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THE SHALLOW-WATER OCTOCORALLIA OF THE WEST INDIAN REGION

A MANUAL FOR MARINE BIOLOGISTS

by

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PREFACE

This paper is a general review of the shallow-water Octocorallia of the West Indian region, designed for the guidance of both the general marine biologist or ecologist working in the West Indies, and the systematist who may be interested in that faunal region and in the families of octocorals characteristic of it. Geographically, this résumé includes the tropical and subtropical regions in the western part of the Atlantic Ocean, from Bermuda south to the reefs of Brazil. Bathymetrically, it is limited to the zone between the low-tide line and 25 fathoms, which includes the region of active reef growth and the areas that are most likely to be investigated by diving and small-scale dredging operations.

As a guide to the identification of these shallow-water octocorals, this paper contains keys to the taxonomic subdivisions of the group and to the species recognized. The couplets for the most part are illustrated, in the style first used by VON KOCH in his monograph on the gorgonians in the *Fauna und Flora des Golfes von Neapel*, to obviate, so far as possible, errors of choice – a shortcoming that has always plagued taxonomic keys. Every effort has been made to characterize the various species as accurately and as clearly as present knowledge allows. The descriptions have been limited to the pertinent taxonomic details necessary for specific differentiation, generously supplemented by simple line illustrations of spicular characters. Although these may seem unduly numerous at first glance, those who, like the author, have had occasion to use the voluminous but poorly illustrated literature of the last three quarters of a century will appreciate them.

As a review of the octocoral fauna of the West Indies, this paper attempts to reduce in number the abundant synonyms of the common but variable species, and to reconcile the species that appear to be valid with the names in the literature. The distinguishable species have been included in the synonymies, but a number of the older nominal species, especially those of LAMARCK, are still unrecognizable and will remain so until their types can be restudied. This paper is therefore not a definitive faunal monograph, but a review in the light of present knowledge and available material which may facilitate the preparation of such a monograph.

The material used in the present study includes, in addition to a collection made by Dr. P. WAGENAAR HUMMELINCK, the extensive West Indian material in the U.S. National Museum, along with specimens collected by the author at various localities in the Florida Keys over a period of more than ten years. Altogether, this material constitutes a more comprehensive collection of West Indian alcyonarians than has been available to any student of the Caribbean area up to the present time.

I am especially indebted to Dr. HUMMELINCK, whose collection forms the nucleus of this paper, and whose encouragement has contributed to its final completion. Dr. F. G. WALTON SMITH, Director of the Marine Laboratory, University of Miami, has extended every convenience and facility at his disposal during my several collecting trips to Florida. Many private individuals have contributed specimens reported herein, including Dr. EUGENIE CLARK, Mr. & Mrs. J. W. DONOVAN, Dr. J. BROOKES KNIGHT, Mr. CONRAD LIMBAUGH, Mr. FRANK LYMAN, Messrs. P. L. and T. L. MCGINTY, Dr. DAVID NICOL, and Mr. & Mrs. JOHN WENTWORTH. My greatest debt is to my colleague Dr. ELISABETH DEICHMANN, of the Museum of Comparative Zoölogy at Harvard University, who has freely given of her wide experience with these perplexing and often exasperating animals. I am mindful of the unselfish help rendered by my associates at the U.S. National Museum, without which this work would not now be completed, and am grateful to my supervisors, who have permitted me to carry out this extended study when I might have been contributing more profitably toward the necessary functions of daily routine and the maintenance of the collections in our charge. In particular, I am indebted to Dr. WALDO L. SCHMITT, Research Associate, then Head Curator of Zoology, and to Dr. FENNER A. CHACE, JR., Curator of the Division of Marine Invertebrates. I wish also to express a special word of thanks to Mrs. PATRICIA ISHAM, zoological illustrator of the U.S. National Museum, who has supplied the guide letters and scales on the drawings and otherwise readied the illustrations for publication, to Mrs. LANELLE W. PETERSON of the Division of Marine Invertebrates, who has assisted immeasurably by her expeditious processing of specimens to prepare them for study and for incorporation in the National Collections, and to my brother, ROBERT W. BAYER, whose help in the preparation of the final manuscript was indispensable.

The greater part of this paper was presented, in slightly different form, to the Faculty of the Graduate Council of The George Washington University as a dissertation in partial fulfillment of the requirements for the degree of Doctor of Philosophy. I am particularly grateful to the members of my consultative committee, especially Drs. IRA B. HANSEN, ELIZABETH E. MORTENSEN and WALDO L. SCHMITT, for their advice, guidance and confidence.

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INTRODUCTION

The octocoral fauna of the West Indies is unique in its profusion of gorgonians that inhabit the shallow waters of the reefs and lagoons. From the low tide level to a depth of ten or fifteen fathoms, the families Gorgoniidae and Plexauridae flourish as they do nowhere else in the world. It was only natural that specimens of these large and colorful corals found their way back to European curiosity cabinets and museums early in the history of exploration in the New World. They were described and illustrated by the foremost naturalists, among them BAUHIN, BOERHAAVE, CATESBY, CLUSIUS, ELLIS, and TOURNEFORT, and LINNAEUS applied his new binominal system of nomenclature to several of them in the tenth and twelfth editions of his *Systema Naturae*. PALLAS, ESPER, LAMARCK and LAMOUROUX added many species to the rapidly growing list, and DUCHASSAING and MICHELOTTI soon after published the first faunistic studies dealing specifically with the corals of the West Indies. In more recent times, VERRILL, HARGITT and ROGERS, KÜKENTHAL, DUBROWSKY, and STIASNY have published papers on the West Indian fauna. The first modern treatment of the fauna, which was edited and partly written by KÜKENTHAL, appeared between 1916 and 1929 under the general title *Die Gorgonarien Westindiens* in the report on KÜKENTHAL and HARTMEYER's expedition to the West Indies. Then, in 1936, DEICHMANN's great monograph on the alcyonarians of the 'Blake' was published but since that time no significant contributions to our knowledge of the fauna have appeared.

In view of the long history of studies on the octocorals of the West Indies and the large number of published papers dealing with them, it is rather surprising to find the commonest and most accessible of them so poorly understood. Even the most recent and comprehensive of the works just mentioned fail to provide a reliable means of identifying the common reef-dwelling plexaurids and gorgoniids, which dominate the fauna. This situation prompted the present author to undertake serious research on the taxonomy of gorgonians while a student at the Marine Laboratory of the University of Miami, and led Dr. F. G. WALTON SMITH to urge the preparation of a guide to the Florida shallow-water alcyonarians along the lines of the present paper.

MATERIALS

The comprehensive collection of alcyonarians in the United States National Museum, gathered by the U.S. Fish Commission Steamer 'Albatross', by various Smithsonian Expeditions, and by many private individuals, contains unparalleled raw material for a study of the shallow-water species of the western Atlantic. The specimens collected in the Lesser Antilles by Dr. P. WAGENAAR HUMMELINCK form the nucleus of this paper; all other material from the West Indies was studied concurrently in an effort to define the variational limits of the different species throughout their ranges, and to correlate these with the species described in the literature. The success of this effort remains to be determined by those who put this paper to practical use.

In addition to the specimens collected by Dr. HUMMELINCK, material in the U.S. National Museum (abbreviated as USNM) from the following areas has been especially useful:

1. The east coast of Florida: a number of specimens dredged in shallow water by T. L. MCGINTY and A. R. THOMPSON on the m/v 'Triton'.
2. The Miami area: specimens dredged at moderate depths by Mr. and Mrs. JOHN WENTWORTH, and others collected on the reefs by myself and colleagues of the Marine Laboratory, University of Miami.
3. The Florida Keys: a large number of specimens obtained in 1884 by Dr. EDWARD PALMER, and others recently collected by FRANK LYMAN.
4. The Dry Tortugas: specimens obtained over a period of years

by Dr. Waldo L. Schmitt, and later by myself and colleagues of the Marine Laboratory while on an expedition upon Mr. William Morrow's yacht 'Spindrift', 1948.

5. The west coast of Florida: specimens collected by Henry Hemphill in 1884, Robert Stewart in 1951–1952, and Dr. J. Brookes Knight in 1952–1956.

6. The Gulf of Mexico: many specimens dredged in shallow waters by the 'Albatross' in 1885, the 'Pelican' in 1940, and the 'Oregon' in 1951–1956.

7. The Bahamas: specimens collected at New Providence, Watling's Island and elsewhere by W. J. Nye of the 'Albatross' party, 1886.

8. Diverse localities in the West Indies: the collections of the Johnson-Smithsonian Deep-Sea Expedition of 1933, the Smithsonian Hartford Expedition of 1937, and the Smithsonian-Bredin Caribbean Expeditions of 1956, 1958, 1959 and 1960, as well as those of the U.S. Fish Commission steamers 'Albatross' and 'Fish Hawk'.

Present State of Knowledge

In perhaps no other group of animals, with the possible exception of the Porifera, is classification and identification so subjective as it is in the Octocorallia, and it is not an exaggeration to state that we still do not know what an alcyonarian species is. This state of affairs results in part from the dearth of material representing the various supposed species, and in part from the variability of the characters that we use to distinguish them. Information on the effects of the physical environment upon the taxonomic characters is almost completely lacking.

At the present time, it is possible to discern two ways in which alcyonarian colonies vary: (1) in the growth form of the colony, which may be profoundly influenced by the surrounding environment; and (2) in the form of the spicules, which presumably reflects the genetic constitution of the colony irrespective of its environment. In certain favorable localities where dense populations of a few species occur under varying conditions, the effect of, for example, depth of water upon growth form can be observed, and some idea can be gained of the variability of spicular characters among individuals of a clearly defined population. Upon the basis of such observations, the otherwise subjective evaluation of characters in specimens from unknown populations becomes scientifically justifiable. It is possible to group the specimens of any large collection into units that demonstrate reasonable uniformity of taxonomic characters in spite of minor variations, and that are discontinuous from one another, which we can call species for all intents and purposes. However, until detailed field observations and experiments, coordinated with comprehensive collecting, clarify the normal range of variability within species and the influence of environmental factors upon the characters that we consider systematically important, the taxonomy of the octocorals will remain in confusion, cluttered with superfluous 'species' that are mere variants of one, and polyphyletic groups made up of several species erroneously synonymized because of superficial similarity.

Systematic Characters

The characters employed in the classification and identification of many other coelenterates, especially the details of the cnidom, the musculature of the polyps, the arrangement of septa, and other histological features, are generally not employed in the Octocorallia, partly because a large array of species have been described without respect to these characters due to the lack of satisfactorily fixed and preserved material, but mostly because of the overall uniformity of these characters throughout the subclass.

The anatomy of some pennatulaceans has been investigated in detail, and has been useful in establishing the scheme of classification at present employed for that group, but it is still not used as an adjunct to identification. In the order Alcyonacea, one family, the Xeniidae, is set off from the others by peculiarities of its septal filaments, but this feature is employed only in the identification of problematical specimens lacking the other morphological characters typical of the family. In the order Gorgonacea, the several families constituting the suborder Scleraxonia are now defined largely on the basis of the arrangement of the gastrodermal solenia and canals, thanks to the work of Verseveldt (1940, 1942).

The systematic characters of the greatest practical value are therefore those that are present in any specimen regardless of its state of preservation, dry or in alcohol, contracted or expanded. They fall mainly into two general categories, those pertaining to the colonies as a whole, and those pertaining to the skeletal elements.

Features of Colonial Morphology

Size and shape of colony. The size and shape of the colony, which depend upon the extent and pattern of budding, may be used to characterize the major groups in a general way. Thus, the Stolonifera, whose species bud only sparingly and only from a creeping stolon, never attain any great size and are usually inconspicuous membranous expansions growing on rocks, shells, or other solid objects. In the order Telestacea, the asexual production of polyps is more abundant, taking place not only upon the stolons but also from the body wall of older polyps, so that larger, arborescent colonies are produced, but even these are comparatively small, since they rarely exceed a foot in height. In the Alcyonacea and the Gorgonacea, budding is profuse and colonies of large size result. In the former group, the polyps are elongate and the space between individuals is filled in with coenenchyme, thus forming massive, fleshy colonies. In the latter, the polyps are short but the thin layer of coenenchyme in which they are imbedded is spread over an erect, tree-like axial structure made of horny material called gorgonin, or of spicules more or less closely fused together. The resultant colonies may reach an imposing size, as in the case of *Primnoa reseda* and *Paragorgia arborea* of northern waters, which may reach the size of small trees. In the tropics, such excesses are less often met with, but *Gorgonia flabellum* and *G. ventalina* of the West Indies may attain a height of six feet or more, and several plexaurid species approach this size. Other species, perhaps closely related to large ones, never reach a large size even under the most favorable of conditions, making it clear that there is an inherent size limit. CARY's investigations (1918) at the Dry Tortugas indicate that most reef-dwelling species reach a medium size in from three to five years, after which growth is very slow. He reported no evidence to indicate death from old age.

Pattern of branching. The pattern of branching is often highly characteristic of species and even genera. The commonest plans are dichotomous and pinnate, the nondescript 'lateral' type being usually a modification of one or the other. In the family Gorgoniidae, ramification is usually pinnate, and the strong tendency toward regular anastomosis is accorded generic significance. In other families, anastomosis of branching is generally thought to be a specific rather than generic character. Branching is predominantly dichotomous in the family Plexauridae, although there are exceptions, sometimes within a single genus. Some of the deeper water genera, such as *Chrysogorgia*, have an extremely regular manner of branching, and even the length of the internodes and the number of polyps appearing on them may be almost mechanically uniform.

Distribution of polyps. The distribution of polyps on the branches is of variable importance. In families having a small number of major gastrodermal stem canals, usually two, as is the case in the Gorgoniidae and the Ellisellidae, the polyps are typically arranged in two longitudinal bands separated by the canals, but when there are several longitudinal canals the polyps are scattered on all sides of the stems and branches, as in the Plexauridae. As is the case with the plan of branching, the arrangement of polyps may show greater regularity in genera of deeper waters. Among the Primnoidae, the polyps are commonly arranged in whorls around the branches, and the number of polyps in each whorl as well as the number of whorls in a given length of stem varies only within extremely narrow limits.

Dimorphism. Dimorphism of polyps, i.e., the occurrence of two types of individuals, namely autozooids and siphonozooids, is characteristic of certain genera of Alcyonacea and Gorgonacea; in the Pennatulacea, other types of individuals have been described. The autozooids, commonly called 'polyps', are the individuals with eight tentacles, eight septa and, usually, eight septal filaments; the siphonozooids, often simply called 'zooids' in the earlier literature, are small individuals with tentacles reduced in size and number and only two septal filaments, sometimes none at all. In the Pennatulacea, the siphonozooids are sterile, but in the Alcyonacea and Gorgonacea they are the sexual individuals of the dimorphic species.

Axis structure. The structure of the supporting axis is a character that has been underestimated in its significance, although its general character has long been used to separate the suborders of Gorgonacea and several of the included families. In those holaxonians that have been investigated, the axial cylinder is the product of a special axis epithelium, best demonstrated at the growing tip of the branches but visible in the older parts of the colony as well. It is ordinarily composed of a central core, soft and cross-chambered in some families, solid and calcified in others, surrounded by concentric layers of gorgonin which may be more or less calcified. In the Scleraxonia, the axial structures are composed of spicular deposits more or less tightly fused together. Since these spicules are the product of scleroblasts lying in the mesogloea, the axis formed by them cannot be considered homologous with the holaxonian axis unless the scleroblasts be considered a fragmented axis epithelium, or unless the presence of a central chord, produced by a terminal axis epithelium, can be demonstrated lying at the center of the spicule-augmented axis. The axis of gorgoniids has a narrow chambered central core surrounded by regular layers of gorgonin bearing little if any calcareous matter, whereas the core of plexaurids is much wider and the layers of gorgonin are separated by numerous lenticular spaces, the loculi, filled with calcareous matter. In the Ellisellidae, Primnoidae, and Chrysogorgiidae the central core is calcareous and not chambered, and the concentric outer layers are heavily calcified. In the Ellisellidae, calcification is radial, in the Primnoidae the layers are undulated, and in the Chrysogorgiidae they are quite smooth and concentric. In both the Holaxonia and the Scleraxonia, families with the calcareous axis interrupted by horny joints occur. Although the holaxonian families have no spicules in the horny nodes, and the calcareous internodes are said to be of a non-spicular nature, they have many basic similarities to the jointed scleraxonians and it is entirely possible that these supposedly divergent families are more closely related than is generally believed.

Color: Color in the Octocorallia is dependent upon three causes, pigments in the tissues, intracellular symbiotic algae in the entoderm, and coloring substance incorporated in the calcareous spicules. The color of preserved specimens is almost always due to the latter cause and is permanent, being insoluble in alcohol, unaltered by drying, and little affected by light. It is sometimes a reliable specific character, as it is in certain species of *Muricea* and the precious corals (*Corallium*), but usually the brightly colored species, especially in the families Gorgoniidae and Ellisellidae, are quite variable. *Leptogorgia virgulata* is one of the finest examples of polychromism, the members of a population ordinarily ranging from nearly white through lemon yellow, ochre, orange, red, and purple to deep violet. The pure yellow and deep violet phases have most or all of their spicules of those colors, but the intermediate colors result from the admixture of red and violet spicules in varying proportions. Other species of Gorgoniidae demonstrate the same phenomenon.

Microscopical Features

The one character most useful in the identification and classification of alcyonarians, the form of the calcareous spicules, was first appreciated by A. VALENCIENNES, who prepared a general revision of the gorgonians founded upon it, but of which only a brief extract (1855) was ever published. Ten years later, KÖLLIKER's *Icones histiologicae* (1865) clearly established the value of spicules in the classification of alcyonarians and presented a new arrangement based upon them. Subsequent authors adopted the system immediately and our present scheme of classification began to take shape.

In the Octocorallia, the coenenchymal sclerites are of two basic types, the monaxial rod or spindle, and the scale or plate. All other spicule forms are derivable from them.

The monaxial forms are *rods* if blunt and nearly cylindrical, *spindles* if fusiform and sharply pointed, and *capstans* if very short, blunt, and surrounded by two regular girdles of tubercles. In some families, such as the Coralliidae and Paragorgiidae, the two whorls of tubercles on the capstans are composed of three projections each, so that there are a total of eight short rays, including the ends of the main axis, projecting in a regular manner from a very short shaft. These are called octoradiate capstans ('Achter' in German), and the suppression of one or both terminal rays produces septem- and sex-radiates ('Siebener' and 'Sechser'). The characteristic four-rayed 'butterfly' spicules of *Plexaurella* are nothing but sex-radiate capstans with four of the rays much enlarged, but other cruciform spicules are usually twin spindles. Spindles with one end much enlarged are descriptively referred to as *clubs*, of which there are many sub-varieties.

Since spindles and rods in many cases show a tendency to flattening, it is probable that plates, scales and other flattened sclerities are derivatives of these simple types. This is almost certainly true in the Chrysogorgiidae, in which the transitional forms can be seen and in which the calcification is concentric, but there is some question about the derivation of the plates of primnoids, in which the calcification is radial.

The various specialized terms applied to spicules are briefly defined in the glossary. Most of the terms are descriptive, and no complicated spicule terminology has grown up in the octocorals as it has in the sponges.

Not only is the form of the spicules themselves of taxonomic importance, but their arrangement in the various parts of the colony is significant. In practically all Alcyonacea and Gorgonacea, the spicules at the surface of the coenenchyme are of a specialized type differing from those of the deeper layers. In the Gorgonacea, there may be two inner layers, the subsurface outer rind, lying outside the longitudinal stem canals, and the inner rind or axial sheath, lying between the stem canals and the axis. An axial sheath layer is almost universally present, although it is extremely thin in some genera, notably those of the Paramuriceidae. Colored spicules are sometimes confined to the axial sheath, sometimes to it and the inner rind, and sometimes they occur in all layers. The sculpture of spicules in the outer layer is often asymmetrically developed into spines, leafy processes and frills of various kinds, but the spicules of the deeper rind and the axial sheath are usually quite symmetrical.

The presence of spicules in the anthocodial part of polyps varies greatly in the different major groups, but it is usually a reliable character of great importance. Thus we find the polyps heavily armored in some groups, such as the Primnoidae, and weakly spiculate in others, such as the Gorgoniidae, but the arrangement of polyp-scales in the primnoids is remarkably constant and highly characteristic, and the size and shape of the anthocodial rods in gorgoniids seem to be reasonably constant. The large distal spicules of the polyps, which guard the calicular apertures during contraction, were used by KÜKENTHAL (1924, p. 88) as a basis for separating the family Muriceidae ('Polypen mit Deckel') from the Plexauridae and Acanthogorgiidae ('Polypen ohne Deckel'), but the fact of the matter is that all three families have a subtentacular armature and the distinction is one of terminology, with this armature called an operculum ('Deckel') in the Muriceidae, and a crown ('Krone') in the other families. Although the operculum as defined by KÜKENTHAL consists of a transverse ring (the collaret) surmounted by eight triangular or chevroned tracts of spindles in the tentacle bases, whereas a crown consists of spicules less regularly disposed, the distinction is still a difficult one to make on a practical basis and has too many exceptions. For example, *Plexaura homomalla*, the type of the genus, has a perfectly good operculum consisting of collaret and points, while many species of *Muricea* have only a crown of spindles less precisely oriented; thus *Plexaura homomalla* would be a muriceid, according to KÜKENTHAL's criteria, and some Muriceas would fall into the Plexauridae. Polyps that are armed with a crown or an operculum as in the Paramuriceidae (Muriceidae of previous authors), Plexauridae, and Gorgoniidae, have a spicule-free neck zone or introvert, which permits the entire distal part of the anthocodiae to be withdrawn into the anthostele or directly into the cortex. On the other hand, the polyps of certain other groups, such as the Ellisellidae and Coralliidae, have a uniform and uninterrupted armature that permits the tentacles to be infolded and the calicular aperture closed, but does not allow complete withdrawal of the tentacular part into the anthostele.

TECHNICAL TERMS

anthocodia: the upper, tentacular part of the polyp which, in many cases, can be retracted within the rind or calycular structure.

anthostele: the lower, thickened part of the body wall of the polyp, often stiffened by spicules, into which the anthocodia may be withdrawn; often equivalent to 'calyx.'

autozooid: a polyp with 8 well-developed tentacles and septa; the only kind of polyp in monomorphic species, the major polyps of dimorphic species.

axis: the central, supporting structure of Gorgonacea and Pennatulacea; in the former, it may be spicular, consolidated or unconsolidated, or horny, with more or less non-spicular calcareous matter.

axis epithelium: the layer of cells derived from ectoderm that produces the axis of Holaxonia.

axoblasts: individual scleroblasts of the axis epithelium.

bark: the rind of holaxonian Gorgonacea.

calyx: the wart-like projecting anthostele.

cnidoblasts: the cells that produce the nematocysts.

coenenchyme: the colonial spiculiferous mesogloea.

collaret: the transverse, subtentacular ring of spicules.

cortex: the outer coenenchymal layer of gorgonaceans, esp. Scleraxonia; the outer, horny layer of the holaxonian axis, as opposed to its medulla or central chord or core.

crown and points: the transverse collaret with the superposed opercular rays.

filaments: the thickened, convoluted edges of the septa; in Octocorallia, the filaments of the two septa opposite the siphonoglyph are very long and heavily flagellated, whereas the remaining six are shorter and glandular.

loculi: the lenticular, calcified areas in the holaxonian axis, esp. of Plexauridae.

medulla: the central zone of the scleraxonian stem; rarely, the central chord of the holaxonian axis.

mesenteries: the soft septa.

mesogloea: the jelly-like substance separating the two cellular layers of coelenterates.

nematocysts: the 'stinging cells' or 'thread cells' characteristic of coelenterates.

operculum: the anthocodial spicular apparatus that more or less closes the calyx or protects the tentacles in contraction.

pinnules: the digitate lateral branches of the tentacles of octocoral polyps.

polyp: any individual of the alcyonarian colony; equivalent to 'autozooid.'

rind: the outer, spiculiferous coenenchyme of Holaxonia.

sclerites: the calcareous skeletal elements of the mesogloea, irrespective of form.

scleroblasts: the ectodermal cells of the mesogloea that produce the calcareous spicules.

septa: the thin, radial, non-calcareous partitions of the polyp.

siphonoglyph: the strongly ciliated groove extending down one side of the pharynx.

siphonozooid: polyps with reduced tentacles or none, and often reduced septal filaments; usually much smaller than autozooids.

solenia: the canals, lined with gastrodermis, that penetrate the coenenchyme and interconnect the gastric cavities of the polyps.

spicules: the calcareous skeletal elements of the mesogloea, irrespective of form; properly, a long, sharp sclerite. Specialized forms are:

- *balloon clubs,* with practically smooth, spheroidal heads, characteristic of *Eunicella.*
- *Blattkeulen,* leaf-clubs (Ger.).
- *brackets,* scaphoids.
- *buccal scales,* those scales just proximad of the operculars in sub-family Calyptrophorinae.
- *capstans,* monaxial rods with two whorls of tubercles and terminal tufts.
- *clubs,* spicules enlarged at one end, often strongly sculptured.
- *crampons,* scaphoids (Fr.).
- *disk-spindles,* derivatives of capstans with the tubercles of the two whorls fused into disks or wheels.

Doppelrädchen, disk spindles or 'double wheels' (Ger.).
double clubs, the bispheroidal, two-handled sclerites of *Corallium.*
double wheels, disk-spindles.
infrabasal scales, in primnoids the sclerites situated between the basal body scales and the scales of the rind.
Keulen, clubs (Ger.).
Klammern, scaphoids (Ger.).
leaf-clubs, clubs with the heads ornamented with foliate processes.
plates, flat sclerites too thick to be called scales.
radiates, sclerites with processes radiating in one plane (stellate), or in various planes in a more or less symmetrical order.
scales, thin, flat or nearly flat sclerites.
scaphoids, spindles more or less distinctly bent in the form of a 'C' and with warts of the convex side reduced.
Scheibenträger, disk-spindles (Ger.).
spindles, straight or nearly straight, monaxial spicules pointed at both ends.
Stachelkeulen, thorny clubs (Ger.).
Stachelplatten, thorn-scales (Ger.).
thorn-clubs, clubs with processes of the head sharp and spiny.
thorn-scales, scale- or plate-like sclerites with a central or marginal projecting process.
torches, clubs with the foliate processes of the head strongly laciniate, resembling burning torches.
wart-clubs, clubs with only low, blunt protuberances ornamenting the head.

stolon: the creeping basal expansions, ribbon-like or membranous, from which the polyps of Stolonifera and Telestacea arise.
Stützbündel: the spicular supporting bundles of nephtheids (Ger.).
supporting bundle: the sheaf of supporting spicules below the anthocodiae of nephtheid polyps.
verruca: the calyx; the tubercles of sclerites.
zooid: in the more recent literature in English, any individual of the colony, irrespective of its morphological specializations, thus equivalent to polyp; in most German language works, equivalent to siphonozooid.

Methods and Techniques

Preservation

Because the identification of octocorals depends largely upon the calcareous spicules that occur in the coenenchyme, specimens preserved dry or in ordinary alcohol are entirely satisfactory for study. Although the arrangement of the anthocodial spicules can be detected in dissections from dry or contracted spirit specimens, it may be observed much more clearly in specimens killed with polyps expanded. Consequently, if time and facilities are available, preparation of such specimens is rewarding. Specimens with polyps expanded may be obtained by allowing them to extend in aquaria or other suitable glass containers and treating them with a narcotizing agent prior to fixation. For octocorals, the best are magnesium chloride, magnesium sulphate, and chloretone (Chlorobutanol).

The first chemical is used as a 7.5%–8.0% solution in *fresh* water, which should be carefully substituted for half the liquid in the aquarium containing the specimen. When, after repeating once or twice until most of the sea-water has been replaced by magnesium chloride solution, the polyps remain extended upon mechanical stimulus, neutralized formalin may be added to kill the specimen. After fixation, transfer to spirit for permanent preservation.

Magnesium sulphate, saturated in sea-water, should be added drop by drop to the aquarium containing the extended specimen. When the polyps no longer respond to touch, the specimen may be fixed, as described above.

Chloretone is administered in crystal form by dropping a small amount on the surface of the water. After a time, the polyps will become insensible to touch and the colony may be fixed in formalin as above noted.

Various species react differently to the different narcotizing chemicals, but most will respond satisfactorily to one or the other of the magnesium salts mentioned earlier. A few species may be found which cannot be narcotized by any of the methods I have mentioned. In these cases it probably is not worth the effort to attempt alternative techniques, of which there are several (e.g., CO_2, menthol, hot formaldehyde). Needless to say, fixation of specimens for histological study must be very carefully effected. Since it is not within the scope of this report to describe histology, techniques pertinent thereto will not be discussed.

Preparation of Spicules

Preparation of spicules for microscopic examination is very easily accomplished without elaborate equipment. The only necessary chemical is a solution of sodium hypochlorite (eau de javelle; milton fluid; anti-formin; Clorox) kept for convenience in a dropper-bottle. The solution should be frequently renewed, because an old and weak solution acts slowly and results in much lost time.

A small fragment of the specimen is placed on a glass slide and a drop of hypochlorite solution added. In a few moments, the organic matter will be entirely dissolved and the spicules freed, whereupon a coverslip may be added and the preparation is ready for examination. Such water-mounts are temporary, but show the calcareous spicules to good advantage because of the discrepancy between the refractive indices of water and calcite. It is important to roll the spicules about, by tapping the coverslip with a fine needle while observing under low magnification, in order to detect any flattening, asymmetry, or other features not obvious from a single view. This is especially important in the Gorgoniidae, in the discussion of which I shall mention the matter again.

The examination of spicules from restricted regions of the colony requires, of course, that samples from those areas be teased out under a stereoscopic microscope and the spicules cleaned separately. It is always instructive, just as a matter of routine, to so dissect a bit of the colony, in order to observe the coenenchymal layers, orientation of spicules in polyps and calyces, and similar details.

For permanent mounts I find it convenient to dissolve out the spicules in a small vial, so that they may be repeatedly washed in clear water to remove all traces of sodium hypochlorite. When clean, the spicules may be dropped on a slide, dried, and mounted in balsam, clarite, hyrax or other medium. The greater the difference between refractive index of specimen and medium, the better, but spicules always become more transparent in permanent mounts.

To avoid this effect, they may be mounted in glycerin buffered to neutrality in an asphalt cell turned upon an ordinary slide, and sealed under a circular cover. This method, although tedious, produces the best results, because the spicules are not totally immobilized and because their refractive index (calcite: n 1.52) is sufficiently different from that of glycerin (n 1.463) that they may be seen clearly. Observation of spicules in permanent mounts can be greatly facilitated by the use of polarizing filters; I keep one always in the sub-stage filter-holder, and another in the most-used ocular. Ordinarily, the filters are used uncrossed (bright-field) but, for some work, such as the examination of tentacles whole-mounted in glycerin or balsam, to determine the spicule arrangement, crossed filters (dark-field) may be used to bring out details with great brilliance.

The optical equipment I find most useful on my microscope are 10×, 20×, and 43× objectives used with a 15× eyepiece. For the large spicules of certain species, a lower eyepiece, either 10× or 5× may be required. A low-power objective is often useful for drawing calyces and anthocodiae, and for this I use a Zeiss variable 1.2–2.4× objective, with which a great range of small magnifications can easily be obtained. A camera lucida is essential for drawing and measuring spicules. For the latter purpose, the camera lucida is used to trace the image of a stage micrometer upon a piece of paper, which can then be used as a ruler to measure directly the drawings of all spicules made with the same optical combination. This method is vastly more accurate and handy than the use of an eyepiece micrometer or reticle.

Nomenclature and Systematics

As every systematist knows, nomenclature encompasses numerous problems even when the systematic units to which the names refer are clearly defined. When, as is the case in the Octocorallia, the limits of the species as well as of the higher categories are in a state of flux, nomenclatural problems become thorny indeed. It is absolutely essential under these conditions to adhere strictly to the law of priority, since deference to the fanciful idol of usage creates more difficulties than it avoids. It has therefore been my policy to employ the earliest available name for every recognizable species, even though this policy results in the upsetting of certain names in more or less general use.

At the generic level, no worker has yet taken the trouble to cite the date and method of type fixation, if types are cited at all. Without accurate knowledge of generic types no clear concept of the genera themselves can exist, so I have spared no effort to determine the earliest type selections for all genera whose types were not fixed at the time of original publication. This procedure has already resulted in a few generic name changes that were momentarily distasteful but necessary to stability.

The nomenclatural problems of geographical, ecological, and individual variation in the alcyonarians have not been met by the general recognition of subspecies and infrasubspecific categories, as has been the practice in certain other groups of animals. Among the Octocorallia, the status of these variants is almost completely unknown and for the time being it cannot be determined which ones are valid, genetic subspecies and which ones are the result of individual variation or environmental influences. Difficulties that arise when it becomes necessary to refer to the often divergent growth forms of what appears to be a single species seem best circumvented by the use of form names. In the present treatment I have so recognized a number of such variants in preference to maintaining them as ill-defined and unjustifiable species and subspecies.

The status of many genera likewise demands clarification, and it will probably be found that many arbitrarily separated groups of species will merge once the valid generic criteria are clearly recognized.

Use of the Keys

There are many systematists who feel that it is impossible to compose satisfactory keys for the identification of animals. Certainly, the characters in some groups of animals lend themselves better to expression in key form than others do, and there may indeed be groups that cannot be keyed at all. In papers on the Octocorallia, it has been almost traditional to present keys, thanks largely to the efforts of W. KÜKENTHAL, who made extensive use of them.

The use of keys may be insidiously misleading due to the combined effect of an intrinsic fault of keys and an inherent shortcoming of their users. The fault of keys lies in the difficulty of expressing succinctly those features that are subject to considerable variation; and the shortcoming of their users lies in the excessive confidence placed in these unavoidably fallible guides. However, if a key is well made, and it is approached with caution, not as an indisputable answer to all questions of identification, but as a guide to the species known to science at the time, then it can be a valuable tool that saves many hours of work.

Accordingly, I have drawn up some new keys and modified some old ones, and furnished them with drawings to illustrate the features expressed in the couplets, hoping thereby to have minimized the fallibility of words and infelicity of expression. Obviously, there is space to show only limited examples of the key characters, so that the natural range of variation is not covered. Perhaps this may call for an even more cautious approach by the user than would otherwise be called for, but it may also result in more accurate and more rapid determinations.

In all cases, the illustrations of spicules are camera lucida drawings of actual examples, and are not diagrammatic. Some of the sketches of colonial form and pattern of branching have been schematized, however.

SYSTEMATIC DESCRIPTIONS

Subclass *OCTOCORALLIA* Haeckel, 1866

Diagnosis. Sedentary, colonial, monomorphic or dimorphic Anthozoa with autozooids invariably bearing eight tentacles, usually pinnate; eight complete septa, with filaments; one siphonoglyph. Siphonozooids, if present, with tentacles reduced in number or lacking, and with filaments on only one pair of septa. Skeleton consisting of calcareous spicules (in all orders but one), a more or less calcified horny central axis that in some groups is made up of fused spicules, or a massive, fibrocrystalline corallum (order Coenothecalia only).

Remarks. The junior term Octocorallia is employed for this subclass in preference to prior names because the first, EHRENBERG's Octactinia, was originally used in a peculiar dual sense ('Zoocorallia Octactinia' and 'Phytocorallia Octactinia') and, moreover, implies relationship with the group well-known as Actiniaria; the second, BLAINVILLE's Zoophytaria, preserves the antiquated botanical association of these animals; and the third, DANA's familiar Alcyonaria, has been used both for the subclass as a whole and for the order here called Alcyonacea. In general discussions, however, it is convenient to use the term 'alcyonarians' in a vernacular sense, in which case it is equivalent to 'octocorals.'

KEY 1

ILLUSTRATED KEY TO THE ORDERS OF OCTOCORALLIA

1a. Colonies are attached to or in the substrate by a special basal disk, creeping stolons, or calcareous root-like processes: 2

1b. Colonies inserted in the soft sea-floor by a fleshy stalk: Order PENNATULACEA

2a. Colonies mostly creeping, encrusting or lobate; if arborescent, the branches lack any trace of axis or medullar region and are perforated to the lowest parts by the long gastric cavities of the polyps; if membranous, composed of only one layer of coenenchyme: 3

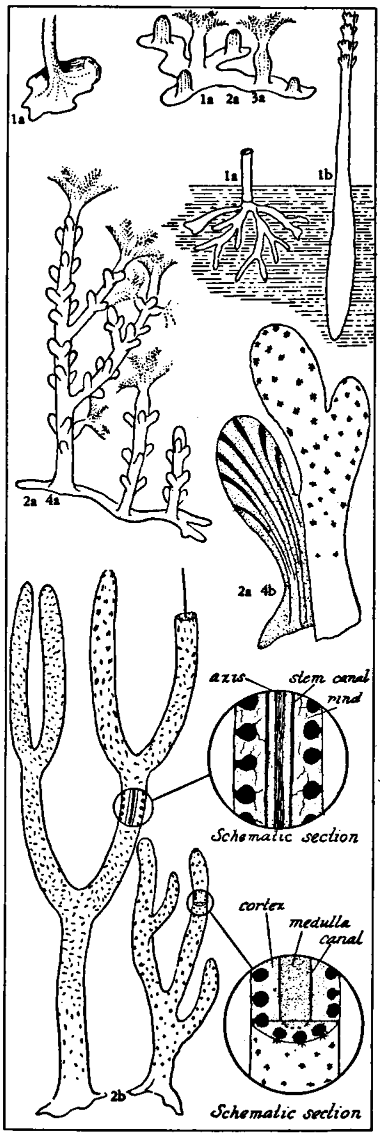
2b. Colonies mostly erect, arborescent, either with a definite axis, horny or calcareous, or a distinct medullar zone into which the gastric cavities do not extend, characterized by spicules of different form or color from those of cortex; if membranous, composed of two layers of coenenchyme; basal layer not penetrated by polyps; gastric cavities short: Order GORGONACEA

3a. Polyps simple, arising from reticulating ribbon-like or membranous stolons; no budding from polyp walls: Order STOLONIFERA

3b. Colonies arborescent or massive: 4

4a. Primary polyps with laterally budded daughters arise from reticulating stolons: Order TELESTACEA

4b. Polyps imbedded in massive, lobate, coenenchymal mass; colonies rarely arborescent, but if so the stems contain extremely long gastric cavities reaching base: Order ALCYONACEA



Order STOLONIFERA Hickson, 1883

Diagnosis. Colonies composed of tall or short, simple, cylindrical polyps arising from a basal stolon which encrusts solid objects; the stolon may be ribbon-like, a reticulum of narrow bands, or a thin, flat sheet.

Remarks. Stoloniferan polyps are often tall, and may be distinguished from the Telestacea by the complete absence of secondary polyps budded off from the primary polyp-wall. When a stoloniferan colony is membranous, it can often be distinguished from membranous Gorgonacea only by the absence of any division of the coenenchyme into distinct layers. In the membranous Gorgonacea the colonies have an outer, or cortical, layer containing the gastric cavities of the polyps and an inner, or medullar, layer set off from the former by (1) a zone of boundary canals; (2) spiculation distinctly different in form, color, or both; or (3) boundary canals and different spiculation.

Stoloniferans are not abundant in the West Indian region and I have never encountered them while collecting in reef habitats. The membranous forms usually met with on the reefs belong to the Gorgonacea (suborder Scleraxonia).

Two species of *Clavularia* have been reported from deep waters in the West Indies: *Clavularia tubaria* Wright & Studer, and *Clavularia bathybius* (Kent). POURTALÈS (1868) reported *Sarcodictyon rugosum* from deep water off Havana, but the type is lost and its identity remains unknown. VERRILL described a red, membranous form that he called *Anthopodium rubens*, found on old *Leptogorgia* axes in shallow water at Fort Macon, North Carolina, which DEICHMANN thought to be a stoloniferan. It has just been rediscovered, and seems to be an encrusting gorgonacean. For a discussion of these species, see DEICHMANN (1936, p. 32–37).

Order **TELESTACEA** Hickson, 1930

Diagnosis. Tall polyps, arising from stolons, produce daughter polyps from their lateral walls, thus forming colonies moderately branched to richly arborescent.

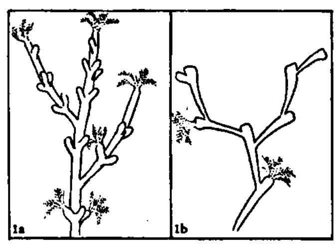
Remarks. This order contains two families distinguished by their manner of budding and colony formation, Telestidae and Pseudocladochonidae. Only Telestidae is known to occur in the Atlantic Ocean.

Key 2

Illustrated key to the families and genera of Telestacea

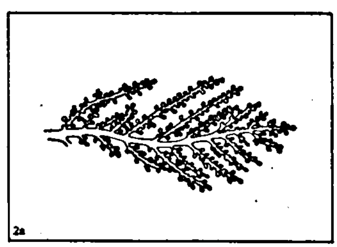
1a. Colonies monopodial, with tall axial and many short lateral polyps: Family Telestidae 2

1b. Colonies sympodial, no dominant axial polyp: Family Pseudocladochonidae, genus *Pseudocladochonus* (not represented in the Atlantic Ocean)



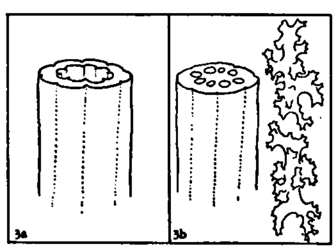
2a. Branching dense, pinnate in one plane: Genus *Coelogorgia* (not represented in the Atlantic Ocean)

2b. Branching loose and open, ordinarily not in one plane, but if so, not dense: 3



3a. Polyps without intrusion of spiculiferous tissue in lower part of gastric cavities; branching commonly beyond third order: Genus *Telesto*

3b. Polyps with spiculiferous mesogloea filling lower part of gastric cavities except for 8 longitudinal canals; branching not beyond third order: Genus *Telestula* (in deep water only)



Family **TELESTIDAE** Milne Edwards & Haime, 1857

Diagnosis. Monopodial colonies with a long axial polyp and shorter lateral polyps.

Remarks. Of the three genera referable to the Telestidae, only one is found in shallow waters of the Atlantic Ocean. The species are easily recognized by their delicate, aborescent colonies which are formed around a long axial polyp that acts as a main stem. It may be rigid because of the spicules in its body-wall, but it is always hollow and never shows any trace of the horny axial rod characteristic of the other arborescent octocorals of the West Indies.

The genus *Telestula* Madsen 1944, created for those species that have the lower part of the gastric cavities filled in with spiculiferous mesogloea except for eight longitudinal canals, occurs in the West Indies but only at considerable depths.

Genus **Telesto** Lamouroux, 1812

Telesto LAMOUROUX 1812, p. 185. (Type species, *Telesto aurantiaca* Lamx., by subsequent designation: MILNE EDWARDS & HAIME 1850, p. lxxvii.)
Telesto, LAMOUROUX 1816, p. 232.
Carijoa F. MÜLLER 1867, p. 330. (Type species, *Carijoa rupicola* Müller, by monotypy.)
Telesco GRAY 1869, p. 21. [Pro *Telesto* Lamx.]
Alexella GRAY 1869, p. 22. (Type species, *T.* (*Alexella*) *Smithii* Gray, by monotypy.)
Telesto, LAACKMANN 1908, p. 41.
Telesto, DEICHMANN 1936, p. 40.

Diagnosis. Colonies monopodial, arborescent; tall, cylindrical polyps arise from reticulating stolons; primary polyps bud off daughters directly from body walls, communicating by way of solenia; gastric cavities open to base of polyps.

Remarks In my opinion, the western Atlantic species of *Telesto* actually belong in two genera. The first, including *T. riisei* and *T. operculata*, with elongate, often branching, rodlike, colorless sclerites in the body walls, and the anthocodial spicules in two series, septal and interseptal; and the second, including *T. sanguinea*, *T. flavula*, *T. fruticulosa*, and *T. nelleae*, with ovate, sometimes pebble-like bodies in the polyp walls, and the anthocodial sclerites in only one interseptal (i.e., tentacular) series. Unfortunately, it is not possible to divide the genus nomenclaturally because the type species of *Telesto* has not yet been sufficiently described to indicate its position. From LAMOUROUX's figure of *T. aurantiaca*, it seems logical to conclude that it belongs to the group including *T. sanguinea*, which means that *T. riisei* and related forms would be assigned to another genus for which F. MÜLLER's name *Carijoa* is available. According to GRAY's figure of *T.* (*Alexella*) *smithii*, his genus *Alexella* is probably synonymous with *Carijoa*.

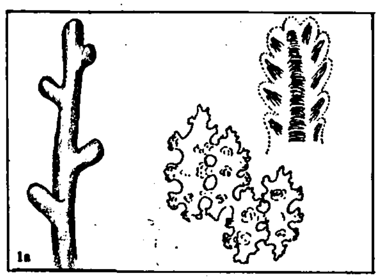
UTINOMI's description (1958) of *Paratelesto*, a new telestid genus from Japanese waters, reached my hands too late for inclusion in the foregoing key. This new genus is distinguished by the great thickening of the body wall of the axial polyps, which contains numerous solenia arranged in several rings, the restricted stolon which takes the form of an expanded base, the short lateral polyps set in spirals, and the rough, coarse protruding spicules set in 8 more or less chevroned double rows in the body walls. A specimen of the type species, *P. rosea* (Kinoshita), from Shirahama, Japan, presented to me by Dr. UTINOMI during a visit to the Seto Marine Biological Laboratory, shows that *Paratelesto* shares certain features in common with the *sanguinea*-group mentioned above but is clearly distinct in the singular development of the coenenchyme in the walls of the axial polyps.

Ecology. Species of *Telesto* may be found from the low-tide line down to great depths. They are not rare on rocky bottoms in moderate depths (5 to 50 fathoms), where they grow upon stones and shells. In shallow water they are commonly found growing upon dock pilings, buoys, and boat bottoms. So far as I know, *Telesto* (specifically, *T. riisei*) is the only octocoral that is a significant fouling organism (see Plate XII).

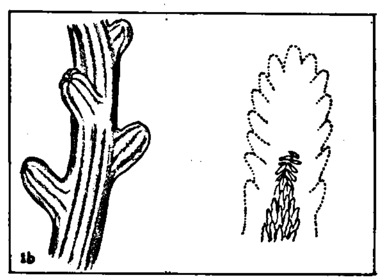
KEY 3

ILLUSTRATED KEY TO THE WEST INDIAN SPECIES OF *TELESTO*

1a. Body walls smooth or with very weak longitudinal grooves; spicules inseparably fused, forming rigid tubes. Pinnules with numerous spicules. Color, bright pink: *Telesto corallina*

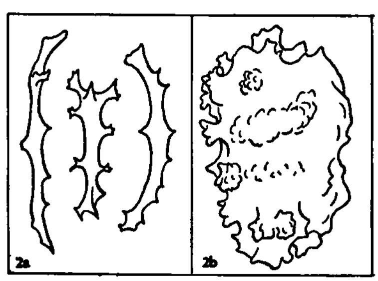


1b. Body walls with distinct longitudinal grooves; spicules fusing in small clumps but not inseparably uniting to form rigid tubes. Pinnules lacking spicules: 2



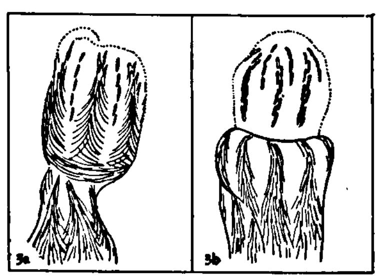
2a. Spicules of body walls in the form of elongate rods with spinose or branching processes: 3

2b. Spicules of body walls chiefly ovate forms with complicated tubercles, often with one side coarse and lumpy: 4



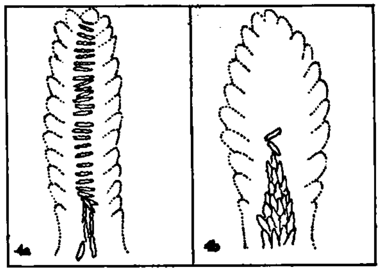
3a. Anthocodial spiculation forming an operculum consisting of transverse collaret and 8 points of flat rods 'en chevron': *Telesto operculata*

3b. Anthocodial spicules longitudinally arranged in sixteen narrow rows: eight on tentacle bases, and eight along septal insertions below the tentacles; not forming an operculum: *Telesto riisei*



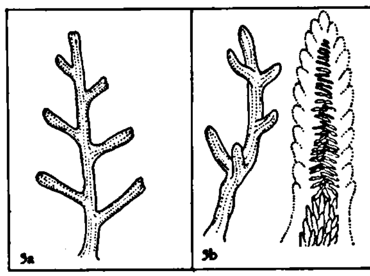
4a. Spicules extending the full length of tentacle rachis: 5

4b. Spicules in only proximal half of tentacles at most; distal half with none, or, rarely, a few scattered, transverse rods: 6



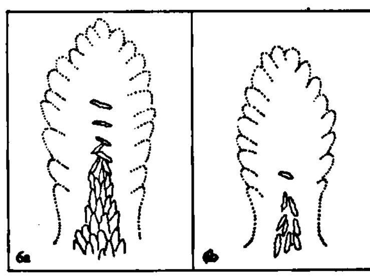
5a. Secondary polyps placed pinnately, in one plane. Tentacles with 2–3 rows of longitudinally arranged spindles at base and a single row of transverse rods in the rachis, as in Key fig. 4a: *Telesto flavula*

5b. Secondary polyps placed all around primary. A dense cluster of longitudinal rods in tentacle bases and transverse rods in a double row in proximal half of rachis: *Telesto sanguinea*



6a. Basal part of tentacles with a dense cluster of of spicules extending nearly half the length of rachis; distalmost few rods sometimes transverse. Color yellow, orange, pink or red: *Telesto fruticulosa*

6b. Basal part of tentacles with only a few spicules; distal part usually with none at all. Color yellowish brown: *Telesto nelleae*



1 **Telesto corallina** Duchassaing, 1870

(Figs, 1, 9 b)

Telesto corallina DUCHASSAING 1870, p. 19. (Guadeloupe, 300 ft.)
?*Cyathopodium elegans* DEICHMANN 1936, p. 38, pl. 2 figs. 1–4. (Barbados, 69 and 81 fms.)

Diagnosis. *Telesto* with body walls lacking conspicuous longitudinal grooves; spicules inseparably fused to form rigid tubes; color, bright pink, anthocodial spicules yellow or colorless.

Description. The body walls are filled with inseparably fused spicules (Fig. 1 f–g), forming solid tubes about 1 mm. in diameter. The axial polyps reach a height of about 50 mm. and bear short lateral polyps at intervals of about 7 mm. and an angle of about 45°, on all sides or more in one plane (Fig. 9 b). The anthocodiae are richly spiculate; at the base of tentacles a few stout rods about 0.15 mm. long, arranged longitudinally (Fig. 1 b–c); back of tentacles packed with tiny, prickly rods about 0.05 mm. long, often curved, placed crosswise; pinnules each with a group of similar but smaller (0.03 mm.) rodlets placed lengthwise (Fig. 1 a). The middle part of the neck-zone is without spicules, but the lower part contains sharply pointed, prickly spindles placed lengthwise (Fig. 1 d); proximad these soon begin to enlarge and eventually develop

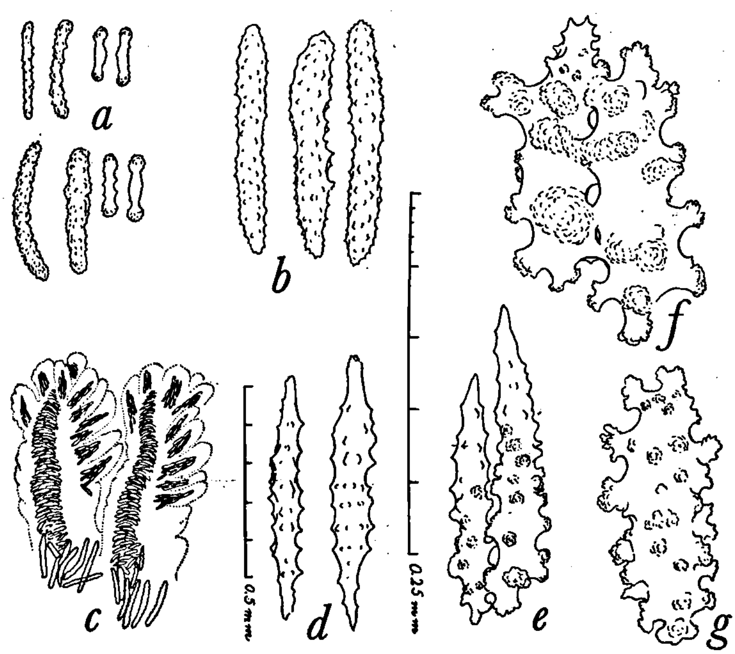


FIGURE 1. *Telesto corallina* Duchassaing, from Puerto Rico (USNM 43788): *a*, tentacular and pinnular rods; *b*, rods of tentacle base; *c*, two tentacles with spiculation; *d*, spindles from the anthocodial neck; *e*, partly fused spindles from calycular margin; *f–g*, spicules of solid part of calycular walls. (Enlargement of *c* indicated by 0.5 mm. scale; that of all spicules by the 0.25 mm. scale.)

into the warty, lobate bodies characteristic of the upper calyx; as soon as the spindles develop complicated tubercles they show signs of coalescence (Fig. 1 e), and not far below the margin of the calyces they reach so advanced a stage of fusion that the calyx is a solid tube. Color in alcohol usually bright red, occasionally pale pink; anthocodial spicules yellow or colorless.

Material. From off PUERTO RICO, 39–100 fms., Johnson-Smithsonian Expedition, 6 lots (USNM 43784–43788, 49508); BARBADOS, off Pelican Island, 80 fms., University of Iowa Barbados-Antigua Exp., 1 lot (USNM 49524).

Distribution. Puerto Rico to Barbados, 38–100 fathoms; probably occurs at moderate depths throughout the Antilles.

Remarks. LAACKMANN (1908, p. 95) doubts whether DUCHASSAING's *Telesto corallina* is a telestid. It is not remarkable that DUCHASSAING, who did not employ the sclerites in his classification of alcyonarians, should have likened the skeletal particles to 'granules' rather than to 'spicules.' The remainder of his description fits well, as also does the depth of capture ('300 pieds').

DEICHMANN's *Cyathopodium elegans* is almost certainly this species, although VERRILL's genus *Cyathopodium*, based on *Aulopora tenuis* Dana, may be identical with *Sarcodictyon* Forbes but is certainly not *Telesto*.

Telesto rigida Wright & Studer also has rigid tubes, but in that species the secondary polyps are about as long as the primary. It was collected west of the Azores in 1675 fathoms.

2 **Telesto operculata** spec. nov.

(Figs. 2, 9 f)

Diagnosis. *Telesto* with body walls longitudinally grooved; spicules as elongate, branching rods, not fused; anthocodial armature in the form of a distinct operculum with collaret; color white or brownish.

Description. Axial polyps about 75 mm. long and 1.5 mm. in diameter arise from membranous, encrusting stolons. Eight narrow, shallow, longitudinal grooves are visible throughout their length. Secondary polyps arise at wide intervals all around the primary

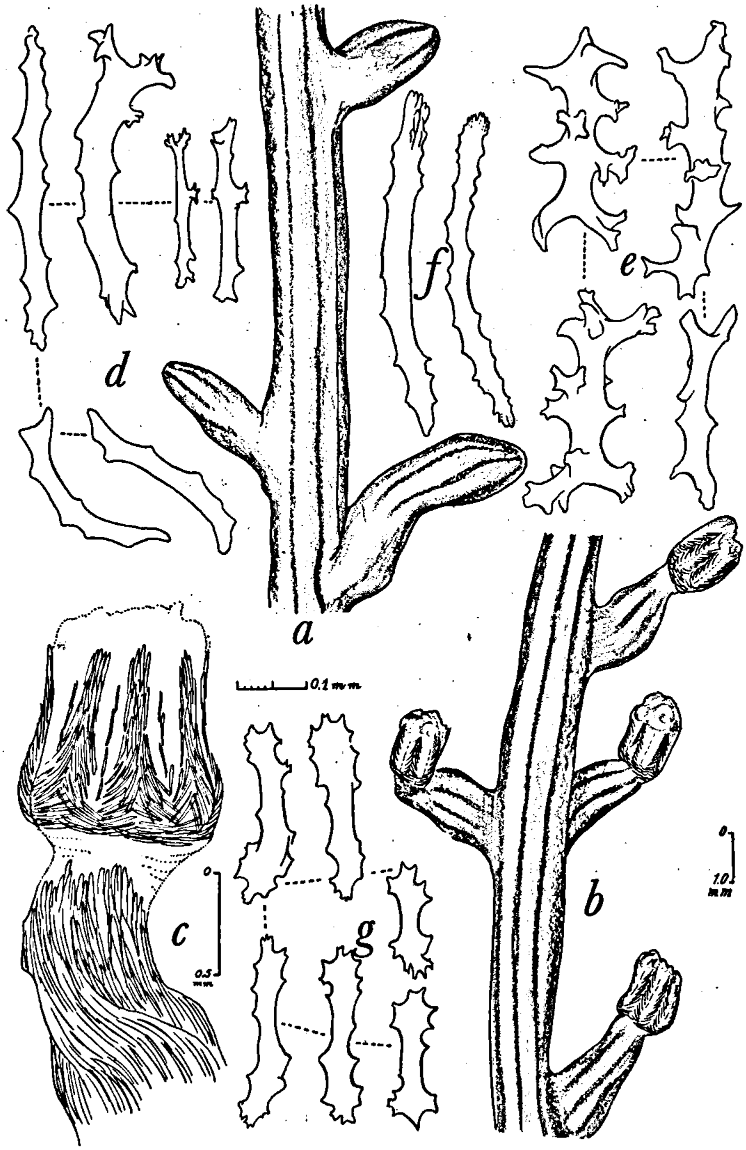


FIGURE 2. *Telesto operculata* spec. nov., the holotype from Cuba (USNM 10127): *a–b*, part of primary polyp with secondary polyps fully retracted and fully exsert; *c*, detail of exsert polyp showing crown; *d*, non-fusing spicules of body wall; *e*, occasionally fusing spicules of body wall; *f*, spicules from the points of the crown; *g*, spicules from the tentacles. (Enlargement of *a* and *b* indicated by 1.0 mm. scale at *b*; of *c*, indicated by adjacent 0.5 mm. scale; of all spicules, *d–g*, by 0.1 mm. scale above *g*.)

polyp body; these elongate to form branches only rarely. The secondary calyces are 3–5 mm. long with the anthocodiae fully retracted (Fig. 2 a). The spicules of the calyces are longitudinally arranged spinose rods up to 0.55 mm. long, forked or branched at one or both ends. The anthocodiae have a long, sparsely spiculate, introversible neck-zone, which contains forked rods longitudinally arranged. The distal part of the anthocodiae is densely spiculated, in the form of a crown and points (Fig. 2 c); below the tentacles are eight points of curved, flat rods 'en chevron' (Fig. 2 f); proximad the rods assume a transverse direction and form a distinct collaret. The proximal half of the tentacles contains longitudinally arranged rods continued from the points; in the distal part the rods are transversely placed, smaller (0.15–0.30 mm.), and have expanded ends (Fig. 2 g). There are no spicules in the pinnules. A row of a few slim rods lies along each septum, above the collaret and between the points. The spicules of the body walls are of two kinds: (1) stout, branching rods about 0.3 mm. long (Fig. 2 e); and (2) straight or curved rods with low processes, up to 0.5 mm. long (Fig. 2 d). The color of the colonies in alcohol is pale brown.

Material. Holotype: north coast of CUBA, off Havana, 23°10′51″ North, 82°19′03″ West, 163 fms., bottom temperature 79.1°F, *Albatross* sta. 2323, 17.I.1885 (USNM 10127); paratypes: near type locality, 3 lots, 143, 155, and 33 fms. respectively, *Albatross* sta. 2319, 2322, 2324 (USNM 10791, 10858, 10136).

Distribution. At present known only from the Straits of Florida, off Havana, Cuba.

Ecology. *Telesto operculata* inhabits water deeper than is usual for *T. riisei*. The branches of the type were infested with folliculinid ciliates, whose loricae remain firmly attached to the pellicle along the grooves in the body walls.

Remarks. In the character of the spicules and the eight septal rows of rods, *Telesto operculata* strongly resembles *T. riisei*, from which it differs in its strong crown and its weakly branched colonies. In contraction, the tentacles are folded inward and downward over the mouth and are completely hidden within the crown. This strong anthocodial armature, which protects the infolded tentacles, apparently lessens the need for speedy retraction since many of the anthocodiae are preserved exsert (Fig. 2 b), unlike the poorly armed species. However, the entire distal part of the anthocodia, including crown and infolded tentacles, can be completely withdrawn inside the calyx.

3 **Telesto riisei** (Duchassaing & Michelotti), 1860

(Figs. 3, 4, 9 g; Plate XII)

Clavularia Rusei DUCHASSAING & MICHELOTTI 1860, p. 34 (St. Thomas.)
Clavularia Riisei, DUCHASSAING & MICHELOTTI 1864, p. 23. [Emended spelling.]
Clavularia Rusei, KÖLLIKER 1865, p. 131, pl. 18 fig. 24. [Spicules of Duchassaing & Michelotti's material.]
Carijoa rupicola F. MÜLLER 1867, p. 330, pl. 9 figs. 56–67. (Desterro, Brazil.)
Telesto riisei, VERRILL 1870, p. 372.
?*Telesto africana* VERRILL 1870, p. 372, fig. 3. (Sherbro Island, West Africa.)
Telesto riisei, HARGITT & ROGERS 1901, p. 278, fig. A. (Puerto Rico.)
Telesto riisei, LAACKMANN 1909, p. 78, fig. C, pl. 3 fig. 4. (St. Thomas; St. John; Tortugas.)
Telesto rupicola, LAACKMANN 1909, p. 81, fig. D, pl. 2 figs. 1–2, pl. 3 fig. 3. (Rio de Janeiro, Brazil; Kingston, Jamaica.)
Telestro riisei, BAYER, 1959, p. 3. fig. 1 (Surinam, French Guiana.)

Diagnosis. *Telesto* with body walls longitudinally grooved; spicules elongate, branching rods, incompletely fused; anthocodial armature weak, in sixteen longitudinal rows, eight septal, eight interseptal. Color in alcohol, white or pale brownish; in life, pale pink or white.

Description. Colonies densely arborescent, the axial polyps often exceeding 30 cm. in length. Body wall with eight grooves, usually distinct. Lateral polyps with calyces 3–5 mm. tall and 1.5 mm. in diameter, 5–10 mm. apart and commonly in pairs or groups of three at about the same level (Fig. 9 g). Anthocodiae with sixteen rows of longitudinal rodlets, eight on the tentacle bases and the other eight along the septa just below the level of the tentacles (Figs. 3 a, b, f; 4 c, d). Spicules in body walls of two kinds: (1) rods 0.15–0.35 mm. long, with numerous branching processes by which they anastomose into groups of considerable size, chiefly in the longitudinal ribs (Figs. 3 d, g; 4 b, f); and (2) long, slender, more or less curved spindles up to 0.6 mm. long, with a few spinose processes but not fusing together (Figs. 3 c, e; 4 a, e), lying beneath the shorter, anastomosing spicules. Color in life, body walls flesh

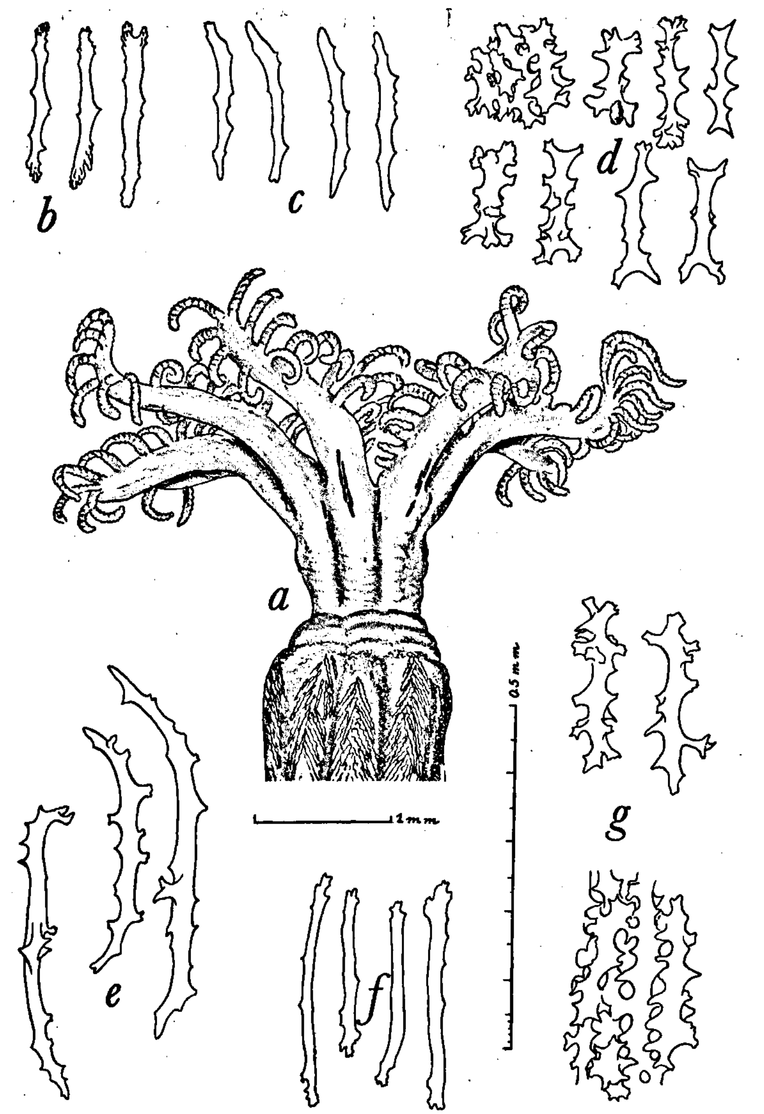


FIGURE 3. *Telesto riisei* (Duchassaing & Michelotti): *a*, polyp of a specimen from Florida (USNM 44066); *b*, anthocodial spicules of a specimen from Puerto Rico (50378); *c*, non-fusing spicules from body wall of same specimen; *d*, partially fusing spicules from body wall of same specimen; *e*, non-fusing spicules from body wall of a specimen from Curaçao (50374); *f*, anthocodial spicules of same specimen; *g*, partially fusing spicules of body wall of same specimen. (Enlargement of *a* indicated by 1 mm. scale; that of all spicules by 0.5 mm. scale at *g*.)

pink, anthocodiae white; in alcohol, all white or brownish, the anthocodiae usually a little darker than the body walls.

Material. Several specimens from Dr. Hummelinck's collection: ARUBA, wharf of Eagle Petroleum Company, on iron beam in open sea, depth 0–1.5 m., station 1302, 4.V.1955 (USNM 50375). CURAÇAO, Caracas Baai, on iron buoy, 10 m. or more deep, sta. 1334, J. S. Zaneveld, 9.II.1955 (USNM 50374, 51273, branches, dry and in alcohol). VENEZUELA, Guanta, on wooden piles in muddy area, 2 m deep, sta. 1202, 15.VIII.1936.

Also studied were the following lots in the collections of the U.S. National Museum: FLORIDA, off Palm Beach (50381); Biscayne Bay (44065–44067, 49691); Key West (50379); DRY TORTUGAS (50096); HISPANIOLA, Dominican Republic, Samana Bay (50380); PUERTO RICO (42146, 42151, 42596, 42597, 50378); JAMAICA, Kingston (7541); ST. LUCIA, near Marigot Bay (51410–51412); SURINAM (50838–50844); FRENCH GUIANA (50912); BRAZIL, Rio de Janeiro (50376), and Bahia (50377).

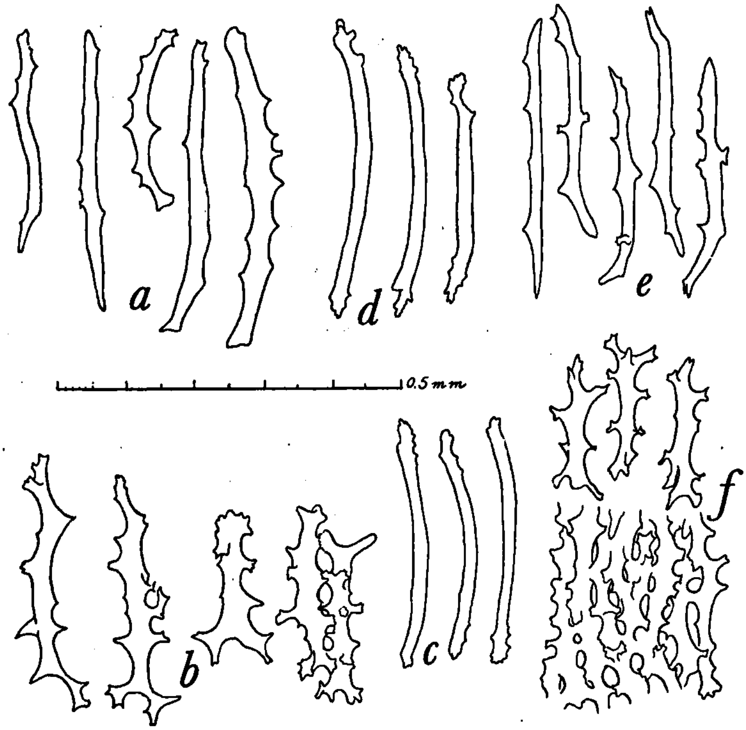


FIGURE 4. *Telesto riisei* (Duchassaing & Michelotti), spicules. *a–c*, of a specimen from Bahia, Brazil (USNM 50377): *a*, non-fusing spicules of body wall; *b*, partially fusing spicules of body wall; *c*, anthocodial spicules. *d–f*, of a specimen from Hispaniola (50380): *d*, anthocodial spicules; *e*, non-fusing spicules of the body wall; *f*, partially fusing spicules of the body wall. (All figures drawn to the same scale.)

Distribution. Palm Beach, Florida, to Brazil; low tide line down to about 30 fathoms.

Ecology. This abundant shallow-water species is often found growing in dense clusters just below the low tide line on dock pilings, often in company with the bryozoan *Zoobotryon pellucidum*. These two large fouling organisms supply shelter to an interesting community of invertebrates including the creeping ctenophore *Coeloplana*, flatworms, nemerteans, and crustaceans.

Remarks. I have gone over the specimens noted above, from widely separated localities extending from Florida to Brazil, and can find among them no justification for the separation of two species. In none of the specimens, regardless of locality, is a completely cohesive skeleton formed by inseparably fused spicules, as LAACKMANN (1908, p. 80) holds to be the case in *T. riisei:* "Die Spicula bilden in der ganzen Stammlänge ein zusammenhängendes Skelet. Längeres Kochen mit Kalilauge bringt keinen Zerfall der Scleriten hervor." In the Brazilian specimens, which agree well with MÜLLER's description of *T. rupicola*, there is about as much fusion of sclerites as there is in West Indian specimens that are essentially topotypes of *T. riisei*. There is variation in the strength of the anthocodial spiculation and in the size of the sclerites in the body walls, but these variations are not correlated with differences in colonial morphology. All evidence indicates that *Telesto riisei* and *Carijoa rupicola* are one and the same species.

4 **Telesto flavula** Deichmann, 1936

(Figs. 5, 9 a)

Telesto flavula DEICHMANN 1936, p. 42, pl. 1 fig. 4, pl. 2 figs. 13–16. (Tortugas, Florida, in 54 fms.)
Telesto favula [sic], BAYER 1952, p. 183. (Off Mobile, Alabama, in 27–35 fms.)

Diagnosis. *Telesto* with grooved body walls; spicules granular, warted on inward surface, sparingly fused; secondary polyps arise pinnately at angles of 45° to 90°, alternate or opposite; tentacle backs with transverse rods in a single row. Color cream-white or yellow, occasionally orange or pinkish.

Description. Axial polyps 1.0–1.5 mm. in diameter and up to 50 mm. in height produce secondary polyps increasing in length basad, opposite or alternate, pinnate, and mostly in one plane (Fig. 9 a). The secondaries originate at angles from 45° to 90°, and occasionally elongate into branches that bear tertiary polyps. All body walls have eight narrow but distinct grooves. The anthocodiae are armed with a few rows of rods about 0.13 mm. in length, longitudinally arranged beneath each tentacle. A single row of transversely placed flat rods about 0.08 mm. long extends from base to tip of the tentacle-backs (Fig. 5 a, c). The neck-zone is weakly spiculated with flat rods about 0.05–0.07 mm. in length (Fig. 5 d). The body walls contain rugose, oval granules about 0.2 mm. long with tubercular sculpture on the inner surface (Fig. 5 e), among which very little fusion occurs. Color in alcohol, cream-white or yellowish, occasionally orange or pinkish; less brightly colored than *T. sanguinea* and *T. fruticulosa*.

Material. Eight lots, all from the northern GULF OF MEXICO in 27–35 fms. (USNM 10384, 10393, 10568, 10569, 10780, 10782, 50393, 50394).

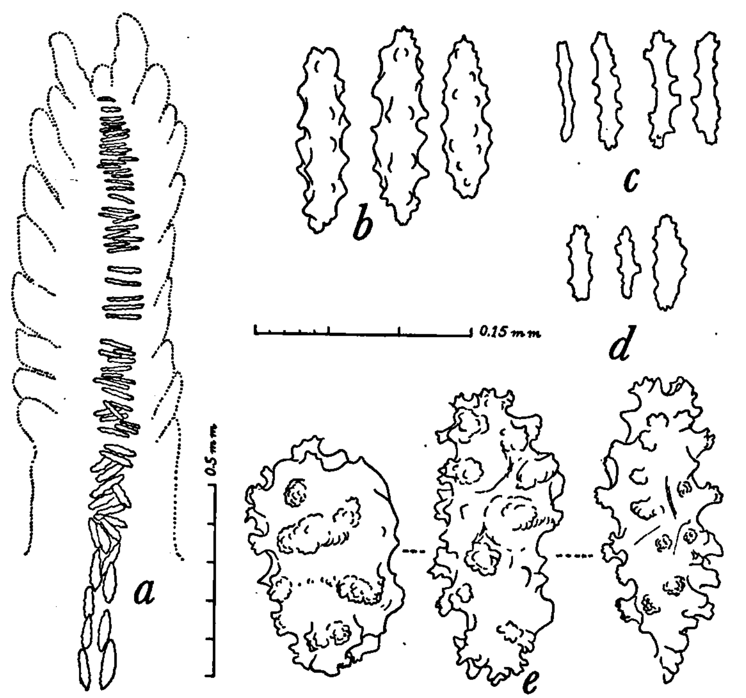


FIGURE 5. *Telesto flavula* Deichmann, from the Gulf of Mexico (USNM 10568): *a*, tentacle showing arrangement of spicules; *b*, spicules of tentacle base; *c*, spicules from tentacle rachis; *d*, spicules from anthocodial neck; *e*, spicules from body wall. (Enlargement of *a* indicated by adjacent 0.5 mm. scale; that of all spicules by 0.15 mm. scale to left of *d*.)

Distribution. Gulf of Mexico, Tortugas.

Ecology. On sandy ground where there is no solid material for support, *Telesto flavula* is sometimes found growing prone. Such specimens, without the usual attachment to rocks, might account for Bosc's *Telesto pelasgica*, although the green color reported for that species is difficult to explain. The unattached colonies were found together with free-living specimens of *Leptogorgia*.

Remarks. *Telesto flavula* is very similar to *T. sanguinea*, but differs in the following points: (1) pinnate arrangement of secondary polyps, which diverge at a wide angle; (2) fewer spicules in the sub-tentacular groups; (3) smaller, flat rods in one row in the tentacle-backs; and (4) weaker spiculation in the neck-zone.

5 **Telesto sanguinea** Deichmann, 1936

(Figs. 6, 9 e)

Telesto sanguinea DEICHMANN 1936, p. 41, pl. 1 fig. 3; pl. 2 figs. 9–12. (Conch Reef and Carysfort Reef, upper Florida Keys, 36–52 fms.)
Telesto sanguinea, BAYER 1952, p. 183. (Palm Beach; Fort Walton; Destin; Cape St. George; Cape San Blas, all Florida, 13–32 fms.)

Diagnosis. *Telesto* with grooved body walls; spicules granular, warted on inward surface, sparsely fusing; secondary polyps on all sides, arising at 45° or less; tentacle-backs with transverse rods in a multiple row. Color bright coral red; rarely pink, orange or yellow.

Description. Axial polyps 1.5–2.0 mm. in diameter and as much as 50–60 mm. in height give rise to secondary polyps about 10 mm. in height, on all sides (Fig. 9 e); sometimes the secondary polyps elongate to produce branches bearing tertiaries. The body walls of both axial and subordinate polyps have eight narrow grooves. The anthocodiae are abundantly spiculated: a cluster of blunt, flattened spindles about 0.13 mm. long longitudinally oriented but somewhat diverging, lies at the base of each tentacle; a tract of transversely placed rods of about the same size extends along the rachis of the tentacles from base to tip but not into the pinnules (Fig. 6 a); neck-zone with flat spindles (Fig. 6 d) like those of the tentacle bases but smaller, usually about 0.08 mm. long, arranged longitudinally in the polyp wall between the septa, increasing in abundance proximad. The sclerites of the body walls

(Fig. 6 e) are granular bodies about 0.2 mm. long, with one side sculptured with complicated tubercles; there are also some small rods with branched processes. A small degree of fusion occurs among the spicules of the body walls but not enough to produce rigid tubes. The color is bright coral red, rarely pink, orange, or yellow, in both fresh and preserved specimens.

Material. From the U.S. National Museum: SOUTH CAROLINA to north FLORIDA, 4 lots (50356–50359); Palm Beach to Miami (49509, 49696, 49933, 50360, 50970); upper Florida Keys (14602, 50809); TORTUGAS area, 5 lots (50361–50365); northern GULF OF MEXICO, 7 lots (43221, 44100, 44125, 49558, 49599, 50061, 50355).

Distribution. South Carolina to the Florida Keys and Gulf of Mexico, at moderate depths (13–60 fms.).

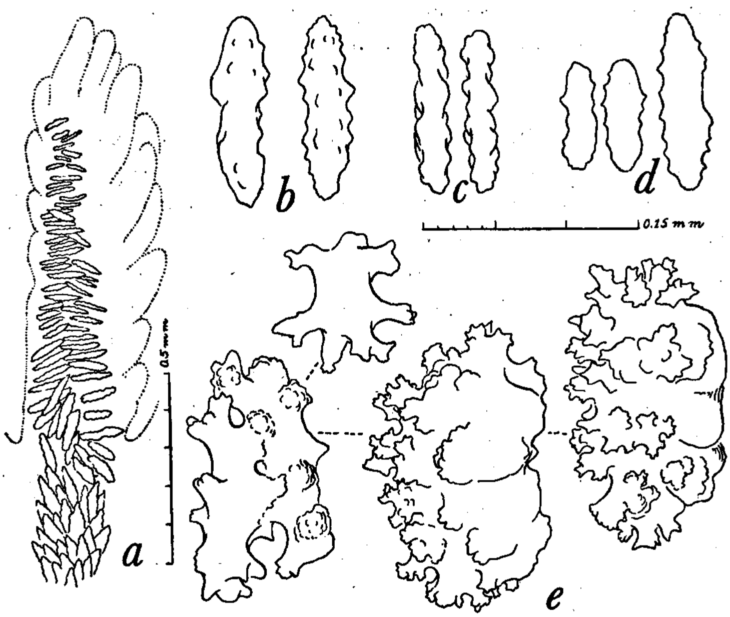


FIGURE 6. *Telesto sanguinea* Deichmann, from the Gulf of Mexico (USNM 43221): *a*, tentacle showing arrangement of spicules; *b*, spicules of tentacle base; *c*, spicules of tentacle rachis; *d*, spicules of anthocodial neck; *e*, spicules of body wall, occasionally fusing. (Enlargement of *a* indicated by adjacent 0.5 mm. scale; that of all spicules by 0.15 mm. scale below *c–d*.)

Remarks. *Telesto sanguinea* is closely allied to *T. flavula* Deichmann and *T. fruticulosa* Dana. *Telesto flavula* differs in its pinnate sequence of budding, and *T. fruticulosa* has a much reduced tentacular spiculation.

Telesto sanguinea is not rare at moderate depths from the southern tip of Florida to the Dry Tortugas and north to Apalachee Bay, where it is characteristically met with on coral rubble bottoms. It has not yet been discovered in the Antilles, where *T. corallina* replaces it.

6 **Telesto fruticulosa** Dana, 1846

(Figs. 7, 9 c)

Telesto fruticulosa DANA 1846, p. 632. (Charleston, South Carolina.)
Telesto fruticulosa, LAACKMANN 1909, p. 74, fig. B.
Telesto fructiculosa [sic], DEICHMANN 1936, p. 43, pl. 2 figs. 20–22. (Cape Fear, North Carolina.)

Diagnosis. *Telesto* with grooved body walls; spicules blunt rods with strong processes; secondary polyps on all sides, short; tentacles with spicules only in proximal half, oriented longitudinally. Color yellow, orange, or red.

Description. The axial polyps are 5–10 cm. tall and give rise on all sides to short daughters, some of which elongate to form branches (Fig. 9 c). The body wall has eight narrow longitudinal grooves and correspondingly wide ribs. The proximal half of the tentacles bears numerous flattened spindles set longitudinally or slightly diverging; the uppermost of these often is crosswise, and sometimes a few rods may lie crosswise in the distal half of the rachis (Fig. 7 a–c). The body walls are filled with stout, blunt rods about 0.2 mm. long, with widely separated, strong processes (Fig. 7 e). The tentacular spindles measure as much as 0.15 × 0.04 mm. (Fig. 7 d). Color of colonies yellow or orange, often with reddish tints and sometimes entirely light red.

Material. Six lots from off the CAROLINA Capes in 15 to 50 fms. (USNM 16613, 16826, 16829, 16834, 16840, 44145).

Distribution. Coast of the Carolinas.

Remarks. *Telesto fruticulosa* is the common telestid of the middle Atlantic coast of North America. It is recognized by the tentacular spiculation, which usually extends only half the length of the rachis and is mostly longitudinal; and by the spicules of the body walls, which are not lumpy granules like those of *T. sanguinea*.

The colonies are commonly overgrown by a sponge that covers everything but the anthocodiae yet seems to do no damage. The sponge may, in turn, be infested with zoanthids.

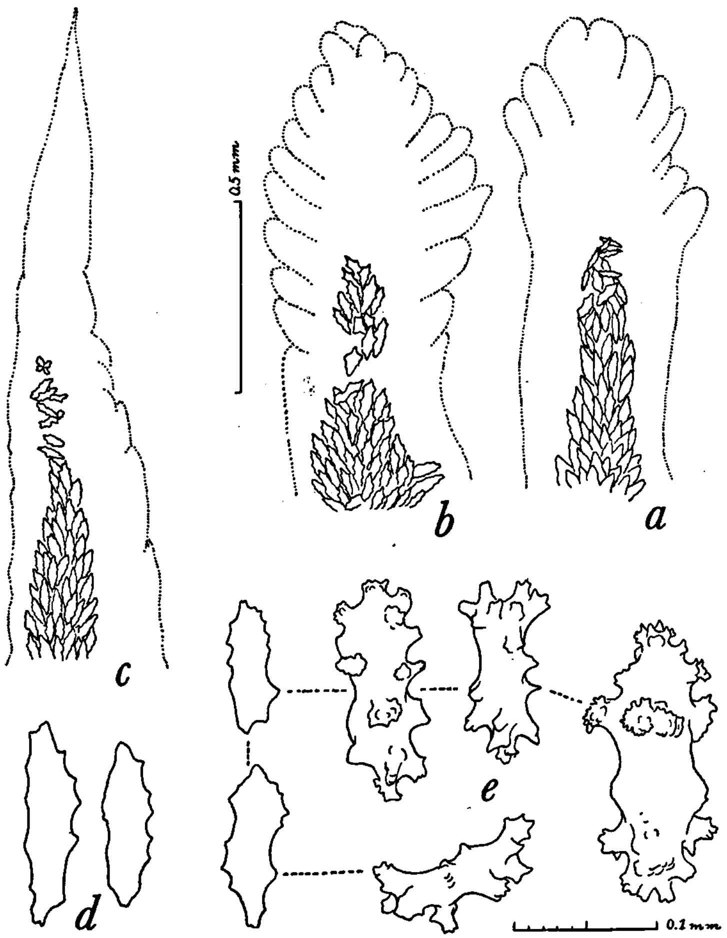


FIGURE 7. *Telesto fruticulosa* Dana, from the Carolina capes: *a*, tentacle (USNM 16829), showing arrangement of spicules; *b*, tentacle (16834); *c*, tentacle(16826); *d*, tentacular spicules of the same specimen; *e*, spicules from body wall of same specimen. (Enlargement of *a–c* indicated by 0.5 mm. scale adjacent to *b*; that of spicules by 0.1 mm. scale adjacent to *e*.)

7 **Telesto nelleae** spec. nov.

(Figs. 8, 9 d)

Diagnosis. *Telesto* with grooved body walls; spicules oval or rodlike, with complex tubercles, and small rods with branching projections; rachis of tentacles with no spicules at all, or a very few extending a short distance up from the basal cluster. Color, yellowish brown.

Description. Axial polyps about 2.0 mm. in diameter and up to 10 cm. in height give rise on all sides to secondary polyps 5 mm. tall and 3–5 mm. apart (Fig. 9 d). The secondaries may elongate to form branches with tertiary polyps. The body walls of the polyps

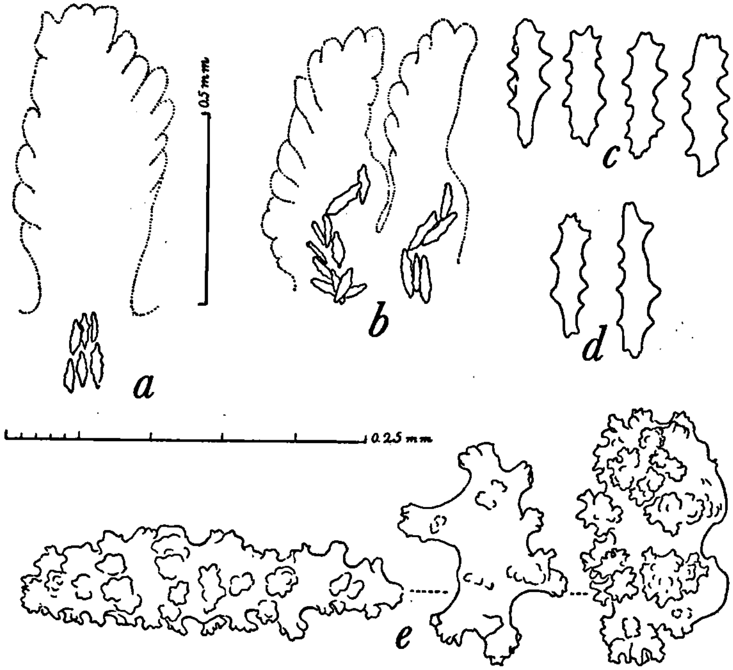


FIGURE 8. *Telesto nelleae* spec. nov. *a*, tentacle of specimen from Straits of Florida (USNM 17306), showing arrangement of spicules; *b*, tentacles from the holotype (50703), showing arrangement of spicules; *c*, tentacular spicules of the type; *d*, spicules from anthocodial neck, type; *e*, spicules of body wall, type. (Enlargement of *a*–*b* indicated by 0.5 mm. scale at *a*; that of all spicules by 0.25 mm. scale below *a*.)

of all orders have eight distinct, narrow grooves. The anthocodiae are weakly spiculated: a small cluster of perhaps ten flat rods 0.1 mm. long, longitudinally arranged, lies at the base of each tentacle; rachis with few or no spicules (Fig. 8 a–c); neck-zone with a few rods like those of the tentacles (Fig. 8 d). Body walls with elongate (up to 0.25 mm. long) or oval (up to 0.17 mm. long) bodies with complicated tubercles; and smaller rods with branching processes (Fig. 8 e). Color in alcohol, yellowish brown.

Material. Holotype: off Cape Hatteras, NORTH CAROLINA, 35°08'30" North, 75°10'00" West, 49 fms., *Albatross* sta. 2596, 17.X.1885 (USNM 507031). Paratypes: several colonies from the same station as the type (USNM 16816 ; and 1 lot from the Straits of Florida, off Havana, CUBA, 23°10'54" North, 82°17'45" West, 115 fms., *Albatross* sta. 2322, 17.I.1885 (USNM 10114). Other material: Two additional lots from the Straits of Florida (USNM 50704, 50705) and 7 from the vicinity of Cape Hatteras (USNM 8357, 8358, 8369, 8373, 16817, 16846, 17306).

Distribution. North Carolina to the Straits of Florida, 15 to 163 fathoms.

Remarks. Three old lots (USNM 8357, 8369, 8373) bear the label '*Telesto aurantiaca*' in VERRILL's handwriting, but they do not at all resemble the original figure of LAMOUROUX's Australian species.

Telesto nelleae is similar to *T. fruticulosa* but differs in having the tentacular spiculation reduced even further, in the form of the sclerites of the body walls, and in color.

Order ALCYONACEA Lamouroux, 1816 (emend. Verrill, 1866)

The order Alcyonacea, so well represented in the Indo-Pacific, is a minor element in the Atlantic fauna. In the West Indian region, with which we are at present concerned, there are no species of this order reaching up to the reef habitats of the immediately subtidal zone. A few species are found in relatively shallow water, and the present treatment is limited to them.

The alcyonaceans form massive or lobate colonies, occasionally arborescent, in which there is no solid axis or differentiated medulla, and in which the gastric cavities of many polyps reach to the base of the colony, thus attaining a length of several centimeters.

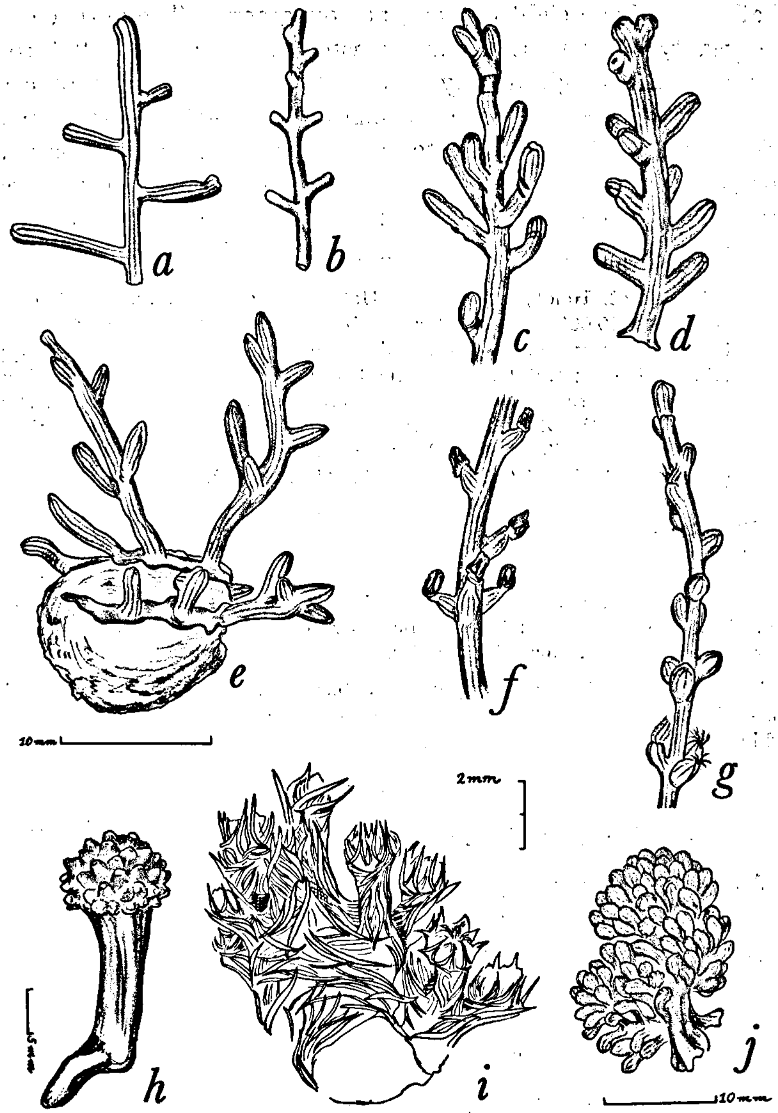


FIGURE 9. Colonies of Telestacea and Alcyonacea: *a*, *Telesto flavula* Deichmann (USNM 10568); *b*, *Telesto corallina* Duchassaing (43784); *c*, *Telesto fruticulosa* Dana (16829); *d*, *Telesto nelleae* spec. nov. (16816); *e*, *Telesto sanguinea* Deichmann (50360); *f*, *Telesto operculata* spec. nov. (10127); *g*, *Telesto riisei* (Duchassaing & Michelotti) (50378); *h*, *Nidalia occidentalis* Gray (49697); *i*, *Neospongodes portoricensis* (Hargitt) (7184); *j*, *Eunephthya nigra* (Pourtalès) (15916). (Enlargement of *a–g* indicated by 10 mm. scale at *e*; that of *h* by adjacent 5 mm. scale; that of *i* by 2 mm. scale; that of *j* by 10 mm. scale.)

Two species forming distinctive, clavate colonies (genus *Nidalia*) are found in moderately shoal water around Florida and in the West Indies, and four others of arborescent growth form (genera *Eunephthya* and *Neospongodes*) inhabit somewhat greater depths. Several more species occur in the deep littoral and coast abyssal zones, but no species of this order are subtidal in the warmer parts of the western Atlantic.

The three families representing the Alcyonacea in West Indian waters may be distinguished by the following key.

KEY 4

KEY TO THE WEST INDIAN FAMILIES OF ALCYONACEA

1a. Colonies arborescent, with polyps scattered or in clusters at the ends of branchlets. Polyps monomorphic: Family NEPHTHEIDAE

1b. Colonies lobate or digitate, with polyps uniformly distributed; or simple, divided into a polypiferous capitulum and a barren stalk: 2

2a. Colonies clavate, with a polypiferous capitulum and a long barren stalk. Polyps strictly monomorphic. Spicules large, colony rough and firm: Family NIDALIIDAE, subfamily Nidaliinae

2b. Colonies lobate or digitate; if simple, mushroom shaped and with a rather short stalk, always dimorphic, and of a somewhat soft or leathery consistency: Family ALCYONIIDAE

Family **ALCYONIIDAE** Lamouroux, 1812 (emend. May, 1899)

In this family the colonies may be lobate or digitate, but the branches are not finely divided as in Nephtheidae. The polyps are uniformly distributed over the lobes or on a discoidal capitulum, and may be of two kinds, autozooids and siphonozooids. The predominant type of spicule is the spindle.

The only alcyoniid genera inhabiting the warm western Atlantic are *Alcyonium* and *Anthomastus*, which occur only at considerable depths.

Family **NIDALIIDAE** Gray, 1869

Nidalidae GRAY 1869, p. 127.
Siphonogorgiacea KÖLLIKER 1875, p. 22.
Nidaliidae, UTINOMI 1958, p. 115.

Diagnosis. Colonies simple or divided into stiff, cylindrical branches. Surface rough, consistency of coenenchyme rigid and brittle, because of densely packed, large, tuberculate spindles. Always monomorphic, anthocodiae partially or completely retractile within bluntly conical verrucae projecting more or less conspicuously above the surface; anthocodial armature in the form of a crown and points.

Remarks. This family has recently been reestablished by UTINOMI (1958) to include the only alcyonacean commonly found at moderate depths in the West Indian region, and the arborescent forms, such as *Siphonogorgia*, of the tropical Indo-Pacific. The Nidaliidae consists of two subfamilies, the Nidaliinae with two genera (*Nidalia* Gray and *Agaricoides* Simpson) and the Siphonogorgiinae with possibly three (*Siphonogorgia* Kölliker, probably *Nephthyigorgia* Kükenthal, and perhaps *Dactylonephthya* Thomson & Simpson).

Genus **Nidalia** Gray, 1835

Nidalia GRAY 1835, p. 59. (Type species, *Nidalia occidentalis* Gray, by monotypy.)
Nidalia, DEICHMANN 1936, p. 55.
Nidalia, UTINOMI 1958, p. 101–119, *passim*.

Diagnosis. Colonies clavate ('torch-like;' UTINOMI), with a hemispherical polypiferous capitulum borne upon a long sterile stalk. Monomorphic, polyps withdrawing into tapered, subcylindrical or bluntly conical calyces. Coenenchyme rigid because of large, tuberculated spindles. Pharynx and introvert of polyps with oval platelets and small, flat scales.

Remarks. The club-shaped or torch-shaped colonies of *Nidalia* are immediately separable from the lower, mushroom-like *Anthomastus* by their firm consistency, prominent calyces, and monomorphic polyps. There are two species of *Nidalia* in the western Atlantic, only one of which has been found at all commonly in shallow water. They may be separated as follows:

Key 5

Key to the western Atlantic species of Nidalia

1a. Spindles slender, length about six times the diameter. Proximal part of introvert or neck-zone of polyps containing numerous flat scales with scalloped edges, and in addition many granulated platelets which abound also in the pharyngeal walls: *Nidalia occidentalis* Gray

1b. Spindles stout, coarse and often blunt, length only about four times the diameter, occasionally even less. Proximal part of introvert containing abundant platelets but few larger scales: *Nidalia rigida* Deichmann

8 **Nidalia occidentalis** Gray, 1835

(Figs. 9 h, 10 a–c)

Nidalia occidentalis Gray 1835, p. 60. (Montserrat.)
Nidalia occidentalis, Deichmann 1936, p. 56, pl. 1 fig. 5; pl. 4 figs. 1–3. (Tortugas to Barbados, 38–170 fms.)
Nidalia occidentalis, Utinomi 1958, p. 102, figs. 1–3. (Cape Canaveral, Fla. Montserrat.)

Diagnosis. *Nidalia* with spindles having a diameter about one-sixth the length.

Material. USNM specimens: South Carolina. off Charleston (49676); Florida, off Cape Canaveral, 7 spec. (50398); off Palm Beach, 9 spec. (49697, 49698); off Miami Beach 2 spec. (50158); off Sombrero Light (50397); Dry Tortugas (50396); in 20–170 fms.

Distribution. From South Carolina to Barbados, in 20 to 170 fathoms.

Remarks. The characteristic yellowish brown, clavate colonies of this species are a common constituent of shallow-water dredgings in the West Indian region.

Family **NEPHTHEIDAE** Gray, 1862 (emend. Utinomi, 1954)

In the Nephtheidae, the polyps, which are never dimorphic, are placed in clusters at the ends of the slender branches of predominantly arborescent colonies. This family, profusely abundant in the shallow waters of the Indo-Pacific, is not represented in the reef habitat of the West Indies, and only sparsely so in greater depths. The two genera of the western Atlantic are separated by DEICHMANN (1936, p. 58) according to the following key:

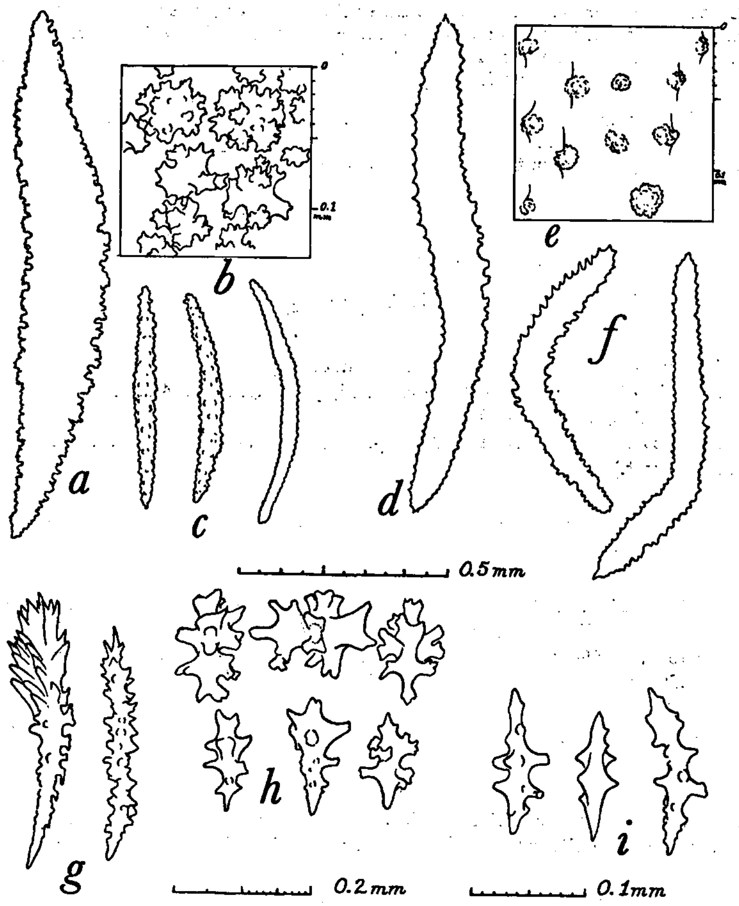


FIGURE 10. *Nidalia occidentalis* Gray, from Florida (USNM 50398): *a*, spindle of stalk; *b*, detail of ornamentation of spindle; *c*, anthocodial spindles. *Neospongodes portoricensis* (Hargitt), from Cuba (7184): *d*, spindle of stalk; *e*, detail of ornamentation of spindle; *f*, anthocodial spindles. *Eunephthya nigra* (Pourtalès), from Florida (15916): *g*, spicules from polyp walls; *h*, spicules from surface layer of stalk; *i*, spicules from interior of stalk. (Enlargement of *a*, *c*, *d*, and *f* indicated by 0.5 mm. scale between *c* and *d*; that of *b* and *e* by scales adjacent; that of *g* by 0.2 mm. scale adjacent; that of *h* and *i* by 0.1 mm. scale below *i*.)

KEY 6

KEY TO THE WESTERN ATLANTIC GENERA OF NEPHTHEIDAE

1a. Zooids in clusters or singly, without projecting bundles of spindles on their outer side: Genus *Eunephthya* Verrill.

1b. Zooids singly, with projecting bundles of spindles on their outer side: Genus *Neospongodes* Kükenthal

Genus **Eunephthya** Verrill, 1869

Eunephthya VERRILL 1869, p. 284. (Type species, *Nephthya thyrsoidea* Verrill 1865, by original designation.)
Eunephthya, DEICHMANN 1936, p. 59.

Diagnosis. Arborescent colonies with clusters of polyps at the branch ends; no bundles of supporting spicules on the outer side of the polyps.

Remarks. One species is fairly common at moderate depths in Florida waters, and may occur in the West Indies. Other species are found in the northern Pacific, the northern Atlantic, and South Africa.

9 **Eunephthya nigra** (Pourtalès), 1868

(Figs. 9 j, 10 g–i)

Nephthya nigra POURTALÈS 1868, p. 130. (Sand Key, Florida, 120 fms.)
Eunephthya nigra, DEICHMANN 1936, p. 60, pl. 1 fig. 7; pl. 4 figs. 5–13; pl. 27 figs. 1–2. (Florida Keys, 98–130 fms.)

Diagnosis. Colonies with a short stalk and compact, rounded clusters of polyps. Spicules of the polyps chiefly rods with simple projections, and bent clubs with foliate heads. Color, sepia brown or slaty gray, the polyps with eight pale bands where the longitudinally disposed spicules show through the epidermis.

Material. Off GEORGIA, 276–440 fms., 168 specimens (USNM 10506, 10543, 10813, 17045); FLORIDA, off Daytona, 438 fms., 20 spec. (USNM 14607, 15916); off Miami, 150 fms. (USNM 50157).

Distribution. Off southern Georgia to the Florida Keys, in 150 to 440 fathoms; not yet reported from the West Indies proper.

Genus **Neospongodes** Kükenthal, 1903

Neospongodes KÜKENTHAL 1903, p. 273. (Type species, *Neospongodes atlantica* Kükenthal, by subsequent designation: DEICHMANN, 1936.)
Neospongodes, DEICHMANN 1936, p. 66.

Diagnosis. Colonies arborescent; polyps in clusters or scattered on the terminal branches, supported by a group of stout spicules ('Stützbündel') on the abaxial side.

Remarks. Five species have been described in the western Atlantic, two of them off Brazil and three in the West Indies proper. Of these five, two, *Neospongodes agassizii* Deichmann and *N. caribaea* Deichmann, belong to the genus *Siphonogorgia*, not previously reported in the western Atlantic, and hence to the foregoing family. Only one true nephtheid seems to be at all common in the Caribbean area.

10 **Neospongodes portoricensis** (Hargitt), 1901

(Figs. 9 i, 10 d–f)

Spongodes portoricensis Hargitt 1901, in: Hargitt & Rogers, p. 279, fig. B. (Porto Rico, 75–76 fms.)
Neospongodes portoricensis, Deichmann 1936, p. 67, pl. 1 fig. 10; pl. 27 figs. 3–12. (St. Croix to Barbados, 56–264 fms.)

Diagnosis. A number of stubby branches arise from a stout stalk. Polyps tall and curved inward, supported by a group of stout, converging spindles that project little if at all. Operculum consisting of eight usually unequal pairs of bent spindles, and a few accessory rods. Color of colonies creamy white in alcohol; spicules colorless.

Material. Cuba, off Havana, 122 fms. (USNM 7184); off the north coast of Puerto Rico, 80–120 fms. (USNM 50399).

Distribution. Straits of Florida to Barbados (and possibly Brazil), in 38 to 278 fathoms.

Order **GORGONACEA** Lamouroux, 1816 (emend. Verrill, 1866)

Diagnosis. Polyps with uniformly short gastric cavities. An axial structure of some kind always present; either a dense, horny or calcareous central cylinder, or a medullar zone of spicules bound together more tightly than those of the cortex. Medullar spicules usually of different form, and sometimes different color, from those of cortex.

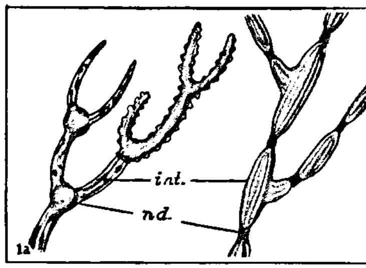
Distribution. Marine waters from Arctic to Antarctic; low tide line to the abyssal.

Key 7

Illustrated key to the families of Gorgonacea

1a. The axis is composed of alternating horny and calcareous joints: 16

1b. The axis is not jointed: 2

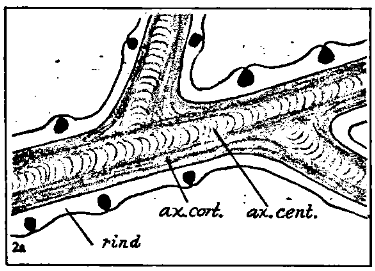


2a. Axis with a soft, cross-chambered central core: 8

2b. Axis without a cross-chambered central core: 3

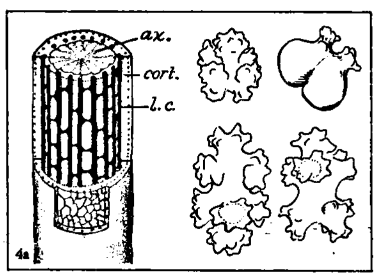
3a. The axis is a spicular medulla, in one family rigidly calcareous: 4

3b. The axis is a calcified but more or less flexible horny rod with a solid core: 12



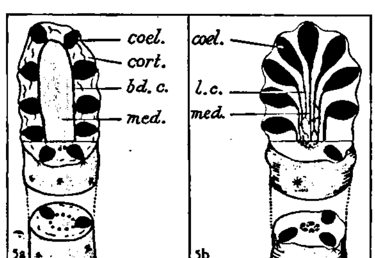
4a. The axis is solidly calcareous; cortical spicules chiefly capstans with 6, 7, or 8 rays, sometimes modified into double clubs: Family Coralliidae

4b. The axis is a medulla containing separable spicules: 5



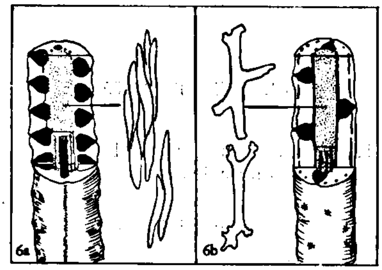
5a. The medulla is separated from the cortex by a ring of longitudinal boundary canals; no gastrodermal canals in medulla: 6

5b. No ring of boundary canals separating medulla from cortex; gastrodermal canals perforate the medulla: 7



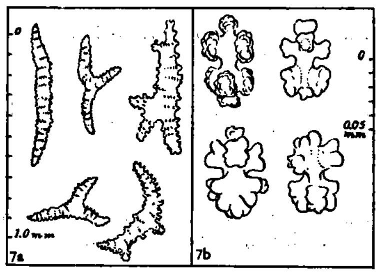
6a. Medullar spicules smooth and anastomosing. Two larger longitudinal canals on opposite sides of the branches: Family SUBERGORGIIDAE

6b. Medullar spicules ornamented with warts, spines or branching processes by which they may be joined together; longitudinal canals of about equal size: Family ANTHOTHELIDAE



7a. Polyps monomorphic. Cortical spicules fusiform, no capstans: Family BRIAREIDAE.

7b. Polyps dimorphic. Cortical spicules predominantly capstans: Family PARAGORGIIDAE

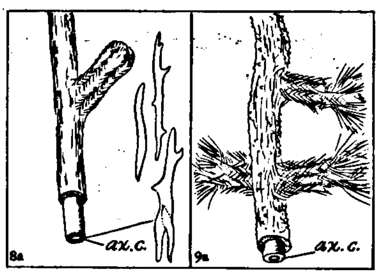


8a. The layer of axis surrounding the chambered core is composed of smooth flattened, fusiform spicules: Family KEROEIDIDAE

8b. The layer of axis surrounding the chambered core never contains calcareous material in spicular form: 9

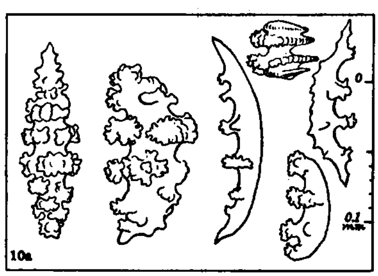
9a. The anthosteles project stiffly; polyps lack a neck-zone free of spicules, so that only the tentacles may be retracted: Family ACANTHOGORGIIDAE

9b. Anthocodiae retractile; if there are projecting anthosteles, a neck-zone with few or no spicules enables the anthocodiae to retract more or less completely: 10

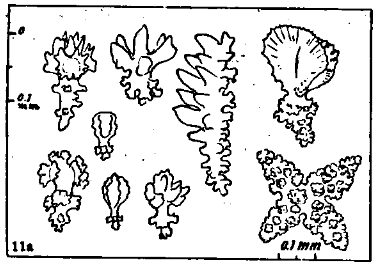


10a. Longest spicules rarely exceeding 0.2 mm., usually not over 0.15 mm.; tubercular sculpture in transverse belts, sometimes fused into disks; no clubs. Cortex of axis little loculated if at all: Family GORGONIIDAE.

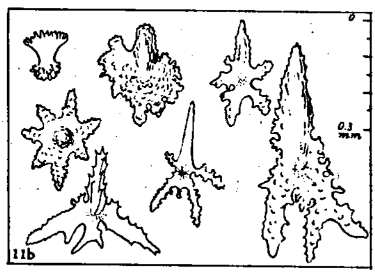
10b. Longest spicules exceeding 0.2 mm., often many times that size, with sculpture usually irregular and not arranged in transverse belts. Cortex of axis loculated: 11



11a. Spicules almost always including clubs of various kind; if clubs absent, the typical sclerites are 4-rayed 'butterflies', or large spindles often with spines on the outer surface. Crown usually weak and irregular. Branches usually stout: Family PLEXAURIDAE

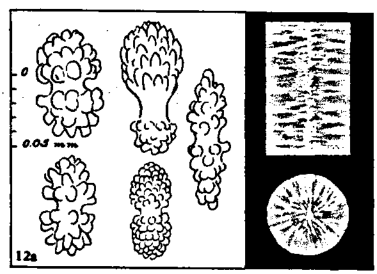


11b. Spicules including thornscales, stars, rosettes, foliate spindles, large plates or spindles, but no clubs. Crown strong, forming 8 regular points over a distinct transverse collaret. Branches usually slender: Family PARAMURICEIDAE



12a. Spicules as characteristic double heads or clubs. Axis calcification radially oriented: Family ELLISELLIDAE

12b. Spicules as minute corpuscles, large scales, or spindles. Axis calcification not radially oriented: 13

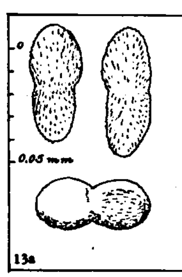


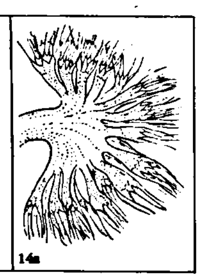
13a. Spicules as minute, discoidal or bidiscoidal corpuscles 0.025 to 0.07 mm. in greatest diameter: Family IFALUKELLIDAE

13b. Spicules as large scales or spindles: 14

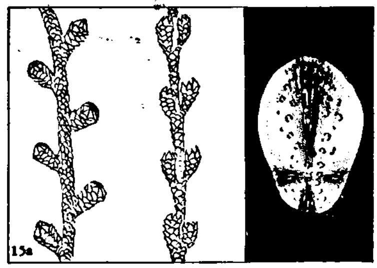
14a. Polyps united by their bases to form polyp-leaves disposed biserially along unbranched stems. Spicules as scales: Family AINIGMAPTILIDAE

14b. Polyps isolated or in whorls, never united to form polyp-leaves: 15

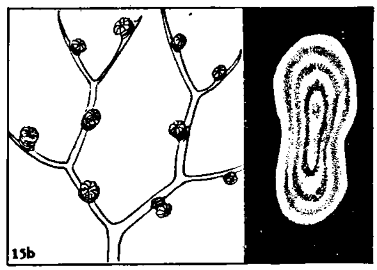




15a. Branching pinnate, dichotomous or bushy, rarely simple. Axis with concentric layers strongly undulated. Polyps in pairs or whorls, sometimes scattered. Polyp spicules scale-like; branches with thick scales that may be irregular or elongate; scales showing a cruciform pattern in polarized light: Family PRIMNOIDAE

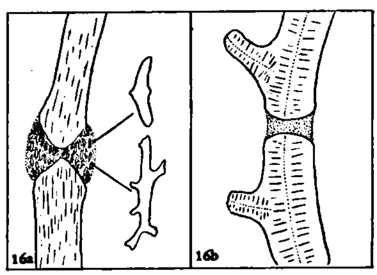


15b. Branches simple or dichotomously divided, arising from the mainstem spirally, rarely irregularly or unilaterally. Polyps scattered, sometimes biserial, not in pairs or whorls. Spicules scale-like, fusiform, or rod-like; scales showing a concentric pattern in polarized light: Family CHRYSOGORGIIDAE



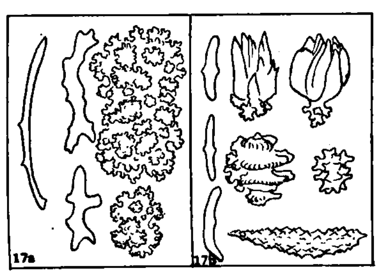
16a. The horny nodes contain spicules: 17

16b. The horny nodes contain no spicules whatever: Family ISIDIDAE



17a. Cortical spicules are thick plates (stellate in their young stages) closely fitted as in mosaic: Family PARISIDIDAE

17b. Cortical spicules are spindles, disk-spindles or clubs, not flat plates: Family MELITHAEIDAE



Suborder *SCLERAXONIA* Studer, 1887

Diagnosis. Gorgonaceans with axial structure composed of spicules, either free or inseparably fused.

Remarks. The waters of the West Indian region are not rich in scleraxonians, of which only three species are commonly encountered in reef habitats; they are readily recognized by their encrusting or lobate colonial form. The arborescent species of somewhat deeper water have a central axis of closely packed spicules that affords the colonies a considerable degree of rigidity.

Distribution. Except for a few boreal species, the suborder is limited to warm waters. The greatest number of species occurs in the East Indies and Philippines, but there is moderate representation in the West Indies. They inhabit depths from low tide to the abyssal.

Family **BRIAREIDAE** Gray, 1859

Diagnosis. Monomorphic Scleraxonia with a continuous medulla containing separable spicules, which is perforated by gastrodermal canals all the way to the branch tips, and which is not separated from the cortex by a ring of boundary canals.

Distribution. Tropical western Atlantic; Indo-Pacific.

Genus **Briareum** Blainville, 1830

Briareum BLAINVILLE 1830, *60*, p. 484. (Type species, *Briareum gorgonoideum* Blainville = *Briareum asbestinum* (Pallas), by monotypy.)

Asbestia NARDO 1845, p. 106. (Type species, *Asbestia asbestina* (Pallas), by monotypy.)

Solenopodium KÜKENTHAL 1916a, p. 174. (Type species, *Solenopodium stechei* (Kükenthal), by subsequent designation: KÜKENTHAL 1916b, p. 468).

Briareum, KÜKENTHAL 1919, p. 45.

Briareum, DEICHMANN 1936, p. 79.

Diagnosis. Briareids with large, tuberculate spindles and three-armed bodies.

Remarks. The phylogenetic position of this genus has long been the subject of debate. The most recent, as well as the most thorough, investigation of the matter is that of VERSEVELDT (1940, p. 9), but I believe that his conclusion regarding the relationship of *Briareum* remains open to question because of certain points of interpretation. Consequently, the usual arrangement of the genus among the Gorgonacea is retained, at least for the present.

I can find no reason for retaining the Pacific species of *Solenopodium* in a separate genus. Moreover, KÜKENTHAL's *Erythropodium marquesarum* undoubtedly came from the Atlantic rather than the Pacific Marquesas and therefore belongs also to *Briareum*. This view is borne out by the fact that KÜKENTHAL described from the same collection (KÖLLIKER's, in Munich) a *Eunicella marquesarum*, which is nothing more than the common West Indian *Plexaura flexuosa*.

11 **Briareum asbestinum** (Pallas), 1766

(Fig. 11)

Alcyonium asbestinum PALLAS 1766, p. 344. (Mare Americanum.)

Briareum gorgonoideum BLAINVILLE 1830, *60*, p. 484.

not *Alcyonium gorgonoides* ELLIS & SOLANDER 1786, p. 181, p. 9 figs. 1–2. [A zoanthid.]

Ammothea polyanthes DUCHASSAING & MICHELOTTI 1860, p. 15, pl. 1 fig. 6 (St. Thomas.)

Erythropodium marquesarum KÜKENTHAL 1916a, p. 173. [Nomen nudum.]

Briareum asbestinum, KÜKENTHAL 1916b, p. 469, figs. F–H, pl. 23 fig. 2. (Florida; Tortugas; Haiti; St. Thomas.)

Erythropodium marquesarum KÜKENTHAL 1919, p. 34, fihs. 1–7. (Marquesas-Inseln in 22–37 m Tiefe.)

Erythropodium polyanthes, DEICHMANN 1936, p. 77, pl. 5 fig. 23. (St. Thomas; type material.)

Briareum asbestinum, DEICHMANN 1936, p. 79, pl. 5 figs. 1–2. (Carysfort Reef, Florida.)

Briareum asbestinum, VERSEVELDT 1940, p. 9, figs. 2–4.

Diagnosis. As for the genus.

Material. In Dr. Hummelinck's collection the species is represented from ST. BARTHÉLEMY, island of La Fourche, on rock debris at 2 m., sta. 1124, 2. VI. 1949, 2 dry colonies, 1 in alcohol (USNM 50400, 51314). Found by Dr. J. H. Stock at ST. EUSTATIUS, Gallows Bay, 11. II. 1959, dried piece (Amsterdam).

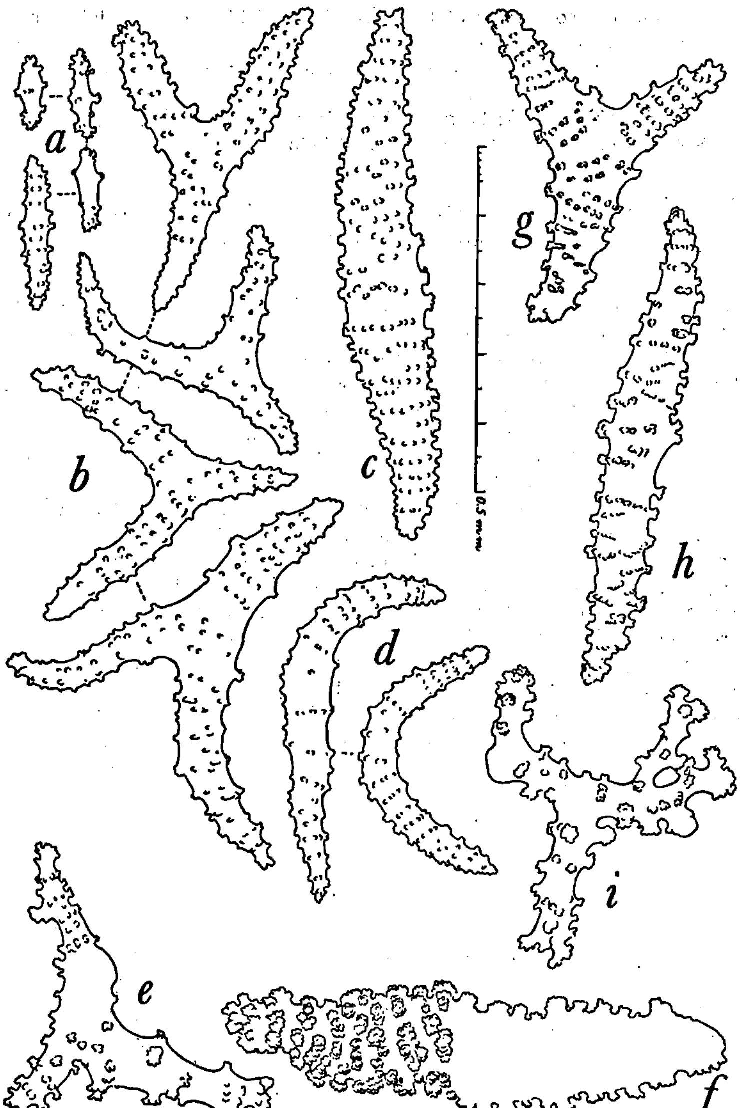


FIGURE 11. *Briareum asbestinum* (Pallas). *a–f*, spicules of a specimen from St. Barts (USNM 50400): *a*, stubby rods of outer layer; *b*, colorless tripods of outer layer; *c*, white spindles of outer layer; *d*, curved white spindles of outer layer; *e*, purple tripod of inner layer; *f*, purple spindle of inner layer (sculpture partially shown). *g–i*, spicules of one of the original specimens of *Ammothea polyanthes* from St. Thomas (Leiden Museum): *g*, colorless tripod of outer layer; *h*, colorless spindle of outer layer; *i*, purple tripod of inner layer. (All figures drawn to the same scale.)

From the collections of the U.S. National Museum, the following were also examined: southern FLORIDA, including the Keys (43228, 49668); the BAHAMAS (33034, 43220, 43257, 50401); CUBA (49476); OLD PROVIDENCE, 3 lots (44110–44112); ANTIGUA (43069); BARBADOS (43413); TOBAGO, Milford Bay (51413); MEXICO, Arrecife Alacranes, Yucatan (51428, 51452, 51460), Cozumel Isl., Quintana Roo (51453).

Distribution. Southern Florida, the Bahamas, Caribbean Sea, and the West Indian Islands south to Barbados.

Remarks. This exceedingly variable species is common from southern Florida through most of the West Indies. Colonies may be erect and lobate or digitate, or merely encrusting (sometimes upon the dead axes of other gorgonians). The polyps are very large in the expanded state (STIASNY 1935b, p. 182, fig. 1), purplish gray in color; they are packed with zooxanthellae and lack spicules. Protruding, false calyces appear in varying degrees of prominence, due largely to conditions of preservation; in some specimens, they are tall, flexible tubes, in others only low verrucae, and in many they do not project at all. There are usually some fully retracted polyps on specimens that show very prominent calyces, indicating that the character is not of a morphological nature. The coenenchyme contains a cortical zone of predominantly colorless spicules, straight or curved spindles of large size and many tripods (Fig. 11 b–d); and a medullar zone with mostly purple spicules shaped like those of the cortex but larger and coarser (Fig. 11 e–f), and a number of branching bodies among which some coalescence may occur. In erect colonies, the medulla is perforated by coelenteric canals that connect directly with the gastric cavities of the polyps.

On figure 11 are also shown examples of spicules from one of DUCHASSAING & MICHELOTTI's original specimens of *Ammothea polyanthes* from St. Thomas (g–i), which has generously been made available by Dr. L. B. HOLTHUIS of the Leiden Museum. It is entirely possible that studies in the field will reveal characters permitting the recognition of *Erythropodium polyanthes* as a valid species, but preserved material does not justify such a separation at the present time.

Family ANTHOTHELIDAE Broch, 1916

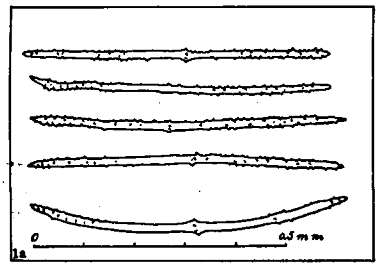
Diagnosis. Monomorphic Scleraxonia with a circle of longitudinal boundary canals separating medulla from cortex. Solenia perforating the medulla in larger branches. Spicules fusiform, sometimes clavate or bent, occasionally with radiate bodies and capstans.

Key 8

Illustrated key to the West Indian subfamilies and genera of Anthothelidae

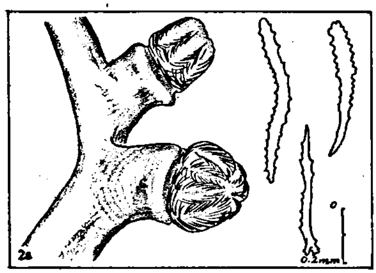
1a. The medullar spicules are long, prickly needles (subfamily Sempererininae): Genus *Iciligorgia*

1b. The medullar spicules are stouter and not needle-like: 2



2a. Branches slender, polyps with prominent, cylindrical calyces; anthocodiae usually exsert, their spicules often clavate. Cortical spicules not capstans (subfamily Anthothelinae): Genus *Anthothela*

2b. Branches stouter, calyces conical or hemispherical; anthocodiae retractile, without clavate spicules. Cortex with capstans or radiate forms, at least in calyces and outer layer (subfamily Spongiodermatinae): 3

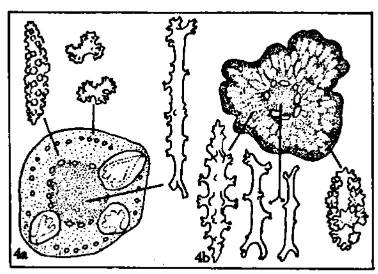


3a. The cortical spicules include many elongate spindles: 4

3b. The cortical spicules are predominantly radiate forms: 5

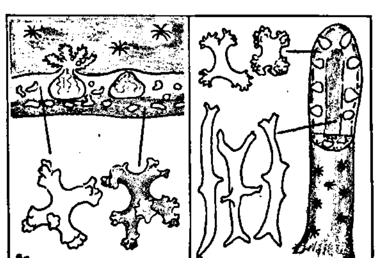
4a. Colonies arborescent, red or yellow. Outer cortex with many small radiates as well as large spindles; inner cortex not vesicular, with spindles only. Medullar rods with branching processes: Genus *Diodogorgia*

4b. Colonies clavate, unbranched, white. Outer cortex thin, filled with belted spindles and capstans; inner zone thick, vesicular with long, warted spindles. Medullar rods forked at one or both ends: Genus *Tripalea*



5a. Colonies are encrusting sheets. Spicules chiefly 6-radiates, those of medulla red, partially fusing: Genus *Erythropodium*

5b. Colonies with erect, digitate branches. Medullar spicules are elongate, branching rods unlike the cortical radiates: Genus *Titanideum*



Genus **Iciligorgia** Duchassaing, 1870

Iciligorgia DUCHASSAING 1870, p. 12. (Type species, *Iciligorgia schrammi* Duchassaing, by monotypy.)
Iciligorgia, DEICHMANN 1936, p. 82.

Diagnosis. Anthothelidae with long, slim needles in the medulla; polyps biserial, forming low calyces.

Remarks. This genus appears to be strictly West Indian, with a single species. Its nearest relatives are *Solenocaulon*, which forms colonies with a peculiar, tubular main stem, and *Semperina*, which differs in having the polyps scattered on one face of the branches rather than biserially disposed.

The Pacific species described by AURIVILLIUS (1931, p. 11) as *Iciligorgia boninensis* belongs to the genus *Anthothela*. The Indo-Pacific *Alertigorgia* (= *Machaerigorgia*) *orientalis* (Ridley), which was originally, and has been subsequently, referred to *Iciligorgia*, actually belongs in a distinct genus.

12 **Iciligorgia schrammi** Duchassaing, 1870

(Fig. 12; Frontispice)

Iciligorgia schrammi DUCHASSAING 1870, p. 12. (Guadeloupe.)
Iciligorgia ballini KÜKENTHAL 1908, p. 17. (St. Thomas.)
Iciligorgia schrammi, DEICHMANN 1936, p. 82, p. 5 figs. 3–5. (Dry Tortugas; Dominica; Montserrat.)
Iciligorgia schrammi, BAYER 1959, p. 6, fig. 2. (Brazil.)

Diagnosis. Colonies dichotomously branched, mostly in one plane; twig ends fistulose (Fig. 12a); polyps biserial, forming low calyces that may be undetectable in dry material; anthocodiae strongly armed with spindles 'en chevron'; cortex with tuberculate rods (Fig. 12 b); medulla with long, slender needles (Fig. 12 c). Color, brown.

Material. From the U. S. National Museum: FLORIDA, off Palm Beach (49709, 49710, 49941); off Elliott Key (49609); off CAT CAY, Bahamas (50161); CUBA, off Havana (7208, 10134, 17053, 44092, 44093); north of PUERTO RICO (43796); BRAZIL, off mouth of Amazon River (50846).

Distribution. East coast of Florida, the Bahamas and West Indies, south to the mouth of the Amazon River; 6–196 fathoms.

Remarks. This very distinct species could hardly be mistaken for any other in the West Indies. Near the end of the twigs, the edges of the branches are rolled back and joined medially to produce a distinctly fistulose condition (Fig. 12 a). In this regard, *Iciligorgia schrammi* is very close to the genus *Semperina*, differing chiefly in the biserial arrangement of the polyps. The tendency to produce tubular branches reaches its highest development in the East Indian *Solenocaulon*, in which the edges of the main stem recurve and meet to form a wide, hollow tube, while the small twigs exactly resemble those of *Iciligorgia*. The spiculation, especially that of the medulla, is very similar in all three genera.

Genus **Anthothela** Verrill, 1879

Anthothela Verrill 1879a, 32. (Type species, *Anthothela grandiflora* (Sars), by monotypy.)
Anthothela, Verrill 1879, p. 199
Anthothela, Verrill 1922, p. 18.

Diagnosis. Anthothelidae forming colonies of slender, crooked branches without large main stems. Calyces prominent, cylindrical; anthocodial armature strong. Spicules of medulla as strongly

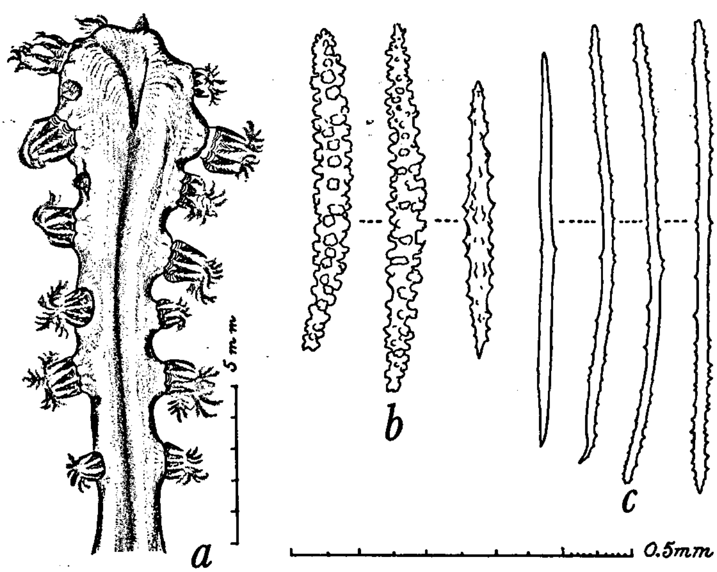


FIGURE 12. *Iciligorgia schrammi* Duchassaing, from Florida (USNM 49609): *a*, twig end with exsert anthocodiae; *b*, cortical spindles; *c*, medullar needles. (Enlargement of *a* indicated by adjacent 5 mm. scale; that of *b–c* by 0.5 mm. scale.)

thorny spindles; stem cortex and calyx walls containing many bent or clavate spindles; no radiate bodies.

Remarks. In the western Atlantic, the genus *Anthothela* is represented by the type species, *A. grandiflora*, which is common on the Grand Banks and extends south, in deep water, to Fernandina, Florida. A new species is here described, the first record for the genus in the Gulf of Mexico.

13 **Anthothela tropicalis** spec. nov.

(Fig. 13)

Diagnosis. *Anthothela* with surface of calyces and cortex roughened by the projecting ends of angularly bent spindles. Crown with eight points composed of spinose spindles 'en chevron', resting upon a wide and diffuse collaret of many transverse rows of spindles.

Description. The type consists of several crooked branches that seem to have been part of a tangled mass. The branches are cylindrical, about 2.0 mm. in diameter, bearing polyps widely separated on all sides. The polyps are fully retractile within cylindrical calyces about 1.5 mm. tall, but most are exsert in preservation (Fig. 13 g). The anthocodiae have a strong crown consisting of eight points of crowded, curved, spinose spindles 0.3–0.4 mm. long (Fig. 13 b) arranged 'en chevron', merging into a broad zone of transversely placed spindles that form a diffuse collaret. The tentacles contain smaller, spinose spindles with the spines larger at one end than elsewhere (Fig. 13 a), longitudinally arranged. In the pharynx are found numerous slender, spinose spindles about 0.1 mm. long (Fig. 13 f). The surface of calyces and cortex is thorny in appearance due to the projecting ends of bent 'hockey-stick' spindles. In the calyces, where they are best developed, these spicules are mostly 0.4–0.8 mm. long (fig. 13 e); in the cortex they are smaller and many ordinary spindles are mixed with them (Fig. 13 d). The medulla contains slender, sharply thorny spindles of diverse size (Fig. 13 c), often exceeding a length of 0.5 mm. The cortex is separated from the medulla by a ring of longitudinal boundary canals (Fig. 13 h), but the material is not sufficiently well-preserved to determine the extent to which the medulla is perforated by solenia. The colonies are ivory white in alcohol.

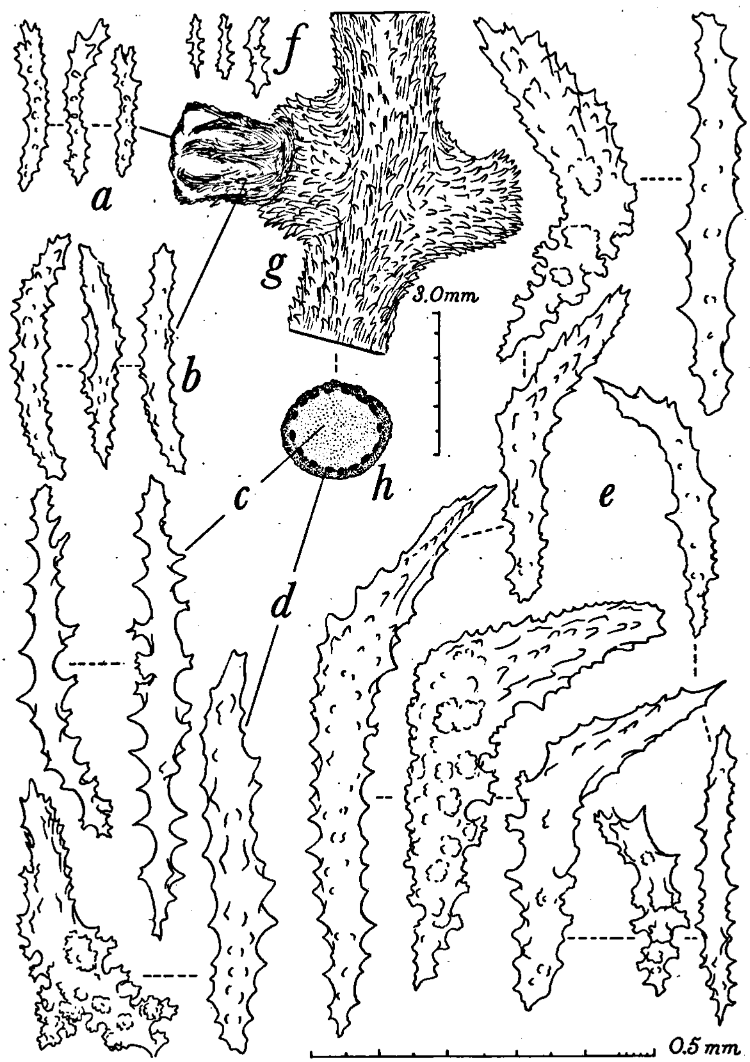


FIGURE 13. *Anthothela tropicalis* spec. nov.; the holotype from Texas (USNM 50650): *a*, tentacular spicules; *b*, crown spicules; *c*, medullar spindles; *d*, cortical spindles; *e*, calycular spicules; *f*, spinose rods of pharynx; *g*, part of branch with exsert polyp; *h*, cross section of stem. (Enlargement of *g–h* shown by 3.0 mm. scale adjacent; that of all spicules by 0.5 mm. scale at *e*, lower right.)

Material. Holotype: southeast of Galveston, TEXAS, 27°32′ North, 93°01.6′ West, 400–450 fms., *Oregon* sta. 534, 11.IV.1952 (USNM 50650).

Remarks. This deep-water species is described here because of its unusual interest. It is the first find of the genus *Anthothela* in the Gulf of Mexico, and is closely related to *Anthothela pacifica* (Kükenthal) of the Pacific coast, with which it forms a twin pair.

Anthothela tropicalis differs from *A. grandiflora* and resembles *A. pacifica* in the rough surface resulting from the projecting spicules. It differs from *A. pacifica* in having smaller and more numerous spicules in the crown, and a broader collaret.

Genus **Tripalea** Bayer, 1955

Tripalea BAYER 1955a, p. 208. (Type species, *Suberia clavaria* Studer 1878, by original designation.)

Diagnosis. Monomorphic Scleraxonia producing erect colonies with the medulla lacking solenia and separated from the cortex by a ring of boundary canals. Cortex consisting of two layers: a thick inner layer with many wide lacunae whose walls contain relatively few spicules (Fig. 14 a–b); and an outer dense layer packed with spicules (Fig. 14 a, c), which extends into the inner cortex as an investement of the gastric cavities of the polyps. Outer layer with capstans and short, belted spindles; spongy layer with elongate, belted spindles; medulla with forked rods.

Remarks. This genus was erected to receive *Suberia clavaria* because the type species of *Suberia* (*S. köllikeri*) was removed to the genus *Semperina*, making the genera synonymous. The structure of *S. clavaria* is unique among scleraxonians and fully warrants a separate genus.

My statement (BAYER 1955, p. 208) that there are solenia in the medulla is incorrect. The longitudinal canals, which are coelenteric, originate at the periphery of the medulla and, as growth proceeds, appear to be pushed apart by the enlarging medulla and somewhat imbedded in its outermost region. I have examined several more specimens and have been able to observe the tip of the medulla; nowhere is it perforated by coelenteric canals.

The extension of the polyps as long coelenteric canals is strongly suggestive of *Briareum*, but in *Tripalea* the medulla takes form between the uppermost polyps and the canals lie in a ring around it, becoming farther and farther apart as the medulla increases in diameter proximad. The circular canal system is not continuous since it consists of coelenteric extensions of polyps that arose at different levels in the colony; it is, however, a boundary system in the broad sense and *Tripalea* must, for the time, be reckoned among the Anthothelidae. Its long coelenteric canals, arranged in a ring between cortex and medulla, give it a position intermediate between *Briareum* and the anthothelid genera.

The intercommunicating lacunae of the deeper, spongy cortex probably represent a highly aberrant solenial system. The mesogloea separating them is much reduced and contains but few spicules.

Further studies upon the anatomy of this genus are badly needed; unfortunately, the limited material at my disposal is neither sufficient in quantity nor well enough preserved to make this possible.

14 **Tripalea clavaria** (Studer), 1878

(Fig. 14)

Suberia clavaria STUDER 1878, p. 667, p. 5 fig. 38 a–b. (35°0.1′ South, 54°24.9′ West; 36°48′ South, 55°35′ West.)
Suberia clavaria, KÜKENTHAL 1919, p. 85, figs. 32–38, p. 35 fig. 25. (Punta Medanos, Ost-Patagonien; Montevideo.)

Diagnosis. As for the genus.

Material. Three lots from URUGUAY, vicinity of Montevideo (USNM 43421, 50403, 50404).

Distribution. Off the eastern coast of South America.

Remarks. The spiculation and character of the cortex make *Tripalea clavaria* readily distinguishable from white colonies of *Titanideum* (which are very uncommon). The spicules of the outer layer are capstans and short, blunt, belted spindles (Fig. 14 b); those of the inner, spongy layer are longer spindles with less crowded sculpture (Fig. 14 c). KÜKENTHAL (1919) incorrectly figures the latter for medullar sclerites, which in reality are forked rods (Fig. 14 d).

Tripalea clavaria is apparently a cool-water species. The surface temperature at the point of collection of one of the above lots (43421) was 68°F. The northern limit of its range, so far as known, is Rio de Janeiro, and it probably does not enter West Indian waters.

Genus **Diodogorgia** Kükenthal, 1919

Diodogorgia KÜKENTHAL 1919, p. 96. (Type species, *Diodogorgia ceratosa* Kükenthal = *Solanderia nodulifera* Hargitt, by monotypy.)
Diodogorgia, DEICHMANN 1936, p. 85.

Diagnosis. A ring of boundary canals separates medulla from cortex; a plexus of solenia divides cortex into a thin outer and a thick inner layer. Cortex with long spindles having tubercular sculpture and, in the surface layer, many small, radiate sclerites which continue into the lower part of the polyp walls; medulla with branched rods.

Remarks. The various described forms seem referable to a single variable species, which takes the oldest available name.

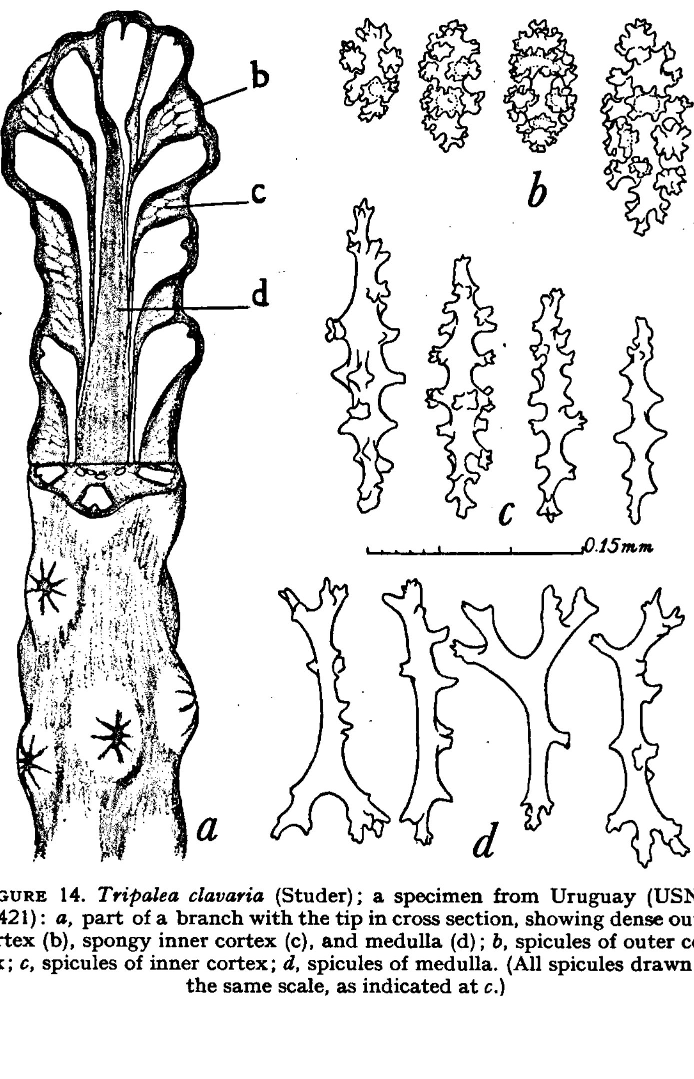


FIGURE 14. *Tripalea clavaria* (Studer); a specimen from Uruguay (USNM 43421): *a*, part of a branch with the tip in cross section, showing dense outer cortex (b), spongy inner cortex (c), and medulla (d); *b*, spicules of outer cortex; *c*, spicules of inner cortex; *d*, spicules of medulla. (All spicules drawn to the same scale, as indicated at *c*.)

15 **Diodogorgia nodulifera** (Hargitt), 1901

(Fig. 15)

Solanderia nodulifera Hargitt 1901, in: HARGITT & ROGERS, p. 279, fig. C 1, 3–5. (St. Thomas.)
Solanderia crustata Hargitt 1901, in: HARGITT & ROGERS, p. 280, fig. C 2, 6–7. (Mayaguez Harbor.)
Diodogorgia ceratosa KÜKENTHAL 1919, p. 97, figs. 44–52. (Golf von Mexico.)
Diodogorgia cervicornis KÜKENTHAL 1919, p. 645. (St. Thomas.)
Corallium vanderbilti BOONE 1933, p. 51, pls. 12–14. (Casilda, south coast of Cuba, in 100+ fathoms.)
Diodogorgia ceratosa, DEICHMANN 1936, p. 86. (Cumaná, Venezuela.)
Diodogorgia nodulifera, DEICHMANN 1936, p. 87, pl. 5 figs. 11–19. (Florida; Tortugas; Great Bahamas Bank; St. Croix; Montserrat.)
Diodogorgia nodulifera, BAYER 1959, p. 6, fig. 3 (Surinam.)

Diagnosis. Surface layer of cortex with many small 4-, 5-, and 6-radiate sclerites (Fig. 15 b, f, j), which are numerous also in the calyx walls; deeper layer with tuberculate spindles and rods (Fig. 15 a, d, h); medulla with branched rods (Fig. 15 c, e, i).

Material. Hargitt's type of *Solanderia nodulifera:* off ST. THOMAS, Sail Rock W. by N. 1/2 N., 6 miles, 20–23 fms., coral, *Fish Hawk* sta. 6079, 6.II.1899 (USNM 42607). Hargitt's type of *Solanderia crustata:* Mayaguez Harbor, PUERTO RICO, tangent of land about Pt. Melomas S. 13–1/2 miles, Custom House E. 1/4 N., 4–3/8 miles, 33–1/2 fms., sand and mud, *Fish Hawk* sta 6064, 20.I.1899 (USNM 42609). Also examined were several stout, red colonies all from FLORIDA vicinity of Palm Beach (USNM 49702, 49703, 49704, 49929); 1 specimen yellow with red calyces, from Palm Beach (USNM 49705); and some uniformly yellow or orange colonies, often with very tall calyces, from PUERTO RICO (USNM 50424), and from PANAMA and the Gulf of Darien (USNM 7612, 16547); and one small pink colony from SURINAM (USNM 50791).

Distribution. Southern Florida, Greater and Lesser Antilles, and the shores of South America as far as Surinam; in 20–100 fathoms.

Remarks. I have before me typical specimens of *Diodogorgia ceratosa* as originally described by KÜKENTHAL, HARGITT's types of *Solanderia nodulifera* and *S. crustata*, robust material like that called *D. ceratosa* by DEICHMANN, slim specimens with extremely prominent calyces even taller than those described for *D. cervicornis*, and several additional specimens more or less closely resembling the type of *S. nodulifera*. The spicules are of the same kind in all, though varying somewhat in size, and I can find no consistent correlation between spicular variation and colonial variation. The commonest form seems to be the yellow sort with red patches around the calycular apertures.

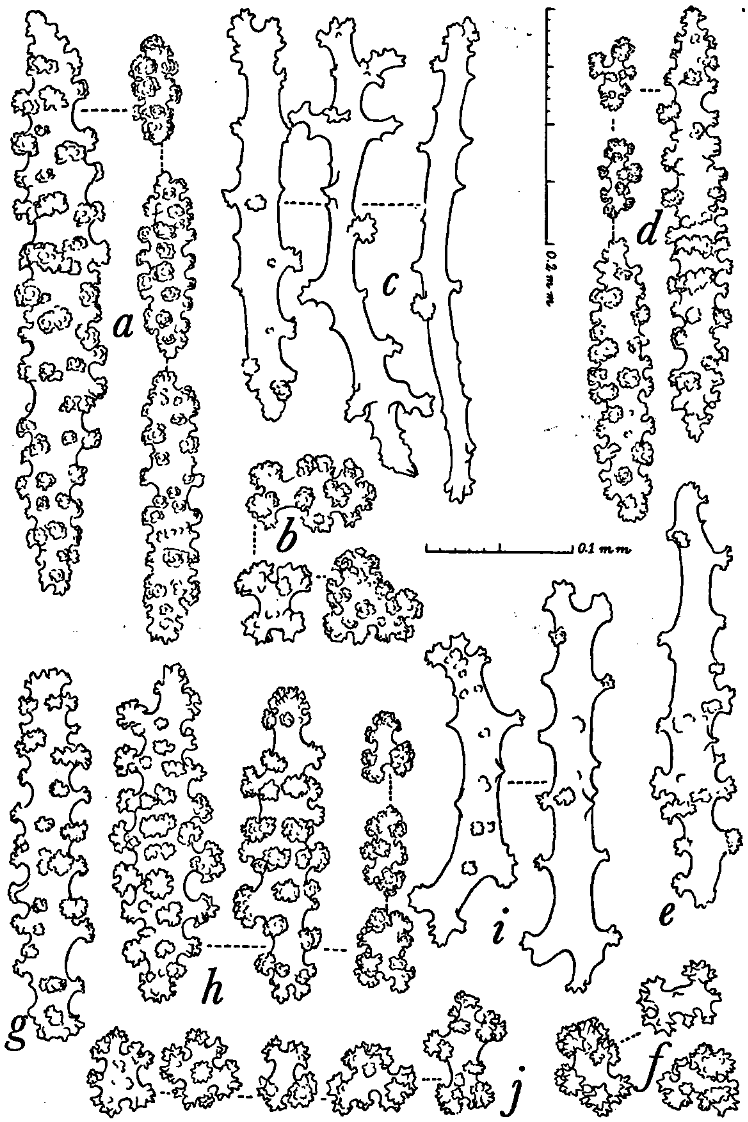


FIGURE 15. *Diodogorgia nodulifera* (Hargitt), from Panama, spicules. *a–c*, of a slender specimen like *D. cervicornis* (USNM 16547): *a*, cortical spindles; *b*, radiates from lower part of anthocodiae; *c*, medullar rods. *d–f*, of Hargitt's type of *S. nodulifera* from St. Thomas (42607): *d*, cortical spicules; *e*, medullar rod; *f*, radiates from lower part of anthocodiae. *g–j*, of a stout specimen with inconspicuous calyces from Florida (49703): *g*, spindle from deeper cortex; *h*, spicules of outer cortex; *i*, medullar rods; *j*, radiates from lower part of anthocodiae. (Enlargement of *b*, *f*, and *j* indicated by 0.1 mm. scale at right of *b*; that of all other spicules by 0.2 mm. scale left of *d*.)

In the accompanying figure are illustrated spicules from the type specimen of *S. nodulifera* (Fig. 15 d–f); from a stout, red specimen from Florida (Fig. 15 g–i); and from a slender, '*ceratosa*-type' colony from the Gulf of Darien (Fig. 15 a–c).

Genus **Erythropodium** Kölliker, 1865

Erythropodium KÖLLIKER 1865, p. 141. (Type species, *Xenia carybaeorum* [*sic*] Duchassaing & Michelotti, by monotypy.)

Diagnosis. Colonies membranous. Spicules all 6-radiates, colorless in the outer cortex, red in the inner.

Remarks. In my opinion, the species subsequently referred to this genus belong elsewhere. *Erythropodium polyanthes* and *E. marquesarum* are considered synonymous with *Briareum asbestinum*, and the genus *Erythropodium* thus reverts to its monotypic status. Its closest relative appears to be VERRILL's genus *Callipodium* from the Panamic province, but the colonies of that genus have a different form as well as a somewhat different spiculation.

16 **Erythropodium caribaeorum** (Duchassaing & Michelotti), 1860

(Fig. 16 e–h)

Xaenia caribaeorum DUCHASSAING & MICHELOTTI 1860, p. 16, pl. 1 figs 8–11 (St. Thomas.)
Erythropodium carybaeorum, KÖLLIKER 1865, p. 141, p.l 12 figs. 10–11.
Erythropodium caribaeorum, KÜKENTHAL 1916b, p. 445, figs. A–E (Ostküste von St. Thomas; Golf von Kingston auf Jamaika: Drunken-Man Key bei Port Henderson.)

Diagnosis. As for the genus.

Material. ST. EUSTATIUS, Gallows Bay, rocky beach at 1–2 m, sta. 1116B, Hummelinck coll., 15.VII.1949, 2 dry spec., one growing on *Coralliophila* (USNM 52049).

Also single USNM specimens from FLORIDA, Biscayne Key (44143); ST. JOHN (44142); and OLD PROVIDENCE (44147).

Distribution. From southern Florida to the Virgin Islands; Caribbean Sea. Apparently uncommon.

Remarks. KÖLLIKER's figures establish the identity of this species beyond a doubt, and KÜKENTHAL's description considerably elaborates our knowledge of it. The colonies form thin, firm, purplish-gray expansions on rocks; when the polyps

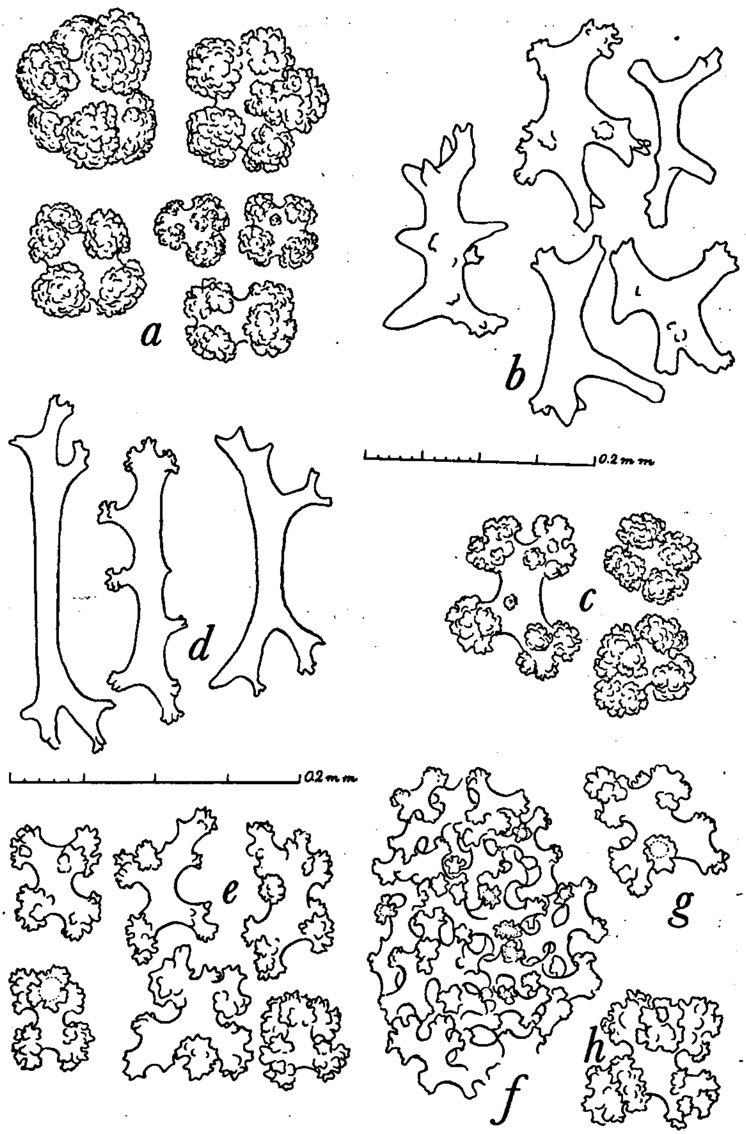


FIGURE 16. *Titanideum frauenfeldii* (Kölliker), spicules. *a–b*, of a specimen from Florida (USNM 50425): *a*, radiates from cortex; *b*, branched bodies from medulla. *c–d*, of a specimen from off Cape Fear (16842): *c*, radiates from cortex; *d*, branched bodies from medulla. *Erythropodium caribaeorum* (Duchassaing & Michelotti), spicules of a specimen from Florida (44143): *e*, colorless radiates from outer layer; *f*, cluster of fused red radiates of innermost layer; *g–h*, red radiates of inner layer. (Enlargement of *a–d* indicated by 0.2 mm. scale below *b*; that of *e–h* by 0.2 mm. scale above *e*.)

are retracted, slightly projecting calyces may be visible, but more often only star-shaped apertures. The spicules are all derivatives of 6-radiates; those of the inner layer (Fig. 16 g–h), red in color, do not differ materially from the colorless spicules of the cortex (Fig. 16 e) except that they may be a little larger and more ornately sculptured, and may fuse into a solid basement layer (Fig. 16 f).

Genus **Titanideum** Verrill, 1864

Titanideum VERRILL 1864, p. 39. (Type species, *Gorgonia suberosa* Ellis & Solander 1786 (not Pallas 1766) = *Solanderia Frauenfeldii* Kölliker 1865, by monotypy.)
Titanideum, DEICHMANN 1936, p. 83.

Diagnosis. Branches erect, cylindrical; medulla separated from cortex by a ring of longitudinal boundary canals; cortex divided into two layers by a plexus of solenia. Cortical sclerites in the form of short radiate bodies with three to six rays; no spindles; medulla with elongate, branched bodies.

Remarks. This genus is distinguished from *Diodogorgia* by the absence of elongate spindles in the cortex. The evidence afforded by the literature indicates that the South African genus *Spongioderma* differs in no important regard.

17 **Titanideum frauenfeldii** (Kölliker), 1865

(Fig. 16 a–d)

Gorgonia suberosa ELLIS & SOLANDER 1786, p. 193. (Coast of South Carolina.)
not *Gorgonia suberosa* PALLAS 1766, p. 191. [= *Subergorgia suberosa*.]
Titanideum suberosum, VERRILL 1864b, p. 39. (Charleston, S.C.; Beaufort, N.C.; Stono Inlet.)
Solanderia Frauenfeldii KÖLLIKER 1865, p. 141, pl. 19 figs 19–20, 22.
Titanideum suberosum, DEICHMANN 1936, p. 83, pl. 5, figs. 6–10 (Charleston, S.C.; Beaufort, N.C.; Garden Key, Dry Tortugas.)

Diagnosis. As for the genus.

Material. From the U.S. National Museum: NORTH CAROLINA, vicinity of Cape Hatteras, 15–68 fms. (8348, 8349, 8352, 8356, 16814, 16815, 17308, 17309, 17313, 43032, 43034); off Cape Lookout, 18 fms. (43033); off Cape Fear, 15 fms. (16604, 16818, 16842, 43031); SOUTH CAROLINA, off Little River and Port Royal, 8–18 fms. (16832, 16845, 49587, 49588, 49678, 49683); FLORIDA, off Jacksonville, 40 fms. (50425); off Palm Beach, 20–75 fms. (49699, 49700, 49701); CUBA, off Havana, 115–130 fms. (10096, 10859).

Remarks. Individuals of this species reach a considerable size with several stout, cylindrical branches about 8 mm. in diameter, but they commonly are small, digitate colonies with no branches. The stems are perforated by a ring of longitudinal canals between the cortex and medulla, and by a network of solenia that divides the cortex into a thin outer and a thick inner layer. Both layers of the cortex contain radiate sclerites with three to six rays (Fig. 16 c); the medullar spicules are elongate, branched rods (Fig. 16 d). In specimens from southerly localities, the spicules are larger and coarser (Fig. 16 a–b). The color ordinarily is bright pinkish red, sometimes yellowish orange; rarely, specimens are white, in which case they resemble *Tripalea clavaria* from which they may readily be distinguished by spiculation.

Genus **Anthopodium** Verrill, 1872

Anthopodium VERRILL 1872, p. 434. (Type species, *Anthopodium rubens* Verrill, by monotypy.)

After the major part of this manuscript was completed, Dr. WILLIS HEWATT and Mr. ROBERT PARKER submitted some specimens collected on the coast of Texas that proved to be the long-lost *Anthopodium rubens* Verrill. Since VERRILL gave no figures of his type, which is lost, and there has been some doubt as to its proper position in the Octocorallia, the accompanying figures and description have been added to the manuscript. The key to the family Anthothelidae has not been revised to include it, because the species is so distinctive that it should be easily recognizable from the figures.

Because of the scarcity of VERRILL's older papers, the original description of *Anthopodium* (1872, p. 434) is quoted in full:

> Corallum with an encrusting, firm coenenchyma, from which arise prominent, tubular verrucae, with rather large polyps at the summit. The surface of the coenenchyma and verrucae is minutely granulous with rough irregular spicula, closely united together. The spicula are of many forms and sizes, and are remarkable for their irregularity and roughness; the most prominent kinds are very roughly warted and spinulose oblong forms, and rougher lacerate club-shaped ones, many of which are flattened at the large end. Besides these are numerous rudely spinulose spindles, and an abundance of the small, short glomerate kinds.
>
> This genus is allied to *Telesto* on one side and *Callipodium* V. on the other. It resembles the latter somewhat in general appearance and mode of growth, but has very different spicula; to the former it is somewhat allied in the structure of the coenenchyma and polyp-tubes, and especially in the interlocking of the rough spicula, but the spicula are very different in structure; the walls are thicker and more rigid; and the mode of growth quite different.
>
> *Anthopodium rubens* V., sp. nov.
>
> Corallum encrusting, creeping over the dead axis of *Leptogorgia* and forming a continuous, thin, firm, finely granulous crust, from which the elongated verrucae arise nearly at right angles, though usually inclined upward. The polyp-cells are large, at the summit of the tubular and nearly cylindrical verrucae, which are variable in height and are much crowded in some parts and irregularly scattered in others; their surface is finely granulous, with minute

rough spicula. Height of the longest verrucae .28 of an inch; diameter .06. Color, uniform light red.

The spicula of the coenenchyma and verrucae are light but bright red; the larger ones are irregularly oblong, blunt at the ends, and covered throughout with rough, often lacerate, spinulose warts; some of these were .288 mm by .084, .264 by .072, .228 by .096, .216 by .084. With these there are many irregular, rudely spinulose, acute spindles of about the same length, but more slender, measuring .204 by .048, .192 by .060. There are many smaller obtuse, fusiform, oblong and glomerate spicula, of various sizes, covered with rough spinulose warts, like the larger ones. The club-shaped spicula are less numerous, and usually smaller than the largest oblong ones, but are similarly covered with rude spinules. There are also many small oblong spicula, with a smooth naked median zone, and bearing a few small acute spinules on each end, and other similar ones with small distant spinules on all parts; some of these are irregularly branched, either with three, four, five, or more points, but regular crosses are rare. The polyp-spicula are deep red, simple, fusiform or club-shaped spicula, with a few irregular minute spinules, or with the surface merely uneven; they are about .156 long and .036 in diameter.

Fort Macon, N.C., - Prof. E. S. Morse.

The specimens recently collected on the coast of Texas are described as follows:

18 **Anthopodium rubens** Verrill, 1872

(Fig. 17)

Anthopodium rubens VERRILL 1872, p. 434. (Fort Macon, North Carolina; on dead *Leptogorgia* stems.)
Anthopodium rubens, DEICHMANN 1936, p. 37.

Diagnosis. Small, membranous colonies with strongly projecting calyces. Polyp walls with small radiates; outer cortex with tuberculate rods and oval bodies; medulla with large radiates. Color, dull red.

Description. Colonies small, encrusting, rounded, about 10 mm. in diameter (Fig. 17 d); monomorphic. Polyps forming tubular calyces about 3.0 mm. in height and 2.0–2.5 mm. in diameter. Anthocodiae fully retractile, with numerous spicules in the body wall but none in the tentacles. Lower half of the gastric cavities imbedded in the colonial coenenchyme; a basal layer about 2.0 mm. thick, containing spicules and solenia but not penetrated by the polyp cavities, represents a medullar zone. The anthocodial

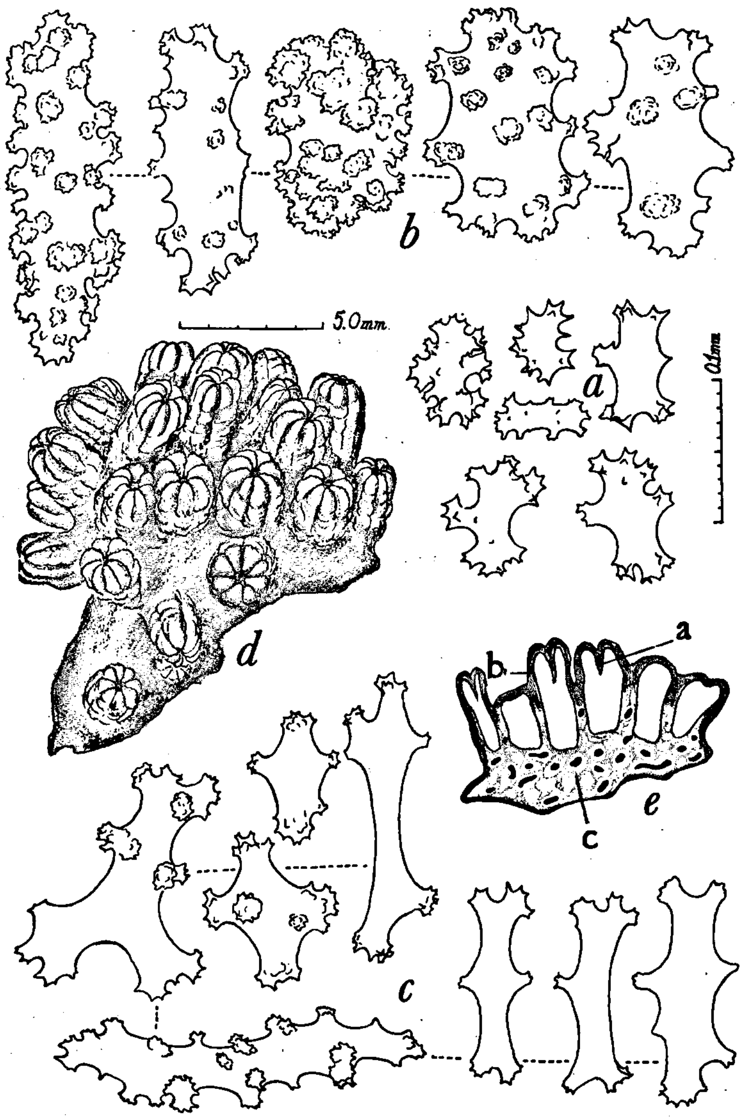


FIGURE 17. *Anthopodium rubens* Verrill; *a* specimen from Texas (USNM 50523): *a*, spicules of anthocodial walls; *b*, spicules from surface of cortex; *c*, from inner (medullar) layer; *d*, entire colony; *e*, semi-diagrammatic cross section of colony showing position of solenia (in black) and localization of spicules illustrated in *a–c*. (Enlargement of all spicules indicated by 0.1 mm. scale to right of *a*; that of *d–e* by 5.0 mm. scale above *d*.)

walls contain numerous small, flattened rods or oval sclerites with short, radiating, spinose marginal processes, which are mostly 0.05–0.10 mm. long (Fig. 17 a). The calycular walls and outer layer of coenenchyme are filled with flattened, coarsely tuberculate rods and oval bodies (Fig. 17 b); length of rods about 0.26 mm; of ovals, about 0.17 mm. Inner coenenchyme with numerous flattened, blunt rods, triradiates and quadriradiates with blunt, spinose processes (Fig. 17 c), along with a few coarsely tuberculate rods similar to those of the outer layer; the radiates measure from 0.08 to 0.2 mm. in major diameter; the blunt rods are commonly about 0.15 mm., occasionally 0.2 mm., in length. All of the spicules range in color from almost colorless to clear reddish pink, those of the outer layer the darkest. The spicules of the basement layer are more or less fused together and somewhat more coarsely sculptured than those in the layers above, as is the case also in *Erythropodium* and *Callipodium*.

Material. East Bank, 20 miles off Freeport, TEXAS, 5–8 fms., growing on rocks, shells, and hydroid stems, collected by divers, 4.VI.1956, 2 lots (USNM 50523, 50524).

Remarks. As VERRILL pointed out, the colonial form of *Anthopodium* resembles that of *Callipodium* Verrill from the Pacific coast. However, the spicules of *Anthopodium* bear a closer resemblance to those of *Callipodium* than VERRILL indicated, although they are not identical. They are also strongly reminiscent of those to be seen in *Diodogorgia*, especially the rods of the inner coenenchyme.

There is no doubt that *Anthopodium* belongs close to the gorgonacean genera mentioned above, and therefore in the scleraxonian family Anthothelidae.

Suborder *HOLAXONIA* Studer, 1887

Diagnosis. Gorgonaceans with axial structures not composed of spicules, or if so with a distinct chambered core.

Remarks. The great majority of the West Indian shallow-water octocorals belong to this suborder. They have a distinct supporting axis composed of a horny outer part and a chambered central core. In some shallow-water genera, notably in the family Plexauridae, the horny part of the axis may be permeated with calcareous material that is not in spicular form; in one deep-water family, Keroeididae, the outer part of the axis cylinder contains smooth, fusiform spicules but they surround a distinct chambered core.

It should be clear from the remarks above that the Holaxonia is not an entirely homogeneous group. Various classifications have been proposed, none of them completely satisfactory. Iam following herein the arrangement used in the *Treatise on Invertebrate Paleontology* (BAYER 1956), which combines the views of KÜKENTHAL and his students, HICKSON, STIASNY, and DEICHMANN.

Family **KEROEIDIDAE** K. Kinoshita, 1910

Diagnosis. Holaxonia with a chambered central core in the axis, but with the calcareous matter of the axial cortex taking the form of smooth, slender, fusiform spicules.

Distribution. Indo-Pacific as far east as Hawaii; one species in the West Indies. Moderate to considerable depths.

Genus **Lignella** Gray, 1870

Lignella GRAY 1870b, p. 407. (Type species, *Lignella richardi* = *Gorgonia richardii* Lamouroux, by monotypy.)
Keroeides (pars), DEICHMANN 1936, p. 88

Diagnosis. Keroeididae with tall, cylindrical polyps having spicules arranged 'en chevron' in eight longitudinal tracts.

Distribution. West Indies, in moderate depths.

Remarks. The tall, cylindrical polyps with their spicules in chevrons serve to distinguish the single West Indian keroeidid from those of the Indo-Pacific region, and it seems amply justifiable to recognize GRAY's genus *Lignella*, established for *Gorgonia richardii* Lamouroux.

19 **Lignella richardii** (Lamouroux), 1816

(Fig. 18)

Gorgonia Richardii LAMOUROUX 1816, p. 407. (Antilles.)
Lignella Richardi, GRAY 1870b, p. 408. (West Indies.)
Keroeides richardii, DEICHMANN 1936, p. 89. (St. Vincent; Guadeloupe; Barbados; in 73–150 fms.)

Miss DEICHMANN has described this curious species, but no figures have ever been given of the spicules. The accompanying illustrations show the characteristic spiculation of the axial cortex (Fig. 18 c) and of the rind (Fig. 18 b), and the arrangement of spicules on the calyces (Fig. 18 a).

Material. Off Pelican Island, BARBADOS, 100 fms., fragments (USNM 49436).

Remarks. The cylindrical calyces strongly projecting from slender branches impart to *Lignella richardii* the appearance of an acanthogorgiid. Its spicules are

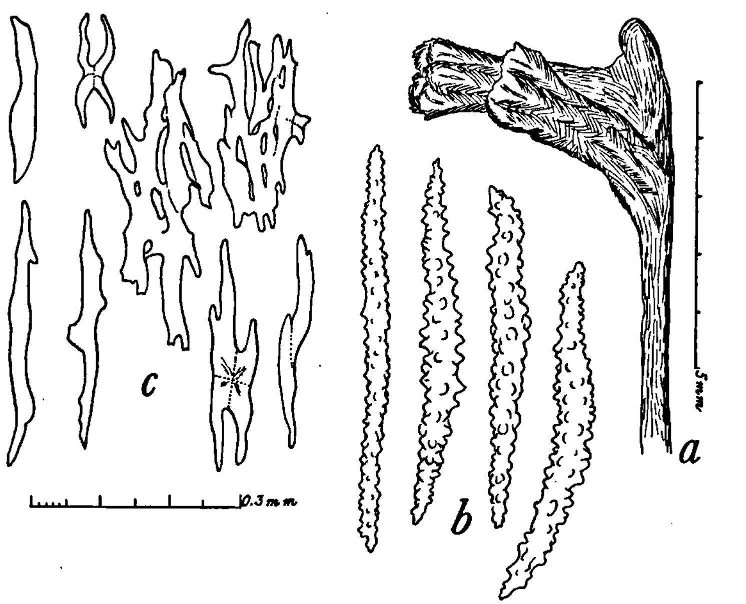


FIGURE 18. *Lignella richardii* (Lamouroux); a specimen from Barbados (USNM 49436): *a*, branch tip with two polyps; *b*, rind sclerites; *c*, anastomosing sclerites of axial cortex. (Enlargement of *a* indicated by 5 mm. scale adjacent; that of *b–c* by 0.3 mm. scale.)

similar to those of the Acanthogorgiidae, and its axis has a wide, chambered core that is lined with a fairly thick layer of horny matter setting it off sharply from the surrounding spicular zone, which is thinner than in the Indo-Pacific species of *Keroeides*. Thus, *L. richardii* assumes even closer resemblance to typical Holaxonia than do *K. koreni* and the other Pacific species.

The horny wall of the chambered central core in *Keroeides* and *Lignella* suggests that the axis of holaxonians developed from the central core, and that the so-called axial sheath is a vestige of the spicular axial cortex. Furthermore, the spicules of the axial sheath of holaxonians are usually different from those of the rind, just as the axial sclerites of *Keroeides* and the outer medullar spicules of scleraxonians differ from those of the surrounding layers of rind.

Family ACANTHOGORGIIDAE Gray, 1859

Diagnosis. Holaxonians having a purely horny axis with a wide, chambered central core. Rind thin. Nonretractile polyps form prominent, cylindrical calyces with spicules arranged 'en chevron' in eight longitudinal fields; calycular spicules continuous with those of the tentacular crown, without any intervening spicule-free neck-zone or transverse collaret; consequently, there is no clear demarcation between anthocodia and anthostele. Spicules fusiform, often bent; radiate forms in the inner layer of some species.

Remarks. Only one genus of this family occurs in the western Atlantic, namely, *Acanthogorgia*. It is characterized by long, spinous spindles in the tentacle bases, which project and form a thorny crown around the tentacles. Two species are found in the West Indies: *A. aspera* Pourtalès, which has crowded polyps with smooth projecting spines; and *A. schrammi* (Duchassaing & Michelotti), which has scattered polyps with rough spines. Both have been taken exclusively in deep water, those in the West Indies usually deeper than 100 fathoms.

A brief description and illustration of *A. aspera* are given below as an example of the genus.

20 **Acanthogorgia aspera** Pourtalès, 1867

(Fig. 19)

Acanthogorgia aspera POURTALÈS 1867, p. 113. (Off Havana, Cuba.)
Acanthogorgia aspera, DEICHMANN 1936, p. 150, pl. 16 figs 14-27; pl. 31 figs 2–2a. (Havana; Porto Rico; St. Vincent; Dominica; Barbados.)

Description. The colonies are rather openly branched, laterally and in one plane. The polyps are closely placed around the branches, and measure 1–3 mm. in height and 1 mm. in diameter; they have a bristling armature of projecting spines around the tentacles (Fig. 19 a). The spines of the projecting spicules are entirely smooth and glassy (Fig. 19 b); the spindles set 'en chevron' in the body walls are distantly spinose (Fig. 19 c).

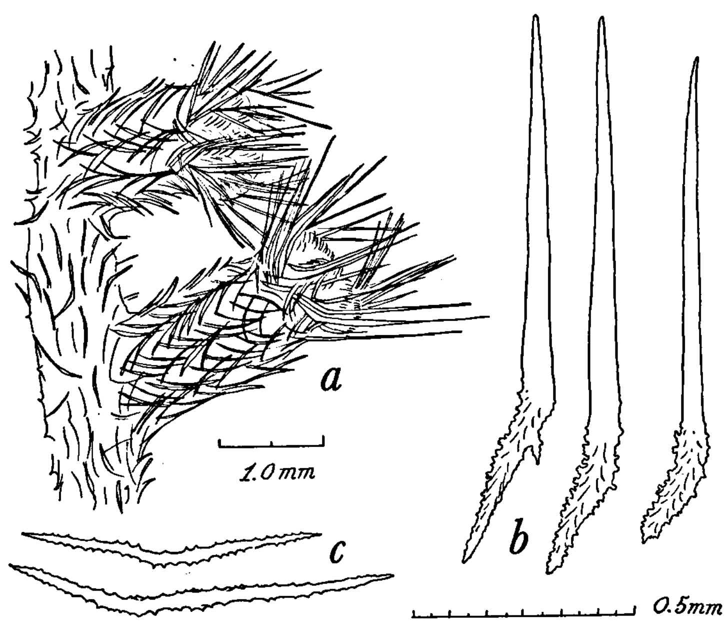


FIGURE 19. *Acanthogorgia aspera* Pourtalès; a specimen from the Bahamas (USNM 49427): *a*, part of branch with two polyps; *b*, spinous spicules of calyx margin; *c*, spindles of stem rind. (Enlargement of *a* indicated by 1.0 mm. scale adjacent; that of *b–c* by 0.5 mm. scale.)

Family **PARAMURICEIDAE** Bayer, 1956

Diagnosis. Holaxonia with branching mostly in one plane, free or anastomosing; rarely bushy or unbranched. Calyces usually prominent, crown well developed, usually with collaret. Coenenchyme usually thin, axial sheath with a thin layer of spicules sometimes limited to bands between the stem canals, or missing entirely. Spiculation extremely diverse, outer cortex often containing large spindles or plates up to 5 mm. long, or other characteristic forms but not clubs; calyces often with thorn-scales. Axis horny, the cortex loculated, the medulla chambered.

Remarks. The removal of the type genus *Muricea* from the family Muriceidae required the renaming of the family in its present form (BAYER 1956, p. *F*203). It may yet require further subdivision into a restricted Paramuriceidae including only the genera with thorn-scales or comparable sclerites, and a new family including those genera with generalized spicules in the form of spindles or plates but no thorn-scales.

The Paramuriceidae do not invade the reef habitat and therefore have not been extensively treated in this paper. Moreover, the splendid monograph of the western Atlantic Alcyonaria by DEICHMANN (1936), which deals with the deep-water fauna, covers the family (as Muriceidae) in detail. I offer as new only an illustrated key to the genera, to aid in the generic determination of any specimens that may be encountered.

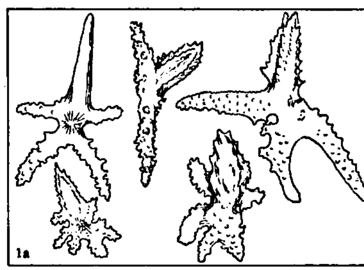
The family Paramuriceidae attains its richest development in the Indo-West-Pacific, and chiefly in the vicinity of the Malay Archipelago, where a large number of species are to be found in depths of less than 100 fathoms. A few species venture into cold, northern waters and into depths as great as 500 fathoms.

Key 9

Illustrated Key to the Western Atlantic Genera of Paramuriceidae

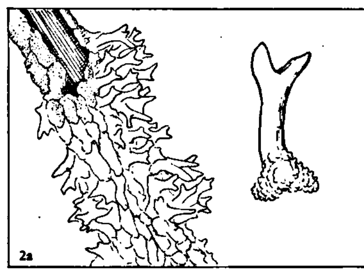
1a. Sclerites of the calyx wall and margin are thorn-scales, with a root-like base and a projecting distal part: 2

1b. None of the sclerites are thorn-scales: 7



2a. Spicules of cortex in one layer, no axial sheath layer with special spiculation. Thorn-scales stout, with a simple, bifurcate, or antler-like process: Genus *Acanthacis*

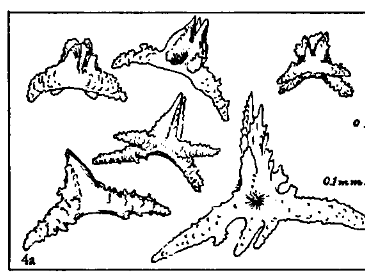
2b. Spicules of cortex in two layers, special spiculation in axial sheath well-developed. Thorn-scales more delicate, with a single spine, a foliate process, or several projections: 3



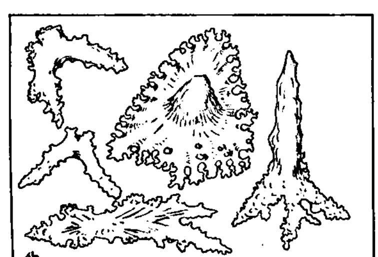
3a. The cortical sclerites are fusiforms: 5

3b. The cortical sclerites are scales, plates, or multiradiate bodies: 4

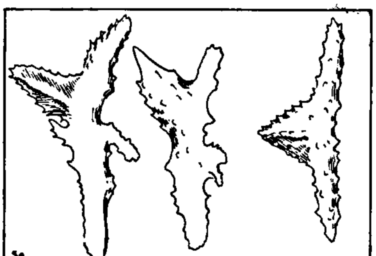
4a. The cortical sclerites are fourarmed bodies with a pyramidial, more or less serrated central projection; calycular thorn-scales with a broad, branched base and a laciniate, foliate, or digitate outer process: Genus *Villogorgia*



4b. The cortical sclerites are knee-bent rods and/or large plates with serrate edges and sometimes a projecting central process; calycular thorn-scales usually with a single stout spine: Genus *Paramuricea*.



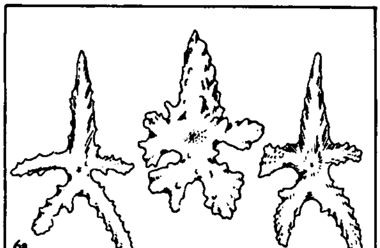
5a. The calycular thorn-scales have a narrow basal part with a slanting, serrated spine arising near the distal end. The fusiform cortical spicules have a stout, more or less thorny central process, which is large in proportion to the rest of the spicule: Genus *Trachymuricea*



5a

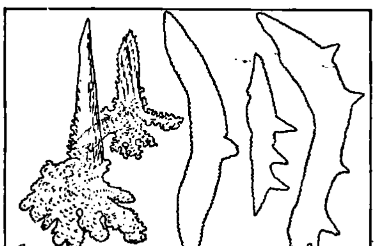
5b. The calycular thorn-scales have a broad, lobate base: 6

6a. The calycular thorn-scales have a sharp, nearly smooth projecting point. Spicules of cortex without conspicuous projecting spines: Genus *Echinomuricea*



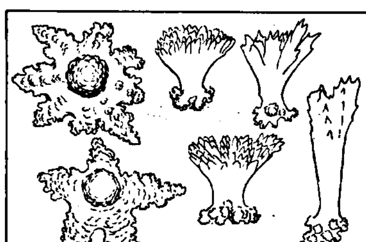
6a

6b. The calycular thorn-scales have a serrated process which in some species is stubby and blunt. Most of the cortical spindles with one or several projecting spines: Genus *Placogorgia*



6b

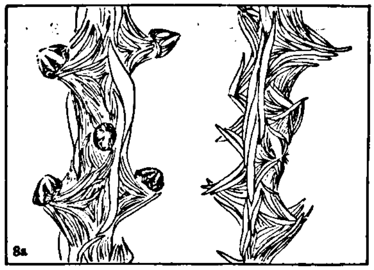
7a. Cortex with an outer layer of double-rosettes, which become lopsided around the calycular apertures; and an inner layer of large, stellate plates with a central boss: Genus *Bebryce*



7a

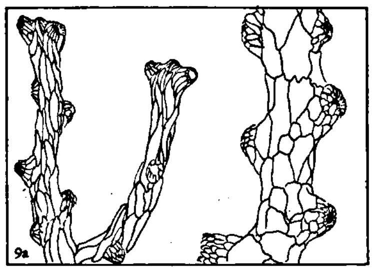
7b. Cortex with spindles, or plates that are not stellate: 8

8a. Cortical spicules in the form of long, slender, sinuous spindles, not conspicuously flattened. Calyces formed by tracts of spindles converging from both sides, sometimes forming prominent, shelf-like receptacles for the anthocodiae: Genus *Hypnogorgia*



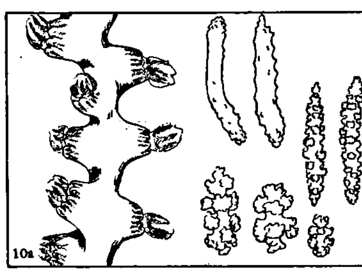
8b. Cortical sclerites as large, coarse plates thick, flattened spindles; or double cones, short spindles, or capstans. Calyces wart-like or subcylindrical, not shelf-like: 9

9a. Cortical sclerites as large, flattened spindles or broad plates, translucent and glassy in appearance, with fine, tuberculate sculpture: Genus *Scleracis*

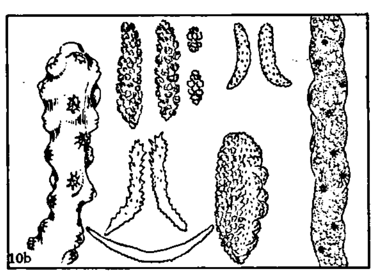


9b. Spicules not as flattened spindles; if plates, they are coarsely rugose and opaque: 10

10a. Cortical spicules in the form of capstans and spindles, the latter concentrated in the calyces, which are usually biserial. Anthocodiae with a strong crown of bar-like rods, straight or curved: Genus *Swiftia*



10b. Cortical sclerites mostly coarse, rugose plates, sometimes tuberculate spindles and double heads. Calyces usually placed all around branches. Crown without the stout bar-like rods: Genus: *Thesea*



Genus **Acanthacis** Deichmann, 1936

Acanthacis DEICHMANN 1936, p. 130 (Type species, *Acanthacis scabra* Deichmann, by original designation.)

Genus **Villogorgia** Duchassaing & Michelotti, 1860

Villogorgia DUCHASSAING & MICHELOTTI 1860, p. 32. (Type species, *Villogorgia nigrescens* Duch. & Mich., by monotypy.)

Genus **Paramuricea** Kölliker, 1865

Paramuricea KÖLLIKER 1865, p. 136. Type species, *Gorgonia placomus* Linnaeus 1758, by subsequent designation: E.P. WRIGHT, Zool. Record *1866*, p. 628.)
Paramuricea, DEICHMANN 1936, p. 134.

Genus **Trachymuricea** Deichmann, 1936

Trachymuricea DEICHMANN 1936, p. 132. (Type species, *Trachymuricea hirta* (Pourtalès), by original designation.)

Genus **Echinomuricea** Verrill, 1869

Echinomuricea VERRILL 1869a, p. 285. (Type species, *Echinomuricea coccinea* = *Acanthogorgia coccinea* = ?*Nephthya coccinea* Stimpson 1855, by original designation and monotypy.)

Genus **Placogorgia** Studer, 1887

Placogorgia STUDER 1887, p. 56. (Type species, *Placogorgia atlantica* Wright & Studer 1889, by subsequent monotypy: WRIGHT & STUDER 1889, p. 114.)

Genus **Bebryce** Phillippi, 1842

Bebryce PHILIPPI 1842, p. 35. (Type species, *Bebryce mollis* Philippi, by monotypy.)
Bebryce, DEICHMANN 1936, p. 124

Genus **Hypnogorgia** Duchassaing & Michelotti, 1864

Hypnogorgia DUCHASSAING & MICHELOTTI 1864, p. 21. (Type species, *Hypnogorgia pendula* Duch. & Mich., by monotypy.)
?*Caliacis* DEICHMANN 1936, p. 106. (Type species, *Caliacis nutans* = *Thesea nutans* Duch. & Mich. 1864, by original designation and monotypy.)

Genus **Scleracis** Kükenthal, 1919

Scleracis KÜKENTHAL 1919, p. 837, 908. (Type species, *Scleracis pumila* Kükenthal 1919 = *Acis guadalupensis* Duchassaing & Michelotti 1869, by monotypy).

Genus **Swiftia** Duchassaing & Michelotti, 1864

Swiftia DUCHASSAING & MICHELOTTI 1864, p. 13. (Type species, *Swiftia exserta* = *Gorgonia exserta* Ellis & Solander 1786, by monotypy.)

This genus is usually assigned to the family Gorgoniidae (DEICHMANN 1936, p. 185), but it seems to have more in common with the paramuriceids and plexaurids than with the gorgoniids.

Genus **Thesea** Duchassaing & Michelotti, 1860

Thesea DUCHASSAING & MICHELOTTI 1860, p. 18. (Type species, *Thesea exerta* Duch. & Mich. 1860, not *Gorgonia exserta* Ellis & Solander 1786, = *Thesea guadalupensis* Duch. & Mich. 1864, by monotypy.)

This genus has features suggesting relationship with the Plexauridae, to which family it may eventually be removed.

Family **PLEXAURIDAE** Gray, 1859

Diagnosis. Holaxonians having an axis with cross-chambered central core and a cortex commonly (but not always) loculated. Coenenchyme usually thick, with a circle of longitudinal canals surrounding the axis. Spicules large, often reaching a length of several millimeters. Polyps with or without anthocodial armature; when present, it forms a strong operculum in only a few species.

Distribution. All warm, shallow, marine waters; especially well-represented in the American tropics.

Remarks. The thick-branched holaxonians of tropical Atlantic reefs are invariably plexaurids; some of the slimmer colonies also may belong to this family, but they must be recognized by means of the spicules, which are always much larger and more irregularly sculptured than those of the Gorgoniidae. Moreover, plexaurid spicules commonly take the form of clubs, a type never found in gorgoniid genera.

A great many names have been proposed for various plexaurid species, often several for a single one. This was the natural result when the specific criteria used were limited to the variable external characteristics of the colonies. Characters of spiculation afforded a better basis for the establishment of species after the appearance of KÖLLIKER's paper of 1865, but even then the variability of the spicules was not always apparent when only a few specimens were available. Thus it often came to pass that specimens were named rather than species, and a considerable number of nominal genera and species appeared in the literature. When suites of specimens are available for study, the tremendous capacity for variation within species becomes apparent.

The protean disguises of many Caribbean plexaurids have been penetrated by the keen systematic eye of my esteemed colleague, Miss ELISABETH DEICHMANN of the Museum of Comparative Zoölogy at Harvard University. The treatment of the species given below grew out of many discussions with her and is a broad adaptation of her manuscript classification of Bermudian plexaurids, which she has generously put at my disposal. Miss DEICHMANN's examination of type material in European museums, especially DUCHASSAING & MICHELOTTI's types in Turin, has made possible the reduction of many synonyms, and her familiarity with the collections and works of A. E. VERRILL has disposed of others.

The generic arrangement employed here differs somewhat from that proposed by Miss DEICHMANN. In my opinion, the distinctive western Atlantic genera are: (1) *Muricea*, (2) *Muriceopsis*, (3) *Eunicella*, and (4) *Plexaurella*. The remainder fall into ill-defined groups that have taken the names *Plexaura*, *Pseudoplexaura*, *Plexauropsis*, *Eunicea*, and *Euniceopsis*. Miss DEICHMANN has shown that *Plexauropsis bicolor* Verrill is nothing more than *Pseudoplexaura crassa*, so *Plexauropsis* must yield to *Pseudoplexaura*. However, it is very difficult to defend the latter genus, which differs from *Plexaura* chiefly in its paucity of anthocodial spicules. According to VERRILL, *Euniceopsis* differs from *Eunicea* in the presence of a good anthocodial armature, and although this is a difference of degree, it proves to be consistent and is useful in dividing *Eunicea* sensu lato into two subgenera. We also find no little difficulty in distinguishing *Eunicea* from *Plexaura*. The accepted difference – projecting calyces in *Eunicea*, none in *Plexaura* – is so variable that it holds good only in extreme cases. When we refer to the spicules, we find that the species with prominent calyces have elongate spindles in the axial sheath, whereas those without have predominantly oval capstans. If this criterion is accepted, the species segregate in the two genera approximately as they have in the past, and the position of most questionable species can be decided. Unfortunately, there is variation in this character also, and some species with long spindles in the axial sheath have some capstans as well, and some predominantly with capstans may have spindles, especially near the tips of the branches, thus making practical application of the character rather difficult.

The last word remains to be said regarding the plexaurids. So many species have been described without figures that a re-examination of all pertinent types is necessary before the synonymies can be clarified in full. While studying plexaurids I have often fallen prey to perplexity, just as the user of these pages is certain to do. Species that could not be reconciled with any existing description or figure have been described as new even though it may develop that some or all of them have previously been described in an unrecognizable manner. Such a course seems preferable either to treating them as 'species indeterminatae' or to applying doubtful names to them.

Special methods of study. In studying specimens of plexaurids it is necessary to isolate with care the spicules from the various strata of coenenchyme. To obtain an uncontaminated sample of axial sheath spicules, take only the tissue between the longitudinal canals and the axis; this may adhere to the axis when the outer rind of dry specimens is broken away, or may be seen as a thin, purple layer lining the axis cavity when an alcoholic specimen is split open longitudinally. Because of the variation of spicules from tip to base of the colonies, samples should be examined from the terminal branches, from the middle region, and from the base of the specimen. The spicules of the terminal branches are more nearly constant in form than those of other regions and have be used in drawing up the keys herein, with qualifications regarding variation in cases that seemed especially misleading.

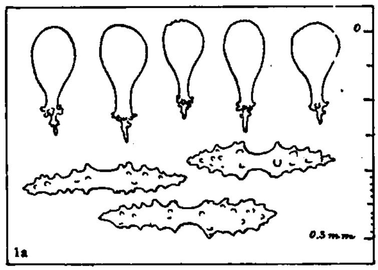
The anthocodial armature is best observed in alcoholic specimens, preferably expanded, but it can be studied satisfactorily in dry material as well. The retracted polyp should be dissected out under the stereoscopic microscope, then soaked for a few moments in a drop of dilute potassium hydroxide. After this, rinse in a drop of water, teasing away any adhering cortical tissue that may remain, and transfer to glycerin. Observation under moderate powers of the compound microscope may be facilitated by the use of crossed polaroid filters, one in the substage, the other in the ocular.

Key 10

Illustrated key to the West Indian genera of the Plexauridae

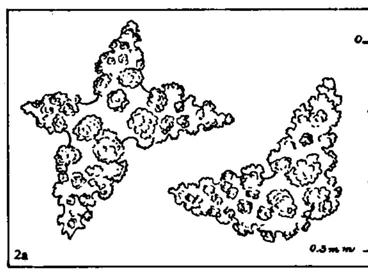
1a. Surface of rind with a dense layer of flask-shaped balloon-clubs; inner layer with double spindles: Genus *Eunicella*

1b. No superficial layer of balloon-clubs: 2



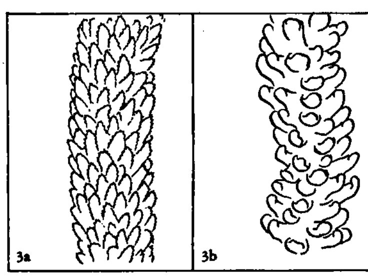
2a. Characteristic spicules of the cortex are large, 4-rayed 'butterfly' spicules; no purple spicules in the axial sheath: Genus *Plexaurella*

2b. Four-rayed spicules do not predominate in the rind: 3



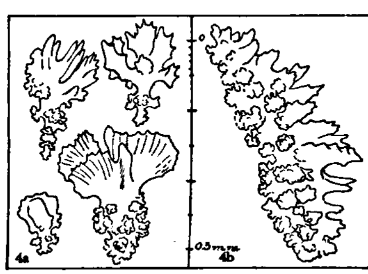
3a. Polyps always forming tall, pointed, shelf like calyces made rough by large, projecting spicules. Axial sheath without purple spicules: Genus *Muricea*

3b. Polyps often forming no calyces at all; when tall, they are not prickly because of projecting spicules. Some or all of the axial sheath spicules purple: 4



4a. Spicules of cortex in three layers: outer rind containing clubs of various form (never balloon-clubs); middle layer with spindles that often are much larger than the clubs; axial sheath with purple spindles and/or capstans: 5

4b. Spicules of cortex in two layers: outer rind containing large, unilaterally spinose spindles, but no layer of clubs at surface; axial sheath with symmetrical spindles, usually purple: Genus *Muriceopsis*

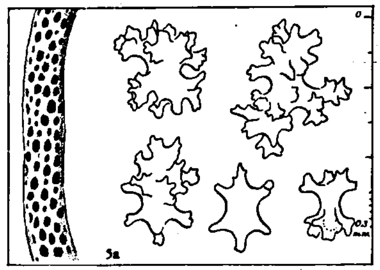


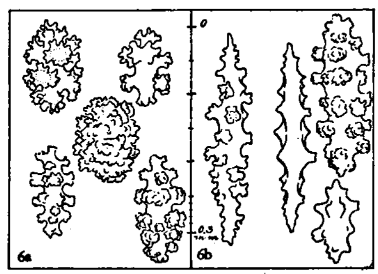
5a. Axial sheath with deep reddish purple capstans, irregular bodies, branched forms, and simple spindles. Polyps fully retractile, anthocodiae unarmed or with a few small rods; openings porelike, no projecting calyces: Genus *Pseudoplexaura*

5b. Axial sheath with capstans, spindles, or both, at least some of them purple or lavender, but no branched forms. Polyps with or without calyces; anthocodial armature moderate or strong: 6

6a. Axial sheath containing stubby capstans and/or stellate forms, always deep reddish purple: Genus *Plexaura*

6b. Axial sheath containing mostly spindles, or blunt spindles and capstans, the latter especially in the trunk and large branches, sometimes purple, sometimes partly violet, partly colorless: Genus *Eunicea*





Genus **Plexaura** Lamouroux, 1812

Plexaura Lamouroux 1812, p. 187. (Type species, *Gorgonia homomalla* Esper, by subsequent designation: Verrill 1912, p. 382.)
Plexaura, Moser 1921, p. 110.
Plexaura, Kükenthal 1924, p. 111.
Plexaura, Stiasny 1935d, p. 44.

Diagnosis. Plexaurids with the axial sheath spicules in the form of short capstans with six or eight rays, or belted rods that may develop into multiradiate spheroidal bodies, deep reddish purple in color. The spicules of the outer rind are chiefly clubs, foliate or thorny and, in some species, unilaterally foliate spindles. The middle layer contains ordinary warty spindles. The anthocodiae are armed with straight or curved rods that are more or less flattened, forming a crown with or without a collaret. Calyces not well developed, apertures pore-like or pit-like, sometimes with a raised rim, sometimes with a slight lower lip.

Distribution. Bermuda, southern Florida and the Gulf of Mexico south to Curaçao. The Indo-Pacific species attributed to the genus by various authors appear not to be congeneric with the West Indian species.

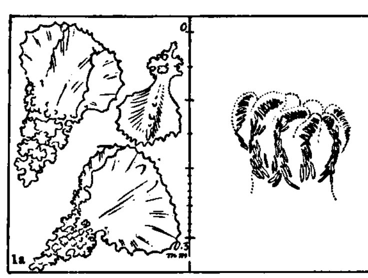
Remarks. The genus *Plexaura* is restricted to those species with predominantly short, reddish purple capstans in the inner rind, spindles and clubs of various kinds in the outer layers, and armature of more or less bent and flattened rods in the anthocodiae. *Pseudoplexaura* differs mainly in having the polyps completely unarmed or with at most a few tiny, flat rods.

I am able to distinguish only three species in the West Indian region: *Plexaura homomalla* (Esper), *P. nina* Bayer & Deichmann, and *P. flexuosa* Lamouroux.

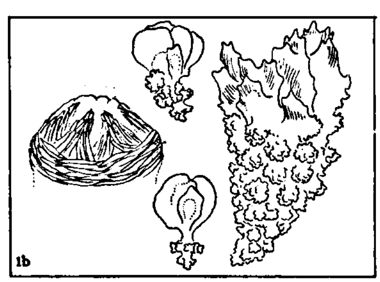
Key 11

Illustrated key to the species of *Plexaura*

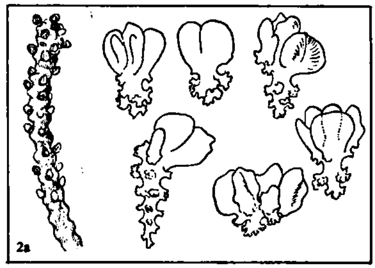
1a. Surface of rind with a dense layer of large leaf-clubs with 3 or 4 broad, serrate folia. Spindles of middle layer large and stout, 2 mm. or more in length. Anthocodiae with a crown consisting of 8 points but no collaret. Colonies brown, purple or yellow: *Plexaura flexuosa* Lamouroux



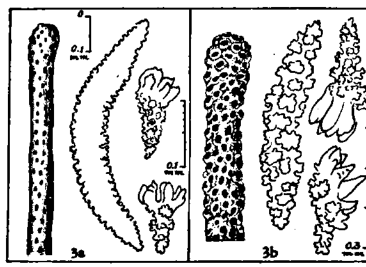
1b. Leaf-clubs of surface layer with several small, serrate blades or 2–4 smoothly rounded folia. Spindles of middle layer at most about 1 mm. long. Anthocodiae having a strong crown with collaret: 2



2a. Colonies sparsely branched, dichotomous, in one plane; end branches up to 25 cm. long and 1.5 mm. in diameter Anthocodiae commonly preserved exsert. Surface of rind containing clubs of moderate size with several smooth, rounded leaves: *Plexaura nina* Bayer & Deichmann



2b. Colonies profusely branched, end branches up to 10 cm. long and 2.5–5.0 mm. in diameter. Anthocodiae usually not preserved exsert. Surface of rind containing large clubs with laciniate folia: *Plexaura homomalla* (Esper)



3a. Colonies tall, end branches about 2.5 mm. in diameter: *Plexaura homomalla* forma *kükenthali* Moser

3b. Colonies broad, end branches 4–5 mm. in diameter: *Plexaura homomalla*, typical form

21 **Plexaura homomalla** (Esper), 1792 forma **homomalla**

(Fig. 20; Pl. I fig. 6, XVI)

?*Gorgonia humosa* ESPER 1791, *2*, p. 36, pl. 6. („Der Wohnplaz dieser Coralle ist mir unbekannt, wahrscheinlich aber ist es die Insel Curassao.")
Gorgonia homomalla ESPER 1792, *2*, p. 104, pl. 29. („Aus dem mittelländischen Meer.")
Plexaura homomalla, VERRILL 1907, p. 304, fig. 147, pl. 35A fig. 3. (Bermuda.)
Plexaura homomalla, KÜKENTHAL 1924, p. 117.
Plexauropsis tricolor STIASNY 1935a, p. 241. (Bermuda.)
?*Plexaura homomalla*, STIASNY 1935d, p. 66. (Mer amérique; Portorico.)
Plexauropsis tricolor, STIASNY 1935 d, p. 69, fig. R, pl. 3 fig. 12. (Bermuda.)
Plexaura flexuosa, STIASNY 1941d, p. 105. (Blanquilla, Venezuela.)

Diagnosis. Colonies bushy, flattened, branched laterally and dichotomously (Pl. I fig. 6). Polyps strongly armed with a crown resting upon a distinct transverse collaret. Axial sheath containing deep reddish purple capstans (Fig. 20 d, h, l); middle layer with white (rarely violet) spindles up to 0.8 mm. long (Fig. 20 a, e, j); outer layer with large, asymmetrical leaf-clubs with numerous

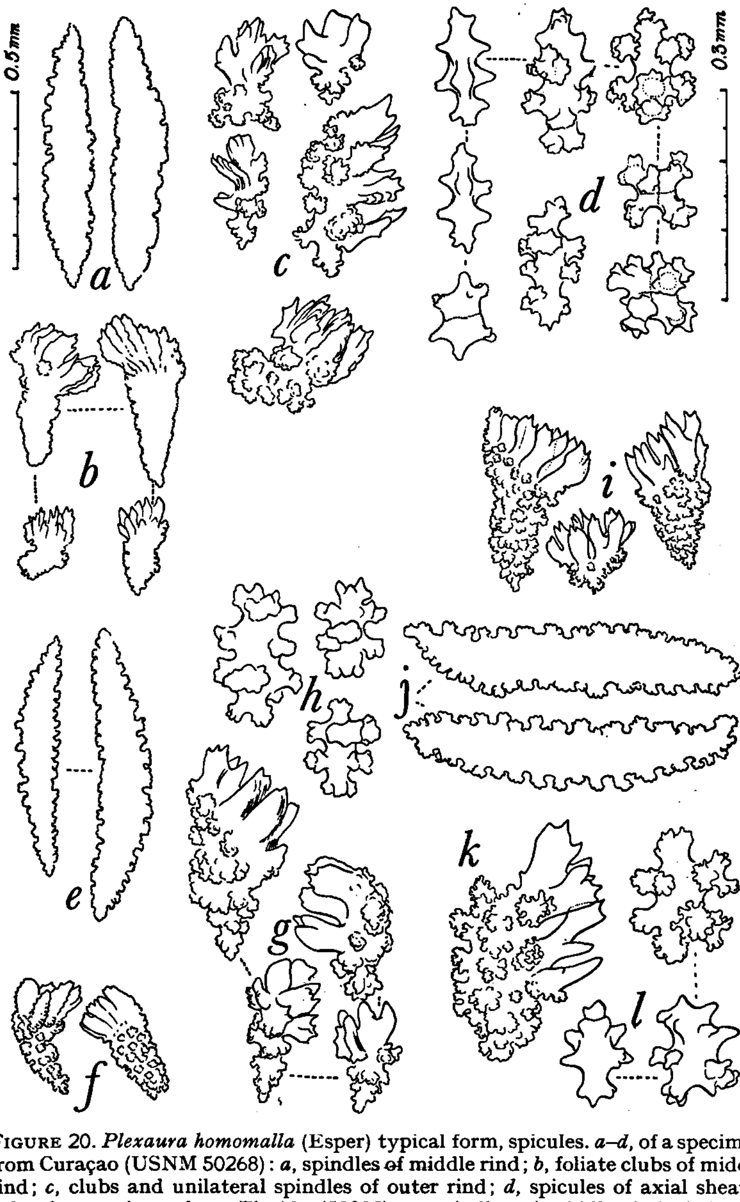


FIGURE 20. *Plexaura homomalla* (Esper) typical form, spicules. *a–d*, of a specimen from Curaçao (USNM 50268): *a*, spindles of middle rind; *b*, foliate clubs of middle rind; *c*, clubs and unilateral spindles of outer rind; *d*, spicules of axial sheath. *e–h*, of a specimen from Florida (50302): *e*, spindles of middle rind; *f*, foliate clubs of middle rind; *g*, clubs of outer cortex; *h*, spicules of axial sheath. *i–l*, of a specimen from Bermuda (Stiasny's type of *Plexauropsis tricolor*): *i*, foliate clubs of middle rind; *j*, spindles of middle rind; *k*, unilaterally foliate body from outer rind; *l*, spicules of axial sheath. (Enlargement of *a–b*, *e–f*, *i–j*, indicated by 0.5 mm. scale at *a*; that of *c–d*, *g–h*, *k–l* by 0.3 mm. scale at *d*.)

serrate leaves, up to about 0.5 mm. in length (Fig. 20 b, f, i). Cortex friable when dry, with granular surface and gaping calycular orifices, often with a raised rim. Colonies drying to a deep brown, blackish brown, or nearly black; purplish brown in alcohol.

Material. The collection of Dr. Hummelinck, deposited in the U.S. National Museum, includes the following: ARUBA, east coast at Rincón, on sandy reef debris, about 1 m. deep, sta. 1310A, 7.V.1955, dry branch of large colony (51312). CURAÇAO, Knip Bay, on rock, 1 m., sta. 1017, 8.I.1949, 2 dry specimens (50268). Plaja Djerimi, rock, 2.5–4 m., sta. 1019A, 29.I.1949, 2 dry spec. (50312). Boca Lagoen, 23.X.1948, 3 dry spec. (50311); north side, rock, 2 m., sta. 1020, 13.XI.1948, 8 dry spec. (50308). Boca Santoe Pretoe, sandy rock, 2 m., sta. 1022, 28.X.1948, 2 dry spec. (50309). Santa Marta Bay, Acropora-reef, 3 m., Dr. J. H. Stock, 8.X.1958 (51301; Amsterdam). KLEIN BONAIRE, east coast, reef debris on sandy beach, 1–1.5 m, sta. 1049B, 13.IX.1948, fragments in alcohol (50502); sandy reef, 3 m., sta. 1049C, 13.IX.1948, fragments in alc. (50683). BONAIRE, north of Punt Vierkant, sandy reef, 2 m., sta. 1059B, 9.IX.1948, dry spec. (50307). BLANQUILLA, Playa Valuchu, sandy bottom, 3 m., 21.VII.1936, 2 dry spec. described by Stiasny 1941, p. 105. ST. BARTHÉLEMY, La Fourche, rock debris, 2 m., sta. 1124, 2.VI.1949, dry spec. (50310).

USNM specimens from BERMUDA, FLORIDA, and the BAHAMAS were used for comparison, and, in addition: JAMAICA, Lime Cay, Port Royal Cays (51353, 51371, 51373); Pigeon Island (51370); Don Christopher's Cove near St. Ann's Bay (51369); GRAND CAYMAN (51372); MEXICO, Arrecife Alacranes, Yucatan (51430, 51450, 51451, 51462), Mujeres Harbor, Quintana Roo (51753–51755). Fragments of the types of *Plexauropsis tricolor* Stiasny, from Bermuda, were made available by the Leiden Museum.

Distribution. Bermuda, southern Florida, Caribbean islands.

Remarks. In its typical form, *Plexaura homomalla* is a highly characteristic species recognized as easily by its outward appearance as by its spicules. A large number of specimens examined resemble exactly the original figure given by ESPER, and their spicules are in agreement with those of ESPER's material figured by KÖLLIKER.

STIASNY's figure of *Plexauropsis tricolor* shows a small but typical specimen of *Plexaura homomalla*, and the spicules agree satisfactorily in form and size. The yellow-brown spicules of the middle layer reported by Stiasny are nonexistent; spicules of *P. homomalla* are very difficult to clean, and the organic matter remaining on them – especially on the ornately sculptured forms of the middle layer – may impart to them a brownish or yellowish color. When thoroughly clean, all spicules are purple or white.

Several specimens from southern Florida, the Bahamas, and Old Providence have an atypical form of growth which tends to be quite bushy when well developed with slender, flexible branchlets about 2.5 mm. in diameter. Colonies of this type were described by MOSER in 1921 under the name *Plexaura kükenthali*, which may be retained to designate this particular form.

21 **Plexaura homomalla** (Esper), 1792 forma **kükenthali** Moser, 1921

(Fig. 21; Pl. I fig. 5)

Plexaura kükenthali MOSER 1921, p. 117. (Kingston.)

Diagnosis. Colonies with branches more slender than in the typical form, the terminals about 15 cm. long and 2.5 mm. in diameter (Pl. I fig. 5). The large, laciniate clubs and asymmetrically foliate bodies characteristic of the typical form are reduced in size but still recognizable (Fig. 21 b, e); spindles of cortex (Fig. 21 a, d) and radiates of the axial sheath (Fig. 21 c, g) like those of the typical form.

Material. Single dry USNM specimens from: FLORIDA, Biscayne Key, 6–7 fms., F. M. Bayer coll., 26.VI.1950 (50611); upper Florida Keys, Caesar's Creek, James E. Benedict, 1901 (50477); NEW PROVIDENCE, Conrad Limbaugh, 1956 (50554); PUERTO RICO, *Fish Hawk* (42140); OLD PROVIDENCE, *Albatross*, 4–9.IV.1884 (50476).

Remarks. The specimen from Old Providence is a small colony, about 16 cm. tall, with rich lateral branching. The terminal branchlets are about 2.5 mm. in diameter, 3 cm. long, and distinctly clavate. The cortex is friable, without projecting calyces. Nearly all of the middle spindles are curved (Fig. 21 a).

The specimen from Caesar's Creek, Florida, is a larger colony, about 39 cm. tall, with longer terminal branches. It is densely bushy and the branches ascend nearly parallel with one another. The cortex is friable, and only part of the spindles are curved.

Plexaura homomalla forma *kükenthali* differs from the typical form in the slender branchlets and the dense ramification, which produce colonies proportionately taller and bushier, and in the suppression of the large, laciniate clubs characteristic of the typical form.

22 **Plexaura nina** Bayer & Deichmann, 1958

(Figs. 22, 28 b)

Plexaura nina BAYER & DEICHMANN 1958, p. 227, figs. 1–3. (Tongue of the Ocean, Great Bahama Bank.)

Diagnosis. Slender, sparsely branched, dichotomous colonies with terminal branches 1.5–2.0 mm. in diameter. Calyces low. Crown strong: 4–6 bent rods 'en chevron' beneath each tentacle

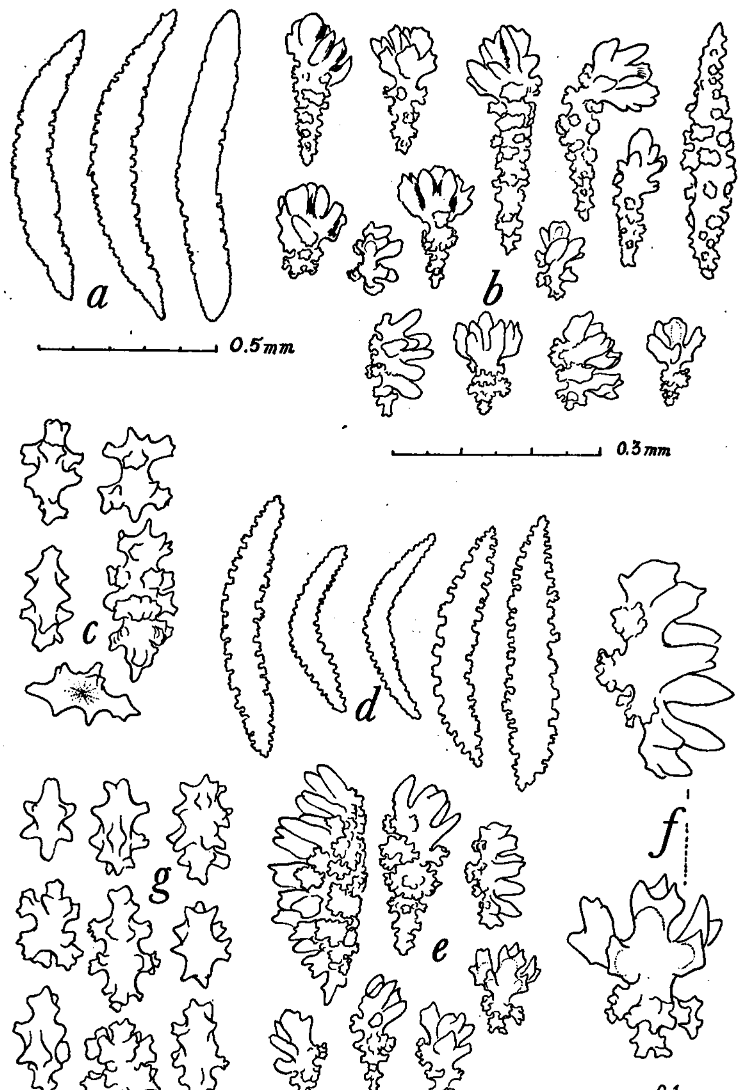


FIGURE 21. *Plexaura homomalla* forma *kükenthali* Moser, spicules. *a–c*, of a specimen from Old Providence (USNM 50476): *a*, spindles from middle rind; *b*, clubs and unilateral bodies from outer rind; *c*, spicules of axial sheath. *d–g*, of a specimen from Florida (50477): *d*, spindles from middle rind; *e*, clubs and unilateral bodies from outer rind; *f*, spicules from outer rind at greater magnification; *g*, spicules of axial sheath. (Enlargement of *a* and *d* indicated by 0.5 mm. scale at *a*; that of *b*, *c*, *e*, and *g* by 0.3 mm. scale at *b*; that of *f* by 0.1 mm. scale at *f*.)

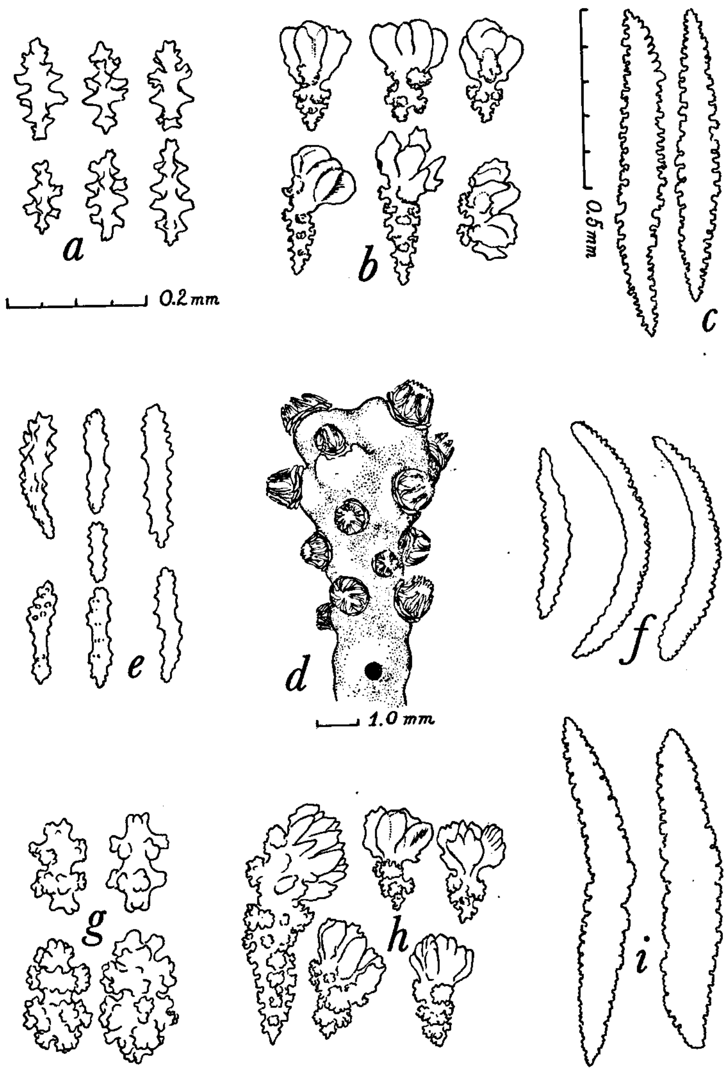


FIGURE 22. *Plexaura nina* Bayer & Deichmann; the holotype from the Great Bahama Bank (USNM 50562): *a*, spicules of the axial sheath from the end branch; *b*, clubs of the outer rind from an end branch; *c*, spindles of the middle rind from an end branch; *d*, branch tip; *e*, tentacular rods; *f*, bent spindles from the crown; *g*, spicules of the axial sheath from the main stem; *h*, clubs of the outer rind from the main stem; *i*, spindles of the middle rind from the main stem. (Enlargement of *a–b*, *e–h* indicated by 0.2 mm. scale at *a*; that of *c* and *i* by 0.5 mm. scale at *c*; that of *d* by adjacent 1.0 mm. scale.)

resting on a collaret of 2–3 transverse rows of curved rods. Outer cortex with leaf-clubs up to 0.15 mm. in length; middle layer with warted spindles up to 0.7 mm. in length, mostly white, some lavender; inner layer with bright purple capstans measuring 0.1 mm. in length, and spindles with simple warts, about 0.25 mm.; toward the base, the capstans increase in size and become the predominant form of sclerite.

Description. The complete type colony measures 40 cm. in height, with unbranched terminal twigs up to 15 cm. in length. Ramification is sparse, in one plane, and dichotomous; the branches arise at wide angles, between 45° and 90° (Fig. 27 b). The terminal branches are very flexible and slender, only 1.5–2.0 mm. in diameter. The branches increase in girth proximad only slightly, and the main trunk has a maximum diameter of about 5 mm. The polyps retract into low, mound-like calyces, but the anthocodial armature is so strong that many of them have been preserved exsert (Fig. 22 d). There are eight points of 4–6 bent rods 'en chevron' below the tentacles, over a collaret of about 2–3 rows of curved rods; these major spicules of the crown are large, as much as 0.7 mm. in length (Fig. 22 f). In the tentacles there are numerous flat rods, straight or curved, with serrate edges; these measure about 0.2 mm. (Fig. 22 e). At the apex of each point, where the tentacles bend sharply, the protruding end of the rods may be enlarged and spinose. The outer layer of cortex contains numerous leaf clubs of rather small size and some unilaterally foliate capstans. Near the branch tips the clubs are mostly 0.1–0.15 mm. in length (Fig. 22 b), but toward the base of the colony they become larger and coarser, attaining a length of 0.2 mm. (Fig. 22 h). Spindles with one end enlarged and asymmetrically foliate occur near the calycular margins. The middle layer of rind contains coarsely tuberculate spindles ranging in length from 0.6 mm. at the branch tips (Fig. 22 c) to 1.2 mm. at the base (Fig. 22 i). In the branches most of the spindles are white, but toward the base some of them are purple. The axial sheath contains bright purple capstans and, near the branch ends, some spindles with prominent, simple processes (Fig. 22 a). In the distal parts of the colonies the capstans measure about 0.1 mm. and the spindles 0.25 mm.; toward the base the capstans may be as long as 0.15

mm., and the spindles disappear (Fig. 22 g). In alcohol the rind is purplish brown and the calycular margins are nearly white; the exsert anthocodiae are white.

Material. The type colony and a fragment, from the south end of the Tongue of the Ocean, GREAT BAHAMA BANK, 23°34'00" North, 76°33'00" West, 36 fms., bottom 74.2°F., *Albatross* sta 2649, 12.IV.1866 (USNM 50562).

Distribution. Known only from the type locality.

Remarks. *Plexaura nina* is similar to *P. homomalla* in many respects. It differs in its lax and straggly growth form with very slender twigs, its small leaf-clubs, and its unusually strong crown. The clubs are similar in form to those of *P. homomalla* but are much smaller, and the spindles are more slender.

It is interesting that deep-water representatives of the commonest reef-dwelling genera, *Plexaura*, *Eunicea*, and *Pseudopterogorgia*, should appear in a single haul. They are indicative of a quiet-water facies of the reef habitat. It would be very instructive to observe the changes in the gorgonian fauna at this locality, beginning with the typical reef habitat and descending to the level of the present specimens, or deeper. Such a study would certainly be possible with modern diving apparatus.

23 **Plexaura flexuosa** Lamouroux, 1821

(Fig. 23; Pl. IV fig. 4, XVI, XVII)

Plexaura flexuosa LAMOUROUX 1821, p. 135, p. 70 figs. 1–2. (Havana.)
Plexaura salicornoides MILNE EDWARDS & HAIME 1857, *1* p. 153, pl. B2 fig. 2. (Martinique.)
Plexaura mutica DUCHASSAING & MICHELOTTI 1860, p. 28, p. 3 figs. 9–10. (St. Thomas.)
Eunicella marquesarum KÜKENTHAL 1919, p. 906. (Marquesas Inseln.)
Plexaura flexuosula KÜKENTHAL 1924, p. 118.
Plexaura flexuosa, GORDON 1925, p. 19, pl. 4 fig. 4 a–c. (Curaçao.)
Plexaura mutica, GORDON 1925, p. 17, pl. 3 figs. 1, 8; pl. 4 fig. 1. (Curaçao.)
Plexaura flexuosa, STIASNY 1935d, p. 57, pl. 4 fig. 18, pl. 7 figs. 35–36. (Haiti; Martinique; Curaçao; Tortugas.)
Plexaura edwardsi, STIASNY 1935d, p. 51, fig. 0, pl. 4 figs. 19–20, pl. 7 fig. 34. (Bermuda; Dry Tortugas.)
Eunicea humilis, STIASNY 1935d, p. 74, fig. T, pl. 3 fig. 14, pl. 7 fig. 32. (Curaçao.)
Eunicea hicksoni STIASNY 1935c, p. 115. (Curaçao.)
Eunicella marquesarum, STIASNY 1938, p. 27, pl. 3 figs. 9–10, pl. 8 figs. 30, 33. [KÜKENTHAL's type redescribed and figured.]
not *Plexaura flexuosa*, STIASNY 1941d, p. 105. [= *Pl. homomalla*.]

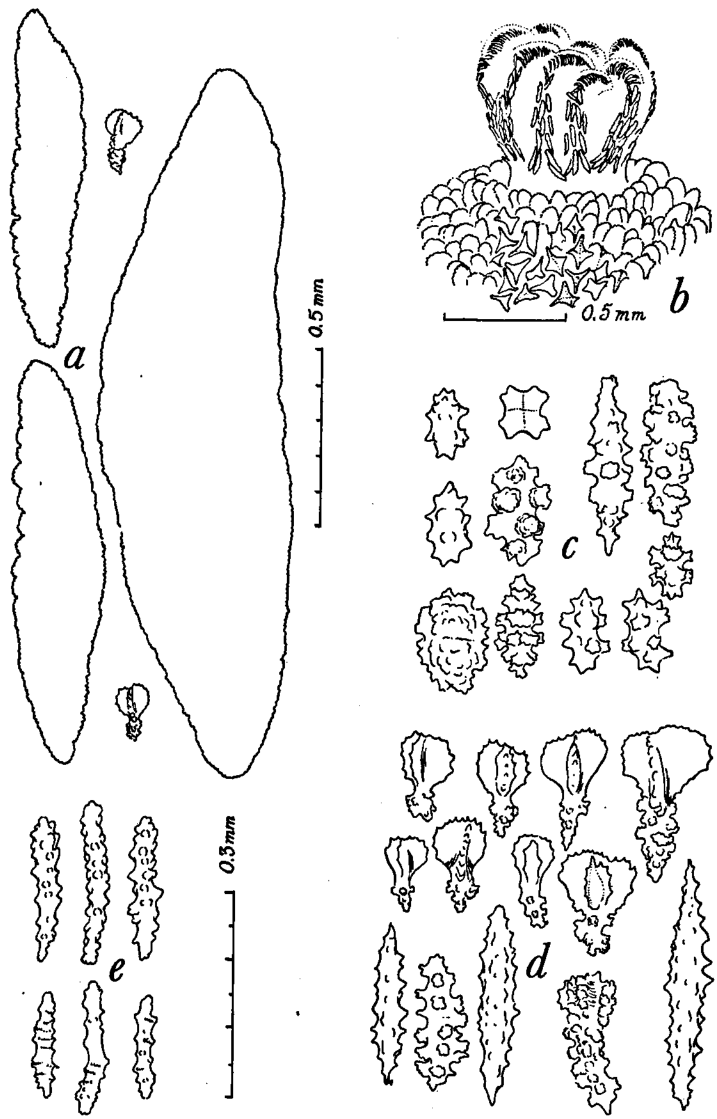


FIGURE 23. *Plexaura flexuosa* Lamouroux; spicules of a specimen from Curaçao (USNM 50270): *a*, large spindles of the middle layer of rind with two clubs drawn to the same scale; *b*, exsert anthocodia showing arrangement of the spicules as a crown without collaret; *c*, spicules of the axial sheath; *d*, leaf-clubs of the surface layer and spindles of underlying layer of rind; *e*, anthocodial rods. (Enlargement of *a* indicated by 0.5 mm. scale adjacent; that of *b* by 0.5 mm. scale adjacent; that of *c–e* by 0.3 mm. scale at *e*.)

Diagnosis. Branching profuse and bushy but usually tending to spread in one plane (Pl. IV fig. 4). Apertures commonly with an inconspicuous lower lip, especially near tips of branches. Anthocodial armature without collaret (Fig. 23 b), consisting of tuberculate rods (Fig. 23 e). Surface layer of rind with large leaf-clubs about 0.2 mm. long (Fig. 23 d); middle layer with stout spindles up to 2.0 mm. in length (Fig. 23 a); axial sheath with deep reddish purple capstans, stellate bodies, and short, belted rods (Fig. 23 c). Color of colonies purple, yellow, or brown.

Material. The following specimens from Dr. Hummelinck's collection, deposited in the U.S. National Museum: ARUBA, east coast at Rincón, sandy rock debris, 1.5 m., sta. 1310A, 7.V.1955, dry fragments of a large, densely branched specimen 30 cm. high, 45 cm. wide (50738). One small, damaged colony, J. G. van den Bergh, 1955, dry (51301). CURAÇAO, Westpunt, R. Flachs and J. van der Werf, 5.XII.1954, branch in alcohol (51272). Plaja Djerimi, on piece of rock among sand and eelgrass, 4 m., sta. 1019A, 29.I.1949 dry spec. (50305). Boca Lagoen, rock, 2 m., sta. 1020, 13.XI.1948, dry spec. (50270). Boca Santoe Pretoe, sandy rock, 2 m., sta. 1022, 28.X.1948, 3 dry spec. (50306). Santa Marta Bay, Acropora reef, 3 m., J. H. Stock, 8.X.1958 (51300; Amsterdam). Blauwbaai, reef, 3 m., J. H. Stock, 17.X.1958 (51309; Amsterdam). Piscadera Bay, 2 m., J. H. Stock, 10.XI.1958 (51302; Amsterdam). BONAIRE, Lac, sandy reef, 1–2 m., sta. 1068 a, 1.X.1948, fragments in alc. (50506). ST. EUSTATIUS, Gallows Bay, rock, 2 m., sta. 1116B, 15.VI. 1949, dry spec. (50303). ANGUILLA, north of Sandy Ground, sandy reef, 2 m., sta. 1142, 19.VI.1949, 2 dry spec. (50304).

In addition to this material, specimens from the same Museum have been consulted: FLORIDA, Miami (50251); BAHAMAS (44105, 50351, 50352, 50370, 50555, 50659, 50718, 50727); CUBA (50699); SABA BANK (50336); ST. KITTS (50339); ANTIGUA (50338); ST. LUCIA (50337); OLD PROVIDENCE (50366); MEXICO, Blanquilla Reef, Cabo Rojo (50915); GRAND CAYMAN (51374); JAMAICA, Pigeon Island (51375, 51376, 51379), Don Christopher's Cove near St. Ann's Bay (51378), Lime Cay, Drunkenman's Cay, Port Royal Cays (51377, 51380); MEXICO, Arrecife Blanquilla and Isla Sacrificios, Veracruz (51454, 51455, 51458), Cayo Arenas and Arrecife Alacranes, Yucatan (51431–51433, 51445), Bahia de la Ascension and B. de la Espiritu Santo, Quintana Roo (51764, 51768, 51769). The Leiden Museum supplied samples of P. J. H. Molengraaff's specimen from Curaçao (Gordon 1925, p. 19) and Stiasny's type of *Eunicea hicksoni*, also from Curaçao.

Distribution. Bermuda, southern Florida, the Antilles, and the Caribbean islands.

Remarks. This widespread species is one of the commonest gorgonians to be found on the reefs throughout its range. Because of its variable outward appearance it has received many names in the literature, but it is always recognizable by its beautiful, large leaf-clubs with serrate folia, and its coarse, large spindles.

Small colonies are usually branched in one plane, but larger ones become quite bushy although still distinctly flattened. The diameter of the final branchlets ranges from 2.5 to 4.5 mm.; they may be slightly clavate, or tapered. The coenenchyme around the apertures is usually a little raised, especially beneath, so as to form a small lip below each orifice.

The colonies may range in color from nearly white through yellow, pale brown, dark brown and purple to reddish purple. The axial sheath spicules are always deep reddish purple; the outer ones may be colorless, yellow, or violet, according to the color of the colony.

Genus **Pseudoplexaura** Wright & Studer, 1889

Pseudoplexaura WRIGHT & STUDER 1889, p. 141. (Type species *Pseudoplexaura crassa* W. & S. (not Ellis & Sol. 1786) = *Gorgonia porosa* Houttuyn 1772, by monotypy.)

Plexauropsis VERRILL 1907, p. 309. (Type species, *Plexauropsis bicolor* Verrill = *Pseudoplexaura crassa* Wright & Studer = *Gorgonia porosa* Houttuyn, by monotypy.)

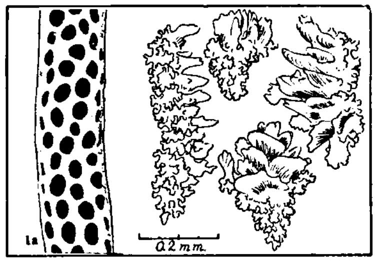
Diagnosis. Axial sheath with irregular multiradiate bodies, capstans and, near the branch tips, sharp spindles, all sculptured with prominent, complex tubercles, deep reddish purple in color. Outer rind with small leaf-clubs or smooth-headed wart-clubs, one-sided spiny spindles, and capstans, all colorless. Middle rind with spindles of moderate size, usually about 1 mm. in length, opaque white or purple in color. Polyps lacking spiculation or at most with a few delicate flat rodlets, retracting fully within gaping, oval pores, with no trace of projecting calyces. Rind smooth, creamy or yellowish white, often with the purple spicules of the inner layers showing through; occasionally all purple.

Distribution. Bermuda; Florida Keys; Bahamas; Antilles.

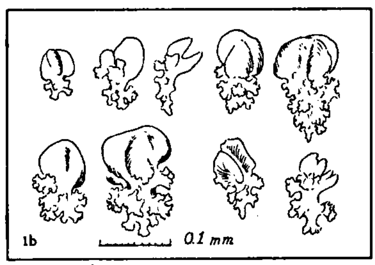
KEY 12

ILLUSTRATED KEY TO THE SPECIES OF *Pseudoplexaura*

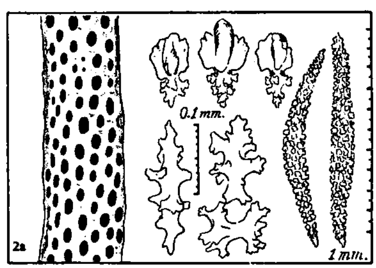
1a. Outer layer of cortex with large clubs, up to 0.4 mm. long, coarsely and thornily sculptured, grading into unilaterally spinose spindles; slender spindles as much as 1 mm. long, with tall, widely spaced tubercles, predominate. Calicular apertures widely gaping in dry material, separated by less than their own diameter: *Pseudoplexaura porosa* (Houttuyn)



1b. Outer cortex with a dense superficial layer of small, compact clubs with globular or foliate heads, mostly under 0.2 mm. long. Spindles not the dominating spicule form: 2



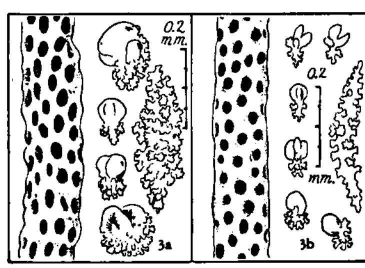
2a. Terminal branches cylindrical and rather stout, up to 6 mm. in diameter; colonies broad and bushy. Outer cortex with small leaf-clubs mostly 0.1 mm. in length, and slender, closely tuberculated spindles reaching 1 mm. or slightly more. Axial sheath with bright purple spindles and capstans: *Pseudoplexaura crucis* spec. nov.



2b. Terminal branches slender and tapering, 3–4 mm. in diameter; colonies tall and ascending. Spindles small, usually under 0.5 mm. in length: 3

3a. Clubs reaching a length of 0.2 mm., usually with globose heads, rarely foliate. Spindles stout, with close, complicated sculpture. Colonies of moderate size: *Pseudoplexaura wagenaari* (Stiasny)

3b. Clubs mostly 0.1 mm. long, with heads composed of a few rounded folia, only occasionally globose. Spindles slender. with distant, rather simple sculpture, Colonies tall: *Pseudoplexaura flagellosa* (Houttuyn)



24 **Pseudoplexaura porosa** (Houttuyn), 1772

(Fig. 24 a–c; Pl. I fig. 1–2, XVIII)

Gorgonia porosa Houttuyn 1772, p. 335, pl. 123 fig. 4.
not *Gorgonia crassa* ELLIS & SOLANDER 1786, p. 91. [= *Pseudoplexaura flagellosa* (Houttuyn).]
Gorgonia porosa, ESPER 1791, *2*, p. 49, pl. 10. ('Zur Zeit ist der Aufenthalt dieser Gattung noch nicht bekannt ...')
Pseudoplexaura crassa, WRIGHT & STUDER 1889, p. 142, pl. 33 fig. 3. (Bermuda.)
Pseudoplexaura crassa, VERRILL 1907, p. 307, figs. 150–152, pl. 33, pl. 36B fig. 3 [not pl. 36A as stated]. (Bermuda.)
Pseudoplexaura crassa, CHESTER 1913, p. 737. (Bermuda.)
?*Plexaura ramosa* MOSER 1921, p. 117. (Kingston, Westindien.)
Plexaura porosa, GORDON 1925, p. 21, pl. 3 fig. 5, pl. 4 fig. 5. (Caracas Bay, Curaçao.)
Pseudoplexaura crassa, GORDON 1925, p. 21, pl. 3 fig. 6, pl. 4 fig. 6. (Caracas Bay, Curaçao.)
Plexaurella vermiculata, var. *porosa* DUBROWSKY 1934, p. 2, figs. 1–6. (Dry Tortugas.)
Plexaurella dubrovskyi STIASNY 1935a, p. 238. (Tortugas.)
Plexaurella dubrovskyi, STIASNY 1935d, p. 28, fig. G, pl. 3 fig. 15. (Tortugas, Dubrowsky's material.)
Plexaurella van der horsti STIASNY 1935 a, p. 238. (Caracas Bay, Curaçao.)
Plexaurella vanderhorsti, STIASNY 1935d, p. 33, fig. I, pl. 3 fig. 11. (Caracas Bay, Curaçao.)

Diagnosis. Outer layers of rind containing abundant colorless spindles reaching 0.6–1.0 mm. in length, with prominent but widely spaced tubercles (Fig. 24 c), commonly developed as strong spines along one side, and large clubs up to 0.4 mm. in length, grading into the unilaterally thorny spindles (Fig. 24 a). Spicules in the deeper layers of the rind colored deep purple, spindles often branched and forming 3- or 4-rayed bodies (Fig. 24 c). Axial sheath with deep purple capstans (0.1–0.15 mm.), small spindles (0.2 mm. and longer), and irregular bodies (0.15 mm. and larger) (Fig. 24 b). Anthocodiae unarmed. Apertures oval, gaping, about 1 × 1.5 mm. in diameter, closely set in weakly spiraling vertical series, separated by less than their own diameter. No trace of calicular projections. Colonies attaining large size, up to 2.25 m. Terminal branches (dried) of typical specimens about 4 mm. in diameter, but as thick as 7 mm. in stout colonies ('*dubrovskyi*-form') and as slender as 2 mm. in tall colonies with reduced cortical spiculation (*Plexaura turgida* Ehrenberg sensu Moser and Kükenthal). Color (dry), light brown or ivory white; in alcohol, white or gray; in life, light yellow or brownish (VERRILL 1907), deep reddish purple or 'pansy purple' of Ridgway (L.W. PETERSON, original observation 1960).

Material. Several USNM specimens have been studied, including a fragment of Esper's material sent to Verrill by Kölliker (MCZ 4441; USNM 50927); 16 specimens from BERMUDA, E. Deichmann (50081) and L. W. Peterson (51688–51702); FLORIDA, off Biscayne, Elliott and Ragged Keys (50252, 50257, 51686), Key West (50496, 50541), and DRY TORTUGAS (1629); BAHAMAS (16932, 50134, 51687); Virgin Islands, ST. JOHN (51703); JAMAICA, Pigeon Island (51381, 51382); and YUCATAN, Isla Pérez, Arrecife Alacranes, F. Bonet (51449).

Also several of the stout '*dubrovskyi*-form', including a fragment of the type from Dry Tortugas, H. Boschma, through the courtesy of the Leiden Museum; 2 specimens from Bermuda (51704, 51705); Florida, Dry Tortugas (50340, 50497); and Yucatan, Isla Pérez, Arrecife Alacranes (51443).

A number of the slender, flaccid '*turgida*-form' from Bermuda (50678); Florida, upper Keys (50735, 51708, 51709), Key West (50592); PUERTO RICO, s. of Vieques Is., *Oregon* sta. 2628 (51710); and COLOMBIA, off Golfo de Morrosquillo, *Albatross* sta. 2143 (7616).

Several colonies questionably assigned to *P. porosa*, but differing in the presence of small clubs in the outer rind, from Florida, off Key Largo (51706); Bahamas, New Providence (49787, 50717); OLD PROVIDENCE Is. (51707); and Yucatan, Isla Pérez, Arrecife Alacranes (51434).

Distribution. Bermuda; southern Florida; West Indies south to Colombia and Curaçao. Although this is primarily a reef-inhabiting species, the records from Vieques Is. (51710) and Colombia (7616) are from 120 and 155 fathoms, indicating that it may descend considerably below the limit of reef growth.

Remarks. All specimens in which the predominant spicules of the outer rind are large spindles with prominent tubercles, many of them unilaterally spinose, and in which the clubs are large and thorny, have been treated as *P. porosa*. Specimens with these characters show considerable variation in external form, from thickly arborescent colonies with rather stout cylindrical branches exactly resembling HOUTTUYN's figure, to a more slender, ascending growth form with very soft, flexible, tapered branches. Some colonies of the latter form have extraordinarily few spicules in the outer rind which is thus extremely flaccid (*Plexaura turgida* Ehrenberg, KÜKENTHAL 1924, p. 114, partim), and others have some small clubs and capstans in the outer layer, somewhat like those of *P. wagenaari* and *P. flagellosa*. When the effect of environmental factors upon growth form and spiculation has been investigated thoroughly, it may prove that these variants actually are distinct species, but my material does not provide adequate justification for their separation at the present time.

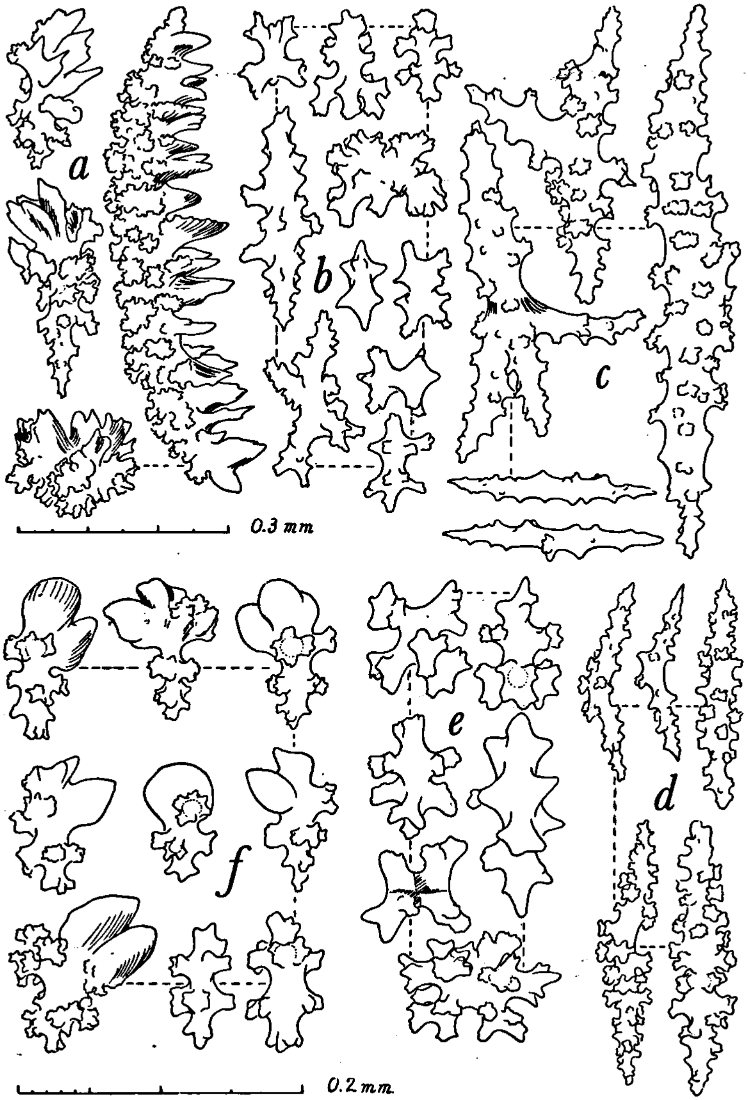


FIGURE 24. *Pseudoplexaura porosa* (Houttuyn); spicules of a specimen from Bermuda (USNM 51692): *a*, laciniate clubs and spindles of outer rind; *b*, purple spicules of axial sheath; *c*, white spindles and purple branched bodies of deeper layer. *Pseudoplexaura flagellosa* (Houttuyn); spicules of a specimen from Bermuda (51714): *d*, purple and white spindles of outer rind; *e*, purple spicules of axial sheath; *f*, colorless clubs and capstans of outer rind. (Enlargement of *a–d* indicated by 0.3 mm. scale at *a*; that of *f* by 0.2 mm. scale below.)

25 **Pseudoplexaura flagellosa** (Houttuyn), 1772

(Fig. 24 d–f; Pl. XVIII)

Lithophyton Americanum, maximum, cinereum, cortice punctato TOURNEFORT 1700, p. 34 and plate.
Gorgonia flagellosa HOUTTUYN 1772, p. 336. [The specimen represented by Tournefort's figure of Lithophyton Americanum, maximum, cinereum, etc., 1700, p. 34, is here selected as lectotype of *G. flagellosa*.]
Gorgonia crassa ELLIS & SOLANDER 1786, p. 91. [The specimen represented by Tournefort's figure of Lithophyton Americanum, maximum, cinereum, etc., 1700, p. 34, cited in synonymy by ELLIS & SOLANDER, is here selected as lectotype of *G. crassa*.]
not *Gorgonia Antipathes* LINNAEUS 1758, p. 801.
Gorgonia Antipathes (pars), ESPER 1791, *2*, p. 90, pl. 23 [but not 24–27].
Plexaura antipathes, KÖLLIKER 1865, p. 138, pl. 18 figs. 21–22.
Plexaura Esperi VERRILL 1907, p. 305, figs. 153–155. (Bermuda.)
?*Plexaura laevigata* MOSER 1921, p. 118. (Westindien.)
?*Plexaurella porosa* GORDON 1925, p. 22, pl. 3 fig. 9, pl. 4 fig. 7. (Caracas Bay, Curaçao.)
not *Plexaura porosa*, GORDON 1925, p. 21, pl. 3 fig. 5, pl. 4 fig. 5. [= *Pseudoplexaura porosa* (Houttuyn).]
?*Plexaurella porosa*, STIASNY 1935b, p. 31, fig. H. [Gordon's type redescribed and figured.]

Diagnosis. Outer layers of rind containing few to moderately abundant small, slender spindles, many of them bent, both purple and white, with prominent, not very crowded tubercles, up to 0.5 mm. in length but usually smaller (Fig. 24 d), and numerous colorless capstans (about 0.1 mm.) and small leaf-clubs (mostly 0.1 mm. but up to 0.15 mm.) (Fig. 24 f). Axial sheath with deep purple 6-, 7- and 8-radiate capstans, sometimes becoming complex but remaining rather small, mostly under 0.15 mm. in the terminal branches, and small spindles (Fig. 24 e). Anthocodiae weakly armed with a few flat rodlets. Apertures porelike, usually under 1 mm. in diameter, separated by their own diameter or more, in irregular vertical rows. No projecting calyces. Colonies moderately large, reaching a height of 1 m., possibly more; branching dichotomous, end branches long and ascending, 2–3 mm. in diameter (Pl. XVIII). Color (dry), light yellowish brown or purplish brown; in alcohol, pale gray or white.

Material. Ten USNM specimens, including 3 from BERMUDA, L. W. Peterson 25. VIII. 1960 (51712–51714); 2 from FLORIDA, near Key West, E. Palmer (50372) and *Fish Hawk* sta. 7295 (50371); 3 from Virgin Islands, ST. JOHN, C. R. Shoemaker 10. VII. 1915 (49772) and T. Chess 9. I. 1960 (51566), ST. CROIX, R. E. Schroeder VIII. 1960 (51711); JAMAICA, Little Pelican Cay, A. Fontaine 22. III. 1953 (51383); GRAND CAYMAN, C. B. Lewis XII. 1944 (51354).

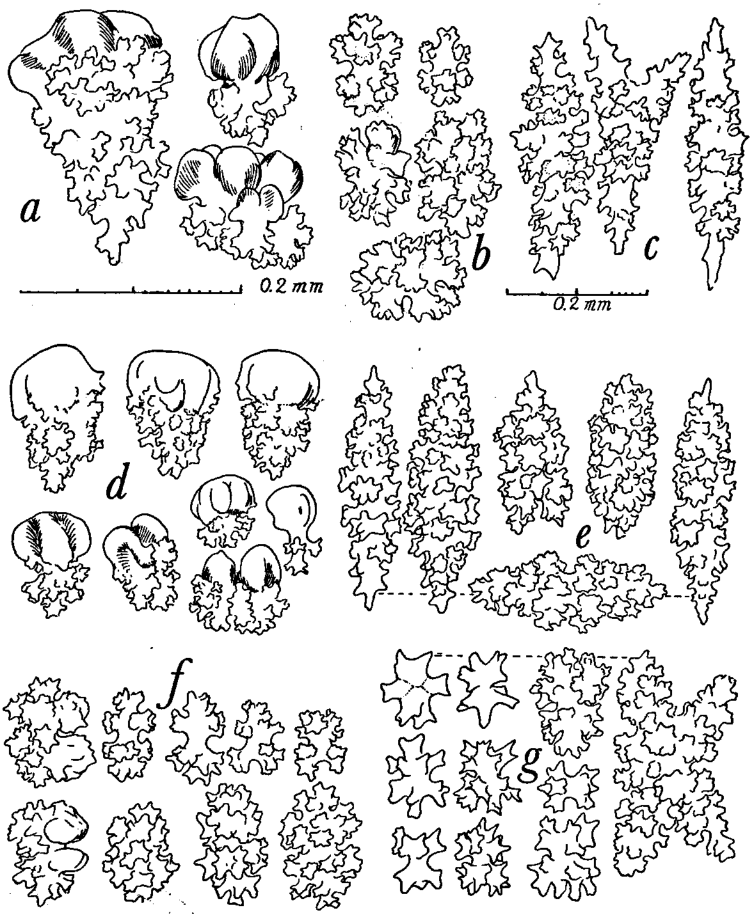


FIGURE 25. *Pseudoplexaura wagenaari* (Stiasny); *a–c*, spicules of syntype from Los Frailes (USNM 50741): *a*, clubs of outer layer; *b*, white capstans, purple and white irregulars; *c*, spindles. *d–g*, spicules of a specimen from Florida (6917): *d*, clubs; *e*, outer spindles; *f*, colorless capstans and irregulars of outer layer; *g*, purple capstans and irregulars of axial sheath. (Enlargement of *a* shown by adjacent 0.2 mm. scale; that of *b–g* by 0.2 mm. scale at *c*.)

Distribution. Bermuda; Florida Keys; West Indies, as far south as Curaçao?

Remarks. This species is easily recognized by the short, rather narrow spindles and the small leaf-clubs and capstans of the outer cortex. The apertures are never so large as in *P. porosa*, the colonies are not quite so robust and profusely branched, and the dichotomy of branching is more regular.

This clearly is the *Gorgonia antipathes* that ESPER illustrated on his plate 23, the spicules of which were illustrated by KÖLLIKER (1865), and is beyond any doubt the species called *Plexaura esperi* by VERRILL. Moreover, the Lithophyton Americanum, maximum, cinereum, cortice punctato of TOURNEFORT, which HOUTTUYN called *Gorgonia flagellosa*, is very probably this species, as *G. porosa* has quite a different aspect and *P. wagenaari* is neither so large nor so profusely branched. I have elected to submerge ELLIS & SOLANDER's *G. crassa* as a synonym of *flagellosa* by designating TOURNEFORT's specimen as the lectotype of their species rather than HUGHES's 'Incrusted Sea-Rod', which they also cite in their description of *crassa*, because that is undoubtedly the well-known *Plexaura flexuosa* of LAMOUROUX.

26 **Pseudoplexaura wagenaari** (Stiasny), 1941

(Fig. 25; Pl. I fig. 3, XIX)

Plexaura wagenaari STIASNY 1941d, p. 103, fig. A, pl. 1 figs. 1–4. (La Pecha and Puerto Real, Los Frailes.)

Diagnosis. Outer layer of rind containing abundant clubs with thick, spheroidal heads sometimes 3-flanged, sometimes multifoliate, especially the largest which may exceed 0.2 mm. in length, usually globose and sometimes twinned in the smaller (Fig. 25 a, d); many colorless capstans, which become quite complicated when fully developed (Fig. 25 b, f); and rather small spindles, both white and purple, mostly under 0.5 mm. in length (usually 0.2–0.4 mm.) and moderately stout, with close set, complicated tubercles (Fig. 25 c, e). Axial sheath with purple capstans, many of them becoming complicated spheroids of very deep color when fully developed, and purple spindles like those of the outer rind, some of which are branched, producing 3- and 4-rayed bodies (Fig. 25 g). Anthocodiae weakly armed with a few flat rodlets. Apertures porelike, oval, 0.5–1.0 mm. in diameter, usually separated by more than their own diameters, but in some colonies rather crowded. No projecting calyces, but the lower rim of the apertures may be slightly raised.

Colonies rather small, usually under 30 cm. in height, dichotomously branched, with a few long, slender, tapered end-branches 3–4 mm. in diameter (Pl. I fig. 3, XIX). Color (dry), gray or brown; in alcohol, pale gray or brown to almost white; in life, rose, gray, or light greenish gray, polyps chestnut brown to dark brown (STIASNY); sometimes purple (L. W. PETERSON, original observation).

Material. A fragment of one of the types, collected by Hummelinck on the islands of Los FRAILES: La Pecha, sandy debris, 2 m., sta. 1215, 19. VI. 1936, was made available by the Rijksmuseum van Natuurlijke Historie, Leiden, through the kindness of Dr. L. B. Holthuis (USNM 50741). Also studied by Stiasny were four fragments from Los Frailes, Puerto Real, sandy debris, 3–4 m., sta. 1214, 18. VI. 1936 (not examined by me).

The collections of the U.S. National Museum also contain 2 specimens from BERMUDA, L. W. Peterson 25. VIII. 1960 (51715) and 3. IX. 1960 (51716); FLORIDA, 4 from Ragged Keys and Caesars Creek, J. E. Benedict 1901 (50349, 50350, 50761), 2 off Elliott Key, F. M. Bayer 13. III. 1948 and 1. IX. 1951 (50258, 50736), 29 specimens from between John's Pass and Pass-a-Grille, H. Hemphill I. 1884 (6917), one spec. off Anclote Keys, *Silver Bay* sta. 571 (51483), one vicinity of Key West (44237); Virgin Islands, R. E. Schroeder, ST. JOHN XI. 1960 (51724) and ST. CROIX VIII. 1960 (51717); and BARBADOS, Lord's Castle, Univ. Iowa Barbados Exped. 1918 (51291).

Distribution. Bermuda; southern and western Florida as far north as Anclote Keys; West Indies south to the Venezuelan Islands.

Remarks. This species is easily recognized by the abundant, rather large spheroidal clubs and white capstans of the outer cortex, and the small but stout and complicated spindles. All the colonies I have seen are rather small, mostly under 30 cm. in height, and sparsely branched, with only a few (at most 18–20) slender, more or less tapered end branches.

27 **Pseudoplexaura crucis** spec. nov.

(Fig. 26; Pl. XIII)

Diagnosis. Outer layer of cortex with abundant small (0.1–0.15 mm.) 3-flanged leaf-clubs (Fig. 26 b, g); narrow, straight or curved spindles with close, complex tubercles, slightly more than 1 mm. long (Fig. 26 e), which in the deeper layers are smaller, often branched, and purple in color (Fig. 26 d, f). Axial sheath with purple

6-, 7- and 8-radiate capstans, simple and branched spindles and irregular bodies (Fig. 26 c). Anthocodiae moderately armed with small rods (Fig. 26 a). Apertures circular or slightly ovate, pore-like, at most 1 mm. in diameter, rather closely crowded (Pl. XIII). No projecting calyces but, toward the branch tips, some of the apertures may have the lower rim slightly raised. Colonies broad, profusely branched, lateral-dichotomous; branches cylindrical, 4.5–6.0 mm. in diameter.

Description. The type (Pl. XIII) is a complete colony 34 cm. high, broad and rather flattened in form, with profuse lateral-dichotomous branching. The end branches are stout, cylindrical, little tapered, blunt or weakly clavate, 4.5–6.0 mm. in diameter. The pores are almost circular, the largest scarcely 1 mm. in diameter, rather closely placed. Near the branch tips some of the apertures have a slightly raised lower rim but there is otherwise no trace of calycular projections. The leaf-clubs of the outer rind are quite ornate, usually 3-winged, rather small, mostly 0.1 mm. long but a few may reach 0.15 mm., especially in the lower parts of the colony. Small, simple capstans are infrequent. The largest white spindles of the middle layer reach a length of about 1 mm., rarely a little more. They are slender and commonly somewhat curved, closely sculptured with complicated tubercles. Deeper in the rind, smaller, more coarsely sculptured purple spindles appear, many of them irregularly branched. In the axial sheath there are small, bright purple capstans with 6, 7 or 8 rays, as well as small spindles and irregular radiate forms. In general, the spicules become coarser, though not noticeably larger, toward the base of the colony. The anthocodiae are more strongly armed than in any other species of the genus known at present, with a cluster of converging rodlets beneath each tentacle, continuing irregularly along the backs of the tentacles. Color of the dry colony, light olivaceous gray to brownish gray.

Material. The holotype, from Virgin Islands, St. John, Chocolate Hole, 6 m., T. Chess 9. I. 1960 (USNM 51718). Also a paratype, a large branch which apparently is part of a full-grown colony, same data (51565).

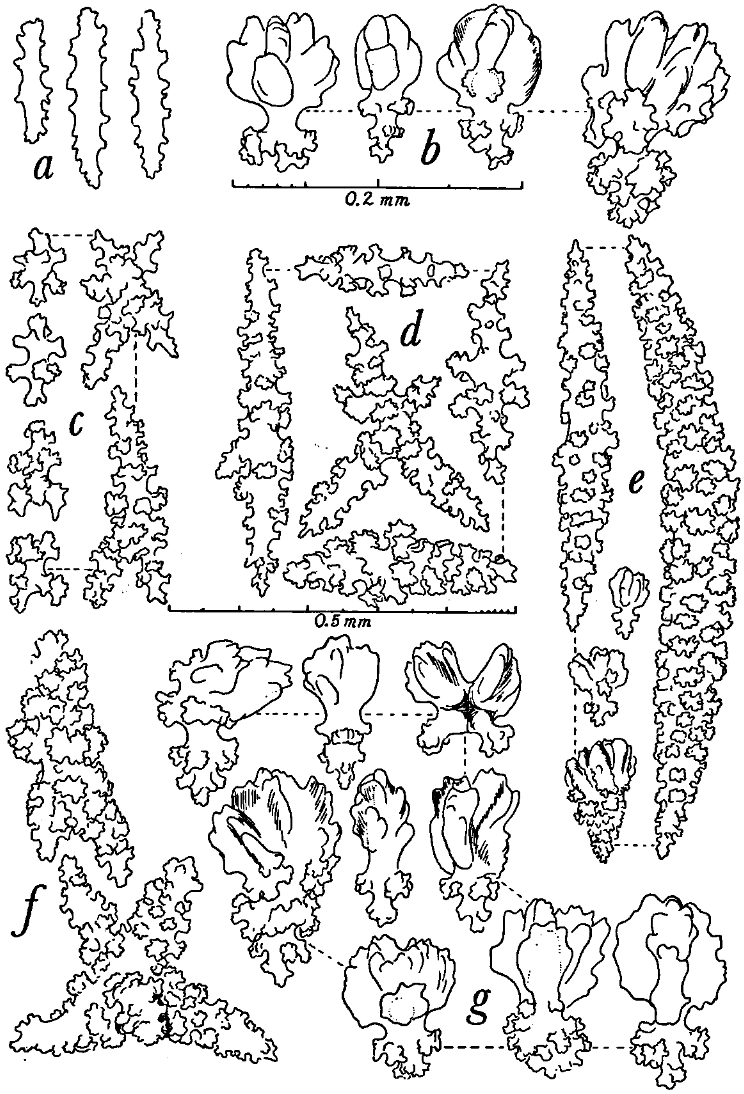


FIGURE 26. *Pseudoplexaura crucis* spec. nov. Spicules of the type from St. John (USNM 51718): *a*, anthocodial rods; *b*, clubs from branch tip; *c*, purple spicules of axial sheath; *d*, purple spindles and branched forms from deeper rind; *e*, spindles and clubs of outer rind; *f*, purple branched forms of axial sheath near base; *g*, clubs from main stem. (Enlargement of *a*, *b*, *g* indicated by 0.2 mm. scale at *b*; that of *c–f* by 0.4 mm. scale below *d*.)

Genus **Eunicella** Verrill, 1869

Eunicella VERRILL 1869, p. 425. (Type species, *Gorgonia verrucosa* Pallas 1766, by original designation.)
Eunicella, DEICHMANN 1936, p. 92.
Eunicella, STIASNY 1938, p. 5.

Diagnosis. Plexaurids with surface layer of rind densely packed with minute balloon-clubs oriented with heads outward; inner layer of rind containing double spindles, never purple in color. Colonies usually branched in one plane, occasionally filiform.

Distribution. Both shores of the Atlantic Ocean; Mediterranean; Indo-West Pacific. Littoral and coast abyssal.

Remarks. This genus is represented in the western Atlantic only at depths in excess of 200 fathoms. Three species occur in the West Indian region: *Eunicella modesta* Verrill, *Eunicella tenuis* Verrill, and *Eunicella albatrossi* Stiasny. None of these occur in reef habitats and are therefore not described herein. A colony of the commonest species, *Eunicella modesta* Verrill 1883, from 440 fath. off Fernandina, Florida (USNM 10505) is shown on Pl. XV, together with a photomicrograph of its highly characteristic spicules. (See DEICHMANN 1936, p. 93.)

Genus **Eunicea** Lamouroux, 1816

Eunicea LAMOUROUX 1816, p. 431. (Type species, *Eunicea mammosa* Lamouroux 1816, by subsequent designation: BAYER 1955, p. 212).
Eunicea, KUNZE 1916, p. 505.
Eunicea, KÜKENTHAL 1924, p. 118.
Eunicea, STIASNY 1935d, p. 73.

Diagnosis. Plexaurids with spicules of the axial sheath consisting entirely or in major part of elongate spindles or rods, either colorless, pale violet, or dark reddish purple. The spicules of the outer rind are mostly clubs, either foliate, tuberculate, or spinose, the last being called thorn-clubs or torches according to their shape; there also may be foliate spheroids and unilaterally spinose spindles. The middle layer contains ordinary spindles, often of large size. The anthocodiae are armed with straight or curved rods. Calyces are usually well-developed and may stand out prominently from the surface of the rind.

Distribution. Warm western Atlantic: Bermuda; Florida; the Bahamas; Antilles; Caribbean.

Remarks. The genus *Eunicea* is characterized by the predominance of spindle- or rod-like spicules in the axial sheath. Prominent calyces may be present, but they are not always strongly projecting and may consist only of a slightly raised rim; sometimes projecting most on the lower rim, thus forming a lip; or 8-lobed. Occasionally the opening may be quite flush with the surface of the rind.

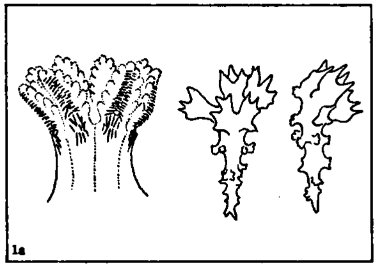
The genus *Eunicea* may conveniently be subdivided on the basis of anthocodial spiculation into subgenus *Eunicea* s.s. having mainly tentacular spiculation, with the species *mammosa* (type), *laxispica*, *succinea*, *pinta*, and *palmeri;* and subgenus *Euniceopsis* Verrill having a strong crown below the tentacular armature, with the species *tournejorti* (type), *asperula*, *fusca*, *clavigera*, *calyculata*, *laciniata*, and *knighti*. Future work may demonstrate that these subgenera are actually of full generic importance, and that the group of species here treated under *Euniceopsis* can further be split into two subgenera.

Eunicea ransoni Stiasny 1937, in the Michelin collections of the Paris Museum, reported from "Indes Occidentales," is not a *Eunicea* at all, but *Muricea appressa* Verrill, and therefore must have originated on the Pacific coast of Mexico or Central America – not the West Indies.

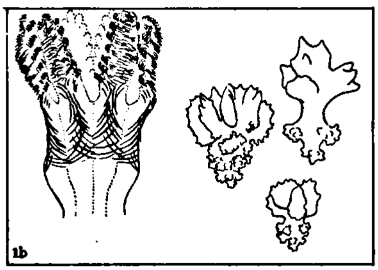
KEY 13

ILLUSTRATED KEY TO THE SPECIES OF *Eunicea*

1a. Strongest part of anthocodial armature lies on tentacle backs; body wall below tentacles with few or no spicules. Surface of rind contains clubs in the form of torches (subgenus *Eunicea* s.s.): 2

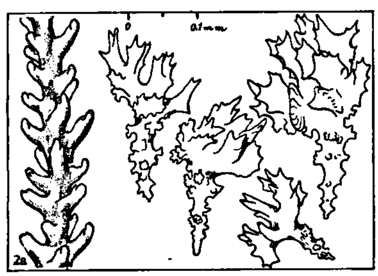


1b. Strongest part of anthocodial armature lies in body wall below tentacles where numerous spindles form a distinct crown. Surface of rind contains leaf-clubs or wart-clubs (subgenus *Euniceopsis*): 7



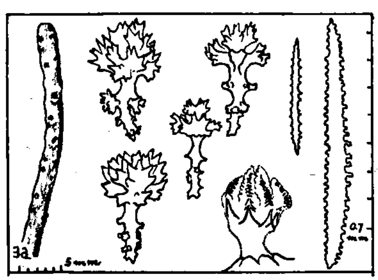
2a. Calyces long, tubular, 5–8 mm. tall. Torches large, irregular, spinose: *Eunicea laxispica* (Lamarck)

2b. Calyces less than 5 mm. tall, mammiform, shelf-like, or absent: 3

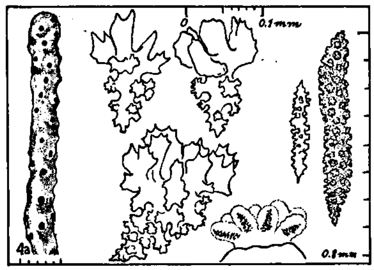


3a. Branches slender, 2.0–2.5 mm. in diameter. Calyces not projecting, apertures 8-lobed. Anthocodiae with a weak crown containing 1–3 pairs of curved rods 'en chevron' in each sector, below the tentacular armature. Torches very thorny. Cortical spindles slender: *Eunicea pinta* Bayer & Deichmann

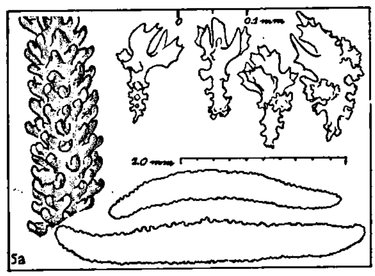
3b. Branches usually more than 3 mm. in diameter. Calyces more or less projecting, mammiform, shelf-like, sometimes obscure or absent. Proximal rods of tentacular armature somewhat larger than the rest but not forming a crown. Torches more foliate: 4



4a. Calyces with inconspicuous lower lip or not projecting at all. Most or all spindles of middle cortex purple, rarely reaching 1 mm. in length, usually no more than 0.8 mm. Some of the torches transformed into ornate leafy spheroids: *Eunicea palmeri* spec. nov.

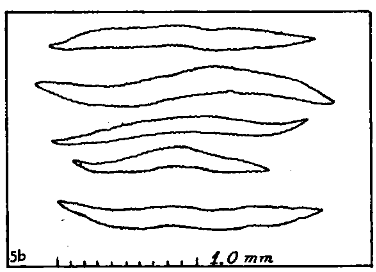


4b. Calyces verruciform, hemispherical or short-tubular. Spindles of middle cortex both purple and white, often exceeding 1 mm. in length. Surface layer containing mostly torches, leafy spheroids rare: 5



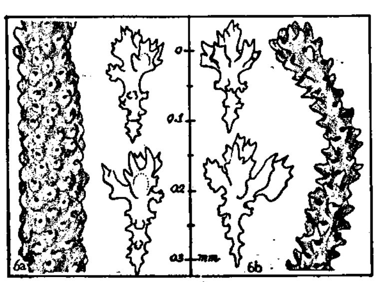
5a. Calyces mammiform or short-tubular, with a tumid lower lip. Dry colonies pale or medium brown. Large spindles of middle cortex rathet stout, 5–8 times as long as wide: *Eunicea mammosa* Lamouroux

5b. Calyces hemispherical or shelf-like. Dry colonies dark brown or blackish. Large spindles of middle cortex more slender, 10–13 times as long as wide: 6



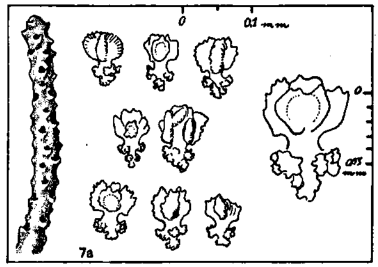
6a. Colonies broadly flabellate; branches stout. Calyces hemispherical: *Eunicea succinea* (Pallas), typical form

6b. Colonies taller, bushy or straggling branches slender. Calyces shelf-like: *Eunicea succinea* forma *plantaginea* Lamarck



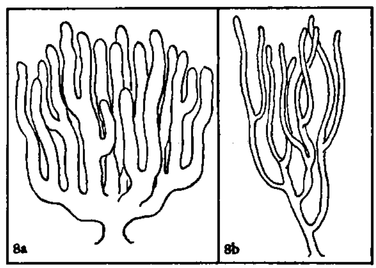
7a. Terminal branches 3 mm. or less in diameter, quite flexible. Calyces forming low elevations, lower lip faintly indicated or absent: *Eunicea fusca* Duchassaing & Michelotti

7b. Terminal branches usually more than 3 mm. in diameter: 8

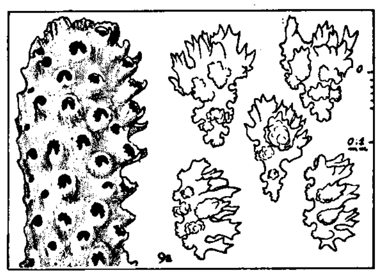


8a. Colonies broad, candelabrum-formed: 9

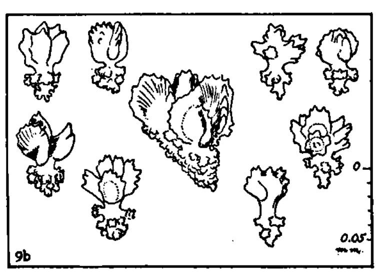
8b. Colonies straggling, tall and ascending, sometimes bushy, but not candelabrum-formed: 11



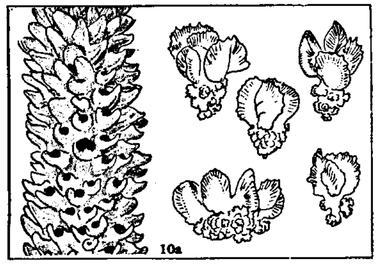
9a. Spicules of surface layer in the form of aculeate leaf-clubs and asymmetrically spinose bodies. Large spindles slender. Axial sheath spicules mostly lavender. Calyces gaping, with 8 marginal lobes of which the lower forms a falcate lip: *Eunicea laciniata* Duchassaing & Michelotti



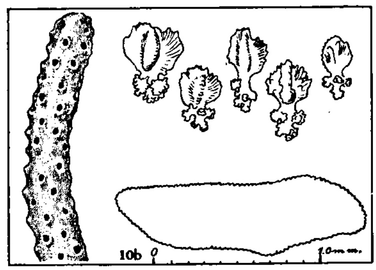
9b. Spicules in the form of wart-clubs or non-spiny leaf-clubs. Large spindles stout. Axial sheath spicules mostly colorless, but a few violet near base and in young colonies: 10



10a. Colonies very stout, terminal branches 10–15 mm. in diameter. Calyces with well-developed lower lip: *Eunicea tourneforti* Milne Edwards & Haime, typical form

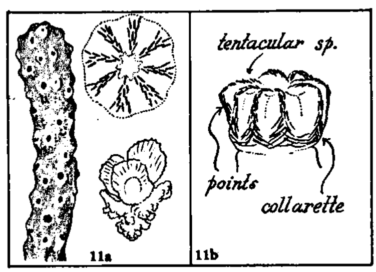


10b. Colonies moderately stout, terminal branches 6–10 mm. in diameter. Calyces with poorly developed lower lip that may be visible only near branch tips: *Eunicea tourneforti*, forma *atra* Verrill



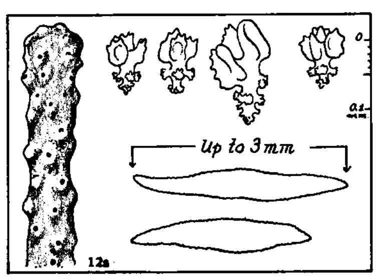
11a. Crown composed of rather few spindles up to about 0.3 mm. long, the proximal ones not forming a conspicuous collaret. Axial sheath spicules mostly colorless except in young colonies and near base of large specimens, where some pale violet forms occur: *Eunicea asperula* Milne Edwards & Haime

11b. Crown composed of numerous spindles 0.3–0.7 mm. long, or more, proximal ones strongly oblique or transverse, forming a collaret. Lavender spicules occur throughout axial sheath in colonies of all sizes: 12



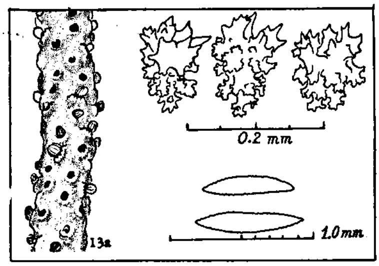
12a. Largest spindles of middle cortex 2–3 mm. long, slender $5^1/_2$ to 7 times as long as wide. Surface layer of cortex with small clubs about 0.1 mm. long: *Eunicea clavigera* spec. nov.

12b. Largest spindles of middle layer not more than 2 mm. long. Clubs of surface layer commonly longer than 0.15 mm.: 13

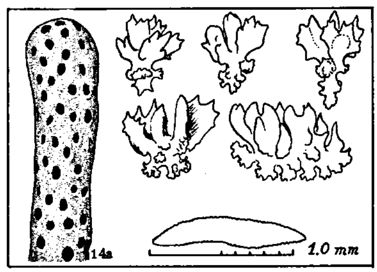


13a. Largest spindles of middle layer up to 0.8 mm. long. Clubs and spheroidal bodies of surface layer coarse and thorny: *Eunicea* sp. indet.

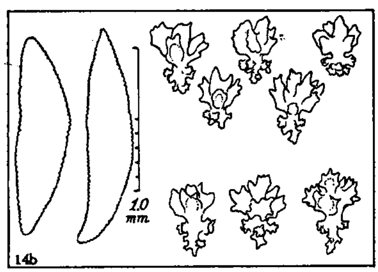
13b. Largest spindles of middle layer 1 mm. or more in length. Clubs not especially thorny: 14



14a. Margin of calycular apertures not raised above surface of cortex except on terminal branches, where a small, blunt lower lip may be present. Largest spindles of middle layer 1.2–1.5 mm. long, 5–6 times as long as wide. Surface layer with many unilateral leafy spheroids, leaf-clubs not abundant: *Eunicea knighti* spec. nov.

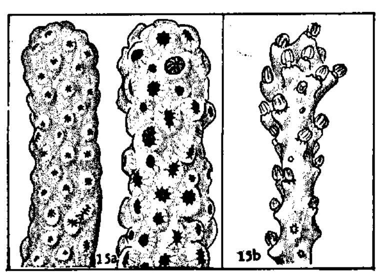


14b. Margin of calycular apertures projecting throughout most of colony, orifice terminal or up-turned but lower rim not forming a prominent lip. Largest spindles of middle cortex 1.5–2.0 mm. long, 3–5 times as long as wide. Surface layer with many small leaf-clubs and wart-clubs: 15



15a. Colonies very stout, with long, ascending branches 8–16 mm. in diameter: *Eunicea calyculata* Ellis & Solander, typical form

15b. Colonies smaller, slender, branches only 4–5 mm. in diameter: *Eunicea calyculata* Ellis & Solander, forma *coronata*, nov.



Subgenus **Eunicea** s.s.

Diagnosis. Anthocodial armature consists of small, flattened rods located mostly in the tentacles.

28 **Eunicea (Eunicea) laxispica** (Lamarck), 1815

(Fig. 27; Pl. XX)

Gorgonia laxispica LAMARCK 1815b, p. 163. (l'Océan américain?)
Eunicea laxispica, STIASNY 1951, p. 52, pl. 9 fig. A, pl. 16 figs. 1–3. (Guadeloupe.)

Diagnosis. Openly branched colonies with exceptionally tall, tubular calyces up to 8 mm. in height (Fig. 27 a). Tentacles with small rods (Fig. 27 c–d), transverse or oblique except at the base (Fig. 27 b). Axial sheath containing numerous acute spindles with complex tubercles, purple in color (Fig. 27 e); middle layer of rind containing elongate spindles up to 1.8 mm. long and about 9 times as long as wide (Fig. 27 g); surface layer containing ornate torches of large size, reaching about 0.3 mm. in length (Fig. 27 f). Color of colonies in alcohol, cream white.

Material. The collections of the U.S. National Museum contain a specimen from NEW PROVIDENCE, collected by Conrad Limbaugh (50553), and fragments from two localities off PUERTO RICO, *Fish Hawk* (42147, 42590) and the Johnson-Smithsonian Exp. (43794, 43795).

Distribution. Bahamas; Antilles.

Remarks. This distinctive species appears to be uncommon. I have never collected it, and the material in the U.S. National Museum is rather meager. Its rarity in collections may be due to the fact that it lives in somewhat greater depths than do most Euniceas.

29 **Eunicea (Eunicea) pinta** Bayer & Deichmann, 1958

(Figs. 28a, 29)

Eunicea pinta BAYER & DEICHMANN 1958, p. 232, figs. 1,4–5.

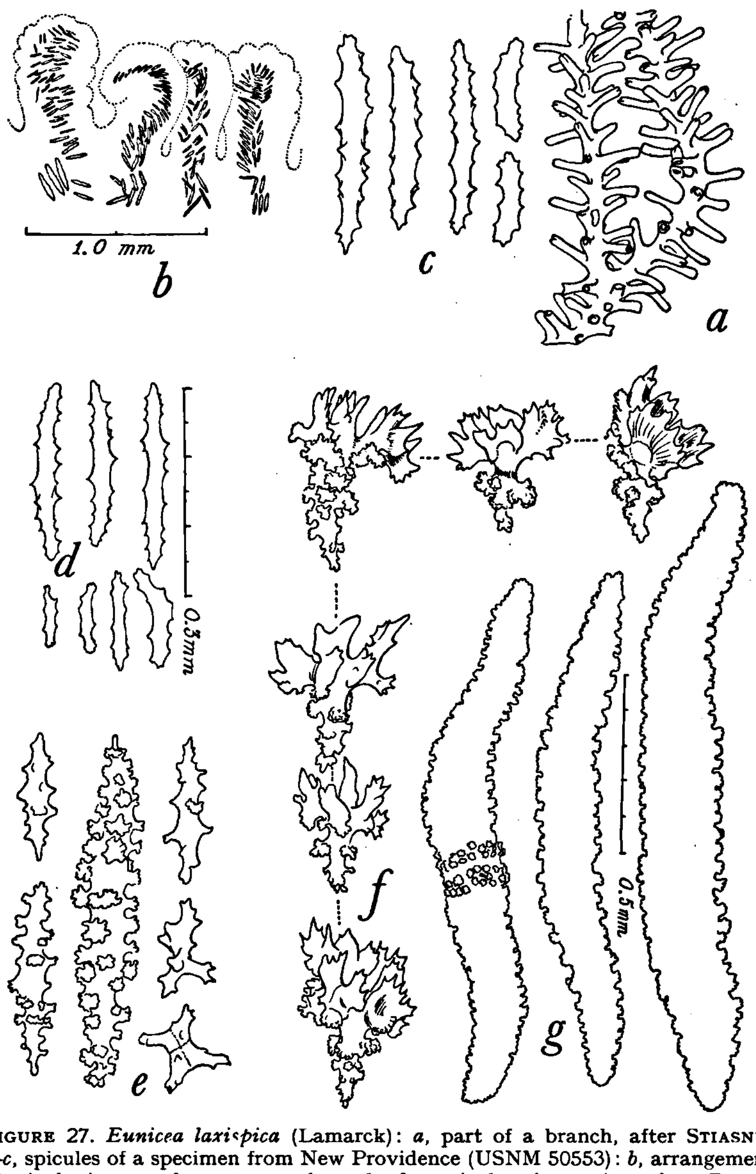


FIGURE 27. *Eunicea laxispica* (Lamarck): *a*, part of a branch, after STIASNY. *b–c*, spicules of a specimen from New Providence (USNM 50553): *b*, arrangement of spicules in tentacles; *c*, tentacular rods. *d–g*, spicules of a specimen from Puerto Rico (43795); *d*, anthocodial rods; *e*, spicules of axial sheath; *f*, torches of outer rind; *g*, spindles of middle rind. (Enlargement of *b* and *g* indicated by scales adjacent; that of *c–f* by 0.3 mm. scale at *d*.)

Diagnosis. Colonies tall and openly branched, dichotomous and lateral; terminal branches 2.0–2.5 mm. in diameter. Polyps with a crown of 1–3 pairs of bent rods beneath each tentacle, and small rods transverse in the tentacle backs. Torches with large, spinose heads and slender handles. Middle layer with colorless needles and slim spindles 1.0–1.8 mm. in length; inner layer with purple spindles and capstans.

Description. The colonies are very tall and straggling, with long, flexible terminal branches 2.0–2.5 mm. in diameter and up to 50 cm. in length, arising laterally or dichotomously at wide angles (Fig. 28 a). Projecting calyces are not developed but the anthocodiae are mostly preserved exsert. The crown (Fig. 29 b) contains

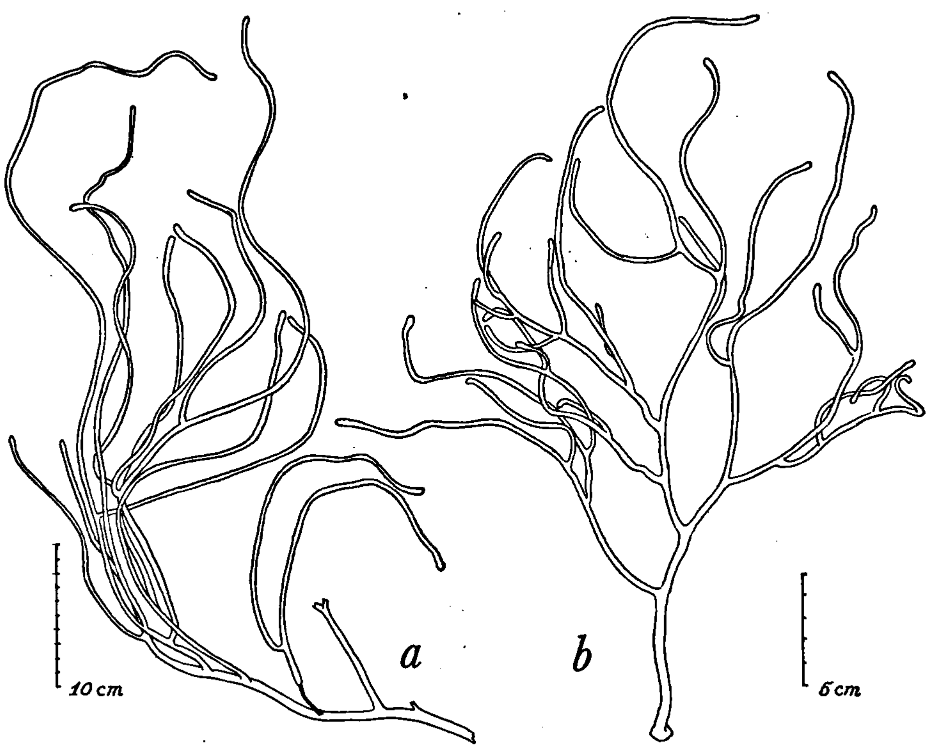


FIGURE 28. *Eunicea pinta* Bayer & Deichmann; *a*, colony. *Plexaura nina* Bayer & Deichmann; *b*, colony. (Reductions as indicated by scales.)

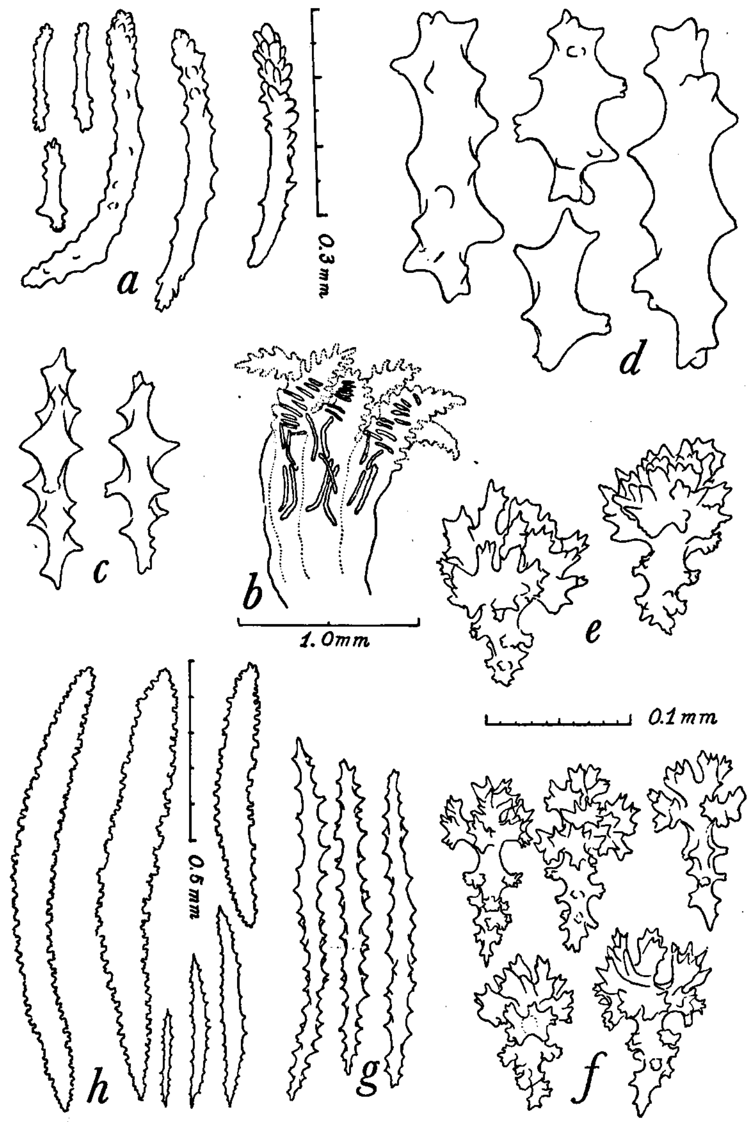


FIGURE 29. *Eunicea pinta* Bayer & Deichmann; spicules of the holotype from the Great Bahama Bank (USNM 50563): *a*, spicules of the crown; *b*, arrangement of spicules in anthocodia; *c*, spicules of axial sheath near branch tip; *d*, spicules of axial sheath near base; *e*, torches of surface layer near base; *f*, torches of surface layer near branch tip; *g*, aculeate needles of middle rind near branch tip; *h*, spindles of middle rind near base (needles like those in *g*, and smaller spindles, are more numerous than large spindles). (Enlargement of *a* and *g* indicated by 0.3 mm. scale at *a*; that of *b* by adjacent 1.0 mm. scale; that of *c–f* by 0.1 mm. scale above *f*; that of *h* by 0.5 mm. scale adjacent.)

a pair of bent rods about 0.4 mm. long beneath each tentacle and numerous small, flat rods transversely placed in the tentacle backs (Fig. 29 a). The spinose torches of the outer layer (Fig. 29 f) are very characteristic and unlike those of any other known species. The middle layer of rind contains abundant colorless needles about 0.5 mm. in length (Fig. 29 g), and slender, curved spindles with complex tubercles; distally, the spindles measure about 1.0 × 0.05 mm., increasing in length and girth toward the base of the colony where they may measure 1.8 × 0.2 mm. (Fig. 29 h). All spicules of the middle and outer layers of cortex are colorless. The axial sheath contains bright purple spindles and capstans. Distally, the spindles are about 0.2 mm. in length (Fig. 29 c), increasing somewhat in size toward the middle of the colony. As the base is approached, the spindles become quite blunt, and stubby capstans predominate (Fig. 29 d). The color of the colony in alcohol is pure white.

Material. The type colony and fragments, from the south end of the Tongue of the Ocean, GREAT BAHAMA BANK, 23°34'00" North, 76°33'00" West, 36 fms., bottom 74.2°F., *Albatross* sta. 2649, 12.IV.1886 (USNM 50563).

Distribution. Known only from the type locality.

Remarks. The spicules of *Eunicea pinta* suggest relationship with *Eunicea mammosa* Lamouroux. Its slender, flexible growth form is probably the result of its deep-water habitat.

30 **Eunicea (Eunicea) palmeri** spec. nov.

(Fig. 30 a–j; Pl. I fig. 4, II fig. 4)

Diagnosis. Tall colonies with terminal branches long and slender 3–4 mm. in diameter. Anthocodiae very weakly spiculate. Axial sheath with purple spindles, capstans, and, near the trunk, oval bodies. Spindles of the middle layer at most 0.8–1.0 mm. in length, all purple. Outer layer with colorless torches that may become extremely ornate.

Description. Colonies with exceptionally soft and flexible, long, slender branches 3–4 mm. in diameter and up to 35 cm. in length.

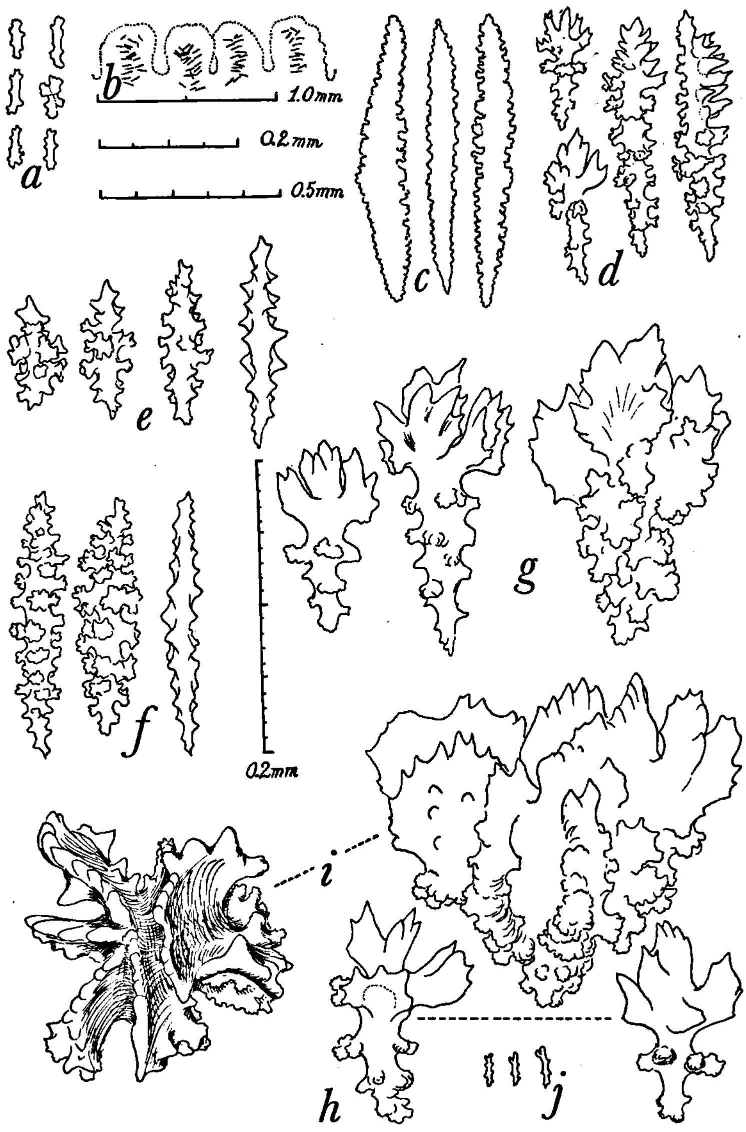


FIGURE 30. *Eunicea palmeri* spec. nov. *a–g*, spicules of the holotype from Florida (USNM 50747): *a*, flat rodlets of tentacles; *b*, arrangement of spicules in tentacles; *c*, spindles of middle rind; *d*, torches and unilaterally spined forms of outer rind; *e*, spicules of axial sheath near branch tip; *f*, spicules of axial sheath near base; *g*, torches at greater enlargement. *h–j*, spicules of a specimen from Key West (50679): *h*, ordinary torches of outer layer; *i*, large torches of outer layer, one from the side, one from above; *j*, tentacular rodlets. (Enlargement of *a*, *d*, *e*, *f*, *i* indicated by 0.2 mm. scale at *b*; that of *b* by 1.0 mm. scale at *b*; that of *c* by 0.5 mm. scale at *b*; that of *g–i* by 0.2 mm. scale to right of *f*.)

Small colonies may be branched in one plane, in an irregular candelabrum form with rather few branches (Pl. II fig. 4); larger colonies tend to become quite bushy (Pl. I fig. 4). Calyces are developed in some specimens, chiefly near the branch tips, as a low, shelf-like lip beneath each aperture, but in other specimens they are not present at all. The anthocodiae are very weakly spiculated, having only a few tiny, flat rods (Fig. 30 a–b) crosswise in the tentacles. The axial sheath contains deep reddish purple spindles, some of them slender and acute, sculptured with simple processes, others stout, not so sharp, and covered with complex tubercles (Fig. 30 e); toward the base of the colonies they increase in size (Fig. 30 f), and some coarse, oval bodies may occasionally be found. The middle layer of rind has slender, purple spindles usually about 0.8 mm. long but reaching 1.0 mm. in some specimens (Fig. 30 c). The outer layer of rind contains purple spindles with strong thorns on one side, and colorless torches with sharply laciniate heads (Fig. 30 d, g); toward the base of the colonies many of the clubs may be very coarse and stout, with short, tuberculate handles and elaborately foliate and laciniate heads (Fig. 30 i). In some colonies, these exceptionally ornate clubs are very abundant and may be found even in the terminal branches. The color of fresh and alcoholic specimens is purplish gray, purplish brown, or grayish brown; the deep purple spindles may be seen at the surface among the colorless torches. Dry colonies are brown; the coenenchyme becomes so friable that the specimens are easily damaged.

Material. Holotype: FLORIDA, seaward side of Soldier Key, Biscayne Bay, depth 3–4 feet at low tide, F. M. Bayer coll., 10.IV.1948 (USNM 50747). Other material: 7 alcoholic specimens from the same locality (USNM 50388, 50389, 50743); dry colonies from Caesar's Creek, upper Florida Keys, J. E. Benedict, 1901 (USNM 50690), and from Key West, Dr. Edward Palmer, 1884 (USNM 50679).

Distribution. At present known only from the Florida Keys, from Soldier Key to Key West.

Ecology. *Eunicea palmeri* is abundant in 3–6 feet of water on the seaward shore of Soldier and Ragged Keys, where it grows together with *Pseudopterogorgia acerosa P. americana, Plexaurella dichotoma,* and others. Colonies at Soldier Key have been found infested with a creeping ctenophore, *Coeloplana.*

Remarks. This species is easily recognized by the spindles of the middle rind, which are all colored purple and rarely reach a length of 1 mm. The peculiar, ornate clubs with broad head and short handle are also very distinctive, but are uncommon in some colonies. The weak spiculation of the anthocodiae is a noteworthy feature.

31 **Eunicea (Eunicea) mammosa** Lamouroux, 1816

(Fig. 31; Pl. II fig. 1)

Gorgoniae muricatae Variet. Esper 1796, *Forts. 1*, p. 152, pl. 39A. ("Ohne bestimmte Anzeige des Aufenthalts.")
Eunicea mammosa Lamouroux 1816, p. 438, pl. 17.
Gorgonia madrepora Dana 1846, p. 671. (West Indies.)
Gorgonia mammosa, Dana 1846, p. 672. (West Indies.)
Eunicea Esperi Duchassaing & Michelotti 1860, p. 20, pl. 2 figs. 4–5. (St. Thomas.)
Eunicea Ehrenbergi Duchassaing & Michelotti 1860, p. 21, pl. 2 figs 6–7. (Guadeloupe.)
Eunicea mammosa, Kükenthal 1924, p. 120, fig. 86.
Eunicea mammosa, Stiasny 1935d, p. 81, pl. 7 fig. 33. (Dry Tortugas.)

Diagnosis. Colonies spread mostly in one plane, the branching lateral and dichotomous (Pl. II fig. 1). Calyces short, tubular and bluntly rounded so as to appear mammiform, close-set and directed upward. Anthocodial armature tentacular, no crown below tentacles (Fig. 31 e–f). Axial sheath containing acute purple spindles; some sculptured with simple spinules, others with complex tubercles (Fig. 31 b); middle rind containing coarsely tuberculate spindles reaching a length of about 1.5 mm. and 5 to 8 times as long as wide, purple, white, or bicolored (Fig. 31 a); outer rind with colorless torches up to about 0.2 mm. long (Fig. 31 c–d).

Material. Collected by Hummelinck at Bonaire, Lac, sandy reef, 1–2 m. deep, sta. 1068A, 1.X.1948, fragments in alcohol (USNM 50499).

The collections of the U.S. National Museum contain several specimens from the Florida Keys (50342), Bahamas (14367, 14510, 50136, 50247, 50320, 50552, 50726), Cuba (34521), Saba Bank (50331), Old Providence (49767), and also from Grand Cayman (51384), and Jamaica, Little Pelican Cay, Portland Bight (51356), Gun Cay, Port Royal Cays (51385); Mexico, Mujeres Hbr., Quintana Roo (51751, 51752).

Distribution. Florida Keys and the Antilles.

Remarks. Most specimens of this species are pale yellowish brown in color. The close-set calyces have a turgid, obese appearance not seen in other Euniceas. Among different colonies there is a certain amount of variation in diameter of bran-

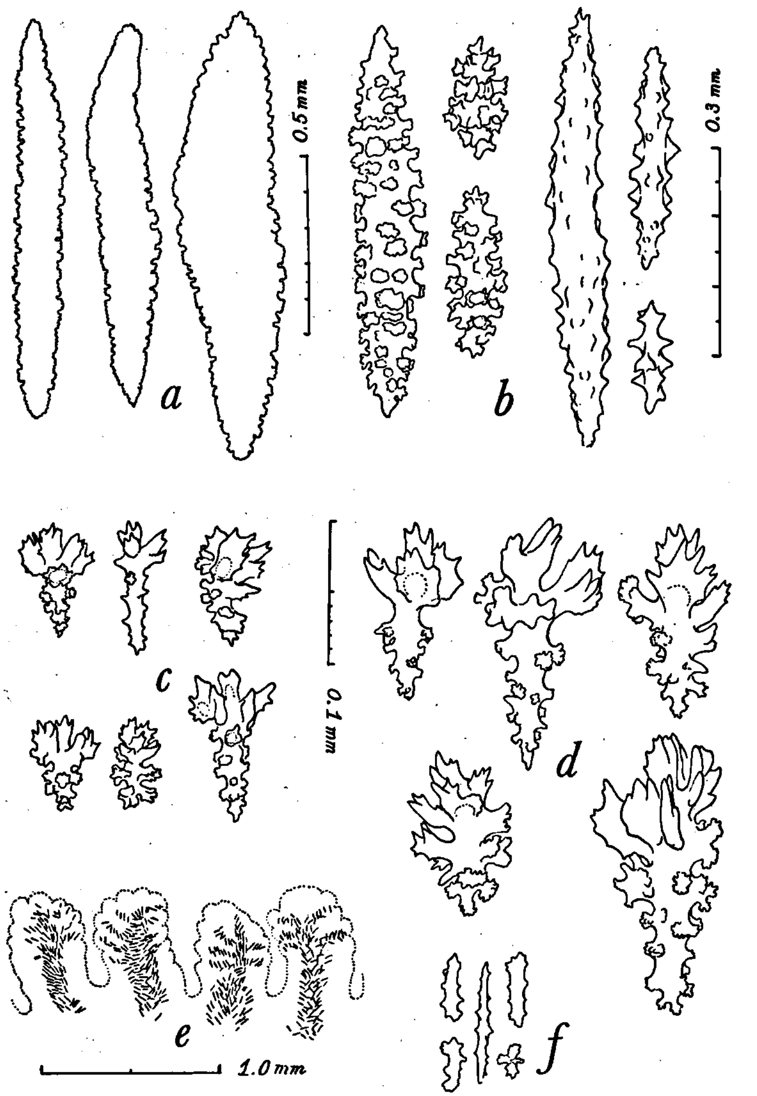


FIGURE 31. *Eunicea mammosa* Lamouroux, spicules. *a–d*, of a specimen from Andros, Bahamas (USNM 50247): *a*, spindles of middle rind; *b*, spicules of axial sheath; *c*, torches of outer rind; *d*, torches at greater magnification; *e*, arrangement of spicules in the tentacles of another specimen from the same locality; *f*, tentacular rods. (Enlargement of a indicated by 0.5 mm. scale adjacent; that of *b*, *c*, *f* by 0.3 mm. scale at *b*; that of *d* by 0.1 mm. scale at left; that of *e* by 1.0 mm. scale below.)

ches, colonial form, and the prominence and closeness of calyces, which has resulted in the addition of several synonyms to the literature. DUCHASSAING & MICHELOTTI's *Eunicea esperi* is a small form with tall calyces, which DANA had earlier called *Gorgonia madrepora*; *Eunicea ehrenbergi* Duchassaing & Michelotti is the slender form to which LAMOUROUX originally gave the name *mammosa*. Specimens from Florida are usually robust, with stout branches and chubby calyces. The spiculation of all the growth forms is so similar that it is impossible, at least for the present, to distinguish between them.

32 **Eunicea (Eunicea) succinea** (Pallas), 1766 forma **succinea**

(Fig. 32; Pl. II fig. 2)

Gorgonia succinea PALLAS 1766, p. 200. ("Locum: ignoro.")
Gorgonia succinea, ESPER 1796, *Forts. 1*, p. 163, pl. 46.
Eunicea Succinea, LAMOUROUX 1816, p. 437.
Eunicea succinea, KÖLLIKER 1865, p. 137, pl. 18 figs. 17, 24.
not *Eunicea succinea*, KUNZE 1916, p. 546, pl. 26 fig. 10. [= *Eunicea* (*Euniceopsis*) *asperula* Milne Edwards & Haime?]
?*Eunicea succinea*, STIASNY 1935d, p. 83, pl. 3 fig. 13, pl. 7 fig. 37. (Curaçao; St. Thomas; Bermuda.)

Diagnosis. Colonies low, spread in one plane, candelabrum-shaped (Pl. II fig. 2). End branches about 7 mm. in diameter, with polyps in numerous close-set, irregular, weak spirals, forming nearly hemispherical, slightly up-turned calyces. Anthocodiae with flat rodlets (Fig. 32 b) in the tentacles, distally transverse, proximally longitudinal (Fig. 32 a). Axial sheath containing deep reddish purple spindles reaching a length of 0.5 mm., some with simple, conical processes, others with complex tubercles (Fig. 32 d, f); middle layer of rind containing slender, white spindles as much as 2.0 mm. long and 10 to 13 times as long as wide (Fig. 32 c, h); outer layer containing numerous laciniate, colorless torches 0.15–0.25 mm. long (Fig. 32 e, g). Color of dry colonies dark brown, often blackish, with the summit of the calyces paler.

Material. Collected by Hummelinck at ST. EUSTATIUS, Gallows Bay, rocks, 2m., sta. 1116B, 15.VII.1949, 4 dry specimens (USNM 50317); and ST. BARTHÉLEMY, Fourche, rock debris, 1.5 m., sta. 1124, 2.VI.1949, 5 dry spec., fragments in alcohol (USNM 50318).

Also examined were specimens from ST. CHRISTOPHER, Frigate Bay, Smithsonian-Bredin Exp., 14.V.1956 (USNM 50326), and TOBAGO, Milford Bay (51414).

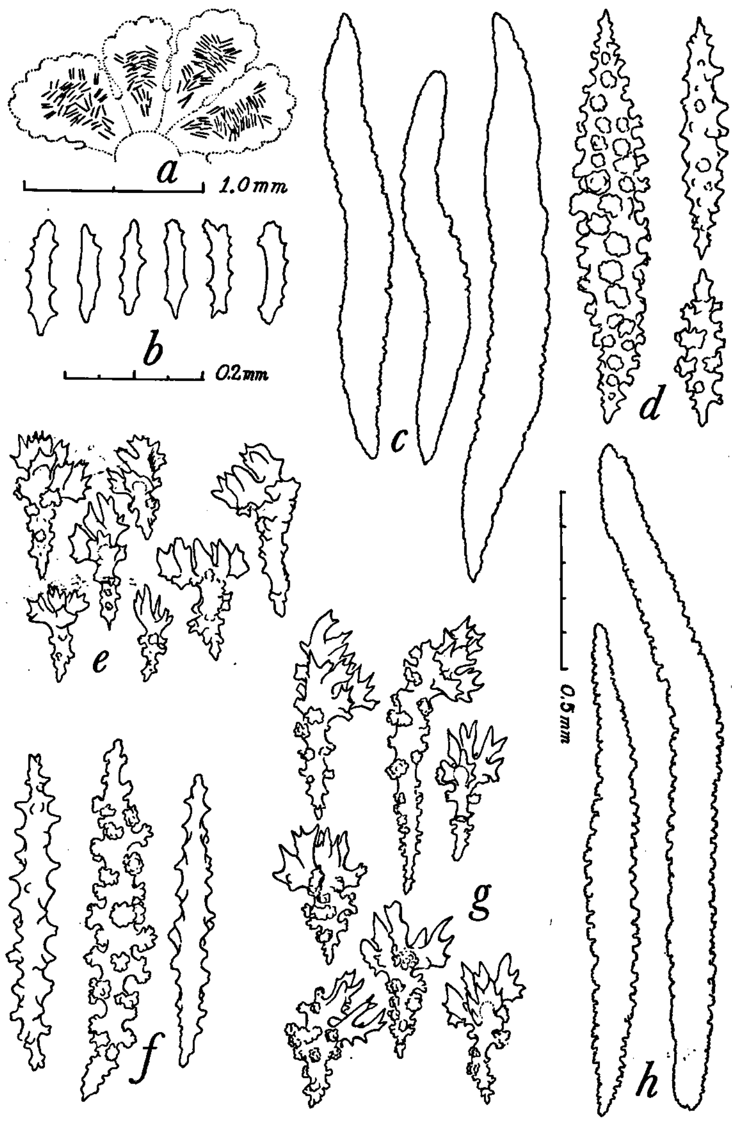


FIGURE 32. *Eunicea succinea* (Pallas), typical form. *a–e*, a specimen from St. Barts (USNM 50318): *a*, arrangement of spicules in the tentacles; *b*, tentacular spicules; *c*, spindles of the middle rind near branch tip; *d*, spindles of axial sheath near branch tip; *e*, torches of outer rind near branch tip. *f–h*, a specimen from St. Eustatius (50317): *f*, spindles of axial sheath near branch tip; *g*, torches of outer rind near branch tip; *h*, spindles of middle rind near branch tip. (Enlargement of *a* indicated by 1.0 mm. scale below; that of *b* and *d–g* by 0.2 mm. scale at *b*; that of *c* and *h* by 0.5 mm. scale at *h*.)

Distribution. Bermuda? Florida Keys? West Indies.

Remarks. The specimens from St. Barts very closely resemble ESPER's excellent picture of *Gorgonia succinea*, which may be taken as typical of the species, and also agree with PALLAS' brief original description. Moreover, their spicules correspond well with KÖLLIKER's figures of spicules from ESPER's specimen in Erlangen, so the identity of the present material seems firmly established.

The specimen from the Dry Tortugas that KUNZE (1916) described is surely not *Eunicea succinea*. KUNZE did not illustrate the spicules of his material, so it is impossible to say exactly what he had. It may have been the species called *Eunicea (Euniceopsis) asperula* Milne Edwards & Haime in the present report.

32a Eunicea (Eunicea) succinea (Pallas) forma plantaginea (Lamarck)

(Fig. 33; Pl. II fig. 5)

Gorgonia plantaginea LAMARCK 1815, p. 163.
?*Eunicea calyculata*, LAMOUROUX 1816, p. 438
Eunicea calyculata, KUNZE 1916, p. 523, figs. H–L, pl. 24 fig. 4. (St. Thomas; Tortugas; Kingston.)
not *Gorgonia calyculata* ELLIS & SOLANDER 1786, p. 95. (= *Eunicea calyculata*.)
Eunicea hummelincki STIASNY 1941d, p. 109, fig. C, pl. 2 figs. 9–12. (Blanquilla: Playa Valuchu.)

Diagnosis. Like typical form but colonies tall and rather bushy, with branches 3–5 mm. in diameter and 20–25 cm. long (Pl. 2 fig. 5); calyces with lower lip.

Description. In this form, the calyces are prominent, upturned, and have a more or less distinct lip. The anthocodial armature (Fig. 33 a–b) resembles that of typical form. The axial sheath contains acute, slender, deep reddish purple spindles, sometimes with one end forked to produce tripods (Fig. 33 c); middle rind with long, slender, white spindles up to 2.0 mm. long and 10 times as long as wide (Fig. 33 e); outer layer with large, colorless torches 0.15–0.25 mm. in length (Fig. 33 d). Color of dry colonies light or medium brown.

Material. From Hummelinck's collection, a branch of the type of *Eunicea hummelincki* Stiasny, through the courtesy of Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie at Leiden: BLANQUILLA, Playa Valuchu, sand with scattered pieces of rock, 3 m., 21.VI.1936, "auf derselben Fussplatte als das 2. Stöckchen von *Plexaura flexuosa* Lmx."

Also studied were specimens in the collections of the U.S. National Museum, from the FLORIDA KEYS (50367) and from ST. JOHN (44095, 50266).

Distribution. Florida Keys and the Antilles.

Remarks. This is the form commonly called *Eunicea calyculata* (Ellis & Solander). However, reference to ELLIS & SOLANDER's original description, and a glance at their figure (pl. 18 fig. 2, although not labeled, conforms precisely to the description), make it clear that the present material is entirely different.

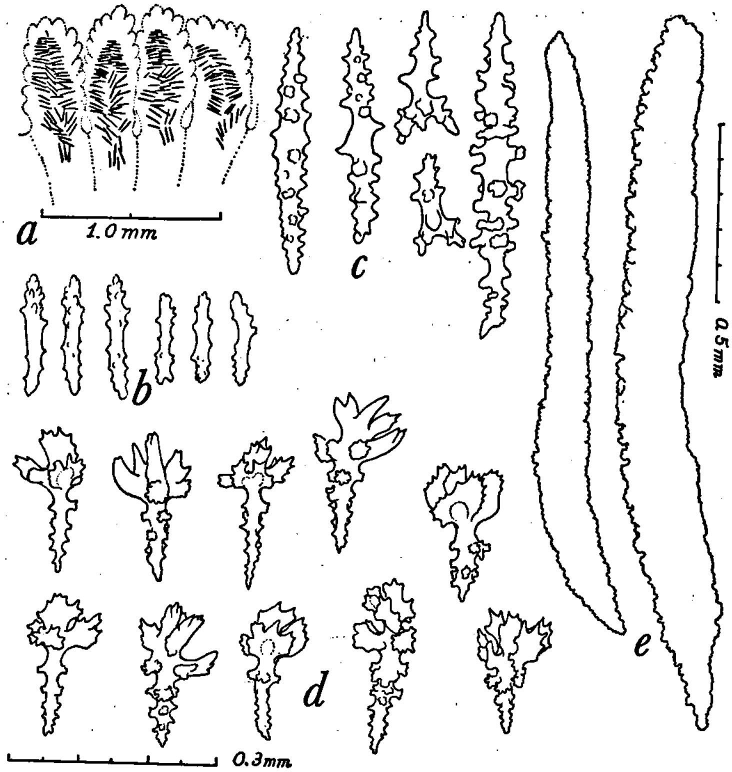


FIGURE 33. *Eunicea succinea* (Pallas) forma *plantaginea* (Lamarck); spicules of a specimen from St. John (USNM 50266): *a*, arrangement of spicules in tentacles; *b*, tentacular rods; *c*, spicules of the axial sheath near the branch tips; *d*, torches of outer rind; *e*, spindles of middle rind. (Enlargement of *a* indicated by 1.0 mm. scale below; that of *b*, *c*, *d* by 0.3 mm. scale at *d*; that of *e* by adjacent 0.5 mm. scale.)

Subgenus **Euniceopsis** Verrill

Euniceopsis VERRILL 1907, p. 311. (Type species, *Eunicea tourneforti* Milne Edwards & Haime, by original designation.)

Diagnosis. Anthocodial armature consists of stout spindles forming a strong subtentacular crown that may be a distinct operculum, and tentacular rods that often extend into the pinnules.

33 **Eunicea (Euniceopsis) fusca** Duchassaing & Michelotti, 1860

(Fig. 34; Pl. III fig. 6)

Eunicea fusca DUCHASSAING & MICHELOTTI 1860, p. 25, pl. 3, figs. 5–6. (Guadeloupe; St. Thomas; St. Croix.)
not *Plexaura fusca,* MOSER 1921, p. 115 [in key]. [= *E. tourneforti* Milne Edwards & Haime?]

Diagnosis. Branching lateral-dichotomous, producing colonies varying in form from low and bushy to tall and straggling; terminal branches slender and flexible, 2.5–3.0 mm. in diameter, short or long according to the stature of the colony (Pl. III fig. 6). Calycular openings often with a low rim, sometimes a little stronger below, but commonly quite flush with the surface of the rind. The axial sheath contains colorless and pale violet capstans, many of which elongate into blunt rods (Fig. 34 a, i); the middle layer includes white spindles, ordinarily about 1.0 mm. long, rarely somewhat longer (Fig. 34 d, l); the outer rind consists of a dense layer of small wart-clubs 0.075–0.10 mm. long (Fig. 34 b–c, j–k). Color of colonies dark grey, either dry or in alcohol.

Material. BERMUDA, a short, shrubby colony collected by Dr. Elisabeth Deichmann, 1951 (USNM 50077), and a tall specimen branched nearly in one plane, Dr. David Nicol, 1956 (USNM 50677); ST. LUCIA, Port Castries, *Albatross*, 3.XII.1887 (USNM 50387); MEXICO, Arrecife Blanquilla, Veracruz, F. Bonet, 12.V.1957 (51456).

Distribution. Bermuda to the Lesser Antilles.

Remarks. The specimens of *Eunicea fusca* that I have seen are of very diverse outward appearance, tall and slender to short and shrubby, yet in the girth of the final branches, prominence of calyces, and details of spiculation they are identical.

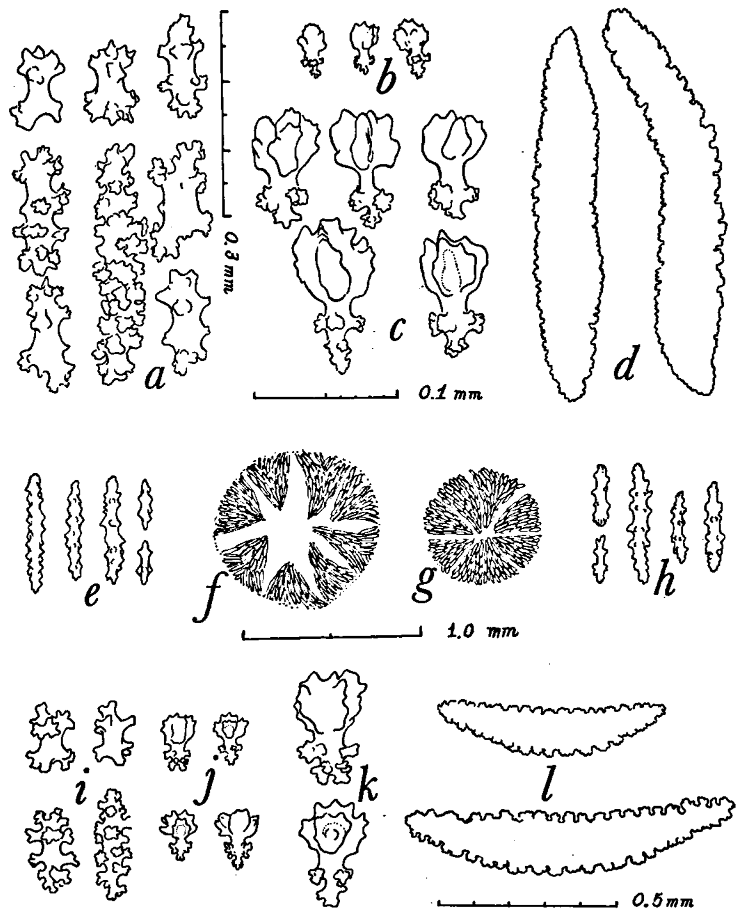


FIGURE 34. *Eunicea fusca* Duchassaing & Michelotti, spicules. *a–f*, of a specimen from Bermuda (USNM 50077): *a*, spicules of axial sheath from a terminal branch; *b*, clubs of outer rind; *c*, clubs at greater magnification; *d*, spindles of middle rind; *e*, rods from crown; *f*, arrangement of spicules in crown. *g–l*, of a specimen from St. Lucia (50387): *g*, arrangement of spicules in crown; *h*, rods from crown; *i*, spicules of axial sheath; *j*, clubs of outer rind; *k*, clubs at greater magnification; *l*, spindles of middle rind. (Enlargement of *a*, *b*, *e*, *h*, *i*, and *j* indicated by 0.3 mm. scale at *a*; that of *f* and *g* by 1.0 mm. scale below; that of *c* and *k* by 0.1 mm. scale at *c*; that of *d* and *l* by 0.5 mm. scale at *l*.)

In the small colony from Bermuda, most of the spicules of the axial sheath are lavender, even in the terminal branches, whereas in the taller specimens they are mostly colorless except in the trunk. Such a state of affairs might be expected if the production of lavender spicules is limited to the early stages of colonial growth; colorless spicules formed later would progressively reduce the proportion of colored forms, which would ultimately become very sparsely distributed in those regions formed early in the development of the colony.

34 **Eunicea (Euniceopsis) laciniata**
Duchassaing & Michelotti, 1860

(Fig. 35; Pl. III figs. 1–2, XIV fig. 11)

Eunicea laciniata DUCHASSAING & MICHELOTTI 1860, p. 23, pl. 2 figs. 12–13 (St. Thomas.)
?*Eunicea lugubris* DUCHASSAING & MICHELOTTI 1860, p. 25, pl. 3 figs. 7–8. (Antilles.)
Eunicea lugubris, STIASNY 1935d, p. 78, fig. U, pl. 5 fig. 23, pl. 7 fig. 31. (Bermuda; Tortugas.)

Diagnosis. Colonies with stout, more or less clavate branches 10–15 mm. in diameter (Pl. III figs. 1–2). Calycular orifices large, gaping, the margins with eight distinct lobes, of which the lowest forms a prominent, up-turned lip. Crown well-developed (Fig. 35 a–c). Axial sheath containing colorless and pale violet spindles having either simple or complex tubercles (Fig. 35 d); middle layer containing long, slender, white spindles as much as 2.5 mm. in length and 10 times as long as wide (Fig. 35 e); surface layer with stout, laciniate clubs about 0.15 mm. in length, and unilaterally foliate spindles about 0.2 mm. in length, all colorless (Fig. 35 f). The color of dry colonies is dark or light brown.

Material. FLORIDA, off Elliott Key, 15.V.1948, small dry specimen (USNM 50373); ST. CHRISTOPHER, Smithsonian-Bredin Exp., 12.IV.1956, large dry spec. (USNM 50330); MEXICO, Isla de Enmedio, Veracruz, F. Bonet, 17–18.V.1957 (51459).

Distribution. Bermuda, if STIASNY's record is correct; Florida Keys and the Antilles.

Remarks. *Eunicea laciniata* seems not to have been recognized since DUCHASSAING & MICHELOTTI's original description of it, except under the possibly synonymous name *lugubris*. It may be recognized by its distinctive external form, and its identity verified by the large, laciniate clubs and spindles of the outer rind and the slender spindles of the middle layer.

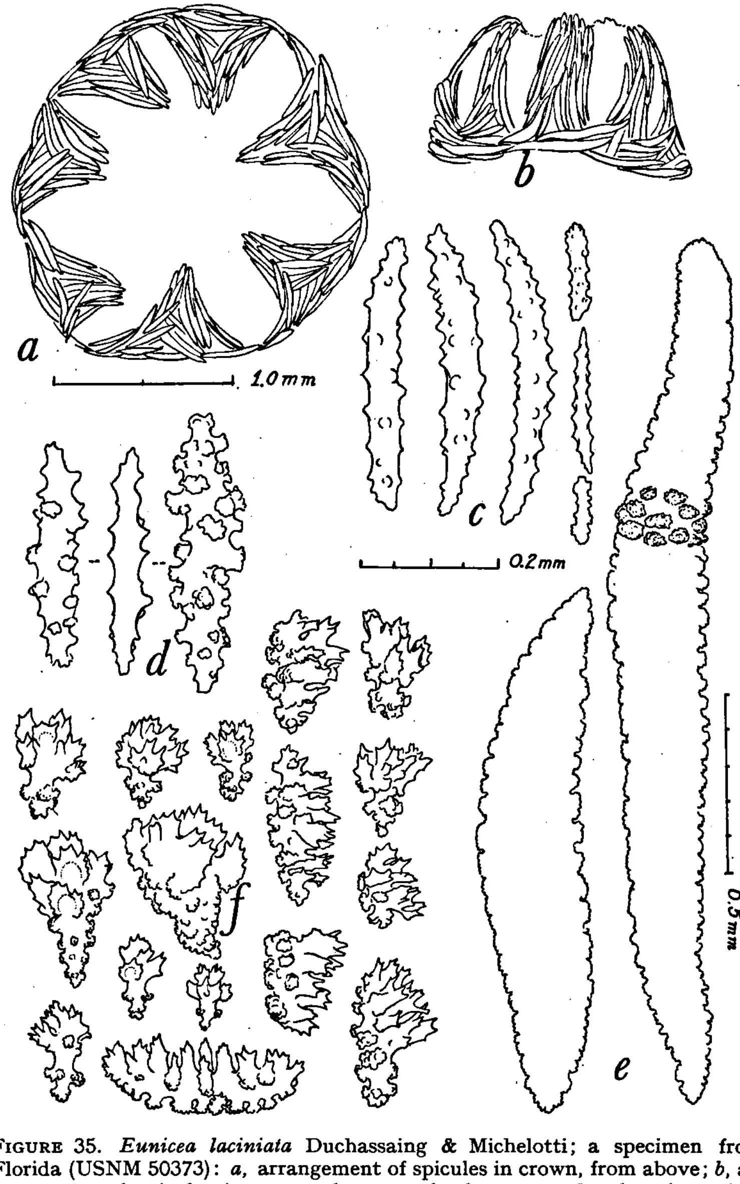


FIGURE 35. *Eunicea laciniata* Duchassaing & Michelotti; a specimen from Florida (USNM 50373): *a*, arrangement of spicules in crown, from above; *b*, arrangement of spicules in crown, less completely retracted polyp, from side; *c*, crown spicules; *d*, spindles of axial sheath; *e*, spindles of middle rind; *f*. spicules of outermost layer of cortex. (Enlargement of *a* and *b* indicated by 1.0 mm. scale at *a*; that of *c*, *d*, *f* by 0.2 mm. scale at *c*; that of *e* by 0.5 mm. scale adjacent.)

35 Eunicea (Euniceopsis) tourneforti
Milne Edwards & Haime, 1857
forma **tourneforti**

Fig. 36; Pl. II fig. 7, XIV fig. 1–7, XXI)

Eunicea Tourneforti MILNE EDWARDS & HAIME 1857, *1*, p. 150.
Eunicea Rousseaui MILNE EDWARDS & HAIME 1857, *1*, p. 151. (Martinique.)
Eunicea rousseaui, HARGITT & ROGERS 1901, p. 283, pl. 3 fig. 1. (Porto Rico.)
Euniceopsis Tourneforti, VERRILL 1907, p. 313. (Castle Harbor; the Reach; and reefs of Bermuda.)
?*Eunicea tourneforti*, KUNZE 1916, p. 528, fig. M, pl. 25 fig. 5. (Barbados.)
Eunicea tourneforti, GORDON 1925, p. 19, pl. 3 figs. 3–3a; pl. 4 fig. 3. (Caracas Bay, Curaçao.)
Eunicea tourneforti, STIASNY 1935d, p. 85, pl. 5 fig. 22. (Tortugas; Curaçao.)

Diagnosis. Colonies flat, candelabrum-formed, with stout, stiff branches 10–15 mm. in diameter (Pl. II fig. 7); axis often greatly compressed in the plane of branching, the branches sometimes anastomosing. Calyces prominent, with a strong, up-turned lower lip. Crown strong but the collaret indistinct (Fig. 36 e–g). Axial sheath containing blunt rods with complex tubercles, and some shorter capstans, colorless or pale violet (Fig. 36 b); middle layer of rind containing very large, stout, white spindles 1.5 mm. long and about 3.5 times as long as wide (Fig. 36 a); outer layer containing abundant wart- and leaf-clubs 0.1–0.15 mm. long (Fig. 36 c–d), and occasionally some unilaterally foliate spindles and capstans of similar size. Dry colonies are dark gray or blackish brown.

Material. CURAÇAO, Frater Arnoldo, 1950, 2 dry specimens (USNM 50368). Santa Marta Bay, reef, 3 m., J. H. Stock, 12.X.1958, greyish in color (Amsterdam). ST. EUSTATIUS, Gallows Bay, rock, 2 m., sta. 1116B, 15.VII.1949, dry spec. (USNM 50267). ST. MARTIN, Point Blanche Bay, cast ashore, 5.VII.1955, dry spec. (USNM 50427).

In addition USNM specimens from the FLORIDA Keys (50316), DRY TORTUGAS (50275), northern BAHAMAS (14556, 49786), JAMAICA, Don Christopher's Cove (51358, 51388), PUERTO RICO (42137), ST. CHRISTOPHER (50329), and GUADELOUPE (44051.)

Distribution. Bermuda; Florida Keys; Bahamas; Greater and Lesser Antilles.

Ecology. "It is found in ... inner waters, where there are strong currents, but is more common and larger on the outer reefs." (VERRILL 1907, p. 313.)

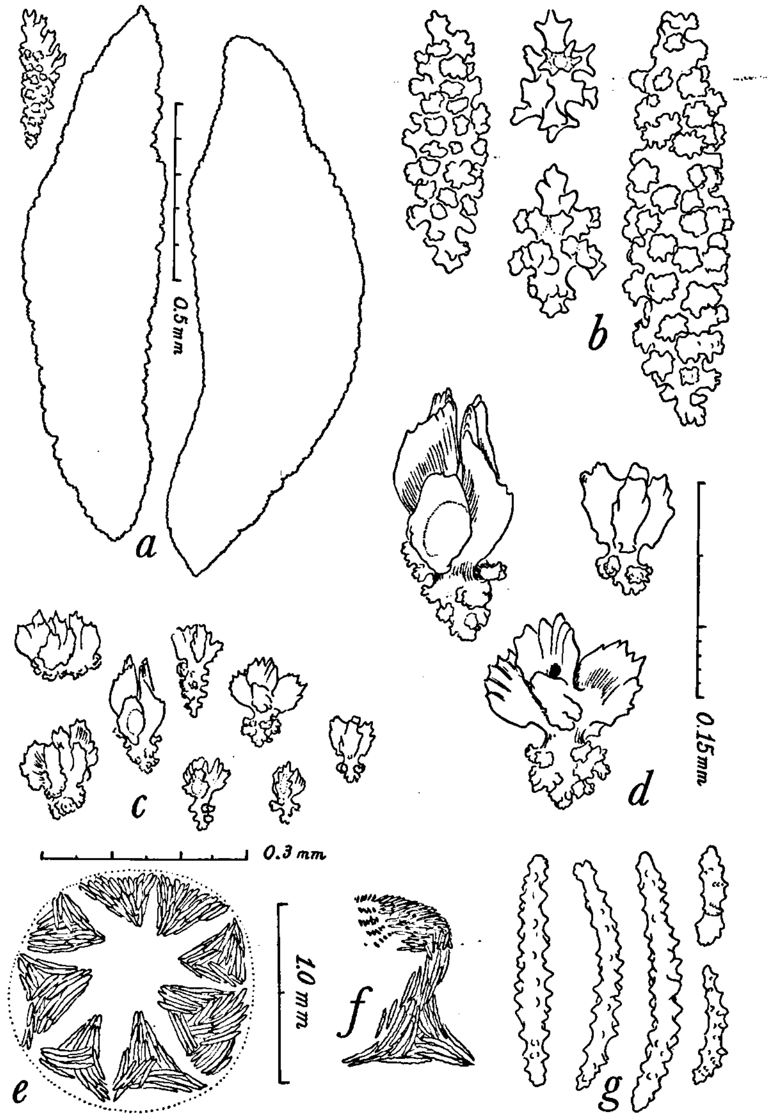


FIGURE 36. *Eunicea tourneforti* Milne Edwards & Haime, typical form. *a–d*, spicules of a specimen from St. Eustatius (USNM 50267): *a*, spindles of middle rind; *b*, spicules of axial sheath; *c*, clubs of outer rind; *d*, outer clubs at greater magnification. *e–g*, a specimen from Florida (50275): *e*, arrangement of spicules in crown, from above; *f*, arrangement of spicules in one segment of crown, from side (tentacular part twisted to show side view); *g*, crown spicules. (Enlargement of *a* indicated by 0.5 mm. scale; that of *b*, *c*, *g* by 0.3 mm. scale at *c*; that of *d* by 0.15 mm. scale to right; that of *e* and *f* by 1.0 mm. scale.)

Remarks. A variable but easily recognized species. In its typical form, the stout-branched, flabellate colonies have strongly projecting calyces with prominent lower lip. The surface layer contains small clubs of characteristic form, the middle layer contains stout spindles, and the spicules of the axial sheath are mostly colorless.

35a Eunicea (Euniceopsis) tourneforti Milne Edwards & Haime, 1857 forma **atra** Verrill, 1901

(Fig. 37; Pl. II fig. 6, XXIV)

?*Eunicea Sayoti* DUCHASSAING & MICHELOTTI 1860, p. 22. (St. Thomas.)
?*Eunicea Sagoti* [sic], KÖLLIKER 1865, p. 137, pl. 18 fig. 16.
Eunicea atra VERRILL 1901, p. 52, pl. 9 figs. 4–5. (Bermuda.)
Euniceopsis atra, VERRILL 1907, p. 315, figs. 164–165. (The Reach, Bermuda.)

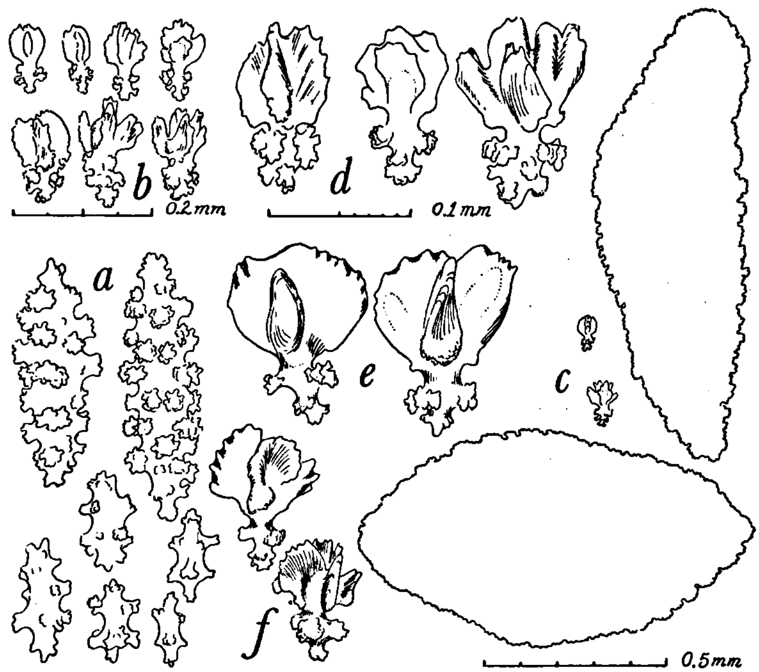


FIGURE 37. *Eunicea tourneforti* Milne Edwards & Haime, forma *atra* Verrill; spicules of a specimen from Bermuda (USNM 50080): *a*, spicules of axial sheath; *b*, clubs of outer rind; *c*, spindles of middle rind, with two outer clubs drawn to same scale; *d*, clubs at greater magnification; *e*, outer clubs of a specimen from Bermuda (51720); *f*, outer clubs of a specimen from St. Croix (51723). (Enlargement of *a* and *b* indicated by 0.2 mm. scale below *b*; that of *c* by 0.5 mm. scale below *c*; that of *d*, *e*, *f* by 0.1 mm. scale at *d*.)

Diagnosis. Colonies like those of typical form but more loosely branched (Pl. II fig. 6), the branches only 6–10 mm. in diameter. Polyps fully retractile, with a small lower lip, especially in those near the branch tips. Spicules practically identical with those of typical form and showing similar variation. Large spindles (Fig. 37 c) sometimes stouter than in nominate form; clubs of outer layer (Fig. 37 b) are 3-winged leaf-clubs with the folia either marginally expanded or sharp-edged (Fig. 37 d); in some colonies the broad, sharp-edged clubs predominate and grow rather large (Fig. 37 e), and in others are quite ornate (Fig. 37 f). The usual size of the clubs is about 0.1 mm., but a few may grow considerably larger as in the nominate form. The spicules of the axial sheath (Fig. 37 a) are like those of the typical form, mostly or entirely colorless in the upper branches, some white and some pale purple at the base and throughout in small colonies. Dry colonies dark gray or blackish brown in color.

Material. BERMUDA, Whalebone Bay (USNM 50080), and Somerset (USNM 50341), both specimens collected by Dr. Elisabeth Deichmann; ST. CROIX, Buck Island, R. E. Schroeder, VIII. 1960 (USNM 51743); JAMAICA, Pigeon Island (USNM 51390).

Distribution. Bermuda (probably sympatric with E. *tourneforti* forma *tourneforti*); Jamaica.

Remarks. VERRILL (1907, p. 315) says that "the coenenchyma is inky black in life, and when taken from the water it exudes a large amount of black mucus that stains one's hands and clothes like ink. It also discolors a large quantity of alcohol or formol solution."

This form of *Eunicea tourneforti* may easily be recognized by its straight, rather stiff branches that show only small lower lips beneath the apertures, the characteristic black color, the small clubs of the surface layer, and the stout spindles of middle of rind.

36 **Eunicea (Euniceopsis) asperula**
Milne Edwards & Haime, 1857

(Fig. 38; Pl. II fig. 3, XIV fig. 8–10)

Eunicea asperula MILNE EDWARDS & HAIME 1857, *1*, p. 150. (Martinique.)
?*Eunicea succinea*, KUNZE 1916, p. 546, pl. 26 fig. 10. (Tortugas.)

Diagnosis. Tall colonies with irregularly dichotomous ramification (Pl. II fig. 3), the branches rather few, long, and ascending,

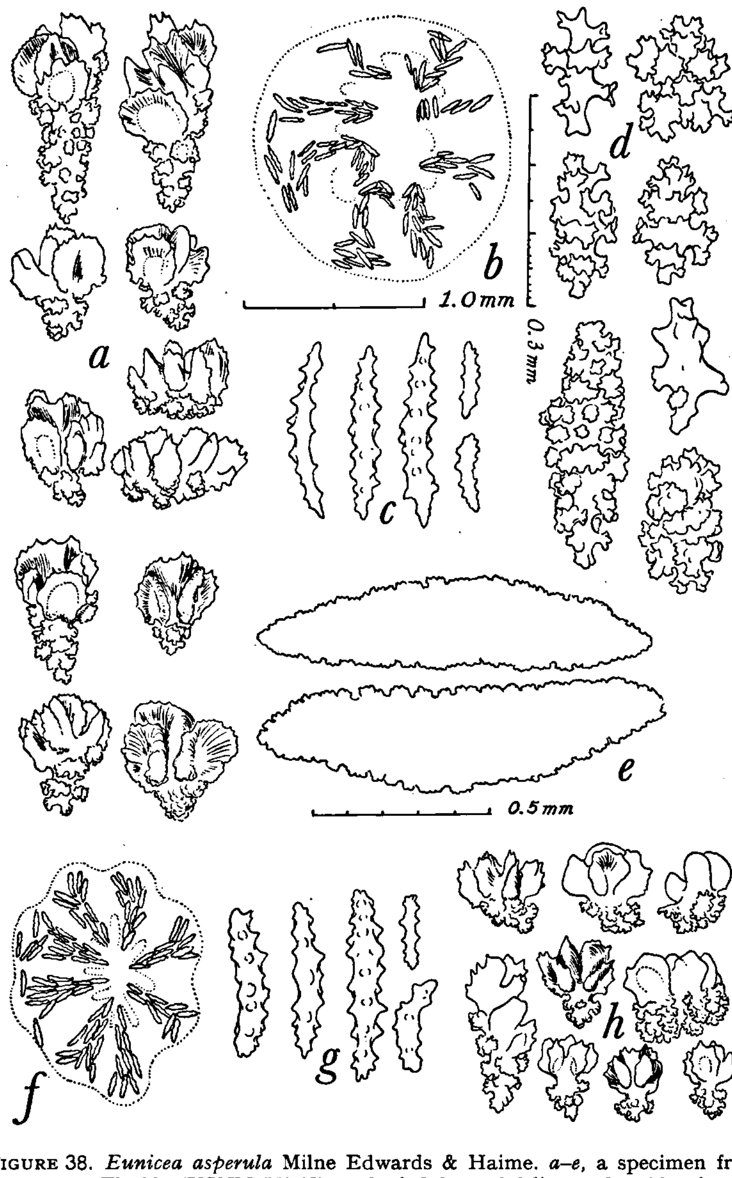


FIGURE 38. *Eunicea asperula* Milne Edwards & Haime. *a–e*, a specimen from Key West, Florida (USNM 50752): *a*, leaf-clubs and foliate spheroids of outer rind; *b*, arrangement of spicules in crown, from above; *c*, anthocodial spicules; *d*, spicules of axial sheath; *e*, spindles from middle rind. *f–h*, a specimen from Florida (3102): *f*, arrangement of spicules in crown; *g*, anthocodial spicules; *h*, clubs and foliate spheroids of outer rind. (Enlargement of *a*, *c*, *d*, *g*, *h* indicated by 0.3 mm. scale at left of *d*; that of *b* and *f* by 1.0 mm. scale at *b*; that of *e* by 0.5 mm. scale below.)

mostly 3–4 mm. in diameter but occasionally larger. Calyces closely crowded, with a short lower lip. Anthocodiae with a weak armature of small rods (Fig. 38 c, g) in a triangular field below each tentacle (Fig. 38 b, f). Axial sheath containing blunt rods sculptured with complicated tubercles, and numerous short capstans that may develop into multiradiate, spheroidal bodies (Fig. 38 d); all types colorless in the upper parts of the colony, but near the base some of the spicules may be pale violet. Middle layer of rind with white spindles of moderate size, rarely longer than 1.0 mm. and usually not much more than 0.8 mm. (Fig. 38, e); outer layer of rind with stubby wart- and leaf-clubs ordinarily about 0.15 mm. long, and many leafy spheroids which, in some specimens, have the foliations thick and smooth, in others thin and serrate (Fig. 38, a, h). Color of dry colonies gray, brownish gray, or blackish; texture very hard and brittle.

Material. The specimens are all from the older collections of the U.S. National Museum and were taken from the southwest coast of FLORIDA (50753) and the upper Florida Keys at Caesar's Creek (50751) to Key West (50752).

Distribution. South Florida and the Keys to the Lesser Antilles.

Remarks. The various specimens examined show great variation in regard to spicules, but agree in these basic points: (1) the axial sheath contains blunt spindles or rods, and capstans that develop into profusely sculptured spheroids, colorless in the terminal branches, partly pale violet near the base; (2) the spindles of the middle rind are of moderate size; and (3) the outer layer of rind contains numerous small leaf-clubs and foliate spheroids.

Although KUNZE did not figure the spicules of his "*Eunicea succinea*" it is fairly certain from the description and the photograph of the colony that he had *Eunicea asperula* in hand.

37 **Eunicea (Euniceopsis) clavigera** spec. nov.

Figs. 39–40; Pl. IV fig. 3)

?*Eunicea turgida* EHRENBERG 1834, p. 364. (No locality given.)
?*Plexaura turgida*, VERRILL 1864b, p. 35. (Florida Reefs.)

Diagnosis. Colonies with long, ascending branches up to 5 mm. in diameter, slightly clavate. Anthocodiae with a strong crown of spindles 'en chevron' but without collaret. Calyces well-separated, moderately prominent, low-conical, with aperture terminal or directed upward. Axial sheath containing acute, slender spindles, light purple in color, some with simple and some with complex processes; middle layer containing large spindles 2–3 mm. in length, all white or white with purple core; outer layer with many small leaf-clubs about 0.1 mm. long, and infrequent small leafy spheroids.

Description. Although the three specimens before me differ in external appearance, the difference is mostly one of size. In all of them, the terminal branches are proportionately long, slightly clavate (Pl. IV fig. 3); the polyps retract within low but distinct,

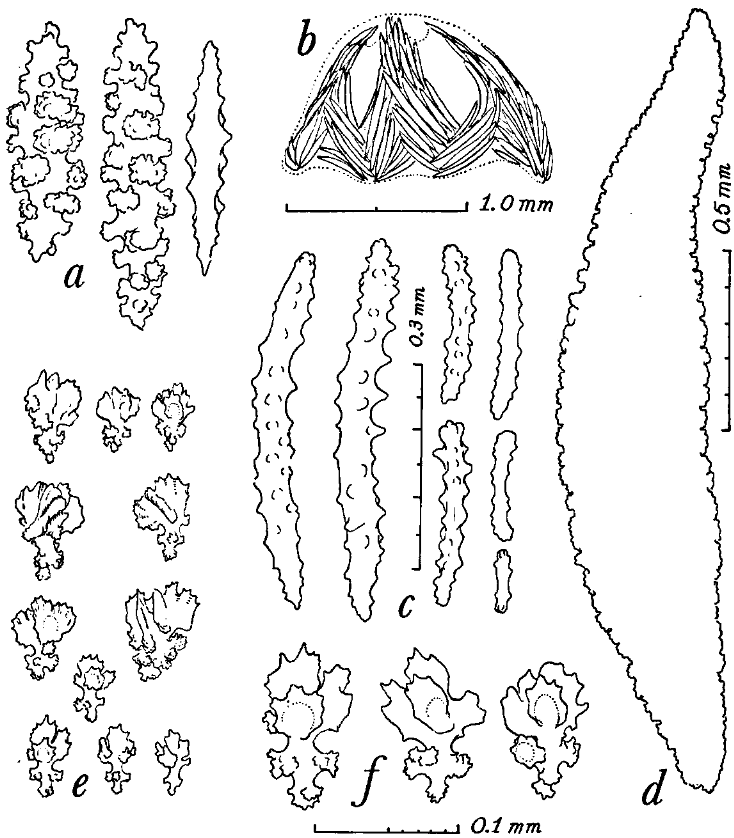


FIGURE 39. *Eunicea clavigera* spec. nov.; spicules of a specimen from Bermuda (USNM 50076): *a*, spindles of axial sheath; *b*, arrangement of spicules in crown, side view; *c*, anthocodial spicules; *d*, spindle of middle rind; *e*, clubs of outer rind; *f*, outer clubs at greater magnification. (Enlargement of *a*, *c*, and *e* indicated by 0.3 mm. scale at *c*; that of *b* by 1.0 mm. scale below; that of *d* by 0.5 mm. scale adjacent; that of *f* by 0.1 mm. scale below.)

mound-like or bluntly conical calyces with more or less up-turned mouths; the anthocodiae are armed with a strong crown of spindles (Figs. 39 c, 40 c) in chevrons below the tentacles, which has no collaret below it (Figs. 39 b, 40 b); the surface of the rind is packed with minute clubs about 0.1 mm. long (Figs. 39 e–f, 40 e–f); the middle layer of cortex contains the large spindles (Figs. 39 d, 40 d) characteristic of *Euniceopsis* but they are longer (up to 3.0 mm.)

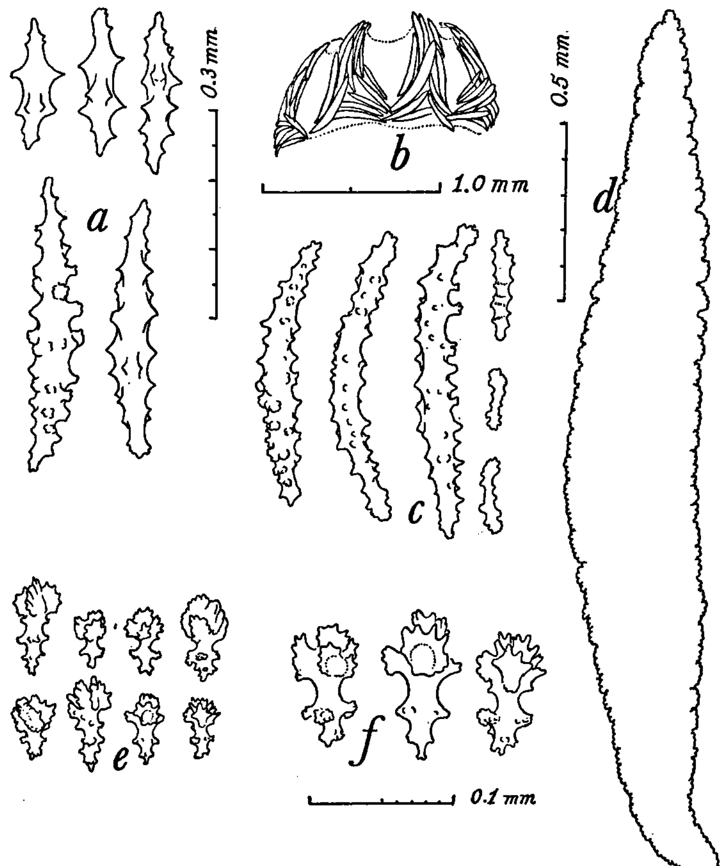


FIGURE 40. *Eunicea clavigera* spec. nov.; spicules of the holotype from Curaçao (USNM 50265): *a*, spindles of axial sheath; *b*, arrangement of spicules in the crown, side view; *c*, anthocodial spicules; *d*, spindle of middle rind; *e*, clubs of outer rind; *f*, clubs at higher magnification. (Enlargement of *a*, *c*, and *e* indicated by 0.3 mm. scale at *a*; that of *b* by 1.0 mm. scale below; that of *d* by 0.5 mm. scale to left; that of *f* by 0.1 mm. scale below.)

and more slender ($5^1/_2$ to 7 times as long as wide) than those of *E. tourneforti* and *E. calyculata*, not so slender as those of *E. laciniata*, and larger in all respects than those of *E. fusca, asperula,* and *knighti;* and the axial sheath contains acute purple spindles, some with simple, conical projections and others with compound tubercles (Figs. 39 a, 40 a).

The specimen from Bermuda (USNM 50076) is the largest, with erect, clavate terminal branches 5 mm. in diameter and 15 cm. or more in length (Pl. IV fig. 3). The calyces are quite prominent, the apertures mostly directed upward, occasionally with a hint of a blunt lower lip. Branching appears not to be profuse, but the specimen is fragmentary. The color of the dry colony is medium brown.

The material from Curaçao (USNM 50265) is more slender but agrees in other external features. The specimens in alcohol are black, but this color is due to a fine, particulate sediment that covers the surface.

The small specimen taken at a depth of 70 fathoms off Cat Cay in the Bahamas (USNM 50160) agrees in the strong crown without collaret, the surface layer of tiny clubs, and the large but relatively slender spindles of the middle cortex. It differs from the other specimens in its very slender branches, only 2.0 mm. in diameter (3.5 mm. at the swollen tips), but this difference may be due to ecological factors present at its exceptionally deep habitat.

Material. Holotype from CURAÇAO, Caracas Baai, on chain buoy submerged several meters deep for about 15 years, J. S. Zaneveld and P. Wagenaar Hummelinck coll., 22.IV.1955, several branches in alcohol (USNM 50265),

Other material studied: BERMUDA, North Rock, a branch collected by diver for E. Deichmann, 23.VII.1951 (USNM 50076); off CAT CAY, Bahamas, small specimen dredged at 70 fms. by Mr. & Mrs. John Wentworth, VI.1947 (USNM 50160).

Distribution. Bermuda; Bahamas to Curaçao.

Remarks. The specimens of *Eunicea clavigera* have some characters in common with *Eunicea calyculata* (Ellis & Solander) but are less robust, and they differ from the slender form of that species by lacking a collaret beneath the crown. The clubs of the surface layer and the spindles of the middle layer are larger in *E. clavigera*, which also has not so many of the unilaterally spinose spindles and asymmetrical clubs as are found in *E. calyculata*. It is possible that *E. clavigera* will fall into synonymy with some previously described species, perhaps *E. turgida* Ehrenberg, but the material now at hand cannot be assigned definitely to any of the species in the literature.

38 **Eunicea (Euniceopsis) knighti** spec. nov.

(Figs. 41–42; Pl. III figs. 5, 7)

Diagnosis. Colonies tall, with several elongate, ascending, slightly clavate branches about 5 mm. in diameter (as little as 3 mm. and as much as 7 mm., sometimes in the same colony; Pl. III figs. 5, 7). Polyps fully retractile, usually forming no projecting calyces at all and visible as gaping, oval orifices; rarely a slightly projecting rim beneath each aperture, chiefly near the ends of branches. Axial sheath containing colorless and pale or medium purple capstans and rods, mostly blunt; middle layer of rind containing white spindles, the largest usually 1.2–1.5 mm. in length; the outer layer of rind contains small (0.1 mm.) wart-clubs, many of which are rather foliate, and leafy spheroids derived from unilaterally foliate spindles or capstans. Color of dry or alcoholic specimens brown, yellowish brown, or gray.

Description. The type is a dichotomously branched colony 29 cm. in height; division begins near the base and gives rise to several long, cylindrical branches 6 mm. in diameter, slightly clavate at the ends. The rind is smooth, with open, pore-like apertures showing only the faintest tendency to produce raised rims. The anthocodiae with their conspicuous crowns are almost completely retracted. The proximal crown spicules are oblique or transverse and form a collaret of variable strength (Figs. 41 b, 42 a, c, e). The spicules of the outer cortex (Fig. 41 e–f) are diverse in form, chiefly ornate derivatives of spindles and clubs. Unilaterally foliate spheroids and one-sided spindles are abundant. The spindles of the middle layer are of moderate size, not over 1.5 mm. in length. The spicules of the axial sheath include both spindles and capstans (Fig. 41 a), many of them colored purple throughout the colony.

Material. Holotype from FLORIDA, Soldier Key, Biscayne Bay, F. M. Bayer coll., 19.IV.1948 (USNM 50430). Also U.S. National Museum specimens from the Florida coast in the Gulf of Mexico: off Cape Romano, J. Q. Tierney, 28.IX.1948 (44234); between John's Pass and Pass-a-Grille, Henry Hemphill, I. 1884 (50692); off Sarasota, J. Brookes Knight, 23.II.1951 (50431); and off Alligator Harbor, northwest Florida, Harold J. Humm, 29.XI.1952 (50681).

Distribution. Eastern Gulf of Mexico, from Alligator Harbor south to the Florida Keys and northward to the vicinity of Biscayne Bay.

Remarks. *Eunicea knighti* may be recognized by the unilaterally foliate spheroids, spindles and capstans of the outer rind, along with the absence of projecting ca-

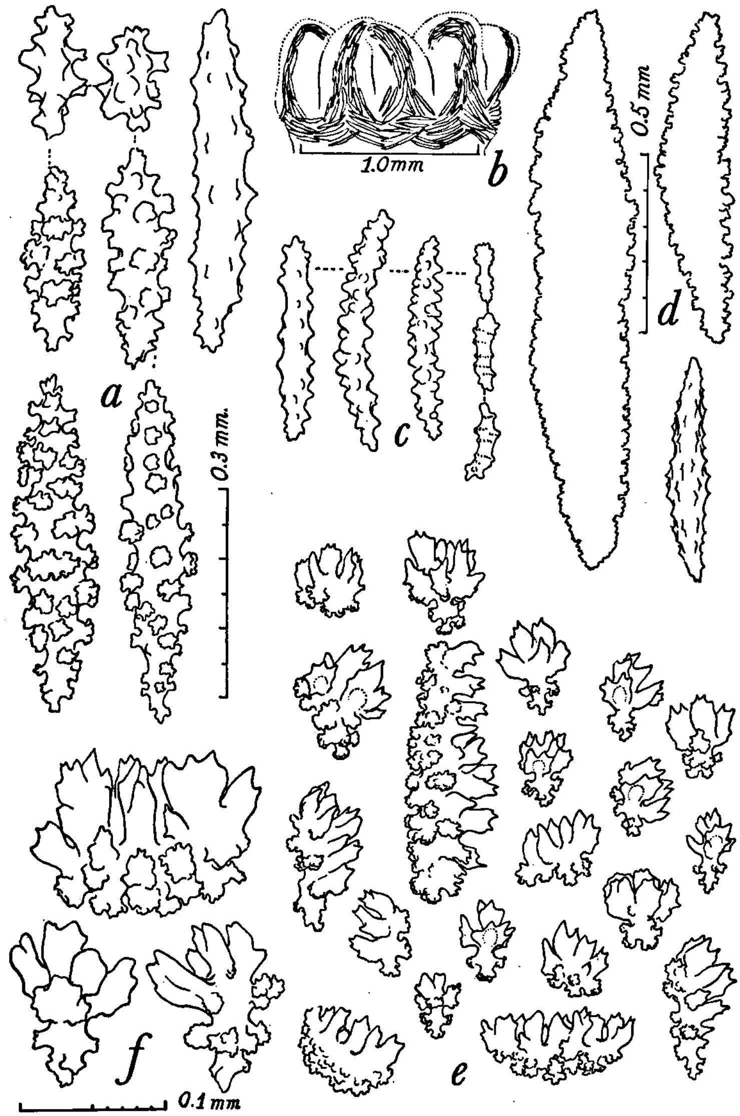


FIGURE 41. *Eunicea knighti* spec. nov.; spicules of the holotype from Florida (USNM 50430): *a*, spicules of axial sheath; *b*, arrangement of spicules in the crown, side view; *c*, anthocodial spicules; *d*, spindles of middle rind; *e*, spicules of outer rind; *f*, two clubs and foliate spheroid at greater magnification. (Enlargement of *a*, *c*, and *e* indicated by 0.3 mm. scale at *a*; that of *b* by 1.0 mm. scale below; that of *d* by 0.5 mm. scale; that of *f* by 0.1 mm. scale below.)

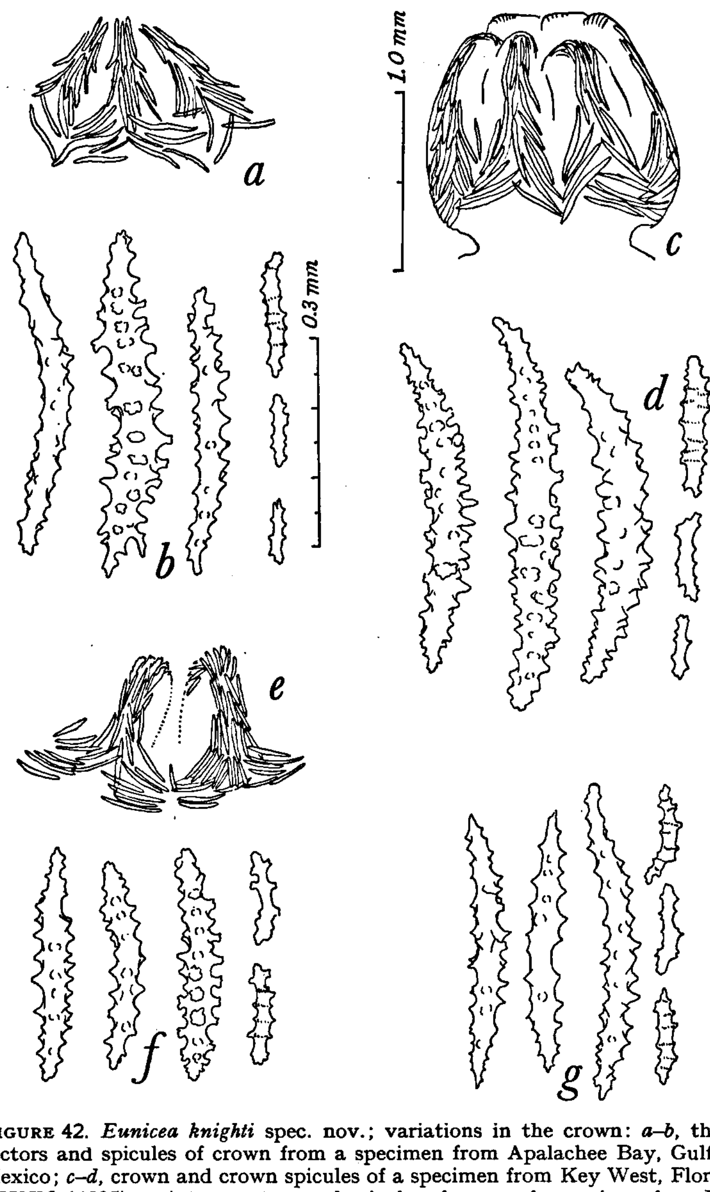


FIGURE 42. *Eunicea knighti* spec. nov.; variations in the crown: *a–b*, three sectors and spicules of crown from a specimen from Apalachee Bay, Gulf of Mexico; *c–d*, crown and crown spicules of a specimen from Key West, Florida (USNM 44235); *e–f*, two sectors and spicules of crown of a specimen from Dry Tortugas (50759); *g*, crown spicules of a specimen from the Gulf coast of Florida (50692). (Enlargement of *a*, *c*, and *e* indicated by 1.0 mm. scale at *c*; that of *b*, *d*, *f*, and *g* by 0.3 mm. scale at *b*.)

lyces. In some colonies there may be rims developed on the proximal edge of the apertures near the branch tips. The branches commonly are quite stout, 5 mm. or more in diameter, but some colonies are slender, and specimens with stout branches may also have some slender ones.

This species seems to be quite common along the Gulf coast of Florida. It is not rare at Soldier Key in Biscayne Bay, where it closely resembles the common *Plexaurella* with which it is associated.

39 **Eunicea (Euniceopsis) calyculata** (Ellis & Solander), 1786 forma **calyculata**

Figs. 43–46; Pl. III fig. 3, XXII, XXIII)

Gorgonia calyculata Ellis & Solander 1786, p. 95 [pl. 18 fig. 2].
Gorgonia multicauda Lamarck 1815b, p. 162. (Habite l'Océan américain.)
Eunicea clavaria Lamouroux 1816, p. 437. (Antilles.)
Eunicea clavaria, Lamouroux 1821, p. 36, pl. 18 fig. 2.
Eunicea multicauda, Milne Edwards & Haime 1857, *1*, p. 148.
Eunicea grandis Verrill 1900, p. 570, pl. 69 figs. 3, 3a. (Bermuda reefs.)
Eunicea crassa Hargitt & Rogers 1901, p. 283, pl. 2 figs. 1–9. (Porto Rico.)
Euniceopsis grandis, Verrill 1907, p. 313, figs. 161–162, pl. 33A, pl. 33B fig. 1a, pl. 36A fig. 3 [not pl. 36B as stated]. (Bermuda.)
Eunicea multicauda, Kunze 1916, p. 532, figs. N–R, pl. 25 fig. 6. (Barbados.)
Eunicea sparsiflora Kunze 1916, p. 537, figs. S–T, pl. 25 fig. 7. (Barbados.)
not *Eunicea calyculata*, Kunze 1916, p. 523, figs. H–L, pl. 24 fig. 4.
Eunicea multicauda, var. Gordon 1925, p. 18, pl. 3 fig. 2, pl. 4 fig. 2. (Caracas Bay, Curaçao.)
Eunicea multicauda Gordoni Stiasny 1935d, p. 81, fig. V, pl. 7 figs. 38–39. (Tortugas; Curaçao.)

Diagnosis. Colonies tall, terminal branches stout, cylindrical, 8–16 mm. in diameter (Pl. III fig. 3). Anthocodiae densely spiculate, the spindles often exceeding 0.6 mm. in length (Figs. 43 f, 44 f, 45 f); crown with a more or less distinct collaret (Figs. 43 e, 44 e, 45 e). Calyces low, usually gaping, more or less up-turned but without projecting lower lip. Axial sheath with white and pale violet blunt spindles, rods, and capstans (Figs. 43 a, 44 a, 45 a); middle layer with large, white spindles up to 2.0 mm. in length, 3.5 to 5 times as long as wide and often resembling rice grains in proportions (Figs. 43 b, 44 b, 45 b); outer rind with small wart-clubs 0.08–0.13 mm. in length, and a few small leafy spheroids (Figs. 43 c–d, 44 c–d, 45 c–d). Color of dry colonies light or dark brown.

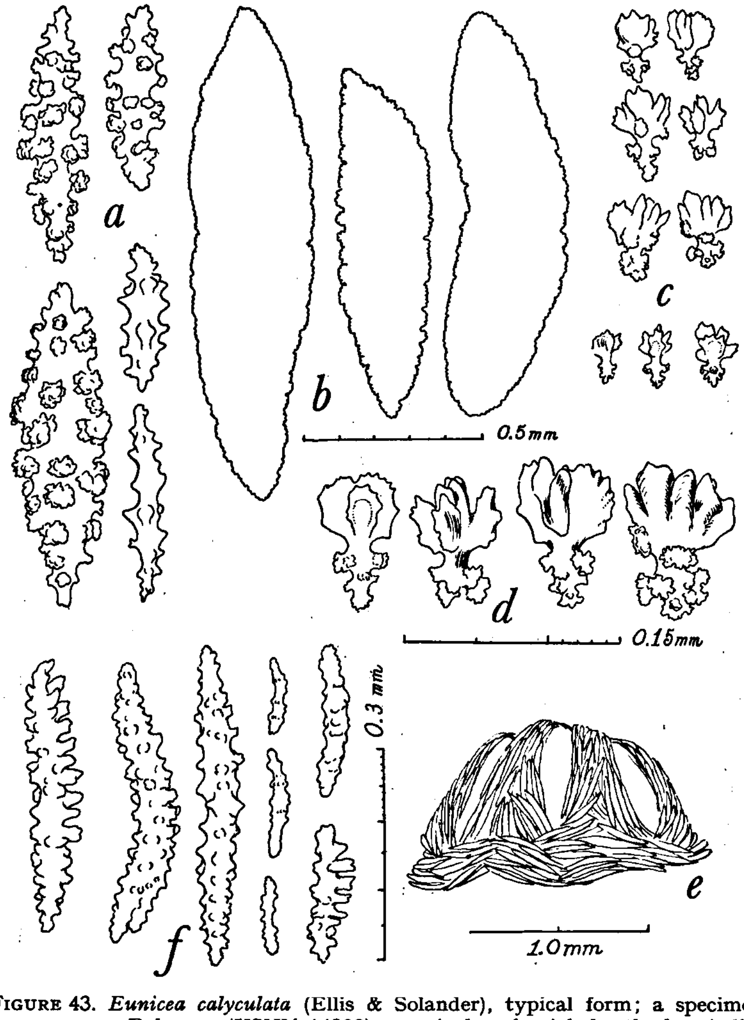


FIGURE 43. *Eunicea calyculata* (Ellis & Solander), typical form; a specimen from Nassau, Bahamas (USNM 14389): *a*, spicules of axial sheath; *b*, spindles of middle rind; *c*, clubs of outer rind; *d*, clubs at greater magnification; *e*, side view of crown; *f*, anthocodial spicules. (Enlargement of *a*, *c*, and *f* indicated 0.3 mm. scale at right of *f*; that of *b* by 0.5 mm. scale adjacent; that of *d* by 0.15 mm. scale adjacent; that of *e* by 1.0 mm. scale adjacent.)

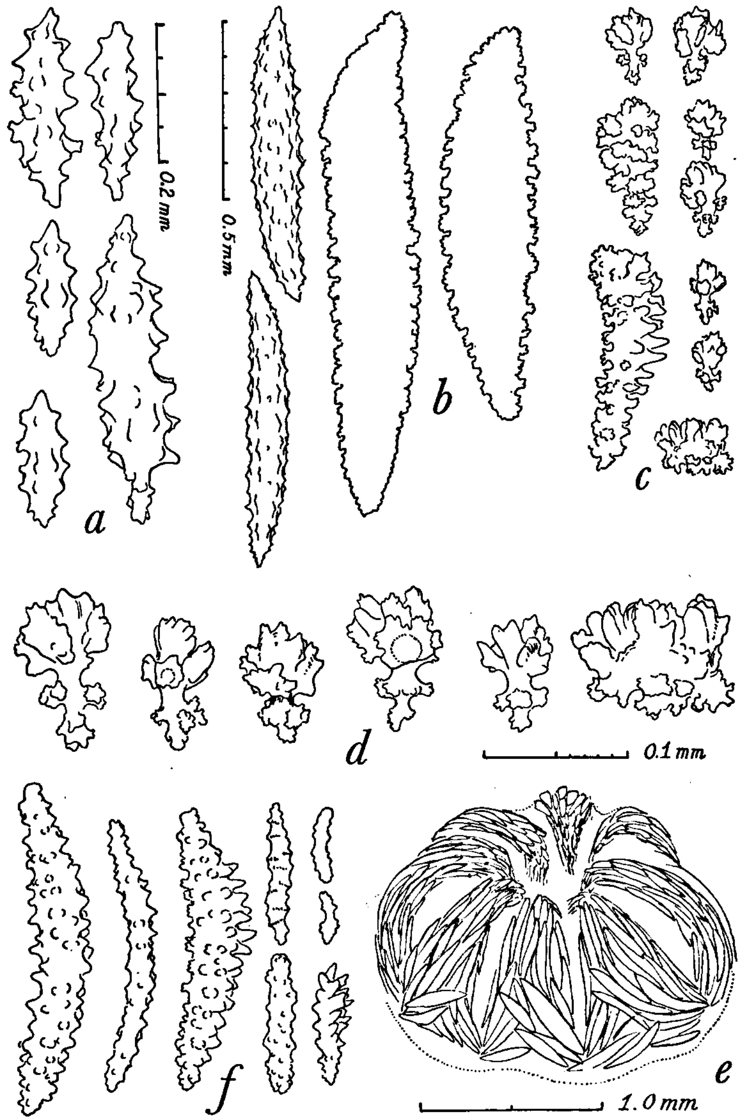


FIGURE 44. *Eunicea calyculata* (Ellis & Solander), typical form; a specimen from Bermuda (USNM 50079): *a*, spicules of axial sheath; *b*, spindless of middle rind; *c*, spicules of outer rind; *d*, clubs and spheroid of outer layer, at greater magnification; *e*, oblique view of crown; *f*, anthocodial spicules. (Enlargement of *a*, *c*, and *f* indicated by 0.2 mm. scale at *a*) that of *b* by 0.5 mm. scale adjacent; that of *d* by 0.1 mm. scale below; that of *e* by 1.0 mm. scale below.)

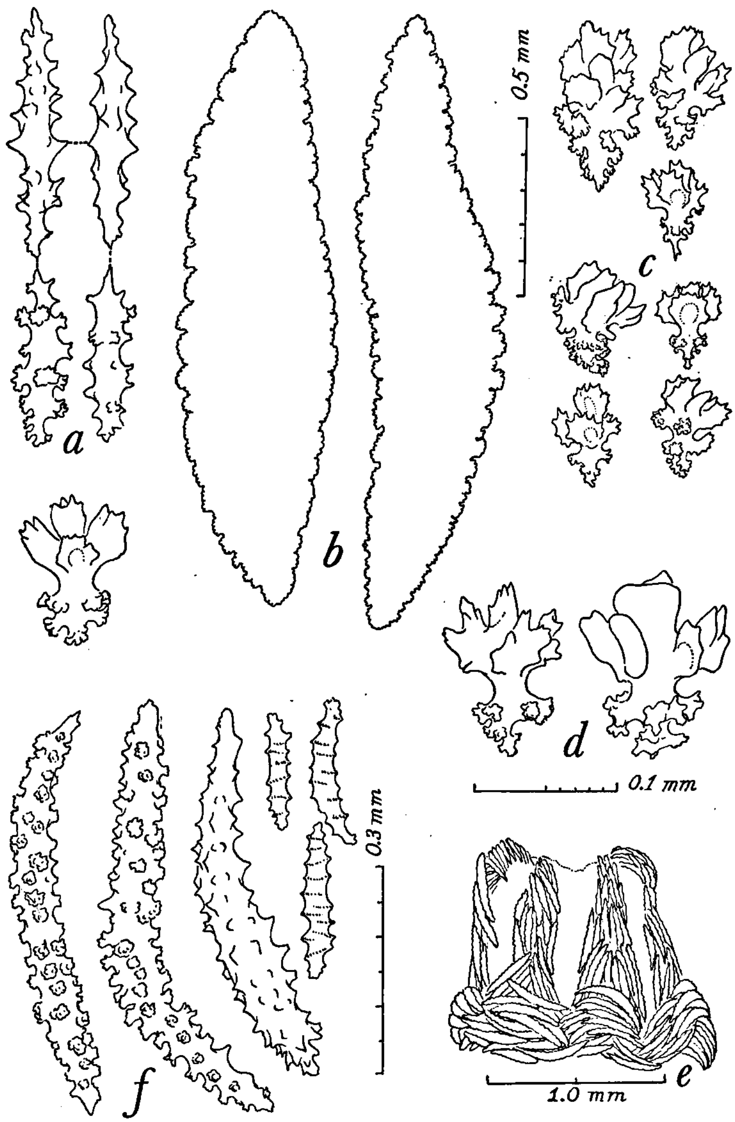


FIGURE 45. *Eunicea calyculata* (Ellis & Solander), typical form; a specimen from off Palm Beach, Florida (USNM 49719): *a*, spicules of axial sheath; *b*, spindles of middle rind; *c*, spicules of outer rind; *d*, clubs of outer rind at greater magnification (third club-shaped spicule underneath the letter *a*); *e*, side view of crown; *f*, anthocodial spicules. (Enlargement of *a*, *c*, and *f* indicated by 0.3 mm scale at *f*; that of *b* by 0.5 mm. scale adjacent; that of *d* by 0.1 mm. scale below; that of *e* by 1.0 mm. scale below.)

Material. CURAÇAO, Santa Marta Bay, Acropora reef, 3 m., J. H. Stock, 8.X.1958 (Amsterdam).

From the U.S. National Museum: BERMUDA, Dr. E. Deichmann coll., 1951, small dry specimen (50079); FLORIDA, off Palm Beach, A. R. Thompson and T. L. MacGinty, yacht *Triton*, V.1950, small colony in alcohol (49719); NEW PROVIDENCE, east end of Long Key, Nassau, W. J. Nye, *Albatross*, 1886, large dry spec. (14389); PUERTO RICO, *Fish Hawk*, 1898–1899, large dry spec. (42138); MEXICO, Arrecife Alacranes, Yucatan (51447).

Distribution. Bermuda; Bahamas; south Florida to Curaçao.

Remarks. The original description of *Gorgonia calyculata* reads as follows: "This Gorgon grows in a subdivided order, having erect thick branches, with truncated papillae. The flesh is ash-colored without, and purple on the inside, furnished with large cup-shaped mouths, disposed close together in a quincunx order, and looking upwards, having polypes with eight fringed claws extending themselves from them. The bone is of a dark brown color, and horny in nature." (ELLIS & SOLANDER 1786, p. 95.)

The foregoing description agrees so precisely with figure 2 on plate18 of the same work, to which the explanation was lost prior to publication, that there is no doubt that the latter represents the same species. LAMOUROUX (1821) in his edition of ELLIS & SOLANDER's work, gave the name *Eunicea clavaria* to this same figure. The specimens called *multicauda* by LAMARCK, *grandis* by VERRILL, and *sparsiflora* by KUNZE, all belong to ELLIS & SOLANDER's *G. calyculata*.

39a **Eunicea (Euniceopsis) calyculata** (Ellis & Solander), 1786 forma **coronata** nov.

(Fig. 46; Pl. III fig. 4)

Diagnosis. Colonies low, 15–20 cm. in height; diameter of branches about 4 mm. exclusive of calyces. A broad zone of transverse spicules below the points of the crown. Spiculation otherwise as in the typical form.

Material. Two complete colonies from the Campeche Bank, MEXICO, 21°35′ North, 90° 45′ West, 18 fms., *Oregon* sta. 1047, 13.V.1954 (USNM 50686).

Distribution. Known at present only from the original locality.

Remarks. Two colonies dredged by the 'Oregon' in the Gulf of Campeche agree with *Eunicea calyculata* in all particulars except their small size and broad collaret (Fig. 46 e). The calyces are prominent and up-turned as they often are in typical *E. calyculata*, and the anthocodiae are exsert in preservation. The spindles of the axial sheath (Fig. 46 a), the large spindles of the middle layer (Fig. 46 b), the clubs and spheroids of the outer layer (Fig. 46 c–d), and the spicules of the crown (Fig. 46 f) are like those of the typical form.

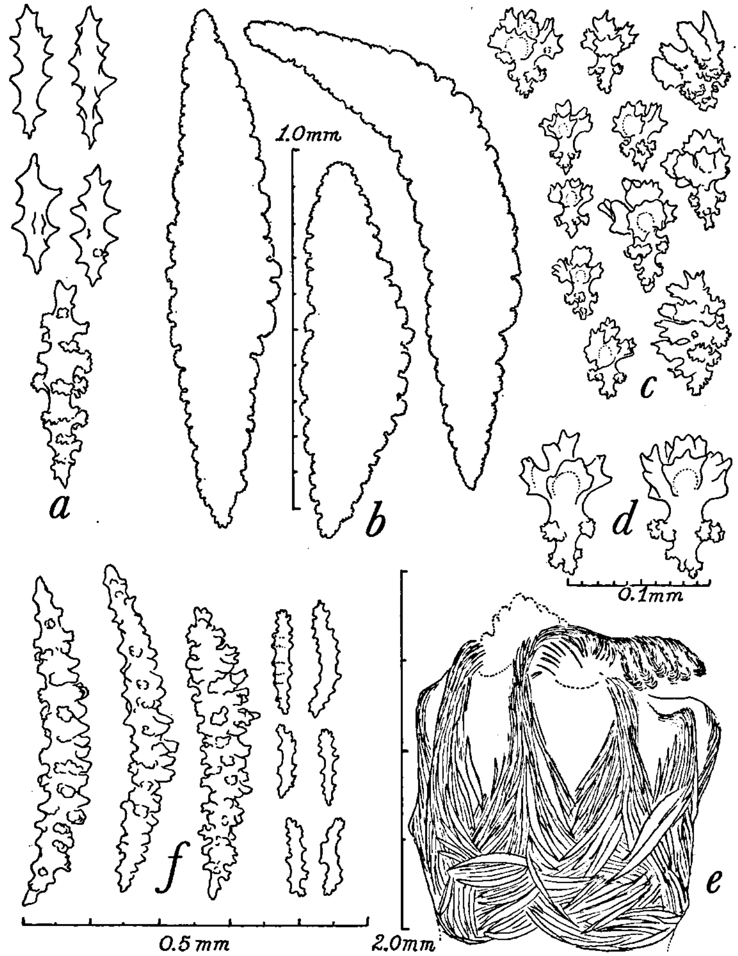


FIGURE 46. *Eunicea calyculata* (Ellis & Solander), forma *coronata* nov.; a specimen from Campeche Bank (USNM 50686): *a*, spicules of axial sheath; *b*, spindles of middle rind; *c*, spicules of outer rind; *d*, clubs of outer rind, at greater magnification; *e*, side view of crown, one tentacle extended to show arrangement of spicules; *f*, anthocodial spicules. (Enlargement of *a*, *c*, and *f* indicated by 0.5 mm. scale at *f*; that of *b* by 1.0 mm. scale; that of *d* by 0.1 mm. scale; that of *e* by 2.0 mm. scale at left.)

40 **Eunicea (Euniceopsis)** sp. indet.

(Fig. 47)

Represented by only a few branches in poor condition is a specimen of *Euniceopsis* whose spiculation is quite different from that of any known species. It has the thick branches and low, often gaping calyces of *Eunicea* (*Euniceopsis*) *calyculata*, a strong crown with proximal spindles oblique or transverse (Fig. 47 b), and distinctly purple spicules in the axial sheath (Fig. 47 a). It differs from *E. calyculata* in the small size (up to 0.7–0.8 mm.) of the spindles in the middle cortex (Fig. 47 d), and the coarse, spinulose character of the clubs in the surface layer (Fig. 47 e). The latter are strongly reminiscent of the thorny clubs of *Psammogorgia* from the Pacific coast of Central America.

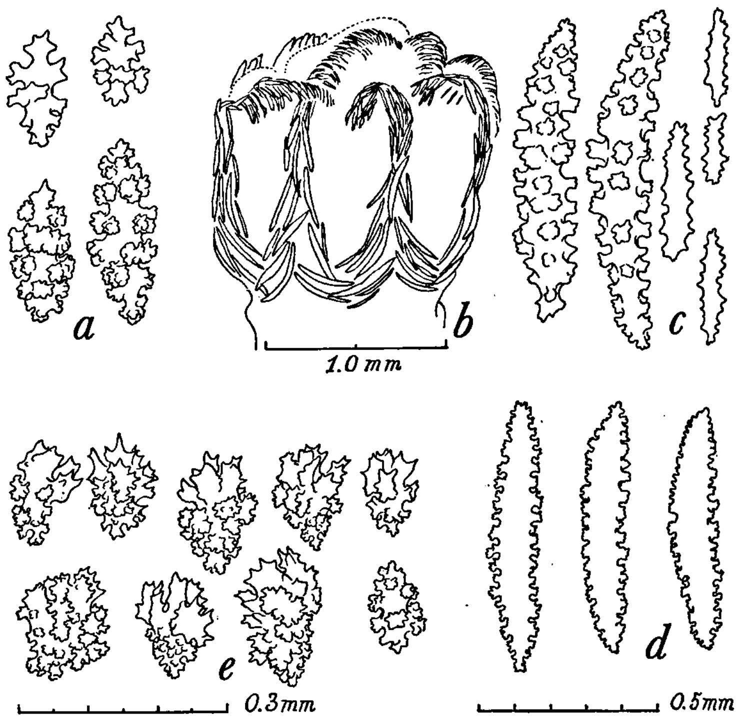


FIGURE 47. *Eunicea* sp. indet., from St. Martin's Reef, Florida Banks (USNM 16353): *a*, spicules of axial sheath; *b*, side view of crown; *c*, anthocodial spicules; *d*, spindles of middle rind; *e*, sclerites of outer rind. (Enlargement of *a*, *c*, and *e* indicated by 0.3 mm. scale below *e*; that of *b* indicated by 1.0 mm. scale below; that of *d* by 0.5 mm. scale below.)

In details of spiculation, the present material agrees most closely with *Eunicea knighti*, which contains many unilaterally foliate forms, but *E. knighti* also has well-formed leaf-clubs, and its asymmetrically foliate spindles reach a larger size (cf. Fig. 41 e–f).

It seems likely that this specimen represents a distinct species, but the scanty material available is not sufficient for the proper establishment of a new species.

Material. Fragments in alcohol, FLORIDA, from off the northwest end of St. Martin's Reef, 28°50′ North, 83° West, collected by Lt. F. J. Moser, 1887 (USNM 16353).

Genus **Muriceopsis** Aurivillius, 1931

Muriceopsis AURIVILLIUS 1931, p. 114. (Type species, *Muriceopsis tuberculata* Aurivillius (not Esper) = *Eunicea humilis* Milne Edwards & Haime = *Gorgonia sulphurea* Donovan, by original designation.)
Plexauropsis (part), STIASNY 1935d, p. 69.
not *Plexauropsis* VERRILL 1907, p. 309. [= *Pseudoplexaura.*]
Muriceopsis, DEICHMANN & BAYER 1959, p. 3.

Diagnosis. Arborescent colonies of either pinnate or bushy from, with slender branches and slightly projecting shelf-like or lip-like calyces. Axial sheath with slender, sharply pointed spindles, colorless or deep purple. Outer cortex contains large spindles with tall, complicated folia and spines on the outer surface, often more pointed at one end and sometimes distinctly club-like; deeper region of cortex with spicules symmetrically ornamented; no layer of small clubs at the surface of the rind.

Distribution. Bermuda? Florida Keys to Brazil; West Africa?

Remarks. The one-sided spindles that look like nudibranchs, which predominate in the outer rind, are very characteristic of the genus. *Muriceopsis* is apparently related to *Muricea* but the calyces are not so well developed, the spicules are smaller, and those of the axial sheath are not infrequently of a purple color.

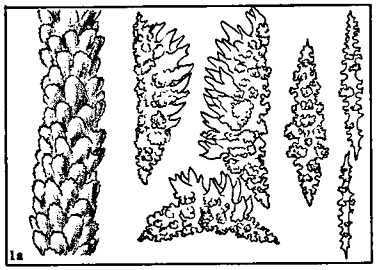
VERRILL's genus *Plexauropsis* was based upon a specimen of *Pseudoplexaura porosa* and cannot be maintained.

KEY 14

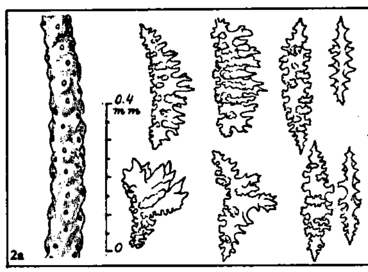
ILLUSTRATED KEY TO THE SPECIES OF *Muriceopsis*

1a. Colonies densely bushy. Polyps with distinctly projecting nariform calyces: *Muriceopsis sulphurea* (Donovan)

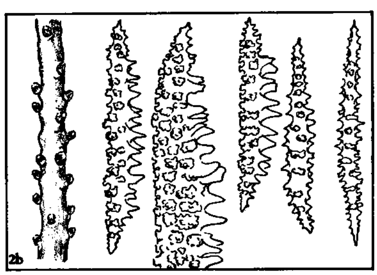
1b. Colonies pinnately branched, plumose; calyces low or absent: 2



2a. Colonies in the form of large, composite plumes. Outer cortex with stout, unilaterally spinose clubs and spindles up to about 0.4 mm. in length. Reef-dwelling species: *Muriceopsis flavida* (Lamarck)



2b. Colonies in the form of small feathers. Unilaterally spinose spindles of outer cortex are long and slender, up to 1.0 mm in length. Deep-water species: *Muriceopsis petila* spec. nov.



41 **Muriceopsis sulphurea** (Donovan), 1825

(Fig. 48 a–b; Pl. II fig. 8)

Gorgonia citrina, LAMARCK 1815b, p. 84. (l'Océan américain?)
not *Gorgonia citrina* ESPER 1792, *2*, p. 129, pl. 38. [= *Pterogorgia citrina*.]
Gorgonia sulphurea DONOVAN 1825, *4*, p. 126. (The Brasilian Sea.)
Muricea sulphurea, EHRENBERG 1834, p. 358.
Eunicea humilis MILNE EDWARDS & HAIME 1857, *1*, p. 149, pl. B^2 fig. 1. (Bahia.)

Muricea humilis, + vars. *humilis*, *mutans*, and *macra* VERRILL 1912, p. 377, fig. 1, pl. 29 figs. 1–1a, pl. 32 figs. 4–5, pl. 35 fig. 2. (Abrolhos Reefs to Guarapary, Brazil.)
Muricea acropora VERRILL 1912, p. 379, pl. 32 fig. 3, pl. 35 figs. 1–1a. (Mar Grande, Bahia, Brazil.)
Muriceopsis tuberculata, AURIVILLIUS 1931, p. 115. (St. Barthélemy.)
not *Gorgonia tuberculata* ESPER 1792, *2*, p. 127, pl. 37.
not *Eunicea humilis*, STIASNY 1935d, p. 74, fig. T, pl. 3 fig. 14, pl. 7 fig. 32. [= *Plexaura flexuosa* Lamouroux.]
Muriceopsis sulphurea, DEICHMANN & BAYER 1959, p. 6, pls. 1, 3. (Brazil.)

Diagnosis. Colonies low and shrub-like, with irregular pinnate branching (Pl. II fig. 8); twigs about 3 mm. in diameter, with polyps forming shelf-like or nariform calyces. Axial sheath containing slender spindles about 0.3 mm. in length, yellow, rarely purple (Fig. 48 a); outer rind with stout, ornately foliate, unilaterally developed "nudibranch-like" spindles, and some smaller torches or clubs not arranged in a special stratum at the surface (Fig. 48 b). Color yellow in both dry or alcoholic material.

Material. A number of USNM specimens from the coast of BRAZIL (5282, 5285, 5303, 49660, 49661). ST. LUCIA, Gros Inlet (51416). PUERTO RICO, Vega Baja (51931, 52031). From the Leiden Museum a specimen collected in 1886 by A. J. van Koolwijk, questionably at ARUBA.

Distribution. Brazil,Aruba?, St. Lucia, St. Barts, Puerto Rico

Ecology. The coelentera of one of the specimens examined contained the shells of larval pelecypods and gastropods in some abundance; the polyps must have been feeding heavily upon larval mollusks just before it was collected.

Remarks. This characteristic but variable species has received several names because of its different growth forms. These vary from low, scrubby colonies only 4–5 cm. in height to rather elongate, spindly forms 18–20 cm. tall, which approach the appearance of *M. flavida*. The calyces of *M. sulphurea* are more prominent than those of *flavida*, and its spicules are more coarsely and profusely sculptured.

42 **Muriceopsis flavida** (Lamarck), 1815

(Fig. 48 c–f; Pl. IV fig. 1)

Gorgonia flavida LAMARCK 1815b, p. 158. (Habite l'Océan des Antilles.)
Muricea flexuosa, HARGITT & ROGERS 1901, p. 283, fig. F. (Gallardo Bank, P. Rico.)
Plexauropsis? flavida, STIASNY 1935d, p. 71, fig. S, pl. 1, fig. 5. (Curaçao.)
Plexauropsis flavida, STIASNY 1941d, p. 106, pl. 1 figs. 5–6. (Los Frailes.)
Plexauropsis puertorealis STIASNY 1941d, p. 107, fig. B, pl. 1 figs. 7–8. (Los Frailes.)
Muriceopsis flavida, DEICHMANN & BAYER 1959, p. 8, pl. 4. (Florida, Antilles, Cuba, Puerto Rico, Guadeloupe, Tobago; Mauritius?)

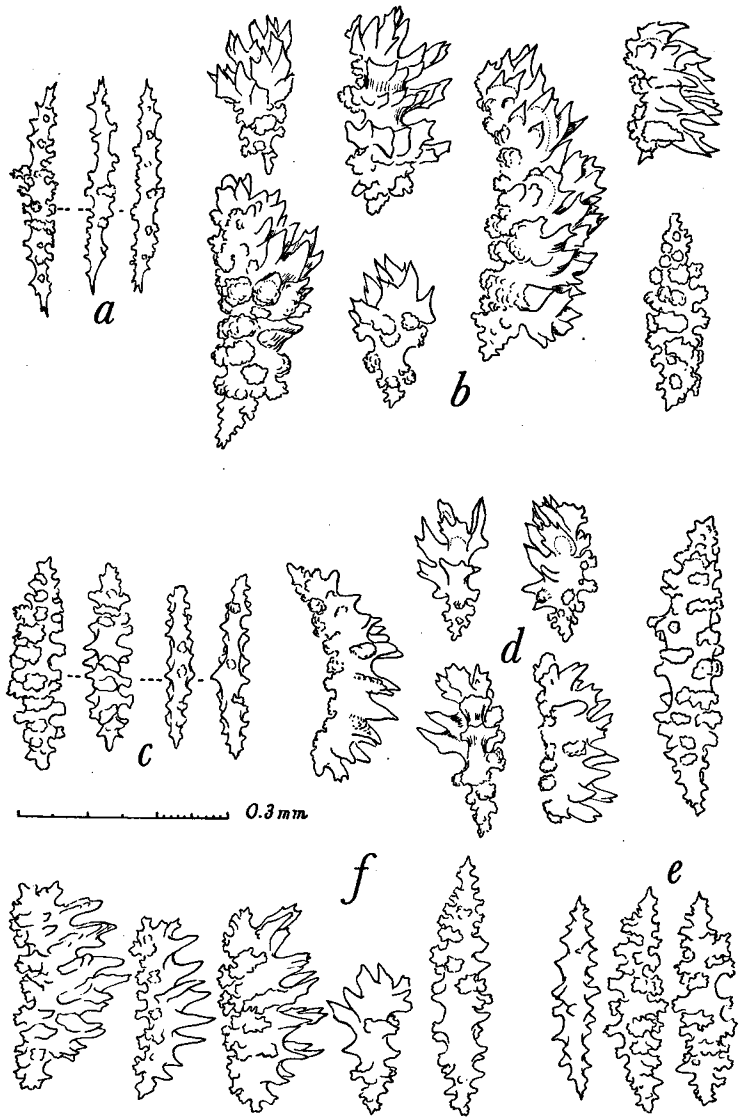


FIGURE 48. *Muriceopsis sulphurea* (Donovan), spicules of a specimen from Brazil (USNM 5286): *a*, spindles of axial sheath; *b*, spicules of the outer rind. *Muriceopsis flavida* (Lamarck), spicules of a specimen from St. Thomas (50245): *c*, spindles of axial sheath; *d*, spicules of outer rind; spicules of the type specimen in the Paris Museum: *e*, spindles of axial sheath; *f*, spicules of outer rind. (All figures drawn to the same scale.)

Diagnosis. Tall, plumose, pinnately branched colonies (Pl. IV fig. 1) with cylindrical branchlets bearing polyps all around; calycular apertures commonly with a small, shelf-like lip below. Axial sheath with slender, acute spindles up to 0.3 mm. in length, purple (Fig. 48 c, e); outer rind with stout, unilaterally spinose spindles about 0.3 mm. in length, and asymmetrical clubs measuring 0.20–0.25 mm. (Fig. 48 d, f). Color of colonies olivaceous yellow, grayish yellow, or purple, depending upon the proportion of yellow and purple sclerites in the rind.

Material. Los FRAILES, La Pecha, sandy rock debris, 1–2 m., sta. 1215, Hummelinck coll., 19.VI.1936, dried fragments (USNM 50324). Puerto Real, sandy debris, 3–4 m., sta. 1214, Hummelinck coll., 18.VI.1936, fragments of the type of *Plexauropsis puertorealis* Stiasny (USNM 50253). A part of Stiasny's type of *Plexauropsis flavida*, through the courtesy of Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie at Leiden. In addition to the above a large number of USNM specimens; among these are: a fragment of Lamarck's type in the Paris Museum, received through the kindness of Prof. Gilbert Ranson; specimens from south FLORIDA (50256); the BAHAMAS (14374, 50137, 50263, 50321), PUERTO RICO (42593), ST. JOHN (50133, 50245), SABA BANK (50343), GUADELOUPE (44053), DOMINICA (50344), ST. LUCIA, south of Marigot Bay (51415), and GRAND CAYMAN (51391).

Distribution. Bermuda?, south Florida and the West Indies.

Remarks. STIASNY's *Plexauropsis puertorealis* is in very close agreement with *Muriceopsis flavida*, of which the purple specimens do not significantly differ from yellow ones. STIASNY's *Plexauropsis flavida* seems to be identical with LAMARCK's *Gorgonia flavida.*

43 **Muriceopsis petila** spec. nov.

(Fig. 49; Pl. IV fig. 2)

Diagnosis. Colonies branched in an open, pinnate manner (Pl. IV fig. 2); branches slender, of uniform diameter (1.5–2.0 mm.); polyps on all sides, more or less exsert in preservation, forming low, conical calyces. Axial sheath containing slender, violet or colorless spindles about 0.35 mm. in length (Fig. 49 a, d); outer cortex with colorless, elongate, unilaterally spinose spindles up to 1.0 mm. long, some of them stouter at one end and of club-like

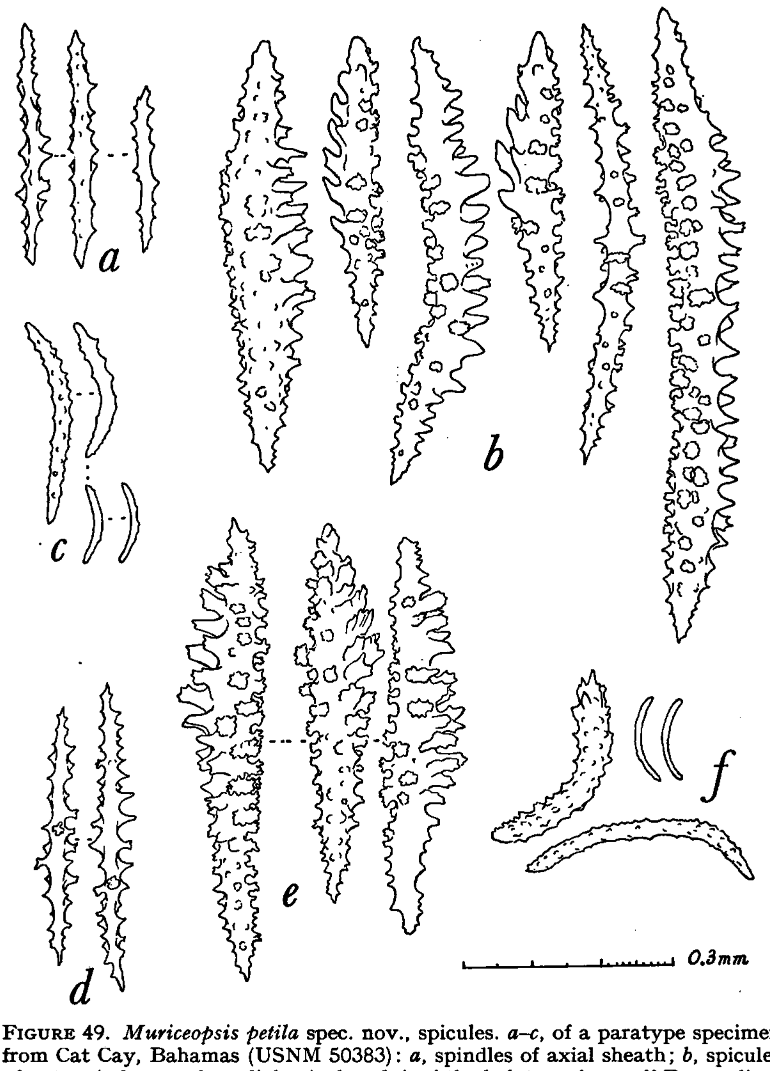


FIGURE 49. *Muriceopsis petila* spec. nov., spicules. *a–c*, of a paratype specimen from Cat Cay, Bahamas (USNM 50383): *a*, spindles of axial sheath; *b*, spicules of outer rind; *c*, anthocodial spicules. *d–f*, of the holotype from off Fernandina, Florida (50382): *d*, spindles of axial sheath; *e*, spicules of outer rind; *f*, anthocodial spicules. (All figures drawn to the same scale.)

form (Fig. 49 b, e). Anthocodiae armed with curved rods up to 0.3 mm. in length, those in the pinnules about 0.1 mm. (Fig. 49 c, f). Color of alcoholic specimens pale lavender, due to the purple color of the axial sheath spicules which shows through the colorless spicules of the outer rind.

Description. The type is a stem (branch?) about 15.5 cm. tall, bearing numerous pinnate twigs 3–4 cm. in length, arising at intervals of 5–15 mm. The twigs are cylindrical, the polyps situated on all sides and exsert in preservation. The axial sheath contains slim, acute spindles 0.3–0.4 mm. in length (Fig. 49 d), and the outer rind has unilaterally spinose spindles and weakly clavate forms (Fig. 49 e). The anthocodiae have a strong armature of bent rods (Fig. 49 f) arranged to form a crown; the spicules of the points are spinose at the distal end; the tentacles are packed with c-shaped rodlets.

The specimen from 'Albatross' station 2649 is a larger colony, about 30 cm. tall, with its base of attachment. Although the branching is distinctly pinnate, the branchlets all arise from the upper side of the main branches; they are as much as 10 cm. in length, and the interval between them is usually about 10 mm. but may be as great as 30 mm.

The specimens from Cat Cay are fragmentary but show the typical pinnate manner of branching and conform well in regard to spiculation.

Material. Holotype from FLORIDA, off Fernandina, 30° 58′ 30″ North, 79° 38′ 30″ West, 294 fms., bottom 46.3° F., *Albatross* sta. 2668, 5.V.1886 (USNM 50382). Paratypes from CAT CAY, Bahamas, dredged in 70 fms. by Mr. & Mrs. John Wentworth, VI.1947, 3 specimens (USNM 50383); GREAT BAHAMA BANK, south end of the Tongue of the Ocean, 23°34′00″ North, 76°33′00″ West, 36 fms., bottom 74.2°F., *Albatross* sta. 2649, 12.IV. 1886 (USNM 50384).

Distribution. Fernandina, Florida, to the Great Bahama Bank, 36–294 fathoms.

Genus **Plexaurella** Kölliker, 1865

Plexaurella VALENCIENNES 1855, p. 10. [Nomen nudum.]
Plexaurella KÖLLIKER 1865, p. 138. (Type species, *Gorgonia dichotoma* Esper, by subsequent designation: KUNZE 1916, p. 555.)
Plexaurella, KUNZE 1916, p. 553.

Diagnosis. Stout, dichotomously branched plexaurids with predominantly or exclusively quadriradiate 'butterfly' spicules in the rind; axial sheath spicules not purple in color. Polyps with a few rods, usually minute, in the anthocodiae; rarely a strong crown.

Distribution. The western Atlantic from Bermuda to Brazil.

Remarks. The quadriradiate spicules are highly characteristic. When the ordinary spindles of other genera occur in twin form, the resultant quadriradiates are similar to the normal spicules of *Plexaurella* but are infrequent among the ordinary spindles, which predominate.

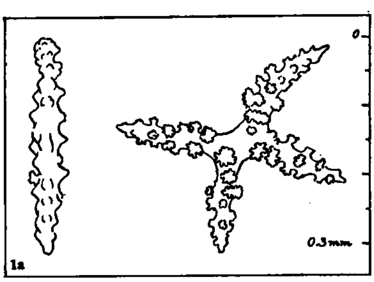
KÜKENTHAL (1924) accepts nine species, and does not include those described from Brazil by VERRILL (1912). I am able to distinguish only six species but others may be demonstrable when adequate studies are made on a large series of specimens.

KEY 15

ILLUSTRATED KEY TO THE SPECIES OF *Plexaurella*

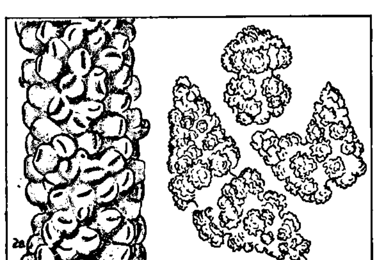
1a. Polyps strongly armed with stout rods about 0.3 mm. long. Quadriradiates with slender arms. Colonies with a few long branches 10–15 mm. in diameter. Rind elevated around apertures: ***Plexaurella nutans*** (Duchassaing & Michelotti)

1b. Polyps weakly armed, the rods only 0.05–0.07 mm. long. Arms of quadriradiates stout: 2

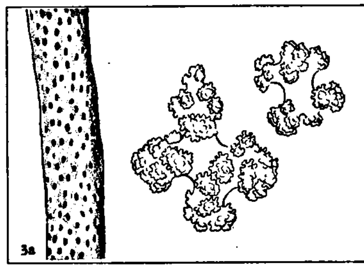


2a. Calyces protuberant, non-retractile. Cortex with coarsely sculptured bent spindles, double heads, and small butterflies: ***Plexaurella grandiflora*** Verrill

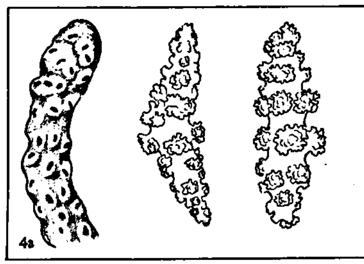
2b. Calyces not protuberant, but rind may be elevated around apertures: 3



3a. Most of the spicules of the middle layer sexradiates with two arms more strongly developed; butterflies with short rays; axial sheath with symmetrical sexradiates. Colonies with long, rodlike branches 5–7 mm. in diameter; rind smooth, apertures porelike: *Plexaurella grisea* Kunze



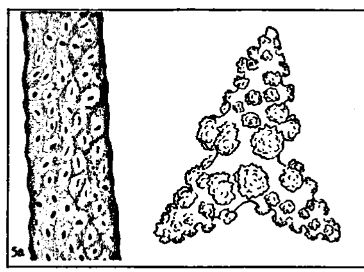
3b. Most of the spicules of the middle layer are quadriradiate butterflies or double spindles that are straight or bent at the waist: 4



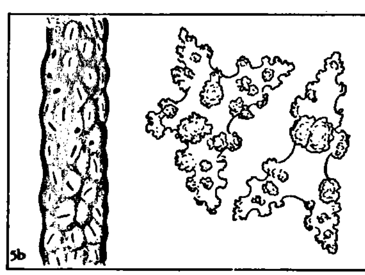
4a. Terminal branches slender, diameter 6 mm. or less; colonies forming low, shrubby bushes, sometimes taller and slender. Rind sclerites are chiefly straight or bent spindles about 0.3 mm. long: *Plexaurella pumila* Verrill

4b. Terminal branches stouter, 7–18 mm. in diameter: 5

5a. Large sclerites of middle rind are coarsely sculptured triradiates and butterflies with rays 0.2 mm. long. Branches 7–18 mm. in diameter. Rind usually elevated around apertures: *Plexaurella dichotoma* (Esper)



5b. Large sclerites of middle rind are more sparsely sculptured and have rays 0.15 mm. long. Branches about 9 mm. in diameter, rind elevated around apertures: *Plexaurella fusifera* Kunze



44 **Plexaurella dichotoma** (Esper), 1791

(Fig. 50; Pl. VI figs. 6–7, XXIII, XXIV, XXV)

Gorgonia dichotoma Esper 1791, *2*, p. 59, pl. 14. (Von den südlichen americanischen Inseln.)
Eunicea anceps Duchassaing & Michelotti 1860, p. 25, pl. 3 figs. 1–2. (St. Thomas.)
Plexaurella dichotoma, Hargitt & Rogers 1901, p. 285. (Porto Rico.)
Plexaurella dichotoma, Verrill 1907, p. 310, figs. 156–157, pl. 33B fig. 1b, pl. 36A fig. 2 (spicules of Esper's specimen), pl. 36A fig. 1 (spicules of the type of *Eunicea anceps* Duchassaing & Michelotti). (Bermuda: outer reefs; Castle Harbor; Great Sound.)
?*Plexaurella cylindrica* Verrill 1912, p. 384, pl. 32 fig. 7, pl. 34 fig. 4, pl. 35 figs. 4, 14. (Abrolhos Reefs.)
?*Plexaurella braziliana* Verrill 1912, p. 385, pl. 34 figs. 3–3a, pl. 35 figs. 12–12a, 15. (Abrolhos Reefs.)
Plexaurella obesa Verrill 1912, p. 383, pl. 31 fig. 3; pl. 32 fig. 9; pl. 34 fig. 6. (Fernando Noronha, Brazil.)
Plexaurella curvata Kunze 1916, p. 582, figs. B′–E′, pl. 27 fig. 9. (Barbados; Kingston; St. Thomas.)
Plexaurella dichotoma, Kunze 1916, p. 569, figs. N–P, pl. 28 fig. 5. (Barbados.)
Plexaurella heteropora, Kunze 1916, p. 567, figs. K–M, pl. 27 fig. 4. (Barbados.)

Diagnosis. Colonies bushy, dichotomously branched, the end twigs from 10 to 15 mm. in diameter, long and straight or short and crooked depending upon the habitat, only slightly clavate if at all (Pl. VI figs. 6–7). Rind raised around the apertures in most cases. Axial sheath contains spindles, triradiates and quadriradiates about 0.3 mm. long (Fig. 50 b); middle layer contains straight and bent spindles, triradiates and quadriradiates with strong tubercles, all about 0.35 mm. in length (Fig. 50 a, e); the outermost layer of rind contains small sexradiate capstans that are mostly about 0.1 mm. in length; many of them have two rays enlarged, producing antler-shaped bodies (Fig. 50 c, f); the anthocodiae are weakly spiculated with tiny flat rods (Fig. 50 d, g).

Material. From Hummelinck's collection: St. Eustatius, Gallows Bay, rocks, 2 m., sta. 1116B, 15.VII.1949, 1 dry specimen (USNM 50420). St. Martin, Little Bay, rocks, 3 m., J. H. Stock, 7.II.1959 (Amsterdam). Anguilla, north of Sandy Ground, rocky beach with sandy reef, 1–3 m., sta. 1142, 19.VI.1949, 4 dry and 2 alcoholic spec. (USNM 50410, 50669, 50745).

Additional USNM specimens: Florida, Biscayne Bay (50319), Key Largo (50419); Dry Tortugas (50269, 50390); Bahamas (14390); Grand Cayman

(51393); JAMAICA (7523), Lime Cay and Gun Cay, Port Royal Cays (51360, 51392), Pigeon Island (51394, 51395), off Portland Bight, 11 fms. (51359); ST. THOMAS (50418); BARBUDA (50333); MEXICO, Arrefice Alacranes, Yucatan (51435, 51446); BRAZIL (5278).

Distribution. Bermuda; southern Florida, throughout the Antilles, to the reefs of Brazil.

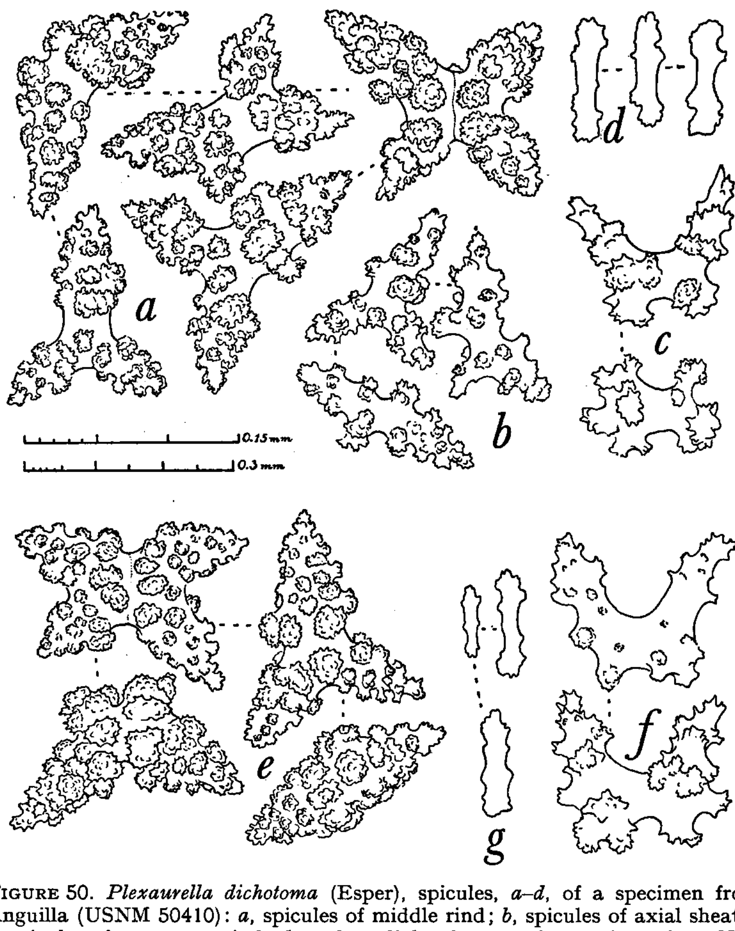


FIGURE 50. *Plexaurella dichotoma* (Esper), spicules, *a–d*, of a specimen from Anguilla (USNM 50410): *a*, spicules of middle rind; *b*, spicules of axial sheath; *c*, spicules of outermost rind; *d*, anthocodial rods. *e–g*, of a specimen from New Providence, Bahamas (14390): *e*, spicules of middle rind; *f*, spicules of outermost rind; *g*, anthocodial rods. (Enlargement of *a*, *b*, and *e* indicated by the 0.3 mm. scale below *a*; that of *c*, *d*, *f*, *g* by the 0.15 mm. scale below *a*.)

Remarks. It has been a common practice to assign almost any *Plexaurella* to the species *dichotoma*. I am an unwilling conformist in this practice, for what I treat here as *dichotoma* may be a complex of species which the material available is insufficient to separate. All stout specimens with a tendency to produce rimmed apertures and with large, coarsely tuberculate butterfly-spicules with thick rays (like VERRILL's figures of the type spicules) have been called *dichotoma*. KUNZE's *P. dichotoma grisea* has entirely different spicules and has been treated as a separate species, perhaps identical with his *P. teres* and *P. vermiculata*. It remains to be determined whether or not this is actually the *vermiculata* of LAMARCK.

45 **Plexaurella nutans** (Duchassaing & Michelotti), 1860

(Fig. 51; Pl. XIII figs. 2a, 2b)

Eunicea nutans DUCHASSAING & MICHELOTTI 1860, p. 24, pl. 3 figs. 3–4. (St. Thomas.)
Plexaurella nutans, KÖLLIKER 1865, p. 138, pl. 18 fig. 15. (Spicule from Duchassaing & Michelotti's material.)
Plexaurella crassa, KÖLLIKER 1865, p. 138, pl. 18 fig. 12.
Plexaurella affinis BELL 1889, p. 48, pl. 3 fig. 3. (West Indies.)
Plexaurella friabilis, KUNZE 1916, p. 560, figs. A–C, pl. 27 fig. 1. (St. Thomas.)
not *Plexaura friabilis* LAMOUROUX 1816, p. 430.
not *Plexaura friabilis*, VERRILL 1866, p. 186 [= *Euplexaura capensis* Verrill; Cape of Good Hope.]
Plexaurella kunzei KÜKENTHAL 1924, p. 102, fig. 73.

Diagnosis. Colonies very tall, sparingly branched in a dichotomous manner; terminal branches 10–15 mm. in diameter, up to 1 m. in length, more or less clavate; apertures widely separated, the rind forming an elevated rim around each. Axial sheath with spindles, crosses, and capstans, the latter often in "antler" form, ranging in size from 0.15 to 0.25 mm. (Fig. 51 a); middle layer of rind containing spindles, triradiates, and quadriradiates of slender form and large size, up to 0.45 mm. in total length or width (Fig. 51 b); the surface layer includes the usual capstans, many of them antler-shaped, mostly 0.075–0.10 mm. in greatest dimension (Fig. 51 d), but not uncommonly 0.15–0.2 mm. (Fig. 51 c); the anthocodiae have an armature unusually strong for the genus, consisting of blunt rods up to 0.3 mm. in length (Fig. 51 e). Color in alcohol, putty-gray or light brown.

Material. USNM specimens: FLORIDA, Biscayne Bay, F. M. Bayer coll. (50322), Cape Romano, J. Q. Tierney (44236); near the DRY TORTUGAS, *Oregon* (50130); JAMAICA (51361).

Distribution. Southern Florida, Gulf of Mexico and West Indies.

Remarks. *Plexaurella nutans* is at once recognized by its striking outward appearance, by the slender build of its large spindles and crosses in the middle cortex, and by the unusually strong anthocodial armature of rods larger than those of any other *Plexaurella.*

46 **Plexaurella grandiflora** Verrill, 1912

(Fig. 52; Pl. VI fig. 5)

Plexaurella (Pseudeunicea) grandiflora VERRILL 1912, p. 388, pl. 31 fig. 6, pl. 32 fig. 10, pl. 34 fig. 1, pl. 35 figs. 3–3a. (Mar Grande, Brazil.)
Plexaurella verrucosa VERRILL 1912, p. 387, pl. 31 fig. 4, pl. 32 fig. 6, pl. 34 fig. 5, pl. 35 figs. 13–13a. (Candeias, Pernambuco, Brazil.)

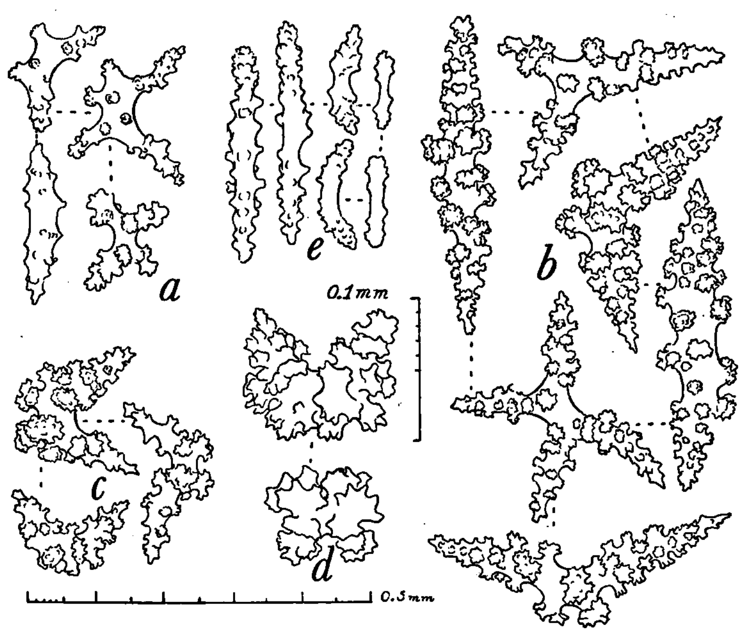


FIGURE 51. *Plexaurella nutans* (Duchassaing & Michelotti), spicules of a specimen from Dry Tortugas (USNM 50130): *a*, spicules of axial sheath; b, spicules of middle rind; *c*, larger spicules of outer rind; *d*, smaller spicules of surface layer; *e*, anthocodial rods. (Enlargement of *a–c* and *e* indicated by 0.5 mm. scale at lower left; that of *d* by 0.1 mm. scale adjacent.)

Diagnosis. Colonies dichotomously branched, the terminal branches 9–15 mm. in diameter including the crowded calyces (Pl. VI fig. 5). Polyps close-set, forming tall, tubular, bilabiate calyces into which the anthocodiae retract. Axial sheath with double spindles, double heads, and small butterflies, mostly about 0.1–0.2 mm. in greatest dimension (Fig. 52 b); middle layer with closely and coarsely sculptured double heads (0.15 mm.), double spindles either straight or bent at the waist (0.3–0.35 mm.), and small butterflies (Fig. 52 a); outer layer of rind with small double heads about 0.1 mm. long, often asymmetrically developed (Fig. 52 c); tentacles with flat rods reaching a length of 0.07 mm. (Fig. 52 d). Color of dry colonies, light or medium brown.

Material. Eight USNM specimens with very prominent calyces, from BRAZIL, Parahyba do Norte (5270) and Mar Grande, Bahia (5271–5276, 5312); also 8 specimens with calyces less prominent from Parahyba do Norte (5263, 5267, 5269, 5315, 5316) and Candeias, Pernambuco (5265, 5319, 5320); all collected by Richard Rathbun, 1876.

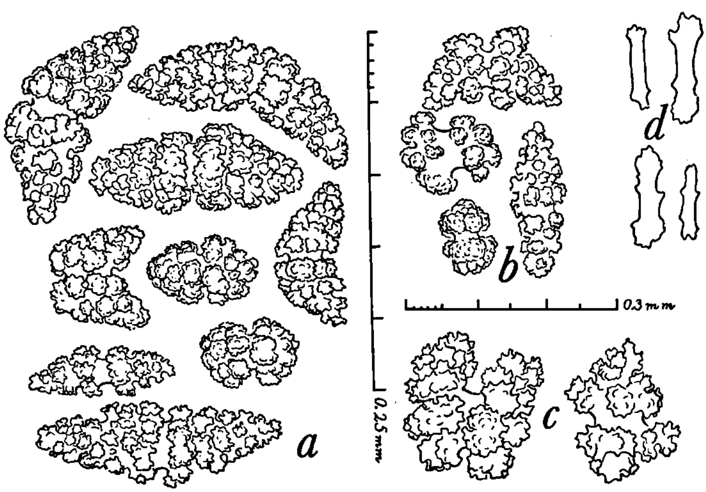


FIGURE 52. *Plexaurella grandiflora* Verrill, spicules of a specimen from Brazil (USNM 5276): *a*, spicules of middle rind; *b*, spicules of axial sheath; *c*, spicules of outer rind; *d*, anthocodial rods. (Enlargement of *a* and *b* indicated by 0.3 mm. scale below *b*; that of *c* and *d* by 0.25 mm. scale at right of *a*.)

Distribution. Reefs of Brazil; probably endemic.

Remarks. *Plexaurella grandiflora* is one of the most distinctive species of the genus. In appearance, it is not unlike the stoutest specimens of *Eunicea mammosa*, although its branching is characteristically dichotomous. The geographic distributions of the two species are not known to overlap and confusion is unlikely.

The specimens that Verrill called *Plexaurella verrucosa* are more slender than typical *grandiflora*, with calyces less prominent but still protruding and bilabiate. The spicules are practically identical with those of *grandiflora* (as can be seen even from Verrill's original figures), making it impossible to maintain the two as separate species.

47 **Plexaurella grisea** Kunze, 1916

(Fig. 53; Pl. VI fig. 4)

?*Plexaurella anguiculoides* BELL 1889, p. 48, pl. 3 fig. 4 (West Indies.)
?*Plexaurella vermiculata*, BELL 1889, p. 45, pl. 3 fig. 5. (West Indies.)
Plexaurella dichotoma, var. *grisea* KUNZE 1916, p. 573, figs. Q–R, pl. 28 fig. 6. (Barbados.)
?*Plexaurella teres* KUNZE 1916, p. 575, figs. S–T. (Fundort unbekannt.)
?*Plexaurella vermiculata*, KUNZE 1916, p. 576, figs. U–W, pl. 28 fig. 7 (Barbados.).

Diagnosis. Colonies tall, the branches 7–12 mm. in diameter, cylindrical, straight and stiff (Pl. VI fig. 4). Margins of apertures slightly elevated or not at all. Axial sheath containing sexradiates about 0.15 mm. in diameter, and some flattened rods (Fig. 53 b, f); middle rind with stout sexradiates, some of them with two of the rays longer, and also some short-rayed, stubby butterfly-spicules (Fig. 53 a, e); outermost layer with small sexradiates, most of them with two rays a little longer than the others, producing antler-spicules (Fig. 53 d, h); anthocodiae with flat rodlets about 0.06 mm. in length (Fig. 63 c, g).

Material. Several items from the USNM: ST. CHRISTOPHER, coral reef opposite Frigate Bay, coll. D. V. Nicholson, Smithsonian-Bredin Exp., 12.IV.1956, large specimen closely corresponding with Kunze's description of *Plexaurella dichotoma* var. *grisea* (50534); SWAN ISLAND, C. H. Townsend, II.1887 (50688); TOBAGO, Milford Bay, between Pigeon Point and Crown Point (51417).

Questionably referred to *P. grisea* are specimens from the southwest coast of FLORIDA, Henry Hemphill, I.1884 (50535), and from Bache Shoal off Elliott Key, F. M. Bayer, IV.1948 (50536).

Distribution. Florida Keys? Antilles and Caribbean.

Remarks. The specimen from St. Christopher agrees so well with KUNZE's description of the spicules of *P. dichotoma* var. *grisea* that the differences in gross characteristics must be given minor consideration. The present specimen is more slender (diameter of branches 7–8 mm. as compared with 9.0–11.5 mm. in KUNZE's), erect, without any tendency toward raised margins around the apertures. As is well known, the growth form may be influenced by ecological factors, and the elevation around the apertures may vary according to preservation.

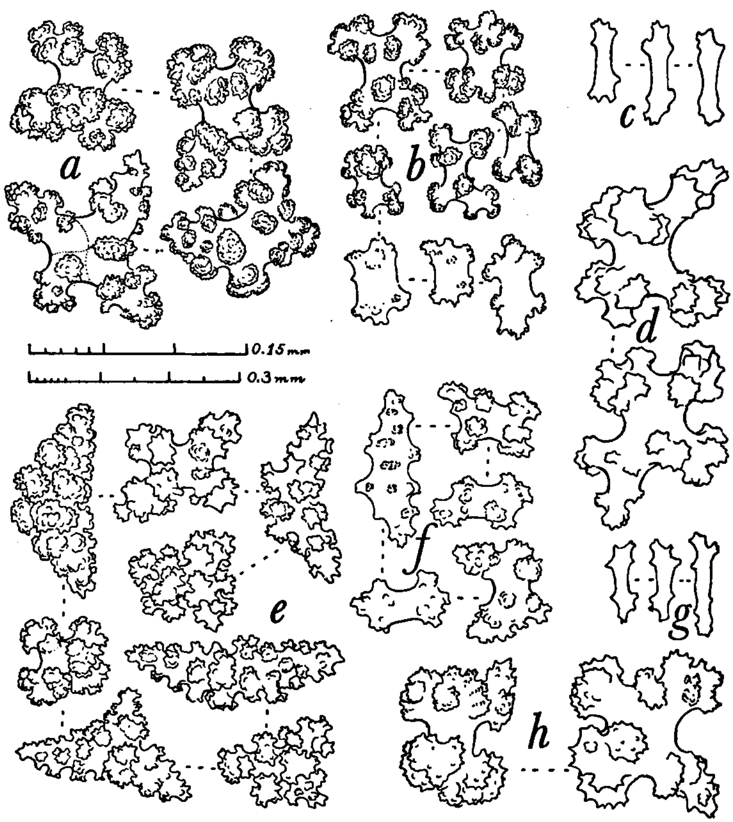


FIGURE 53. *Plexaurella grisea* Kunze, spicules. *a–d*, of a specimen from St. Christopher (USNM 50534): *a*, spicules of middle rind; *b*, spicules of axial sheath; *c*, anthocodial rods; *d*, spicules of outer rind. *e–h*, of a specimen from Florida (50535): *e*, spicules of middle cortex; *f*, spicules of axial sheath; *g*, anthocodial rods; *h*, spicules of outer cortex. (Enlargement of *a–b* and *e–f* indicated by 0.3 mm. scale above *e*; that of *c–d* and *g–h* by 0.15 mm. scale below *a*.)

The specimens from Florida localities differ in several regards, but all specimens with abundant sexradiates, stubby butterfly-forms, and smooth, straight and stiff branches are for the present being included under the name *grisea*. It is possible that the Florida material represents BELL's *P. anguiculoides*, but additional material is needed before the species can be distinguished clearly.

48 **Plexaurella pumila** Verrill, 1912

(Fig. 54 a–d; Pl. VI figs. 1–3)

Plexaurella pumila VERRILL 1912, p. 386, pl. 31 fig. 5, pl. 32 fig. 8, pl. 34 fig. 2. (Periperí Point, Bahia, Brazil.)
Plexaurella minuta KUNZE 1916, p. 565, figs. G–J, pl. 27 fig. 3. (Mexico.)
?*Plexaurella tenuis* KUNZE 1916, p. 579, figs. x–z, A′, pl. 27 fig. 8. (St. Thomas.)

Diagnosis. Colonies low or of moderate height, laterally branched, the terminal branches 3.5–4.5 mm. in diameter, often clavate (Pl. VI figs. 1–3). Surface of rind raised as a rim around the calycular orifices. Axial sheath with straight, blunt spindles warted in transverse belts, measuring 0.2 mm. in length, and a few small butterfly-spicules (Fig. 54 c); near the base these becomes stouter and capstans are more numerous (Fig. 54 b); middle rind with belted spindles, either straight or bent, about 0.3 mm. in length, and a few triradiates and butterfly-forms (Fig. 54 a); outermost layer contains minute sexradiates about 0.05–0.1 mm. in length (Fig. 54 d).

Material. A number of USNM specimens, all from BRAZIL: 8 from Mapelle, Bahia (5260–5262, 5279–5281, 5317, 5318); 2 from Candeias Reef, Pernambuco (5264, 5266); and 1 from Parahyba do Norte (5268); all collected by Richard Rathbun, 1876.

Distribution. Reefs of Brazil; if the two records given by KUNZE (1916) are correct, the species extends northward through the Lesser Antilles and the Caribbean coast of Mexico.

Remarks. KUNZE's *Plexaurella minuta* undoubtedly belongs to VERRILL's species; it is a small colony typical of the form found in Brazil. *Plexaurella tenuis*, which agrees with *P. pumila* in diameter of branches and in the size and form of the spicules of all layers, closely resembles some of the taller specimens from Brazil but is even more elongate.

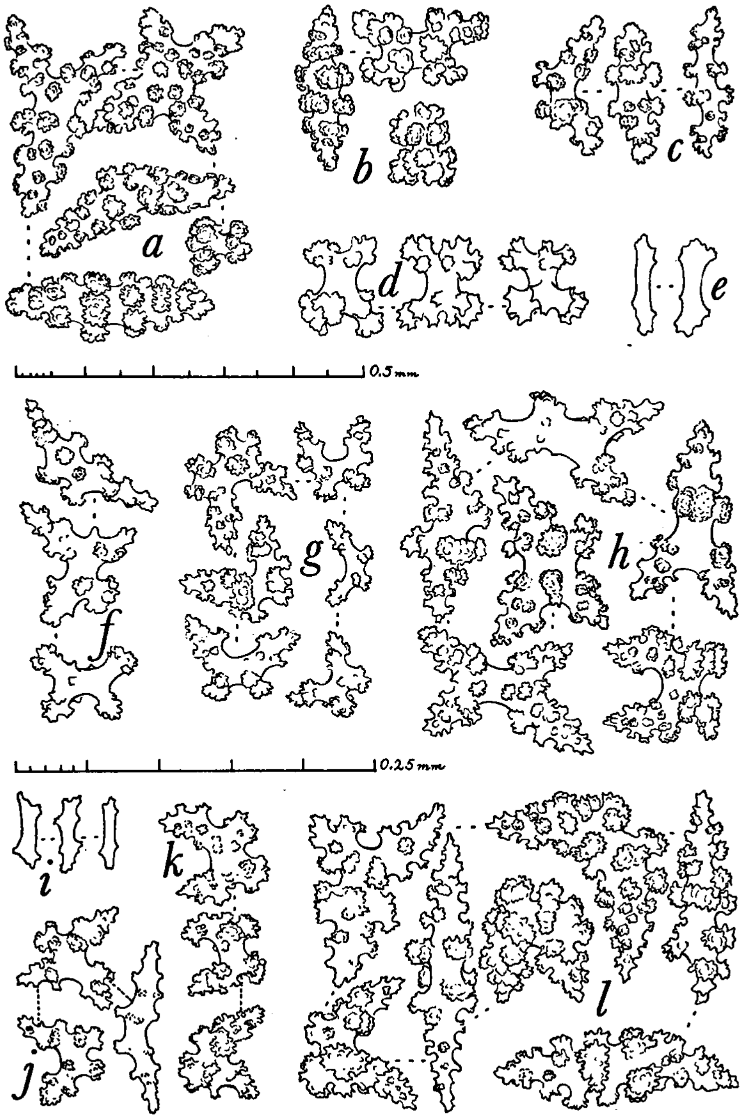


FIGURE 54. *Plexaurella pumila* Verrill, a specimen from Bahia, Brazil (USNM 5279): *a*, spicules of middle rind; *b*, spicules of axial sheath of main stem; *c*, spicules of axial sheath of terminal branch; *d*, spicules of outer rind. *Plexaurella fusifera* Kunze, spicules. *e–h*, of a specimen from Cuba (50711): *e*, anthocodial rods; *f*, spicules of axial sheath; *g*, spicules of outer rind; *h*, spicules of middle rind; *i–l*, of a specimen from Sarasota, Florida (50602): *i*, anthocodial rods; *j*, spicules of axial sheath; *k*, spicules of outer rind; *l*, spicules of middle rind. (Enlargement of *a–c*, *f–h*, *j–l* indicated by 0.5 mm. scale below *a*; that of *d*, *e*, and *i* by 0.25 mm. scale above *i*.)

49 **Plexaurella fusifera** Kunze, 1916

(Fig. 54 e–l)

Plexaurella fusifera KUNZE 1916, p. 563, figs. D–F, pl. 27 fig. 2. (Barbados.)

Diagnosis. Colonies dichotomously branched, with the terminal branches moderately or very long, 8.0–10.5 mm. in diameter and somewhat clavate; calyces well-separated, the rind a little elevated around the orifices to form a distinct rim. Axial sheath containing irregular spindles, crosses, and sexradiates often with two rays longer (Fig. 54 f, j); middle cortex with quadriradiate butterflies, triradiates, and spindles, measuring about 0.3–0.4 mm. in their greatest dimension (Fig. 54 h, l); outermost layer with numerous capstans having two long rays ('antlerforms'), mostly 0.10–0.15 mm. in greatest dimension (Fig. 54 g, k); the polyps contain small, flat rods 0.05–0.07 mm. in length (Fig. 54 e, i). Color, yellowish brown or gray.

Material. In the U.S. National Museum: Gulf of Mexico near FLORIDA, about 3$^1/_2$ miles southwest of Longboat Pass, Sarasota, J. Brookes Knight coll., 24.III.1915 (50602); Key Vaca, Henry Hemphill, 1884, 2 lots (16848); DRY TORTUGAS, Garden Key, M. H. Boehme and F. M. Bayer, 26.IV. 1948 (50708); CUBA, Enseñada de Cajon, off Cape San Antonio, P. Bartsch and J. B. Henderson, Tomas Barrera Exp., 22–23.V.1914, 4 large colonies (50711).

Distribution. Southern Florida and the Antilles.

Remarks. The specimens from Cuba are large and richly branched, nearly a meter in height. They agree with *P. fusifera* in most points of spiculation and in such details of gross morphology as have been described. The branches resemble those of *Plexaurella nutans* but are more slender, and the colonies are more profusely branched. There is not a preponderance of spindles as noted by KUNZE, and radiate forms are abundant (Fig. 54 f–h).

The specimen from Sarasota, Florida is smaller than those from Cuba and has abundant spindles in the middle layer of rind (Fig. 54 l).

Genus **Muricea** Lamouroux, 1821

Muricea LAMOUROUX 1821, p. 36. (Type species, *Muricea spicifera* Lamouroux, by subsequent designation: MILNE EDWARDS & HAIME 1850.)
Muricea, RIESS 1929, p. 383.
Eumuricea (part), RIESS 1929, p. 397.
Muricea, KÜKENTHAL 1924, p. 141.
Muricea, DEICHMANN 1936, p. 99.

Diagnosis. Plexaurids with usually stout branches covered with prominent, shelf-like calyces which have a rough surface due to the projecting spinose spindles in their walls. Spicules of the axial sheath in the form of capstans, spindles, and oval bodies, never purple in color.

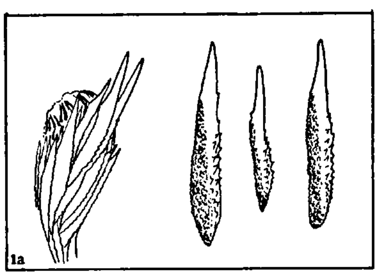
Distribution. Bermuda; southern Florida and the Antilles; southern California to Panama; endemic amphi-American.

Remarks. Only two species are eligible to be the type species of the genus *Muricea*: *Muricea elongata* Lamouroux and *M. spicifera* Lamouroux. In 1850, Milne Edwards & Haime unambiguously designated the latter. Its questionable identity creates an academic problem, but the concept of the genus is not altered whether we consider *Muricea spicifera* to be synonymous with *M. muricata* (Pallas), or a good species identical with that called *M. atlantica* (Kükenthal) in the present paper.

Key 16

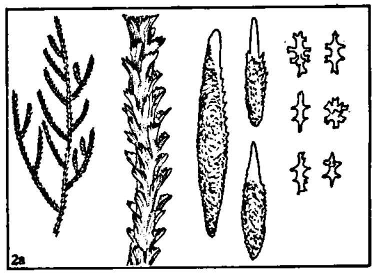
Illustrated key to the West Indian species of *Muricea*

1a. Calycular spindles with a strong, smooth, terminal spike: 2

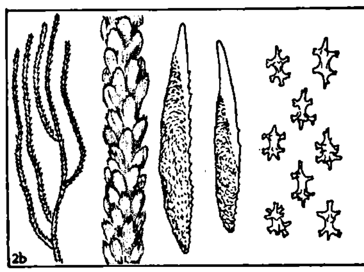


1b. Calycular spindles with prickles or several stout, slanting spines on the outer surface, but no strong terminal spike: 3

2a. Branching pinnate, twigs short and stiff. The smaller calycular spindles have a terminal spike: *Muricea pinnata* spec. nov.

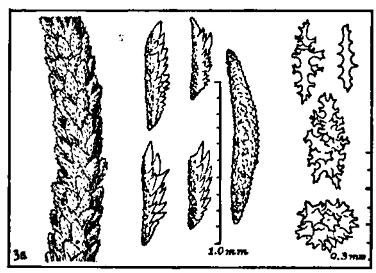


2b. Branching lateral, twigs long and flexible. Large calycular spindles also have a terminal spike: *Muricea laxa* Verrill



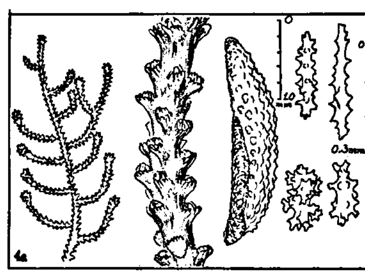
3a. Colonies tall and bushy, branching openly pinnate, with long, ascending terminal twigs. Calycular spindles less than 1 mm. long, with several slanting spines on the outer surface: *Muricea elongata* Lamouroux

3b. Colonies branched in one plane or several parallel planes: 4

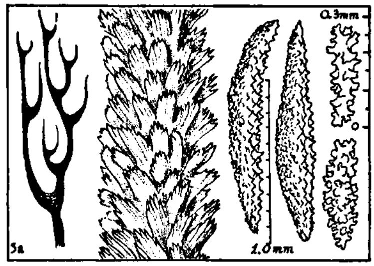


4a. Branching regularly pinnate, with short branchlets. Calycular spindles with low, blunt spines on the outer surface: *Muricea pendula* Verrill

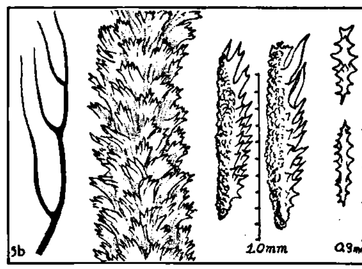
4b. Branching lateral, not pinnate; colonies broad, spreading: 5



5a. Axis conspicuously flattened in branch axils. Calycular spindles have prickles or simple spines on outer surface; axial sheath spicules with complicated sculpture: *Muricea muricata* (Pallas)



5b. Axis not conspicuously flattened in branch axils. Calycular spindles with several strong, slanting spines; axial sheath spicules with spinous, simple processes: *Muricea atlantica* (Kükenthal)



50 Muricea muricata (Pallas), 1766

(Fig. 55; Pl. V fig. 5)

Gorgonia muricata PALLAS 1766, p. 198. (Locus: Archipelagus Americanus.)
Gorgonia muricata, ESPER 1791, *2*, p. 42, pl. 8. ("Am häufigsten bey Curassao, und St. Cristoph.")
Gorgonia muricata (eine Abänderung ...) ESPER 1792, *2*, p. 130, pl. 39.
not *Gorgoniae muricatae* Variet. ESPER 1796, Fortsetzung *1*, p. 152, pl. 39A [= *Eunicea mammosa* Lamouroux.]
Gorgonia lima LAMARCK 1815b, p. 163. (Habite l'Océan des Antilles.)
not *Gorgonia muricata*, LAMARCK 1815b, p. 163.
?*Muricea spicifera* LAMOUROUX 1821, p. 36, pl. 71 figs. 1–2. (Océan des Antilles.)
?*Muricea muricata* (?) GORDON 1925, p. 15. (Curaçao.)
not *Muricea muricata*, RIESS 1929, p. 391. [= *Muricea atlantica* (Kükenthal).]
Muricea spicifera, DEICHMANN 1936, p. 102, pl. 9 figs. 9–11. (Florida; Dry Tortugas; Havana; Guadeloupe.)
not *Muricea muricata*, DEICHMANN 1936, p. 100. [= *Muricea atlantica* (Kükenthal).]

Diagnosis. Colonies spread in one plane, broad and flabellate, laterally branched and with strongly flattened axis in the branch axils (Pl. V fig. 5). Spindles of outer layer (Fig. 55 c) either with simple spinules on the outer surface and tubercles on the inner, or covered with tubercles only; no large, branching spines. Axial sheath near branch tips containing blunt spindles and rods, most of which are ornamented with complicated tubercles (Fig. 55 b); near the base, many coarse, globular, ovate, or elongate forms occur (Fig. 55 a). Dry colonies grayish white or pale yellowish brown in color.

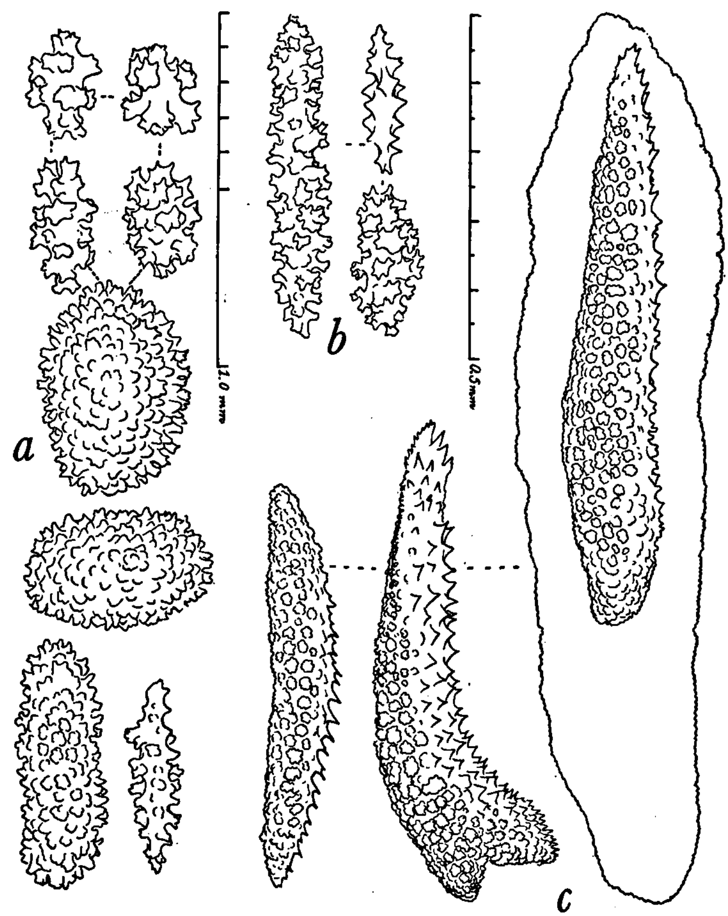


FIGURE 55. *Muricea muricata* (Pallas), spicules of a specimen from Klein Curaçao (USNM 50314): *a*, spicules of axial sheath of main stem; *b*, spicules of axial sheath of terminal branch; *c*, spindles of outer rind, the larger in outline only. (Enlargement of *a* and *b* indicated by 0.5 mm. scale at right of *b*; that of *c* by 1.0 mm. scale at right of *a*.)

Material. From Hummelinck's collection: KLEIN CURAÇAO, cast ashore, sta. 1046, 1.X.1948, 6 dry specimens (USNM 50314). ST. EUSTATIUS, Gallows Bay, rocks, 2 m., sta. 1116B, 15.VII.1949, dry spec. (USNM 50313).

In addition to the above, 2 specimens from BARBADOS, State University of Iowa Barbados-Antigua Exp., 1918 (USNM 42003, 44118).

Distribution. Florida to Curaçao.

Remarks. The original description of *Muricea muricata* distinctly mentions the flattening of the axis in the branch axils (PALLAS 1766, p. 199): "Rami divaricato adscendentes, inaequales, ad axillas depressi. Lignum coriaceo-corneum, in ramis (siccatione) saepe depressiusculum..." ESPER (1791, p. 43) describes his specimens as having the axis of the branches "breit gedruckt und besonders in den Winkeln" and correctly calls them *muricata*. LAMARCK identified his specimens with ESPER's *muricata* and gave them the name *Gorgonia lima*. However, it is by no means clear whether or not LAMOUROUX's *Muricea spicifera* is the same species; indeed, the description and figure apply almost as well to the common *Muricea* without axillary flattening. The misapplication of the name *spicifera* to the present species seems to have originated with DANA (1846, p. 673). It seems to me more logical to apply the name *muricata*, in its original sense, to the *Muricea* with flat axils as figured by ESPER. Its type locality ("Archipelagus Americanus") should be restricted to Curaçao.

51 **Muricea atlantica** (Kükenthal), 1919

(Fig. 56; Pl. V fig. 4)

Gorgonia muricata, LAMARCK 1815b, p. 163. (Habite l'Océan des Antilles.)
not *Gorgonia muricata* PALLAS 1766, p. 198.
Muricea muricata, VERRILL 1907, p. 301, figs. 144–145, pl. 33B fig. 2a, pl. 33C fig. 2d, pl. 36 fig. 2(7). (Bailey Bay and Castle Harbor, Bermuda.)
Eumuricea atlantica (Riess ms.) KÜKENTHAL 1919, p. 907. (Tortugas; Kingston.)
Eumuricea atlantica, RIESS 1929, p. 399, pl. 8 fig. 4. (Tortugas; Kingston.)
Eunicensis dentata DUBROWSKY 1934, p. 11, figs. 11–15, 21–22, 24–48; pl. 1. (Tortugas.)
Muricea muricata, DEICHMANN 1936, p. 100, pl. 6 fig. 1, pl. 9 figs. 1–3. (Florida; Havana.)
Muricea muricata, STIASNY 1941b, p. 262, figs. 9–10. (Tortugas; Dubrowsky's type.)
Muricea muricata, AURIVILLIUS 1931, p. 105, fig. 20. (Bermuda; St. Bartholomew.)

Diagnosis. Colonies laterally branched in one plane, broad and flabellate (Pl. V fig. 4); axis with at most only a slight indication of flattening in the branch axils. Spindles of outer layer with strong, often spinulose, spines on the outer surface (Fig. 56 d). Axial sheath near branch tips containing sharply pointed spindles, most of them with simple, spinous processes (Fig. 56 c); toward the base the spicules are larger and more commonly sculptured with tubercles, but no large globular and ovate bodies occur (Fig. 56 b). The typical arrangement of the spicules of the crown is shown in Figure 56 a.

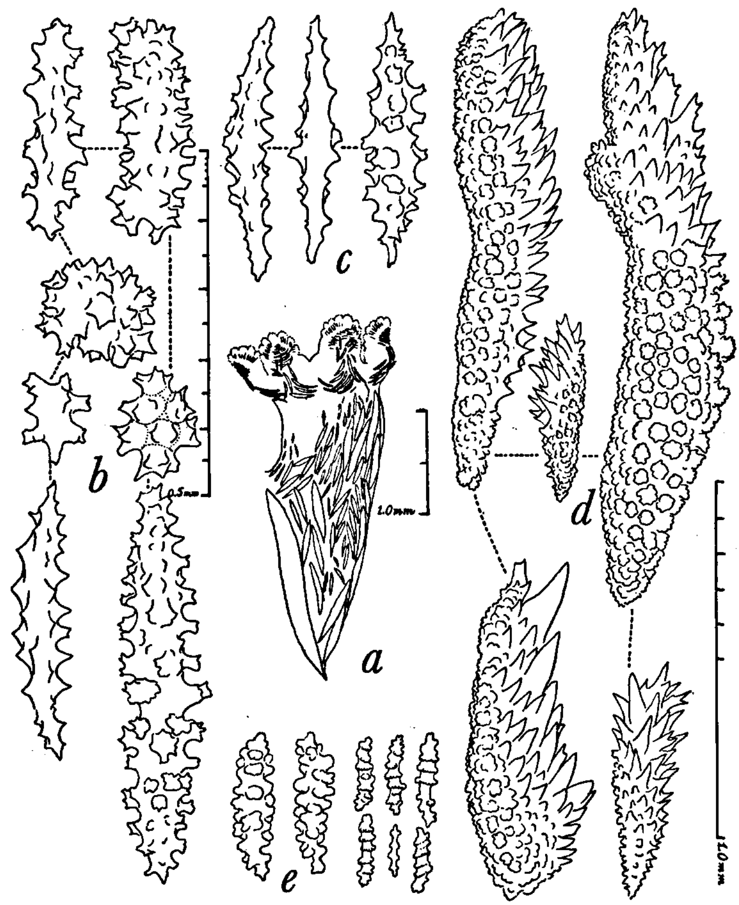


FIGURE 56. *Muricea atlantica* (Kükenthal), a specimen from Key Largo, Florida (USNM 49769): *a*, expanded polyp showing relationship of crown to calyx; *b*, spicules of axial sheath of large branch; *c*, spicules of axial sheath of terminal branch; *d*, spicules of outer rind; *e*, spicules of crown. (Enlargement of *a* indicated by 1.0 mm. scale adjacent; that of *b*, *c*, and *e* by 0.5 mm. scale at right of *b*; that of *d* by 1.0 mm. scale adjacent.)

Material. A large number of USNM specimens; including: BERMUDA (50656); FLORIDA, Soldier Key, Biscayne Bay (50672), Elliott Key (50254), Key Largo (49769); NEW PROVIDENCE, Bahamas (50557); CUBA, Cayo Hutia (50700); JAMAICA, Rackham Cay, Port Royal Cays (51396); off Portland Bight, 10 fms. (51362); GRAND CAYMAN (51397).

Distribution. Bermuda; Bahamas; southern Florida and the Keys; Antilles.

Remarks. LAMARCK chose to call the *Muricea* with winged axils *lima*, and to apply the name *muricata* to specimens without axillary flattening, in spite of the fact that PALLAS' original description of *muricata* clearly mentions this character and that ESPER's figures (plates 8 and 39) show it distinctly. The diagnosis of *Gorgonia lima* corresponds exactly with that of *G. muricata*, and the two species must accordingly be treated as synonymous. LAMOUROUX's *Muricea spicifera* is not certainly identifiable, but it is neither described nor figured as having compressed axils and thus may actually be the present species. If this be true, the name *spicifera*, which DEICHMANN (1936) used for *muricata*, has a hundred years' priority over *atlantica*, although to apply it to the present species while using *muricata* in its original sense would exactly reverse the usage of DEICHMANN. In view of the doubtful identity of *M. spicifera*, it seems better to use the next available name for the non-winged species, which is *atlantica* of Kükenthal.

52 **Muricea pinnata** spec. nov.

(Fig. 57 a–d; Pl. V fig. 6)

Muricea laxa, BAYER 1952, p. 184.
not *Muricea laxa* VERRILL 1864b, p. 36.

Diagnosis. Colonies branched pinnately in one plane. Spindles of calycular walls with a smooth terminal spike. Axial sheath with spinose spindles and double stars.

Description. The colony is erect and branched pinnately in one plane (Pl. V fig. 6). The branchlets are widely spaced, short, 2.5–3.0 mm. in diameter, slightly curved, and springing from the main stem at angles of 40°–45°. The calyces are small and not crowded. The axial sheath contains small octoradiate capstans (double stars) about 0.1 mm. in length, some of which are more elongate and rod-like, up to 0.15 mm. long, with two whorls of spines (Fig. 57 c); toward the base, the axial sheath spicules become somewhat stouter (Fig. 57 d). The outer rind contains long, slender spindles

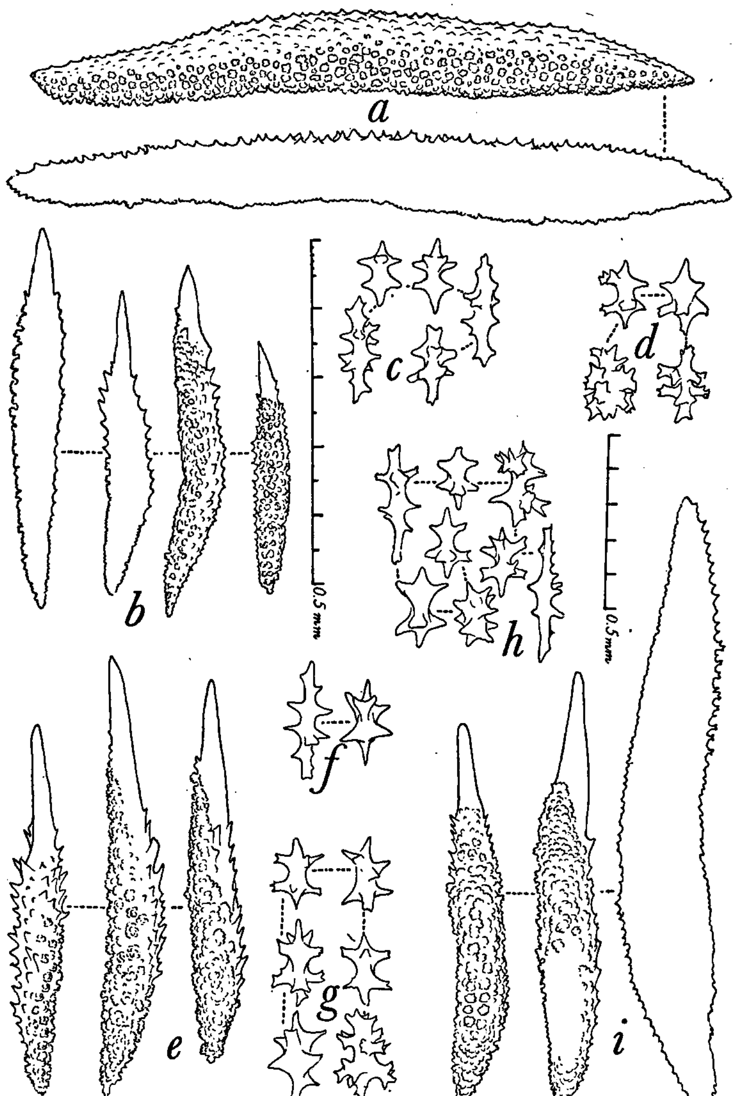


FIGURE 57. *Muricea pinnata* spec. nov., spicules of the holotype from southeast of Jamaica (USNM 7148): *a*, spicules of stem rind, one in outline only; *b*, spicules of calycular walls; *c*, spicules of axial sheath of terminal branch; *d*, spicules of axial sheath of main stem. *Muricea laxa* Verrill; *e–g*, spicules of a specimen from Dry Tortugas (50162): *e*, spicules of calycular walls; *f*, spicules of axial sheath of terminal branch; *g*, spicules of axial sheath of main stem. *h–i*, spicules of a specimen from Cat Cay, Bahamas (49495): *h*, spicules of axial sheath of terminal branch; *i*, spicules of calycular walls and rind, the latter in outline only. (Enlargement of a indicated by 0.5 mm. scale at right of *b*; that of all other figures by 0.5 mm. scale at right of *h*.)

measuring as much as 2.0 mm., spinulose on the outer surface and tuberculate on the inner (Fig. 57 a). The smaller spindles of the calycular walls have a short, smooth, terminal spike (Fig. 57 b). The color of the colony in alcohol is white.

Material. Holotype from the Caribbean Sea southeast of JAMAICA, 17°44′05″ North, 75°39′00″ West, 23 fms., *Albatross* sta. 2138, 29.II.1884 (USNM 7148).

Distribution. Known only from the type locality.

Remarks. The pinnate branching of *Muricea pinnata* gives it a resemblance to *M. pendula* Verrill, and its spindles with a strong terminal spine bear a strong similarity to *M. laxa* Verrill. However, *M. pinnata* has much smaller capstans in the axial sheath than has *M. pendula*, its calycular spindles have a terminal spike, and its end branches are more slender and arise at a smaller angle. From *M. laxa* it differs in its distinctly pinnate ramification with short, stiff branchlets, and in the smaller size of the spicules with terminal spike.

53 **Muricea laxa** Verrill, 1864

(Fig. 57 e–i; Pl. V fig. 2)

Muricea laxa VERRILL 1864b, p. 36. (Florida.)
Muricea pendula, RIESS 1929, p. 385, pl. 8 fig. 1. (Barbados; Campeche Bank.)
not *Muricea pendula* VERRILL 1864a, p. 9.
Muricea laxa, RIESS 1929, p. 388, pl. 8 fig. 2. (Barbados.)
Muricea laxa, DEICHMANN 1936, p. 101, pl. 9 figs. 4–8, pl. 28 figs. 1–1a. (Florida; Verrill's type.)

Diagnosis. Colonies with long, flexible branchlets not pinnate, not in one plane. Calycular spindles with smooth terminal spike. Axial sheath with spinose spindles and double stars.

Description. The colonies have long, flexible branches usually not in one plane (Pl. V fig. 2). The calyces are narrow and pointed, directed upward. The axial sheath contains octoradiate capstans (double stars) about 0.1 mm. in length (Fig. 57 g) and, near the branch tips, elongate forms with two whorls of spines, reaching a length of 0.2 mm. (Fig. 57 f, h). The outer cortex contains stout spindles, those in the calyx walls with a smooth, strong, terminal spike (Fig. 57 e, i). The color of the colonies is white in alcohol, grayish or bluish white in life; occasionally yellowish brown.

Material. From the U.S. National Museum, specimens from the west coast of FLORIDA (16347, 43222), Cape Florida (50250), DRY TORTUGAS (50162, 50240), BAHAMAS, Cat Cay (49495), and CUBA, off Havana (10140).

Distribution. West coast of Florida, the Keys and Dry Tortugas; Bahamas; Antilles.

Ecology. This species apparently never invades the true reef habitat. The present records indicate a bathymetric range between 10 and 70 fathoms.

Remarks. Colonies of *Muricea laxa* closely resemble small specimens of *M. elongata* Lamouroux. However, the spindles of *M. laxa* characteristically have a single terminal spine, whereas those of *M. elongata* have a multiple row of stout, flattened spines along one side but not a simple terminal spine. The spicules of the axial sheath in *M. laxa*, aside from being smaller, do not develop the extremely complicated bodies found in *M. elongata*. Specimens of *M. elongata* are commonly of a yellowish color, whereas those of *M. laxa* are usually pure white.

54 **Muricea elongata** Lamouroux, 1821

(Fig. 58 a–c; Pl. V fig. 1)

Muricea elongata LAMOUROUX 1821, p. 37, pl. 71 figs. 3–4. (Havana.)
Muricea elongata, VERRILL 1864b, p. 36. (Florida and West Indies.)

Diagnosis. Colonies tall, not in one plane, branching distantly pinnate. Large spindles with a multiple row of smooth spines on the outer surface but not a terminal spike. Axial sheath containing double stars that develop profuse sculpture.

Description. The colonies are bushy and commonly very tall (Pl. V fig. 1). Branching is openly pinnate but the twigs are long and ascending and do not produce a plumose aspect. The calyces are closely crowded, sharply pointed, and directed upward. The axial sheath contains spinose spindles (Fig. 58 b) near the branch tips, but lower in the colony many stellate capstans appear, which develop profuse and complicated sculpture (Fig. 58 c) and predominate near the base. The outer rind contains stout spindles with strong spines on one side (Fig. 58 a). The spines tend to be rather flat and often appressed so that the sculpture has an imbricated appearance. Dry colonies orange brown; in alcohol, yellowish brown, rarely white. The color is incorporated in the spicules, which are clear yellow or amber-colored.

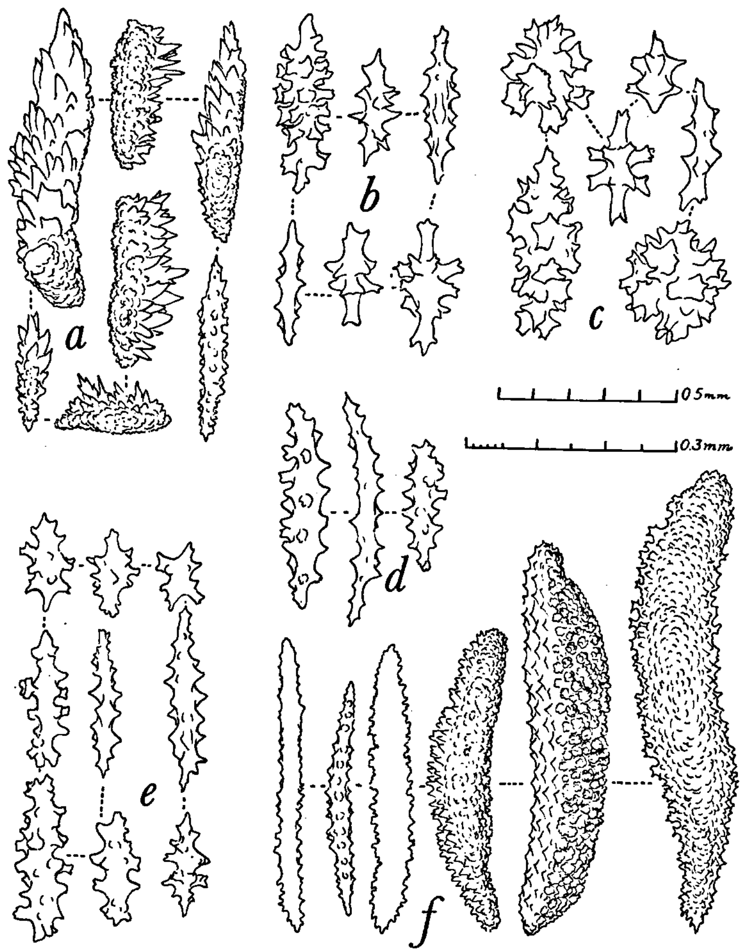


FIGURE 58. *Muricea elongata* Lamouroux, a specimen from Ragged Keys, Florida (USNM 50272): *a*, spicules of calycular walls and rind; *b*, spicules of axial sheath of terminal branch; *c*, spicules of axial sheath of main stem. *Muricea pendula* Verrill, a specimen from North Carolina (49748): *d*, spicules of axial sheath of terminal branchlet; *e*, spicules of axial sheath of main stem; *f*, spicules of calycular walls and rind. (Enlargement of *a* and *f* indicated by 0.5 mm. scale below *c*; that of *b–e* by 0.3 mm. scale at right of *d*.)

Material. NEW PROVIDENCE, between Hog Island and Athol Island, sandy bottom with eelgrass, 3 m., sta. 1149, Hummelinck coll., 16.VIII.1949, fragmentary specimen (USNM 50246).

A number of other USNM specimens; these include colonies from southern FLORIDA and the Keys (50255, 50272, 50428), the DRY TORTUGAS (50271, 50273), the west coast of Florida (44146), and BARBADOS (50510).

Distribution. West coast of Florida, the Keys and Dry Tortugas; Bahamas; Antilles.

Remarks. This is the common *Muricea* of inshore waters from Miami southward; it also occurs along the Gulf coast of Florida north to Apalachee Bay.

55 **Muricea pendula** Verrill, 1864

(Fig. 58 d–f; Pl. V fig. 3)

Muricea elegans (Agassiz ms.), VERRILL 1864a, p. 9. (Charleston, South Carolina.)
not *Muricea elegans* DUCHASSAING & MICHELOTTI 1860, p. 19. [Unidentifiable.]
Muricea pendula VERRILL 1864a, p. 45.
not *Muricea pendula*, RIESS 1929, p. 385, pl. 8 fig. 1. [= *Muricea laxa* Verrill.]
Muricea pendula, DEICHMANN 1936, p. 103, pl. 9 figs. 12–14. (Charleston, S.C.: VERRILL's type.)

Diagnosis. Colonies openly pinnate, in one plane. Large spicules of outer rind with only spinules on outer surface, without terminal spike. Axial sheath with spinose spindles and capstans.

Description. The colonies are tall and openly but regularly pinnate, with the end twigs usually 20–30 mm. long but as much as 50 mm., originating from the main stems at right angles but soon turning upward; branching is in one plane and anastomoses occur infrequently (Pl. 5 fig. 3). The calyces are openly spaced, conspicuously standing out from the rind, with a pointed lip. In the axial sheath of the terminal branches there are acute spindles with spinous sculpture (Fig. 58 d), but toward the base of the colony, short capstans appear and on the trunk become the predominant type of sclerite (Fig. 58 e). In the outer rind there are stout spindles with the tubercles of the outer surface transformed into blunt prickles, but without strong spines (Fig. 58 f). Color, brownish yellow or brownish orange; spicules amber-colored.

Material. USNM material from the coast of THE CAROLINAS (49739, 49744, 49748, 50069); and from the Gulf of Mexico off northwest FLORIDA (44222, 44223), LOUISIANA (49812), and TEXAS (50533).

Distribution. Coast of the Carolinas; northern Gulf of Mexico from Florida to Texas; a typical Carolinian disjunct distribution. Bathymetric range 7 to 15 fathoms.

Remarks. *Muricea pendula* is easily recognized by its pinnate branching and the absence of strong outer spines or terminal spikes on the spindles of the calycular walls.

Family **GORGONIIDAE** Lamouroux, 1812

Diagnosis. Holaxonia having a purely horny axis with cortex loculated little or not at all and with a narrow, cross-chambered central core. Spicules small, reaching a length of about 0.3 mm., ornamented with tubercles arranged in regular transverse girdles, exclusively spindles or derivatives thereof. Anthocodiae with a weak crown of flat rodlets with sinuous or scalloped margins, fully retractile, sometimes forming hemispherical calycular verrucae, usually in biserial arrangement on the branches, in a few cases generally distributed.

Remarks. In the study of gorgoniids it is of the utmost importance to observe the nature of the spicules carefully. It is necessary to roll the spicules about in order to detect any asymmetry of sculpture, and to be sure that scaphoids lying on their backs are not mistaken for simple spindles. Temporary spicule preparations, in water, are better for this purpose than are permanent mounts, because the spicules are free and can easily be rolled over for observation from all sides.

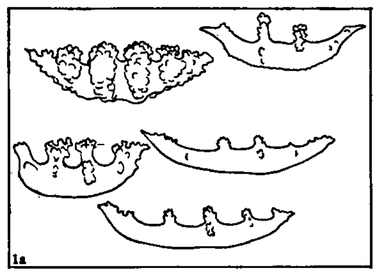
The family Gorgoniidae contains some of the most important reef and shallow-water species in the West Indian region and, together with the Plexauridae, makes up the major part of the shallow-water octocoral fauna.

Key 17

Illustrated key to the West Indian genera of *Gorgoniidae*

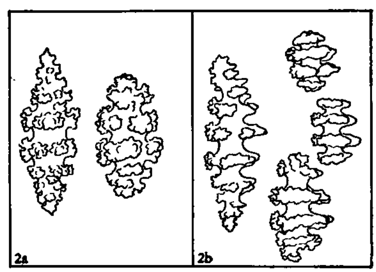
1a. Spicules include curved, canoe-shaped scaphoids: 4

1b. Scaphoids not present: 2



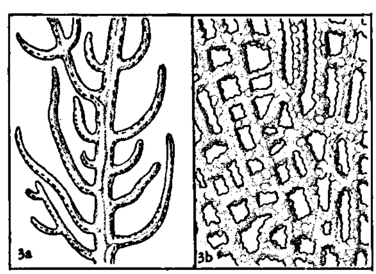
2a. The cortical spicules are spindles only, either blunt or acute or both, but never with spines along one side or tubercles fused into disks: 3

2b. Many of the spindles have the tubercles fused into disks: Genus *Leptogorgia*



3a. Branches slender, free, never anastomosing: Genus *Lophogorgia*

3b. Branches regularly anastomosing: Genus *Pacifigorgia*

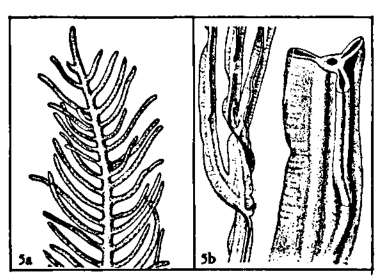


4a. Branches entirely free: 5

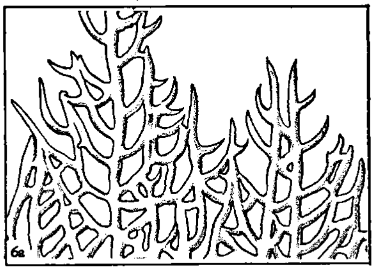
4b. Branches anastomose: 6

5a. Branching pinnate, twigs round or slightly flattened, but without conspicuous marginal flanges into which the polyps retract: Genus *Pseudopterogorgia*

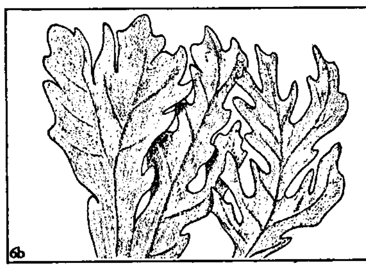
5b. Branching lateral, twigs flat or triangular because of longitudinal flanges of coenenchyme into which the polyps retract: Genus *Pterogorgia*



6a. Branches anastomose regularly, forming flat, net-like fans: Genus *Gorgonia*



6b. Axis of branches anastomosing loosely, the spaces filled in with coenenchyme to form broad, leaf-like fronds: Genus *Phyllogorgia*



Genus **Lophogorgia** Milne & Edwards Haime, 1857

Lophogorgia MILNE EDWARDS & HAIME 1857, *1*, p. 167. (Type species, *Gorgonia palma* Pallas 1766, by monotypy.)
Litigorgia (part) VERRILL 1868b, p. 414. (Type species, *Litigorgia florae* Verrill 1868, by subsequent designation: VERRILL 1868a, p. 387.)
Leptogorgia (part), DEICHMANN 1936, p. 175.
Leptogorgia, BAYER 1951, p. 98.

Diagnosis. Pinnate or laterally branched gorgoniids without anastomosis, having spindles with symmetrical sculpture not fusing into disks. Anthocodiae with weak crown of flat rods.

Remarks. The genus *Lophogorgia* is the most generalized of the gorgoniids. It lacks spicular specialization and has no strong colonial modifications. Among the Gorgoniidae it alone has practically world-wide distribution in temperate and tropical waters. *Gorgonia sarmentosa*, the type species of the genus *Gorgonella*, belongs here. Species of *Lophogorgia* are found on both shores of the Atlantic, in the Mediterranean, and in the Indian and Pacific Oceans.

Concerning my assignment of various species to the genera *Lophogorgia* and *Leptogorgia*, the first consideration is one of systematics, namely that we are in fact dealing with two genera, which can be separated upon spicular characters rather than peculiarities of colonial form such as the flattening of branches and the distribution of polyps along the twigs. The second consideration is partly nomenclatural and partly systematic, and revolves around the question of what names should be applied to these two genera. As we know, the genus *Lophogorgia* has as its type species the *Gorgonia palma* of PALLAS (1766), by virtue of monotypy. That species, from the Cape of Good Hope, can be recognized with considerable assurance, and is found to have spiculation consisting of symmetrically sculptured blunt capstans. The type of the genus *Leptogorgia*, selected by VERRILL (1869b, p. 420), is the *Loptogorgia viminalis* of MILNE EDWARDS & HAIME, under which those authors listed as questionable synonyms the original *Gorgonia viminalis* of PALLAS and that of DELLE CHIAJE, and as positive synonyms the *G. viminalis* of ESPER and the uncharacterized *Plexaura viminalis* of VALENCIENNES. It is therefore clear that the *Leptogorgia viminalis* of MILNE EDWARDS & HAIME is identical with that of ESPER, which is the common east American whip-coral with many of its capstans transformed into disk-spindles. The question of what PALLAS' *Gorgonia viminalis* was does not vitally concern us here because the identity of *Leptogorgia viminalis* as the type species of the genus *Leptogorgia* depends upon what MILNE EDWARDS & HAIME had before them and not upon the species with which they identified their material.

It would be ideal to examine the types of all the species concerned, as PAX & MÜLLER (1956) in their recent paper on the gorgonians of the Congo consider necessary, but there can be little doubt about the identity of *Lophogorgia palma*, nor of *Leptogorgia viminalis* sensu MILNE EDWARDS & HAIME. Thanks to Professor G. RANSON of the Muséum National d'Histoire Naturelle at Paris, I have been able to examine a fragment of LAMARCK's type of *G. virgulata*, which proves to be the same as ESPER's *viminalis*. Thus the name *virgulata* Lamarck 1815 must stand for MILNE EDWARDS & HAIME's *viminalis* until it can be established that this species is identical with *Gorgonia viminalis* Pallas. The result will have no bearing upon the generic name *Leptogorgia*, but only upon the name of its type species, the identity of which seems clearly established. I therefore maintain my separation of *Leptogorgia* and *Lophogorgia* as set forth in 1951. No clear evidence is available, at least from the illustrations given by BIELSCHOWSKY (1929), STIASNY (1936), and PAX & MÜLLER (1956), that the West African species they assigned to *Leptogorgia* have the disk-spindles characteristic of that genus, and they must accordingly be assigned to *Lophogorgia* instead.

KEY 18

ILLUSTRATED KEY TO THE WEST INDIAN SPECIES OF *Lophogorgia*

1a. Colonies pinnate, rind yellow with red or purple calyces: *Lophogorgia sanguinolenta* (Pallas)

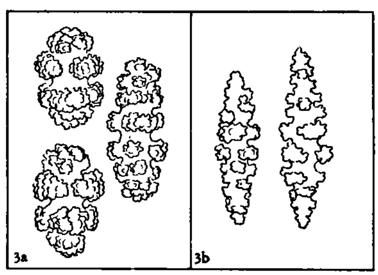
1b. Colonies of various form, uniformly colored or with calyces somewhat paler than the rind: 2

2a. Anthocodial rods only half as long as the longest spindles of the rind. Branching pinnate, bushy. Color, rose-purple: *Lophogorgia violacea* (Pallas)

2b. Anthocodial rods more than 3/4 as long as the longest spindles of the rind, and sometimes longer: 3

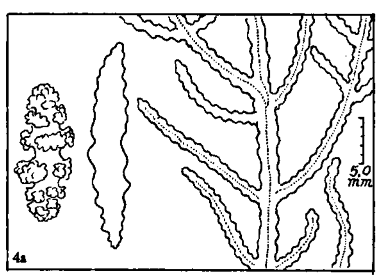
3a. Cortical sclerites predominantly blunt capstans; acute spindles rare or absent: 4

3b. Cortical sclerites including many acute spindles in addition to blunt capstans: 6

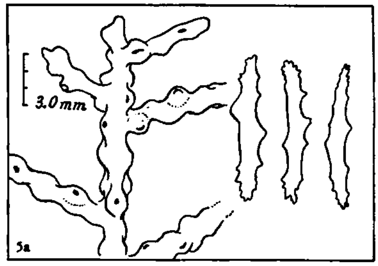


4a. Largest anthocodial rods up to 1.5 times as long as the longest spindles of the rind. Terminal branchlets with calyces in a single row along the two edges. Color bright vermilion red: *Lophogorgia miniata* (Milne Edwards & Haime)

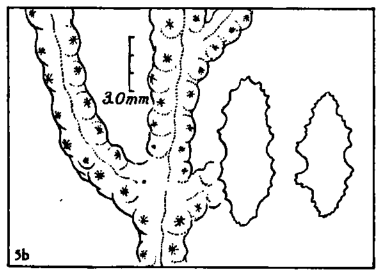
4b. Largest anthocodial rods only slightly, if at all, longer than longest spindles of rind: 5



5a. Terminal twigs slender, about 0.5 mm. in diameter exclusive of calyces. Anthocodial rods narrow, with nearly parallel edges indented with broad scallops. Color, purplish red: *Lophogorgia* sp. indet. (b)

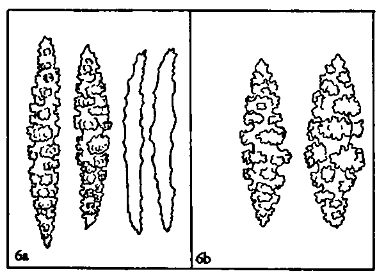


5b. Terminal twigs stout, 1–2 mm. in diameter exclusive of calyces. Anthocodial rods broad, tapered toward the ends, with numerous small serrations in the margins. Color orange, red, or purple: *Lophogorgia hebes* (Verrill)



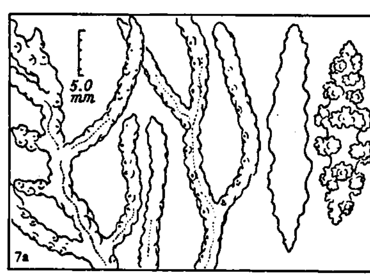
6a. Spindles predominantly long and sharp, about 6 times as long as wide; small, blunt capstans not numerous. Anthocodial rods colorless, about as long as the cortical spindles and very slender: *Lophogorgia barbadensis* spec. nov.

6b. Acute spindles stouter, usually only 3 to 4.5 times as long as wide. Anthocodial rods colored: 7

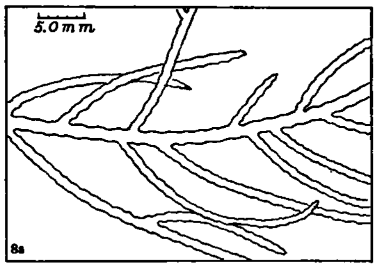


7a. Colonies openly pinnate, with stout, upward-curving, crooked branches and twigs. Diameter of terminal branches 1.5–2.0 mm.; *Lophogorgia* sp. indet. (a)

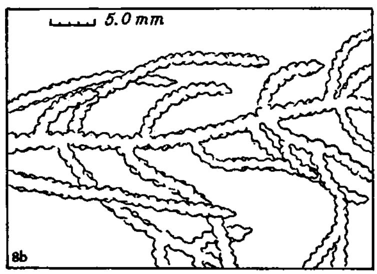
7b. Colonies with slender branchlets about 0.5 mm. in diameter: 8



8a. Colonies orange, vermilion or bright red; regularly pinnate, twigs long and nearly straight, not markedly curving upward. Calyces usually in strict single series along two sides of terminal twigs: *Lophogorgia cardinalis* spec. nov.



8b. Colonies purple or reddish purple, irregularly pinnate, twigs rather short, crooked, curving upward. Calyces commonly in alternating double series along the two sides of terminal twigs: *Lophogorgia punicea* (Milne Edwards & Haime)



56 **Lophogorgia sanguinolenta** (Pallas), 1766

Gorgonia sanguinolenta PALLAS 1766, p. 175. (Mare Atlanticum, Americanum.)

?*Gorgonia sanguinolenta*, ESPER 1791, *2*, p. 86, pl. 22. ("Nach allen übereinstimmenden Nachrichten, hält sich diese Gorgonie in den Meeren des Mittägigen America auf, wo sie auch sehr häufig angetroffen wird.")

Gorgonia petechizans, ESPER 1791, *2*, p. 55, pl. 13. ("Unsere Horncoralle wird überdiss nie in dem mittelländischen Meer, sondern nach übereinstimmenden Nachrichten in dem ostindischen Ocean gefunden.")

not *Gorgonia petechizans* PALLAS 1766, p. 196.

Pterogorgia turgida EHRENBERG 1834, p. 370. (Prope insulam Sti Thomae.)

Pterogorgia festiva DUCHASSAING & MICHELOTTI 1860, p. 31. (St. Thomas.)

Gorgonia sanguinolenta, KÖLLIKER 1865, p. 139, pl. 18 fig. 39.

Leptogorgia sanguinolenta, DEICHMANN 1936, p. 181, pl. 17 figs. 1–2, pl. 19 figs. 39–40. (Hayti; West Indies.)

Diagnosis. Branching openly pinnate, with short terminal branchlets. Cortex yellow with red or purple calyces.

Material. No specimens examined.

Remarks. Due to lack of material it is impossible to define this species accurately at the present time. *Lophogorgia sanguinolenta* is probably the only West Indian species of the genus with purple calyces on a yellow rind, in which color phase it would be unmistakable. However, according to DEICHMANN (1936, p. 181), it occurs in a completely violet phase that would be difficult to recognize. A unicolored specimen collected by A. J. VAN KOOLWIJK, probably at Aruba, agrees except for color with KÖLLIKER's figure of the spicules of *Gorgonia sanguinolenta*, which probably were taken from ESPER's specimen, and with specimens of *Lophogorgia hebes* (Verrill) from North America, but this is not considered sufficient evidence to equate the two species. The bicolored form is retained as distinct until adequate comparative material becomes available.

57 **Lophogorgia violacea** (Pallas), 1766

(Fig. 59 a–i; Pl. VII figs. 1, 3)

Gorgonia violacea PALLAS 1766, p. 176. (Mare Americanum.)
Gorgonia purpurea, ESPER 1796, Fortsetz. *1*, p. 159, pl. 43.
not *Gorgonia purpurea* PALLAS 1766, p. 187 [= ?*Leptogorgia virgulata* (Lamarck).]
Lophogorgia violacea, BAYER 1959, p. 19 (Paqueta, Brazil, and Rio de Janeiro.)

Diagnosis. Colonies low, shrubby, pinnate (Pl. 7 figs. 1, 3). Calyces distinct, low, rounded, in alternating double series along two sides of the branchlets. Spicules of cortex as blunt capstans (Fig. 59 a, f, i) and acute double spindles (Fig. 59 b, d, g); anthocodial rods (Fig. 59 c, e, h) half, or less than half, as long as the longest spindles.

Material. BRAZIL, Paqueta, 3–4 fms., 12.II.1877, 2 specimens in alcohol (USNM 17329); Rio de Janeiro, dry spec. (USNM 50225), both collected by Richard Rathbun.

Distribution. Coast of Brazil.

Remarks. The specimen from Rio de Janeiro closely resembles ESPER's figure of *Gorgonia purpurea*, which is certainly not the *purpurea* of Pallas. The dry colony is dusky purplish rose in color, but in alcohol the color is bright reddish purple. Spicules deep amber red, anthocodials colorless.

58 **Lophogorgia barbadensis** spec. nov.

(Fig. 59 j–l)

Leptogorgia sp. DEICHMANN 1936, p. 184, pl. 17 fig. 5., pl. 19 figs. 41–43. (St. Croix.)

Diagnosis. Colony pinnate, branches rigid; calyces low-conical, biserial. Cortex containing slender, acute spindles 6 times as long as

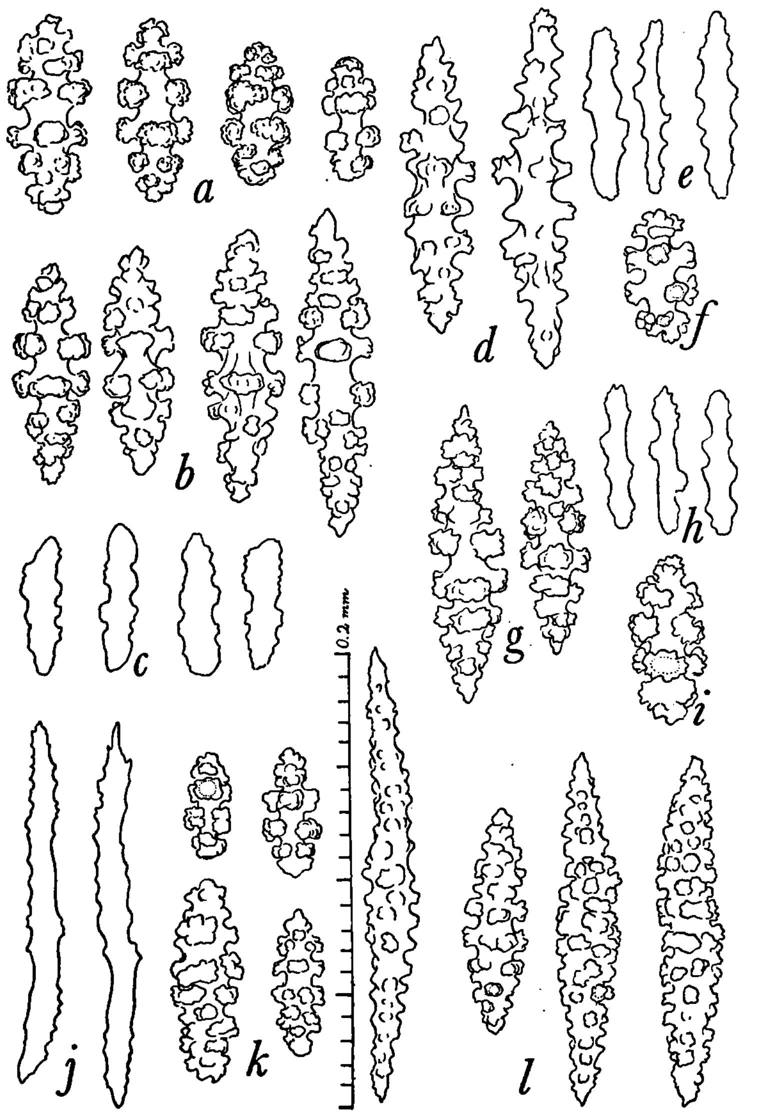


FIGURE 59. *Lophogorgia violacea* (Pallas), spicules. *a–c*, of a specimen from Rio de Janeiro (USNM 50225): *a*, capstans of outer rind; *b*, spindles of inner rind; *c*, anthocodial rods. *d–f*, of a specimen from Paqueta, Brazil (17329): *d*, spindles of inner rind; *e*, anthocodial rods; *f*, capstans of outer rind. *g–i*, of another specimen from Paqueta: *g*, spindles of inner rind; *h*, anthocodial rods; *i*. capstans of outer rind. *Lophogorgia barbadensis* spec. nov., spicules of the holotype from Barbados (50227): *j*, anthocodial rods; *k*, capstans and blunt spindles of outer rind; *l*, acute spindles of inner rind. (All figures drawn to the same scale.)

wide, and small, blunt capstans; anthocodial rods slender, flat, as long as the acute spindles. Color orange red, calyces paler.

Description. The holotype is a broken colony 7 cm. tall including the base of attachment. The main stem, which is 1.0 mm. in diameter, pinnately gives off widely spaced lateral branchlets arising at angles from 65° to 70°. One of the branches bears three small twigs on its upper edge. The polyps form low-conical calyces, which are biserially arranged, 2–5 mm. apart, closest near the twig ends, most distant on the main stem. The predominant spicules are slender, acute spindles with little trace of a median waist (Fig. 59 l). They are about 0.15 mm. long and 0.025 mm. in diameter; in the axial sheath the acute spindles are somewhat longer and less strongly sculptured. There are also a few blunt capstans 0.05–0.09 mm. in length in the outer cortex (Fig. 59 k). The anthocodiae are armed with long, narrow, flattened rods measuring as much as 0.17 mm. in length (Fig. 59 j). The colony is dark orange red in color, becoming yellowish around the calycular orifices. The cortical spicules are amber yellow, the anthocodial rods quite colorless.

Material. Holotype from BARBADOS, $1^1/_4$ miles due west of white lighthouse at Needham Point, 67–70 fms., University of Iowa Barbados-Antigua Exp., sta. 11, 16. V. 1918 (USNM 50227).

Distribution. St. Croix, 38 fathoms; Barbados, 67–70 fathoms.

Remarks. *Lophogorgia barbadensis* is certainly identical with Deichmann's *Leptogorgia* sp. It is here treated as a new species because it is quite distinct from any species heretofore described in the literature, and because it should not continue nameless indefinitely.

59 **Lophogorgia cardinalis** spec. nov.

(Fig. 60; Pl. VII fig. 5)

Diagnosis. Colonies pinnate, branches flexible; calyces low, rounded, biserial, crowded. Cortex containing acute spindles about 4 times as long as wide, and blunt capstans; anthocodial rods equaling or slightly exceeding the length of the longest spindles. Color uniform, brilliant red, occasionally dull orange.

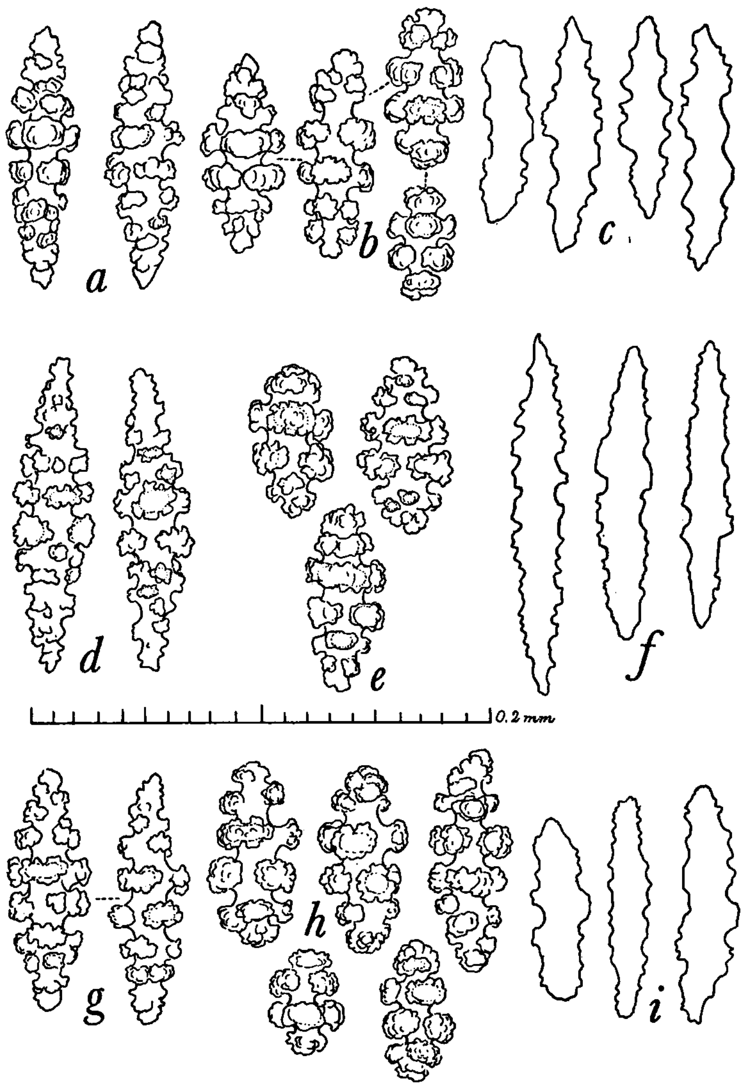


FIGURE 60. *Lophogorgia cardinalis* spec. nov., spicules. *a–c*, of the holotype from Palm Beach, Florida (USNM 50230): *a*, acute spindles of inner rind; *b*, blunt spindles and capstans of outer rind; *c*, anthocodial rods. *d–f*, of a paratype from Florida (50231): *d*, acute spindles of inner rind; *e*, blunt spindles and capstans of outer cortex; *f*, anthocodial rods. *g–i*, of another paratype (49927): *g*, acute spindles of inner cortex; *h*, blunt spindles and capstans of outer cortex; *i*, anthocodial rods. (All figures drawn to the sample scale.)

Description. The type is a branch 11.5 cm. tall without base of attachment. Ramification is in one plane, regularly pinnate. The branchlets originate at angles from 40° to 50° along both sides of the main stem, at intervals of 3–13 mm. They are gently curved, up to 6 cm. long, and only slightly more slender than the main stem. The calyces are biserial and closely set so that the branches are flattened and about 2 mm. wide overall. The biserial arrangement of polyps is quite uniform near the branch tips but proximally the calyces in each row incline alternately toward front and back of the colony. The cortical spiculation consists of blunt capstans (Fig. 60 b) and numerous acute spindles (Fig. 60 a). The former reach a length of about 0.1 mm., the latter 0.12 mm. The anthocodial rods are of the usual shape (Fig. 60 c), and the largest ones are equal in length to the longest spindles of the cortex. The color of the colony in alcohol is brilliant vermilion red; the cortical spicules are clear orange, the anthocodial rods pinkish.

The paratype specimens (Pl. VII fig. 5) from the same station that yielded the holotype agree satisfactorily with the type, as do specimens from nine other stations off southern Florida. The largest specimens, 12–15 cm. tall, have a stout main trunk 4–5 mm. in diameter, and some strong lateral branches that subdivide in the typical pinnate manner. In some colonies the acute spindles are exceptionally slender (Fig. 60 d), and there is variation in the length of the anthocodial rods (Fig. 60 f, i).

A specimen from off Captiva Island, west coast of Florida, and another from off Havana, Cuba, are alike in being dull orange rather than bright red in color. The former specimen does not differ in spiculation from the typical red colonies, but the one from Havana has unusually large and stout anthocodial rods.

Material. Holotype from FLORIDA, Palm Beach, 20 fms., A. R. Thompson and T. L. McGinty coll., yacht *Triton* sta. 183, 22.VII.1950 (USNM 50230). Thirty paratypes from the vicinity of Palm Beach, A. R. Thompson, T. L. McGinty, and J. W. Donovan (USNM 49711, 49714, 49716, 49926, 49927, 49932, 50231, 50232). Other USNM material: off Captiva Island, 26°14.3′ North, 83°47′ West, 44 fms., Robert H. Stewart, 12.VI.1952 (50052); DRY TORTUGAS, 6 miles south of south channel buoy, 18 fms., W. L. Schmitt, sta. 44, 22.VII.1924 (49525); CUBA, vicinity of Havana, 23°10′36″ North, 82°19′12″ West, 169 fms., *Albatross* sta. 2333, 19.I.1885 (10174).

Distribution. Palm Beach, Florida, to the north coast of Cuba, in 15–169 fathoms.

Remarks. *Lophogorgia cardinalis* differs from *L. barbadensis* in its stouter spindles and flexible colonies. In specimens with unusually slender spindles, the sculpture is less crowded than in *L. barbadensis*, and the anthocodial rods are colored yellow and are of different shape. From *L. miniata*, the other bright red *Lophogorgia* of the West Indies, *L. cardinalis* differs in having pointed spindles, slender anthocodial rods not much longer than the cortical sclerites, and a more distinctly pinnate colonial form.

60 **Lophogorgia punicea** (Milne Edwards & Haime), 1857

(Figs. 61 a–h, 62 a–e; Pl. VII fig. 6)

Gorgonia punicea VALENCIENNES 1855, p. 12. (Brésil, Rio de Janeiro.) [Nomen nudum.]
Gorgonia pumicea, MILNE EDWARDS & HAIME 1857, *1*, p. 160 (Brésil.) [Error of transcription.]
Leptogorgia purpurea, (part) WRIGHT & STUDER 1889, p. 151, pl. 29 fig. 1, pl. 34 fig. 3 (Bahia, Brazil, 10–20 fms.; but probably not the record from Sarmiento Channel, Chile, 400 fms.)
Leptogorgia pumicea, VERRILL 1912, p. 399, pl. 33 fig. 10 (spicules of type in Paris Museum), fig. 9 (spicules of specimen from Rio de Janeiro, U.S. Expl. Exp.), p. 35 fig. 11 (branchlet of latter).
?*Leptogorgia studeri* VERRILL 1912, p. 400. (Nom. nov. for *L. purpurea* Wright & Studer, non Pallas.)
Leptogorgia rathbunii VERRILL 1912, p. 397, pl. 29 figs. 4–4a, pl. 33 fig. 11, pl. 35 figs. 9–9a. (Parannao, Brazil.)
Leptogorgia pumicea, STIASNY 1951, p. 73. (Brésil.)
?*Leptogorgia diffusa,* STIASNY 1951, p. 71, pl. 20 fig. B, pl. 21 figs. 2–3. (Guyane française, Ile Royale.)
not *Leptogorgia diffusa* VERRILL 1868a, p. 397. (Bay of Panama; Costa Rica.)

Diagnosis. Branching openly pinnate (Pl. VII fig. 6), terminal twigs 0.5 mm. in diameter, ascending; calyces prominent, hemispherical, in alternating double rows on two sides of branches. Cortical spicules include numerous acute double spindles up to 0.11 mm. long (Fig. 61 a, d, g), and blunt capstans up to 0.08 mm. (Fig. 61 b, e, g); anthocodial rods flat, as long as the longest cortical spicules (Fig. 61 c, f, h). Color, dark purple or reddish purple; cortical spicules orange-red; anthocodials pink.

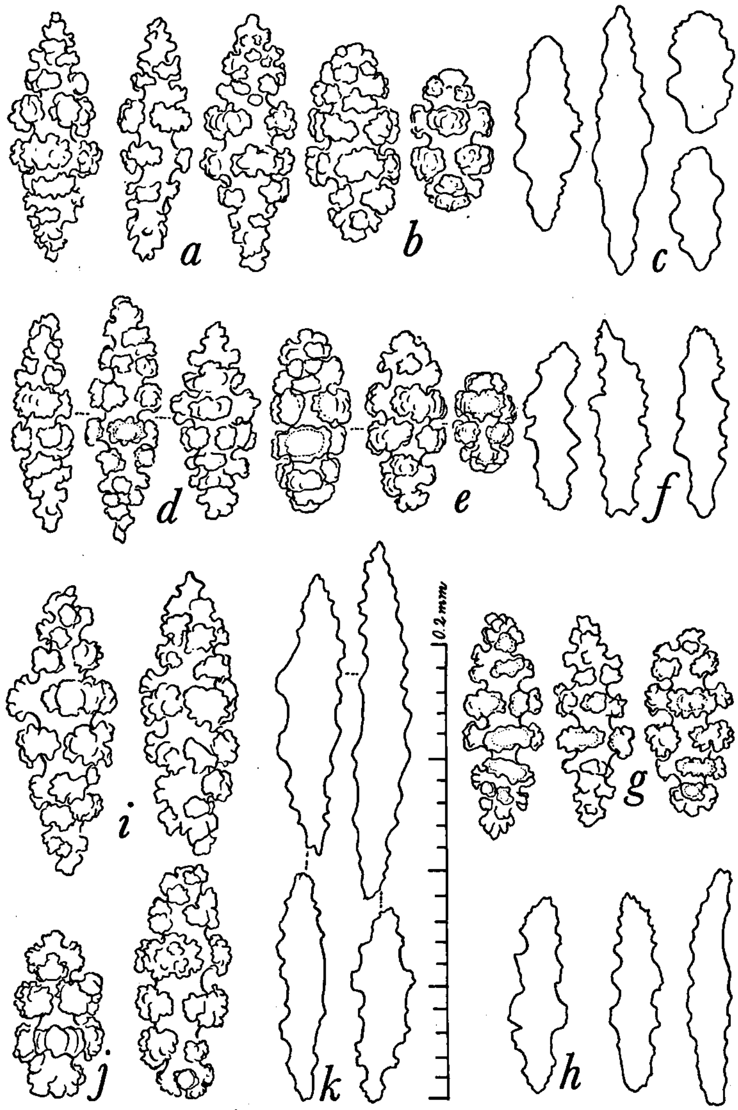


FIGURE 61. *Lophogorgia punicea* (Milne Edwards & Haime), spicules. *a–c*, of a specimen from Rio de Janeiro, Brazil (USNM 633): *a*, acute spindles of inner rind; *b*, blunt spindle and capstan of outer rind; *c*, anthocodial rods. *d–f*, of a specimen from near Rebecca Shoal, Florida (44228): *d*, acute spindles of inner rind; *e*, blunt spindles and capstan of outer rind; *f*, anthocodial rods. *g–h*, of a specimen from Palm Beach, Florida (49713): *g*, spindles of rind; *h*, anthocodial rods. *Lophogorgia* sp. indet. (a), spicules of specimen from the Gulf of Mexico (50413): *i*, acute spindles of inner rind; *j*, blunt spindle and capstan of outer rind; *k*, anthocodial rods. (All figures drawn to the same scale.)

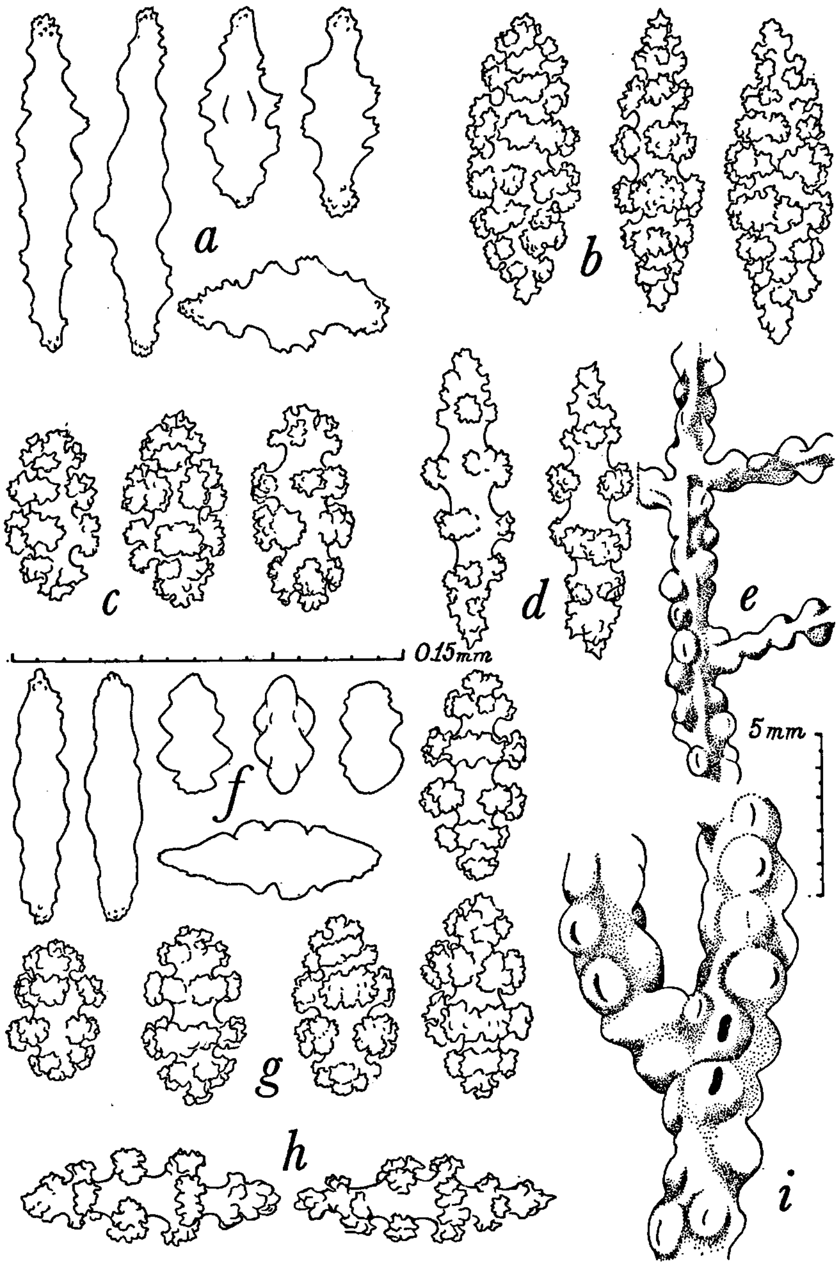


FIGURE 62. *a–e*, *Lophogorgia punicea* (Milne Edwards & Haime) (a syntype of *Leptogorgia rathbunii* Verrill from Brazil (PMYC 4556): *a*, flat anthocodial rods; *b*, acute spindles of outer cortex; *c*, blunt capstans of outer cortex; *d*, spindles of axial sheath; *e*, part of a branch. *f–i*, *Lophogorgia hebes* (Verrill) (the type of *Leptogorgia rubropurpurea* Verrill from Brazil (4523): *f*, flat anthocodial rods; *g*, blunt capstans of outer cortex; *h*, spindles of axial sheath; *i*, part of a branch. (Enlargement of all spicules according to 0.15 mm. scale; enlargement of *e* and *i* according to 5 mm. scale.)

Material. BRAZIL, Rio de Janeiro, J. P. Couthouy coll., U.S. Exploring Exp., 1838, dry specimen (USNM 633); FLORIDA, near Rebecca Shoal, 24°34′ North, 82°37′ West, 10.5 fms., J. Q. Tierney, 2.X.1948, alcoholic spec. (USNM 44228); Palm Beach, 40 fms., A. R. Thompson and T. L. McGinty, yacht *Triton*, 26.IV.1950, alc. spec. (USNM 49713). Also a syntype of *Leptogorgia rathbunii* Verrill (PMYC 4556) from Parannao, Brazil, C. F. Hartt Exp. through the courtesy of Dr. Willard D. Hartman of the Peabody Museum.

Distribution. Southern Florida to Brazil.

Remarks. The specimen from the Exploring Expedition was collected at the type locality and agrees in details with the short description given by MILNE EDWARDS & HAIME (1857, p. 160), and with the figures of spicules from the type given by VERRILL (1912, pl. 33 fig. 10). No significant difference can be found between the topotypic specimen and those from Florida. Both Brazilian and Floridian material have numerous acute double spindles up to 0.11 mm. long, blunt capstans reaching about 0.08 mm., and flat, tapered anthocodial rods at most only slightly longer than the longest spindles of the cortex.

One of the specimens from Florida (44228) is outwardly very similar to the topotype, although slightly more slender. Its spicules are somewhat smaller. The other (49713) is stouter, with straighter branches, and its spindles are less acute. Inasmuch as these differences fall within the range of variation seen in other species of the genus, there is no sound reason for separating the specimens taken at Florida localities from those collected in Brazil.

The name *punicea*, established as a nomen nudum by VALENCIENNES, obviously refers to the color of the colonies (Latin *puniceus*, reddish, red, or purple-colored). MILNE EDWARDS & HAIME (1857), in validating the name, incorrectly cited it as '*pumicea*' (Latin *pumiceus*, of pumice or soft stone), a spelling that has been used in the few subsequent references to the species. Because MILNE EDWARDS & HAIME cited the name incorrectly both in synonymy and in the main heading, because those authors committed similar errors of transcription (e.g., '*laxispina*' for *laxispica*) elsewhere in the same work, and because the adjective *pumiceus* has nothing at all to do with the specimens described, the original spelling proposed by VALENCIENNES is retained.

61 **Lophogorgia hebes** (Verrill), 1869

(Figs. 62 f–i, 63; Pl. VII fig. 4)

Leptogorgia hebes VERRILL 1869,b p. 422. (Key West.)
Leptogorgia rubropurpurea VERRILL 1912, p. 398, pl. 29 figs. 5–5a, pl. 30 fig. 1, pl. 33 fig. 8, pl. 35 figs. 10–10a. (Rio de Janeiro, Brazil.)
Leptogorgia hebes, DEICHMANN 1936, p. 179, pl. 17 fig. 3, pl. 19 figs. 16–23. (Beaufort, North Carolina, and Cape Fear River, Florida [error?].)

Diagnosis. Colonies profusely branched, mostly in one plane, irregularly pinnate; terminal twigs 1–2 mm. in diameter, ascending (Pl. VII fig. 4); calyces in alternating double rows along the two edges of the twigs, multiple rows along the larger branches, and all around the main branches and trunk, where are in rows separated by distinct grooves that indicate the presence of the stem canals. Distinct, hemispherical calyces are formed in the older parts of the colonies, but on the twigs the polyps commonly form no calyces or only indistinct ones. Spicules chiefly blunt, ovate capstans (Fig. 63 a, e, g, j); those of the inner layer may be more slender and tapered, sometimes acute (Fig. 63 b, d, h), but such forms are not abundant. Anthocodial rods usually about the same length as the largest cortical spicules, but longer in some colonies (Fig. 63 c, f, i, k). Color of colonies orange, red, reddish purple, or deep purple; cortical spicules of corresponding colors; anthocodial rods pink, yellow, or amber-colored.

Material. USNM specimens from: North Carolina, near mouth of New River, 25 feet, A. S. Pearse coll., 29.VI.1949 (49589); 7 miles west of Boca Grande sea buoy, 26°40′ North, 82°27′ West, 8 fms., J. Q. Tierney, 28.IX.1948 (44226); 8 miles north-east of East Pass sea buoy, 29°50′ North, 84°32′ West, J. Q. Tierney, 26.X.1948 (44227); Florida, off Longboat Pass, Sarasota, J. Brookes Knight, 1951 and 1952, 5 spec. (49953, 50260); Texas, Matagorda, John Kain (49751); Port Aransas, 20 fms., W. K. Emerson (50411); and a fragment, possibly from Aruba, collected by A. J. van Koolwijk, 1886 (50412). Also the type specimen of *Leptogorgia rubropurpurea* Verrill (PMYC 4523) from Brazil, Rio de Janeiro, C. F. Hartt Exp.; through the courtesy of Dr. Willard D. Hartman of the Peabody Museum.

Distribution. North Carolina to Brazil; apparently absent from the southeast coast of Florida but abundant along most of the Gulf coast of that state, where it grows in company with *Leptogorgia virgulata*.

Remarks. Toward the northern limit of its range, where *Leptogorgia virgulata* and *L. setacea* are the only other gorgoniids present, the much-branched, flattened colonies of *Lophogorgia hebes* serve to separate it at a glance from other members of the family. There is, however, a considerable degree of variation, both in colonial form and in spiculation, which presents some difficulty in separating *L. hebes* from those that occur with it in more southerly waters. The calyces of *L. hebes* may be hemispherical and prominent or low and quite flush with the surface of the rind, even in the same colony, but they usually project at least to a small extent. Colonies

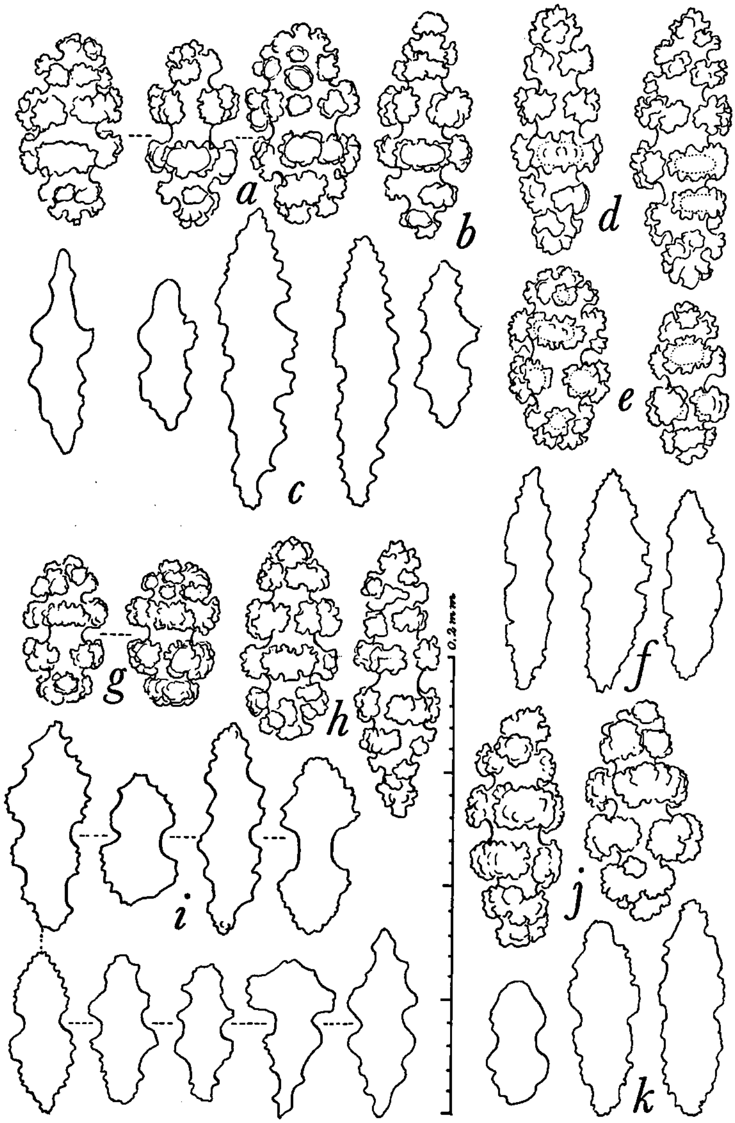


FIGURE 63. *Lophogorgia hebes* (Verrill), spicules. *a–c*, of a reddish purple specimen from Texas (USNM 50531): *a*, capstans of outer rind; *b*, spindle of inner rind; *c*, anthocodial rods. *d–f*, of a purple specimen from Sarasota, Florida (50260): *d*, spindles of inner rind; *e*, capstans of outer rind; *f*, anthocodial rods. *g–i*, of a yellow specimen from Texas (49751): *g*, capstans of outer rind; *h*, spindles of ineer rind; *i*, anthocodial rods. *j–k*, of a specimen from North Carolina (49589): *j*, spicules of rind; *k*, anthocodial rods. (All figures drawn to the same scale.)

are always profusely branched and ramification tends to proceed in one plane; large colonies may assume the form of a dense bush (pl. VII fig. 4) but remain distinctly flattened, whereas smaller colonies are commonly flabellate and quite flat.

Characteristic of this species regardless of growth form are the plump, blunt, deep reddish, purple, or yellow cortical spindles and the broad, flat, brightly colored (pink, yellow, or amber) anthocodial rods the largest of which are as long as or slightly longer than the longest cortical spindles. The spindles of the outer cortex are predominantly blunt, but the axial sheath contains some sclerites that are more or less acute and a few of this type may be found in preparations of the outer layer.

62 **Lophogorgia miniata** (Milne Edwards & Haime), 1857

(Fig. 64 a–c)

Gorgonia miniata Valenciennes 1855, p. 12. (Guadeloupe.) [Nomen nudum.]
Gorgonia miniata Milne Edwards & Haime 1857, *1*, p. 160. (Antilles.)
Leptogorgia miniata, Deichmann 1936, p. 180, pl. 19 figs. 1–7. (Puerto Colombia, Colombia.)

Diagnosis. Colonies branched in one plane, openly pinnate, the twigs commonly opposite but not always so, generally 12–25 mm. long but a few more than 30 mm. Calyces low, bluntly conical, distinct, usually in single series along the two edges of the twigs and in alternating double rows along the larger branches. Spicules predominantly blunt capstans about 0.08–0.09 mm. long (Fig. 64 b), but more acute double spindles about 0.1 mm. long (Fig. 64 a) are not unusual. The longest anthocodial rods (Fig. 64 c) are longer than the largest rind sclerites by as much as 1.7 times. Color, bright vermilion red.

Material. A dry fragment, presumably part of the type in the Paris Museum, sent to Verrill by Kölliker; Antilles (MCZ 5017). Also a complete specimen, dry, from Puerto Colombia, Colombia, collected by Brother Elias (USNM 49590).

Distribution. Lesser Antilles and south shore of the Caribbean.

Remarks. The large specimen from Colombia is very similar to the fragment from Paris in the collections of the Museum of Comparative Zoölogy. There are numerous blunt capstans about 0.08 mm. in length, and spindles, also blunt, up to 0.1 mm. The anthocodial rods, which are nearly twice the length of the longest cortical spindles, are flat, tapered toward the ends, serrate, and orange or salmon pink in color. The cortical spicules are clear orange-red.

63 **Lophogorgia** sp. indet. (a)

(Fig. 61 i–k)

Diagnosis. Colonies pinnate, branches stiff, 1.5–2.0 mm. in diameter, crooked, upward curving. Calyces in alternating double rows along each side of the branches, producing a squarish cross section. The longer cortical spindles acutely pointed. Largest anthocodial rods somewhat longer than the longest cortical spindles.

Description. A flabellate colony 17 cm. tall without base, branched in one plane, closely resembles *Lophogorgia hebes* (Verrill) in general aspect. The polyps are in alternating double rows along two sides of the branches, imparting to them a squarish cross section. The major branches ascend sinuously, and the openly pinnate lateral twigs curve upward to follow the course of the main branches. The calyces are prominent and, toward the base, become hemispherical and oriented in rows separated by grooves marking the path of the stem canals. The spiculation differs

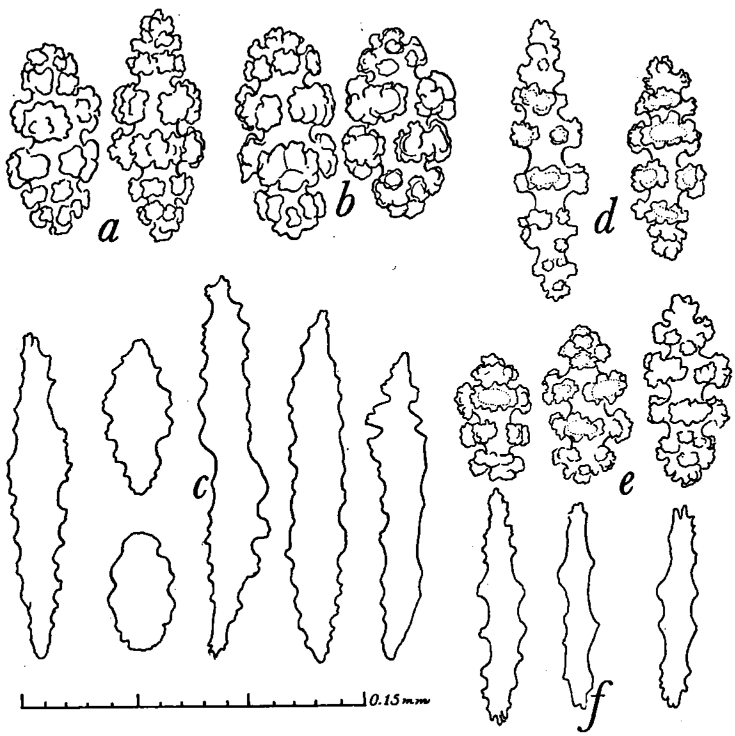


FIGURE 64. *Lophogorgia miniata* (Milne Edwards & Haime), spicules of a specimen from Colombia (USNM 49590): *a*, spindles of inner rind; *b*, capstans of outer rind; *c*, anthocodial rods. *Lophogorgia* sp. indet. (b), spicules of a specimen from Brazil (50226): *d*, spindles of inner rind; *e*, capstans of outer rind; *f*, anthocodial rods. (All figures drawn to the same scale.)

from that of *L. hebes* in the presence of numerous stout but acute spindles (Fig. 61 i) as well as blunt capstans (Fig. 61 j). The flat rods of the anthocodiae (Fig. 61 k) are more slender than is usually the case in *L. hebes*.

Material. Gulf coast of FLORIDA, F. G. Walton Smith coll., 1947, University of Miami Gulf Exp., lot 213, 1947, 1 specimen (USNM 50413).

Distribution. West coast of Florida.

Remarks. The material available is not sufficient to determine whether the differences between this form and *Lophogorgia hebes* represent individual variation or specific difference. It is included in the key and listed without a name, in the hope that additional material will be recognized.

64 **Lophogorgia** sp. indet. (b)

(Fig. 64 d–f; Pl. VII fig. 2)

Diagnosis. Colonies branched in one plane, openly pinnate; terminal twigs stiff and nearly straight, slightly ascending (Pl. VII fig. 2). Calyces prominent, close set, alternating in two rows on each edge of the twigs and branches. The cortical spicules are slender but blunt capstans up to 0.08 mm. in length in the outer layer (Fig. 64 e), and slender, more acute spindles up to 0.12 mm. long in the axial sheath (Fig. 64 d). The flat anthocodial rods (Fig. 64 f) reach a length of 0.1 mm. Color of colonies, bright red ("scarlet-red or coral-red," Verrill). Spicules dull red, anthocodial rods colorless.

Material. BRAZIL, Paqueta, Richard Rathbun coll., 12.II.1877, 1 alcoholic specimen (USNM 50226).

Remarks. This specimen bears a strong outward resemblance to Wright & Studer's *Leptogorgia purpurea* from Bahia, Brazil, which is possibly identical with the species treated herein as *Lophogorgia punicea* (Milne Edwards & Haime). It differs, however, in its narrow, colorless anthocodial rods (fig. 64f) and, since those spicules seem to form a reasonably constant character, it cannot be synonymized with that species. Neither is the available material adequate for description as a new species, so it must remain for the present as a *species indeterminata*.

Genus **Pacifigorgia** Bayer, 1951

Pacifigorgia BAYER 1951, p. 94. (Type species, *Gorgonia stenobrochis* Valenciennes 1846, by original designation.)

Diagnosis. Colonies flabellate, in one plane; branches closely and regularly anastomosing to form a network. Cortical spicules including only acute double spindles and blunt double heads, never scaphoids.

Distribution. Pacific coast from the Gulf of California to Panama; Atlantic coast from Trinidad to Brazil. Endemic amphi-American.

Remarks. It is not necessary to repeat here the historical aspects of this genus, which were discussed at the time of its original publication and in a subsequent paper (BAYER 1953).

The genus *Pacifigorgia*, which contains about fifteen species in all, is represented in the Atlantic Ocean by only one, which has received several names over the years.

65 Pacifigorgia elegans (Milne Edwards & Haime), 1857

(Fig. 65)

Rhipidogorgia elegans MILNE EDWARDS & HAIME 1857, *1*, p. 177. (Iles de la Trinité.)
Rhipidogorgia elegans, DUCHASSAING & MICHELOTTI 1864, p. 20, pl. 4 fig. 4. (In insula Trinitatis.)
Gorgonia hartti VERRILL 1912, p. 391, pl. 29 figs. 6–6a, pl. 30 fig. 2, pl. 33 fig. 6, pl., 35 fig. 6. (Marannao, Brazil.)
Gorgonaria [sic] *Crevauxi* STIASNY 1951, p. 72, pl. 22 figs. 4–5, pl. 20 fig. C. (Guyane française, Iles du Salut, Ile Royale.)
Rhipidogorgia elegans, STIASNY 1951, p. 70, pl. 20 fig. A. (La Trinité.)
Pacifigorgia elegans, BAYER 1959, p. 19, fig. 5. (Surinam.)

Diagnosis. Bright reddish purple anastomosing sea fans with cortical spindles reaching 0.12 mm. in length (Fig. 65 a) and double

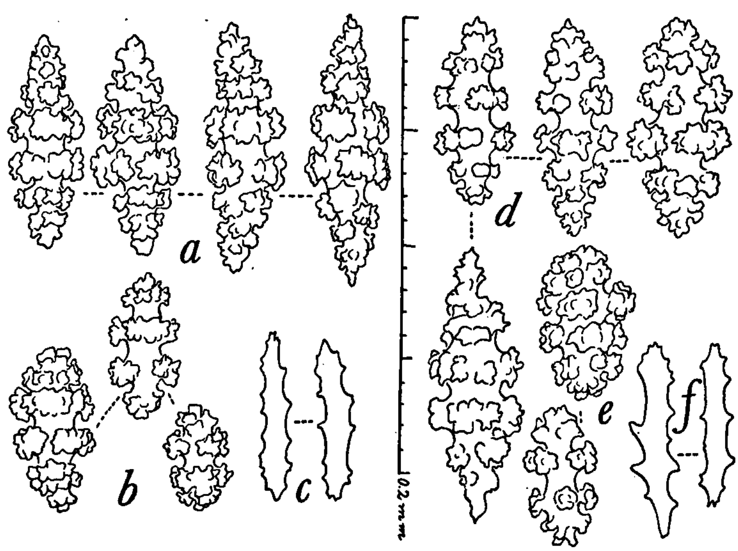


FIGURE 65. *Pacifigorgia elegans* (Milne Edwards & Haime). *a–c*, spicules of a specimen from Trinidad: *a*, spindles; *b*, double heads; *c*, anthocodial rods. *d–f*, syntype of *Gorgonia crevauxi* Stiasny from French Guiana: *d*, spindles; *e*, double heads; *f*, anthocodial rods. (All figures drawn to same scale.)

heads somewhat shorter, 0.05–0.08 mm., sometimes 0.1 mm. (Fig. 65 b). Anthocodiae with slender flat rods having widely spaced marginal serrations, usually about 0.07 mm. long but commonly shorter and occasionally longer (Fig. 65 c).

Material. Specimens from TRINIDAD, Toco, collected by Dr. Elisabeth Deichmann, in the Museum of Comparative Zoölogy; and a fragment of a syntype of *G. crevauxi* Stiasny from FRENCH GUIANA, through the courtesy of Dr. L. B. Holthuis of the Leiden Museum (USNM 50742). Several specimens from SURINAM, in 15 fathoms (USNM 50953).

Distribution. Trinidad to Maranhao, Brazil. Could be expected at Curaçao and adjacent islands, but has not yet been reported inside the Caribbean.

Remarks. Specimens collected by Miss DEICHMANN at Toco, Trinidad, agree in form with both VERRILL's and DUCHASSAING & MICHELOTTI's species, and with the former in regard to spiculation. It should be noted that the scaphoids mentioned by VERRILL for *G. hartti* are the result of contamination.

The syntype of *G. crevauxi* is identical with *G. hartti* except for the fact that the blunt double heads are somewhat larger. All published descriptions and all available material indicate that in the Atlantic there is but a single species of *Pacifigorgia*, for which the earliest name is *elegans* of MILNE EDWARDS & HAIME.

Genus **Leptogorgia** Milne Edwards & Haime, 1857

Leptogorgia MILNE EDWARDS & HAIME 1857, *1*, p. 163. (Type species, *Leptogorgia viminalis* Milne Edwards & Haime = *Gorgonia virgulata* Lamarck = ?*Gorgonia viminalis* Pallas, by subsequent designation: VERRILL 1869b, p. 420.]
Leptogorgia, VERRILL 1869b, p. 419.
Leptogorgia, (part) BIELSCHOWSKY 1929, p. 81.
Leptogorgia, (part) DEICHMANN 1936, p. 175.

Diagnosis. Gorgoniids with outer coenenchymal spindles partly in the form of short disk-spindles, partly long spindles with tubercles of outer surface partly fused and higher than those of the inner surface; inner coenenchyme with spindles having sculpture uniformly developed on all sides. Anthocodiae with weak or strong armature.

Distribution. Chesapeake Bay to the reefs of Brazil.

Remarks. There is absolutely no justification for considering *Gorgonia petechizans* Pallas to be the type species of *Leptogorgia* as was done by BIELSCHOWSKY and later authors, because that species was not originally included in *Leptogorgia*.

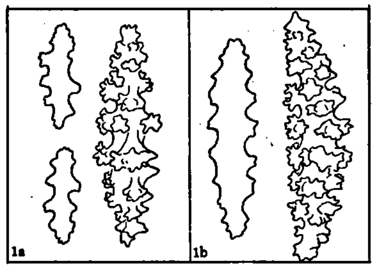
My concept of the genus differs from that of BIELSCHOWSKY in that I exclude all those species that have uniformly sculptured cortical spindles. Those species agree satisfactorily with the definition of *Lophogorgia*, where it seems more logical to place them.

KEY 19

ILLUSTRATED KEY TO THE SPECIES OF *Leptogorgia*

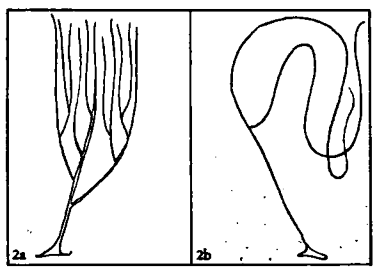
1a. Anthocodial armature weak, the flat rods always less than $^2/_3$ the length of the longest spindles of the rind. Colonies usually attached but sometimes free: 2

1b. Anthocodial armature strong, the rods reaching or exceeding $^2/_3$ the length of the longest spindles in the rind. Colonies usually unattached: 3



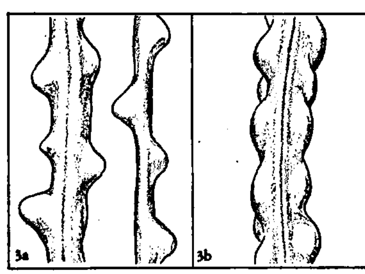
2a. Colonies with a number of long, straight branches, usually rather stiff; always attached: *Leptogorgia virgulata* (Lam.)

2b. Colonies unbranched or with only one or two long, slender, flexible branches. Colonies sometimes unattached: *Leptogorgia setacea* (Pallas)



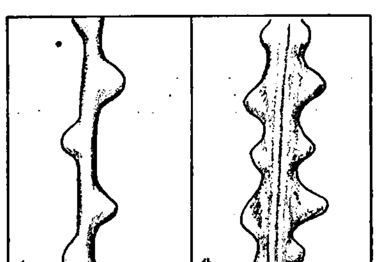
3a. Calyces prominent, widely separated: 4

3b. Calyces distinct but more closely spaced: *Leptogorgia medusa* (Bayer)



4a. Extremely slender colonies, diameter of stems (excluding calyces) 0.75 mm. or less: *Leptogorgia stheno* (Bayer)

4b. Stouter colonies, diameter of stems (excluding calyces) 0.9 mm. or more: *Leptogorgia euryale* (Bayer)



66 Leptogorgia virgulata (Lamarck), 1815

(Fig. 66; Pl. VII fig. 7)

?*Gorgonia viminalis* PALLAS 1766, p. 184. (Mare Mediterraneum [in error, if this is the same species as Esper's].)
Gorgonia viminalis, ELLIS & SOLANDER 1786, p. 82, pl. 12 fig. 1. (Charleston, in South Carolina.)
Gorgonia viminalis, ESPER 1791, *2*, p. 51, pl. 11 [but not 11A]. (Das mittelländische Meer [in error].)
Gorgonia virgulata LAMARCK 1815b, p. 157. (Habite l'Océan atlantique américain.)
Gorgonia ceratophyta, var. *flava* + var. *rubra* DONOVAN 1825, *4*, p. 114, 115.
Leptogorgia tenuis VERRILL 1864a, p. 8. (Bay of New York.)
Leptogorgia brasiliensis VERRILL 1912, p. 392, pl. 29 figs. 3–3a, pl. 33 fig. 7, pl. 35 figs. 7–7a. (Mapelle, Bahia, Brazil.)
Leptogorgia sulfurea BIELSCHOWSKY 1929, p. 126, fig. 20, pl. 3 fig. 11. (Verbreitung?)
Leptogorgia virgulata, BIELSCHOWSKY 1929, p. 127, fig. 21, pl. 3 fig. 12. (Charleston, S. C.; Morehead City, N.C.)
Leptogorgia virgulata, DEICHMANN 1936, p. 177, pl. 19 figs. 24–34. (New York to Florida.)

Diagnosis. Colonies attached, with several long, whip-like branches (Pl. VII fig. 7). Polyps in multiple series along two sides of the branches, without projecting calyces, armed with flat rods (Fig. 66 c, g, h) half or less than half as long as the longest coenenchymal spindles. The shorter spicules of the outer cortex are mostly disk-spindles (Fig. 66 a, e, i); the longer spindles of the inner cortex are symmetrically sculptured (Fig. 66 b, f, j).

Material. A large number of specimens in the U. S. National Museum, from the BAY OF NEW YORK (569, 765, 766), CHESAPEAKE BAY (49763), NORTH CAROLINA (43036, 43415, 43420, 49592, 49753), SOUTH CAROLINA (44057, 49602, 50509), GEORGIA (49669, 49679), west coast of FLORIDA (6877, 15903, 44229, 44230, 44232, 49690, 49732, 49752, 50056, 50259, 50544, 50545, 50564, 50566, 50657), LOUISIANA (49813), and TEXAS (50529, 50532, 50416); also material from BRAZIL, collected by R. Rathbun (49749).

Distribution. Bay of New York? Chesapeake Bay to Georgia; west coast of Florida to Brazil.

Remarks. This is the common, moderately branched, whip-like *Leptogorgia* of the American east coast. The specimens from Brazil do not differ significantly, but may prove to be separable as a geographic subspecies. I have not seen material from localities between Texas and Brazil; the record from Jamaica, published by HARGITT & ROGERS (1901, p. 287) remains to be confirmed.

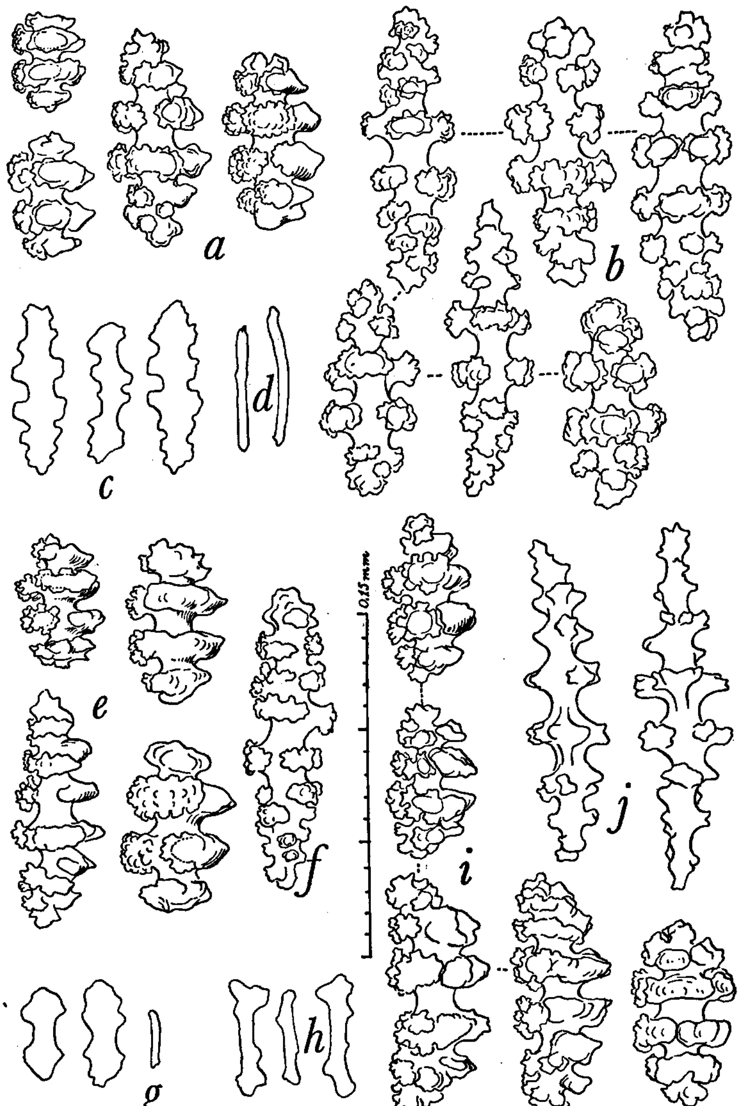


FIGURE 66. *Leptogorgia virgulata* (Lamarck), spicules. *a–d*, specimen from the Carolinas: *a*, disk-spindles; *b*, regular spindles of inner cortex; *c*, flat anthocodial rods; *d*, rodlets of tentacles. *e–g*, specimen from northwest Florida: *e*, disk-spindles; *f*, regular spindles; *g*, anthocodial and tentacular rods. *h–j*, specimen from Brazil: *h*, anthocodial rods; *i*, disk-spindles; *j*. regular spindles (All figures drawn to the same scale.)

67 **Leptogorgia setacea** (Pallas), 1766

(Figs. 67, 68 a–d)

Gorgonia setacea Pallas 1766, p. 182. (Mare Americanum.)
Pterogorgia gracilis Verrill 1868a, p. 359, pl. 4 figs. 2–3. (Abrolhos Reefs, Brazil.)
Gorgonia gracilis, Verrill 1912, p. 393, pl. 29 fig. 2, pl. 35 figs. 5–5a. (Abrolhos Reefs, Brazil.)
not *Xiphigorgia setacea*, Kükenthal 1916b, p. 502.
Leptogorgia virgulata, Cowles 1930, p. 332. (Chesapeake Bay.)
Leptogorgia setacea, Deichmann 1936, p. 178, pl. 19 figs. 35–38. (North Carolina; Texas; Brazil.)

Diagnosis. Colonies attached or free, unbranched or with a very few long, flexible branches; polyps in single or double series along two sides of the stems, with low or moderately prominent calyces. Anthocodial rods (Fig. 67 d, e, m) less than 2/3 the length of the longest cortical spindles, usually only half or less than half as long. Disk-spindles of cortex similar to those of *L. virgulata* but more ornately sculptured (Fig. 67 b, h, j); outer rind also containing spindles with warts of outer surface more or less fused and spine like (Fig. 67 a, g, k). Spindles of inner rind uniformly sculptured all around (Fig. 67 c, i, l). Color, purple or yellow; Brazilian specimens may be nearly white.

Material. A large number of USNM specimens from Virginia, Chesapeake Bay and vicinity, including those reported by Cowles (1930) (17319, 43029, 43241, 43242, 43245, 43252, 43254, 49757, 50588, 50702, 50706), and from Florida, Fernandina (50590); from the Gulf of Mexico, west Florida (42717); Louisiana (50652), Texas (44218, 43411, 49977), and Mexico, Matamoras (42162); also several specimens from Brazil (33606, 49657, 49659, 50654).

Distribution. Chesapeake Bay to Brazil. This species seems to have about the same range as *L. virgulata*, but has not been reported north of Chesapeake Bay.

Ecology. *Leptogorgia setacea* ventures into bays and river mouths where salinity is much reduced. It has been taken in Chesapeake Bay as far north as the mouth of the Potomac River (Cowles 1930, p. 332). In Brazil, it "grows abundantly in little tufts on the edges of the reefs of the Abrolhos region below low-tide, with *Hymenogorgia quercifolia*." (Verrill 1868a, p. 360.) It is one of the few species of gorgonian that can live completely unattached.

Remarks. *Leptogorgia setacea* is a common inshore species along the Atlantic coast of North America, from Chesapeake Bay southward. It can be recognized by its unbranched, often unattached, filiform colonies with low, crowded, biserial calyces and small anthocodial rods. Its color may be yellow, purple, or some intermediate shade.

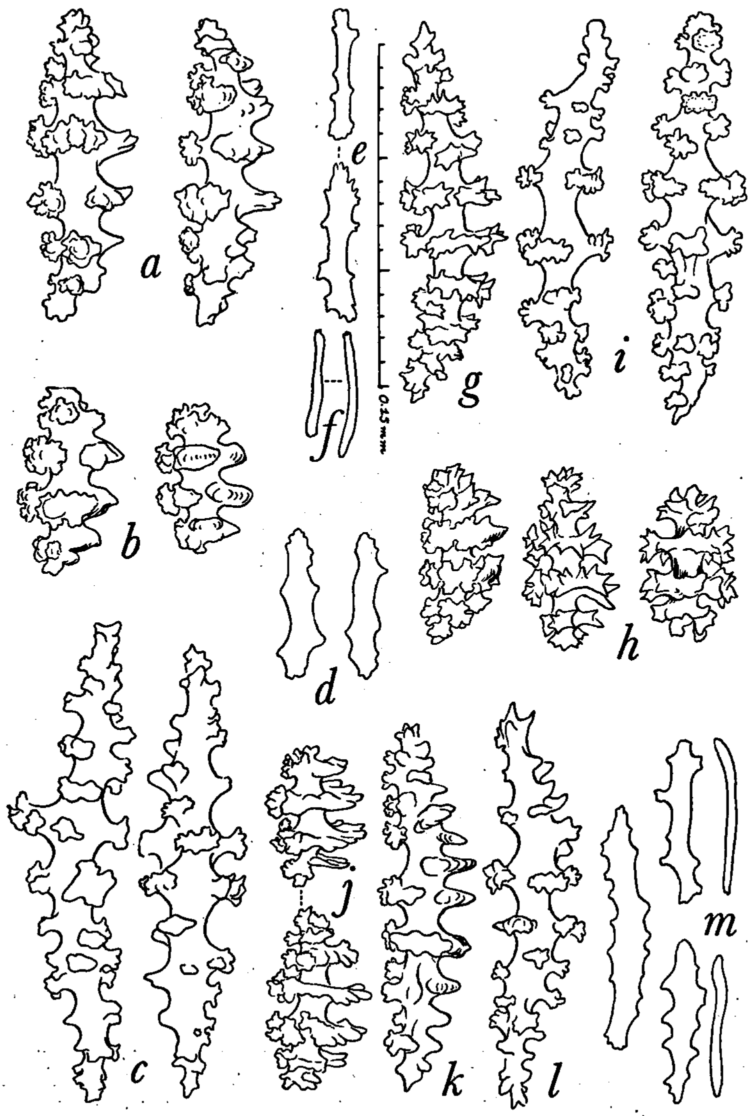


FIGURE 67. *Leptogorgia setacea* (Pallas), spicules. *a–d*, specimen from Chesapeake Bay: *a*, spindles of outer cortex; *b*, disk-spindles of outer cortex; *c*, spindles of inner cortex; *d*, anthocodial rods. *e–i*, specimen from Texas: *e*, anthocodial rods; *f*, tentacular rods; *g*, spindles of outer cortex; *h*, disk-spindles of outer cortex; *i*, spindles of inner cortex. *j–l*, specimen from British Guiana: *j*, disk-spindles of outer cortex; *k*, spindle of outer cortex; *l*, spindle of inner cortex; *m*, anthocodial and tentacular rods. (All figures drawn to same scale.)

The spicules of Brazilian specimens (Fig. 68 a–d) do not differ significantly from those of North American specimens.

68 **Leptogorgia medusa** (Bayer), 1952

(Fig. 68 e–g)

Eugorgia medusa BAYER 1952, p. 188, fig. 1 t–y. (Off Boca Grande, Carabelle, and Cape San Blas, Florida.)

Diagnosis. Colonies fixed or free, unbranched or with one or two long branches; diameter of stems 1.0–1.5 mm., exclusive of calyces. Polyps forming low, rounded, contiguous calyces set in double rows on each side of the stem in the midregion of the colony, single rows near the growing tips. Anthocodial rods up to 0.11 mm. in length (Fig. 68 g), the largest coenenchymal spindles about 0.14 mm. Outer rind with short disk-spindles and long spindles with partly fused warts (Fig. 68 e); inner rind with symmetrical spindles and small, flattened, belted rods (Fig. 68 f).

Material. The original USNM specimens from FLORIDA, off Boca Grande Light (10483), south of Carrabelle (holotype 49766, paratype 10464), and south of Cape San Blas (10331), Gulf of Mexico, 24–27 fms.

Distribution. Northern Gulf of Mexico.

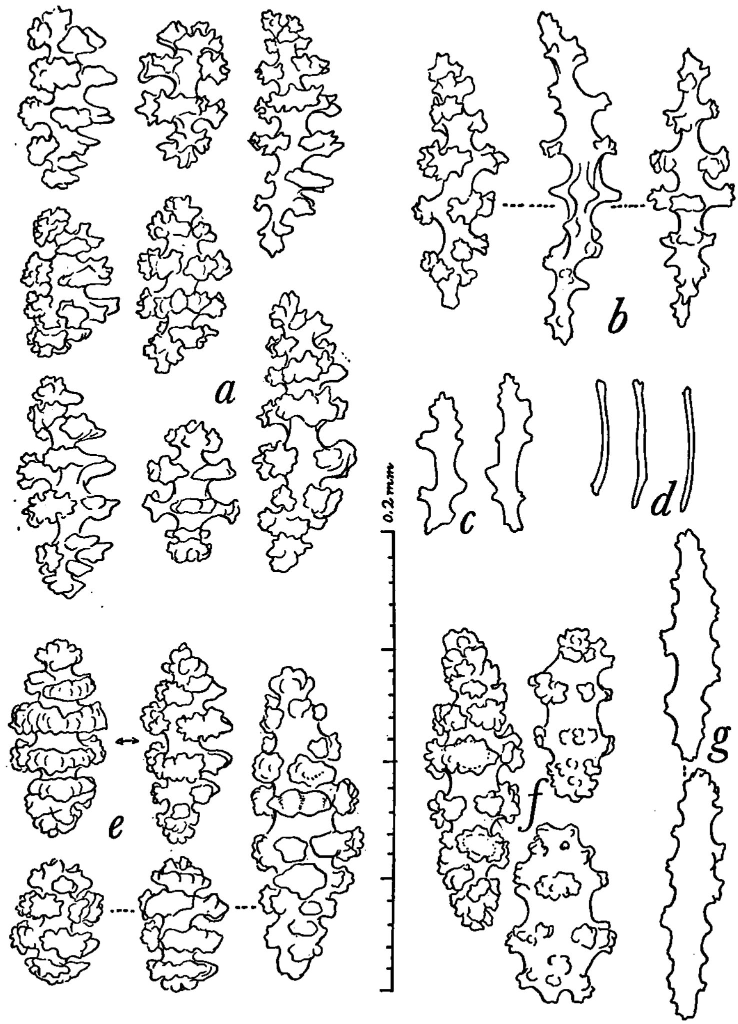
Remarks. Colonies of *Leptogorgia medusa* are distinctive because of their low, close-set calyces and their uniform yellowish or pinkish buff coloration. The anthocodial armature is quite strong.

69 **Leptogorgia stheno** (Bayer), 1952

(Fig. 69 a–e)

Eugorgia stheno BAYER 1952, p. 186, fig. 1 j–n. (Off Palm Beach and Miami, Florida, and Mobile, Alabama.)
Leptogorgia stheno, BAYER 1959, p. 17, fig. 4. (Surinam.)

Diagnosis. Colonies unattached, unbranched or rarely with one or two branches, extremely slender, diameter 0.4–0.75 mm. exclusive of calyces. Polyps biserial, alternating, forming prominent, conical calyces; anthocodiae armed with stout rods (Fig. 69 c) often attaining a length of 0.14 mm., or equal to the longest cortical spindles. Outer rind contains disk-spindles and longer spindles with partly fused warts (Fig. 69 a–b); inner rind contains symmetrically ornamented spindles (Fig. 69 d). Color, white or yellow, with red calyces;



FIGURES 68. *Leptogorgia setacea* (Pallas), spicules of a specimen from Brazil: *a*, disk-spindles and longer spindles with fused warts, from outer rind; *b*, spindles of inner rind; *c*, anthocodial rods; *d*, tentacular rods. *Leptogorgia medusa* (Bayer), spicules of a specimen from off Boca Grande, Florida: *e*, disk-spindles and longer spindles with fused warts, from outer rind; *f*, spindle and flat rods of inner cortex; *g*, anthocodial rods. (All figures drawn to same scale.)

uniform pale (white or yellow) and dark (reddish or pinkish orange) specimens, with yellow anthocodial rods, are occasionally found.

Material. The original USNM specimens, from FLORIDA, off Palm Beach (49784), Miami (49785), and ALABAMA, Mobile (holotype 49774, paratypes 49775–49777, also 49778–49783); five additional lots from off Palm Beach (50429, 50438) and the Gulf of Mexico (50033, 50062, 50063). One fragment of an extremely slender colony from SURINAM, in 14 fms. (50845).

Distribution. From Palm Beach, Florida, to the coast of Alabama; 14–67 fathoms.

Remarks. This species is very common on sandy ground in the Gulf of Mexico, where the colonies live completely unattached and have normal growing tips at both ends. Both attached and unattached specimens have been taken on rocky bottom off the east coast of Florida.

The incomplete material from Surinam might have lived either attached or free; the predominantly soft character of the bottom, mud with shells, suggests that they probably were unattached.

70 **Leptogorgia euryale** (Bayer), 1952

(Fig. 69 f–i)

Eugorgia euryale BAYER 1952, p. 186, fig. 1 o–s. (Gulf of Mexico, south of Carrabelle, Florida.)
?*Xiphigorgia setacea*, KÜKENTHAL 1916b, p. 502, figs. Z, A', pl. 23 fig. 6. (Honduras.)

Diagnosis. Colonies attached or free, simple, rarely branched, moderately slender, 0.9–1.0 mm. in diameter exclusive of calyces; polyps in alternating double rows along two sides of the stem, becoming strictly biserial near the growing ends; calyces prominent, widely separated. Longest anthocodial rods (Fig. 69 h) 0.75–0.8 as long as the longest cortical spindles. Outer rind with disk-spindles (Fig. 69 i); inner rind with symmetrically sculptured spindles (Fig. 69 f). Color, pale pink, calyces red with yellow area around aperture.

Material. FLORIDA, south of Carrabelle, 24 fms. (holotype USNM 49764, paratype 49765).

Distribution. Northern Gulf of Mexico; Honduras?

Remarks. It seems likely that the specimen that KÜKENTHAL called *Xiphigorgia setacea* is in reality the present species. Its few, long branches with prominent calyces and its coloration agree perfectly. Unfortunately, KÜKENTHAL did not figure the spicules of his specimen in adequate detail,

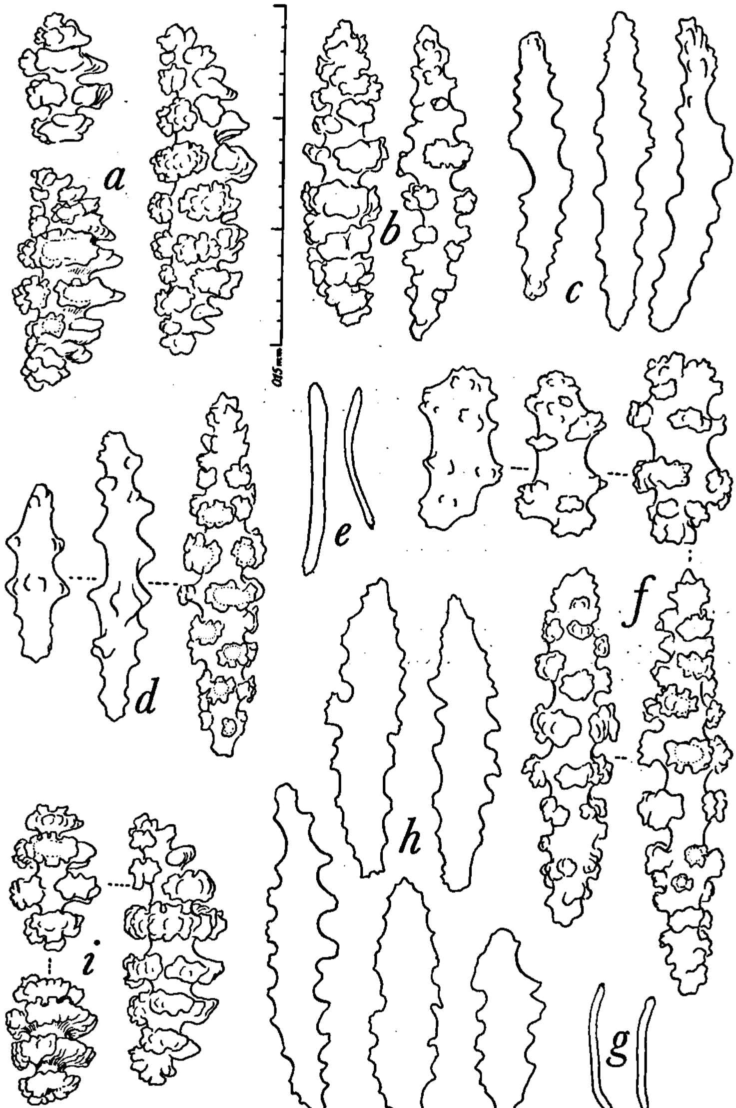


FIGURE 69. *Leptogorgia stheno* (Bayer), spicules: *a*, disk-spindles and longer spindles with fused warts, from outer cortex; *b*, spindles with partly fused warts, from outer cortex; *c*, anthocodial rods; *d*, spindles of inner cortex; *e*, tentacular rods. *Leptogorgia euryale* (Bayer), spicules: *f*, spindles and flattened rods of inner cortex; *g*, tentacular rods; *h*, flat rods from anthocodiae; *i*, disk-spindles and longer spindles with fused warts, from outer cortex. (All figures drawn to same scale.)

Leptogorgia euryale is similar to *L. stheno* but much stouter, with longer symmetrical spindles, up to 0.185 mm. in length, and anthocodial rods reaching about 0.15 mm. Like *L. medusa*, the axial sheath layer of *L. euryale* contains blunt, flattened rods that seem to be missing in *stheno*.

Genus **Pseudopterogorgia** Kükenthal, 1919

Pterogorgia (part) of EHRENBERG, DANA, VALENCIENNES, DUCHASSAING & MICHELOTTI, KÖLLIKER, *et aliis*.
not *Pterogorgia* EHRENBERG 1834, p. 368. (Type species, *Gorgonia anceps* Pallas 1766, by subsequent designation: MILNE EDWARDS & HAIME 1850, p. lxxx.)
Pterogorgia, BIELSCHOWSKY 1918, p. 52.
Pterogorgia, KÜKENTHAL 1919, p. 853
Pseudopterogorgia KÜKENTHAL 1919, p. 854. (Type species, *Pseudopterogorgia australiensis* (Ridley), by original designation.)
Pterogorgia, KÜKENTHAL 1924, p. 351.
Pseudopterogorgia, KÜKENTHAL 1924, p. 355.
Pterogorgia, BIELSCHOWSKY 1929, p. 197.
Pterogorgia, DEICHMANN 1936, p. 193.
Antillogorgia BAYER 1951, p. 97. (Type species, *Gorgonia acerosa* Pallas 1766, by original designation.)

Diagnosis. Pinnately branched gorgoniids completely lacking anastomosis of branchlets. Outer layer of rind containing canoe-shaped scaphoid spicules.

Distribution. Bermuda; south and west Florida to Brazil; Indo-west-Pacific: Ceylon, East Indies, Phillippines, Torres Straits; Peru?

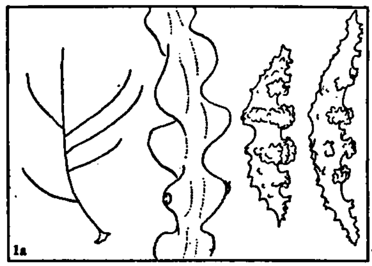
Remarks. The genus *Antillogorgia* was established to accomodate the plumose gorgoniids with scaphoid spicules, eliminated from *Pterogorgia* by its restriction to non-plumose forms with broad, flat branches (= *Xiphigorgia*). It is now quite clear, however, that several Indo-Pacific species, for which the name *Pseudopterogorgia* was proposed by KÜKENTHAL, are generically inseparable. Thus, the genus *Antillogorgia* becomes a junior subjective synonym of *Pseudopterogorgia*.

The scaphoids of Indo-Pacific species are characterized by features not found in those of the western Atlantic and there is some justification for recognizing two groups of species distinguished on this basis. The scaphoids of all Indo-Pacific species seem to be of one type, and of most Caribbean species of another, but one Atlantic species is very close to the Indo-Pacific group in this regard, and at least two others show intermediate conditions. I therefore have some hesitancy in formally subdividing the genus. If such subdivision proves advisable, *P. bipinnata* will belong to the nominate subgenus along with *P. australiensis* (Ridley), *P. oppositipinna* (Ridley) and its subspecies *parvispiculata* Bielschowsky, *P. pinnata* (Nutting) and *P. luzonica* Kükenthal. The remaining Atlantic species will fall within the subgenus *Antillogorgia* with *G. acerosa* as its type, with the possible exception of *P. blanquillensis* and *P. rigida*, which have scaphoids of an intermediate type.

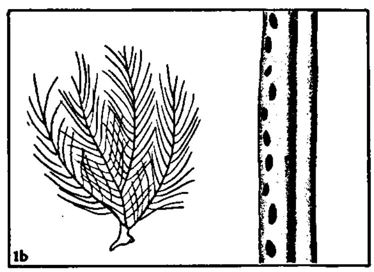
Key 20

Illustrated key to the species of *Pseudopterogorgia*

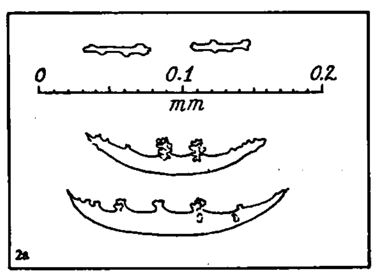
1a. Polyps forming distinct, conical calyces. Colonies small and straggling, openly pinnate, with few branchlets: 12. *Pseudopterogorgia marcgravii* spec. nov.



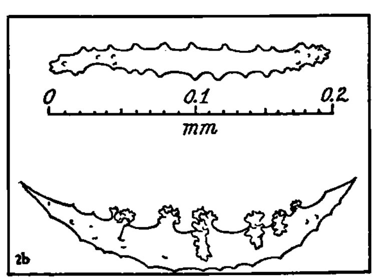
1b. Polyps forming low, indistinct calyces or none at all. Colonies larger, closely and regularly pinnate: 2



2a. Scaphoids reaching at most a length of 0.18 mm.; anthocodial rods when present not more than 0.14 mm. in length: 3

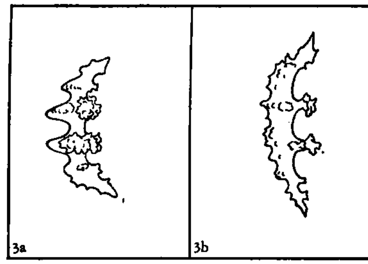


2b. Many of the scaphoids 0.2 mm. in length and often more than that. Anthocodial rods numerous and large, commonly exceeding 0.14 mm. in length: 9

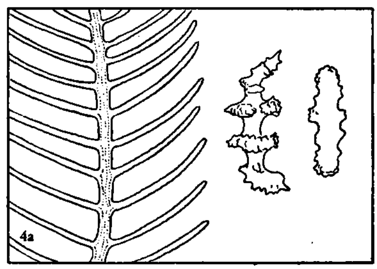


3a. Sculpture of convex side of scaphoids as high as, or higher than, that of concave side, and fused into prominent transverse ridges or collars: 4

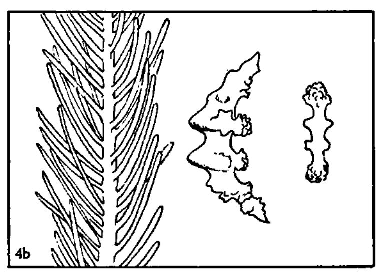
3b. Sculpture of convex side of scaphoids lower than that of concave side, sometimes suppressed completely: 5



4a. Twigs 4–10 mm. apart, strictly opposite, in one plane: *Pseudopterogorgia bipinnata* (Verrill)

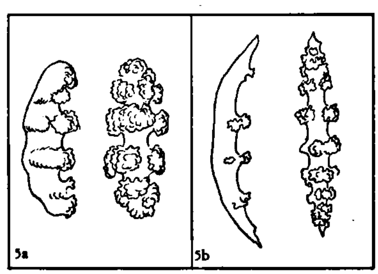


4b. Twigs 4 mm. apart or less, not strictly opposite, not in one plane, strongly ascending: *Pseudopterogorgia kallos* (Bielschowsky)



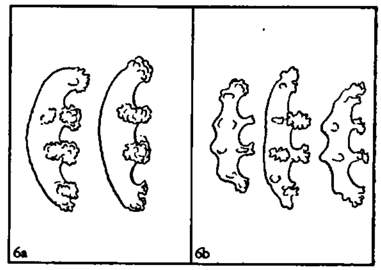
5a. Scaphoids typically blunt at the ends; regular spindles also blunt: 6

5b. Scaphoids pointed at the ends; regular spindles acute: 7



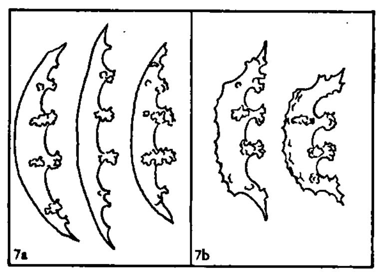
6a. Convex profile of scaphoids smooth or minutely echinulate, without low, broad ridges continued from concave side: *Pseudopterogorgia rigida* (Bielschowsky)

6b. Convex profile of scaphoids strongly echinulate, rarely smooth, often with low, broad, transverse ridges: *Pseudopterogorgia blanquillensis* (Stiasny)



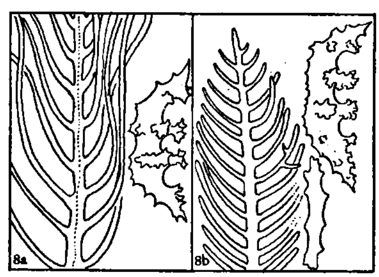
7a. Scaphoids slender, gently and uniformly curved, parenthesis-like, the ends not recurved outward; convex profile smooth or very finely echinulate: *Pseudopterogorgia acerosa* (Pallas)

7b. Scaphoids stouter, more strongly bent, the ends recurved outward; convex profile distinctly echinulate: 8



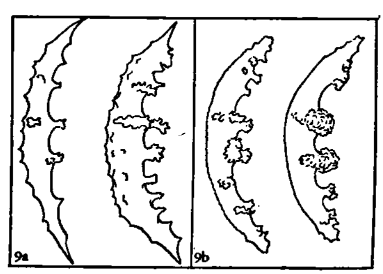
8a. Large, flexible, ostrich-plume colonies with long branchlets; very slimy in life. Anthocodial rods lacking: *Pseudopterogorgia americana* (Gmelin)

8b. Small, stiff, feather-like colonies with short branchlets; flat rods present in anthocodiae: *Pseudopterogorgia hummelincki* spec. nov.

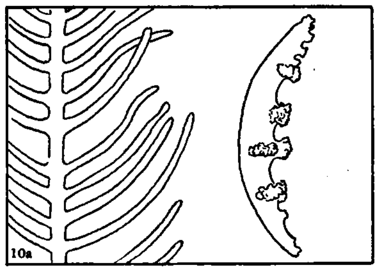


9a. Convex profile of scaphoids strongly echinulate. Branches flexible and slender, 0.5–0.75 mm. in width: 11

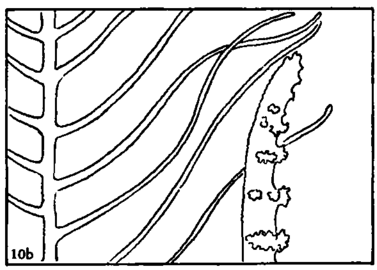
9b. Convex profile of scaphoids smooth or only weakly echinulate. Branches stouter, 1.5–2.0 mm. in width: 10



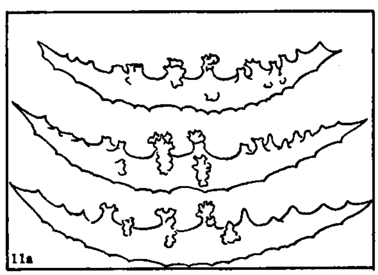
10a. Branchlets rather short, 3–4 cm., rather stiff. Scaphoids strongly curved. Colonies yellow or purple: *Pseudopterogorgia elisabethae* spec. nov.



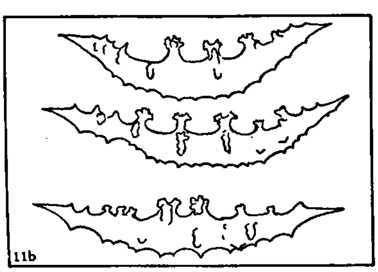
10b. Branchlets rather long, 6–10 cm., flexible. Scaphoids moderately curved. Colonies white: *Pseudopterogorgia albatrossae* spec. nov.



11a. Curvature of scaphoids uniform, parenthesis-like, the ends not recurved outward: *Pseudopterogorgia navia* spec. nov.



11b. Many scaphoids more strongly bent near the ends, which are recurved outward: *Pseudopterogorgia hystrix* spec. nov.



71 Pseudopterogorgia bipinnata (Verrill), 1864

(Figs. 70–72; Pl. VIII fig. 3, XI fig. 1)

Pterogorgia bipinnata VERRILL 1864b, p. 31. (Cumaná, Venezuela.)
not *Gorgonia bipinnata*, HARGITT & ROGERS 1901, p. 287, pl. 3 fig. 4. [= *Gorgonia mariae* spec. nov.]
not *Pterogorgia bipinnata*, BIELSCHOWSKY 1918, p. 61. [= *Pseudopterogorgia acerosa* (Pallas).]
Pterogorgia antillarum BIELSCHOWSKY 1918, p. 61. (St. Thomas.)
not *Pterogorgia bipinnata*, BIELSCHOWSKY 1929, p. 213, fig. 37, pl. 4 fig. 21. [= *Pseudopterogorgia acerosa* (Pallas).]
Pterogorgia antillarum, BIELSCHOWSKY 1929, p. 215, fig. 38, pl. 5 fig. 25. (St. Thomas.)
Pterogorgia bipinnata, DEICHMANN 1936, p. 195, pl. 21 figs. 1–16. (Marquesas, Florida; Cumaná, Venezuela.)
Pseudopterogorgia bipinnata, BAYER 1959, p. 20

Diagnosis. Colonies pinnately branched, chiefly in one plane, the secondary branches often branched to form bipinnate colonies. Twigs rather stiff, blunt, 25–40 mm. in length at full growth (longer than this, they bear lateral twigs), somewhat flattened, 1.0–1.5 mm. wide, straight or gently curved; almost invariably they are opposite, openly and quite uniformly spaced at intervals of about 5 mm. (4–8 mm.) and arising at angles of 60° to 70° with the main stems; a few twigs low in the colony may anastomose here and there. Polyps in a double row, commonly alternating, along each edge of the twigs, fully retractile and visible as small slits without any calycular prominence. Axis of main trunk more or less flattened in the plane of branching, longitudinally striated, brown in color; in the branches and twigs it becomes paler in color and very slender. Cortex consisting of an outer layer containing scaphoids up to 0.18 mm. in length, with the belts of tubercles fused to form collars on the convex side, as high as or higher than the unfused complicated tubercles on the concave side, and symmetrical, acute spindles up to 0.2 mm. in length; and an inner layer of spindles only. Anthocodiae with armature of large, flat rods with scalloped edges, 0.07–0.14 mm. in length, arranged 'en chevron' in the tentacle bases. Color usually violet, occasionally yellow or whitish; spicules clear violet, colorless, or pale yellow; anthocodial rods colorless.

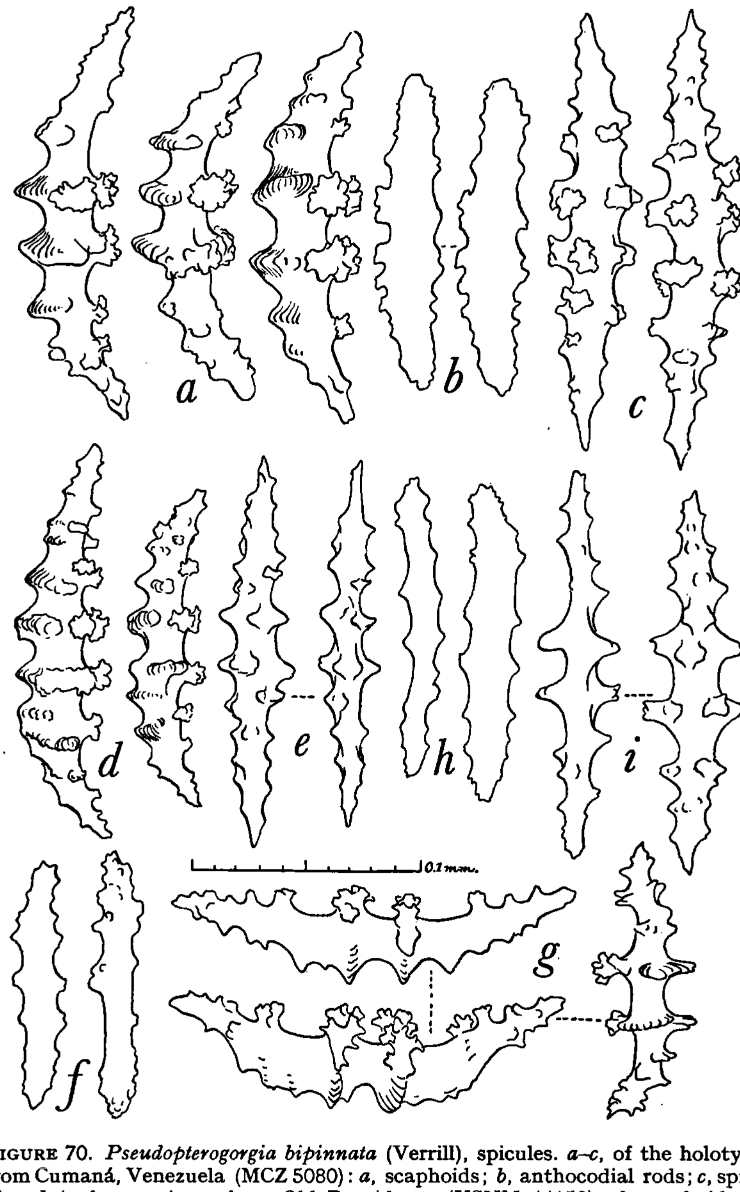


FIGURE 70. *Pseudopterogorgia bipinnata* (Verrill), spicules. *a–c*, of the holotype from Cumaná, Venezuela (MCZ 5080): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles. *d–f*, of a specimen from Old Providence (USNM 44150): *d*, scaphoids; *e*, spindles; *f*, anthocodial rods. *g–i*, of a specimen from the Dry Tortugas (50249): *g*, scaphoids; *h*, anthocodial rods; *i*, spindles. (All figures drawn to the same scale).

Description. The holotype is a colony 22 cm. in height, lacking base, and 18 cm. in breadth (Pl. VIII fig. 3). It is spread in one plane and branched in a regualr pinnate manner with the twigs arising from the stems at a wide angle (60°–70°). Eight of the lateral branches from the main stem are much elongated and produce lateral branches to form a bipinnate colony. There are a few anastomoses among twigs in the lower part of the colony, but a reticulate network is not formed. The spicules are long, pointed scaphoids reaching a length of 0.18 mm., which show typical fusion of the warts on the convex side (Fig. 70 a). The deeper layer of cortex contains symmetrical spindles of acute, slender form (Fig. 70 c). The anthocodial rods are flat and have numerous marginal sinuosities (Fig. 70 b). The dry colony is violet in color.

Material. The holotype from VENEZUELA, Cumaná, collected by J. P. Couthouy, V. 1859 (MCZ 5080); one specimen from the MARQUESAS KEYS (MCZ 5082), two from the DRY TORTUGAS (MCZ 5083, USNM 50249), and several other USNM specimens from: FLORIDA Keys (50214, 50239), BAHAMAS (14513, 50212, 50213, 50731), CUBA (50216), GRAND CAYMAN (51398), OLD PROVIDENCE (44149, 44150).

Distribution. The Bahamas, Florida Keys and Antilles, Caribbean islands, and northern coast of South America.

Remarks. There has been confusion in the literature regarding this species, partly because of its variability and partly because of erroneous determinations. The following notes on the variation of the specimens studied are presented to clarify the identity of the species and the limits of its variation.

USNM 14513 contains two colonies about 20 cm. in height. They are quite bushy in appearance because neither the main branches nor the simple branchlets remain in one plane. The branchlets are 1.5–1.75 mm. wide and reach a length of about 30 mm. before giving rise to secondary branchlets. The polyps are not arranged strictly in double rows, but in irregular multiple tracts along the sides of the branchlets. The scaphoids reach a length of 0.16 mm. and have rather low, thick collars on their convex side (Fig. 70 a); the symmetrical spindles reach 0.17 mm. and are not unusual in any way (Fig. 70 c); the anthocodial rods are large, up to 0.13 mm. in length, and closely resemble those of the type (Fig. 70 b). In alcohol the colonies are light reddish purple, the polyps appearing as small, creamy white spots.

USNM 44149 is a small fragment of a colony of slender growth form. The twigs, which are narrow, 1.0 mm. wide and up to 30 mm. long, are in one plane and 3–4 mm. apart. The polyps occur usually in a single row along the narrow edges of the twigs. The scaphoids are up to 0.13 mm. in length and have thick, often warty collars on the convex side (Fig. 72 j); the spindles are rather slender and attain a length of 0.18 mm. (Fig. 72 i); the anthocodial rods are unusually narrow and at

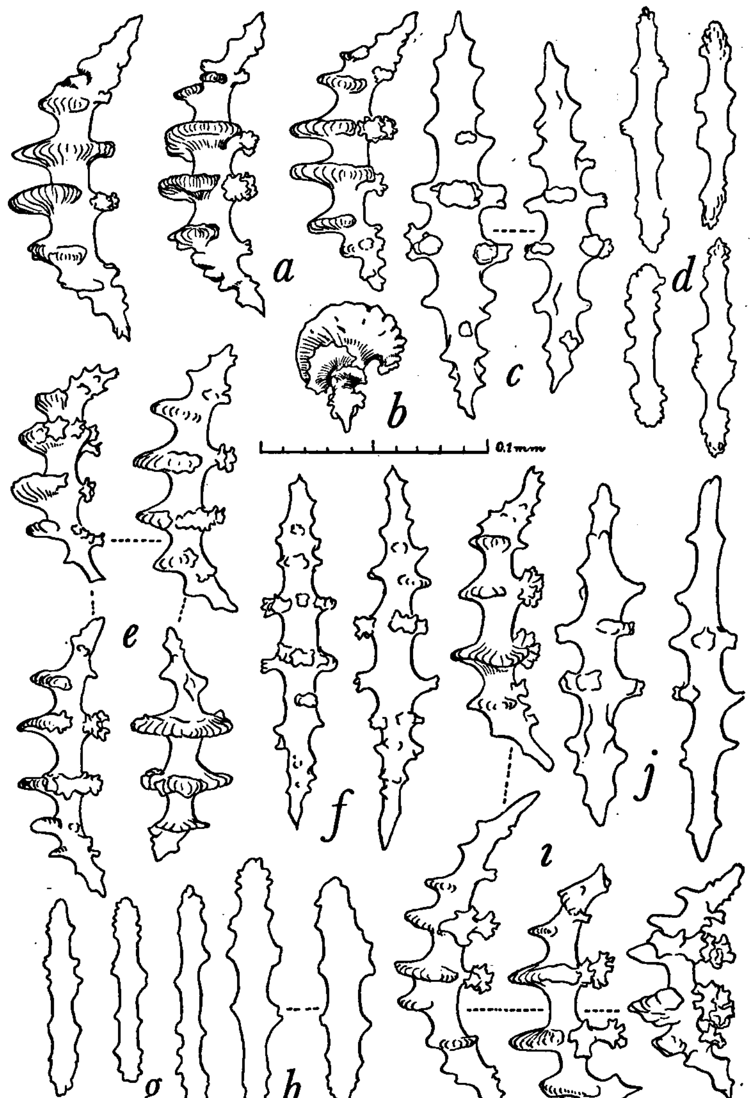


FIGURE 71. *Pseudopterogorgia bipinnata* (Verrill), spicules. *a–d*, of a specimen from Cuba (USNM 50216): *a*, scaphoids; *b*, end view of scaphoid; *c*, spindles; *d*, anthocodial rods. *e–g*, of a specimen from the Marquesas Keys (MCZ 5082): *e*, scaphoids; *f*, spindles; *g*, anthocodial rods. *h–j*, of a specimen from Nassau, New Providence (USNM 50212): *h*, anthocodial rods; *i*, scaphoids; *j*, spindles. (All figures drawn to the same scale.)

most 0.1 mm. long, with only moderate marginal lobulation. Colony pale violet in alcohol.

USNM 44150 is a single branch, very flexible and limber, about 13 cm. in length. It bears pinnate, opposite branches 30 mm. long at intervals of about 6 mm. The polyps occur in an open, alternating row along each side of the twigs. They are not fully retracted in preservation and thus are quite prominent, but they seem to have no well-formed calyces. The scaphoids reach a length of 0.17 mm. and have rather low, broad collars on the convex side (Fig. 70 d); the spindles are slender, acute, and about the same size as the scaphoids (Fig. 70 e); the anthocodial rods reach, or slightly exceed, 0.11 mm. The color of the specimen in alcohol is brownish white, but in life it apparently was green. The field label says: "Alcohol extracted the bright green color so rapidly this was at first glance taken to be an alga and was for a time kept in formalin." (W. L. Schmitt.)

USNM 50212 is a flabellate branch with bipinnate ramification closely resembling the type specimen. It differs in having somewhat smaller scaphoids with strongly developed collars on the convex side (Fig. 71 i) and slightly smaller anthocodial rods (Fig. 71 h).

USNM 50213 is a tall and rather straggling colony with a stout main stem and several large branches. The unbranched lateral twigs reach a length of about 30 mm. before producing secondary twigs. The polyps are arranged in multiple rows along the two sides of the branchlets just as in 14513. The spicules include scaphoids up to 0.12 mm. in length, with thick collars; typical spindles up to 0.15 mm.; and anthocodial rods about 0.11 mm. long. The color in alcohol is light reddish purple, with the polyps appearing as white dots.

USNM 50214 is the largest specimen in the collection, a straggly but profusely branched colony about 45 cm. in height. Its branching is pinnate, with the twigs widely separated, usually 6 mm. apart but often as much as 15 mm. and occasionally 20–30 mm.; twigs 1.5–2.75 mm. wide and as much as 6 cm. long before producing secondary branchlets. The major branches are long and ascending, not in one plane. The scaphoids are at most 0.12 mm. in length, some with thick, coarse collars, some with thin, crest-like flanges on the convex surface (Fig. 72 e); the spindles also reach a length of about 0.12 mm. and are of typical form (Fig. 72 g); the anthocodial rods are small, at most 0.075 mm. in length, and broad (Fig. 72 d, h). Color of the dry colony, deep purple.

USNM 50216 is a broken colony 32 cm. tall, including base. It had several large lateral branches of which only one remains. Ramification is pinnate and the twigs are mostly in one plane, 5–6 mm. apart and up to 5.5. cm. in length before they produce secondary branchlets. The cortex is poorly preserved but the polyps seem to be in multiple lateral rows. In this specimen, the scaphoids, which are at most 0.15 mm. in lentgh, have exceptionally high and crest-like collars around the convex side (Fig. 70 a); the symmetrical spindles reach a length of 0.18 mm. (Fig. 71 c); and the anthocodial rods 0.11 mm. (Fig. 71 d). The dry specimen is pale, cream-yellow.

MCZ 5082 is an extremely fragmentary specimen. Its scaphoids (Fig. 71 e) have strongly developed, crest-like collars similar to those of USNM 50212. The anthocodial rods are of similar size but more slender (Fig. 71 g). Color of the dry colony, pale violet.

MCZ 5083 is a small colony about 14 cm. in height, complete with base. It is branched up to the third order; the simple lateral twigs are slender, about 1.0 mm.

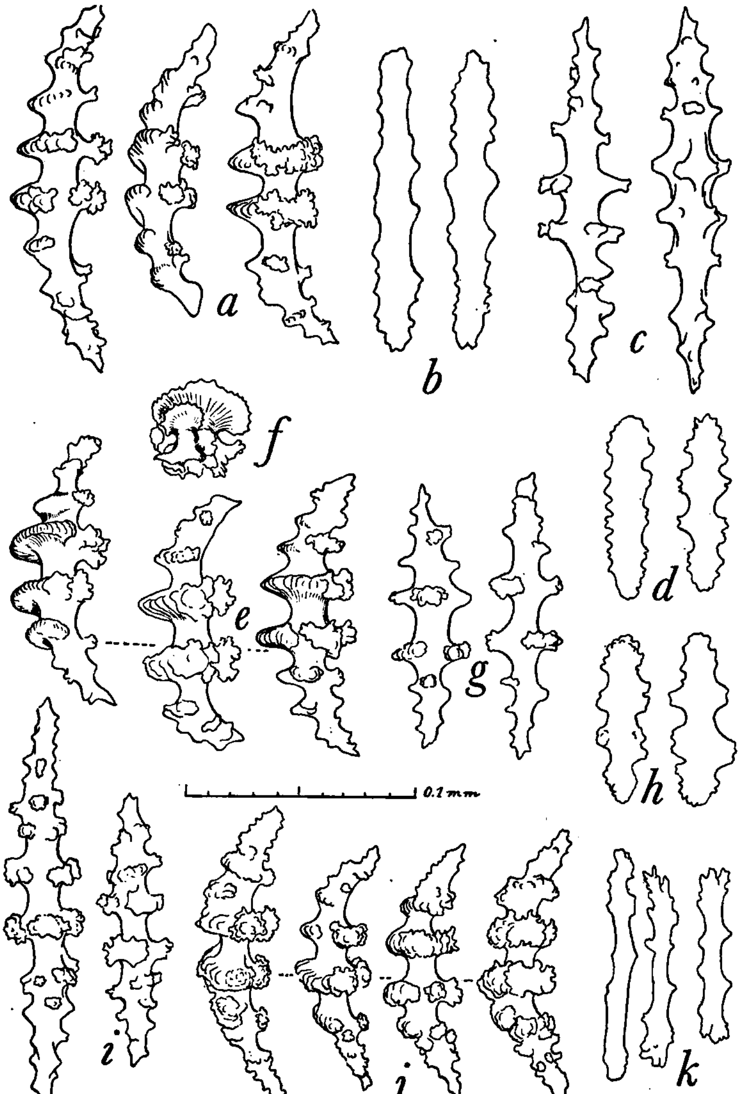


FIGURE 72. *Pseudopterogorgia bipinnata* (Verrill), spicules. *a–c*, of a specimen from Nassau (USNM 14513): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles. *d–h*, of a specimen from off Rodriguez Key, Florida: *d* and *h*, anthocodial rods; *e*, scaphoids; *f*, end view of scaphoid; *g*, spindles. *i–k*, of a specimen from Old Providence (USNM 44149): *i*, spindles; *j*, scaphoids; *k*, anthocodial rods. (All figures drawn to the same scale.)

wide and up to 45 mm. long. The branchlets lie in one plane but a few of the larger branches stray from the principal plane of the colony. The scaphoids reach a length of 0.13 mm. and have thick collars on their convex side; the spindles are of typical form and reach a length of 0.15 mm. The anthocodial rods are up to 0.09 mm. long. The dry colony is yellowish white; the spicules are almost colorless.

72 **Pseudopterogorgia kallos** (Bielschowsky), 1918

(Fig. 73)

Pterogorgia kallos Bielschowsky 1918, p. 62.

Pterogorgia kallos, Kükenthal 1919, p. 919. (Tortugas, Bird Key Riff in 22–23 m. Tiefe.)

Pterogorgia kallos, Bielschowsky 1929, p. 217, fig. 39, pl. 4 fig. 22. (Tortugas, Bird Key Riff.)

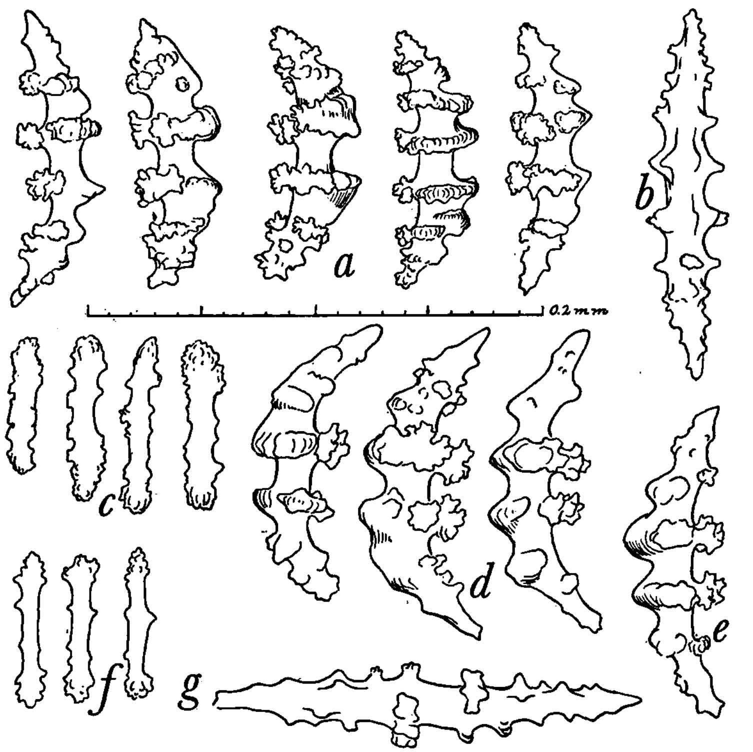


Figure 73. *Pseudopterogorgia kallos* (Bielschowsky), spicules. *a–c*, of a specimen from Florida (USNM 50215): *a*, scaphoids; *b*, spindle; *c*, anthocodial rods. *d–g*, of a specimen from Cuba (MCZ 3981): *d–e*, scaphoids; *f*, anthocodial rods; *g*, spindle. (All figures drawn to the same scale.)

Diagnosis. Plumose colonies with crowded branchlets not strictly in one plane and arising at an angle of 45° or less. Scaphoids commonly with the space between the transverse crests of the convex side filled in. Anthocodial rods narrow, up to 0.08 mm. long.

Material. A fragmentary specimen from FLORIDA, probably from the vicinity of Miami at Bache Shoal or Triumph Reef (USNM 50215), and a fragment from CUBA, probably north coast (MCZ 3981).

Distribution. Florida Keys, Dry Tortugas, and Cuba.

Remarks. The West Indian collections that I have examined contain two specimens of this species, one from Florida and one from Cuba. They are alike in their plumose form, with the twigs more closely spaced (4 mm. or less) than in *P. bipinnata*, not strictly in one plane, not strictly opposite, and ascending more sharply (45° or less) than is usual in *P. bipinnata* (55°–70°). In the specimen from Florida, some of the unbranched twigs are as long as 7 cm., but 3–4 cm. is usual. The longest unbranched twigs of the Cuban specimen are about 4.5 cm., with 2.5–3.5 cm. usual. In both specimens the twigs are nearly cylindrical, the polyps arranged bilaterally in multiple series separated by a narrow naked tract along front and back of twigs. No calyces are formed and the polyps are completely retracted. The spiculation of the two colonies is very similar. The scaphoids of both show a tendency to fill in the spaces between the collars of the convex side except for the median waist, giving them a coarse appearance. They are at most about 0.14 mm. long in the Cuban specimen (Fig. 73 d, e), 0.13 mm. in the one from Florida (Fig. 73 a). The spindles of both agree in form, but are slightly larger in the Cuban example (Fig. 73 g). The anthocodial rods are small, slender, and have distinctly enlarged and tuberculate ends, a condition not observed in the material of *bipinnata*. In the Cuban specimen, which has larger cortical sclerites, the anthocodial rods (Fig. 73 f) reach a length of 0.068 mm.; in the Floridian specimen they may be as long as 0.075 mm. (Fig. 73 c). The Cuban specimen is yellow, the one from Florida grayish brown with purplish tinges; both are dry.

Pseudopterogorgia kallos is very close to the shrubby examples of *P. bipinnata* but can, in summary, be recognized by: (1) the bushy habit of growth, with steeply ascending twigs not strictly in one plane and not always opposite; (2) the scaphoids with the spaces between the crests of the convex side filled in except for the median constriction; and (3) the short anthocodial rods with noticeably clubbed ends.

73 **Pseudopterogorgia rigida** (Bielschowsky), 1929

(Fig. 74; Pl. IX fig. 1)

Pterogorgia acerosa, var. *rigida* BIELSCHOWSKY 1929, p. 212, fig. 36, pl. 5 fig. 24. (Kingston, Jamaica; Barbados.)
Pterogorgia americana, DEICHMANN 1936, p. 196, pl. 21 figs. 29–32. (Florida.)
not *Gorgonia americana* GMELIN 1791, p. 3799.
Antillogorgia americana, BAYER 1952, p. 185. (Big Marco Pass, Florida.)

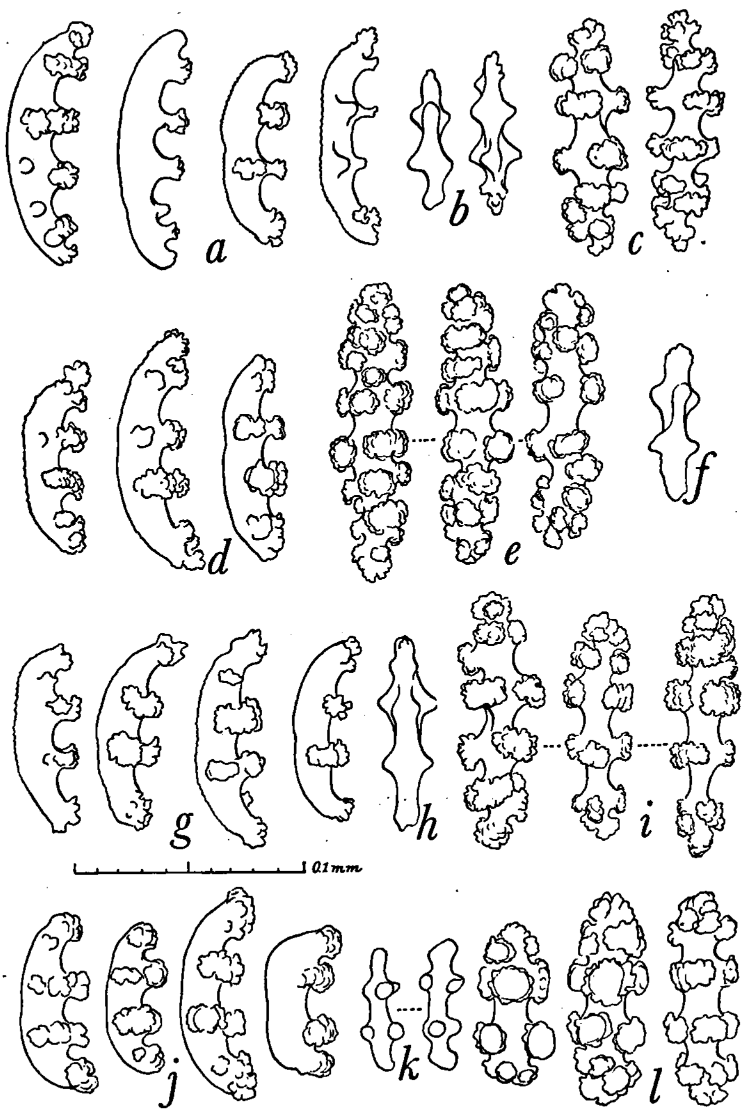


FIGURE 74. *Pseudopterogorgia rigida* (Bielschowsky), spicules. *a–c*, of a specimen from southwest Florida (USNM 44225): *a*, scaphoids; *b*, octoradiate rods from polyps; *c*, spindles. *d–f*, of a specimen from Biscayne Key (50210): *d*, scaphoids; *e*, spindles; *f*, octoradiate rod from polyp. *g–i*, of a specimen from the Dry Tortugas: *g*, scaphoids; *h*, octoradiate rod from polyp; *i*, spindles. *j–l*, of a specimen from Cuba (50209): *j*, scaphoids; *k*, octoradiate rods from polyps; *l*, spindles. (All figures drawn to the same scale.)

Diagnosis. Large, plumose colonies; polyps in biserial multiple rows. Scaphoids blunt, with terminal clusters of tubercles and smooth convex profile; spindles blunt; no flat rods in anthocodiae.

Material. Single USNM specimens: from FLORIDA, off Biscayne Key, in 16–34 feet of water (50210); west of Big Marco Pass, 6.5 fms. (44225); the DRY TORTUGAS (50211); and CUBA, Tarara Beach (50209).

Distribution. Southern Florida and the Keys; Greater Antilles incl. Jamaica; Lesser Antilles.

Remarks. This is the species that Miss DEICHMANN in her monograph called *Pterogorgia americana*. She has subsequently suggested to me (*in litt.*) that the real *americana*, based upon ELLIS & SOLANDER's plate 14, figure 3 (1786), is the species with rather flat branchlets, often exsert polyps, and acute, echinulate scaphoids, and, with Miss DEICHMANN's permission, I adopt that treatment here. The present species, which has smooth, blunt scaphoids and round branchlets was first recognizably described and figured by BIELSCHOWSKY under the name *Pterogorgia acerosa* var. *rigida* and that name, elevated to specific rank, is here employed.

Pseudopterogorgia rigida has a very distinctive spiculation including smooth, blunt scaphoids (Fig. 74 a, d, g, j) and stubby spindles (Fig. 74 c, e, i, l). Its polyps have a few small octoradiate rods (Figs. 74 b, f, h, k) but no flat rods. In external form the colonies are quite variable, but the branchlets usually are almost cylindrical, with the polyps in multiple rows along the sides (Pl. IX fig. 1).

This appears to be an uncommon species. It is not represented in material I have seen from the southern part of the Antilles.

74 **Pseudopterogorgia blanquillensis** (Stiasny), 1941

(Fig. 75 a–c)

Pterogorgia blanquillensis STIASNY 1941d, p. 113, fig. D, pl. 2 figs. 13–14. (Blanquilla, Porto del Jaque.)

Diagnosis. Plumose colonies; polyps in single or multiple bilateral rows. Scaphoids blunt, convex profile with low, transverse ridges and commonly echinulate; spindles blunt; no flat rods in anthocodiae.

Material. A fragment of the type, from BLANQUILLA, Playa del Jaque, sandy debris, 4 m. deep, sta. 1213, 22.VII.1936 (Leiden Museum).

Remarks. In spiculation, *Pseudopterogorgia blanquillensis* with its blunt spindles and scaphoids with warty ends resembles *P. rigida*, of which it may prove to be a synonym. The colonies are typical 'ostrich plumes' with branchlets up to 12 cm.

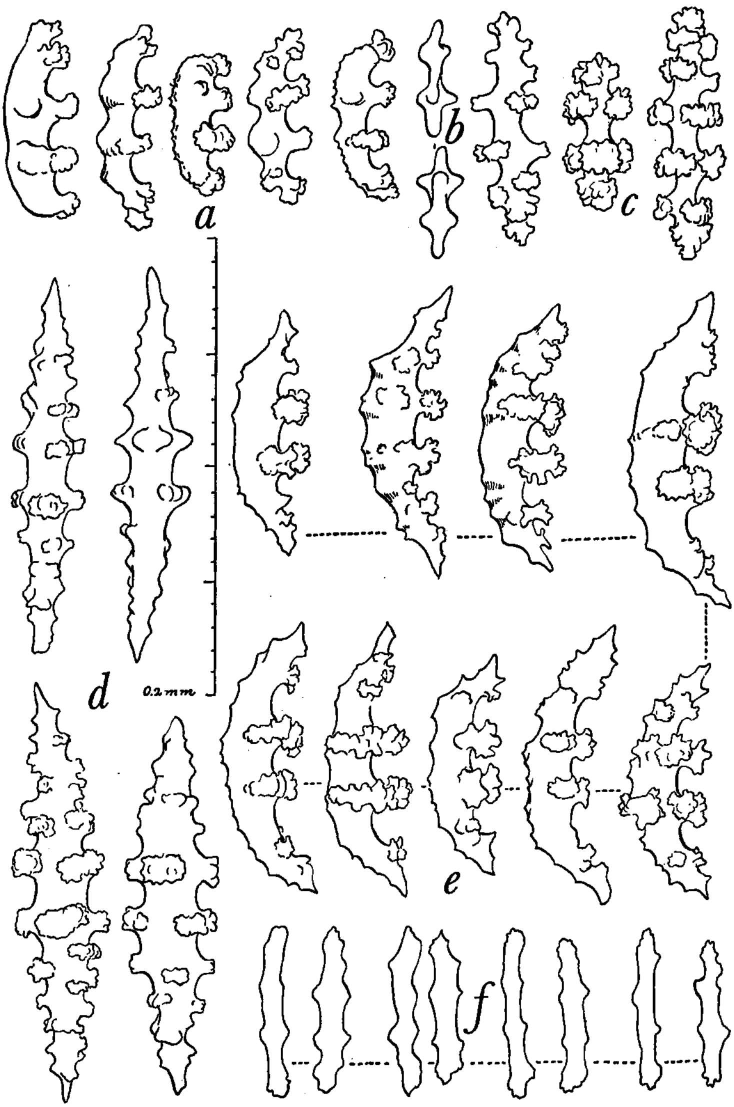


FIGURE 75. *Pseudopterogorgia blanquillensis* (Stiasny), spicules of the holotype from Blanquilla (Leiden Museum); *a*, scaphoids; *b*, octoradiate rods from polyps; *c*, spindles. *Pseudopterogorgia hummelincki* spec. nov., spicules of the holotype from Anguilla (USNM 50203): *d*, spindles; *e*, scaphoids; *f*, anthocodial rods. (All figures drawn to the same scale.)

in length. The two original specimens were both quite small for the genus, some species of which attain considerable size. Whether *P. blanquillensis* represents a small species, young colonies, or specimens growing in an unfavorable environment cannot be determined from the existing material. However, I am temporarily maintaining it as a distinct species in which the scaphoids are echinulate and transversely ridged on the convex side, in contrast with *P. rigida* in which they are smooth.

75 **Pseudopterogorgia acerosa** (Pallas), 1766

(Fig. 76; Pl. IX fig. 3)

Gorgonia acerosa PALLAS 1766, p. 172. (Mare Americanum, Mediterraneum.)
Gorgonia setosa ESPER 1791, *2*, p. 66, pl. 17. ("Von den südlichen amerikanischen Küsten, besonders von den Inseln Jamaica und Curassao.")
Gorgonia acerosa, ESPER 1792, *2*, p. 106, pl. 31.
Pterogorgia pinnata, MILNE EDWARDS & HAIME 1857, *1*, p. 168. (Antilles.)
not *Gorgonia pinnata* LINNAEUS 1758, p. 802. (O. Asiatico.)
Pterogorgia bipinnata, BIELSCHOWSKY 1929, p. 213, fig. 37, pl. 4 fig. 21. (Barbados.)
not *Pterogorgia bipinnata* VERRILL 1864b, p. 31.
Pterogorgia acerosa, forma *typica* and forma *arbuscula* BIELSCHOWSKY 1929, p. 209, figs. 32–34, pl. 4 figs. 19–20. (Kingston, St. Thomas, Tortugas, Barbados.)
not *Pterogorgia acerosa*, var. *elastica* BIELSCHOWSKY 1929, p. 210, fig. 35, pl. 5 fig. 23. [= *Pseudopterogorgia americana* (Gmelin).]
not *Pterogorgia acerosa*, var. *rigida* BIELSCHOWSKY 1929, p. 212, fig. 36, pl. 5 fig. 24. [= *Pseudopterogorgia rigida* (Bielschowsky).]
Pterogorgia acerosa, DEICHMANN 1936, p. 198, pl. 21 figs. 17–20. (Florida and Hayti.)
Pterogorgia ellisiana, DEICHMANN 1936, p. 199, pl. 21 figs. 21–24. (Florida and Cuba.)
not *Pterogorgia ellisiana* MILNE EDWARDS & HAIME 1857, *1*, p. 169. [= *Pseudopterogorgia americana* (Gmelin).]
Pterogorgia acerosa, var. *elastica*, STIASNY 1941d, p. 112. (Los Frailes.)

Diagnosis. Large, plumose colonies; surface not slimy in life. Scaphoids smooth or finely echinulate, weakly curved, acute, less than 0.18 mm. in length; spindles acute; anthocodiae with delicate, flat rods.

Material. From Dr. Hummelinck's collection: CURAÇAO, Knip Baai, on perpendicular cliff, 1 m., sta. 1017, 8.I.1949, specimen in alcohol (USNM 50447). Santa Marta Bay, sandy bottom, 3.4 m., J. H. Stock, 12.X.1958 Amsterdam). Piscadera, inner bay near turtle hatchery, sandy bottom, 3 m., J. H. Stock, 6.I.1959 (51305; Amsterdam). Valentijnbaai, 4 m., J. H. Stock, 2.XII. 1958 (51306; Amsterdam). BONAIRE, Kralendijk, Hotel Zeebad, sandy coral debris, 2.5 m., 24.II.1949, dry spec. (USNM 50208) and 2 branches in alc. (USNM 50449); 4 m., 12.IV.1955, dry colony (USNM 51313). LOS FRAILES, Puerto Real, sandy debris, 3–4 m., sta. 1214, 18.VI. 1936, dry fragments, part of the material studied by Stiasny (1941, p. 112)

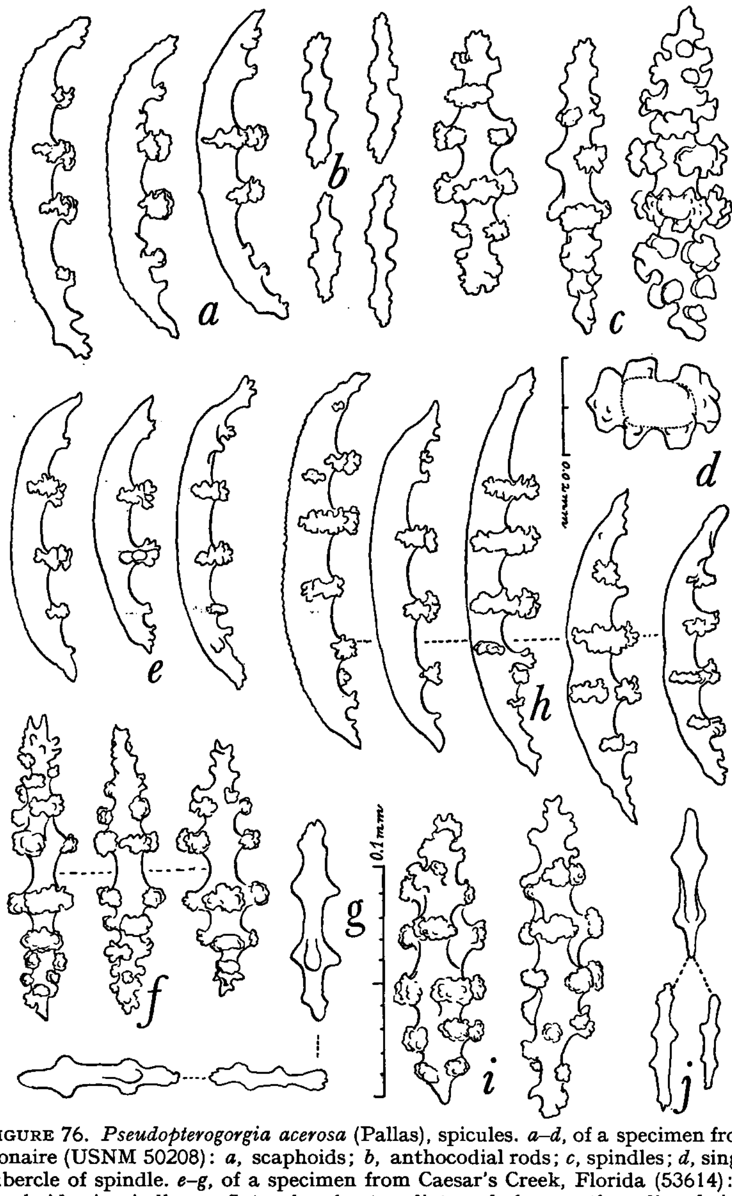


FIGURE 76. *Pseudopterogorgia acerosa* (Pallas), spicules. *a–d*, of a specimen from Bonaire (USNM 50208): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles; *d*, single tubercle of spindle. *e–g*, of a specimen from Caesar's Creek, Florida (53614): *e*, scaphoids; *f*, spindles; *g*, flat rod and octoradiate rods from anthocodiae. *h–j*, of a specimen from the west coast of Florida (6914): *h*, scaphoids; *i*, spindles; *j*, octoradiate rods and flat rods from anthocodiae. (All figures drawn to the same scale except *d*, to which the 0.02 mm. scale applies.)

(USNM 50414). St. Barthélemy, La Fourche island, rocky beach, 2.5 m., sta. 1124, 2.VI.1949, large dry spec. (USNM 50754) and branches in alc. (USNM 50446).

In addition to the above, a great many USNM specimens, including the west coast of Florida (6914, 49754, 50402), the Florida Keys and Tortugas (50097, 50236, 50241, 50450, 50674, 50732); Mexico, Gulf of Campêche (49942), Blanquilla Reef off Cabo Rojo (50917), Arrecife Alacranes, Yucatan (51436, 51437, 51461); Bahamas (50547); Hispaniola, Haiti (4075); Jamaica (33099), Pigeon Island (51400), Port Royal Cays (51363, 51399, 51401–51403); Montserrat, Fox Bay (51418); Guadeloupe (44055); Dominica (50335); Aruba (50658), and Old Providence (33617).

Distribution. Bermuda, south and west Florida, Florida Keys, Bahamas, Gulf of Mexico, Caribbean Islands, Antilles.

Ecology. Abundant along the Florida Keys at depths of 3 feet or more (at low tide); commonly associated with *Pseudopterogorgia americana*, *Pterogorgia anceps*, *Plexaurella dichotoma*, and *Muricea atlantica*. Often host of the snails *Simnia* and *Cyphoma*, the shrimp *Tozeuma*, and the basket-star *Astrophyton*.

Remarks. This is one of the two common West Indian sea-plumes. It is characterized by its acute, slender, gently curved, smooth or nearly smooth scaphoids (Fig. 76 a, e, h). The spindles are acute (Fig. 76 c, f, i), and there are delicate, flat rods in the polyps (Fig. 76 b, g, j) along with the sparse, octoradiate rods.

Many specimens show a tendency to form long, drooping branchlets very widely spaced along the stems. Such specimens were identified as *Pterogorgia ellisiana* by Deichmann (1936), but *P. ellisiana* is synonymous with *Pseudopterogorgia americana* (Gmelin) as the citation of Ellis & Solander's plate 14, figure 3 in the original synonymy suggests. An examination of spicules from a sample of *P. ellisiana* that Kölliker sent to Verrill from Paris confirms this view. The more openly branched specimens seem to differ in no essential from the denser ones, and there is no justification for retaining names for the many small variations.

76 **Pseudopterogorgia americana** (Gmelin), 1791

Fig. 77; Pl. IX fig. 2, XIX)

Gorgonia pinnata, Ellis & Solander 1786, p. 87, pl. 14 fig. 3. (West Indies.)
not *Gorgonia pinnata* Linnaeus 1758, p. 802.
Gorgonia americana Gmelin 1791, p. 3799. (Habitat in mari American mediam alluente frequens.)
Pterogorgia ellisiana Milne Edwards & Haime 1857, *1*, p. 169. (Guadeloupe.)
not *Pterogorgia americana*, Deichmann 1936, p. 196, pl. 21 figs. 29–32. [= *Pseudopterogorgia rigida* (Bielschowsky).]

Diagnosis. Large, plumose colonies; surface very slimy in life. Scaphoids strongly curved, the sharp ends often recurved outward, convex profile distinctly echinulate; spindles acute; no flat rods in anthocodiae.

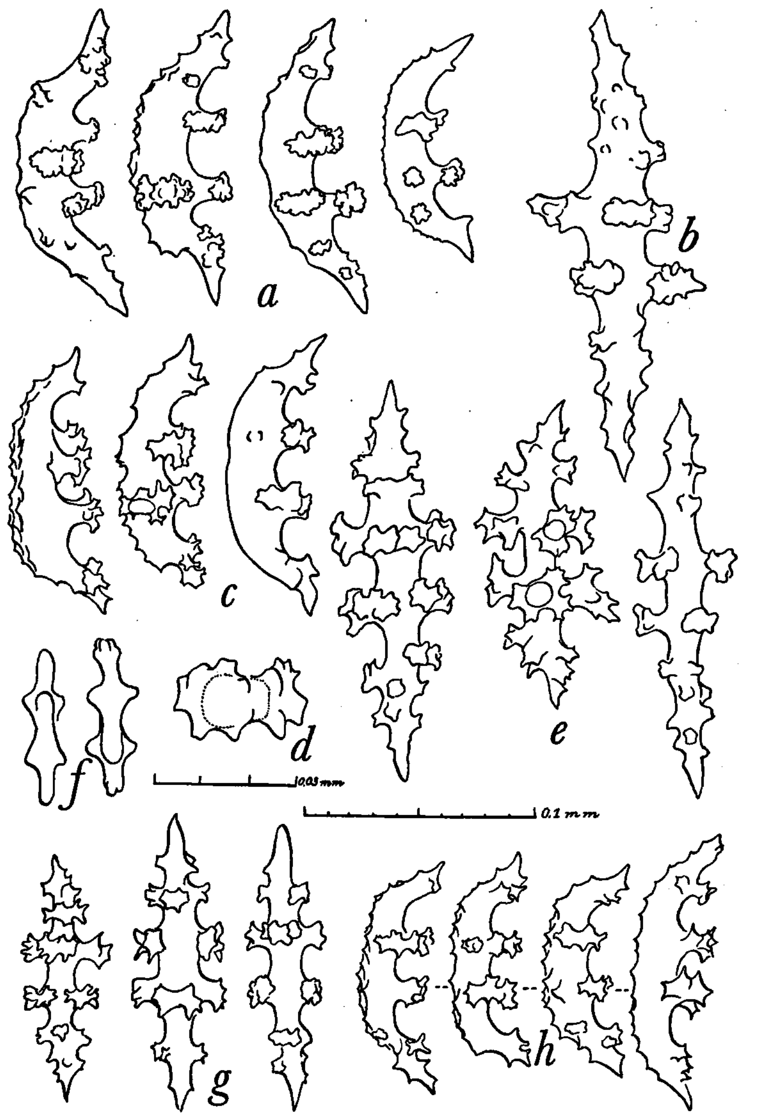


FIGURE 77. *Pseudopterogorgia americana* (Gmelin), spicules. *a–b*, of a specimen from Bermuda (USNM 50207): *a*, scaphoids; *b*, spindle. *c–e*, of a specimen from Bonaire (50206): *c*, scaphoids; *d*, tubercle of scaphoid; *e*, spindles. *f–h*, of a specimen from St. Thomas (50205): *f*, octoradiate rods from polyps; *g*, spindles; *h*, scaphoids. (All figures drawn to the same scale except *d*, to which the 0.03 mm. scale applies.)

Material. The following USNM lots from Dr. Hummelinck's collection: BONAIRE, Kralendijk roadstead, on two covered buoys, cleaned 20 months before, 0–1.5 m., sta. 1053,21.IX. 1948, 4 branches in alcohol (50748). Kralendijk, Hotel Zeebad, sandy coral debris, 2.5 m., 24.II.1949, 1 complete dry specimen (50206). Lac, sandy reef with debris, 1–2 m., sta. 1068a, 1.X.1948, 3 branches in alc. (50445, 50749). ISLOTE AVES, sandy western shore, about 20 m., 12.V.1949, branch in alc. (50750). Also collected by J. H. Stock on CURAÇAO: Playa Chikitoe, sandy reef, 4 m., 23.XI.1958 (51307); Santa Marta Baai, Acropora reef, 3 m., 8.X.1958 (Amsterdam).

In addition to the above, numerous USNM specimens, from various localities: BERMUDA (50207, 50676); FLORIDA Keys and TORTUGAS (50391, 50608, 50673); BAHAMAS (33053, 50238, 50262, 50722, 50729); JAMAICA (7540), Port Antonio (51366, 51367), Old Harbour Bay (51365), Pigeon Island (51405), Port Royal Cays (51404); ST. THOMAS (50205); SABA Bank (50334); ST. CHRISTOPHER (50332); ANTIGUA, off Black's Point (51421); ST. LUCIA, south of Marigot Bay (51420); BARBADOS (50237); TOBAGO, Milford Bay (51419); Curaçao (50661); ARUBA (50662); MEXICO, Isla Sacrificios, Veracruz (51442, 51457).

Distribution. Bermuda, Florida Keys, Bahamas, Antilles.

Ecology. In the Florida Keys, *P. americana* occurs together with *P. acerosa* both in shallow water along the seaward shore and in deeper water along the outer reefs.

Remarks. Distinct differences in spiculation serve to distinguish *Pseudopterogorgia americana* from *P. acerosa*. The scaphoids have a characteristic profile, with the convex side usually echinulate, that is best expressed in the illustrations give herewith (Fig. 77 a, c, h), and the spindles are large and ornately sculptured (Fig. 77 b, e, g). Moreover, *P. americana* seems never to have any of the flattened anthocodial rods that are always present in *acerosa*.

In the field, *P. americana* can usually be distinguished from *acerosa* by its slimy surface and its ability to produce great quantities of thick mucus in the container in which it is carried. Because of this secretion, the branches usually stick together in drying and the specimens so treated have a most unattractive aspect. When preserved in spirit, the polyps, which contract slowly, are usually fixed in a more or less expanded condition even without narcotization. This characteristic no doubt accounts for the beautifully expanded specimen that ELLIS & SOLANDER illustrate. The alcoholic specimens obtained by Dr. HUMMELINCK are similarly expanded.

In the laboratory, samples prepared for spicule study break down very slowly and with great difficulty in sodium hypochlorite solution. A freshly made and unwashed spicule preparation shows vast numbers of zooxanthellae, which resist solution in sodium hypochlorite – many more, in fact, than can ever be seen in preparations of *P. acerosa* and *rigida*. It appears that there is a correlation between the production of mucus, the resistance of the mesogloea to solution in sodium hypochlorite, and the abundance of symbiotic algae.

77 **Pseudopterogorgia hummelincki** spec. nov.

(Fig. 75 d–f; Pl. VIII figs. 4–5)

Diagnosis. Colonies small, spread in one plane; branching pinnate; branches occasionally subdivided to the third order. Lateral twigs not strictly in one plane, cylindrical, terminally blunt, ascending, up to 30 mm. long but commonly only 15 or 20 mm., and 1.5–2.0 mm. in diameter. Polyps fully retractile, in a multiple row along two sides of the twigs, separated by narrow naked tracts front and back. Scaphoids moderately curved, echinulate, terminally acute, up to 0.15 mm. in length. Spindles acute, with a median girdle, about 0.19 mm. in length. The flat tentacular rods are narrow, blunt, 0.07–0.08 mm. in length. Color of dry colonies creamy white or pale lemon yellow, with purple tinge at the base.

Description. The type is a colony 12.5 cm. in height, flabellate, pinnately branched (Pl. VIII fig. 5). The main stem gives off five major branches that are secondarily branched, and several others that show new lateral twigs. The unbranched twigs are not strictly in one plane, 2.5–3.0 mm. apart, up to about 30 mm. in length and 2.0 mm. in diameter. Even the tiny twigs at the distal part of the main stem have the same diameter. The twigs are cylindrical, blunt, and have a rather stiff appearance; they arise from the branches at angles from 45° to 50° and curve gently upward. The cortex is quite thick; the polyps withdraw into it completely without leaving any sign of calyces. The polyps occupy two broad bands along the sides of the twigs; between them is a narrow naked tract (marking the course of the large longitudinal canal) which joins with the system of longitudinal grooves (indicating the stem canals) on the main branches. The cortical spicules include scaphoids up to about 0.14 mm. in length, which have acute ends and distinctly echinulate convex profile (Fig. 75 e). An occasional, rather blunt scaphoid may be found, but the predominant type is acute. There also are long, acute spindles, situated chiefly in the axial sheath, which reach a length of 0.19 mm. (Fig. 75 d); they have a median girdle separating the two central whorls of tubercles. The anthocodiae are armed with flat rods, which are slender, with a few obtuse marginal processes (Fig. 75 f). The cortical spicules are pale yellow or colorless; part of those in the axial sheath are violet. The colony is pale lemon yellow, tinged with violet at the base.

A paratype from the same station is like the holotype in all essential features. It is 20 cm. tall, spread in one plane, with short lateral twigs of the same size and interval as in the holotype and likewise not strictly in one plane. Some of the lateral twigs have developed into strong branches with pinnate twigs of their own. The spiculation is identical with that of the type. The colony is cream white, tinged with violet toward the base.

Material. ANGUILLA, Upper Prickly Pear Island, P. Wagenaar Hummelinck coll., 17.VI.1949 (holotype, USNM 50203, paratype 50204).

Distribution. Known only from the type locality.

Remarks. In growth form, *Pseudopterogorgia hummelincki* resembles the *bipinnata* group of species but may readily be distinguished from them by the scaphoids, which lack any trace of high, transverse crests around the convex side. The spicules of *P. hummelincki* are similar to those of *americana*, which has quite a different growth form.

78 **Pseudopterogorgia elisabethae** spec. nov.

(Fig. 78; Pl. VIII fig. 2)

not *Pterogorgia bipinnata*, var. *sparsiramosa* BIELSCHOWSKY 1929, p. 215, pl. 5 fig. 26. [= *Pseudopterogorgia acerosa*.]
Pterogorgia sparsiramosa, DEICHMANN 1936, p. 197. (West Indies.)

Diagnosis. Colonies pinnately branched; twigs in one plane, 3.5 to 10 mm. apart (average, 6 mm.), flattened, 5 cm. long and 1.5–2.0 mm. wide, the polyps in single or alternating double series along the edges. Scaphoids coarsely pointed, smooth or slightly echinulate on the convex profile, often with a median waist, reaching a length of 0.225 mm.; spindles up to 0.24 mm.; anthocodial rods 0.18 mm.

Description. The holotype is a complete colony 26 cm. tall. The main stem, which is 4 mm. in maximum diameter, gives off several lateral branches, some of them stunted, some of ordinary length, and two large ones that are further subdivided and form the major part of the colony (Pl. VIII fig. 2). The simple lateral twigs, which arise roughly in one plane, are flattened, about 2 mm. wide and as much as 5 cm. long; they originate at angles of from 40° to 45°, at intervals of 5–10 mm. The polyps are arranged chiefly in double rows along the two edges of the branches, becoming uniserial only near the twig tips. The cortex contains coarsely pointed scaphoids with smooth or slightly echinulate convex profile, that reach or somewhat exceed a length of 0.2 mm. (Fig. 78 a). There

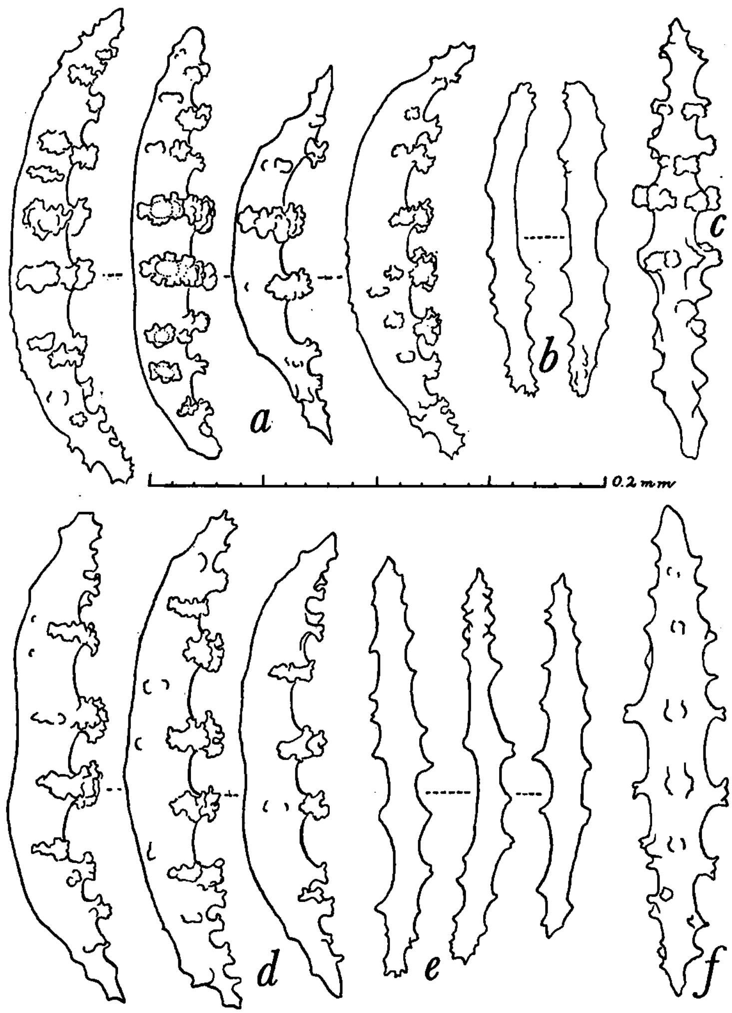


FIGURE 78. *Pseudopterogorgia elisabethae* spec. nov., spicules. *a–c*, of the holotype from Cuba (USNM 34679): *a*, scaphoids; *b*, anthocodial rods; *c*, spindle. *d–f*, of a paratype (50068): *d*, scaphoids; *e*, anthocodial rods; *f*, spindle. (All figures drawn to the same scale.)

are also simple spindles of the usual type (Fig. 78 c). The anthocodiae have a good armature of flat rods up to 0.14 mm. long (Fig. 78 b). The color of the colony in alcohol is deep cadmium yellow; the axis is nearly black in the older parts; spicules pale yellow.

One of the paratypes is only a branch of a large colony; it is 10 cm. high, branched in a regular pinnate manner with the twigs in one plane. The twigs are up to 5 cm. in length, flattened, 1.5–2.0 mm. wide, with polyps in alternating double series along the edges. One of the branches bears secondary and tertiary branchlets. The polyps are incompletely retracted but do not form projecting calyces. The scaphoids are large, acute, echinulate or smooth on the convex side, usually with a distinct median constriction, the largest observed was 0.025 mm. long. The regular spindles are of the ordinary type and reach a length of 0.24 mm. The anthocodial armature consists of slender, flattened rods up to 0.15 mm. long. The colony in alcohol is pale violet, polyps whitish.

The other paratype, received from the Museum of Comparative Zoölogy, is a stout branch about 15. cm. long. The longest branchlets reach a length of 4.5 cm. and are about 2 mm. wide, with polyps in alternating double rows along the edges; the anthocodiae are incompletely retracted. The main stem canals, numbering one to three on each side, are conspicuously visible as dark streaks. The scaphoids are bluntly pointed, with a smooth or only slightly irregular convex profile having a median constriction, and reaching a length of 0.22 mm. (Fig. 78 d). The spindles are of the usual kind (Fig. 78 f) and of the same length as the scaphoids. The anthocodial rods are larger than in the type, reaching 0.18 mm. (Fig. 78 e). The colony is yellow in alcohol.

Material. Holotype from Cuba, Bahia Honda, 2–12 fms., J. B. Henderson and Paul Bartsch coll., Tomas Barrera Exp., sta. 15, 4–5.VI.1914 (USNM 34679). A paratype from Florida, east of Cape Florida, Biscayne Key, 30 fms., F. M. Bayer, 29.II.1948 (USNM 50235); one dry specimen from New Providence, Conrad Limbaugh, 1956 (USNM 50560); also one specimen labelled 'West Indies', received from the Museum of Comparative Zoölogy (MCZ 5083) through the kindness of Dr. Elisabeth Deichmann (USNM 50068).

Distribution. Bahamas, Florida Keys; Cuba.

Remarks. The distinguishing features of *Pseudopterogorgia elisabethae* are its short, stout branchlets, large, moderately pointed scaphoids with nearly or quite smooth convex surface, and large anthocodial rods. The colonies may be either yellow or purple.

79 **Pseudopterogorgia albatrossae** spec. nov.

(Fig. 79; Pl. VIII fig. 1)

Diagnosis. Pinnate colonies with flexible branchlets up to 12 cm. long. Scaphoids slender, moderately curved, echinulate, bluntly pointed, reaching a length of 0.25 mm. Anthocodial rods 0.15 mm. long.

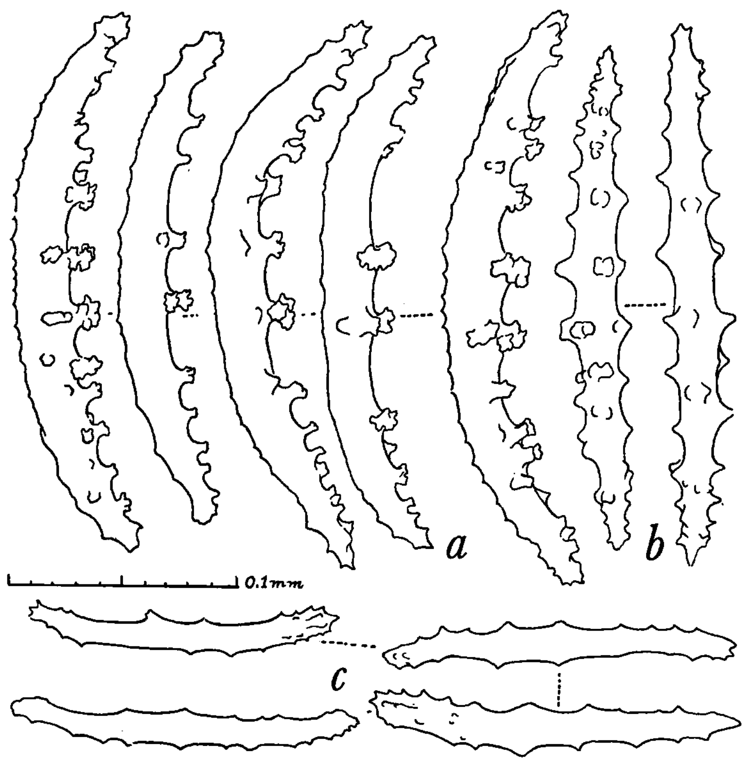


FIGURE 79. *Pseudopterogorgia albatrossae* spec. nov., spicules of the holotype from between Jamaica and Haiti (USNM 50233): *a*, scaphoids; *b*, spindles; *c*, anthocodial rods. (All figures drawn to the same scale.)

Description. The type is a complete colony about 40 cm. tall. The main trunk, which has a maximum diameter of about 5 mm. just above the base, is rather short and crooked, evidently deformed. The major part of the colony derives from two of the lateral branches, which have numerous long, flexible pinnate branches arising in one plane. These are mostly 5–15 mm. apart, 2 mm. wide, and as much as 12 cm. long; they are long and drooping, and the upper part of the colony is generally quite supple. The polyps are fully retractile but are preserved more or less exsert over most of the colony so that there appear to be calyces in an irregularly alternating double row along each edge of the branchlets. The cortex contains long, arcuate scaphoids with moderately echinulate convex profile, the largest reaching a length of 0.25 mm. (Fig. 79 a). The simple spindles of the deeper layer of rind (Fig. 79 b) attain a length almost equal to that of the scaphoids. The anthocodiae are well-armed with flat rods of the usual shape, up to 0.15 mm. long (Fig. 79 c). The color of the colony in alcohol is pale brown, with a tinge of violet on the main branches. Here the dark colored horny axis can be seen through the translucent rind, and several dark, longitudinal streaks mark the course of the main stem canals.

Material. Holotype, from the north end of Albatross Bank between JAMAICA and Haiti, 17°44′05″ North, 75°39′00″ West, 23 fms., coral and broken shell, *Albatross* sta. 2138, 29.II.1884 (USNM 50233). A second specimen from the same station (USNM 50234). A third one from ST. JOHN, outer ridge 6 mi. s.e., 200 feet, T. Chess, 13.I.1960 (USNM 51750).

Distribution. Albatross Bank; St. John.

Ecology. The type specimen is infested with barnacles that form galls, and there are four small ophiuroids entwined around the branchlets. The second specimen has similar barnacles and ophiuroids and, besides, two small crinoids clinging to its branches.

Remarks. The second specimen from the type locality is similar to the holotype in general appearance and spiculation, but its scaphoids are more sharply echinulate. They are of the same size and shape as those of the type, and do not have the very regular, arcuate curve and acute ends to be seen in the scaphoids of *Pseudopterogorgia navia.*

80 **Pseudopterogorgia navia** spec. nov.

(Fig. 80; Pl. VIII fig. 7)

Diagnosis. Pinnate colonies with flexible branchlets up to

6.5 cm. long. Scaphoids arcuate, sharply pointed, conspicuously echinulate, 0.26 mm. long. Anthocodial rods up to 0.18 mm. long.

Description. The holotype is a flexible, drooping colony about 20 cm. in height (Pl. VIII fig. 7). It is pinnately branched in one plane, the lower branches being likewise branched. The terminal branchlets arise at intervals of 10–25 mm. and are about 6 cm. long when fully developed. The uppermost six or seven of them decrease in length, the youngest being about 1.5 cm. long. The branchlets are distinctly flattened, 0.5–0.75 mm. in width, and bear the polyps biserially. The rind may be a little elevated near the polyps but no calyces are formed. The anthocodiae are mostly exsert in the preserved specimen, perhaps because the heavy armature of flat rods 'en chevron' (Fig. 80 b) hindered retraction or rendered it unnecessary. The cortical sclerites are huge scaphoids attaining a length of 0.26 mm., and acute spindles of about the same size. The scaphoids are arcuate, parenthesis-like, and very sharply echinulate on the convex surface (Fig. 80 c). The spindles are also sculptured with spinous projections (Fig. 80 d). The bases of the tentacles contain flat rods up to 0.18 mm. in length, arranged 'en chevron' (Fig. 80 a).

The collections of the Museum of Comparative Zoölogy contain a specimen that is referable to this species. It is young, only about 13 cm. in height, with none of the lateral branchlets further subdivided. The longest branchlets are about 5 cm. in length, flattened, 1.0–1.5 mm. wide, with the polyps biserially arranged in an alternating row along each edge. Almost all of the polyps are exsert so that the anthocodiae with their strong armature are clearly visible. The cortex contains arcuate, echinulate scaphoids reaching a length of 0.24 mm. (Fig. 80 f), and straight spindles as much as 0.27 mm. length (Fig. 80 e). The anthocodial rods (Fig. 80 g) are practically identical in shape and size with those observed in the type.

The holotype is white, with colorless spicules; the small specimen from the Museum of Comparative Zoölogy is light purple, with clear, pale violet spicules.

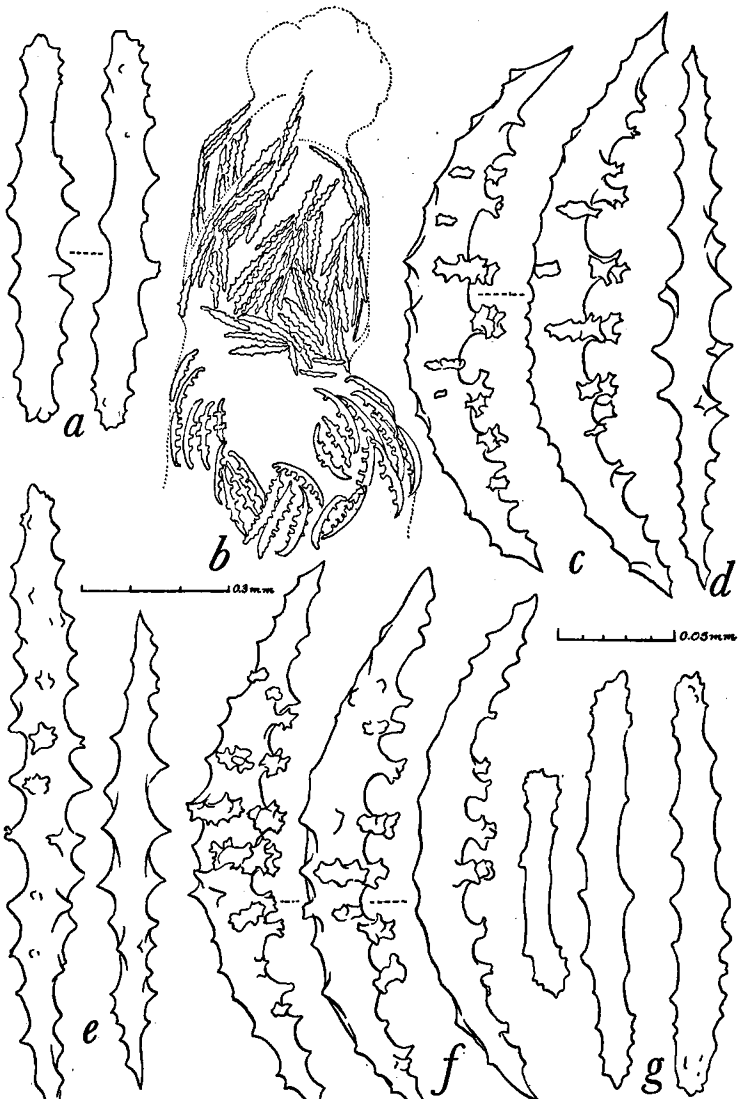


FIGURE 80. *Pseudopterogorgia navia* spec. nov., spicules. *a–d*, of the holotype from Hispaniola (USNM 50070): *a*, anthocodial rods; *b*, anthocodial spiculation; *c*, scaphoids; *d*, spindle. *e–g*, of the paratype: *e*, spindles; *f*, scaphoids; *g*, anthocodial rods. (All figures drawn to the same scale except *b*, to which the 0.3 mm. scale applies.)

Material. Holotype from the north coast of HISPANIOLA, 19°10'35" North, 69°20'45" West, 15 fms., Johnson-Smithsonian Exp., *Caroline* sta. 51, 16.II.1933 (USNM 50070). Paratype from BAHAMAS, off Orange Key, 9 fms., Pourtalès Gulf Stream Explorations, cast no. 2, 1.IV.1869 (MCZ 5047).

Distribution. Bahamas and Greater Antilles.

Remarks. The two specimens described above, while differing somewhat in superficial appearance, agree so well as to spiculation that they must be considered as representatives of the same species. The size and form of the scaphoids distinguish this species from all others heretofore described.

81 **Pseudopterogorgia hystrix** spec. nov.

(Fig. 81; Pl. XI figs. 2–3)

Diagnosis. Pinnate colonies with slender branchlets up to 12 cm. long. Scaphoids sharply echinulate, many of them with the ends recurved outward, reaching a length of 0.25 mm. Anthocodial rods up to 0.15 mm. in length.

Description. The holotype is a regularly pinnate colony about 35 cm. tall, with the base of attachment. The lateral branchlets, which are about 1.5 mm. wide and reach a length of 12 cm., arise at intervals of 10–20 mm. and at angles of 45°–60°. The polyps are biserial, with a strong anthocodial armature but without projecting calyces. The cortex contains echinulate scaphoids (Fig. 81 a, b) up to 0.25 mm. long, with their ends very sharp and often recurved outward; the tubercles of the concave side are tall and spinous, extending around the spicule laterally as sharp ridges or acute spines. The straight spindles are slender, acute, and often exceed a length of 0.2 mm. (Fig. 81 d). The anthocodial rods reach a length of 0.15 mm. and are of conventional form (Fig. 81 c). The colony is pale gray in alcohol, the spicules colorless.

Material. From the south end of the Tongue of the Ocean, GREAT BAHAMA BANK, 23°34'00" North, 76°33'00" West, 36 fms., bottom 74.2°F, *Albatross* sta. 2649, 12.IV.1886 (holotype USNM 50385, paratype 50386.)

Distribution. Known only from the type locality.

Ecology. *Pseudopterogorgia hystrix* appears to be one of a non-reef assemblage made up of deep-water representatives of the typical reef genera. Also collected

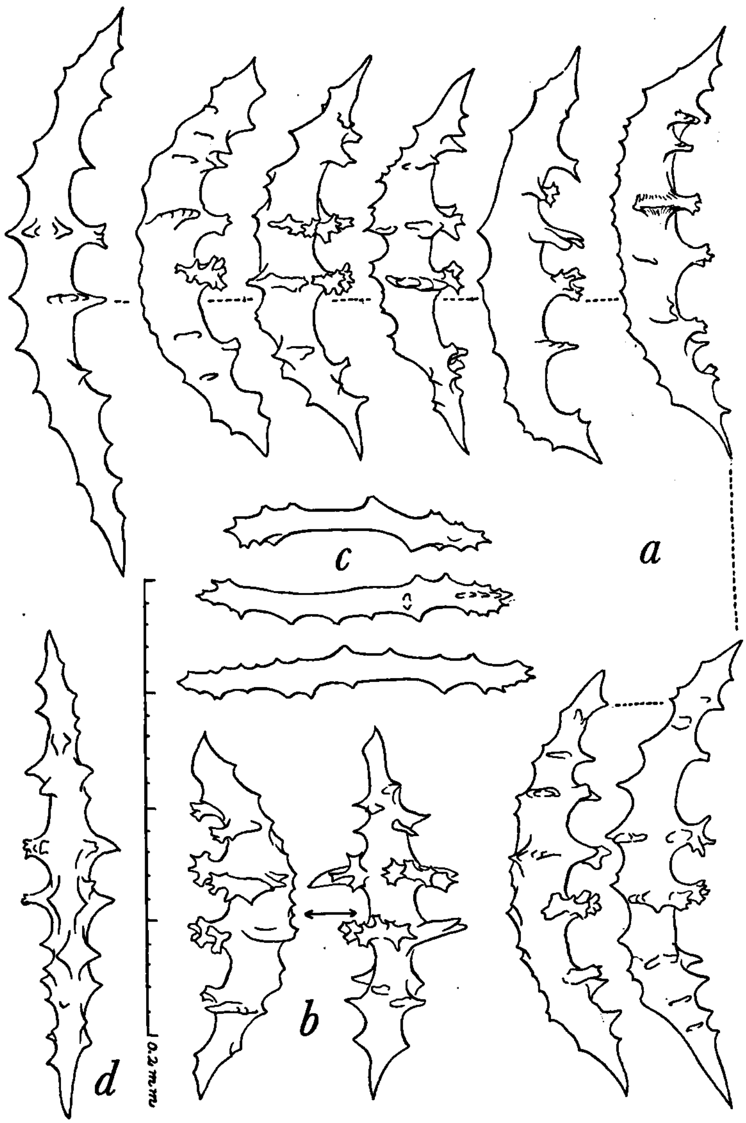


FIGURE 81. *Pseudopterogorgia hystrix* spec. nov., spicules of the holotype from the Great Bahama Bank (USNM 50385): *a*, scaphoids; *b*, two views of the same scaphoid; *c*, anthocodial rods; *d*, spindle. (All figures drawn to the same scale.)

at the same station were *Plexaura nina* and *Eunicea pinta*, both new species related to common reef-dwelling forms.

Remarks. The spicules of *Pseudopterogorgia hystrix* are even more spinose than are those of *P. navia*, and the very sharp ends of the scaphoids are recurved outward as in *P. americana*. Only the longest of the scaphoids equal in size those of *P. navia*; the majority measure 0.18–0.20 mm.

The tissues of *Pseudopterogorgia hystrix* contain abundant zooxanthellae and show a resistance to sodium hypochlorite like that noted in *P. americana*, but to a lesser degree.

The most distinctive feature of *P. hystrix* is the conspicuous and acute sculpturing of the scaphoids, which are shaped like those of *P. americana*.

82 **Pseudopterogorgia marcgravii** spec. nov.

(Fig. 82)

Diagnosis. Small colonies, under 10 cm. tall, very sparsely branched in a pinnate manner, sometimes unbranched. Polyps biserial, usually alternate, forming prominent calyces. Spicules including acute scaphoids with irregular convex profile, and symmetrical spindles. Anthocodiae with flat rods expanded at the ends.

Description. The type is a nearly complete colony about 5 cm. tall (Fig. 82 a). The main stem, which is 0.75 mm. in diameter, gives off five pinnate lateral branches, two on one side, widely separated, three on the other, close together; the longest of these is about 35 mm. long and 0.5 mm. in diameter. All the branches originate at an angle of about 60°, except for one that is not normal. The polyps are 2–4 mm. apart, biserial, and form moderately to strongly projecting calyces (Fig. 82 b). They are absent from the proximal half of the main stem. The cortical spicules are chiefly scaphoids with the convex profile irregularly serrated (Fig. 82 c) and symmetrical spindles of conventional form (Fig. 82 d). The spicules of the calycular walls (Fig. 82 c–d) may be somewhat longer than those of the stem rind (Fig. 82 e–f) but otherwise are not different. The anthocodiae contain short, flat rodlets with expanded ends and peculiar, granular sculpture (Fig. 82 g). The colony in alcohol is pale brown, almost white; the spicules are colorless.

The several paratypes are either simple or have one or two branches. The calyces are prominent and biserial, but they often incline alternately toward front and back of the colony. The antho-

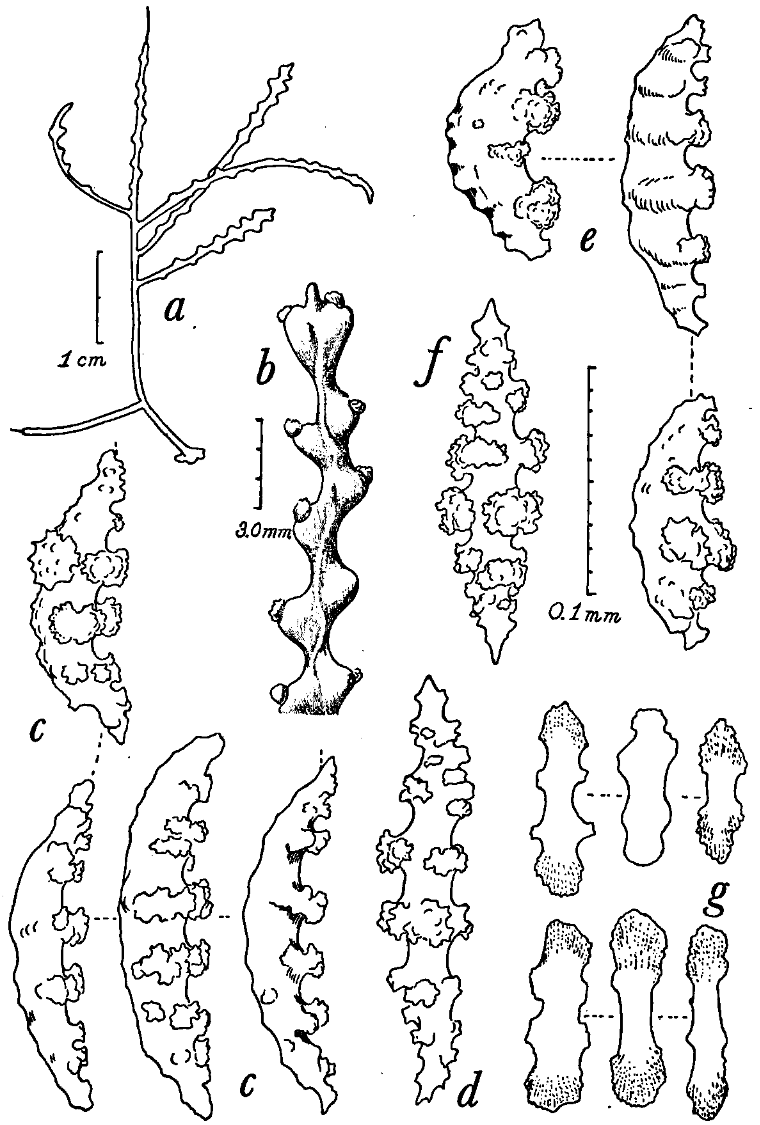


FIGURE 82. *Pseudopterogorgia marcgravii* spec. nov., the holotype from Brazil (USNM 50228): *a*, the entire colony; *b*, branch tip; *c*, scaphoids from the calycular walls; *d*, spindle from the calycular walls; *e*, scaphoids from the stem rind; *f*, spindle from stem rind; *g*, flat rods from anthocodiae. (Enlargement of *a* and *b* as indicated by scales; all spicules drawn to the same scale, shown to the right of *f*.)

codiae are often preserved exsert. The spiculation is uniformly like that of the type. The color is nearly white, with a tinge of purple toward the base in some specimens.

Material. BRAZIL, off Parahyba do Norte (João Pessoa), 6°59′30″ South, 34°47′60″ West, 20 fms., bottom 79°F, *Albatross* sta. 2758, 16.XII.1887 (holotype USNM 50228, 17 paratypes 50229).

Distribution. Known only from the type locality.

Remarks. *Pseudopterogorgia marcgravii* differs from other members of the genus in its dwarf growth form and prominent calyces. Its rude scaphoids and peculiar anthocodial rods are unlike other members of the genus. It is also easily distinguished from small colonies or branches of *Phyllogorgia dilatata*, which have thick branches with pore-like apertures on all sides.

Genus **Gorgonia** Linnaeus, 1758

Gorgonia LINNAEUS 1758, p. 800. (Type species, *Gorgonia flabellum* L., by subsequent designation: VERRILL 1868a, p. 386.)
Rhipidigorgia VALENCIENNES 1855, p. 13. (Type species, *Rhipidigorgia flabellum* (L.), by subsequent designation: VERRILL 1868a, p. 385.)
Gorgonia, BAYER 1951, p. 93.

Diagnosis. Net-formed gorgoniids with scaphoid spicules.

Distribution. Bermuda and south Florida to Curaçao: endemic West Indian.

Remarks. Among the sea-fans of the West Indian region there is always a noticeable variation in color, size of meshes, flattening of branches, and form of spicules. The extremes of variation may differ from one another to a marked degree and, in the absence of large suites of specimens, could be considered morphologically distinct species. It may have been such variants that led LINNAEUS to name, in the 10th edition of his *Systema Naturae*, two species of sea-fan: (1) the common Venus' Fan, *Gorgonia flabellum*; and (2) *Gorgonia ventalina*, of which he said (p. 801): "Differt haec a G. flabello solum ramis non versus ramulos, sed a lateribus exterioribus compressis," and then explained that from the published figures he could not decide to which of the two species the various synonyms applied.

When a large suite of specimens of the common sea-fan is examined with care, it will be observed that many specimens do, indeed, have the branches flattened in the plane of branching, as LINNAEUS described for *G. ventalina* ("a lateribus exterioribus compressis"), and not at right angles to it ("non versus ramulos [compressis]"). It seems logical that such specimens, with branches 'externally compressed,' are true *ventalina* as LINNAEUS understood it. It remains only to demonstrate that this form can be separated from *flabellum* on valid taxonomic grounds.

It is, I think, quite clear that PALLAS' *Gorgonia ventilabrum*, in which LINNAEUS' *G. ventalina* was erroneously included, is not the same species, nor is ESPER's *G. ventalina*. It obviously was ESPER's figure that led BIELSCHOWSKY to identify a small, reddish purple sea-fan of the Panamic province as *G. ventalina*, but in spite of the fact that it may be the species that ESPER figured, it certainly has nothing to do with LINNAEUS' original *ventalina*.

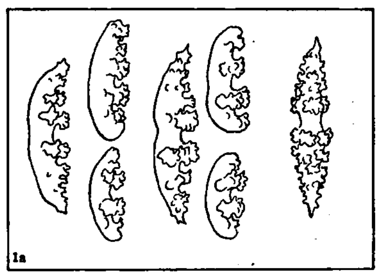
In the West Indies there are four species of sea-fans with anastomosing branches, three of them belonging to the genus *Gorgonia*.

KEY 21

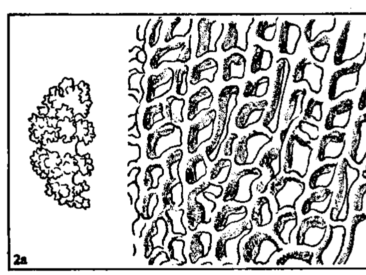
ILLUSTRATED KEY TO THE SPECIES OF *Gorgonia*

1a. Convex profile of scaphoids smooth. Branches usually not strongly flattened at right angles to plane of the fan: *Gorgonia mariae* spec. nov.

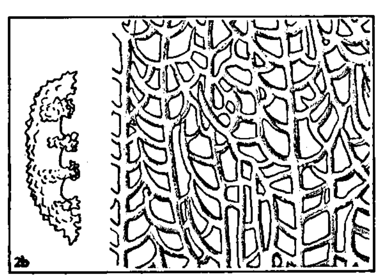
1b. Convex profile of scaphoids noticeably sculptured; perfectly smooth scaphoids not present: 2



2a. Convex profile of many scaphoids with tuberculate sculpture. Ascending and connecting branches strongly flattened at right angles to the plane of the fan. Anthocodial rods 0.05–0.08 mm. long: *Gorgonia flabellum* Linnaeus



2b. Convex profile of scaphoids with echinulate sculpture, but never with complex tubercles. Ascending branches inconspicuously flattened at right angles to plane of the fan or not at all; connecting branches flattened in plane of fan. Anthocodial rods 0.065–0.10 mm. long: *Gorgonia ventalina* Linnaeus



83 **Gorgonia flabellum** Linnaeus, 1758 forma **flabellum**

(Fig. 83; Pl. X fig. 2)

Frutex marinus elegantissimus CLUSIUS 1605, p. 120, woodcut. (Ex India Orientali.)
Planta coralii natura CERUTUS 1622, p. 16, coppercut. (Ex Americano Oceano.)
Flabellum Veneris ELLIS 1755, p. 61, pl. 26 fig. A. (West-Indies.)
Gorgonia Flabellum LINNAEUS 1758, p. 801. (Habitat in O. Indico.)
Rhipidigorgia flabellum, VALENCIENNES 1855, p. 13.
Rhipidogorgia [*sic*] *flabellum*, DUCHASSAING & MICHELOTTI 1860, p. 33. (Antilles.)
Gorgonia flabellum, BAYER 1951, p. 93, fig. 1. (CERUTUS' fig. reproduced.)

Diagnosis. *Gorgonia* with ascending branches and connecting branchlets strongly compressed at right angles to the plane of the fan; no free branchlets arising from the surface of the fan. Scaphoids commonly with complex tubercles on convex side (Fig. 83 c, d, h). Anthocodial rods usually 0.05–0.06 mm. long, rarely longer (Fig. 83 a, f, g). Color, grayish white or pale lavender; sometimes deep yellow.

Material. From Dr. Hummelinck's collection in the USNM: BONAIRE, Punt Vierkant, sandy reef, 1 m., sta. 1059a, 26.III.1955, dry fragment (51345). Lac, cast ashore, 25.II.1949, 2 dry specimens (50220). ANGUILLA, north of Sandy Ground, rocky beach behind sandy reef, 1.5 m., sta. 1142, 19.VI.1949, complete dry colony (51344). Upper Prickly Pear Island, cast ashore, 17.VI.1949, 4 dry spec. (50223).

From the same Museum: a large number of specimens from several localities including NEW PROVIDENCE, Nassau (14365), Long Key (14369), WATLING'S ISLAND (San Salvador, Bahamas) (14400); HISPANIOLA, Haiti (50217, 50730); MEXICO, Mujeres Hbr., Quintana Roo (51756–51758), Cozumel Island (51766), Bahia de la Ascencion, Quintana Roo (51767), B. de la Espiritu Santo, Quintana Roo (51765).

Distribution. Abundant in the Bahamas, becoming scarce to the south through the Lesser Antilles; apparently absent from Bermuda and uncommon in Florida.

Ecology. In the Florida Keys, neither *Gorgonia flabellum* nor *G. ventalina* occurs near the shore, but only in deeper water on lagoonal reef patches and along the outer reefs.

In certain situations, probably where current patterns are unusual, individuals of *G. flabellum* may produce numerous lateral branchlets from one or both faces of the flabellum. This ecophenotype was given the name *occatoria* by MILNE EDWARDS & HAIME (1857). Such a form apparently does not occur in *G. ventalina*, which, however, may produce some small accessory fans in much the same manner.

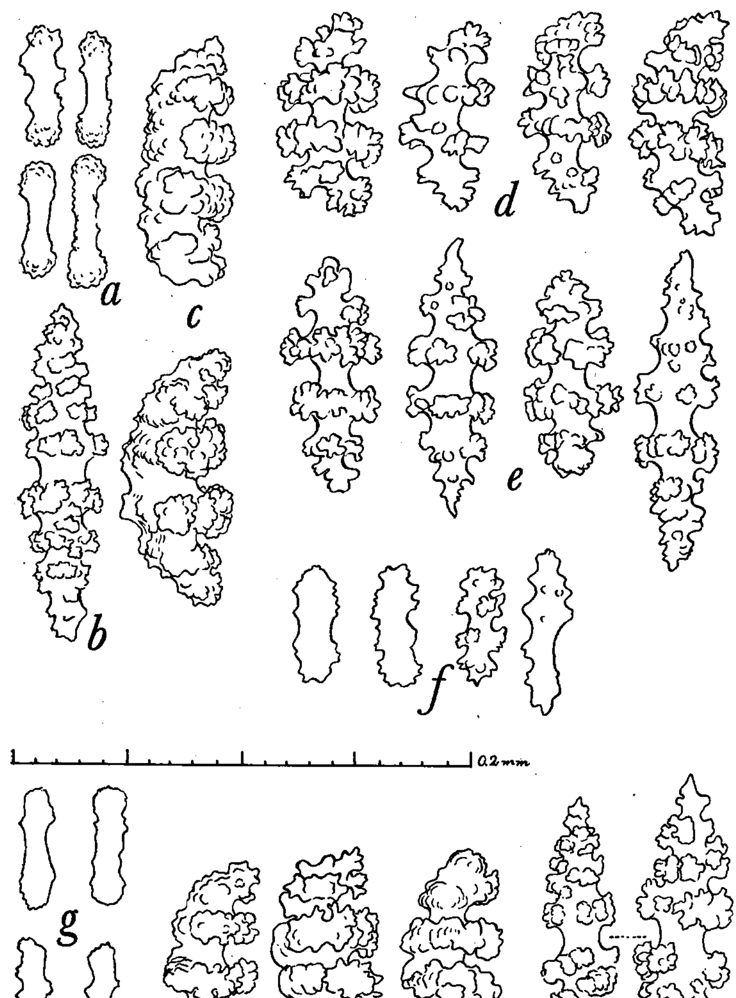


FIGURE 83. *Gorgonia flabellum* Linnaeus, typical form spicules. *a–c*, of a specimen from Trinidad (USNM 14400): *a*, anthocodial rods; *b*, spindle; *c*, scaphoids. *d–f*, of a specimen from Nassau (14365): *d*, scaphoids; *e*, spindles; *f*, anthocodial rods. *g–i*, of a specimen from Long Key, New Providence (14369): *g*, anthocodial rods; *h*, scaphoids; *i*, spindles. (All figures drawn to the same scale.)

Remarks. Many of the sea-fans from the Bahamas exactly fit the original description of *Gorgonia flabellum* as given by LINNAEUS (1758, p. 801): "Gorgonia reticulata, ramis interne compressis," and also agree with his characterization in the *Hortus Cliffortianus*: "Lithoxylon retiforme, ramis parallele compressis: primordialibus crassioribus." These fans are further distinguished by the tuberculate sculpture of the convex side of the scaphoid spicules. Toward the west, in Florida, and the south, in the Lesser Antilles, *G. flabellum* becomes less and less abundant and, unfortunately, less easily recognized. The flattening of the branches may be less pronounced and colonies approach the external appearance of *G. ventalina*, the commoner species in those areas. The spicules remain recognizable, however, and it is upon their characteristics that *G. flabellum* is best distinguished from *G. ventalina*.

83a **Gorgonia flabellum** Linnaeus, 1758 forma **occatoria** Milne Edwards & Haime, 1857

(Fig. 84)

Rhipidigorgia occatoria VALENCIENNES 1855, p. 13. (Guadeloupe.) [Nomen nudum.]
Rhipidigorgia occatoria MILNE EDWARDS & HAIME 1857, *1*, p. 175. (Côtes de la Guadeloupe.)

Diagnosis. *Gorgonia flabellum* with numerous short branchlets growing from one or both sides of the fan. The scaphoids (Fig. 84 a), spindles (Fig. 84 b), and anthocodial rods (Fig. 84 c) are identical with those of the typical form.

Material. Collected by Dr. Hummelinck: ST. JOHN, Turner Bay, rock debris, 1 m., sta. 1407, 18.VI.1955, dry colony with commensal gastropods; *Coralliophila* attached to base and several yellow *Neosimnia* clinging to branches (USNM 51346).

From the U.S. National Museum: several specimens from NEW PROVIDENCE, Nassau (50755), Long Key (50756), and the Sea Garden at the east of Hog Island (50757); and one from HISPANIOLA, Haiti (50224).

Distribution. Probably coincides with that of the typical form.

Remarks. It appears quite certain that specimens of this growth form were in hand when VALENCIENNES (1855) and MILNE EDWARDS & HAIME (1857) established *Rhipidigorgia occatoria*. The latter authors state (p. 175): "Un grand nombre de petites branches accessoires naissant sur l'une et l'autre surface de l'éventail formé par le polypiéroïde." Furthermore, the color was said to be whitish, as several of the specimens before me are.

84 **Gorgonia ventalina** Linnaeus, 1758

(Figs. 85–86; Pl. X fig. 1, XXVII)

Gorgonia Ventalina LINNAEUS 1758, p. 801. (Habitat in O. Americano & Asiatico.)
not *Gorgonia ventilabrum* PALLAS 1766, p. 165.
not *Gorgonia ventalina*, ESPER 1791, *2*, p. 20, pl. 1. [= ?*Pacifigorgia elegans* (Duchassaing & Michelotti).]
not *Gorgonia ventalina*, BIELSCHOWSKY 1929, p. 152, fig. 25, pl. 3 fig. 14.
Gorgonia flabellum, VERRILL 1907, p. 297, fig. 142, pl. 33C figs. 2–3, pl. 36 fig. 1 (1a).

Diagnosis. *Gorgonia* with branches usually compressed in the plane of the fan; ascending branches occasionally somewhat compressed at right angles to the fan, but not the connecting branchlets. Scaphoids with sculpture of convex side reduced to low prickles, sometimes placed on low transverse ridges (Figs. 85 a, f; 86 a, d, e); spindles acute (Figs. 85 b, e; 86 c, f); anthocodial rods 0.065–0.1 mm. long (Figs. 85 c–d; 86 b, g). Color of colonies, yellow or purple, occasionally whitish.

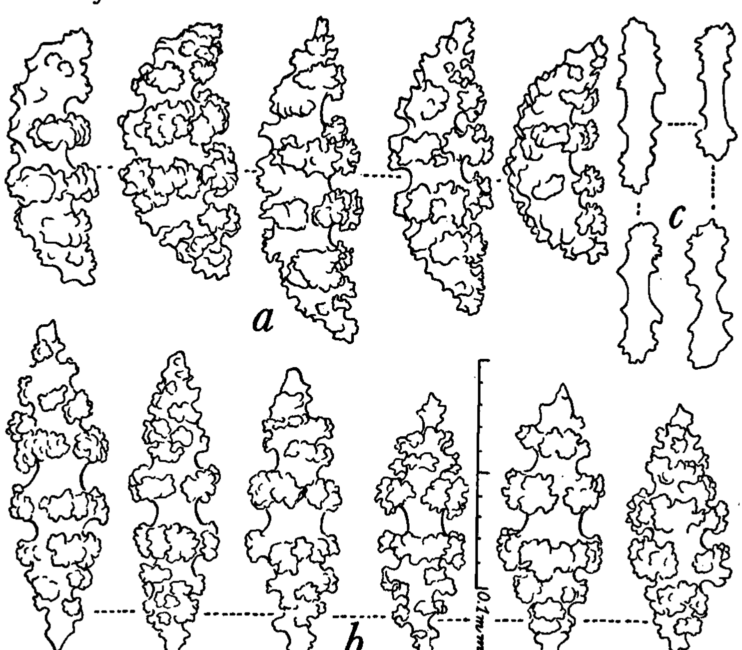


FIGURE 84. *Gorgonia flabellum* Linnaeus, forma *occatoria* Milne Edwards & Haime: spicules of a specimen from Haiti (USNM 50224): a, scaphoids; *b*, spindles; *c*, anthocodial rods. (All figures drawn to the same scale.)

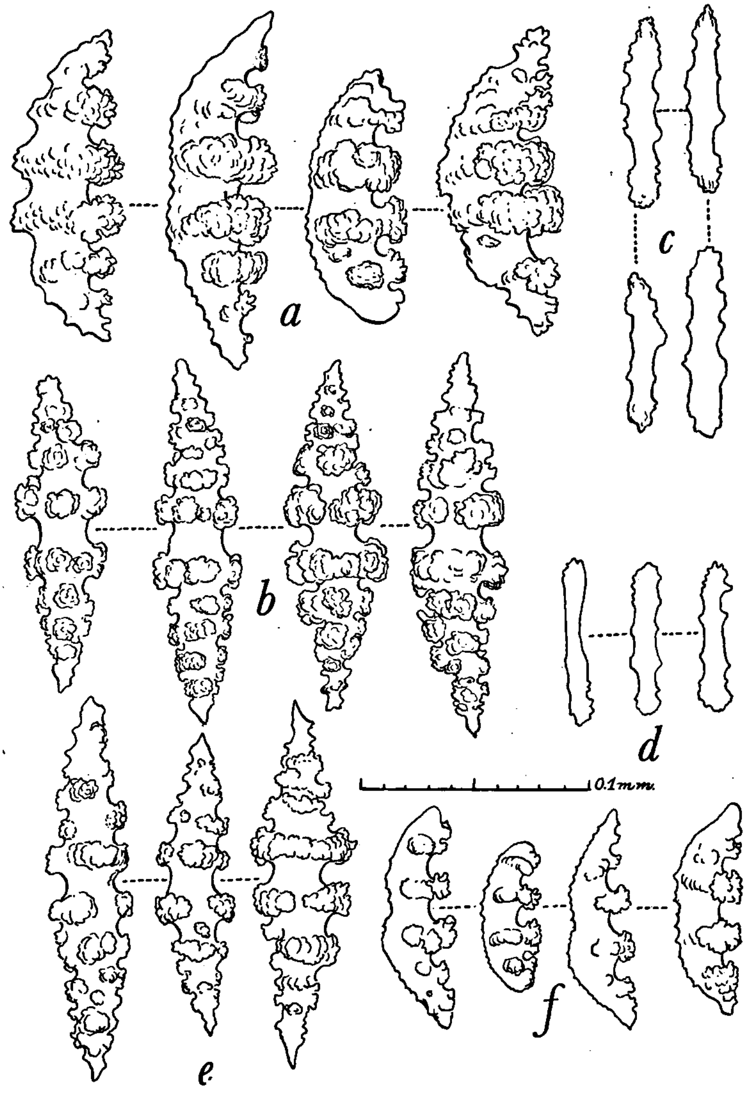


FIGURE 85. *Gorgonia ventalina* Linnaeus, spicules. *a–c*, of a specimen from Rodriguez Key, Florida (USNM 8860): *a*, scaphoids; *b*, spindles; *c*, anthocodial rods. *d–f*, of a specimen from Bonaire (50218): *d*, anthocodial rods; *e*, spindles, *f*, scaphoids. (All figures drawn to the same scale.)

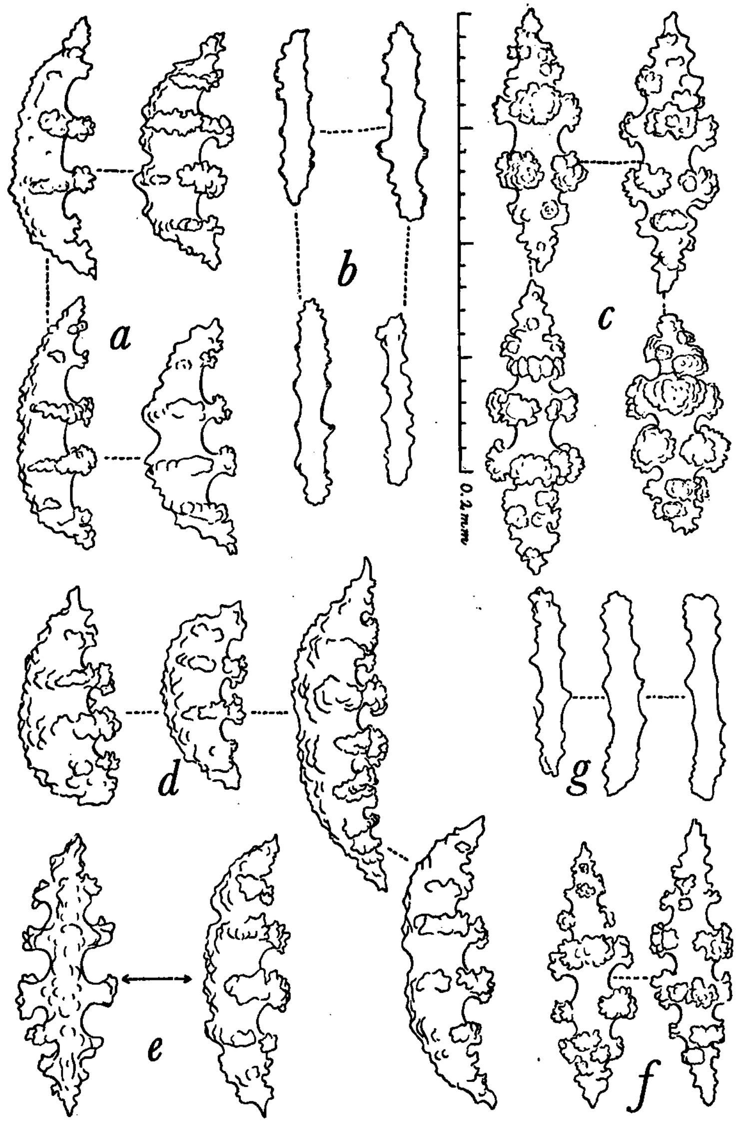


FIGURE 86. *Gorgonia ventalina* Linnaeus, spicules. *a–c*, of a specimen from St. Barts (USNM 50222): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles. *d–g*, of a specimen from St. James (50758): *d*, scaphoids; *e*, two views of same scaphoid; *f*, spindles; *g*, anthocodial rods. (All figures drawn to the same scale.)

Material. USNM specimens from Dr. Hummelinck's collection: BONAIRE, Kralendijk roadstead, from two covered buoys cleaned 20 months before, 0–1.5 m., sta. 1053, 21.XI.1948, 11 small specimens in alcohol (50218). Punt Vierkant, sandy reef, 2 m., sta. 1059B, 9.IX.1948, fragments in alc. (50219). KLEIN CURAÇAO, J. S. Zaneveld, 9.I.1955 (51352). Found by J. H. Stock on CURAÇAO: Blauwbaai, 3 m., 17.X.1958; Fuik Baai, 3 m., 3.XI.1958 (Amsterdam). ST. EUSTATIUS, Gallows Bay, rocky beach, 2 m., sta. 1116B, 15.VII.1949, dry spec. (50221); J. H. Stock, 11.II.1959 (Amsterdam). ST. BARTHÉLEMY, Fourche, rock debris, 1.5 m., sta. 1124, 2.VI.1949, 6 complete dry spec. and fragments in alc. (50222, 51347).

Many other USNM specimens from various localities: BERMUDA (50670, 50671); FLORIDA Keys (8860); DRY TORTUGAS (50392); BAHAMAS, New Providence (50550, 50719), Rum Cay (50725), Watling's Island (50696); CUBA (34680); HISPANIOLA, Haiti (4082); JAMAICA, Port Royal Cays (51406); PUERTO RIÇO (42144); VIRGIN ISLANDS (49561, 50348); SABA Bank (50346); ST. CHRISTOPHER (50347); ANTIGUA (34045); TOBAGO, Milford Bay (51422); Curaçao and ARUBA (50663, 50664, courtesy of the Leiden Museum); OLD PROVIDENCE (8857).

Distribution. Geographically, *Gorgonia ventalina* ranges from Bermuda south to Curaçao. In Florida, it extends through the Keys southward to the Dry Tortugas but, so far as I know, does not occur on the Gulf coast of Florida; where it reappears on the mainland to the southward cannot be determined from available records. The U.S. National Museum has a very badly damaged specimen said to be from Texas, but there is absolutely no assurance that the species lives off that coast. The collections from the Gulf of Campeche and the Yucatan Peninsula, scant though they are, do not include it. It is known from Old Providence Island off Nicaragua, and may occur on the mainland in that latitude. It occurs at Curaçao, Aruba, Bonaire, and probably all the other islands of the Leeward Group, and perhaps lives also along the mainland.

Ecology. Along the Florida Keys, sea-fans are restricted to the outer reefs and the reef patches in deeper water in the lagoon. At Bermuda, according to VERRILL (1907, p. 298), it reaches its maximum growth off the outer reefs in 10 to 20 feet of water, where its height may be 5 to 6 feet.

Remarks. It is no easier to separate the various references in the literature into their proper species today than it was in Linnaeus' time. The correct assignment of the older references will depend upon a reexamination of specimens, insofar as they are extant, and it will likely prove that many of them deal with both *Gorgonia ventalina* and *G. flabellum*.

85 **Gorgonia mariae** spec. nov. forma **mariae**

(Figs. 87–88 a–c; Pl. X figs. 3–4)

Gorgonia bipinnata, HARGITT & ROGERS 1901, p. 287, pl. 3 fig. 4. (Off. St. Thomas and Vieques Island.)
not *Pterogorgia bipinnata* VERRILL 1864b, p. 31.

Diagnosis. *Gorgonia* with large meshes. Scaphoid spicules with their convex profile entirely smooth, the long ones pointed, the short one blunt and stubby. Spindles mostly double cones with girdles of very complicated tubercles. Anthocodial rods narrow, with enlarged ends, up to 0.06 mm. in length.

Description. All of the known colonies are of small size, the largest being a complete specimen about 28 cm. in height. The holotype is a complete colony 20 cm. in height and about the same in width. Branching is pinnate, in one plane, and regularly anastomosed. The branchlets are 1.0–2.0 mm. wide, but 1.5 mm. is usual; they arise at intervals of 3–6 mm. (commonly 4–5 mm.), usually in an alternating manner and, as soon as they are sufficiently long (10–15 mm.), anastomose freely with one another. Small colonies tend to show few anastomoses until some strong lateral branches are developed, but as soon as this occurs the branchlets invariably fuse so that well-developed colonies are complete nets. The polyps, which occur in irregular, alternating double rows along the two edges of the branchlets, usually appear as tiny slits, occasionally with a somewhat raised rim, and rarely at the summit of a slight coenenchymal swelling. Protruding calyces are not formed. There are the usual two categories of spicules in the cortex, namely, scaphoids and spindles. The scaphoids are of two types: (1) long and acute, and (2) short and blunt. The former reach a length of 0.16 mm. and are gently curved and sharply pointed; the latter are at most 0.12 mm. long, usually 0.06–0.08 mm., with blunt, incurved ends that give them the appearance of beetle-grubs or, perhaps, mammalian embryos. Both long and short scaphoids are entirely smooth on their convex surface (Figs. 87 a, d; 88 a). The spindles are very acute double cones up to 0.17 mm. in length;

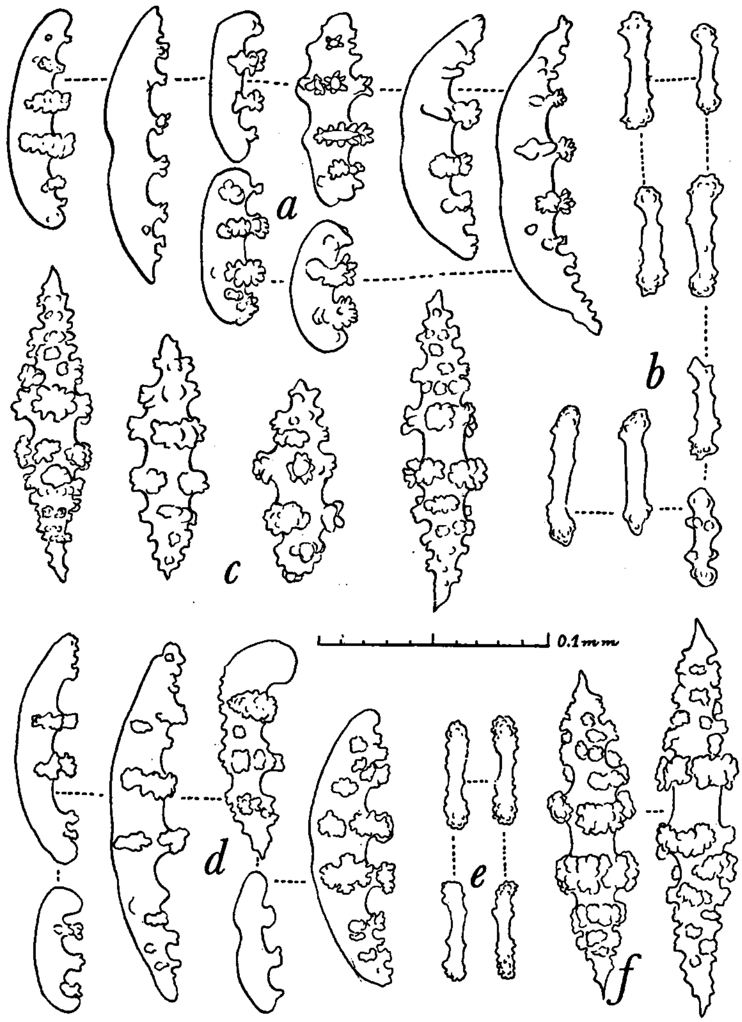


FIGURE 87. *Gorgonia mariae* spec. nov., spicules. *a–c*, of a paratype from St. Eustatius (USNM 50422): *a*, scaphoids; *b*, anthocodial rods; *c*, spindles. *d–f*, of a specimen from Puerto Rico (50073): *d*, scaphoids; *e*, anthocodial rods; *f*, spindles. (All figures drawn to the same scale.)

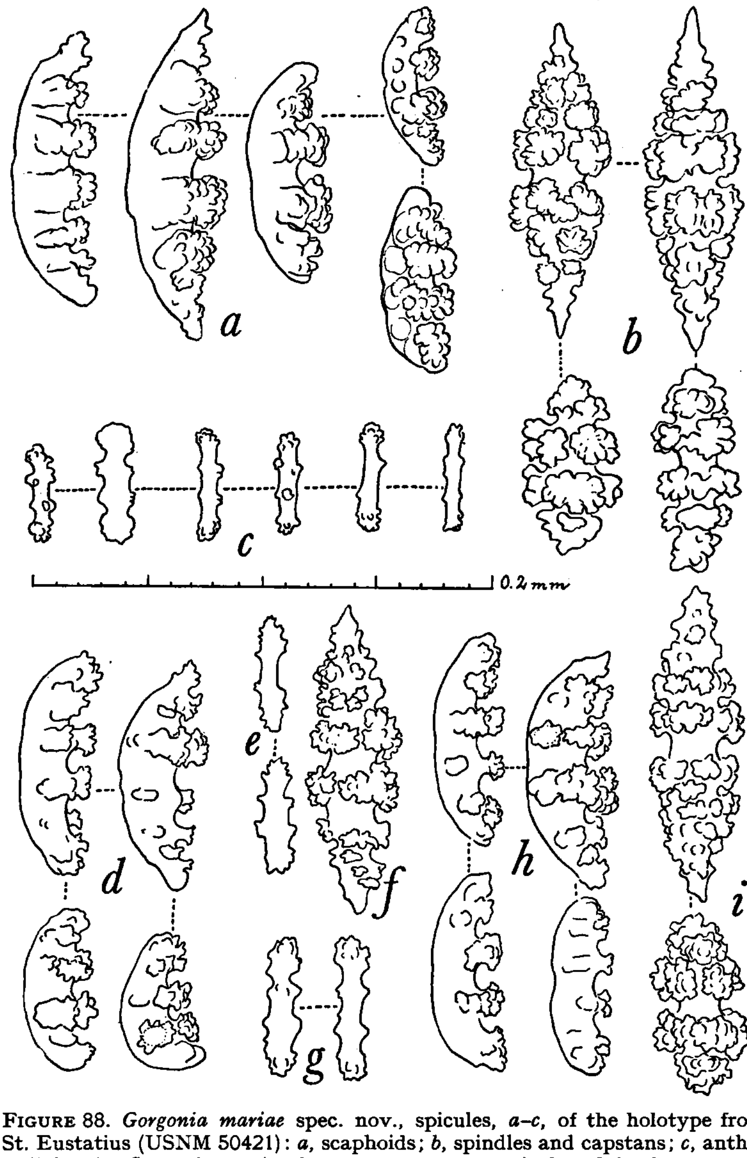


FIGURE 88. *Gorgonia mariae* spec. nov., spicules, *a–c*, of the holotype from St. Eustatius (USNM 50421): *a*, scaphoids; *b*, spindles and capstans; *c*, anthocodial rods. *Gorgonia mariae* forma *cymosa* nov., spicules, *d–i*, of two specimens from St. Martin (50423): *d* and *h*, scaphoids; *e* and *g*, anthocodial rods; *f* and *i*, spindles. (All figures drawn to the same scale.)

most of them are of the usual '*Gorgonia*-type' with transverse belts of very complicated tubercles (Figs. 87 c, f; 88 b). A few short, stubby capstans may be present, in some colonies but seem to be missing from others. The anthocodial rods, which are narrow and have enlarged ends (Figs. 87 b, e; 88 c), reach a length of 0.06 mm. Dry colonies lemon yellow, occasionally tinged with violet near the base; specimens from deeper water nearly white.

Material. From Dr. Hummelinck's collection: ST. EUSTATIUS, Gallows Bay, rocks, 2 m., sta. 1116B, 15.VII.1949, 14 specimens (holotype USNM 50421, paratypes 50422). ANGUILLA, Upper Prickly Pear Island, 17.VI.1949, 1 spec. (USNM 50653).

Other USNM material: One of the specimens reported by Hargitt & Rogers, from off ST. THOMAS, Sail Rock W. by N., 1/2 N., 6 miles, 20–23 fms., *Fish Hawk* sta. 6079, 6.II.1899 (42153); ST. JOHN, 50–200 feet, T. Chess, 1960 (51747–51749); PUERTO RICO, 18°27'35" North, 65°33'35" West, 26

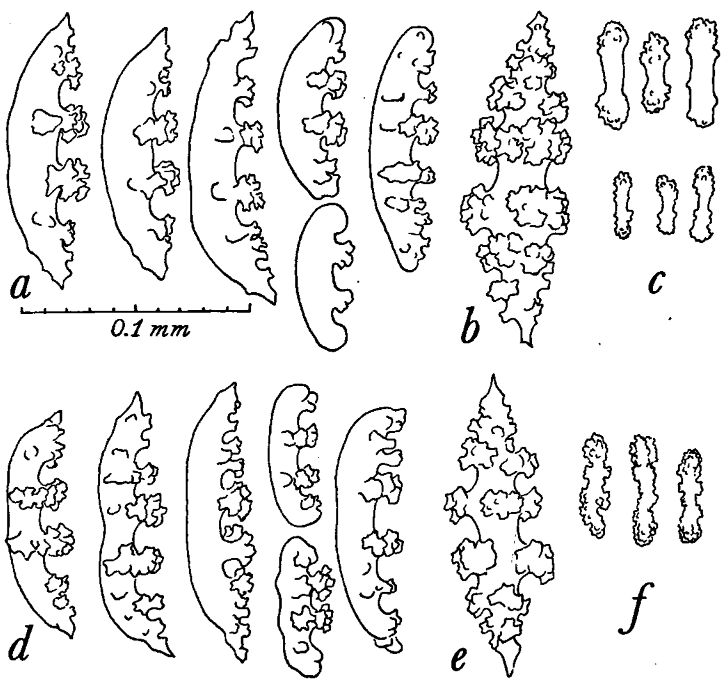


FIGURE 89. *Gorgonia mariae* spec. nov., forma *plumosa* nov. Spicules of two paratypes from Anegada (USNM 51027): *a*, scaphoids; *b*, spindle; and *c*, anthocodial rods of specimen at left in Pl. XI fig. 4; *d*, scaphoids; *e*, spindle; and *f*, anthocodial rods of specimen at right in Pl. XI fig. 4. (All figures uniformly enlarged according to 0.1 mm. scale.)

fms., *Caroline* sta. 75, Johnson-Smithsonian Exp., 25.II.1933, large but fragmentary spec. (50073); near Santurce, Ted Arnow, XII.1958 (51348); SABA Bank, 17°28′ North, 63°13′ West, Smithsonian-Bredin Exp., sta. 106–56, 13.IV.1956, two spec. (50345). Through courtesy of Dr. Elisabeth Deichmann of the Museum of Comparative Zoölogy, a specimen from CUBA (MCZ 3979), and another without locality (MCZ 3980). Specimens from between St. Thomas and St. John, 15–20 fms., 23. XII. 1905, and between St. John and Thatch Cay, 15± fms., 9. III. 1906, both Th. Mortensen, were examined in Univ. Zool. Museum Copenhagen.

Distribution. Recorded with certainty from Cuba, Puerto Rico, St. Thomas, St. John, Anguilla, and St. Eustatius; the forma *cymosa* from Puerto Rico and St. Martin; the forma *plumosa* from Puerto Rico and Anegada. From a little below low tide to 26 fathoms.

Remarks. *Gorgonia mariae* was first figured by HARGITT & ROGERS under the name *Gorgonia bipinnata* (Verrill), but only the colony was figured. It has, of course, nothing whatever to do with VERRILL's species, which has entirely different spicules.

85a **Gorgonia mariae** spec. nov. forma **cymosa** nov.

(Fig. 88 d–i; Pl. X fig. 5)

Diagnosis. Regularly anastomosing, flabellate colonies with numerous short, free branchlets arising from one or both faces of the fan. Yellow with purplish tints. Spiculation identical with that of the typical form.

Material. Five colonies of this growth form, collected by Hummelinck on ST. MARTIN, Point Blanche Bay, cast ashore, 5.VI.1955 (USNM 50423).

Five dry specimens, found by Ted Arnow on the north coast of PUERTO RICO, Santurce, 20.VI.1959 (USNM 51351).

Remarks. Two of the above-mentioned colonies demonstrate the fullest development of the *occatoria*-condition, with numerous short branchlets (some of them sub-branched) springing densely from both surfaces of the fan. The other colonies show it to a lesser degree, one of them only slightly. In all cases the spicules (Fig. 88 d–i) are like those of the typical form.

85b **Gorgonia mariae** spec. nov. forma **plumosa** nov.

(Fig. 89; Pl. XI fig. 1)

Diagnosis. Tall, plumose colonies with anastomosis of inner and lower branchlets but with many terminal twigs remaining entirely free. Bright yellow, infrequently with purplish tints. Spiculation as in the typical form.

Material. Five colonies of this growth form, collected by Dr. Waldo Schmitt on ANEGADA, Pomato Point, depth about 1 m., Smithsonian – Bredin Caribbean Exp. II, sta. 42–58, 8.IV.1958 (USNM 51027). Dry material found by Ted Arnow on the north coast of PUERTO RICO, near Punta Puerto Nuevo, 24.III.1959, 5 spec. (51349), and 6.VI.1959, 7 spec. (51350).

Remarks. These tall plumose colonies, which reach a height of about 40 cm., have much the appearance of a *Pseudopterogorgia*, and indeed are quite like *P. hummelincki*, although larger. Closer examination reveals a lax but constant anastomosis of branchlets never found in species of *Pseudopterogorgia*, and the terminal portions of these colonies are identical with the free tips of fully anastomosed examples of typical *G. mariae*. The bright yellow color of the rind is the same as in typical *mariae* from shallow habitats, showing similar weak tints of purple. The spiculation (fig. 89) is in such close conformity with that of *G. mariae* forma *mariae* and forma *cymosa* that there can be no doubt that we are here dealing with a single morphologically labile species with at least three growth forms.

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

Phyllogorgia MILNE EDWARDS & HAIME 1850, p. lxxx. (Type species, *Gorgonia dilatata* Esper 1806, by original designation.)
Hymenogorgia VALENCIENNES 1855, p. 13. (Type species, *Hymenogorgia quercifolia* = *Gorgonia Quercus folium* Ehrenberg 1834 = *Gorgonia dilatata* Esper 1806, by monotypy.)

Diagnosis. Colonies flabellate, ramification pinnate, lax, loosely anastomosing; coenenchyme greatly expanded in the plane of ramification, more or less completely filling in the spaces between branches to produce laciniated, leaf-like, or broadly-lobed colonies. Cortical spicules are scaphoids with echinulate convex profile, and stout, belted spindles.

Distribution. Guadeloupe? Brazil.

Remarks. VERRILL (1912, p. 394) correctly observed that anastomosis of the axis occurs in typical *G. quercusfolium*, and that the spicules do not differ from *G. dilatata*, making it impossible to maintain VALENCIENNES' genus *Hymenogorgia*.

Several species and varieties of these leaf-corals have been described, largely because of their extraordinary variation in growth form. There is also a wide range of variation in the spicules but, unfortunately, the two variables do not correlate so it is impossible to recognize more than a single species.

86 **Phyllogorgia dilatata** (Esper), 1806

(Fig. 90; Pl. X fig. 6)

Gorgonia dilatata ESPER 1806, Fortsetz. *2*, p. 25, pl. 51. ("Wahrscheinlich das Meer des südlichen America.")
Gorgonia Quercus folium EHRENBERG 1834, p. 367.
Phyllogorgia dilatata, MILNE EDWARDS & HAIME 1850, p. lxxx. (Bahia.)
Phyllogorgia foliata VALENCIENNES 1855, p. 13. (Guadeloupe.) [Nomen nudum.]
Phyllogorgia foliata VERRILL 1912, p. 397, pl. 33 fig. 5. (Guadeloupe; locality doubtful.) [Spicules of type in Paris Museum described and figured; name validated.]
Phyllogorgia frondosa VERRILL 1912, p. 395, pl. 31 fig. 2, pl. 33 fig. 4, pl. 35 fig. 8. (Abrolhos Reefs, Brazil.)
Phyllogorgia quercifolia var. *quercifolia* + var. *lacerata* VERRILL 1912, p. 394, pl. 30 fig. 3, pl. 32 fig. 1, pl. 33 figs. 1–1a; p. 395, pl. 30 fig. 4, pl. 32 fig. 2, pl. 33 fig. 2. (Cape Frio to Pernambuco.)
Phyllogorgia dilatata, VERRILL 1912, p. 396, pl. 33 fig. 3. (Bahia.) [Spicules of Milne Edwards' specimen in the Paris Museum.]
Phyllogorgia dilatata, BAYER 1959, p. 20.

Diagnosis. As for the genus. The spicules of the cortex are scaphoids of various curvature (Fig. 90 b, c, e, g) and belted spindles, some acute, some blunt (Fig. 90 a, d, f, i). The anthocodiae seem to lack flat rods, but have small octoradiate rods (Fig. 90 h).

Material. Several USNM specimens from Periperí, the Abrolhos Islands, and Fernando de Noronha, BRAZIL, collected by the Hartt Exp. They include specimens of the typical *dilatata* form (5245, 5258), *frondosa* form (5249), *quercifolia* form (5252, 5253, 5257), and *lacerata* form (5256).

Distribution. Guadeloupe? Coast of Brazil from Cape Frio to Pernambuco.

Ecology. VERRILL (1868a, p. 359) quotes HARTT's observations on this species: This is a very common species on the Brazilian coast, and ranges from Cape Frio northward to Pernambuco. It is very abundant at the entrance to the Bay of Victoria, as well as at the Abrolhos, Porto Seguro, and Bahia. It sometimes occurs in some of the larger tide pools on the surface of the reefs at low-tide level, but its usual station is on the edges of the reef, and ranging from low-water mark downward to a depth of 5–6 feet or more. It is sometimes laid bear [*sic*] by spring tides. The color, when alive, is yellowish or pinkish; the latter tint is apt to fade in drying. A small *Ovulum* (*O. gibbosum*) is parasitic on this species.

Genus **Pterogorgia** Ehrenberg, 1834

Pterogorgia (part) EHRENBERG 1834, p. 368. (Type species, *Gorgonia anceps* Pallas, by subsequent designation: MILNE EDWARDS & HAIME 1850, p. lxxx.)
Xiphigorgia (part) MILNE EDWARDS & HAIME 1857, *1*, p. 171. (Type species, *Gorgonia anceps* Pallas, by subsequent designation: BIELSCHOWSKY 1918, p. 62.)
Pterogorgia, BAYER 1951, p. 96.

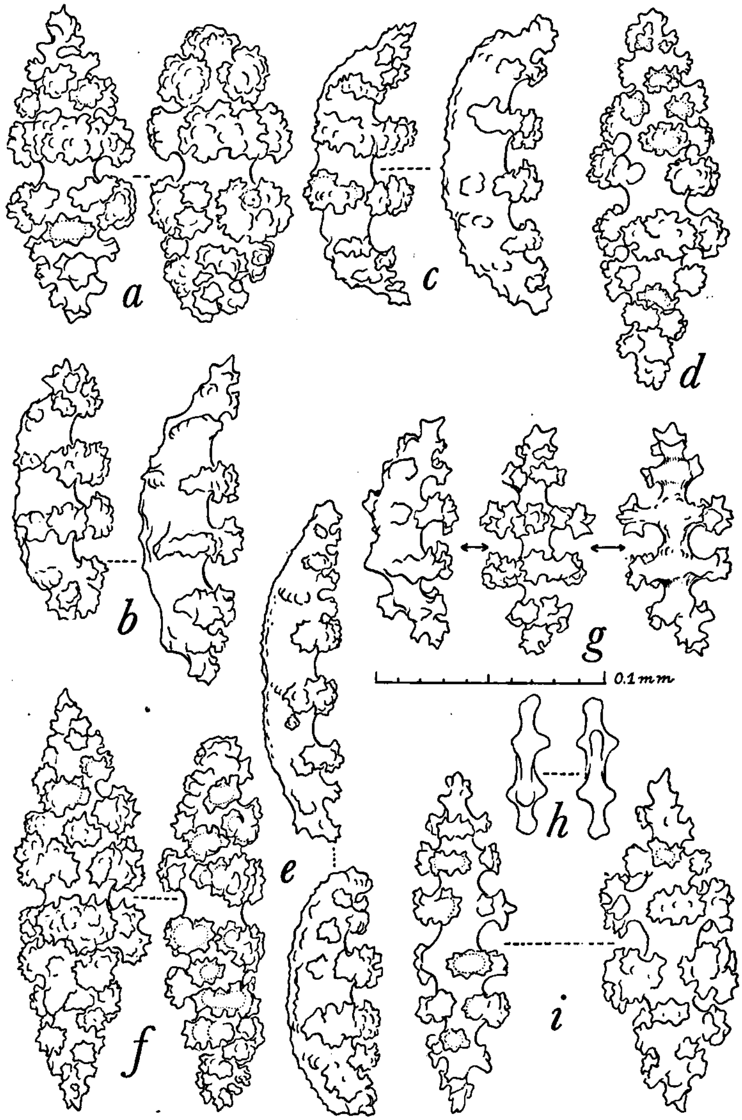


FIGURE 90. *Phyllogorgia dilatata* (Esper), from Brazil, spicules. *a–b*, of a specimen of the *lacerata* form (USNM 5526): *a*, scaphoids; *b*, spindles. *c–d*, of a specimen of the *frondosa* form (5249): *c*, scaphoids; *d*, spindle. *e–f*, of a specimen of typical *dilatata* form (5428): *e*, scaphoids; *f*, spindles. *g–i*, of another specimen of *dilatata* form (5252): *g*, three views of the same scaphoid; *h*, octoradiate rods from polyps; *i*, spindles. (All figures drawn to the same scale.)

Diagnosis. Gorgoniids with lateral branching; polyps retractile into thin, longitudinal cortical flanges. Scaphoids blunt, with coarse ornamentation.

Distribution. Bermuda, southern Florida and the Keys; Greater Antilles south to Curaçao.

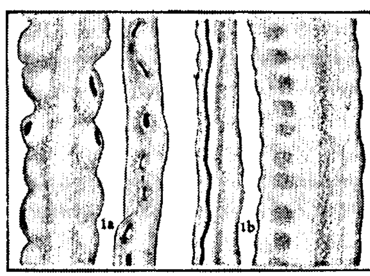
Remarks. I have already pointed out (1951, p. 96) that the application of EHRENBERG's generic name *Pterogorgia* was narrowed by MILNE EDWARDS & HAIME's selection of *Gorgonia anceps* Pallas as genotype to those species having the polyps retractile within longitudinal coenenchymal flanges which impart to the branches a flat or triangular cross section. *Xiphigorgia*, proposed in 1857 and containing *G. anceps* Pallas and *G. setacea* Pallas was consequently stillborn; the genotype designation of *G. anceps* Pallas by BIELSCHOWSKY consigned it irrevocably to its nomenclatural grave as a junior synonym of *Pterogorgia*. Only by extralegal means could it now be re-established, an action that I feel would scarcely be justifiable.

KEY 22

ILLUSTRATED KEY TO THE SPECIES OF *Pterogorgia*

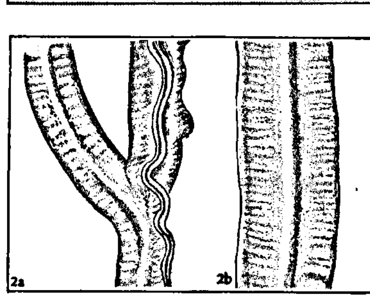
1a. Polyps retracting into low, distinct calyces each with its own separate slit-like aperture, along the two narrow edges of the branches. Color commonly yellow with reddish purple calyces appearing as marginal spots; occasionally uniform olivaceous gray: *Pterogorgia citrina* (Esper)

1b. Polyps retracting into close-set calyces within a common groove along the narrow edges of the branches, calicular apertures usually not appearing as separate slits: 2



2a. Branches 3–6 mm. wide, usually with 3 or 4 edges even in young specimens; some colonies with only a few scattered calyces along one flat side, or with no trace at all of a third edge; colonies tall and bushy when fully developed: *Pterogorgia anceps* (Pallas)

2b. Branches 7–10+ mm. wide, always flat, never more than 2 distinct margins bearing polyps; colonies broad, rather sparingly branched, tending to remain in one plane: *Pterogorgia guadalupensis* Duchassaing & Michelin



87 **Pterogorgia citrina** (Esper), 1792

(Fig. 91 d–f; Pl. IX fig. 5)

Gorgonia citrina ESPER 1792, *2*, p. 129, pl. 38. ("Es wurde diese Coralle aus America beygebracht, und nach jener Anzeige ist die Küste von Neuspanien der bestimmtere Aufenthalt.")
Pterogorgia citrina, DUCHASSAING & MICHELOTTI 1860, p. 30. (Antilles.)
Xiphigorgia citrina, KÜKENTHAL 1916, p. 498, figs. W–Y, pl. 23 fig. 5. (St. Thomas; Tortugas.)
Pterogorgia citrina, BAYER 1951, p. 97.

It is scarcely necessary to redescribe this common shallow-water gorgoniid. Drawings of the spicules (Fig. 91 d–f) and branches (Key 22, la) are given for comparison with those of the other two species. A photograph of the colony is given on Pl. IX fig. 5.

Material. From Dr. Hummelinck's collection, now in the U.S. National Museum: ARUBA, Pova Beach, cast ashore, 27.IV.1955, dry specimen (50737). CURAÇAO, Boca Grandi, cast ashore, sta. 1016A, 2.V.1930, dry fragments (50199). BONAIRE, 1948, spec. in alcohol (50198); Lac, sandy reef, 1.5 m., sta. 1068a, 1.X.1948, alc. spec. (50744). GRENADA, near St. George's, cast ashore, sta. 1392, 22.I.1955, dry spec. (50739). ST. EUSTATIUS, Gallows Bay, rocks, 2 m., sta. 1116B, 15.VII.1949, 6 dry spec. (50195); J. H. Stock, 11.II.1959, purple (51308; Amsterdam). ST. MARTIN, Simpson Bay, cast ashore, 27.V.1949, dry spec. (50197). ANGUILLA, North of Sandy Ground, rocky beach with sandy reef, 1–2 m., sta. 1142, 19.VI.1949, 6 dry spec. and fragments in alc. (50196, 50667).

In addition many other USNM specimens from various West Indian localities including FLORIDA, Palm Beach (49717), Florida Keys (4043), BAHAMAS (14372), JAMAICA, Hanover, Bull Bay (51368), GUADELOUPE (44054), Aruba (50200, received from the Leiden Museum), and MEXICO, Cozumel Island (51771).

Distribution. Bermuda; southern Florida and the Keys to Curaçao.

88 **Pterogorgia anceps** (Pallas), 1766

(Fig. 91 a–c; Pl. IX fig. 4, XXVI)

Gorgonia anceps PALLAS 1766, p. 183. (Mare Americanum.)
Gorgonia anceps, ESPER 1792, *2*, p. 38, pl. 7 ("Die südlichen Küsten von America, und besonders ... Cürassao.")
Pterogorgia anceps, EHRENBERG 1834, p. 369.
Xiphigorgia anceps, KÜKENTHAL 1916b, p. 493, figs. R–V, pl. 23 fig. 4. (Drunken Man Cay, Bai von Kingston, Jamaika.)
Pterogorgia anceps, BAYER 1951, p. 96.

This species is probably as widely known as *P. citrina*. It has much the same geographic range, excepting Bermuda, but inhabits a slightly lower zone. It is a larger species, whose branches come off at an acute angle suggestive of dichotomy. The terminal twigs are always longer, wider, and flatter than those of *P. citrina*. In

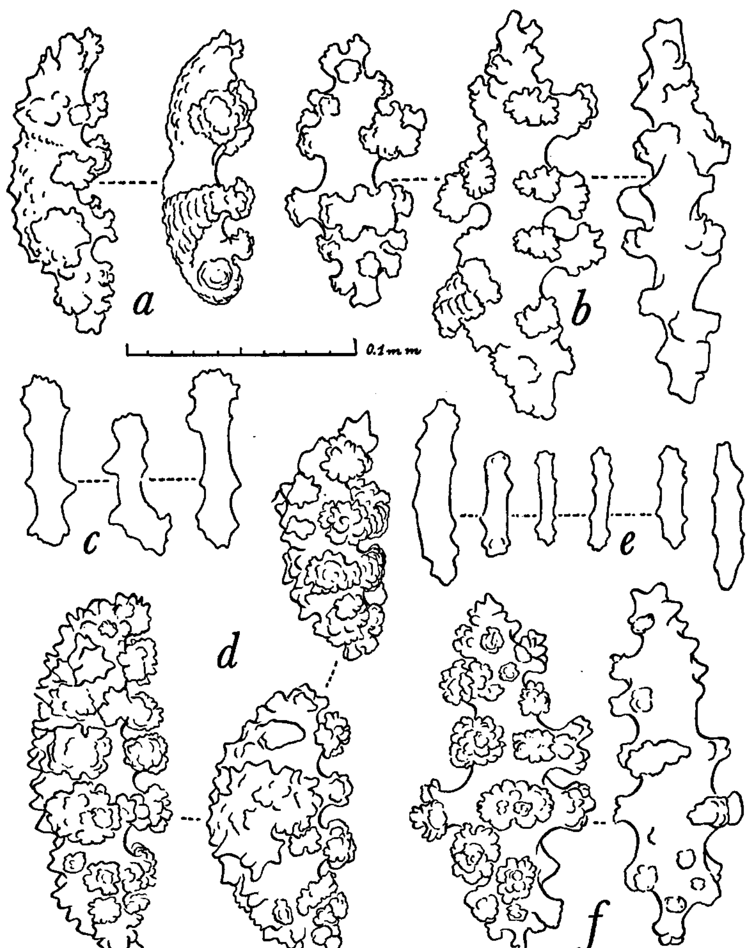


FIGURE 91. *Pterogorgia anceps* (Pallas), spicules of a specimen from Florida (USNM 8855): *a*, scaphoids; *b*, spindles; *c*, anthocodial rods. *Pterogorgia citrina* (Esper), spicules of a specimen from St. Eustatius (50195): *d*, scaphoids; *e*, anthocodial rods; *f*, spindles. (All figures drawn to the same scale.)

the lower parts of the colony there is a strong tendency toward three-flanged branches which is characteristic. Rarely, both *P. citrina* and *P. guadalupensis* may have a few polyps along the flat side of the lower branches, but they never occur so regularly and abundantly as to form a third continuous flange. *P. anceps* ordinarily is brownish purple in color, sometimes olive green or gray, rarely dull yellow. Spicules are illustrated on Fig. 91 a–c, and the complete colony on Pl. IX fig. 4 and XXVI.

Material. A number of USNM specimens, mostly from localities around FLORIDA, Palm Beach (49720), Florida Keys to Dry TORTUGAS (49756, 50369, 50616, 50666), and Sarasota on the Gulf coast (50057); also specimens from the BAHAMAS (50558), CUBA (50701), JAMAICA, Yallahs Point (51407), GRAND CAYMAN (51408, 51409), and MEXICO, Mujeres Hbr., Quintana Roo (51759–51762), Cozumel Isl. (51770), Bahia de la Ascencion, Quintana Roo (51763).

Distribution. Southern Florida to Curaçao; apparently absent from Bermuda.

89 **Pterogorgia guadalupensis** Duchassaing & Michelin, 1846

(Fig. 92; Pl. IX fig. 6)

Pterogorgia guadalupensis DUCHASSAING & MICHELIN 1846, p. 218.
Xiphigorgia guadalupensis, DUCHASSAING & MICHELOTTI 1860, p. 33, pl. 4 fig. 3. (Guadeloupe.)
Pterogorgia guadalupensis, BAYER 1951, p. 97. (Gulf of Mexico.)

An examination of the spicules of this species reveals that they are little different from those of *P. anceps* and *P. citrina*. They include a somewhat higher proportion of branching forms than is usual in the other species, and their sculpture is very coarse (Fig. 92). The specimen collected by Dr. HUMMELINCK in Curaçao has larger tentacular rods (up to 0.1 mm. long) than has *P. anceps*, but those of the specimen from Florida and of another from Curaçao measure 0.08 mm., rarely 0.09 mm.

The wide, flat branches, over 7 mm. across in the terminal regions and 10 mm. or more toward the base, are highly distinctive. All the colonies that I have seen show an inclination to branch in one plane, thus producing a flabellate form (Pl. 9 fig. 6), whereas *P. anceps* is typically quite bushy, branching in all directions.

Material. From Dr. Hummelinck's collection: ARUBA, J. G. v. d. Bergh coll., 1955, dry spec. (USNM 51311). CURAÇAO, received from the Curaçao

Museum, dry spec. (USNM 50315); Boca Santoe Pretoe, rocky beach, about 1 m., sta. 1022, 12.III.1949, several branches in alcohol (USNM 50201).

In addition, the specimens reported by Bayer, 1951 (p. 97), which were collected 4 miles S.W. by W. of Smith Shoal Light, FLORIDA, 24°41′ North, 81°58′ West, in 7¹/₄ fathoms, by J. Q. Tierney, University of Miami Marine Laboratory Gulf Exp., 29.IX.1948 (USNM 44233).

Distribution. Florida Keys to Curaçao.

Family ELLISELLIDAE Gray, 1859

Gorgonellidae DEICHMANN 1936, p. 202.

Diagnosis. Holaxonians branching mostly in one plane, free or anastomosing, or unbranched. Calyces in biserial single or multiple rows; always with a naked tract along the main longitudinal

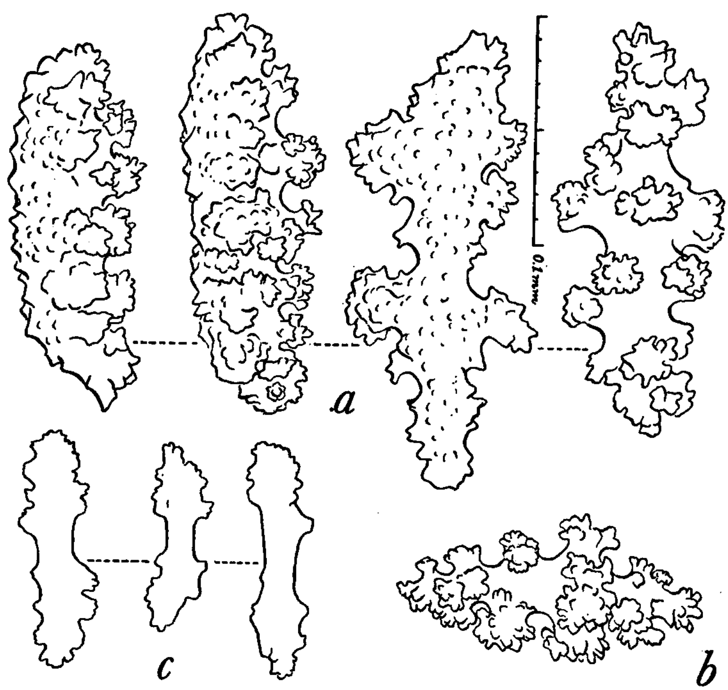


FIGURE 92. *Pterogorgia guadalupensis* Duchassaing & Michelin; spicules of a specimen from Curaçao (USNM 50201): *a*, scaphoids and irregular spindles of outer rind; *b*, spindle of inner rind; *c*, anthocodial rods. (All spicules drawn to the same scale.)

stem canals, of which there are usually two, sometimes three. Cortical sclerites characteristically as small double clubs, 0.05–0.1 mm. long, in some genera becoming more elongate in the calycular walls, where they may reach 0.2 mm. Axis heavily calcified in a radial pattern, the core calcareous and not chambered.

Remarks. This family is unmistakably characterized by the distinctive dumbbell-shaped or double head spicules and the strongly calcified axis with radial structure present in all species.

In the West Indies, there are about a dozen species inhabiting depths ranging from 25 to about 450 fathoms; they have been described and figured in detail by DEICHMANN. Keys to all the genera are given by KÜKENTHAL (1919, 1924), TOEPLITZ (1929), and DEICHMANN (1936).

A key to the West Indian genera is presented below, along with the description of a new species of *Nicella* from the Caribbean Sea.

KEY 23

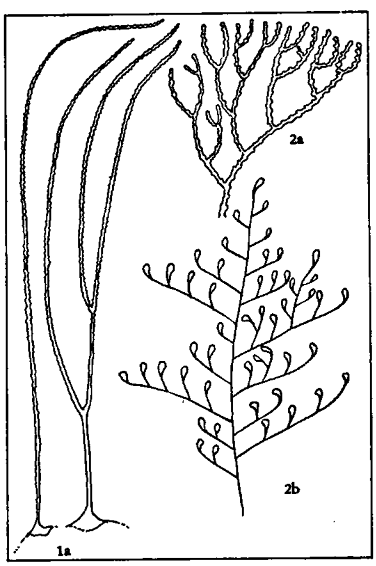
ILLUSTRATED KEY TO THE WEST INDIAN GENERA OF ELLISELLIDAE

1a. Colonies unbranched or with a few long, slender, whiplike branches: Genus *Ellisella*

1b. Colonies with numerous branches mostly in one plane, not long and whiplike: 2

2a. Branching lateral or dichotomous; sympodial: Genus *Nicella*

2b. Primary branching lateral, terminal branching pinnate; monopodial; Genus *Riisea*



Genus **Ellisella** Gray, 1858

Ellisella GRAY 1858, p. 287. (Type species, *Gorgonia elongata* PALLAS 1766, by subsequent designation: NUTTING 1910, p. 31.)
Scirpearia EHRENBERG 1834, p. 288.
not 'Scirpéaires' CUVIER 1817, *4*, p. 85. [*Scirpearia* in several later editions.]
Scirpearia, DEICHMANN 1936, p. 206.

Diagnosis. Whiplike or sparsely branched ellisellids with polyps biserial or in bilateral tracts. Rind with double spheres 0.05–0.1 mm. in length; calycular walls with spindles or double spindles up to about 0.2 mm. in length.

Distribution. Western Atlantic: Bermuda, Florida, Gulf of Mexico, Caribbean and West Indies. Eastern Atlantic: Azores to South Africa. Red Sea, Indian Ocean, East Indies, eastward in the warmer parts of the Pacific to the Gulf of California (new records, to be reported elsewhere).

Ellisella elongata and *E. barbadensis* occur from the northern shore of the Gulf of Mexico and southern Florida to the vicinity of the mouth of the Amazon River, Brazil, the former at depths from 15 to 120 fathoms and the latter from 11 to 262 fathoms.

Remarks. The differences of spiculation employed in the discrimination of species in this genus are exceedingly subtle and difficult both to interpret and to express in words and simple drawings. The typical size range of the cortical spicules, the relative sizes of cortical and calicular spicules, and the arrangement of tubercles on the dumb-bell shaped cortical sclerites all must be taken into consideration. The size and, to a lesser extent, the form of the pharyngeal sclerites seems to differ among the various species and should be investigated more thoroughly. Due to their small size and the need for careful dissection to locate them, they have not been described for most species and their variability is not known.

Because of its uniformity, the colonial form is of scant importance in the recognition of species, although branching, when it occurs, appreciably narrows the field that must be searched. The development of calyces is also a character of limited value, because in a single colony the polyps in the upper parts may produce tall, cylindrical verrucae but retract fully toward the base; however, species that usually have tall, rigid verrucae almost always show some indication of them. Color is consistent in some species but not in others and is therefore unreliable.

Large species of Ellisellidae, such as *Ellisella barbadensis* and *E. elongata*, require a rocky substrate for attachment. Where conditions are suitable, they may grow in dense stands at depths from a few feet below low tide down to 10 or 20 fathoms. Smaller species may inhabit sandy or muddy bottoms, where they attach to any small pebbles or shells that may be present, or even lie prone and grow quite free of any attachment.

Six valid species are described from the western part of the Atlantic under the generic name *Scirpearia* by DEICHMANN (1936). Two of these are found in shallow water in the West Indian region, where they can be dredged with limited equipment or collected by diving. These two species that extend upward into shallow water are described as representatives of the genus. *Ellisella atlantica*, *E. funiculina*, and *E. grandis* also occur at moderate depths (BAYER 1958a, p. 386); at present, *E. grandiflora* Deichmann is known only from 191–218 fathoms.

90 **Ellisella barbadensis** (Duchassaing & Michelotti)

(Fig. 93)

Juncella barbadensis DUCHASSAING & MICHELOTTI 1864, p. 22, pl. 5 figs. 5–6. (Barbados; Guadeloupe.)
not *Juncella barbadensis*, WRIGHT & STUDER 1889, p. 159.
Scirpearia rigida typica Toeplitz in KÜKENTHAL 1919, p. 859. (No locality.)
Scirpearia rigida var. *tenuis* Toeplitz in KÜKENTHAL 1919, p. 859. (No locality.)
Scirpearia rigida, TOEPLITZ 1929, p. 297, fig. 11, pl. 6 fig. 5 (Barbados, 100 fms.)
Scirpearia rigida, var. *tenuis*, TOEPLITZ 1929, p. 299, fig. 12, pl. 6 fig. 5a. (Barbados, 183 meters.)
?*Scirpearia flagellum*, TOEPLITZ 1929, p. 308, fig. 16. (Barbados, 55 meters.)
Scirpearia barbadensis, DEICHMANN 1936, p. 208, pl. 24 figs. 1–19. (Havana; St. Croix; Grenada; Barbados; 92–262 fms.)
Ellisella barbadensis, BAYER 1958a, p. 386, fig. 4b. (South of Mobile, Alabama, 41–42 fms.)
Ellisella barbadensis, BAYER 1959, p. 21, fig. 9. (Surinam; Brazil; 75–110 fms.)

Diagnosis. Flagelliform colonies reaching a large size. Calyces upturned, prominent; biserial or in multiple lateral bands. Spicules of outer cortex predominantly dumb-bell forms in the shape of double heads, reaching a length of 0.06 mm.; capstans infrequent, chiefly localized in the axial sheath, where they reach a length of 0.07–0.08 mm. Spicules of the calyces including many double spindles up to 0.11 mm. in length. Color of colony (dry) white to brick red.

Description. The specimen from which the accompanying illustrations were made is an exceptionally large one collected by diving off the south east coast of Florida. The colony was more than 6 feet in length, with a diameter of about 8 mm. near the base.

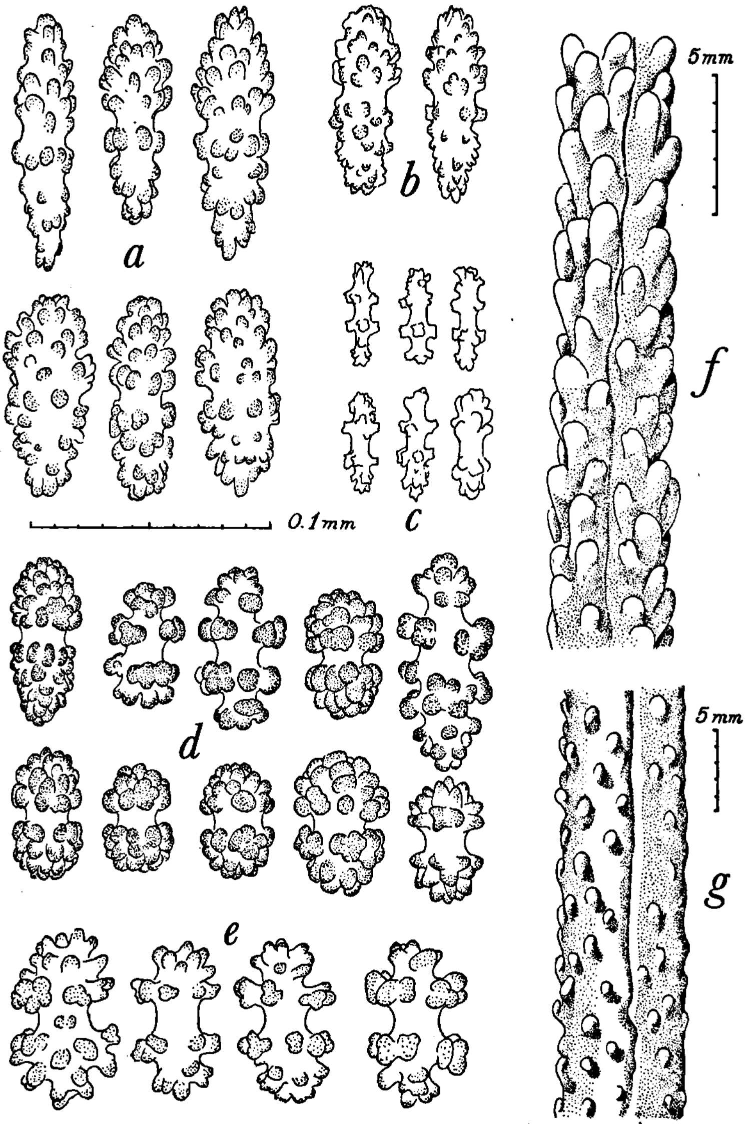


FIGURE 93. *Ellisella barbadensis* (Duchassaing & Michelotti): a specimen from Port Everglades, Florida (UMML 7-181; also USNM 51342). *a*, pale yellow, flattened calycular rods; *b*, practically colorless, flattened tentacular rods; *c*, colorless pharyngeal rodlets; *d*, deep amber-colored double-head (predominant) and capstan types of dumb-bells from outer cortex; *e*, more or less flattened, pale yellow capstans from axial sheath; *f*, part of the colony within about 1 foot of apex; *g*, part of the colony close to the base. (All spicules uniformly enlarged according to 0.1 mm scale; enlargement of *f* and *g* indicated by individual 5 mm. scales.)

The extreme tip is not preserved, but the uppermost part observed has a diameter of about 3.5 mm. (exclusive of calyces) and carries the polyps in two bilateral tracts of 3–4 rows, separated by two longitudinal grooves that mark the position of the main stem canals (Fig. 93 f). The calyces are prominent and upturned, in the lower part of the colony appressed and scale-like (Fig. 93 g). In the type specimen, the polyps were originally described and figured as being biserial, but DEICHMANN (1936, p. 208) indicates that the species is of extremely variable external form, and mentions specimens with as many as three rows of polyps in the lateral tracts.

The spicules of the present specimen agree in size and form with those described by DEICHMANN (1936, p. 208). The predominant form in the outer cortex is the double head with regular, close-set tubercles, the plump ones mostly 0.05–0.06 mm. long; the slender ones up to 0.07 mm. (Fig. 93 d). A few spicules of the capstan type, with tubercles arranged in two belts and terminal clusters, are present in the outer cortex, but are found mainly in the axial sheath, where they are distinctly flattened and up to 0.08 mm. in length (Fig. 93 e). The special sclerites of the calyces are elongated, flattened double spindles up to 0.12 mm. in length (Fig. 93 a); similar but smaller bodies occur in the tentacles (Fig. 93 b). The tops of the tubercles are granulated, most conspicuously in the double heads of the outer cortex, more weakly in those of the calyces, tentacles and axial sheath. The pharynx contains rodlets about 0.04 mm. long, with two belts of warts, and a few that resemble the cortical heads on a miniature scale (Fig. 93 c).

In this specimen, the spicules of the outer cortex are of a deep amber color, those of the axial sheath and calyces are pale yellow, and those of the tentacles and pharynx colorless or nearly so. When alive, the colony was bright vermilion red in color; dry, it is dull brick red that brightens to indian red upon moistening with alcohol. The color of the preserved specimen is due to the concentration of colored spicules, but the vermilion hue of the living animal must have been due, at least in part, to unstable cellular pigments.

Five additional specimens, from Miami, Florida, are of closely similar external form, varying somewhat in the size of the calyces and in the size of the spicules, which tend to be smaller than those of the colony from Port Everglades.

Material. Two miles southeast of Port Everglades, FLORIDA, off jetties, depth 65+ feet, collected by Eugene Shinn, 15.VI.1958; tip and lower part of a large colony more than six feet long (USNM 51342). Off sea buoy at entrance of channel to Miami harbor, 115 feet, Eugene Shinn, 1.III.1959; one complete colony 71.5 inches in length, and the uppermost parts of four others measuring 73 inches (broken at both ends), 78.75 inches (broken at both ends), 84.75 inches (cut off at base, attachment missing), and 89.75 inches (cut off at base, attachment missing) (USNM 51343). (Parts of colonies preserved in University of Miami Marine Laboratory reference collection UMML 7-181.) For the privilege of examining these specimens I am indebted to the collector, and to Dr. Harding B. Owre. Also single USNM specimens from off St. Augustine, Florida, 25 fms. (50395); off Havana, CUBA, 213 fms. (10272); south of Mobile, ALABAMA, 41–42 fms (50610); SURINAM, 75–80 fms (51294); and from off the mouth of the Amazon River, BRAZIL, 110 fms. (50904).

Distribution. East coast of Florida and northern shore of the Gulf of Mexico southward through the Antilles to Brazil, at least as far as the mouth of the Amazon River; in depths from 11 to 262 fathoms.

91 **Ellisella elongata** (Pallas)

(Fig. 94)

Gorgonia elongata PALLAS 1766, p. 179. (Oceanus Atlanticus: ex Sinu Gaditano; Curassoa.)

Gorgonia elongata, ESPER 1806, *2*, p. 35, pl. 55. (Trankenbar.)

Ellisella elongata, GRAY 1857, p. 287. (No locality.)

Ellisella elongata, TOEPLITZ 1929, p. 285. (No locality.)

Scirpearia cylindrica TOEPLITZ 1929, p. 306, fig. 15, pl. 7 fig. 7. (Barbados, 40–50 meters.)

Scirpearia elongata, DEICHMANN 1936, p. 212, pl. 24 figs. 46–48. (Montserrat; Barbados; Honduras; 41–120 fms.)

Ellisella elongata, BAYER 1958a, p. 386, fig. 4e–f. (Gulf of Mexico: off Fort Walton Florida, 13–14 fms.; off Cape San Blas, Florida, 60 fms.)

Ellisella elongata, BAYER 1959, p. 23, figs. 10–12. (Surinam; French Guiana; Brazil; 15–110 fms.)

Diagnosis. Colonies large, branched, with a few long, slender, whiplike but rather stiff branches; young colonies occasionally flagelliform. Calyces hemispherical, low, apertures directed upward; in 2–3 longitudinal tracts composed of 2–5 oblique rows of polyps. Spicules of outer cortex containing many dumb-bells of the capstan type, up to 0.075 mm. long, and smaller double heads mostly 0.05–0.06 mm. Axial sheath containing flattened capstans with weaker tuberculation. Spicules of calyces are short, blunt rods up to 0.09 mm. long. Color (dry) white to brick red, commonly brick red with white calyces.

Description. The specimen from which the accompanying figures were made is a large, branched colony more than a meter in height, with about 25 long, stiff, nearly straight terminal branches. Ramification begins near the base is and dichotomous. The main stem has a diameter of 6 mm. and the terminal branches about 2 mm. (exclusive of calyces). On some branches there are two longitudinal tracts of polyps, on others three. Near the branch tips these tracts are composed of oblique rows of two polyps, gradually increasing in number based up to five; on the largest branches and main trunk the oblique rows of polyps become quite irregular and indistinct.

The spicules of this large example agree in the main with the description and figures of West Indian material given by DEICHMANN (1936). In the outer cortex, dumb-bells of the capstan type (i.e., with two transverse girdles of tubercles and terminal clusters) 0.06–0.075 mm. long predominate but there also are double heads of smaller size, up to 0.05–0.06 mm. (Fig. 94 d). The axial sheath contains flattened capstans up to 0.085 mm. long (Fig. 94 e). The special sclerites of the calicles are blunt double spindles and double rods reaching a length of 0.09 mm. (Fig. 94 a). Similar but smaller spicules are found in the tentacles (Fig. 94 b). As usual, the tubercles of these spicules are granulated, strongly in those of the cortex, faintly in those of the axial sheath and tentacles. The pharynx contains belted rods of remarkably large size – up to 0.085 mm. – longer than the cortical dumb-bells (Fig. 94 c).

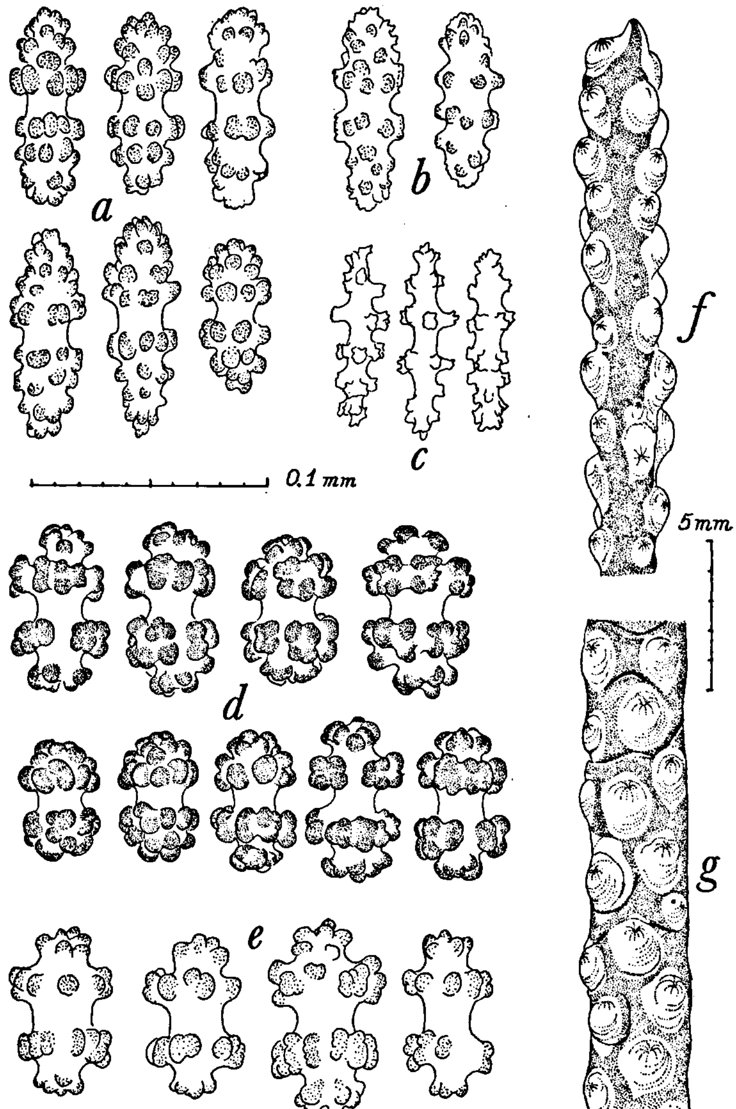


FIGURE 94. *Ellisella elongata* (Pallas): a specimen from off Cape San Blas, Florida (USNM 50415). *a*, colorless, flattened calycular rods; *b*, colorless, flattened tentacular rods; *c*, colorless pharyngeal rods; *d*, amber-colored capstan (predominant) and double-head types of dumb-bells from outer cortex; *e*, more or less flattened, pale yellow capstans from axial sheath; *f*, branch tip; *g*, part of a large branch near its origin. (All spicules uniformly enlarged according to 0.1 mm. scale; enlargement of *f* and *g* indicated by 5 mm. scale.)

In this bicolored specimen, which has white calyces and light brick-red rind ("ferruginous" of RIDGWAY), the spicules of the outer cortex are clear amber yellow in color, those of the axial sheath pale yellow. All spicules of the calyces, tentacles and pharynx are colorless. Other specimens range in color from white to uniform brick-red; the colony illustrated by ESPER is a uniform light red.

Material. A large dry colony roughly 4 feet tall, with about 25 long, stiff endbranches produced dichotomously, dredged off Cape San Blas, FLORIDA, in 60 fms. (Bayer 1958a, fig. 4f) (USNM 50415). Also three other USNM specimens from the Gulf of Mexico, off Fort Walton, Florida, 14–15 fms. (50066; Bayer 1958a, fig. 4e); south of Pensacola, Florida, 30 fms. (50684); and south of Galveston, TEXAS, 47–50 fms. (50900). Specimens from the coast of SURINAM, 75–80 fms. (51295), FRENCH GUIANA, 15 and 19 fms. (50901, 50903) and from BRAZIL, 38 and 110 fms. (50899, 50902; Bayer 1959, p. 23).

Distribution. Northern part of the Gulf of Mexico southward through the Antilles and Caribbean to Brazil, at least as far south as the mouth of the Amazon River; in depths from 14 to 120 fathoms.

Remarks. The 'capstan' form of the cortical spicules differentiates *Ellisella elongata* from *E. barbadensis* and *E. atlantica*, in both of which the 'double head' type of dumb-bell predominates. The branching colonial form further distinguishes it from all other western Atlantic species of *Ellisella* except *E. grandis*, which seems consistently to have slightly larger calicular rods.

Genus **Nicella** Gray, 1870

Nicella GRAY 1870a, p. 40. (Type species, *Nicella Mauritiana* Gray = *Scirpearia dichotoma* Gray, by monotypy.)
Nicella, DEICHMANN 1936, p. 216.

Diagnosis. Ellisellids branched sympodially in one plane, in a dichotomous manner; occasionally lateral. Spicules of rind as blunt double heads, those of the thin axial sheath layer somewhat more flattened and less closely sculptured than those of the outer layer; spicules of the calycular walls as spindles or double spindles about twice as long as the double heads of the rind.

Remarks. Four species of *Nicella* are reported in the West Indies by DEICHMANN (1936) and TOEPLITZ (1929). A fifth, from moderate depths in the Caribbean Sea, is reported below.

92 **Nicella schmitti** spec. nov.

(Fig. 95 a–e)

Diagnosis. Branching unilaterally dichotomous, branches arising at about 45°. Calyces biserial, cylindrical, 1.0 mm. tall, inclined upward. Surface of rind verrucose. Outer cortical spicules as double heads 0.05–0.07 mm. long; axial sheath spicules the same size but flattened and less closely sculptured; spicules of calycular walls as double spindles 0.09–0.1 mm. long. Color of colonies brick red, in alcohol.

Description. Two identical branches from the same dredge haul, and probably from the same specimen, represent the species. The branching is dichotomous in a somewhat unilateral manner, the branchlets almost straight and quite stiff (Fig. 95 a). The diameter of the branches is slightly over 1.0 mm. The calyces are almost cylindrical, about 1.0 mm. tall, and inclined upward; they occur on the two sides of the branches, the individuals alternatingly inclined toward front and back. The surface of the rind is covered with conspicuous papillae and has a distinctly rough appearance. The outer layer of rind contains double heads of the usual type, 0.05–0.07 mm. long (Fig. 95 b); the inner rind, or axial sheath, is extremely thin and contains spicules of the same size but somewhat flattened and less strongly sculptured (Fig. 95 c); the calycular walls contain double spindles about 0.1 mm. long, with a distinct median waist (Fig. 95 d); in the tentacles are small rods with 2–4 whorls of prominent projections (Fig. 95 e). The color of the colony in alcohol is uniformly brick red.

Material. Two branches, from off Colon, PANAMA, 9°32′20″ North, 79°54′45″ West, 34 fms., *Albatross*, sta. 2147, 2.IV.1884 (holotype USNM 7587, paratype 7611).

Distribution. Known only from the type locality.

Remarks. This is the first really distinct species of *Nicella* to be reported from the West Indian region since *N. guadalupensis* was described by DUCHASSAING & MICHELOTTI (1860), the other three known forms being either close to or identical with that species. *Nicella schmitti* differs strikingly in external appearance, with its nearly straight branches, prominent cylindrical calyces, and con-

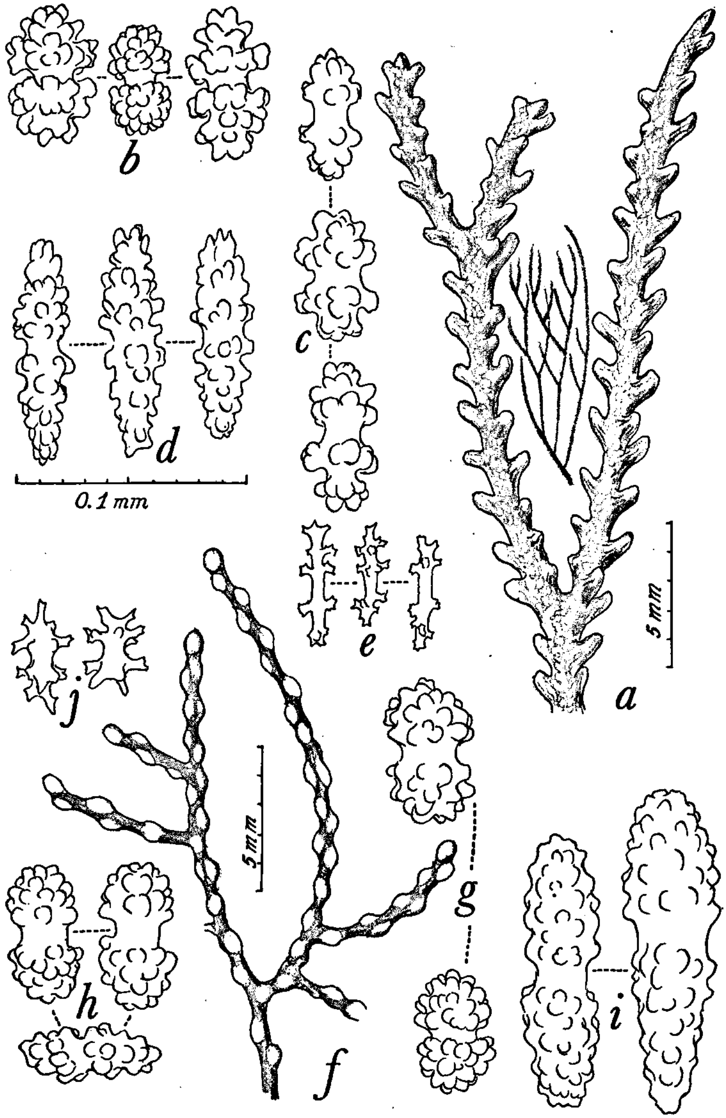


FIGURE 95. *Nicella schmitti* spec. nov., the holotype (USNM 7587): *a*, terminal branches and sketch of branching pattern; *b*, spicules of outer rind; *c*, spicules of inner rind; *d*, spicules of calyces; *e*, spicules of tentacles. *Nicella guadalupensis* (Duchassaing & Michelotti), a specimen from Barbados (49514): *f*, terminal branches; *g*, spicules of outer rind; *h*, spicules of inner rind; *i*, spicules of calyces; *j*, spicules of tentacles. (Enlargement of *a* and *f* indicated by respective scales (but sketch of branching at *a* is reduced); all spicules drawn to the scale indicated at *d*.)

spicuously verrucose rind. The discrepancy in size between the cortical double heads and the calycular spindles is not so pronounced as in *N. guadalupensis*, *N. obesa*, and related species, but much greater than in the species of *Verrucella*.

Spicules of *Nicella guadalupensis* were not figured by DEICHMANN, so a few are shown here for comparison with those of *N. schmitti*.

93 **Nicella guadalupensis** (Duchassaing & Michelotti), 1860

(Fig. 95 f–j)

Verrucella guadalupensis DUCHASSAING & MICHELOTTI 1860, p. 33, pl. 4 figs. 5–6. (Guadeloupe.)
Nicella guadalupensis, DEICHMANN 1936, p. 218, pl. 36. (Dry Tortugas to Barbados.)

Diagnosis. Branching more or less unilaterally dichotomous, branches arising at 80°–90° (Fig. 95 f). Calyces hemispherical or verruciform. Surface of rind smooth. Outer cortical spicules as double heads 0.06 to 0.07 mm. long (Fig. 95 g); those of the axial sheath similar in size and form but flattened (Fig. 95 h); calycular spindles 0.1–0.15 mm. long (Fig. 95 i). Color of rind brick red or dark orange; calyces white or yellow.

Material. The specimen illustrated, a fragmentary colony from BARBADOS, University of Iowa Barbados-Antigua Exped. sta. 65, 1918 (USNM 49514). Also, a number of colonies from off CUBA (7091, 7617, 49492), PUERTO RICO (50949), VIRGIN ISLANDS (43789), ANTIGUA (49424), Barbados (44119, 44122, 44134–44136, 49473, 49487, 49511, 49516, 50579, 51277), YUCATAN (43052, 49437), HONDURAS (50896–50898), and 'West Indies' (43110).

Distribution. Florida Keys to Barbados, 75–170 fathoms.

Remarks. I have dissected apart the outer and inner cortical layers with great care and find that the spicules are the same in both except for a greater degree of flattening in those of the inner layer. The long double spindles occur only in the calycular walls, not in the inner layer of cortex as has been reported.

Genus **Riisea** Duchassaing & Michelotti, 1860

Rusea DUCHASSAING & MICHELOTTI 1860, p. 18. (Type species, *Rusea paniculata* Duchassaing & Michelotti, by monotypy.) [Erroneous spelling.]
Riisea, DUCHASSAING & MICHELOTTI 1864, p. 14. [Corrected spelling.]
Riisea, DEICHMANN 1936, p. 224.
Riisea, BAYER 1956, p. 215.

Diagnosis. Monopodial, pinnately branched ellisellids with spiculation as in *Nicella*. Calyces clavate, usually terminal on short, slender twigs.

Remarks. The ellisellid affinities of *Riisea* were recognized by KÖLLIKER (1865), but subsequent workers removed the genus to the family Chrysogorgiidae. This arrangement was maintained by KÜKENTHAL and DEICHMANN, although the latter author pointed out the doubt entertained by VERRILL. On the basis of the axis structure, which resembles that of *Nicella* and the other ellisellid genera, *Riisea* has recently been returned to the family Ellisellidae.

Family **PRIMNOIDAE** Gray, 1857

Diagnosis. Arborescent gorgonaceans with a strongly calcified but unjointed axis whose concentric layers are distinctly or strongly undulated in conformity with the longitudinally grooved surface. No radial orientation of calcareous material. Polyps large, 1–5 mm. in height, usually bent inward toward the axis, set in whorls, pairs or singly. Polyp sclerites in the form of scales, usually in eight distinct longitudinal rows, the uppermost scale of each row folding inward to form a sector of the operculum; scales show a cruciform pattern when viewed in the dark field of polarizing microscope.

Remarks. The Primnoidae is a large and important family, most of whose species live at considerable depths. In the tropical western Atlantic, however, some species may be found in depths of less than 100 fathoms, and in the Gulf of Mexico *Callogorgia verticillata* has been taken in water as shallow as 20 fathoms.

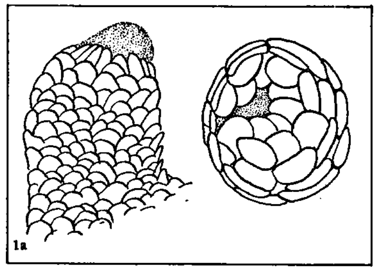
The West Indian primnoids have been thoroughly treated by DEICHMANN (1936), and the large papers of KÜKENTHAL (1919 and 1924) consider the family on a world-wide basis. Detailed treatment in the present work would therefore be superfluous, and coverage is limited to an illustrated key to all of the genera and a few remarks concerning the one species that is known to venture into the bathymetric region under consideration.

Of the thirteen genera herein recognized, seven occur in the West Indian area. DEICHMANN (1936) reports thirteen species and one variety inhabiting depths from 30 to 1742 fathoms.

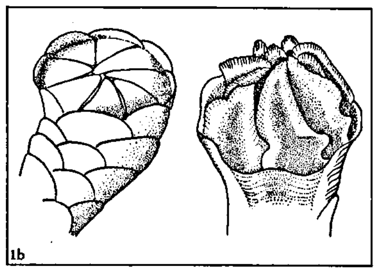
KEY 24

ILLUSTRATED KEY TO THE GENERA OF PRIMNOIDAE

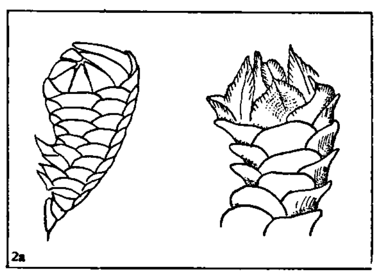
1a. Polyps with scales irregularly arranged; distal scales not differentiated into special marginal and opercular scales: Genus *Primnoeides*



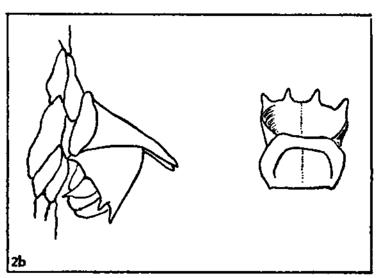
1b. Polyps with scales regularly arranged in longitudinal rows; distalmost scales folding as an operculum over the retracted tentacles: 2



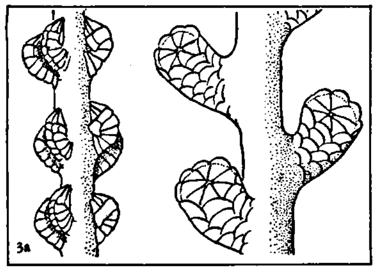
2a. Polyp body protected by numerous scales: 3



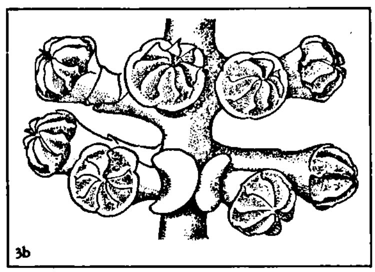
2b. Polyp body encased in a cuirass made up of two or three pairs of large scales that partially or completely surround it and may be fused together ringwise: 11



3a. Polyps inclined upward at angles of 45° or less and often curved inward toward the axis: 4

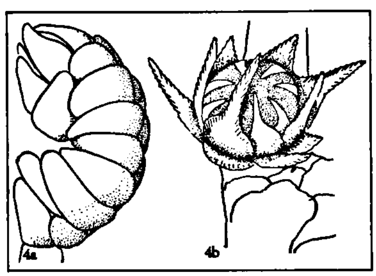


3b. Polyps standing at about 90° with the axis, never curved inward: 9



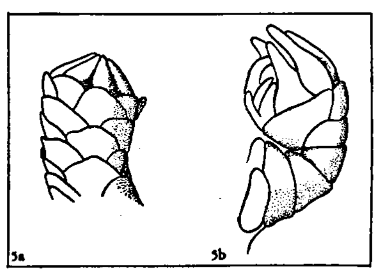
4a. The marginal scales cannot be folded inward over the operculars: 5

4b. The marginal scales can be folded over the operculars, which may be much reduced in size: 8



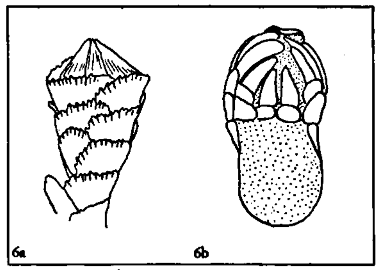
5a. Polyps with eight longitudinal rows of body scales: Genus *Plumarella*

5b. Polyps with fewer than eight longitudinal rows of body scales: 6

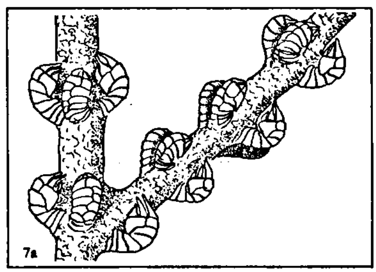


6a. Adaxial body scales about as large as the abaxial: Genus *Pterostenella*

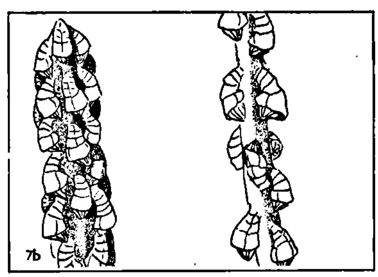
6b. Adaxial body scales reduced in size or completely missing, leaving adaxial surface of polyp almost naked: 7



7a. Polyps regularly arranged in pairs or whorls, usually facing upward: Genus *Callogorgia*

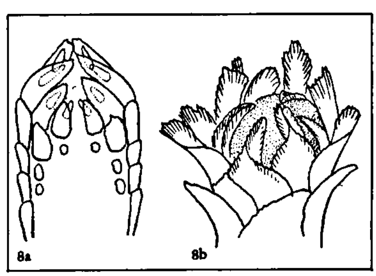


7b. Polyps irregularly arranged, not in whorls, usually facing downward: Genus *Primnoa*

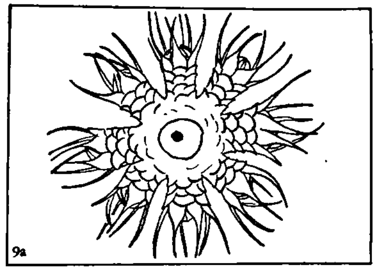


8a. Polyps in whorls, closely appressed to the stem; marginal scales covering operculars which often are reduced in size and completely hidden. Colonies unbranched, whiplike, or with a few long, slender branches produced dichotomously: Genus *Primnoella*

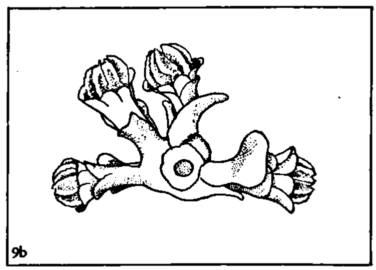
8b. Polyps singly, in pairs, or in whorls but not appressed to the stem; marginal scales not completely covering operculars, which are more or less functional. Colonies profusely branched, usually in the form of a bottle-brush, sometimes dichotomously or pinnately and in one plane: Genus *Thouarella*



9a. Polyps arranged in crowded whorls of eight or more; marginal scales with projecting spines. Colonies unbranched: Genus *Callozostron*

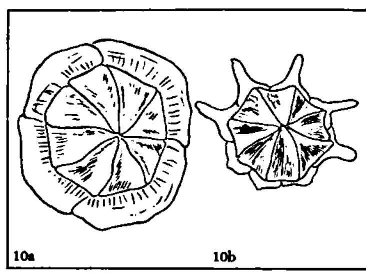


9b. Polyps arranged singly or in widely spaced whorls of five or fewer. Colonies profusely branched: 10



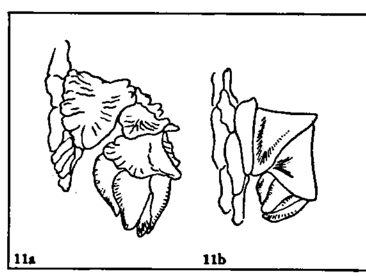
10a. Marginal scales four in number: Genus *Candidella*

10b. Marginal scales eight in number: Genus *Parastenella*

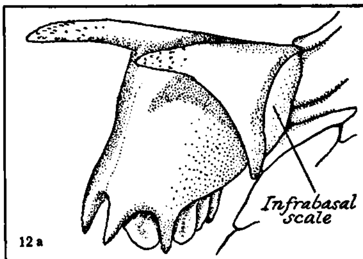


11a. Polyps with three (rarely four) pairs of large body scales: Genus *Narella*

11b. Polyps with two pairs of large body scales: 12

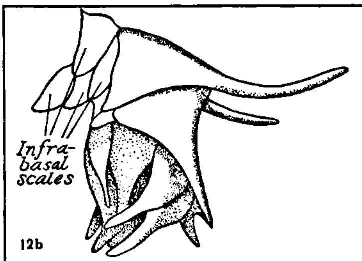


12a. One pair of small infrabasal scales between basal scales and stem scales; no adaxial buccal scales: Genus *Calyptrophora*



12a

12b. Several pairs of small infra-basal scales lie between basal body scales and scales of stem rind; vestigial adaxial buccal scales present: Genus *Arthrogorgia*



12b

Genus **Callogorgia** Gray, 1858

Callogorgia GRAY 1858, p. 286. (Type species, *Gorgonia verticillata* Pallas, by monotypy.)
Caligorgia, DEICHMANN 1936, p. 158.

Calligorgia and *Caligorgia* are quite inadmissible variant spellings; the latter was introduced by WRIGHT & STUDER in the 'Challenger' Report (1889) and so gained wide usage. It must be dropped.

Distribution. This genus has a virtually cosmopolitan distribution, although most of its species belong to the Indo-Pacific region. Two species occur in the West Indies, one of them also in the Mediterranean. One species has been described from the Antarctic and two from cold waters in the North Pacific.

Species of *Callogorgia* characteristically inhabit considerable depths, down to 2472 meters, but in the Gulf of Mexico, the common *Callogorgia verticillata* has been taken as shallow as 20 fathoms.

94 **Callogorgia verticillata** (Pallas), 1766

(Fig. 96)

Gorgonia verticillata PALLAS 1766, p. 177. (Mare Mediterraneum, Atlanticum.)
Caligorgia verticillata, DEICHMANN 1936, p. 159, pl. 25 figs. 5–9, pl. 26 fig. 6. (Cuba, Jamaica, and the Windward Islands.)

This species has been described by DEICHMANN, so it will suffice here only to give a figure and to note that *C. verticillata* has clavate polyps (Fig. 96 b) with strongly sculptured scales (Fig. 96 c) numbering 8–10 in each abaxial row and a low operculum composed of scales with several radial ridges but no terminal tooth (Fig. 96 d), whereas *C. gracilis* (Milne Edwards & Haime) has nearly cylindrical polyps with almost smooth scales numbering 4–7 in each abaxial row, and a tall, conical operculum composed of scales with a strong apical tooth. *C. gracilis* has not yet been found in water as shallow as has *C. verticillata*.

Material. One specimen from the CAMPECHE BANK, Gulf of Mexico, 21°17′ North, 91°18′ West, in 20 fms., *Oregon* sta. 1048, 13.V.1954 (USNM 50527). Also a number of USNM specimens from deeper water (100–250 fms.) off the FLORIDA Keys (44131, 44159, 44160, 44161), Cay Sal Bank (50185), the northern coast of CUBA (10104), and off SURINAM, east of Paramaribo, 75–80 fms. (51257).

Distribution. In the West Indian region, from the Florida Keys to Surinam; also the Mediterranean Sea and probably the eastern part of the Atlantic.

Family **CHRYSOGORGIIDAE** Verrill, 1883

Diagnosis. Holaxonia with axis heavily calcified, its core solid, not cross-chambered; layers concentric, smooth, rarely undulated (one genus); calcification not radial. Sclerites of rind and of polyps in the form of rods or needles, in many species modified into thin scales or plates, with granular or aculeate ornamentation; calcification concentric, no cruciform pattern under polarized light. Basal disk calcareous, simple and adherent to solid objects, or root-like for securing the colony in mud.

Remarks. Inasmuch as this deep-water family has been thoroughly covered by DEICHMANN (1936), treatment here is limited to a key to the genera.

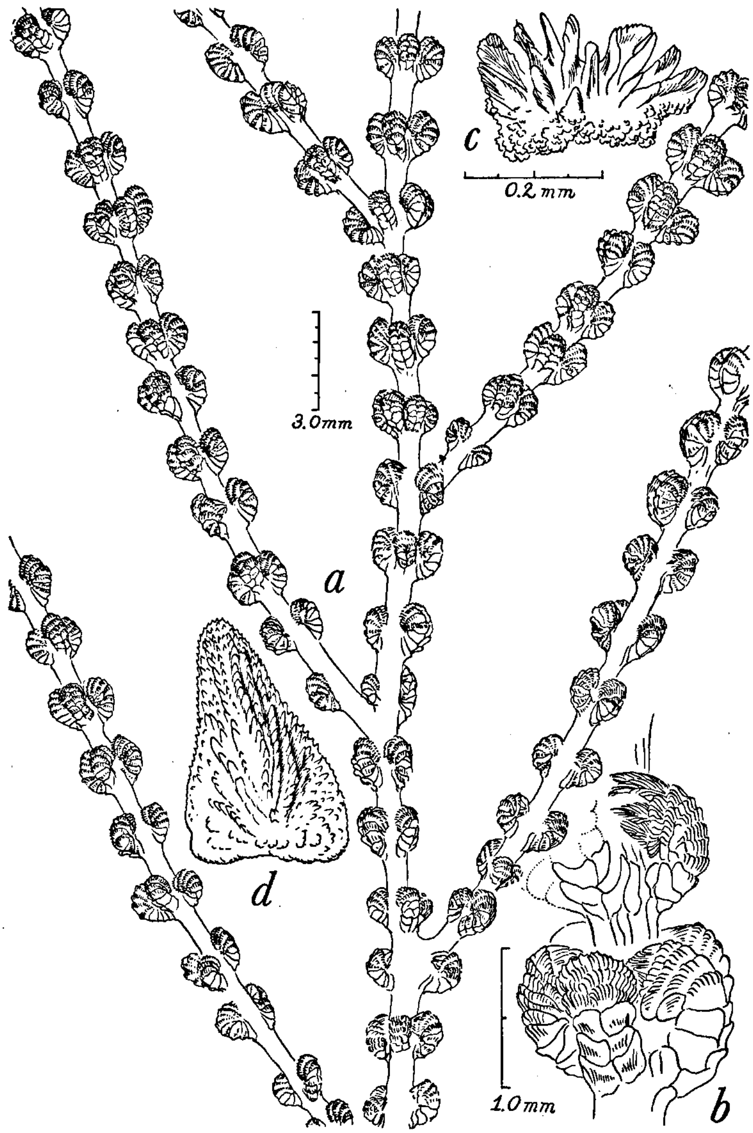


FIGURE 96. *Callogorgia verticillata* (Pallas); a specimen from the Florida Keys (USNM 44159): *a*, part of a branch (enlarged as indicated by 3.0 mm. scale); *b*, whorls of polyps (enlarged as indicated by 1.0 mm. scale); *c*, abaxial body scale (enlarged as indicated by 0.2 mm. scale); *d*, opercular scale (at same magnification as *c*.)

Key 25

Key to the genera of Chrysogorgiidae

1a. Polyps without an operculum of eight large plates: 2

1b. Polyps with an operculum of eight triangular plates: Genus *Chalcogorgia* Bayer

2a. Colonies unbranched: Genus *Radicipes* Stearns

2b. Colonies branched: 3

3a. Polyps closely crowded, sometimes in two rows: Genus *Trichogorgia* Hickson

3b. Polyps widely scattered, on all sides or uniserial: 4

4a. Branchlets dichotomizing several times: 5

4b. Branchlets simple, unilateral: 6

5a. Colonies sympodial, usually with a zigzag main trunk: Genus *Chrysogorgia* Duchassaing & Michelotti

5b. Colonies monopodial, with a long, straight main trunk: Genus *Metallogorgia* Versluys

6a. Branchlets arising from the outside of a main stem coiled in an upright spiral. Spicules as plates and spindles: Genus *Iridogorgia* Verrill

6b. Branchlets arising from one side of a straight main setm not spirally twisted. Spicules as irrgular bodies: Genus *Pleurogorgia* Versluys

In the West Indies the Family **ISIDIDAE** Lamouroux, 1812, occurs exclusively in deep water, and therefore is not considered here. See Deichmann 1936, p. 237.

Order **PENNATULACEA** Verrill, 1865

Diagnosis. Unbranched colonial octocorals consisting of a primary polyp that elongates to produce a barren proximal stalk, which anchors the colony in a soft substrate, and a polypiferous distal rachis from which secondary polyps arise. Gastric cavity of primary polyp divided into two primary and two secondary longitudinal canals by fleshy partitions at the center of which a more or less calcified horny axial rod usually is produced. Secondary polyps dimorphic. Spicules in the form of smooth, cylindrical or three-flanged rods or needles, rarely tuberculated; or small scales or plates.

Remarks. The order Pennatulacea is not conspicuously represented in the shallow waters of the West Indian region, and since its species are adapted for life on sandy or muddy bottoms they are not to be expected in the reef community. In the western Atlantic, two species of *Renilla* are found intertidally, and could occur in sandy areas associated with reefs. One species of *Virgularia* has been trawled at moderate depths in a number of localities along the Gulf and southeast coasts of the United States, and may be expected in favorable localities throughout the Caribbean area.

Since a complete treatment of the western Atlantic pennatulids is found in DEICHMANN's monograph of 1936, only a few species likely to be encountered in shallow water are mentioned here.

Suborder *SESSILIFLORAE* Kükenthal, 1915

Family **RENILLIDAE** Gray, 1860

Diagnosis. Pennatulacea with a slender stalk lacking an axial rod, and a broad, flat frond bearing dimorphic polyps on the upper surface only. Spicules in the form of three-flanged rods or needles.

Genus **Renilla** Lamarck, 1816

Renilla LAMARCK 1816, p. 428. (Type species, *Renilla americana* Lamarck = *Renilla reniformis* (Pallas), by monotypy.)
Renilla, DEICHMANN 1936, p. 257.

Diagnosis. As for the family.

Distribution. From Cape Hatteras to the Straits of Magellan, and from California to Chile; endemic amphi-American.

The species of the Atlantic coast of the southeastern United States is *Renilla reniformis* (Pallas), which also extends into the Antilles. *Renilla mülleri* Kölliker occurs along the Gulf and Caribbean coasts of the mainland south to Brazil. As far as I know, *R. reniformis* does not enter the Gulf of Mexico and *R. mülleri* does not occur outside of it to the northward.

95 **Renilla reniformis** (Pallas), 1766

Pennatula reniformis PALLAS 1766, p. 374. (Mare Americanum.)
Renilla reniformis forma *typica* DEICHMANN 1936, p. 259. (North and South Carolina; northern Florida.)

Diagnosis. Frond cordate, not conspicuously wider than long; stalk longer than the radius of the frond, projecting distinctly beyond the notch in which it is inserted. Spicules of stalk shorter than those of the frond. Color rose or pale purple. Some specimens with frond white or yellow and stalk deep purple.

Material. CURAÇAO: Westpunt Baai, in sand near rampart wall, 2.5 m., J. S. Zaneveld, 27.XII.1958, 2 specimens in alcohol (USNM 51276), one with pale violet frond and purple stalk, the other pale yellow with purple stalk; cast ashore, J. S. Zaneveld, 16.IX.1956, 2 spec. in alcohol (USNM 51275), one with pale violet frond and purple stalk, the other with yellow frond and purple stalk. (Both have the frond unusually broad and the stalk unusually short, almost as in *R. mülleri*, but this difference appears to be due in part to the state of contraction; the spicules are quite typical of *reniformis*.) Plaja Djerimi, sandy shore, 11.XII.1948 (USNM 50669). Santa Marta Baai, 7.XII.1958; Vaersen Baai, 25.XI.1958 and 6.I.1959 (USNM 51304); Piscadera Baai, 21.II.1959 (USNM 51303); all collected by J. H. Stock (Amsterdam). Caracas Baai (?), IV.1955, spec. in alc. (USNM 51274). ST. MARTIN: Little Bay, in sand, 1 m., J. H. Stock, 2.II.1959, purple (Amsterdam).

The collections of the U.S. National Museum contain a number of specimens from various localities on the North American coast, including NORTH CAROLINA (43256, 49594), SOUTH CAROLINA (43212, 43251, 50132), and FLORIDA (49723).

Distribution. Southeast coast of the United States from Cape Hatteras to Florida; Antilles; east coast of South America.

Remarks. Specimens from northern localities, especially the eastern coast of the United States, tend to be pale in color, whereas those from the South American coast are usually a much darker purple. The former are referred by DEICHMANN (1936) to forma *typica*, and the latter to forma *americana* Lamarck. These color forms seem to be inconsistent, since specimens from the Antilles may be either uniformly dark purple, or pale (yellowish or purplish white) with a deep purple stalk, and retention of names for them seems to serve no useful purpose.

96 **Renilla mülleri** Kölliker, 1872

(Fig. 97)

Renilla Mülleri Kölliker 1872, p. 106, pl. 20 figs. 172, 176. (Mazatlan; Desterro, Brazil.)
Renilla mülleri, Deichmann 1936, p. 258. (Gulf of Mexico; Venezuela; Brazil; Chile; west coast of Central America.)
Renilla mülleri, Bayer 1959, p. 31, fig. 14 (Surinam.)

Diagnosis. Frond reniform, broader than long; stalk short, usually less than the radius of the frond, not conspicuously projecting beyond the notch in which it is inserted. Spicules of the stalk about as long as those of the frond. Color white to deep purple.

Material. Several specimens from the Gulf of Mexico, between Apalachee Bay and the coast of Texas (USNM 49575, 49633, 49680, 49681, 49743, 49810). Five lots from Surinam, in 10–28 fathoms (USNM 50826–50830).

Distribution. Continental shore of the Gulf of Mexico and Caribbean south to Brazil; west coast of Central America to Chile.

Family **KOPHOBELEMNIDAE** Gray, 1860

Diagnosis. Bilateral seapens commonly of clavate form with tendency toward radial symmetry. Autozooids in more or less distinct ventral and lateral longitudinal rows, leaving a dorsal streak naked. Siphonozooids distributed between the autozooids everywhere on the rachis except along the dorsal streak. Axial rod well developed.

Remarks. This family comprises two genera, both of which are represented in the western Atlantic. *Kophobelemnon* Asbjörnsen, an inhabitant of cold or deep water from the Grand Banks south to the latitude of Virginia, in 215 to 2369 fathoms (mostly deeper than 500 fathoms), is characterized by three-flanged, twisted rods, often with tubercles and serrated edges; *Sclerobelemnon* Kölliker occurs in warm, shallow water in the Caribbean area where it

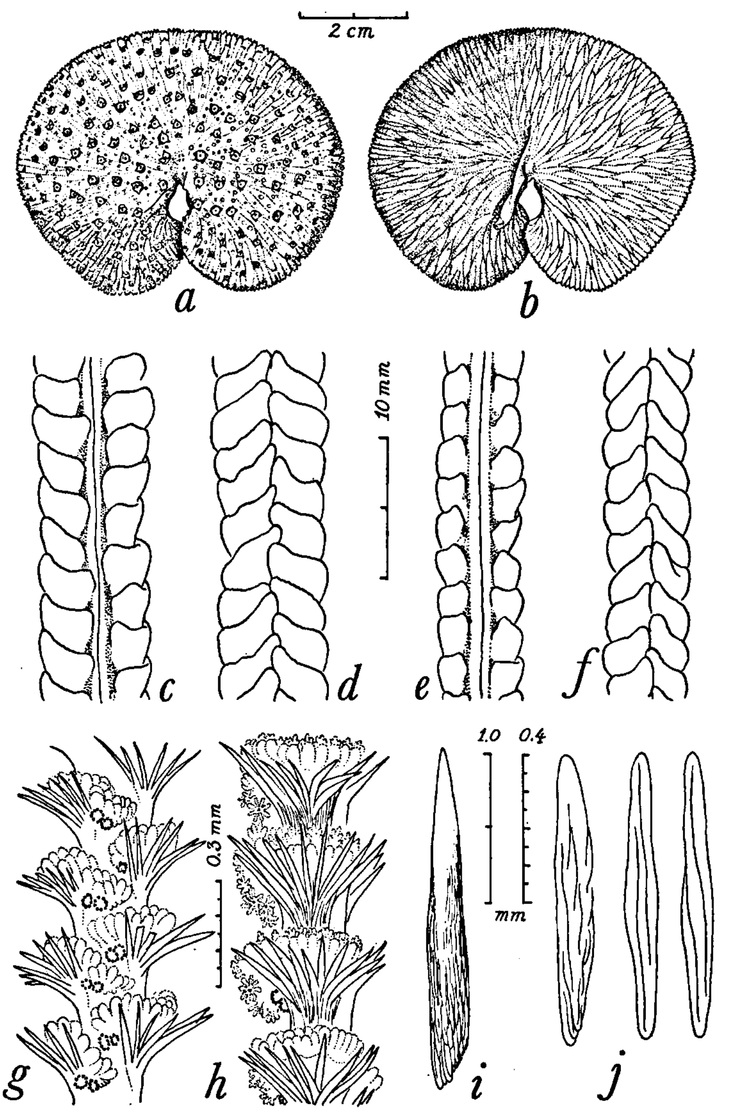


FIGURE 97. *Renilla mülleri* Kölliker, from Surinam: *a*, dorsal view; *b*, ventral view. *Virgularia presbytes* Bayer, from Surinam: *c* and *e*, dorsal view; *d* and *f*, ventral view. *Stylatula diadema* Bayer, from Surinam: *g*, ventral view, and *h*, lateral view of part of rachis of type; *i*, large needle from the supporting fan; *j*, smaller, 3-flanged rods from supporting fan. (Enlargement as indicated by scales.)

is known at present from Trinidad (Gulf of Paria) to Surinam in 30–34 fathoms, and is distinguished from *Kophobelemnon* by its spicules, which take the form of oval platelets that may be somewhat constricted medially and have serrated ends. Both genera have wide ranges outside the western Atlantic.

Genus **Sclerobelemnon** Kölliker, 1872

Sclerobelemnon KÖLLIKER 1872, p. 117, 131. (Type species, *Sclerobelemnon Schmeltzii* Kölliker, by monotypy.)
Mesobelemnon GRAVIER 1907, p. 159. (Type species, *Mesobelemnon gracile* Gravier, by monotypy.)
Sclerobelemnon, HICKSON 1916, p. 77.

Remarks. These clavate seapens resemble some of the radially organized veretillids in both colonial form and spiculation, but have a clearly discernible naked dorsal tract along the rachis, which places them in the section "Pennatulina biserialia" (KÜKENTHAL 1915, p. 26).

97 **Sclerobelemnon theseus** Bayer, 1959

(Fig. 98)

Sclerobelemnon theseus BAYER 1959, p. 33, figs. 18–21. (Gulf of Paria, 31–24 fms.; Surinam, 30 fms.)

Diagnosis. Slender, elongate, slightly clavate *Sclerobelemnon* with stalk slightly more than half the total length. End-swelling of stalk inconspicuous or absent in most specimens. Autozooids in about 9 irregular longitudinal rows, leaving a dorsal streak naked, with indication of pseudocalyces dependent upon degree of contraction. Siphonozooids numerous, in irregular longitudinal rows on all sides of the rachis including the dorsal streak. Autozooids with proximal portion of body wall filled with flat scales somewhat resembling a double-bitted axe head, tentacles with tiny needles longitudinally arranged; surface of rachis with scales like those of pseudocalyces but smaller; stalk with small, oval platelets usually with median constriction and serrated ends.

Description. See BAYER 1959, p. 33.

Material. The type series. TRINIDAD, Gulf of Paria, 31–34 fms., *Albatross* sta. 2121–2122, holotype (USNM 50954) and 19 paratypes (7072); SURINAM, *Coquette* sta. 226, 30 fms., paratype (50955), and one other specimen trawled off Surinam (50956).

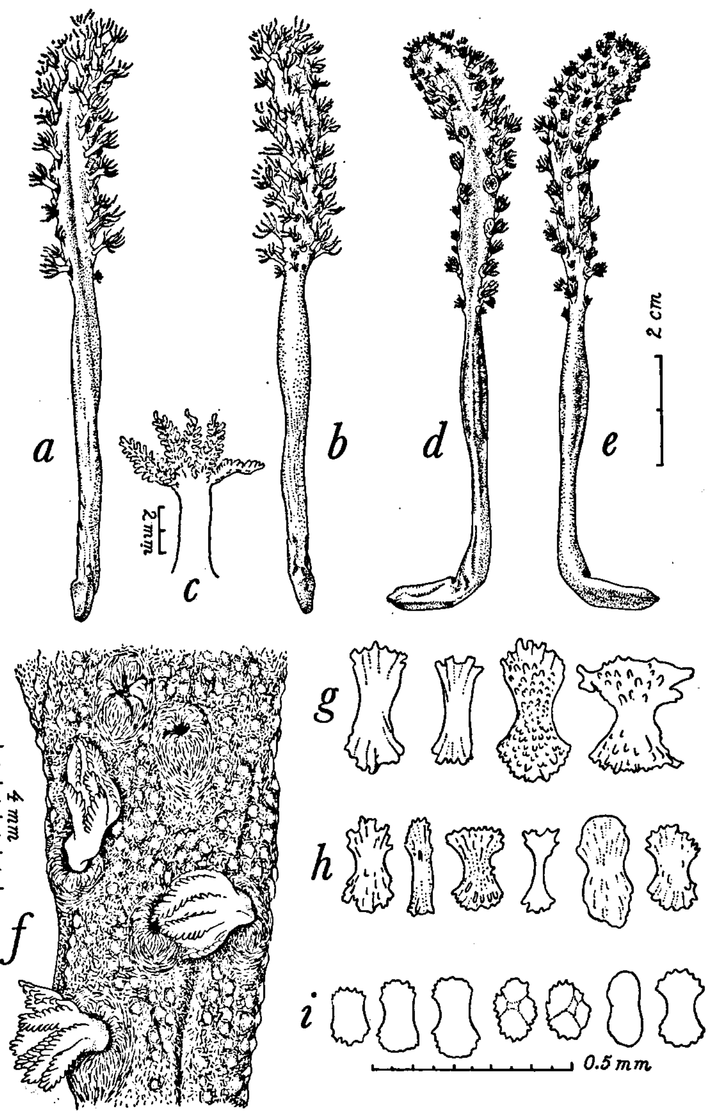


FIGURE 98. *Sclerobelemnon theseus* Bayer: *a*, dorsal, and *b*, ventral view, and *c*, autozooid of paratype from Surinam; *d*, dorsal, and *e*, ventral view, *f*, part of rachis showing expanded autozooids and pseudocalyces of retracted individuals, *g*, scales from pseudocalyces, *h*, scales from surface of rachis, and *i*, platelets from stalk of holotype from Trinidad. (*a–b* and *d–e* drawn to the same scale, as indicated at *e*; *c* and *f–i* as indicated.)

Remarks. This seapen seems to be common at least locally along the northeastern coast of South America, and is no doubt widely distributed on soft ground in the proper bathymetric range along this coast.

Sclerobelemnon theseus can be recognized by its *Kophobelemnon*-like form and its distinctive spiculation, and can be confused with no other species at present known from the Caribbean area.

As seems also to be the case in *Sclerobelemnon schmeltzii* Kölliker from Japan, there is no perceptible midline free of siphonozooids in *S. theseus*, although such a midline is described in *S. burgeri* (Herklotz) and in the species of *Kophobelemnon*.

Suborder *SUBSELLIFLORAE* Kükenthal, 1915

Family VIRGULARIIDAE Verrill, 1868

Diagnosis. Long, slender Pennatulacea with autozooids arranged in leaves bilaterally along the rachis.

Remarks. Both of the genera included in this family by Deichmann, *Virgularia* and *Stylatula*, occur in the West Indian region. The former is represented by a species that is not infrequently dredged in moderate depths.

Genus **Virgularia** Lamarck, 1816

Virgularia Lamarck 1816, p. 429. (Type species, *Pennatula mirabilis* Müller 1776, by subsequent designation: Milne Edwards & Haime, 1850.)
Virgularia, Deichmann 1936, p. 272.

Diagnosis. Virgulariids with crowded leaves composed of autozooids of nearly equal size. Spicules in the form of small corpuscles very sparsely distributed in the stalk or absent entirely.

Distribution. Practically cosmopolitan.

98 **Virgularia presbytes** Bayer, 1955

(Fig. 97)

Virgularia spec. Deichmann 1936, p. 274. (Corpus Christi, Texas.)
Virgularia presbytes Bayer 1955, p. 295, figs. 1, 2a–e. (Cape Canaveral, Florida; Mobile, Alabama; Galveston and Corpus Christi, Texas, 9–32 fms.)

Diagnosis. Virgularias with thick, fleshy polyp leaves composed of 13–30 autozooids united by the full length of their anthosteles, showing no distinct projecting calyces and without marginal tubercles; leaves in pairs fused more or less completely on the ventral side of the rachis but well-separated on the dorsal side, leaving free a distinctly grooved dorsal track; siphonozooids in 2–7 irregular, crowded rows between the polyp leaves, in the larger specimens extending out onto the dorsal track in an irregular longitudinal row or field on either side of the median groove. Axis stout, in cross section round toward the apex, oval or dorso-ventrally flattened toward the base. No spicules were found in either the polyp leaves or the rachis.

Material. The original specimens from FLORIDA, off Cape Canaveral, 9 fms. (holotype USNM 50143, paratypes 49755); and USNM material from ALABAMA, vicinity of Mobile (49758), TEXAS, Galveston (43023), Corpus Christi (43214), and SURINAM (50821–50824, 50910).

Distribution. Southeast coast of the United States; Gulf of Mexico; Surinam; probably occurs in the Caribbean. Depths from 9–32 fathoms.

Genus **Stylatula** Verrill, 1864

Stylatula VERRILL 1864b, p. 30. (Type species, *Stylatula elongata* Verrill 1864, non Gabb, by subsequent designation: Kükenthal 1915.)
Stylatula, KÜKENTHAL 1915, p. 67.
Stylatula, DEICHMANN 1936, p. 269.

Diagnosis. Virgulariids with autozooids united to form ridge-like or distinctly foliate polyp leaves supported beneath by a "fan" or "plate" of stout, radiating spicules that may project beyond the margin of the leaves. Spicules in the form of prismatic needles.

Remarks. There appear to be at least four distinctly different species of *Stylatula* in tropical western Atlantic waters. Since they may be locally common in shallow water throughout the area, the following key, based upon information contained in KÖLLIKER's monograph (1870–72) and upon the examination of a limited amount of material, is offered as a provisional guide for their separation.

Key 26

Provisional key to the western Atlantic species of *Stylatula*

1a. Siphonozooids lateral on the rachis in the leaf axils, not on the leaves: 2

1b. Siphonozooids in rosettes on the lower surface of the polyp leaves near their ventral end. Autozooids 25–30, in alternating double rows; bodies of autozooids without spicules. 8–12 pairs of leaves in 2 cm. of rachis. Spicular plate with 8–12 large spines: *Stylatula diadema* Bayer

2a. Autozooids 15 or fewer in each leaf: 3

2b. Autozooids 26 or more in each leaf; 9 pairs of leaves in 2 cm. of rachis. Spicular plate with 7–8, sometimes up to 12, large spines: *Stylatula antillarum* Kölliker

3a. Each leaf with a single row of 3–7 distinctly separated autozooids joined only in their lowest parts; tentacles and body walls of autozooids often with spicules. 3–4 pairs of polyp leaves in 2 cm. of rachis; 10–12 large, spinelike spicules in the supporting plate: *Stylatula elegans* (Danielssen)

3b. Each leaf with a single row of 7–8 (up to 12 according to Kölliker) autozooids fused together except for a short, free, distal calycular part; tentacles and body walls devoid of spicules. 6–8 pairs of polyp leaves in 2 cm. of rachis; 4–5 large, spinelike spicules in the supporting plate (my observation of the types in the British Museum; according to Kölliker, 7–8 spines, based upon the same material): *Stylatula brasiliensis* (Gray)

99 **Stylatula diadema** Bayer, 1959

(Fig. 97)

Stylatula diadema Bayer 1959, p. 38, fig. 17 (Surinam.)

Diagnosis. Slender *Stylatula* with 8–12 pairs of polyp leaves in 2 cm. of rachis. Autozooids 25–30 in each leaf, arranged in alternating double row near middle of leaf, becoming a single zigzag row dorsally and ventrally. Supporting plate with 8–12 large needles 2.2–2.7 mm. long, and numerous smaller needles. No spicules in tentacles and body walls. Spicules in rachis arranged in two narrow lateral bands from which the spicules of the supporting plates extend. Siphonozooids placed on lower surface of polyp leaves, in one or two circles or rosettes near the ventral end of the leaves. Axis stiff, rounded-quadrangular, with a shallow groove along each side.

Description. See Bayer 1959, p. 38.

Material. The USNM type series, from four *Coquette* localities off Surinam: sta. 2, 15 fms.; sta. 144, 14 fms.; sta. 188, 15 fms.; and sta. 191, 14 fms.; 11.V.–10.VI.1957 (holotype 50834; paratypes 50833, 50835).

Remarks. The peculiar location of the siphonozooids serves to distinguish *Stylatula diadema* from all species of the genus heretofore described.

ECOLOGY

The distribution of alcyonarians in diverse habitats is obviously controlled by the physiological requirements of the organisms themselves, and they will occur wherever the environment satisfies these requirements. Unfortunately, little experimental work has been performed upon alcyonarians, so the bulk of knowledge in this field is assumed from work on other anthozoans or depends upon observations on the distribution of various species under diverse ecological situations. The important limiting factors are temperature, salinity, light, and depth. Concomitant factors are the nature of the substrate and sedimentation.

Limiting Factors

Temperature

The only work done on the temperature relations of alcyonarians is that of Cary (1918) who determined the upper limit of tolerance for twelve species growing on the reefs around the Dry Tortugas. He found that the various species were killed by one hour's exposure to temperatures between 34.5° and 38.2° C. The most resistant of the species studied was *Briareum asbestinum* (Pallas), which died after exposure to 38.2° C., and the least resistant were the plexaurids, all of which succumbed to 34.5°–35.0° C. The gorgoniids were intermediate with death temperatures between 37.0° and 37.5° C. Cary found no constant relationship between respiration rate and resistance to high temperatures. The most heat-resistant species, *Briareum asbestinum,* had the lowest rate of respiration, contrary to the situation found in madrepores by Mayer (Vaughan & Wells 1943, p. 56), but the gorgoniids showed the highest rate of respiration, and resistance to high temperature exceeded only by *Briareum.*

In the peripheral populations of a tropic-derived fauna it is naturally the annual minimum water temperature that controls distribution and not the maximum. It has been pointed out by students of coral reefs that hermatypic corals make vigorous growth only in areas with a minimum water temperature not less than 20°C. (= 69°F.) in the coldest part of the year. Since most of the shallow-water alcyonarians in the West Indian region are members of the reef community, we can safely assume that they will conform to the temperature requirements of coral reefs in general, even though we know almost nothing about the requirements of the alcyonarians themselves. Most species must be able to withstand a few degrees less than the minimum temperature required for reef growth or they could not exist in Bermuda where the minimum surface temperature is 66°F. (= 18.9°C.) (FUGLISTER 1947, p. 23), and even in the vicinity of Miami, Florida, surface temperature may be as low as 19.58°C. =(67.3°F.) in mid-winter (Voss & Voss, 1955, p. 207).

Reasonably healthy reef growth occurs at Bermuda, and the alcyonarian component consists of typical Antillean species. VERRILL (1907) reports seventeen species, which represent less than 25% of the Antillean fauna. On the continental shore, the West Indian gorgonian fauna stops roughly at Jupiter Inlet at the northern border of Palm Beach County, perhaps in part because the necessary solid bottom does not prevail north of that point, but no doubt in part also because the warm waters of the Florida Current swing offshore at about that point on the coast. Because of the resultant drop in temperature, a faunal break occurs on the coast of Florida at about Palm Beach, which is therefore a critical area from a zoogeographic standpoint. It would be most instructive to have detailed collections of gorgonians from a number of localities between Miami and Jupiter Inlet, with observations on water temperatures during the cold months.

On the West coast of Florida, Antillean species extend northward in greatly reduced numbers to Alligator Harbor and vicinity, but along this coast the bottom is generally inhospitable to gorgonians, being sandy, and it is difficult to separate the effects of temperature from those of the poor substrate.

North of Palm Beach to the vicinity of the Virginia Capes and Chesapeake Bay, the shallow water fauna is very distinctive, being virtually limited to three species, *Leptogorgia virgulata, L. setacea,* and *Lophogorgia hebes.* In slightly deeper water, *Muricea pendula* and *Telesto fruticulosa* also occur. Of these, the first two, and probably also the third, have a disjunct distribution omitting south Florida and resuming along the Gulf coast to extend southward to the reefs of Brazil. The last two species seem to be restricted to the northern part of this range and are characteristic of the so-called Carolinian fauna that has an isolated arm in the northern Gulf of Mexico. These species, which tolerate both low temperatures (less than 45°F. minimum at the mouth of Chesapeake Bay) and low salinities, are not restricted by the maximum temperatures in the tropical part of their range, but according to present records they do not range out into the Antillean islands and must be excluded from that area by some other factor. Their distribution seems intimately tied to the continental shore. Too little collecting has been done along the coastline between Corpus Christi, Texas, and the reefs of Brazil to provide any clear picture of the distributional behavior of the alcyonarians occurring in that region.

The temperature requirements of species typical of deeper waters certainly differ widely from those of reef-dwelling species, but probably are sufficiently narrow to restrict distribution to a limited bathymetric range.

Salinity

Very few species of alcyonarians can be found in waters subject to fluctuations in salinity. Along the southeastern coast of the United States *Leptogorgia setacea* and *L. virgulata* inhabit inshore waters of salinity less than that of the adjacent sea. In Chesapeake Bay, for instance, *L. setacea* has been found generally over the lower half of the Bay or as far north as the mouth of the Potomac River, where bottom salinity was 17.2‰. *Leptogorgia virgulata* has not been recorded from areas of such low salinity although it, too, occurs within Chesapeake Bay. Both species are known also to inhabit purely marine environments.

In areas where coral reefs are best developed, the surface salinity averages 36‰, but madrepores normally living under these conditions can endure appreciably higher and lower concentrations for short periods. At the Dry Tortugas, experimental work showed that reef corals could tolerate water reduced to 80% of the normal 36.01‰ concentration for 24 hours without ill effects, and concentrations from 110% to 133% of normal salinity for 12 hours (VAUGHAN & WELLS 1943, p. 58). There is no reason to assume that alcyonarians have the same tolerances as reef corals and it remains for experimental work to determine what their capacity is in this regard.

Illumination

Alcyonarians are affected by light in the same way that reef corals are, and for the same reason. Reef-dwelling species are, without known exception, heavily infested with symbiotic algae, the zooxanthellae, which require light for processes of photosynthesis. In the case of madrepores, experimental work has shown that the algae are not essential to the coral, which can live for some months in complete darkness as long as food is provided (YONGE & NICHOLLS 1931). It is therefore not clear whether the algae are indeed the factor limiting the distribution of reef corals to depths receiving sufficient light for photosynthesis. A more intimate relationship has been demonstrated between certain alcyonarians and their zooxanthellae (GOHAR 1940, 1948). In these cases, the algae are necessary to the nutrition of the alcyonarians, which die if deprived of light even though food is provided, and which thrive in light even though starved. No experimental work has been done on the relationship of zooxanthellae to the reef-dwelling Gorgonacea of the West Indian region.

Depth of water

The bathymetric distribution of alcyonarians seems to follow phylogenetic lines, some families being restricted to moderate depths, others to intermediate ranges, and still others to the deep seas. The reef-dwelling species ordinarily do not quite reach the low tide level, since they cannot tolerate exposure to air for any appreciable period. Therefore, for any given species, the minimum depth limit at mean low tide is about equal to the average height of the colony; some species adjust their height and growth form to the depth in which they grow, forming broad, bushy colonies in very shallow water, and tall, slender ones in depths allowing maximum growth.

The genera and species of the reef environment usually do not descend very far below it. Their place is taken by other genera and species with greater bathymetric ranges, from 25 or so fathoms down to 300 or 400. At the lower end of this range, the characteristically abyssal groups assume dominance and continue downward to great depths (the deepest record is 6250 meters for a species of *Umbellula* taken by the 'Galathea' Expedition).

The West Indian region is only moderately rich in alcyonarians, with a total of about 196 species [1], of which some 75, or 38% of the total, are inhabitants of the reefs and shallow waters less than 25 fathoms in depth. Most of these species belong to two families, the Plexauridae and the Gorgoniidae, and are large and conspicuous forms, thus assuming a disproportionately prominent place in the reef community. It is impossible to state how this proportion of shallow-water to deep-water species in the West Indies compares with another warm-water fauna, such as that of the East Indies, because no other fauna has been investigated in sufficient detail. The 'Siboga' and the 'Snellius' Expeditions, both of which explored the East Indies, collected primarily by dredging, and although much work was done in depths of less than 50 meters, the dredge is not adaptable to sampling the reef community proper and it must be assumed that this segment of the fauna remains largely uninvestigated.

A valid comparison of the reef-dwelling components of the alcyonarian faunas of the West Indies and the East Indies cannot yet be made because the East Indian shallow-water fauna has not been extensively sampled by hand collecting, whereas a large proportion of the West Indian collections was taken by hand. However,

[1]) Compiled from DEICHMANN (1936) for the deep-water groups, and from the present report for the shallow-water families; some additional records from BAYER (1952, 1955, and 1957).

it is instructive to note that of about 445 species (Stolonifera, Telestacea, Alcyonacea and Gorgonacea) collected by the 'Siboga' Expedition, 263 (59%) were taken at depths shallower than 50 meters. Of the 445 species, 235 were Gorgonacea, representing about 56% of the fauna, which is a very low proportion when compared with the West Indies where about 85% of the total fauna of 196 species belong to the Gorgonacea. Since the predominant reef forms in the East Indies are alcyonaceans, which are poorly represented in the Caribbean, a better comparison may be had if we restrict ourselves to the Gorgonacea. Following this procedure, we find that 100 of the 235 species of Gorgonacea were collected in less than 50 meters, or 42% as compared with 41% in the Antilles. In the East Indies a greater proportion of the total alcyonarian fauna inhabits shallow

TABLE 1

COMPARISON OF THE PROPORTION OF SHALLOW-WATER SPECIES IN THE ALCYONARIAN FAUNAS OF THE EAST AND WEST INDIES

	East Indies (Siboga Collection)		West Indies	
	Total Species	Species in Less than 50 meters	Total Species	Species in Less than 50 Meters (or 25 Fathoms
Stolonifera	14	11 (79%),	...	....
Telestacea	8	5 (63%)	7	4 (57%)
Alcyonacea	188	147 (78%)	9	0 (0)
Gorgonacea	235	100 (42%)	167	68 (41%)
Scleraxonia	39	29 (74%)	9	5 (56%)
Holaxonia	196	71 (36%)	158	63 (40%)
Acanthogordiidae	14	4 (29%)	2	0 (0)
Paramuriceidae	81	40 (49%)	41	0 (0)
Plexauridae	13	10 (76%)	37	31 (84%)
Gorgoniidae	4	2 (50%)	34	31 (91%)
Ellisellidae	21	12 (57%)	11	0 (0)
Chrysogorgiidae	25	0 (0)	11	0 (0)
Primnoidae	25	1 (4%)	14	1 (7%)
Isididae	13	2 (15%)	8	0 (0)
Pennatulacea	...	....	13	3 (23%)
	445	263 (59%)	196	75 (38%)

water than in the West Indies, but the proportion of shallow-water Gorgonacea is about the same. The apparent dominance of alcyonarians on Atlantic reefs is due to the profusion of a rather small number of conspicuous species, whereas in the East Indies a greater proportion of a richer but less conspicuous fauna inhabits shallow water. (Table 1)

Nature of the Substrate

Work by CARY (1914) indicates that the planulae of gorgonians are similar to those of corals in requiring a rough, solid bottom for attachment. Young colonies were invariably found growing in small depressions in the coral rock. The suitability of the substrate is thus of prime importance to these sessile animals, and is one of the major factors controlling their distribution. This is clearly demonstrated by comparing the southwest coast of Florida with the Florida Keys, the former having a predominantly sandy bottom, the latter with vast tracts of solid reef rock. Dense fields of gorgonians are found covering the rocky bottoms along the Keys, but only scattered outcrops of rock along the sandy west coast can support gorgonians and other sessile reef animals. Although solid support is essential to gorgonians in the turbulent upper layers of water, it is not required by certain species living in deep or quiet waters. One entire order, the Pennatulacea, characteristically inhabits only soft bottoms of sand or mud, into which the fleshy, stalk-like lower end of the colony is inserted. A few gorgonians, notably chrysogorgiids and isidids, are able to form a basal attachment suitable to the substrate, spreading and rootlike if the bottom is soft, a simple calcareous disk if it is rocky. A small number of species belonging to families that usually require solid support have been found growing unattached on the soft sea floor. One of the first records of this kind was *Filigella gracilis* described by GRAY (1868). COWLES (1930, p. 332) mentioned the discovery of gorgonians, which he called *Leptogorgia virgulata*, growing unattached in Chesapeake Bay; STIASNY (1939, p. 301) described a West African genus (*Filigorgia*) with three species showing no evidence of attachment, and recently BAYER (1952, p. 186–188) reported three new species of *Eugorgia* (now transferred to *Leptogorgia*) that live free on sandy bottom. In some species, colonies have been found with a minute base of attachment fixed to small shells while the majority show evidence of growth at both ends, and in others such as *Leptogorgia setacea*, colonies are as frequently found free as attached. It seems probable that if the settling planula of any of these species attaches to a large enough object it will grow in the usual fixed position, but if no large objects are available and it is obliged to attach to a tiny shell, sand grain, or other minute object, it will eventually topple over and lie prone, then commencing to grow at both ends. Since it has been observed that if normally attached specimens of gorgonians are detached they necrose and soon die from abrasion on the sea floor, it follows that the species growing free on the bottom are either not subjected to fatal abrasion or are resistant to any abrasion that may occur.

Octocorallia as Members of the Reef Community

As has already been pointed out in the remarks on bathymetric distribution, a considerable proportion of the alcyonarian fauna in both Atlantic and Pacific Oceans inhabits reef and shoal-water situations. Although the percentage of species living in less than 50 meters appears to be greater in the East Indian fauna in the West Indian (see Table 1), the families characteristic of this habitat in the West Indies are represented by large, conspicuous, colorful forms that in many places overshadow the madrepores in both size and numbers. The octocorals therefore have greater prominence in the Atlantic reef community than they enjoy in the Indo-Pacific, where this habitat is occupied by families of drab, inconspicuous (but often large) species that closely resemble madrepores in build. In both geographic regions, characteristic micro-communities have developed around the various alcyonarians in the reef assemblage. The intimacy of relationship between the various members of the alcyonarian micro-community and their hosts ranges from the fortuitous, in which a fish may hide among the branches of a gorgonian, to parasitism, in which copepods invade the gastrodermal canals and live there permanently.

Parasites

The best-known parasites of octocorals are the copepods of the family Lamippidae, as described by ZULUETA (1908, 1910). Barnacles of the order Ascothoracica are not infrequent parasites of Gorgonacea, especially in deeper waters; the relationship of barnacle to host is unknown in the case of *Balanus galeatus*, which attaches to the axial rod of gorgonians and lives imbedded in the soft tissues. The young of certain pycnogonids enter the polyps of gorgonians and remain encysted there for some time (STOCK 1953, p. 307). The large, reef-dwelling Alcyonacea of the western Pacific are often found to have large snails of the genus *Rapa* living imbedded in their tissues, often with no communication to the outside except through the gastric cavities of the alcyonarian polyps, which bring water for respiration; the source of nutrition is unknown.

Symbionts

So far as is known, all reef-dwelling alcyonarians contain unicellular algae, the zooxanthellae, living intracellularly in the entoderm. As YONGE & NICHOLLS (1931) pointed out, the zooxanthellae of madrepores are not necessary to the life of the coral, but those of at least a few alcyonarians are required in nutrition (GOHAR 1940, 1948). There is also some evidence that certain species of Gorgonacea with especially abundant zooxanthellae have lost most, if not all, of their nematocysts, and with them the power to feed. Moreover, with feeding unnecessary, the need for digestive tissues fades and the glandular areas of the septal filaments may be much reduced. Conversely, the species with few zooxanthellae may have especially abundant nematocysts and well-developed digestive structures, indicating dependence on external sources of food (BAYER 1954).

Commensals

The host relationships of a variety of invertebrates associated with octocorals are little known, but since they are obviously intimate and to a large extent obligatory, the organisms involved may for convenience be classed as commensals.

COELENTERATES. *Hydrichthella epigorgia* Stechow, a hydroid, lives on the Japanese shallow-water plexaurid *Anthoplexaura dimorpha* Kükenthal.

CTENOPHORES. KOMAI (1922) has reported the presence of the sessile ctenophore *Coeloplana* on colonies of *Dendronephthya* in Japan. The present author observed plexaurid gorgonians heavily infested with related ctenophores in the Palau Islands in 1955 and in the Florida Keys in 1960.

POLYCHAETES. Deep-water primnoids commonly are infested with polychaetes, which cause a malformation of the scale-like spicules of the gorgonian host. *Acanthogorgia* and *Corallium* produce coenenchymal flaps, runways or tunnels under stimulation by the polychaetes, but the spicules themselves are not modified. In *Anthogorgia*, the worms inhabit the stem canals, and in *Echinogorgia* they have been found living in deep grooves formed in the thick, fleshy rind.

CRUSTACEANS. Anomuran crustaceans of the families Porcellanidae and Chirostylidae are often found clinging to gorgonian colonies, the former in shallow water, the latter in greater depths. In the western Pacific, a spider crab, *Xenocarcinus depressus* Miers, lives among the branches of the shallow-water gorgonian *Melithaea*, which it mimics precisely in color. In Florida, a shrimp, *Tozeuma carolinensis*, which ordinarily inhabits eelgrasses, has also been found inhabiting colonies of *Pseudopterogorgia*, where it takes on a special color phase (Voss 1957).

MOLLUSKS. Three species of the gastropod genus *Cyphoma* are conspicuous associates of *Pseudopterogorgia*, *Plexaura*, *Plexaurella*, and related gorgonians in the West Indies. Their spotted mantles, which completely cover the shell, provide effective camouflage in spite of bright coloration. The feeding habits of *Cyphoma* are unknown, so its relationship to the host is not clear. Its eggs are deposited in gelatinous capsules on the surface of the gorgonian branches. A related snail, *Simnia*, lives upon *Leptogorgia* and *Gorgonia* in the Atlantic and upon various genera of Gorgonacea in the Pacific. The large 'egg cowry' of the Pacific lives in association with the massive alcyonaceans of shallow waters, and several related genera of snails have similar habits.

In cold waters, gorgonians are often infested with primitive, worm-like mollusks of the order Solenogastres. They have been found in abundance on primnoid corals from the Antarctic, and upon *Acanthogorgia* and *Paramuricea* in northern waters.

EPIZOA. A number of invertebrates depend upon gorgonians for support. It is common to find the hydrocoral *Millepora* growing on the exposed axis of various species in the western Atlantic. The millepore apparently never settles on healthy gorgonians, but once it gains a foothold on the accidentally exposed axis it rapidly spreads, killing the gorgonian before it. Several kinds of echinoderms, notably Ophiuroidea and Crinoidea, regularly cling to healthy gorgonians. Of these, the basket star (*Astrophyton muricatum*) is especially conspicuous in the tropical Atlantic, where it lives inextricably entwined among the branches of *Pseudopterogorgia* and other gorgonians of the reef community. Littoral crinoids of the order Comatulida in both Atlantic and Indo-Pacific regions commonly utilize gorgonians for support, but the degree to which they are dependent upon the coral is unknown.

OTHER ASSOCIATIONS. It is well known that certain species of reef-fishes regularly take refuge among the branches of gorgonians, with which they blend perfectly. Notable among these is the trumpet-fish (*Aulostomus*), which lurks among sea-plumes in wait for its prey. In the Pacific, the so-called shrimp-fish (*Centriscus*) may resort to gorgonians for protection when pursued, but they will also hide among the branches of stony corals or the long spines of sea urchins.

OCTOCORALLIA AS REEF-FORMERS

The role of alcyonarians as formers of reef limestone has been investigated by CARY, both in the Dry Tortugas (1918) and Samoa (1931). In the western Atlantic, virtually all reef-dwelling alcyonarians are members of the gorgonacean families Gorgoniidae and Plexauridae, whose calcareous skeleton takes the form of minute mesogloeal spicules. The average spicule content of twelve species was found to be 27.4% of the wet weight of the colonies, and the average weight of spicules per square yard, based on twenty samples, was 2.1225 pounds. Records for five years showed that one-fifth of the total gorgonian fauna is destroyed annually, releasing one ton of limestone per acre in the form of spicules. Many of these spicules would be swept away by currents or dissolved, but a substantial proportion would still be available for incorporation in the general reef mass.

No Gorgonacea were found on the reefs at Tutuila, Samoa, where four species of Alcyonacea were the dominant alcyonarians. The spicule content of these four species averaged 8.73%, 9.48%, 22.783%, and 35.58% of the wet weight. It is not necessary for these alcyonaceans to die before their spicules become available for incorporation in the reef mass since those in the basal part of the colonies become cemented together to form solid spicule rock, which remains in place. The spicule rock formed by alcyonarians was found to be harder and more durable than the skeletons of most madrepores, which it often covered and protected from the disintegrative forces operative on the reef.

The contribution made to the reef mass by alcyonarians on both Atlantic and Pacific reefs is therefore found to be considerable, and imparts to them an importance in reef formation that is generally unappreciated.

ZOOGEOGRAPHY

The West Indian Region

As defined by Hummelinck (1940, p. 24; 1953, p. 2), the *West Indies proper* include all of the Antilles, the Bahamas, the Florida Keys, the Islands of the Caribbean, and the Bermudas. The great insular arc of the Antilles is subdivided into the Greater Antilles, extending from Cuba to Puerto Rico inclusively, and the Lesser Antilles, extending from the Virgin Islands to Trinidad and Aruba. The Lesser Antilles are further divided into a Windward Group (Bovenwindse Eilanden, Islas de Barlovento, Isles sur le Vent) consisting of the islands from the Virgins to Grenada, and a Leeward Group (Benedenwindse Eilanden, Islas de Sotaventó, Isles sous le Vent) including those from Los Testigos to Aruba and Los Monges, at the mouth of the Gulf of Maracaibo.

Faunistically, extensions of the *West Indian region* reach into the Gulf of Mexico and up the east coast of Florida, and south along the northeast coast of South America to the reefs of Brazil. Since it is quite impossible to draw any hard and fast boundary between the fauna of the Gulf of Mexico and the southeastern coast of the United States and that of the West Indies proper, those areas are included in the present treatment. Moreover, the available information on the alcyonarian fauna of Brazil is also included, since so little is known of that interesting region.

The accompanying map (Fig. 99) shows the general location of localities from which the material used in this study was collected. From this it will be seen that numerous samplings have been made along the southeastern coast of the United States, especially around the peninsula of Florida. The shores of the Gulf of Mexico, with the exception of western and northwestern Florida and the coast of

Texas, have been rather poorly investigated and are far from well known even in those regions most thoroughly collected.

Among the islands of the West Indies, the Lesser Antilles (the Windward Group in the sense of HUMMELINCK) are the most thoroughly known and provide the greatest number of collecting localities in the present study.

Extensive collections have been made in the Bahamas, especially in the vicinity of New Providence, Bimini, and Andros, but even these are incomplete, owing to the fact that most of them result

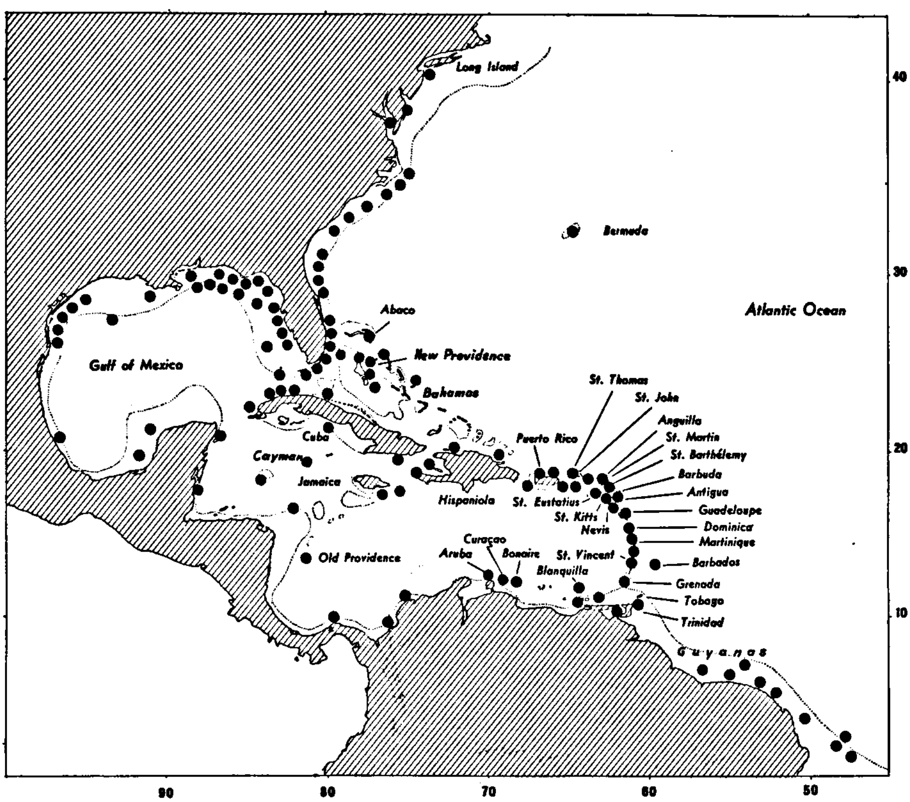


FIGURE 99. Approximate positions of western Atlantic localities represented in the material used for the present study.

from short stays in well known places rather than from intensive collecting around many of the islands.

Almost nothing is known of the shore fauna of the Greater Antillean islands, although several exploratory vessels have worked the deeper waters around them. The reefs along the coast of Yucatan, Honduras and Panama are a conspicuous and vexing zoogeographic gap, as are the banks and small islands of the western Caribbean.

The Caribbean coast of South America has been little explored and the number of shallow-water octocorals reported is pitifully small. The Netherlands islands off the Venezuelan coast have been collected rather well, but the adjacent mainland, which probably supports a somewhat different gorgonian fauna, has not.

Except for records provided by some recent fisheries investigations by the exploratory vessels 'Coquette' and 'Oregon', the coast of South America south and east of Trinidad forms another troublesome gap in our faunal knowledge. A few older collections from this area have been reported, rather inadequately, by STIASNY (1951). The gorgonian fauna of the Brazilian coast has been studied by VERRILL (1912), but thorough collecting is still needed even in this region.

THE OCTOCORAL FAUNA OF THE WARM WESTERN ATLANTIC

The octocoral fauna of the tropical and subtropical parts of the western Atlantic amounts to about 195 species, not a rich fauna when compared with that of the Indo-Malayan region, where the number of alcyonaceans alone may exceed this number, but it is without doubt the most spectacular one to be found anywhere in the world. This results from the preponderance of large, colorful gorgonians in the reef fauna, which produce the fantastic 'Sea Gardens' of the Bahamas, the Florida Keys, and the upper part of the Antillean chain. This fauna is made up mostly of species belonging to two families, the Gorgoniidae and the Plexauridae, which account for 51 of the 54 species reported from reef habitats, and 62 of the 75 species living in depths of 24 fathoms or less. The species that this study has found to be valid are listed in Table 2, which indicates their general occurrence throughout the geographic region under consideration.

TABLE 2

GEOGRAPHICAL DISTRIBUTION OF SHALLOW-WATER OCTOCORALLIA IN THE WARM WESTERN ATLANTIC

Systematic List

* species occurring in less than 25 fathoms but not in reef habitat

† species occurring in more than 25 fathoms

× specimens studied in present paper

\+ record from literature

	Systematic List	Geographical regions																	
		Atl. coast to E. Florida	E. Florida to Dry Tortugas	West coast of Florida	Northern Gulf of Mexico	E. coast of Mex. & C. Amer.	Bermuda Islands	Bahama Islands	Cuba	Hispaniola	Puerto Rico	Jamaica	Cayman Islands	Windward Group	Leeward Group	Old Providence	North coast of S. America	Guyana	Brazil
									Greater Antilles					Lesser Antilles					
	TELESTACEA																		
	Telestidae																		
†1	*Telesto corallina*	–	–	–	–	–	–	–	×	–	×	–	–	×	–	–	–	–	–
†2	*Telesto operculata*	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–
*3	*Telesto riisei*	–	×	–	–	–	–	–	–	×	×	×	–	×	×	–	×	×	×
*4	*Telesto flavula*	–	+	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
*5	*Telesto sanguinea*	×	×	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
*6	*Telesto fruticulosa*	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
†7	*Telesto nelleae*	×	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–
	ALCYONACEA																		
	Alcyoniidae																		
*8	*Nidalia occidentalis*	×	×	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
	Nephtheidae																		
†9	*Eunephthya nigra*	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
†10	*Neospongodes portoricensis*	–	–	–	–	–	–	–	×	–	×	–	–	+	–	–	–	–	–
	GORGONACEA (Scleraxonia)																		
	Briareidae																		
11	*Briareum asbestinum*	–	×	–	–	×	–	×	×	+	–	–	–	×	×	×	–	–	–
	Anthothelidae																		
12	*Iciligorgia schrammi*	–	×	–	–	–	–	×	×	–	×	–	–	–	–	–	–	–	×
†13	*Anthothela tropicalis*	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
†14	*Tripalea clavaria*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
*15	*Diodogorgia nodulifera*	–	×	–	–	×	–	+	+	–	×	–	–	×	–	–	+	×	–
16	*Erythropodium caribaeorum*	–	×	–	–	–	–	–	–	–	–	+	–	×	–	×	–	–	–
†17	*Titanideum frauenfeldii*	×	×	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–
*18	*Anthopodium rubens*	+	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	GORGONACEA (Holaxonia)																		
	Keroeididae																		
†19	*Lignella richardii*	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
	Acanthogorgiidae																		
†20	*Acanthogorgia aspera*	–	–	–	–	–	–	×	+	–	+	–	–	+	–	–	–	–	–
	Plexauridae																		
21	*Plexaura homomalla*, typical form	–	×	–	–	×	×	×	–	–	–	×	×	×	×	–	–	–	–
21a	*Plexaura homomalla*, forma *kükenthali*	–	×	–	–	–	–	×	–	–	×	+	–	–	–	×	–	–	–
†22	*Plexaura nina*	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–
23	*Plexaura flexuosa*	–	×	–	–	×	+	×	×	–	–	×	×	×	×	×	–	–	–
24	*Pseudoplexaura porosa*	–	×	–	–	×	×	×	–	–	×	×	–	×	+	×	×	–	–
25	*Pseudoplexaura flagellosa*	–	×	–	–	–	×	–	–	–	–	×	×	×	×	–	–	–	–
26	*Pseudoplexaura wagenaari*	–	×	×	–	–	×	–	–	–	–	–	–	×	×	–	–	–	–
27	*Pseudoplexaura crucis*	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
28	*Eunicea laxispica*	–	–	–	–	–	–	×	–	–	×	–	–	×	–	–	–	–	–
†29	*Eunicea pinta*	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–
30	*Eunicea palmeri*	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
31	*Eunicea mammosa*	–	×	–	–	×	–	×	×	–	–	×	×	×	×	×	–	–	–
32	*Eunicea succinea*, typical form	–	–	–	–	–	+	–	–	–	–	–	–	×	×	–	–	–	–
32a	*Eunicea succinea*, forma *plantaginea*	–	×	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–

TABLE 2 (*Continued*)

Systematic List * species occurring in less than 25 fathoms but not in reef habitat † species occurring in more than 25 fathoms × specimens studied in present paper + record from literature	Geographical regions																	
								Greater Antilles					Lesser Antilles					
	Atl. coast to E. Florida	E. Florida to Dry Tortugas	West coast of Florida	Northern Gulf of Mexico	E. coast of Mex. & C. Amer.	Bermuda Islands	Bahama Islands	Cuba	Hispaniola	Puerto Rico	Jamaica	Cayman Islands	Windward Group	Leeward Group	Old Providence	North coast of S. America	Guyana	Brazil
33 *Eunicea fusca*	–	–	–	–	×	×	–	–	–	–	–	–	×	–	–	–	–	–
34 *Eunicea laciniata*	–	×	–	–	×	+	–	–	–	–	–	–	×	–	–	–	–	–
35 *Eunicea tourneforti*, typical form	–	×	–	–	–	+	×	–	–	×	×	–	×	×	–	–	–	–
35a *Eunicea tourneforti*, forma *atra*	–	–	–	–	–	×	–	–	–	–	×	–	×	–	–	–	–	–
36 *Eunicea asperula*	–	×	×	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
37 *Eunicea clavigera*	–	–	–	–	–	×	×	–	–	–	–	–	–	×	–	–	–	–
38 *Eunicea knighti*	–	×	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
39 *Eunicea calyculata*, typical form	–	×	–	–	×	×	×	–	–	×	–	–	+	×	–	–	–	–
39a *Eunicea calyculata*, forma *coronata*	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–
40 *Eunicea* sp.	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
41 *Muriceopsis sulphurea*	–	–	–	–	–	–	–	–	–	×	–	–	×	×	–	–	–	×
42 *Muriceopsis flavida*	–	×	–	–	–	–	×	+	–	×	–	×	×	×	–	–	–	–
†43 *Muriceopsis petila*	–	×	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–
44 *Plexaurella dichotoma*	–	×	–	–	×	+	×	–	–	+	×	×	×	–	–	–	–	×
45 *Plexaurella nutans*	–	×	×	–	–	–	–	–	–	–	×	–	+	–	–	–	–	–
46 *Plexaurella grandiflora*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×
47 *Plexaurella grisea*	–	×	×	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
48 *Plexaurella pumila*	–	–	–	–	+	–	–	–	–	–	–	–	+	–	–	–	–	×
49 *Plexaurella fusifera*	–	×	×	–	–	–	–	×	–	–	–	–	+	–	–	–	–	–
50 *Muricea muricata*	–	+	–	–	–	–	–	+	–	–	–	–	×	×	–	–	–	–
51 *Muricea atlantica*	–	×	–	–	–	×	×	×	–	–	×	×	+	–	–	–	–	–
†52 *Muricea pinnata*	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–	–	–
*53 *Muricea laxa*	–	×	×	–	+	–	×	×	–	–	–	–	+	–	–	–	–	–
54 *Muricea elongata*	–	×	×	–	–	–	×	+	–	–	–	–	×	–	–	–	–	–
*55 *Muricea pendula*	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gorgoniidae																		
56 *Lophogorgia sanguinolenta*	–	–	–	–	–	–	–	–	+	–	–	–	+	–	–	–	–	–
57 *Lophogorgia violacea*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×
†58 *Lophogorgia barbadensis*	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
*59 *Lophogorgia cardinalis*	–	×	×	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–
60 *Lophogorgia punicea*	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	×
61 *Lophogorgia hebes*	×	+	×	×	–	–	–	–	–	–	–	–	–	×	–	–	–	×
62 *Lophogorgia miniata*	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	×	–	–
63 *Lophogorgia* sp.	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
64 *Lophogorgia* sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×
65 *Pacifigorgia elegans*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	+
*66 *Leptogorgia virgulata*	×	–	×	×	–	–	–	–	–	–	+	–	–	–	–	–	–	×
*67 *Leptogorgia setacea*	×	–	×	×	×	–	–	–	–	–	–	–	–	–	–	–	–	×
*68 *Leptogorgia medusa*	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
†69 *Leptogorgia stheno*	–	×	–	×	–	–	–	–	–	–	–	–	–	–	–	–	×	–
*70 *Leptogorgia euryale*	–	–	–	×	+	–	–	–	–	–	–	–	–	–	–	–	–	–
71 *Pseudopterogorgia bipinnata*	–	×	–	–	–	–	×	×	–	–	–	×	+	–	×	×	–	–
72 *Pseudopterogorgia kallos*	–	×	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–
73 *Pseudopterogorgia rigida*	–	×	×	–	–	–	–	×	–	–	+	+	+	–	–	–	–	–
74 *Pseudopterogorgia blanquillensis*	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–
75 *Pseudopterogorgia acerosa*	–	×	×	–	×	+	×	+	×	–	×	–	×	×	×	–	–	–
76 *Pseudopterogorgia americana*	–	×	–	–	×	×	×	–	–	–	×	–	×	×	–	–	–	–
77 *Pseudopterogorgia hummelincki*	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	–	–	–
*78 *Pseudopterogorgia elisabethae*	–	×	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–
*79 *Pseudopterogorgia albatrossae*	–	–	–	–	–	–	–	–	–	–	×	–	×	–	–	–	–	–
*80 *Pseudopterogorgia navia*	–	–	–	–	–	–	×	–	×	–	–	–	–	–	–	–	–	–
†81 *Pseudopterogorgia hystrix*	–	–	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–
*82 *Pseudopterogorgia marcgravii*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×

TABLE 2 (*Continued*)

Systematic List

* species occurring in less than 25 fathoms but not in reef habitat

† species occurring in more than 25 fathoms

× specimens studied in present paper

\+ record from literature

Systematic List	Geographical regions																	
	Atl. coast to E. Florida	E. Florida to Dry Tortugas	West coast of Florida	Northern Gulf of Mexico	E. coast of Mex. & C. Amer.	Bermuda Islands	Bahama Islands	Greater Antilles: Cuba	Greater Antilles: Hispaniola	Greater Antilles: Puerto Rico	Greater Antilles: Jamaica	Cayman Islands	Lesser Antilles: Windward Group	Lesser Antilles: Leeward Group	Old Providence	North coast of S. America	Guyana	Brazil
83 *Gorgonia flabellum*, typical form	–	+	–	–	×	–	×	–	×	–	–	–	×	×	–	–	–	–
83a *Gorgonia flabellum*, forma *occatoria*	–	–	–	–	–	–	×	–	×	–	–	–	×	–	–	–	–	–
84 *Gorgonia ventalina*	–	×	–	–	–	×	×	×	×	×	×	–	×	×	×	–	–	–
85 *Gorgonia mariae*, typical form	–	–	–	–	–	–	–	×	–	×	–	–	×	–	–	–	–	–
85a *Gorgonia mariae*, forma *cymosa*	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–	–	–	–
85b *Gorgonia mariae*, forma *plumosa*	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–	–	–	–
86 *Phyllogorgia dilatata*	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	×
87 *Pterogorgia citrina*	–	×	–	–	×	+	×	–	–	–	×	–	×	×	–	–	–	–
88 *Pterogorgia anceps*	–	×	×	–	×	–	×	×	–	–	×	×	–	+	–	–	–	–
89 *Pterogorgia guadalupensis*	–	×	–	–	–	–	–	–	–	–	–	–	+	×	–	–	–	–
Ellisellidae																		
*90 *Ellisella barbadensis*	–	×	–	×	–	–	–	×	–	–	–	–	+	–	–	–	×	×
*91 *Ellisella elongata*	–	–	–	×	+	–	–	–	–	–	–	–	+	–	–	–	×	×
†92 *Nicella schmitti*	–	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–	–
†93 *Nicella guadelupensis*	–	+	–	–	×	–	–	×	–	×	–	–	×	–	–	–	–	–
Primnoidae																		
*94 *Callogorgia verticillata*	–	×	–	–	×	–	–	×	–	–	+	–	+	–	–	–	×	–
PENNATULACEA																		
Renillidae																		
*95 *Renilla reniformis*	×	×	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–
*96 *Renilla mülleri*	–	–	–	×	–	–	–	–	–	–	–	–	–	–	–	+	×	+
Kophobelemnidae																		
*97 *Sclerobelemnon theseus*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–
Virgulariidae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
*98 *Virgularia presbytes*	–	×	–	×	–	–	–	–	–	–	–	–	–	–	–	–	×	–
*99 *Stylatula diadema*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	–
Total number of species and forms reported	12	54	17	16	24	18	32	29	8	19	23	10	59	26	9	8	12	19

DISTRIBUTION BY REGION

The Atlantic seaboard

The coast of New Jersey, Delaware, Maryland and Virginia, including Delaware and Chesapeake Bays, has been investigated with some degree of intensity, at least locally, and the shallow-water octocorallian fauna proves to be very limited. Only *Leptogorgia setacea* and *L. virgulata* are reported from localities in Chesapeake and Delaware Bays; the latter species was reported years ago (as *L. tenuis*) from the 'Bay of New York' but I have seen no specimens from so far north collected in recent times.

The waters off the Carolinas have been sampled rather thoroughly, chiefly at moderate depths, by the 'Albatross' and the 'Fish Hawk', and more recently by the 'Silver Bay' and the 'Bowers'. Localities in North Carolina are located mainly in the vicinity of Cape Hatteras, Cape Lookout (including Beaufort and Morehead City), New River, and Cape Fear (near the city of Wilmington). From this region come *Telesto fruticulosa*, *T. nelleae*, *Titanideum frauenfeldii*, *Muricea pendula*, *Leptogorgia virgulata*, *Lophogorgia hebes*, and *Renilla reniformis*. *Leptogorgia setacea* undoubtedly occurs, but is not present in the collections before me. *Anthopodium rubens*, which was originally reported from Ft. Macon, North Carolina, has not subsequently been found in this region, probably being overlooked due to its modest and inconspicuous little colonies.
In South Carolina, localities are in the vicinity of Myrtle Beach, Winyah Bay, Charleston, and Port Royal. Collections from this area include *Telesto sanguinea*, *Nidalia occidentalis*, *Titanideum frauenfeldii*, *Leptogorgia virgulata*, and *Renilla reniformis*. The absence of *Leptogorgia setacea*, *Lophogorgia hebes*, and *Muricea pendula* is no doubt due to inadequate collecting.

The available collections contain few specimens from localities along the coast of Georgia. Those present come mostly from the vicinity of Savannah and Brunswick. From shallow warer come *Leptogorgia virgulata* and *Renilla reniformis*; further collecting can be expected to yield several additional species. Offshore dredgings in deep water have brought up *Eunephthya nigra* and *Eunicella modesta*, which are briefly treated in this paper as representatives of their respective genera.

From a faunal standpoint, the east coast of Florida, or at least that part of it from Fernandina south to Cape Canaveral, cannot be separated from Georgia and the Carolinas. In shallow and moderate depths, *Telesto sanguinea*, *Nidalia occidentalis*, *Titanideum frauenfeldii*, *Muricea pendula*, *Leptogorgia setacea* and *Renilla reniformis* occur, while in deep water *Eunephthya nigra* and *Eunicella modesta* are extremely abundant. A deep-littoral representative of a characteristic tropical reef-dwelling genus, *Muriceopsis*, appears as a transitional element; this is a new species, *M. petila*, whose distribution is as yet imperfectly known. *Ellisella barbadensis*, also a West Indian species, has been dredged off St. Augustine.

The coast of Florida between Cape Canaveral and Palm Beach has been poorly explored for octocorals but presumably conforms more or less closely with the region to the north.

Just north of Palm Beach, the Florida current (Gulf Stream) swings offshore, causing a rather distinct faunal break. South of this boundary, shallow-water West Indian species appear on the rocky outcrops near shore and down to depths of 25 or 30 fathoms. *Telesto riisei, Nidalia occidentalis, Titanideum frauenfeldii, Iciligorgia schrammi, Diodogorgia nodulifera, Eunicea calyculata, Muricea elongata, Lophogorgia cardinalis, L. punicea, Leptogorgia stheno, Pterogorgia anceps, P. citrina*, and *Renilla reniformis* have all been reported. *Pseudopterogorgia* and some plexaurids occur abundantly on the rocky ledges at Palm Beach, Lake Worth and Boynton, but unfortunately are not represented in the collections available for study at this time.

In the vicinity of Miami, the shallow-water octocoral fauna is purely West Indian. Collections from shallow dredging and shore-collecting off Miami, Biscayne Key, and Cape Florida include *Telesto riisei, T. sanguinea, Nidalia occidentalis, Briareum asbestinum, Erythropodium caribaeorum, Plexaura flexuosa, P. homomalla* forma *kükenthali, Pseudoplexaura porosa, Eunicea tourneforti, Muriceopsis flavida, Muricea laxa, Plexaurella dichotoma, Leptogorgia stheno, Pseudopterogorgia acerosa, P. bipinnata, P. kallos, P. rigida, P. elisabethae*, and *Pterogorgia anceps*. Many more species certainly are present.

The Florida Keys, beginning with Soldier Key at the entrance of Biscayne Bay and extending south and west to the Dry Tortugas, some 70 miles west of Key West, is a chain of islands exceptionally rich in gorgonian corals. The northern islands in this chain, Soldier Key, Ragged Keys, and Elliott Key together with the intervening passes such as Caesar's Creek, and the adjacent reefs, notably

Triumph Reef and Bache Shoal, have been very diligently collected by marine biologists from the University of Miami Marine Laboratory. The several larger and many smaller islands to south and west also have been rather thoroughly collected over a long period of time but probably not so intensively as have the upper Keys. The following list, incomplete though it certainly is, gives the commonest species and some of the localities at which they have been collected (indicated by abbreviations, arranged approximately in geographical sequence from northeast to southwest).

List of Octocorallia from Localities in the Florida Keys

Abbrevations of localities:

BP = Big Pine Key
C = Caesar's Creek
E = Elliott Key (with Bache Shoal and Triumph Reef)
KL = Key Largo
KV = Key Vaca
KW = Key West
LV = Lignum Vitae Lake
M = Mangrove Key, NE of Key West
Rag = Ragged Keys
Rod = Rodriguez Key
SP = Salt Pond Key, NE of Key West
Sol = Soldier Key
SL = Sombrero Light
T = Dry Tortugas and nearby banks

(Species indicated with an asterisk come from shallow-water dredging.)

*Telesto sanguinea** (KL)
*Nidalia occidentalis** (SL)
Briareum asbestinum (Sol, Rod, LV)
*Iciligorgia schrammi** (E, T)
*Diodogorgia nodulifera** (E)
*Titanideum frauenfeldii** (T)
Plexaura flexuosa (Sol, Rag, Rod, T)
Plexaura homomalla, typical (Rod, E)
Plexaura homomalla f. *kükenthali* (C)
Pseudoplexaura flagellosa (M, KW)
Pseudoplexaura porosa (E, Rod, KW,T)
Pseudoplexaura wagenaari (Rag, C, E, KW)
Eunicea asperula (C, KW)
Eunicea calyculata (Sol)
Eunicea knighti (Sol)
Eunicea laciniata (E)
Eunicea mammosa (C, Rod, KW, T)
Eunicea palmeri (Sol, C, KW)
Eunicea tourneforti (Sol)
Muriceopsis flavida (E)
Plexaurella dichotoma (S, KL, T)
Plexaurella fusifera (KV, T)
Plexaurella nutans (Sol, T)
Muricea atlantica (Sol, E, KL, T)
Muricea elongata (Rag, E, C, T)
*Muricea laxa** (T)
*Lophogorgia cardinalis** (T)
Lophogorgia punicea (T)
Pseudopterogorgia acerosa (Sol, C, KW, T)
Pseudopterogorgia americana (Sol, KW, T)
Pseudopterogorgia bipinnata (Rod, T)
Pseudopterogorgia rigida (T)
Gorgonia ventalina (KL, T)
Pterogorgia anceps (Sol, C, BP, KW)
Pterogorgia citrina (Sol)
Pterogorgia guadalupensis (KW)

The Gulf of Mexico

The distribution of octocorals in the Gulf of Mexico has been discussed briefly elsewhere (BAYER 1954, 1958). The abyssal species show a characteristically wide distribution. The deep littoral fauna is mainly West Indian, and most if not all of its elements may be expected to turn up in the Gulf as dredging operations bring in more and more new records. However, the shallow-water fauna has two distinct elements, the West Indian, which invades from the south, and the Carolinian, which forms a disjunct pocket along the northern Gulf coast from northwest Florida to Texas. The Carolinian species present in the northern Gulf are *Anthopodium rubens, Muricea pendula, Lophogorgia hebes, Leptogorgia virgulata*, and *L. setacea. Muricea pendula* has been collected off Laguna Beach, Florida, off Louisiana, and off Padre Island, Texas, but not off the coast of peninsular Florida. *Lophogorgia hebes* occurs along most if not all of the Gulf coast of Florida and west to Texas; its distribution in the western Gulf and Caribbean is not known, but it occurs in Brazil (as *Leptogorgia rubropurpurea* Verrill). *Leptogorgia virgulata* and *L. setacea* have a similar distribution but apparently do not extend very far south of Fort Myers on the Florida coast; both are known from Brazil. They seem to be the only shallow-water gorgonians along much of the northern Gulf coast.

The West Indian representatives are *Pseudoplexaura wagenaari, Eunicea asperula, E. calyculata, E. knighti, Plexaurella grisea, P. fusifera, P. nutans, Muricea elongata, M. laxa, Pseudopterogorgia acerosa, Pterogorgia anceps*, and *Ellisella elongata*. Although several of these species reach as far north as Tampa, Florida, only *Eunicea knighti, Muricea elongata* and *Ellisella elongata* are known to occur in the region of Apalachee Bay. The two species of *Telesto* common along west Florida, *T. sanguinea* and *T. flavula*, seem to be retricted to continental shores for they have not been recovered from West Indian localities.

The mainland coast of Central America

The least known part of the area covered in this paper is the mainland coast of the Caribbean. Except for a few dredgings off the Canal Zone and in the Gulf of Darien, which yielded *Diodogorgia nodulifera* and *Nicella schmitti*, and the records of *Eunicea tourneforti* from Belize (British Honduras), *Lophorgorgia miniata* from Puerto Colombia, *Telestio riisei* from Guanta (Venezuela), and *Pseudopterogorgia bipinnata* from Cumaná, nothing is known of the composition of the alcyonarian fauna. The few indications just noted suggest that it is typically West Indian at both shallow and moderate depths, but any faunal peculiarities remain to be demonstrated.

West Indian localities

The octocorals of Bermuda, the northernmost frontier of the West Indian fauna, have been studied in some detail by VERRILL (1907) and DEICHMANN (in Ms). The collections in the U.S. National Museum contain the following Bermudian species: *Plexaura homomalla*. *P. flexuosa*, *Pseudoplexaura porosa*, *P. flagellosa*, *P. wagenaari*, *Eunicea calyculata*, *E. clavigera*, *E. fusca*, *E. tourneforti* f. *atra*, *Muricea atlantica*, *Pseudopterogorgia acerosa*, *P. americana*, *Gorgonia ventalina*, *Pterogorgia citrina*.

Large numbers of the more conspicuous gorgonians have been collected at several localities in the Bahamas. The largest number of species on the following list comes from New Providence and the adjacent small cays, Long Island and Hog Island. Smaller collections are present from Abaco, Andros, Bimini, Cat Cay, Eleuthera, Orange Key, Rum Cay, the lower end of the Tongue of the Ocean, and Watling's Island. Thorough collecting at these localities presumably would yield the same species recorded from New Providence.

LIST OF OCTOCORALLIA FROM LOCALITIES IN THE BAHAMAS

Abbreviations of localities:

Ab = Abaco	N = New Providence, Long and Hog Is.
An = Andros	O = Orange Key
B = Bimini	R = Rum Cay
C = Cat Cay	T = Tongue of the Ocean
E = Eleuthera	W = Watling's Island (San Salvador)

(Species indicated with an asterisk were dredged at shallow or moderate depths.)

Briareum asbestinum (An, E, N)	*Muriceopsis petila* * (C, T)
*Iciligorgia schrammi** (C)	*Plexaurella dichotoma* (N)
Plexaura flexuosa (B, N, W)	*Muricea atlantica* (N)
Plexaura homomalla, typical (An, N, W)	*Muricea elongata* (N)
Plexaura homomalla f. *kükenthali* (N)	*Muricea laxa** (C)
*Plexaura nina** (T)	*Muricea muricata* (B, N)
Pseudoplexaura laevigata (N)	*Pseudopterogorgia acerosa* (N)
Pseudoplexaura porosa, typical (B, N, R)	*Pseudopterogorgia americana* (An, N, R)
Pseudoplexaura ramosa (N)	*Pseudopterogorgia bipinnata* (N, R)
Eunicea calyculata (N)	*Pseudopterogorgia elisabethae* (N)
*Eunicea clavigera** (C)	*Pseudopterogorgia hystrix** (T)
Eunicea laxispica (N)	*Pseudopterogorgia navia** (O)
Eunicea mammosa (Ab, An, B, N, R)	*Gorgonia flabellum* (N, W)
*Eunicea pinta** (T)	*Gorgonia ventalina* (N, R, W)
Eunicea tournefortii (N)	*Pterogorgia anceps* (N)
Muriceopsis flavida (B, N, R)	*Pterogorgia citrina* (B, N)

Collections of octocorals from localities in the Greater Antilles are strangely few. The limited material available suggests that the reef fauna has a composition much like that of the Florida Keys, but additional species could be expected and some faunal differences between the north and south coasts of the major islands are not unlikely. Such zoogeographic features will be revealed only after comprehensive field work has been done on all coasts of the islands in question.

The collections available to me contain the following species from localities in Cuba, mostly toward the western end of the island (species dredged at moderate depths are indicated by an asterisk): *Telesto operculata**, *Telesto nelleae**, *Neospongodes portoricensis**, *Briareum asbestinum*, *Iciligorgia schrammi**, *Titanideum frauenfeldii**, *Plexaura flexuosa*, *Eunicea mammosa*, *Muriceopsis flavida*, *Plexaurella dichotoma*, *Plexaurella fusifera*, *Muricea atlantica*, *Muricea muricata*, *Muricea laxa**, *Lophogorgia cardinalis**, *Leptogorgia setacea*, *Pseudopterogorgia americana*, *Pseudopterogorgia bipinnata*, *Pseudopterogorgia elisabethae**, *Pseudopterogorgia kallos*, *Pseudopterogorgia rigida*, *Gorgonia mariae*, *Gorgonia ventalina*, *Pterogorgia anceps*, *Ellisella barbadensis*, *Nicella guadalupensis*, and *Riisea paniculata*.

Very few specimens are available from the island of Hispaniola. I have seen: *Telesto riisei*, *Plexaura flexuosa*, *Pseudoplexaura porosa*, *Pseudopterogorgia acerosa*, *Pseudopterogorgia navia*, *Gorgonia flabellum* and *Gorgonia ventalina*.

Work around Puerto Rico by the U.S. Fish Commission steamer 'Fish Hawk' provides a better sampling of octocorals: *Telesto corallina**, *Telesto riisei*, *Neospongodes portoricensis**, *Iciligorgia schrammi**, *Diodogorgia nodulifera**, *Plexaura flexuosa* *Plexaura homomalla*, *Eunicea calyculata*, *Eunicea laxispica*, *Eunicea tourne-*

forti, Muriceopsis flavida, Pseudopterogorgia acerosa, Gorgonia mariae, Gorgonia ventalina, and *Riisea paniculata**.

Records from Jamaica are disappointingly few; these include: *Telesto riisei, Plexaura homomalla, P. flexuosa, Pseudoplexaura porosa, P. flagellosa, Eunicea mammosa, E. tourneforti, Plexaurella dichotoma, P. nutans, Muricea atlantica, M. pinnata* *, *Pseudopterogorgia acerosa, P. americana, P. albatrossae* *, *Gorgonia ventalina, Pterogorgia anceps, P. citrina.*

The material studied for this report contains specimens from many islands of the Lesser Antilles', although in no case is a very large number of species recorded from any one island.

The localities on the Windward Group represented, followed by the number of species from each, are as follows:

Anegada (1)
Anguilla (6)
Antigua (2)
Islote Aves (1)
Barbados (14)
Barbuda (1)
Dominica (4)
Grenada (1)
Guadeloupe (5)
Saba Bank (7)
St. Barthélemy (5)
St. Christopher (7)
St. Eustatius (8)
St. John (7)
St. Lucia (2)
St. Martin (3)
St. Thomas (5)

Amongst the collections from these 17 localities, *Plexaura flexuosa* occurs most frequently, being present in 8 (or 47%); *Plexaurella dichotoma, Gorgonia mariae,* and *Pterogorgia citrina* are next, with 6 occurrences out of 17 (or 35%); *Briareum asbestinum, Eunicea tourneforti,* and *Pseudopterogorgia americana* are present from 5 of the islands (or 29%); *Eunicea succinea, Muriceopsis flavida, Gorgonia ventalina,* and *Pseudopterogorgia acerosa* from 4 (or 25%); *Muricea muricata* from 3 (18%); *Gorgonia flabellum* from 2 (12%); and *Erythropodium caribaeorum, Plexaura homomalla, Eunicea calyculata, Eunicea fusca, Eunicea mammosa, Plexaurella grisea, Muricea elongata, Muricea atlantica, Muricea laxa, Pseudoplexaura ramosa, Pseudopterogorgia hummelincki, Lophogorgia barbadensis,* and *Renilla reniformis* are the least abundant, each coming from only one (6%) of the islands represented. I have no doubt that all of these species (and more) occur at all of the places mentioned above as well as on every other island in the Lesser Antilles; the absence of certain species from a given locality tends only to reflect their relative rarity or the difficulty of collecting them. Thus we can say that, e.g., *Eunicea calyculata* either lives in a habitat that is difficult of access, or is relatively uncommon in the gorgonian population, whereas *Plexaura flexuosa* occurs in numbers almost everywhere and is practically certain to be encountered.

The islands of the Leeward Group, off the coast of Venezuela, support an alcyonarian fauna that is West Indian in composition although somewhat attenuated in number of species. The collections studied amount to 22 species.

In the following list, A = Aruba, Bon = Bonaire, C = Curaçao, Bl = Blanquilla, and F = Los Frailes.

Telesto riisei (C)	*Muriceopsis flavida* (F)
Plexaura flexuosa (A, Bl, Bon, C)	*Lophogorgia hebes* (A ?)
Plexaura homomalla (Bon, C)	*Pseudopterogorgia acerosa* (Bon, C, F)
Pseudoplexaura wagenaari (F)	*Pseudopterogorgia americana* (A, Bon, C)
Eunicea clavigera (C)	*Pseudopterogorgia blanquillensis* (Bl)
Eunicea mammosa (Bon)	*Gorgonia flabellum* (Bon)
Eunicea succinea (Bl, C)	*Gorgonia ventalina* (A, Bon, C)
E. succinea f. *plantaginea* (Bl)	*Pterogorgia anceps* (A)
Eunicea tournefortі (C)	*Pterogorgia citrina* (A, Bon, C)
Muricea muricata (C)	*Pterogorgia guadalupensis* (C)
Muriceopsis sulphurea (A)	*Renilla reniformis* (C)

The South American coast

Of particular interest is the material obtained during exploratory fisheries operations off the coast of the Guianas and Brazil by the 'Coquette' in 1957 and the 'Oregon' in 1957 and 1958. The presence of *Iciligorgia schrammi, Diodogorgia nodulifera, Ellisella barbadensis* and *E. elongata* shows that the offshore (but still relatively shallow-water) fauna has a decidedly West Indian flavor and is possibly only an extension of the Antillean fauna. At somewhat greater depths (50–150 fms.), the occurrence of such genera as *Thesea, Muricea, Ellisella* and *Callogorgia* indicates that West Indian faunal affinities persist also in this bathymetric range. (See BAYER, 1959).

The reef fauna of Brazil contains an endemic element consisting of such species as *Phyllogorgia dilatata* and *Plexaurella grandiflora*, and a non-endemic western Atlantic element typified by *Leptogorgia virgulata* and *Lophogorgia hebes*, which extend northward to the vicinity of Cape Hatteras on the North American coast. The geographical limits of the endemic component are not known.

DISTRIBUTION OF GENERA AND SPECIES

Order TELESTACEA

Family Telestidae

Genus *Telesto*. In the West Indies the order Telestacea is represented by a single genus, of which only one species is found at about low tide level. This is *Telesto riisei*, which ranges from southern

Florida through the Florida Keys and the Antilles south to the coast of Brazil. The remaining species, which may prove to be subgenerically or even generically distinct, are found at moderate depths, tow of them along the coast of the Carolinas, two of them in the Gulf of Mexico. The common species in the Florida Keys, *Telesto sanguinea*, has not yet been reported from the Antilles proper, where it is replaced by the very different *T. corallina*.

Order **ALCYONACEA**

Family **Nidaliidae**

Genus *Nidalia*. This is the only alcyonacean genus that approaches the bathymetric region covered by this paper. It has been found from South Carolina to the Dry Tortugas, the Gulf of Mexico (1 record from the Texas coast), and the Barbados. The absence of records off Cuba and Hispaniola indicate a lack of dredging in those regions and not a discontinuity of distribution.

Family **Nephtheidae**

None of the members of this family invade the reefs and shallow waters in the West Indies. The distribution of *Neospongodes portoricensis* corresponds with that of other Antillean alcyonarians from the same bathymetric range, while *Eunephthya nigra* belongs to a cold water group that demonstrates equatorial submergence.

Order **GORGONACEA**

Family **Briareidae**

Genus *Briareum*. The single West Indian species of this genus occurs commonly from the Dry Tortugas and Florida Keys through the Bahamas, Greater Antilles, and Lesser Antilles as far south as Barbados. I have been unable to discover any differences, generic or specific, between *Erythropodium polyanthes* and *Briareum asbestinum*. Moreover, since at least some of the Indo-Pacific species of *Solenopodium* are generically indistinguishable, *Briareum* can no longer be considered an endemic Caribbean genus.

Family **Anthothelidae**

Genus *Anthothela*. Until the present time, *Anthothela* has been represented in the Atlantic by a single species occurring from the Grand Banks south to Fernandina, Florida, in deep water. A distinctly different species has now been recorded from the Gulf of Mexico, also in deep water, which proves to be a new species closely related to the eastern Pacific *Anthothela pacifica* (Kükenthal), forming with it an eastern Pacific – western Atlantic twin-pair of species. The genus is also represented in the eastern Atlantic, and in the Indo-Pacific from east Africa to Hawaii and the Galapagos.

Genus *Iciligorgia*. The Caribbean species is common at moderate depths from Palm Beach, Florida, to Dominica. The West Indian genus *Iciligorgia* is very closely allied to the Indo-Pacific genera *Semperina* and *Solenocaulon*.

Genus *Tripalea*. The anatomical features of this genus render it quite unique, and the few records of its occurrence indicate that it is endemic in the western Atlantic. The single species, *T. clavaria*, is known from the eastern coast of South America between 23° South and 37° South.

Genus *Diodogorgia*. Material at hand indicates that this genus is represented in the western Atlantic by a single species which ranges from Palm Beach, Florida, south to Montserrat and the southern shore of the Caribbean. It probably occurs throughout the Antilles and around the rim of the Caribbean. Stiasny has described a species from the west coast of Africa (1939, p. 174), but so far the genus seems confined to the Atlantic.

Genus *Titanideum*. One species in the western Atlantic, occurring between Cape Hatteras and the Straits of Florida; it apparently does not extend very far into the Antilles. If this species follows the Carolinian disjunct pattern of distribution it may be expected in the northern part of the Gulf of Mexico, but extensive trawlings by the 'Pelican' and 'Oregon' in this area have failed to disclose its presence there.

Genus *Erythropodium*. From the southern tip of Florida to the northernmost of the windward Lesser Antilles and the western Caribbean. This genus has nothing to do with the Indo-Pacific species assigned to it by various authors, and is endemic in the Caribbean area.

Genus *Anthopodium*. Known from only two localities: Fort Macon, North Carolina, and the coast of Texas. It probably conforms to the Carolinian disjunct pattern since it has not been found in Florida. Its nearest relative is *Callipodium*, of the Panamic province.

Family **Keroeididae**

Genus *Lignella*. The West Indian representative of this family differs so widely from typical *Keroeides* that it is necessary to separate it as a distinct genus, which is endemic in the western Atlantic. Members of the genus *Keroeides* proper are distributed from the East Indies to Hawaii.

Family **Acanthogorgiidae**

No members of this family occur in shallow water in the West Indies. The western Atlantic species are found off Nova Scotia and the Grand Banks in depths of 170 to 677 fathoms, and in the West Indies, 75 to 400 fathoms.

Family **Plexauridae**

Genus *Plexaura*. Although a number of Indo-Pacific species have been referred to this genus from time to time, it is quite clear that they are all generically distinct and require reallocation. The present studies indicate the validity of three species, one of them with a named growth forma. *Plexaura homomalla* and *Plexaura flexuosa* have practically identical ranges, including Bermuda, southern Florida the Keys, the Antilles and the Caribbean islands. *Plexaura homomalla* forma *kükenthali* has been found off Miami, Florida, in the Bahamas, and at Old Providence in the Caribbean, and probably has a range identical with that of the typical form. *Plexaura nina* is a deep-water (36 fathoms) species closely related to *P. homomalla*, which is known only from the type locality in the Bahamas.

Genus *Pseudoplexaura*. This genus is also completely endemic in the West Indian region. *P. porosa* is recorded from Bermuda, the Florida Keys and Dry Tortugas, Bahamas, Lesser Antilles, Jamaica, and Curaçao; *P. flagellosa* is known from Bermuda, the Florida Keys, Lesser Antilles, Jamaica, and possibly Curaçao; *P. wagenaari* occurs in Bermuda, the Florida Keys, west coast of Florida, and the Lesser Antilles south to the Venezuelan Islands; *P. crucis* is known as yet only from the Virgin Islands but probably will be found throughout the Antilles.

Genus *Eunicella*. No representatives of this genus are found in shallow water in the West Indies. Off the eastern coast of the United States, two species are found at depths between 276 and 440 fathoms.

Genus *Eunicea*. This genus includes some of the most important reef-dwelling gorgonians of the western Atlantic. The most widely distributed species extend from Bermuda south to the Leeward Group of the Lesser Antilles, including the Florida Keys, Bahamas, and the Caribbean islands. These include *Eunicea tourneforti* and its slender forma *atra*, *E. calyculata*, *E. clavigera*, *E. laciniata*, and *E. fusca*. Most of the remaining species, which do not extend to Bermuda, have similar ranges over the Antillean region, except for *Eunicea knighti*, which is restricted to the west coast of Florida and the Keys. From records presently available, it seems that no species of *Eunicea* extends south to Brazil.

Genus *Muriceopsis*. Of the reef-dwelling species of *Muriceopsis*, one, *M. flavida*, extends from southern Florida and the Bahamas south to Curaçao, and the other, *M. sulphurea* (= *humilis*), is common on the South American mainland but becomes scarce through the Lesser Antilles and northward to Puerto Rico.

Genus *Plexaurella*. Of the six species recognized herein, one extends from Bermuda to Brazil (*P. dichotoma*), two seem to be limited to the Brazilian fauna (*P. grandiflora*, *pumila*), and the others are more or less purely Antillean. The genus is strictly endemic in the western Atlantic.

Genus *Muricea*. This is the only amphi-American genus of shallow-water plexaurids; none of the species occurs in both oceans.

When the Panamic fauna is adequately investigated, it will probably be found that one or more twin-pairs exist in the two regions. *Muricea pendula* is the only representative of the genus extending into cool water; it has a disjunct Carolinian distribution, extending from Texas to northwest Florida, and along the coast of the Carolinas. The common species *M. atlantica* and *M. muricata* have a typical Antillean distribution, with *M. atlantica* occurring in Bermuda. *Muricea elongata* and *M. laxa* appear to be common in the vicinity of the Florida Keys, but not much is known of their distribution outside of this area. *Muricea pinnata* is at present known only from a single locality in the Caribbean Sea.

Family **Gorgoniidae**

Genus *Lophogorgia*. This is the most widely distributed of all gorgoniid genera, being practically circumtropical. In the western Atlantic, at least one species, *L. punicea,* extends from Florida to Brazil. The others are apparently restricted either to the northern or the southern half of this range. *Lophogorgia hebes* has a typical disjunct Carolinian distribution, *L. cardinalis, L. miniata, L. barbadensis,* and *L. sanguinolenta* seem to be Antillean, and *L. purpurea* South American. Additional records are required to clarify the distribution of these species.

Genus *Pacifigorgia*. The distribution of this genus is amphi-American, with numerous species in the Panamic province but only one in the western Atlantic. It has already been suggested that *P. elegans* is a relict of the period when Central American portals permitted a continuous trans-American fauna, surviving only in those regions that suffered the least change of environmental conditions after final closure of the last portal.

Genus *Leptogorgia*. All evidence indicates that this genus is endemic in the western Atlantic. The common *Leptogorgia virgulata* and *L. setacea* of the eastern seaboard of the United States extend south to Brazil, probably following the continental coast; no records of either species can be substantiated from Antillean localities. Three additional species have been described from the Gulf of Mexico.

Genus *Pseudopterogorgia.* The West Indian members of this genus, referred in the past to *Pterogorgia* (sensu Bielschowsky, Kükenthal, et al.) and *Antillogorgia* (Bayer), are not generically separable from the Indo-west-Pacific species for which *Pseudopterogorgia* originally was established, although it does appear that ten of the twelve West Indian species form a group of species distinct from the other two plus four from the Indo-Pacific. In spite of the fact that the genus is not endemic in the West Indies, a group of species somewhat divergent from their Indo-Pacific relatives has certainly developed there and assumed a rôle of major importance among the reef-dwelling gorgonians. *Pseudopterogorgia bipinnata, P. blanquillensis,* and possibly *P. rigida* are more closely related to the Indo-Pacific group of species and may form with them a recognizable subgenus. Of the nine remaining species, two (*acerosa* and *americana*) extend as far north as Bermuda, six are found generally through the Antilles, and one (*marcgravii*) is at present known only from Brazil. *P. acerosa* penetrates northward into the Gulf of Mexico, certainly as far as Tampa, and probably into Apalachee Bay, and has been taken also in the Gulf of Campeche.

Genus *Gorgonia.* This well known genus occurs throughout the West Indian region, from Bermuda and southern Florida through the Antillean arc to Trinidad. Available record indicate that both Linnaean species, *G. flabellum* and *G. ventalina,* occur together in the Bahamas, Florida Keys, and Antilles; it appears that only *G. ventalina* occurs in Bermuda. The third species of the genus, *G. mariae,* is restricted to the northern part of the Antillean chain, from Cuba to St. Eustatius.

Genus *Phyllogorgia.* The one species of this genus is not certainly known from any locality outside of Brazil, but was reported from Guadeloupe by MILNE EDWARDS & HAIME (1857). It would probably have been noticed more recently if it actually occurs in the Antilles.

Genus *Pterogorgia.* The three species of the genus are virtually sympatric but *P. citrina* seems to be the only one of them that reaches Bermuda, and *P. anceps* the only one found along the west coast of Florida.

Family **Ellisellidae**

In comparison with the East Indian region, the tropical western Atlantic is poor in members of this family. Three genera, *Ellisella* (= *Scirpearia*), *Nicella*, and *Riisea*, are present; the four additional genera that make up the family are exclusively Indo-west-Pacific in their distribution. *Riisea* appears to be endemic in the West Indies. Both *Ellisella* and *Nicella* occur on both sides of the Atlantic but are not so well represented on the west coast of Africa as the literature might indicate. Contrary to KÜKENTHAL's belief, the genus *Ellisella* does occur on the Pacific coast of Mexico and accordingly is the only genus of the family known to have a practically circumtropical distribution: western Atlantic, eastern Atlantic, Mediterranean, Red Sea, Indian Ocean, East Indies, western Pacific, and eastern Pacific.

In the West Indies, most ellisellids inhabit moderate to considerable depths and only a few extend within range of shallow water diving equipment, whereas a number of East Indian species occur just below low tide mark.

Order **PENNATULACEA**

Many members of this order enjoy wide geographical ranges and those from great depths may be cosmopolitan. Of the pennatulacean genera included in this treatment, *Renilla* is of particular interest because of its endemic amphi-American distribution. Two species, *Renilla reniformis* and *R. mülleri*, occur on both Atlantic and Pacific coasts of the Americas, the latter without any discernible regional differentiation. Unfortunately, collection records are not sufficiently complete to reveal whether or not the populations are continuous around the southern tip of South America. Such a case seems unlikely.

The genus *Sclerobelemnon*, which has only recently been detected in the Caribbean area, is otherwise known from the Red Sea, Indian Ocean, Japan, the Philippines and Australia.

The virgulariid genera *Virgularia* and *Stylatula* are widely distributed in both the Atlantic and Indo-Pacific. At least one species of *Stylatula, S. elegans,* occurs in both northern Atlantic and northern Pacific, and other species may prove to be similarly widespread once synonymies have been clarified adequately.

Faunistic Regions

The western Atlantic warm-water fauna is unified by the broad distribution of the common *Leptogorgia virgulata* and *L. setacea,* which extend from the Virginia Capes south to the reefs of Brazil. Within this vast geographic area, several faunal subdivisions are more or less clearly defined:

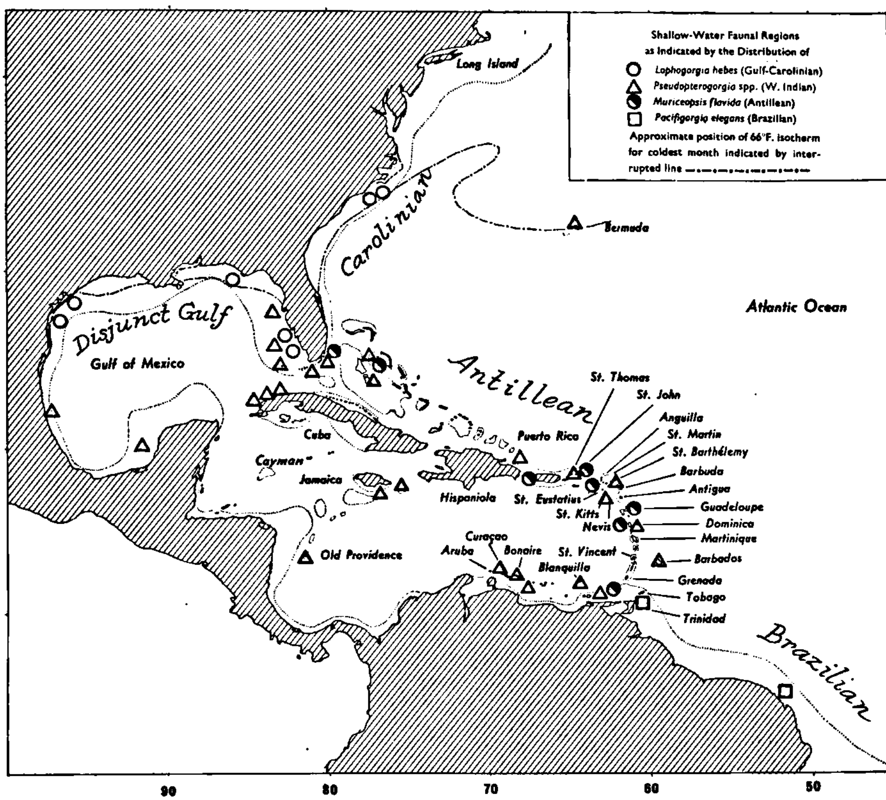


Figure 100. Shallow water faunal regions.

1. *Carolinian:* The Atlantic coast from the Virginia Capes to Georgia or east Florida. (*Telesto fruticulosa, T. nelleae, Titanideum frauenfeldii.*)

2. *Disjunct Gulf – Carolinian:* The Carolinian region plus the northern shore of the Gulf of Mexico, distinctly separated by more or less of the Florida peninsula. (*Muricea pendula.*)

3. *West Indian:* The islands of the West Indies, the Caribbean Sea, southern Florida, and Bermuda. (*Antillogorgia acerosa, A. americana, Gorgonia ventalina, Plexaura flexuosa.*)

4. *Antillean:* The Antillean islands from Trinidad to Cuba, and including the Florida Keys and Bahamas. (*Diodogorgia nodulifera, Iciligorgia schrammi, Gorgonia flabellum, Pterogorgia anceps.*)

5. *Brazilian:* The coast of the Guianas to the reefs of Brazil. (*Muriceopsis humilis, Phyllogorgia dilatata.*)

Adequate data are not now available to permit the recognition of any clear-cut smaller faunal areas. The broad faunal areas are indicated on the accompanying map. (Figure 100)

Comparative Distribution of the Deeper-water Fauna

Although species occurring at depths greater than 25 fathoms are for the most part not included in this report, it is desirable to summarize briefly their distributional characteristics in order to draw comparisons with the shallow-water population. Seasonal temperature fluctuations are much reduced as depth increases, and it is accordingly no surprise to learn that the genera and species living at depths of 25–100 fathoms exceed the geographical bounds of their shallow-water relatives. In the Gulf of Mexico the paramuriceids and ellisellids characteristic of the Antillean islands continue northward from the Tortugas around the rim of the Gulf basin wherever suitable bottom occurs within the requisite depth range. Even the great discharge of silt-laden fresh water from the Mississippi River seems not to affect the distribution of gorgonians below 25 fathoms, for dredgings off the delta mouth by the 'Oregon' have revealed a typical West Indian assemblage. (Figure 101)

Relationships of the Western Atlantic Alcyonarian Fauna

The faunas of the West Indian region (or the warm-water west Atlantic) and the Panamic region (warm-water east Pacific) are closely related. As pointed out above, the families Gorgoniidae and Plexauridae are common to the shallow waters of both areas and, since species of both families are elsewhere uncommon or even rare, are virtually characteristic of them.

As I have elsewhere pointed out (1953), the genus *Lophogorgia* has several species in the Panamic and West Indian regions whereas other genera are more or less restricted to one area or the other. Thus, *Leptogorgia* is limited to the Atlantic, and its counterpart

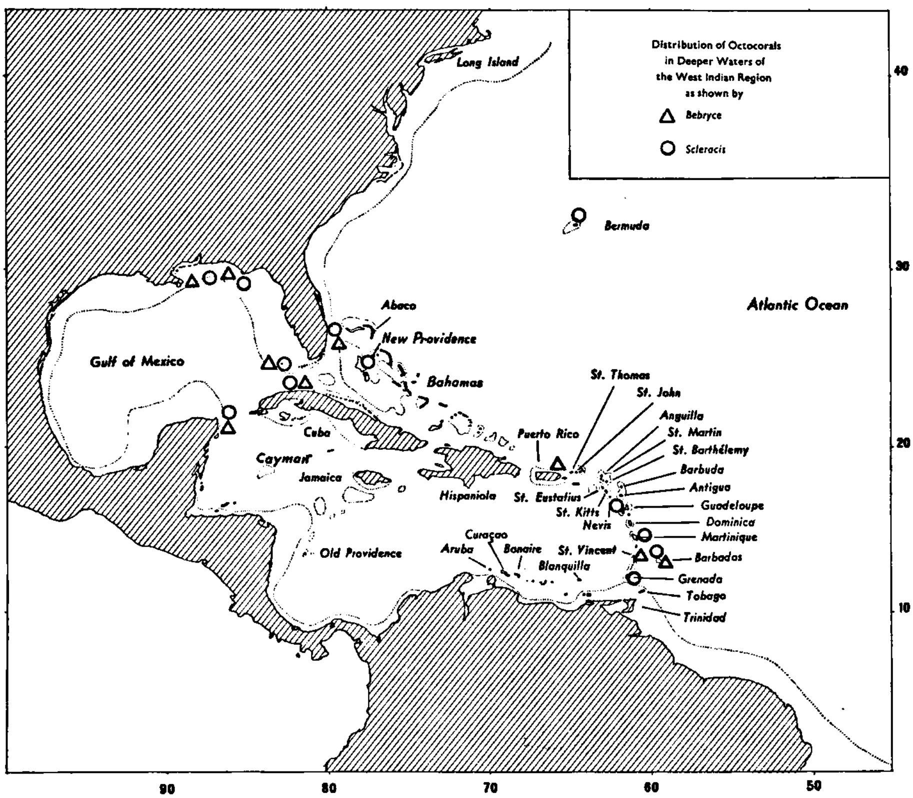


FIGURE 101. Distribution of typical deeper water West Indian Octocorallia.

Eugorgia to the Pacific; *Pacifigorgia* has numerous species in the Panamic fauna, but one relict appears in Trinidad and Brazil.

Among the Plexauridae as herein recognized, one genus, *Muricea*, is represented both in the West Indies and in the Panamic-Californian region, whereas all the other shallow-water genera are restricted either to the Atlantic or the Pacific. *Plexaura*, *Plexaurella*, *Eunicea*, and *Muriceopsis* are endemic in the Atlantic, and *Psammogorgia* is limited to the Pacific coast.

The former faunal confluence of the two areas is clearly indicated by the distribution of the gorgonians, but even more clearly by that of the pennatulid genus *Renilla*, a warm shallow-water group that has two species common to the two oceans, one of which shows subspecific differentiation.

If we tabulate the distribution of the two predominant shallow-water families of the western Atlantic, the strong independence of the fauna becomes clear. (Table 3)

TABLE 3

ZOOGEOGRAPHIC RELATIONSHIPS OF WEST INDIAN GORGONIIDAE AND PLEXAURIDAE

	Gorgoniidae		*Plexauridae*	
	Species (34)	Genera (7)	Species (35)	Genera (6)
Endemic western Atlantic . . .	34 (100%)	4 (57%)	35 (100%)	5 (83%)
West Atlantic and Panamic (= 'Amphi-American')	0	1 (14%)	0	1 (17%)
West Atlantic and East Atlantic (= 'Amphi-Atlantic')	0	0	0	0
West Atlantic and Indo-Pacific (including circumtropical) . .	0	2 (29%)	0	0

It has been shown that the West Indian fauna contains six genera and thirty four species of Plexauridae and seven genera and thirty three species of Gorgoniidae, of which 67% of the genera and 100% of the species are endemic in the western Atlantic. Let us now see what percentage of the genera and species of these families as a whole occurs in the western Atlantic region. Using KÜKENTHAL's monographs (1919, 1924) as a basis, we find a total of 13 genera and

103 species of Plexauridae, and 9 genera and 86 species of Gorgoniidae. (Table 4)

TABLE 4

GEOGRAPHICAL DISTRIBUTION OF THE GENERA AND SPECIES OF GORGONIIDAE AND PLEXAURIDAE

	Gorgoniidae		*Plexauridae*	
	Species (86)	Genera (9)	Species (103)	Genera (13)
Endemic western Atlantic	34 (40%)	4 (44%)	35 (34%)	5 (38%)
Eastern Atlantic	9 (10%)	1 (11%)	5 (5%)	1 (7.7)
Mediterranean	1 (1.2%)	1 (11%)	2 (2%)	1 (7.7%)
Indo-West Pacific	6 (7%)	1 (11%)	46 (45%)	5 (38%)
Endemic eastern Pacific	32 (37%)	2 (22%)	14 (14%)	1 (7.7%)

For the sake of comparison, let us prepare a table of the zoogeographic affinities of some gorgonians from that part of the continental shelf lying between 25 and 150 fathoms in depth. The reef genera of the Plexauridae and Gorgoniidae invade this region to only a small extent, and the members of its typical families, the Primnoidae, Paramuriceidae, and Ellisellidae, correspondingly do not approach the reef habitat.

Because the present account does not consider these families of deeper waters, we must go to the literature for the necessary data, depending mainly upon the work of KÜKENTHAL (1919, 1924) and DEICHMANN (1936). As examples for tabulation, we may take the Primnoidae and the Ellisellidae (= Gorgonellidae), the former with its species concentrated in the deeper waters of the continental shelf and slope and in the abysses, and the latter in the shallower parts of the bathymetric zone under discussion. In her monograph of the western Atlantic Alcyonaria, DEICHMANN (1936) lists two ellisellid genera in the West Indies, viz. *Scirpearia* (properly *Ellisella*) and *Nicella,* and I have recently transferred the genus *Riisea* from the Chrysogorgiidae to the Ellisellidae (BAYER 1955), bringing the total to three. The Indo-Pacific genus *Junceella* as recorded in the Atlantic (DEICHMANN 1936, p. 204) seems to be based upon an *Ellisella* with unusually asymmetrical spicules, or upon an error of labelling, or both (BAYER 1958, p. 384, 386). Three others genera, also of the Indo-Pacific region, complete the family. The Primnoidae, following the same author, is represented in the Atlantic by seven genera. (Table 5)

TABLE 5

ZOOGEOGRAPHIC RELATIONSHIPS OF WEST INDIAN ELLISELLIDAE AND PRIMNOIDAE

	Ellisellidae		*Primnoidae*	
	Species (10)	Genera (3)	Species (16)	Genera (7)
Endemic western Atlantic . . .	10 (100%)	1 (33%)	12 (75%)	0
West Atlantic and Panamic (= 'Amphi-American')	0	0,	0	0
West Atlantic and East Atlantic (= 'Amphi-Atlantic')	0	0	4 (25%)	0
West Atlantic and Indo-Pacific (including circumtropical) . .	0	2 (66%)	0	7 (100%)

In the West Indian region we find less generic endemism in the gorgonian families of the deeper waters than in those of shallow-water habitats. Among the ellisellids, a family with strong affinity for the shallower waters, a single monotypic genus is restricted to the warm western Atlantic. On the other hand, the genera of Primnoidae, a family with strong affinity for the deeper waters, show no endemism in the western Atlantic and even the percentage of species endemic there is low if compared with that of other families. It is apparent that the Atlantic Ocean forms a barrier to trans-Atlantic migration of alcyonarians living in moderate depths, but not to those of the deeper waters.

AMPHI-AMERICAN AND AMPHI-ATLANTIC DISTRIBUTION

The amphi-American element in the West Indian fauna obviously must consist of only those genera and species that have persisted unchanged since the interruption of a continuous Atlantic-Pacific American fauna. This element is represented in shallow water by the genera *Muricea* (Plexauridae), *Lophogorgia* and *Pacifigorgia* (Gorgoniidae), and *Renilla* (Pennatulacea) with its species *reniformis* and *mülleri;* of these, the genus *Lophogorgia* is circumtropical rather than strictly amphi-American. In deeper waters the picture is clouded by lack of reliable information on the Pacific coastal fauna, although the genera *Telesto*, *Anthothela*, *Swiftia*, *Thesea*, *Callogorgia*, *Plumarella*, and probably others, occur on both Atlantic and Pacific coasts of the Americas. Most, if not all, of these genera are circumtropical rather than amphi-American.

Correspondingly, any amphi-Atlantic elements must represent genera or species that are or were distributed continuously between the two areas, or that have remained stable since continuity existed. In shallow water, only two genera, *Lophogorgia* and *Telesto*, are definitely common to both sides of the Atlantic, and both of them are circumtropical genera. The only reported shallow-water amphi-Atlantic species, *Lophogorgia sanguinolenta*, appears from all indications to be two distinct species. The fact that no members of this large circumtropical genus occur on both sides of the Atlantic indicates that there is now little or no faunal interchange and that the areas have been isolated, at least as far as gorgonians are concerned, for a long time. It appears that a truly amphi-Atlantic element exists only in the deep-water fauna, among species of the Primnoidae and perhaps also the Paramuriceidae and Anthothelidae.

Thus, we have a definite amphi-American element in the shallow-water Octocorallia, but no demonstrable amphi-Atlantic fauna; in deeper water there certainly are both amphi-American and amphi-Atlantic elements and, although their extent is not known, they probably are not large.

TETHYAN DISTRIBUTION

Tables 3 and 5 and the foregoing discussion have shown that there is no strictly amphi-Atlantic element in the shallow-water gorgonians, and only a small one among the deeper-water forms. The genera common to the eastern and western shores of the Atlantic are mostly circumtropical rather than amphi-Atlantic, and since many of them are warm-water groups, they have no possible migration route from ocean to ocean. Consequently, they have at present a highly discontinuous distribution, groups of species being isolated in the western Atlantic, eastern Atlantic-Mediterranean, Indo-West Pacific, and eastern Pacific by continental land masses, the East Pacific Barrier, and the Atlantic Barrier.

EKMAN (1953, p. 40) points out that the warm-water fauna of the western Atlantic has a somewhat closer relationship with the Indo-Pacific than has that of the Pacific coast of the Americas. Although it is not correct as stated by EKMAN that no species of Gorgonellidae (= Ellisellidae) occur along the western shores of America, a number of paramuriceid genera, e.g., *Bebryce*, *Villogorgia*, and *Placogorgia*, which are otherwise circumtropical, do show such a distribution. Others, such as *Swiftia*, definitely occur on both American coasts as well as in the Indo-West Pacific. In contrast, the genus *Corallium* skips the western Atlantic but occurs from the eastern Atlantic through the Mediterranean, Indian Ocean, Malay Archipelago and Japan, east to Hawaii and Guadelupe Island off the Mexican coast.

As suggested by STIASNY (1936, p. 39–42), this discontinuity certainly finds its best explanation in the Tethys Sea, a great body of water that girdled nearly the entire earth until the time of the middle Tertiary and made possible the existence of a continuous circumtropical Tethys fauna.

The strongest manifestation of the Tethyan distribution is found in the warm-water alcyonarians living at moderate depths, many of which have groups of species in both Atlantic and Indo-West Pacific which must have been isolated since sometime toward the middle or end of the Tertiary, but which still clearly retain their generic identity.

The high degree of generic and specific endemism in tropical American reef alcyonarians is indicative of profuse development of the two predominant families in this area, and the low amphi-American element suggests that the Atlantic and Pacific American faunas have reached their present state of development in rather recent times, i.e., since the closure of the Central American portals. The West Indian reef fauna is therefore a young fauna, but one with its heritage in the Tethys. The West Indian shelf, slope, and deep-sea alcyonarian fauna owes its characteristics not only to the old Tethys Sea with its continuous circumtropical fauna, but also to the more stable conditions at greater depths, which have not stimulated evolution beyond the specific level.

SUMMARY

The alcyonarian fauna of the West Indies is prolific and conspicuous and has been known for many years, with the natural result that a great many more species have been described than actually exist. The deep-water fauna, which received little attention prior to the work of VERRILL, was thoroughly reviewed by DEICHMANN in 1936. The shallow-water and reef fauna was the subject of a series of extensive papers by KÜKENTHAL and his collaborators, KUNZE, MOSER, RIESS, BIELSCHOWSKY, and TOEPLITZ, but this ambitious study appears to have been based upon inadequate collections and its usefulness is seriously limited by the number of synonyms and misidentifications that it contains. No comprehensive survey of the fauna exists, and there is no satisfactory guide for the identification of specimens.

This paper, which was prepared at the request of Dr. P. WAGENAAR HUMMELINCK, Secretary of the Stichting 'Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen' (Foundation for Scientific Research in Surinam and the Netherlands Antilles), forms such a guide and at the same time reviews the fauna to the extent permitted by the collections in hand and the literature. With Dr. HUMMELINCK's collection of West Indian octocorals serving as a nucleus, the pertinent material in the collections of the U.S. National Museum was critically revised and correlated with the literature in order to gain an accurate picture of the known fauna. As a result of this study, it was possible to recognize 75 species of alcyonarians belonging to the orders Telestacea, Alcyonacea, Gorgonacea, and Pennatulacea inhabiting the reefs and shallow waters of the warm western Atlantic. An additional 21 species from deeper water are also included for comparative purposes or because they inhabit the transitional zone just below

the region of active reef growth. Seventeen species and a few growth forms are described as new to science. Each species is diagnosed and illustrated with drawings of the details of spiculation and, in the case of new or especially common species, photographs of the colonial form. Taxonomic keys with couplets illustrated for clarity are provided to facilitate the identification of specimens. The species described in this paper are arranged as indicated in the Table of Contents (p. 3–7).

A total of 96 species are described from the region including the Bermudas, the southeastern coast of the United States, the Bahamas and Antilles, and the east coast of South America south to the reefs of Brazil. Of these, 52 species occur in the reef habitat proper or closely associated with it, and another 23 species occur in depths of 25 fathoms or less. The orders Telestacea, Alcyonacea, and Pennatulacea are togehter represented by only 13 species within the bathymetric limits set forth, the remaining 83 belonging to the order Gorgonacea. The littoral and reef-dwelling representatives of the last-named order belong for the most part to the two families Plexauridae and Gorgoniidae, which include 35 and 34 species respectively. When the shallow-water alcyonarian fauna is added to the deep-water fauna as reported by DEICHMANN, a total of 196 species is revealed for the area. This is a fauna of only modest proportions when compared with that of the East Indies, where some 445 species (exclusive of Pennatulacea) were obtained by the 'Siboga' Expedition, but nevertheless, the gorgonians are the dominant sessile animals on many of the reefs of Florida, the Bahamas, and the Antilles. This dense population consists chiefly of about a dozen species, all the others being rare or of local occurrence, so it appears that the reef fauna is rich in individuals but poor in species.

The distribution of alcyonarians is influenced by a variety of factors, among them salinity, temperature, illumination, depth of water, and character of the bottom. It is not possible to single out any one factor as the most important, since they all interact closely, but there is no doubt that temperature is one of the most influential.

Although temperature requirements and tolerations have not been determined experimentally for alcyonarians, they can reasonably be assumed to parallel more or less closely those of the principal reef-formers. It has been observed that formation of reefs does not take place in waters that drop below 68°F. for any appreciable period during the winter. Since active growth of reefs occurs at Bermuda, the northernmost limit of the West Indian fauna, its annual minimum temperature of 66°F, may be taken as the limit for reef formation in the West Indian area. Tropical alcyonarians occur up to this minimum isotherm of both coasts of Florida.

Most alcyonarians are stenohaline and require salinities within the range found in the open sea. However, the occurrence of a few species, such as *Leptogorgia setacea* of the southeastern coast of the United States, in the brackish inshore waters of bays and river mouths indicates that a limited degree of euryhalinity does occur in the Octocorallia.

A rough and solid bottom is apparently as necessary for the attachment of gorgonian planulae as it is for those of madrepores, and the importance of this requirement is clearly demonstrated on the west coast of Florida, where reef communities gain a foothold only on the scattered solid outcrops on an otherwise broad, sandy shelf. A few species of Gorgonacea are known to live unattached, the colonies apparently doing so in some cases because no suitable objects were available for attachment, in others because they were broken loose from their original solid support but continued to live in a prone position. Certain deep-water gorgonacean groups (families Chrysogorgiidae and Isididae) that inhabit areas with a scarcity of solid material are able to adapt the form of their holdfast to the conditions present at the time of metamorphosis, producing either a calcareous basal disk for attachment to shells and stones, or a branched, rootlike process for anchoring the colony firmly in a muddy bottom. The pennatulaceans, which are adapted for life on soft bottoms, require either sand or mud and therefore are not found closely associated with reef communities.

The octocorals of the reefs are restricted bathymetrically to the upper 25 fathoms of water, perhaps because of their symbiotic zooxanthellae, which require sunlight for the process of photosynthesis, but the physiological relationships of zooxanthellae and their coelenterate hosts are in general less clearly understood in the octocorals than in the madrepores, so the cause of the bathymetric-photic correlation cannot be stated in general terms. Obviously, the vertical distribution of those octocorals that are dependent upon their zooxanthellae for nutrition is governed by the physiological requirements of the algae. In those octocorals that are nutritionally independent of their zooxanthellae (as appears to be generally the case among scleractinian corals) other ecological factors must limit bathymetric distribution.

In the West Indies, almost all of the shallow-water octocorals, which represent 38% of the total known fauna, belong to the two families Plexauridae and Gorgoniidae. Very few members of these families extend downward below 25 fathoms, and very few members of the deep-water families venture into water shallower than this. In the East Indies, where a rich tropical alcyonarian fauna exists, 59% of the species taken by the 'Siboga'-Expedition lived in depths shallower than 50 meters, but this fauna is inordinately rich in groups poorly represented in the West Indies, where 85% of the species are gorgonaceans. In both regions, somewhat more than 40% of the gorgonaceans occur in depths less than 50 meters.

The alcyonarians are an important component of the reef community, perhaps more so in the West Indies than elsewhere in the tropics because of the great profusion of a few conspicuous forms in the reef habitat. They provide shelter and sustenance for a wide array of casual associates, epizoa, commensals, and parasites, ranging from other coelenterates to fishes. Moreover, when they die they liberate great quantities of calcareous spicules which are then available for incorporation into the general mass of the reef.

The alcyonarian fauna of the warm parts of the western Atlantic shows a high degree of endemism and only indistinct subdivision into smaller faunal regions. It is possible to distinguish a Carolinian fauna occupying the southeastern coast of the United States, with part of its species occurring only along the Atlantic coast and part of them with isolated populations in the northern Gulf of Mexico. At least three species follow the continental coast more or less continuously from the Carolinas to Brazil. This is basically a continental fauna and its species do not range out into the West Indian islands.

The fauna of the West Indies is essentially an insular fauna and it suffers depletion wherever it invades continental coasts. The largest number of reef dwelling species seems to occur in the northern islands of the Lesser Antilles, the Greater Antilles, and the Florida Keys. At the present time, more species are known from the last-named locality than from the islands of the Greater Antilles, but it has certainly been more thoroughly explored. Intensive collecting will probably reveal an even larger number of species in the northeastern part of the Antilles. Antillean species extend along both coasts of Florida northward to about the 66°F. minimum surface isotherm, but their number is sharply diminished. A small group of the hardiest species reaches Bermuda, which is the northernmost outpost of the West Indian fauna.

Records indicate that the Antillean fauna becomes attenuated also toward the southern islands of the Lesser Antilles, and the Leeward Group along the coast of South America has a fauna comparable in many respects with that of Bermuda. However, the fauna of Bermuda is restricted by the low temperature of the water during midwinter (66°F), a limiting factor that does not exist at the low latitude of the Leeward Islands. The fauna must instead be restricted by other ecological factors, perhaps imposed by the proximity of the continental coast.

The alcyonarian fauna of the reefs of Brazil, although composed largely of West Indian genera – *Plexaurella*, *Muriceopsis*, *Lophogorgia* – shares few species, perhaps no more than three or four, with the Antillean region to the north, and is probably the most distinct of the subregions of the western Atlantic.

Within the broad limits of the warm western Atlantic faunal region, extending from Bermuda south to Brazil, we can distinguish an insular Antillean fauna centered in the northeastern part of the Antilles; a continental Carolinian fauna along the southeastern

Atlantic seabord, some of its species with disjunct populations in the Gulf of Mexico and some following virtually the entire coastline from the Carolinas to Brazil; and a Brazilian fauna extending northward along the South American coast as far as Trinidad.

The presence in the West Indies of Alcyonarian genera known also in the tropical Indo-West Pacific can be explained only on the basis of former faunal continuity. The presence of a small amphi-American element clearly points to the existence of a continuous East Pacific–West Atlantic (or trans-American) fauna during the past, and the high level of endemism in the West Indian region suggests a subsequent rapid development of a new fauna from remnants of the old, left behind after closure of the Central American seaways. The distribution of modern alcyonarians corroborates the former existence of a great equatorial sea, the Tethys, that permitted circumtropical distribution of marine animals, which geology tells us existed during much of Earth's history between the Cambrian and the Tertiary.

POST SCRIPT

During the many months this volume has been in press, many new specimens and new observations have become available to me, requiring more or less extensive revisions at several points in the text. Such alterations must obviously result in some inconsistencies in the general discussions, and I hope that the most obvious of these have been corrected. For those that have escaped, I beg the reader's indulgence. I would like to take this opportunity to express once again my sincere appreciation to the Editor, Dr. P. Wagenaar Hummelinck, and to the publishers Messrs. Martinus Nijhoff, for their continued patience and willing assistance whereby my wishes have been transformed into type. Without them, this book could not have come into being.

SUGGESTIONS FOR FURTHER STUDY

It has been shown in the foregoing pages that the characters upon which the classification of octocorals depends – e.g., the ramification and general form of the entire colony, the size, shape and color of the spicules, and the development of anthocodial armature in the polyps – are subject to a degree of variation and intergradation that imposes an uncomfortably large element of doubt upon the resultant system. These perplexities will be dispelled only when the influence of the environment upon the morphological features of the colonies is fully understood. Even large suites of specimens from many localities fail to provide such understanding, and it is now becoming obvious that only through an experimental approach will the answers to many questions be found. The West Indian region – i.e., southern Florida, the Bahamas and Antilles – provides one of the richest grounds in the world for reef-dwelling gorgonians, with several marine laboratories at which experiments in controlled ecology could readily be undertaken.

By the simple technique of transplanting young colonies on tiles, some of the easily recognized forms – e.g., *Pseudopterogorgia acerosa* and *P. americana*, *Pterogorgia anceps* and *Pt. citrina*, *Plexaura flexuosa* and *P. homomalla*, *Plexaurella dichotoma*, and *Muricea muricata* – could be moved about from one situation to another, where the principal environmental factors, including current, temperature, salinity, and light, could be measured and recorded and their effects upon the growing colonies determined. It is known that currents have a marked effect upon the branching of reef corals, millepores, and calcareous algae (Abe 1937, p. 309) and they probably exert a similar influence upon the growth form of gorgonians. However, the influence of environmental factors upon the size and shape of the skeletal spicules of octocorals is as yet completely unknown, but possibly could be determined by repeated examination of the spicules formed at the growing tips of colonies transplanted into habitats with selected environmental characteristics, and comparison with samples taken before they were moved. The resultant information would be invaluable in defining the limits of ecological variation within species and could well provide a new and solid foundation for the identification and classification of the Octocorallia.

Until studies of this kind are undertaken to determine valid means of defining species and their ecological variants, classification of the octocorals will remain subject to changes imposed by the differing taxonomic interpretations employed by various workers, and instability inevitably will prevail.

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[New names in CAPITAL LETTERS; other names in valid use in *italic letters;* names not in valid use in ordinary Roman letters. Page number of main reference in bold face numbers (**25**).]

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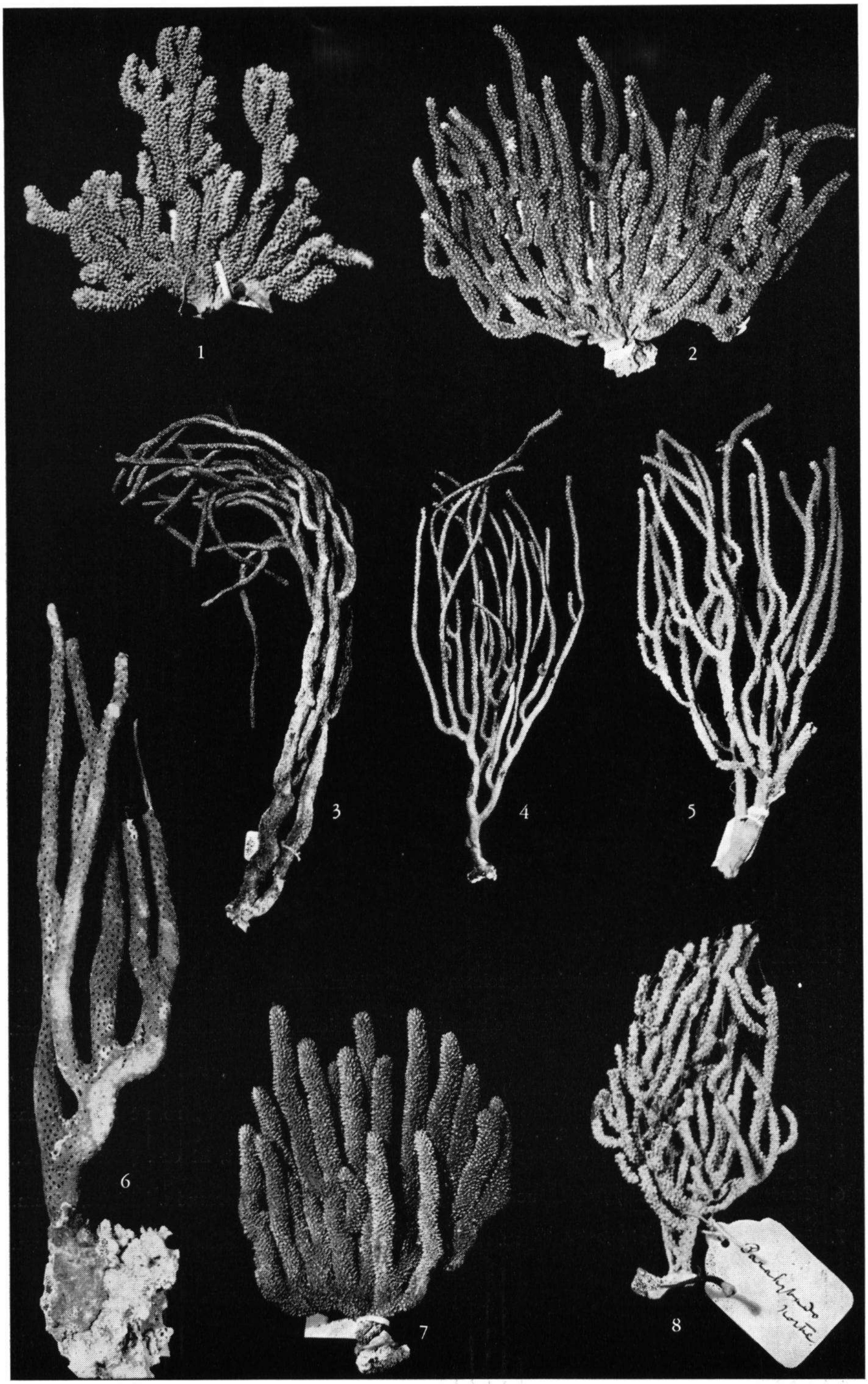
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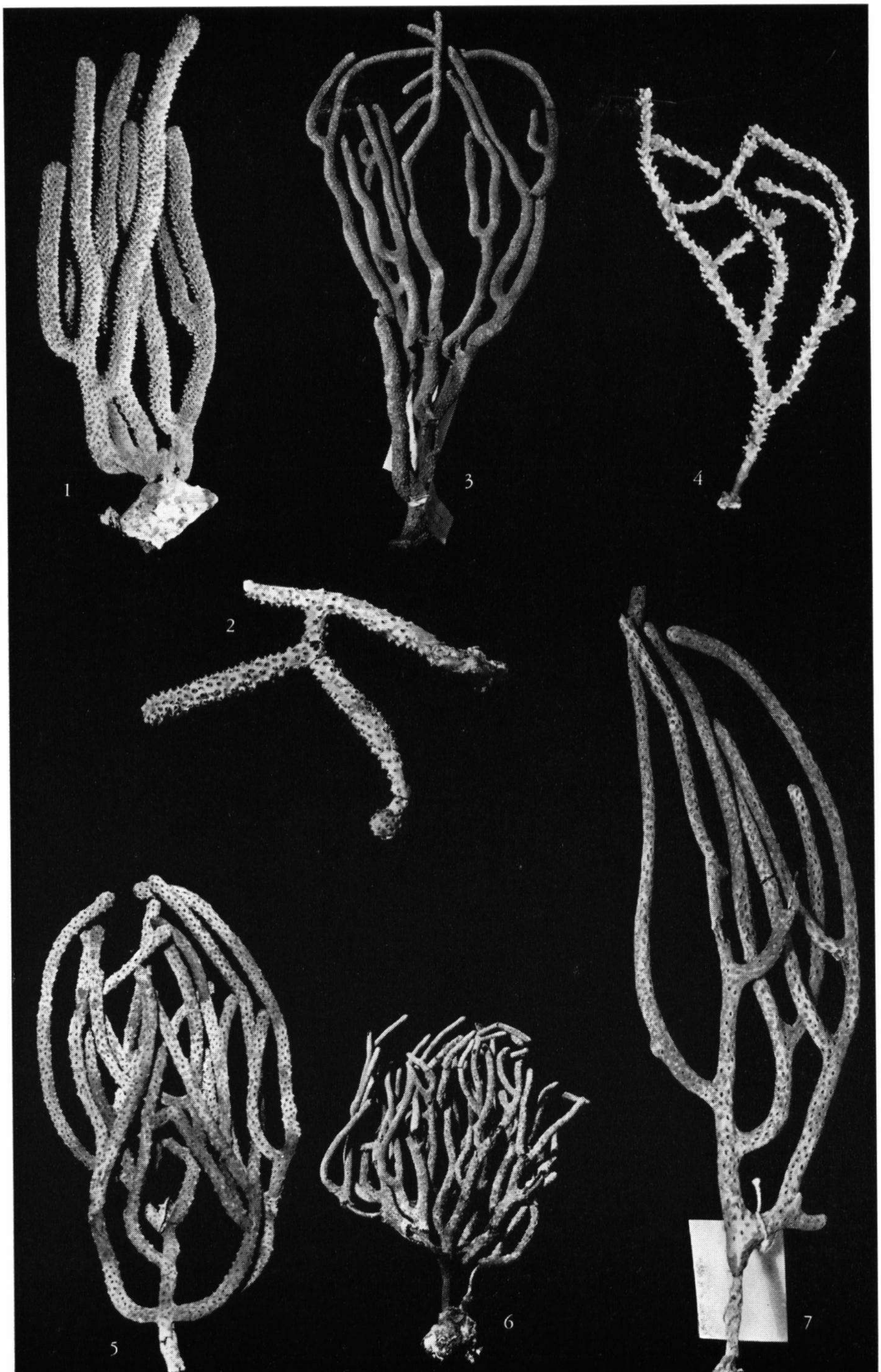
PLATE III



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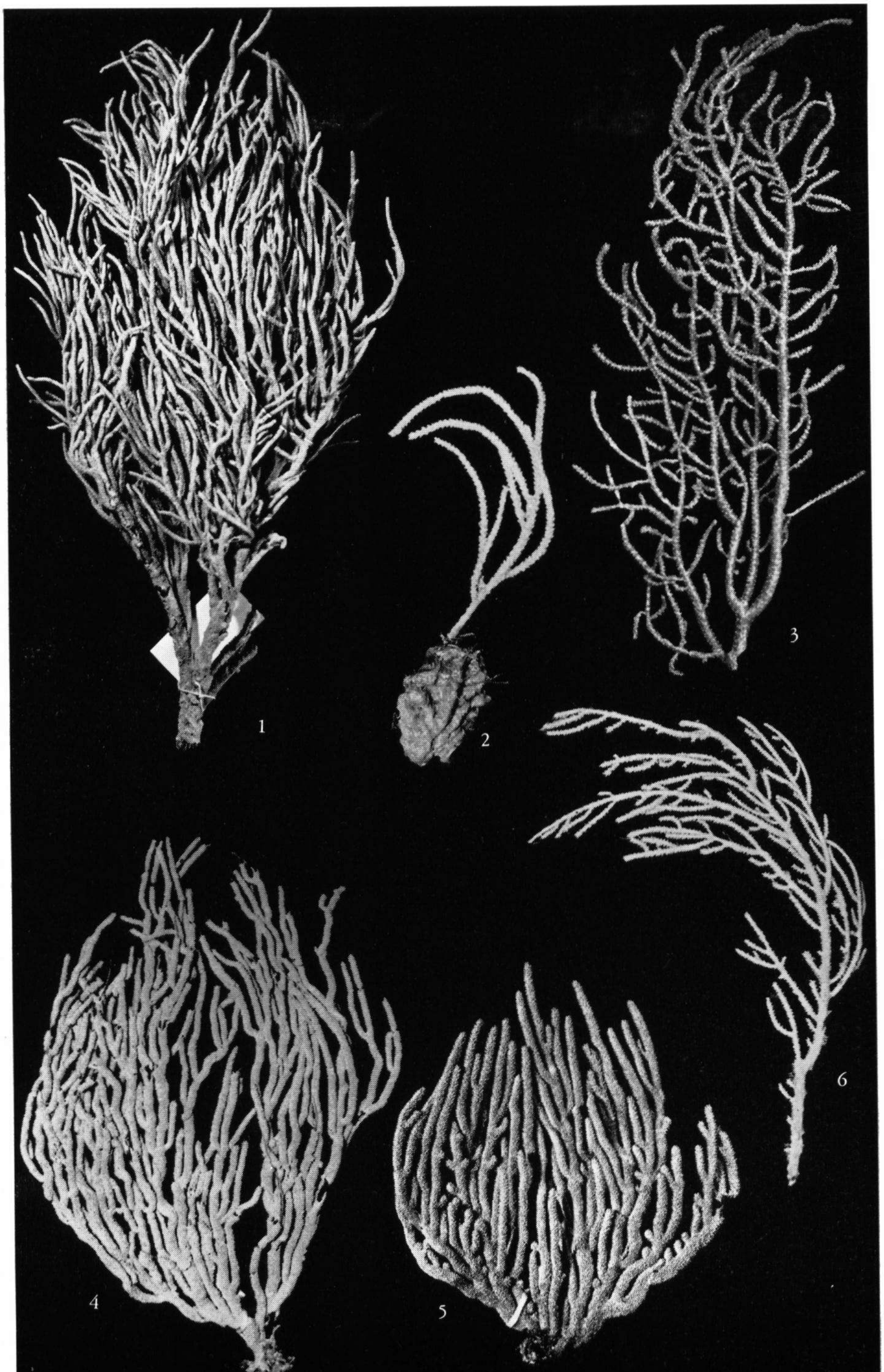
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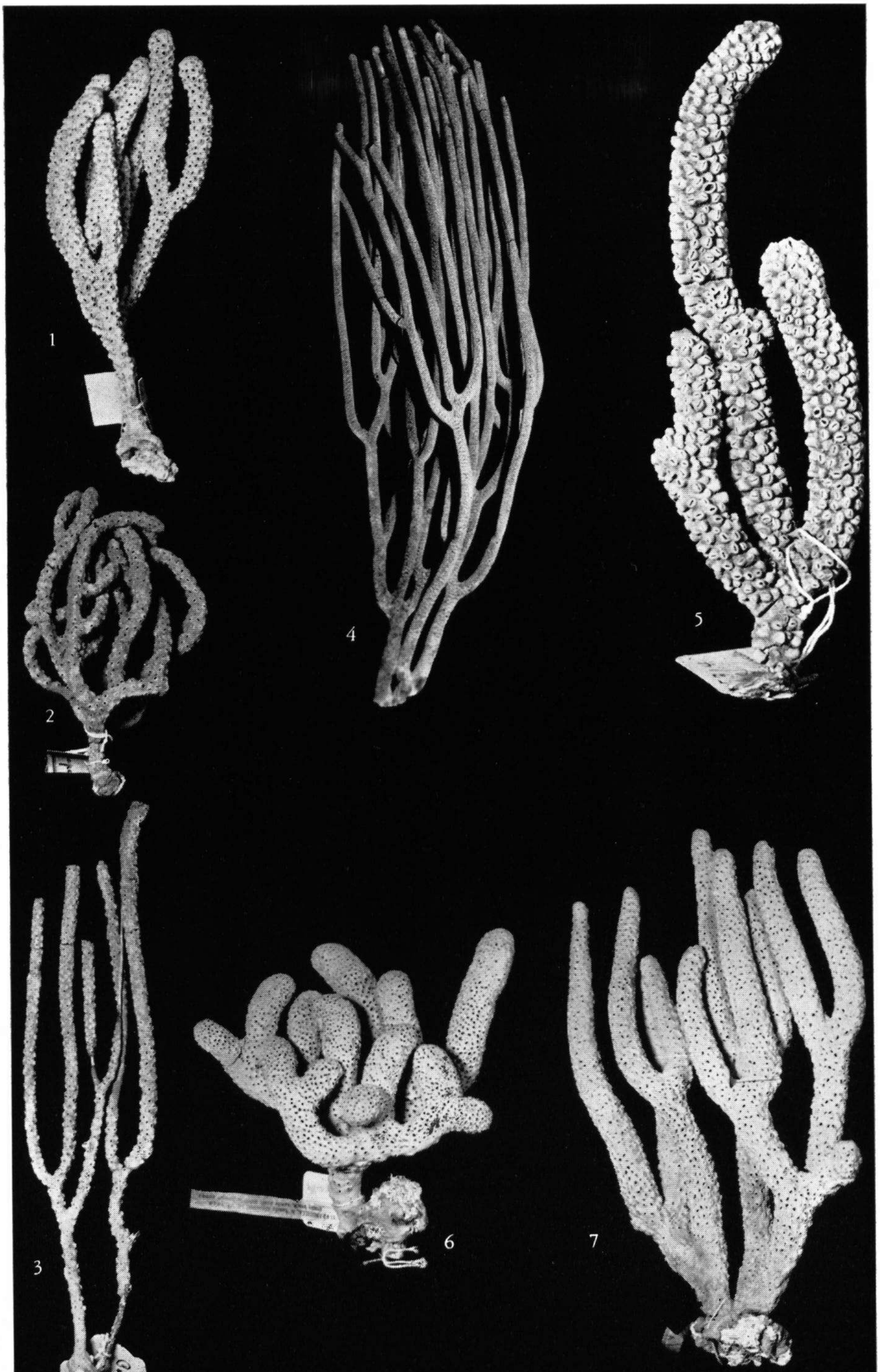
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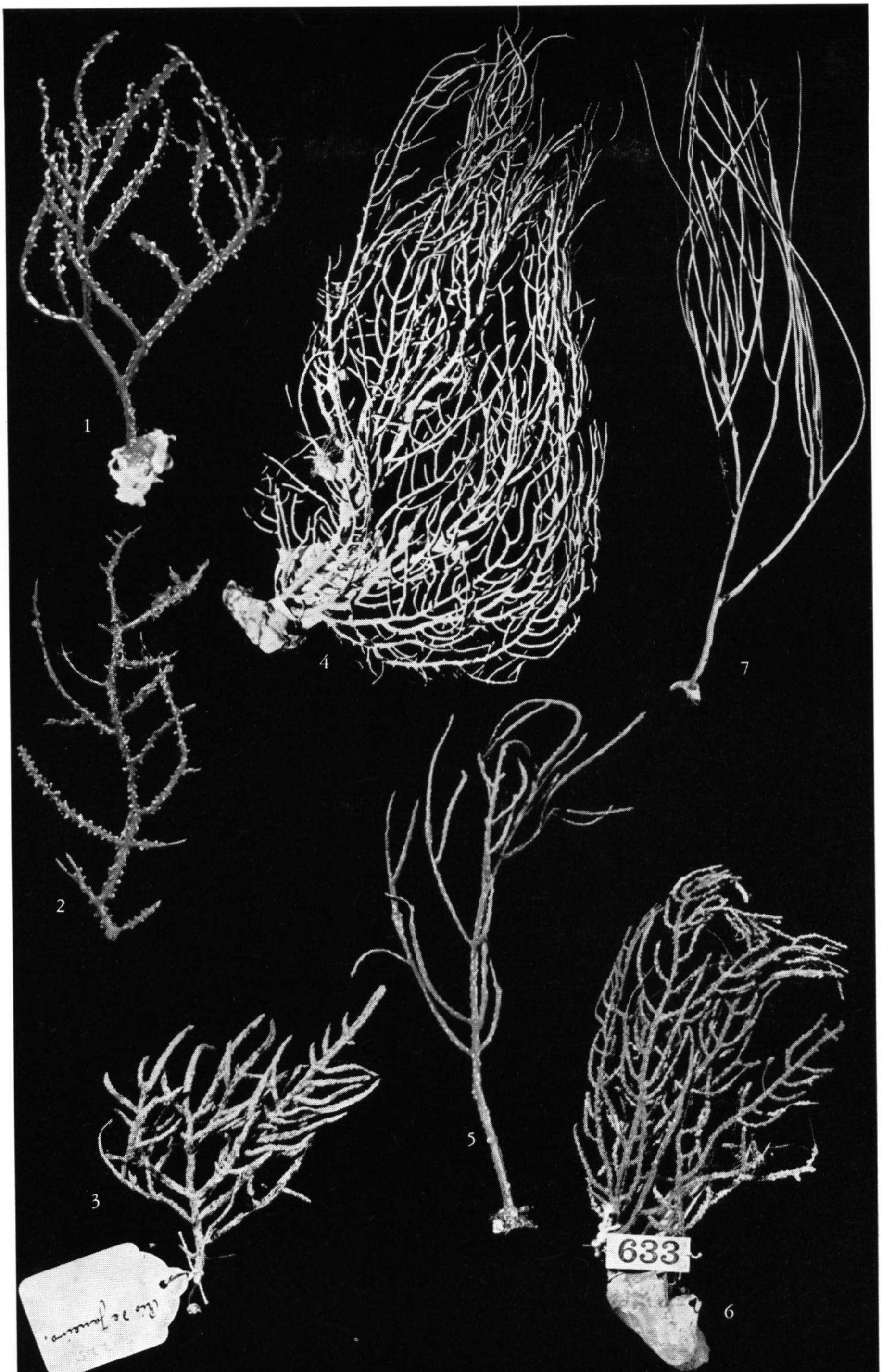
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6. *Pseudopterogorgia americana* (Gmelin), from Curaçao. Height, 30 cm. (52053)
7. *Pseudopterogorgia navia* spec. nov., from Hispaniola. Height, 20 cm. (USNM 50070)

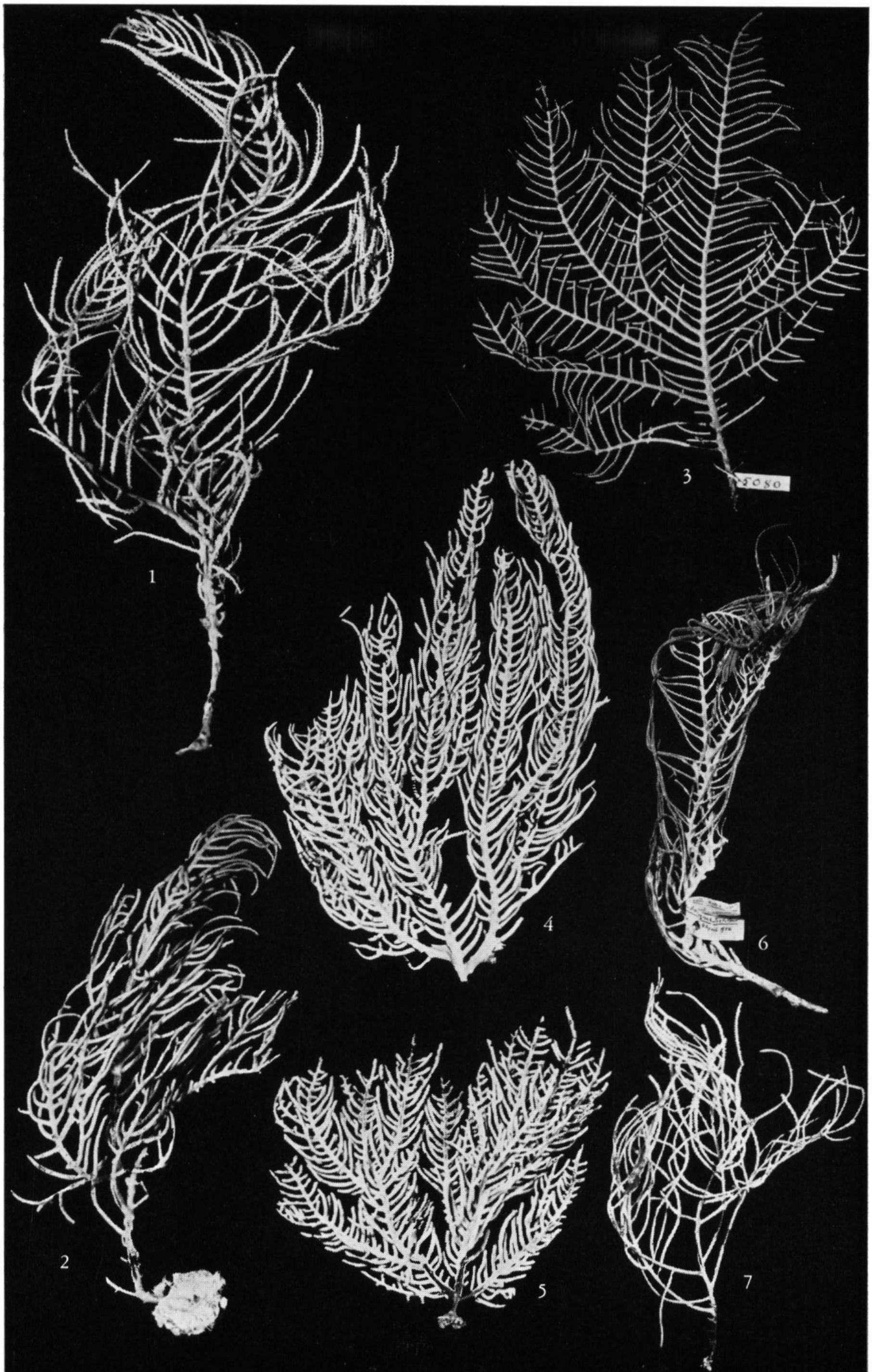
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PLATE IX

1. *Pseudopterogorgia rigida* (Bielschowsky), from the Dry Tortugas. Height, 28 cm. (USNM 50211)
2. *Pseudopterogorgia americana* (Gmelin), from Bonaire. Height, 20 cm. (50206)
3. *Pseudopterogorgia acerosa* (Pallas), from Curaçao. Height, 50 cm. (Car. Marien-Biol. Inst.)
4. *Pterogorgia anceps* (Pallas). Height, 35 cm. (USNM 8855)
5. *Pterogorgia citrina* (Esper), from St. Eustatius. Height, 17 cm. (50195)
6. *Pterogorgia guadalupensis* Duchassaing & Michelotti, from the Florida Keys. Height, 24 cm. (44233)

PLATE IX

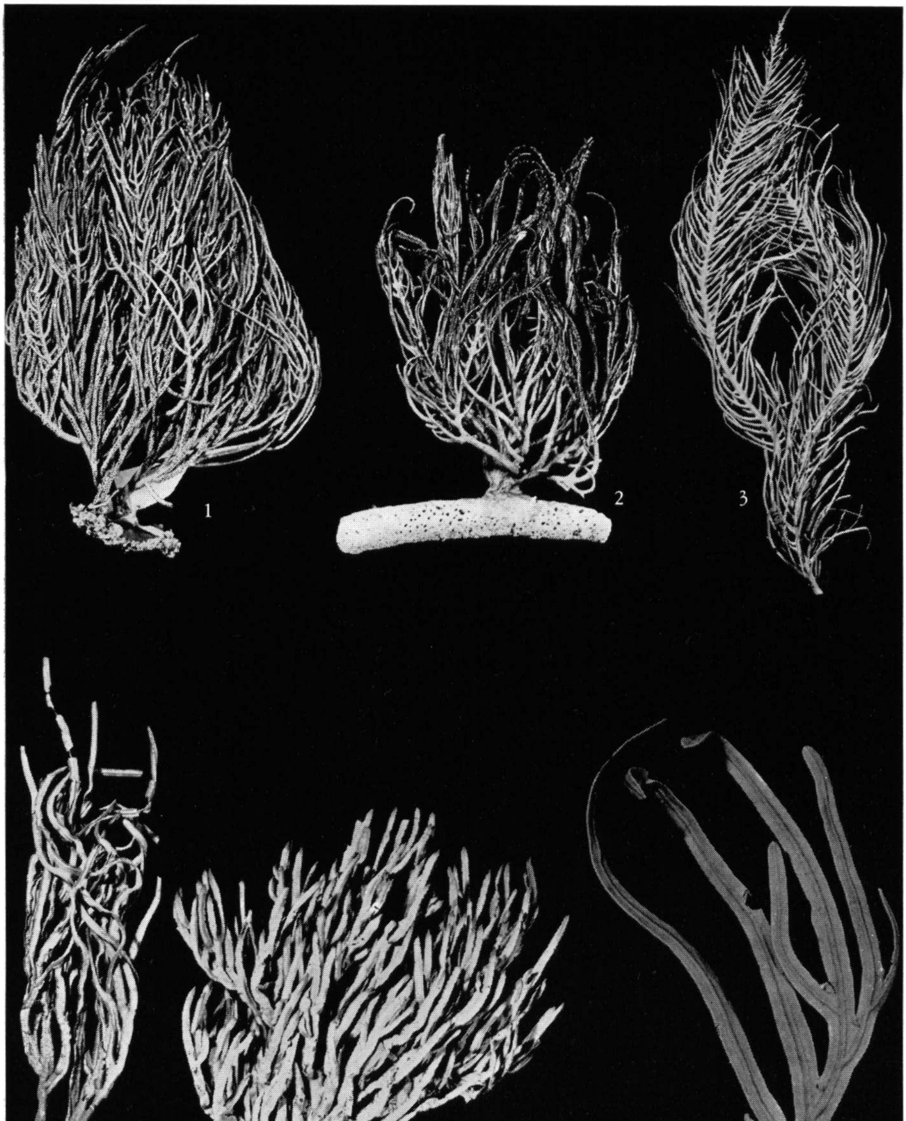
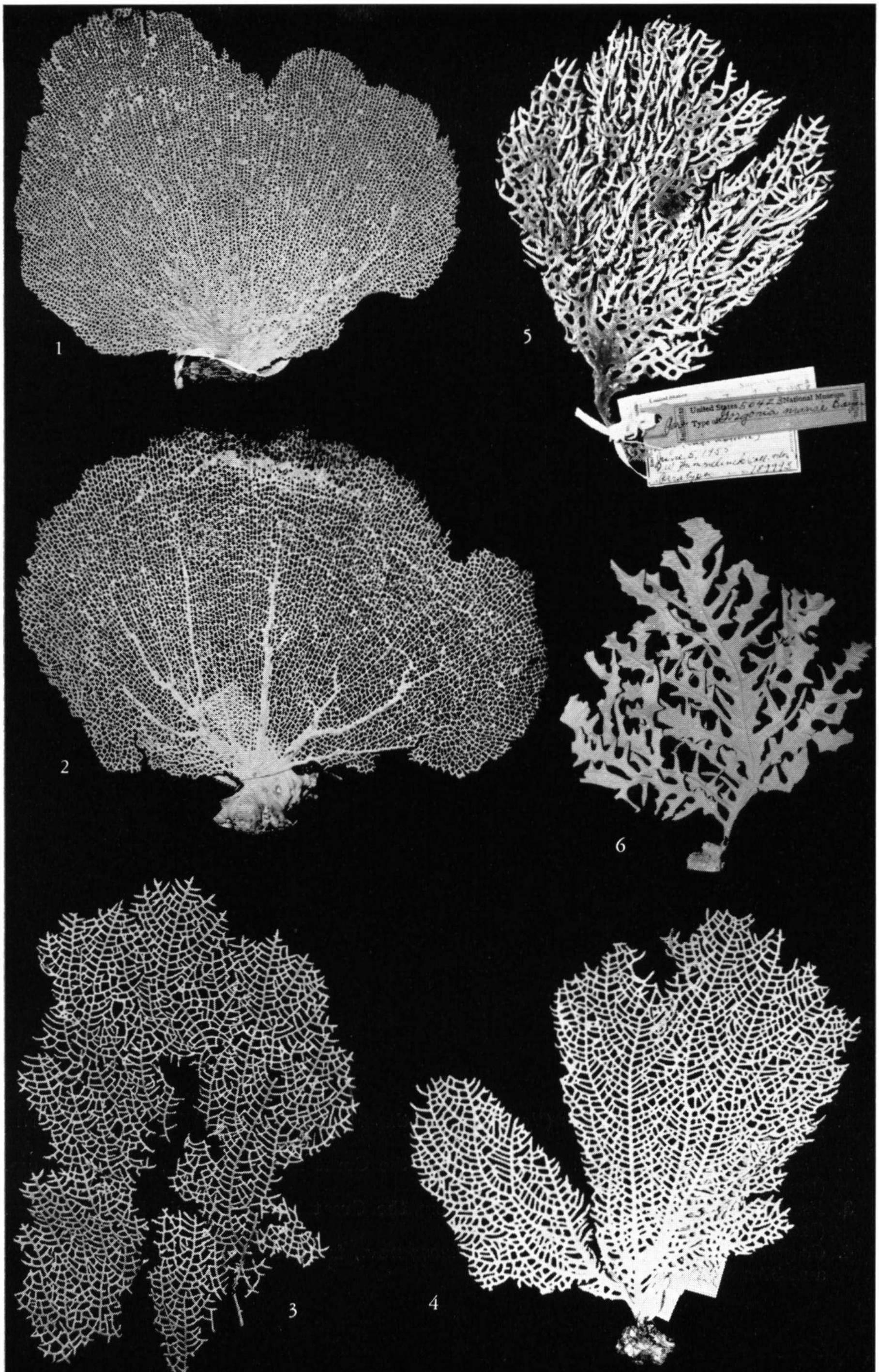


PLATE X

1. *Gorgonia ventalina* Linnaeus, from St. Barthélemy. Height, 28 cm. (USNM 50222)
2. *Gorgonia flabellum* Linnaeus, from New Providence, Bahamas. Height, 27 cm. (14365)
3. *Gorgonia mariae* spec. nov., from Puerto Rico. Height, 26 cm. (50073)
4. *Gorgonia mariae* spec. nov., from St. Eustatius. Height, 20 cm. (Holotype, 50421)
5. *Gorgonia mariae* spec. nov., forma *cymosa* nov., from St. Martin. Height, 17 cm. (Paratype, 50423)
6. *Phyllogorgia dilatata* (Esper), from Brazil. Height, 24 cm. (5252)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United States
National Museum
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PLATE XI

1. *Pseudopterogorgia bipinnata* (Verrill), from the Florida Keys. Height, 45 cm. (USNM 50214)
2. *Pseudopterogorgia hystrix* spec. nov., from the Great Bahama Bank, Height, 20 cm. (Paratype, 50386)
3. *Pseudopterogorgia hystrix* spec. nov., from the Great Bahama Bank. Height 35 cm. (Holotype, 50385)
4. *Gorgonia mariae* spec. nov., forma *plumosa* nov., from Anegada. Height 40 cm (left) and 37 cm (right). (Paratypes, 51027)

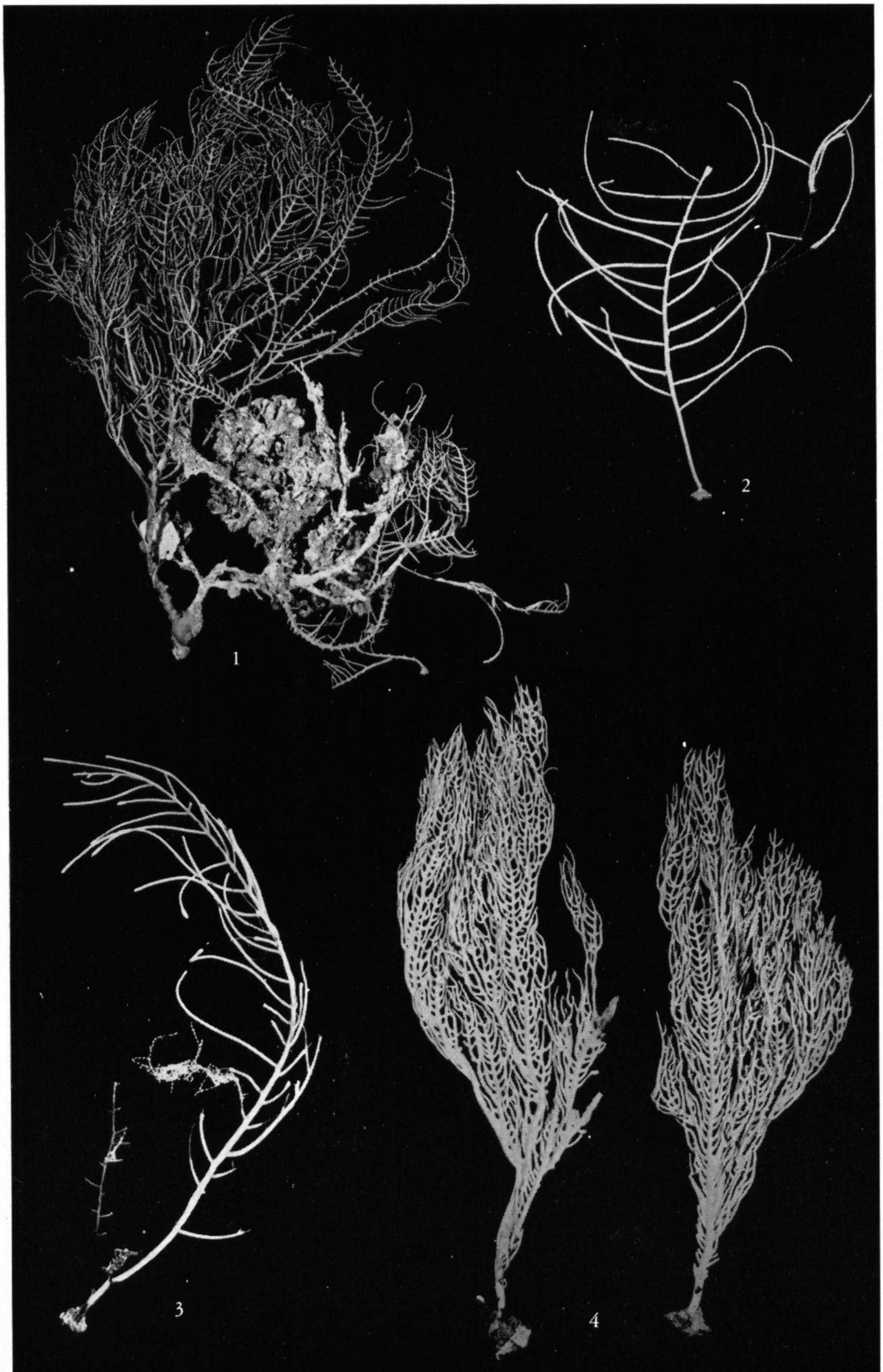
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PLATE XII

Above, *Telesto riisei* (Duchassaing & Michelotti), together with *Tubastraea tenuilamellosa* (Milne Edwards & Haime), on iron beam of wharf near Oranjestad, Aruba. (USNM 50375) Photograph by P. Wagenaar Hummelinck.

Below, *Telesto riisei* (Duchassaing & Michelotti), from Florida: taken from bottom of ship anchored 1 year in Biscayne Bay (USNM 44065).

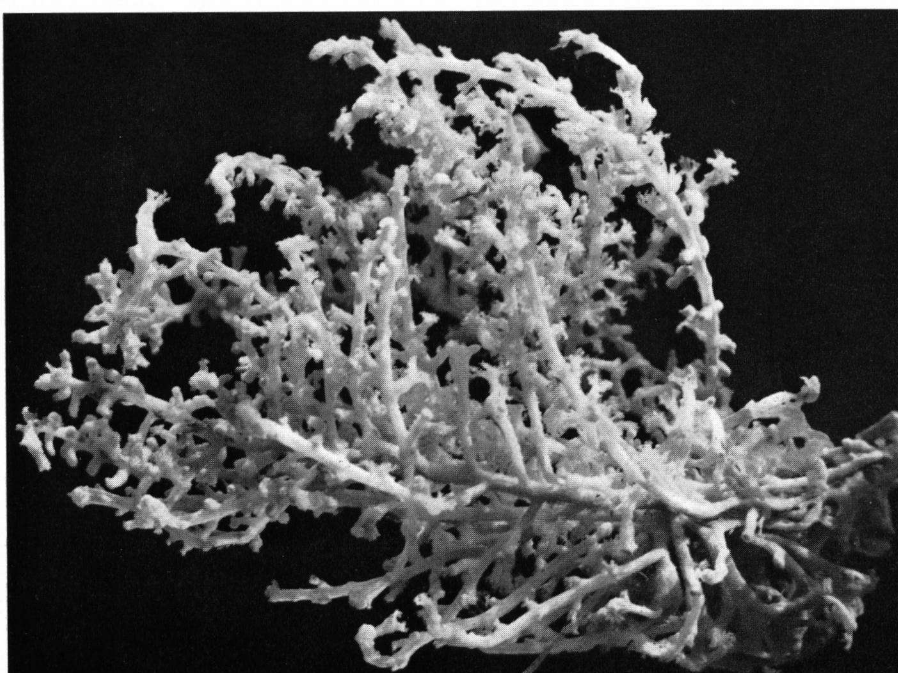

PLATE XIII

1a. *Pseudoplexaura crucis* spec. nov., from Virgin Islands. Height, 34 cm. (Holotype, USNM 51718) 1b. The same, detail of branches.

2a. *Plexaurella nutans* (Duchassaing & Michelotti), from Soldier Key, Florida. Height, 47 cm. (51725) 2b. The same, detail of branches.

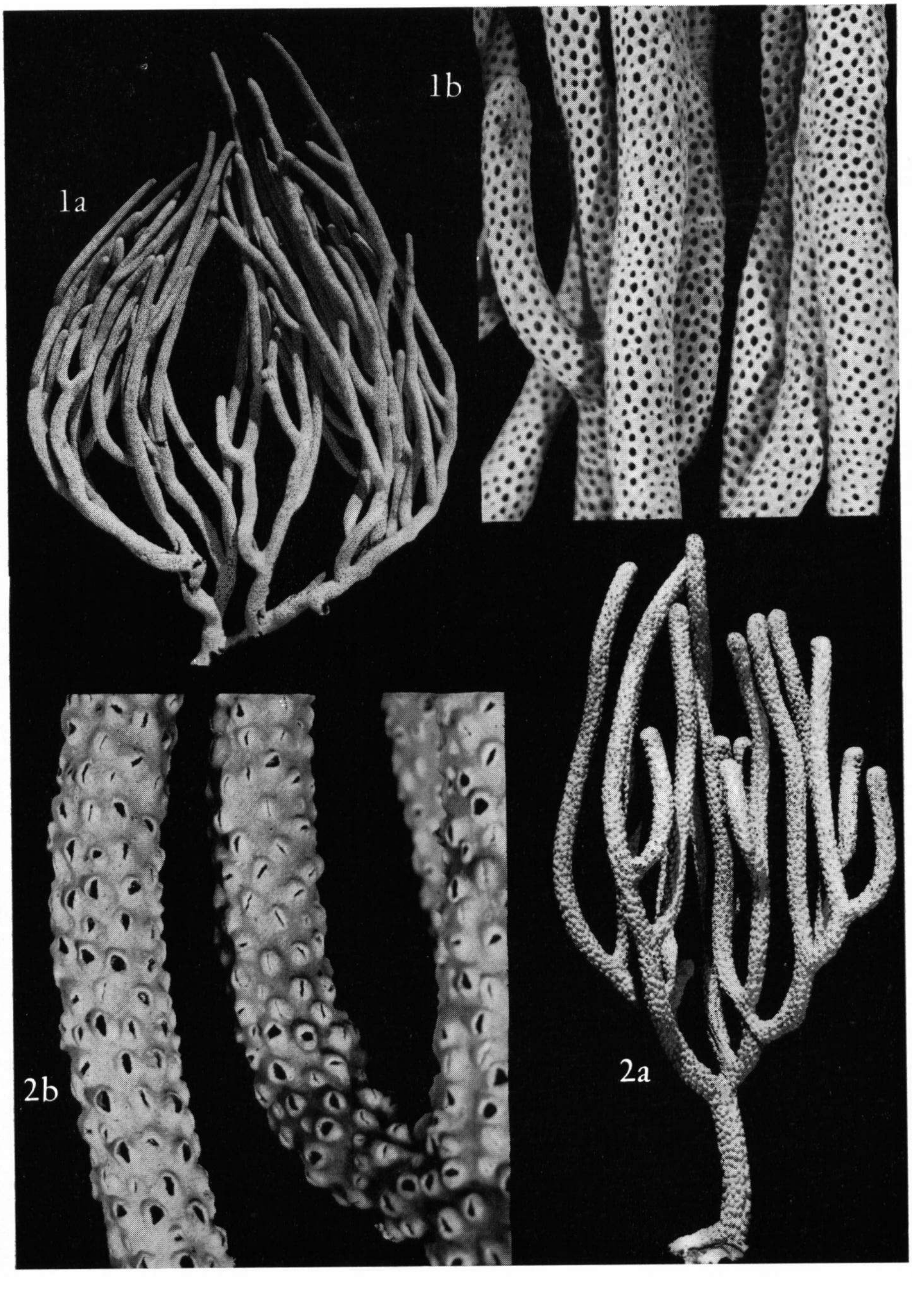
1a
1b
2a
2b

PLATE XIV

1–4. *Eunicea tourneforti* Milne Edwards & Haime. Details of four specimens from Soldier Key, Florida, showing variation in calyces. 1. A typical, broad specimen 22 cm. tall. (UMML) 2. A specimen 20 cm. tall, with less prominent calyces. (USNM 51727) 3. A tall, bushy colony 39 cm. tall, with crowded calyces. This is the specimen shown on Pl. XXI. (51728) 4. A bushy colony 38 cm. tall, with inconspicuous calyces. (51729)

5–7. *Eunicea tourneforti* Milne Edwards & Haime. Details of three specimens from the same locality in Bermuda, showing variation in calyces. 5. A candelabrum-shaped colony 20 cm. tall, with slender branches. (51730) 6. A narrower colony 24 cm. tall, with stouter branches. (51731) 7. A stout colony 22 cm. tall, with thick branches and blunt, crowded calyces. (51732)

8–10. *Eunicea asperula* Milne Edwards & Haime. Details of three specimens from Soldier Key, Florida, showing variation in calyces. 8. An upright, bushy colony 43 cm. tall, with prominent calyces. (51733) 9. A straggling colony 42 cm. tall, with inconspicuous calyces. (UMML) 10. A slender, upright colony 44 cm. tall, with crowded, sharp calyces. (USNM 51734)

11. *Eunicea laciniata* Duchassaing & Michelotti. Two branch tips of an exceptionally stout colony from Yucatan. (51459)

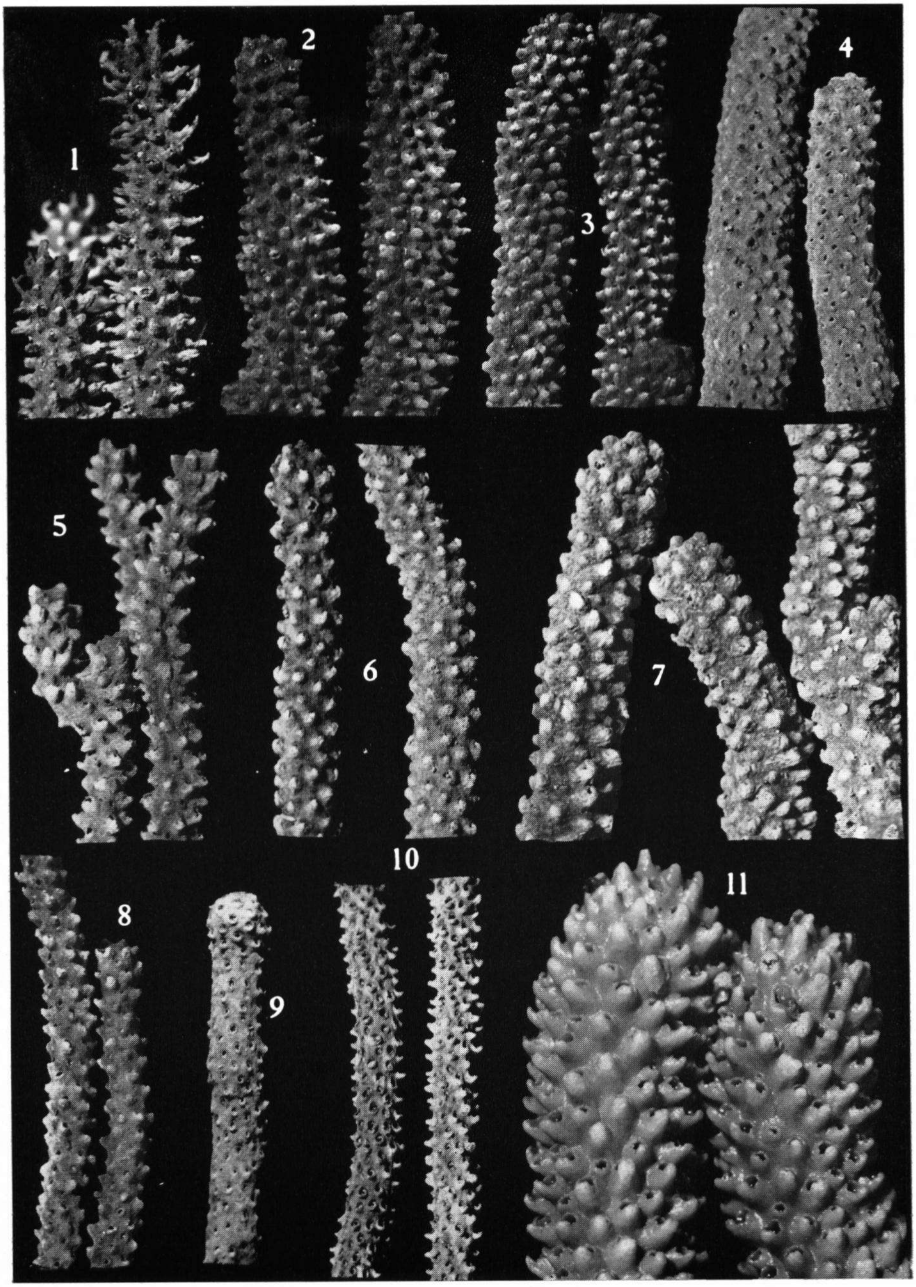
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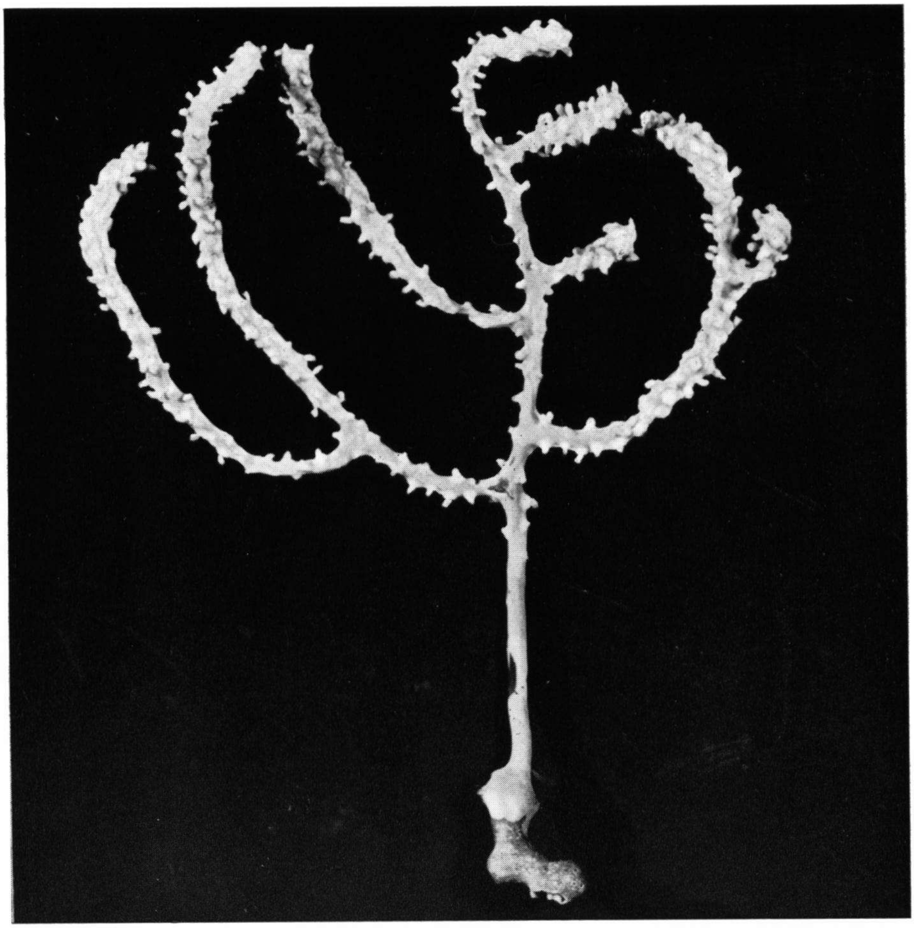
PLATE XV

Eunicella modesta Verrill, from Fernandina, Florida, 440 fathoms. Above, the entire colony. Height, 12 cm. Below, spicules; mostly balloon clubs of surface layer, but two double spindles of inner layer near middle of field, and three broken anthocodial rods at lower right. (USNM 10505)



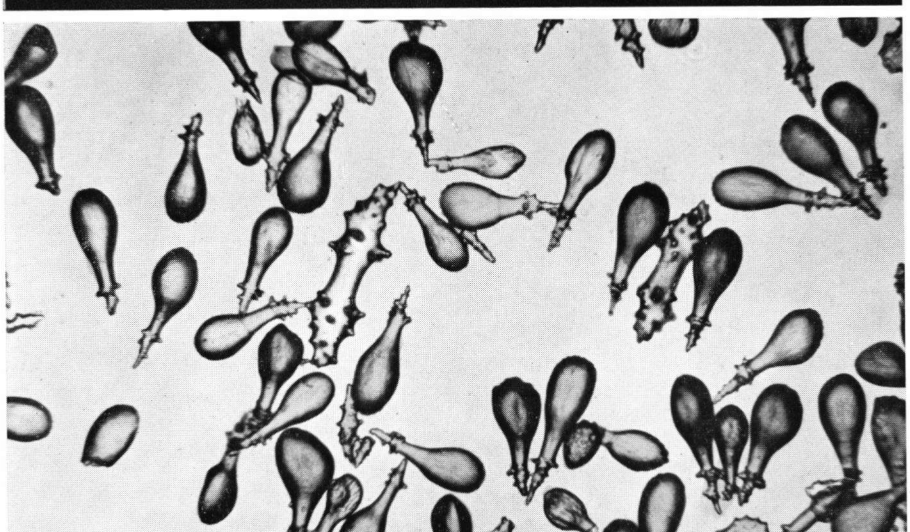


PLATE XVI

Left, *Plexaura homomalla* (Esper). Living colony photographed under water at Buck Island, St. Croix, VIII. 1960. (Branch, USNM 51735)

Right, *Plexaura flexuosa* Lamouroux. Living colony photographed under water at Buck Island, St. Croix, VIII. 1960. (Branch, 51736)

Both photographs by R. E. Schroeder.

PLATE XVI

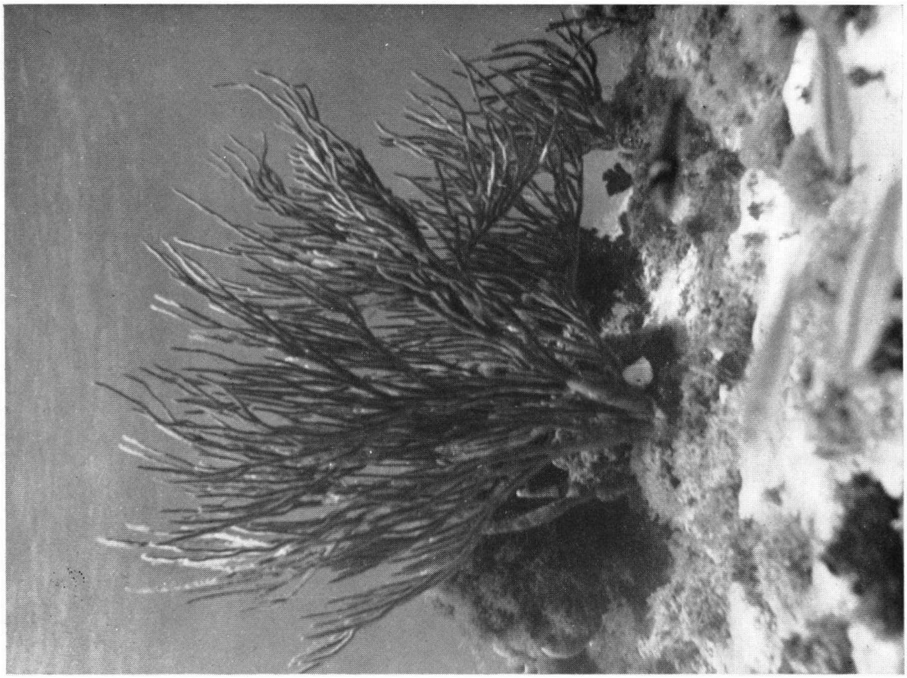


PLATE XVII
Left, *Plexaura flexuosa* Lamouroux. Living colony photographed under water at Soldier Key, Florida, 10. X. 1960.
Right, the same colony prepared as a dry specimen. Height, 41 cm. (USNM 51737)

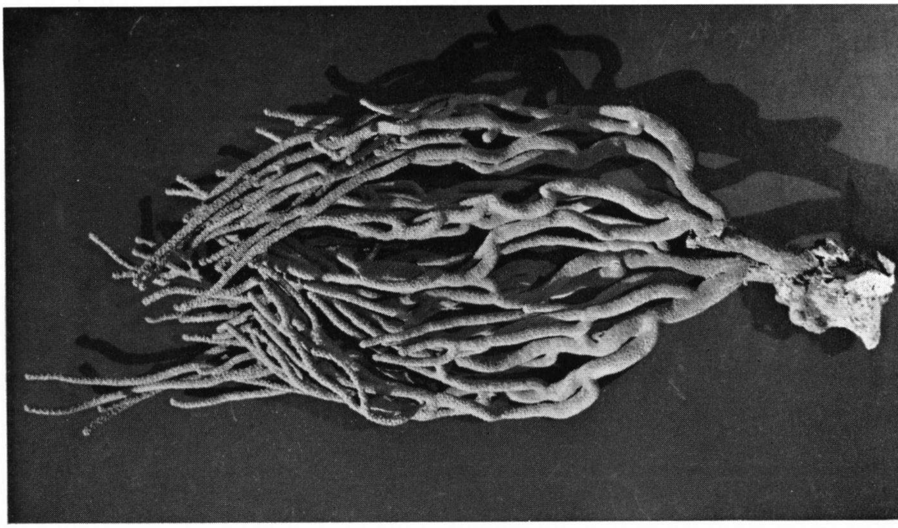
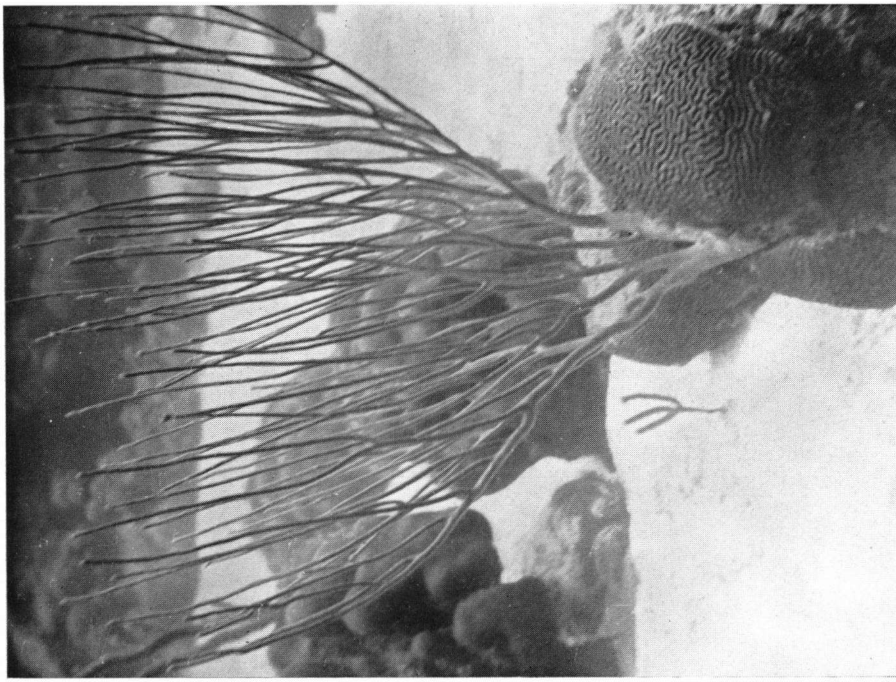


PLATE XVIII

Left, *Pseudoplexaura porosa* (Houttuyn). Living colony photographed under water at Buck Island, St. Croix, VIII. 1960. (Branch, USNM 51703)

Right, *Pseudoplexaura flagellosa* (Houttuyn). Living colony photographed under water at Buck Island, St. Croix, VIII. 1960. (Branch, 51711)

Both photographs by R. E. Schroeder.



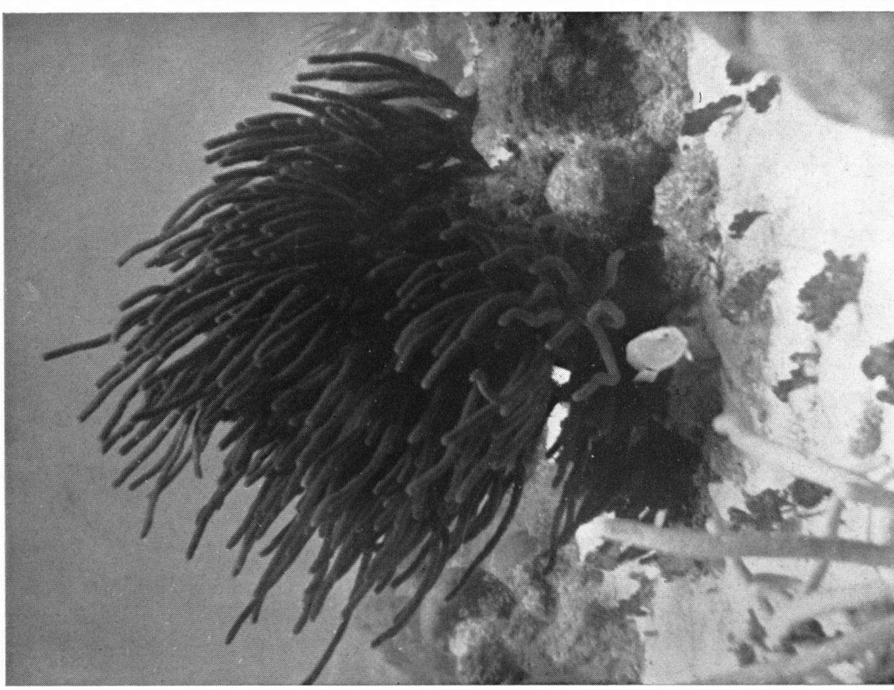


PLATE XIX

Top, *Pseudopterogorgia americana* (Gmelin). Living colony photographed under water at Soldier Key, Florida, 10. X. 1960. Height, 57 cm. (USNM 51738)

Bottom, *Pseudoplexaura wagenaari* (Stiasny). Living colony photographed under water at St. John, XI. 1960. (Branch, 51724.) Photograph by R. E. Schroeder.

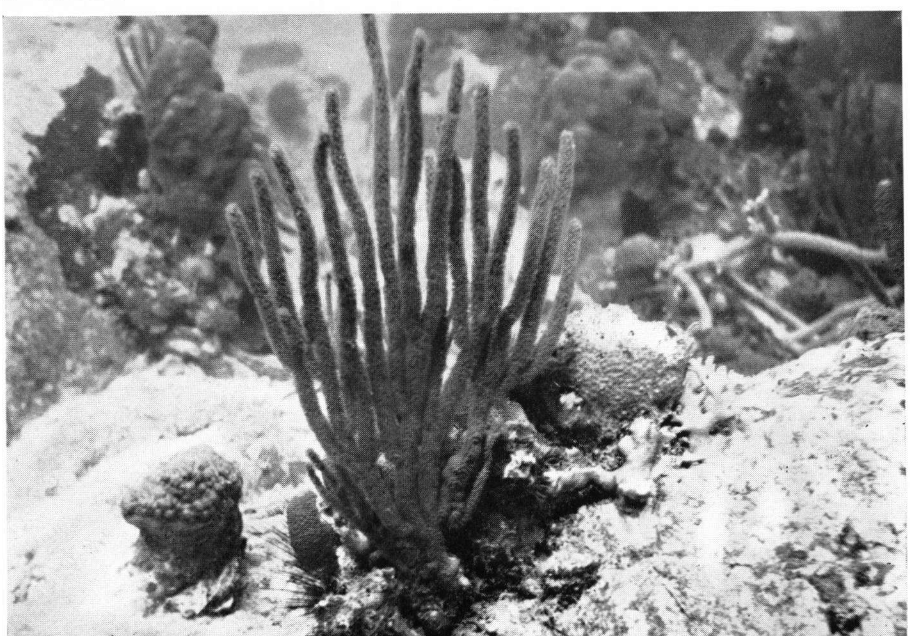


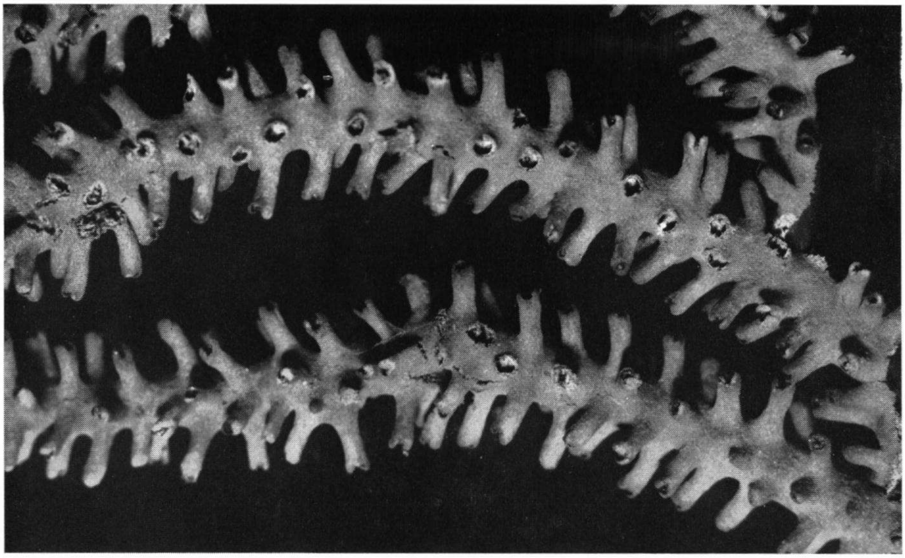
PLATE XX

Left, *Eunicea laxispica* (Lamarck). Living colony photographed under water at St. John, XI. 1960. Photograph by R. E. Schroeder.

Middle, the same colony prepared as a dry specimen. The three branches at left of living specimen have been removed. Height, 30 cm. (USNM 51739)

Right, Details of same, showing calyces.

PLATE XX



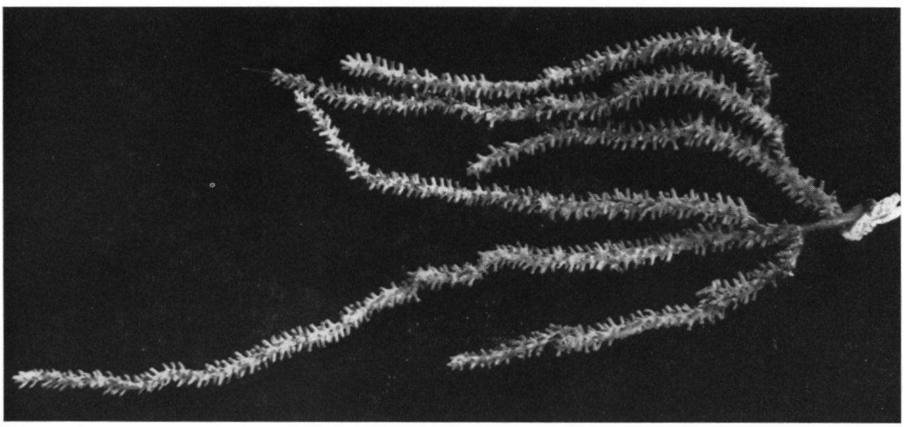


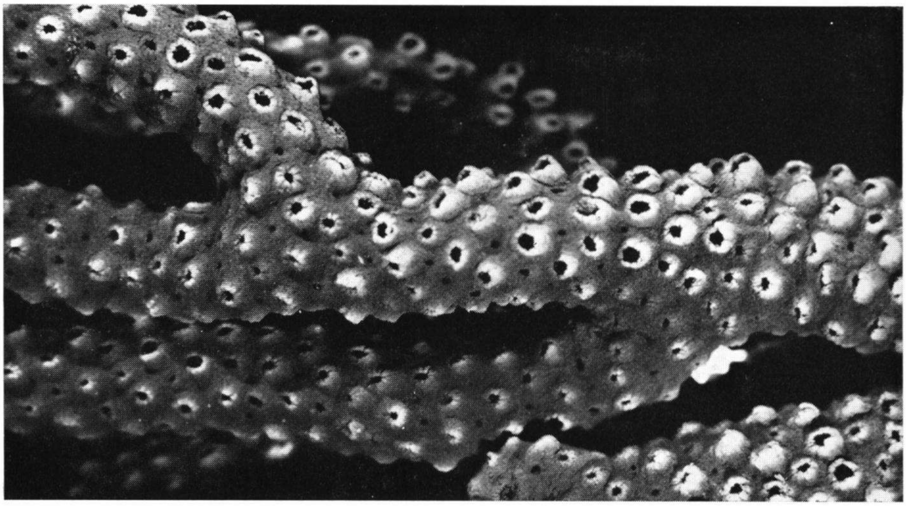
PLATE XXI

Left, *Eunicea tourneforti* Milne Edwards & Haime. Living colony photographed under water at Soldier Key, Florida, 10. X. 1960. Polyps partially expanded.
Right, the same colony preserved as a dry specimen. Height, 39 cm. (USNM 51728)

PLATE XXI

PLATE XXII

Left, *Eunicea calyculata* (Ellis & Solander). Living colony photographed under water at Soldier Key, Florida, 10. X. 1960. Polyps almost fully expanded.
Middle, the same colony prepared as a dry specimen. Height, 40 cm. (USNM 51740)
Right details of same showing calyces.



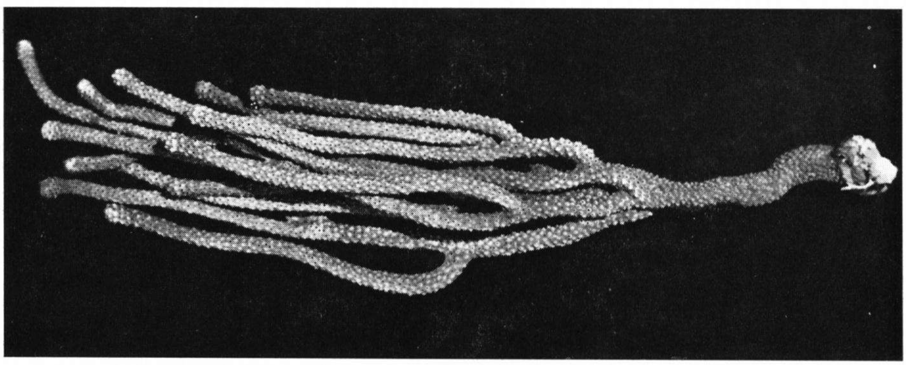
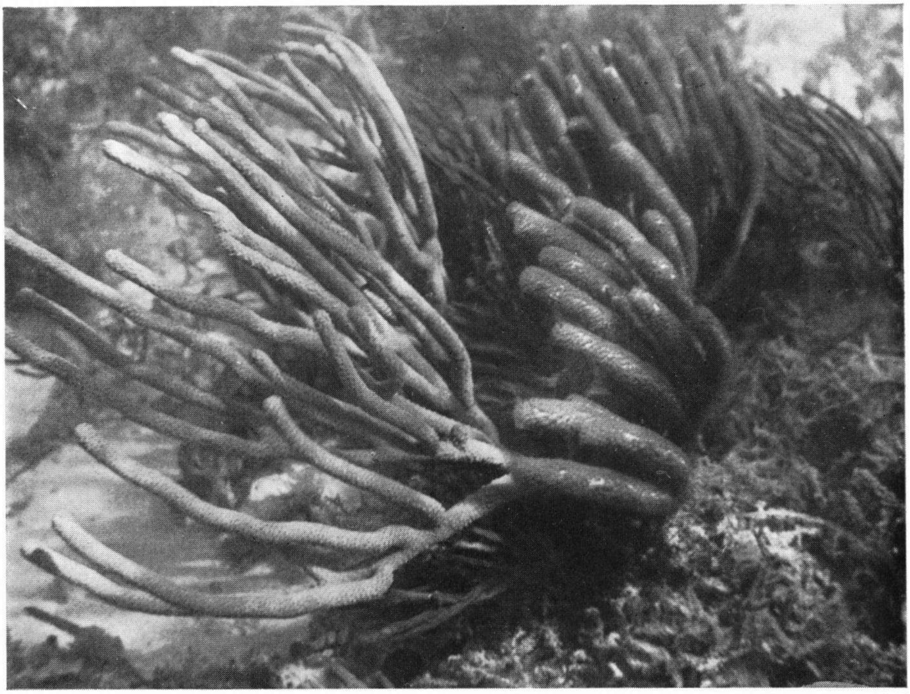


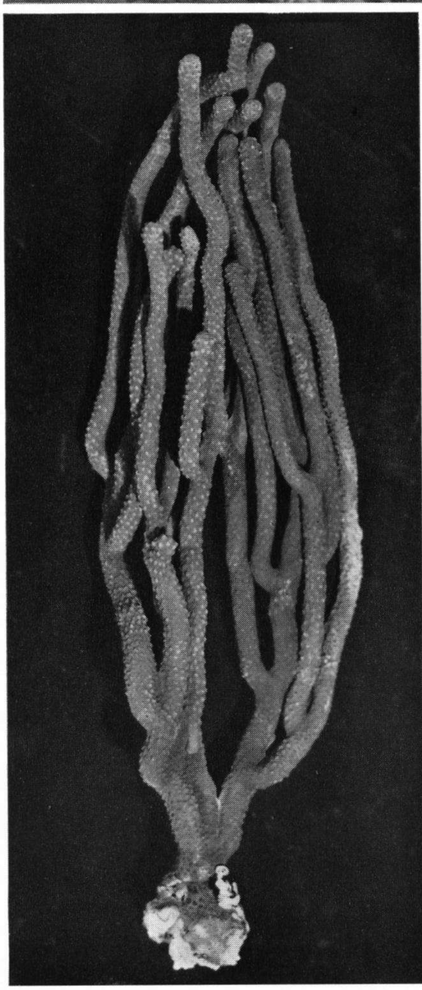
PLATE XXIII

Top, living colonies of *Eunicea calyculata* (Ellis & Solander) (left, polyps retracted) and *Plexaurella dichotoma* (Esper) (right, polyps fully expanded), photographed at Soldier Key, Florida, 10. X. 1960.

Bottom left, the same colony of *E. calyculata* prepared as a dry specimen. Height, 37 cm. (USNM 51741)

Bottom right, the same colony of *P. dichotoma* preserved as a dry specimen. Height, 26 cm. (51742)





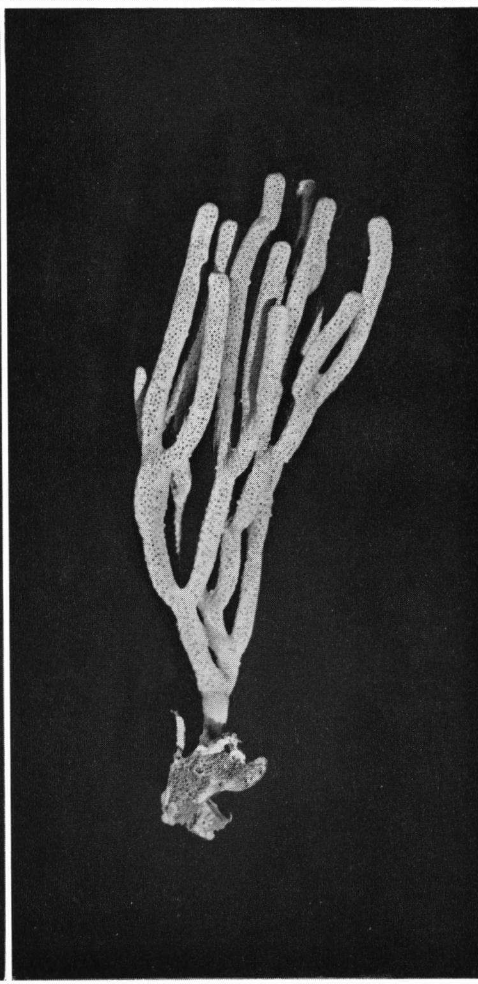
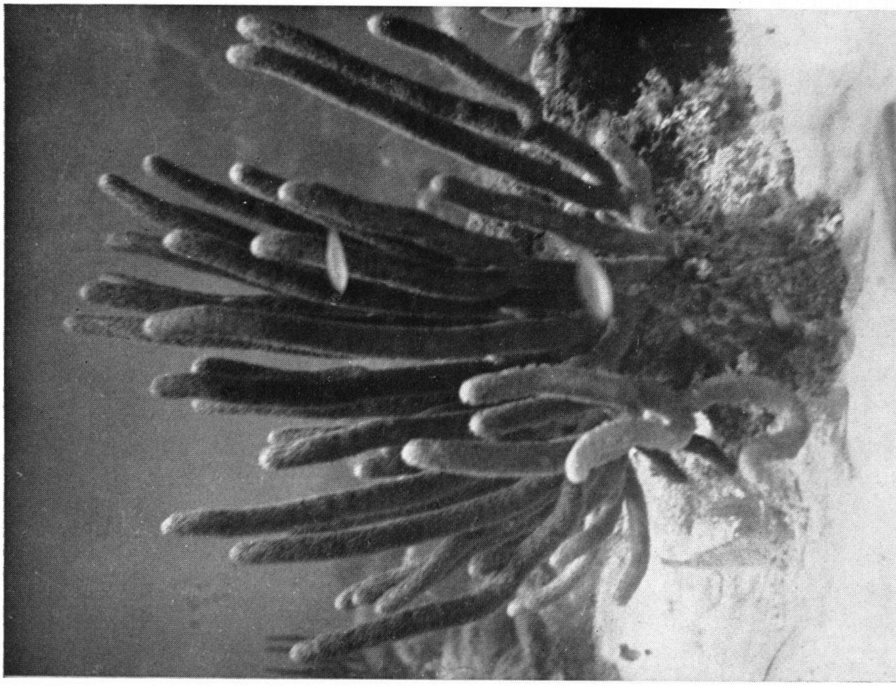


PLATE XXIV

Left, *Eunicea tourneforti* Milne Edwards & Haime, forma *atra* Verrill. Living candelabrum-shaped colony photographed under water at Buck Island, St. Croix, VIII. 1960. (Branch, USNM 51723)

Right, *Plexaurella dichotoma* (Esper). Living colony photographed under water at Buck Island, St. Croix, VIII. 1960. (Branch, USNM 51743)

Both photographs by R. E. Schroeder.



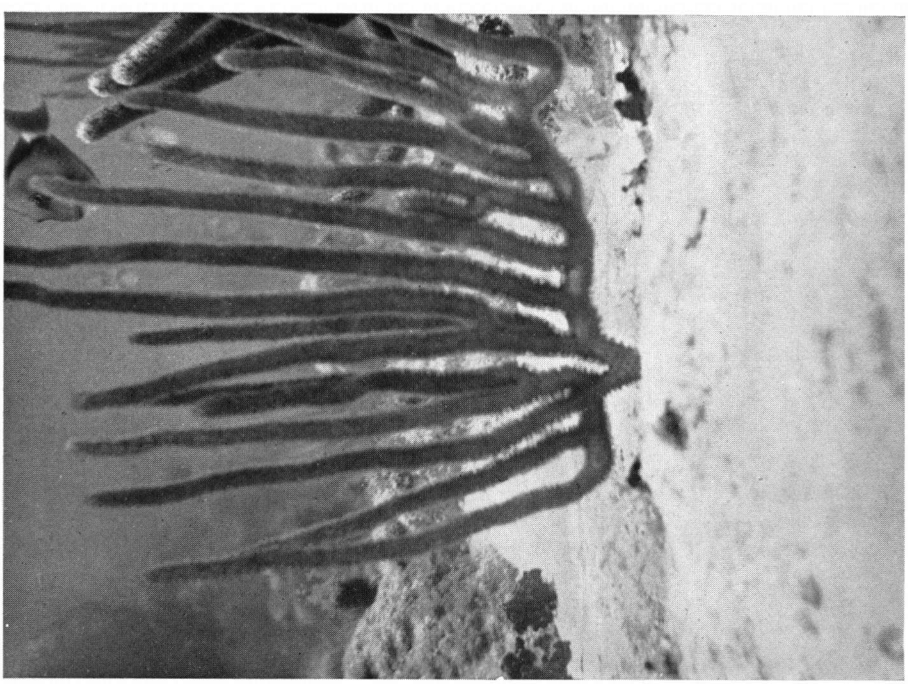
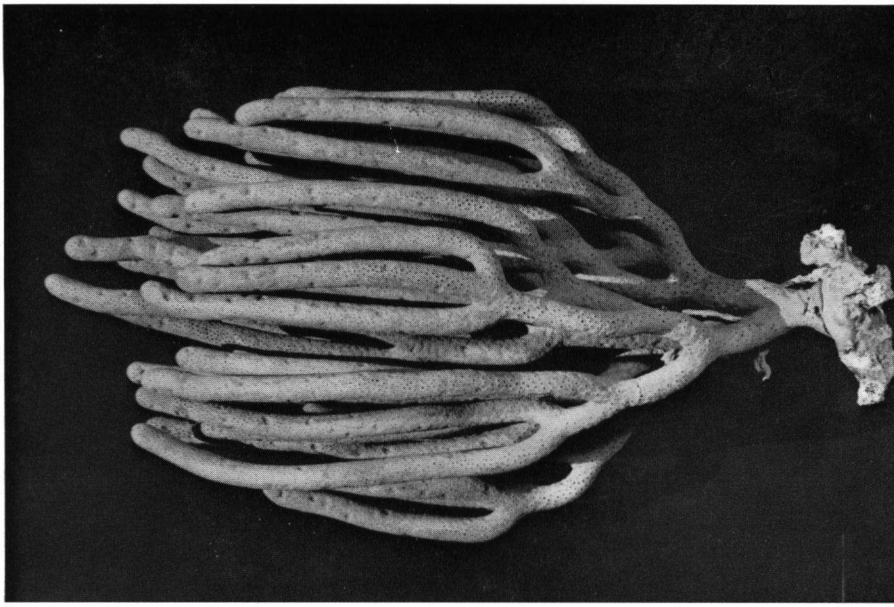


PLATE XXV

Left, *Plexaurella dichotoma* (Esper). Living colony, polyps fully expanded, photographed under water at Soldier Key, Florida, 10. X. 1960.

Right, the same colony prepared as a dry specimen. Height, 30 cm. (USNM 51744)

PLATE XXV



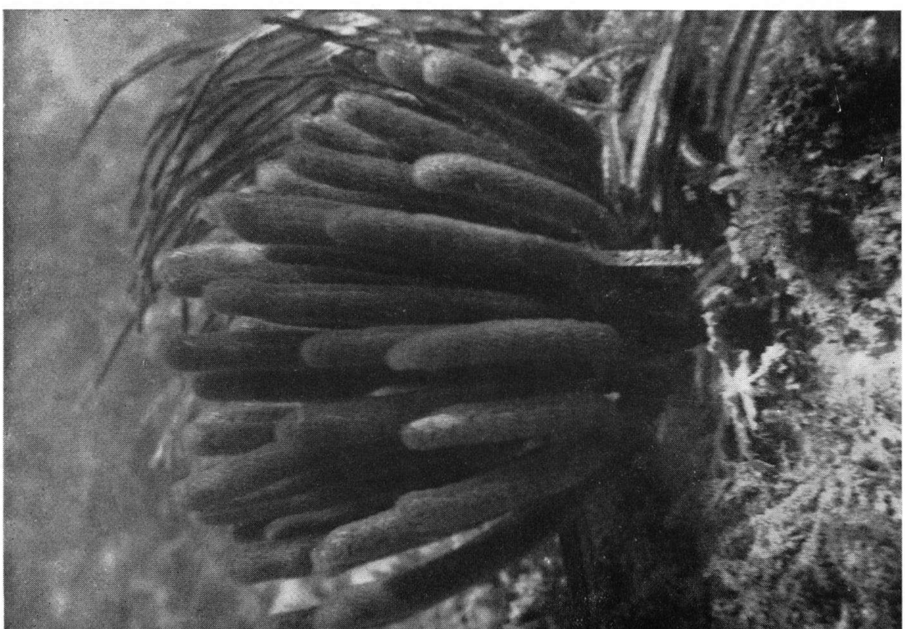


PLATE XXVI

Left, *Pterogorgia anceps* (Pallas). Living colony, fully expanded, photographed under water at Soldier Key, Florida, 10. X. 1960.

Right, the same colony prepared as a dry specimen. Height, 55 cm. (USNM 51745)

PLATE XXVI

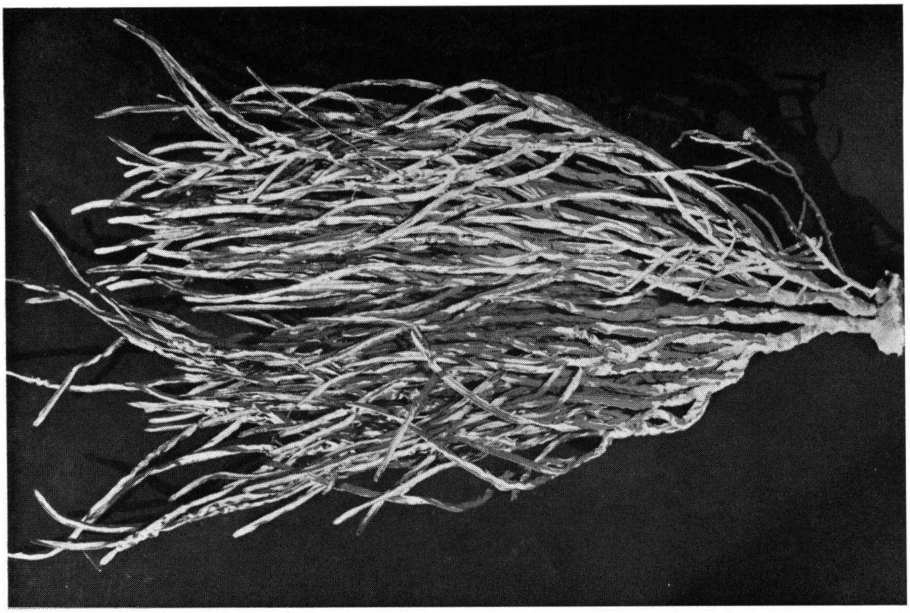


PLATE XXVII
Left, *Gorgonia ventalina* Linnaeus. Living colony photographed under water at St. John, XI. 1960. Photograph by R. E. Schroeder.
Right, the same colony prepared as a dry specimen. Height, 25 cm. (USNM 51746)