OCTOCORALLIA FROM VARIOUS LOCALITIES IN THE PACIFIC OCEAN

by

J. VERSEVELDT
Zwolle, The Netherlands

With 10 plates and 28 text-figures

INTRODUCTION

At the request of Dr. Dennis M. Devaney, Invertebrate Zoologist, Bernice P. Bishop Museum, Honolulu, Hawaii, I investigated a number of Polynesian soft corals kept in the Museum mentioned.

At the same time Professor Paul J. Scheuer, University of Hawaii at Manoa, Department of Chemistry, Honolulu, Hawaii, asked me to identify some octocorals from Enewetak Atoll (Marshall Is.) and from Ponape Island (Carolines).

These collections include several well-known species which are not described in the present paper. I only mention their names with the localities added in parentheses: *Cladiella pachyclados* (Klunzinger, 1877) (American Samoa); *Lobophytum borbonicum* (Von Marenzeller, 1886) (Enewetak); *Lobophytum pauciflorum* (Ehrenberg, 1834) (Enewetak, Wake I., Kingman Reef, Cook Is.); *Lobophytum schoedei* Moser, 1919 (Wake I.); *Sarcophyton acutangulum* (Von Marenzeller, 1886) (American Samoa, Cook Is.); *Sarcophyton crassocaule* Moser, 1919 (Christmas I.); *Sarcophyton ehrenbergi* Von Marenzeller, 1886 (Fiji Is.); *Sarcophyton glaucum* (Quoy & Gaimard, 1833) (American Samoa, Enewetak); *Sarcophyton trocheliophorum* Von Marenzeller, 1886 (Fanning Atoll, Enewetak, Wake I., Washington I., Kingman Reef); *Sinularia flexibilis* (Quoy & Gaimard, 1833) (Fiji Is.); *Sinularia leptoclados* (Ehrenberg, 1834) (Gambier Is., Fanning Atoll, Enewetak); *Sinularia macrodactyla* Kolonko, 1926 (Fiji Is.); *Sinularia polydactyla* (Ehrenberg, 1834) (Fiji Is., Guam, Samoa); *Xenia crassa* Schenk, 1896 (Fiji Is.); *Xenia lillieae* Roxas, 1933 (Fiji Is.); *Xenia membranacea* Schenk, 1896 (Carolines); *Dendronephthya* (*Roxasia*) *mirabilis* Henderson, 1909 (Enewetak); *Nephthea chabrolii* Audouin, 1828 (Carolines).

Of a number of the remaining species a more or less full description is given. They are mentioned in the following list.

Order Alcyonacea Lamouroux, 1816

Family Alcyoniidae Lamouroux, 1812. — *Cladiella devaneyi* sp. nov.; *Cladiella papillosa* Tixier-Durivault, 1942; *Cladiella subtilis* Tixier-Durivault, 1970; *Lobophytum catalai* Tixier-Durivault, 1957; *Lobophytum denticulatum* Tixier-Durivault, 1956; *Lobophytum salvati* Tixier-Durivault, 1970; *Lobophytum variatum* Tixier-Durivault, 1957; *Sinularia abrupta* Tixier-Durivault, 1970; *Sinularia brongersma* Verseveldt, 1972; (*Sinularia firma* Tixier-Durivault, 1970, see below); *Sinularia compacta* Tixier-Durivault, 1970; *Sinularia gravis* Tixier-Durivault, 1970; *Sinularia gyrosa* (Klunzinger, 1877); *Sinularia numerosa* Tixier-Durivault, 1970; *Sinularia procera* sp. nov.; *Sinularia rigida* (Dana, 1846); *Sinularia sandensis* sp. nov.; *Sinularia venusta* Tixier-Durivault, 1970; *Sinularia vervoorti* sp. nov.

From this list it appears that the collections contain four new species, viz *Cladiella devaneyi, Sinularia procera, Sinularia sandensis,* and *Sinularia vervoorti.*

Specimens of *Sinularia firma* Tixier-Durivault, 1970, are absent in our collections, but in view of a comparison with the allied species *S. abrupta* and *S. brongersmai* I gave drawings of the sclerites of the type specimen (fig. 15).

The majority of the specimens reported upon are now in the Bernice P. Bishop Museum; their register numbers are preceded by the abbreviation BPBM. Duplicates form part of the collection of the Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands; their register numbers are preceded by the abbreviation RMNH. The specimens I received from Dr. Paul J. Scheuer are all kept in RMNH. I am indebted to Dr. Dennis M. Devaney and to Dr. Paul J. Scheuer for placing the material at my disposal.

I have had the opportunity to work for some days at the Muséum National d'Histoire Naturelle, Laboratoire de Malacologie, Paris, France, in order to make photographs of a good many of Tixier-Durivault's type specimens and to collect small fragments of them, so as to make mounted slides of the sclerites. In the descriptions of a number of species I give drawings of the sclerites both of the specimen investigated and of the type specimen. I tender my best thanks to Madame A. Tixier-Durivault and to Madame H. J. d'Hondt for their hospitality and assistance.

My stay at Paris and also that of my friend and photographer Mr. G. J. Vrijmoeth was made possible by a grant from the Alida Buitendijk Fonds. I thank Professor W. Vervoort, director of the Rijksmuseum van Natuur-

lijke Historie, Leiden, for his mediation, and also for his interest in my work on the whole. It is with great pleasure that I name one of the new species after him.

Finally I am thankful to Mr. W. ter Spill for touching up the English text, and to Mr. G. J. Vrijmoeth for making the photographs.

Taxonomic Report

Cladiella devaneyi sp. nov. (fig. 1a-l, pl. 1 fig. 1)

Material. — Rurutu I., off village Avera, W-side of island, depth 30 m, 28 February 1971. D. M. Devaney, collector. BPBM D504, one colony, the holotype.

Description. — The sterile stalk, which is attached to a piece of coral, is only 6 mm high. The capitulum has diameters of 45 and 50 mm (pl. 1 fig. 1). The lobes are not densely placed. Most of the primary lobes divide upwards into some short, round lobuli; sometimes the tip of the lobes is only slightly indented. The total height of the lobes is 8 to 9 mm; the lobuli are 5 to 6 mm high and 3 to 5 mm wide.

The openings into which the polyps are withdrawn are closed with eight triangular teeth, 0.20 mm long. The diameter of the openings is 0.50 mm; the centres of the polyps are 0.60 to 0.70 mm apart.

The spicules in the surface layer of the lobes are of the following kinds: (1) minute granular, finger-biscuit-shaped, anthocodial spicules 0.045 to 0.050 mm long; in the centre there is a light strip (fig. 1a); (2) slightly larger granular rods 0.06 to 0.08 mm long (fig. 1b); and (3) dumb-bells 0.09 to 0.14 mm long, with blunt spines at both ends and a high median waist, which is 0.042 to 0.050 mm wide (fig. 1c-f). In the interior of the lobes the same dumb-bells occur, but some have wider heads, up to 0.07 mm (fig. 1g). They may be as long as 0.15 mm.

In the surface layer of the sterile stalk there are minute dumb-bells 0.06 to 0.07 mm long (fig. 1h, i), and numerous intermediate forms (fig. 1j) to larger coenenchymal sclerites 0.110 to 0.125 mm long, with a waist 0.042 to 0.054 mm wide, and heads 0.070 to 0.085 mm wide (fig. 1k, l). Slender types like that in fig. 1j are about 0.135 mm long, their waist is 0.042 to 0.045 mm wide, the heads are about 0.070 mm wide.

Colour. — In alcohol the colour is white.

Remarks. — Spicules with great dimensions (up to 0.15 mm long) like those described above only occur with a few *Cladiella* species. With none of these does our specimen agree.

I name the new species after Dr. Dennis M. Devaney, collector of the specimen.

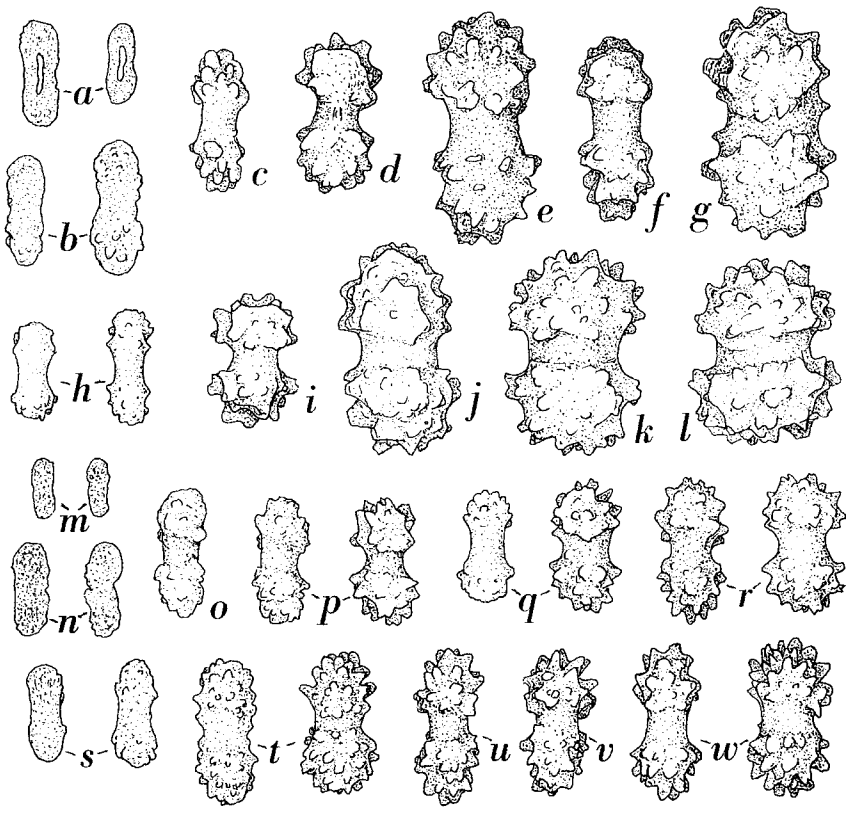


Fig. 1. *Cladiella devaneyi* sp. nov., holotype, BPBM D504. a-f, sclerites from surface layer of a lobe; g, sclerite from interior of a lobe; h, i, sclerites from surface layer of the sterile stalk; j-l, sclerites from interior of the sterile stalk. × 220. *Cladiella papillosa* Tixier-Durivault, type specimen. m-o, sclerites from surface layer of a lobe; p, sclerites from interior of a lobe; q, sclerites from surface layer of the sterile stalk; r, sclerites from interior of the sterile stalk. × 220. *Cladiella papillosa* Tixier-Durivault, BPBM D507. s, t, anthocodial sclerites; u, sclerite from surface layer of a lobe; v, sclerite from interior of a lobe; w, sclerites from interior of the sterile stalk. × 220.

Cladiella papillosa Tixier-Durivault, 1942 (fig. 1m-w, pl. 1 fig. 2)

Lobularia papillosa Tixier-Durivault, 1942: 80; 1948: 179-185, figs. 173-178.
Cladiella papillosa, Tixier-Durivault, 1969: 135; 1970a: 199.

Material. — Gambier Is., Sta. GA IV: W-side of Aukena I., depth 1.5-6.0 m, 12 October 1967; very common in shallow water. D. M. Devaney, collector. BPBM D507, one colony; RMNH Coel. no. 11757, a fragment of that colony.

Description. — The encrusting colony is attached to a coral-concretion (pl. 1 fig. 2). The sterile stalk is soft; there are few spicules in it. It is 10 to 20 mm high. The capitulum has diameters of 85 and 70 mm; the upper side is flat owing to squeezing during fixation. In places where the lobes are not compressed we see that they are small, up to 7 mm long and

2 to 4 mm wide. They are finger-shaped or spherical, sometimes indented.

The closely set polyps are not completely retracted, they protrude above the surface for a distance of 0.20 to 0.40 mm. They are cylindrical, 0.50 to 0.60 mm wide; the centres are 0.50 to 0.70 mm apart. The body wall of the polyps is thickly filled with spicules: granular rods 0.05 to 0.07 mm long (figs. 1s), and dumb-bells 0.08 to 0.09 mm long, with narrow heads, which bear a large number of blunt spines (fig. 1t). In the surface layer of lobes and sterile stalk and in the coenenchyme there are dumb-bells, which differ very little from each other in length and shape: they are usually slender, with spined, narrow heads and a rather long waist. In most cases the length varies from 0.08 to 0.09 mm, but in the sterile stalk a few reach a length of 0.105 and even of 0.110 mm (fig. 1u-w).

Colour. — In alcohol the colony is cream-coloured.

Remarks. — The colony agrees well with Tixier-Durivault's description (1948) of this species. According to her there are two kinds of colonies: (a) with densely placed lobes, and (b) with more remote lobes. I investigated one of the former (type?) colonies; the sclerites are represented in fig. 1m-r. In this colony the spicules are smaller than those depicted in her figs. 174-178, but the dimensions of the sclerites in our colony agree very well with them.

Both in the (type?) specimen from the Paris Museum and in our specimen there are no anthocodial spicules with a light, transparent median space as represented in Tixier-Durivault's fig. 178 k-m (1948).

Geographical distribution. — The species has been recorded from Gambier Is. and Tuamotu Is. According to the above field-note the species is "very common in shallow water" in the neighbourhood of the Gambier Islands.

Cladiella subtilis Tixier-Durivault, 1970 (fig. 2, pl. 2)

Cladiella subtilis Tixier-Durivault, 1970a: 189-190, figs. 12-14.

Material. — Gambier Is., Sta. GA IV: W-side of Aukena I., depth 1.5-6.0 m, 12 October 1967; very common in shallow water. D. M. Devaney, collector. BPBM D506, one colony; RMNH Coel. no. 11750, a part of this colony.

Description. — The encrusting colony has a very low sterile stalk, 5 to 8 mm high. The capitulum has diameters of 130 and 65 mm (pl. 2). It consists of a number of primary lobes, which bear polygonal groups of lobules. The latter are closely set, blunt, cone-shaped, 4 to 7 mm wide; sometimes the lobules are indented, or they bear knob-like smaller lobules.

The surface of the lobes shows a honeycomb-like structure of narrow, pentagonal or hexagonal partition-lines between the retracted zooids. The latter have diameters of 1.00 to 1.20 mm. The slightly hollow centres of the zooids are about 1 mm apart.

In the surface layer of the lobes we find the following types of sclerites: (1) minute rods 0.035 to 0.055 mm long, the smaller ones are nearly smooth, the larger ones have tiny, rounded processes (fig. 2a-c); and (2) dumbbells 0.07 to 0.09 mm long, with weakly developed ends and a long median waist (fig. 2d-f). In all other parts of the colony the same type of dumbbells occurs, 0.08 to 0.10 mm long, the waist is 0.030 to 0.036 mm wide, the heads bear rounded or cone-shaped prominences (fig. 2g-i).

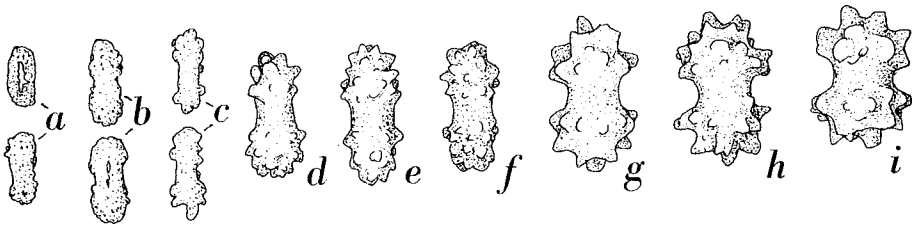


Fig. 2. *Cladiella subtilis* Tixier-Durivault, BPBM D506. a-f, sclerites from surface layer of a lobe; g-i, sclerites from coenenchyme of the sterile stalk. × 220.

Colour. — In alcohol the colony is white.

Remark. — The specimen agrees well with Tixier-Durivault's description (1970a) of *C. subtilis*. Judging from the given dimensions the enlargement of the colony in her fig. 12 must be × 3/4.

Geographical distribution. — The species has been recorded from New Caledonia.

Lobophytum catalai Tixier-Durivault, 1957 (figs. 3, 4, pl. 3)

Lobophytum catalai Tixier-Durivault, 1957: 111; 1958: 131-132, figs. 139, 143, 144; 1966: 76-78, figs. 58-60; 1969: 137-138; 1970a: 218.

Material. — Igurin I., Enewetak Atoll, depth 3.5-4.5 m, December 1964. Murchison & Naughton, collectors. BPBM D483, one colony.

Chinimi I., Enewetak Atoll, 29 December 1964. BPBM D486, one fragment.

Manuai I., Cook group, patch reef in lagoon, 6 March 1971. D. M. Devaney, collector. BPBM D493, one small colony.

Rarotonga I., Cook group, N-side of island, between Motutou I. and Black Lock, seaward side, depth 27-30 m, 10 March 1971. D. M. Devaney, collector. RMNH Coel. no. 11742, one colony.

Rurutu I., off village Avera, W-side of island, depth 30 m, 28 February 1971. D. M. Devaney, collector. RMNH Coel. no. 11741, one fragment.

Description. — One colony (BPBM D493) is very small. The total height is 24 mm. The capitulum has a diameter of up to 25 mm; it consist of a few small, flat lobes, arranged radially.

The other colonies are much larger (pl. 3). The height of the sterile stalk varies from 25 to 50 mm. The capitula have diameters of 85-115 × 45-75 mm. The lobes are up to 40 mm high and 10 to 14 mm thick. They

vary greatly in form from robust digitiform processes to flattened, radially directed folds or crests. The latter may be slightly differentiated or their edge may be deeply indented, forming digitiform secondary lobes.

The autozooids are relatively few in number, the centres are 2 to 3 mm apart. The siphonozooids are crowded, in the terminal parts of the lobes four to five between two autozooids, in the lower parts five to ten.

The spicules in the surface layer of the lobes are of the following kinds: (1) tiny rods 0.04 to 0.06 mm long, with two girdles of minuscule warts and terminal tufts (fig. 3a-c); (2) clubs varying in length from 0.06 to

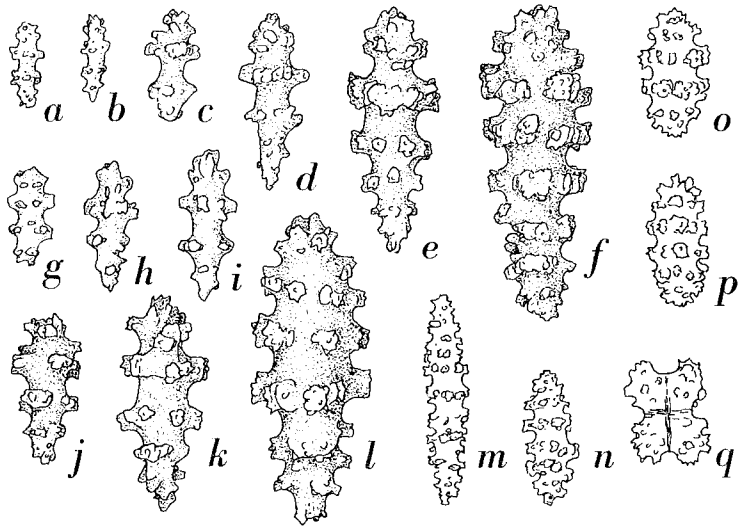


Fig. 3. *Lobophytum catalai* Tixier-Durivault, BPBM D483. a-f, spicules from surface layer of a lobe; g-l, spicules from outer layer of the sterile stalk; m, n, spicules from coenenchyme of a lobe; o-q, spicules from coenenchyme of the sterile stalk. a-l, × 220; m-q, × 65.

0.20 mm, with rather weakly developed heads, and handles with girdles of warts (fig. 3d-f). In the coenenchyme of the lobes are: (1) blunt spindles 0.22 to 0.31 mm long, with two to four distinct whorls of tubercles and a number of terminal wart-like processes (fig. 3n); and (2) acute spindles up to 0.48 mm long, with more whorls (fig. 3m), but in other specimens they are slightly shorter.

The surface layer of the sterile stalk has numerous rods and clubs; the smaller ones are 0.05 to 0.08 mm long (fig. 3g), the larger ones are up to 0.19 mm long (fig. 3h-l). In the interior of the stalk there are blunt spindles and barrels 0.22 to 0.27 mm long (fig. 3o, p). In addition, the interior of lobes and stalk contains warty crosses (fig. 3q).

Colour. — The colour varies from light brown to light grey.

Remarks. — The enlargement of the type specimen in Tixier-Durivault's fig. 139 (1958) is about × 3/5. The drawings of the spicules in fig. 4 have been made from mounted spicules of that type specimen. According to Tixier-Durivault (1958: 132) the spindles in the interior of the lobes are 0.28 to 0.33 mm long, but in the type specimen the length is 0.33 to 0.35 mm; a few are up to 0.40 mm.

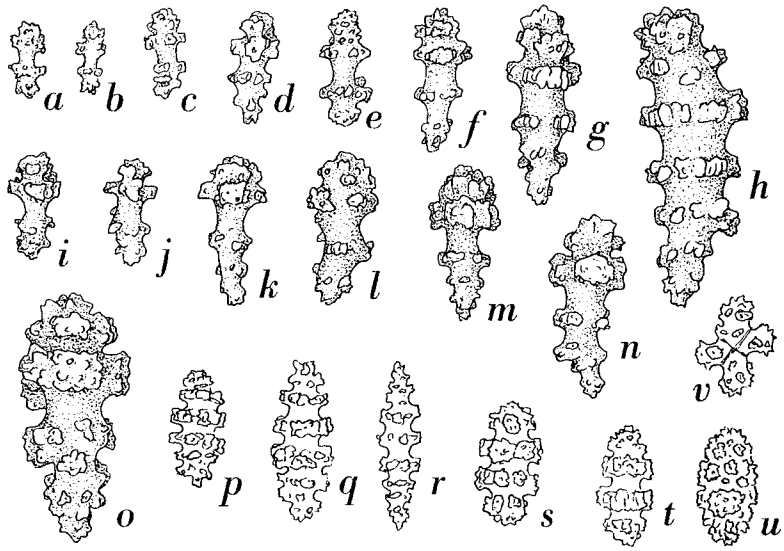


Fig. 4. *Lobophytum catalai* Tixier-Durivault, type specimen. a-h, spicules from surface layer of a lobe; i-o, spicules from surface layer of the sterile stalk; p-r, spicules from interior of a lobe; s-v, spicules from interior of the sterile stalk. a-o, × 220; p-v, × 65.

I also compared our colonies with the type specimen of *Lobophytum nodosum* Tixier-Durivault (1969: 139-140, figs. 1-3). The spicules are identical with those in *L. catalai*. And in *L. catalai*, too, the lobes may be swollen up terminally. The only difference between the two species may be the distribution of the zooids: in *L. nodosum* the autozooids are probably less distant, viz 1.30-2.00 mm (according to my own observation), and the number of siphonozooids between two autozooids is smaller, viz., four to five (according to Tixier-Durivault, 1969).

Geographical distribution. — The species has been recorded from Fiji Is., Vietnam, Madagascar, Tuamotu Is., and New Caledonia.

Lobophytum denticulatum Tixier-Durivault, 1956 (figs. 5, 6, pl. 4 fig. 2)

Lobophytum denticulatum Tixier-Durivault, 1956, 481; 1958: 105-106, figs. 103, 108, 109; 1966: 64-66, figs. 43-45.

Material. — Peale I., Wake Is., 28 August 1964. A. H. Banner, collector. BPBM D501, two fragments; RMNH Coel. no. 11739, two fragments.

Igurin I., Enewetak Atoll, depth 3.5-4.5 m, December 1964. Murchison & Naughton, collectors. BPBM D484, one fragment.

Description. — The sterile stalk is low, spread outwards, and furrowed longitudinally. The disc carries rather closely set, flat lobes, 8 to 10 mm thick and 30 to 35 mm high (pl. 4 fig. 2).

The centres of the retracted autozooids are 0.70 to 1.10 mm apart. The siphonozooids are indistinct, there is only one between two autozooids.

The surface layer of the lobes has clubs, 0.08 to 0.19 mm long, with warty heads and pointed or blunt handles, which bear girdles of warts (fig. 5a-f). A few crosses are present. In the interior of the lobes are pointed or blunt-ended spindles, covered with many girdles of tubercles or low spines, the length is 0.27 to 0.42 mm (fig. 5l-n).

The outer layer of the sterile stalk has clubs of nearly the same shape and length as those in the lobes (fig. 5g-k). Larger clubs, 0.20 to 0.27 mm long, are intermediate forms to coenenchymal spicules. Small rods like

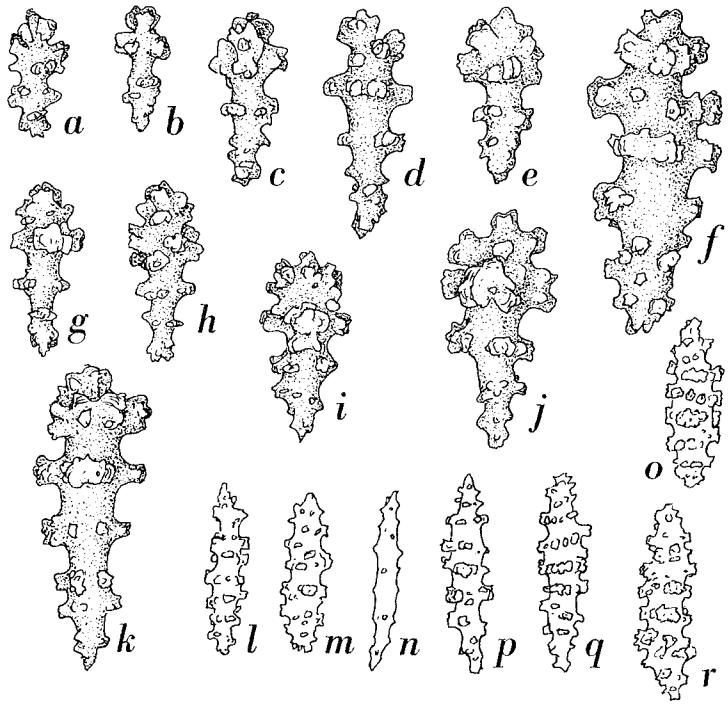


Fig. 5. *Lobophytum denticulatum* Tixier-Durivault, BPBM D484. a-f, sclerites from surface layer of a lobe; g-k, sclerites from surface layer of the sterile stalk; l-n, spicules from coenenchyme of a lobe; o-r, spicules from interior of the sterile stalk. a-k, × 220; l-r, × 65.

those in fig. 6n-p and 0.07 to 0.14 mm long, with two whorls of cone-shaped processes also occur. The interior of the stalk contains thick spindles 0.25 to 0.32 mm long, with six or more girdles of warts (fig. 50), and slender, pointed spindles, up to 0.42 mm long, with many girdles of smaller warts (fig. 5p-r).

Colour. — In alcohol the colour is creamy.

Remark. — I compared our specimens with the type specimen, represented by Tixier-Durivault (1958: fig. 103; enlargement about × 4/7), and by Tixier-Durivault (1966: fig. 43; about natural size). The drawings in fig. 6 represent the spicules from this type specimen.

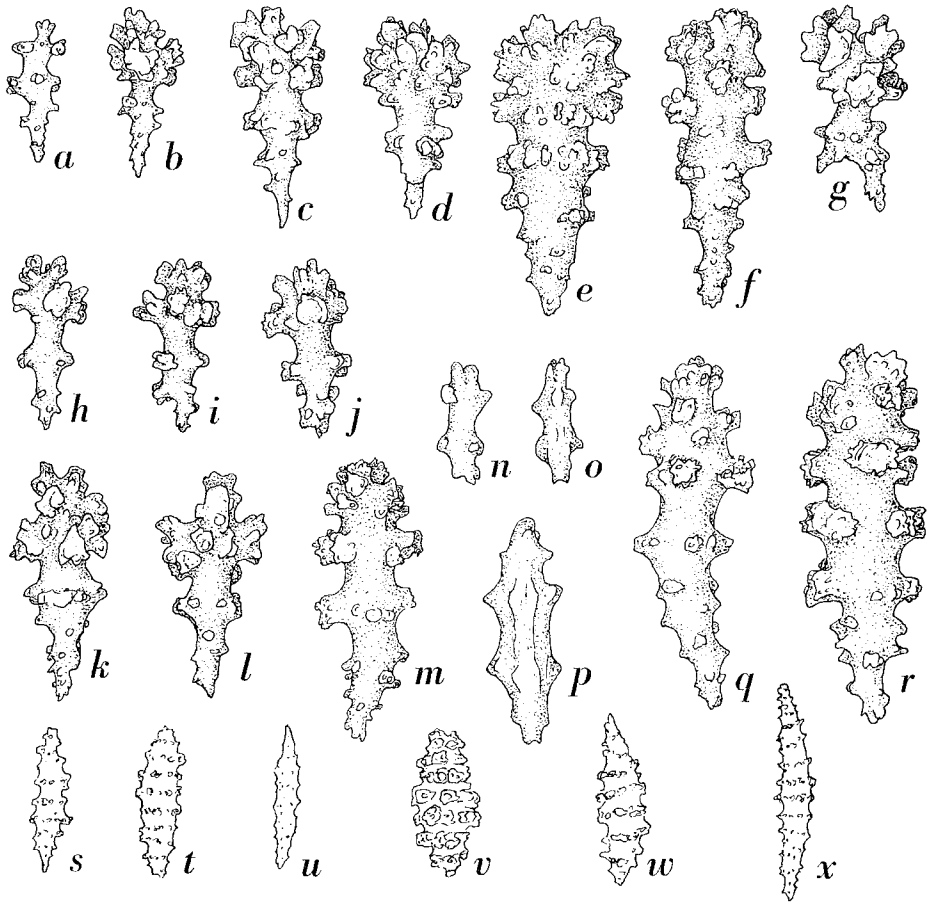


Fig. 6. *Lobophytum denticulatum* Tixier-Durivault, type specimen. a-g, sclerites from surface layer of a lobe; h-r, sclerites from surface layer of the sterile stalk; s-u, spicules from interior of a lobe; v-x, spicules from interior of the sterile stalk. a-r, × 220; s-x, × 65.

Geographical distribution. — The species has been recorded from Madagascar.

Lobophytum salvati Tixier-Durivault, 1970 (figs. 7, 8, pl. 10 fig. 2)

Lobophytum salvati Tixier-Durivault, 1970a: 207-208, figs. 32-34.

Material. — Washington I., August 1924, "Whipporwill" Expedition A. BPBM D241, one colony; RMNH Coel. no. 11752, a fragment of that colony.

Description. — The low, encrusting colony measures 25 mm in total height; the diameters are 100 and 65 mm (pl. 10 fig. 2). The sterile stalk is shallow, and widens upwards. The round edge of the capitulum projects a little. The thick, rather densely placed lobes are low, only 10 to 15 mm high, usually oblong, 13 to 22 mm long and 8 to 13 mm wide.

The autozooids stand wide apart, the distance is 1.40 to 2.20 mm. The siphonozooids are small, but sufficiently visible; there are four to six or more between two autozooids.

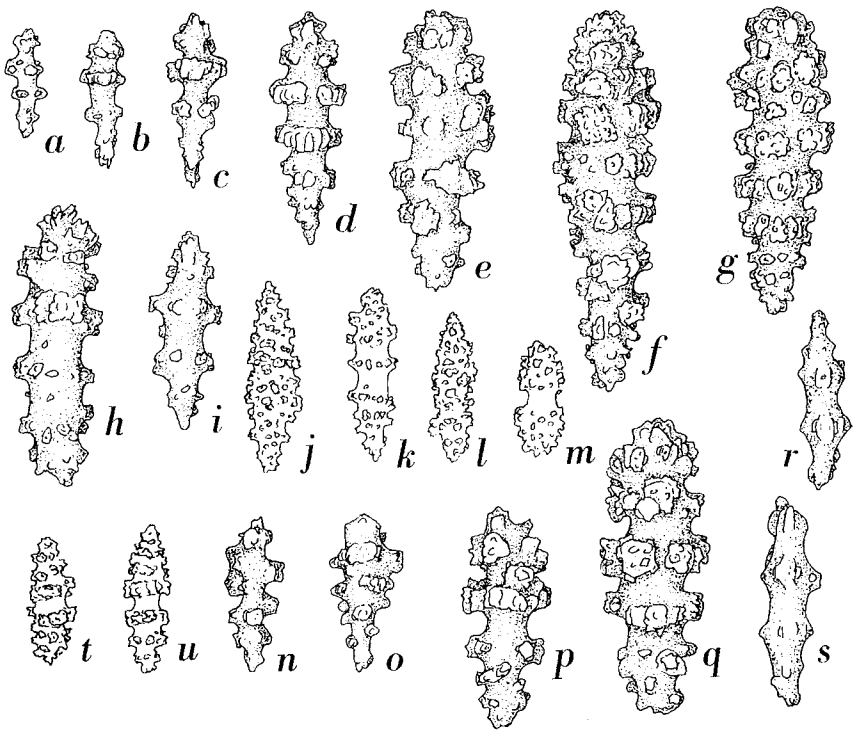


Fig. 7. *Lobophytum salvati* Tixier-Durivault, BPBM D241. a-i, sclerites from surface layer of a lobe; j-m, sclerites from interior of a lobe; n-s, sclerites from surface layer of the sterile stalk; t, u, spicules from interior of the sterile stalk. a-i, n-s, × 220; j-m, t, u, × 65.

The surface layer of the lobes has clubs, 0.09 to 0.24 mm long. The smaller ones have few warts (fig. 7b-e), the larger ones have strongly warty heads; the handles bear warts in girdles (fig. 7f, g). In addition, we find tiny rods, 0.05 to 0.07 mm long, with two girdles of small prominences (fig. 7a), and larger cylinders and spindles, 0.12 to 0.24 mm long (fig. 7h, i). In the interior of the lobes are cylinders and spindles, 0.30 to 0.40 mm long (rarely up to 0.47 mm); the warts are arranged in girdles or they are irregularly distributed. In many cases there is a median waist (fig. 7j-m).

In the surface layer of the sterile stalk the clubs vary from 0.08 to 0.22 mm in length; they have zones of warts (fig. 7n-q). There are also more or less fusiform spicules with cone-shaped processes, and 0.09 to 0.14 mm long (fig. 7r, s). The interior has cylinders and spindles, 0.18 to 0.30 mm

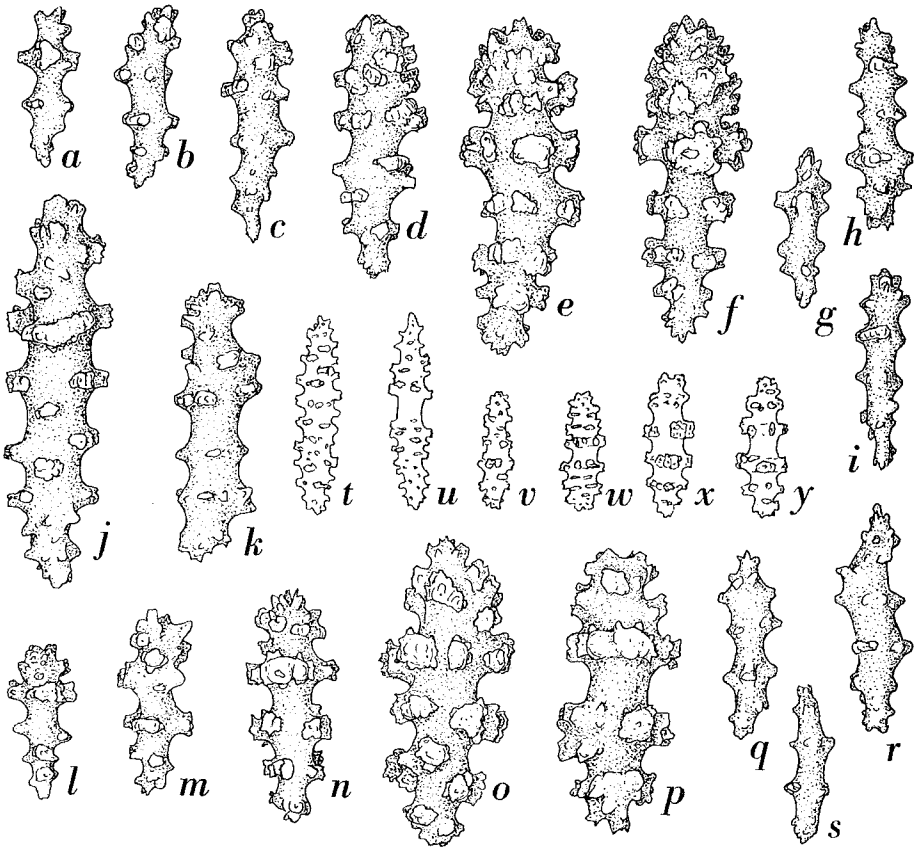


Fig. 8. *Lobophytum salvati* Tixier-Durivault, type specimen. a-k, sclerites from outer layer of a lobe; l-s, sclerites from surface layer of the sterile stalk; t-w, spicules from interior of a lobe; x, y, spicules from interior of the sterile stalk. a-s, × 220; t-y, × 65.

long, sometimes up to 0.37 mm (fig. 7t, u). In most cases the warts are placed in whorls: four distinct whorls, usually a median waist between them, and terminal tufts of smaller warts. In the coenenchyme of the lobes and of the sterile stalk crosses are present.

Colour. — In alcohol the colony is brown.

Remarks. — The spicules in our specimen correspond well with those in Tixier-Durivault's type specimen, the latter are represented in fig. 8. In our specimen the coenenchymal spicules in the stalk may be longer, up to 0.37 mm (in the type specimen 0.32 mm), and in the lobes up to 0.47 mm (in the type specimen 0.40 mm). Tiny spicules like those depicted in fig. 7a, b are scarce in the type colony.

The enlargement of the type colony in Tixier-Durivault's fig. 32 (1970a) is × 4/5. In this colony the sterile stalk is higher, the lobes are more slender. But with regard to the distribution of the zooids there is a full agreement.

Geographical distribution. — The species has been recorded from New Caledonia.

Lobophytum variatum Tixier-Durivault, 1957 (figs. 9-11)

Lobophytum variatum Tixier-Durivault, 1957: 110-111; 1958: 99-100, figs. 94, 99, 100; 1970a: 208-209.

Material. — Vatia Bay, Tutuila I., American Samoa, NW-side of bay in front of school seawall, approximately 100 m from shore, depth 7.5-15.0 m, 1 May 1974. D. M. Devaney, collector. BPBM D492, one fragment.

Rurutu I., off village Avera, W-side of island, depth 30 m, 28 February 1971. D. M. Devaney, collector. RMNH Coel. no. 11751, one fragment.

Description of specimen BPBM D492. — The hollow, shell-shaped fragment measures 55 × 50 mm in diameter. The thin edge is curved downwards. The surface of the disc is smooth. The retracted autozooids are not clearly visible. Along the margin of the disc the centres are 0.50 mm apart, towards the central part of it the distance is 0.50 to 1.00 mm. The siphonozooids are even more difficult to observe, and hardly distinguishable from the autozooids. This is also true of sections parallel to the surface, as the width of the gastric cavities of the two kinds of zooids is nearly the same. But in the gastric cavities of the autozooids the retracted anthocodiae can be seen. It appears that along the margin of the disc the number of siphonozooids between two autozooids varies from none to one, in the central part from none to two.

In the surface layer of the disc we find clubs 0.07 to 0.17 mm long, with warty heads, the handles have warts usually arranged in whorls (fig. 9a-e). There are also clumsy clubs up to 0.25 mm long, with densely placed,

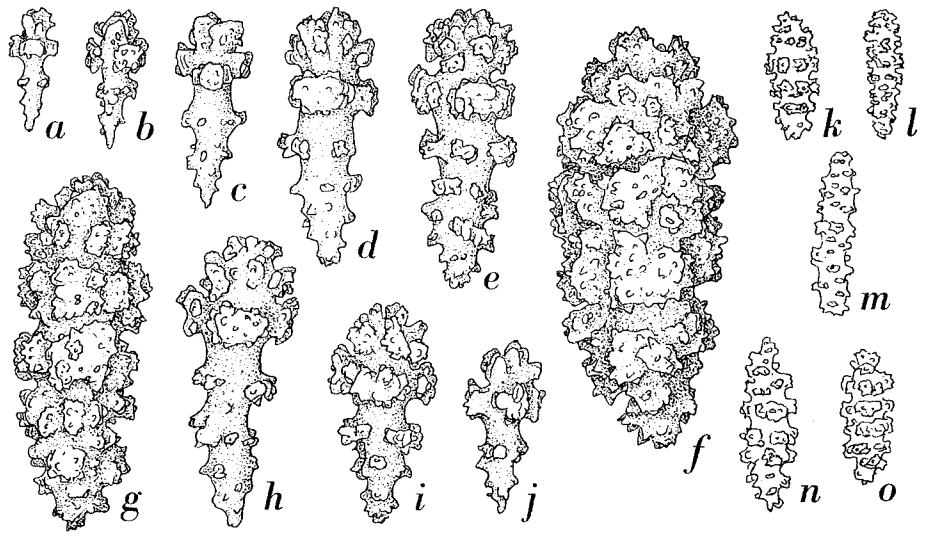


Fig. 9. *Lobophytum variatum* Tixier-Durivault, BPBM D492. a-f, sclerites from outer layer of the disc; g-j, sclerites from surface layer of the sterile stalk; k-m, spicules from interior of the disc; n, o, spicules from interior of the sterile stalk. a-j, × 220; k-o, × 65.

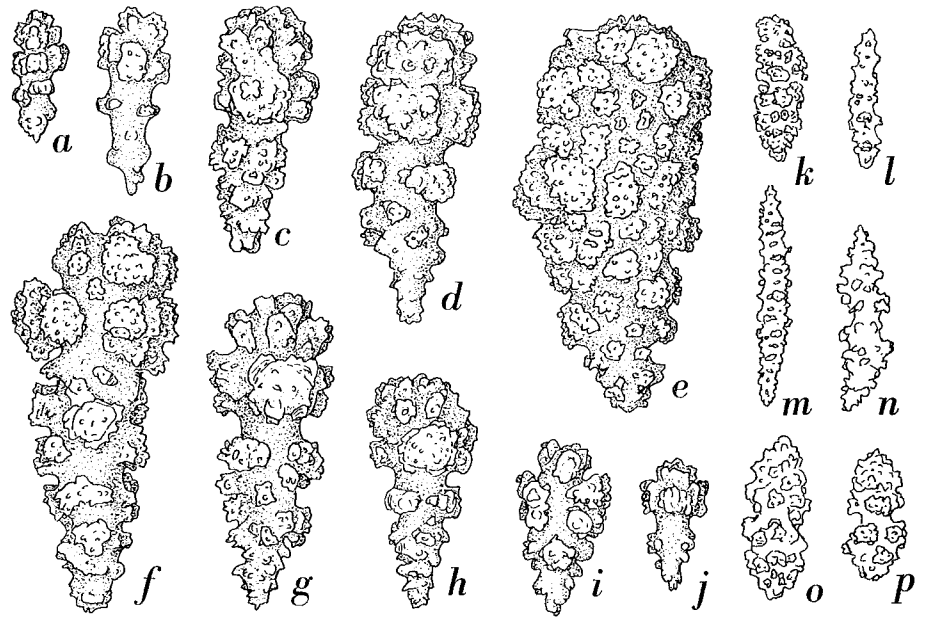


Fig. 10. *Lobophytum variatum* Tixier-Durivault, RMNH Coel. no. 11751. a-e, sclerites from surface layer of the disc; f-j, sclerites from surface layer of the sterile stalk; k-m, spicules from interior of the disc; n-p, sclerites from interior of the sterile stalk. a-j, × 220; k-p, × 65.

large, coarse warts (fig. 9f). In the outer layer of the sterile stalk (in this case nothing else but the underside of the fragment) the clubs are 0.12 to 0.22 mm long; the heads are covered with coarse, spiny warts, the handles are blunt-ended, and they often bear the warts in girdles (fig. 9g-j).

In the coenenchyme of disc and sterile stalk (the coenenchyme is only up to about 10 mm thick) the sclerites are warty cylinders and spindles. The warts are arranged in girdles (fig. 9k, o), or they are irregularly distributed (fig. 9l, n). The sclerites are 0.25 to 0.32 mm long, in the deeper layers they may be longer, up to 0.36 mm (fig. 9m). Crosses and nearly smooth spindles (as represented in fig. 11t-v) are scarce.

Colour. — In alcohol the fragment is creamy-greyish.

Variability. — The specimen RMNH Coel. no. 11751 has a concave disc

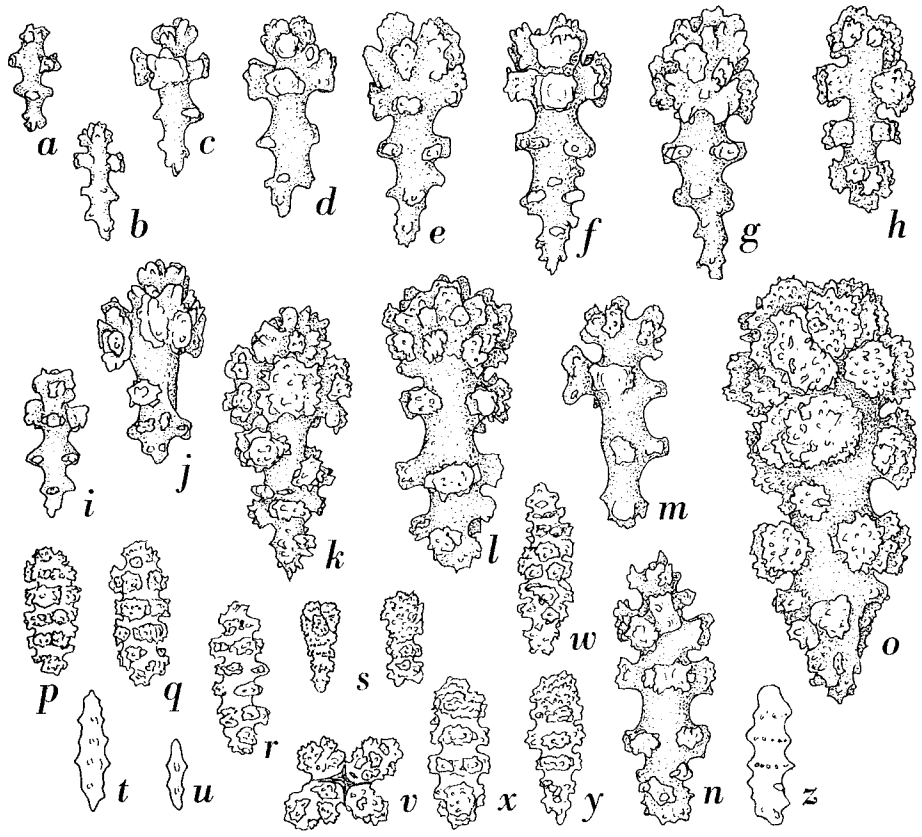


Fig. 11. *Lobophytum variatum* Tixier-Durivault, type specimen. a-h, sclerites from surface layer of the disc; i-o, sclerites from surface layer of the sterile stalk; p-v, spicules from interior of the disc; w-z, spicules from interior of the sterile stalk. a-o, × 220; p-z, × 65.

with a few low knobs along the edge. The sterile stalk is 15 to 25 mm high. The autozooids and siphonozooids are very difficult to discern. The sclerites hardly differ from those described above (fig. 10). But in the coenenchyme of the disc long, slender spindles occur, up to 0.50 mm long (fig. 10m). Crosses and smooth spindles are less scarce.

Remarks. — The sclerites from Tixier-Durivault's type specimen are represented in fig. 11; this type specimen can be found in her publication of 1958, fig. 94. The enlargement of the colony in that figure is about × 6/7.

Geographical distribution. — The species has been recorded from New Caledonia.

Sinularia abrupta Tixier-Durivault, 1970 (figs. 12, 13, pl. 5 fig. 2)

Sinularia abrupta Tixier-Durivault, 1970b: 135-140, figs. 2-5.

Material. — Fanning Atoll, ocean side, just north of West Pass, 3 July 1965. Collector: Smithsonian Trip aboard U.S.S. Arikara. BPBM D481, one fragment; RMNH Coel. no. 11738, one fragment.

Moku Manu I., NW-side, Oahu, Hawaii Is., depth 18 m, 7 February 1974. D. M. Devaney & M. Missakian, collectors. BPBM D498, one colony; RMNH Coel. no. 11740, one colony.

Description of the specimen BPBM D481. — The sterile stalk varies in height from 40 to 55 mm (pl. 5 fig. 2). In places the capitulum projects a little beyond the stalk with a rounded edge, but usually it does not project at all. The thick, flattened primary lobes, up to 50 mm high, are turned to one side. Sometimes they are digitiform, but usually they are branched, or form twisted crests. The lobules are 6 to 10 mm thick.

The polyps are retracted within small pits, 0.40 mm in diameter. Their centres are 0.70 to 1.00 mm apart.

In the surface layer of the lobes there are foliaceous clubs, 0.08 to 0.09 mm long; a few are up to 0.20 mm long (fig. 12a-f). In the outer layer of the sterile stalk the leaf-clubs are slightly longer and wider (fig. 12g-i); clubs with a length of 0.15 to 0.20 mm have more spiny heads (fig. 12j). In the coenenchyme of lobes and sterile stalk we find spindles up to 4 mm long. They have a slight median constriction, and are densely covered with large, coarse warts (fig. 12k-q).

Colour. — In alcohol the colour is brown.

Variability. — The fragment RMNH Coel. no. 11738 also has a high stalk. Probably it is a part of the same colony as the fragment just described.

The colonies BPBM D498 and RMNH Coel. no. 11740 have sterile stalks 15 to 25 mm high. The flattened lobes reach a length of about 30 mm, the thickness is 6 mm. The colour is yellowish-light brown.

Remarks. — I compared the specimens with one of Tixier-Durivault's

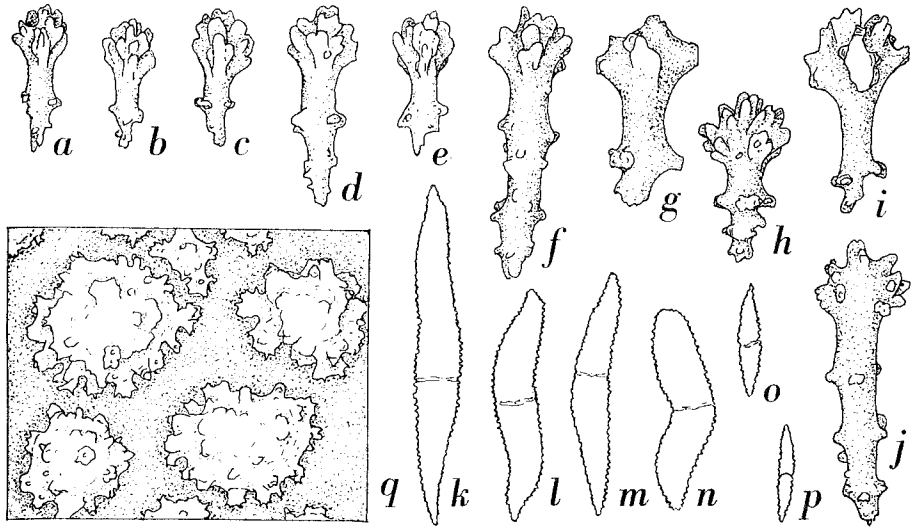


Fig. 12. *Sinularia abrupta* Tixier-Durivault, BPBM D481. a-f, sclerites from surface layer of a lobe; g-j, sclerites from surface layer of the sterile stalk; k-p, spicules from interior of the sterile stalk; q, tubercles on a coenenchymal spicule. a-j, q, × 220; k-p, × 10.

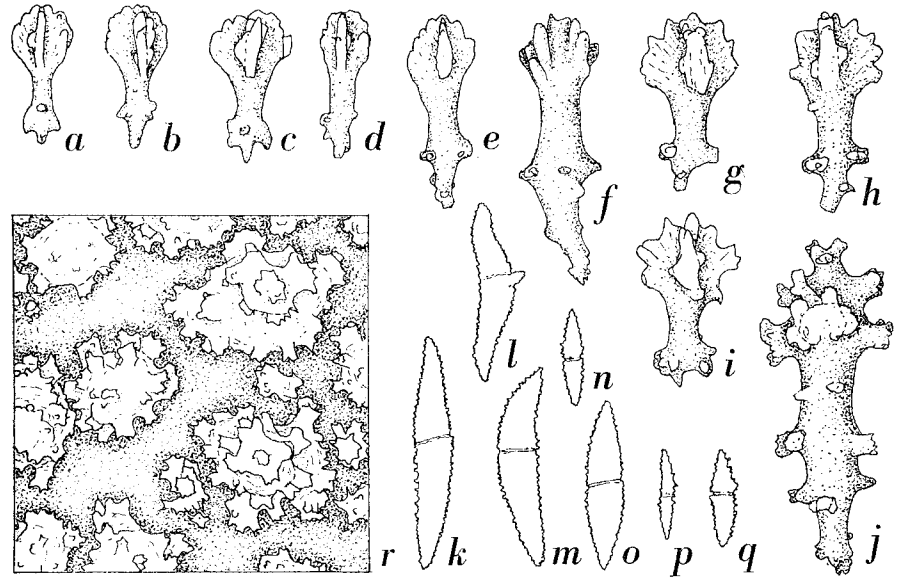


Fig. 13. *Sinularia abrupta* Tixier-Durivault, type specimen. a-f, sclerites from surface layer of a lobe; g-j, sclerites from surface layer of the sterile stalk; k-q, spicules from coenenchyme of the sterile stalk; r, warts on a coenenchymal spicule. a-j, r, × 220; k-q, × 10.

type specimens; there is a complete agreement. The drawings given in fig. 13 are of the sclerites in this type specimen. A striking feature is that the tubercles on the coenenchymal spicules are more densely placed than Tixier-Durivault records.

Geographical distribution. — The species has been recorded from some localities off Nha-Trang (Vietnam).

Sinularia brongersmai Verseveldt, 1972 (fig. 14, pl. 6 fig. 2)

Sinularia brongersmai Verseveldt, 1972: 460-463, figs. 2, 3, pl. 1 fig. 2.

Material. — Mambualau I., Kamba Village, off east coast of Viti Levu, Fiji Is., depth 1 m, 13 November 1963. Helfrich & Cooper, collectors. BPBM D479, one fragment; RMNH Coel. no. 11746, one fragment.

Remarks. — In many respects *S. brongersmai* resembles *S. abrupta*, described above, especially with regard to the dimensions and the shape of the lobes, of the clubs in the surface layer of the lobes, and of the spindles

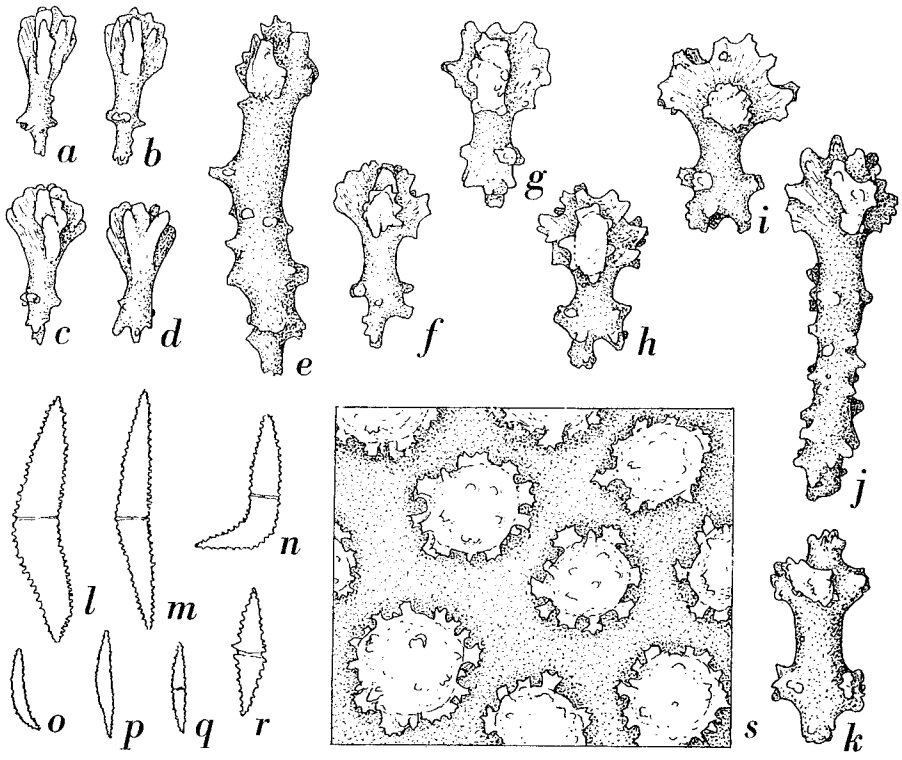


Fig. 14. *Sinularia brongersmai* Verseveldt, BPBM D479. a-e, sclerites from surface layer of a lobe; f-k, sclerites from surface layer of the sterile stalk; l-r, spicules from coenenchyme of the sterile stalk; s, tubercles on a coenenchymal spicule. a-k, s, × 220; l-r, × 10.

in the coenenchyme. But the clubs in the surface layer of the sterile stalk are different. In *S. abrupta* the clubs represented in fig. 13g, h are the most common ones, in *S. brongersmai* the clubs in fig. 14g-i. In *S. abrupta* the tubercles covering the coenenchymal spicules are larger and coarser than those in *S. brongersmai* (cf. Verseveldt, 1972, fig 2w, and fig. 14s in the present paper with fig. 12q and fig. 13r).

Sinularia firma Tixier-Durivault, 1970 (fig. 15)

Sinularia firma Tixier-Durivault, 1970a: 289-292, figs. 145-147; 1972: 21.

Remarks. — In our collections there is no specimen belonging to this species. But I considered it necessary to compare the colonies of *S. abrupta* described above with Tixier-Durivault's type specimen of *S. firma*, because in this species, too, the clubs in the outer layer of the sterile stalk have foliaceous heads, and the lobes are digitiform, rather thick, but short. It appears that the enlargement of the colony drawn in Tixier-Durivault's fig. 145 (1970a) comes to × 5/6, so that the lobes are shorter than 20 mm. Moreover, I found that the heads of the clubs in the lobes and in the

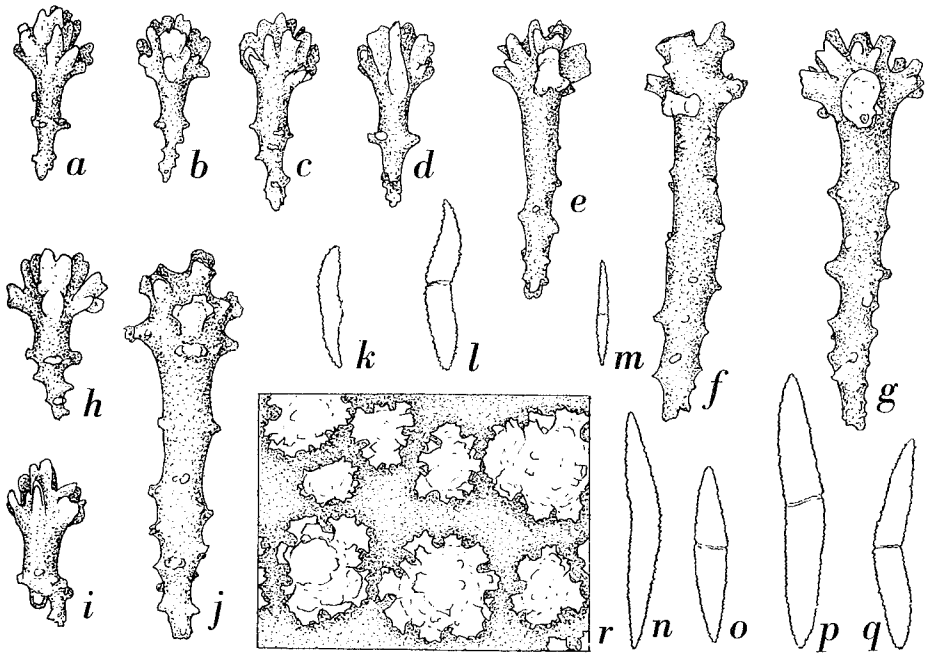


Fig. 15. *Sinularia firma* Tixier-Durivault, type specimen. a-g, sclerites from outer layer of a lobe; h-j, sclerites from outer layer of the sterile stalk: k-q, spicules from coenenchyme of the sterile stalk; r, warts on a coenenchymal spicule. a-j, r, × 220; k-q, × 10.

sterile stalk are beset with many blunt-ended spines and narrow leaves; their handles, too, differ from those in *S. abrupta* and *S. brongersmai*. For the sake of clarity I give drawings of the spicules of the type specimen of *S. firma* (fig. 15).

Sinularia compacta Tixier-Durivault, 1970 (figs. 16, 17, pl. 5 fig. 1)

Sinularia compacta Tixier-Durivault, 1970a: 248-249, figs. 83-85.

Material. — Marotiri Is. (Bass Is.), off SE-Isle, WNW-side, 20 February 1971. D. M. Devaney, collector. BPBM D496, one colony; RMNH Coel. no. 11747, a part of this colony.

Description. — The colony has a total height of about 35 mm. The sterile stalk is only 10 mm high. The capitulum has diameters of 70 and 60 mm (pl. 5 fig. 1). It projects strongly beyond the stalk, its edge is turned downwards. Seen from above the lobes are round, oval, oviform, or 8-shaped; their width is 5 to 7 mm, the height is up to 15 mm.

The polyps are retracted within pits, which have a diameter of 0.30 to 0.40 mm; their centres are 0.90 to 1.10 mm apart.

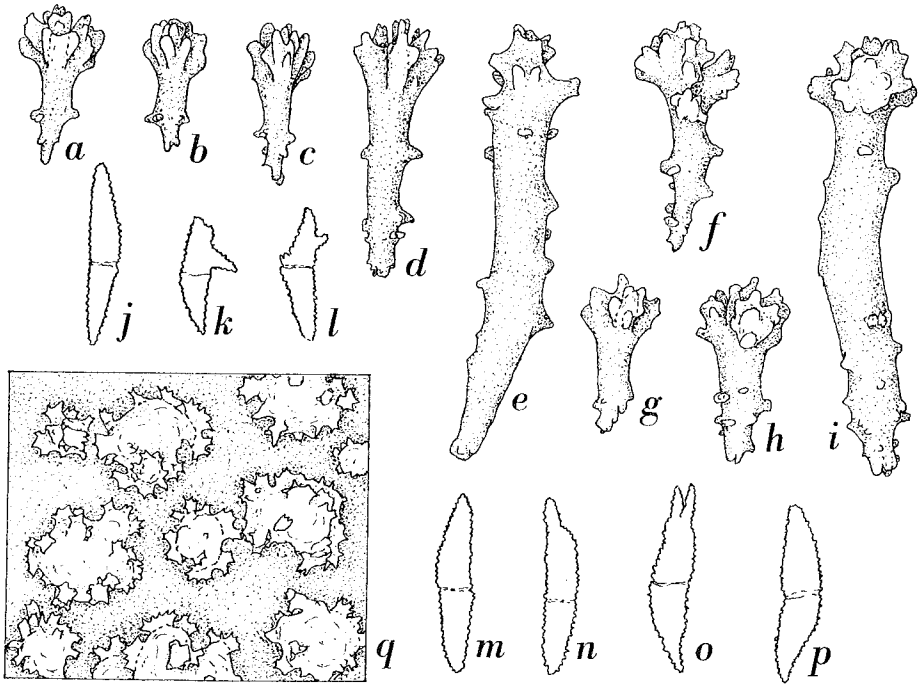


Fig. 16. *Sinularia compacta* Tixier-Durivault, BPBM D496. a-e, sclerites from surface layer of a lobe; f-i, sclerites from surface layer of the sterile stalk; j-p, spicules from coenenchyme of the sterile stalk; q, tubercles on a coenenchymal spicule. a-i, q, × 220; j-p, × 10.

The surface layer of the lobes has leaf-clubs, 0.08 to 0.15 mm long (fig. 16a-d). Larger clubs have a less developed head, composed of spines and small warts; they are up to 0.31 mm long (fig. 16e). In the surface layer of the sterile stalk the leaf-clubs are wider, but the length is like that in the lobes (fig. 16f-i).

In the interior of the lobes we find straight or curved spindles; a few are irregularly branched. They have a median constriction; the length is up to 2.60 mm. The tubercles are medium-sized, high, crenelated, often arranged in transverse rows; smaller spicules bear spines. The coenenchymal spicules in the sterile stalk resemble those in the lobes (fig. 16j-p). The tubercles are usually irregularly distributed (fig. 16q).

Colour. — In alcohol the colony is dark-grey, the pits of the retracted zooids are black.

Remark. — Fig. 17 shows the spicules of the type specimen, described

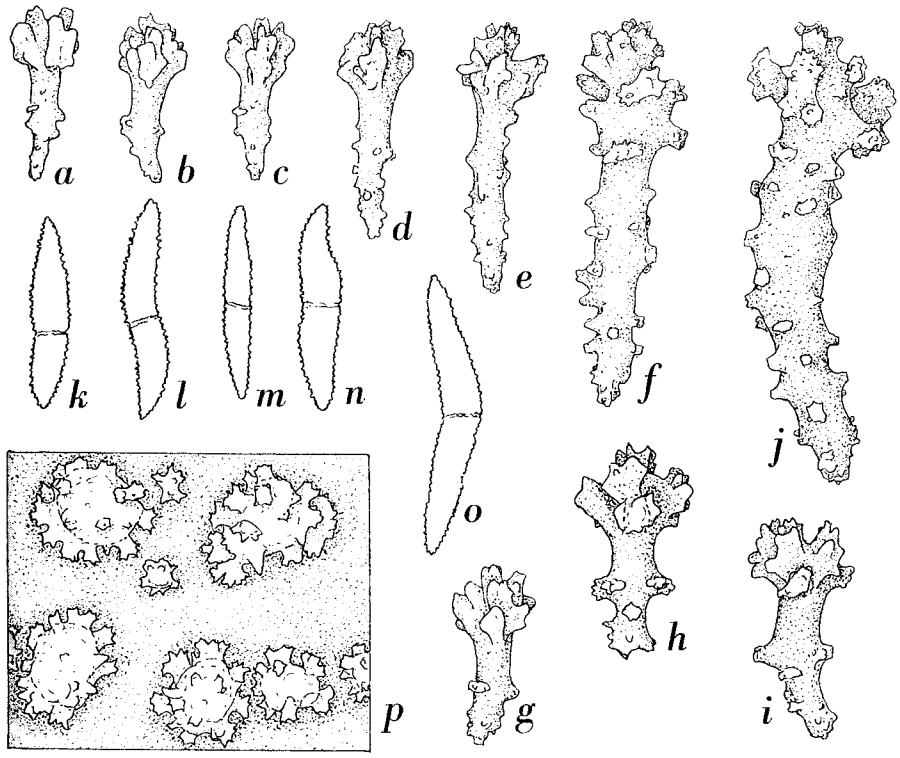


Fig. 17. *Sinularia compacta* Tixier-Durivault, type specimen. a-f, sclerites from surface layer of a lobe; g-j, sclerites from surface layer of the sterile stalk; k-o, spicules from interior of the sterile stalk; p, tubercles on a coenenchymal spicule. a-j, p, × 220; k-o, × 10.

by Tixier-Durivault, 1970a. The only difference with our specimen seems to be the unbranched form of the coenenchymal spicules. At all events I could not find them in my mounted slides, but Tixier-Durivault actually did find them; see her fig. 84F, H.

Geographical distribution. — The species has been recorded from New Caledonia.

Sinularia gravis Tixier-Durivault, 1970 (figs. 18, 19, pl. 4 fig. 1)

Sinularia gravis Tixier-Durivault, 1970a: 249-252, figs. 86-89.

Material. — Papara district, Atimaono, Tahiti, 3 January 1965. BPBM D500, two fragments; RMNH Coel. no. 11743, two fragments.

Description. — The fragments are probably parts of one, low, encrusting colony. At the base of the sterile stalk there is a thick, projecting edge. Upwards the stalk spreads out strongly. The capitulum consists of upright, sinuous lobes, up to 25 mm high (pl. 4 fig. 1). The polyps are retracted; they leave small pits, the centres of which are 0.80 to 1.10 mm apart.

In the surface layer of the lobes the clavate sclerites are of the following kinds: (1) small clubs about 0.12 mm long, with narrow heads (fig. 18a, b); (2) stouter clubs 0.15 to 0.20 mm long, most of them with strongly developed, warty heads (fig. 18c-e); and (3) long club-shaped spicules 0.21 to 0.29 mm long (fig. 18f); the latter are intermediate forms to fusiform spicules.

In the surface layer of the sterile stalk the clubs are shorter and wider (fig. 18g-i, k-n). The length usually varies from 0.12 to 0.17 mm, but shorter clubs (fig. 18m) and longer ones (fig. 18n) also occur. The most striking forms are those with very thick heads (fig. 18k). In addition to the clubs we find crosses (fig. 18j), and thick-set rods with a number of spines and warts at each end (fig. 18i).

In the coenenchyme of the lobes and of the sterile stalk we find slender, irregularly curved spindles, usually not longer than 4 mm (fig. 18p, r, t), but in the stalk one spicule reaches a length of 5.70 mm (fig. 18o). Others are short and thick, up to 0.75 mm wide (fig. 18s, u), or they are branched (fig. 18q). The sclerites bear distant, small warts (fig. 18v) or cone-shaped spines; sometimes they are regularly arranged in transverse rows.

Colour. — In alcohol the colour is creamy-white.

Remark. — With some hesitation I refer the fragments to *S. gravis* Tixier-Durivault, 1970a. A comparison with the type specimen reveals the following differences: (1) in the type specimen the clubs have less developed heads (fig. 19c-e, h, i, m); (2) the coenenchymal spicules are slightly

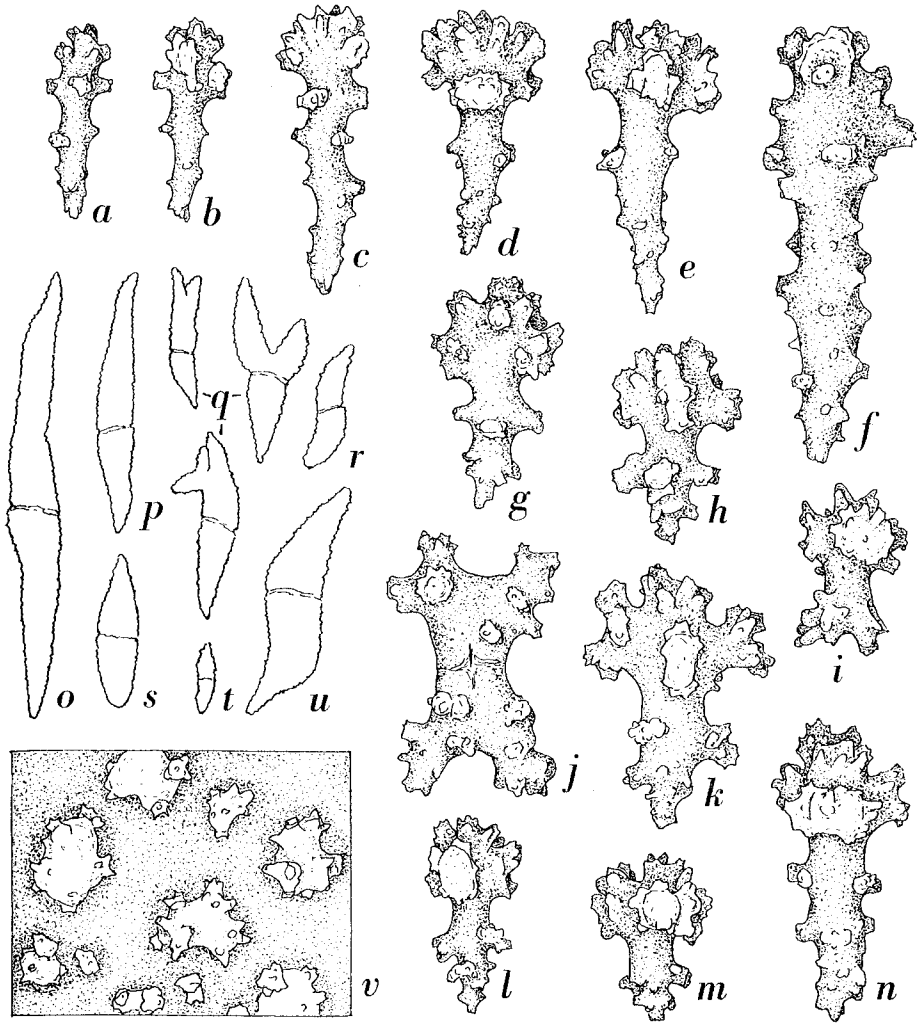


Fig. 18. *Sinularia gravis* Tixier-Durivault, BPBM D500. a-f, sclerites from outer layer of a lobe; g-n, sclerites from outer layer of the sterile stalk; o-u, spicules from coenenchyme of the sterile stalk; v, warts on a coenenchymal spicule. a-n, v, × 220; o-u, × 10.

shorter (fig. 19n-q); (3) the warts on these spicules are a little smaller (fig. 19r). In the type specimen the centres of the retracted zooids are 0.80 to 1.10 mm apart, just as in our specimen (or specimens).

Geographical distribution. — The species has been recorded from New Caledonia.

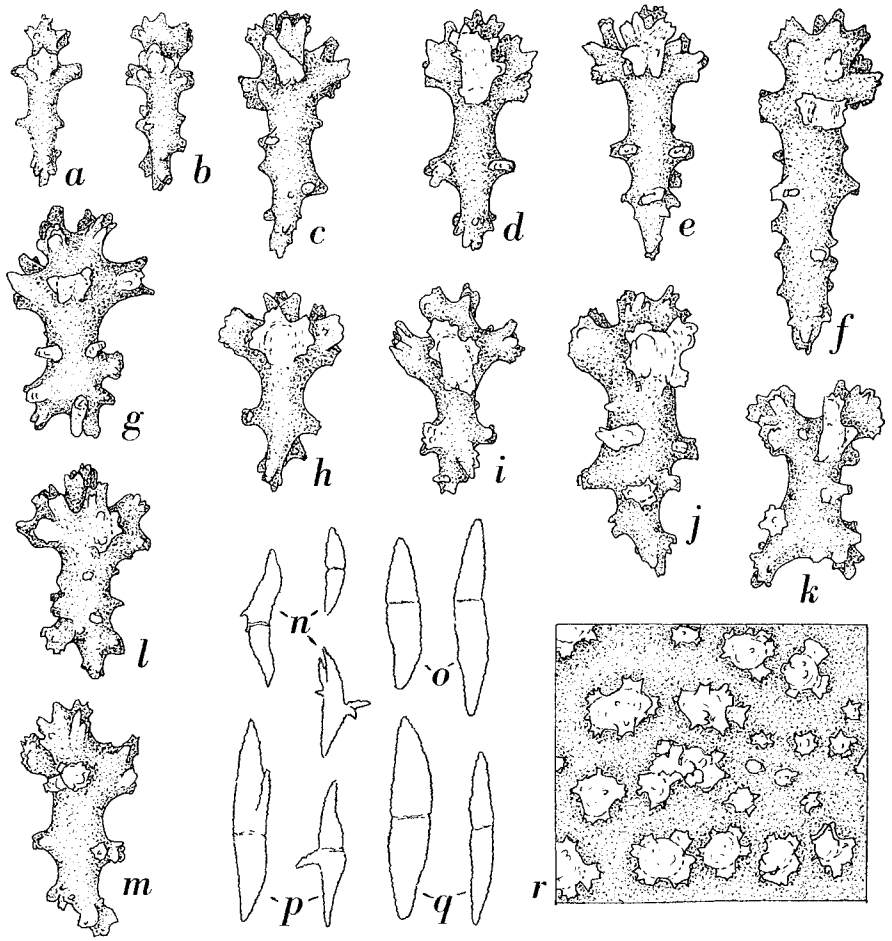


Fig. 19. *Sinularia gravis* Tixier-Durivault, type specimen. a-f, sclerites from surface layer of a lobe; g-m, sclerites from surface layer of the sterile stalk; n-q, spicules from interior of the sterile stalk; r, warts on a coenenchymal spicule. a-m, r, × 220; n-q, × 10.

Sinularia gyrosa (Klunzinger, 1877) (fig. 20, pl. 6 fig. 1, pl. 7 fig. 1)

Alcyonium gyrosum Klunzinger, 1877: 27, pl. 2 fig. 1.

Sinularia gyrosa, Lüttschwager, 1915: 6-7; Kolonko, 1926: 329; Macfadyen, 1936: 36-37; Tixier-Durivault, 1945: 56; 1951: 17-20, figs. 6, 9-12; 1953: 314-315; 1966: 167-169, figs. 160-162; 1969: 148-149; 1970a: 248; 1970b: 177.

Material. — Marotiri Is. (Bass Is.), off SE-Isle, WNW-side, 20 February 1971. D. M. Devaney, collector. BPBM D497, one colony.

Aitutake I., Cook group, depth 15 m, 8 March 1971. D. M. Devaney, collector. BPBM D495, one colony; RMNH Coel. no. 11749, one fragment.

Description of specimen BPBM D497. — The firm colony has a sterile stalk, up to 25 mm high; it has been cut off obliquely. The capitulum extends

slightly beyond the stalk. Its diameters are 70 and 45 mm. It consists of densely placed wall-like lobes, twisting and turning over the surface, and up to about 12 mm high (pl. 6 fig. 1).

The polyps are completely retracted into small, deep pits, 0.40 to 0.60 mm in diameter; the centres of the pits are 0.80 to 1.00 mm apart.

In the surface layer of the capitulum we find clubs, varying in length from 0.09 to 0.25 mm, but most of them are 0.12 to 0.17 mm long. A good many have a central wart (fig. 20a, d, f); they resemble the clubs of *S. polydactyla* (Ehrenberg). Others have heads with more irregularly placed warts (fig. 20b, c, e, g). Long clubs with weakly developed heads (fig. 20c) are

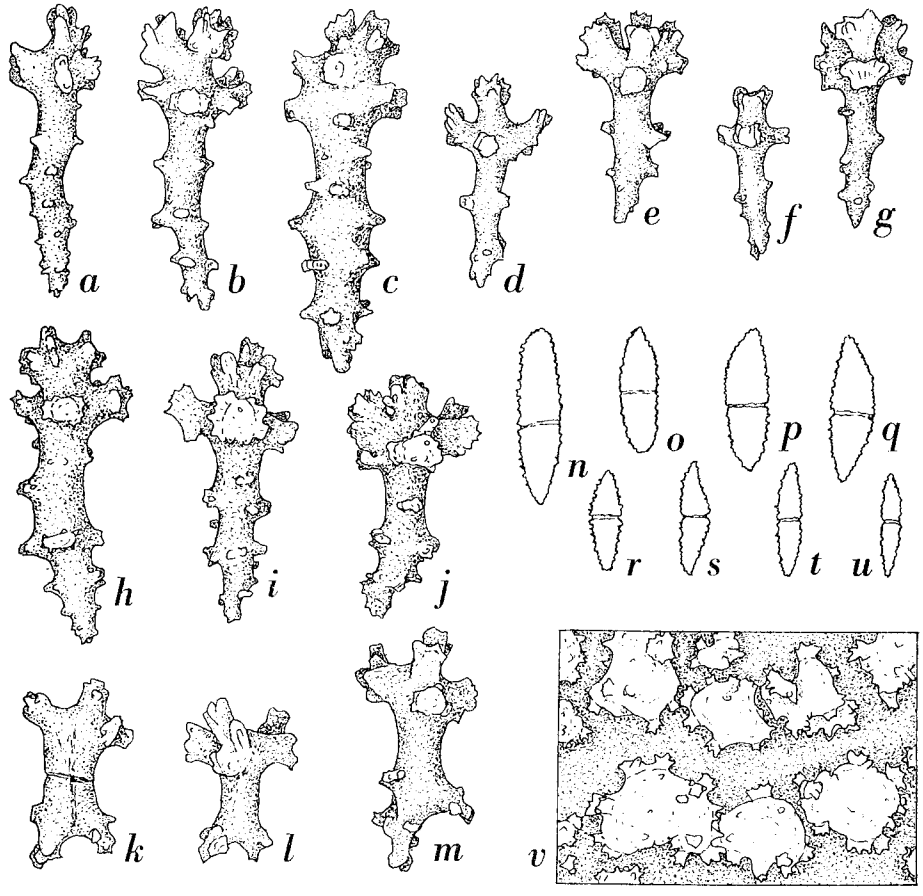


Fig. 20. *Sinularia gyrosa* (Klunzinger), BPBM D497. a-g, sclerites from surface layer of a lobe; h-m, sclerites from surface layer of the sterile stalk; n-u, spicules from coenenchyme of the sterile stalk; v, warts on a coenenchymal spicule. a-m, v, × 220; n-u, × 10.

intermediate forms between normal clubs and spiny spindles, 0.20 to 0.30 mm long. In the outer layer of the sterile stalk the clubs are slightly wider, but the length is the same (fig. 20h-j). Moreover, both in capitulum and in sterile stalk irregular forms occur: crosses, thick, short rods with two "heads", etc. (fig. 20k-m).

The interior of capitulum and sterile stalk has blunt-ended spindles and cylinders, pointed lozenge-shaped spicules, and intermediate forms between these (fig. 20n-u). Most spicules have a distinct median constriction. In the lobes the length is up to 1.50 mm, in the sterile stalk they are longer, up to 2.20 mm; the width is up to 0.65 mm. The warts are medium-sized, sometimes they are placed in girdles (fig. 20v).

Colour. — In alcohol the colony is dark grey-brown.

Variability. — The colony BPBM D495 and the fragment RMNH Coel. no. 11749 are white (pl. 7 fig. 1).

Remarks. — I compared my specimens with one of the colonies identified with *S. gyrosa* by Tixier-Durivault. The twisted, wall-like lobes of this colony are larger and less densely arranged. The coenenchymal spicules in these lobes are up to 2 mm long. But for the rest there is a striking agreement; the polyps are retracted into clearly visible pits, the clubs and spindles in the surface layers of capitulum and stalk are identical, and the coenenchymal spicules in the stalk are up to 2.20 mm long.

These spicules are shorter than those described by Klunzinger (1877: 27). According to this author they are up to 4 mm long. Macfadyen (1936: 36-37) records the same length, but in her colony from Low Isles these spicules are only 2.20 mm long (2.2 cm is a slip).

I presume that some errors have crept into Tixier-Durivault's publications (1951, 1966). I wonder whether in her publication of 1951 the drawings of the figures 9 and 11 have been interchanged, the spicules in the interior of the stalk being larger than those in the capitulum. Moreover, the length of the basal(?) coenenchymal spicules is more than 1 mm, the spicule represented in her fig. 9a is about 1.75 mm long. At all events, the numbers of the figures 161 and 162 in her paper of 1966 have been shifted.

Geographical distribution — The species has been recorded from the Red Sea, Aldabra Is., Palau Is., Maer I. and Low Is. (Great Barrier Reef), Palawan (Philippines), Tahiti, Gambier Is., off Noumea (New Caledonia), and Bay of Nha-Trang (Vietnam).

Sinularia numerosa Tixier-Durivault, 1970 (figs. 21, 22, pl. 8 fig. 2)

Sinularia numerosa Tixier-Durivault, 1970a: 273-277, figs. 120-123.

Material. — Gambier Is., Sta. GA IV: W-side of Aukena I., depth 1.5-6.0 m, 12 October 1967. D. M. Devaney, collector. BPBM D505, one colony; RMNH Coel. no. 11760, a fragment of this colony.

Description. — The capitulum of the firm, incomplete colony has diameters of 70 and 50 mm (pl. 8 fig. 2). It consists of some densely placed primary lobes, 30 mm high, which bear many twisted, crest-shaped secondary lobes, 10 to 20 mm high, and tapering upwards. The capitulum projects beyond the short sterile stalk.

The polyps are retracted into small pits, 0.40 mm in diameter; the centres are about 1.00 mm apart.

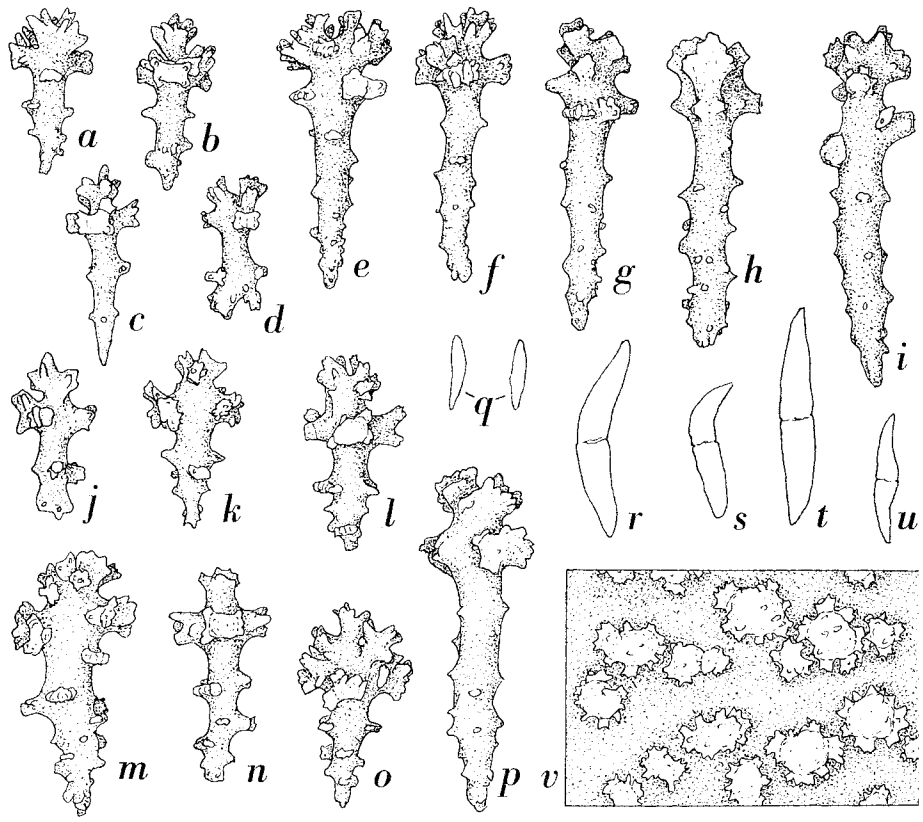


Fig. 21. *Sinularia numerosa* Tixier-Durivault, BPBM D505. a-i, sclerites from outer layer of a lobe; j-p, sclerites from outer layer of the sterile stalk; q-u, spicules from coenenchyme of the sterile stalk; v, warts on a coenenchymal spicule. a-p, v, × 220; q-u, × 10.

The outer layer of the lobes has clubs, 0.12 to 0.24 mm long. The head is composed either of irregularly placed warts (fig. 21a, e, g-i) or of a central wart with a wreath of warts below it (fig. 21b, c). Intermediate forms (fig. 21f), irregular forms (fig. 21d), and crosses are also met with.

In the surface layer of the sterile stalk the same types occur, but they are thicker (fig. 21j-p).

In the coenenchyme of lobes and stalk there are pointed or blunt spindles, up to 2.50 mm long (fig. 21q-u), with a median constriction. The tubercles, sometimes arranged in transverse rows, are small (fig. 21v).

Colour. — In alcohol the colony is greyish, but many crests are brown.

Remarks. — I compared my colony with one of Tixier-Durivault's type specimens. There is a full agreement. The spicules of this specimen are represented in fig. 22.

Geographical distribution. — The type specimens have been collected at New Caledonia.

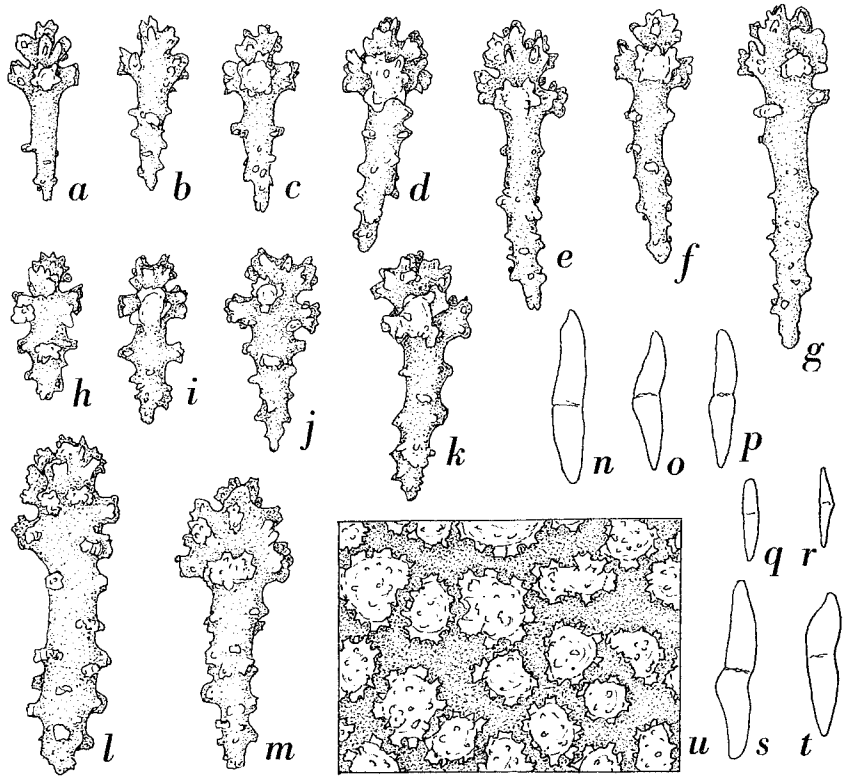


Fig. 22. *Sinularia numerosa* Tixier-Durivault, type specimen. a-g, sclerites from surface layer of a lobe; h-m, sclerites from surface layer of the sterile stalk; n-t, spicules from coenenchyme of the sterile stalk; u, warts on a coenenchymal spicule. a-m, u, × 220; n-t, × 10.

Sinularia procera sp. nov. (fig. 23, pl. 9 fig. 2)

Material. — Pago Pago, Samoa, September 1923. G. P. Wilder & O. H. Swezey, collectors. BPBM D512, one fragment, the holotype.

Description. — The fragment consists of the distal part of the sterile stalk and the capitulum. The sterile stalk is 20 mm wide; it has been cut off obliquely. The interior consists of rather few canals, about 1 mm wide, with thick walls between.

The capitulum consists of some primary lobes, which bear flabby, slender lobules or twigs, up to 45 mm long, and 5 mm wide at the base; they taper distally (fig. 23a; pl. 9 fig. 2). The lobes are covered with retracted zooids (fig. 23b). On the primary lobes the centres are 0.60 to 0.80 mm apart, on the twigs the distance is 0.35 to 0.55 mm. In the interior of the twigs there is one central canal.

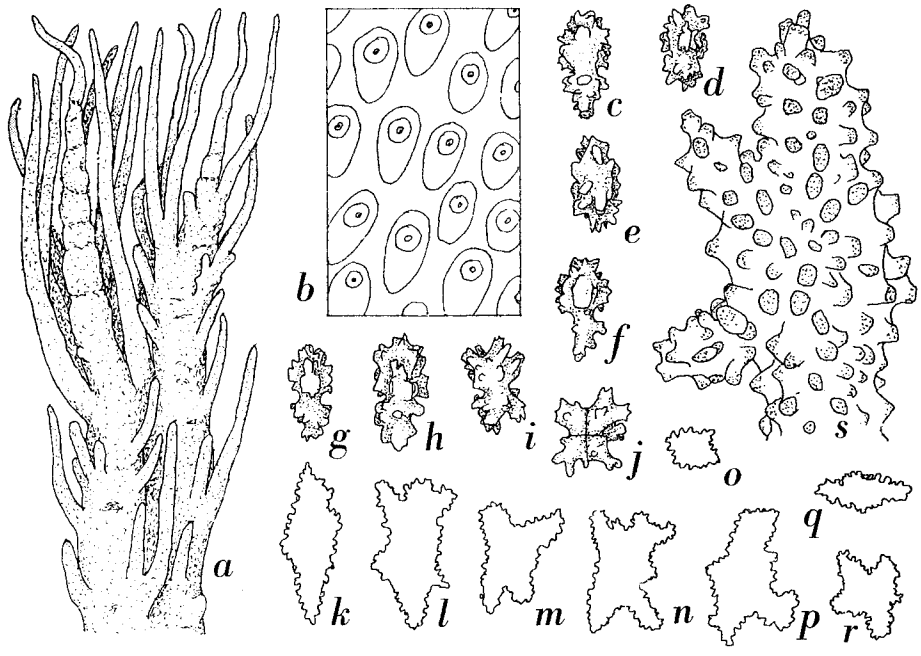


Fig. 23. *Sinularia procera* sp. nov., holotype, BPBM D512. a, part of the capitulum; b, surface of a lobe with retracted zooids; c-j, sclerites from surface layer of the sterile stalk; k-r, sclerites from interior of the sterile stalk; s, part of such a coenenchymal sclerite. a, natural size; b, k-r, × 20; c-j, × 220; s, × 65.

The lobes and lobules are devoid of spicules. The surface layer of the sterile stalk has tiny spicules, 0.05 to 0.07 mm long. Some of them are slightly clavate (fig. 23c, f), but most of them are irregularly shaped rods (fig. 23d, e, g-i). Besides, many four-rayed stars or crosses are found (fig. 23j). In the interior of the stalk there are irregular bodies, up to 1 mm

long, and covered with high, rounded prominences, whose blunt tips bear very tiny spines (fig. 23k-s).

Colour. — In alcohol the colony is creamy.

Remarks. — The shape of the colony and the absence of sclerites in the lobes bring to mind *S. flexibilis* (Quoy & Gaimard, 1833). But in our specimen the lobes and lobules are probably longer, and the spicules in the sterile stalk are quite different.

The question arises whether the smallness of the coenenchymal sclerites (up to 1 mm) does not prevent referring the species to the genus *Sinularia*. It might be better to refer it to the genus *Alcyonium*? I think we have to do here with a borderline case. Within the genus *Alcyonium* there are a few species with rather long spicules, e.g., *A. dendroides* Thomson & Dean, 1931, *A. læve* Tixier-Durivault, 1955 and *A. laxum* Tixier-Durivault, 1955. In these species the coenenchymal spicules are as long as 0.90 mm. With respect to this our specimen could be an *Alcyonium*. But on the other hand Kolonko (1926: 311) found in one of the colonies of *Sinularia flexibilis* coenenchymal spicules with a length of 0.70 to 1.00 mm, consequently very short ones. Besides, the shape of our colony resembles so much that of *S. flexibilis*, that I have decided to refer our specimen to the genus *Sinularia*. Perhaps we shall see in later finds of specimens with complete stalks that in the basal part of the stalk the spicules are longer than those found in the distal part of it in our specimen.

The proposed specific name *procera* (Latin: *procerus* = tall, slender) refers to the shape of the lobes and lobules.

Sinularia rigida (Dana, 1846) (fig. 24, pl. 9 fig. 1)

Alcyonium rigidum Dana, 1846: 622, pl. 58 fig. 2; Milne Edwards & Haime, 1857: 120.
Lobularia rigida, Gray, 1869: 122.
Alcyonium rigidum var. *amboinensis* Burchardt, 1903; 667-668, pl. 54 fig. 9, pl. 56 fig. 9; Lüttschwager, 1915: 10-11; Kolonko, 1926: 312-313; Thomson & Dean, 1931: 51-52; Tixier-Durivault, 1951: 76-78, fig. 97; 1966: 195-198.
non *Alcyonium rigidum*, May, 1899: 109, pl. 5 fig. 5a-c; Lüttschwager, 1915: 10; Kolonko, 1926: 312.
? Sinularia rigida, Tixier-Durivault, 1945: 147; 1951: 74-76, figs. 89, 93, 99-102; 1953: 318-319; 1970a: 254-255; 1970b: 211.

Material. — Enewetak Atoll, on pinnacle off Parry (Elmer) I., depth 9 m, 16 January 1975. B. N. Ravi, collector. RMNH Coel. no. 11771, one incomplete colony.

Description. — The incomplete, firm, encrusting colony is very flat. It measures only about 25 mm in total height. The sterile stalk is low, and strongly spread outwards. The slightly concave disc has diameters of 103 and 80 mm (pl. 9 fig. 1). The remote lobes are usually 10 to 15 mm high, a few are up to 20 mm long. They are finger-like, 4 to 5 mm wide, some

are cone-shaped. In a transverse section they are circular or oval. They may be unbranched, or ramify into a few lobules; the tips are rounded.

The retracted zooids are quite invisible, and do not even leave any small pits in the surface of the lobes.

In the surface layer of the lobes are the following kinds of sclerites: (1) clubs 0.10 to 0.20 mm long, provided with a central wart (fig. 24b-d, f); (2) clubs 0.10 to 0.25 mm long, with relatively wide, warty heads (fig. 24a, e, g); the handles of the clubs are usually thin and pointed; (3) tiny, slender rods 0.08 to 0.10 mm long, chiefly with two girdles of minute, blunt processes and terminal tufts of these; and (4) spindles 0.20 to 0.32 mm long,

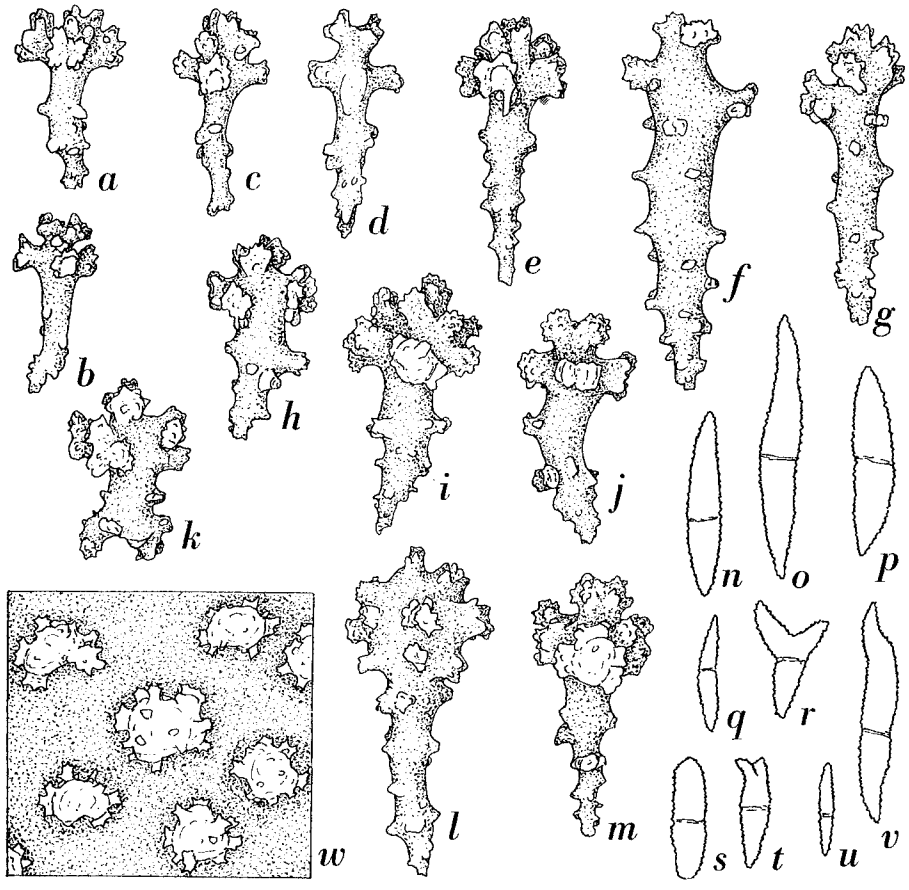


Fig. 24. *Sinularia rigida* (Dana), RMNH Coel. no. 11771. a-g, sclerites from surface layer of a lobe; h-m, sclerites from surface layer of the sterile stalk; n-v, spicules from coenenchyme of the sterile stalk; w, tubercles on a coenenchymal spicule. a-m, w, × 220; n-v, × 10.

with few blunt thorns. The sclerite represented in fig. 24f may be considered an intermediate form between these spindles and the clubs.

The surface layer of the sterile basal part has clubs with wider, warty heads and thicker handles (fig. 24h-j, l, m); they are 0.13 to 0.20 mm long. In addition to these we find: (1) clubs with short, blunt handles with a varying number of tubercles at the base (fig. 24k); (2) clubs with bifurcated handles, and (3) thick spindles about 0.20 to 0.25 mm long, and bearing spines or conical processes.

The interior of the lobes contains straight or curved spindles up to 2.90 mm long and 0.45 mm wide, and rather densely covered with small or medium-sized, crenelated tubercles arranged in transverse rows. In the sterile basal part the spindles may be longer, up to 3.40 mm, the width is up to 0.50 mm (fig. 24n-v); a few are bifurcated at one end. The warts are irregularly distributed (fig. 24w) or placed in rows.

Colour. — In alcohol the colony is creamy-yellowish.

Remarks. — The original diagnosis of *Alcyonium (Simularia) rigidum* reads as follows: "Rigid, spreading, incrusting and subexplanate; branches usually simple, short digitiform, scarcely 1 inch long, and 2 to 4 lines thick, obtuse, frequently very remote" (Dana, 1846: 622). Dana added to this: "This stiff and rigid species forms flat or convex incrustations, with scattered digitiform branches, hardly an inch long, often separated by bare intervals of considerable width".

Our specimen agrees very well with this diagnosis and description.

Unfortunately some confusion has arisen afterwards with respect to the species, chiefly as a result of the fact that Dana did not record anything about the sclerites. May's description (1899: 109) gave occasion to this confusion. He said that the coenenchyme of his specimen was fine-grained, that the coenenchymal sclerites, 0.285 mm long and 0.095 mm wide, are cylindrical with usually four distinct girdles of tubercles, and that in the interior of the lobes the spicules, 0.475 mm long and 0.076 mm wide, have many distinct girdles of warts.

But May's drawings of these spicules (his pl. 5 fig. 5b, c) fail to show these girdles. Kolonko (1926: 312) already pointed out this discrepancy, and he intentionally ignored the presence of the girdles of warts in his diagnosis. I think he was wrong in doing so. For May expressly mentioned the girdles of warts, and it seems obvious that the drawings are incorrect and not the text. The more so as in May's pl. 5 fig. 10b we cannot see any trace of girdles of warts, whereas May mentioned them in his diagnosis of *Lobophytum crassum* var. *australicum* (May, 1899: 120: "Spindeln mit deutlichen Warzengürteln").

In my opinion May did not describe a *Sinularia* species, but a *Lobophytum* species, and consequently Lüttschwager's (1914) and Kolonko's (1926) descriptions are incorrect, since these authors refer to May's paper.

Burchardt (1903: 667) described *Alcyonium rigidum* var. *amboinensis*. The reason why he established this new variety seems to be that in his variety the (coenenchymal) spicules are five to six times longer than those in May's specimen. But, since, as we have shown above, May did not describe a specimen of *S. rigida*, I think Burchardt's specimen is nothing else but *S. rigida*. The same holds for the specimens described by Lüttschwager (1915: 10-11) and Thomson & Dean (1931: 51-52). And our specimen fully agrees with Burchardt's description.

Tixier-Durivault (1951) described a dried specimen from the Red Sea. I have my doubts about the correctness of this identification. In her colony the sterile stalk is erect ("dressé"), and the lobes are densely placed. Her fig. 93 does not clarify matters. I investigated one of the colonies identified by her with *S. rigida*. In that colony the lobes are very long, and densely pressed together. The coenenchymal spicules in lobes and stalk are up to 2.50 mm long, and not irregularly branched like the spindles in her figs. 89 and 99, only a few are forked at one end.

Geographical distribution. — The species has been recorded from Fiji Is., Amboina, Roti I., Reunion I., and East Africa.

Sinularia sandensis sp. nov. (fig. 25, pl. 8 fig. 1)

Material. — Sand I., Enewetak Atoll, on pinnacle, depth 18 m, 7 July 1974. F. X. Woolard, collector. RMNH Coel. no. 11765, three fragments, parts of the type specimen.

Description. — It is regrettable that the colony has been cut up into pieces. This makes it impossible to give a photograph of the whole colony; a drawing of a single lobe (fig. 25a) and a photograph of one of the fragments will have to suffice (pl. 8 fig. 1).

The sterile stalk is stiff, but rather soft to the touch. It is about 20 mm wide, the length cannot be ascertained. It has deep longitudinal furrows. In the interior we see wide canals with thin walls between them.

The capitulum consists of a number of primary lobes, which ramify into long secondary and tertiary lobules or twigs. All lobes and twigs are flabby, and strongly flattened. The twigs are 10 to 15 mm long and about 2 mm wide; in the interior there are two or three flat canals.

Of the polyps hardly any trace is to be found. They presumably only occur on the twigs. A few could be seen projecting beyond the surface. The outer layer of the twigs seems to have been affected by some unknown

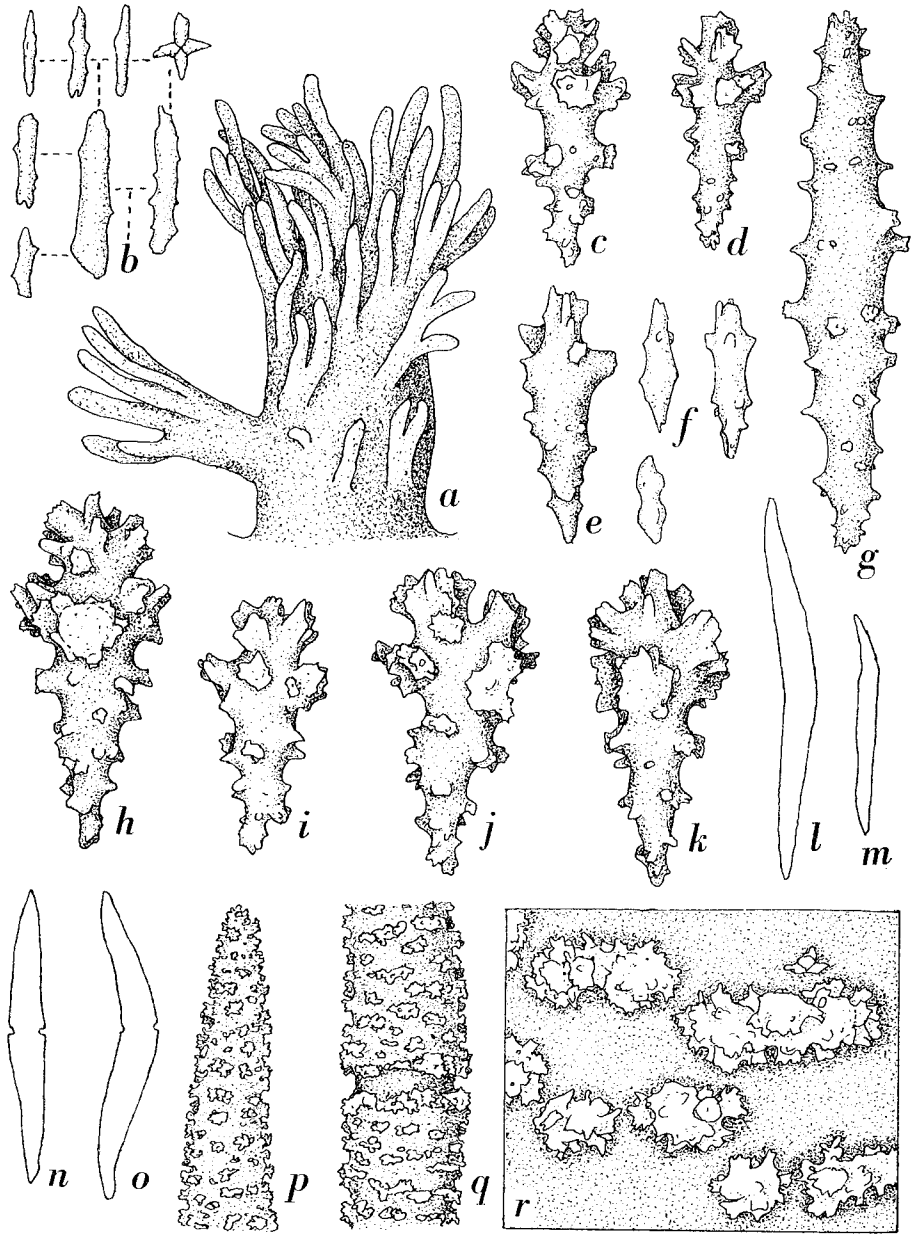


Fig. 25. *Sinularia sandensis* sp. nov., type specimen, RMNH Coel. no. 11765. a, primary lobe with secondary and tertiary lobules; b, spicules from surface layer of a lobe; c-f, sclerites from surface layer of distal part of the sterile stalk; g-k, sclerites from surface layer of middle part of the sterile stalk; l-o, spicules from coenenchyme of the sterile stalk; p, q, parts of such coenenchymal spicules; r, warts on a coenenchymal spicule. a, × 1.4; b-k, r, × 220; l-o, × 10; p, q, × 40.

cause. It contains tiny rods, 0.03 to 0.10 mm long (fig. 25b). In the polyps the same rods occur, irregularly distributed. The thin canal-walls are devoid of spicules.

The surface layer of the sterile stalk has numerous clubs, 0.15 to 0.21 mm long, with wide, warty heads and usually pointed handles (fig. 25h-k). Besides, we find spindles, 0.25 to 0.36 mm long, sparsely covered with spines or small warts (fig. 25g). In the distal part of the stalk the clubs are slightly smaller (fig. 25c-e), the rods are also small, and weakly spined (fig. 25f). The canal-walls of the sterile stalk have slender, pointed spindles, up to 5.25 mm long and 0:31 to 0.46 mm wide (without warts; up to 0.55 mm, warts included). They often show a median constriction (fig. 25l-q). The warts are very irregular in outline: across they may be very long, in a longitudinal direction of the spicule the width is about 0.05 to 0.07 mm (fig. 25r).

Colour. — In alcohol the fragments are brown, partly black owing to some external influence.

Remarks. — The shape of the colony with its stiff sterile stalk and flaccid lobes recalls *S. flexibilis* (Quoy & Gaimard, 1833). But the new species differs from it in the spiculation. The shape of the colony also bears a slight resemblance to that of *S. capillosa* Tixier-Durivault, 1970b, and of *S. procera* sp. nov., described in this paper, but here, too, the spicules are different.

The specific name is a derivative of the name of the type locality.

Sinularia venusta Tixier-Durivault, 1970 (figs. 26, 27, pl. 7 fig. 2)

Sinularia venusta Tixier-Durivault, 1970a: 283, figs. 136-138.

Material. — Peale I., Wake Is., 28 August 1964. A.H. Banner, collector. BPBM D503, one fragment; RMNH Coel. no. 11744, one fragment.

Wake Is., 1923. Tanager Expedition. BPBM D426, one colony.

Description of specimen RMNH Coel. no. 11744. — The capitulum has diameters of 90 and 70 mm (pl. 7 fig. 2). It projects beyond the sterile stalk, which is up to 40 mm high. The capitulum consists of a number of densely placed primary lobes, up to 30 mm high, which, at different heights, bear many lobules; the latter vary in size and shape from tiny knobs to spherical or finger-shaped processes, 2 to 5 mm wide.

The clubs in the surface layer of the lobes are 0.12 to 0.24 mm long (fig. 26a-f). The heads, up to 0.10 mm wide, have warts. The handles bear spines and small warts. The clubs in the outer layer of the sterile stalk scarcely differ from those in the lobes (fig. 26g-j). Both in lobes and sterile stalk some clubs may have forked handles (fig. 26f, g). In the coenenchyme of lobes and stalk we find the same type of spicules: spindles, wide

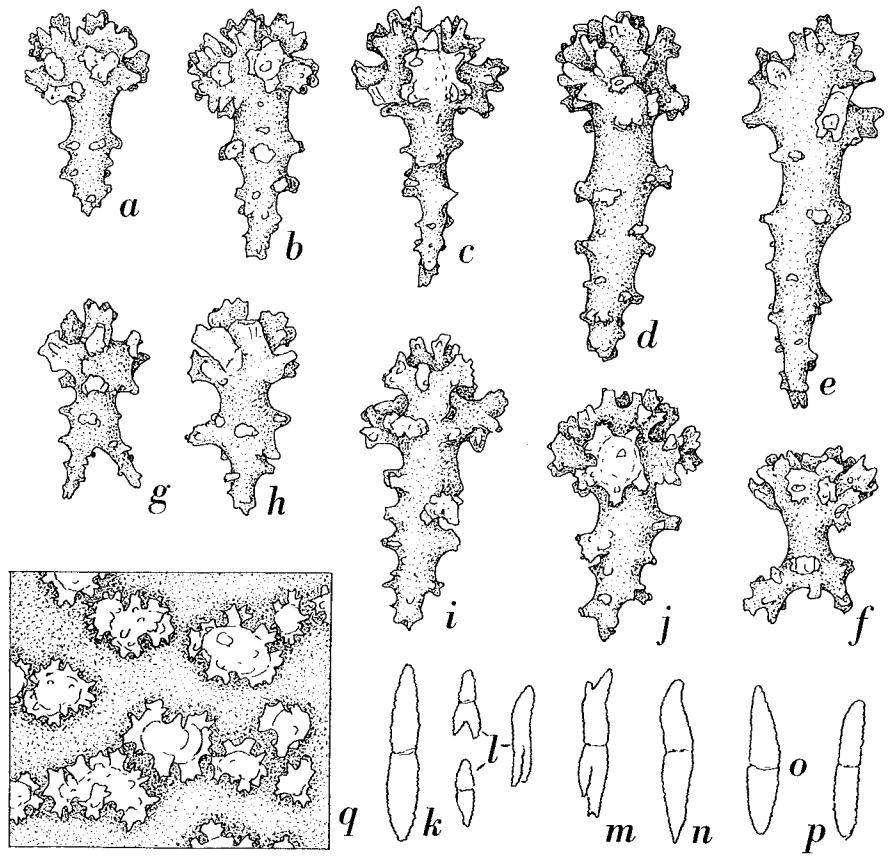


Fig. 26. *Sinularia venusta* Tixier-Durivault, BPBM D503. a-f, sclerites from surface layer of a lobe; g-j, sclerites from surface layer of the sterile stalk; k-p, sclerites from coenenchyme of the sterile stalk; q, tubercles on a coenenchymal spicule. a-j, q, × 220; k-p, × 10.

or slender, pointed or blunt-ended, straight or curved, sometimes bifurcated at one end, and up to 2.50 mm long (fig. 26k-p). The tubercles on these spicules are medium-sized, and not densely placed (fig. 26q).

Colour. — In alcohol the colony is creamy.

Variability. — The specimen BPBM D503 agrees in all respects with the colony just described. It is possible that they are parts of the same colony. The diameters of the capitulum are 70 and 50 mm. Specimen BPBM D426 is slightly smaller, the sterile stalk is 30 to 40 mm high.

Remarks. — The colonies described above are much larger than the type specimen, depicted in Tixier-Durivault's fig. 136 (1970a); the enlargement of the colony in this figure is about × 1.3. The sclerites of the type speci-

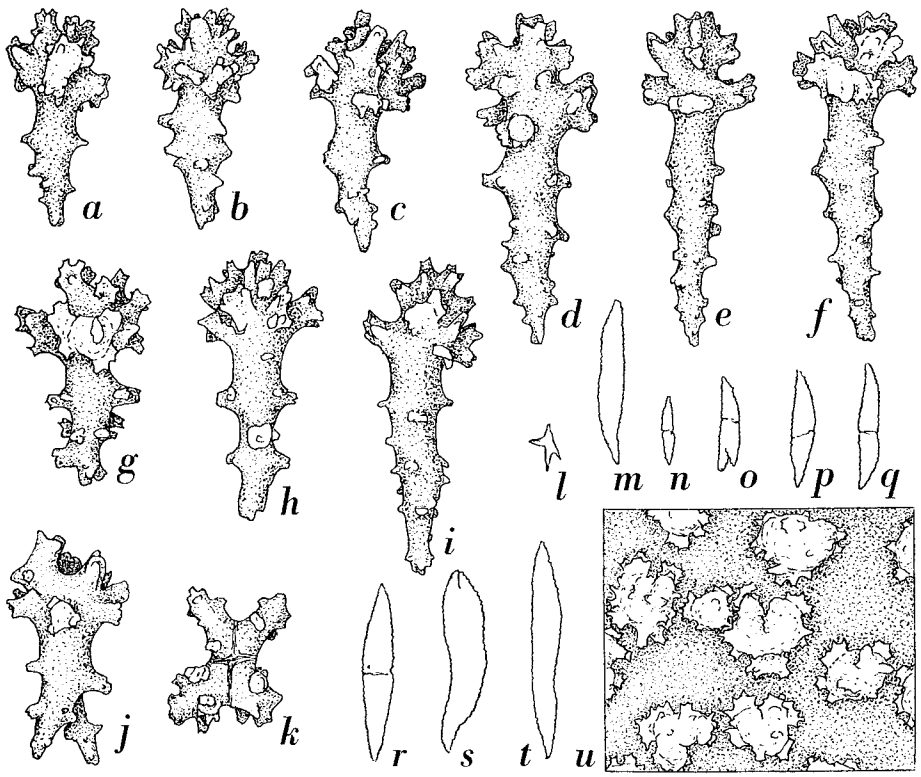


Fig. 27. *Sinularia venusta* Tixier-Durivault, type specimen. a-f, sclerites from surface layer of a lobe; g-k, sclerites from surface layer of the sterile stalk; l-t, spicules from coenenchyme of the sterile stalk; u, tubercles on a coenenchymal spicule. a-k, u, × 220; l-t, × 10.

men are represented in fig. 27. The heads of the clubs are narrower, up to 0.08 mm; clubs with forked handles (fig. 27j) are scarce, but crosses (fig. 27k) are rather numerous. The coenenchymal spicules may reach a length of 3 mm.

Sinularia vervoorti sp. nov. (fig. 28, pl. 10 fig. 1)

Material. — Guam, 1902; A. Seale, collector. BPBM D243, one colony, the holotype; RMNH Coel. no. 11755, a fragment of this colony.

Description. — The low, encrusting, firm colony is 35 to 50 mm high. The capitulum has diameters of 105 and 65 mm (pl. 10 fig. 1). The sterile stalk is attached to a piece of coral. It shows irregular, longitudinal grooves, and in some places a transverse striation. The capitulum consists of broad and short, stumpy lobes, usually compressed against one another, with apical

diameters of 5 to 15 mm; the height is up to about 10 mm. The flattened upper side of the lobes often has a central pit. Sometimes the lobes are sinuous.

The polyps are completely retracted, leaving small pits; the centres of these are 0.60 to 0.80 mm apart.

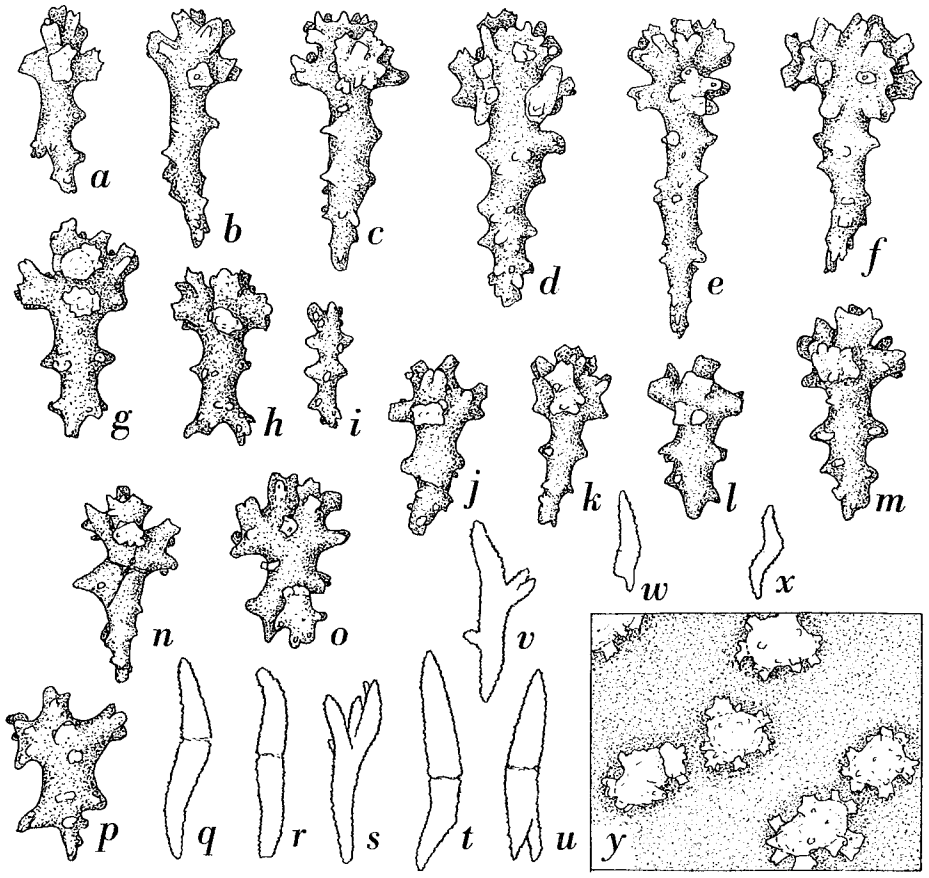


Fig. 28. *Sinularia vervoorti* sp. nov., holotype, BPBM D243. a-i, sclerites from surface layer of a lobe; j-p, sclerites from surface layer of the sterile stalk; q-x, spicules from coenenchyme of the sterile stalk; y, warts on a coenenchymal spicule. a-p, y, × 220; q-x, × 10.

The surface layer of the lobes has clubs 0.12 to 0.21 mm long (fig. 28a-g). The heads are warty. Sometimes it looks as if there is a central wart. The handles have irregularly distributed, short processes. Aberrant forms (fig. 28h) and small clubs, about 0.07 mm long (fig. 28i) also occur. In the

interior of the lobes there are spindles, up to 2.80 mm long, usually curved, often bifurcated at one end, or provided with bizarre processes.

In the sterile stalk we find, broadly, the same spicules. The clubs in the surface layer are shorter, up to 0.15 mm, and wider (fig. 28j-p). The spicules in the coenenchyme (fig. 28q-x) are identical with those in the lobes. The warts are small, and not crowded (fig. 28y).

Colour. — In alcohol the colour is light-brown.

Remarks. — The species is characterized by the low, truncate lobes with tiny pits on their upper surface. It is named after Dr. W. Vervoort, director of the Rijksmuseum van Natuurlijke Historie, Leiden.

References

AUDOUIN, J. V., 1828. Explication sommaire des planches de polypes de l'Égypte et de la Syrie, publiées par J. C. Savigny dans Description de l'Égypte, 23.

BURCHARDT, E., 1903. Alcyonaceen von Thursday Island (Torres Strasse) und Amboina. II. Alcyonaceen von Amboina in: Semon, Zoologische Forschungsreisen 5 (6). — Denkschr. med.-naturw. Ges. Jena, 8: 654-682, pls. 54-57.

DANA, J. D., 1846. Zoophytes. U.S. exploring Exped. during the years 1838-1842, 7: i-x, 1-740, text-figs. 1-45, pls. 1-61.

EHRENBERG, C. G., 1834. Beiträge zur physiologischen Kenntniss der Corallenthiere im allgemeinen, und besonders des Rothen Meeres, nebst einem Versuche zur physiologischen Systematik derselben. — Abhandl. K. Akad. Wiss. Berlin, 1832 (1) :225-380.

GRAY, J. E., 1869. Notes on the fleshy alcyonoid corals (Alcyonium, Linn., or Zoophytaria carnosa). — Ann. Mag. nat. Hist., (4) 3: 117-131.

HENDERSON, W. D., in: J. A. THOMSON & J. J. SIMPSON, 1909. An account of the Alcyonarians collected by the Royal Indian Marine Survey Ship "Investigator" in the Indian Ocean. II. The Alcyonarians of the littoral area: i-xviii, 1-319, text-figs. 1-77, pls. 1-9. (Indian Museum, Calcutta).

KLUNZINGER, C. B., 1877. Die Korallthiere des Rothen Meeres. I. Die Alcyonarien und Malacodermen: i-vii, 1-98, pls. 1-8.

KOLONKO, K., 1926. Beiträge zu einer Revision der Alcyonarien. Die Gattung Sinularia. — Mitt. zool. Museum Berlin, 12 (2): 291-334, pls. 1-4.

LAMOUROUX, J. V. F., 1812. Mémoire sur la montée et sur une nouvelle classification des Polypiers coralligènes non entièrement pierreux. — Nouv. Bull. Soc. philom. Paris, 1812: 181-188.

——, 1816. Histoire des Polypiers coralligènes flexibles, vulgairement nommés Zoophytes: i-lxxxiv, 1-560, pls. 1-19.

LÜTTSCHWAGER, J., 1915. Beiträge zu einer Revision der Familie Alcyoniidae. — Arch. Naturgesch., (A) 80 (10): 1-42, figs. 1-9.

MACFADYEN, L. M. I., 1936. Alcyonaria (Stolonifera, Alcyonacea, Telestacea and Gorgonacea). — Great Barrier Reef Exped. 1928-29, Scient. Rep., 5 (2): 19-71, text-figs. 1-11, pls. 1-5.

MARENZELLER, E. VON, 1886. Ueber die Sarcophytum benannten Alcyoniiden. — Zool. Jahrb. (Syst.), 1: 341-368, pl. 9.

MAY, W., 1899. Beiträge zur Systematik und Chorologie der Alcyonaceen. — Jena. Zeitschr. Naturw., 33: 1-180, pls. 1-5.

MILNE EDWARDS, H. & J. HAIME, 1857. Histoire naturelle des coralliaires ou polypes proprement dits, 1: 1-663 + atlas.

MOSER, J., 1919. Beiträge zu einer Revision der Alcyonarien. I. Die Gattungen Sarcophyton Lesson und Lobophytum Marenzeller. — Mitt. zool. Mus. Berlin, 9 (2): 219-294, text-figs. 1-26, pls. 5, 6.

QUOY, J. R. C. & J. P. GAIMARD, 1833. Zoophytes. Voyage de découvertes de l'Astrolabe, Zoologie, 4: 1-390, pls. 1-26.

ROXAS, H. A., 1933. Philippine Alcyonaria. I. The families Cornulariidae and Xeniidae. — Philipp. J. Sci., 50 (1): 49-110, pls. 1-4.

SCHENK, A., 1896. Clavulariiden, Xeniiden und Alcyoniiden von Ternate. — Abh. Senckenb. naturf. Ges., 23 (1): 41-80, pl. 2-4.

THOMSON, J. A. & L. M. I. DEAN, 1931. The Alcyonacea of the Siboga Expedition with an addendum to the Gorgonacea. — Siboga-Exp. Monogr., 13 (d): 1-227, 1 text-fig., pls. 1-28.

TIXIER-DURIVAULT, A., 1942. Note sur une nouvelle espèce d'Alcyoniidae: Lobularia papillosa n.sp. — Bull. Mus. nat. Hist. nat. Paris, (2) 14 (1): 80-87.

——, 1945. Les Alcyonaires du Muséum: I. Famille des Alcyoniidae. 2. Genre Sinularia. — Bull. Mus. nat. Hist. nat. Paris, (2) 17 (1): 55-63.

——, 1948. Révision de la famille des Alcyoniidae. I. Le genre Lobularia Ehrbg (nec Lamarck). — Mém. Mus. nat. Hist. nat. Paris, (n.s.) 23 (1): 1-256, figs. 1-248.

——, 1951. Révision de la famille des Alcyoniidae. Le genre Sinularia May, 1898. — Mém. Inst. roy. Sci. nat. Belgique, (2) 40: 1-146, figs. 1-194.

——, 1953. Sur quelques Alcyoniidés de Tahiti et des îles Fidji. — Bull. Mus. nat. Hist. nat. Paris, (2) 25 (3): 311-319, 1 fig.

——, 1955. Alcyonaires atlantiques intertropicaux. — Expéd. océan. belge dans les eaux côtières africaines de l'Atlantique Sud (1948-1949), Rés. sci., 3 (4): 197-246, figs. 1-36. (Institut Royal Sciences naturelles, Bruxelles).

——, 1956-57. Les Alcyonaires du Muséum. I. Famille des Alcyoniidae. 4. Genre Lobophytum. — Bull. Mus. nat. Hist. nat. Paris, (2) 28 (5): 476-482; (2) 29 (1): 106-111.

——, 1958. Révision de la famille des Alcyoniidae: Les genres Sarcophytum et Lobophytum. — Zool. Verhand. Leiden, 36: 1-180, figs. 1-214.

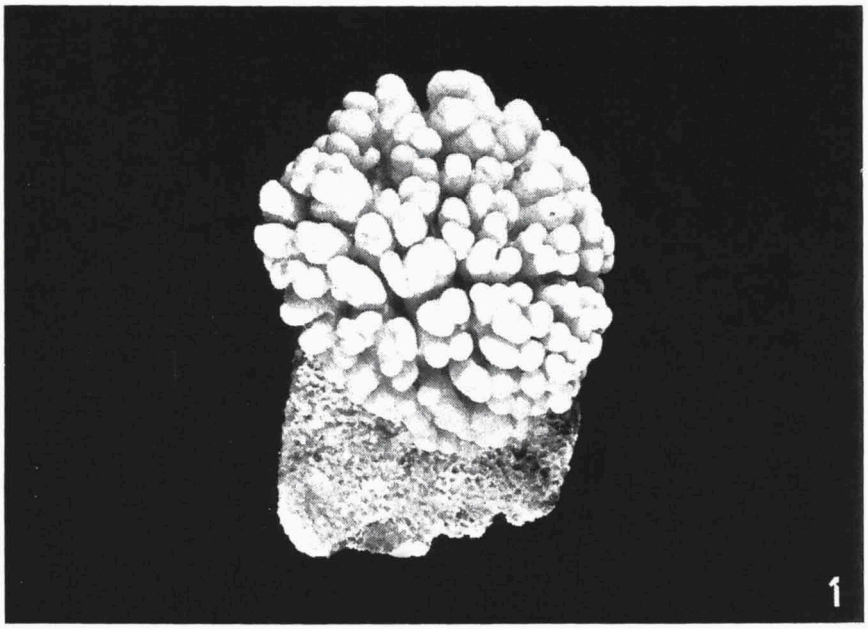
——, 1966. Octocoralliaires de Madagascar et des îles avoisinantes. — Faune de Madagascar, 21: 1-456, figs. 1-399.

——, 1969. Les Alcyoniidae des Tuamotu (Mururoa) et des Gambier. — Cahiers du Pacifique, 13: 133-157, figs. 1-9.

——, 1970a. Les octocoralliaires de Nouvelle-Calédonie. — L'Expédition française sur les récifs coralliens de la Nouvelle-Calédonie organisée sous l'égide de la fondation Singer-Polignac 1960-1963, 4: 171-350, figs. 1-173.

——, 1970b. Les octocoralliaires de Nha-Trang (Viet-Nam). — Cahiers du Pacifique, 14: 115-236, figs. 1-74.

VERSEVELDT, J., 1972. Report on a few octocorals from Eniwetok Atoll, Marshall Islands. — Zool. Meded. 47: 457-464, text-figs. 1-3, pl. 1.



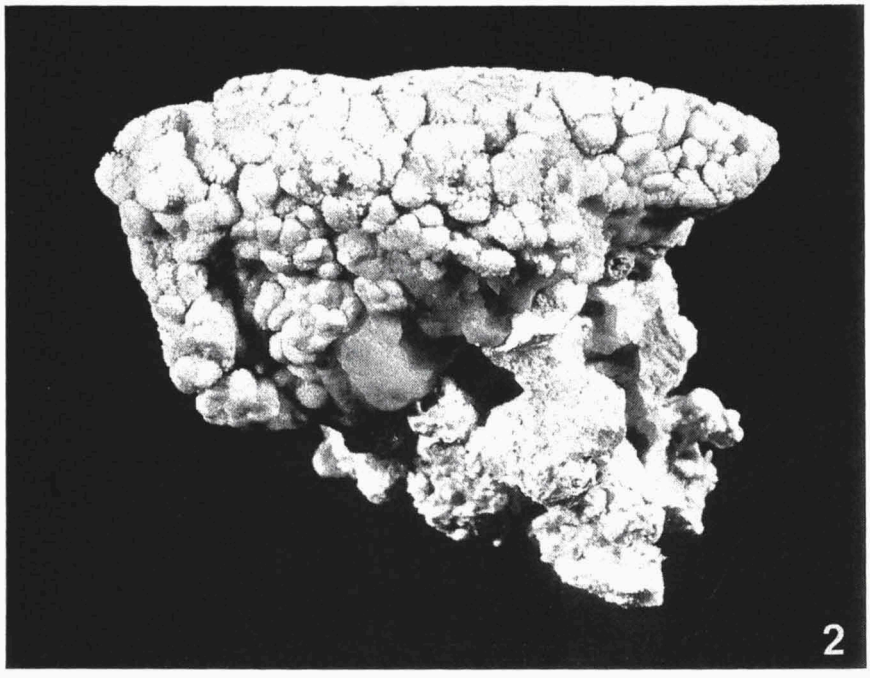
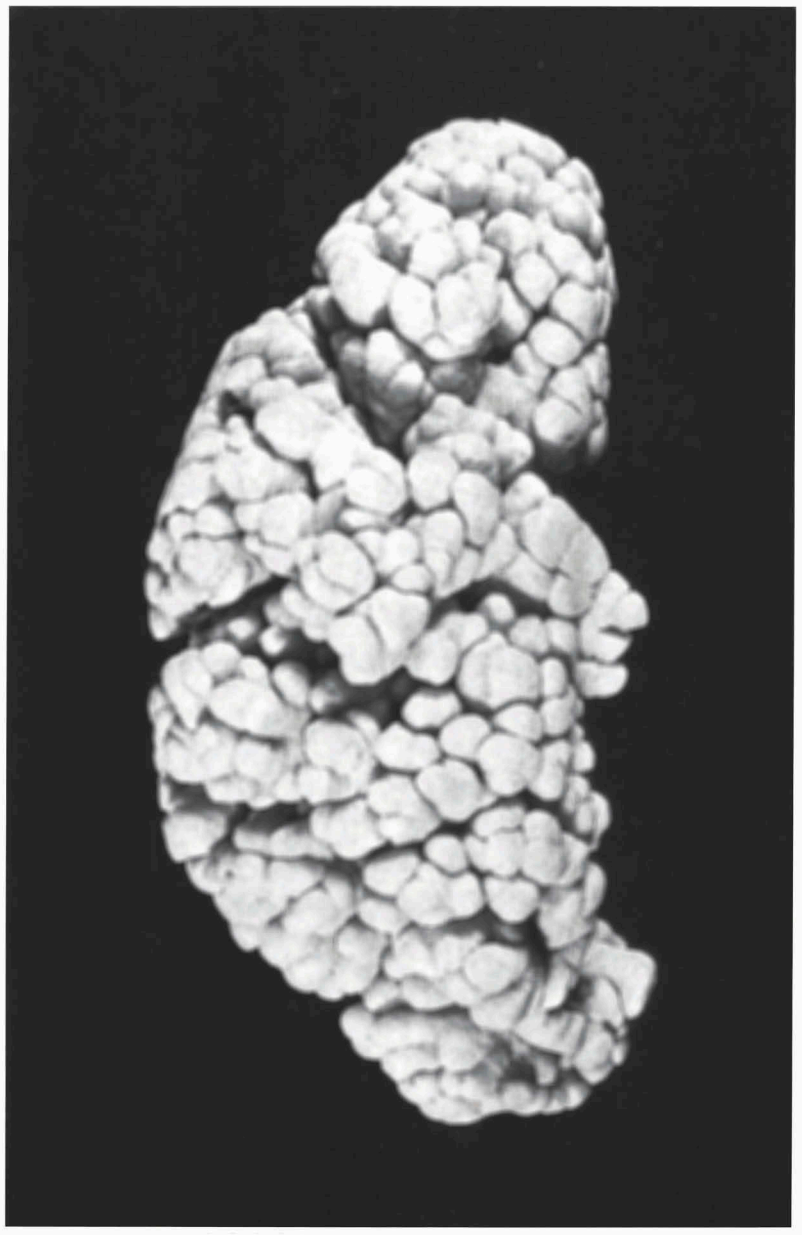
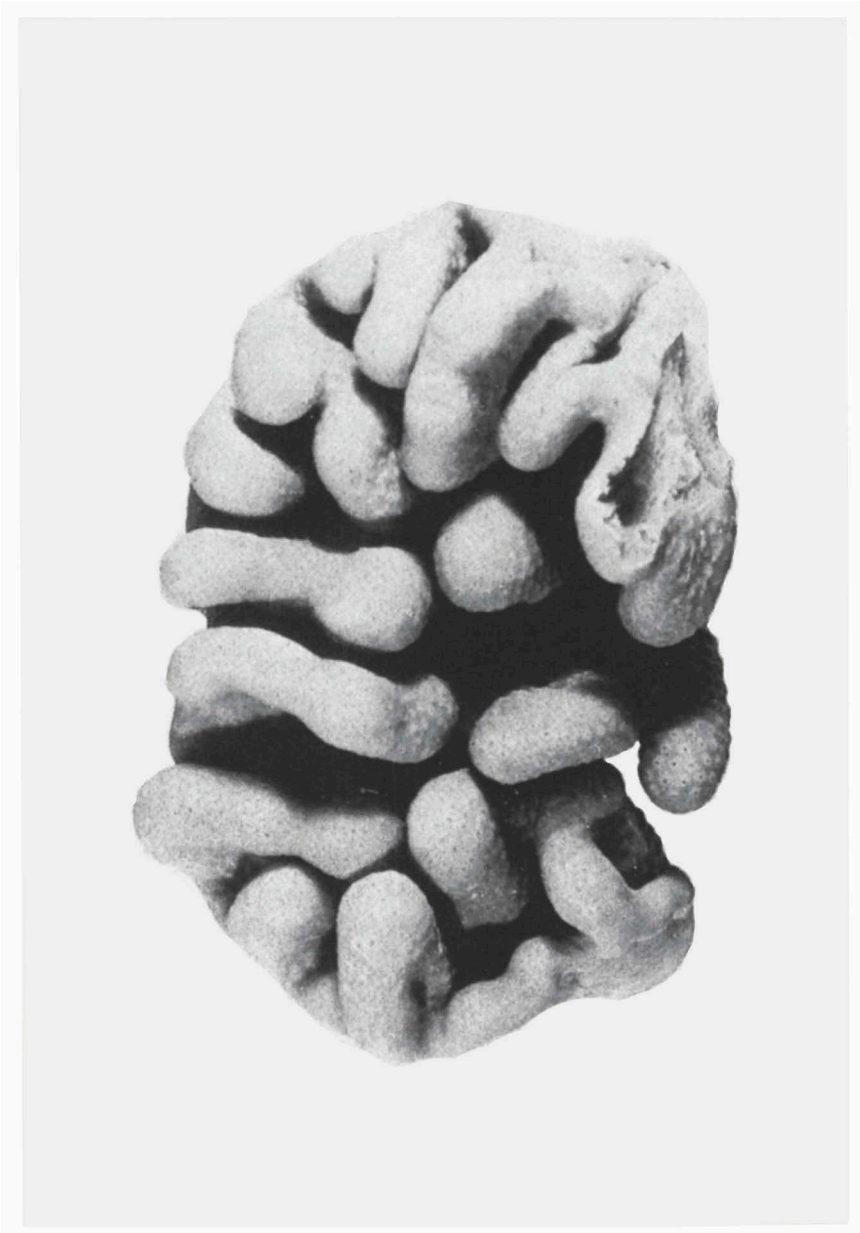


Fig. 1. *Cladiella devaneyi* sp. nov., holotype, BPBM D504. × 1.
Fig. 2. *Cladiella papillosa* Tixier-Durivault, BPBM D507. × 1.



Cladiella subtilis Tixier-Durivault, BPBM D506. × 1.



Lobophytum catalai Tixier-Durivault, BPBM D483. × 1.

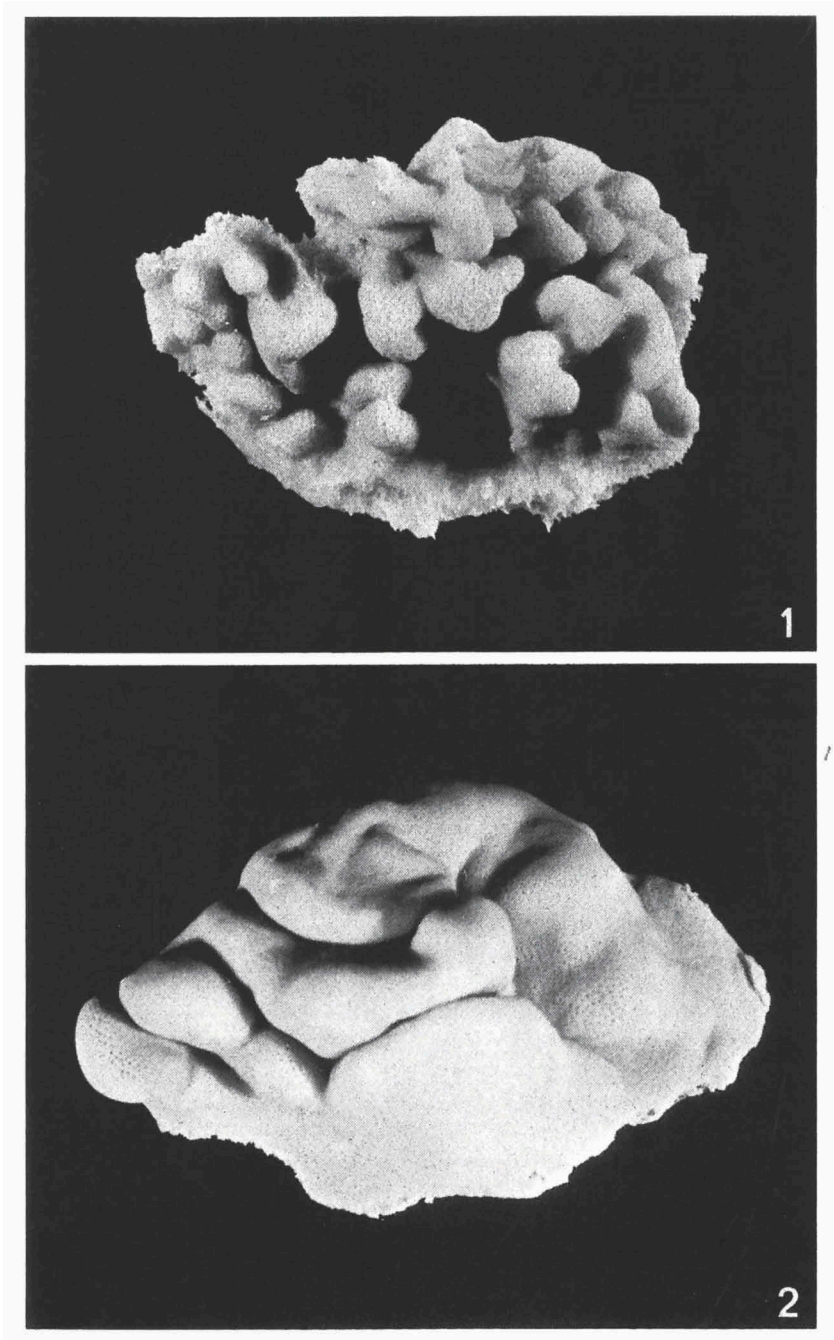
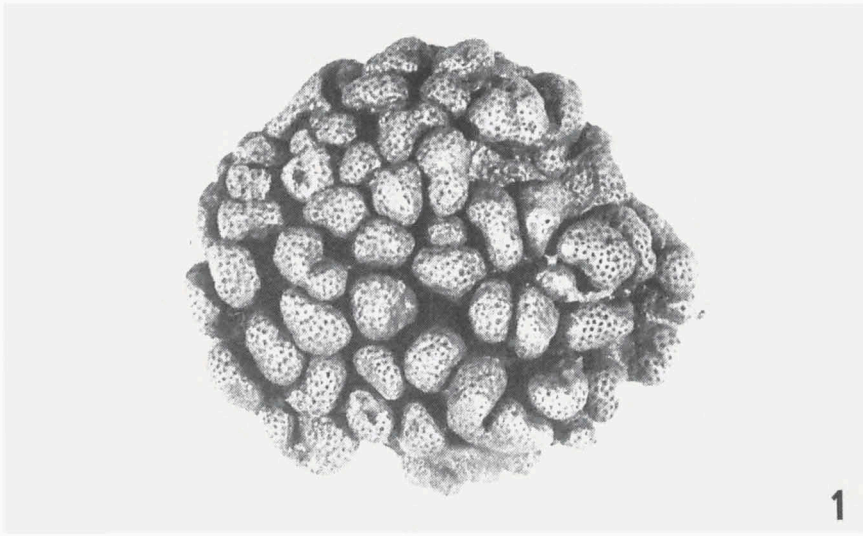


Fig. 1. *Sinularia gravis* Tixier-Durivault, BPBM D500. × 1.
Fig. 2. *Lobophytum denticulatum* Tixier-Durivault, RMNH Coel. no. 11739. × 1.



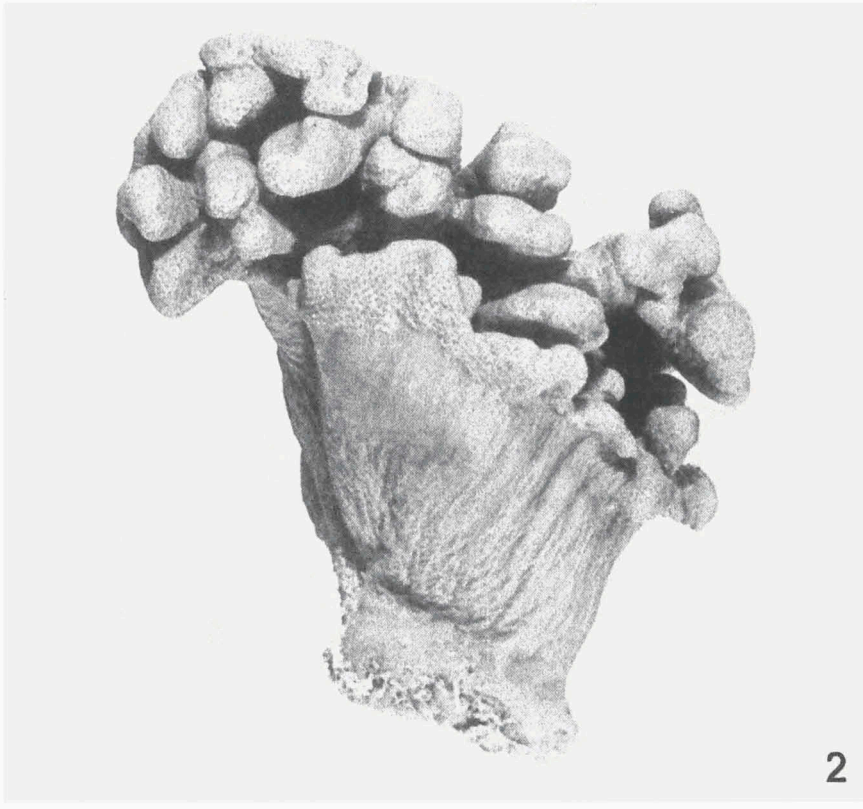


Fig. 1. *Sinularia compacta* Tixier-Durivault, BPBM D496. × 1.
Fig. 2. *Sinularia abrupta* Tixier-Durivault, BPBM D481. × 1.

Fig. 1. *Sinularia gyrosa* (Klunzinger), BPBM D497. × 1.
Fig. 2. *Sinularia brongersmai* Verseveldt, BPBM D479. × 1.

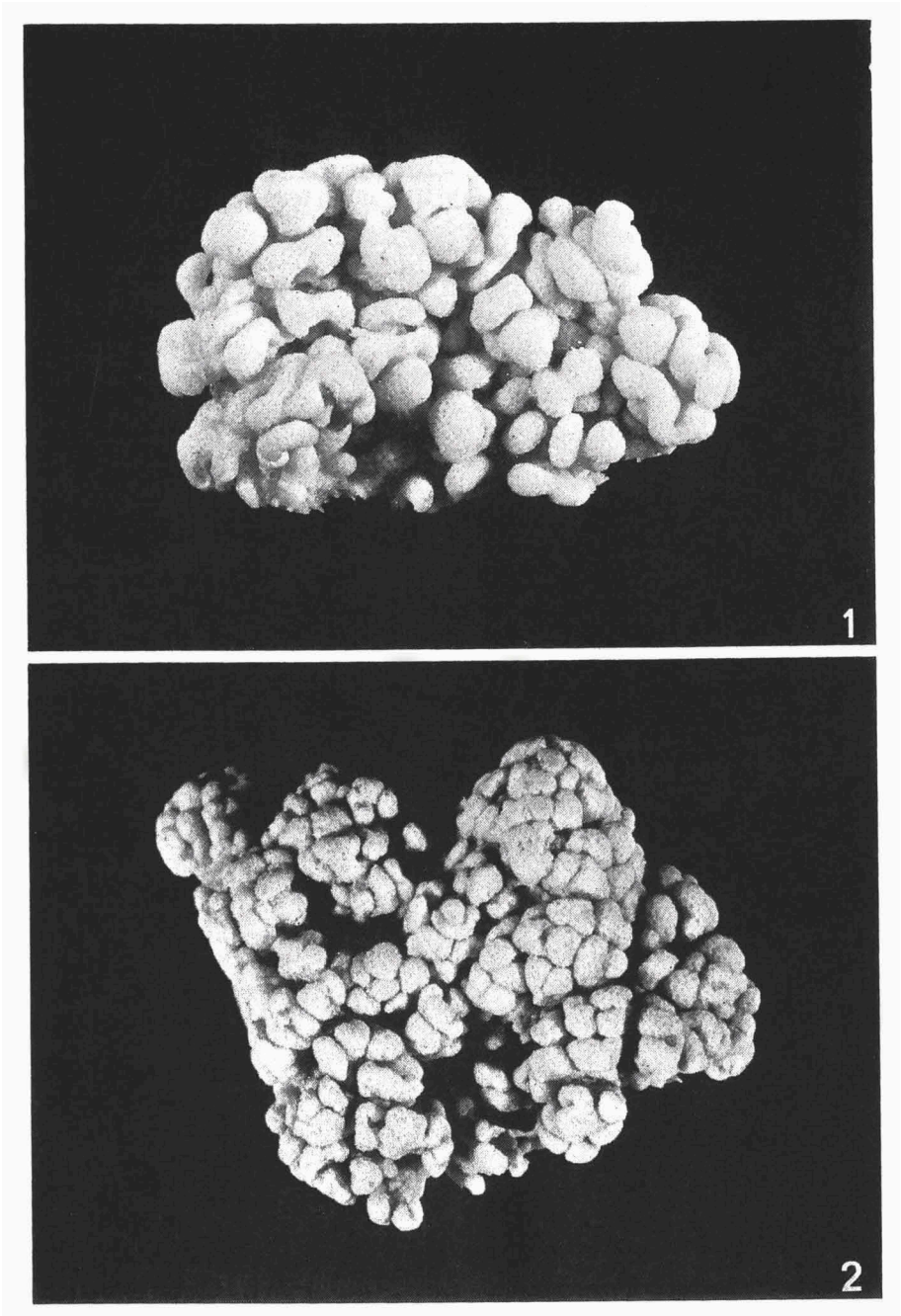
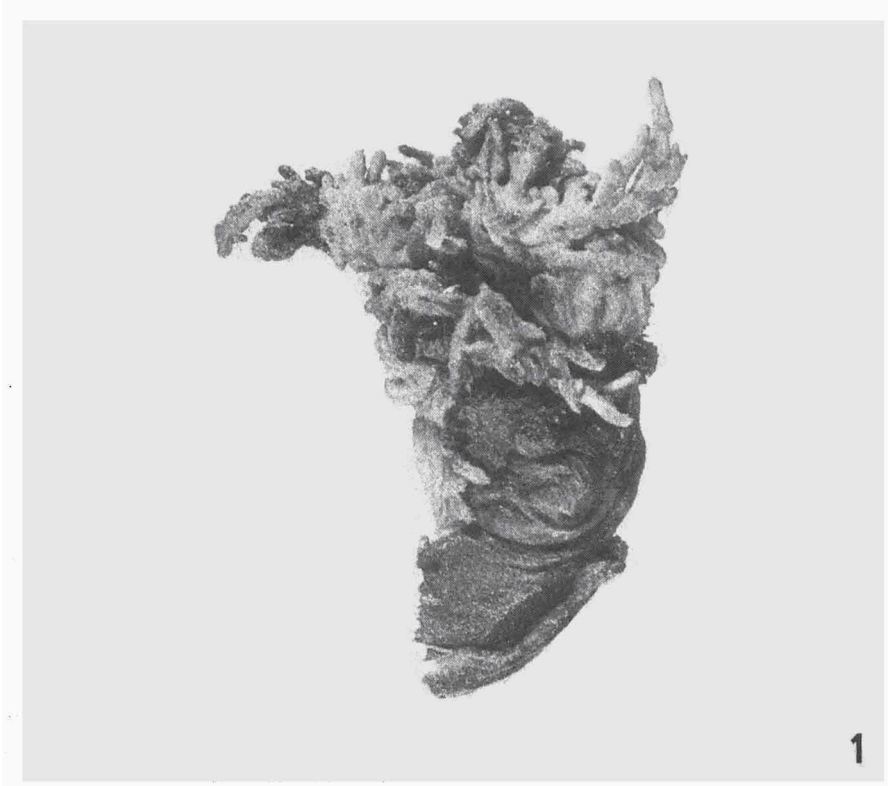


Fig. 1. *Sinularia gyrosa* (Klunzinger), RMNH Coel. no. 11749. × 1.
Fig. 2. *Sinularia venusta* Tixier-Durivault, RMNH Coel. no. 11744. × 1.



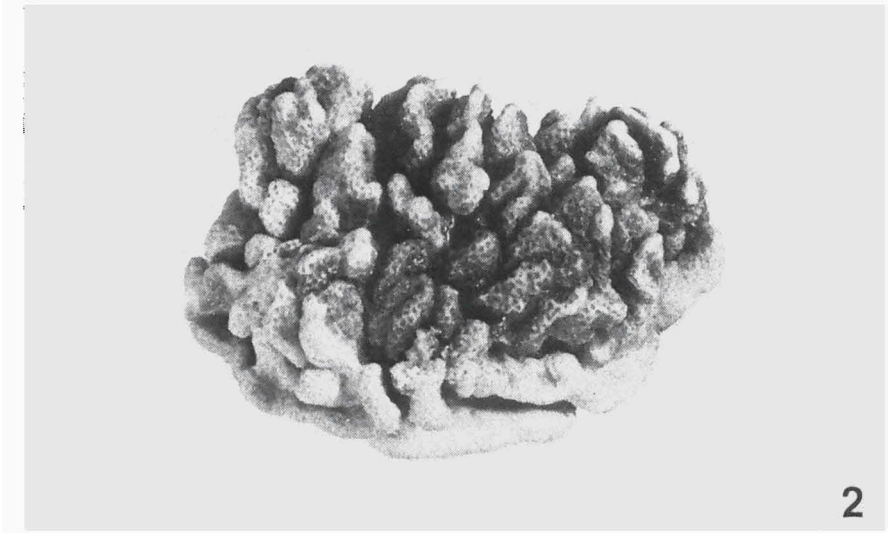


Fig. 1. *Sinularia sandensis* sp. nov., type specimen, RMNH Coel. no. 11765. × 1.
Fig. 2. *Sinularia numerosa* Tixier-Durivault, BPBM D505. × 1.

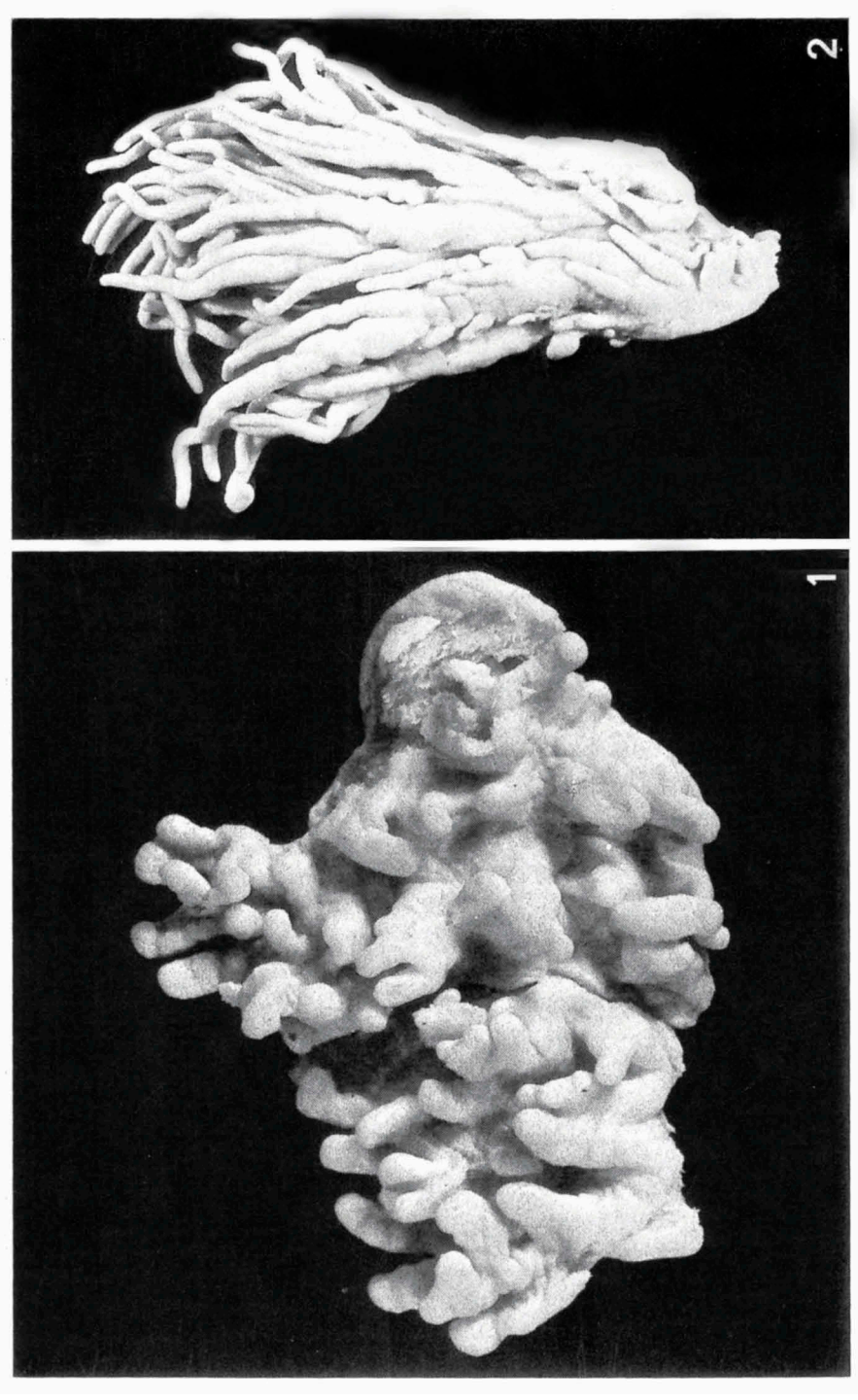


Fig. 1. *Sinularia rigida* (Dana), RMNH Coel. no. 11771. × 1.
Fig. 2. *Sinularia procera* sp. nov., holotype, BPBM D512. × 1.

Fig. 1. *Sinularia vervoorti* sp. nov., holotype, BPBM D243. × 1.
Fig. 2. *Lobophytum salvati* Tixier-Durivault, BPBM D241. × 1.