

FEB 05 2001

# A New Species of the Soft Coral Genus *Eleutherobia* Pütter, 1900 (Coelenterata: Alcyoniidae) from the Tonga Islands

by

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The soft coral genus *Eleutherobia* (family Alcyoniidae) was previously known to contain fifteen valid species, and is distributed from eastern and southern Africa to the western Pacific. A new species is here described from Tonga, thereby making a total of sixteen species, and extending the known range of the genus approximately 3000 km to the southeast into the central South Pacific. The new taxon is superficially similar to *Eleutherobia grayi* (J. A. Thomson and Dean, 1931), from the Indonesian and Ryukyuan archipelagos, but is distinguished from it and all other species by a unique complement of sclerite types.

The Indo-Pacific and southern African soft coral genus *Eleutherobia* is noteworthy for recently discovered, bioactive, natural products that have been isolated from two Indian Ocean species. These compounds include novel diterpenes (Hooper et al. 1997) and the cytotoxic agent eleutherobin (Long et al. 1998). The latter compound has recently been found to have anticancer properties and has recently been synthesized (Xiao et al. 1999). The diterpenes are produced by *Eleutherobia lutea* Benayahu and Schleyer, 1995, from the east coast of South Africa, and eleutherobin comes from an undescribed species off the west coast of Australia.

Of the fifteen described species that are considered valid for the genus *Eleutherobia*, twelve inhabit the Indo-West Pacific from East Africa to Japan and Indonesia, and three are considered endemic to southern Africa [Verseveldt and Bayer (1988) and the present paper]. Verseveldt and Bayer (1988) provided a taxonomic revision of the genus *Eleutherobia*, Williams (1992a) reviewed the southern African species, and Benayahu and Schleyer (1995) described a new species from South Africa. Color photographs of living soft corals in the genus are provided by Williams (1996:34) and Benayahu and Schleyer (1995:2).

A recently discovered species from Tonga is here described. It differs from other members of the genus by having a sclerite complement that includes very slender capstans with thin radiating whorls of tubercles, a relatively large number of crosses > 0.10 mm in length (many of which have elongated tapering points), and a scarcity of triradiate forms or needle-like spindles. The addition of the new species makes a total of sixteen species of *Eleutherobia* recognized as valid—three from southern Africa and thirteen from the Indo-West Pacific.

## METHODS

Material was collected by SCUBA and preserved in 70% ethanol. Sclerites were isolated using sodium hypochlorite. Micrographs were made using a Kodak MDS100 digital video camera and a

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Wild M400 photomicroscope. Scanning electron micrographs were made on Hitachi S-510 and Leo 1400 Series scanning electron microscopes. Abbreviations used in the text are as follows: CAS (California Academy of Sciences, San Francisco), CRRF (Coral Reef Research Foundation, Palau).

## SYSTEMATIC ACCOUNT

Family Alcyoniidae Lamouroux, 1812

### *Eleutherobia* Pütter, 1900

*Eleutherobia* Pütter, 1900:449. Verseveldt and Bayer, 1988:27. Williams, 1992:306.

*Nidalia* (in part): *non* Gray, 1835.

*Bellonella* (in part): *non* Gray, 1862.

*Metalcyonium* (in part): *non* Pfeffer, 1889.

**DIAGNOSIS.** — Alcyoniid soft corals with colonies digitiform, finger-shaped, often conical and tapering, rarely multilobate. Polyps monomorphic. Calyces absent, although retracted polyps often form low rounded to conspicuous protuberances. Sclerites mostly derived from radiates, although spindles, crosses, barrels, or tuberculate spheroids may also be present.

**TYPE SPECIES.** — *Eleutherobia japonica* Pütter, 1900, by monotypy.

**DIVERSITY AND DISTRIBUTION.** — Sixteen species of the Indo-West Pacific (southern and eastern Africa to Japan and Tonga).

### *Eleutherobia zanahoria* sp. nov.

Figs. 1–8

**MATERIAL EXAMINED.** — **HOLOTYPE:** CAS 118501, station number CRRF #OCDN 5464-X, Tonga, southwest of Vavau, south side of Kitu channel, a small channel between Kitu Island and north side of Nuapapu Island (18° 41.25'S, 174° 04.05'W), 25–30 m depth, 12 November 1997, collected by Coral Reef Research Foundation, one whole specimen, 64 mm in length. **PARATYPES:** CAS 118502, same data as holotype, one whole specimen, 63 mm in length. CAS 118503, same data as holotype, one specimen cut in half longitudinally, 53 mm in length.

**DIAGNOSIS.** — Alcyoniid soft corals with digitiform to lobate colony shape. Several finger-like lobes may be united by a common basal holdfast. Stalk very short, polyps distributed over approximately 95% of each colony. Sclerites are radiates, crosses, and irregular forms presumably derived from radiates; some crosses with finely attenuated tips. Polypary sclerites relatively gracile, 0.04–0.12 mm long; holdfast and stalk sclerites more robust, 0.07–0.16 mm long. Polyp sclerites absent. External coenenchymal color carrot orange throughout. Sclerites pale yellow-orange.

**DESCRIPTION.** — **Growth form and size:** The wet-preserved holotype is unbranched and finger-shaped, elongate conical, gradually tapering from proximal base to distal end. The apex is gently rounded. The basal holdfast has the largest width (20 mm), while the apex region has the smallest width (5 mm). The polypary comprises over 95% of the total colony length, as the polyps begin to appear immediately above the holdfast (Fig. 1). Wet-preserved paratype CAS 118702 is 63 mm in length, and lobate with four terminal lobes arising from two trunks that are unified into a single trunk and holdfast at the base (Fig. 2). The widest portion of the specimen is in the holdfast region (31 mm), while the narrowest lobe is 4 mm in width just below its apex. The lobes vary from 8 to 28 mm in length. They are mostly cylindrical in shape and slightly curved with gently rounded ends. Wet-preserved paratype CAS 118503 is 53 mm in length and similar in shape to the holotype. The widest portion at the base measures 9 mm, while the narrowest portion near the apex is 3 mm in width.



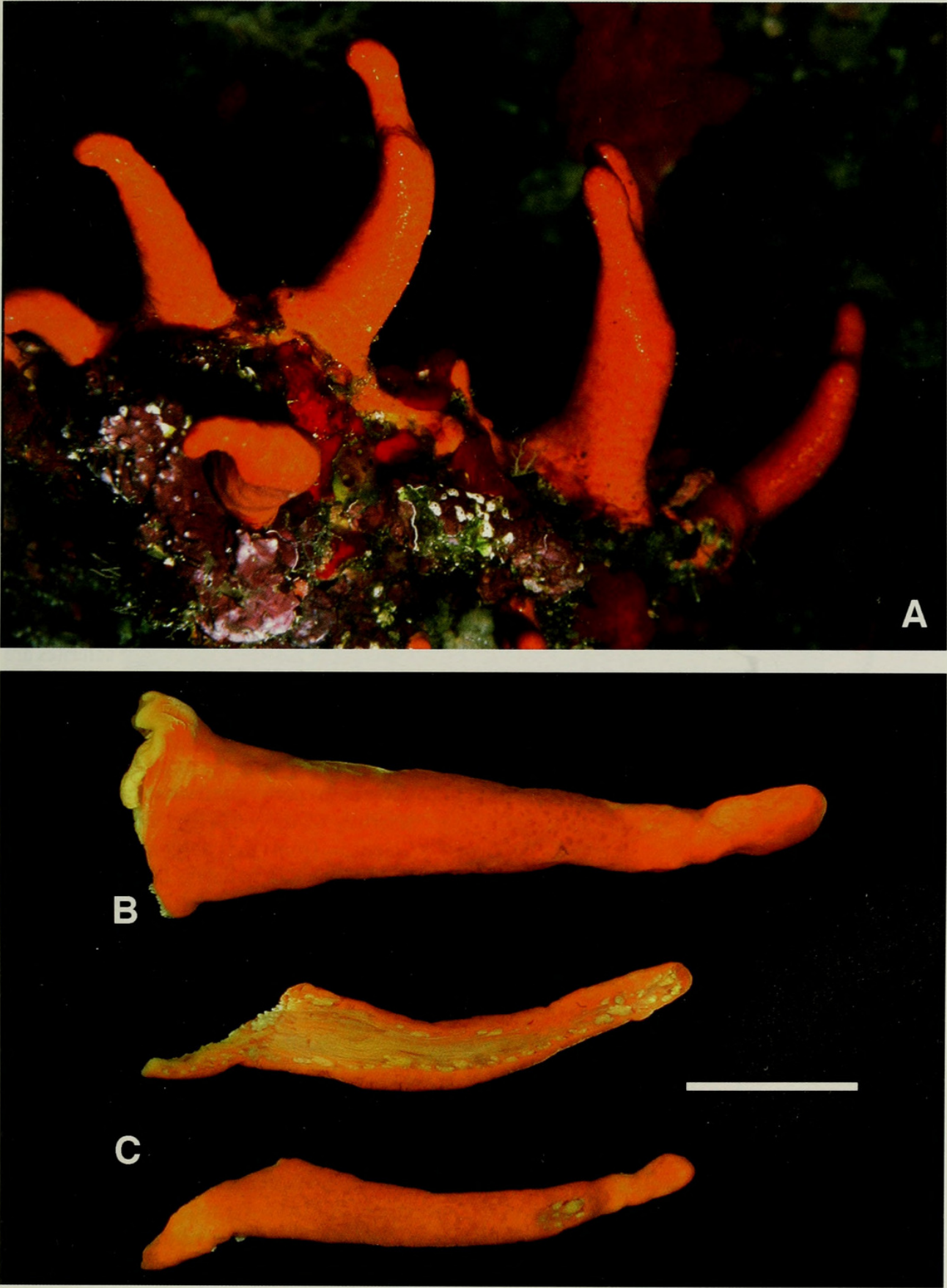


FIGURE 1. *Eleutherobia zanahoria* sp. nov. A. Underwater photograph of living soft corals at the type locality. Photograph by Pat Colin, courtesy of the Coral Reef Research Foundation, Palau. B. Wet-preserved holotype (CAS 118501), 64 mm in length. C. Wet-preserved paratype (CAS 118503), 53 mm in length; cut longitudinally into two halves; scale bar = 16 mm.



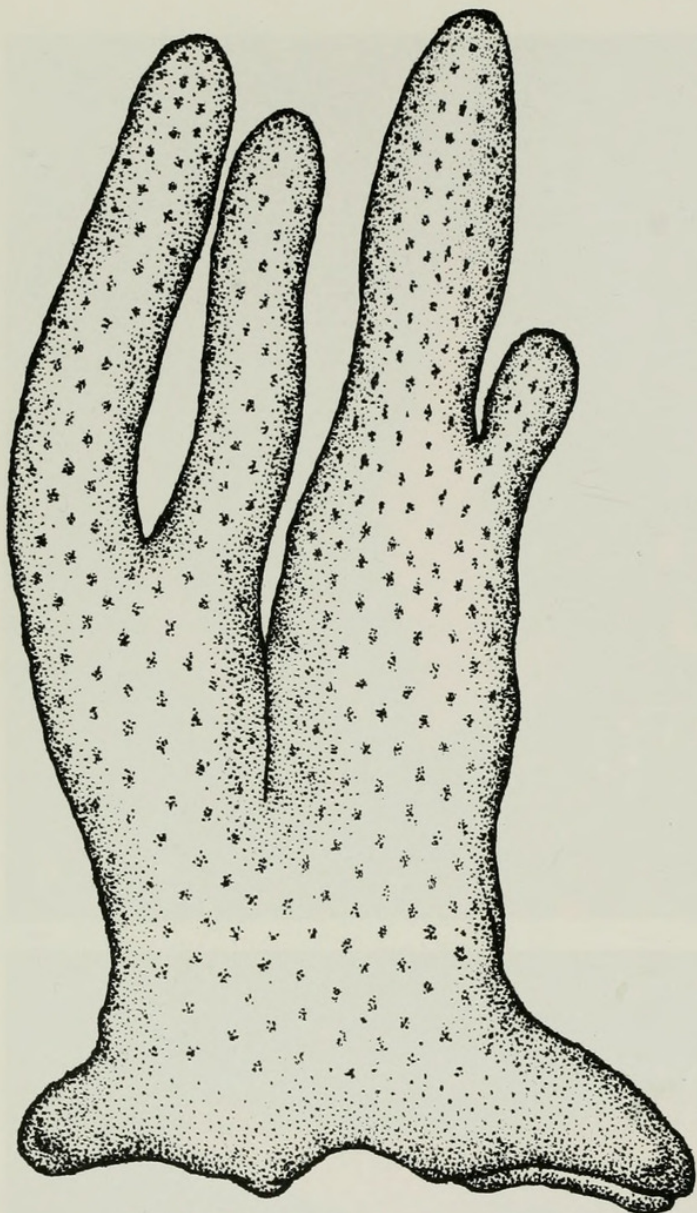


FIGURE 2. *Eleutherobia zanahoria* sp. nov. Paratype (CAS 118502); maximum length 63 mm.

(Fig. 1C). In both paratypes, as in the holotype, polyps appear immediately above the holdfast region, so that it is difficult to distinguish a conspicuous stalk region.

**Polyps.** The polyps are retracted into the colonies in all specimens and are thus not observable. A piece of surface coenenchyme was removed in paratype CAS 118503 to show the arrangement of several retracted polyps (Fig. 3). A single polyp that was isolated from paratype CAS 118503 and dissolved in sodium hypochlorite, revealed no sclerites in the anthocodial region or polyp walls. Calyces are absent, the retracted polyps form recessed slits or depressions on the surface of the polypary, or they are flush with the surrounding polypary surface.

**Sclerites.** The sclerites are densely set in the surface and subsurface coenenchyme of the polypary and holdfast region, as well as in the deep interior of the holdfast region. Sclerites are absent from the polyps and walls of the gastric cavities. The sclerites are radiates, crosses, and irregularly-shaped forms that are presumably derived from radiates, 0.04–0.17 mm in length. The sclerites of the polypary are more gracile and, for the most part, somewhat smaller than sclerites of the stalk and holdfast region. Sclerites from the polypary surface are mostly slender radiates, 0.05–0.09 mm in length (Figs. 4A, 5). Sclerites from the subsurface of the polypary are similar radiates, including some crosses and irregular forms, 0.04–0.12 mm in length (Figs. 5,

6B). Sclerites from the surface of the holdfast region are relatively robust radiates, crosses, and irregular forms, 0.07–0.17 mm long (Figs. 4B, 7). Sclerites from the deep interior of the holdfast region are robust, mostly irregular forms derived from and similar to radiates, with some radiates and crosses, 0.08–0.16 mm long (Figs. 6A, 7).

**Color.** The coenenchyme is vivid orange throughout (Fig. 1); polyps are creamy white. Sclerites are pale orange or yellowish, some are colorless.

**ETYMOLOGY.** — The specific epithet is derived from the Spanish, *zanahoria* (a carrot); in reference to the carrot-like appearance and color of this soft coral.

**DISTRIBUTION.** — Known from the type locality—the Tonga Islands in the central, South Pacific Ocean (Fig. 8). This species is also reported to occur on the Great Barrier Reef, Queensland, Australia (P. Alderslade, pers. comm.).



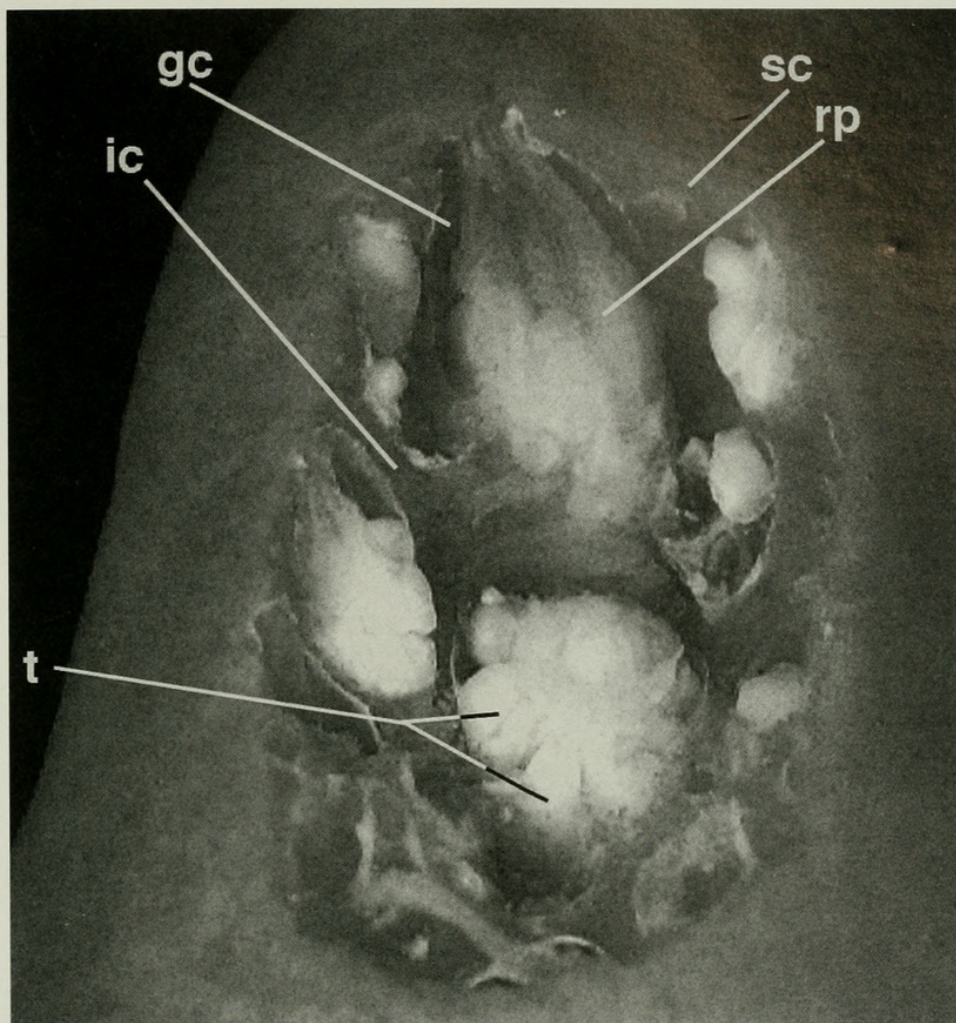


FIGURE 3. *Eleutherobia zanahoria* sp. nov. Micrograph of paratype (CAS 118503) with portion of surface coenenchyme removed, showing interior of colony and several retracted polyps. Abbreviations: gc - gastric cavity; ic - interior coenenchyme; rp - retracted polyp; sc - surface coenenchyme; t - tentacle. Scale bar = 1.3 mm.

## DISCUSSION

Species of the genus *Eleutherobia* closely resemble those of another Indo-West Pacific genus, *Paraminabea* Williams and Alderslade, 1999. The two taxa differ however, in that species of *Eleutherobia* are monomorphic, while those of *Paraminabea* have dimorphic polyps (Williams 1992b:5, fig. 2C; Williams and Alderslade 1999:347, fig. 6B). Unfortunately, siphonozooids are often very difficult to observe in preserved material. This circumstance has been at least partly responsible for the misidentification of soft coral material in the past, and will no doubt result in similar mistakes being made in the future. Thin sectioning of the surface and subsurface coenenchyme of the polypary of the soft coral in question, together with the microscopic examination of these sections, is often necessary to detect siphonozooids in tightly contracted and retracted preserved material.

Of the twenty valid species of the genus *Eleutherobia*, *E. zanahoria* sp. nov. is superficially most similar to *Eleutherobia grayi* (J. A. Thomson and Dean 1931), redescribed by Verseveldt and Bayer (1988:33), from Indonesia and the Ryukyu Islands. The two species can be differentiated as follows. In wet-preserved specimens of *E. grayi*, the retracted polyps often form low rounded, to more pronounced and mammiform, to conical protuberances on the surface of the polypary. In *E. zanahoria* sp. nov., on the other hand, retracted polyps in preserved specimens or retracted living animals, appear as shallow slits or pits, or are flush with the surface of the polypary (Fig. 1). Although sclerite size is simi-



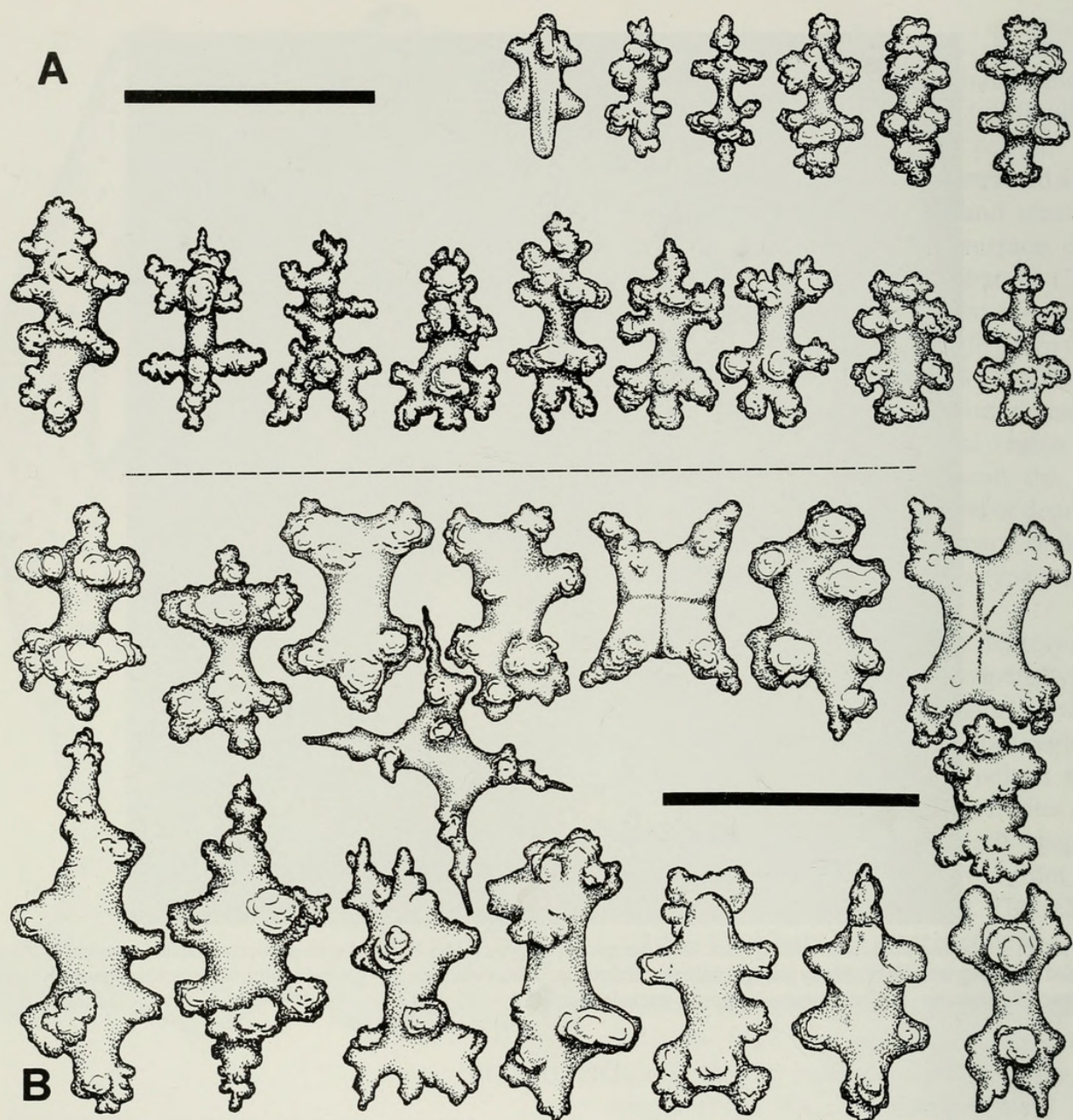


FIGURE 4. *Eleutherobia zanahoria* sp. nov. A. Sclerites from the surface of the polypary. B. Sclerites from the surface of the holdfast region of the stalk. Scale bars = 0.1 mm.

lar in both species, the complement of sclerites differs. In *E. grayi*, triradiates are relatively common and the crosses (quadriradiates) that are found, are relatively small (< 0.06 mm long), and have short and knobby or truncated rays (Verseveldt and Bayer 1988:93, fig. 24). By comparison, in *E. zanahoria* sp. nov., triradiates are rare or absent, and many crosses are relatively large (up to 0.14 mm in length), and have finely tapered and acute-tipped rays (Figs. 4B, 5A, 6A, 7A–B, 7F). Finally, in regards to coloration, the two species differ in that *E. grayi* is bicolored (red or red-orange with yellow retracted polyp mounds, while *E. zanahoria* sp. nov. is uniform bright orange throughout (Fig. 1).



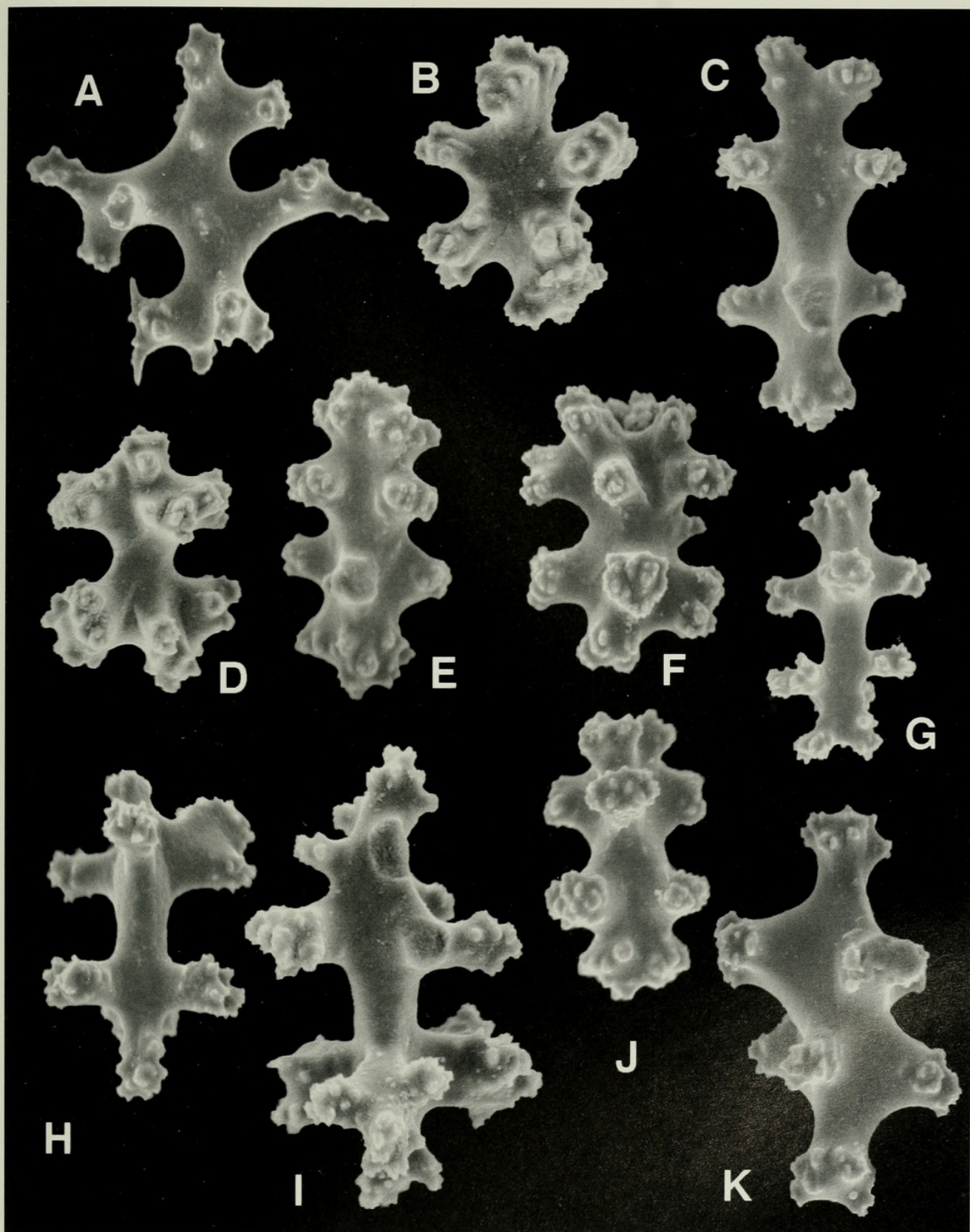


FIGURE 5. *Eleutherobia zanaoria* sp. nov. Scanning electron micrographs of sclerites from the polyparium. A. 0.09 mm; B. 0.05 mm; C. 0.07 mm; D. 0.05 mm; E. 0.07 mm; F. 0.06 mm; G. 0.06 mm; H. 0.06 mm; I. 0.06 mm; J. 0.06 mm; K. 0.09 mm.



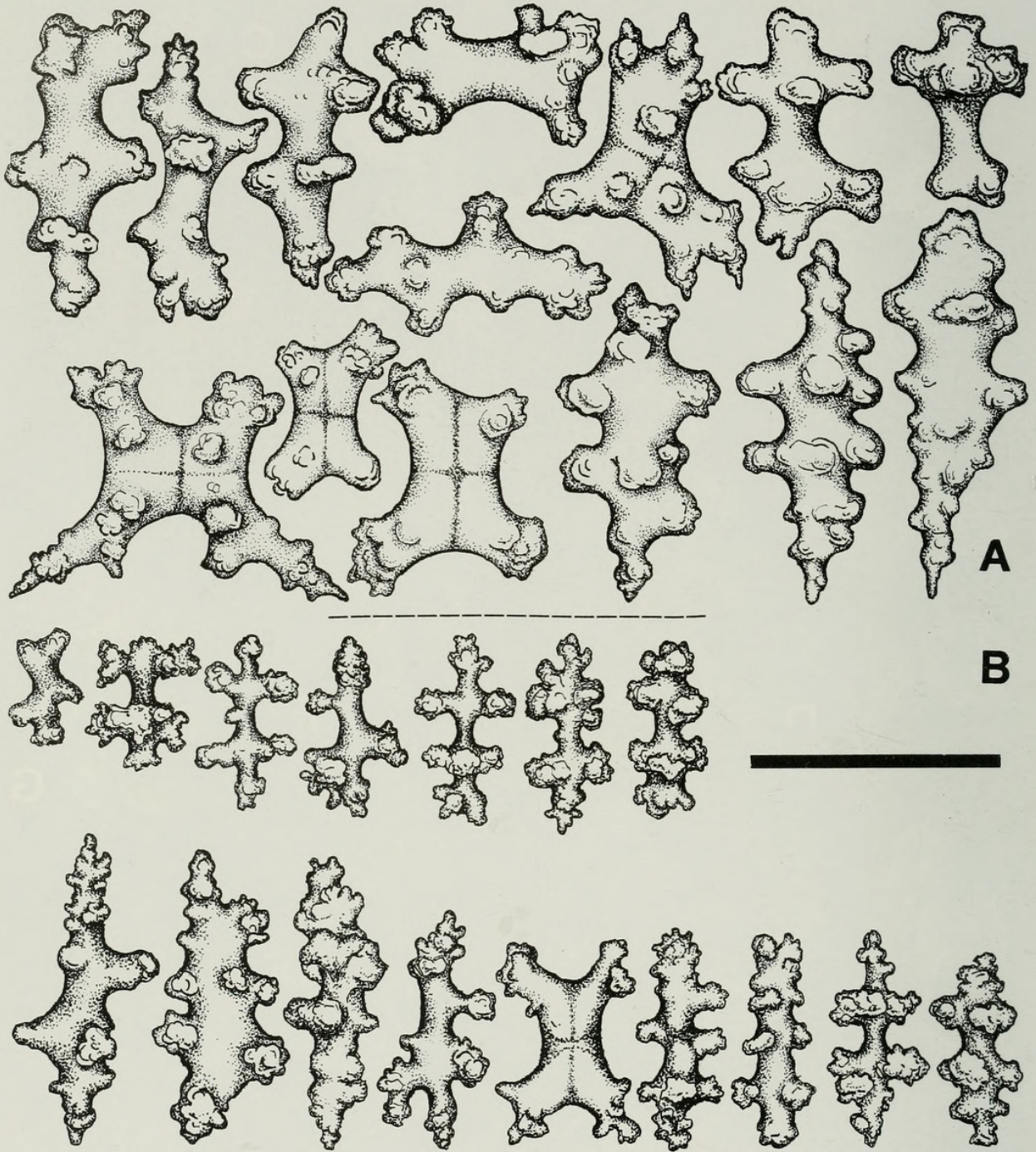


FIGURE 6. *Eleutherobia zanahoria* sp. nov. A. Sclerites from the interior of the holdfast. B. Sclerites from the interior of the polypary. Scale bar for A and B = 0.1 mm.

#### ACKNOWLEDGMENTS

I am grateful to Alan Leviton and Katie Martin (Scientific Publications, California Academy of Sciences), Leen van Ofwegen (National Museum of Natural History, Leiden), and Phil Alderslade (Northern Territory Museum of Arts and Sciences, Darwin) for their comments and suggestions. I also thank Delisse Ortiz and Ángel Valdés (Department of Invertebrate Zoology and Geology, California Academy of Sciences) for derivation of the specific epithet.

Field work was made possible by a contract from the United States National Cancer Institute to Pat and Lori Colin, Coral Reef Research Foundation, Palau.



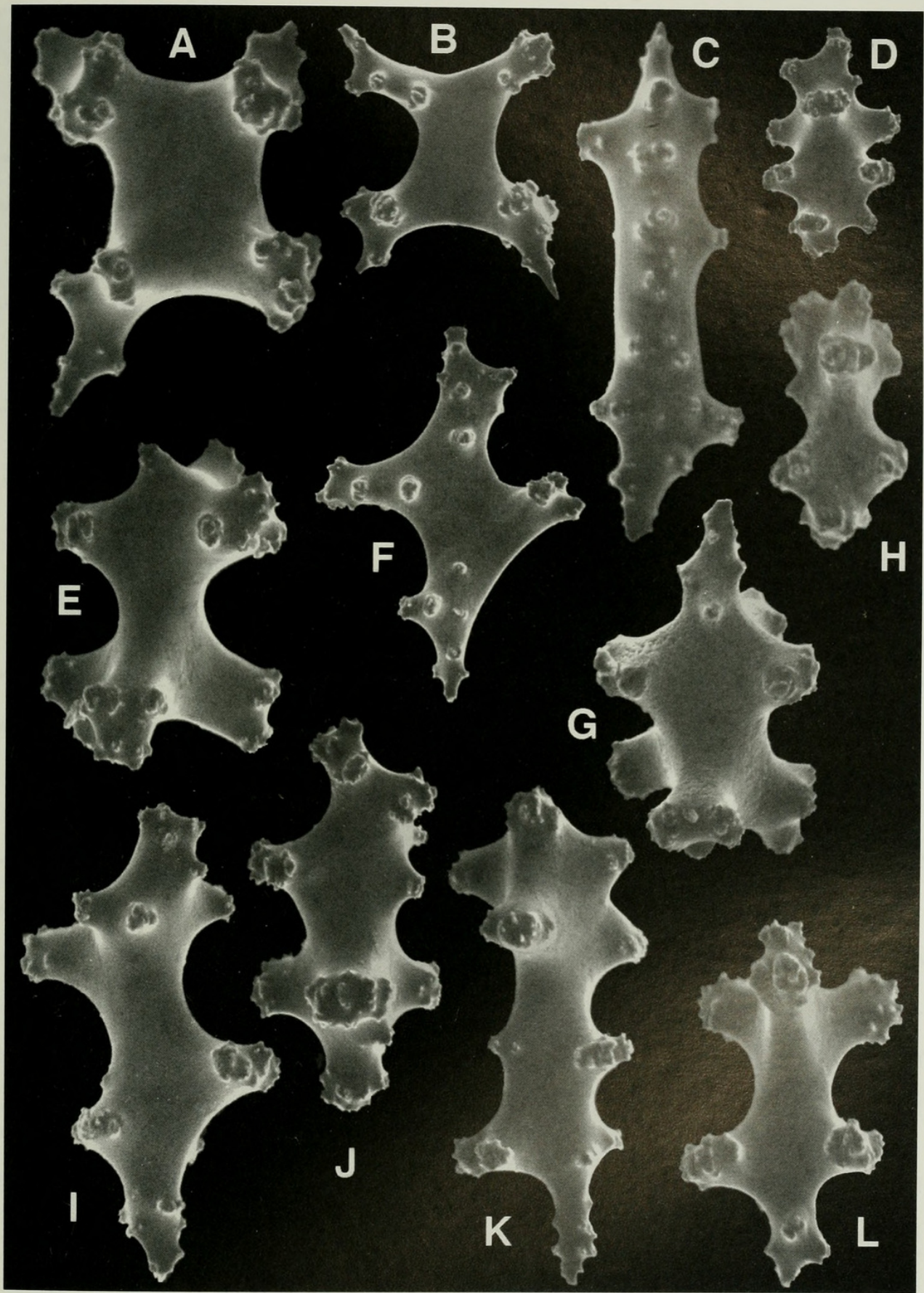


FIGURE 7. *Eleutherobia zanahoria* sp. nov. Scanning electron micrographs of sclerites from the holdfast region of the stalk. A. 0.14 mm; B. 0.10 mm; C. 0.09 mm; D. 0.08 mm; E. 0.08 mm; F. 0.10 mm; G. 0.08 mm; H. 0.08 mm; I. 0.10 mm; J. 0.08 mm; K. 0.10 mm; L. 0.09 mm.





FIGURE 8. Map of the Indo-West Pacific showing geographic distribution of the genus *Eleutherobia*. Arrow shows type locality of *Eleutherobia zanahoria* sp. nov.

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