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Revision of the common Octocorallia of the Mediterranean circalittoral II. Alcyonacea

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ABSTRACT

Five alcyonarian species (*Alcyonium palmatum, A. acaule, Parerythropodium coralloides, Maasella edwardsi, Paralcyonium spinulosum*) from the Mediterranean circalittoral zone are described, all but one (*Alcyonium palmatum*) occurring on rocky bottoms. Application of the priority rule of zoological nomenclature led to the renaming of one species, while in another case a different generic name is applied. A complete description of the five species is given including colony form, morphology of the living polyps, morphology and morphometry of the spicules. The latter were observed by means of light microscopy and scanning electron microscopy. The ecology of each species is briefly described.

RÉSUMÉ

Cinq espèces d'alcyonaires (*Alcyonium palmatum, A. acaule, Parerythropodium coralloides, Maasella edwardsi, Paralcyonium spinulosum*) du circalittoral méditerranéen sont décrites, toutes sauf une (*Alcyonium palmatum*) provenant du substrat dur. L'application de la règle de priorité de la nomenclature zoologique a donné lieu à un changement de nom pour une espèce et un genre. Une description détaillée de tous ces animaux est fournie, comprenant la morphologie des colonies entières et celle des polypes vivants, et la morphologie et la morphométrie des spicules. Ces derniers furent observés à l'aide de deux techniques différentes: microscopie photonique et microscopie électronique à balayage. L'écologie de chaque espèce est abordée sommairement.

INTRODUCTION

As pointed out in the first part of our revision of Mediterranean Octocorallia (Weinberg, 1976), several reasons seem to justify this kind of work. Many (diving) biologists encounter animals which they do not know, and identification is sometimes extremely difficult. The problems one encounters

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when trying to obtain early publications, the shortage of data on living animals, and the lack of published field observations are among the most important reasons which prompted us to undertake this task.

It is not astonishing, therefore, that almost simultaneously with our first part another review of the Mediterranean gorgonians appeared (Carpine & Grasshoff, 1975), the authors and ourselves unfortunately ignoring each others' activities in this field. Whereas we confine ourselves to the circalittoral zone[1]), Carpine & Grasshoff (1975) included the gorgonians from deeper zones in their description. We do recommend their very accurate and thorough publication to any reader interested in Mediterranean gorgonians.

The order considered in the present paper, Alcyonacea, contains some rarer shallow water octocorals from the Mediterranean. Some species here encountered were confused and misidentified by many authors, as will be shown below. Undoubtedly the reasons for which some of the species are so little known lie in the fact that they are much smaller in size and less frequently encountered than the conspicuous gorgonians. The relative scarceness of some species is reflected in the greater rarity of data on their ecology than was the case in the gorgonians.

Materials and Methods

All specimens were collected by Scuba divers, unless stated otherwise, and observed alive in aquaria prior to fixation. Fixation took place in 10% formalin, after anesthetization with 0.5% $MgSO_4$ in seawater. Later, the colonies were transferred to jars containing 70% aethyl-alcohol. All specimens are kept in the collection of the Zoological Museum of Amsterdam (ZMA). Spicules were obtained by dissolution of the soft tissues in cold and concentrated sodium-hypochlorite (Javel), and examined with a light microscope and a scanning electron microscope. In the first case, large series of spicules have been photographed for each species. These pictures were classified according to the origin of each type of spicule, and reproduced by means of line drawings (Plates 2, 4, 6, 9, 11, 14 and 16). In the latter case, spicules were examined with the Stereoscan MkII, from Cambridge. In order to obtain electrically conductive spicules, they were covered with a layer of gold, evaporated *in vacuo*. This layer being only 200 Å thick, it dissimulates no detail; therefore the resulting pictures contain more information than those obtained by other techniques (Plates 5, 7, 12, 15 and 17).

Underwater light measurements were made with a Relative Irradiance Meter (Weinberg, 1974), which compares light above the water surface with light at the sites where the animals live. Measurements were carried out in the blue-green part of the spectrum (peak at 480 nm, band-width 60 nm). Light values are given in percentages as compared with the surface values.

[1]) By circalittoral zone we mean the photic zone of the sublittoral. In french terminology our zone would comprise infralittoral and circalittoral. In the Mediterranean, our zone extends to a depth of approximately 100 m.

Measurements were all made during the summer and around noon, in view of enabling comparison.

Order ALCYONACEA Lamouroux, 1816

Family Alcyoniidae Lamouroux, 1812

Genus **Alcyonium** Linnaeus, 1758

Diagnosis of the genus *Alcyonium*:
"Colonies fleshy, lobated or digitated; polyps monomorphous; spicules mostly spinous spindles or rods" (after Tixier-Durivault, 1966).

Alcyonium palmatum Pallas, 1766

(Collection ZMA Dredged: COEL. 16, 2188, 2189, 2190, 2191, 2192, 2195, 2196, 5052, 7806, 7807. Collected by divers: COEL. 17)

Synonymy:

Alcyonium palmatum Pallas, 1766
Lobularia palmata; Lamarck, 1816
Alcyon palmé; Milne Edwards, 1835b
Alcyonium palmatum; Marion, 1878
Alcyonium palmatum; Marion, 1882
Alcyonium palmatum; Stossich, 1885
Alcyonium palmatum; v. Koch, 1891b
Alcyonium palmatum; May, 1900
Alcyonium palmatum; Roule, 1900
Alcyonium palmatum forma *adriatica* Kükenthal, 1907a
Alcyonium palmatum forma *typica* Kükenthal, 1907a
Alcyonium adriaticum; Kükenthal, 1909
Alcyonium palmatum; Thomson, 1927
Alcyonium palmatum; Thomson, 1929
Alcyonium palmatum; Durivault, 1937
Alcyonium palmatum; Tixier-Durivault, 1940
Alcyonium palmatum; Stiasny, 1941
Alcyonium palmatum; Rossi, 1950
Alcyonium palmatum; Broch, 1953
Alcyonium palmatum; Bérenguier, 1954
Alcyonium adriaticum; Pax & Müller, 1962
Alcyonium palmatum; Verseveldt, 1964

This species, one of the best known in the Mediterranean, (it was called "Main de Larron" or "robbers hand" by fishermen since the Middle Ages), was first named by Pallas (1766) (sp. 203, p. 349). An excellent description was given by Milne Edwards (1835b), who gallicized the name into "Alcyon palmé". Very clear pictures (Figs. 1—11) accompany his text, showing the entire colony, details of expanded and retracted polyps, internal anatomy and spicules. Marion (1878) was the first to separate Mediterranean specimens of *Alcyonium* into the species *palmatum* and *acaule* (see next section),

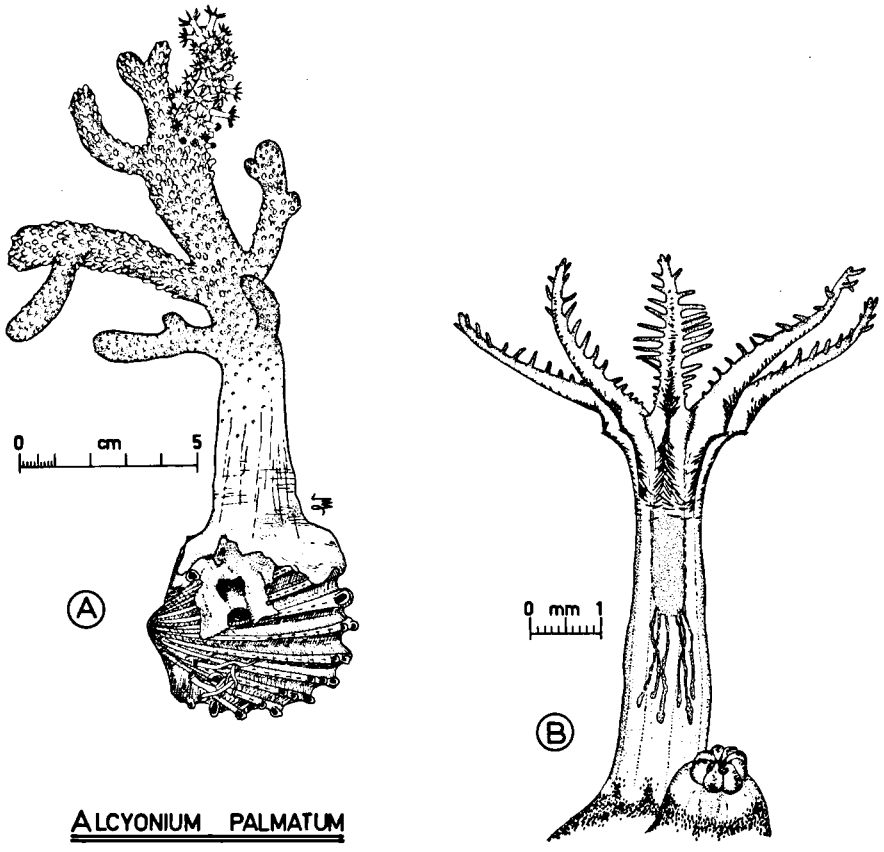


Plate 1. *Alcyonium palmatum.* A. Colony growing on a shell of *Cardium echinatum.* Note the long, sterile (polyp-less) stalk. In one lobe the polyps are expanded. B. Detail of a polyp.

the former being characteristic for muddy bottoms, the latter growing on "fonds coralligènes" (= nullipore bottoms). This distinction is based upon morphology of the colonies as well as of the spicules, both being adequately depicted (Figs. 1, 10, 11). Kükenthal (1907a), in his comparison of specimens of *Alcyonium* from Trieste and Naples, not only created a new species, *A. brioniense* (see next section), but divided *A. palmatum* into the formae *typica* and *adriatica,* which differ from each other in the form of the spicules. In 1909, Kükenthal even went as far as to raise one of the forms to specific rank, as *A. adriaticum.* Bérenguier (1954) redescribed the species, reaching the conclusion that *Alcyonium adriaticum* Kükenthal, 1909 is synonymous with *A. palmatum.* Nevertheless, Pax & Müller (1962) maintained Kükenthal's species. In the most recent revision of the Mediterranean *Alcyonium* species, Verseveldt (1964) agreed with the views of Bérenguier in reuniting *A. adriaticum* and *A. palmatum,* because spicules proved to be variable from

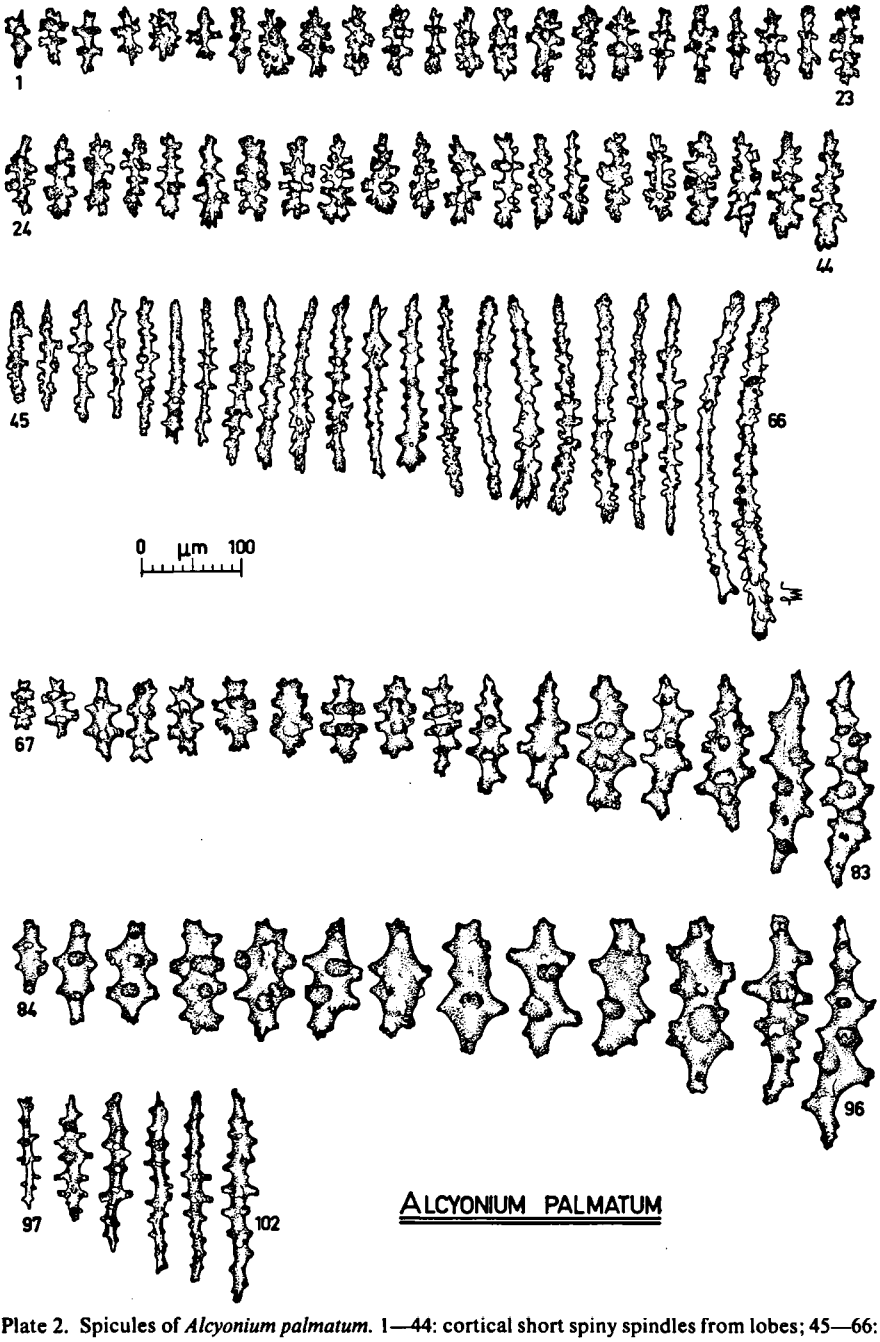


Plate 2. Spicules of *Alcyonium palmatum*. 1—44: cortical short spiny spindles from lobes; 45—66: coenenchymal and polypean spindles from lobes; 67—83: cortical plump spindles with rough warts from stalk; 84—96: coenenchymal plump spindles with smooth warts from stalk; 97—102: slender spindles from stalk.

one specimen to another. We wish to emphasize this fact, which applies to many octocorals. It is for this reason that we made drawings of a large series of spicules for each specimen examined, and even so, spicules from another specimen, although belonging to the same species, may differ somewhat.

The colonies (Plate 1A) are fleshy and branched, measuring up to 50 cm (average 10-20 cm) when extended. They comprise a long sterile stalk (without polyps) from which several finger-like, flexible, polyp-bearing lobes originate. The colonies are somewhat translucent and pale in colour, usually creamy white or pink, in some cases yellow, orange or red. The sterile stalk is always white. The extended polyps (Plate 1B) are some 10 mm high, their tentacles are up to 3 mm long bearing 10-14 pinnules on either side, the longest pinnules being found (as usually for Octocorallia) halfway the tentacles. The crown spicules form about 25 transversal rows. Coenenchymal spicules are not densely packed. The spicules differ in form and colour, dependent on the body region from which they originate (Durivault, 1937; Tixier-Durivault, 1940). We can distinguish (Plate 2):

— capstans and short warty spindles from the cortical layer of the lobes (55—125 μm);
— slender spindles with small warts from coenenchyme and polyps of the lobes (100—340 μm);
— plump capstans and short spindles with coarse warts from the cortex of the sterile stalk (50—215 μm);
— broad, smooth capstans and short spindles from the coenenchyme of the stalk (70—235 μm);
— slender spiny spindles from the sterile stalk (110—210 μm).

The species usually lives on muddy or sandy bottoms, the sterile stalk often being buried in the sediment. In most cases the animal lives fixed onto some hard body: shell, stone etc. *Alcyonium palmatum* is found in depths ranging from 20—200 m, and is present throughout the entire Western Basin of the Mediterranean. Eggs and planulae are to be observed from June till October (Pax & Müller, 1962).

Alcyonium acaule Marion, 1878

(Collection ZMA: COEL. 2171, 2172, 7778, 7779, 7780, 7781, 7782, 7804)

Synonymy:

Alcyonium acaule Marion, 1878
Alcyonium palmatum var. *acaule*; Marion, 1882
Alcyonium palmatum var. *acaule*; Carus, 1885
Alcyonium acaule; Von Koch, 1891b
Alcyonium palmatum; Roule, 1900
Alcyonium brioniense Kükenthal, 1907a
Alcyonium acaule; Lo Bianco, 1909
Alcyonium palmatum var. *acaule*; Thomson, 1927
Alcyonium palmatum var. *acaule*; Thomson, 1929

Alcyonium palmatum; Stiasny, 1941
Alcyonium acaule; Bérenguier, 1954
Alcyonium brioniense; Pax & Müller, 1962
Alcyonium acaule; Verseveldt, 1964
Alcyonium acaule; Laubier, 1966
Alcyonium acaule; Weinberg, 1975b

In 1878, Marion reported the existence of an *Alcyonium* which differred in many ways from *A. palmatum*. This new type was found on hard substratum, lacked the long sterile stalk, was firmer and rougher to touch, never exceeded 12 cm in length, and was usually dark in colour. Moreover, the spicules in this new type were somewhat different from those of *A. palmatum*. Marion (1878) proposed to name the new species *A. acaule* (stalkless), after its most noteworthy characteristic. Later, in 1882, he preferred to consider the animal a variety of *A. palmatum*. Von Koch (1891b) considered *A. acaule* a valid species, whereas Roule (1900) claimed that he had observed a great number of intermediate forms, and concluded that *A. acaule* should be reunited with the senior *A. palmatum*. Shortly after, Kükenthal (1907a) described a new species, *A. brioniense* from the Adriatic Sea. Stiasny (1941), although considering *A. palmatum* the only valid Mediterranean species, was aware of the great similarity between specimens described as *A. acaule* and *A. brioniense*. Bérenguier (1954) recognized *A. acaule* as a valid species distinct from *A. palmatum*, considering *A. brioniense* a synonym of the former. In spite of this, the name *A. brioniense* continued to be used by Pax & Müller (1962) in their study of Adriatic anthozoans. Verseveldt (1964) undertook a thorough comparison of the Mediterranean *Alcyonium* species and the literature involved, concluding like Bérenguier (1954) that *A. brioniense* is a junior synonym of *A. acaule*, and that the latter in turn is to be considered a valid species.

The colonies of *A. acaule* (Plate 3A) resemble those of *A. palmatum* in many respects. Some differences do occur, however: the colonies are generally smaller and the sterile stalk is extremely short. We did find colonies as high as 20 cm (ZMA COEL. 7780) which is considerably taller than the 12 cm limit that was assumed previously. The finger-like lobes originating from the base are short and rigid. The animals are opaque and usually dark red, although brownish, orange, yellowish and even pink colonies are also found. The extended polyps (Plate 3B, 3C) are 6 mm long at most, with 1.5 mm long tentacles bearing 8—12 pinnules on either side. In this animal, like in all other octocorals we know, the pinnules halfway the tentacle are longer than the other ones. We therefore doubt the reliability of Kükenthal (1907a) when he states that one of the characteristics of *A. brioniense* is the fact that the proximal pinnules are the longest, their size decreasing gradually towards the tip of the tentacles. He probably overlooked the most proximal pinnules, possibly due to the fact that the animals examined were not completely extended. The number of transversal rows formed by the crown spicules varies greatly (6 to 29), but it must be noted

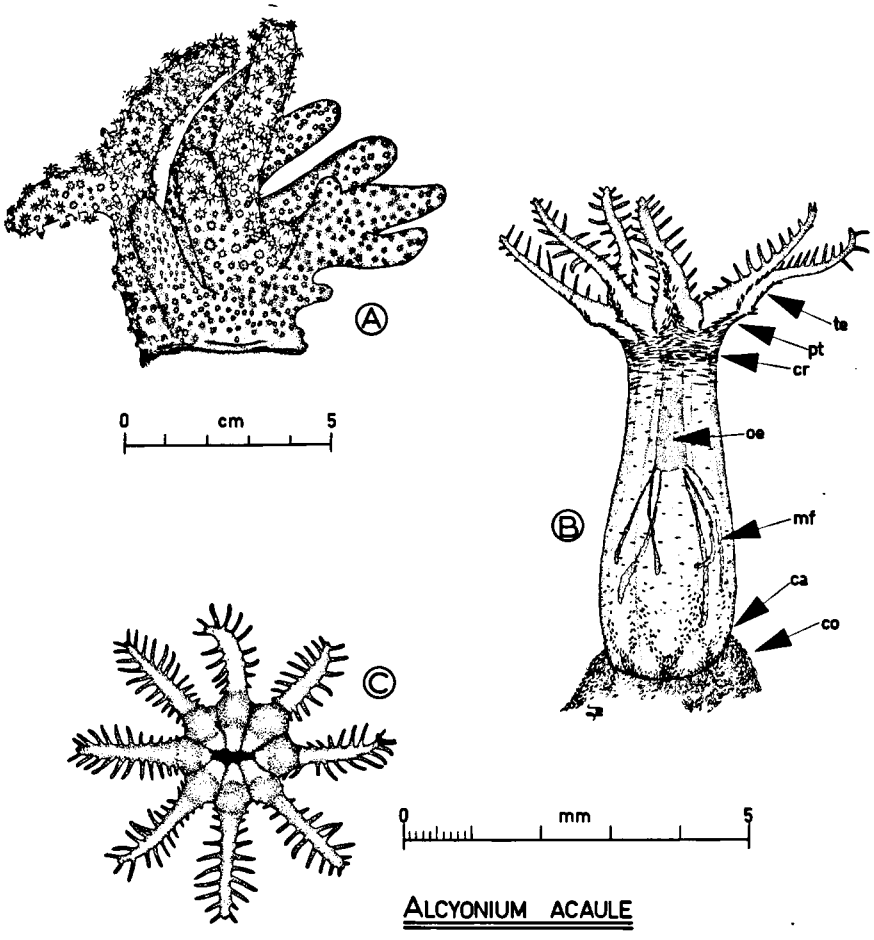


Plate 3. *Alcyonium acaule*. A. Colony with partly expanded and partly retracted polyps. Note the broad stalk, containing polyps almost to its bottom. B. Detail of polyp; te=tentacular spicules, pt= points, cr=crown, oe=oesophagus, mf=mesenterial filaments, ca=calyx, co=cortex. C. Detail of tentacles. Within one single polyp 8—12 pairs of pinnules per tentacle may occur.

that in some specimens the number of anthocodial spicules is so great, that it is hard to decide where the crown begins. Coenenchymal spicules are densely packed: the colonies are rather firm to the touch. The spicules from the lobes (Plates 4, 5) occur in five categories:

— small spindles from cortex and coenenchyme (70—185 μm);
— small spindles from the calyces, with one broad, spiny end, and a pointed one (75—115 μm);
— long slender spindles from crouwn and points (155—340 μm);
— minute spicules, probably from the oesophagus (45—75 μm);

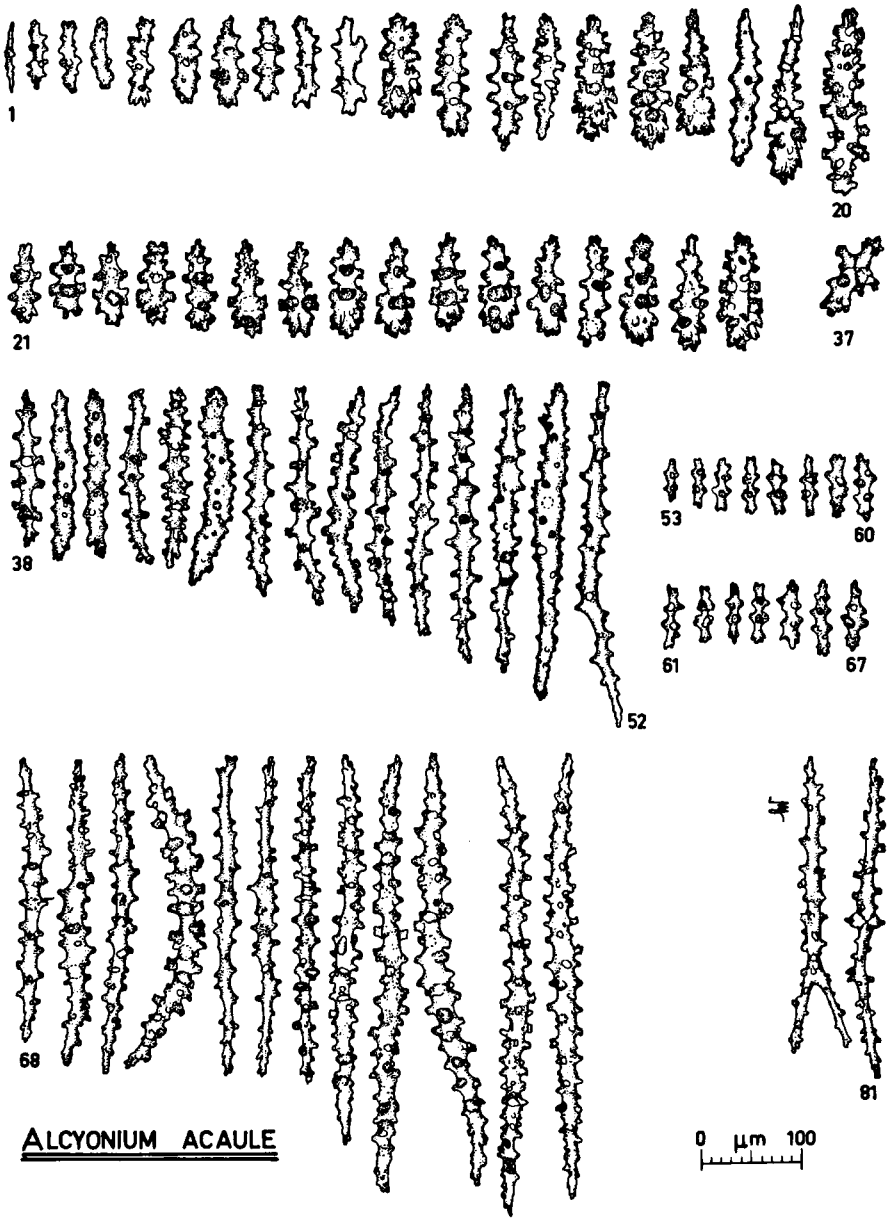


Plate 4. Spicules from the extremity of a lobe in *Alcyonium acaule*. 1—20: short spindles from cortex and coenenchyme; 21—37: short spindles from calyx; 38—52: long, slender spindles from crown and points; 53—67: small capstans and spindles, probably from oesophagus; 68—81: long, slender spindles from coenenchyme. The tentacular spicules are not shown.

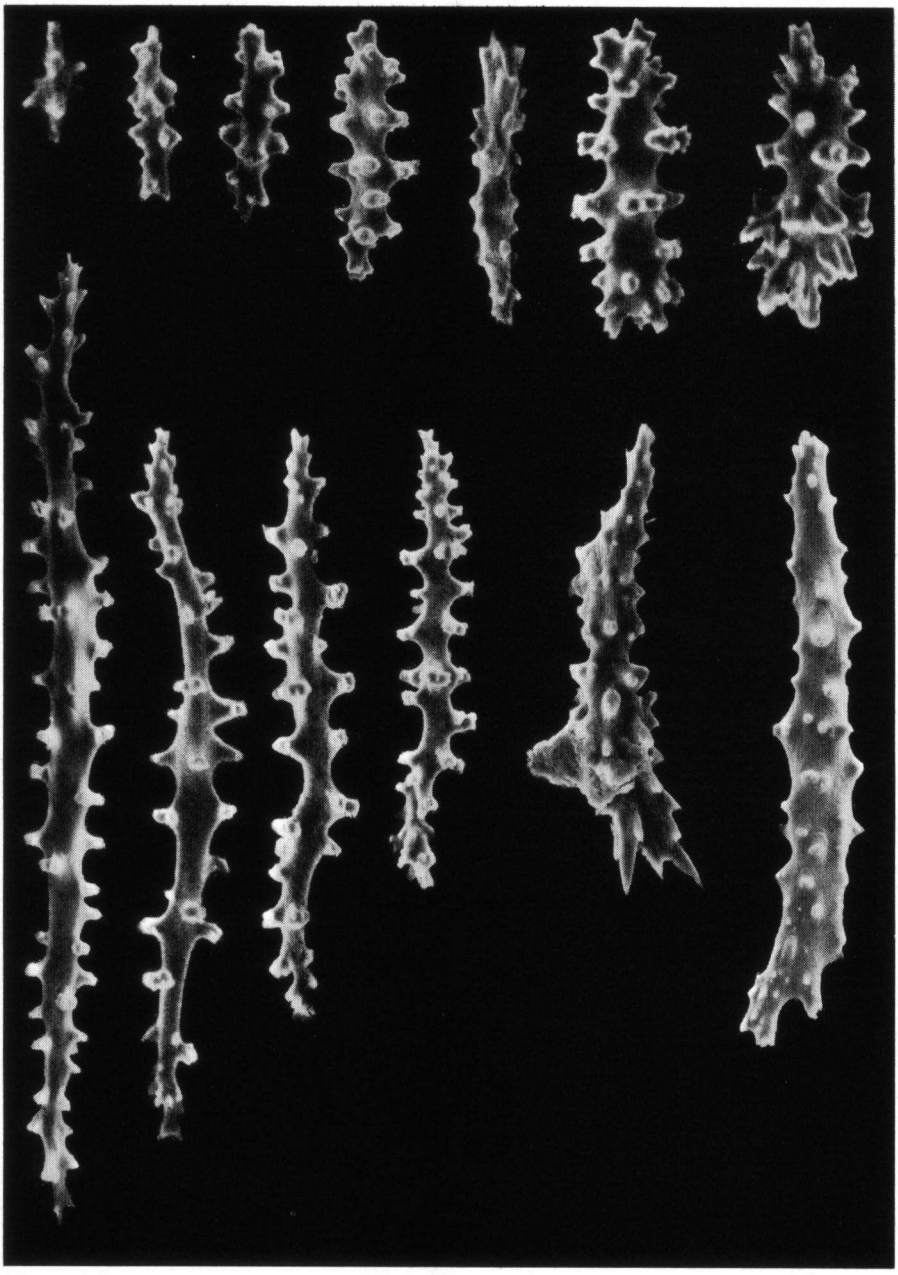


Plate 5. Lobular spicules from *Alcyonium acaule*. Magnification: 400 x.

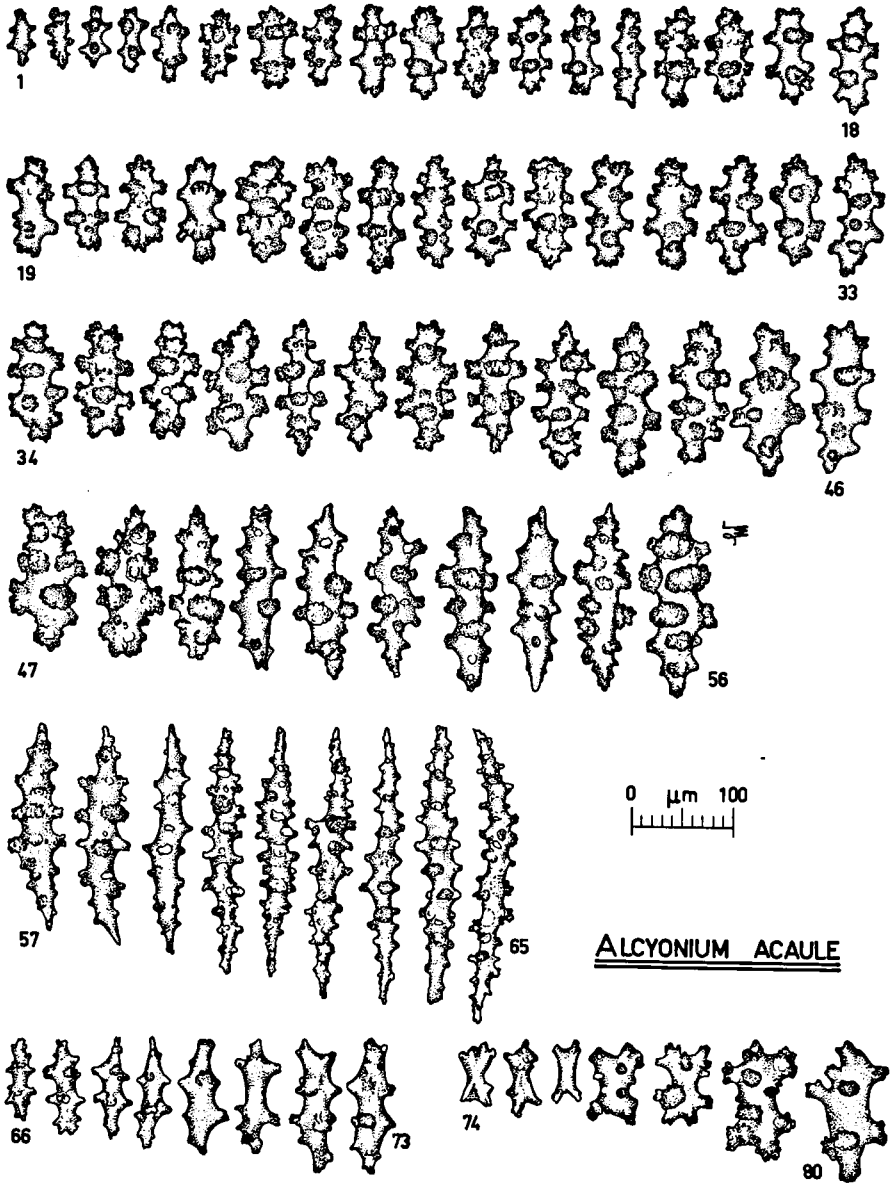


Plate 6. Spicules from sterile stalk of *Alcyonium acaule*. 1—56: plump spindles with coarse warts from cortex; 57—65: slender spindles with fine warts from coenenchyme; 66—73: small spindles with smooth warts, origin unknown; 74—80: irregular forms.

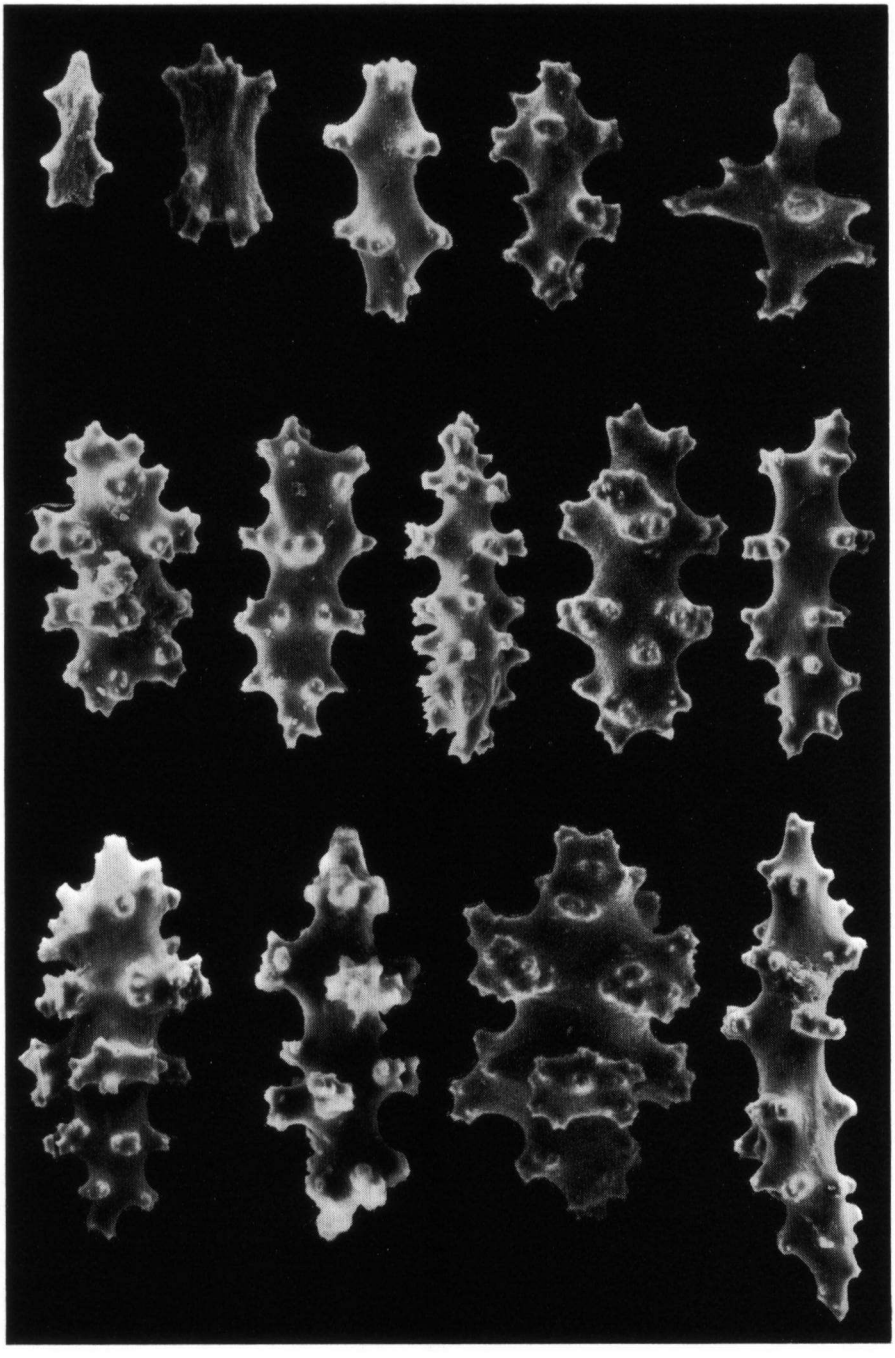


Plate 7. Spicules from sterile stalk of *Alcyonium acaule*. Magnification: 400 x

Colony number	1	2	3	4	5	6	7	8	9	10
colony colour	pink	pink	yellow -white	yellow -white	orange -red	brown -red	brown -red	dark red	dark red	dark red
cortex	red, white	red, white	white	white, yellow	yellow	red	orange -red	red	red	red
calyx	red	red	red	red	red	red	red	red	red	red
crown	red	red, white	yellow	red	red	red	red	white	red	red
points	red	red, white	yellow	red, yellow	red, yellow	red, yellow	red, yellow	white	red, yellow	red, yellow
tentacle	red, white	white	white, yellow	red, yellow	red, yellow	red, yellow	white, yellow	white	red, yellow	red, yellow
oeso-phagus	red	red	red	red	red	red	red	red	red	red
number of rows	6 -19	15 -22	8 -17	8 -23	13 -23	10 -26	7 -15	12 -20	12 -29	9 -22

Table I. Colour of entire colony of *Alcyonium acaule*, colour of spicules from cortex, calyx, crown, points, tentacles, oesophagus; number of rows in crown. Observations on 10 specimens.

— long, slender spindles from coenenchyme (280—455 µm);
— tentacular spicules (not shown on the plates) (50—300 µm);

In the short, sterile stalk, the following categories (Plates 6, 7) are encountered:

— plump capstans and short spindles with coarse warts, from the cortex (55—190 µm);
— slender spindles with fine warts, from the coenenchyme (200—295 µm);
— smooth spicules with fine warts, origin unknown (85—135 µm);

When seen externally, the coloration of entire colonies and of spicules from different body regions may vary wildly. Table I summarizes some data based on 10 specimens, all from Banyuls s/Mer.

The species occurs on hard substratum, in depths ranging from 12—45 m (Pax & Müller, 1962; Weinberg, 1975b). We encountered the species in light conditions ranging from 1.1—5.6%. It is present throughout the entire Western Mediterranean. According to Lo Bianco (1909), eggs are observed from September to October, whereas planulae occur in July. We observed small eggs in specimens collected in August. It seems, therefore, that eggs from the previous summer take one year to develop into larvae, but more needs to be known about the reproductive cycle of this and other Octocorallia.

Genus **Parerythropodium** Kükenthal, 1916

Diagnosis of the genus *Parerythropodium*:
"Colonies encrusting, polyps monomorphous and retractile, present in varying densities on the entire colony. Spicules spindles, stars or double clubs to be found in the coenenchyme as well as in the polyps" (Partly after Tixier-Durivault, 1966).

Parerythropodium coralloides (Pallas, 1766)

(Collection ZMA: COEL. 3, 4, 1895, 3151, 3153, 3513, 3514, 7462, 7463, 7464, 7465, 7774, 7792, 7809)

Synonymy:

Gorgonia coralloides Pallas, 1766
Gorgonia coralloides; Esper, 1794
Sympodium coralloides; Ehrenberg, 1832
Sympodium coralloides; Milne-Edwards, 1857
Sympodium coralloides; Marion, 1882
Sympodium coralloides; Carus, 1885
Sympodium coralloides; Stossich, 1885
Alcyonium coralloides; Von Koch, 1891a
Alcyonium coralloides; Von Koch, 1891b
Sympodium coralloïdes; de Lacaze-Duthiers, 1900
Alcyonium coralloides; May, 1900
Alcyonium coralloides; Roule, 1900
Alcyonium coralloides; Lo Bianco, 1909
Parerythropodium coralloides; Kükenthal, 1916
Alcyonium coralloides; Thomson, 1929
Alcyonium coralloides; Stiasny, 1937
Alcyonium coralloides; Stiasny, 1941
Alcyonium coralloides; Bérenguier, 1954
Parerythropodium coralloides; Pax & Müller, 1962
Parerythropodium coralloides; Laubier, 1966
Parerythropodium coralloides; Fredj, 1972
Parerythropodium coralloides; Weinberg, 1975a,b

The first author known to describe the species was Boccone (1674), who took the animal for fragments of *Corallium rubrum* which had adhered to wooden branches. Marsilli (1725) gave an extensive description, but no name. Pallas (1766) recognized the animal as a species which differs from *C. rubrum,* but as he examined a specimen growing on a dead gorgonian axis he took it to be a gorgonian which he named *Gorgonia coralloides.* Esper (1794) maintained this nomenclature, and gave a beautiful figure (Plate XXXII) of the animal. Subsequently, it was shifted to the genera *Sympodium, Alcyonium* and *Parerythropodium,* respectively. The animal can assume different colours: white, pink, or red. Recently, Weinberg (1975a) has compared five differently coloured specimens, and concluded that they all belong to the same species.

Parerythropodium coralloides occurs under the same circumstances as *Rolandia rosea,* the latter having sometimes been taken for the former. Whereas well developed colonies of *R. rosea* (Weinberg, in preparation) are characterized by the regular distribution of their polyps, by the uniform thickness of the double-layered coenenchyme, and by the outer mucous sheath which weakens its wine-red colour, the polyps of *P. coralloides* (Plate 8A) occur in aggregates upon clumps of coenenchyme, between which are stretched thin lamellae of sterile coenenchyme. The latter is monolayered,

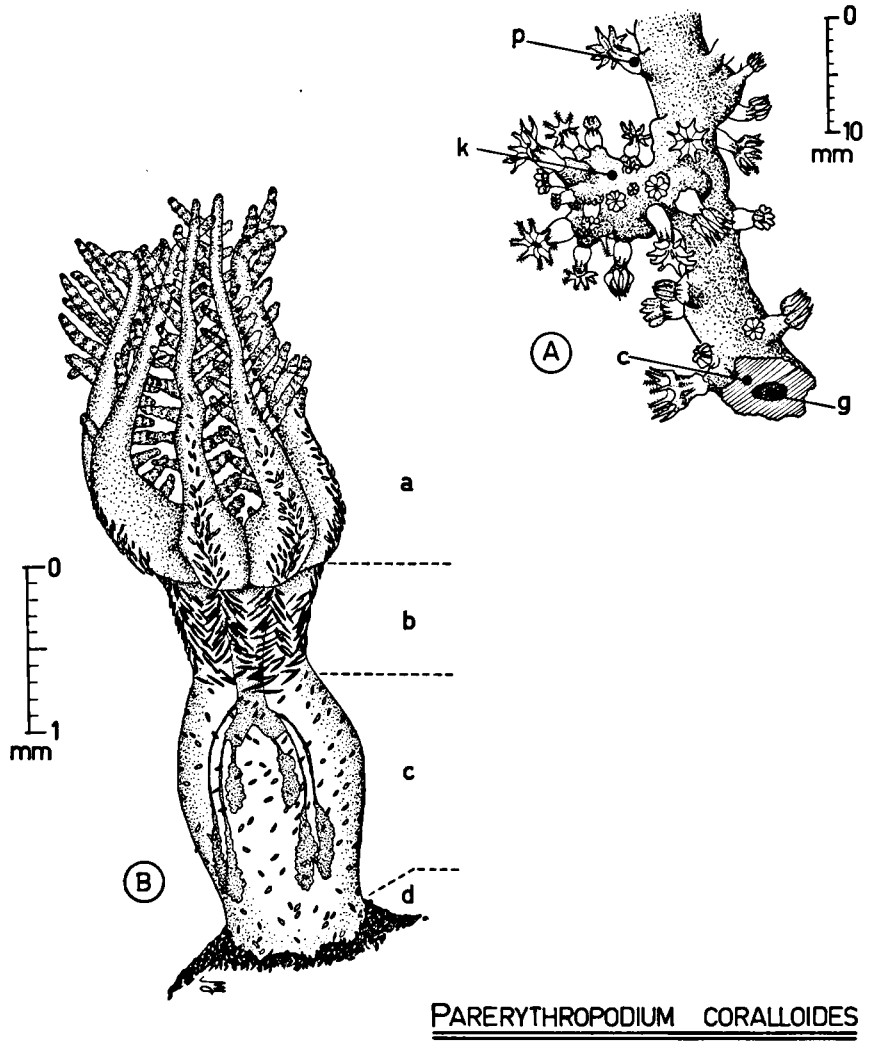
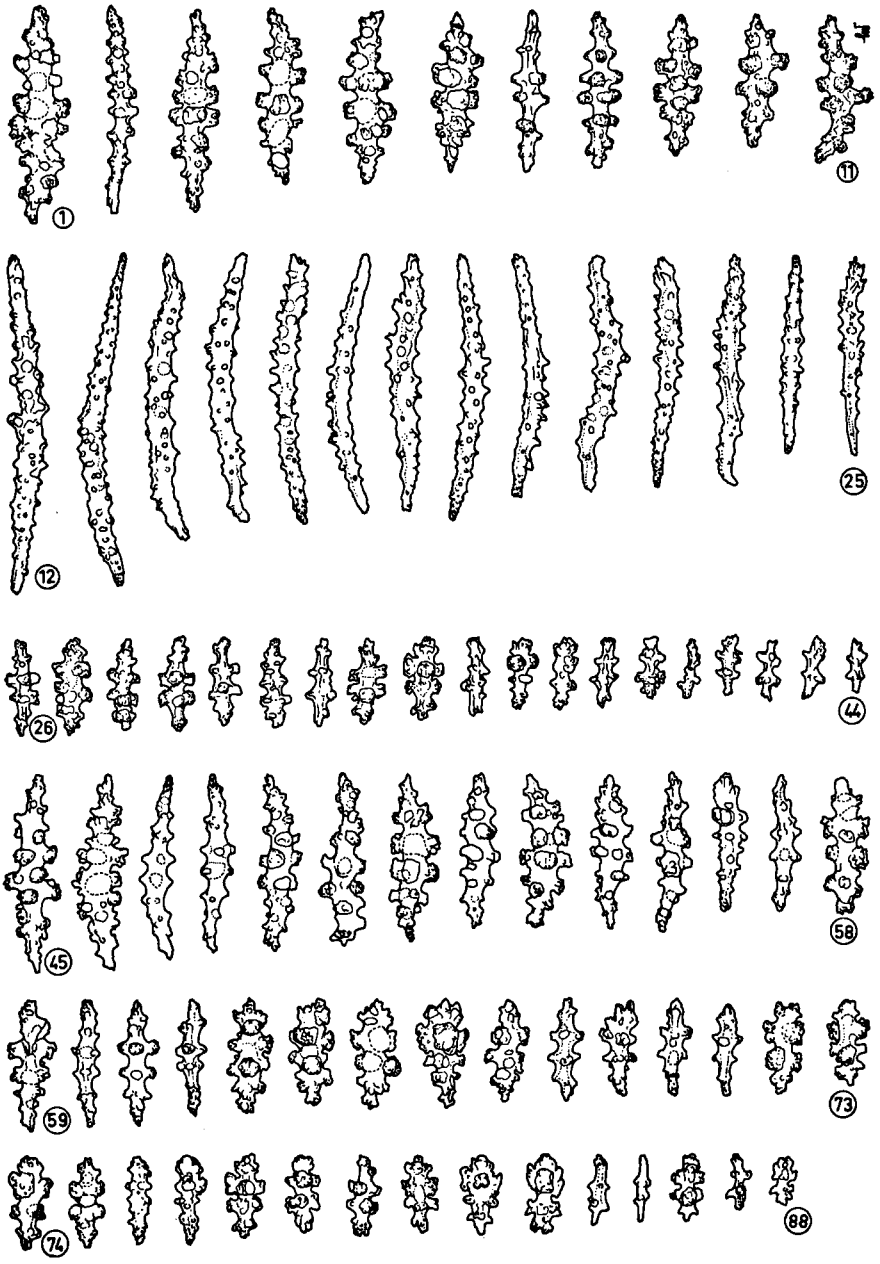


Plate 8. *Parerythropodium coralloides.* A. Part of a colony overgrowing a dead gorgonian's axis (g). Polyps (p) emerge at irregular intervals from the coenenchyme (c) which forms knots (k) at places with high polypean concentrations. B. Detail of a polyp. Spicules occur in 4 distinct regions; a: tentacles, b: crown and points, c: proximal part of anthocodia, d: calyx and coenenchyme.

filled with spicules which confer their colour to the colonies: red, pink, or white. A mucous sheath is not to be found. The fully retractile polyps of *P. coralloides* (Plate 8B) measure some 3—4 mm, the tentacles up to 2 mm, with two rows of 12—15 pinnules on either side. The latter may attain 0.5 mm in length, with very conspicuous rows of nematocysts. Moreover,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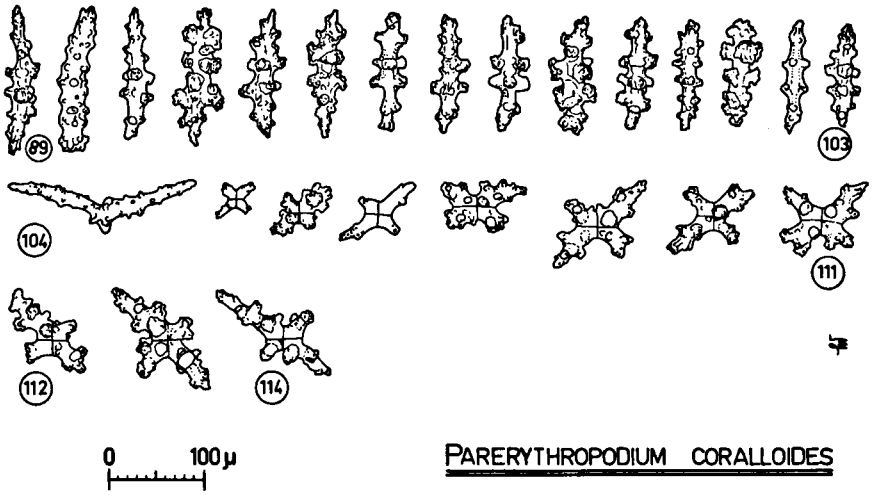


Plate 9. Spicules of *Parerythropodium coralloides*. 1—11: zone a (tentacles); 12—25: zone b (crown and points); 26—44: zone c (proximal part of anthocodia); 45—88: zone d (calyx and coenenchyme); 89—103: place in the colony unknown; 104—111: cruciform spicules.

the polyps are ornamented with spicules very similar to those of *Alcyonium acaule*. These spicules occur in four distinct body regions:

— tentacular spicules (region a);
— spicules from the distal part of the anthocodia, forming crown and points (region b);
— spicules from the proximal part of the anthocodia (region c);
— spicules from the anthostele (calyx) and coenenchyme (region d).

Plate 8B shows a polyp with these different regions. The very typical spicules from each body region are shown in plate 9. The colour of the spicules may vary from one region to the other, according to the specimen. In the specimens described by Weinberg (1975a), this colour distribution occurred as summarized in table II. The general appearance

region	specimen 1	specimen 2	specimen 3	specimen 4	specimen 5
a	yellow	yellow	white	white	white
b	red	pink	pink	yellow	white
c	yellow	yellow	white	yellow	white
d	red	pink	pink	white	white

Table II. Colour of the spicules from different body regions in *Parerythropodium coralloides*. For explanation see text.

of specimen 1 was wine-red, that of specimens 2 and 3 pink, and specimens 4 and 5 were white. The spicules from region a were found to be some 200 µm long (range: 130—360 µm) and approximately 50 µm thick.

In region b, the average length is 300 μm (range: 190—460 μm), with a width of 35 μm. For the two remaining regions these dimensions are, respectively, 100 μm (56—250 μm) and 35 μm. The only noteworthy difference between the specimens being their colour, it was concluded that they belong to the same species.

Stiasny (1937) described a species from Mauritania (found between 20 and 110 m) which he named *Parerythropodium maris-tenebrosi.* On examining the type specimen (ZMA COEL. 3010) we found that in this case the regions are also coloured differently (white, red, red, white for regions a, b, c, d, respectively). The forms of the spicules from the different regions are similar to those of *P. coralloides,* their size a trifle smaller. The question may be put forward whether on account of these small differences, and of the different locality (although many exponents of the Mediterranean fauna are found in this part of the Eastern Atlantic), it is justified to call this a distinct species. We are inclined to decide negatively. The same question could be raised for *P. grandiflorum,* a species from deeper water (about 400 m) found in the Azores, recently created by Tixier-Durivault & d'Hondt (1975).

P. coralloides occurs in depths ranging from 2—100 m (Lo Bianco, 1909; Fredj, 1972; personal observation: ZMA COEL. 7792), and was found by us in relative irradiance values ranging from 0.6 to 6.8%. It grows mainly on gorgonian axes (we found it on *Eunicella singularis, E. cavolinii, E. verrucosa*[2]*, Lophogorgia ceratophyta, Paramuricea clavata*), but also on ascidians (*Microcosmus*), shells (*Pteria hirundo*) and rock. It is definitely present in the entire Western basin of the Mediterranean, but if thorough examination of *P. maris-tenebrosi* and/or *P. grandiflorum* would lead to assimilation with *P. coralloides,* the distribution area of the species would include part of the Eastern Atlantic.

We observed small eggs in specimens collected in November, whereas de Lacaze-Duthiers (1900) mentions May-July as the reproductory period, and Lo Bianco obtained larvae in the aquarium in June.

Family Maasellidae Poche, 1914

Genus **Maasella** Poche, 1914

The species to be dealt with below was first described by de Lacaze-Duthiers (1888) and placed in the genus *Paralcyonium.* Almost simultaneously, Viguier (1888) described the same species, creating the new genus *Fascicularia.* In 1914 Poche pointed out (p. 87—88) that this genus was preoccupied, and gave it a new name: *Maasella.* The family Fascicularidae was therefore renamed Maasellidae. When in 1954 Bayer also remarked that *Fascicularia* was preoccupied, he proposed a new generic name: *Viguieriotes,*

[2]) No personal observation. See Carpine & Grasshoff (1975, p. 81 fig. 42) where the species is erroneously placed in the genus *Paralcyonium.*

the family name becoming Viguieriotidae. Bayer (1954) apparently overlooked the work of Poche (1914), that has priority.

Diagnosis of the genus *Maasella*: "Colonies formed by groups of polyps, connected to each other by means of stolons. Within each group, the basal parts of the polyps are fused together to form a pedicel, stiffened by spicules. Above the pedicel, the polyps are independent; no secondary polyps are to be found. The polyps of a same group do not communicate directly with each other" (Partly after Motz-Kossowska & Fage, 1907).

Maasella edwardsi (de Lacaze-Duthiers, 1888)

(Collection ZMA: COEL. 7766, 7767, 7768, 7793, 7794, 7795)

Synonymy:

Paralcyonium Edwardsii de Lacaze-Duthiers, 1888
Fascicularia radicans Viguier, 1888
Fascicularia Edwardsi; Viguier, 1888
? *Cereopsis Studeri* Von Koch, 1891b
Paralcyonium elegans; Von Koch, 1891b
Fascicularia Edwarsii; de Lacaze-Duthiers, 1900
Fascicularia edwardsi; Motz-Kossowska & Fage, 1907
? *Gersemia studeri*; Kükenthal, 1907b
? *Cereopsis studeri*; Stiasny, 1941
Fascicularia Milne Edwardsi; Bérenguier, 1954
Paralcyonium elegans; Bérenguier, 1954
Viguieriotes edwardsii; Laubier, 1966

On June 25, 1888, de Lacaze-Duthiers briefly described (p. 1774) an anthozoan from Banyuls, which he named *Paralcyonium Edwarsii.* As he dedicated the species to Henri Milne Edwards, the correct specific name should have been *edwardsi.* On July 16, 1888, Viguier published a short note on an octocorallian from Algeria, which he named *Fascicularia radicans.* He sent a more elaborate manuscript, with plates, to de Lacaze-Duthiers, who was, at the time, director of the "Archives de Zoologie Expérimentale et Générale". The latter recognized Viguier's species to be identical with his *Paralcyonium,* with the result that Viguier (1888) published, in the "Archives", his original text, having altered only the name into *Fascicularia Edwardsi,* de Lac. Duth. This is a very accurate description of the species (p. 357—372, figs. 1—19). Some years later, Von Koch (1891b) described (p. 671—672, figs. 23, 24) a new species from Naples, *Cereopsis Studeri.* Although his description is rather incomplete (he dealt with one heavily damaged specimen), it corresponds as far as we can judge, with Viguier's species. In his description of *Paralcyonium elegans,* Von Koch (1891b, p. 672—674, fig. 25) obviously dealt with specimens belonging to *P. elegans* (see next section), while others belonged to *Maasella edwardsi*: "Einere weitere Eigenthümlichkeit der Colonien von Paralcyonium sind die stolonenartigen Fortsätze, welche die einzelnen Busche mit einander verbinden.

[. . . .]. Die einzelnen Colonien weichen je nach Alter und Aufenthalt ziemlich von einander ab. Die Farbe geht von zartem Rehbraun, das bei ausgestreckten Exemplaren fast ganz verschwindet, bis ein dunkles Braun oder Braungrau, und zwar findet sich letzteres häufig bei kleinen Büschen. Der Mundrand leuchtet bei auffallendem Licht lebhaft grün".

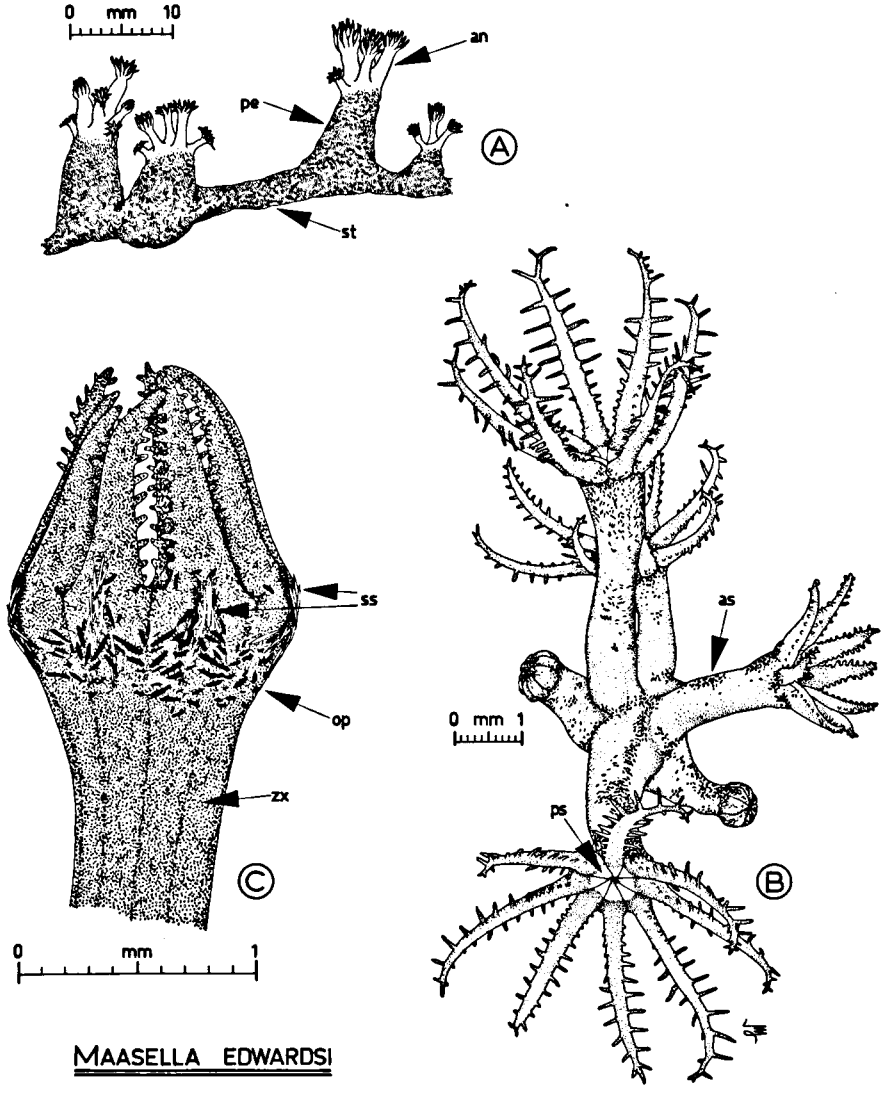
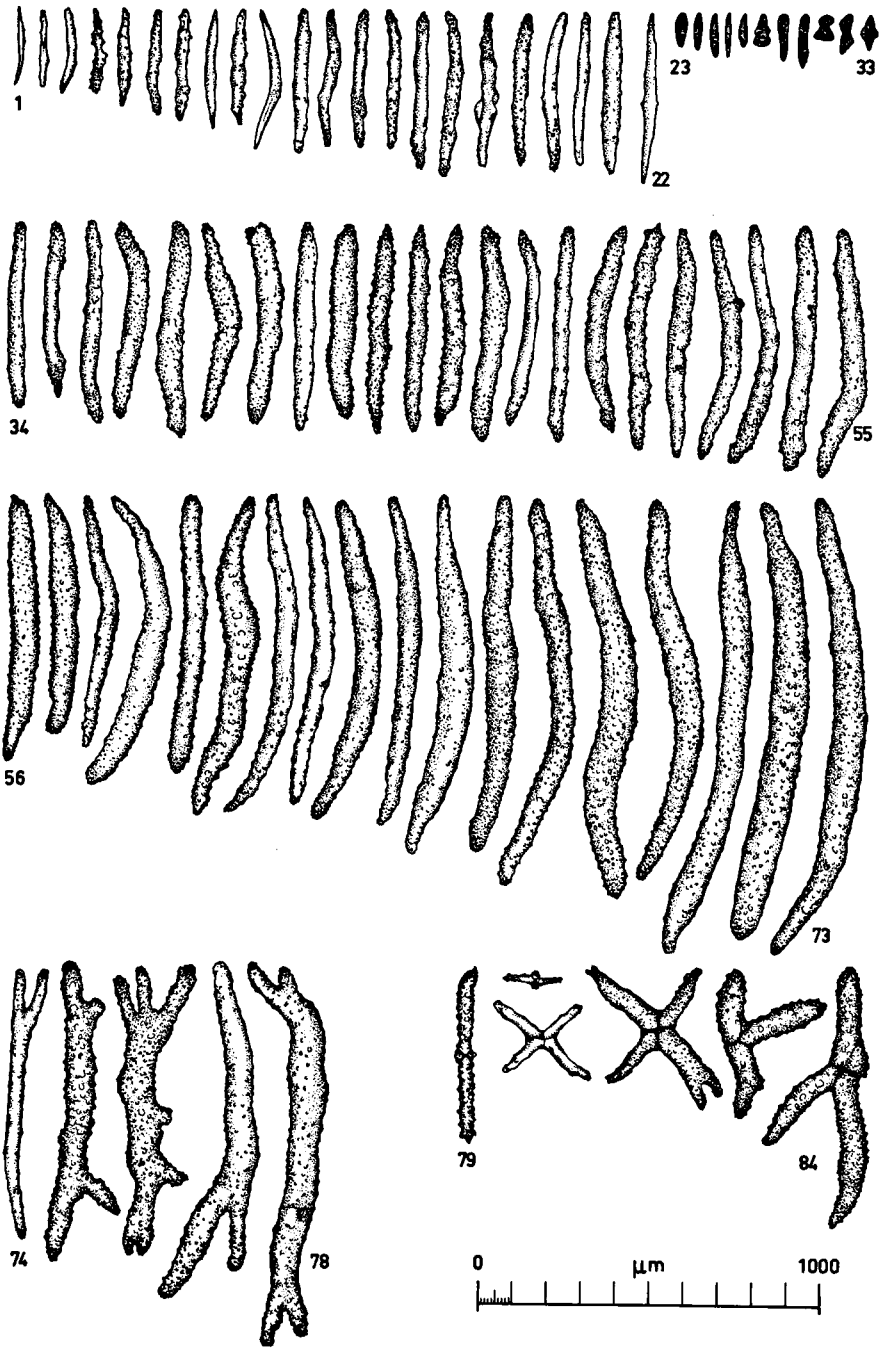


Plate 10. *Maasella edwardsi.* A. Four groups of polyps connected to each other by means of stolons (st). Each group consists of a pedicel (pe) and several anthocodiae (an). B. Detail of anthocodiae showing the anthocodial spicules (as) and the peristome (pe) which is emerald green in living specimens. C. Detail of one polyp, coloured brown by zooxanthellae (zx); subtentacular spicules comprise oval platelets (op) and slender spindles (ss).

In a postscriptum on his work on Mediterranean alcyonians, de Lacaze-Duthiers (1900) raised the argument whether or not the species *edwardsi* and *elegans* must be considered to belong to the same genus. Motz-Kossowska & Fage (1907), in a very thorough comparison of the species, conserved the genera *Fascicularia* and *Paralcyonium* as distinct, but only hesitantly so (p. 440—441): "Nous ne discuterons pas la question de savoir si ces caractères différentiels sont suffisants pour justifier une coupe générique entre ces deux types. Il est toujours extrêmement délicat de définir le critérium du genre et de l'espèce, surtout quand on s'adresse à un groupe aussi homogène que celui de Alcyonaires". We quite agree with their argument, but like them we provisorily conserve the separate genera. This decision is partly based on the examination of a specimen from the Siboga collection (ZMA COEL. 2999) which was identified as *Paralcyonium elegans* by Thomson & Dean (1931). We do not believe this specimen to belong to the Mediterranean species formerly called *P. elegans* (see next section), but it possesses some striking similarities which are not shared by the species *edwardsi*. Hence we continue to place the latter in a genus of its own.

Stiasny (1941) gave a more detailed description (p. 17—20) of Von Koch's species *Cereopsis studeri*. The similarity with Viguier's species is striking, especially when we consider Fig. 8, although the groups of polyps are very near to each other, and stolons are not visible. This may be due to the differences in substratum: Viguier's specimen grew on a piece of coal and had ample space, whereas Stiasny's specimen grew on a small colony of the bryozoan *Myriozoum truncatum*.The spiculation of the polyp (Fig. 9) corresponds exactly with our Plate 10C, although Kükenthal's description (1907b, p. 384—385) is somewhat different. The description of the spicules corresponds with Viguier's species, but the drawings (Fig. 10) clearly differ. This gives no clue, however, because we know from experience that Stiasny's drawings of spicules are often unreliable. The colour of both v. Koch's and Stiasny's specimens is described as colourless in the polyps, yellowish in the basal parts. This corresponds to the colouring of our specimens conserved in alcohol, whereas living colonies are brown due to symbiotic zooxanthellae. Although we cannot reach a definite conclusion as to the identity of *C. studeri* with *Maasella edwardsi*, it seems very likely that they belong to the same species. It must be noted in this respect that neither Von Koch (1891b) nor Stiasny (1941) ever mentioned the description of *M. edwardsi* by Viguier (1888). Had they seen it, they certainly would not have recognized *C. studeri* as a distinct species without a thorough comparison.

Recently, Bérenguier (1954) compared specimens of *Fascicularia Milne-Edwardsi* (sic) with colonies of *Paralcyonium elegans*. The author did not, however, actually see the second species: no mention was made of the important secondary polyps (see next section). It is no wonder therefore that all specimens were identified as belonging to the same species, which was then (erroneously) called *Paralcyonium elegans*. Laubier (1966) points out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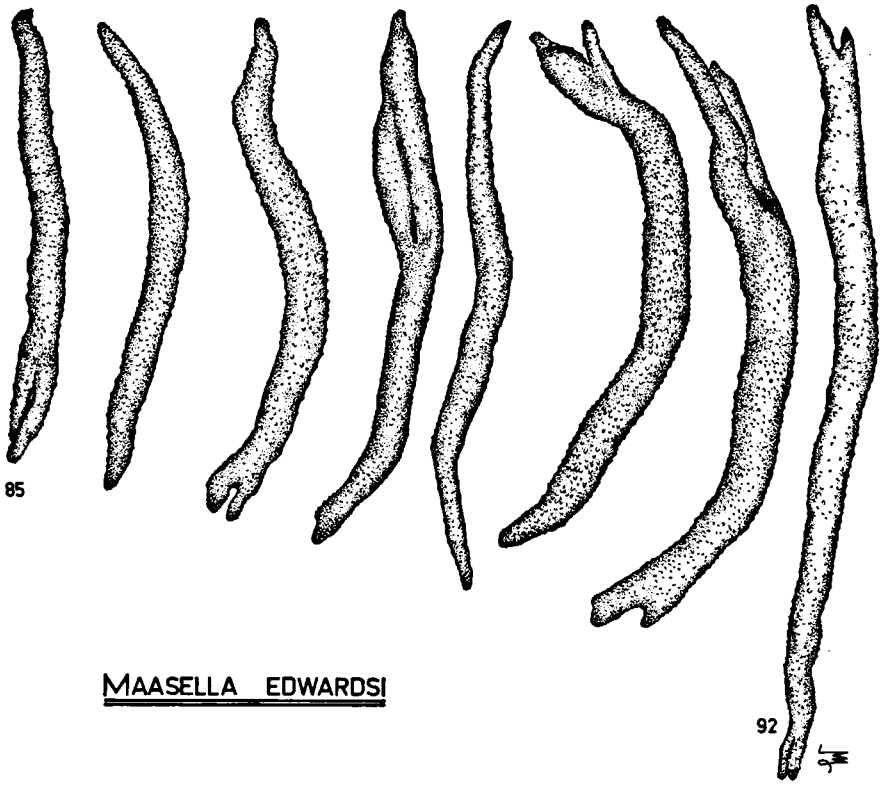

Plate 11. Spicules from *Maasella edwardsi*. 1—22: anthocodial spicules; 23—33: oval platelets; 34—92: spicules from pedicel. Note the many furcated forms.

that Bérenguier did not take into account the ecological data already presented by de Lacaze-Duthiers (1888, 1900), according to which both "types" are found to occur next to each other, whereas Bérenguier (1954) supposed them to be ecotypes occurring in different depths. Laubier (1966) concisely compares *P. elegans* and *M. edwardsi*, confirming the criteria used by Motz-Kossowska & Fage (1907). The most important are: *Maasella edwardsi* characterized by its brown colour due to zooxanthellae, by the emerald green oral disk, by the absence of secondary polyps; *Paralcyonium elegans* being virtually transparent, carrying secondary (and sometimes tertiary) polyps. We believe that Laubier (1966) is wrong, however, in supposing that Bérenguier (1954) dealt with colonies of *P. elegans* on account that no mention was made of either a "tronc polypifère", or the green oral disk. On the other hand, as we already pointed out, Bérenguier (1954) never mentioned secondary polyps. More important, the fact that zooxanthellae were observed, together with Bérenguier's plate XA (compare with our plate 10B) leads us to believe that the author dealt with specimens of *Maasella edwardsi*.

Plate 12. Spicules from *Maasella edwardsi*. Top row: oval platelets and spindles from anthocodiae. Bottom row: long spindles from pedicel, showing the abundant furcated forms. Magnification: 100×.

From the preceeding discussion the most important characteristics of *Maasella edwardsi* have already appeared. We will summarize:

- The colonies consist of small groups of polyps, connected to each other by means of stolons (Plate 10A).
- Each group comprises a pedicel 3—10 mm high, resulting from the fusion of the individual anthosteles, from which 3—8 independent anthocodiae protrude. The basal pedicel is stiffened by spicules.
- The anthocodiae (Plate 10B) reach some 4 mm in length when fully extended. They are coloured brown by zooxanthellae. The anthocodial spicules appear as bright white specks. The peristome is emerald green. The tentacles bear 11—15 pinnules on either side.
- Spicules may be sparsely present over the entire anthocodia (Plate 10B), sometimes they occur only just below the tentacles (Plate 10C). Anthocodial spicules comprise flat, opaque, oval platelets (Plate 10C, Plate 11 nos. 23—33, Plate 12) with a length ranging from 80—170 μm, and on the proximal part of the tentacles occur very slender smooth spindles, with a length varying from 200—250 μm (Plate 10C, Plate 11 nos. 1—3, 8, 10, 22, Plate 12).
- The spicules from the anthosteles (pedicel) are long, irregular rods, sometimes furcated, beset with small warts (Plate 11, nos. 34—92, Plate 12), their length being comprised between 250—2200 μm.

The animals occur beyond any doubt on the free surface of hard substratum from 12 m (Viguier, 1888) to 40 m (Laubier, 1966), and probably deeper (Bérenguier, 1954). We very frequently found the stolons and the pedicels to be overgrown by calcareous red algae, which may explain why Bérenguier (1954) did not describe the pedicels. If *Cereopsis studeri* should be a synonym of *Maasella edwardsi,* the species is found in depths up to 300 m.

The animal is known from Naples (Von Koch, 1891b), Marseilles (Bérenguier, 1954), Banyuls (de Lacaze-Duthiers, 1888, 1900; Laubier, 1966; personal observation) and Algeria (Viguier, 1888; de Lacaze-Duthiers, 1888, 1900).

Nothing is known about its reproductive cycle, except that Viguier (1888) observed eggs in May.

Genus **Paralcyonium** Milne Edwards & Haime, 1850

Diagnosis of the genus *Paralcyonium*:
"Colonies formed by groups of polyps, connected to each other by extremely short stolons. Pedicel stiffened by spicules, above which the anthocodiae of the primary polyps remain fused in a common body communicating with each other. Only the distal parts of the polyps emerge from the common trunk, upon which secondary, sometimes tertiary, polyps originate" (Partly after Motz-Kossowska & Fage, 1907).

Paralcyonium spinulosum (Delle Chiaje, 1822)

(Collection ZMA: COEL. 7769, 7796 (dredged), 7797, 7798, 7799)

Synonymy:

Lobularia spinulosa Delle Chiaje, 1822
Lobularia spinulosa; Delle Chiaje, 1828
Alcyonide élégante; Milne Edwards, 1835a
Paralcyonium elegans Milne Edwards, 1857
Paralcyonium elegans; Marion, 1882
Paralcyonium elegans; Carus, 1885
Paralcyonium elegans; Von Koch, 1891b
Alcyonium elegans; May, 1900
Paralcyonium elegans; Motz-Kossowska & Fage, 1907
Paralcyonium elegans; Lo Bianco, 1909
Paralcyonium elegans; Thomson, 1927
Paralcyonium elegans; Thomson, 1929
Paralcyonium elegans; Stiasny, 1941
Paralcyonium elegans; Rossi, 1950
Paralcyonium elegans; Laubier, 1966

For nearly 120 years this species has carried the name *Paralcyonium elegans* given by Milne Edwards, 1857. The authors dealing with the species obviously ignored the animal called *Lobularia spinulosa* by Delle Chiaje (1822, 1828). Nevertheless, his plate XXXII displays beyond any doubt (Fig. 3) a colony of the species described as *Paralcyonium elegans* by subsequent authors. The identity is emphasized by his fig. 4 showing the detail of primary and secondary polyps, a feature unique for the genus *Paralcyonium*. The animal grew, according to the same author on deep rocks. Some years after this original description, Milne Edwards (1835a) gives a detailed account of an octocorallian which he names "Alcyonide élégante". His detailed figures (Pl. 12, 13 figs. 1—9) and description establish beyond any doubt the synonymy with Delle Chiaje's species. Nevertheless, the name *Paralcyonium elegans*, which was given subsequently by Milne Edwards (1857), remained in use ever since. As we have already pointed out in the section devoted to *Maasella edwardsi*, Von Koch (1891b) saw both species, but took them for one: *P. elegans*. Proof that he actually has seen specimens of *Paralcyonium spinulosum* is given by the following quotation (p. 673): "Erst bei grösseren Büschen, die bis 20 cm lang werden, sind die vorher einfachen Polypen zu Zweigen geworden, welche 2—10, auch wohl noch mehr ziemlich regelmässig in 2 Reihen angeordnete, secundäre Polypen tragen".

The most extensive study was made by Motz-Kossowska & Fage (1907), who compared *Maasella edwardsi* with *Paralcyonium spinulosum*. Their description is very complete, and they pointed out the main characteristics distinguishing *P. spinulosum* from *M. edwardsi*:

— no zooxanthellae,
— anthocodiae remain fused above the stiff pedicel,
— presence of secondary polyps budding on the primary ones,
— direct communication of the polyps with each other.

Stiasny (1941) completed the previous descriptions with some very accurate figures (Figs. 5—7) of the anthocodial armature. He showed that primary polyps possess more subtentacular spicules than secondary ones.

It is regrettable that Bérenguier (1954), in spite of the previous extensive and reliable descriptions, was not aware that none of the specimens she examined belonged to *Paralcyonium*. The last author to study the species was Laubier (1966), who concluded that *P. spinulosum* is a valid species, living under ecological conditions quite different from those in which *Maasella edwardsi* is found. We will summarize the main morphological characteristics of the species:

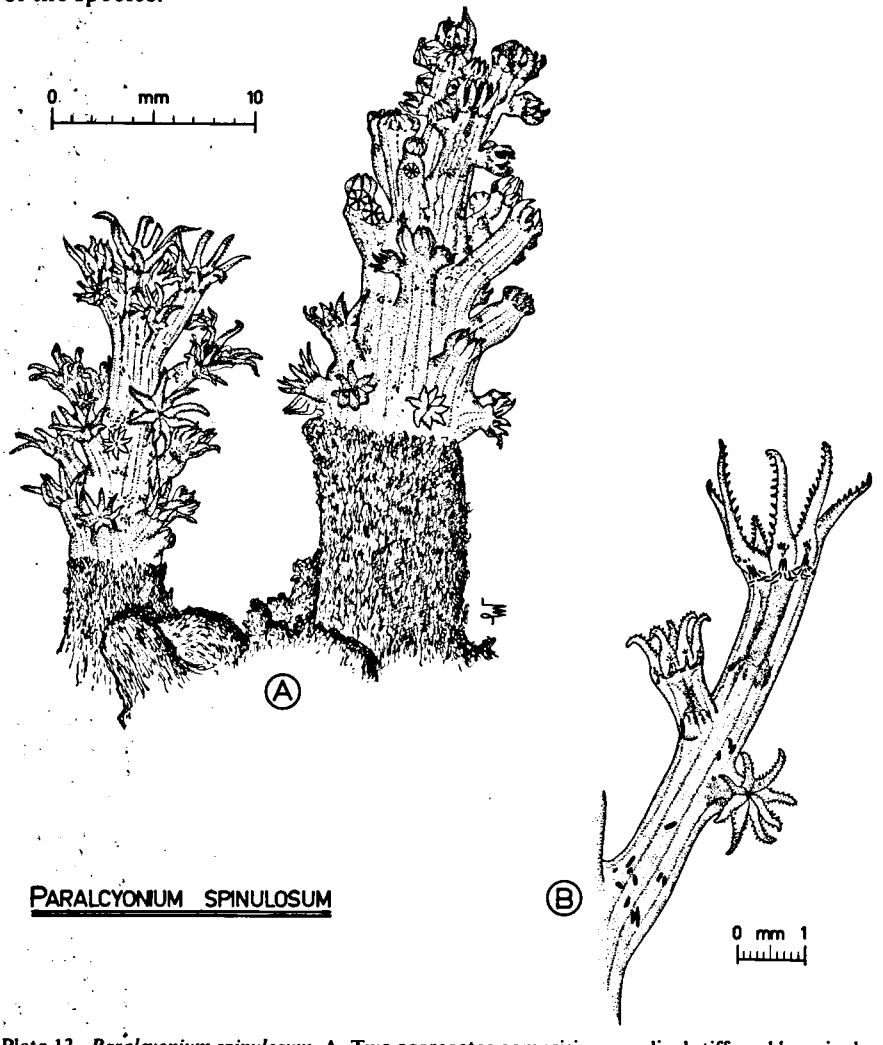

Plate 13. *Paralcyonium spinulosum*. A. Two aggregates comprising a pedicel stiffened by spicules and covered with a leathery film, and a transparent trunk from which the anthocodiae sprout. B. Detail of primary polyp bearing two secondary polyps.

— The colonies (Plate 13A) consist of aggregates of polyps, connected to each other by stolons which are so short that the aggregates seem fused together in their lower parts.
— Each aggregate comprises a stout pedicel, stiffened by long spicules, and covered on the outside by a brown leathery film. From this basal column a pink, transparent cylinder arises, being the result of the fusion of the polyps into a common trunk from which individual anthocodiae sprout at different levels.

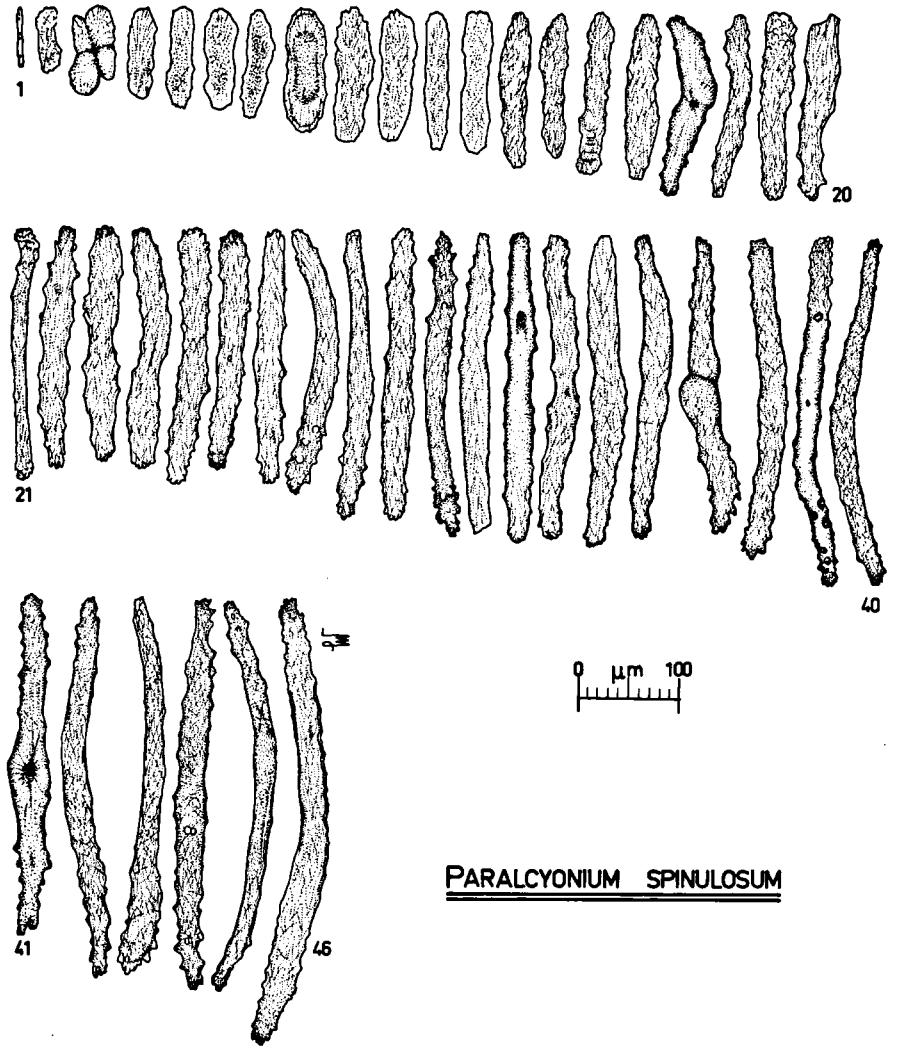

Plate 14. Spicules from trunk and polyps of *Paralcyonium spimulosum*. 1—20: oval platelets, 21—46: spindles. Note the fibrous nature of the spicules.

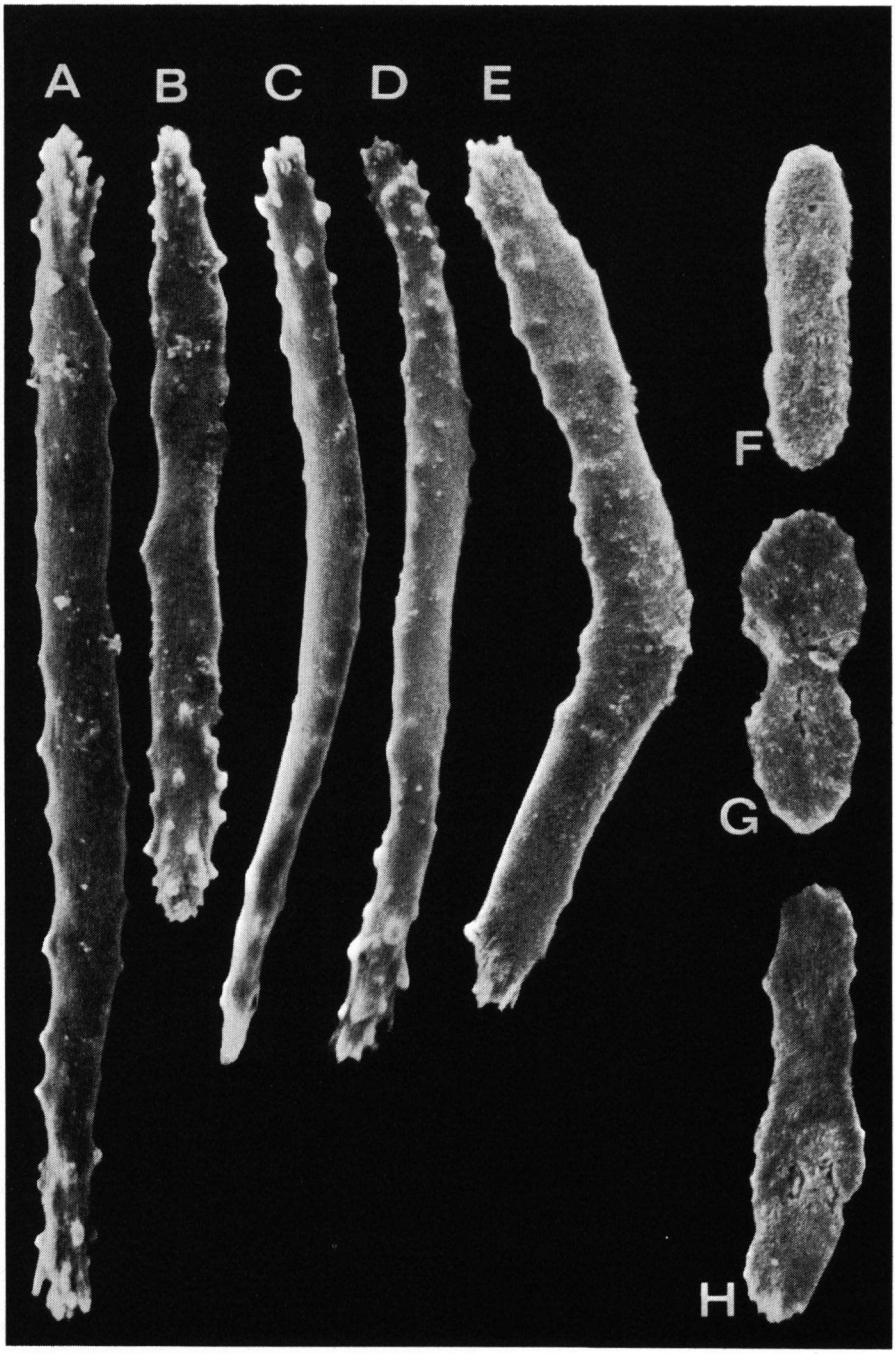

Plate 15. Spicules from the polyps of *Paralcyonium spinulosum*. A—E: spindles, F—H: oval platelets. Magnification: 400×.

— Neither trunk nor anthocodiae contain zooxanthellae. On the primary polyps secondary (Plate 13B) and sometimes tertiary polyps are found, being the result of budding. Primary polyps attain some 35 mm in height, secondary ones 10 mm. The tentacles bear two rows of 13—14 pinnules.

— The trunk is sparsely covered with spicules, which are opaque. Some rows of subtentacular spicules are found in the polyps, often

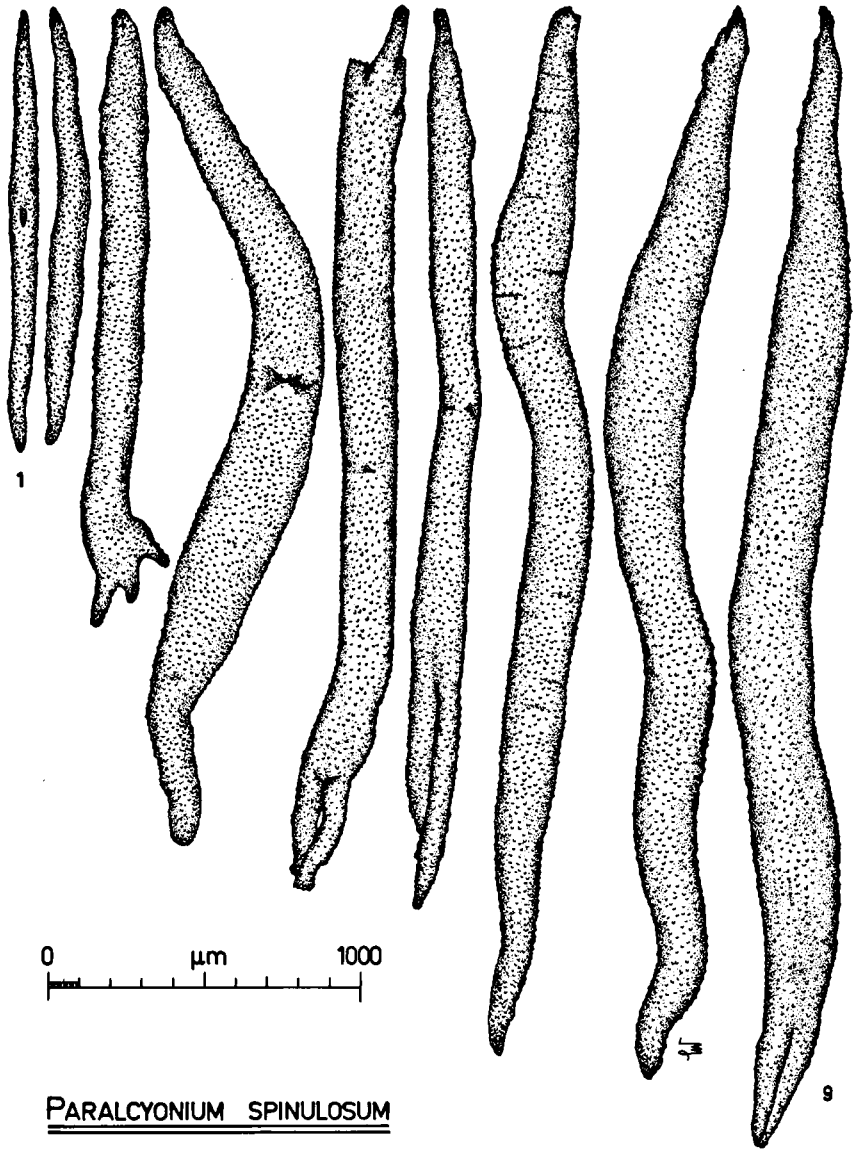

Plate 16. Spicules from pedicel of *Paralcyonium spinulosum*.

forming distinct chevrons. The anthocodial spiculation differs from that of *Maasella edwardsi* (compare Plates 13B and 10C). The anthocodial spicules (Plates 14, 15) consist of flat, oval platelets, often narrower in their middle part (60—180 µm) and longer, slenderer spicules (225—445 µm).

— The spicules from the pedicel (Plates 16, 17) consist of extremely

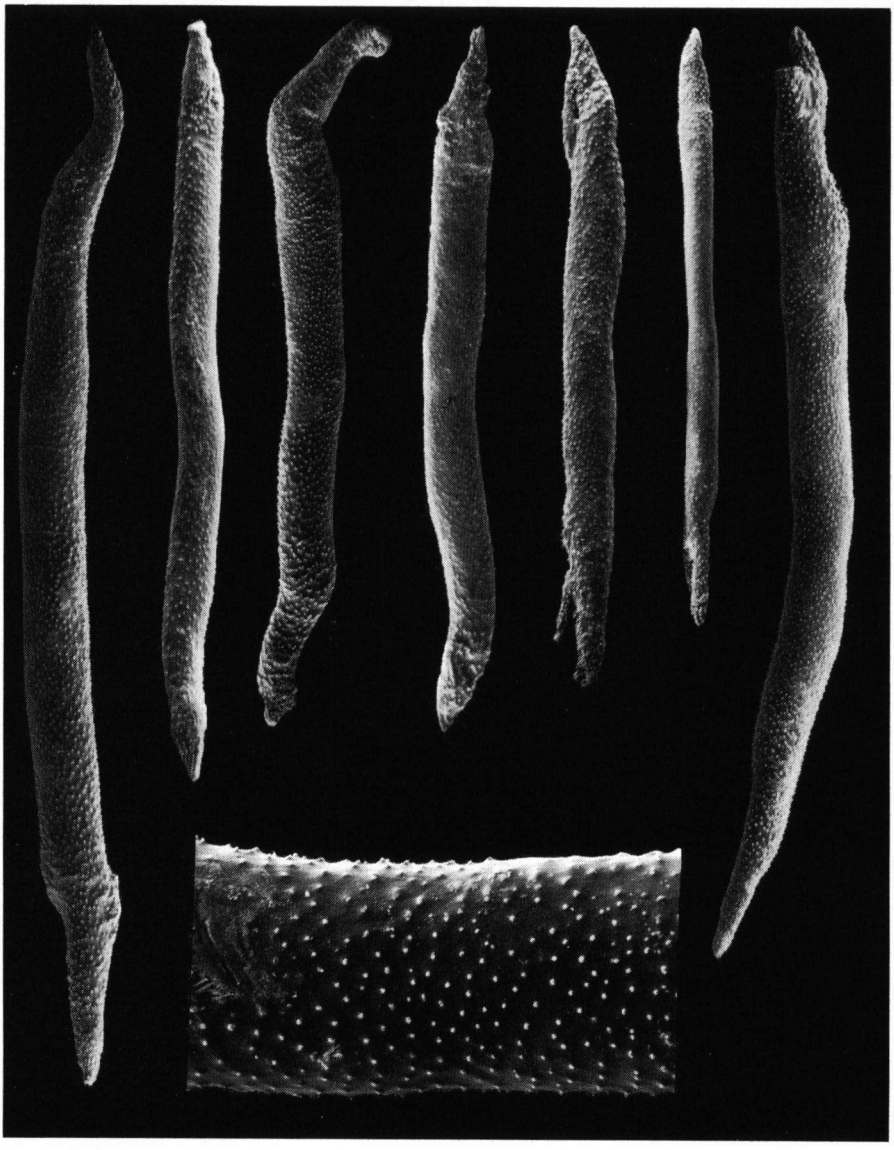

Plate 17. Spicules from pedicel of *Paralcyonium spinulosum* (magnification: 40 x). Detail showing minute warts on surface of spicules (magnification: 160 x).

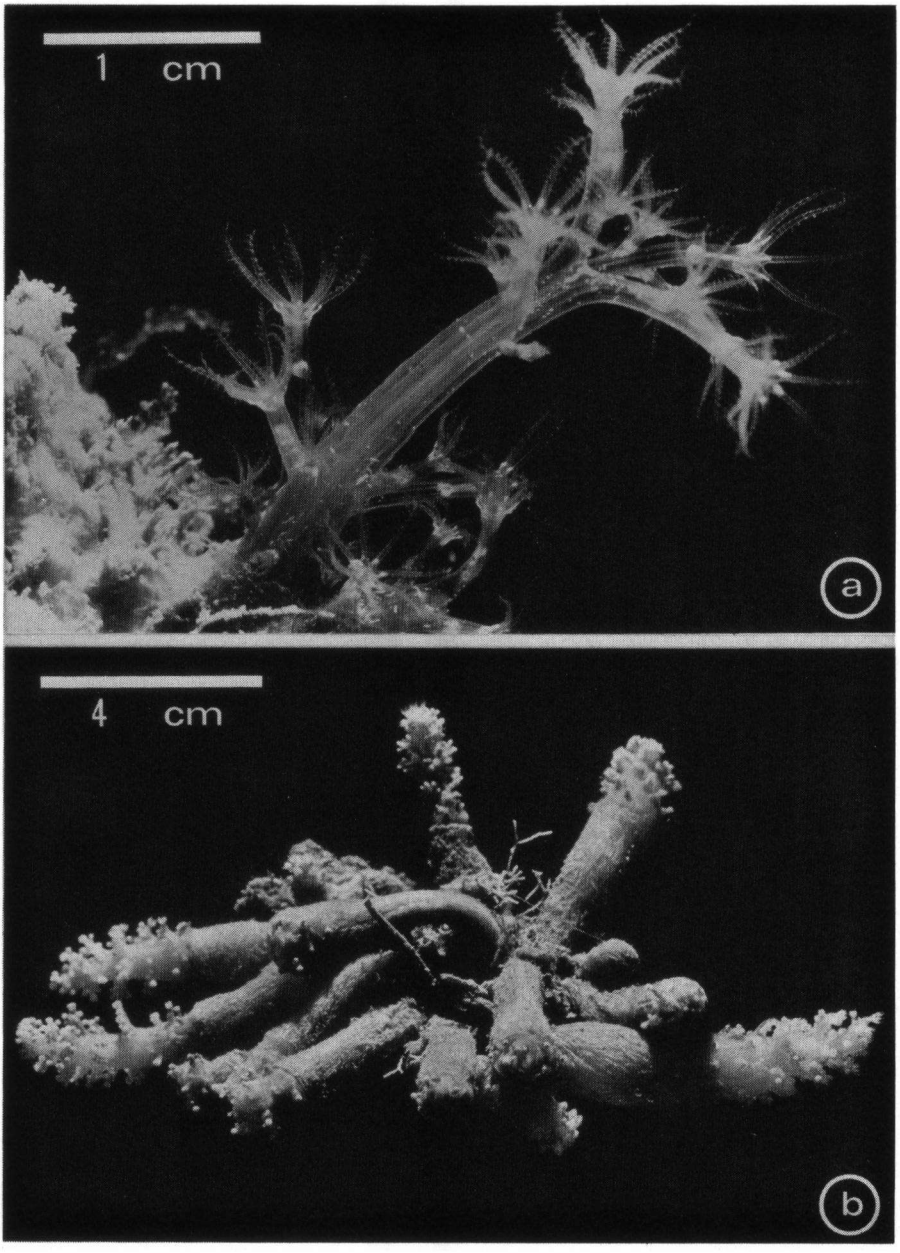

Plate 18. Colonies of *Paralcyonium spinulosum*. a. Small colony from 22 m depth. b. Tall colonies from 90 m depth.

long spindles (1440—3660 µm) covered with small warts. These spicules are transparent.

The species occurs from 22 m (personal observation) to 90 m (Laubier, 1966; personal observation). In the shallower parts of its distributional range the animal lives in almost closed cavities of the rocky substratum. The colonies are delicate in this case (Plate 18A), with an average size of 3—5 cm. Animals living deeper develop taller colonies. This fact was already reported by Laubier (1966). Our plate 18B shows several specimens growing on the ascidian *Microcosmus sulcatus* (ZMA COEL. 7796) dredged at a depth of 90 m near Banyuls s/Mer. The colonies attain 7—10 cm in this case.

Paralcyonium spinulosum is known from Naples (Delle Chiaje, 1822, 1828; Von Koch, 1891b; Stiasny, 1941), Marseilles (Marion, 1882), Banyuls (de Lacaze-Duthiers, 1888, 1900; Motz-Kossowska & Fage, 1907; Laubier, 1966; personal observation) and Algeria (de Lacaze-Duthiers, 1888).

Lo Bianco (1909) observed eggs from June till October, Motz-Kossowska & Fage (1907) in the end of July.

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References

Bayer, F. M.
1954 New names for two genera of Octocorallia. — J. Wash. Acad. Sc., **44** (9): 296.

Bérenguier, A.
1954 Contribution à l'étude des Octocoralliaires de Méditerranée occidentale. — Rec. Trav. Stat. mar. Endoume, **12** (7): 53—96.

Boccone, P.
1674 Recherches et Observations Naturelles: 1—328. (Jean Jansson, Amsterdam).

Broch, H.
1953 Octocorals and stony corals of the high Adriatic trawling grounds. — Ribarstveno-biološka ekspdcicija m/b „Hvar", Izvješća-Rep. Inst. oceanogr. Ribarstvo-Split, **6** (2): 1—22.

Carpine, C. & M. Grasshoff
1975 Les Gorgonaires de la Méditerranée. — Bull. Inst. océanogr. Monaco, **71** (1430): 1—140.

Carus, J. V.
1885 Prodromus faunae mediterraneae, **1**: i—xi, 1—524. (E. Schweizerbart Verlagshandlung, Stuttgart).

DELLE CHIAJE, S.
1822 Memorie sulla storia e notonomia degli animali senza vertebre del regno di Napoli. Atlas : Tav. I—IV, I—LXIX (Società Tipografica, Napoli).
1828 Memorie sulla storia e notonomia degli animali senza vertebre del regno di Napoli. **3** : I—XX, 1—232 (Società Tipografica, Napoli).

DURIVAULT, A.
1937 Forme et mode de répartition des spicules chez Alcyonium palmatum Pall. — Bull. Mus. nat. Hist. nat., (2), **9** (4) : 278—282.

EHRENBERG, C. G.
1832 Beiträge zur physiologischen Kenntnis der Corallenthiere im Algemeinen und besonders des Rothen Meeres, nebst einem Versuche zur physiologischen Systematik derselben. — Abh. kgl. Akad. Wiss. Berlin, **1832** : 225—380.

ESPER, E. J. C.
1794 Die Pflanzenthiere in Abbildungen nach der Natur, **2** : 1—303, 106 pls. (Käspischen Buchhandlung, Nürnberg).

FREDJ, G.
1972 Compte rendu de plongée en S.P. 300 sur les fonds à Laminaria rodriguezii Bornet de la pointe de Revellata (Corse). — Bull. Inst. océanogr. Monaco, **71** (1421) : 1—42.

KOCH, G. VON
1891a Die systematische Stellung von Sympodium coralloides Pallas. — Zool. Jahrb. Abt. Syst., **5** (1) : 76—92.
1891b Die Alcyonacea des Golfes von Neapel. — Mitth. zool. Stat. Neapel, **9** (4) : 652—676.

KÜKENTHAL, W.
1907a Alcyonium brioniense n. sp. Ein neues Alcyonium des Mittelmeeres. — Jen. Ztschr. Naturw., **42** : 61—72.
1907b Versuch einer Revision der Alcyonarien. II. Die Familie der Nephtyiden. — Zool. Jahrb. Abt. Syst., **24** : 317—390.
1909 Beobachtungen an einigen Korallentieren des Adriatischen Meeres. — Aus der Natur, **5** (11) : 321—328.
1916 Die Gorgonarien Westindiens. Kap. 1. Die Scleraxonier. — Zool. Jahrb., Suppl. **11**: 444—484.

LACAZE-DUTHIERS, H. DE
1888 Les progrès du laboratoire de Roscoff et du laboratoire Arago. — C.R. Acad. Sc. Paris, **106** : 1770—1777.
1900 Coralliaires du Golfe du Lion. Alcyonaires. — Arch. Zool. exp. gén., **3** (8) : 353—462.

LAMARCK, J. B. P. A. DE
1816 Histoire naturelle des animaux sans vertèbres, **2** : 1—568 (Verdière, Paris).

LAUBIER, L.
1966 Le coralligène des Albères. Monographie biocénotique. — Ann. Inst. océanogr. Paris, **43** (2) : 139—316.

LO BIANCO, S.
1909 Notize biologiche riguardanti specialmente il periodo di maturità sessuale degli animali del golfo di Napoli. — Mitth. zool. Stat. Neapel, **19** (4) : 513—761.

MARION, A.-F.
1878 Deux jours de draguages dans le Golfe d'Alger. — Rev. Sci. nat., **7** (1) : 137—164.
1882 Les Alcyonaires du Golfe de Marseille. — C.R. Acad. Sç. Paris, **94** : 985—988.

MARSILLI, L. F.
1725 Histoire physique de la mer : i—xi, 1—173, 40 pls. (La Compagnie, Amsterdam).

MAY, W.
1900 Beiträge zur Systematik und Chorologie der Alcyonaceen. — Jen. Ztschr. Naturw., **33** : 1—180.

MILNE EDWARDS, H.
1835a Mémoire sur un nouveau genre de la famille des Alcyoniens (genre Alcyonide). — Ann. Sci. nat., **2** (4) : 323—333, 2 pls.
1835b Observations sur les Alcyons proprements dits. — Ann. Sci. nat., **2** (4) : 333—343, 3 pls.
1857 Histoire naturelle des coralliaires ou polypes proprement dits, **1** : i—viii, i—xxxiv, 1—326 (Roret, Paris).

MOTZ-KOSSOWSKA, S. & L. FAGE
1907 Contributions à l'étude de la famille des Fascicularidés. — Arch. Zool. exp. gén., **4** (7) : 423—443.

PALLAS, P. S.
1766 Elenchus Zoophytorum : i—xvi, 1—451 (Petrus van Cleef, Hagae Comitum).

PAX, F. & I. MÜLLER
1962 Die Anthozoenfauna der Adria. — Fauna Flora Adriat., **3** : 9—343.

POCHE, F.
1914 Das System der Coelenterata. — Arch. Naturgesch., **80A** (5) : 47—128.

ROSSI, L.
1950 Celenterati del Golfo di Rapallo (Riviera Ligure). — Boll. Ist. Zool. Univ. Torino, **2** (4) : 193—235.

ROULE, L.
1900 Notice sur les Anthozoaires des côtes de la Corse. — Bull. Soc. zool. France, **25** : 125—135.

STIASNY, G.
1937 Parerythropodium maris-tenebrosi n. sp., eine neue Alcyonarie von der Küste West-Afrikas. — Proc. kon Ned. Akad. Wetensch. Amsterdam, **15** (8) : 735—744.
1941 Alcyonaria und Gorgonaria aus dem Golf von Neapel. — Pubbl. Staz. zool. Napoli, **19** (1) : 1—47.

STOSSICH, M.
1885 Prospetto della fauna del Mare Adriatico. 6. Coelenterata. — Boll. Soc. Adriat. Sci. nat. Trieste, **9** : 112—155.

THOMSON, J. A.
1927 Alcyonaires provenant des campagnes scientifiques du Prince Albert Ier de Monaco. — Rés. Camp. sci. Albert I, Monaco, **73** : 1—77, 6 pls.
1929 Alcyonaires des environs de Monaco et de localités diverses. — Bull. Inst. océanogr. Monaco, **534** : 1—10.

THOMSON, J. A. & L. M. I. DEAN
1931 The Alcyonacea of the Siboga Expedition. — Monogr. Siboga Exped. **13** (d) : 1—227, 28 pls.

TIXIER-DURIVAULT, A.
1940 Contribution à l'étude du Métabolisme du Calcium et du Fer chez l'Alcyonium palmatum Pallas. — Ann. Inst. océanogr., **20** (5) : 311—379.
1966 Octocoralliaires de Madagascar et des Iles avoisinantes. — Faune Madagascar, **21** : 1—456.

TIXIER-DURIVAULT, A. & M.-J. D'HONDT
1975 Les Octocoralliaires de la campagne Biaçores. — Bull. Mus. nat. Hist. nat., (3) **252** (Zoologie, **174**): 1361—1433.

VERSEVELDT, J.
1964 Notes on mediterranean Alcyonium species (Coelenterata: Octocorallia). — Zoöl. Meded., **39**: 153—167.

VIGUIER, C.
1888 Etudes sur les animaux inférieurs de la baie d'Alger. — Arch. Zool. exp. gén., **6** (2): 351—373.

WEINBERG, S.
1974 A relative irradiance meter for submarine ecological measurements. — Neth. J. Sea Res., **8** (4): 354—360.
1975a Contribution à la connaissance de Parerythropodium coralloides (Pallas, 1766) (Octocorallia, Alcyonacea). — Beaufortia, **23** (298): 53—73.
1975b Écologie des Octocoralliaires communs du substrat dur dans la région de Banyuls-sur-Mer. Essai d'une méthode. — Bijdr. Dierk., **45** (1): 50—70.
1976 Revision of the common Octocorallia of the Mediterranean circalittoral. I. Gorgonacea. — Beaufortia, **24** (313): 63—104.
1977 Revision of the common Octocorallia of the Mediterranean circalittoral. III. Stolonifera. — Beaufortia (in preparation).

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