

**Studies on western Atlantic Octocorallia (Gorgonacea: Ellisellidae).  
Part 7: The genera *Riisea* Duchassaing & Michelotti, 1860  
and *Nicella* Gray, 1870**

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*Abstract.*—The eleven western Atlantic species belonging to the two ellisellid genera *Riisea* and *Nicella* are described and illustrated. Six new species of *Nicella* are described, and another distinguished as new but not described. A dichotomous key and a table of comparisons is provided for the eleven western Atlantic species of *Nicella*. An annotated list of the 19 species of this genus is given. Detailed morphology of the double head sclerites and the type of body wall sclerite were used to distinguish species. Specimens of these genera were common at shelf and upper slope depths throughout the tropical western Atlantic, the deepest record being at 819 m. Specimens from 140 stations were examined as well as the types of all previously described species of western Atlantic *Nicella*.

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This is the seventh in a series of revisions of the approximately 170 species of western Atlantic deep-water octocorals, thus far all dealing with families within the suborder Calcaxonia. This contribution revises two western Atlantic genera in the family Ellisellidae. The ellisellids comprise a family consisting of four genera and about 95 species, the family being circumtropical in distribution (except for the eastern Pacific and Hawaiian Islands) and occurring at depths of littoral to 819 m, although most species are confined to shelf depths. The eleven species and two genera revised herein (Table 1) constitute about half of the western Atlantic ellisellid species, one of those genera, the monotypic genus *Riisea*, being endemic to the western Atlantic. The family Ellisellidae is one of the most sharply circumscribed families in the Gorgonacea, characterized by having sclerites consisting of double heads and spindles or rods, but within it distinctions

even among the genera are unclear and have recently been reanalyzed (Bayer & Grasshoff 1994, 1995). Species boundaries are also difficult to establish, as explained below. In general, the Ellisellidae is a taxonomically challenging group that requires much patience and memory to understand its taxonomy.

#### Materials and Methods

This study was based on an examination of specimens collected from 140 deep-water stations (see <http://si-ddr.si.edu:8080/dspace/handle/123456789/122> for station coordinates) the majority of which were obtained from the R/V *Pillsbury* and R/V *Oregon*. Types of all previously described western Atlantic species of *Nicella* were examined as well as representatives of half of the extralimital species. Most of these specimens are now deposited at the National Museum of Natural History (NMNH).

Table 1.—The 19 valid species of the genus *Nicella*, arranged by ocean basin, and their approximate distributions. A reference to *N. atlantica* by Bayer (1973:389) is a *nomen nudum* and was probably meant to refer to *N. americana*.

Species	Ocean Basin
<i>N. guadalupensis</i> (Duch. & Mich. 1860)	Western Atlantic, 27–395 m
<i>N. americana</i> Toeplitz in Kükenthal, 1919 = <i>N. ramosa</i> Toeplitz in Kükenthal, 1919	Western Atlantic, 62–237 m
<i>N. obesa</i> Deichmann, 1936	Western Atlantic, 174–819 m
<i>N. goreau</i> Bayer, 1973	Western Atlantic, 45–146 m
<i>N. spicula</i> , n. sp.	Western Atlantic, 44–82 m
<i>N. deichmannae</i> , n. sp.	Western Atlantic, 27–403 m
<i>N. hebes</i> , n. sp.	Western Atlantic, 27–327 m
<i>N. lanceolata</i> , n. sp.	Western Atlantic, 229–244 m
<i>N. sp. A</i>	Western Atlantic, 55–329 m
<i>N. gracilis</i> , n. sp.	Western Atlantic, 60–481 m
<i>N. robusta</i> , n. sp.	Western Atlantic, 110–259 m
<i>N. granifera</i> (Kölliker 1865) = <i>V. guernei</i> Studer, 1901	Eastern Atlantic, 200–454 m
<i>N. alba</i> Toeplitz in Kükenthal, 1919	Red Sea, 168 m
<i>N. multiramosa</i> Kükenthal, 1919	SE Atlantic (W. Africa), depth unknown
<i>N. dichotoma</i> (Gray 1860) = <i>Nicella mauritiana</i> Gray, 1870	Mauritius and Andaman Sea, Indian Ocean, 77 m
<i>N. carinata</i> Nutting, 1910 = <i>N. coralloides</i> Nutting, 1910	Western Pacific, 36–113 m
<i>N. laxa</i> Whitelegge, 1897	Western Pacific, 30–128 m
<i>N. flabellata</i> (Whitelegge 1897)	Western Pacific, 60–494 m
<i>N. magna</i> Grasshoff, 1999	New Caledonia, 55–80 m

The terminology used in the descriptions follows Bayer et al. (1983). Synonymies for all species are purported to be complete. In the material examined sections, specimens are assumed to be preserved in alcohol unless otherwise noted. The SEM photomicrographs were taken by the author and F. M. Bayer, both using a variety of instruments in the SEM Lab of the NMNH. SEM stub numbers prefaced with a B pertain to the numbered series of Bayer, those prefaced with a C to that of Cairns. Those labeled “scan stub B” pertain to a series taken in 1971 and enumerated before Bayer’s main sequence.

The following abbreviations are used: Vessels: *Alb*-U.S. Fish Commission Steamer *Albatross*; *BA*-Barbados-Antigua Expedition of 1918 (University of Iowa); *BL*-U.S. Coast Survey Steamer *Blake*; *CI*-R/V *Columbus Iselin*; *G*-R/V

*Gerda*; *JS*-Johnson-Smithsonian Deep-Sea Expedition of 1933 (*Yacht Caroline*); *JSL-I, II*-*Johnson-Sea-Link I* and *II*; *O-M/V*, *R/V Oregon* and *R/V Oregon II*; *P-R/V Pillsbury*; *SB-M/V* and *R/V Silver Bay*; *SOFLA*-Southwest Florida Shelf Ecosystem Study (a BLM/MMS program).

Museums: *LACM*-Los Angeles County Museum; *MCZ*-Museum of Comparative Zoology, Harvard; *MSNT*-Regional Museum of Natural Sciences, Turin, Italy; *MZUF*-Zoological Museum, Museum of Natural History, University of Florence, Italy; *USNM*-United States National Museum (now the National Museum of Natural History (NMNH)).

Other abbreviations: *DH* - double head; *L:W* - ratio of maximum length to maximum width of a sclerite (a crude measure of shape); *SEM* - scanning electron microscope stub number.

Systematics  
 Subclass Octocorallia  
 Order Gorgonacea  
 Suborder Calcxonia  
 Family Ellisellidae Gray, 1860  
*Riisea* Duchassaing & Michelotti, 1860  
 (*nom. conserv.*)

*Rusea* Duchassaing & Michelotti, 1860:294.—Kölliker, 1865:140.

*Herophile* Steenstrup, 1861:121.—Wright & Studer, 1889:153.

*Riisea* Duchassaing & Michelotti, 1864:108.—Studer, 1887: 41.—Wright & Studer, 1889:24.—Versluys, 1902: 96.—Kükenthal, 1919:500; 1924:385.—Deichmann, 1936:224.—Bayer, 1956: F214; 1961:290–291; 1981:932 (key to ellisellid genera).—Bayer & Grasshoff, 1994: 23 (key to genera), 41–42 (synonymy and discussion); 1995:631 (key to ellisellid genera).

*Herophila* Studer, 1887:41.—Wright & Studer, 1889: xli, 278 (incorrect subsequent spelling).

*Type species.*—*Riisea paniculata* Duchassaing & Michelotti, 1860, by monotypy.

*Herophile:* *H. regia* Steenstrup, 1851, by monotypy.

*Diagnosis.*—Monopodial stem first gives rise to dichotomous branching, followed by pinnate branching of terminal branchlets. Calyces terminal, placed on short twigs arranged in an opposite alternate pinnate fashion. Sclerites consist primarily of spindles and double heads, the former usually 2.5–3.0 times the length of the former. Flattened plate-like spindles also present, as are wart clubs and spiny double stars, the latter lining the pharynx.

*Distribution.*—Caribbean, Bahamas, Gulf of Mexico; 110–704 m.

*Remarks.*—*Riisea* is very similar to *Nicella*, especially in the nature of its sclerite types but differing in colony form, i.e., paniculate colonies with terminal polyps. Bayer & Grasshoff (1994) suggested that *Riisea* could be considered as

a subgenus of *Nicella* but kept the genera separate in all their publications.

*Riisea paniculata* Duchassaing & Michelotti, 1860  
 Figs. 2, 4

*Rusea paniculata* Duchassaing & Michelotti, 1860:294–295 (18–19 of reprint), pl. 2, figs. 1–3.—Kölliker, 1865:140, pl. 15, fig. 7, pl. 18, fig. 44.

*Herophile regia* Steenstrup, 1861:121–122 (Danish); 1862:74–76 (German translation).

*Riisea paniculata:* Duchassaing & Michelotti, 1864:108 (14 of reprint) (listed).—Duchassaing, 1870:17–18 (listed).—Wright & Studer, 1889:24, 278 (Jamaica).—Versluys, 1902:97–101, text-figs. 163–168 (full description).—Kükenthal, 1919:500–501; 1924:385–386, text-fig. 188.—Deichmann, 1936: 225–226, pl. 2, fig. 9, pl. 23, figs. 8–18, pl. 35, fig. 2.—Bayer, 1955:215–216, pl. 5, figs. a, b; 1956:F214, figs. 155, 2a–c, 158, 3a, b.—Bayer & Grasshoff, 1994:43 (synonymy).—Bayer & Grasshoff, 1997: 11–13 (ICZN proposal).—Anonymous, 1998:734 (ICZN opinion).—Bayer & Cairns (Verrill), 2004: pl. 6, figs. 6, 7 (type), pl. 14, figs. 11, 11a, pl. 35, figs. 1–2 (type), pl. 116, fig. 2.

*Material examined.*—*Alb*-2330, 1 branch, USNM 49790; *Scripps-J*-647, 1 colony, USNM 51591; *R/V Cape Florida*, 2 white colonies, USNM 73933; *CI*-35, 2 white branches, USNM 1017258; *Eastward* 31281, 1 white branch, USNM 94525; *G*-503, 1 white colony and branch, USNM 52899 and 53059; *G*-713, 1 branch, USNM 53056; *JS*-49, 1 branch, USNM 43803; *JSL-I*-1356, 1 colony, USNM 1081560; *JSL-I*-2582, 1 white branch, USNM 89385; *JSL-I*-2008, 1 large white colony, LACM; *O*-3608, 1 white branch, USNM 53058; *O*-4170, 1 branch, USNM 94502; *O*-4305, 2 colonies and branches, SEM stub C1189, USNM 52896; *P*-211, 2 dry colonies, USNM 1084225; *P*-424, 1 colony, SEM stubs

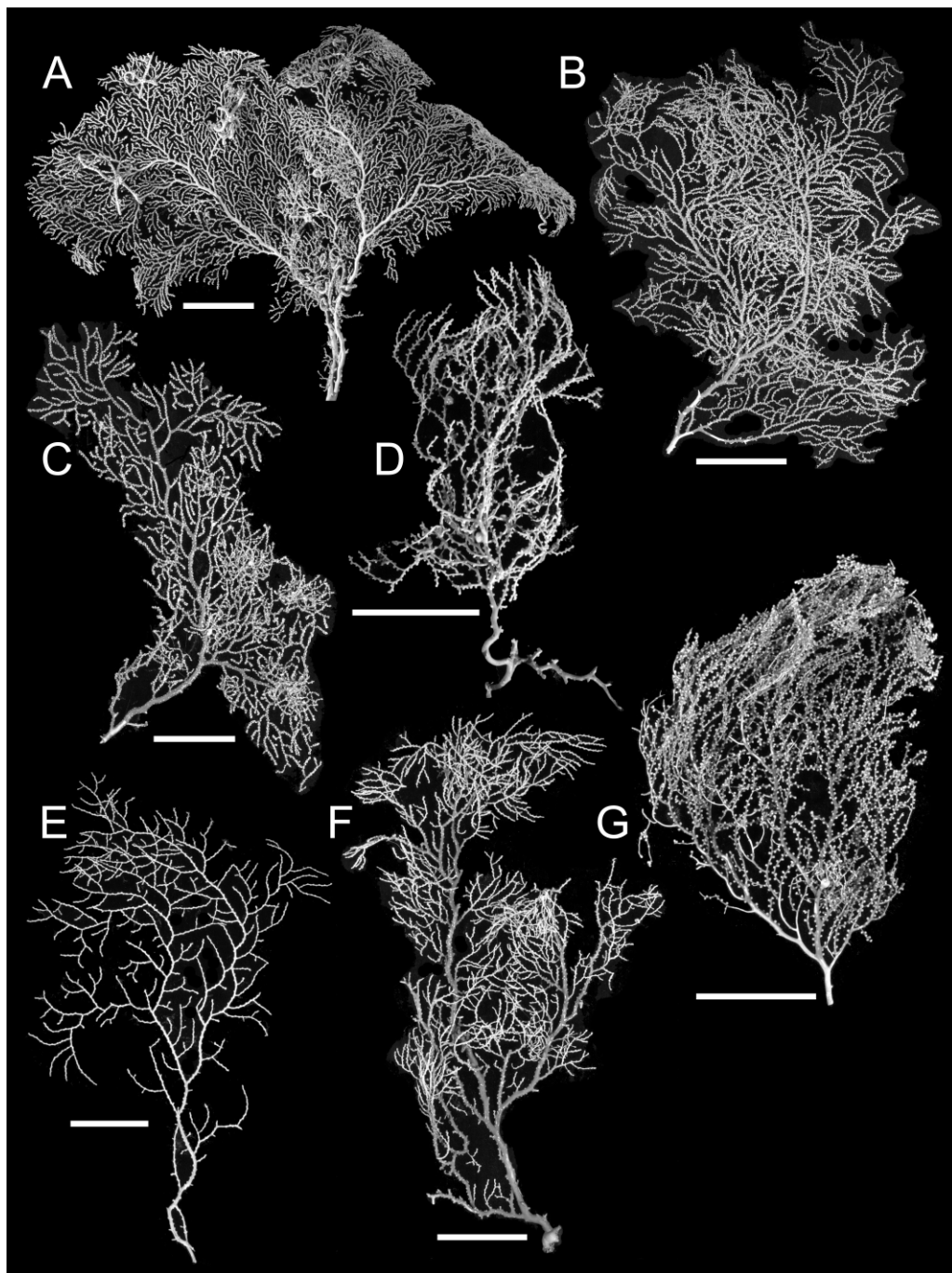


Fig. 1. A, Holotype of *Nicella deichmannae*; B, holotype of *N. spicula*; C, holotype of *N. hebes*; D, holotype of *N. gracilis*; E, holotype of *N. lanceolata*; F, holotype of *N. robusta*; G, specimen of *Nicella* sp. A, P-424, USNM 53042. Scale bars: 5 cm.

C1187-1188, USNM 52897; *P*-479, 1 white branch, USNM 53057; *P*-592, 1 white colony, USNM 52898; *P*-848, 1 colony, USNM 52894; *P*-875, 1 colony, USNM 94497; *P*-907, 1 colony and 1 branch, USNM 52893; *P*-919, 1 branch, USNM 52892; *P*-1303, 1 branch, USNM 94498; *P*-1386, 1 large colony, USNM 59281; *P*-1387, several branches in alcohol and 1 dry, USNM 52895 and 93934 (all colonies assumed to have orange coenenchyme unless otherwise stated.)

*Types and type localities.*—*Riisea paniculata*: Rossi (1956) indicated that the holotype is in the Turin Museum (NC244), but Volpi & Benvenuti (2003) indicated this same specimen to be a lectotype (MSNT 410), as well as noting the presence of two small paralectotypes deposited in Florence (MZUF 576). Type locality: Barbados, depth unknown.

*Herophile regia*: Holotype colony “3 feet tall” deposited in Copenhagen State Museum. Type Locality: West Indies, depth unknown. Not seen.

*Description.*—Colonies reach up to 1 m in height (e.g., *P*-1386), large colonies having a calcified basal diameter of up to 9 mm and anchored by a white, spreading calcareous holdfast. Branching of the larger monopodial stem is dichotomous, up to five orders, each major branch roughly planar, but because the branches diverge at various angles from the main branch, a bushy colony results. Terminal branchlets are pinnately branched and may be up to 14 cm in length. The axis is grey in color and faintly striate. The coenenchyme of the branches of most specimens is orange, the calyces white, the orange color due primarily to the color of the numerous double heads in the coenenchyme, but in some cases the entire colony is white.

As Deichmann (1936:225) quaintly puts it, the calyces are shaped as “Dutch clay pots,” occurring in alternating opposite arrangement (pinnately), always terminal and supported by short twigs. The

apical calyx of a major branch is usually larger (and older) than the other calyces on that branch, in that it is the first calyx formed on an incipient branch, subsequent calyces budding just proximal to the apical calyx on the gradually lengthening branchlet, resulting in the smallest calyces being directly adjacent to the apical calyx and the larger ones away from the apical calyx. Calyces are spaced 3–4 mm apart on a fully developed branchlet. They are cylindrical to campanulate in shape and up to 3.4 mm in length.

Six types of sclerites occur in most calyces, the kinds, sizes and relative percentages of those sclerites depending on the position within the colony. The body wall of the calyx consists primarily (40–90%, usually 80%) of 3 or 4 layers of slender (L:W = 5.0–10.0), elongate (0.15–0.25 mm), ungirdled spindles arranged in longitudinal rows but in a chevron-shaped arrangement. The remaining 20% of the calyx walls consist of a single exterior layer of double heads measuring 50–90  $\mu$ m in length (average 70  $\mu$ m). The waist of the double heads is 8–13  $\mu$ m in length and is wide, about 60% the width of the sclerites; the tubercles are rounded and 9–10  $\mu$ m in height. The ratio of the length of the longest spindle to longest double head is about 2.7. Occasionally, but rarely, up to 50% of the spindles are replaced by flat plates up to 0.23 mm in length. These sclerites are about the same size as the spindles but have blunt ends and are flattened, not circular, in cross-section (Fig. 2B). Wart clubs and girdled spindles also rarely occur in this region. The body wall grades into the tentacles, which, except for the pinnules, also consist almost entirely of spindles, but usually smaller (0.10–0.20 mm) and stouter (L:W = 3.5–5.0) than those in the body wall. Double heads and wart clubs are quite rare in this region, but occasionally, some of the spindles are replaced with flat plates. The basal half to two-

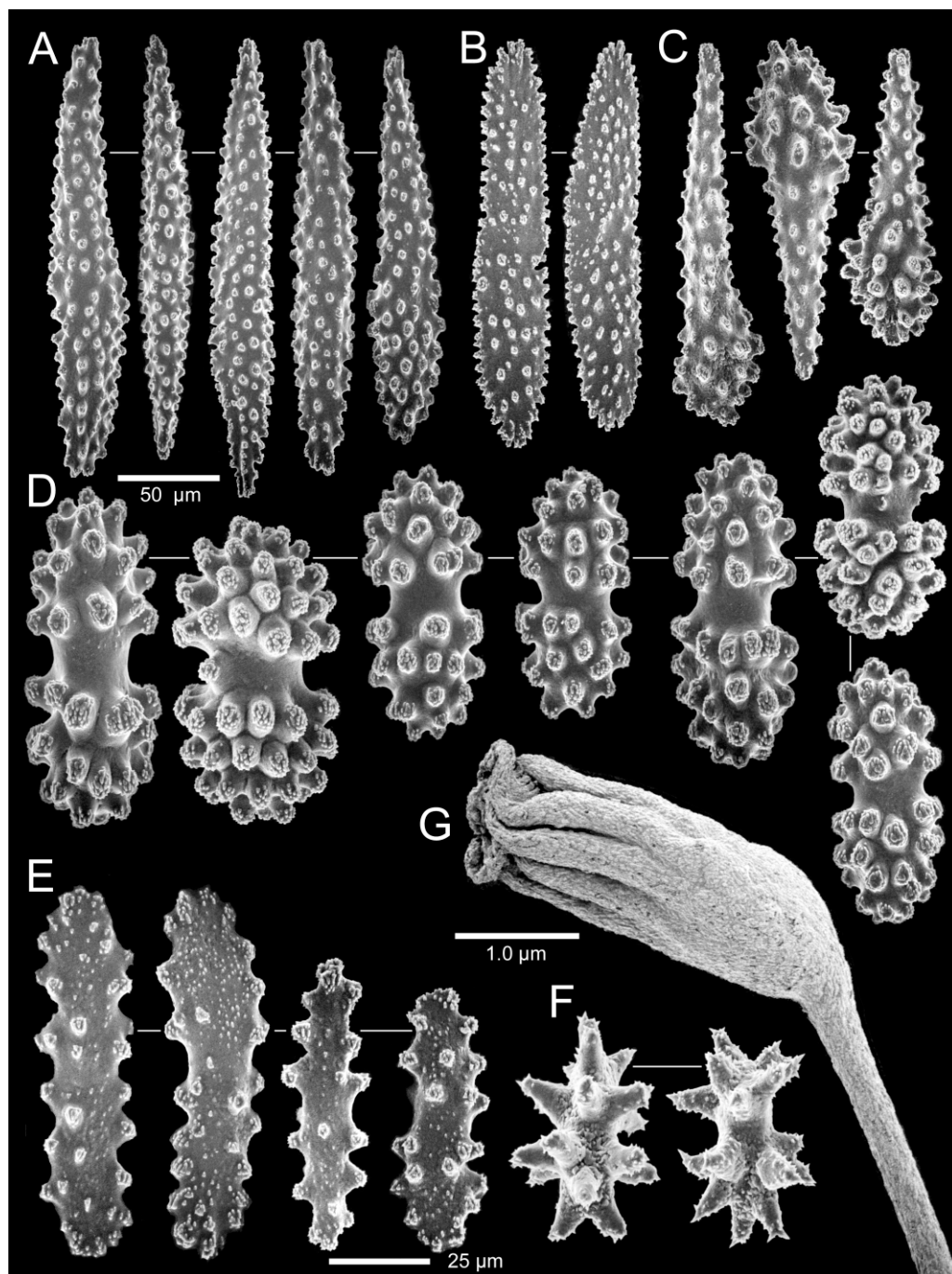


Fig. 2. A–G, Sclerites of *Riisea paniculata* (A, D, JS-49; B, G, P-907; C, E, G-713; F, O-4305): A, five spindles; B, two flat rods; C, three clubs; D, seven double heads; E, four pinnular plates; F, two pharyngeal sclerites; G, lateral view of a polyp. Scale bars: A–C, 50  $\mu$ m; D–F, 25  $\mu$ m; G, 1 mm.

thirds of the tentacles are united in a thin elastic web, which does not appear to include any sclerites, this web contributing toward the infundibuliform oral region leading to the mouth. No distinctive tentacular sclerites were noted. The pinular sclerites are small (50–100  $\mu\text{m}$  length), flat, sparsely sculptured plates. In the coenenchyme the ratio of sclerites is essentially reversed to that of the body wall, consisting primarily (20–90%, usually 80%) of three layers of double heads ranging from 38–90  $\mu\text{m}$  (average 70  $\mu\text{m}$ ) in length. They are positioned such that their long axis is parallel to the branch axis. There is a very short transition region near the base of the calyx where the predominant sclerite type changes from double head to spindle. The remaining 10–20% are robust (L:W = 3.1–3.8) spindles that occur near the branch axis, occasionally substituted for by flat plates of a similar size. Wart clubs and girdled spindles are rare. Finally, the pharynx is largely devoid of sclerites but does contain 8 thin, crowded, longitudinal rows of small (50–60  $\mu\text{m}$  in length), spiny double stars, these rows corresponding to the mesenterial insertions. The tissue of the pharynx resists dissolution by bleach more than any other tissue of the coral.

*Remarks.*—In most specimens the sclerites of the calyx body wall consists of 80% slender spindles and 20% double heads, whereas the coenenchymal tissue is the opposite: 20% spindles and 80% double heads, a transition region occurring at the base of the calyx. However, in some specimens, a certain percentage of the spindles are replaced by equally sized flattened spindles (plates), which may constitute as much as 50% of the body wall sclerites and 30% of the coenenchymal. Because this replacement is variable among specimens and because all other characters appear to be identical, this change in sclerite complement is not interpreted as a species level difference. Likewise, most specimens have an orange

coenenchyme and white calyces, the orange color conferred by the orange-colored double heads in the coenenchyme, but some specimens (see Material Examined) are completely white; this is also considered to be intraspecific variation.

Large ophiuroids that match the color of the gorgonian are often found attached to colonies of this species, identified as of the genus *Asteroporpa* and *Asteroschema* (identified by C. Ahearn).

*Distribution.*—Bahamas, Caribbean, off Suriname, northwest Gulf of Mexico off Louisiana (Fig. 4); 110–704 m, with one anomalous record at 31 m (O-4170) off Suriname.

#### *Nicella* Gray, 1870

*Nicella* Gray, 1870:40.—Studer, 1887: 67–68.—Simpson, 1910:360–362 (in part).—Nutting, 1910:28.—Kükenthal, 1919:861 (key to species); 1924:376–377 (key to species).—Toeplitz, 1929:334–346 (monographic treatment, including key to species).—Deichmann, 1936: 216–217.—Bayer, 1956:F214; 1961: 287; 389–390.—Grasshoff, 1972:82 (eastern Atlantic species).—Bayer, 1981:934 (key to ellisellid genera).—Bayer & Grasshoff, 1994:23, 39–40 (key to ellisellid genera, synonymy and discussion); 1995:631 (key to ellisellid genera).—Grasshoff, 1999:84 (discussion of Pacific species).

*Type species.*—*Nicella mauritiana* Gray, 1870, [= *Nicella dichotoma* (Gray 1860)], by monotypy.

*Diagnosis.*—Colonies flabellate; branching dichotomous, occasionally becoming loosely pinnate; branch anastomosis rare; end branches short relative to height of colony. Calyces arranged on branch edges in alternate biserial manner. Body wall and coenenchymal sclerites consist of an outer layer of double heads and inner layers of girdled rods or spindles, the latter types sometimes flattened or even scale-like; rods and spindles morpholog-

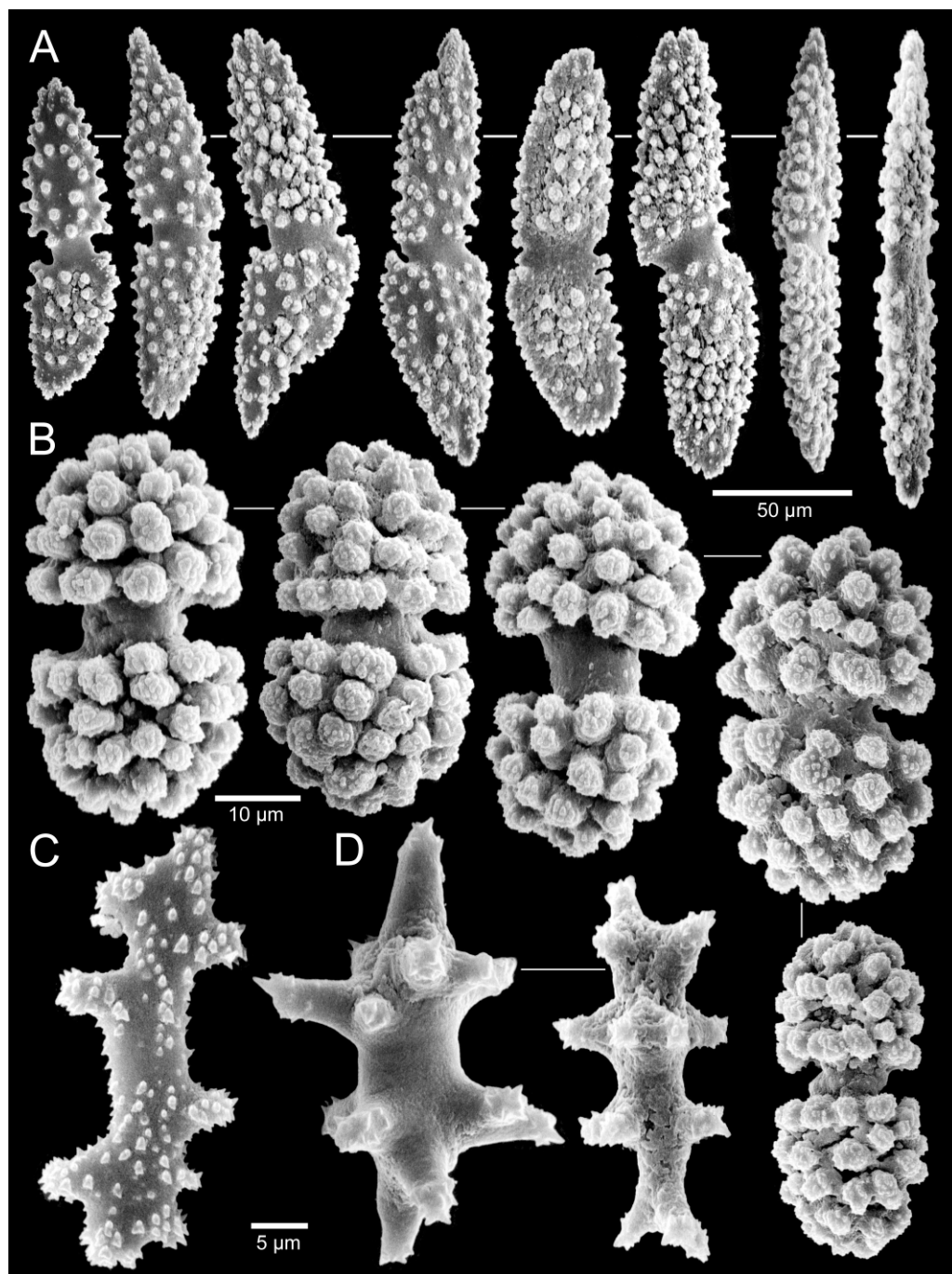


Fig. 3. A–D, Sclerites from holotype (USNM 53124) of *Nicella goreau*: A, eight flattened, asymmetrical rods; B, five double heads; C, one pinnular plate; D, two pharyngeal sclerites. Scale bars: A, 50  $\mu\text{m}$ ; B, 10  $\mu\text{m}$ ; C, D, 5  $\mu\text{m}$ .



ically distinct from double heads, usually measuring 2–5 times length of a typical double head. Clubs and needles sometimes also present in calyx; distinctive pharyngeal (spiny double stars), pinnular (elongate plates), and tentacular (stubby rods) sclerites also present in polyps.

*Distribution.*—Circumtropical except for central and eastern Pacific; 27–819 m (see Table 1).

*Remarks.*—The most complete account of the genus *Nicella* was given by Toeplitz (1929) in her revision of the West Indian Ellisellidae. Her species diagnoses are longer than most species descriptions of others, and her detailed descriptions are three times as long, rivaled only by the detailed and meticulous descriptions of Madsen (1944). Toeplitz also included a 13 page discussion of the genus, discussing taxonomic characters and concluding with a key to all known species at that time. Her 1929 revision was presaged by several short diagnoses of new species included as an appendix to Kükenthal (1919), and, thus, those species must be cited as Toeplitz in Kükenthal, 1919, not Toeplitz (1929). Charlotte Toeplitz, a student of W. Kükenthal, unfortunately, did not publish any additional papers on Octocorallia.

As previously mentioned, *Nicella* is quite similar to *Riisea* but is also similar to *Ctenocella* (see Bayer 1981, Bayer & Grasshoff 1994, 1995), differing from that genus in having relatively short distal branches and having spindles that are demonstrably larger than the double heads, in the case of *Nicella* usually 2–5 times the length of the double heads, although there are sometimes intergrades in size, but these intermediates are not common (see Bayer & Grasshoff 1994:41). The best recent account of *Nicella* is Bayer & Grasshoff (1994), which includes a synonymy for the genus and a redescription of the type species.

*Nicella* is a notoriously difficult genus in which to differentiate species. Referring

to the western Atlantic species of this genus, Deichmann (1936:217) stated: “No key is given as it is almost impossible to express the differences between these species.” Diagnostic characters used by previous authors included: colony shape and color; calyx size, shape, and orientation; and size, shape, and type of the dominant body wall sclerite. In this review, the greatest emphasis is given to sclerite morphology (Table 2), as color and calyx characteristics sometimes change with preservation. Characters found to be of most use in differentiating species, analyzed individually or in combination, include: type (spindle or flattened rod), size, and shape (expressed as L:W ratio, symmetry, and ornamentation) of the predominant, large body wall sclerites; the length and width of the double head waist; the height and shape of the double head tubercles; and the length and shape (L:W ratio) of the tentacular rods. These differences were often small but consistent among species but it remains to be seen if these differences represent species, subspecies, populations or even hybridization events. Very little to no differences were found in the pharyngeal and pinnular sclerites among species. Great emphasis is given to the shape of the double heads as a consistent discriminating character. Lewis & Wallis (1991) hypothesized that the shape and random placement of ellisellid double heads conferred a stiffness to the coenenchyme, the tubercles covering each head acting like a Velcro surface retarding motion in all directions. If it is evolutionarily important to have a stiff coenenchyme/branch and if double heads promote this quality, then perhaps the double head is a component that is under selection pressure and, thus, may be indicative of species differences.

In all species examined, a faint dark line about 0.13 mm in width occurs within the coenenchyme on both sides of the colony; this line is usually straight but

Table 2.—Distinguishing characteristics of the western Atlantic *Nicella*.

Species	Color	Body Wall Sclerites (listed in order of abundance)	Double Head Waist: Length; % of width	Double Head Tubercles: Height; Shape	Tentacular Rods: Length and L:W
<i>N. goreau</i> Bayer, 1973	Dichromatic: orange-red and white	Asymmetric girdled flattened rods (0.12–0.17 mm), L:W = 4.0–6.0; spindles (to 0.20 mm), L:W = 5.5–7; DH (40–50 µm); needles (up to 0.19 mm), L:W = 10–15	4–5 µm; 50%	3–6 µm; rounded	55–75 µm; 2.6–3.6
<i>N. americana</i> Toeplitz, 1919	Dichromatic: orange, pale orange	Non-girdled flattened rods (0.11–0.18 mm), L:W = 2.8–3.7; DH (40–70 µm); needles (0.13–0.15 mm), L:W = 8–11	2–5 µm; 50%	7–9 µm; conical	60–80 µm; 2.5–3.1
<i>N. spiculata</i> , n. sp.	Dichromatic: dark orange, yellowish	Small girdled flattened rods (80–100 µm), L:W = 2–3; DH (45–55 µm); needles (up to 100 µm), L:W = 6–8	4–5 µm; 50–60%	8–9 µm; cylindrical	45–60 µm; 2.0–2.3
<i>N. deichmannae</i> , n. sp.	Dichromatic: orange and white	Inconspicuously girdled flattened rods (0.16–0.21 mm), L:W = 3.5–4.5; two size classes of DH (40–50, 80–100 µm); spindles (to 0.25 mm), L:W = 6.8–7.1; clubs (84–150 µm); needles (to 0.19 mm), L:W = 10	6–10 µm; 25–33%	6–8 µm; rounded	59–84 µm; 2.5–3.5
<i>N. hebes</i> , n. sp.	Dichromatic: pale orange and white	Girdled flattened rods (0.15–0.22 mm), L:W = 3.2–5.7; spindles (0.15–0.22 mm); DH (35–50, 50–90 µm); clubs (0.11–0.13 mm)	0–4 µm; 60–65%	5–8 µm; rounded to clavate	68–72 µm; 2.5–2.8
<i>N. lanceolata</i> , n. sp.	White	Inconspicuously girdled, blade-like (flat), sometimes curved spindles (smooth with serrate edges, 0.17–0.41 mm), L:W = 6–7.5; girdled spindles (0.19–0.39 mm), L:W = 4.5–5.5; DH (45–75 µm); smooth needles (0.22–0.26 mm), L:W = 9–11; clubs (0.15–0.19 mm)	9–12 µm; 30–40%	8–10 µm; rounded	62–140 µm; 3–6
<i>N. obesa</i> Deichmann, 1936	White	Rotund girdled spindles (0.11–0.17 mm), L:W = 2.5–4.0; DH (50–75 µm)	6–9 µm; 50%	6–7 µm; rounded to clavate	77–100 µm; 2.2–2.9
<i>N. guadalupensis</i> Duch. & Mich., 1860	Dichromatic: orange and white	Robust girdled spindles (0.10–0.20 mm), L:W = 2.5–3.5; DH (35–80 µm); clubs	5–9 µm; 50–60%	7–9 µm; rounded to clavate	47–90 µm; 1.8–3.0
<i>N. sp. A.</i>	Dichromatic: orange and white	Robust girdled spindles (0.16–0.26 mm), L:W = 5.0–7.4; DH (65–100 µm); clubs (0.13–0.18 mm)	0–9 µm; 50%	13–17 µm; conical, occasionally bifid	78–115 µm; 3.7–3.8
<i>N. gracilis</i> , n. sp.	White	Slender girdled spindles (0.08–0.25 mm), L:W = 3.6–6.5; DH (45–90 µm); flattened rods (to 0.24 mm)	8–12 µm; 40%	10–14 µm; conical to bifid	82–102 µm; 3.1–3.6
<i>N. robusta</i> , n. sp.	Dichromatic: orange and white	Sparsely sculptured spiny spindles (0.15–0.37 mm), L:W = 4–6; DH (50–70, 100 µm); smooth plates (0.13–0.17 mm); needles (0.16–0.23 mm)	9–11 µm; 30–40%	8–10 µm; conical	80–140 µm; 3–4

may meander and bifurcates when branching occurs. The lines overlay the two large dorsal and ventral solenial canals, which, being devoid of sclerites and occupying most of the width of the coenenchyme, allows the color of the underlying axis to appear as a superficial line. These two large solenial canals do not appear to be linked with calyces, whereas adjacent smaller solenial canals (diameter 0.09 mm) connect the calyces. Dye placed at the broken end of one of these tubes will be transported by capillary pressure as much as 15 mm even in a dead colony. Such an arrangement was noted for *Nicella flabellata* and other ellisellids by Simpson (1910:261–264, 365) and may be a common feature to all ellisellids. However, unlike the species discussed by Simpson, a longitudinal axial groove does not correspond to the two large solenial canals.

An eleventh species of western Atlantic *Nicella*, referred to herein as *Nicella* sp. A, will be reported elsewhere but for completeness is included in this work in the key, table of comparisons (Table 2), and as illustrations (Figs. 1G, 13).

Dichotomous key to the western Atlantic species of *Nicella*

- 1. Predominant large body wall sclerites are flattened scale-like rods and/or spindles (usually blunt tipped) . . . . . 2
- 1'. Predominant large body wall sclerites are rotund or only slightly flattened spindles and/or rods (usually with pointed tips) . . . . . 7
- 2. Most body wall sclerites less than 0.1 mm in length . . . . . *N. spicula*
- 2'. Most body wall sclerites (rods and spindles) more than 0.1 mm in length . . . . . 3
- 3. Waist of double heads over half of sclerite width . . . . . 4
- 3'. Waist of double heads less than half of sclerite width . . . . . 6
- 4. Double head waist quite short (0–4 μm); double head L:W = 1.1–1.4

- (almost circular in some cases); needles rare . . . . . *N. hebes*
- 4'. Double head waist usually 4–5 μm in length; double heads L:W = 1.6–2.2; needles common . . . . . 5
- 5. Many of the body wall flattened rods asymmetrical in shape, having a L:W of 4–6 . . . . . *N. goreau*
- 5'. Flattened rods symmetrical in shape, having a L:W of 3–4 . . . . . *N. americana*
- 6. Flattened rods up to 0.21 mm in length (L:W = 3.5–4.5); rods granular and blunt-tipped; branching dense . . . . . *N. deichmannae*
- 6'. Flattened rods up to 0.41 mm (L:W = 4.4–5.5); some rods smooth, serrate, and sharply tipped (like blades); branching loose and recurved . . . . . *N. lanceolata*
- 7. Tubercles on double heads short (6–8 μm in height) and rounded to clavate in shape . . . . . 8
- 7'. Tubercles on double heads taller (9–17 μm in height) and conical . . . . . 9
- 8. Colonies white; polyps large (about 1 mm long); L:W of tentacular sclerites 2.2–2.9; pinnular sclerites 50–60 μm; colonies usually found deeper than 400 m . . . . . *N. obesa*
- 8'. Colonies dichromatic; polyps smaller; L:W of tentacular sclerites 2.0–2.4; pinnular sclerites 40–50 μm; colonies usually found shallower than 400 m . . . . . *N. guadalupensis*
- 9. Waist of double heads more than half width of sclerite . . . . . *N. sp. A*
- 9'. Waist of double heads less than half width of sclerite . . . . . 10
- 10. Colonies white; tubercles on double heads 10–14 μm in height; tubercles on spindles and rods closely spaced and rounded . . . . . *N. gracilis*
- 10'. Colonies orange and white; tubercles on double heads 8–10 μm in height; tubercles on spindles sparse and pointed . . . . . *N. robusta*

*Nicella goreau* Bayer, 1973  
Figs. 3, 4

*Nicella guadalupensis*: Bayer, 1960:181 (USNM 8972); 1961:290 (in part: USNM

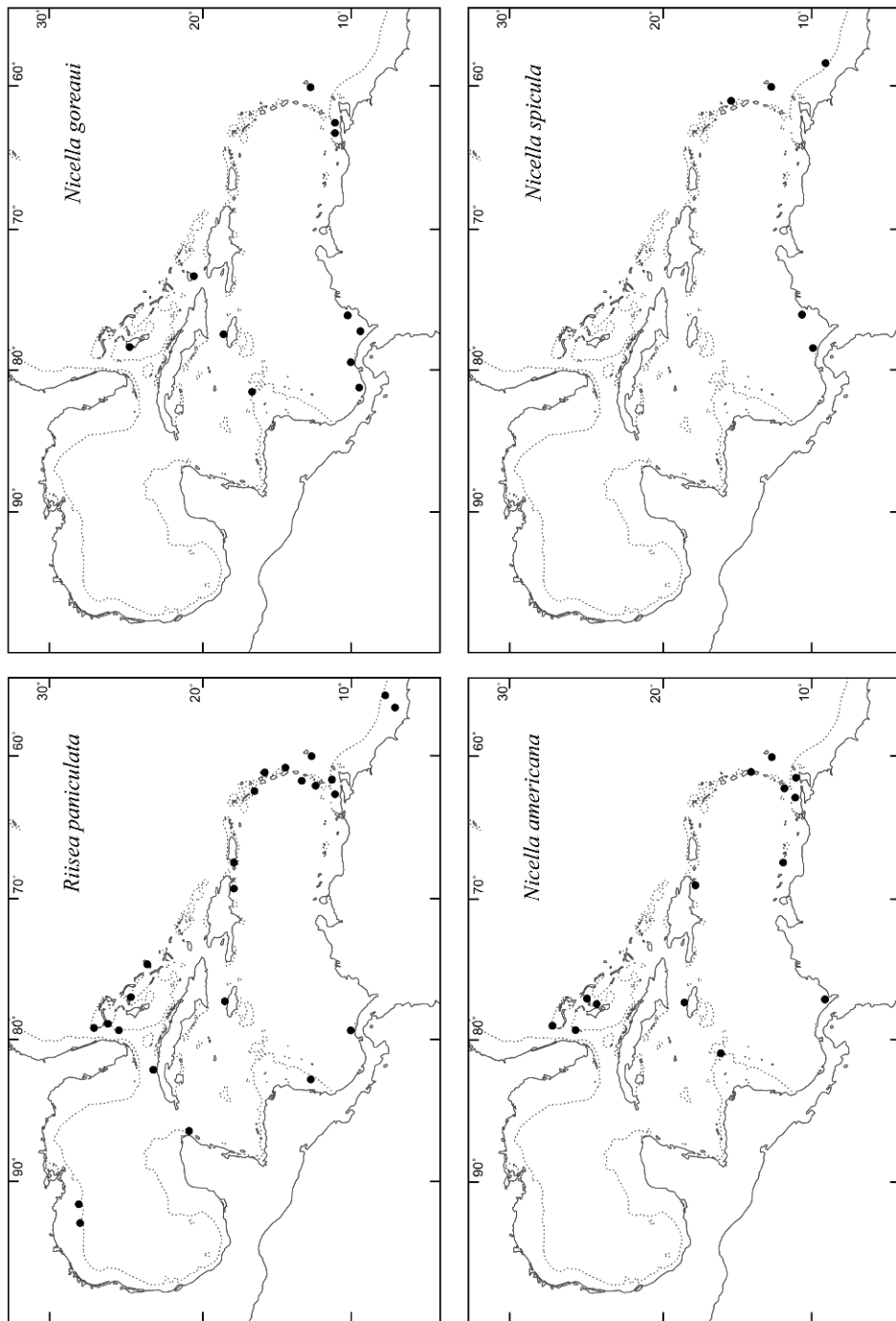


Fig. 4. Distribution maps of *Rيسةa paniculata*, *Nicella goreau*, *Nicella americana*, and *N. spicula*.

49424, 49487, 50896, the specimen illustrated by Bayer later became a paratype of *N. goreau* but is herein reidentified as *N. americana*.

*Nicella goreau* Bayer, 1973:390–397: in part (pls. 1–4 (not 5), types as listed below).

*Material examined*.—Types (see below); BA 34, 1 colony, USNM 49487; P-330, 1 colony, USNM 53240; P-392, 1 colony, USNM 53237.

*Types*.—All types of *N. goreau* examined, but only the following considered to be typical: Holotype: 1 dry colony, SEM scan stub B57, USNM 53124. Paratypes: BA 36, 2 colonies, USNM 49424; O-1875, 2 colonies, USNM 50896; O-5423, 5 colonies, USNM 53108; P-324, 5 colonies, USNM 53110; P-403, 1 dry colony and 5 alcohol colonies, USNM 53094; P-444, 5 colonies, USNM 53103; P-705, 1 dry colony and 5 alcohol colonies, USNM 53112; P-709, 2 colonies, USNM 53113; Discovery Bay, Jamaica, 11 dry colonies, 55–98 m, USNM 53086–53092, 53117, 53118, 53122; Rio Bueno, Jamaica, 45 m, 1 dry colony, SEM scan stub B40, USNM 53120; Runaway Bay, Jamaica, 102–110 m, 2 dry colonies, USNM 53084 and 53085; Pear Tree Bottom, Jamaica, 72–75 m, 1 dry colony, USNM 53119; off Andros, Bahamas, 1 dry colony, USNM 53123.

*Type locality*.—Discovery Bay, Jamaica, 61 m, 25 Oct 1966.

*Description*.—Colonies are uniplanar and rather delicate, usually taller than broad but sometimes equally so (e.g., 55 cm in height and 59 cm wide), and slightly curved such that the convex face (anterior by definition) faces away from the current and is calyx-bearing. Colonies are attached by an irregularly-shaped, white, calcareous holdfast. A stout vertical main stem emerges from the holdfast and usually after 4–5 cm divides in two, the angle of this axil being 45–80°, after which branching is irregularly dichotomous leading to very fine terminal

branchlets; some branch anastomosis occurs. The holotype, one of the largest colonies known, is 60 cm in height and 45 cm in width, with a basal branch diameter of 3.8 mm, and a holdfast 32 mm in width. The axis is light gray in color. Most colonies are usually a light orange in color with even paler orange calyces; some colonies are a darker reddish-orange or even a homogeneous off-white.

Calyces are most common on the branch edges, where they occur in an opposite alternating fashion, separated by 0.2–0.4 mm, although they may also occur on the anterior face and usually one occurs on the tip of each branchlet. Well-preserved calyces are mammiform in shape, standing perpendicular to the branch up to 0.6–0.8 mm in height and having a basal diameter of about 0.8 mm. Calyces are usually white or a paler shade of the coenenchymal color due to the paler or clear color of its component sclerites.

The calyx body wall consists of a mixture of girdled rods, spindles, and needles [about 0.66 of the sclerites, called “double cones” and “double spindles” by Bayer (1973)] and double heads (about 0.33 of the sclerites). The predominant calyx body wall sclerite is the girdled, blunt tipped, flattened rod (0.12–0.17 mm in length, L:W = 4–6). Also present are acutely tipped spindles (up to 0.20 mm in length, L:W = 5.5–7.0), and sparsely granulated needles (up to 0.19 mm, L:W = 10–15), in that order of abundance. About 10–30% of the girdled flattened rods are asymmetric [called “slippers” by Bayer (1973)], in that one of the end members of the rod is of a different shape, size, and/or orientation, or both end members may be aligned but the connecting waist region is oblique or slanted. Most double heads are 40–50 µm in length, have a L:W of 1.6–2.2, and a thick waist (about 50% that of the sclerite) 4–5 µm long. Their heads are covered with rounded tubercles 4–5 µm in diameter and

3–6  $\mu\text{m}$  in height. Larger double heads also occur, gradually transitioning to elongate rods and spindles. Double heads are usually three dimensional but are sometimes flattened. The main shaft of the tentacles bear stubby girdled rods 55–77  $\mu\text{m}$  in length (L:W = 2.6–3.6). The flat pinnular sclerites (illustrated as a pharyngeal by Bayer, 1973: fig. 3c, upper) and pharyngeal sclerites are typical in shape for the genus, measuring 37–46  $\mu\text{m}$  and 38–50  $\mu\text{m}$  in length, respectively. The coenenchymal sclerites consist primarily (about 60%) of double heads and an equal mixture of flattened girdled rods and spindles, all these sclerites of similar size and shape to those found in the body wall.

*Comparisons.*—*Nicella goreau* is distinctive among all other species in that a significant number of its flattened rods and spindles are asymmetrical, one end being larger, misshapen, or directed obliquely. Among those species with flattened plate-like spindles and rods it is distinctive in having a significant number of needle-shaped sclerites in the calyx and a relatively high L:W of its rods (Table 2).

*Remarks.*—The “loose” or porous structure of the sclerites reported by Bayer (1973) is observable only with SEM (see Fig. 3A herein) and is probably not a species level character. The description of *N. goreau* was the first to employ the new technique of scanning electron microscopy to illustrate octocoral sclerites and thus ushered in an era of much more detailed, accurate, and more efficient observation and measurement of these characters. It also ultimately allowed a finer division of species boundaries (see below). SEM of sclerites is now considered routine for a proper octocoral identification and description.

In Bayer's (1973:397) original description of *N. goreau*, he admitted that it was an extremely variable species but chose to consolidate this variation as one species. Now, over 30 yr later and after tens of thousands of SEM photomicrographs, I

conclude that *N. goreau* includes a complex of closely related species, four others of which were included in the type series of the species: *N. americana*, *N. deichmannae*, *N. sp. A*, and *Nicella spicula*.

The western Atlantic ophiuroid *Hemieuryale pustulata* occurs on many specimens of this species. It also occurs on the specimen reputedly collected from the Gulf of California [see Bayer (1960), identified as *N. guadalupensis*], which supports Bayer's suspicion that a labelling error had occurred concerning this specimen.

*Distribution.*—Bahamas and southern Caribbean, off Maranhão, Brazil (Fig. 4); 45–146 m.

*Nicella americana* Toeplitz in  
Kükenthal, 1919  
Figs. 4, 5

*Nicella americana* Toeplitz in Kükenthal, 1919:925.—Kükenthal, 1924: 378.—Toeplitz, 1929:354–357, pl. 7, fig. 10, text fig. 23.—?Deichmann, 1936:216, 220.

*Nicella ramosa* Toeplitz in Kükenthal, 1919:925 (new synonym); 1929: 346.—Kükenthal, 1924:377.—Deichmann, 1936:220.

*Nicella guadalupensis*: Bayer, 1961: 290 (in part: fig. 95j–i, USNM 49473, 49514, 49511, 50579, 50898).

*Nicella goreau* Bayer, 1973: 390 (in part: pl. 5, USNM 44134, 49514, 50898, 53093, 53095, 53096, 53099, 53100, 53104, 53107, 53111, 53116).

*Material examined.*—BA 9, 2 branches, USNM 50579; BA 21, 2 colonies, USNM 44134; BA 26, 1 colony, USNM 49511; BA 64, 5 colonies, USNM 49473 and 91857; BA 65, 2 colonies, USNM 49514; G-392, 1 colony, SEM scan stub B47, USNM 53107; G-713, 2 colonies, USNM 53099; JSL-I-1499, 1 colony, USNM 1086729; O-1891, 1 colony, USNM 50898; O-4224, 1 colony, USNM 53247; O-5016, 2 dry colonies, USNM 53081; O-5970, 1 colony, USNM 1086730; P-403, 5 colonies, SEM

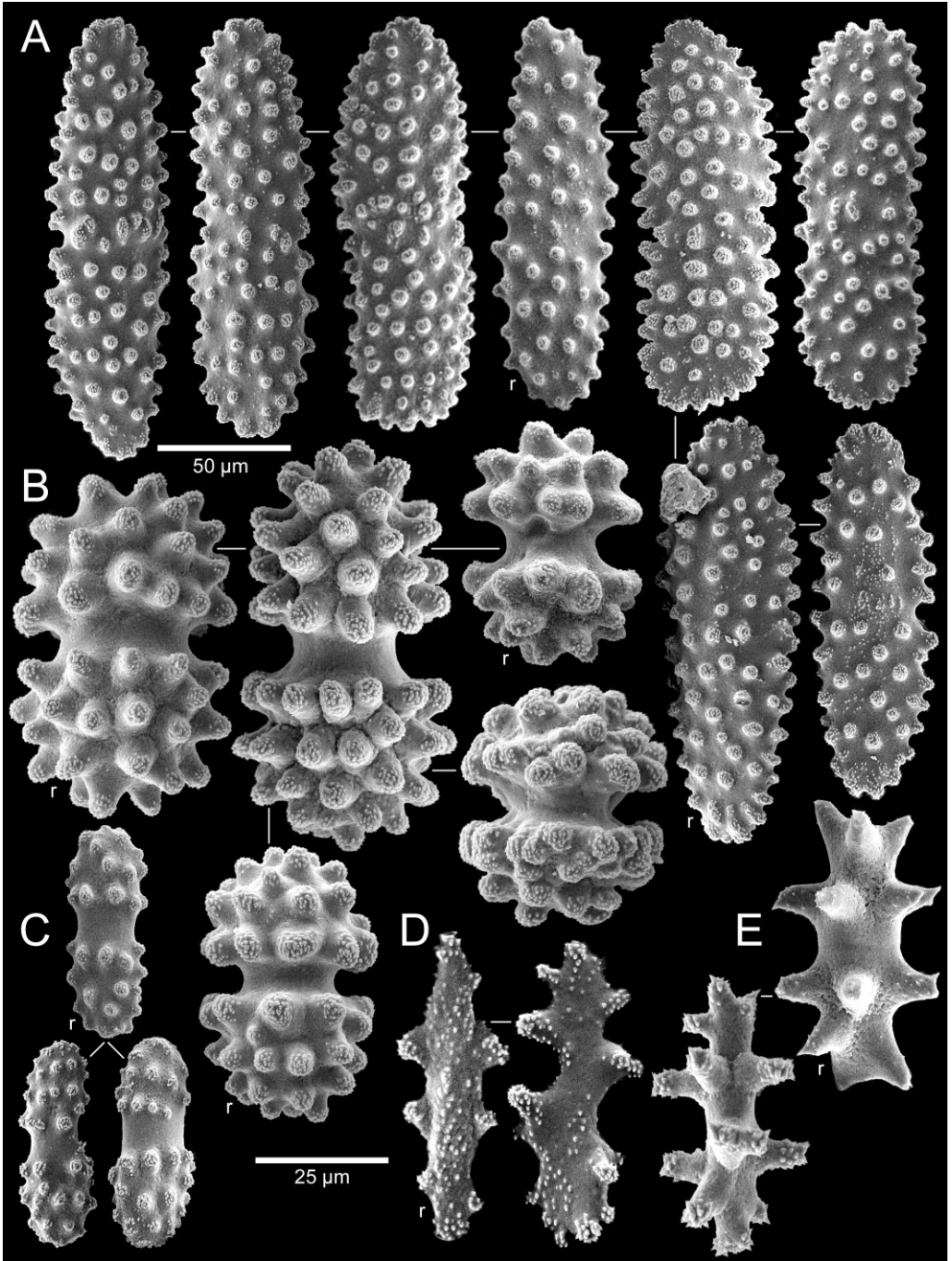


Fig. 5. A–E, Sclerites of *Nicella americana* (from syntypes of *N. americana* (ZSM 20044805) and *N. ramosa* (ZSM 20044807), sclerites from the latter labelled with an r): A, eight flattened rods; B, five double heads; C, three tentacular rods; D, two pinnular plates; E, two pharyngeal sclerites. Scale bars: A, C, 50 µm; B, D, E, 25 µm.

scan stub B13, USNM 53100; *P*-705, 1 dry colony, USNM 53116; *P*-736, 5 dry and 12 alcohol colonies, USNM 53096, 53104, 53230, 53515; *P*-854, 2 dry colonies, SEM stub B2389, USNM 53252; *P*-887, 5 colonies, USNM 53111; *P*-1386, 2 colonies, USNM 1015568; *P*-1387, 1 dry colony, USNM 53083; west end of Nassau, Bahamas, 2 dry colonies, SEM scan stub B48, USNM 53093; Small Hope Bay, Andros Bahamas, 46-92 m, 1 dry colony, SEM scan stub B55, USNM 53095. Types of *N. americana* and *N. ramosa* (see below).

*Types and type localities.*—Five syntypes of *N. americana* are deposited at the Zoologische Staatssammlung München (ZSM 20044805); a specimen is also deposited at the USNM in the form of SEM stubs C1200–1201. Type Locality: “Barbados, 183 m.” The types were probably collected on the *Hassler* from one of eight stations made off Sandy Bay, Barbados on 29–30 Dec 1871.

Three syntypes of *N. ramosa* are also deposited at the Zoologische Staatssammlung München (ZSM 20044807); a specimen is also deposited at the USNM in the form of SEM stubs C1202–1203. Type Locality: same as above.

*Description.*—Colonies are uniplanar and large, up to 60 cm tall and 55 cm wide, and like *N. goreau*, the fan is slightly curved away from the current. The largest basal main branch is 8 mm in diameter; branching commences and persists very close to the base of the colony. Most colonies are intense to light orange, the calyces usually being a paler shade of orange, but not white.

Calyces occur primarily in alternating opposite fashion of the branch edges, although occasionally face the anterior side. They are mammiform in shape, up to 0.9 mm in diameter and height.

The calyx body wall consists primarily of non-girdled, blunt-tipped, flattened rods, a much smaller percentage of double heads, and some needles. The

flattened rods range in length from 0.11 to 0.18 mm, but average about 0.14 mm, and are rather broad (L:W = 2.8–3.3–3.7); in thickness they are 0.01–0.02 mm. These rods are usually straight and symmetrical, with parallel edges; they are covered with tubercles 5–6  $\mu$ m in diameter. The double heads are 40–70  $\mu$ m in length, have a L:W of 1.5–2.0, and a thick waist (about 50% that of the sclerite) that is 2–5  $\mu$ m long. The heads are covered with conical tubercles 7–9  $\mu$ m in height. Needles occur but are rare, measuring 0.13–0.15 mm in length and having a L:W of 8–11. The rotund tentacular sclerites are girdled, 60–80  $\mu$ m in length, and have a L:W of 2.5–3.1. The flat pinnular sclerites measure 55–50  $\mu$ m in length; the pharyngeals are 40–55  $\mu$ m in length. The coenenchymal sclerites consist of flattened rods and double heads as described for the calyx wall and occur in the same relative percentage.

*Comparisons.*—*Nicella americana* is quite similar to *N. goreau* but differs in having ungirdled (or inconspicuously girdled), flattened rods that are symmetrical in shape, and that are broader, as evidenced by having a smaller L:W ratio. Also, the double head tubercles are taller and the double heads have a shorter waist region. *N. americana* is also similar to *N. deichmannae*, but the latter species has double heads with much longer and thinner waist regions (Table 2). SEM of the sclerites from the type specimens of *N. americana* and *N. ramosa* showed no significant differences.

*Distribution.*—Bahamas, Antilles, southern Caribbean, off Maranhão, Brazil (Fig. 4); 62–237 m, but most records shallower than 150 m.

*Nicella spicula*, new species

Figs. 1B, 4, 6

*Nicella goreau* Bayer, 1973:390 (in part: USNM 44122, 53102, 53105, 53106, 53114, 53115).



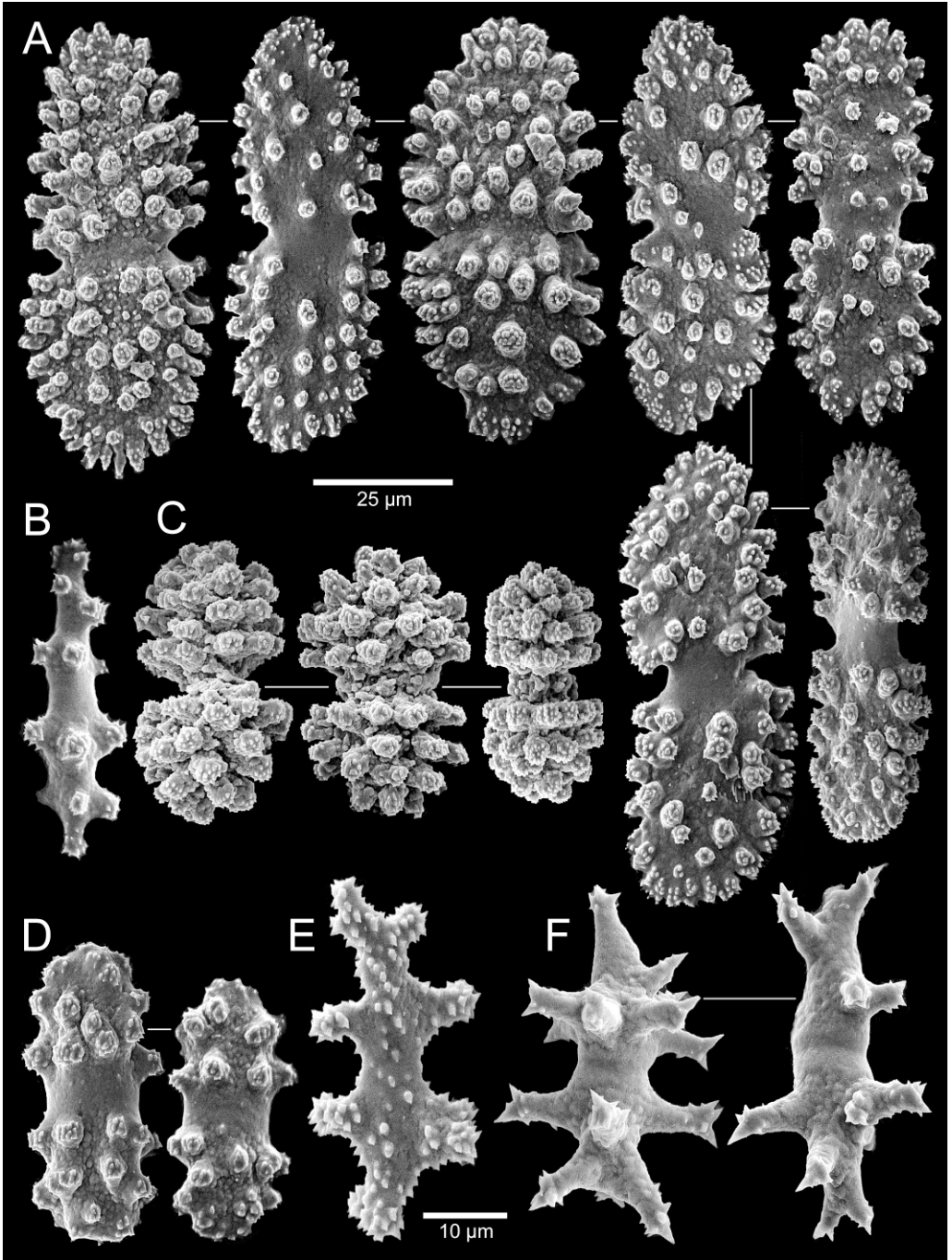


Fig. 6. A–F, Sclerites from holotype of *Nicella spicula*: A, seven flattened rods; B, a spindle; C, three double heads; D, two tentacular rods; E, a pinnular plate; F, two pharyngeal sclerites. Scale bars: A–D, 25 µm; E, F, 10 µm.

*Material examined* types.—Holotype: P-928, 1 colony in 4 pieces, SEM stubs C1212-1213, USNM 53106. Paratypes: BA 92, 1 complete colony, USNM 44122; P-331, 3 large dry colonies (USNM 53115) and 3 colonies in alcohol (USNM 53102); P-389, 2 complete colonies, USNM 53105; P-691, 1 colony in about 8 pieces, USNM 53114.

*Type locality*.—15°25'N, 61°14'W (off eastern coast of Dominica, Lesser Antilles), 42–44 m.

*Description*.—Colonies are uniplanar, the largest (P-331) 60 cm tall, its base embedded in a sponge. The holotype is smaller, 25 cm in height and 18 cm broad, with a truncated basal stem having a diameter of 2.2 mm. Colonies are attached by a thin white encrusting calcareous holdfast. Branching is irregularly dichotomous. Colonies are dark orange in color, the calyces lighter orange to yellowish, although those of the holotype are lavender in color. The calyces stand perpendicular to the branches, occurring in an opposite alternate pattern on all branches and occasionally on the anterior face. They are cylindrical: 0.6–0.8 mm in height and 0.4–0.5 mm in diameter.

The calyx body wall consists primarily of small (80–100  $\mu\text{m}$  in length, only rarely exceeding 0.1 mm), flat (only 5–8  $\mu\text{m}$  in thickness), blunt-tipped, girdled rods, having a rather low L:W of 2–3. Their waist is a well-defined indentation 8–10  $\mu\text{m}$  in length, and the edges of the rods are serrate, caused by projecting tubercles up to 7  $\mu\text{m}$  tall and 5  $\mu\text{m}$  in diameter. Each tubercle in turn bears 10–20 sharp, triangular spines, the spines about 1  $\mu\text{m}$  in height. The calyx wall also contains a lesser number of double heads ranging from 45–55  $\mu\text{m}$  in length and having a L:W of 1.5–2.0. Their waist region is 4–5  $\mu\text{m}$  in length and is 50–60% the thickness of the sclerite. The tubercles on the double heads are fairly tall (up to 9  $\mu\text{m}$ ), cylindrical in shape, and bear small spines as described for the rod

tubercles. Even fewer in number are elongate girdled spindles (needles) ranging from 60–100  $\mu\text{m}$  in length and having a L:W of 6–8. The stubby girdled tentacular rods are 45–60  $\mu\text{m}$  in length, with a L:W of 2.0–2.3. Pinnular sclerites are short (30–35  $\mu\text{m}$  in length) and the pharyngeals range from 40–50  $\mu\text{m}$ . The coenenchymal sclerites consist of short flattened rods and double heads as described above in a ratio of about 4:1.

*Comparisons*.—This species is distinctive among the western Atlantic species in having such short and flat rods (Table 2). The prominent tubercles on the rods, themselves spinose, also appears to be unique.

*Remarks*.—Commensal comatulid crinoids and ophiuroids cling to the branches of this species.

*Etymology*.—This species is named *spicula* (Latin diminutive of *spica*), meaning point or spear, the basis for the word spicule, an allusion to the small sclerites of this species.

*Distribution*.—Southern Caribbean from Panama to Dominica, and off Guyana (Fig. 4); 44–82 m.

#### *Nicella deichmannae*, new species

Figs. 1A, 7, 9

*Nicella guadalupensis*: Bayer, 1961:290 (in part: USNM 7617, 49492, 49437).—Deichmann, 1936:218–219 (in part: MCZ 4751).

*Nicella goreau*: Bayer, 1973:390 (in part: USNM 50897, 53097, 53101).

*Material examined* types.—Holotype: P-1387, 1 large dry colony, SEM stubs C1214-1215, USNM 53097 (also a paratype of *N. goreau*). Paratypes: G-251, 2 colonies, USNM 53023; G-398, 2 colonies, USNM 53022; JSL-I-2582, 1 colony, USNM 89387, 89394; JSL-II-819, 2 colonies, USNM 1086739; O-3608, 1 large colony, SEM scan stub B16, USNM 53028; O-4305, 1 colony, USNM 53248; P-705 (a, d), 1 branch and 1 dry branch, USNM 1086742; P-1387, 2 colonies,

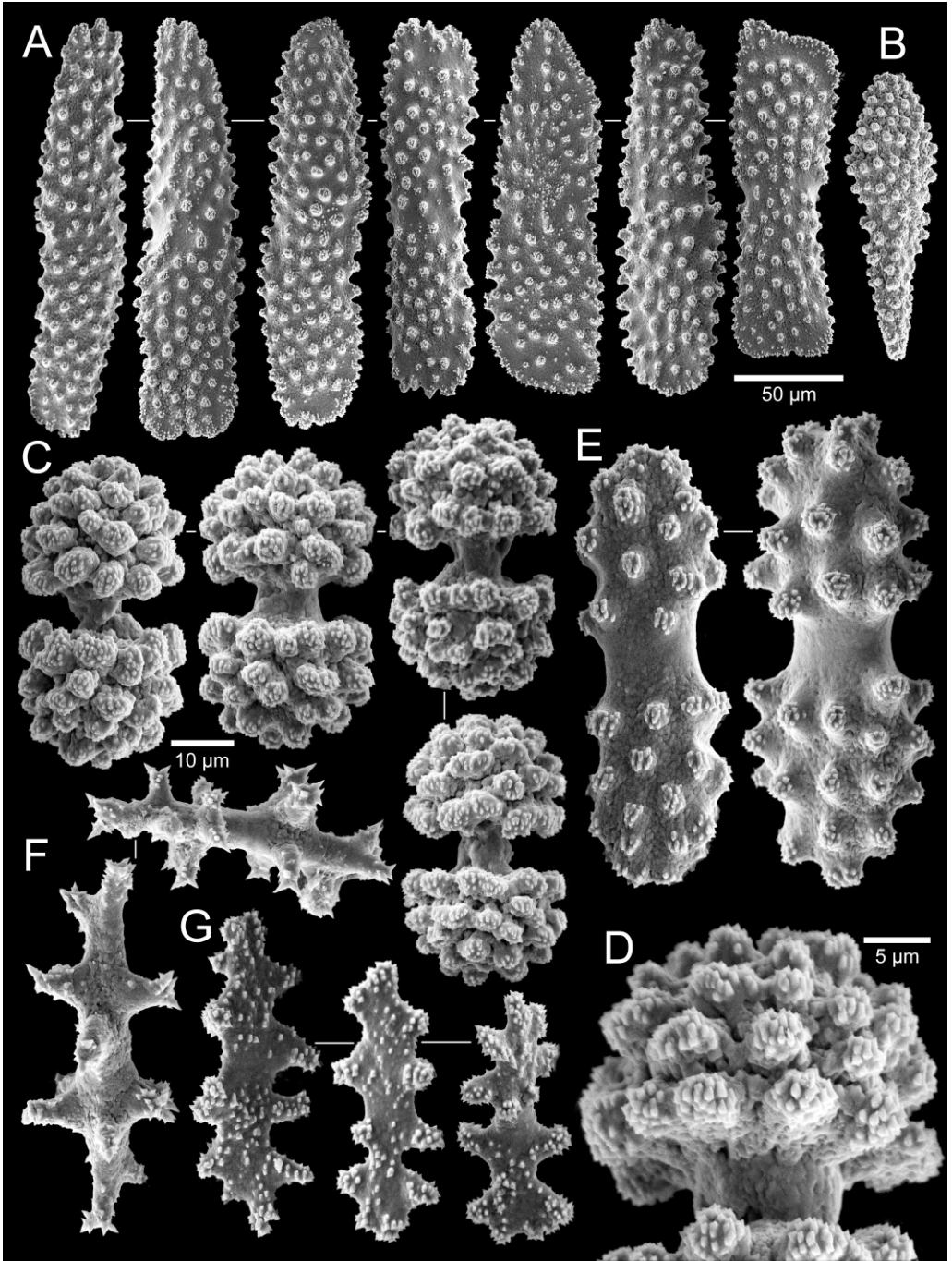


Fig. 7. A–G, Sclerites from holotype of *Nicella deichmannae*: A, seven flattened rods; B, a club; C, four double heads; D, enlargement of one end of a double head showing tubercles; E, two tentacular rods; F, two pharyngeal sclerites; G, three pinnular plates. Scale bars: A, B, 50  $\mu\text{m}$ ; C, E–G, 10  $\mu\text{m}$ ; D, 5  $\mu\text{m}$ .

USNM 1086738; *P*-1407, 1 dry colony, USNM 53032; *P*-1413, 1 dry colony, USNM 100237; SOFLA 29, 2 colonies, USNM 73710, 73711; SOFLA 38, 1 dry colony, USNM 87009. **Non-Types:** *Alb*-2153, 1 colony, USNM 7617; *Alb*-2157, 1 colony, USNM 49492; BA 26, 1 colony, USNM 1086743; *BL*-246, 4 dry colonies, MCZ 4771 (Verrill #5985); *BL*-276, 4 specimens, MCZ 4751, and unnumbered SEM stub at USNM; *Cape Florida*, 3 colonies, USNM 73935; *JSL-I*-1354, 1 colony, USNM 1086740; *O*-1875, 1 colony, USNM 50897; *O*-3772, 3 colonies, USNM 53026; *P*-425, 2 colonies, USNM 53101; *P*-479, 1 colony, USNM 53236; *P*-1143, 1 colony, USNM 1086741; *SB*-3496, 1 colony, USNM 53029; *SB*-5190, 1 colony, USNM 53030; SOFLA 35, 11 colonies, USNM 73705, 73713, 73714, 73717, 73718, 74843.

*Type locality.*—18°21'N, 69°06'W (off southeastern coast of the Dominican Republic), 130–165 m.

*Description.*—Colonies are uniplanar, usually taller than broad, and slightly curved presumably away from the current, the largest colony (*O*-3608) being 28 cm in height and 20 cm broad, with a broken base having a diameter of 3.8 mm. As with all other species, colonies are attached by an irregularly shaped, white, calcareous holdfast, whereas the axis is a dull grey. Branching is initially dichotomous for the first 4 or 5 bifurcations, after which it becomes irregularly pinnate. The color of colonies is quite variable: most colonies are pale orange with white or at least paler orange calyces, whereas other colonies are uniformly white or uniformly light orange but fading to uniformly white at branch tips.

Calyces are most common on the branch edges, where they occur in opposite alternating fashion. Well-preserved calyces are conical in shape and rarely exceed 0.7 mm in height.

The sclerites of the body wall consist of flattened rods, double heads, spindles, and

a few clubs and needles, in that order of abundance. The majority of the sclerites (60–70%) are blunt-tipped, flattened rods 0.16–0.21 mm in length and with a L:W of 3.5–4.5. These plate-like sclerites are straight (rarely asymmetric) and have only a very subtle or no waist region. Next in abundance are the double heads, most measuring 40–50  $\mu$ m in length and having a L:W of 1.8–2.1. Their waist region is 6–10  $\mu$ m long but quite slender, i.e., only 25–33% the width of the sclerite, one end of the connecting waist often being slightly smaller than the other. The heads of these sclerites bear a grape-like cluster of at least three tiers of rounded tubercles, each up to 6–8  $\mu$ m in height. A larger class of double head is less common, measuring 80–100  $\mu$ m in length and having a more robust waist (60% of sclerite width) and fewer and more sparse tubercles. Normal three-dimensional spindles, also with faint to no girdling, are rare (about 10%), also measuring up to 0.25 mm and having a L:W of 6.8–7.1; clubs (84–150  $\mu$ m in length) and needles (0.19 mm in length, L:W = 10) are rarer still. The stubby, girdled tentacular rods are 59–84  $\mu$ m in length, with a L:W of 2.5–3.5. The flat pinnular sclerites measure 50–65  $\mu$ m in length and the pharyngeals 48–57  $\mu$ m. The coenenchymal sclerites are composed of an approximately equal mixture of double heads and flattened rods (as described for the body wall) and a relatively small component of spindles (about 10% of total).

*Comparisons.*—The most distinctive feature of *N. deichmannae* is its very thin-waisted double heads, which support robust tuberculate heads on either side (Table 2). These sclerites are often broken at the waist probably because of their slender waist.

*Remarks.*—Ophiuroids of the genera *Asteroschema*, *Ophiocantha*, and *Ophiomitra* are common commensals.

*Etymology.*—This species is named in honor of Elisabeth Deichmann, who

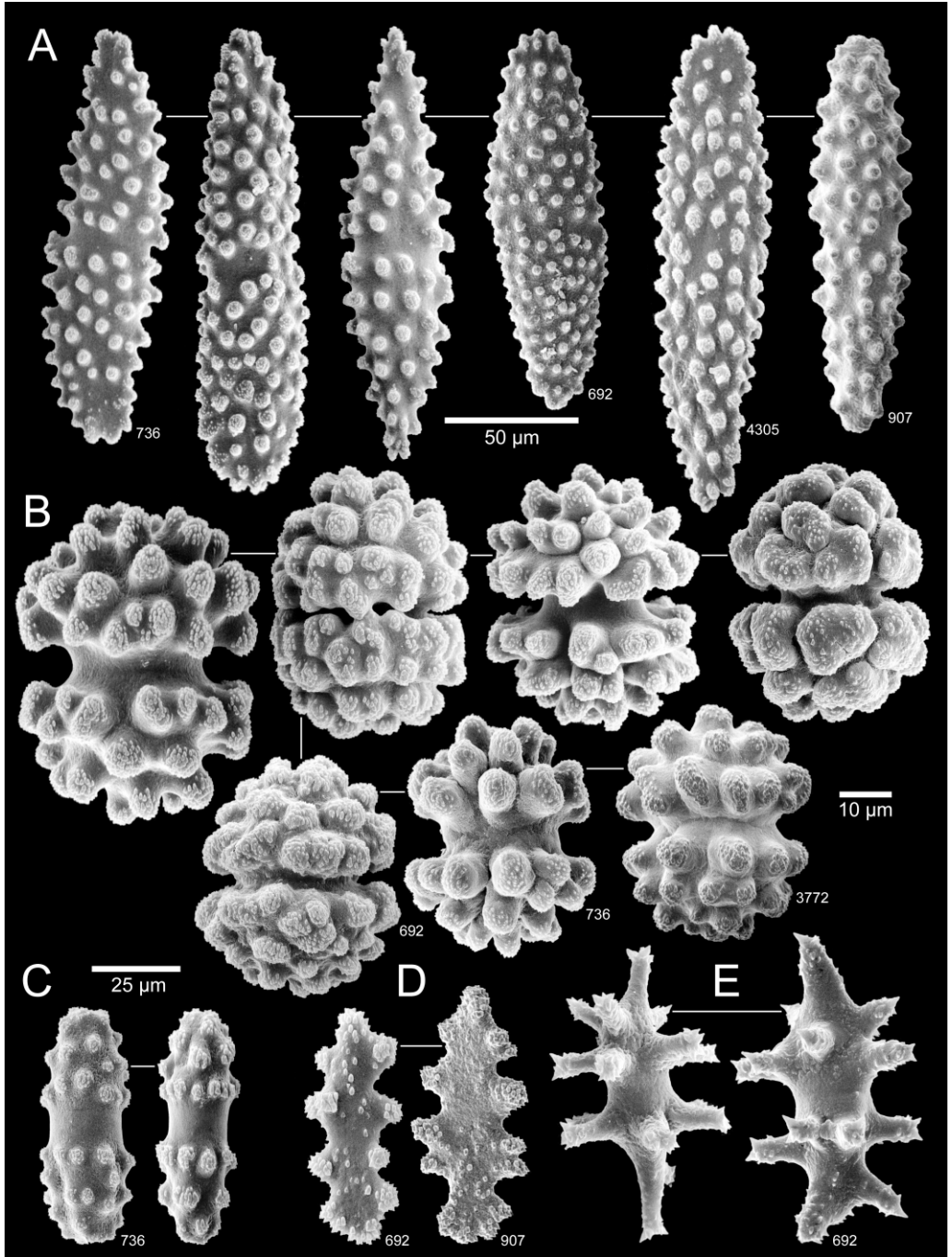


Fig. 8. A–E, Sclerites of *Nicella hebes* (sclerites marked with 736 are from *P*-736, with 4305 from *O*-4305, with 692 from *G*-692, with 3772 from *O*-3772, with 907 from *P*-907, and those unmarked are from the holotype): A, six spindles; B, seven double heads; C, two tentacular rods; D, two pinnular plates; E, two pharyngeal sclerites. Scale bars: A, 50 μm; B, D, E, 10 μm; C, 25 μm.

published the first complete revision of the deep-water western Atlantic octocorals (Deichmann 1936).

*Distribution*.—Bahamas, Antilles, north-western Caribbean, northwestern Gulf of Mexico (Fig. 9); 27–403 m, but most commonly collected at 150–300 m.

***Nicella hebes*, new species**

Figs. 1C, 8, 9

*Nicella guadalupensis*: Bayer, 1961:290 (in part: USNM 44119).

*Verrucella hebes* (nom. nud.) Bayer & Cairns (Verrill), 2004: pl. 14, fig. 6, pl. 36, figs. 3, 3a.

*Verrucella (Stellicella) hebes* (nom. nud.) Bayer & Cairns (Verrill), 2004: pl. 99, fig. 2.

*Gorgonella hebes* (nom. nud.) Bayer & Cairns (Verrill), 2004: pl. 146, fig. 1.

*Material examined*/types.—Holotype: P-691, colony and SEM scan stub B53, USNM 53062. Paratypes: *Cape Florida*, 5 colonies, USNM 73934; *JSL-I-2582*, 1 colony, USNM 89388; *O-3608*, 1 colony, USNM 53061; *O-4459*, 1 colony, USNM 53077; *P-424*, 1 colony, USNM 53066; *P-887*, 2 colonies, USNM 53075 and 53079; *P-907*, 3 branches and SEM scan stub B2, USNM 53063; *P-969*, 1 colony, USNM 53067; *P-1387*, 3 colonies, USNM 1086744; *P-1393*, 1 colony, USNM 1086745; SOFLA 23, 1 colony, USNM 73709. **Non-Types**: BA 37, 1 colony, USNM 44119; BL-45, 4 dry colonies, MCZ 4771 (Verrill #5979); BL-290, 2 dry colonies, MCZ 4773 (Verrill #6038); *Explorer* 4, 1 colony, USNM 53076; *G-692*, 1 colony and SEM scan stub B52, USNM 53072; *O-3772*, branches, USNM 53060 and SEM scan stub B3; *O-4305*, 1 colony and SEM scan stub B1 and B6, USNM 53069; *P-736*, 1 colony and SEM scan stub B54, USNM 53065; *P-855*, 1 colony, USNM 53064; SOFLA 35, 12 colonies, USNM 73712, 73715, 73716; SOFLA 36, 3 colonies, USNM 73724, 94507; SOFLA 38, 12 colonies, USNM 73719-73723; west coast of Barbados,

depth unknown, coll. by J. B. Lewis, 1961, 1 colony, USNM 53073.

*Type locality*.—8°25'N, 58°08'W (off Guyana), 92 m.

*Description*.—Colonies are uniplanar, usually broader than tall, and slightly curved such that the concave face of the colony faces toward the current. Colonies are attached by a white calcareous hold-fast. Branching is irregularly dichotomous and occasionally anastomotic, especially among small branches of large colonies, the anastomoses reinforcing the integrity of the flabellar network of branches. The holotype is one of the largest colonies but unusually narrow, measuring 26 cm in height and only 12 cm in width, having a broken basal branch diameter of 2.9 mm. The axis is cream colored and faintly longitudinally striate. Colonies are usually pale orange with white calyces, however some colonies are uniformly light red and yet others are dichromatic but are totally white for the distal 2–3 cm of each branch.

Calyces occur in a crowded arrangements on all sides of the branches and usually at the branch tip but are most common on the anterior face, i.e., the convex side of the flabellum. Calyces are cylindrical to slightly tapered, rarely more than 0.6 mm in height and of variable width depending on the contraction when preserved and distance away from the distal branch tip. As mentioned, calyces are usually white (due to colorless sclerites) or a paler shade of the coenenchymal color.

The calyx body wall consists primarily of colorless flattened girdled spindles (about 60%) and double heads (about 40%). The spindles (some of which are rotund) are 0.15–0.22 mm in length, having a L:W of 3.2–5.7. The bare girdled region of the spindles is about 8 μm in length, and the spindles are covered with small tubercles 6–8 μm in height and 5–7 μm in diameter. Clubs are also present but rare, measuring 0.11–0.13 mm. The double heads occur as two size classes.

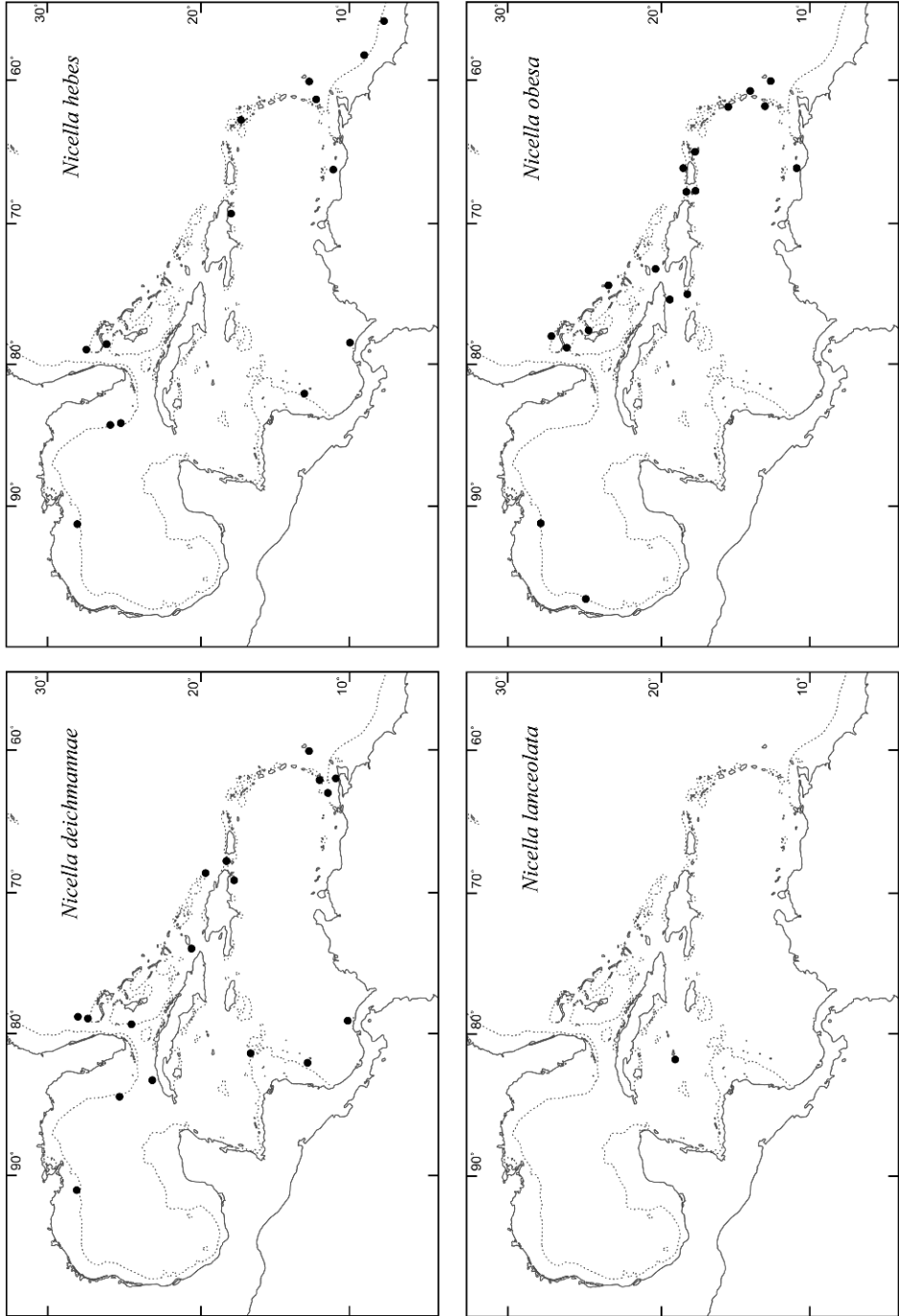


Fig. 9. Distribution maps of *Nicella deichmannae*, *N. hebes*, *N. lanceolata*, and *N. obesa*.

The smaller double heads, which are the predominant form, are only 35–50  $\mu\text{m}$  in length and almost as wide ( $L:W = 1.12\text{--}1.39$ ), somewhat spherical to elliptical in shape. The connecting waist is quite thick (60–65% the width of the sclerite) and short (0–4  $\mu\text{m}$ ), often forming a deep, thin sulcus around the sclerite. The tubercles on these double heads are few in number, large, and rounded, sometimes clavate, measuring 5–8  $\mu\text{m}$  tall and 6–9  $\mu\text{m}$  in distal diameter. They in turn are covered with tiny granules each about 1  $\mu\text{m}$  in diameter. Because they are almost spherical, these small double heads are often oriented on end in a coarse sclerite preparation, instead of on their sides as is the usual case. The larger double heads are 50–90  $\mu\text{m}$  in length and have a higher  $L:W$  of 1.4–1.8. The main shaft of the tentacles bear stubby girdled rods 68–72  $\mu\text{m}$  in length, with a  $L:W$  of 2.5–2.8. The flat pinnular sclerites are typical in shape for the genus, measuring 39–49  $\mu\text{m}$  in length. The three-dimensional pharyngeal sclerites are typical in shape for the genus, measuring 48–59  $\mu\text{m}$  in length. The coenenchymal sclerites near branch tips are predominantly pale orange double heads (about 60%) and spindles (about 40%). Again, the predominant double head is of the smaller variety and the spindles are as those found in the body wall. The coenenchyme of large-diameter branches is largely devoid of spindles and contains mostly large double heads.

*Comparisons.*—The distinctive characteristic of *N. hebes* is the small size of its smaller double head sclerites, which bear low, rounded tubercles on their distal ends, the waist region being reduced to a thin sulcus. This results in an almost spherical double head, characterized by a very low  $L:W$  (Table 2).

*Remarks.*—Some colonies are host to several ophiuroids identified as *Hemieuryale pustulata*. The brittlestars bear tubercles on the dorsal surface of their disc

and arms that are the same size, shape, color and spacing of the octocoral calyces; the arms of the brittlestar are also about the same diameter as the coral branches. The only difference is that the background color of the echinoderm is chocolate brown whereas that of the octocoral is usually pale orange.

The three synonymy entries are all unpublished (intentional nomina nuda) and thus are unavailable manuscript names (see Bayer & Cairns 2004:ii).

*Etymology.*—Greek *hebes*, meaning blunt or stubby, a manuscript name used by Verrill in his unpublished monograph.

*Distribution.*—Widespread throughout tropical western Atlantic from off Louisiana to Suriname, including the Bahamas and southern coast of Caribbean to Nicaragua (Fig. 9); 27–327 m, although most records are between 100–200 m.

*Nicella lanceolata*, new species

Figs. 1E, 9, 10

*Material examined* types.—Holotype: large colony and SEM stubs B2791–2792 and C1197–1198, USNM 93209. Paratype: a single branch probably detached from the holotype, SEM stubs B2793–2794, USNM 93207.

*Type locality.*—Off George Town, Grand Cayman Island, Caribbean, 229–244 m, collected by submersible (Perry sub) in 1984–1986 by Charles G. Messing.

*Description.*—The holotype is uniplanar and sparsely branched, measuring 31 cm tall and 18 cm broad, with a broken basal branch 2.1 mm in diameter. Branching is dichotomous followed by a very loose pinnate arrangement, the branches often gently curved, altogether producing a very open aspect. The axis is light brown and smooth; a complete specimen with holdfast is not available. The holotype is white, containing colorless sclerites.

Calyces are well spaced (1.5–2.3 mm apart) and arranged in opposite, alternating fashion on the branch edges. Calyces



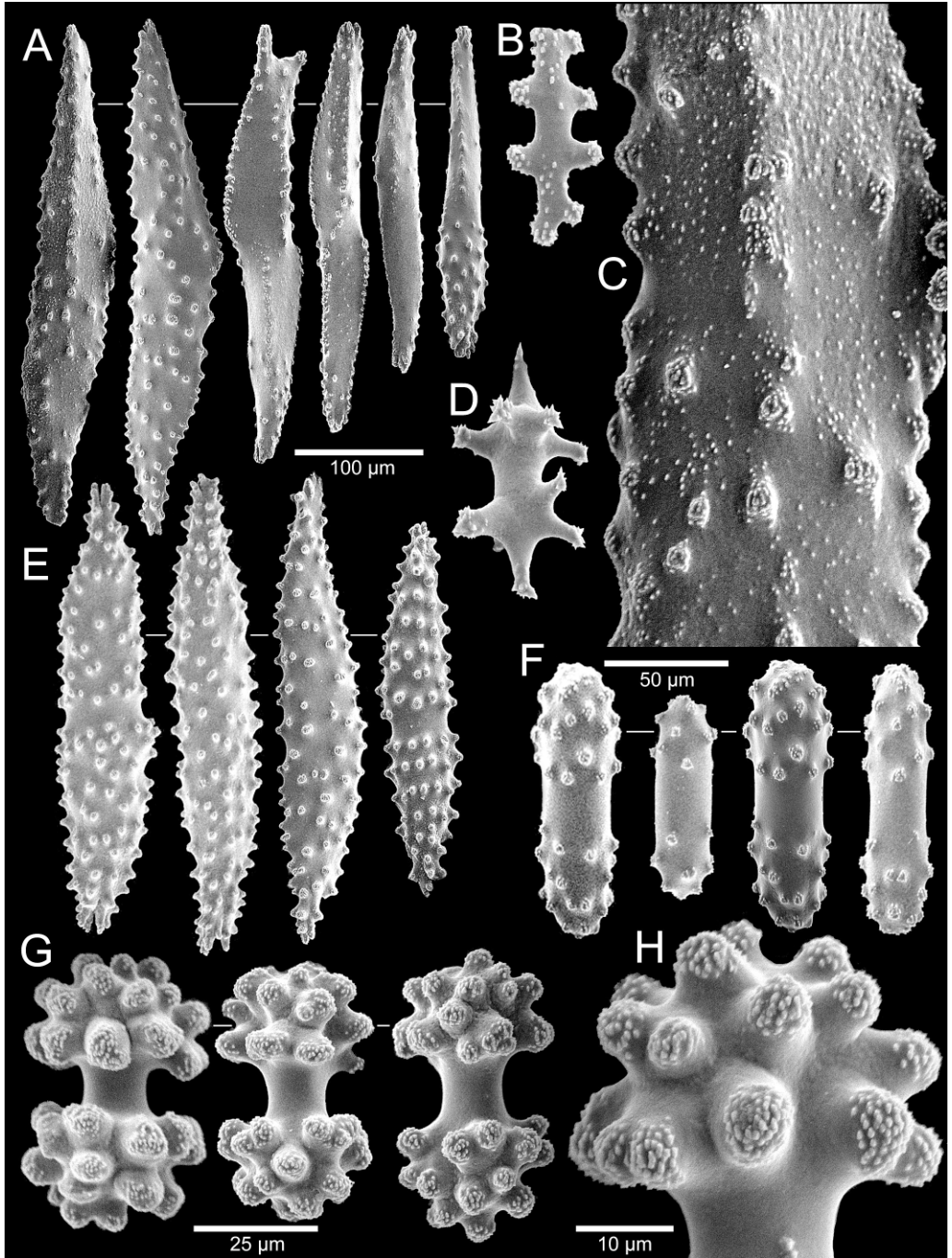


Fig. 10. A–H, Sclerites from the holotype of *Nicella lanceolata*: A, six blade-like spindles; B, a pinnular plate; C, an enlargement of a bladed spindle showing sparse granulation; D, a pharyngeal sclerite; E, four rotund spindles; F, four tentacular rods; G, three double heads; H, enlargement of one end of a double head showing tubercles. Scale bars: A, E, 100  $\mu\text{m}$ ; B–D, G, 25  $\mu\text{m}$ ; F, 50  $\mu\text{m}$ ; H, 10  $\mu\text{m}$ .

are large (up to 1.05 mm in diameter and 0.5 mm in height), and mound-shaped.

The sclerites of the calyx body wall consist of a basal band of elongate, transversely aligned, tuberculate, girdled spindles 0.19–0.39 mm in length and having a L:W of 4.4–5.5. The region distal to this band and merging with the lower parts of the tentacles consists of elongate, longitudinally aligned, smooth to sparsely tuberculate, non-girdled spindles 0.17–0.41 mm in length and having a L:W of 6.0–7.5. Unlike the tuberculate spindles, which are rounded in cross section, these smooth spindles are flat and quite thin (translucent) such that when viewed with a compound microscope produce a concentric birefringent pattern not seen in any other *Nicella* sclerite. Whereas the faces of these flat, blade-like sclerites are relatively smooth, their sharp edges are finely serrate; occasionally these plates are slightly curved (sigmoid) in shape. Together, the tuberculate and blade-like spindles form a crown and points arrangement. In addition to the spindles, the calyx contains a small number of tuberculate clubs (0.15–0.19 mm in length); smooth needles (0.22–0.26 mm in length with a L:W of 9–11); spindles that are transitional in morphology between the tuberculate and smooth forms (having the characteristics of one on one half and the other on the other half); and some double heads. The double heads are 45–75  $\mu\text{m}$  in length, having a L:W of 1.7–2.0. Their waist region is 9–12  $\mu\text{m}$  in length and is thin, only about one-third the width of the sclerite. The tubercles on the double heads are 8–10  $\mu\text{m}$  in height and rounded in shape. The cigar-shaped tentacular rods are elongate, measuring 62–140  $\mu\text{m}$  in length and having a L:W of 3–6, the larger ratio corresponding to the more elongate rods. The pinnular sclerites measure 45–60  $\mu\text{m}$  in length; the pharyngeals, 50–55  $\mu\text{m}$ . The coenenchymal sclerites consist primarily of double heads

(as described in the calyx) and a mixture of tuberculate and smooth, blade-like spindles.

*Comparisons.*—In a genus noted for its subtle and often difficult to define differences among species, it is refreshing to describe such a distinctive species, both in gross and sclerite morphology, albeit from only one specimen. As seen from Table 2, *N. lanceolata* is unique in having extremely long, thin, flat, smooth, blade-like calyx spindles and in having a unique branching arrangement. It is also noteworthy in having a white colony, narrow-waisted double heads, and large calyces.

*Etymology.*—The name is taken from the Latin *lanceolatus* (like a small light spear, lance-like), an allusion to the sharp-edged lance-like calyx spindles.

*Distribution.*—Known only from the type locality (Fig. 9).

*Nicella obesa* Deichmann, 1936

Figs. 9, 11

*Nicella obesa* Deichmann, 1936:217–218, pl. 37, figs. 1, 1a.

*Nicella guadalupensis*: Bayer, 1961:290 (in part: USNM 43789).

*Verrucella (Stellicella) obesa* (nom. nud.) Bayer & Cairns (Verrill), 2004: pl. 95, fig. 8, pl. 99, fig. 5 (*BL*-231).

*Verrucella obesa* (nom. nud.) Bayer & Cairns (Verrill), 2004: pl. 137, figs. 1, 1a (*BL*-231).

*Gorgonella obesa* (nom. nud.) Bayer & Cairns (Verrill), 2004: pl. 148, fig. 4, pl. 149, fig. 3 (*BL*-231).

*Material examined.*—*Alb*-2131, 1 colony, USNM 7091; *Alb*-2135, 1 colony, USNM 7100 and 7436; *CI*-37, 1 branch, USNM 1082126; *G*-691, 1 colony, USNM 53245; *G*-704, 1 colony, USNM 53051; *G*-706, 1 colony, USNM 52733; *G*-707, 1 colony, USNM 52732; *JS*-16, 1 dry branch, USNM 54300; *JS*-43, 5 colonies, USNM 54282; *JS*-102, 1 dry colony, 2 colonies in alcohol, USNM 43789, 50948; *JSL*-I-1501, 1 colony, USNM 1086751; *JSL*-I-2317, 1 colony and SEM stubs

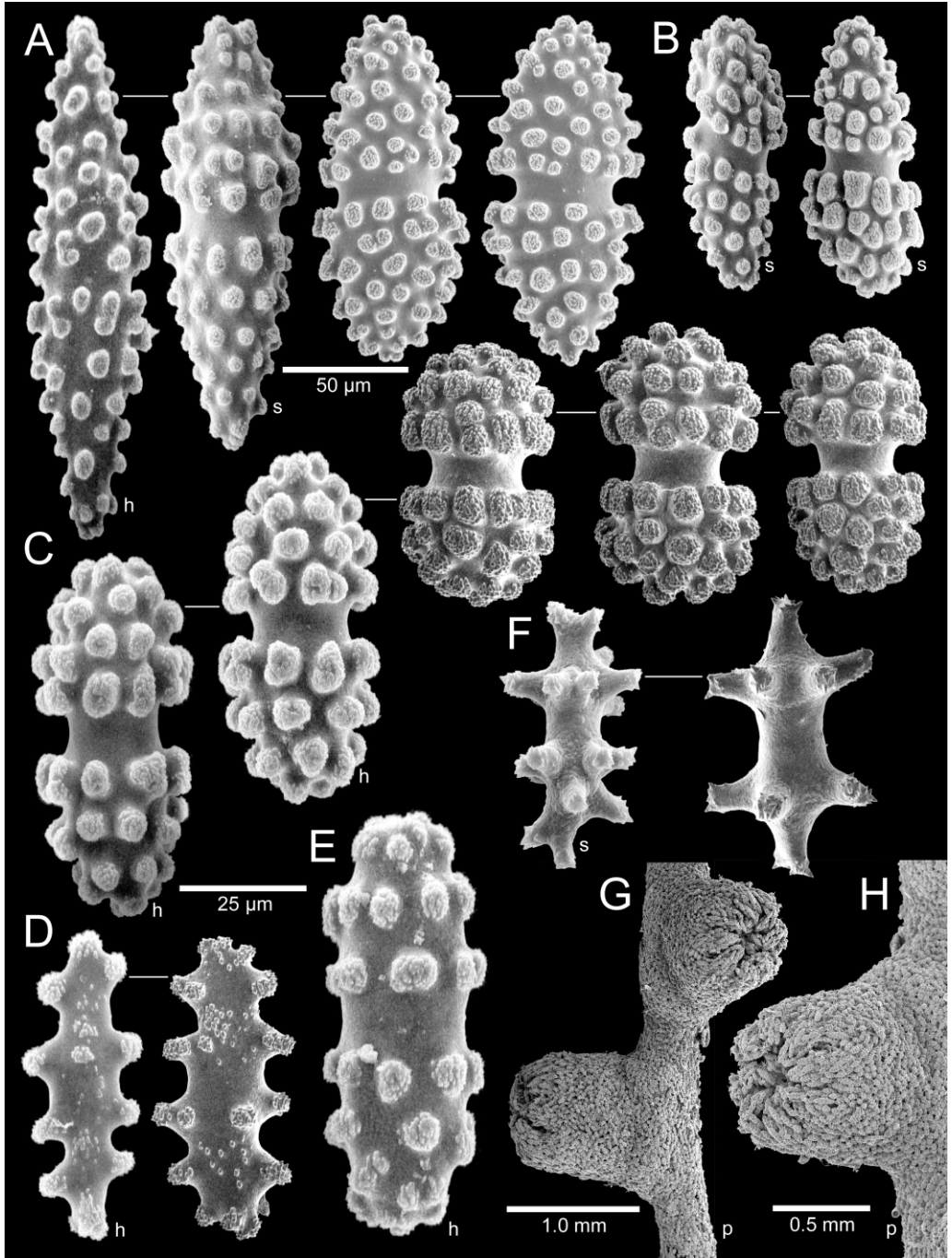


Fig. 11. A–H, Sclerites of *Nicella obesa* (sclerites marked with an h are from the holotype, with an s from SB-5191, with a p from P-1141, and unmarked are from JSL-2317): A, four spindles; B, two sclerites intermediate between spindle and double head; C, five double heads; D, two pinnular plates; E, a tentacular rod; F, two pharyngeal sclerites; G, H, whole polyps. Scale bars: A, B, 50 µm; C–F, 25 µm; G, 1 mm; H, 0.5 mm.

B2380 and B2390, USNM 84332; *JSL-I*-2587, 2 colonies, USNM 89194; *JSL-II*-809, 1 colony, USNM 1086752; *O*-1084, 2 colonies, USNM 53052; *P*-739, 2 colonies, USNM 52731; *P*-890, 5 colonies, SEM stub C1192, USNM 52737; *P*-891, 1 colony, USNM 53050; *P*-1140, 1 colony, USNM 1082127; *P*-1141, 1 branch, SEM stub C1190, USNM 53055; *SB*-3472, 4 branches, USNM 52736; *SB*-5191, 1 colony and SEM scan stub B10, USNM 52735; west coast of Barbados, 50–400 m, coll. Lewis, 22 Aug 1961, NRD2-1-103, 1 colony, SEM stub C1191, USNM 52533; off Barbados, depth unknown, coll. W. R. Bayley, 1905, 1 dry colony, USNM 53054; holotype (MCZ) and SEM scan stub B29 (USNM).

*Types*.—The holotype, consisting of several branches, is deposited at the MCZ (4744, original Verrill number 6405). An SEM sclerite preparation of the holotype is also deposited at the USNM (Bayer scan stub B29). Paratypes from five additional stations are also deposited at the MCZ (see Deichmann 1936).

*Type locality*.—*Blake*-231, 13°12'10"N, 61°17'18"W (off St. Vincent, Lesser Antilles), 174 m, bottom temperature 16.3°C.

*Description*.—Colonies are uniplanar, and irregularly dichotomously and rather densely branched. Most colonies are taller than wide, the largest colony (*Alb*-2135) being 38 cm in height and only 10 cm in width, with a basal diameter of 4.0 mm. Branch anastomosis occurs but is quite rare, sometimes the result of fusion of broken branches back to the main colony. The axis is yellow-grey in color and faintly longitudinally striate. The colony is homogeneously white, the sclerites being clear (colorless). Complete colonies are anchored by a white, spreading calcareous holdfast.

Calyces occur in opposite, alternating fashion on both edges of every branch, standing perpendicular to the branch, and separated from one another by 1.1–

2.0 mm, being more closely spaced on terminal branchlets. Calyces are cylindrical, ranging from 0.7–1.0 mm both in height and diameter, the variation in size probably a result of differential contraction during preservation.

Essentially, four types of sclerites occur in this species: girdled spindles, double heads, small plates (pinnules), and small (pharyngeal) spiny double stars (sensu Bayer et al. 1983: pl. 18, fig. 161), listed in order of abundance. The calyx body wall and tentacles consist primarily of rotund girdled spindles, most ranging from 0.11 to 0.17 mm in length (although some as long as 0.21 mm), with a range of L:W of 2.5–4.0. They occur two layers deep and are covered by an outer layer of double heads. The girdled, or bare, region at the center of the spindle is about 6 µm wide and is invariably present. The discrete tubercles on the spindles are about 12 µm in diameter. Double heads compose about 20% of the body wall sclerites. They are 50–75 µm in length and have a L:W of 1.6–2.3. They have a thick waist 6–9 µm long and about half as wide as the sclerite; their heads bear short, rounded to slightly clavate tubercles 7–8 µm in distal diameter and rarely more than 6 µm in height. The girdled tentacular rods are short and stubby: 77–100 µm in length (L:W = 2.2–2.9). The pinnular sclerites are small, elongate plates (53–62 µm in length, 20–25 µm in width), and fairly flat on both faces, but with four pairs of warty tubercles projecting laterally, each tubercle about 5 µm in diameter (Fig. 11D). The pharyngeal sclerites are about the same size as the pinnular plates, but they have a cylindrical shaft from which two whorls of spines project at each end, each spine up to 10 µm long. The coenenchyme of large-diameter branches that are not close to calyces is composed exclusively of double heads, sometimes up to six layers deep; the coenenchyme closer to calyces consists primarily of double heads (about 80–

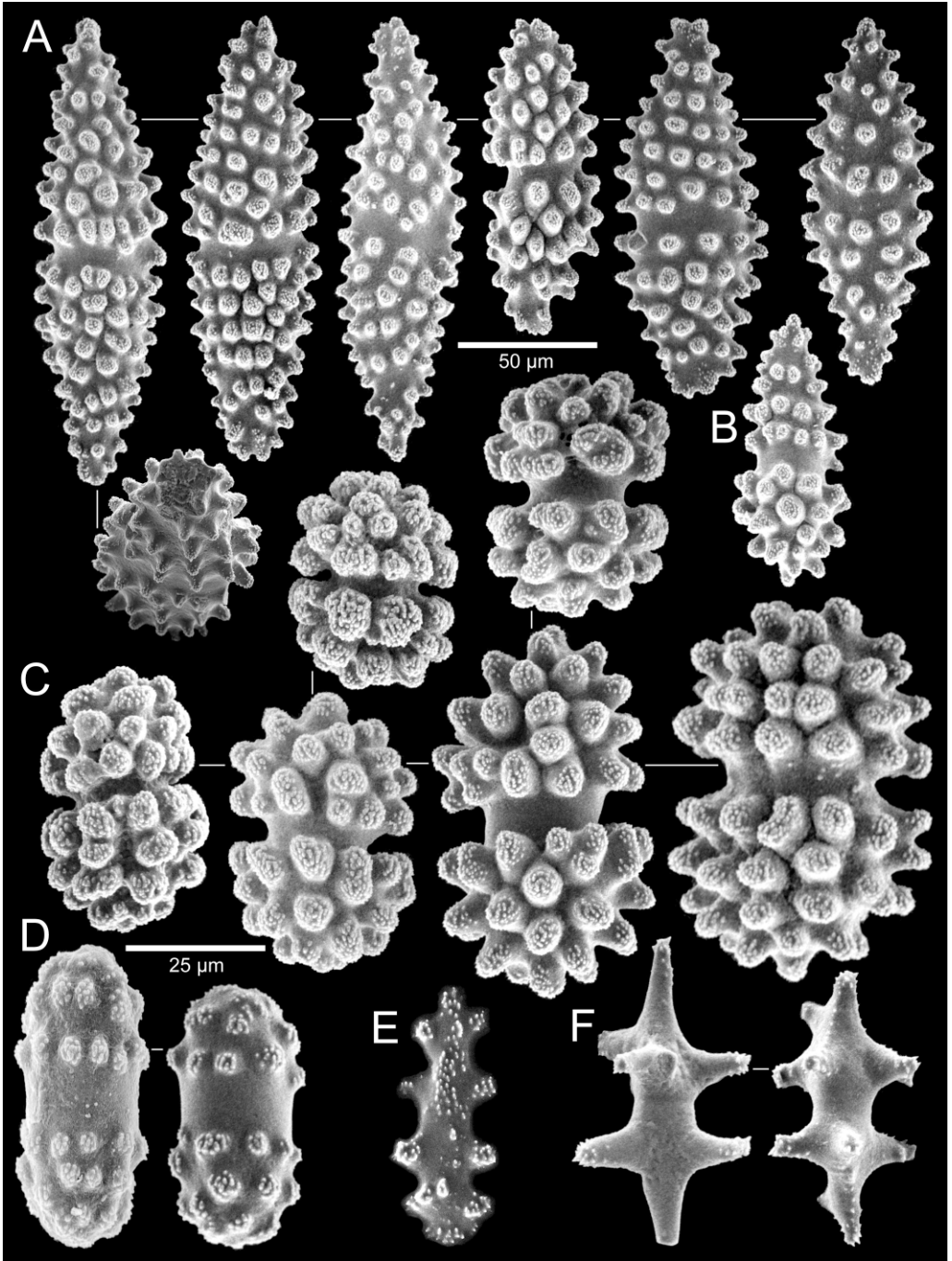


Fig. 12. A–F, Sclerites of *Nicella guadalupensis* (A–D, F, holotype; E, G-714): A, seven spindles, one view obliquely apical; B, a club; C, six double heads; D, two stout tentacular rods; E, a pinnular plate; F, two pharyngeal sclerites. Scale bars: A, B, 50  $\mu\text{m}$ ; C–F, 25  $\mu\text{m}$ .

90%) the remainder being spindles. In both calyx wall and coenenchyme, sclerites intermediate between double heads and girdled spindles occur ranging from 75–110  $\mu\text{m}$  in length, the girdled spindles seeming to be just an elongate version of the double head, both sclerite types having a bare middle region.

*Comparisons.*—*Nicella obesa* and *N. guadalupensis* are quite similar (see Key and Table 2), both species having short, robust rods with a low L:W and no flattened sclerites. *N. obesa* could be interpreted as a deep-water colorless variant of the shallow-water pigmented *N. guadalupensis*, but because the two species have been previously described, their names are retained in this account.

*Remarks.*—Half of the specimens examined hosted a large white commensal ophiuroid (*Asteroschema* sp.), in every case only one brittlestar occurring per colony. Small white anemones (*Amphianthus caribaea*) were also present on about one-third of the colonies, and a white barnacle (*Scapellum* sp.) was attached to about one-fifth of the colonies.

*Distribution.*—Bahamas, throughout Antilles from Cuba to Barbados, west of Isla Tortuga, Venezuela, and the north-west quadrant of the Gulf of Mexico (Fig. 9); 174–819 m, with one dubious record of 48 m (USNM 53052). This is deepest living species in the family.

*Nicella guadalupensis* (Duchassaing & Michelotti, 1860)

Figs. 12, 13

*Verrucella guadalupensis* Duchassaing & Michelotti, 1860:33, pl. 4, figs. 5–6.—Kölliker, 1865:140, pl. 14, fig. 5, pl. 19, figs. 4, 10–11.—Rossi, 1956:6 (type deposition).—Volpi & Benvenuti, 2003:59 (revised type deposition).—Bayer & Cairns (Verrill), 2004: pl. 34, fig. 8 a–m (type specimen).

*Nicella guadalupensis*: Kükenthal, 1924:378 (new comb.).—?Toeplitz, 1929: 350–354, text-fig. 22.—?Deich-

mann, 1936:218–220, pl. 36.—Bayer, 1954: 280 (listed); Bayer, 1956:F214, fig. 154–3; not Bayer, 1960:181 (= *N. goreauii*); Bayer, 1961:290 (in part: only USNM 44136, 43110).

*Verrucella galaxea* Bayer & Cairns (Verrill), nom. nud., 2004: pl. 14, fig. 10, pl. 36, figs. 5, 6, pl. 138, fig. 1.

*Verrucella bella* Bayer & Cairns (Verrill), nom. nud., 2004: pl. 14, fig. 2, pl. 36, figs. 7, 7a.

*Material examined.*—Lectotype; BA 7, 1 colony, USNM 44136; BL-277, 1 dry colony, MCZ 67265 (Verrill # 5995, type of "*V. bella*"); G-392, 2 branches, USNM 53512; G-713, 5 colonies, USNM 53071, 53243; G-714, 1 colony, SEM C1195-1196, USNM 53244; JS-16, 1 dry colony, USNM 54299; JSL-I-1358, 1 colony, USNM 1086727; *Nekton beta*, off Queen's Cay, Belize, 122 m, 25 Oct. 1972, 1 colony, USNM 1086728; O-5016, 1 dry colony, USNM 53251; P-691, 2 large colonies, USNM 53238; P-692, 1 colony and SEM scan stub B9, USNM 53242; P-709, 1 branch, USNM 53241; P-736, 2 colonies in alcohol and one dry, USNM 53251, 1086725; P-854, 4 colonies, USNM 53068; P-855, 1 colony, USNM 53229; P-856, 1 colony, USNM 53231; P-857, 1 colony, USNM 53234; P-887, 6 colonies, USNM, 53235, 53509; P-969, 1 colony and SEM scan stub B8, USNM 53232; P-1387, 1 dry colony, USNM 53253; P-1395, branches, USNM 1086726; SB-3496, 1 branch, USNM 53249; 1.6 km north of San Juan, Puerto Rico, 165 m, Feb. 1958, 1 dry colony, USNM 1010795; West Indies, depth unknown, 1 dry colony, USNM 43110.

*Types.*—Holotype: Turin N. C. 243 (Rossi 1956) but Volpi & Benvenuti (2003) cite a lectotype at the MSNT (351) and a paralectotype at the MZUF (139).

*Type locality.*—Guadeloupe, Lesser Antilles, depth unknown.

*Description.*—Colonies are uniplanar and densely branched, up to 58 cm tall

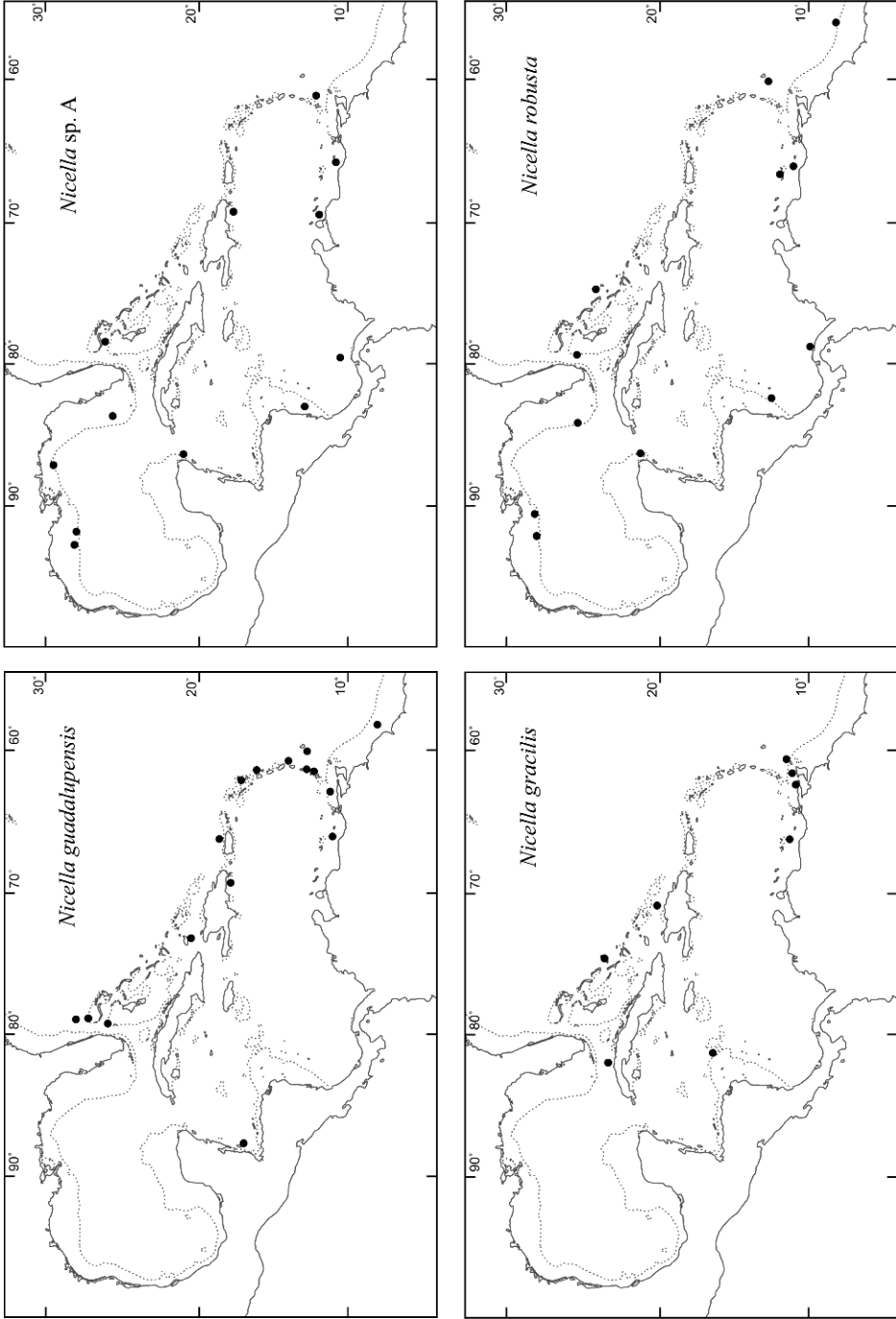


Fig. 13. Distribution maps of *Nicella guadalupensis*, *N. sp. A*, *N. gracilis*, and *N. robusta*.

and equally broad (USNM 53250), and having basal branches up to 8 mm in diameter. Branching is dichotomous basally, changing to irregularly pinnate distally; branch anastomosis occurs but is rare; distal branches are quite delicate. The axis is pale orange and smooth. Most colonies are pale to dark orange with white calyces, although the distal 1–3 cm of terminal branches are exclusively white; in pale orange colonies, the larger-diameter branches are usually a darker shade of orange. Complete colonies are anchored by a massive, white, encrusting calcareous holdfast.

Calyces are closely spaced, occurring in opposite and roughly alternating fashion on both edges of all branches. Calyces are 0.7–0.8 mm in height and 0.7–1.0 mm in basal width, shaped as truncated cones.

The sclerites of the calyx body wall consist of slightly flattened (but not plate-like), robust girdled spindles and smaller double heads in a ratio of about 4:1. The spindles are relatively short (0.10–0.20 mm in length) and thick, having a L:W of 2.5–3.5 and a well-defined waist region 6–10  $\mu\text{m}$  wide and tubercles up to 11  $\mu\text{m}$  in height. Occasionally these sclerites have blunt tips and thus resemble rods. Clubs are rare. The double heads are 35–80  $\mu\text{m}$  in length, having a L:W of 1.5–1.9. Their waist region is 5–9  $\mu\text{m}$  in length and 50–60% of the width of the sclerite. The tubercles on the double heads are 7–9  $\mu\text{m}$  in height and rounded to clavate. The blunt, girdled tentacular rods are short and stubby, ranging from 47–90  $\mu\text{m}$  in length and having a L:W of 1.8–3.0. The flat pinnular sclerites are relatively short: 40–50  $\mu\text{m}$  in length, and the pharyngeals are of equal length. The coenenchymal sclerites also consist of robust spindles and double heads of the same size and shape described for the body wall, the spindles constituting about 70% of those sclerites.

*Comparisons.*—*Nicella guadalupensis* is very similar to *N. obesa* (Table 2), almost

identical in sclerite morphology, and could be interpreted as a shallow-water, pigmented morph of the deeper *N. obesa*; *N. guadalupensis* is not known from deeper than 400 m and *N. obesa* is rarely collected shallower than 400 m. But, because both species have been described previously, their names and integrity are preserved in this account. Aside from depth of capture and color, *N. guadalupensis* differs from *N. obesa* in having smaller pinnular scales and stubbier tentacular rods.

*Remarks.*—Bayer (1961) used the name *N. guadalupensis sensu lato*; the 24 specimens he listed for this species are herein re-identified as: *N. goreau*, *americana*, *obesa*, *deichmannae*, *robusta*, *spicula*, and *hebes*; only 2 of the original 24 are still recognized as *N. guadalupensis*. In fact, Bayer's (1961) figures of *N. guadalupensis* are based on a future paratype of *N. goreau*, which is herein reidentified as *N. americana*. Deichmann's (1936) 10 records of *N. guadalupensis* are probably similarly diverse, but only one has been re-examined, MCZ 4751, which is herein re-identified as *N. deichmannae*.

Most large colonies support at least one to several ophiuroids *Hemieuryale pustulosa* firmly entwined in its branches. The ophiuroid is the same color as the octocoral and bears small white nodules about the same size and color of the calyces. Small anemones and bivalves also attach to the branches.

*Distribution.*—Bahamas and throughout Antilles (but not Cuba) to Cariaco Basin, Venezuela; off Guyana; off Belize (Fig. 13); 27–395 m.

#### *Nicella gracilis*, new species

Figs. 1D, 13, 14

*Material examined* types.—Holotype: P-848, colony and SEM stubs B2368 and C1193-1194, USNM 53039. Paratypes: BL-14, 2 dry colonies, MCZ 5022 (Verrill #6042); JSL-I-1501, 1 colony, USNM 1086750; O-3623, 2 colonies,



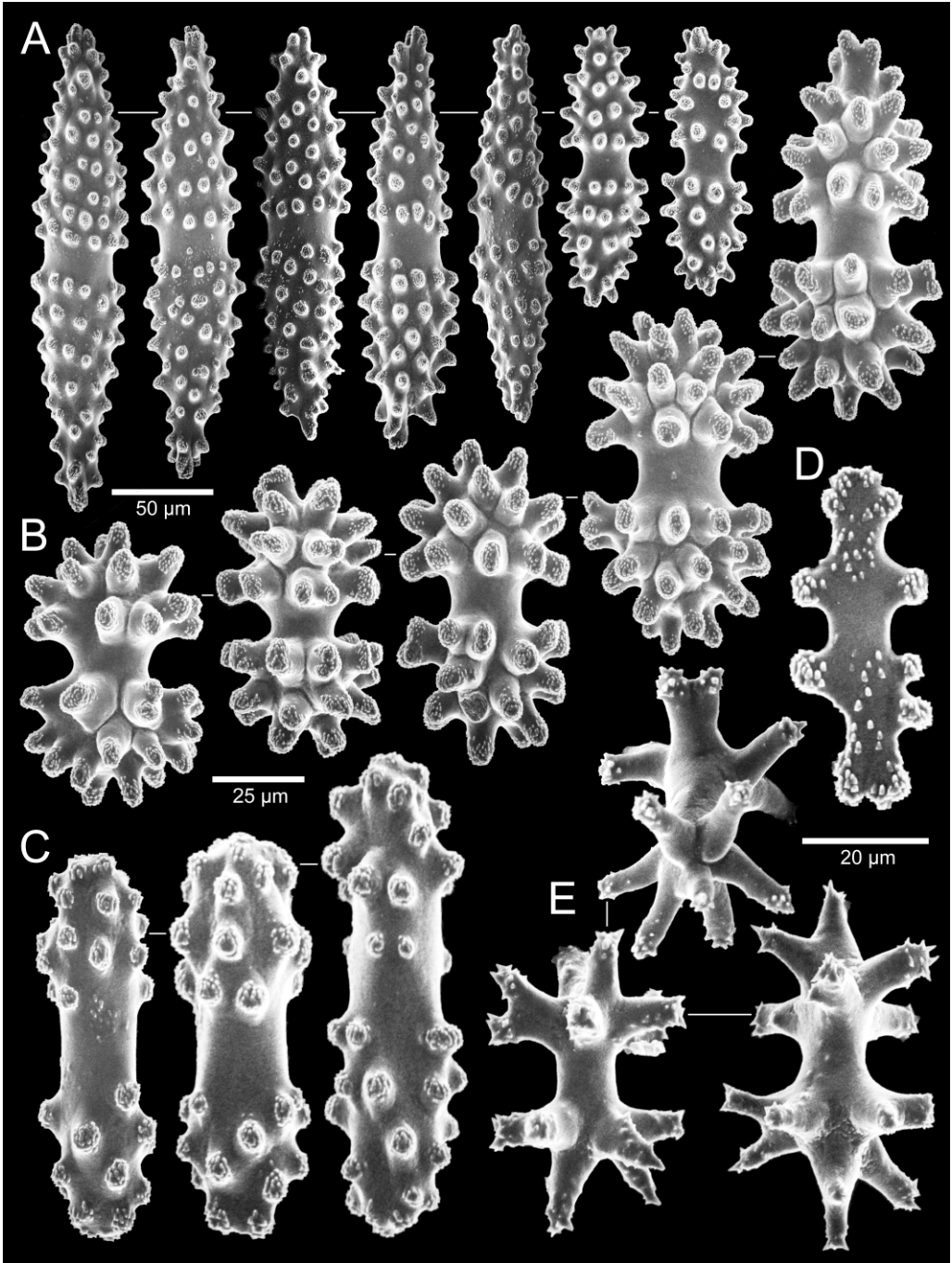


Fig. 14. A–E, Sclerites from the holotype of *Nicella gracilis*: A, seven spindles; B, five double heads; C, three tentacular rods; D, a pinnular plate; E, three pharyngeal sclerites. Scale bars: A, 50  $\mu\text{m}$ ; B, C, 25  $\mu\text{m}$ ; D, E, 20  $\mu\text{m}$ .

USNM 53037; *O*-5021, 1 branch, USNM 53038; *O*-5432, 4 colonies, USNM 53036; *P*-705, 9 dry colonies, 10 alcohol colonies and SEM B2311, USNM 53035 and 94499; *P*-737, 1 branch, USNM 53511.

*Type locality*.—*P*-848: 11°22'N, 61°26.4'W (north of Trinidad), 146 m.

*Description*.—Colonies are uniplanar to slightly bushy in shape, the holotype being bushy and 17 cm tall, whereas the largest colony (*P*-705) is uniplanar, measuring 24 cm in height and 20 cm wide. Few colonies in the type series remain attached, but intact colonies are anchored by a white calcareous holdfast; the largest basal branch diameter is 6.2 mm (*O*-3623). As in *N. obesa*, colonies are homogeneously white, the sclerites clear, and all main branches bear two longitudinal solenial canals that are larger than the others.

Calyces occur in opposite, alternating fashion on both edges of every branch. They are cylindrical to conical in shape and rarely more than 0.8 mm in height, the conical shape perhaps the result of dried preservation.

The calyx body wall consists primarily of slender girdled spindles ranging from 0.08 to 0.25 mm in length and have an L:W range of 3.6–6.5, sclerites over 0.20 mm being common. The bare middle section is 16–20  $\mu$ m in width and the tubercles are 6–8  $\mu$ m in diameter and about 8  $\mu$ m in height. In some cases (but never more than 20% of the sclerites) flattened rods of similar size occur, but these sclerites have rounded tips. Double heads are also present in the outer layer of the calyx body wall, composing about 20–30% of the sclerites. These sclerites are 45–90  $\mu$ m in length, have a L:W of 1.6–2.2, and a robust waist 8–12  $\mu$ m in length and about 40% the width of the sclerites, this percentage smaller than in *N. obesa* only because the tubercles are so tall in this species. The ends of the double heads are covered with prominent, finely granulated tubercles 10–14  $\mu$ m in height and

6–12  $\mu$ m in distal diameter, occasionally bifid, approximating the classification of a double star (sensu Bayer, et al. 1983: pl. 18, fig. 162). These double heads are easily distinguished from spindles of the same size range by their prominent tubercles. The girdled tentacular rods are 82–102  $\mu$ m in length, having a L:W of 3.1–3.6. The pinnular sclerites are 45–62  $\mu$ m in length; the pharyngeals, 50–65  $\mu$ m. The coenenchyme of distal branches consists of girdled spindles and double heads but the ratio is opposite that found in the calyx body wall, i.e., about 60% double heads and 40% spindles. The coenenchyme of large-diameter basal branches consists entirely of double heads.

*Comparisons*.—*Nicella gracilis* is similar to *N. obesa* in various ways including color (Table 2) but differs in having smaller, cone-shaped calyces (may be due to preservation); more elongate (often over 0.20 mm in length and up to 0.25 mm) and more slender spindles (L:W 3.6–6.5 vs. 2.5–4.0 for *N. obesa*); and in having highly sculptured double heads, the tubercles up to 12  $\mu$ m in height and sometimes bifid.

*Remarks*.—White ophiuroids identified as *Asteroschema laeve* are often found living on colonies of *N. gracilis*.

*Etymology*.—The species name *gracilis* (Latin for slender) is in reference to the long, slender, girdled spindles of this species, in contrast to the stouter spindles found in *N. obesa*.

*Distribution*.—Antilles from north of the Dominican Republic to Cariaco Basin, Venezuela; off Thunder Knoll, Honduras; and Bahamas (Fig. 13); 60–481 m.

*Nicella robusta*, new species

Figs. 1F, 13, 15

*Nicella guadalupensis*: Bayer, 1961:290 (in part: USNM 49437).

*Material examined* types.—Holotype: *P*-736, colony and SEM C1199 and scan

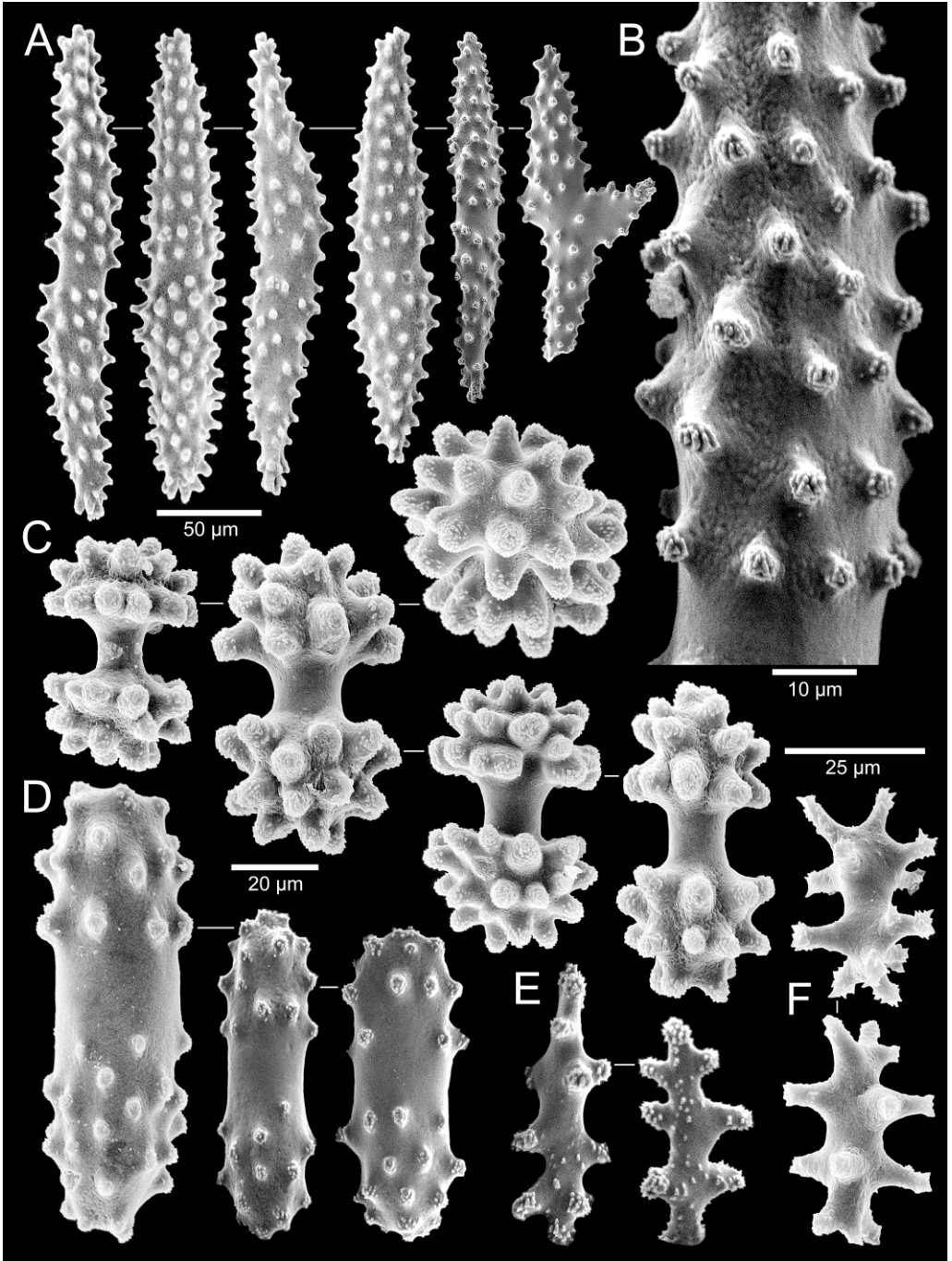


Fig. 15. A–F, Sclerites from the holotype of *Nicella robusta*: A, six spindles; B, enlargement of a spindle showing tubercles; C, five double heads, one in apical view; D, three tentacular rods; E, two pinnular plates; F, two pharyngeal sclerites. Scale bars: A, 50 µm; B, 10 µm; C, E, F, 25 µm; D, 20 µm.

stub B12, USNM 53048. Paratypes: *Alb*-2354, 4 colonies, USNM 49437; BA 37, 1 colony, USNM 53031; *G*-713, 1 colony, USNM 53024; *JSL-I*-1506, 1 colony, USNM 1086748; *JSL-I*-2582, 2 colonies, USNM 89390; *O*-3608, 1 branch, SEM scan stub 59, USNM 53045; *O*-4305, 1 colony, USNM 53025; *P*-424, 2 colonies, USNM 53049; *P*-592, 2 colonies, USNM 53021; *P*-736, 3 alcohol colonies and 2 dry colonies, USNM 53047, 53082, and 53251; *P*-741, 1 branch, USNM 53239; *P*-1303, 4 colonies, USNM 1086747; Scripps *J*-647, 1 colony, USNM 51597; SOFLA 35, 1 branch and 1 dry branch, USNM 74844 and 87011; SOFLA 36, dry branches, USNM 87012.

*Type locality*.—10°57'N, 65°52'W (Cariaco Basin just west of Isla La Tortuga, Venezuela), 69–155 m.

*Description*.—Colonies are uniplanar, the holotype an intact colony 30 cm tall, 12 cm wide, and 4 mm in basal branch diameter, having a calcareous holdfast 10 mm in diameter. Branching is dichotomous followed by loose pinnate. The axis is bronze in color; the colony is uniformly light orange, with the calyces and distal branches a paler shade of orange (almost white). Calyces are small, about 0.6 mm in diameter and 0.4 mm in height, and mound-shaped.

The sclerites of the calyx body consist of large spindles, double heads, small plates, and needles, the latter two classes of sclerites being quite rare. The spindles are 0.15–0.37 mm in length but rarely exceed 0.26 mm in length, having a L:W of 4–6. They have pointed tips, occasionally bifid, and bear sparse but prominent spine-like tubercles up to 6  $\mu$ m in height. The double heads are 50–70  $\mu$ m in length, some extraordinary examples up to 100  $\mu$ m, and have a L:W of 1.5–2.0. Their waist region is 9–11  $\mu$ m in length and is thin, about 30–40% the width of the sclerite. The tubercles on the double heads are tall (8–10  $\mu$ m) and conical in shape. The plates are flat, pointed, unornament-

ed sclerites with serrate edges, measuring 0.13–0.17 mm in length. Needles are 0.16–0.23 mm in length, have a L:W of 8–11, and are sparsely granulated. The stubby tentacular rods are fairly smooth, 80–140  $\mu$ m in length, and have a L:W of 3–4. Pinnular sclerites are 45–55  $\mu$ m in length; the pharyngeals are 40–55  $\mu$ m. The coenenchymal sclerites consist of a mixture of spindles and double heads as described in the calyx wall.

*Comparisons*.—*Nicella robusta* is distinctive in having rather long (up to 0.37 mm), sharply pointed spindles that are sparsely covered with spine-like tubercles. Needles and small plates are also present in small numbers (see Table 2).

*Etymology*.—The species name *robusta* (Latin for strong, robust) is an allusion to the large spindles found in this species.

*Distribution*.—Northeastern Gulf of Mexico, Bahamas, Caribbean, off Guyana (Fig. 13); 110–259 m.

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