as proposed by Deichmann (1936) and followed by me (Bayer, 1961). The size and implied robustness mentioned by Lamouroux are more consistent with *Iciligorgia schrammi* Duchassaing, 1870, but the color of that species, almost black when alive and dark slaty grey when preserved dry, is at variance with the stated color of *G. richardii* ("écorce . . . d'une couleur fauveterne") and is unmistakable. It can only be concluded that *G. richardii* may be *Iciligorgia schrammi,* but cannot be *Keroeides richardii* = *Lignella richardii* Auctt.

Two lots of severely damaged fragments from the Gulf of Mexico northwest of the Dry Tortugas (USNM 74765, 74766) differ in several respects from the other lots listed above and are specifically excluded from the original type series. Determination of their status must await examination of more nearly complete colonies from the same geographical area.

Thelogorgia longiflora new species
Figures 15–18

?*Lignella richardii.*—Bayer, 1961: 83, fig. 18.

Material Examined.—YUCATAN: Off Arrowsmith Bank, 20°50′N, 86°30′W, 46–183 m, R/V GERDA sta. G-956, 29 Jan 1968; one terminal twig in poor condition, USNM 55417.

HONDURAS: Off Puerto Cortes, Gulf of Honduras, 15°46.2′N, 88°10.2′W, 110–112 m, R/V PILLSBURY sta. P-618, 19 Mar 1968; one openly pinnate branch; PARATYPE, USNM 55430.

COLOMBIA: Off Cape Tiburon, Gulf of Uraba, 8°48.7′N, 77°12.7′W, 99–97 m, R/V PILLSBURY sta. P-402, 17 Jul 1966; one damaged colony with very long sterile trunk with broken lateral projections; PARATYPE, USNM 55429.

Gulf of Uraba, 8°52.4′N, 76°50.4′W, 92–99 m, R/V PILLSBURY sta. P-400, 17 Jul 1966; one nearly complete colony lacking holdfast; HOLOTYPE, USNM 55428 (SEM 1872, 1883, 1890, 1896).

LESSER ANTILLES: 2.8 miles off Pelican Island, Barbados, 100 fath. (=183 m), University of Iowa Barbados-Antigua Expedition, sta. 9, 16 May 1918; fragments in poor condition, USNM 49436.

Diagnosis.—*Thelogorgia* with very slender, tall polyps up to 5 mm in height and 0.5 mm in diameter; sclerites of tentacle backs stout, blunt prickly rods mostly bent near one end, up to 0.3 mm long and 0.08 mm in diameter; spindles of body wall longitudinal, with tendency toward *en chevron* arrangement, not interrupted by median zone of oblique and transverse sclerities.

Description.—Branching is openly pinnate from a slender, upright main stem devoid of polyps. The most nearly complete specimen (USNM 55428) is a colony about 23 cm tall, apparently broken off just above the holdfast (Fig. 15). About 3 cm above the base the main stem, 2 mm in diameter, produces a strong lateral branch with two secondary branches, but these apparently were broken off after reaching a considerable size, as they persist only as coenenchyme-covered, healed stumps. Above these the stem is slightly curved and undivided for 6 cm, at which point another healed stump of a lost primary branch occurs on one side, below the first complete branch, which itself remains unbranched for 7 cm. A second complete branch arises 5 mm above this on the same side, followed by three more healed stumps, two on one side, one on the other. Branching is essentially in one plane, the primary branches tending to remain unbranched and without polyps for several cm.

Polyps are arranged biserially along the branches (Fig. 16), 2–4 mm apart but sometimes a little more or less, rarely almost opposite but usually alternating except at the twig tips where ordinarily two polyps are opposed, with the short apex of the growing branch between them. In contracted state, the polyps of

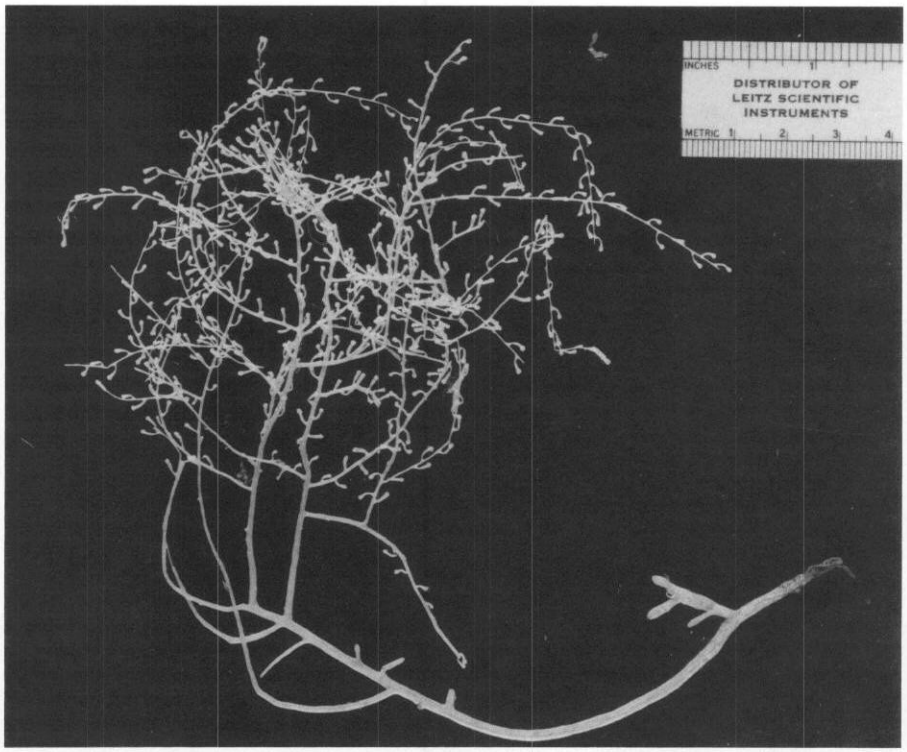

Figure 15. *Thelogorgia longiflora* new species. Holotype colony USNM 55428 from Gulf of Uraba, southwestern Caribbean Sea. Distorted by crowding in container.

preserved specimens are roughly cylindrical, originating from the axis at about 45° with the distal half of the body curving upward more or less strongly, 4–5 mm tall and about 0.5 mm in diameter proximally expanding to nearly 1 mm distally (Fig. 17). The tentacles are folded over the mouth; a double row of blunt rods extends from the base essentially to the tip, the largest 0.25–0.3 mm in length (Fig. 18a), decreasing in size distad; very small curved or bent needles about 0.2 mm long extend along the sides of the tentacles and down into the pinnules (Fig. 18b). Immediately beneath the tentacles, slender spindles 0.4–0.5 mm long and 0.03–0.05 mm in width (Fig. 18e) converge to form eight distinct calicular points which tend to extend from the base of the infolded tentacles as inconspicuous marginal projections. Below the sub-tentacular points, the spindles of the body wall are arranged narrowly *en chevron* in eight interseptal tracts, becoming mostly longitudinal in the proximal part of the body (Fig. 17). The double rows of spindles are not so distinctly *en chevron* as in *Acanthogorgia.* The pharyngeal walls contain minute, flattened rodlets up to about 0.08 mm long (Fig. 18c). On the final branches, the sclerites of the outer coenenchyme of the uppermost branches and terminal twigs are similar to those of the polyp body, but on the main stem they become coarser, blunt, and ornamented by complex tubercules (Fig. 18f).

Etymology.—Combining form of Latin *longus* = long + *Flora,* goddess of flowers, from Latin *flos, floris* = flower, in allusion to the tall polyps with eight petal-like tentacles. Noun in apposition.

Comparisons.—The polyps of *T. longiflora* are nearly as tall as those of *T. vossi*

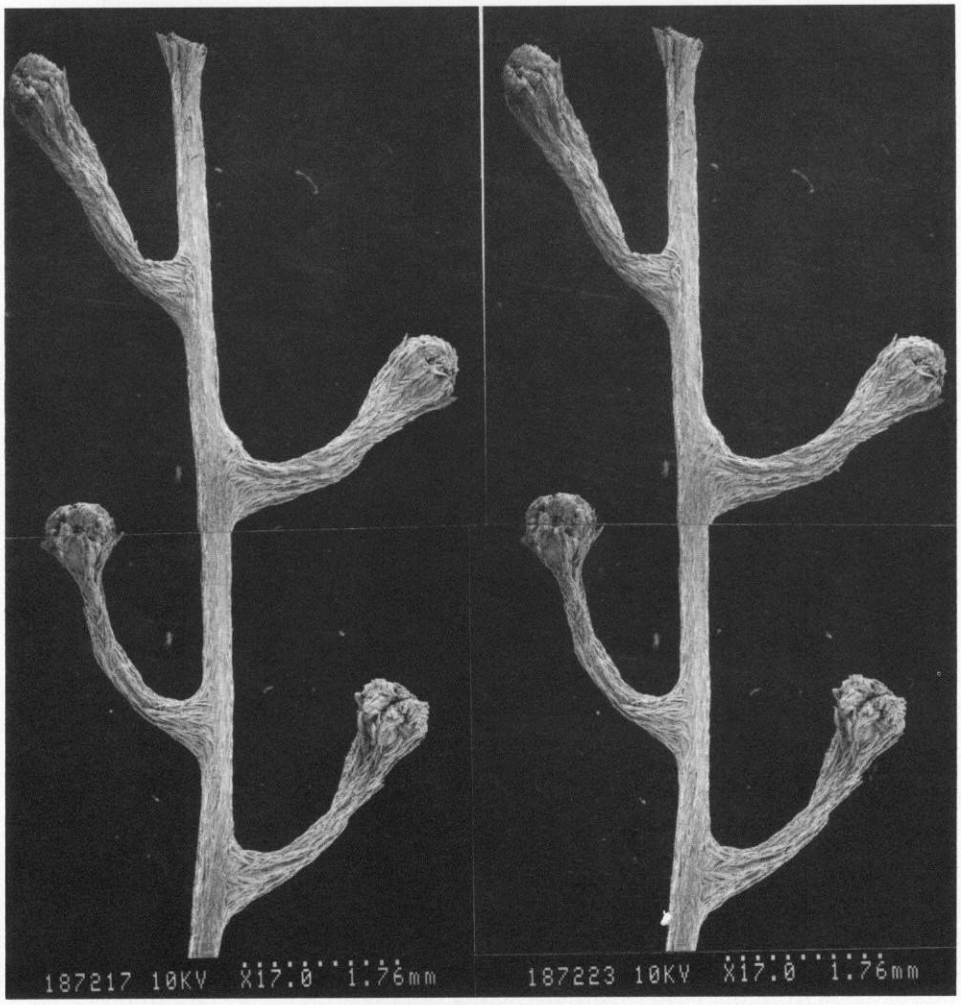

Figure 16. *Thelogorgia longiflora* new species. Part of branchlet of holotype, USNM 55428, from Gulf of Uraba, southwestern Caribbean Sea. Stereoscopic scanning electron micrographs.

but are much narrower, mostly about 0.5 mm in diameter. The spindles of the body wall are arranged longitudinally in 8 interseptal tracts weakly converging *en chevron.* The calicular points show little or no tendency to flare outward to surround the contracted tentacles in a stellate figure.

Remarks.—The species is represented by three closely similar specimens from Honduras and Colombia. One fragmentary specimen from Yucatan (USNM 55417) and another from Barbados (USNM 49436) are only tentatively assigned to *T. longiflora* because of their very poor condition. It should be noted that USNM 49436 is the specimen recorded and illustrated as *Lignella richardii* (Lamouroux) by Bayer (1961: 83, fig. 18).

In his manuscript, Verrill named one of his new *Thelogorgia* species *T. longiflora,* but it is not possible to be sure that the specimens illustrated on the mock-up of his planned plate 148 are identical with the material here described. Although the polyp shown in his figure 2 is similar to but shorter than most of the polyps

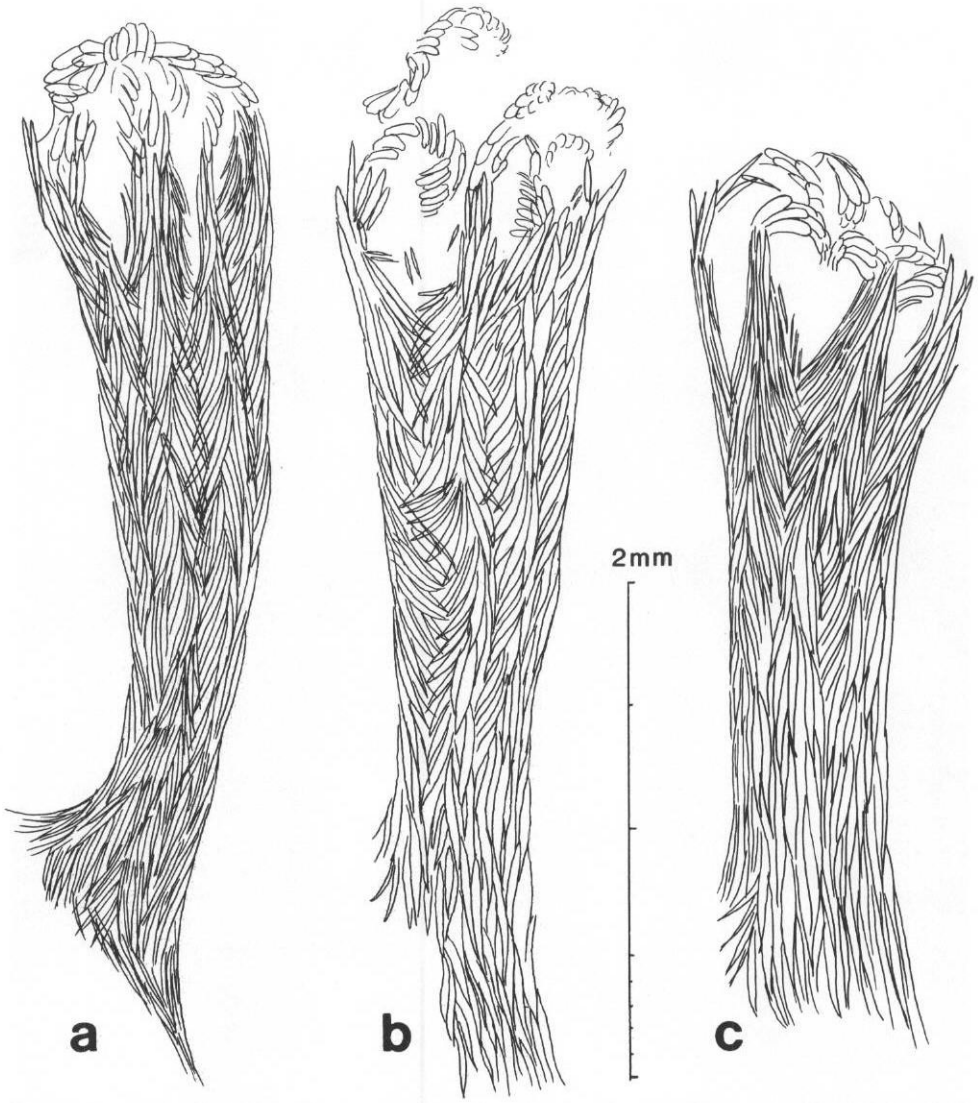

Figure 17. *Thelogorgia longiflora* new species. Contracted polyps: a, of holotype, USNM 55428; b, of paratype, USNM 55430; c, of paratype, USNM 55429. Camera lucida drawings to same scale.

of the present material, that illustrated in figure 1 could be either the species he proposed to call *T. studeri* or the species described herein as *T. stellata*. However, as the name *longiflora* is appropriate for the present specimens and can cause no nomenclatural difficulties, I have adopted it for this species.

Thelogorgia vossi new species
Figures 19–23

"Thelogorgia agassizii" Verrill MS. pl. 23, fig. 1a, b; pl. 67, fig. 1a–f.

Material Examined.—BAHAMAS: Northwest Providence Channel, 26°32′N, 78°55′W, 183–549 m, R/V GERDA sta. G-493, 3 Feb 1965; branch with three terminal twigs, USNM 55416.—Off Great Inagua, 20°54.5′N, 73°28.2′W, 110–220 m, R/V PILLSBURY sta. P-1143, 13 Jan 1970; several broken branchlets, USNM 55113.

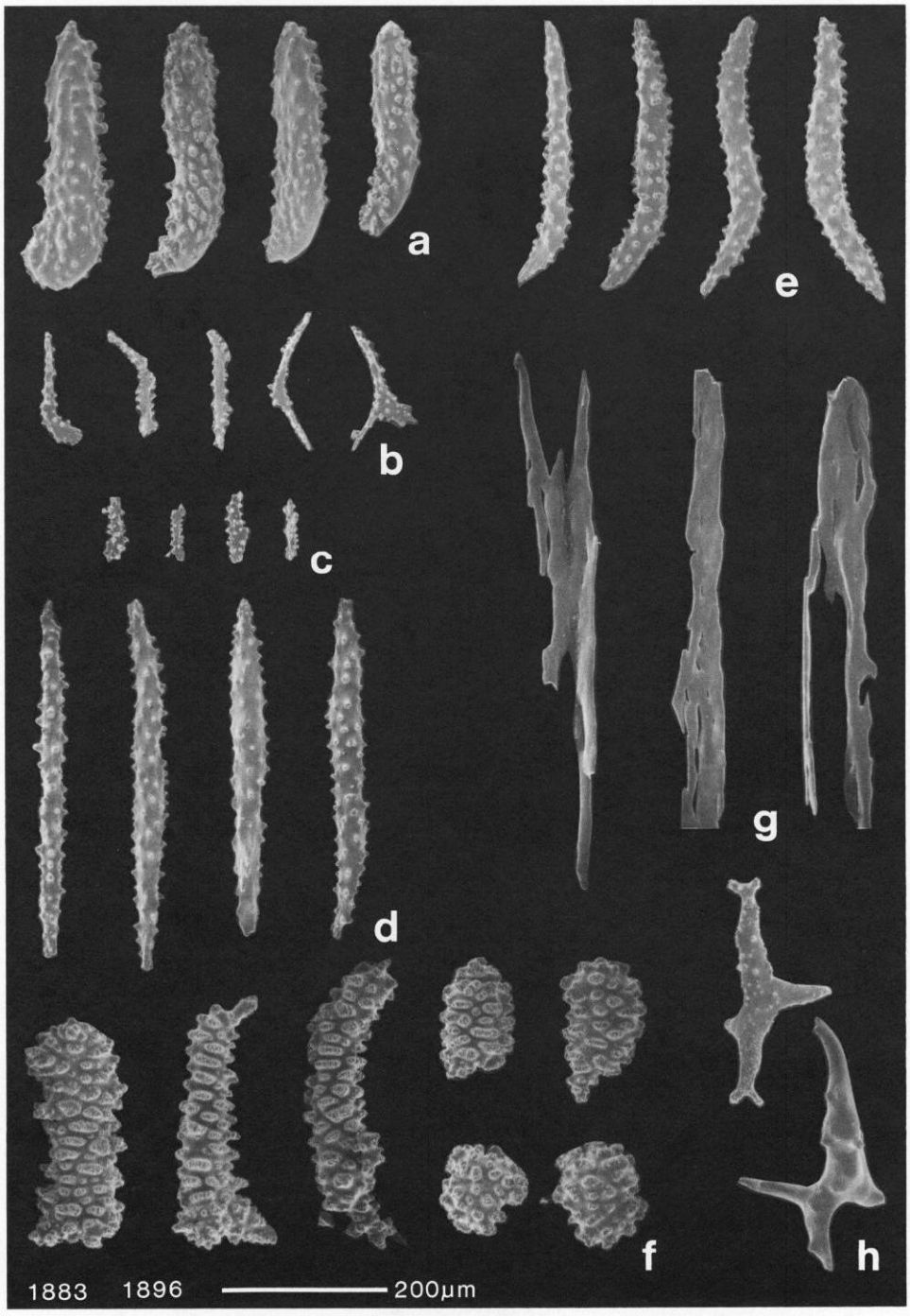

Figure 18. *Thelogorgia longiflora* new species. Sclerites of holotype, USNM 55428: a, bent rods from back of tentacle; b, small, curved spindles from tentacle rachis and pinnules; c, flattened rodlets from pharyngeal wall; d, spindles from body wall of polyp; e, curved spindles from calicular points; f, coarse rods and spheroids from cortex of main stem; g. anastomosed sclerites of axis; h, isolated anastomosing slcerites from axis of main stem. Scanning electron micrographs.

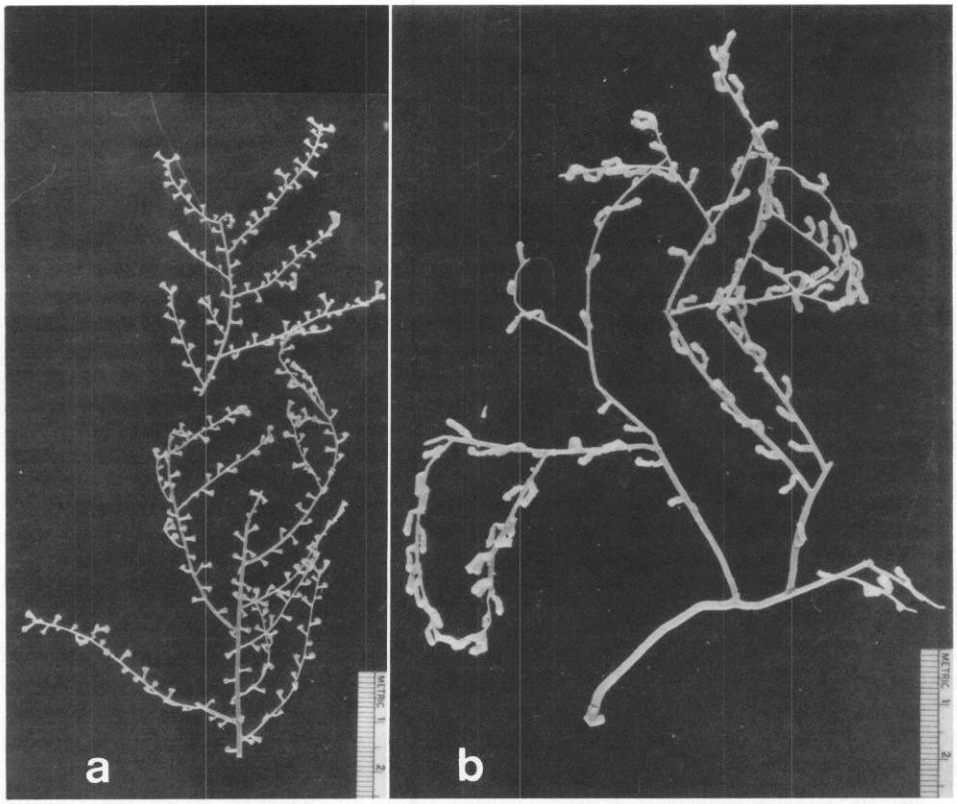

Figure 19. a, *Thelogorgia stellata* new species: paratype branches from Andros Is., USNM 73926. b, *Thelogorgia vossi* new species. Holotype colony from off St. Lucia, USNM 55438.

GREATER ANTILLES: off San Pedro, Dominican Republic, 18°21.7′N, 69°18.4′W, 150 m, R/V PILLSBURY sta. P-1393, 10 Jul 1971; one nearly complete colony about 12 cm tall, with membranous holdfast attached to broken gastropod shell, USNM 55089.

VIRGIN ISLANDS: NW of Tortola, 18°47′N, 64°46.8′W, 205–350 m, R/V PILLSBURY sta. P-991, 23 Jul 1969; one nearly complete colony without holdfast, USNM 55441.

LESSER ANTILLES: One mile off entrance to English Harbor, Antigua, Leeward Islands, University of Iowa Barbados-Antigua Expedition sta. 116, 2 Jul 1918; several fragments, USNM 56612.—Off Martinique, Windward Islands: 14°26.8′N, 60°58.3′W, 115–214 m, R/V PILLSBURY sta. P-907, 9 Jul 1969; branch with two terminal twigs, USNM 55440.—Off St. Lucia, Windward Islands: 14°05.6′N, 60°51.4′W, 198–430 m, R/V PILLSBURY sta. P-890, 7 Jul 1969; one large branch apparently from a larger colony, HOLOTYPE, USNM 55438 (SEM 1685, 1687, 1884, 1890).—Off St. Lucia, Windward Islands: 14°05.2′N, 60°50.3′W, 265–567 m, R/V PILLSBURY sta. P-891, 7 Jul 1969; branch with five end twigs, USNM 55439.

CARIBBEAN SEA: off Pta. Gallinas, Peninsula de Guajira, Colombia: 12°31′N, 71°41′W, 143–146 m, R/V PILLSBURY sta. P-769, 28 Jul 1968; one incomplete colony, USNM 55436.—Between Isla La Tortuga and Isla de Margarita, Venezuela: 11°04′N, 64°44′W, 91 m, R/V PILLSBURY sta. P-722, 21 Jul 1968; fragments in poor condition, USNM 55433.—Off Isla La Tortuga, Venezuela: 10°57′N, 65°52′W, 70–155 m, R/V PILLSBURY sta. P-736, 22 Jul 1968; fragment in poor condition, USNM 55434.—Off Peninsula de Paria, Venezuela: 10°45′N, 62°00′W, 77–86 m, R/V PILLSBURY sta. P-705, 18 Jul 1968; one branch probably from a larger colony, PARATYPE, USNM 56613 (SEM 1681).

SURINAM: 7°28′00″N, 55°11′00″W, 137 m, M/V OREGON sta. 4305, 24 Mar 1963; two badly damaged end branches with terminal twigs, USNM 55415.

Diagnosis.—*Thelogorgia* with cylindrical polyps up to 6 mm tall and 1.5 mm in diameter; sclerities of tentacle backs stout, prickly rods up to 0.6 mm in length

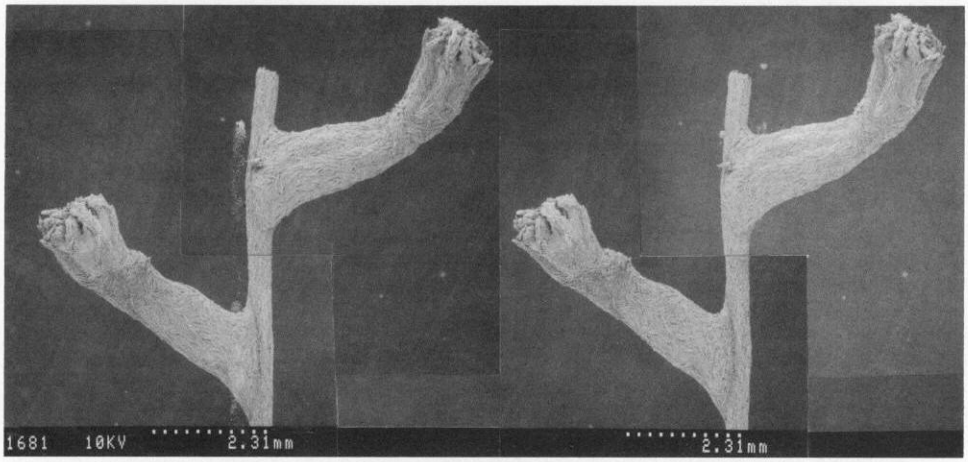

Figure 20. *Thelogorgia vossi* new species. Contracted polyps of paratype colony USNM 56613. Stereoscopic scanning electron micrographs.

and 0.1 mm in diameter, commonly bent near one end; median part of body encircled by zone of irregularly directed oblique and transverse spindles.

Description.—Colonies of small to moderate size (Fig. 19b), height probably not exceeding 30 cm overall, sparingly branched above a tall, slender, irregularly bent sterile main stem, attached to firm substrate by a narrow membranous holdfast. Branching is approximately in one plane, often arising unilaterally from the main stem, rarely if ever higher than second or third order.

The polyps are biserially arranged along the branches (Fig. 20), mostly about 5 mm apart but sometimes a little more or less, regularly directed upward at about 45°, alternating except at the twig tips where two polyps almost invariably are opposed, with the nipple-like tip of the growing branch between them. In contracted state, the polyps of preserved specimens are roughly cylindrical, 5–6 mm tall and about 1 mm in diameter (Fig. 21). Eight shallow longitudinal grooves, more or less obvious depending upon the degree of contraction, follow the course of the mesenteries. The tentacles are folded over the mouth in contraction (Fig. 22), armed with a double row of stout, rather blunt rods (Fig. 23a) extending from the base essentially to the tip, diminishing in size distad; the largest of these are about 0.6 mm in length, curved near one end, and 0.1 mm in width. Small, slender, flattened rodlets about 0.16–0.22 mm long, curved or bent about mid-length (Fig. 23b), lie along the sides of the tentacles, the smallest extending down into the pinnules. Immediately beneath the tentacles, large, thorny spindles up to about 0.5 mm in length and 0.04 mm in width (Fig. 23d) converge to form eight distinct calicular points; the sclerites at the apex of each point project little or not at all from the base of the tentacles. Below the sub-tentacular points, the more or less curved spindles of the body wall (Fig. 23e) are only arranged irregularly *en chevron.* Groups of spindles converging distad are situated along the inter-mesenterial tracts but they do not form regular converging double rows as in *Acanthogorgia.* Each polyp is encircled at about mid-length by a zone of sclerites irregularly arranged obliquely and transversely (Figs. 21, 22), apparently representing the neck-zone or introvert of polyps that are composed of distinct anthocodia and anthostele, but in no case was any degree of retraction observed. The pharyngeal wall is filled with closely scattered small, flattened, thorny spindles

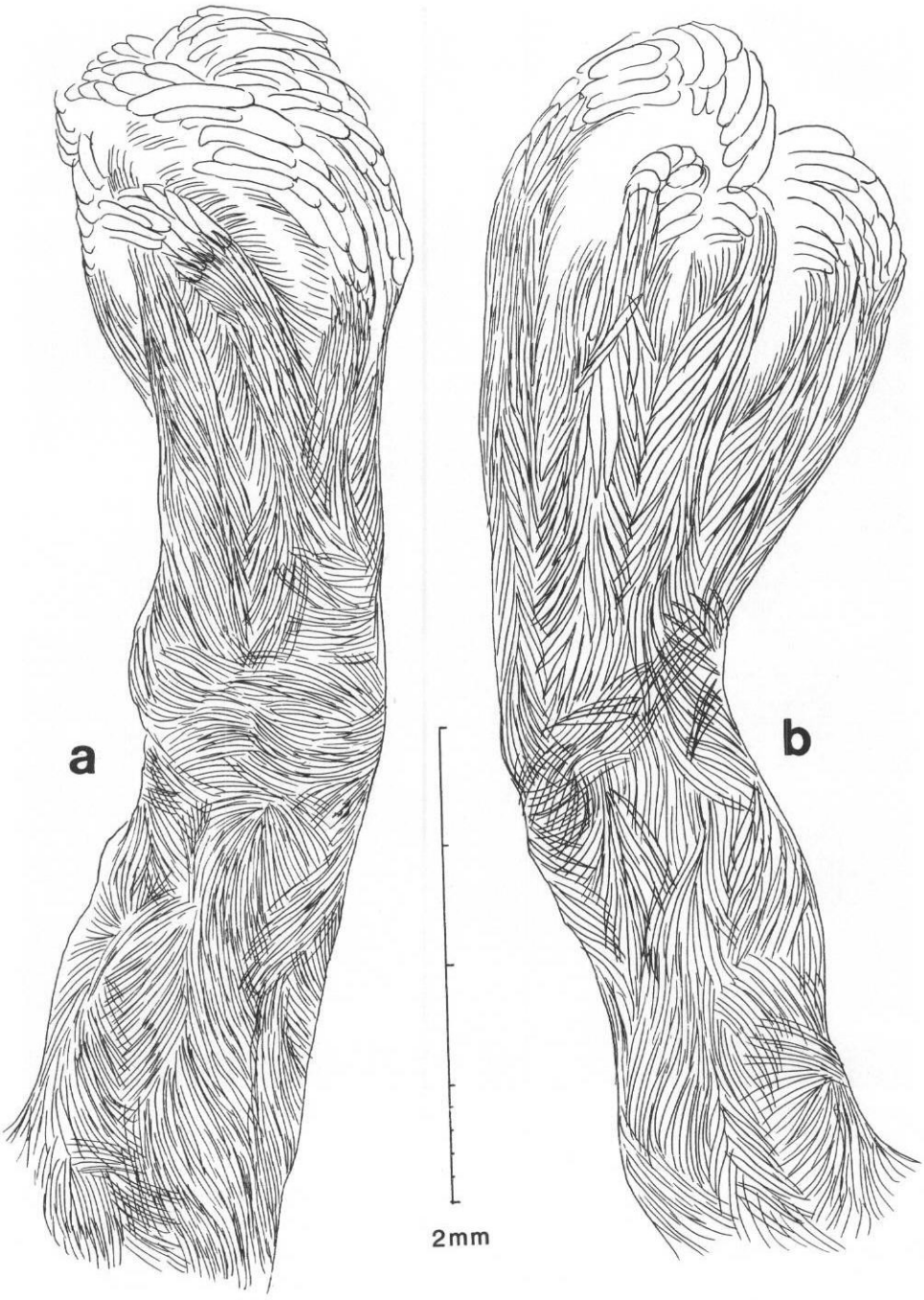

Figure 21. *Thelogorgia vossi* new species. Contracted polyps: a, of holotype USNM 55438; b, of USNM 55440 from off Martinique. Camera lucida drawings.

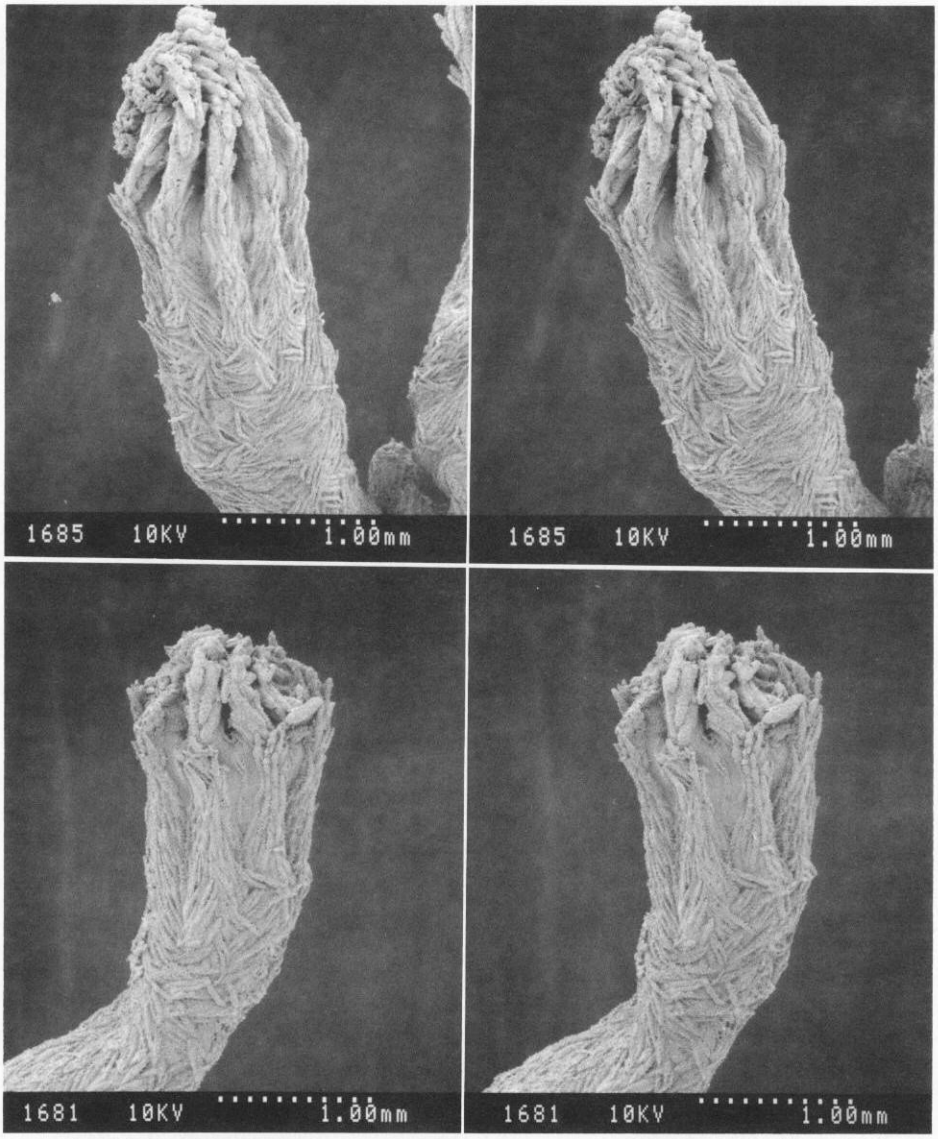

Figure 22. *Thelogorgia vossi* new species. Contracted polyps: top, of holotype, USNM 55438; bottom, of paratype, USNM 56613. Stereoscopic scanning electron micrographs.

and rods (Fig. 23c) the largest of which are about 0.13 mm long, similar in shape to the smaller tentacular sclerites. The sclerites of the coenenchymal cortex on the terminal branches are similar to those of the polyps, but on the largest branches or main stems they become blunt and coarsely sculptured (Fig. 23f). The sclerites of the axis (Fig. 23g) are smooth, flattened, tapered spindles not so intricately anastomosed as in other species of the genus.

Etymology.—In honor of the late Prof. Gilbert L. Voss, longtime friend and colleague, in recognition of his unflagging devotion to marine science, to the conservation of our fragile and imperiled environment, and to the encouragement of students of invertebrate systematics.

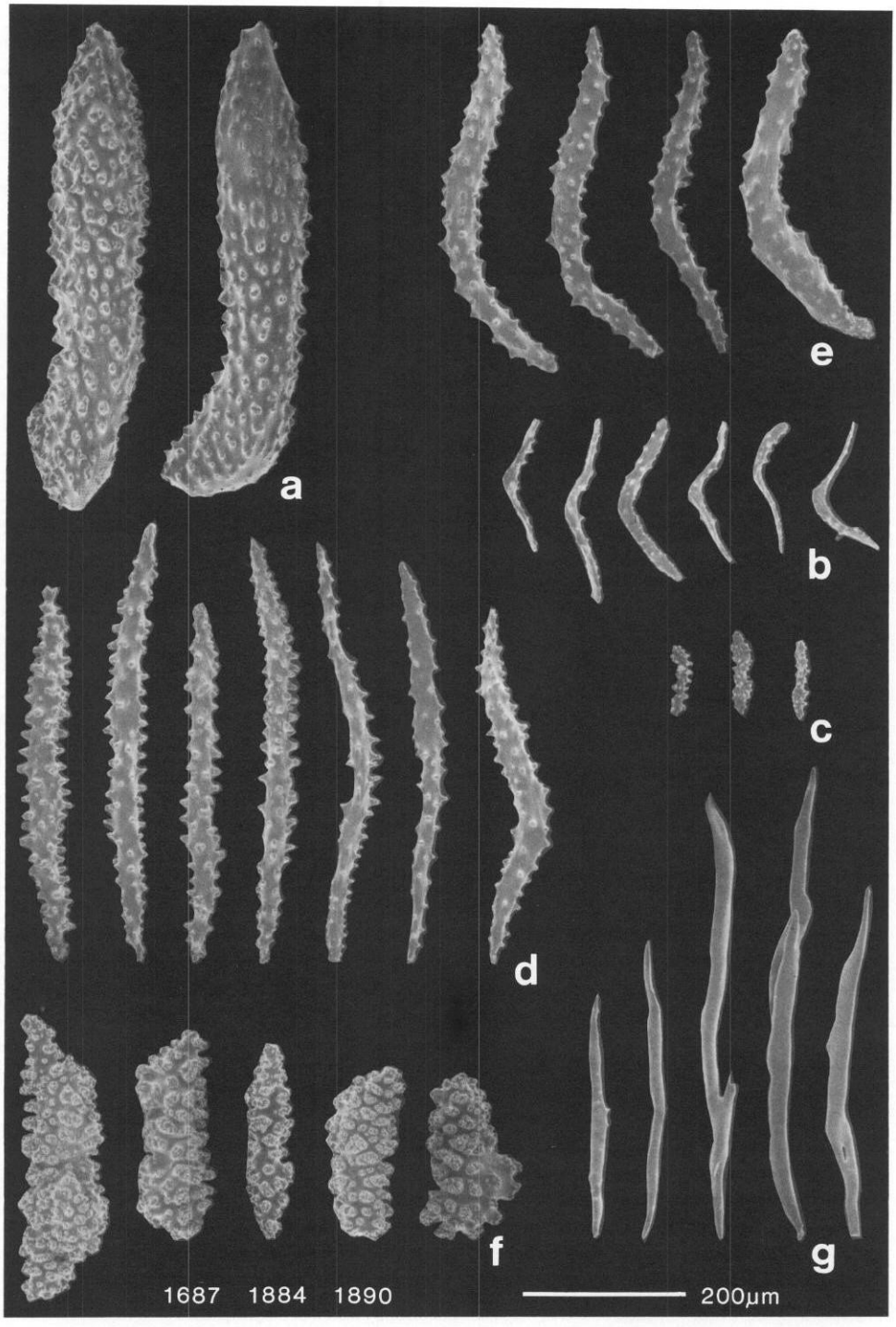

Figure 23. *Thelogorgia vossi* new species. Sclerites of holotype, USNM 55438: a, bent rods from back of tentacle; b, small, bent spindles from tentacle rachis and pinnules; c, flattened rodlets from pharyngeal wall; d, spindles from body wall of polyp; e, curved spindles from calicular points; f, coarse rods from cortex of main stem; g, anastomosed sclerites of axis.

Comparisons.—The polyps of *T. vossi* are the largest of any species in the genus. The calicular points show even less tendency to project outward as a stellate expansion around the contracted tentacles than in *T. longiflora*; the body sclerites are arranged in converging groups rather than regularly *en chevron* and are interrupted by a median zone of irregularly directed sclerites many of which are transverse.

Distribution.—Bahamas, Greater and Lesser Antilles, northern coast of South America at least as far south as Surinam. 70–549 m, probably concentrated in 100–200 m.

Remarks.—All of the specimens obtained are in more or less damaged condition. Perhaps they represent fragments of larger colonies, but the material at hand indicates that colonies do not reach a large size. In only one case was the holdfast obtained (USNM 55089), making it certain that the specimen is almost complete. The total height in this case is 14 cm, of which the main stem devoid of polyps and branches occupies 6 cm. A colony with only two branches, broken off just above the holdfast, is 21 cm tall, of which the sterile main stem occupies 11 cm.

The drawings of contracted polyps of "Thelogorgia agassizii" printed on plate 23 of Verrill's unpublished BLAKE report are the right size for *L. vossi,* but the calyces are shown with a transverse collaret between the anthostele and the distinct subtentacular points. Although the spindles of the body wall below the points do, in fact, assume an irregular transverse orientation, in no observed case do they form a well differentiated collaret of the kind prevalent in paramuiceids as shown in the illustration. The drawings, by A. Hyatt Verrill, appear not to have been made with the aid of a camera lucida and therefore probably contain a substantial subjective element. The drawings of sclerites printed on unpublished plate 68, also obviously free-hand renderings, can only apply to *Lignella,* so I have no hesitation in concluding that Verrill's "Thelogorgia agassizii" is, in fact, the species here described as *Thelogorgia vossi.*

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