STUDIES ON THE FAUNA OF CURAÇAO AND OTHER CARIBBEAN ISLANDS: No. 179

MARINE SPONGES FROM CURAÇAO AND OTHER CARIBBEAN LOCALITIES

PART I. KERATOSA

by

R. W. M. VAN SOEST

(Institute of Taxonomic Zoology, University of Amsterdam)

	Pages	Figures	Plates
Abstract	3		
INTRODUCTION	4		
MATERIAL AND METHODS (maps 1–4)	5		
SPONGIIDAE – Dictyoceratida	8		
Spongia obliqua Duch. & Mich.	8	1	I 1–3
Spongia tubulifera Lamarck	10	2	I 4, II 2
Spongia pertusa Hyatt, comb. nov.	12		II 1
Spongia obscura Hyatt	14	3	II 3
Spongia tampa De Laubenfels & Storr	15	4	II 4
Spongia barbara Duch. & Mich.	16	5	III 1–2
Spongia solitaria Hyatt, comb. nov.	18	(6)	III 4, IV 1
Discussion of the genus *Spongia*	19		
Hippospongia gossypina (Duch. & Mich)	21	7	IV 4
Hippospongia lachne De Laubenfels	22		IV 3
Discussion of the genus *Hippospongia*	22		
Hyattella intestinalis (Lamarck)	23	8	IV 2, V 1–2
? *Coscinoderma musicalis* (Duch. & Mich.)	29	9	V 3
Oligoceras violacea (Duch. & Mich.) comb. nov.	30	10	V 4, VI 1
Ircinia felix (Duch. & Mich.)	33	11	VI 2–3
Ircinia cf. *dendroides* (Schmidt)	36	12	VI 4, VII 1
Ircinia hummelincki sp. n.	37	13	VII 2
Ircinia campana (Lamarck)	39		VII 3
Ircinia strobilina (Lamarck)	40		VII 4, VIII 1–2
Discussion of the genus *Ircinia*	41		
Fasciospongia cerebriformis (Duch. & Mich.)	43	14	VIII 3
Hyrtios proteus Duch. & Mich.	45	15	VIII 4
Hyrtios caracasensis (Carter)	47	16	IX 1

Discussion of the genus *Hyrtios*	48		
Discussion of the family Spongiidae	50		
DYSIDEIDAE – Dictyoceratida	51		
Dysidea janiae (Duch. & Mich.)	51	17	IX 3
Dysidea variabilis (Duch. & Mich.)	52	18	IX 4
Dysidea etheria De Laubenfels	53		X 1
Discussion of the family Dysideidae	54		
APLYSINIDAE – Dictyoceratida	55		
Aplysina fistularis (Pallas)	55		X 2
Aplysina fistularis insularis Duch. & Mich.	56	19	X 3–4
Aplysina fistularis fulva Pallas	57		XI 2
Aplysina archeri (Higgin)	58		XI 3–4
Aplysina lacunosa (Pallas)	61		XII 1–4, XIII 1
Aplysina cauliformis (Carter)	62		XI 1, XIII 2
Discussion of the genus *Aplysina*	63		
Aiolochroia crassa (Hyatt)	65	21	XIII 3
Verongula rigida (Esper)	67	22	XIII 4
Discussion of the family Aplysinidae	69	23	
Discussion of the suborder Dictyoceratida	70		
DARWINELLIDAE – Dendroceratida	71		
Chelonaplysilla erecta Tsurnamal	71	24	XIV 1–2
Pleraplysilla stocki sp. n.	75	25	XIV 3–4
Igernella notabilis (Duch. & Mich) comb. nov.	77	26	XV 1–2
Discussion of the Darwinellidae	80		
Discussion of the suborder Dendroceratida	81		
Discussion of the West Indian Keratosa	81		
ZOOGEOGRAPHIC REMARKS	83		
ECOLOGICAL REMARKS	89		
REFERENCES	91		

ABSTRACT

The present paper, the first one of a series on West Indian Sponges incorporated in the collections of the Zoological Museum of Amsterdam, deals with the Keratosa. A total of 33 species is described and fully illustrated. Part of the material consists of the Duchassaing & Michelotti-collection housed in Amsterdam; of all the Keratosa-types of this collection a photographic illustration and an extensive redescription is given. Most of the type specimens are designated as (para–)lectotypes. Two new species are described, viz. *Ircinia hummelincki* from deeper water off Barbados, and *Pleraplysilla stocki* from mangrove forests in Puerto Rico. Five "forgotten" species are revived, viz. *?Coscinoderma musicalis* (Duch. & Mich., 1864), *Fasciospongia cerebriformis* (Duch. & Mich., 1864), *Hyrtios proteus* Duch. & Mich., 1864, *Hyrtios caracasensis* (Carter, 1882) and *Spongia solitaria* Hyatt, 1877. Application of the priority rules of zoological nomenclature has led to the renaming of five species, viz. *Spongia pertusa* Hyatt, 1877 (for *S. anclotea* De Laubenfels & Storr, 1958), *Hyattella intestinalis* (Lamarck, 1814) (for *Aulena columbia* (De Laubenfels, 1936)), *Oligoceras violacea* (Duch. & Mich., 1864) (for *O. hemorrhages* De Laubenfels, 1936), *Verongula rigida* (Esper, 1794) (for *V. ardis* sensu Wiedenmayer, 1977) and *Igernella notabilis* (Duch. & Mich., 1864 (for *I.* (*Darwinella*) *joyeuxi* (Topsent, 1889)). New records for the West Indies are *Ircinia dendroides* (Schmidt, 1862) and *Chelonaplysilla erecta* Tsurnamal, 1967. The suborders, families, genera and species of Keratosa occurring in the West Indies are discussed; a proposal is made to give suborder status to the family Aplysinidae (= Verongiidae sensu Bergquist & Hartman, 1969). The zoogeography of West Indian Keratosa is preliminarily analyzed and some ecological remarks are made.

INTRODUCTION

Next to the Sponge faunas of European and Mediterranean coastal waters that of the West Indies belongs to the better known Sponge faunas of the world. From PALLAS' time onwards a fairly continuous stream of publications on Sponges has appeared, and the number of species known from the area steadily increased.

Still, as Sponges are extremely liable to variation in form, size and colour, an enormous confusion has arisen, illustrated by a large number of synonymy quotations – unfortunately invariably partially incorrect – in the more recent publications. Notably, the confusion has been greatly enhanced by the actual or alleged loss of important old collections, containing large numbers of types. An example of this is the DUCHASSAING & MICHELOTTI collection, the history of which has been described accurately by WIEDENMAYER (1977). Their collection, comprising 101 new species, has been divided into a part housed in the Turin Museum and a part housed in the Zoological Museum of Amsterdam. The Turin part has been frequently moved, causing loss of a large number of specimens. The whereabouts of the Amsterdam part has been known to spongologists only in the past 15 years. Most of the DUCH. & MICH. names have not been used since their publication (1864), as their descriptions and illustrations were notoriously unrecognizable. Consequently, a nomenclatorial confusion is now in existence, which can only be solved by strict application of the rules of zoological nomenclature. WIEDENMAYER already gave the identity of most of the DUCH. & MICH. specimens in their modern context. One of the purposes of the present series of papers is to supply evidence of these identities and redescribe the DUCH. & MICH. specimens housed in Amsterdam.

The basis for this series of papers, however, is formed by material of more recent collecting activities of Dr. P. WAGENAAR HUMMELINCK and Prof. Dr. J. H. STOCK.

This first part on the Caribbean Sponges in the Zoological Museum of Amsterdam, deals with the Keratosa. A total of 33 species is represented. The most recent monograph on the Keratosa (DE LAUBENFELS, 1948) lists 37 West Indian representatives of this order; since then several old species have been redescribed and several new ones have been erected, together making a rough total of about 45 well established species of Keratosa. Almost two thirds of these are treated below; two new species are erected and 5 old species are reestablished.

ACKNOWLEDGEMENTS

A grant from the Netherlands Organization for the Advancement of Pure Research (Z.W.O.) enabled the author to study the Sponge collection of the British Museum (Natural History). Miss SHIRLEY M. STONE of that Museum is thanked for her hospitality and great help. Dr. N. BOURY-ESNAULT, Muséum National d'Histoire Naturelle (Paris), readily sent some fragments of types on loan. Dr. KLAUS RUETZLER, United States National Museum, Washington, kindly consented to the loan of specimens and donated fragments of type specimens. Dr. RUETZLER also, very generously, donated duplicates of photographic slides made by him of the Turin DUCHASSAING & MICHELOTTI-specimens. Long discussions (both *verbatim* and *in litteris*) with him and his valuable suggestions based on field experience have contributed heavily in the presented results. Dr. FELIX WIEDENMAYER (Naturhistorisches Museum, Basel, Switzerland) most kindly sent me a copy of his MS on the Sponges of the Western Bahamas; in this way I was able to make use of his invaluable accumulation of nomenclatorial, taxonomical and ecological data long in advance of the final publication. Both Dr. RUETZLER and Dr. WIEDENMAYER critically read the MS and made valuable comments and suggested alterations. Dr. P. WAGENAAR HUMMELINCK is thanked most sincerely for the donation of his extensive collections of West Indian Sponges. Mr. L. A. VAN DER LAAN (ZMA) made the photographic illustrations.

MATERIAL AND METHODS

The West Indian Keratose Sponges of the ZMA-collections have been acquired over a large number of years. Important contributors have been Dr. P. WAGENAAR HUMMELINCK (Zoölogisch Laboratorium, Rijksuniversiteit Utrecht) (1948–1970), Prof. Dr. J. H. STOCK (ZMA) (1958–1976), Dr. C. J. VAN DER HORST (1920) (the VAN DER HORST collection has been studied by ARNDT (1927), but the Keratosa were not included). Next to these a number of incidental collections were made by Drs. S. WEINBERG, P. HOETJES, E. WESTINGA, N. BROODBAKKER and H. RINK. Old collection pieces were brought in by S. J. MERTENS, VAN HEUKELOM, VAN LITH DE JEUDE, JARMAN, a.o.

By far the most of the available specimens originated from Curaçao; also in Bonaire and Puerto Rico a fair number of localities were visited. Maps indicating collecting localities are given in Figs. 27–30. Below a list of all localities which yielded Keratosa is given; for further data on the localities visited by Dr. WAGENAAR HUMMELINCK one is referred to his account (1977).

Curaçao: Coraaltabak (1) – Caracasbaai (2) – Schottegat (3) – Piscadera Baai, inner bay (4) – Piscadera Baai, Boca W (5) – Piscadera Baai, 1st buoy (6) – Piscadera Baai, entrance E (7) – Piscadera Baai, pier of Hilton Hotel (8) – Blauwbaai (9) – Fuikbaai E (10) – Awa di Oostpunt (11) – Spaanse Water (12) – Knipbaai S (13) – near Carmabi (14) – St. Michielsbaai (15) – Playa Forti, Westpunt E (16) – 500 m W of Piscadera (17) – Lagoon Jan Thiel, outer side (18) – Playa Chikitu (19) – Santa Martha Baai (20) – Santa Barbara beach (21).
Bonaire: Boca Washikemba (22) – Lac, Cai E (23) – Lac, Binnenklip N-part (24) – Lac, Poejito (Puito) SE (25) – Lac, Poejito NE (26) – Lac, Poejito S (27) – Lac, 300 m E of Palu Calbas (28).
Puerto Rico: Margarita-reef (29) – Isla Magueyes, La Parguera (30) – Punta Cadena NW of Mayagüez (31) – Cabo Rojo, Punta Guaniquilla (32) – 8.7 km S of La Parguera (33) – 18°15′ N, 67°13′ W (34).
Aruba: Oranjestad (35).
St. Eustatius: Off Jakins Bridge (36) – Off Dick Bay (37) – Beach at English Quarter (38).
Saba: Fort Bay (39).
St. Martin: Little Bay (40).
Islote Aves: N-lagoon (41).
St. Thomas (no further data) (42).
Vieques (no further data) (43).
Bahama Islands (no further data) (44).
Cuba (no further data) (45).
Florida: East of Elliott Key (46) – Key Biscayne, N-point (47).
Martinique: Anse de l'Âne, Trois Islets (48).
Margarita: Puenta de la Restinga (49).
Barbados: ½ mile off Holetown (50).
Guyana Shelf: 05°50′ N, 58°10′ W (51).
Jamaica: 18°20′ N, 77°20′ W (52).
Venezuela: North of the peninsula of Paria, NE Venezuela (53).
Tortuga: Southwest coast (54).

Of each single species an extensive description and one or more illustrations are given, as it has become quite apparent that one of the major set-backs of Sponge literature is the briefness of descriptions and lack of adequate illustrations. With each description a list of the studied specimens is given, together with their registration number, collecting locality and date, and any ecological data available. In a short discussion each species is compared to its nearest relatives. Genera and families are discussed in separate sections.

The older material, among which the DUCH. & MICH. specimens, is kept in the dry state. More recent specimens are kept in spirit.

Of each specimen one or more hand made sections have been dried and mounted in Canada balsam for the study of dermal and choanosomal structures. Of those species, in which an examination of the flagellate chambers proved necessary, a hand made section was treated with a haematoxylin solution, washed and mounted in Canada balsam.

For comparison some type material and previously described specimens from other musea were studied, e.g. some of the types of DE LAUBENFELS from the United States National Museum and the British Museum (Natural History). The collection of DUCH. & MICH. fragments present in the British Museum (Natural History) (fragments of the Turin collection) has been reexamined to check WIEDENMAYER's conclusions.

The order in which families, genera and species are treated in general follows that used by WIEDENMAYER (loc.cit.), for no other reasons than tradition. No classificatory reasons should be inferred from this.

Subclass *CERACTINOMORPHA* Lévi, 1953

Definition: Demospongea with viviparous larva; megascleres (if present) always monaxone, microscleres (if present) chelae, sigmata, toxa.

Order **KERATOSA** Grant, 1861

Definition: Ceractinomorpha without proper spicules.

Suborder *DICTYOCERATIDA* Minchin, 1900

Definition: Keratosa with a primary reticulum of spongin fibres.

Family **SPONGIIDAE** Gray, 1867 (sensu Lévi, 1973)

Definition: Dictyoceratida with small rounded choanocyte chambers, and "solid" fibres (not pithed by granular substances).

Genus **Spongia** Linnaeus, 1759

Definition: Spongiidae with a close meshed regular reticulum of spongin fibres consisting of simple primary ascending fibres generally cored with small bits of foreign material and slightly thinner secondary interconnecting fibres which are free from foreign inclusions.

For synonymy and discussion of the genus *Spongia* cf. WIEDENMAYER (1977).

Spongia obliqua Duchassaing & Michelotti, 1864

Spongia obliqua DUCHASSAING & MICHELOTTI, 1864: 38, pl. 4 fig. 5.
Spongia discus DUCHASSAING & MICHELOTTI, 1864: 37.
"Cuba reef sponge" MOORE, 1910: pl. 55.

"Bahama reef sponge" MOORE, 1910: pl. 56.
[Non: *Spongia obliqua* or *S. officinalis* subsp. *obliqua* sensu DE LAUBENFELS, 1936a, 1948, 1949, 1950, 1953, DE LAUBENFELS & STORR, 1958 = all *Spongia tubulifera* Lamarck, 1814.]

Lectotype (per WIEDENMAYER, 1977): ZMA POR. 2099 (ST. THOMAS). Paralectotype: Mus. Turin POR. 107.

Description of the lectotype: (Fig. 1, Pl. I 1)
A macerated laterally flattened sponge, 8 cm high, 10 cm at its widest expansion, 2 cm across at the summit. It is now yellow brown (skin is missing), but has been described as black. Numerous oscules are found on the top only: diameter 2–3 mm. The vertical sides present numerous smaller, presumably inhalant "pores", up to 1 mm in diameter. In between these are numerous acute conules, 3 mm high, 4 mm apart. The skeleton is a fairly regular reticulum; primary fibres are 35–100 μm in diameter and moderately cored by foreign material; they lie at distances of 500–1300 μm. Meshes made by the secondary fibres (15–50 μm) are angular and measure 150–350 μm. The fibres are yellow-brown in colour.

Description of the lectotype of *Spongia discus* Duch. & Mich.: ZMA POR. 2077 (ST. THOMAS) (designation herein; it is the only extant type): (Pl. I 2)
A macerated laterally flattened sponge of the same general form as *Spongia obliqua* lectotype. It is 10 cm high, 7.5 cm wide and 2 cm across. Oscules (1.5–3 mm in diameter) are found only at the summit. No conules. The distance of the primary fibres is 300–700 μm; the primary fibres contain almost no foreign inclusions, their diameter is 28–40 μm. Secondary fibres of 15–20 μm in diameter form meshes of 70–300 μm. Colour of the fibres: light yellow. There are considerable differences with the skeleton of *S. obliqua* lectotype.

ARUBA: ZMA POR. 3544 (Oranjestad, Bucuti reef, coll. P. Wagenaar Hummelinck).
CURAÇAO: ZMA POR. 3533 (Coraaltabak, X. 1905, coll. Visserijonderzoek Curaçao).
BONAIRE: ZMA POR. 3585 (Boca Washikemba, 16. V. 1930, coll. Hummelinck *1069*).
BAHAMA ISLANDS: ZMA POR. 3513 (commercially prepared specimen, don. Instituut voor Nijverheid en Techniek, Amsterdam).

General diagnosis: (Fig. 1, Pl. I 1–3)
Shape, size and consistency: Typical specimens are upright laterally flattened or globose sponges, 4–10 cm high, 2.5–10 cm wide, 2–5 cm across. No tubular outgrowths. Oscules numerous and rather conspicuously placed at the summit, 1–6 mm in diameter. Vertical sides smooth or conulose, crowded with small (about 1 mm in diameter) inhalant openings. Consistency: spongy, compressible.
Colour: black, macerated specimens are light brown.
Dermis: organic, easily detachable.
Skeleton: A fairly regular reticulation of yellow spongin fibres.

Primary ascending fibres 28–100 μm in diameter, lying at distances of 300–1300 μm. Secondary fibres 10–50 μm in diameter forming meshes of 70–400 μm. Coring of the primaries with bits of spicules and small sandgrains is generally slight.

Ecology: One specimen is certain to have grown on the reefs. Further data on this species are unavailable, as it has not been found since 1930 (ZMA POR. 3583).

Distribution: Aruba, Curaçao, Bonaire, St. Thomas, Vieques, Bahamas.

WIEDENMAYER (1977) convincingly narrowed *Spongia obliqua* down to specimens closely resembling the lectotype. All recently published records of *S. obliqua* have been assigned by him to *S. tubulifera* Lamarck, 1814, recognizing the fact that this species also commonly shows non-tubuliferous growth forms. Nevertheless, it is clear that *S. obliqua* is closely related to *S. tubulifera*, which in its turn closely resembles the Mediterrenean *S. officinalis* Linnaeus, 1759.

Spongia tubulifera Lamarck, 1814

Spongia tubulifera LAMARCK, 1814: 384; DUCHASSAING & MICHELOTTI 1864: 34 (in part: only the Turin specimen).
Euspongia officinalis var. *tubulifera;* TOPSENT, 1930: 47, pl. 1 fig. 7.

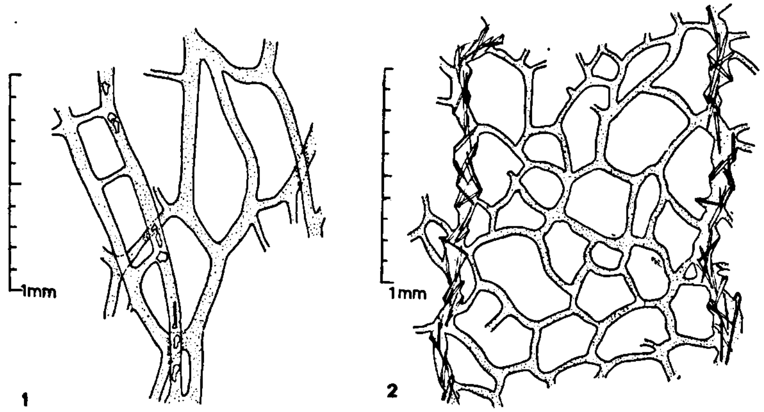


FIGURE 1. Detail of the skeleton of the lectotype of *Spongia obliqua* Duch. & Mich. (cf. Pl. I 1).
FIGURE 2. Detail of the skeleton of *Spongia tubulifera* Lam.

Spongia officinalis subsp. *tubulifera;* HYATT, 1877: 511, pl. 16 fig. 16.
Spongia officinalis subsp. *tubulifera* var. *rotunda* HYATT, 1877: pl. 15 fig. 1, pl. 16 fig. 15.
Spongia officinalis subsp. *tubulifera* var. *exotica* HYATT, 1877: pl. 16 fig. 13.
Spongia officinalis subsp. *tubulifera* var. *solida* HYATT; 1877: 514, pl. 16 fig. 10.
? *Spongia officinalis*; CARTER, 1882: 272.
Euspongia officinalis var. *rotunda*; WILSON, 1902: 402.
Spongia obliqua; DE LAUBENFELS, 1936a: 9, pl. 1 fig. 1; 1953b: 17; DE LAUBENFELS & STORR, 1958: 103, fig. 5.
Spongia officinalis subsp. *obliqua*; DE LAUBENFELS, 1948: 8, pl. 2 figs. 3–4; 1949 4; 1950: 5.
[Non: *Spongia tubulifera*; DUCHASSAING & MICHELOTTI, 1864: 34, in part: ZMA POR. 2257 = *Spongia pertusa*.]
[Nec: *Spongia tubulifera*; WIEDENMAYER, 1977: 55, pl. 1 fig. 1–2, pl. 2 fig. 1 (= *S. pertusa*) (personal communication).]
[Nec: *Spongia officinalis* subsp. *tubulifera* var. *pertusa* HYATT, 1877: 512, pl. 16 fig. 11; var. *mollis* HYATT, 1877: 513, pl. 16 fig. 12; var. *prava* HYATT, 1877: 513, pl. 16 fig. 17; var. *corlosiformis* HYATT, 1877: 513, pl. 16 fig. 14; = all *Spongia pertusa*].
[Nec: *Spongia lacinulosa*; DUCHASSAING & MICHELOTTI, 1864: 35, pl. 4 fig. 4; = *Spongia pertusa* Hyatt, 1877).]
? *Luffaria rupicola* Duch. & Mich. (labeled specimen in ZMA: POR. 1477, which however does not seem to fit the original description).

CURAÇAO: ZMA POR. 3418 (1883, old collection); 3420, 3421, 3449 (Caracas Baai, V. 1920, coll. C. J. van der Horst); 3530 (Schottegat, coll. J. Boeke); 3856 (no further data).
BONAIRE: ZMA POR. 3780 (Lac, Cai E, 0–0.5 m, on *Rhizophora*, 16. X. 1967, coll. P. Wagenaar Hummelinck, *1576*).
"West Indies": ZMA POR. 3547 (coll. Boeke).

General diagnosis: (Fig. 2, Pl. I 4, II 2)

Shape, size and consistency: The shape of this species varies considerably: globose, fist-shaped specimens occur next to laterally spreading masses of tubes. Often there are irregular or regular tube-like lobose outgrowths. All tubes terminate in a thin walled osculum. Oscules 1–4 mm in diameter. Generally the surface of this sponge is finely conulose. The surface of macerated specimens is tightly woven with a regular spreading of small inhalant openings. Size up to 14 cm high, 17 cm in lateral dimensions.

Consistency: toughly spongy, compressible.

Colour: black alive, dark brown to greyish in spirit. Dry specimens without attached dermis are a rich red brown.

Dermis: organic, detachable.

Skeleton: The course of the primaries seems sometimes erratic, their diameter and extent of coring varies greatly. Distance of the primaries 350–1400 μm, diameter 25–110 μm. Secondary fibres 12–30 μm. Meshes 50–700 μm. Fibre colour orange brown.

Ecology: The present material originated all from bays and lagoons; it was not found on the reefs.

Distribution: Curaçao, Bonaire; Key West and Nassau (HYATT, 1877), Tortugas (DE LAUBENFELS, 1936a), Western Bahamas (DE LAUBENFELS, 1949), Bermuda (DE LAUBENFELS, 1950), Gulf of Mexico (DE LAUBENFELS, 1953), Florida and Southern Bahamas (DE LAUBENFELS & STORR, 1958), Bimini (WIEDENMAYER, 1977).

WIEDENMAYER (1977) included in *Spongia tubulifera* also specimens described as such by DUCHASSAING & MICHELOTTI (1864). One of these is present in the ZMA-collection and it does not conform to LAMARCK's *S. tubulifera* despite the fact that TOPSENT (1930) expressed his opinion that these specimens were conspecific. The DUCH. & MICH. specimen together with their *Spongia lacinulosa*, some of HYATT's varieties and WIEDENMAYER's material are considered here to be conspecific with DE LAUBENFELS & STORR's *Spongia anclotea*. The latter differs from *S. tubulifera* in the softer consistency and more shaggy appearance, and the thick walled osculiferous cones. *Spongia anclotea* has already been described by HYATT under the name *S. officinalis* subsp. *tubulifera* var. *pertusa*, and consequently has to bear this name. The Turin specimen of DUCH. & MICH., Mus. Turin no. 112, is indeed conspecific with *S. tubulifera*.

Spongia pertusa Hyatt, 1877 (comb. nov.)

Spongia officinalis subsp. *tubulifera* var. *pertusa* HYATT, 1877: 512, pl. 16 fig. 11.
Spongia officinalis subsp. *tubulifera* var. *mollis* HYATT, 1877: 513, pl. 16 fig. 12.
Spongia officinalis subsp. *tubulifera* var. *prava* HYATT, 1877: 513, pl. 16 fig. 17.
Spongia officinalis subsp. *tubulifera* var. *corlosiformis* HYATT, 1877: 513, pl. 16 fig. 14.
Spongia tubulifera; DUCHASSAING & MICHELOTTI, 1864: 34 (in part: ZMA POR. 2257); WIEDENMAYER, 1977: 55, pl. 1 figs. 1–2, pl. 2 fig. 1 (personal communication F. WIEDENMAYER).
Spongia lacinulosa; DUCHASSAING & MICHELOTTI, 1864: 35, pl. 4 fig. 4. [Non: *S. lacinulosa* LAMARCK, 1814.]

? *Spongia irregularis* var. *pertusa*; LENDENFELD, 1879: 248 (probably only in part).
Spongia anclotea DE LAUBENFELS & STORR, 1958: 106, figs. 15–16.

ST. THOMAS: ZMA POR. 2257 (Duch. & Mich. specimen).
"Amerika": ZMA POR. 3959 (coll. W. J. E. Smissart).

General diagnosis: (Pl. II 1)

Shape, size and consistency: Sponge broadly massive, somewhat convex on the upper part. The DUCH. & MICH. specimen measures 17 × 13 × 9 cm, the second specimen is 30 × 28 × 20 cm. The whole upper surface bears numerous squat osculiferous lobes or cones, up to 5 cm high. Oscules measure up to 9 mm in diameter; they are thick-walled in low lobes, but taper into comparatively thin walled vents in high cones. They are elongate-contorted, irregular in outline. Inhalant "pores" are more or less regularly scattered over the entire surface; they are less conspicuous than in *S. tubulifera*. Consistency: spongy, compressible. Much softer than *S. tubulifera*.

Colour: Described as black; dry macerated specimens are greyish light brown.

Dermis: unknown.

Skeleton: The majority of the primary fibres in the upper part are free from foreign inclusions, but in between cones much more shaggy parts can be found where the primary fibres are filled with broken spicules. Diameter of the primaries 28–55 µm, lying at distances of up to 700 µm. Secondary fibres 12–45 µm, forming rather irregular meshes of 110–600 µm. When viewed with a low magnification the skeletal reticulation of *S. pertusa* is appreciably less coarse than that of *S. obliqua* and *S. tubulifera*.

Ecology: From the account of DE LAUBENFELS & STORR (1958) one might perhaps deduce that it is a reef dweller. WIEDENMAYER (1977) reports it from rocky slopes in lagoons.

Distribution: St. Thomas; Cuba, Guadeloupe, Vieques, Puerto Rico (DUCH. & MICH., 1864), Nassau, Havana, Fernando do Noronha (HYATT, 1877), Florida (DE LAUBENFELS & STORR, 1958), Bimini (WIEDENMAYER, 1977, as *S. tubulifera*).

Dr. KLAUS RUETZLER kindly donated a fragment of the holotype of *S. anclotea* De Laubenfels & Storr, 1958, and provided some photographs of the entire specimen. From this it can be learned that *S. anclotea* is of the same general appearance as the presently studied material, but differs somewhat in the more shaggy appearance and the frequent occurrence of cored primary fibres. These differences are here considered small and of no specific value.

Spongia obscura Hyatt, 1877

Synonymy: cf. WIEDENMAYER, 1977: 56.

CURAÇAO: ZMA POR. 1663, 3415, 3417 (coll. S. J. Mertens, 1887).
CUBA: ZMA POR. 3518 (Commercially prepared specimen, donated by the Instituut voor Nijverheid en Techniek, Amsterdam).

General diagnosis: (Fig. 3, Pl. II 3)

Shape, size and consistency: Cylindrical-conical shaped sponges with scattered oscules on flattened upper surface. Oscules characteristically fringed by paper thin collars or chimneys. Vertical sides conulose and often ridged lengthwise. Size: up to 40 cm in diameter and up to 22 cm in height. Consistency: softly spongy.
Colour: black alive, brown in the macerated state.
Dermis: unknown.
Skeleton: As a whole the skeleton of this species is much more irregular than the afore mentioned species. Primary fibres always follow an erratic course and sometimes divide or anastomose. Meshes are much more elongated. Diameter of the primaries: 40–70 µm (lying at distances of 300–1500 µm), secondaries: 15–45 µm, meshes: 140–850 µm.

Distribution: Curaçao, Cuba; Florida (DE LAUBENFELS & STORR, 1958), North Carolina (WELLS, WELLS & GRAY, 1960). Gulf of Mexico (LITTLE, 1963).

WIEDENMAYER (1977) pointed out, that DE LAUBENFELS & STORR (1958), a.o., misinterpreted *Spongia graminea* Hyatt, 1877. Their "grass" sponges are conspecific with HYATT's *Spongia equina* subsp. *cerebriformis* var. *obscura*. *Spongia graminea* Hyatt is a "glove" sponge, and synonymous with *Spongia cheiris* De Laubenfels & Storr, 1958. *Spongia graminea tampa* De Laubenfels & Storr, 1958, is a separate species (*S. tampa*) with a characteristic cup-shaped habit.

Spongia tampa De Laubenfels & Storr, 1958

Spongia graminea subsp. *tampa* De Laubenfels & Storr, 1958: 110, figs. 9–10.
"Grass sponge", Smith, 1878: pls. 28–29 (not pls. 24–27).

No locality: ZMA POR. 4229, 4230 (without any data at all).

Diagnosis: (Fig. 4, Pl. II 4)

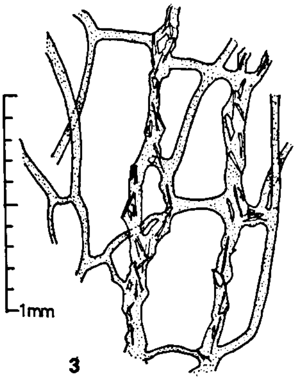
Shape, size and consistency: Both specimens conform closely to the holotype as pictured by De Laubenfels & Storr, 1958 in their figs. 9 and 10. The shape is that of a cup with barely tapering walls. Diameter of the largest specimen 23 cm, height 40 cm. The outside walls are irregularly furrowed and extensively frayed. Numerous oscules are found on the inside walls of the cup; smaller openings of presumable inhalant function are found between the furrows and frayings of the outerside. Consistency: of good commercial quality.

Colour: (of macerated specimens) yellowish red-brown.

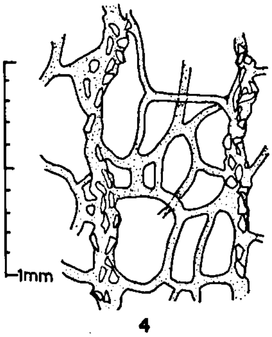
Dermis: unknown.

Skeleton: Rather tightly woven, fairly regular. Primary fibres well developed, following straight, parallel courses, 400–600 μm apart; diameter 40–65 μm. Secondary fibres of very light colour, diameter 15–35 μm, enclose polygonal to rounded (not elongated) meshes of 150–500 μm.

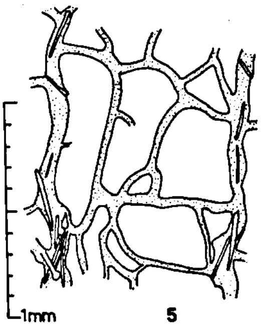
Distribution: Florida.



3



4



5

Figure 3. Detail of the skeleton of *Spongia obscura* Hyatt.
Figure 4. Detail of the skeleton of *Spongia tampa* De Laubenfels & Storr.
Figure 5. Detail of the skeleton of *Spongia barbara* Duch. & Mich.

Although the present specimens lack any accompanying data and their origin is unknown, they look so similar to the holoytpe, that there can be no doubt whatsoever of their identity. *Spongia tampa* is ill known, but from the above presented data it appears that it is not very closely related to *Spongia obscura* if skeletal characteristics have any significance at all.

Spongia barbara Duchassaing & Michelotti, 1864

Spongia barbara DUCHASSAING & MICHELOTTI, 1864: 31; DE LAUBENFELS, 1936b 455; DE LAUBENFELS & STORR, 1958: 105, figs. 13–14, 20; LITTLE, 1963: 33
Spongia vermiculata DUCHASSAING & MICHELOTTI, 1864: 35.
Spongia meandriformis DUCHASSAING & MICHELOTTI, 1864: 33.
Spongia zimocca subsp. *barbara*; DE LAUBENFELS, 1948: 13, text-fig. 3; 1950: 7, fig. 2; 1953: 512.
Spongia barbara subsp. *dura*; DE LAUBENFELS & STORR, 1958: 106, fig. 7.
[Non: *Spongia equina* subsp. *meandriniformis* (sic); HYATT, 1877: 522.]

Lectotype: Mus. Turin POR. 94; paralectotype: ZMA POR. 2074, a specimen labeled "*Spongia barbara*, Viecques" (designation herein). The British Museum collection holds a fragment labeled "*Spongia barbara*" (BMNH. 28.11.12.57), which is not conspecific with the lectotype (it is either a *Spongia*-fragment or a *Hippospongia*-fragment).

Description of the paralectotype from Vieques: (Fig. 5, Pl. III 1)

A macerated globular specimen, 13.5 × 11 × 10 cm in size. A fair number of oscules, 5–11 mm in diameter, are situated on the upper parts. The surface is covered by roundish knob-like conules, separated by meandering grooves. The colour is now dark brown. The skeleton is a fairly regular system of primary ascending fibres of 60–70 μm in diameter, cored by a moderate amount of broken spicules, lying at distances of about 2000 μm, and secondary fibres, 15–50 μm in diameter, forming meshes of 220–750 μm. The fibres are yellow brown in colour.

Description of the lectotype of *Spongia vermiculata*, ZMA POR. 2256, ST. THOMAS (designation herein; it is the only extant type specimen): (Pl. III 2).

The specimen is cylindrical, 9.5 cm long and 3.5 cm in diameter. Oscules are indistinct, perhaps a single larger opening might be regarded as such. Meandering grooves separate "knobs" which are appreciably smaller than those of the lectotype of *S. barbara*; they might better be termed "conules". The primary fibres lie at distances of 400–1500 μm, their diameter is 50–70 μm. Secondary fibres: 15–60 μm in diameter, meshes: 200–600 μm. Fibres yellow brown. The specimen originally was described as brownish black. The consistency is spongy.

Description of the paralectotype of *Spongia meandriformis*, ZMA POR. 2096, VIEQUES (designation herein). (The British Museum holds a DUCH. & MICH.

fragment labeled "*Spongia meandriformis*" which is not conspecific with the lectotype and does not conform to the original description; it is a piece of *Hippospongia gossypina* Duch. & Mich., 1864; lectotype: Mus. Turin POR. 105). (Pl. III 3)

A conical specimen of 5 cm high and 5 cm in its widest expansion. Oscules few in number, distributed evenly, 2–6 mm in diameter. Meandering grooves very conspicuous, the "knobs" are irregular. Primary fibre distance: 500–850 μm, diameter 45–80 μm. Secondary fibres: 15–35 μm, meshes: 150–700 μm. Fibres yellow. Original colour of the specimen brownish black.

General diagnosis: (Fig. 5, Pl. III 1–3)

Shape, size and consistency: Globular, cylindrical or conical. The surface of macerated specimens without skin is characteristically covered by knobs, 2–8 mm in diameter, separated by meandering grooves of 1–3 mm in diameter. Apparently the skin totally masks these surface markings (cf. De Laubenfels & Storr, 1958). Oscules mostly on the upper surface, 2–11 mm in diameter. The species may grow to the size of a human head (cf. De Laubenfels & Storr, 1958). Consistency: spongy, compressible.

Colour: dark brown.

Dermis: fleshy (De Laubenfels & Storr, 1958), covering the meandering subdermal grooves.

Skeleton: Primary ascending fibres well developed and moderately cored with broken spicules. They lie at distances of 400–2000 μm, their diameter is 45–80 μm. Secondary fibres of 15–60 μm form meshes of 150–750 μm.

Ecology: growing in reef localities.

Distribution: St. Thomas, Vieques; St. Martin, Panamá (De Laubenfels, 1936b), Gulf of Mexico (De Laubenfels, 1953; Little, 1963), Florida, Bahamas (De Laubenfels & Storr, 1958).

The "hardhead" variety described as *Spongia barbara dura* Hyatt, 1877 by De Laubenfels & Storr, 1958, shows a strong resemblance to the type specimen of Duchassaing & Michelotti, so if an infraspecific subdivision of this species is necessary this "subspecies" would probably fall to the nominal one.

Spongia solitaria Hyatt, 1877 (comb. nov.)

Spongia equina subsp. *gossypina* var. *solitaria* HYATT, 1877: 519, pl. 16 fig. 3

CURAÇAO: ZMA POR. 3416 (coll. S. J. Mertens, 1887).

Description: (Fig. 6, Pl. III 4, IV 1)

Shape, size and consistency: The specimen is semiglobular, 12 cm high and 17 cm in diameter. The surface from which the dermis is lacking is remarkably smooth, devoid of any conules, brushes, knobs or grooves. The surface skeleton is extremely tightly woven. Three large star-shaped vents or oscular-complexes crown the upper surface. Next to these numerous, fairly conspicuous, round apertures are scattered evenly over the whole of the sponge. The consistency in dry condition is stiff, barely compressible, but immersed in water the sponge is soft and seems to have a reasonable commercial quality. Colour in dry state: light yellow-brown.

The skeleton is very dense, without an apparent difference in diameter between ascending fibres and interconnecting fibres. No cored fibres have been found. Fibre diameter: 15–35 μm, meshes: 80–600 μm. Ascending fibres are frequently in "pairs", connected by short interconnecting fibres like the rungs of a ladder. Fibre colour: a distinctive orange red (in transmitted light). The choanosome is cavernous, but there are no peripheral canals or subdermal spaces.

Distribution: Curaçao (HYATT's specimen was of unknown occurrence).

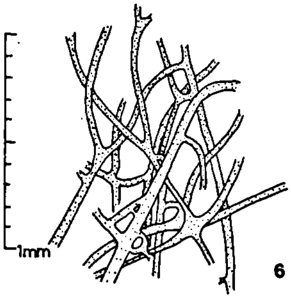
The present specimen closely resembles HYATT's *Spongia equina* subsp. *gossypina* var. *solitaria*, judging from his description and figure. It also bears a superficial resemblance to *Spongia sterea* De Laubenfels & Storr, 1958. Dr. KLAUS RUETZLER kindly donated a fragment of the holotype of this species, and provided some photographs of it. From this it is apparent that *Spongia sterea* is a coarser species, with a less densely woven peripheral skeleton. The primaries are clearly visible, even with the naked eye. They are also thicker (40–60 μm) and are cored abundantly with foreign spicules, so there is little skeletal resemblance. The rich colour of the fibres of *Spongia solitaria* is not found in *S. sterea.*

Dr. WIEDENMAYER (pers. comm.) suggested this species may have been pictured by SMITH (1878, e.g. pls. 19 and 22 (bottom), but not the remaining of his "yellow" sponges).

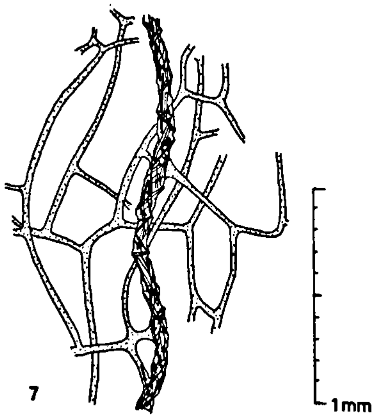
DISCUSSION OF THE GENUS *Spongia*

Of the West Indian *Spongia*-species, which are well established by recent publications there are two not represented in the present collection. They are *Spongia sterea* De Laubenfels & Storr, 1958, and *Spongia graminea* Hyatt, 1877. The first has been discussed above. *Spongia graminea* has been re-established by WIEDENMAYER (1977), as a "glove" sponge; it receives *Spongia cheiris* De Laubenfels & Storr, 1958 as a junior synonym. It is characterized by deeply furrowed vertical sides.

A revision of HYATT's collection is long overdue. It is necessary, both because it has been an extremely rich collection made in a time when "bath" sponges were not rare in the West Indies, and because it will be impossible to have a stable nomenclature of West Indian *Spongia*-species without reexamining this collection. HYATT (1877) used many DUCH. & MICH.-names and as far as can be judged from



6



7

FIGURE 6. Detail of the skeleton of *Spongia solitaria* Hyatt.
FIGURE 7. Detail of the skeleton of the paralectotype of *Hippospongia gossypina* (Duch. & Mich.). (cf. Pl. IV 4)

the remaining types of DUCH. & MICH., this was done incorrectly in most cases.

Of the rediscovered *Spongia*-species described by DUCHASSAING & MICHELOTTI, which have not been accounted for in the above, *Spongia cerebriformis* is referred to *Fasciospongia*, *Spongia clavaherculis* to the Haplosclerid genus *Spinosella*, *Spongia complanata* to the Haplosclerid genus *Haliclona*, *Spongia fenestrata* to the Aplysinid genus *Smenospongia*, *Spongia fusca* to the Haplosclerid genus *Haliclona*, *Spongia gossypina* to the genus *Hippospongia*, *Spongia lapidescens* to *Hippospongia* (transfer herein, WIEDENMAYER (1977) refers to it as *Spongia* spec.), *Spongia manus* to the Haplosclerid genus *Haliclona*, *Spongia marquezii* to the Axinellid genus *Teichaxinella* (fide WIEDENMAYER, 1977), *Spongia musicalis* to *Coscinoderma* (uncertain), *Spongia rubens* to the Haplosclerid genus *Haliclona*.

It will be refrained from in this paper to speculate about DUCH. & MICH. specimens and species which have not been rediscovered, and are probably for ever lost. These should be pronounced unrecognizable. They are: *Spongia cavernosa* Lam. (Non: *S. cavernosa* Lamarck = *Ciocalypta alleni*), *Spongia corlosia*, *Spongia subcircularis*, *Spongia isidis*[1]), *Spongia bartholomei*, *Spongia haagensenii*, *Spongia dumetosa*, *Spongia napiformis*, *Spongia guadelupensis*, *Spongia krebbresii*.

No vernacular or popular names for *Spongia*-species have been added in the present paper because it has been proven in the past that these are untrustworthy and have caused confusion.

Genus **Hippospongia** Schulze, 1879

Hippiospongia De Laubenfels, 1936.

Definition: Spongiidae with a highly developed system of wide and deep subdermal canals, leaving only relatively narrow strips or tufts of the skeleton to reach the surface.

Type species: *Spongia equina* Schmidt, 1862.

---

[1]) The British Museum collection contains a slide, labeled "*Spongia isidis*" Duch. & Mich., and the date given with it is 1891. It is very probably not a slide from the original DUCH. & MICH. specimen. The slide contains some pieces of sponge tissue, showing a neat reticulation of bundles of strongyles (250/10 μm) and scattered flesh spicules consisting of similar strongyles and isochelae (20 μm).

Hippospongia gossypina (Duchassaing & Michelotti, 1864)

Spongia gossypina Duchassaing & Michelotti, 1864: 32, pl. 3 fig. 3.
Spongia lapidescens Duchassaing & Michelotti, 1864: 34.
? *Spongia meandriformis* Duchassaing & Michelotti, 1864: 33 (in part: only the British Museum fragment, BMNH. 27.11.12.77).
Spongia equina subsp. *gossypina*; Hyatt, 1877: 517, pl. 16 fig. 1.
Hippiospongia gossypina; De Laubenfels, 1936a: 12; 1948: 29; De Laubenfels & Storr, 1958: 115; Little, 1963: 34.

Lectotype (designation per De Laubenfels, 1948: 29): BMNH. 28.11.12.70 (a fragment of the Turin specimen, Mus. Turin POR. 108). Paralectotype (designation herein): ZMA POR. 2087. The lectotype originated from Vieques, the paralectotype from St. Thomas.

Description of the paralectotype: (Fig. 7, Pl. IV 4)
An oblong, globular specimen, 7.5 × 8 × 5 cm, growing on a branch of *Acropora*. Dermis missing. The surface consists of deep grooves separating roundish knobs (no tufts). Primary fibres more often than not loaded with broken spicules; they lie at distances of 1100–1300 μm apart and are 50–60 μm in diameter. Secondary fibres 10–25 μm, of clear yellow spongin. Meshes 150–450 μm.

Nassau, Bahamas: ZMA POR. 3516 (commercially prepared specimen, don. Instituut voor Nijverheid en Techniek, Amsterdam).

General diagnosis: (Fig. 7, Pl. IV 4)
Shape, size and consistency: Globular to disc-shaped, up to 14 cm in diameter. No apparent large oscules. Surface divided by fairly narrow subdermal canals into rounded, club-shaped knobs which are smooth, not frayed. Consistency: softly spongy.
Colour: blackish alive (De Laubenfels, 1948).
Dermis: a tough organic skin, which is difficult to detach (De Laubenfels, 1948).
Skeleton: Primary fibres in the paralectotype readily distinguishable, but not differentiated in the Bahama-specimen; apparently the latter condition is the rule (De Laubenfels, 1936a, 1948; De Laubenfels & Storr, 1958). Diameter of the primary fibres 50–100 μm, of the secondary fibres 10–45 μm. Meshes 140–500 μm. Fibre colour: clear yellow.

Ecology: reef dweller.

Distribution: Vieques, St. Thomas, Nassau; Tortugas (De Laubenfels, 1936a), Florida (De Laubenfels & Storr, 1958), Gulf of Mexico (Little, 1963).

This is a clearly defined species. Some of HYATT's varieties of *Spongia equina* subsp. *gossypina* might also belong to it, but it is difficult to make sure from his photographs.

Hippospongia lachne De Laubenfels, 1936

Hippiospongia lachne DE LAUBENFELS, 1936a: 12; 1948: 27, text-fig. 6; DE LAUBENFELS & STORR, 1958: 115, figs. 1–2; LITTLE, 1963: 34.

CURAÇAO: ZMA POR. 1325 (don. S. J. Mertens, 1887).
CUBA: ZMA POR. 3414 (commercially prepared specimen, don. Instituut voor Nijverheid en Techniek, Amsterdam).
FLORIDA: ZMA POR. 3415 (commerc. prep. specimen don. Inst. Nijverheid en Techniek).

General diagnosis: (pl. IV 3)

Shape, size and consistency: Oblong to disc-shaped, often with one large vent in the centre. Size up to 18 cm in diameter. Surface grooves separate typical tufted knobs, which are 8–10 mm high, frayed. Consistency: softly spongy.
Colour: blackish alive (DE LAUBENFELS, 1948).
Dermis: tough, difficult to detach (DE LAUBENFELS, 1948).
Skeleton: Primary fibres not cored, 40–70 μm in diameter, lying at distances of 400–1000 μm. Secondary fibres 8–35 μm. Meshes often elongated, up to 750 μm.
Fibre colour: clear yellow.

Ecology: reef dweller.

Distribution: Curaçao, Cuba, Florida; Tortugas (DE LAUBENFELS, 1936a), Gulf of Mexico (LITTLE, 1963).

DISCUSSION OF THE GENUS *Hippospongia*

The original definition of *Hippospongia* has been emended by DE LAUBENFELS (1936a) for his new genus *Hippiospongia* (erected because BURTON (1934) acted harmful in choosing a neotype for SCHULZE's (1879) *Spongia equina*, which neotype was synonymous with *Spongia officinalis*), in the sense that *Hippospongia* should include all *Spongia*-like species with extensive subdermal canals and a reticulation of spongin fibres in which no distinction could be made between primary and secondary fibres. This emendation is incorrect, as the primary fibres are easily distinguishable; in specimens in which the primaries are uncored these are nevertheless conspicuous by their greater diameter. Cored primaries are found in *Hippospongia gossypina*. On the other hand there are some true *Spongia*-species in which cored primary fibres are extremely rare or even absent (cf. *Spongia solitaria* herein).

As far as is known from recent publications (disregarding HYATT's and LENDENFELD's materials) the species of *Hippospongia* treated above are the only West Indian representatives of the genus. *Hippospongia intestinalis* (Lam.) sensu Wilson, 1902, is referred here to *Hyattella*. BERGQUIST & HARTMAN (1969) announce a new *Hippospongia* species from the West Indies; so far it has not been described yet.

Genus **Hyattella** Lendenfeld, 1889

? *Aulena* Lendenfeld, 1889 (in part: *Aulena columbia* (De Laubenfels, 1948).
Trypespongia De Laubenfels, 1936 (*T. columbia*).
Hyrtios sensu Wiedenmayer, 1977 [non: *Hyrtios* Duch. & Mich., 1864].

Definition (emended herein): Spongiidae with an extremely cavernous or clathrous choanosome and a special dermal "veil" of thin spongin fibres supporting the organic dermis and lining the choanosomal caverns.

If *Spongia nitens* (Schmidt, 1862), type species of the genus *Ditela* Schmidt, 1862 is found to be congeneric with the species described below, *Ditela* should replace *Hyattella*.

Hyattella intestinalis (Lamarck, 1814)

Spongia intestinalis LAMARCK, 1814: 439.
? *Spongelia velata* HYATT, 1877: 534, pl. 17 fig. 8.
Hyattella intestinalis; LENDENFELD, 1889: 116, pl. 20 fig. 6; TOPSENT, 1932: 84, pl. 3 fig. 6; DE LAUBENFELS, 1948: 41; BERGQUIST, MORTON & TIZARD, 1971: 104.

Hippospongia dura LENDENFELD, 1889: 298, pl. 17 fig. 15.
Hippospongia intestinalis; RIDLEY, 1884: 590, pl. 5 fig. D; WILSON, 1902: 402; DENDY, 1905: 214.
Hippospongia clathrata; DENDY, 1905 (Non: *Hircinia clathrata* Carter).
Hippospongia anomala POLÉJAEFF, 1884: 54, pl. 7; DENDY, 1905: 215.
Trypespongia columbia DE LAUBENFELS, 1936a: 13, pl. 2 fig. 2, pl. 5 fig. 3; 1936b: 456.
Aulena columbia; DE LAUBENFELS, 1948: 36, pl. 5 fig. 9, pl. 6 fig. 11; 1953: 513; LITTLE, 1963: 34; STORR, 1964: 41.
Spongia bresiliana BOURY-ESNAULT, 1973: 290, pl. 2 fig. 3.
? *Spongia virgultosa;* BOURY-ESNAULT, 1973: 290 (Non: *S. virgultosa* Schmidt, 1862).
? *Hyrtios cavernosus*; WIEDENMAYER, 1977: 59.
[Non: *Hyrtios proteus* Duch. & Mich., 1864.]
Spongia cerebriformis fo. *insolita* WIEDENMAYER, 1977: 58.
[Non: *Spongia cerebriformis* Duch. & Mich., 1864 = *Fasciospongia cerebriformis*.]
[Nec: *Hircinia caracasensis* Carter, 1882 = *Hyrtios caracasensis*.]

CURAÇAO: ZMA POR. 3856 (Piscadera Baai, Boca W, sandy bottom, 1–1.5 m, 5.1.1964, coll. P. Wagenaar Hummelinck, *1458*), 3883 (Piscadera Baai, 1 m, 26.IX. 1957, coll. J. H. Stock, no. 1), 3957 (Piscadera Baai, 26 m, 23.I.1974, coll. Stock), 4307 (Blauwbaai, 20–30 m, XI.1975, coll. S. Weinberg & E. Westinga).
BONAIRE: ZMA POR. 4236 (Lac, Poejito, on *Rhizophora*, 18.X.1930, coll. Hummelinck, *1064A*).
PUERTO RICO: ZMA POR. 3502, 3886 (18°15′ N, 67°13.5′ W, 40–50 fthm. muddy sand, dredged, 21.II.1963, coll. Stock PR. 86, overgrown partly by *Hymeniacidon* spec.), 4235 (Parguera Magueyes, NE, on *Rhizophora*, 17.IX.1963, coll. Hummelinck, *1417*).

General diagnosis: (Fig. 8, Pl. IV 2, V 1–2)

Shape, size and consistency: Sponge massively encrusting or provided with irregular repent branches. Whether or not these growth forms represent ecophenotypes (the branched form in the present material is known only from deeper waters with muddy sand; the encrusting form originated from reef localities, 1–26 m deep) remains to be decided. Branches up to 26 cm long. Next to clusters of oscules 2–5 mm in diameter, there are scattered roundish to oval vents which give access to deep subdermal grooves or holes penetrating far interiorly. Surface mostly smooth, but particularly in branched specimens there are scattered conulose areas. Consistency toughly spongy. Most specimens seem to contain little flesh.
Colour: chocolate to yellow brown or greyish brown, in spirit the specimens are various shades of brown and grey.
Dermis: tough, organic, easily detachable. It is supported uniformly

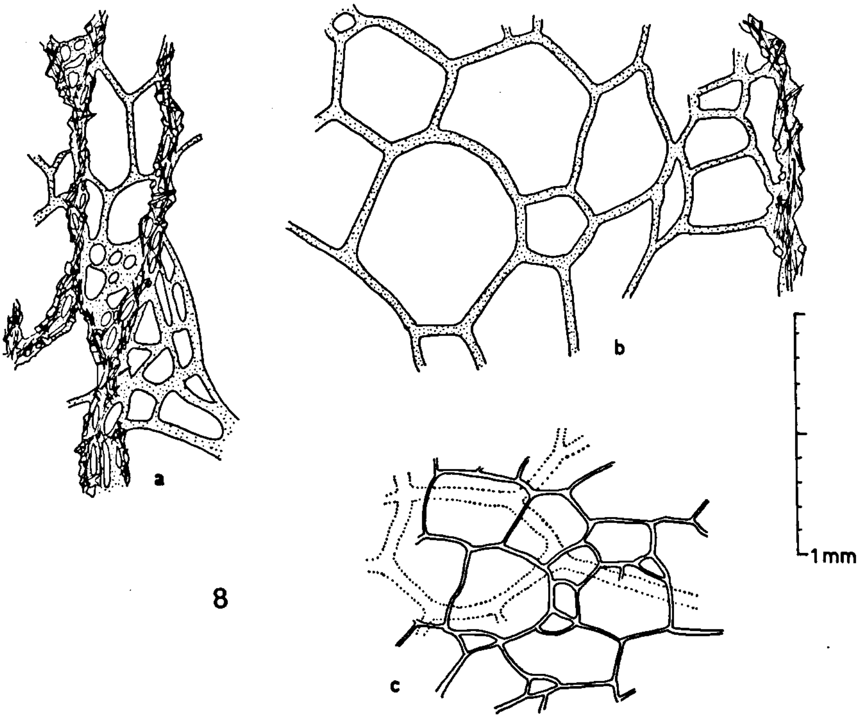


FIGURE 8. Details of the skeleton of *Hyattella intestinalis* (Lam.); a. peripheral skeleton of branched form b. choanosomal skeleton of massive form c. fine-meshed narrow-fibred dermal veil with dotted outline of the choanosomal skeleton underneath.

or only in places by a special dermal "veil" of very slender spongin fibres, clearly differing in size and colour from those of the choanosomal skeleton. Particularly in encrusting specimens from reef localities this dermal skeleton is often hard to find or entirely absent. This same "veil" lines the larger subdermal and choanosomal grooves and holes. Fibre diameter: 6–20 μm, meshes: 60–250 μm, fibre colour: clear, almost white.

Choanosomal skeleton: An irregular, polygonal reticulation of yellow, fairly stout spongin fibres (appreciably coarser than typical *Spongia* and *Hippospongia* skeletons). Primary fibres may be somewhat fasciculate in peripheral regions, particularly in the terminal parts of the branched form. Diameter of the primaries: 60–140 μm, variously cored or free from inclusions, lying at distances of 500–1800 μm. Secondary fibres 10–70 μm in diameter, not cored. Meshes 200–1000 μm. Fibres in some cases lightly and irregularly striated.

Ecology: As has been indicated above, there seem to be two growth forms, a branched and an encrusting one, which are found in different biotopes.

Distribution: Curaçao, Bonaire, Puerto Rico; Australia (LAMARCK, 1814), Zanzibar (HYATT, 1877), Mascarenes (RIDLEY, 1884), Ceylon (DENDY, 1905), Tortugas (DE LAUBENFELS, 1936a), Panamá (DE LAUBENFELS, 1936b), Gulf of Mexico (DE LAUBENFELS, 1953; LITTLE, 1963; STORR, 1964), Solomon Islands (BERGQUIST, MORTON & TIZARD, 1971), Brasil (BOURY-ESNAULT, 1973), Western Bahamas (WIEDENMAYER, 1977); Indomalayan Archipelago (unpubl. material from Siboga Exp.).

The present material is considered synonymous with *Hyattella intestinalis* (Lamarck) mostly on the basis of definitions of this species by later authors as RIDLEY (1884), WILSON (1902) and DENDY (1905). TOPSENT's (1932) redescription of the holotype does not mention the special dermal skeleton which is characteristic of this species. But this character often is very obscurely present and casual study of the skeleton may well cause overlooking it. In all the published descriptions of *Aulena columbia* no mention is made of this dermal veil, but one of DE LAUBENFELS' (1953b) specimens from the Gulf of Mexico, kindly sent on loan to me by Dr. RUETZLER, nevertheless contained it. Dr. RUETZLER (pers. comm.) assured me, that the type specimen is conspecific with the one sent on loan. *Spongia intestinalis* Lamarck as redescribed by TOPSENT (1931) is similar to the branched form described above. *Spongelia velata* Hyatt contains, according to the original description, a dermal veil and looks similar to the massive form described above.

Hippospongia dura Lendenfeld is assigned to this species on the basis of the description of the habit. *Hippospongia intestinalis* of RIDLEY (1884), WILSON (1902) and DENDY (1905) are very clearly the branched form. *Hippospongia clathrata* of DENDY (1905) is not conspecific with CARTER's *Hircinia clathrata;* both specimens have been examined by me in the British Museum. DENDY's specimen is clearly the massive form of *Hyattella intestinalis*, while *Hircinia clathrata* seems to be a different, though related species. *Hippospongia anomala* Poléjaeff looks similar to the massive form, although no mention is made of a special dermal veil in the description. *Trypespongia columbia* De Laubenfels, later assigned to the genus *Aulena* by De Laubenfels (1948), and incorrectly to the genus *Hyrtios* Duch. & Mich. by Wiedenmayer (1977), is also assigned to this species on the basis of the examination of one of De Laubenfels' specimens (cf. above). If, as Wiedenmayer contented, Pallas' *Spongia cavernosa* should be proven to be conspecific, then the species name *intestinalis* would have to be replaced by *cavernosa*. As long as Esper's hypotype has not been redescribed it seems best to retain Lamarck's name.

Judging from the description and photographs of *Spongia cerebriformis fo. insolita* Wiedenmayer, this form corresponds to the branched form of the present species. *Spongia cerebriformis* Duch. & Mich. is a *Fasciospongia*. Both the complete ZMA-type specimen and the two fragments in London are completely alike and match the definition given for *Fasciospongia*.

Hyrtios proteus Duch. & Mich. is represented by two fragments of the type specimens in the British Museum. These fragments are black in colour, coarsely conulose and contain thick primary fibres (up to 200 µm in diameter) filled completely with sand grains next to secondary fibres variously cored and uncored; it cannot be associated with the present species.

Spongia bresiliana Boury-Esnault, 1973 was found to be conspecific with the present species after examination of fragments of the type specimen; possibly, also *S. virgultosa* sensu Boury-Esnault, 1973 from Brazil should be included into the synonymy. *Aulena concertina* De Laubenfels, 1954 probably also belongs to this species.

Table 1 contains a comparison of characteristics of *Hyattella intestinalis* specimens from different localities, described under various names, in order to point out the similarity of the specimens.

Genus **Coscinoderma** Carter, 1885

Definition: Spongiidae with a cortex of sand grains and a skeleton in which both primary and secondary fibres are free from foreign inclusions.

TABLE 1

COMPARISON OF SOME SPECIFIC CHARACTERS OF *Hyatttella intestinalis* FROM DIFFERENT LOCALITIES

All names given below are considered to be synonyms of *H. intestinalis.*
(v) indicates studied specimens.

	Growth form	Dermal "veil"	Primary fibres µm	Secondary fibres µm	Meshes µm	Colour	Locality
Hyattella intestinalis (Lam.) Topsent, 1932	branching	—	50–80	10–70	80–500	—	Australia
Spongelia velata Hyatt, 1877	branching	+	coarse	—	irregular	—	Zanzibar
Hippospongia intestinalis Ridley, 1884	branching	+	—	—	—	pale brown-yellow	Mascarenes
Hippospongia anomala Poléjaeff, 1884	massive	?	120	28	—	pale yellow-white	10° S, 142° E
Hyattella intestinalis Lendenfeld 1889	branching	+	140	60–100	300–600	—	—
Hippospongia dura Lendenfeld, 1889	massive	—	—	27–40	polygonal	—	Atl. coast America
Hippospongia intestinalis Wilson, 1902	branching	+	60	40	350–500	—	Puerto Rico
(V) *Hippospongia intestinalis* Dendy, 1905	branching	+	100	40	—	light brown	Ceylon
Hippospongia anomala Dendy, 1905	massive	+	—	20–30	—	—	Ceylon
Hippospongia clathrata Dendy, 1905	massive	—	—	—	—	brown	Ceylon
Trypespongia columbia De Laubenfels, 1936	massive	—	40–180	20–40	100–400	reddish brown	Tortugas
(V) *Aulena columbia* De Laubenfels, 1953	massive	+ (not in original description)	80	30–40	200–600	pale drab to black	Gulf of Mexico
Aulena concertina De Laubenfels, 1954	branching	—	—	—	—	dark purplish grey	W. Central Pacific
Hyattella intestinalis Bergquist, Morton & Tizaud, 1971	massive	—	—	—	—	—	Solomon Islands
(V) *Spongia bresiliana* Boury-Esnault, 1973	massive	+	50–600	20–50	—	brown-black	Brazil
Spongia virgultosa Boury-Esnault, 1973	branching	+	—	36–80	—	—	Brazil
Hyrtios cavernosus Wiedenmayer, 1977	massive	—	—	—	—	dark grey	Bimini
Spongia cerebriformis insolita Wiedenmayer, 1977	branching	—	50–300	15–30	50–300	black	Bimini
(V) "*Luffariella clathrata*" (not published)	massive	+	100	30–40	300–600	light yellow-brown	Indonesia
(V) *Hyattella intestinalis* present collection	branching	+	65–140	20–55	20–100	light brown	Puerto Rico
(V) *Hyattella intestinalis* present collection	massive	+	60–100	15–60	150–700	chocolate brown	Curaçao

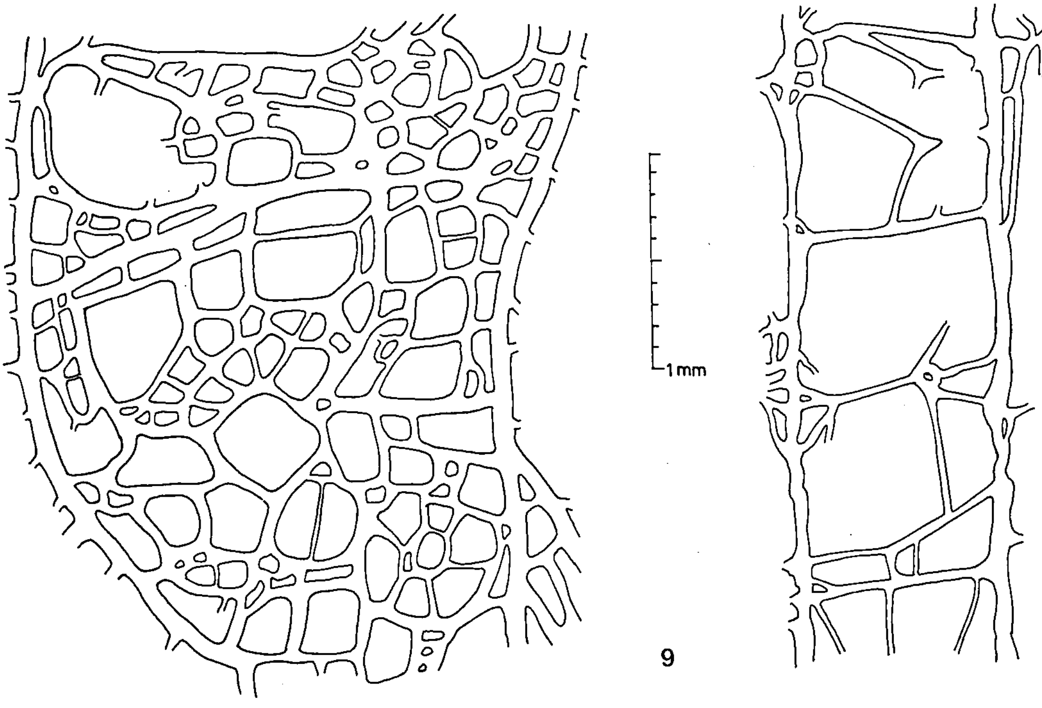
? **Coscinoderma musicalis** (Duchassaing & Michelotti, 1864)

Spongia musicalis Duchassaing & Michelotti, 1864: 39, pl. 6 fig. 2.
Coscinoderma spec. indet.; Wiedenmayer, 1977: table 48.

Lectotype (designation herein): ZMA POR. 2097, St. Thomas (only extant type specimen).

Description of the lectotype: (Fig. 9, Pl. V 3)

Macerated, without cortex or any dermal remants. Laterally compressed, with a convex upper rim, 11.5 × 5 × 2 cm. Oscules 3–6 mm in diameter, about two dozen in number, all situated on the convex upper rim. The surface is finely conulose, in places a tangential reticulation of dermal fibres is present. These fibres are of the same size as those of the choanosome. It is presumed the tangential reticulation originally held a cortex of foreign material. The consistency is brittle and incompressible in the dry state; immersed in water it becomes only slightly more spongy. The



9

Figure 9. Details of the skeleton (denser and wider-meshed parts) of the lectotype of ?*Coscinoderma musicalis* (Duch. & Mich.). (cf. Pl. V 3)

skeleton consists of a reticulation of coarse fibres with little differentiation into primary and secondary fibres. Distance of the primaries: 1200–1500 μm, fibre diameter 30–180 μm; fibres are free from foreign material, but have a peripheral striation. Colour of the fibres: red brown. Original colour of the specimen is stated to have been blackish, turning to yellow in dried specimens (cf. Pl. V 3). It is now dark brown.

Distribution: St. Thomas.

This sponge is only very hesitatingly assigned to the genus *Coscinoderma;* the present specimen (which is not the pictured specimen but sufficiently resembles it and the original description to be certain it is conspecific) is somewhat like LAMARCK's (1814) *Spongia pesleonis*, redescribed as *Coscinoderma pesleonis* by TOPSENT (1931), from Australian waters. It is unlike *Coscinoderma lanuga* De Laubenfels, 1936 (from Tortugas). A portion of the holotype has been donated by Dr. RUETZLER. It differs in possessing a thick greyish coat of sand and a much more slender skeleton. There are no matching descriptions in the literature of West Indian sponges and so far the above redescribed specimen remains the only one known.

Genus **Oligoceras** Schulze, 1879

Definition: Spongiidae with the dermis reinforced with foreign material and both the primary fibres and the secondary fibres heavily loaded with sand grains.

Oligoceras violacea (Duchassaing & Michelotti, 1864) comb. nov.

Acamas violacea DUCHASSAING & MICHELOTTI, 1864: 95, pl. 22 fig. 4.
Oligoceras hemorrhages DE LAUBENFELS, 1936a: 16, pl. 6 fig. 2; 1949: 6; HARTMAN, 1955: 162; HECHTEL, 1965: 11, pl. 1 fig. 5; WIEDENMAYER, 1977: 63.
Oligoceras collectrix subsp. *hemorrhages*; DE LAUBENFELS, 1948: 58, pl. 12 fig. 6.

Lectotype (designation herein): ZMA POR. 615, ST. THOMAS (only extant type specimen).

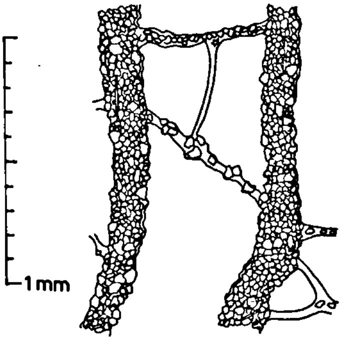
Redescription of the lectotype: (Fig. 10, Pl. V 4)
The type material, kept in dry condition, consists of 5 extremely fragile fragments, in all probability remnants of a repent-ramose specimen. The fragments are 2–4 cm in length and 1–1.5 cm in diameter. They are macerated, but bits of a sandy dermis

are still adhering here and there, between small conules. Oscules are not apparent. The skeleton consists of primary fibres of irregular outline, loaded with sand and broken spicules, 100–280 μm in diameter, lying at distances of 280–1300 μm. Secondary connecting fibres are 20–100 μm in diameter, cored in the axial region with small sand grains lying in a row. The smallest connectives are often uncored. Meshes: 160–560 μm. Fibres of clear yellow spongin without stratification.

CURAÇAO: ZMA POR. 3643 (Awa di Oostpunt, 0.5 m, 17.III.1974, coll. J. H. Stock); 3697 (Fuikbaai, eastern part, 2 m, muddy sand with stones, 5.X.1968, coll. P. Wagenaar Hummelinck, *1644*); 3716 (Piscadera Baai, Boca W., 1–1.5 m, sandy bottom, 5.I.1964, coll. Hummelinck, *1458*; 3971 (Piscadera Baai, entrance E, *Rhizophora*, 28.IX.1963, coll. Hummelinck, *1464*).
BONAIRE: ZMA POR. 3721 (Lac, Puito, tidal zone, on *Rhiz.*, 11.III.1970, coll. Hummelinck, *1577a*); 3804 (the same, 17.IX.1948, coll. Hummelinck, *1064b*); 3986 (Lac, near eastern point of Cay, eelgrass, sandy bottom, 0.5–2 m, 17.IX.1948, coll. Hummelinck, *1067*); 3990 (Lac, Puito, NE, 0–0.5 m, *Rhiz.*, 10.VIII.1967, coll. Hummelinck, *1579*); 3997 (Lac, Puito, S, 0-0.5 m, *Rhiz.*, 10.VIII.1967, coll. Hummelinck, *1064C*); 4019 (Lac, Poejito, tidal zone, *Rhiz.*, 17.IX.1949, coll. Hummelinck, *1064B*).
ST. EUSTATIUS: ZMA POR. 3535 (near Jakin's Bridge, 30 fthms., coll. J. Boeke).
FLORIDA: ZMA POR. 3784 (E. of Elliott Key, 2–6 m, 5.IX.1963, coll. Hummelinck, *1414*).

General diagnosis: (Fig. 10, Pl. V 4, VI 1)

Shape, size and consistency: The shape is persistently lobate to ramose. Typical specimens are clusters of club-shaped lobes. Strongly conulose, conules 0.5–2 mm high, about 2 mm apart. The highest conules are often located near the substrate and sometimes are "forked". Oscules rare, single, 1–3 mm in diameter. Individual



10

FIGURE 10. Detail of the skeleton of the lectotype of *Oligoceras violacea* (Duch. & Mich.). (cf. Pl. V 4)

lobes are 1–6 cm high, 1–2 cm in diameter. The consistency is rather soft, spongy. When handled alive the species gives off a very characteristic purple exudate.
Colour: Dark brown to red-purple alive, light-beige to brown-red in spirit.
Dermis: Soft, organic, loaded with sand and other foreign material.
Choanosome: Skeleton consisting of primary fibres abundantly loaded with foreign material (sand, spicule fragments, foraminiferan shells, etc.), 70–280 µm in diameter, lying at distances of 280 to 1800 µm. Secondary fibres mostly cored, either similarly or only with a single row of small sand grains. Rarely, some of the secondaries are devoid of foreign inclusions; diameter: 15–120 µm. Meshes: 200–750 µm. Fibres not striated. Flagellate chambers: 20–35 µm. Throughout the choanosome variable quantities of foreign material are present outside the fibres. Many of the studied specimens contain filamentous blue algae or calcareous algae.

Ecology: *O. violacea* has been collected from mangrove forests (e.g. Lac, Bonaire) and shallow sandy bottoms; one specimen originated from 30 fthms, type of bottom unknown. This record is somewhat doubtful, as it is a specimen from the "old collection". All other literature data indicate, that this is a species prefering shallow water down to 6 m in depth. Reef occurrence of this sponge has not been reported with certainty.

Distribution: St. Thomas, Curaçao, Bonaire, St. Eustatius, Florida; Western Bahamas (DE LAUBENFELS, 1949; WIEDENMAYER, 1977), Yucatán (HARTMAN, 1955), Jamaica (HECHTEL, 1965).

Next to *O. violacea* (= *O. hemorrhages*) a second species, *O. spongeliformis* (Wilson, 1902) is known from the West Indies. This species has been reported only once and can be barely distinguished from the present one on the basis of its published description. Only its shape seems to be quite different: ramose cylinders up to 25 cm long. No exudate has been reported for this sponge, but as WILSON's specimen was not particularly fresh, this cannot be taken as a distinctive character. The specific identity of *O. spongeliformis* needs to be reestablished.

Genus **Ircinia** Nardo, 1833

Definition: Spongiidae with numerous filamentous spongin threads filling the choanosome and with pronouncedly fascicular ascending tracts of spongin fibres. Both primary and secondary fibres cored by foreign material. Dermis loaded and reticulated by sand grains.

Ircinia felix (Duchassaing & Michelotti, 1864)

Polytherses felix DUCHASSAING & MICHELOTTI, 1864: 72, pl. 13 fig. 2.
Polytherses armata DUCHASSAING & MICHELOTTI, 1864: 70, pl. 13 fig. 1.
Polytherses columnaris DUCHASSAING & MICHELOTTI, 1864: 73.
Ircinia fasciculata sensu De Laubenfels (non: *I. fasciculata* Schmidt, 1862)
For a complete synonymy one is referred to WIEDENMAYER, 1977: 60.

Lectotype of *Polytherses felix* (designation herein): ZMA POR. 1854, ST. THOMAS. Schizoparalectotype: BMNH 28.11.12.23. Paralectotype: Museum Turin, POR. 63.

Redescription of the lectotype: (Pl. VI 2)

Globular sponge, 8 cm high, 5 cm in diameter, attached to a piece of coral. Strongly conulose, conules are about 1 mm high, 2–3 mm apart. Oscules fairly numerous, evenly spread over the entire surface, 3–6 mm in diameter. Dermal pores apparently nearly all closed; the rare ones that are apparent measure 250–350 μm in diameter. Dermis loaded with sand grains. Ascending columns 300–350 μm in diameter (individual fibres 80–170 μm), 1000–2000 μm apart, moderately cored with detritus. Interconnecting fibres 40–90 μm in diameter, sparsely cored. Filaments numerous, 2–5 μm in diameter, with a terminal round knob of 8–10 μm. Choanosome cavernous. The present specimen has been chosen as lectotype rather than the Turin specimen, because it looks, judging from a slide made by Dr. RUETZLER, less typical than the ZMA-specimen.

Redescription of the lectotype of *Polytherses armata* (designation per WIEDENMAYER, 1977) ZMA POR. 1851, ST. THOMAS. (Pl. VI 3)

Laterally flattened, 12 cm across, 9 cm high, 2.5 cm wide. Conules 2–4 mm high, 2–4 mm apart. Oscules rare, 1–3 mm in diameter. Pores rare, 250–350 μm in diameter. Ascending columns 300–500 μm in diameter, 2000 μm apart. Secondary fibres 20–80 μm in diameter, sparsely cored. Filaments numerous, 3–6 μm in diameter, terminal knobs 8 μm.

CURAÇAO: ZMA POR. 3355, 3657 (Spaanse Water, V.1920, coll. C. J. van der Horst), 4057 (Caracasbaai, 5.V.1920, coll. van der Horst), 3620, 3651 (Blauwbaai, 15–20 m, XI.1975, coll. S. Weinberg & E. Westinga), 3602 (500 m W of Piscadera, 15 m, 13.XI.1975, coll. students Prof. Stock), 3714, 3857, 3918 (Piscadera Baai, Boca W, 1–1.5 m, 5.I.1964, coll. P. Wagenaar Hummelinck, *1458*), 4014 (Knipbaai, S, rocks, tidal zone, 8.I.1949, coll. Hummelinck, *1017*).

VENEZUELA: ZMA POR. 3557 (N of peninsula de Paria, 72 m, 15.VII.1968, coll. L. J. K. Klein, Calamar st. 483).

BARBADOS: ZMA POR. 3812 (0.5 mile off Holetown, 100 m, muddy sand, 19.II.1964, coll. Hummelinck, *1442*).

SABA: ZMA POR. 3779 (off Fort Bay, 6.X.1963, coll. Hummelinck, *1431*).

General diagnosis: (Fig. 11, Pl. VI 4)

Shape, size and consistency: Typical specimens tend to be globular or angularly cake-shaped, 12–14 cm in maximal diameter.

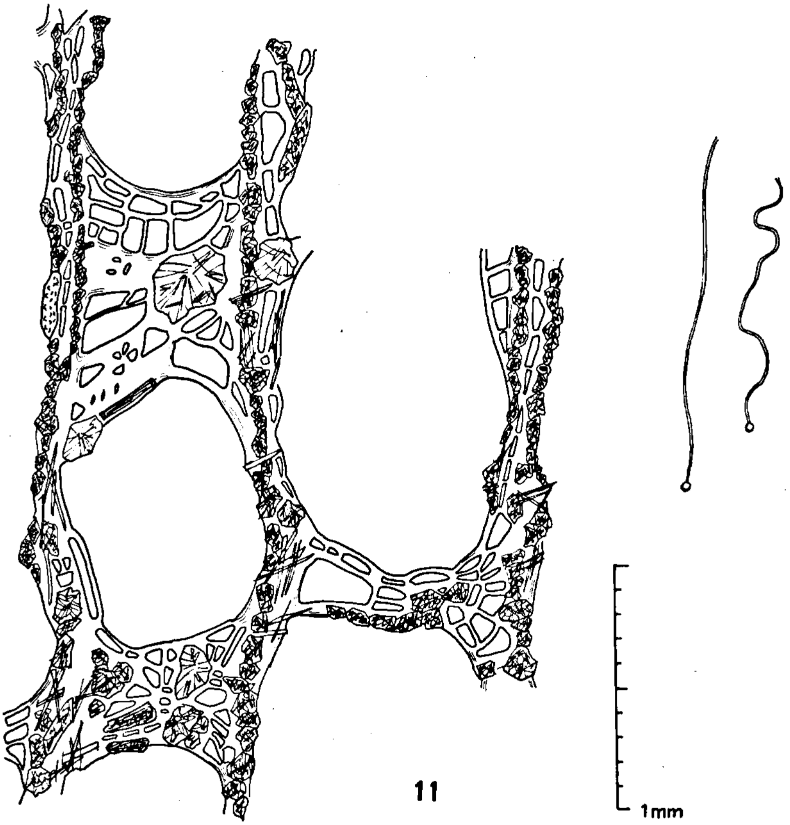


FIGURE 11. Detail of the skeleton of *Ircinia felix* (Duch. & Mich.) and its filaments.

From this typical habit the species may strongly deviate: flatly encrusting, lamellar or ramose specimens are found. The species is rather finely conulose when compared to *I. campana* and *I. strobilina*, the two other common shallow-water *Ircinia*-species of the West Indies. Conules are 0.5–4 mm high (normally 1–2 mm), and 1–6 mm apart (on the average 2–3 mm). Oscules are typically provided with a dark, blackish purple rim, which colour may persist for a long time in preserved specimens. However, some of the preserved specimens lack this important distinctive character. Oscules scattered irregularly, diameter 1–8 mm. The consistency is tough, compressible, difficult to cut or tear. Dry specimens are stony hard. Colour: brown alive, purple brown or beige brown in spirit. Dry specimens are grey.

Dermis: Tough, organic, loaded with sand, which is reticulated around pore openings. It is carried by a reticulation of bundled filaments. Meshes of the dermal reticulation: 80–350 μm.

Choanosome: Ascending columns 200–550 μm in diameter, 1000–2500 μm apart. Connecting fibres 15–100 μm in diameter. Both are cored with sand grains and broken spicules, but especially the connecting fibres only lightly so.

Filaments very numerous, at least 1500 μm long (probably much longer), 2–6 μm in diameter, terminal rounded knob 5–12 μm in diameter.

Ecology: Most of the present specimens originated from reefs or rocks, although a few apparently grew in shallow lagoons. The specimens from deeper water (off Puerto Rico, Barbados, and Venezuela) were growing in muddy sand. The possibility cannot be excluded that they belong to a separate taxon, but for lack of distinguishing morphological characters they are treated as conspecific with *I. felix*.

Distribution: St. Thomas, Curaçao, NE Venezuela, Barbados, Saba; Puerto Rico, Tortola, Nassau (CARTER, 1882), Bahamas (DE LAUBENFELS, 1949; WIEDENMAYER, 1977), Bermuda (DE LAUBENFELS, 1950), Gulf of Mexico (LITTLE, 1963), Florida (STORR, 1964), Jamaica (HECHTEL, 1965).

Although this species undoubtedly belongs to the commonest sponges of the West Indies, its identity still is not completely delimited against other *Ircinia*-species. The name *I. felix* is here used on the authority of HARTMAN, RUETZLER and WIEDENMAYER (cf. WIEDENMAYER, 1977), who claim it is distinct from *I. fasciculata* (Schmidt, 1862), originally described from the Mediterranean.

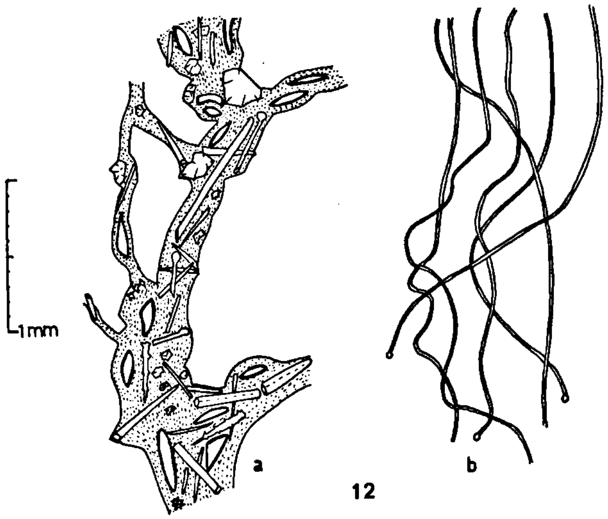
Ircinia cf. **dendroides** (Schmidt, 1862)

? *Hircinia dendroides* SCHMIDT, 1862: 32, pl. 3 fig. 10.
? *Ircinia dendroides*; VACELET, 1959: 90.
Cacospongia dendroides POLÉJAEFF, 1884: 60, pl. 8 figs. 1–3, pl. 6 fig. 14.

BARBADOS: ZMA POR. 3812, 4308 (0.5 mile off Holetown, 100 m, muddy sand, dredged, 19.II.1964, coll. P. Wagenaar Hummelinck, *1442*).
PUERTO RICO: ZMA POR. 3522, 3529 (18°15′ N 67°13.5′ W, 40–50 fthms., bottom muddy sand, dredged, 21.II.1963, coll. J. H. Stock).

Diagnosis: (Fig. 12, Pl. VII 1)

Shape, size and consistency: Thin cylindrical branches, almost certainly creeping, 2.5–9 cm long, diameter 3–5 mm. Surface thickly encrusted by calcareous debris; conules weakly developed, 0.5–3 mm high. Oscules not apparent. Pores are difficult to detect among the dermal debris. Consistency tough; rough to the touch.
Colour: alive unknown, in spirit beige brown.
Dermis: tough, loaded with foreign debris.
Skeleton: Ascending columns 200–450 µm in diameter, cored variously with sand grains and broken spicules. Connecting fibres



12

FIGURE 12. Detail of the skeleton of *Ircinia* cf. *dendroides* (Schmidt) (a) and its filaments (b).

20–70 μm in diameter. Filaments 4–6 μm in diameter, round knob 10–11 μm.

Ecology: Known only from muddy sand in deep water.

Distribution: Barbados, Puerto Rico; W. Pacific (POLÉJAEFF, 1884), ? Mediterranean (SCHMIDT, 1862, VACELET; 1959).

The thinly ramose habit distinguishes the present material from *I. felix*. It is presumed, that similar specimens described by POLÉJAEFF (1884) are conspecific. Whether or not the Mediterranean thinly ramose *Ircinia*-species is conspecific is still somewhat uncertain. Remarkably enough, POLÉJAEFF made no mention of SCHMIDT's species; he treated his specimens as a new species and by coincidence gave it the same name. Should further studies on these forms prove that POLÉJAEFF's and SCHMIDT's species are not identical, then a new name must be given to POLÉJAEFF's and the present material. VACELET (1959) synonymized *I. ramosa* (Keller, 1889) with Mediterranean *I. dendroides*; it is uncertain, whether this has been done correctly. *Ircinia ramosa* (Keller, 1889), as described for the West Indies by DE LAUBENFELS, 1950 and HARTMAN, 1955, differs from the above described material in the erect, more solid and thicker branches. In the same way the ramose form of *I. felix* described by DE LAUBENFELS, 1950 (as *I. fasciculata*) differs strongly by presenting very thick, solid branches.

Ircinia hummelincki n. sp.

Holotype: ZMA POR. 4309.
Type locality: BARBADOS, 0.5 mile off Holetown, 100 m, muddy sand bottom, 19.II.1964, coll. P. Wagenaar Hummelinck, *1442*.

Description: (Fig. 13, Pl. VII 2)

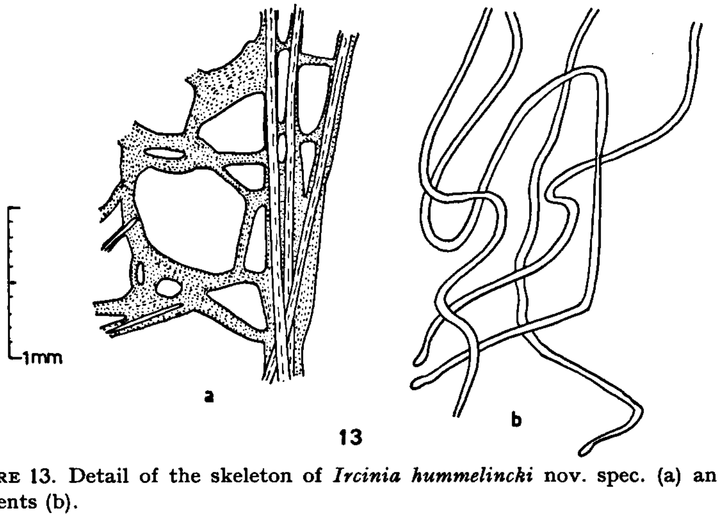
Thinly encrusting on coral debris with a single upright cylindrical branch, 6 cm long, 6 mm in diameter and bluntly terminating (thus bearing considerable outward resemblance to *I.* cf. *dendroides*). Finely conulose, conules 0.5 mm high, 1 mm apart. Surface of the basal part thickly coated with coral debris. Oscules not apparent. Pores obscured by a thick crust of debris. Colour in spirit beige brown. Ascending columns 200–250 μm, sparsely cored with broken spicules; connecting fibres 30–40 μm, often free from inclusions. The outstanding character of this species is the extreme coarseness of the filaments. These are relatively few in number, 15–29 μm in diameter (averaging 18–20 μm), and do not terminate in a rounded knob, although some of them show a slight constriction near their termination.

Ecology: Known only from muddy sand bottom in deeper water.

Distribution: Barbados.

Etymology: Named after its collector, Dr. P. WAGENAAR HUMMELINCK.

By the extreme thickness of its filaments this species stands out among all other West Indian *Ircinia*-species, which have filament diameters up to 10 μm at the most. The closest related species may be *Ircinia paucifilamentosa* Vacelet, 1961 from the Mediterranean, which possesses filament diameters of 9–13 μm with irregular terminal knobs of 25–45 μm in maximum size. It also shares the relative scarceness of the filaments. It is described as a massive sponge with osculiferous projections, yellow white in colour.



13

FIGURE 13. Detail of the skeleton of *Ircinia hummelincki* nov. spec. (a) and its filaments (b).

Ircinia campana (Lamarck, 1816)

Synonymy: cf. HARTMAN, 1955: 162.

CURAÇAO: ZMA POR. 3285 (Piscadera Baai, Hiltonpier, 5 m, 24.XI.1973, coll. J. H. Stock); 3500, 3501 (Blauwbaai, 3 m, 17.X.1958, coll. Stock); 2526 (1922, coll. G. J. H. Molengraaff); 3549 (Caracasbaai, 19.V.1920, coll. C. J. van der Horst); 3656, 3659, 3660 (Caracasbaai, 1924, coll. H. Lamp); 3958 (Blauwbaai, 20–30 m, XI.1975, coll. S. Weinberg & E. Westinga, encrusted by *Hyattella intestinalis* and *Microciona* spec.); 3968 (Spaanse Water, 19.V.1920, coll. van der Horst).
ST. THOMAS: ZMA POR. 1852 (Duch. & Mich. specimen).
"Amerika": ZMA POR. 2683 (coll. van Heukelom).

General diagnosis: (Pl. VII 3)
Shape, size and consistency: Persistently cup-shaped, even in small specimens, although asymmetrical specimens with a lower and a higher cup-wall are common. Surface strongly conulose with medium sized conules: 2–8 mm high (mostly about 4 mm), 3–10 mm apart (mostly 5–6 mm). Conules on inside of the cup distinctly lower and closer together than those on the outside. Oscules only on the inside, although fields of large "pores" (with possible exhalant function) are occasionally found on the outside. Oscules 4–10 mm in diameter. Size of the specimens: height 7.5–50 cm, diameter 8.5–40 cm, thickness of the cup wall 0.5–3.0 cm. Consistency: fleshy, tough.
Colour: reddish brown alive, greyish brown in spirit.
Dermis: Reticulation of foreign material around pores, carried under the skin by a reticulation of filaments. Pores 250–500 µm.
Choanosome: Ascending columns 300–700 µm in diameter, 1000–1750 µm apart, cored sparsely with sand and spicule fragments. Connecting fibres 30–150 µm, sparsely cored. Filaments: 3–6 µm in diameter, knobs 9–10 µm. Filaments sometimes granulated.

Ecology: Common on reefs and rocky lagoon bottoms.
Distribution: Curaçao, St. Thomas; Bahamas, Cuba, Florida (HYATT, 1877), Tortugas (DE LAUBENFELS, 1936a), Canal Zone (DE LAUBENFELS, 1936b), Gulf of Mexico (DE LAUBENFELS, 1953, LITTLE, 1963), Yucatán (HARTMAN, 1955), Brazil (BOURY-ESNAULT, 1973).

Ircinia strobilina (Lamarck, 1816)

Polytherses capitata DUCHASSAING & MICHELOTTI, 1864: 72.
Polytherses longispina DUCHASSAING & MICHELOTTI, 1864: 71.
Polytherses linguiformis DUCHASSAING & MICHELOTTI, 1864: 69.
Polytherses cylindrica DUCHASSAING & MICHELOTTI, 1864: 73.
Polytherses acuta DUCHASSAING & MICHELOTTI, 1864: 72, pl. 13 fig. 3.
For further synonymy cf. WIEDENMAYER, 1977: 61.

Lectotype of *Polytherses longispina* (per Wiedenmayer, 1977): ZMA POR. 1855 (only extant type specimen), ST. THOMAS.

Redescription of the lectotype of *P. longispina*: (Pl. VII 4)
Oval in shape, 8 cm high, 5.5 cm in diameter. Coarsely conulose, conules sharp, 6–8 mm high, 7–10 mm apart. Three oscules of 3 mm in diameter. Ascending columns not very often converging at the periphery, sparsely cored, 700–900 μm apart. Filaments 1–3 μm in diameter, granulated, terminal knobs 5 μm.

Lectotype of *Polytherses capitata* (designation herein) Mus. Turin POR. 60, ST. THOMAS; schizolectotype BMNH. 21.11.12.24; paralectotype ZMA POR. 1853, St. Thomas.
Redescription of the paralectotype of *P. capitata:* (Pl. VIII 1)
Globular sponge of 6 cm high and 4.5 cm in diameter. Strongly conulose, conules 3 mm high, 5–8 mm apart. 2 large and 2 small oscules are present on the upper surface. Near its base a field of small apertures of presumed exhalant function are found. Ascending columns often converging in the periphery to form composite blunt conules. Ascending columns sparsely cored, 200–300 μm in diameter, 300–700 μm apart. Connecting fibres 20–60 μm in diameter. Filaments 4–6 μm in diameter, terminal knob 6–10 μm.

CURAÇAO: ZMA POR. 3283 (Spaanse Water, 19.IV.1920, coll. C. J. van der Horst); 3287 (Barbara Beach, 3 m, 17.I.1974, coll. J. H. Stock, 74/107); 3292 (Piscadera Baai, 1 m, 15.I.1973, coll. Stock, 73/7); 3476 (Caracasbaai, 19.V.1920, coll. van der Horst); 3494 (Fuikbaai, 2 m, 3.XII.1958, coll. Stock, 112); 3575 (Piscadera Baai, near Carmabi, 15–30 m, 10.XII.1975, coll. E. Westinga & P. Hoetjes); 3619, 3624 (Blauwbaai, 15–30 m, XI.1975, coll. S. Weinberg & E. Westinga); 3628 (Piscadera Baai, near Carmabi, 18 m, 14.XI.1975, coll. students Prof. Stock).
PUERTO RICO: 3286, 3288 (Margarita Reef, 6–8 m, 2.II.1963, coll. Stock, PR. 23, 28); 3359 (18°15′ N 67°13.5′ W, 40–50 fthms., bottom muddy sand, 21.II.1963, coll. Stock).
GUYANA SHELF: ZMA POR. 3538 (05°50′ N 58°10′ W, 45 fthms., 17/18.XI.1969, coll. L. J. K. Klein, Calamar stat. 886).
"West Indies": ZMA POR. 3546 (coll. J. Boeke).

General diagnosis: (pl. VIII 2)
Shape, size and consistency: Typically cake-shaped, up to 20 cm high and 23 cm in diameter. Large specimens may show a shallow

depression at their upper side. Many specimens are rounded or laterally expansed masses. Coarsely conulose; perhaps a distinction should be made between specimens with low, broad and blunt, and those with sharp high conules (*"longispina"*). Conules 2–15 mm high, 5–15 mm apart. Oscules 4–10 mm in diameter, either single or in groups. Consistency: tough.

Colour: alive blackish grey on the upper surface, yellow grey near the base. This colour is retained for a long time in preservation. Long preserved specimens are entirely grey or rosy-grey.

Dermis: Thickly loaded with sand. Inhalant openings mostly obscured; when not, they are fairly regularly distributed.

Choanoscome: Ascending columns may be grouped together to form blunt, ridged conules; diameter 200–1000 µm, 700–1700 µm apart. Connecting fibres may be very finely branched (as thin as 8 µm in diameter), or occasionally form perforated spongin plates. Coring sparse. Filaments: 1–6 µm in diameter, sometimes granulated, terminal knobs 5–12 µm.

Ecology: This species is common on reefs, but specimens have been dredged from muddy sand bottoms at greater depths.

Distribution: St. Thomas, Curaçao, Puerto Rico, Guyana shelf; Guadeloupe, Tortola, Vieques (DUCH. & MICH., 1864), Cuba (HYATT, 1877), Bermuda (VERRILL, 1907), Florida (STORR, 1964), Jamaica (HECHTEL, 1965), Bahamas (WIEDENMAYER, 1977).

This species seems to be rather well defined, although possibly some ecophenotypes might be distinguished, based on colour and conule shape.

DISCUSSION OF THE GENUS *Ircinia*

Two other well established species, not represented in the ZMA collections, have been reported from the West Indies, viz. *Ircinia ramosa* (Keller, 1879) as redescribed by DE LAUBENFELS, 1950 and HARTMAN, 1955, and *I. variabilis* (Schmidt, 1862) as redescribed by DE LAUBENFELS, 1950. *Ircinia ramosa* has originally been described from the Red Sea; it is apparently wide-spread in Indo-Pacific waters. DE LAUBENFELS (1950) assigned ramose specimens to

I. ramosa, distinguishing these from branching *I. felix* specimens on the basis of colour (absence of dark oscular rims, ochre brown colour in stead of greenish or lavender brown) and shape of the terminal parts of the branches (blunt ending in *I. ramosa*, sharp ending in *I. felix*). HARTMAN, 1955 added to these differences some dermal and choanosomal differences (no reticulation of detritus around inhalant openings in *I. ramosa*, thinner filaments in *I. ramosa*), but these differences are in view of the above presented data on the variability of *I. felix* of doubtful value. All studied species with the exception of *I. hummelincki* n. sp., have basically an identical dermal and internal structure: reticulated dermal detritus, reticulated subdermal filament bundles, widely variable ascending column diameter, extent of coring and connecting fibre diameter; the filaments of all species, the one excepted, have diameters within 1–6 μm, are sometimes granulated but this occurs regardless of the species.

I. variabilis has been reported by DE LAUBENFELS (1950) from Bermuda. It is distinct from the other species by its striking blue or bluish grey colour.

The following *Polytherses* species of DUCHASSAING & MICHELOTTI have been recovered: *P. felix* (specimens in ZMA, Turin and BMNH, = *I. felix*), *P. armata* (specimens in ZMA, = *I. felix*), *P. columnaris* (specimens in Turin & BMNH, = *I. felix*), *P. campana* (specimen in ZMA, = *I. campana*), *P. capitata* (specimens in ZMA, Turin and BMNH, = *I. strobilina*), *P. longispina* (specimen in ZMA, = *I. strobilina*), *P. linguiformis* (specimens in Turin and BMNH, type of the genus *Polytherses* per DE LAUBENFELS, 1948, = *I. strobilina*), *P. cylindrica* (specimens in Turin and BMNH, = *I. strobilina*). Of *P. ignobilis* a type specimen is incorporated in the Museum at Turin (POR. 61), but it is not represented in the BM; its identity is unknown.

The remaining species of DUCH. & MICH. are no longer represented by type specimens. Of these, *Polytherses acuta* has been figured sufficiently well to be quite certain of its identity (*I. strobilina*). The other species must be considered unrecognizable: *P. tintinnabulum*, *P. tristis*, *P. marginalis*.

Hircinia caracasensis Carter, 1882 is not an *Ircinia* (it lacks the characteristic filaments); it is here assigned to *Hyrtios*.

Genus **Fasciospongia** Burton, 1934

Definition: Spongiidae with fascicular primary fibres, with all fibres clearly stratified and little or no coring of foreign material.

Fasciospongia cerebriformis (Duchassaing & Michelotti, 1864)

Spongia cerebriformis DUCHASSAING & MICHELOTTI, 1864: 32, pl. 3 figs. 5–6.
[Non: *Spongia cerebriformis* fo. *insolita* WIEDENMAYER, 1977: 58 = very probably *Hyattella intestinalis*).]
[Nec: *Spongia sterea* DE LAUBENFELS & STORR, 1958 = valid species of *Spongia* (synonymy suggested by WIEDENMAYER, 1977).]

Lectotype (designation herein): Mus. Turin POR. 91, ST. THOMAS. Paralectotypes: Mus. Turin POR. 91, ZMA POR. 2075. Schizo(para)lectotypes: BMNH 28.11.12.58 and 28.11.12.59 (both St. Thomas).

Redescription of the ZMA-paralectotype: (Fig. 14, pl. VIII 3)
A conical sponge, 8 cm high, 7 cm in diameter at the base. It is crowned by a composite, star-shaped vent, 12 mm in diameter. Originally, the specimen possessed a thick organic dermis, the remains of which still stick to parts of it. Where it is lost, the sponge shows sharp, crude conules with deep valleys between them. The specimen is rigid, brittle and incompressible; immersed in water it is toughly spongy and somewhat compressible. The main fibres are fasciculated, especially at the periphery, each individual fibre 140–240 μm in diameter; fascicules lie at distances of 1200–2500 μm. Secondary fibres branch from the primaries at right angles, at times very wide apart, which makes mesh size highly variable: 300–2500 μm. Both types of fibres are uncored, distinctly laminated at their periphery and very straight. Colour of the fibres: yellow-red.

Distribution: St. Thomas.

So far only the DUCH. & MICH. specimens are known of this species. WIEDENMAYER suggested that the ZMA specimen was conspecific with his *Spongia cerebriformis insolita* and specifically different from the BM-fragments. This is not correct: both the ZMA specimen and the BM fragments are undoubtedly identical and not conspecific with his *S. cerebriformis* nor with *Spongia sterea* De Laubenfels & Storr, 1958. The DUCH. & MICH. specimen has been compared with Mediterranean *Fasciospongia cavernosa* (Schmidt, 1862). They are very much alike in the structure of the skeleton, although the DUCH. & MICH. specimen has coarser fibres. *F. caver-*

nosa has no distinct shape, being massive and much more cavernous. Nevertheless, both seem to be closely related.

This is the first West Indian record of the genus *Fasciospongia.*

Genus **Hyrtios** Duchassaing & Michelotti, 1864

Heteronema Keller, 1879
Thorectopsamma Burton, 1934

Definition: Spongiidae with stratified, fascicular primary fibres, and both primary and secondaries charged with foreign material.

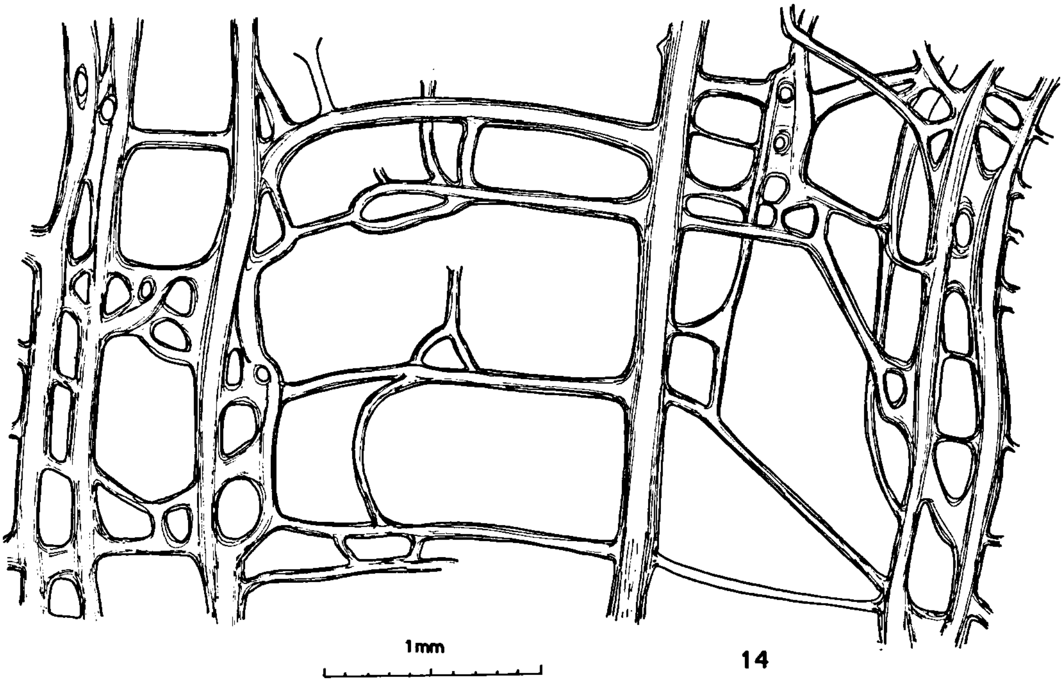


FIGURE 14. Detail of the skeleton of the paralectotype of *Fasciospongia cerebriformis* (Duch. & Mich.). (cf. Pl. VIII 3)

Hyrtios proteus Duchassaing & Michelotti, 1864

Hyrtios proteus DUCHASSAING & MICHELOTTI, 1864: 74, pl. 14 fig. 4.
[Non: *Hyrtios cavernosus* sensu WIEDENMAYER, 1977: 59 = *Hyattella intestinalis*]
Polyfibrospongia echina; DE LAUBENFELS, 1936a: 15.
[Non: *P. echina* DE LAUBENFELS, 1934: 25 = *Smenospongia* cf. *aurea*]

Schizolectotype (per DE LAUBENFELS, 1948): BMNH. 28.11.12.29, ST. THOMAS. Paralectotype: BMNH. 28.11.12.39, St. Thomas. The Turin Museum contains two specimens which have both to be considered paratypes as it is not known from which the BM-fragment was taken (Mus. Turin POR. 46).

CURAÇAO: 3356 (Caracasbaai, V.1920, coll. C. J. van der Horst); 3880 (St. Michielsbaai, XI.1975, coll. students Prof. Stock).

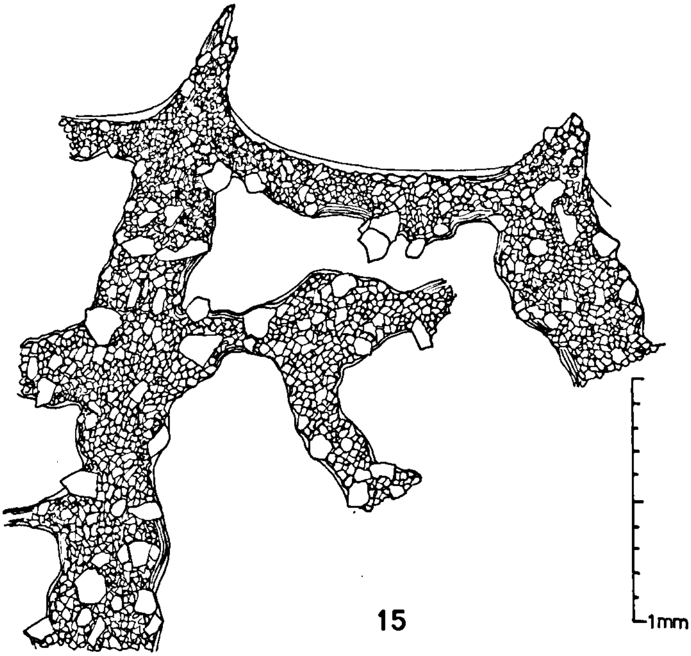


FIGURE 15. Detail of the skeleton of *Hyrtios proteus* Duch. & Mich.

Diagnosis: (Fig. 15, Pl. VIII 4)

Shape, size and consistency: Cake-shaped, up to 10 × 9 × 7 cm, with protruding lobes. Coarsely cavernous. Regularly conulose, conules 1–2 mm high, 3 mm apart. Oscules inconspicuous, singly or in groups on top of the lobes, 2–5 mm in diameter. Consistency: very spongy, not easily torn.

Colour: a very distinctive black, both alive and preserved. Long kept specimens may turn slightly brownish. When the sponge was put into formalin a violet exudate was noticed. The choanosome very strikingly is light brown.

Choanosome: Skeletal fibres are loaded with sand grains, primary fibres are 200–400 μm, secondary fibres 70–150 μm. Rarely, the secondary fibres are free from foreign inclusions for a short stretch. Spongin distinctly laminated. Mesh width 2000 μm, reticulation regular. Choanocyte chambers indistinct (formalin preserved specimens), oval, up to 40 μm.

Ecology: Known only from reef localities.

Distribution: St. Thomas, Curaçao.

The present two specimens have been assigned to *Hyrtios proteus* Duch. & Mich., 1864 on the basis of similarity of colour, habit and skeleton. The two fragments of the type specimens in the British Museum are quite black and contain thick (180 μm) sand-filled primaries and variously cored or uncored secondaries (60 μm).

At first, the view was taken (in accordance with DE LAUBENFELS' ideas), that *Hyrtios proteus* was a Dysideid. The state of preservation of the Curaçao-material was not good enough to allow a study of the flagellate chambers. When it was discovered, that *Polyfibrospongia echina* from Florida, as described by DE LAUBENFELS (1936a), was conspecific (the specimen was kindly sent on loan by Dr RUETZLER), the size of the flagellate chambers (25–40 μm) excluded the possibility of this species being a Dysideid.

Hyrtios caracasensis (Carter, 1882)

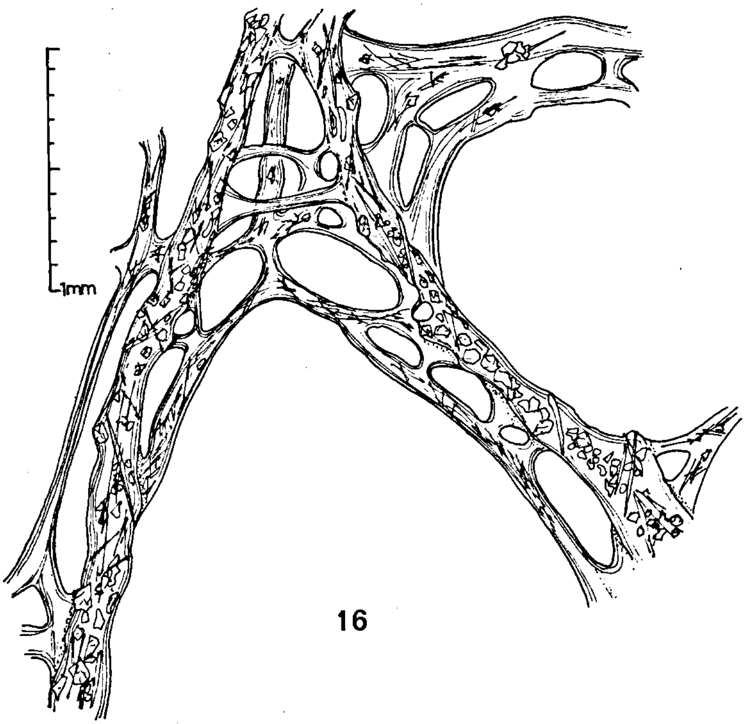
Hircinia caracasensis CARTER, 1882: 273.
[Non: *Hyrtios cavernosus*; WIEDENMAYER, 1977: 59]

Lectotype and paralectotype (per WIEDENMAYER, 1977): BMNH. 39.3.24.17 and 39.3.24.18.

CURAÇAO: ZMA POR. 4228 (Caracasbaai, 5.V.1920, coll. C. J. van der Horst). MARGARITA: ZMA POR. 3978 (Punta Mosquito, S of Porlamar, tidal zone, rocks, rocky, 4.VI.1936, coll. P. Wagenaar Hummelinck, *1216*).

General diagnosis: (Fig. 16, Pl. IX 1)

Lobate, irregularly massive, size up to 4 cm high, 5 cm wide. Lobes 1.5 cm in diameter. Oscules not apparent. Surface conulose, conules 1 mm high, 2 mm apart, stiff (specimens rough to touch).



16

FIGURE 16. Detail of the skeleton of the lectotype of *Hircinia* (= *Hyrtios*) *caracasensis* Carter.

Consistency hard, barely compressible.
Colour: dark purple in spirit.
Dermis: organic, lightly charged with broken spicules, but no distinct dermal layer.
Choanosome: Skeleton irregular, coarse. Primary fibres irregularly fasciculated, 250–450 μm in diameter, lying at distances of up to 2000 μm apart. Secondary fibres likewise irregular, 40–150 μm in diameter, forming meshes of 180–2000 μm. Meshes mostly rounded. Both the primary and secondary fibres are charged with a fair amount of foreign material, chiefly broken spicules, but also sand grains. Periphery of all fibres distinctly stratified. Fibre colour: orange brown. Choanosome outside fibres also charged with many bits of foreign material and traversed by worm tubes. Choanocyte chambers: 28–37 μm.

Ecology: Both specimens originated from rocky substrates in bays.

Distribution: Curaçao, Margarita; Bahamas (CARTER, 1882).

The present material has been assigned to CARTER's *Hircinia caracasensis* mainly on the basis of skeleton characteristics. A slide from the lectotype (BMNH.39.3.24.17) has been examined (cf. Fig. 16) and the skeleton was found to be very much like the present material. WIEDENMAYER (1977) synonymized *Hircinia caracasensis* with *Hyrtios proteus* Duch. & Mich. I do not agree: the skeleton fibres of *Hyrtios proteus* are very much more filled with sand grains than those of *H. caracasensis*, and *H. proteus* is described and figured by DUCHASSAING & MICHELOTTI as being black, while *H. caracasensis* is described as dark purple. Both taxa are here treated as distinct though congeneric.

DISCUSSION OF THE GENUS *Hyrtios*

Hyrtios is considered here to be a senior synonym of the genera *Heteronema* Keller, 1879 (type and only species *H. erecta* Keller, 1879), known only from the Indo-Pacific, and *Thorectopsamma* Burton, 1934 (type species *T. irregularis* Burton, 1934) known from

North Australia and Bermuda. Both genera are defined very similarly: both have a tough organic dermis, both primary and secondary fibres are charged with sand grains and the choanocyte chambers are small and rounded. The only point of difference seemed to be the stratification of the fibres in *Thorectopsamma*, whereas this was stated to be absent in *Heteronema*. DE LAUBENFELS (1948) put them into separate subfamilies on this character. BERGQUIST (1965), having examined the type specimen of *Thorectopsamma irregularis*, already expressed doubts about the generic distinctness of *Heteronema* and *Thorectopsamma*. Examination of the fibres of several Red Sea specimens of *Heteronema erecta* (ZMA POR. 187, det. C. LÉVI) during the present study, revealed the occurrence of stratification in quite a few places in this species. There is no need to uphold both genera as distinct from each other. Moreover, *Hyrtios proteus* cannot be generically distinguished from *Heteronema* and *Thorectopsamma*, as is apparent from the above given descriptions.

There is one West Indian record of the genus *Thorectopsamma*, viz. *T. chromogenia* De Laubenfels, 1950 from Bermuda. This species is probably quite closely related, maybe even conspecific, with *Hyrtios caracasensis*. It has been described as a dark red, rather soft sponge, strongly conulose. The British Museum collection contains a fragment of the type specimen of *T. chromogenia* (BMNH.1948.8.6.3). A slide from this specimen, kindly prepared by Miss S. M. STONE, revealed that the skeleton differs only in one point from those of the ZMA-specimens: the fibres are only half as wide as those of the ZMA-specimens (and of CARTER's specimen). Other details, such as extent of coring, stratification, fasciculation of the primary fibres were alike. The differences (colour, consistency and fibre diameter), must be for the time being considered of enough weight to retain both species as distinct.

Hyrtios vilis Duch. & Mich., 1864 is not represented by type specimens (neither the Turin Museum, nor the BM, nor ZMA contain any specimens) and must be pronounced unrecognizable. *Hyrtios musciformis* Duch. & Mich., 1864 is represented by a type specimen in ZMA. It is referred to the genus *Iotrochota* of the order Poecilosclerida.

DISCUSSION OF THE SPONGIIDAE

The only genera known from the West Indies belonging to the Spongiidae in the sense here used (sensu LÉVI, 1973; BERGQUIST & HARTMAN, 1969), not represented in the present collection are *Polyfibrospongia* Bowerbank, 1877 and *Thorecta* Lendenfeld, 1888, both known from the West Indies by only one species. *Polyfibrospongia echina* De Laubenfels, 1934, however, is not a *Polyfibrospongia* as the type specimen contains pithed fibres. It is referred to the genus *Smenospongia* Wiedenmayer, 1977. The second record of *P. echina* (DE LAUBENFELS, 1936a) appeared to be *Hyrtios proteus* Duch. & Mich., so the genus *Polyfibrospongia* is not represented in the West Indies, so far.

Thorecta horridus (Hyatt, 1877) as extensively redescribed by WIEDENMAYER (1977: 70) may or may not belong in the Keratosa. Dr. RUETZLER (*in litt.*), having examined WIEDENMAYER's material, has some doubts because the skeletal fibres contain only one type of (unbroken) tylostyles. Further information is needed here.

DE LAUBENFELS (1948) used the striation of the fibres as a character for subdividing his family Spongiidae (in which he included the Aplysinids). This seems to be a doubtful character for recognizing higher taxa. For instance: *Heteronema* was distinguished from *Thorectopsamma* on the basis of the absence of striation in the former. However, specimens of *Heteronema erecta* Keller, 1879 from the Red Sea (ZMA POR. 187, det. C. LÉVI) were found to contain striated fibres. In several *Spongia*-species and in *Hyattella intestinalis* faint striation of the fibres can be found. Almost all *Ircinia*-species (classed by DE LAUBENFELS in his Spongiinae) contain striated fibres. It seems clear, that this character is not worth all the emphasis given by DE LAUBENFELS to it. On the other hand it seems now more clear, that the possession of a special fibre pith as found in the Aplysinids is of great importance. Genera like *Fasciospongia* and *Thorecta* should not be classed together with the Aplysinids, but with the remaining Spongiids.

Family **DYSIDEIDAE** Gray, 1867

Definition: Dictyoceratida with large oval or sack-shaped choanocyte chambers.

Genus **Dysidea** Johnston, 1842

Definition: Dysideidae with both the primary and the secondary fibres filled with sand grains and other foreign material.

Dysidea janiae (Duchassaing & Michelotti, 1864)

Terpios janiae DUCHASSAING & MICHELOTTI, 1864: 101, pl. 22 figs. 8–9.
For further synonymy cf. WIEDENMAYER, 1977: 73.

Lectotype (per WIEDENMAYER, 1977): ZMA POR. 2292, ST. THOMAS (only extant type specimen).

Redescription of lectotype: (Fig. 17, pl. IX 2)

An aggregate of 5 tube-like lobes with an apical depression, which looks like, but probably is not, an oscule. Each tube is about 15 mm high, 10 mm in diameter, the "oscule" about 6 mm in diameter. The skeleton is a reticulation of algal filaments, 60–70 μm in diameter, surrounded by a thin layer of spongin. The filaments are encrusted by foreign material. Next to algal filaments also worm tubes support the skeleton.

CURAÇAO: ZMA POR. 3495 (Fuik Baai, 3 m, sandy, 3.XII.1958, coll. J. H. Stock, 109); 3954 (Piscadera Baai, encrusting on poles of Hilton Hotel pier, 1976, coll. H. Rink); 4055 (Spaanse Water, V.1920, coll. C. J. van der Horst).
MARTINIQUE: ZMA POR. 3965 (Anse de l'Âne, Trois Islets, rocks, 10.II.1964, coll. P. Wagenaar Hummelinck, *1439*).

General diagnosis: (Pl. IX 3)

Shape, size and consistency: Aggregates of tubes, encrusting on mollusk shells, rocks, etc. Individual tubes up to 60 mm high, 15 mm across, with an apical depression of up to 10 mm in diameter. No conules. No apparent oscules. Consistency soft, fragile.
Colour: pinkish-white, both alive and in spirit.
Dermis: thin, organic, very fragile.
Choanosome: Typically, a reticulation of algal filaments, 60–80 μm in diameter, surrounded by spongin makes up the skeleton. In places this may be replaced by genuine debris-filled spongin fibres

or by worm tubes. The choanosome is heavily filled with broken spicules of all sorts, sand grains, foraminiferan shells, etc. The scarce flesh contains choanocyte chambers of 42–65 μm in length.

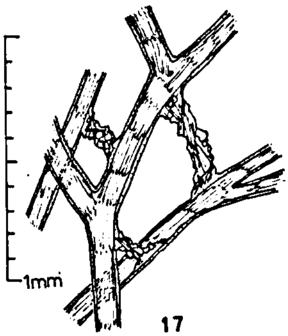
Ecology: Encrusting on hard substrates in lagoons.

Distribution: St. Thomas, Curaçao, Martinique; Bahamas (CARTER, 1882, as *Dysidea tubulosa*; WIEDENMAYER, 1977), Bermuda (DE LAUBENFELS, 1950).

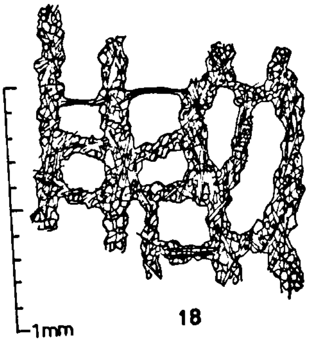
DE LAUBENFELS (1950a) considered this species to be a *Dysidea fragilis* (Montagu, 1818), which had taken algal filaments in stead of sand grains to support its skeleton. However, the life colour, the absence of conules and the apparently consistent shape and texture render this synonymy quite unlikely. It seems to be a well defined species with an interesting obligatory relation to algae of the genus *Jania*.

Dysidea variabilis (Duchassaing & Michelotti, 1864)

Amphimedon variabilis DUCHASSAING & MICHELOTTI, 1864: 80, pl. 21 fig. 4, pl. 22 fig. 2.
Dysidea crawshayi DE LAUBENFELS, 1936a: 28.
[Non: *D. crawshayi*; DE LAUBENFELS, 1948, 1950, 1953; LITTLE, 1963; BERGQUIST & HARTMAN, 1969 = *Ulosa ruetzleri* Wiedenmayer, 1977]
Dysidea variabilis; WIEDENMAYER, 1977: 146.



17



18

FIGURE 17. Detail of the skeleton of the lectotype of *Dysidea janiae* (Duch. & Mich.). (cf. Pl. IX 2)
FIGURE 18. Detail of the skeleton of a paralectotype of *Dysidea variabilis* (Duch. & Mich.). (cf. Pl. IX 4)

Lectotype (designation herein): Mus. Turin, POR. 37, ST. THOMAS. Paralectotypes (designation herein): ZMA POR. 614 & 616, St. Thomas.

Redescription of the paralectotypes: (Fig. 18, Pl. IX 4)
Both lots are now fragmented. Originally they were laterally flattened masses with a row of small oscules on the upper rim. Diameter of the oscules: 3 mm. No conules are apparent. The consistency is extremely crumbly. The skeleton consists of relatively thin fibres (40–80 μm), forming narrow rectangular meshes 150–200 μm wide. The fibres are completely filled with sand grains and broken spicules. Originally described as being orange in colour.

Ecology: Probably from reef localities, as ZMA POR. 616 encrusts a gorgonian stem.

Distribution: St. Thomas; Dry Tortugas (DE LAUBENFELS, 1936a).

WIEDENMAYER's suggestion that DE LAUBENFELS' original material of *Dysidea crawshayi* from the Dry Tortugas is conspecific with *Amphimedon variabilis* of Duch. & Mich. is here taken over, mainly on the basis of the colour (orange). All later records of *D. crawshayi* are to be referred to *Ulosa* (*U. ruetzleri* Wiedenmayer, 1977) according to BERGQUIST & HARTMAN, 1969 and WIEDENMAYER (loc. cit.). A specimen from the Gulf of Mexico identified as *D. crawshayi* by DE LAUBENFELS (1953) was kindly sent on loan by Dr. RUETZLER; it was indeed found to be conspecific with *Ulosa ruetzleri*.

Dysidea etheria De Laubenfels, 1936

Synonymy: cf. WIEDENMAYER, 1977: 73.
CURAÇAO: ZMA POR. 3354 (Caracasbaai, V.1920, coll. C. J. van der Horst); 3531 (Schottegat, coll. J. Boeke); 3951 (Piscadera Baai, encrusting on poles of Hilton Hotel pier, 1976, coll. H. Rink); 3961 (Piscadera Baai, inner bay, 3 m, 17.XII.1958, coll. J. H. Stock, 137).
MARGARITA: ZMA POR. 3695 (Puenta de la Restinga, on rocks near Rhizophora, P. Wagenaar Hummelinck, *1449*).

General diagnosis: (Pl. X 1)
Shape, size and consistency: Amorphous, massively encrusting,

up to 8 × 5 × 2 cm, conulose. Conules 1 mm high, 2–3 mm apart. Oscules flush with the surface, scattered, few in number. Consistency weak, easily torn.
Colour: brilliant to greyish blue alive, light brown to drab in spirit.
Dermis: thin, organic, well developed but easily torn; in places it is carried by tangential skeleton fibres.
Choanosome: A reticulation of skeletal fibres profusely filled with foreign material (sand grains and spicule fragments). Primary fibres always loaded, 140–370 µm in diameter, secondaries sometimes less extensively cored, 30–200 µm in diameter. Free spongin (mostly present at the junction of fibres) clearly stratified. Distance of the primary fibres 1500 µm, meshes rectangular to rounded. Choanocyte chambers 60–100 µm long, 35–60 µm wide. Choanosome charged with foreign material.

Ecology: in bays and lagoons on hard substrates.

Distribution: Curaçao, Margarita; Dry Tortugas (DE LAUBENFELS, 1936a), Bahamas (DE LAUBENFELS, 1949; WIEDENMAYER, 1977), Bermuda (DE LAUBENFELS, 1950), Florida (LITTLE, 1963; STORR, 1964).

This species is clearly defined by its blue colour.

DISCUSSION OF THE DYSIDEIDAE

Of the known West Indian species of the Genus *Dysidea* only *D. fragilis* (Montagu, 1818) was not represented in the present material. It is lavender coloured and typically consists of rounded lobes with an apical, large oscule, which can be closed with iris-type membrane. The species is reported as cosmopolitan in distribution.

The only reliable field character to distinguish *Dysidea*-species in the West Indies appears to be life colour: *Dysidea fragilis* is (greyish) lavender, *D. etheria* is (greyish) blue, *D. variabilis* is orange, and *D. janiae* is pinkish white.

There is one other genus of this family in the West Indies, viz. *Euryspongia*, with one West Indian species *E. rosea* De Laubenfels, 1936. The genus is distinguished by uncored secondary fibres. The species *rosea* is lobate to ramose, and beautifully rose in colour.

Family **APLYSINIDAE** Hyatt, 1877

Definition: Dictyoceratida(?) of which the laminated fibres contain a granular pith; choanocyte chambers are small and rounded; most species show aerophobic properties.

Genus **Aplysina** Nardo, 1833 (= *Verongia* Bowerbank, 1845)

Definition: Aplysinidae with a regular hexagonal reticulum of smooth, moderately thin, moderately pithed fibres.

WIEDENMAYER (1977: 54) convincingly argued that *Verongia* Bowerbank, 1845 is to be regarded as a junior synonym of *Aplysina* Nardo, 1833 as redefined by SCHMIDT, 1862.

Aplysina fistularis (Pallas, 1766)

Spongia fistularis Pallas, 1766 is originally described as a large (up to 4–5 feet) tube of brownish colour in dry condition. It is hinted that it had a yellow life colour, but there remains uncertainty about this vital point. Since *Aplysina archeri* (Higgin, 1875) (to be described below) also forms comparable large tubes life colour is of crucial nomenclatorial importance. Dr. KLAUS RUETZLER (*in litt.*) is convinced that PALLAS' description was intended for the large yellow tubes, of soft consistency, turning black after exposure to air. This view is adopted here. I have examined a photographic slide made by Mr. E. WESTINGA of a group of yellow-brown tubes, estimated to be 40–80 cm in height, found growing on the reefs outside Piscadera Bay, Curaçao, at a depth of 15–20 m. In all probability these are typical *Aplysina fistularis fistularis*-specimens. A black & white print of Mr. WESTINGA's slide is given in Pl. X 2. No typical specimens are available in the present collection, but presumed growth forms will be described below.

Aplysina fistularis insularis Duchassaing & Michelotti, 1864

Luffaria insularis DUCHASSAING & MICHELOTTI, 1864: 61.
Verongia fistularis sensu DE LAUBENFELS, 1948: 82 (in part); STORR, 1964: 41; HECHTEL, 1965: 12, pl. 1 fig. 1.
Aplysina fistularis fistularis; WIEDENMAYER, 1977: 64.
[Non: *Spongia fistularis* PALLAS (SEBA, pl. 95 fig. 1): 385; LINNAEUS, 1767: 1297; ESPER, 1794: pl. 20; EHLERS, 1870: 13; LAMARCK, 1814: 435 = *A. fistularis fistularis*.]
[? Nec: *Spongia tubaeformis* LAMARCK, 1814: 435 = *A. archeri*.]
[? Nec: *Aplysina fistularis aggregata* TOPSENT, 1932: 72 = *A. archeri*.]

Lectotype (per WIEDENMAYER, 1977): ZMA POR. 1475, ST. THOMAS (only extant type specimen).

Redescription of the lectotype: (Fig. 19, pl. X 3)

The specimen is a cluster of irregular lobes with the oscules situated mostly at the sides, not apically. The basis of the specimen rests on an *Ircinia felix*-specimen. The flattened lobes measure 7 cm in height, 1.5 cm in diameter. They are finely conulose with a blackish skin partly abraded to show a yellow fibre reticulation. Oscules 5–7 mm in diameter. The skeleton is a regular reticulation of pithed spongin fibres forming polygonal meshes. Fibre diameter: 70–90 µm, of which the pith occupies 40–60%. Fibres distinctly laminated. Mesh width: 200–800 µm.

ST. THOMAS: ZMA POR. 2374 (Duch. & Mich.-specimen labeled wrongly "*Thalysias rugosa*").
PUERTO RICO: ZMA POR. 3325 (Punta Cadena, NW of Mayagüez, 3 m, 27.I.1963, coll. J. H. Stock, PR. 2); 3326 (Cabo Rojo, Punta Guaniquilla, 6 m, 16.II.1963, coll. Stock, PR. 79)

General diagnosis: (Pl. X 4)

Shape, size and consistency: Characteristic specimens are clusters of low tubes, up to 8 cm in height, and up to 3 cm in diameter, crowned with a thick walled osculum of 4–13 mm in diameter lying in an apical depression and provided with an iris-type diaphragm. Oscules of the same type occasionally also found on the walls of solid lobes. Often irregular fistules which may be subdivided into two or three smaller ones are found. Surface finely conulose. No deep folds or elevations are found, although minor irregularities may occur. Consistency: toughly compressible.

Colour: yellow to yellow-green alive, blackish brown to black when killed and freshly preserved. Long kept spirit specimens may turn somewhat lighter.

Dermis: strongly pigmented, tough, organic.

Skeleton: Regular fibro-reticulation forming hexagonal to rounded meshes of rather small dimensions. Fibres 30–125 μm, pith occupying 15–60% (on the average 35–40%). Fibres laminated. Meshes 200–1500 μm.

Ecology: reef localities.

Distribution: St. Thomas, Puerto Rico; Florida (STORR, 1964), Jamaica (HECHTEL, 1965), Bahamas (WIEDENMAYER, 1977). (No specimens known from Curaçao!)

WIEDENMAYER (1977) treated this form as the typical one, based on DE LAUBENFELS (1948) and HECHTEL (1965). In fact, there are no unequivocal descriptions in literature of the typical large tubed form described by PALLAS. We must await Dr. RUETZLER's forthcoming revision of the Aplysinids in order to understand the taxonomy of this species. For the time being it seems wise to treat the present, apparently wide-spread low-tubed form as distinct from the typical form.

Aplysina fistularis fulva Pallas, 1766

Spongia fulva PALLAS, 1766: 383 (SEBA pl. 95 fig. 9, pl. 96 fig. 1); LAMOUROUX, 1816: 83; GRANT, 1826: 339; 1827: 135.
Luffaria fulva; DUCHASSAING & MICHELOTTI, 1864: 63 (in part), pl. 10 fig. 6 (not pl. 10 fig. 7).
Verongia fulva; DE LAUBENFELS, 1936a: 22; BOURY-ESNAULT, 1973: 288, pl. 3 fig. 4.
Verongia aurea sensu DE LAUBENFELS, 1948: 84; 1953: 515. (Non: *Aplysina aurea* Hyatt, 1875)).
Verongia fistularis sensu DE LAUBENFELS, 1949: 6.
Luffaria cauliformis CARTER, 1882a: 268 (in part)
Aplysina fragilis WILSON, 1902: 408.
Aplysina fistularis fulva; WIEDENMAYER, 1977: 66.

One DUCH. & MICH.-specimen in the ZMA-collection (pl. XI 1) labeled "*Spongia fulva*" has been assigned to *Aplysina cauliformis* (CARTER, 1822) by WIEDENMAYER (1977: table 49), and quite correctly, too, on account of its brownish colour and fine-grained surface. The specimen is a large group of partly anastomosing and dividing branches (33 cm high, diameter of the branches 7–16 mm, oscules 3–4 mm in rows on the branches).

BONAIRE: ZMA POR. 3704 (Lac, W, 300 m E of Palu Calbas, sandy bottom, 11.VIII.1967, coll. P. Wagenaar Hummelinck, *1569*).
TORTUGA: ZMA POR. 4238 (SW coast, sandy reef, between *Acropora*, 4 m, 1.VIII.1936, coll. Hummelinck, *1211A*).
BARBADOS: ZMA POR. 3816 (0.5 mile off Holetown, 100 m, muddy sand, 19.II.1964, coll. Hummelinck, *1442*).

ST. MARTIN: ZMA POR. 4081 (Little Bay, 2–3 m, 7.II.1959, coll. J. H. Stock, 195).
"Antilles": ZMA POR. 2679 (no data).
"Amerika": ZMA POR. 2626, 2630 (no data).

General diagnosis: (Pl. XI 2)

Shape, size and consistency: This form is characterized by erect, solid branches, single or in groups, showing a tendency to subdivide dichotomously; sometimes neighbouring branches anastomose. The branches are up to 40 cm long, 5–16 mm in diameter. Oscules are irregularly scattered over the branches, 2–4 mm in diameter. The branches rise from a solid, massively encrusting base, which may have a few large oscules with iris-type diaphragm. Surface finely conulose, similar to the form to be described below; conules less than 0.5 mm high, about 1 mm apart. No marked grooves, folds or depressions. Consistency: toughly compressible.

Colour: yellow in life, black in spirit. The Barbados-specimen (a single branch from deeper water) is light greyish brown in spirit.

Dermis: tough, difficult to pry loose, organic.

Skeleton: A regular fibro-reticulation making polygonal to rounded meshes.

Fibres: 55–140 μm, pith occupying 15–70% (averaging 35%). Meshes 300–1000 μm.

Ecology: on the bottoms of sandy lagoons, and apparently also in deeper water.

Distribution: St. Thomas, Bonaire, Tortuga, Barbados, St. Martin; Nassau (CARTER, 1882), Puerto Rico (WILSON, 1902), Dry Tortugas (DE LAUBENFELS, 1936a), Bimini (DE LAUBENFELS, 1949; WIEDENMAYER, 1977), Gulf of Mexico (DE LAUBENFELS, 1953).

This form resembles *Aplysina cauliformis* (Carter, 1882). Points of distinction are the more isolated, undivided habit, the pinkish and greenish tinges in life specimens and the pink colour of preserved specimens of the latter species.

Aplysina archeri (Higgin, 1875)

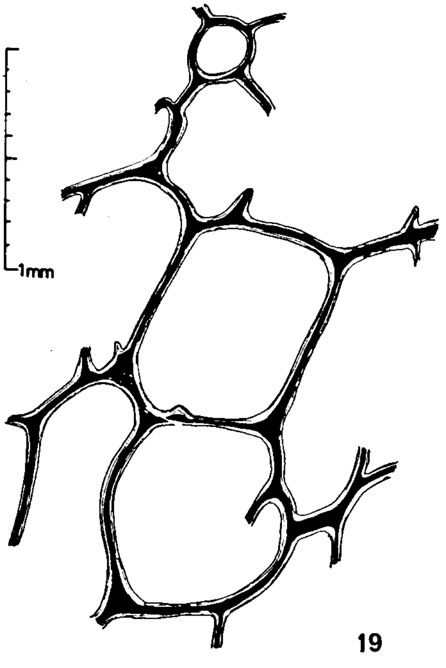
? *Spongia fistularis*; LAMARCK, 1814: 435. [Non *S. fistularis* Pallas, 1766]
? *Spongia tubaeformis* LAMARCK, 1814: 435.
Luffaria archeri HIGGIN, 1875: 223, pl. 6.

Verongia fistularis; Hyatt, 1875: 402 (in part, pinkish specimens).
? *Aplysina fistularis aggregata* Topsent, 1932: 72, pl. 3 fig. 7.
Verongia archeri; Cecil et al., 1976: fig. 6.

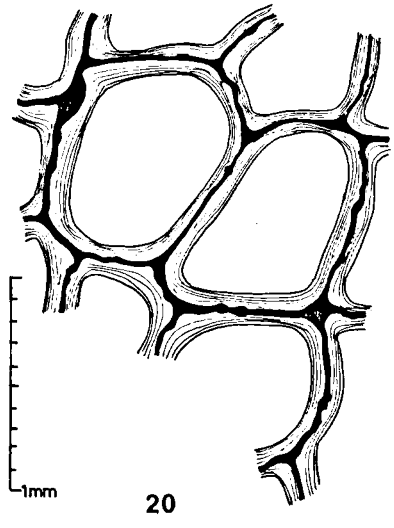
Curaçao: ZMA POR. 2675 (don. Jarman); 3351 (Caracasbaai, 27.IV.1920, coll. C. J. van der Horst; 3353 (Caracasbaai, 19.V.1920, coll. van der Horst); 3413 (don. Jarman); 3507 (500 m W of Piscadera, 40 m, 29.III.1974, coll. J. H. Stock, 74–166); 3579 (Piscadera Baai, near Carmabi, 15–30 m, 10.XII.1975, coll. E. Westinga & P. Hoetjes); 3649 (Blaauwbaai, 15–20 m, XI.1975, coll. S. Weinberg & E. Westinga); 3658 (Caracasbaai, V.1920, coll. van der Horst); 3872 (Playa Forti, Westpunt, 3 m, XI.1975, coll. students Prof. Stock); 3876 (500 m W of Piscadera, 35 m, 13.XI.1975, coll. students Prof. Stock); 3881 (St. Michielsbaai, 2–4 m, 10.XI.1975, coll. students Prof. Stock.
"Antilles": ZMA POR. 2674 (don. van Heukelom).
"America": ZMA POR. 2629 (don. van Heukelom); 2684 (coll. van Lith de Jeude).

General diagnosis: (Pl. XI 3–4)

Shape, size and consistency: Invariably this species forms large



19



20

Figure 19. Detail of the skeleton of the lectotype of *Aplysina fistularis insularis* (Duch. & Mich.). (cf. Pl. X 3)

Figure 20. Detail of the skeleton of a paralectotype of *Luffaria sebae* Duch & Mich. (= *Aplysina lacunosa* (Pallas)). (cf. Pl. XII 2)

tapering tubes, sometimes singly, but more often growing in large groups of up to 22 tubes, which normally are in contact with each other only at their base (in one remarkable specimen three side-tubes growing at right angles with the main tube have developed). The surface, though not presenting the deep meandering grooves and pits of *A. lacunosa*, shows much relief; in most specimens a sometimes obscured pattern of rounded disc-shaped elevations, 3–9 mm in diameter, prevails. The shallow depressions between the elevations contain rows of pores. Surface generally finely conulose. Fistular outcrops on all parts of the tubes occur quite frequently. The larger specimens sometimes present annules as in HIGGIN's pl. 6. Length of the tubes up to 150 cm, diameter near the apex up to 10 cm. Terminal vent thick-walled, up to 8 cm in diameter. Much smaller specimens with smaller vents are most numerous in ZMA-collection.
Consistency: hard, incompressible (there may exist a soft form of this species, cf. CECIL et al., 1976).
Colour: conspicuously pink or purplish gray alive, yellow-brown to dark brown in spirit, dark brown in dry condition.
Dermis: tough, organic.
Skeleton: On the average slightly coarser than that of the preceding species: thicker fibres, larger, more elongate meshes. Fibre diameter: 70–170 µm, pith 15–65%, meshes 350–2000 µm.

Ecology: growing in reef localities, 2–40 m in depth.

Distribution: Curaçao; Yucatán (HIGGIN, 1875), Florida (HYATT, 1875), Jamaica or Virgin Islands (CECIL et al., 1976).

If LAMARCK's material of *Spongia tubaeformis* will be proven to be conspecific with the present large pinkish tubiform species, then the name of LAMARCK has priority. *Aplysina archeri* was considered synonymous with *A. lacunosa* by WIEDENMAYER (1977: 67). This synonymy designation is of course erroneous, as *A. lacunosa* is well characterized by its deep surface pits and grooves.

Although this species is easily the most common *Aplysina* species on the Curaçao reefs, it must be concluded that in most investigated Caribbean areas it is rare. DE LAUBENFELS apparently did not know the species, nor did HECHTEL and WIEDENMAYER.

Aplysina lacunosa (Pallas, 1766)

Luffaria nuciformis Duchassaing & Michelotti, 1864: 60, pl. 11 fig. 2.
Luffaria sebae Duchassaing & Michelotti, 1864: 59.
For further synonymy cf. Wiedenmayer, 1977: 67, with the exception of *Luffaria archeri* Higgin, 1875 = *A. archeri*.

Lectotype of *Luffaria nuciformis* (designation herein): ZMA POR. 1476, St. Thomas (only extant specimen).
Redescription: (Pl. XII 1)
Two closely adhering tubes of 7 cm high and 3.5–4 cm in diameter. Each bears a thick walled apical vent, 10 mm in diameter. The walls of the tube are indented by a few pits only. The macerated specimen is fairly soft and brittle. It is now red brown in colour. The skeleton contains an irregular reticulation of pithed spongin fibres, 70–150 μm in diameter, pith 10–40%, meshes elongated 350–1100 μm.

Lectotype of *Luffaria sebae* (designation herein): Mus. Turin POR. 41, St. Thomas; paralectotypes: ZMA POR. 1478 & 1479, St. Thomas; schizolectotype: BMNH. 28.11.12.14.
Redescription: (Fig. 20, Pl. XII 2–3)
ZMA POR. 1479 is a single tube, 13 cm long, 5.5 cm in diameter and an apical vent of 20 mm. The tube wall shows deep and wide meandering grooves. The consistency is fairly wooden; parts of a black dermis are still in place. Fibres measure 70–140 μm, pith 10–30%, meshes 400–1400 μm. ZMA POR. 1478 consists of a row of 4 adhering tubes, each 10 cm high, 2.5 cm in diameter, with apical oscules of 6–12 mm. The walls of the tubes are heavily indented and pitted. The consistency is wooden. Fibres measure 80–140 μm, pith 10–25%, meshes 400–1000 μm. The BM schizolectotype has fibres 70–120 μm in diameter, pith 10–17% and angular meshes of 450–800 μm.

Curaçao: ZMA POR. 3580 (Piscadera Baai, near Carmabi, 15–30 m, XI.1975, coll. E. Westinga & P. Hoetjes); 3617 (Blauwbaai, 15–20 m, XI.1975, coll. S. Weinberg & E. Westinga).
Puerto Rico: ZMA POR. 3323 + 3349 (18°15′ N 67°13.5′ W, 40–50 fthms., muddy sand, dredge, 21.II.1963, coll. J. H. Stock); 3324 (18°15′ N 67°13.5′ W, 10–20 fthms., muddy sand, dredge, 21.II.1963, coll. Stock).
Jamaica: ZMA POR. 3384 (18°20′ N 77°20′ W, 13.IX.1969, coll. L. J. K. Klein, Calamar stat. 475–68–7, depth unknown, dredged).

General diagnosis: (Pl. XII 4, XIII 1)
Shape, size and consistency: Single or clustered, tapering tubes of up to 35 cm high, 10 cm in diameter, with an apical thick-walled vent of up to 3.5 cm in diameter with iris-type diaphragm. Tapering more strongly towards the base than *A. archeri*; often the base is barely 1 cm in diameter. Tube walls deeply indented (up to 10–12 mm deep) by irregular meandering grooves or disc-shaped

depressions, up to 10 mm deep and wide. Surface between grooves and pits finely to roughly conulose (depending on the extent to which the skeleton fibres penetrate the dermis). Consistency: tough, hardly compressible, although according to Dr. RUETZLER (pers. comm.) there seem to be a "hard" form and a "soft" form.
Colour: Life colour described by collectors as "yellow", "blue green" and "pink". In spirit colours are also diverging: there are blackish, dark brown, greyish, slate-grey and chocolate brown specimens.
Dermis: tough, organic; in some specimens the dermis is penetrated to a large extent by dendritic endings of skeleton fibres.
Skeleton: According to WIEDENMAYER (1977) *A. lacunosa* may be distinguished from the other *Aplysina*-species in the West Indies by the relative thinness of the fibre pith. In some specimens the thin somewhat irregular pith is quite striking, in others the pith was as thick as in the other *Aplysina*-species. Fibre diameter 65–180 µm (thus in the same range as *A. archeri*), pith 8–50% (average 25%), mesh diameter 350–1400 µm. The surface conules are supported by conspicuous free-ending ("dendritic") fibre-terminations.

Ecology: This species is known both from reef and lagoon localities and from sandy flats beyond the reefs. The Puerto Rican specimen ZMA POR. 3349 shows distinct "roots", with which it stood attached in the muddy sand bottom.

Distribution: St. Thomas, Curaçao, Puerto Rico, Jamaica; Tortola, Vieques (DUCH. & MICH., 1864), Dry Tortugas (DE LAUBENFELS, 1936, 1953), Bahamas (WIEDENMAYER, 1977).

Dr. K. RUETZLER is of the opinion there are two species with *A. lacunosa* characters. The colour range is certainly striking (yellow-pink-bluegreen); furthermore WIEDENMAYER's thin pith could be found in only part of the material, viz. the yellow Curaçao specimens (not in pink and blue-green specimens from Puerto Rico and Jamaica). Dr. RUETZLER's forthcoming revision must be awaited for final conclusions.

Aplysina cauliformis (Carter, 1882)

Luffaria fulva; DUCHASSAING & MICHELOTTI, 1864: 63 (in part), pl. 10 fig. 7.
For further synonymy cf. WIEDENMAYER, 1977: 68.

A Duch. & Mich.-fragment somewhat like the one pictured in their pl. 10 fig. 7 is present in the ZMA-collection. It might be the pictured specimen. As mentioned before, the Duch. & Mich. specimen labeled "*Spongia fulva*" (ZMA POR. 2085) (Pl. XI 1) is assigned to the present species on account of its brown colour in dry state.

ISLOTE AVES, W of Dominica: ZMA POR. 4067 (N-lagoon, tidal zone, sand and rocks, 12.V.1949, coll. P. Wagenaar Hummelinck, *1114*).

ST. THOMAS: ZMA POR. 2291, 2085 (Duch. & Mich. material).

Diagnosis: (Pl. XI 1, XIII 2)

Shape, size and consistency: As only a few pieces of branches were present in the recent collections, we must rely on WIEDENMAYER's account. According to this the species forms solitary or somewhat ramose branches rising from an encrusting base. They grow up to 60 cm. The present material comprises 5 pieces of branches, with a diameter of 7–10 mm. Oscules lie in a row and are 1–4 mm in diameter. The surface is very finely conulose (more so than *A. fistularis fulva*). The consistency is stiff, hardly compressible.

Colour: the Islote Aves-specimens are rosy brown in spirit.

Dermis: tough, organic.

Skeleton: round-meshed, fibres 70–130 μm, pith 20–70%, meshes 200–900 μm.

Ecology: growing in lagoons and reef localities (WIEDENMAYER, 1977).

Distribution: Islote Aves, St. Thomas; Antigua (CARTER, 1882), Florida (STORR, 1964), Jamaica (HECHTEL, 1965).

The scanty material makes comparison with *A. fistularis fulva* barely possible. The light colour in spirit as compared to the darker colour of *A. fulva fulva* may be a useful species criterion in preserved specimens. Dr. RUETZLER informed me that in his opinion *A. cauliformis* is the ramose form of *A. archeri*.

DISCUSSION OF THE GENUS *Aplysina*

With the exception of the typical form of *A. fistularis* all the well established species of *Aplysina* sensu Wiedenmayer, 1977 known from the West Indies are represented in the present collection. The remaining Aplysinid species have been allocated to different genera by WIEDENMAYER, viz. *Dendrospongia crassa* Hyatt, 1875 to *Aiolochroia* Wiedenmayer, 1977, *Ianthella ianthella* De Laubenfels, 1949 to *Aiolochroia*, *Ianthella ardis* De Laubenfels, 1950 to *Verongula* Verrill, 1907 (incorrectly), *Aplysina gigantea* Hyatt, 1877 also to *Verongula*, *Aplysina aurea* Hyatt, 1875 (*Spongia fenestrata* sensu Duch. & Mich., 1864) to *Smenospongia* Wiedenmayer, 1977.

Of the rediscovered *Luffaria*-species described by DUCHASSAING & MICHELOTTI, which have not been accounted for in the above, *Luffaria rupicola* is hesitatingly assigned to the genus *Spongia*, as the specimen labeled as such in the ZMA-collection seems clearly *S. tubulifera* Lamarck (and not *Haliclona complanata*, as WIEDENMAYER contented (cf. his table 48), but does not seem to fit DUCH. & MICH.'s description of *L. rupicola*; it might be a case of mislaid labels. All remaining *Luffaria*-species (excepting the ones mentioned above: *L. sebae*, *L. insularis*, *L. fulva*, *L. nuciformis*) are not represented by type material and rather than attempting to guess what they really represent they should be pronounced unrecognizable; these are: *Luffaria fistularis*, *L. picea*, *L. applicata*. Only *L. rigida* is recognizably described; it is transferred to *Verongula*.

CARTER's (1882) collection in the British Museum and in the Liverpool Museum has been reexamined by WIEDENMAYER (1977, table 51). Of the *Luffaria*- and *Aplysina*-species described by him, *Luffaria cauliformis* (together with its varieties) is a valid species of *Aplysina* (cf. above), *Aplysina longissima* is referred to the Haplosclerid genus *Spinosella*, *Aplysina aerophoba* to *Verongula*, *Aplysina compressa* to *Verongula*, *Aplysina cauliformis* to the Haplosclerid genus *Spinosella*.

Genus **Aiolochroia** Wiedenmayer, 1977

Definition: Aplysinidae with irregularly branched, chiefly dendritic, knotty fibres of large diameter.

Aiolochroia crassa (Hyatt, 1875)

Synonymy: cf. WIEDENMAYER, 1977: 75; to it should be added: *Ianthella ardis* DE LAUBENFELS, 1950: 31.

CURAÇAO: ZMA POR. 3289 (Piscadera Baai, near Hilton Pier, loose on the sand, 20.II.1974, coll. J. H. Stock, 74-112); 3594 + 3618 (Lagoon Jan Thiel, outer side, 23-32 m, 16.XI.1975, coll. students Prof. Stock); 3608 (Piscadera Baai, near Carmabi, 11-14 m, 16.XI.1975, coll. students Prof. Stock); 3616 (Blauwbaai, 15-20 m, XI.1975, coll. S. Weinberg & E. Westinga); 3653 (Piscadera Baai, near Hilton Pier, 3 m, 20.I.1974, coll. Stock); 3874 (500 m W of Piscadera, 35 m, 13.XI.1975, coll. students Prof. Stock); 4080 (Piscadera Baai, near Carmabi, 18-20 m, 14.XI. 1975, coll. P. Hoetjes).
PUERTO RICO: ZMA POR. 3290 (8.7 km S of Parguera, 20 m, 23.II.1963, coll. Stock, PR. 104).

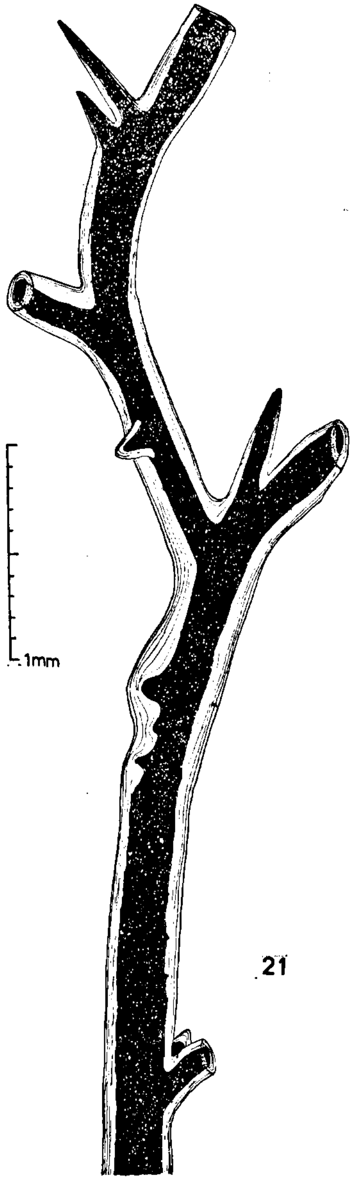
General diagnosis: (Fig. 21, Pl. XIII 3)

Shape, size and consistency: Chiefly massive, frequently lobate to rarely ramose; ramose outcrops up to 15 cm long, lobes up to 6 cm high. Total size up to 17 cm in diameter in massive specimens. Surface irregularly conulose, with large smooth areas showing fields of pores. Interconnecting ridges between conules may enclose polygonal depressions. Conules acute or low and blunt, 2-4 mm high, 2-7 mm apart, but quite irregularly distributed. Oscules inconspicuous 2-4 mm in diameter, on lobal outcrops. Typically, at various places large thick fibres stick out beyond the dermis. Consistency alive: rubbery, cheese-like, somewhat compressible; spirit specimens become hard and incompressible, but are easy to cut. Maceration difficult.

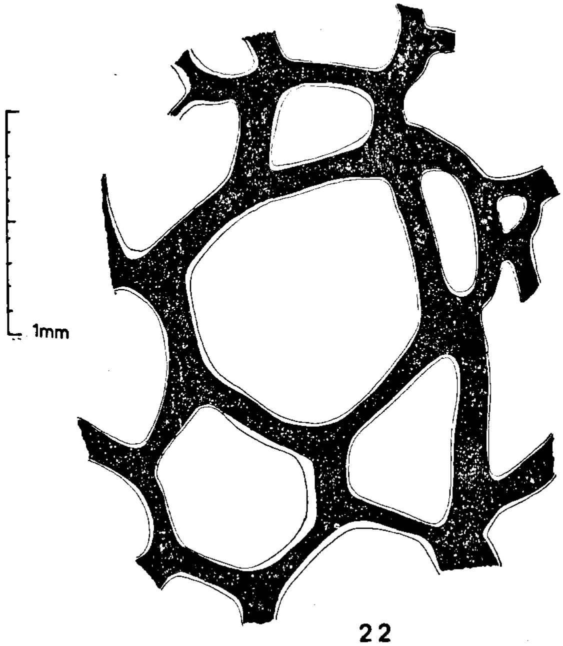
Colour: alive yellow with blue or green spots. After an hour's exposure to air it turns bluish. After some weeks in spirit it changes gradually to greenish brown and eventually to jet black.

Dermis: organic, not clearly separable from the lipostomous choanosomal tissues.

Choanosome: The flesh dominates the skeletal structures. The fibres follow erratic courses, in places forming a round meshed reticulum, elsewhere branching infrequently over large distances, thus resembling to some extent dendritic fibres. Fibre diameter 150-560 µm, pith 40-80%; fibres somewhat irregular in outline.



21



22

FIGURE 21. Detail of a "dendritic" skeletal fibre of *Aiolochroia crassa* (Hyatt)
FIGURE 22. Detail of the skeleton of *Verongula rigida* (Esper).

Ecology: This species is known almost exclusively from reef localities.

Distribution: Curaçao, Puerto Rico; Antigua (Carter, 1882), St. Thomas (WILSON, 1902), Bermuda (VERRILL, 1907; DE LAUBENFELS, 1950 as *Ianthella ardis*), Bahamas (DE LAUBENFELS, 1949; WIEDENMAYER, 1977).

Some small discrepancies between WIEDENMAYER's descriptions and the present material are apparent. WIEDENMAYER mentions the rarity of lobose outcrops in his specimens, while in the present material it is the rule. Clearly marked polygonal depressions surrounded by ridges connecting conules are rare in the present material. WIEDENMAYER apparently misinterpreted *Ianthella ardis* De Laubenfels, 1950. According to Dr. RUETZLER (*in litteris*) it is indistinguishable from the present species.

The genus *Aiolochroia* has been associated with the Dysideidae by WIEDENMAYER (1977), probably following DE LAUBENFELS (1948) (as *Ianthella*). There can be, however, no doubt that this is incorrect. The similarities of *Aiolochroia* and *Aplysina* are so great, that it fits unquestionably in the Aplysinidae. The dendritic nature of the skeleton is very probably of secondary importance and forms part of a general reduction of the skeleton in this genus in favour of a tough fleshy choanosome. The reverse situation is found in *Igernella* Topsent, 1905 (to be discussed below) of the Dendroceratida, where the reticulate skeleton is very probably developed independently by parallel evolution.

Genus **Verongula** Verrill, 1907

Definition: Aplysinidae with peripheral lamellar skeletal structures producing thin surface septa fencing off conspicuous meandering grooves.

Verongula rigida (Esper, 1794)

Verongula ardis; WIEDENMAYER, 1977: 77. (Non: *Ianthella ardis* DE LAUBENFELS, 1950: 31 = *Aiolochroia crassa*)
For further synonymy cf. WIEDENMAYER, 1977: 77.

CURAÇAO: ZMA POR. 3291 (Playa Forti, Westpuntbaai, E-part, 1.5 m, 23.XI.1973, coll. J. H. Stock, 73–19); 3498 (Playa Chikitoe, 4 m, 23.XI.1958, coll. Stock, 91); 3499 (Santa Martha Baai, 5 m, 26.X.1958, coll. Stock, 59).
BONAIRE: ZMA POR. 3537 (Lac, behind reef, sand with debris, 1–2 m, 1.X.1948, coll. P. Wagenaar Hummelinck, *1068a*); 3839 (Lac, Binnenklip, sand and rock, 2.5 m, 10.III.1970, coll. Hummelinck, *1568A*).
ST. THOMAS: ZMA POR. 1474 (Duch. & Mich. specimen labeled incorrectly "*Luffaria fulva*").

Diagnosis: (Fig. 22, Pl. XIII 4)
Shape, size and consistency: Massive lobate. Lobes are perhaps better termed tubes, as each bears a conspicuous apical oscule (in a depression) with perforated diaphragms. Specimens may be up to 20 cm in diameter and 15 cm high; individual tubes are up to 8 cm in height, 4 cm in diameter. Oscules up to 20 mm in diameter. Meandering grooves up to 15 mm in width, up to 20 mm in depth. Lamellar ridges smooth or conulose, mostly under one mm in width, occasionally up to 3 mm. Consistency cheese-like, slightly compressible, easily cut. Maceration of this species follows quickly when compared to *Aiolochroia crassa.*
Colour: yellow, yellow green or green alive, quickly discolouring to brownish green and black when exposed to air.
Dermis: organic, not separable from the choanosome.
Skeleton: A reticulation with elongated-polygonal meshes, in peripheral regions becoming lamellar, thus supporting the meandering ridges. Fibres: 65–180 µm, pith 50–90% (average 70–80%), meshes 300–1700 µm.

Ecology: This species is found in reef localities and lagoons.

Distribution: Curaçao, Bonaire, St. Thomas; Antigua (CARTER, 1882, as *Aplysina aerophoba* in part), Florida (DE LAUBENFELS, 1953; STORR, 1964), Gulf of Mexico (LITTLE, 1963), Jamaica (HECHTEL, 1965), Bahamas (WIEDENMAYER, 1977).

The change of name of this species (*V. ardis* into *V. rigida*) is made on the authority of Dr. RUETZLER, who has examined the type specimen of *Ianthella ardis* and found it to be conspecific with *Aiolochroia crassa* (*in litt.*). The only noteworthy discrepancy with WIEDENMAYER's description is the width of the pith, which appeared to be only 20–30% in Bahama-specimens, compared to 50–90% in the present material. Unlike WIEDENMAYER's suggestion the width of the pith is not of distinctive value to separate *Verongula rigida* from *V. gigantea* (Hyatt, 1875), a species not represented in the ZMA-collection, with a very characteristic cup-shaped habit and large dimensions (synonym according to WIEDENMAYER: *V. praetexta* Hyatt, 1875, but RUETZLER (pers. comm.) thinks this to be a separate species of its own). *Verongula* is thoroughly representative of the family Aplysinidae.

DISCUSSION OF THE FAMILY APLYSINIDAE

There is one other West Indian genus which has been associated with the Aplysinidae, not represented in the present material, viz. *Smenospongia* Wiedenmayer, 1977. Its single species *Smenospongia aurea* (Hyatt, 1875) (= *Spongia fenestrata* sensu DUCH. & MICH., 1864, and CARTER, 1882; not: *S. fenestrata* Lamarck, 1814), has the aerophobic properties of the Aplysinids, but shows a distinct division of its fibres into (fasciculated) primaries and secondaries, both heavily stratified. WIEDENMAYER (1977: 69) denies the occurrence of a pith (although the axial regions of the fibres are described as being quite dark), and indeed an examination of a slide of DUCHAS-

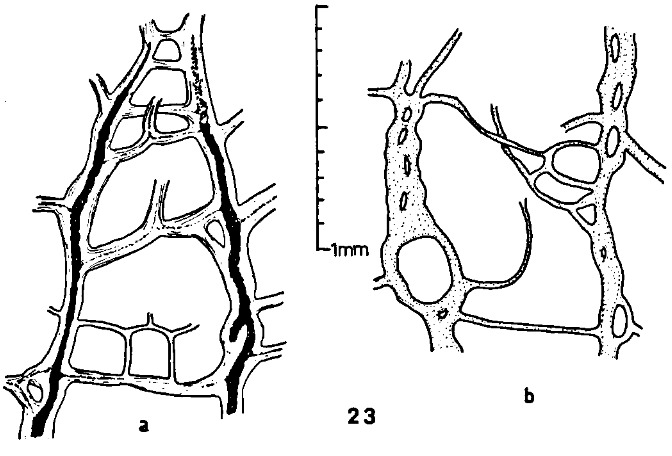


FIGURE 23. Details of the skeleton of the holotype of *Polyfibrospongia echina* De Laubenfels; a. main skeleton with pithed primary fibres b. peripheral skeleton.

SAING & MICHELOTTI's *S. fenestrata* (BMNH 28.11.12.66) also did not reveal pithed fibres. However, the type of *Polyfibrospongia echina* De Laubenfels, 1934 (USNM 22315, sent by RUETZLER), in all its characteristics very similar to WIEDENMAYER's *Smenospongia aurea* and DUCHASSAING & MICHELOTTI's *S. fenestrata*, appeared to contain scattered pithed primary fibres (cf. Fig. 23). Whether or not WIEDENMAYER's and DUCHASSAING & MICHELOTTI's material is conspecific with *Polyfibrospongia echina*, or represent closely related congeneric species is still undecided, although I am inclined to emphasize the similarities and unite them. From these observations it is in any case clear, that *Smenospongia* is a true Aplysinid, with remarkable similarities with some Spongiids (*Polyfibrospongia, Fasciospongia*), thought to be the result of parallel development.

Cacospongia camera De Laubenfels, 1936a, has been associated with the Aplysinids by HECHTEL (1976) as *Psammaplysilla camera*. A fragment of the holotype (USNM 72405) has been kindly sent on loan by Dr. RUETZLER. From this it was learned, that *Cacospongia camera* is a Dendroceratid sponge and definitely not a *Psammaplysilla*. It is not known whether HECHTEL's specimen is conspecific with *Cacospongia camera* or a true *Psammaplysilla*, as it is only mentioned in a species list.

DISCUSSION OF THE SUBORDER DICTYOCERATIDA

If we accept the current subdivision into families of the suborder Dictyoceratida we are forced to redefine the family Spongiidae, because as it now stands it has not a single unique character. Neither the small rounded flagellate chambers (shared with the Aplysinidae), nor the unpithed fibres (shared with the Dysideidae) serve to distinguish it. In fact, the Spongiidae as defined now, comprise all species not referable to both other families. A possible solution of the problem is the reconsideration of the systematic rank of the family Aplysinidae. From BERGQUIST & HARTMAN's (1969) results on the biochemical classification of the Demospongea it can be concluded that the position of the Aplysinidae is probably not properly valued. It seems not incongruous that this group has to be classified as a taxon separate from one uniting the Spongiidae and the Dysideidae, for instance as a separate suborder next to the Dictyoceratida and the Dendroceratida, distinguished from them by the absence of primary and secondary fibres and the possession of a special fibre pith.

Suborder ***DENDROCERATIDA*** Minchin, 1900

Definition: Keratosa with a dendritic skeleton or no skeleton at all.

Family **DARWINELLIDAE** Merejkowski, 1879

Definition: Dendroceratida with a proper skeleton of spongin fibres.

Genus **Chelonaplysilla** De Laubenfels, 1948

Definition: Darwinellidae with the dermis reinforced by a neat reticulation of sand grains.

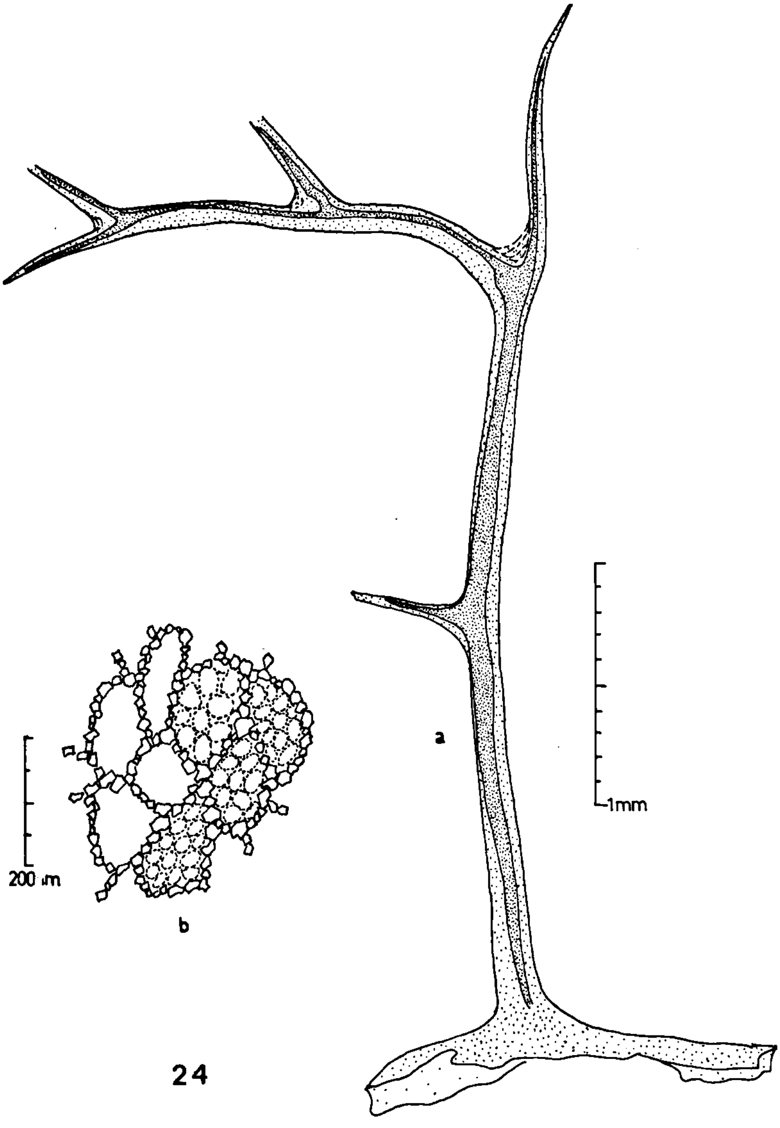
Chelonaplysilla erecta Tsurnamal, 1967

Chelonaplysilla erecta TSURNAMAL, 1967: 96, figs. 1–3.

CURAÇAO: ZMA POR. 4322 (Piscadera Baai, Hilton Hotel pier, shallow water, 1975 coll. H. Rink).
PUERTO RICO: ZMA POR. 4247 (Parguera, Magueyes, NE, on *Rhizophora*, 17.IX.1963, coll. P. Wagenaar Hummelinck, *1417*).

General diagnosis: (Fig. 24, Pl. XIV 1)

Shape, size and consistency: Thinly to thickly encrusting (several millimeters to about one centimeter in thickness); one piece is a definitely ramose elevation of 3.5 cm long and 8 mm in diameter. Strongly conulose, conules acute, 1–3 mm apart, 0.5–1.5 mm high.



24

FIGURE 24. *Chelanoplysilla erecta* Tsurnamal; a. skeletal fibre b. dermal reticulation of sand grains. (cf. Pl. XIV 2)

Oscules few in number, 1–2 mm in diameter, flush with the surface. Consistency soft and fragile.

Colour: described by its collector as bluish-black, in spirit it is blackish purple.

Dermis: Reinforced by a surface reticulation of sand grains, which forms regular rounded meshes of 100–160 µm in diameter. This reticulation is visible to the naked eye and presents a very distinctive identification character. The rounded meshes enclose regular pore fields, each pore being 10–30 µm in diameter.

Choanosome: Of the same colour as the surface. Dendritic fibres rise from a thin spongin base. Colour of the fibres in transmitted light: dark reddish violet. At the base the fibres are about 150 µm in diameter, tapering to a mere 20 µm at the surface. Anastomosing fibres as reported for this species by TSURNAMAL (1967) have not been observed. Individual fibres ramify only rarely in their lower half, but frequently near the surface. Spongin membranes are present at each forking. The fibres are sheathed as typical for the Aplysillids, and show a darker centre part, which is not to be regarded as "pith" as TSURNAMAL did; different sheaths lying over each other have produced this effect. There is no special axial substance as in the Aplysinidae.

Ecology: The species has been found growing on harbour poles and mangrove roots.

Distribution: Curaçao, Puerto Rico. Originally described from the eastern Mediterranean. This is the first record of the genus *Chelonaplysilla* from the West Indies.

The genus *Chelonaplysilla* is at present consisting of three species: *C. noevus* (Carter, 1876) from the eastern Atlantic (CARTER, 1876, TOPSENT, 1905: as *Aplysilla arenosa*), the Mediterranean (TSURNAMAL, 1967), Red Sea (LÉVI, 1958) and Madagascar (VACELET, VASSEUR & LÉVI, 1976); *C. psammophila* (Topsent, 1928) from the North Atlantic; *C. erecta* Tsurnamal, 1967, from the Mediterranean and West Indies. *C. psammophila* differs from both other species by being rosy in colour; all other records are of dark purple or dark violet specimens. TSURNAMAL (1967) has first hand experience with both *C. noevus* and *C. erecta*, and his view that both are specifically

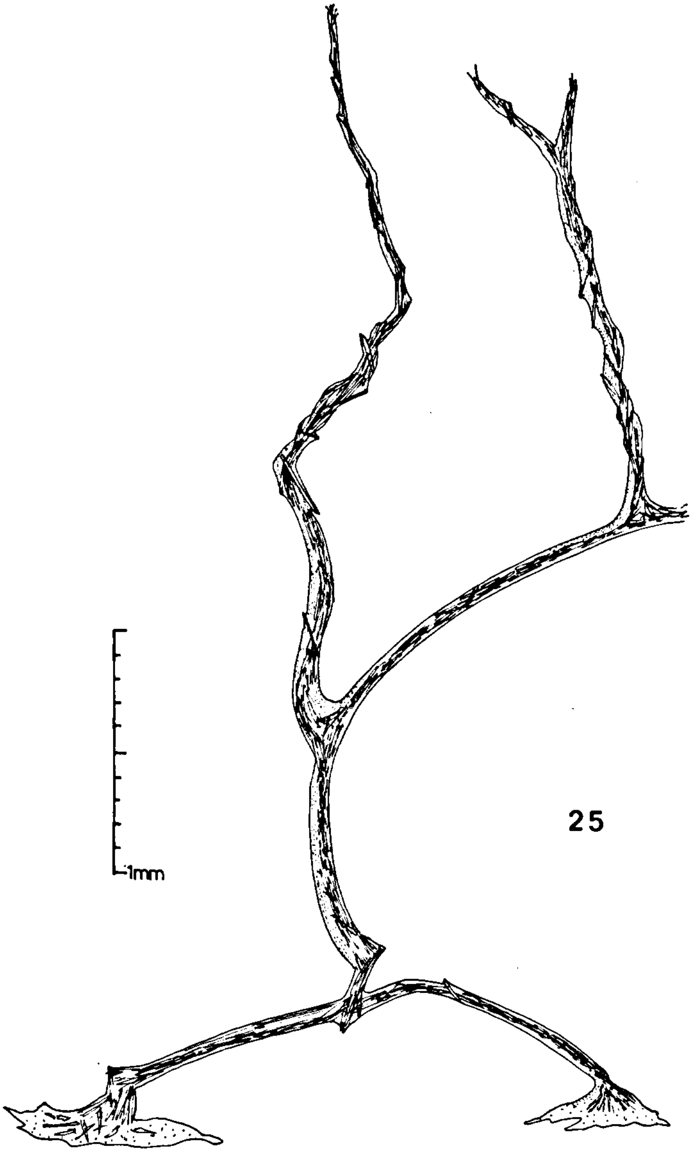


FIGURE 25. Detail of the skeleton of *Pleraplysilla stocki* nov. spec. (cf. Pl. XIV 3–4)

different is here accepted. Differences are the persistent thinly encrusting growth form of *C. noevus* and its more slender skeleton fibres. The West Indian specimens described above are assigned to *C. erecta* rather than to *C. noevus* on the similarity in these characters.

Genus **Pleraplysilla** Topsent, 1905

Definition: Darwinellidae with profusely cored skeleton fibres.

Pleraplysilla stocki n. sp.

Holotype ZMA POR. 3322. Type locality: Isla Magueyes, La Parguera, SW Puerto Rico, on *Rhizophora*, 5.II.1963, coll. J. H. Stock.

Description: (Fig. 25, Pl. XIV 2–3)
Shape, size and consistency: The specimen is a massive encrustation, 10 cm long, 7 cm wide, up to 3 cm thick, on a root of *Rhizophora*. It is strongly and coarsely conulose, with fibres sticking clearly out of the conules, which are up to 3 mm high and 5 mm apart. Scattered oscules, 2–4 mm in diameter, are flush with the surface. The consistency is very soft and fragile.
Colour: alive reddish violet, in spirit somewhat duller, dark purple violet.
Dermis: thin, organic, charged with some broken spicules; heavily pigmented, little or no pores visible.
Choanosome: Heavily pigmented, of the same colour as the exterior. Choanosome moderately filled with broken spicules, riddled with worm tubes and hydroid stalks. Choanocyte chambers large and oval, 50–80/40 µm. Skeleton: erratically dendritic. Dark purple fibres rise from a thin spongin base, branching infrequently, often at right angles. Rarely, anastomosing occurs, producing vague meshes here and there; in some cases two fibres join near the surface to form one conule. The fibres are irregular in outline, laminated and heavily filled with broken spicules and some fine sand grains. Fibre diameter 80–300 µm. Individual fibres have been traced to a length

of 40 mm at the most. The spongin base from which the fibres rise is heavily riddled with calcareous worm tubes. In fact these worm tubes seem to be incorporated in the skeleton to a certain extent, and in all probability the sponge took some extra support from them.

Ecology: growing on mangrove roots.

Distribution: Puerto Rico.

Etymology: Named after its collector, Prof. Dr. J. H. STOCK.

Aplysillid species containing a core of foreign material in their fibres have been reported only occasionally. The genus *Pleraplysilla* is known from only six records: *Aplysilla spinifera* Schulze, 1879 from the Mediterranean; the same species has been redescribed from the Mediterranean by VACELET (1959) and BOURY-ESNAULT (1969) as *Pleraplysilla spinifera*; *Pleraplysilla minchini* Topsent, 1905, from the western Atlantic Ocean, which is reported to consist of a 2 mm thick incrustation of chocolate colour; *P. latens* George & Wilson, 1919 from North Carolina, which has been described as a colourless thin incrustation; this species was later synonymized with *P. minchini* by WELLS et al., 1960; these same authors reported additional material of *P. minchini* from North Carolina.

It is not at all certain that WELLS et al. (1960) were right in their assumption, that the chocolate coloured species from the eastern Atlantic is conspecific with the colourless one from North Carolina, in spite of the fact that flagellate chambers do not differ in size. VACELET (1959) synonymized *P. minchini* with *P. spinifera* (Schulze, 1879). In the mean time it seems clear, that *P. stocki* differs from the known *Pleraplysilla* specimens in its massiveness, its colour, the erratic outline and dark colour of the fibres and in the occurrence (be it rare) of anastomoses.

Genus **Igernella** Topsent, 1905

Definition: Darwinellidae with a secondary reticulate skeleton and diactine or triactine horny spicules.

Igernella notabilis (Duchassaing & Michelotti, 1864) comb. nov.

Euryades notabilis DUCHASSAING & MICHELOTTI, 1864: 106, pl. 25 fig. 3.
Darwinella joyeuxi TOPSENT, 1889: 46, fig. 11; DE LAUBENFELS, 1948: 170, fig. 28; WIEDENMAYER, 1977: 251.
Igernella joyeuxi; TOPSENT, 1905: clxxxviii, fig. 3; BOURY-ESNAULT, 1973: 287.
[Non: *Darwinella joyeuxi*; LITTLE, 1963: 37 = *Igernella* spec.]

Lectotype (per WIEDENMAYER, 1977): ZMA POR. 1044, ST. THOMAS. Schizoparalectotype: BM. 1928.11.12.38. There is one type specimen in the Turin Museum (POR. no. 43), designated paralectotype herein.

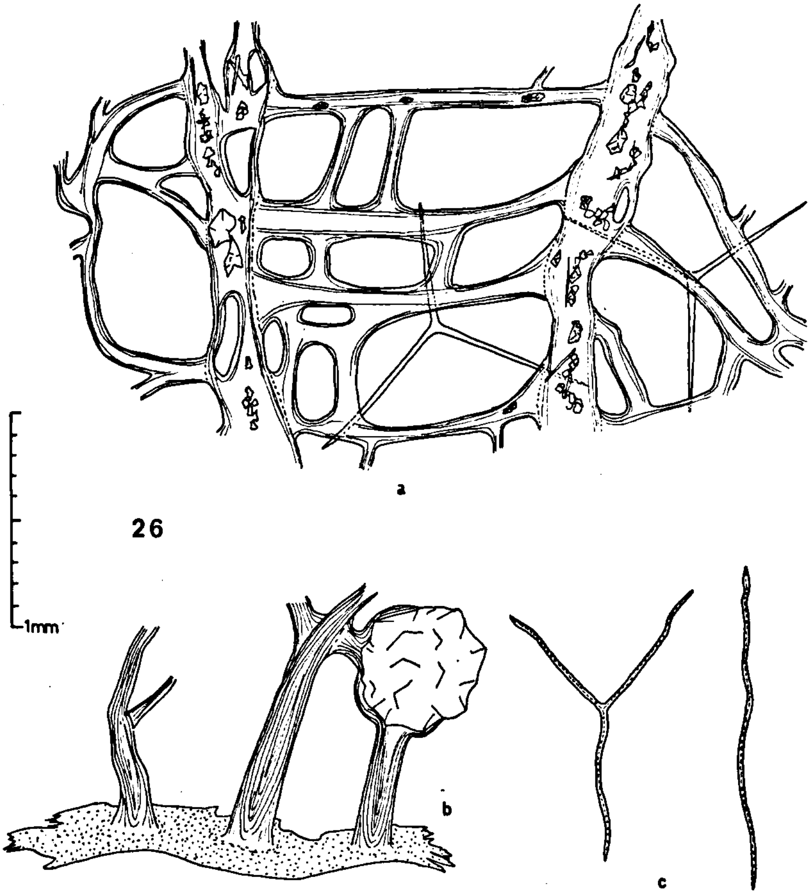


FIGURE 26. Details of the skeleton of *Igernella notabilis* (Duch. & Mich.); a. main skeleton b. fibres rising from a basal plate of spongin, c. horny spicules.

Redescription of the lectotype: (Fig. 26, Pl. XIV 4)

Judging from the DUCH. & MICH. illustration (pl. 25 fig. 3) the lectotype is closely resembling the figured specimen. The lectotype is now broken into three pieces; together they form a cluster of 5 adhering tubes, each 4.5 cm high and 2.5 cm in diameter. Apical oscules are 7–12 mm in diameter. The tubes are macerated. Fibre endings (presumed to have formed conules 1–3 mm apart, 1 mm high. The skeleton consists of a reticulation of spongin fibres with sometimes ascending bundles of "primaries". The fibres contain various amounts of foreign debris. Reticulation of "secondary" fibres is very irregular. Several perforated spongin plates have been observed. All fibres are distinctly laminated. "Primary" fibres are 150–300 μm in diameter, "secondaries" 25–100 μm. Meshes 150–1500 μm. Regularly built triactine horny spicules are fairly numerous; each ray makes an angle of 120° with its neighbour. Ray size: 520–700 μm/17–25 μm.

CURAÇAO: ZMA POR. 3611 (Blauwbaai, 15–20 m, XI.1975, coll. S. Weinberg & E. Westinga).
ST. EUSTATIUS: ZMA POR. 4082 (beach at English Quarter, 22.VI.1976, coll. J. H. Stock).

General **diagnosis**: (Fig. 26, Pl. XV 1)

Shape, size and consistency: The sponge forms clusters of tubes, often lying in a row; tubes are 4–6 cm high, 2.5–4 cm in diameter, crowned with an apical osculum up to 20 mm in diameter. The walls of the tubes are regularly conulose. Conules are acute and interconnected by ridges outlining small round depressions of 1–3 mm in diameter. The consistency is very spongy, easily torn.

Colour: brick-red alive, reddish brown in spirit.

Dermis: organic, thin, stretched over subdermal spaces.

Choanosome: The poorly developed fleshy parts are charged with sand grains.

Skeleton: With some difficulty a basal plate of spongin resting on the substratum could be found. From this individual fibres rise for a short distance undivided (about 300–500 μm), after which some are anastomosing with their neighbours thus forming a reticulate skeletal plan quite near the base of the sponge. Other fibres at first send out dendritic branches at sharp angles, but eventually only a short way higher up in the sponge these are also anastomosing into a reticulate skeleton. Thus almost the whole of the skeleton is reticulate in structure. The Curaçao specimen is particularly rich in foreign material. In places the skeleton looks somewhat like a *Dysidea*. Fibres: primaries 110–300 μm in diameter, secondaries 15–100 μm. Meshes 100–1800 μm. Spicules: Both triactine and diactine horny spicules are found abundantly throughout the sponge. Ray size of triactines: 500–900 µm/17–23 µm; diactines: 1400–1600 µm/20–22 µm. The St. Eustatius specimen did not contain any horny spicules, but resembles closely the D. & M. type specimen. As it is a beach worn specimen it is presumed the horny spicules were lost.

Ecology: The species is known from reef localities.

Distribution: St. Thomas, Curaçao, St. Eustatius; Gulf of Campêche (México) (TOPSENT, 1889), Brazil (BOURY-ESNAULT, 1973).

Euryades notabilis was considered an *Euryspongia* by DE LAUBENFELS (1936a). The BM-slide of the Schizoparalectotype indeed does not contain – by accident – any horny spicules, but the fragment itself contained numerous spicules readily visible in the macerated skeleton when viewed under low magnification. Also DUCHASSAING & MICHELOTTI (1864) arranged *Euryades* under the higher taxon name "Tricuspidatae" and mention "grandes spicules tricuspides" explicitly in their diagnosis of *Euryades* (preoccupied by *Euryades* Felder & Felder, 1864 (Lepidoptera)).

Originally *Igernella joyeuxi* (Topsent, 1889) was placed in the genus *Darwinella* Schultze, 1865 on account of the presence of the horny spicules. Subsequently, *Darwinella* was divided into two genera by TOPSENT (1905) on account of the differences in skeletal plans between *D. joyeuxi* on the one hand, and all other described *Darwinella* species on the other hand. The genus *Igernella* Topsent, 1905 was created to reflect these differences. TOPSENT (loc.cit.) even created a new family to receive *Pleraplysilla* and *Igernella*, on the basis of the presence of cored fibres (Pleraplysillidae) or uncored fibres (Darwinellidae, including *Aplysilla* and *Darwinella*). As it is judged unlikely by most recent authors to presume that such a unique character as the possession of horny spicules was evolved twice independently, TOPSENT's classification of the Dendroceratida has found no followers.

The genus *Igernella* was suppressed by DE LAUBENFELS (1948), but not on sufficient grounds. From descriptions of DE LAUBENFELS (1950 and 1953) of *Darwinella muelleri* Schultze, 1865, it has become clear that he was not aware of the large differences found in the skeletons of West Indian *Darwinella* specimens. His description of *D. muelleri* from Bermuda (1950) makes it abundantly clear that this specimen was a true *Darwinella* with a thinly encrusting habit and a typical dendritic skeleton. His material from the Gulf of Mexico described under the same name (DE LAUBENFELS, 1953) has been kindly sent on loan by Dr. RUETZLER (USNM) and re-examined. The specimen (USNM.23345) is very clearly an *Igernella* with an upright tubiform habit and a reticulate skeleton. The skeletal fibres of this specimen are only 15–90 µm in diameter, and the habit tends to be ramose. It is almost certainly not conspecific with *Igernella notabilis*, nor of course with *Darwinella muelleri* and thus will require a new name. LITTLE (1963) described similar specimens under the name *Darwinella joyeuxi*.

There is only one other West Indian *Darwinella* known, viz. *Darwinella rosacea* Hechtel, 1965. Judging from HECHTEL's description there can be no doubt that this is a true *Darwinella*; PRONZATO (1975) suggested it is conspecific with the Mediterranean *D. intermedia* Topsent, 1925.

To summarize it seems now clear that the West Indian species possessing horny spicules are referable to two genera, viz. *Darwinella* with two established species: *D. muelleri*, recognizable as a thin yellow crust, *D. rosacea* (or *D. intermedia*), recognizable as a thin rose-red crust, and the genus *Igernella* with two species: *I. notabilis*, recognizable as a brick-red, fairly coarsely conulose cluster of tubes, and an unnamed species, recognizable as an orange tubulo-ramose, rather fine-grained sponge.

DISCUSSION OF THE DARWINELLIDAE

The genus *Aplysilla* Schulze, 1878 is represented in the West Indies by two well established species: the cosmopolitan *A. sulfurea* Schulze, 1878, characterized by its thinly encrusting yellow habit, known from Bermuda (DE LAUBENFELS, 1950) and North Carolina (GEORGE & WILSON, 1919), and *A. glacialis* (Merejkowski, 1878), which is a beautiful rose pink, reported from Bermuda by DE LAUBENFELS, 1950. The genus *Aplysilla* is in need of a new definition, as it is at present impossible to define it without referring to other genera: all species lacking the unique characters of the other genera are assigned to *Aplysilla.*

The genus *Dendrilla* Lendenfeld, 1888 is represented in the West Indies by *D. nux* De Laubenfels, 1950 from Bermuda, transferred to *Megalopastas* by VACELET, 1958. A portion of the holotype is present in the British Museum (BM 1948.8.6.12). It is a massive piece, dark purple in colour (originally blue-black), soft and fragile, with fibres sticking out beyond the dermis. The generic character was revealed in a slide kindly prepared by Miss STONE: dendritic fibres frequently anastomosing into round meshes in peripheral parts only. *Cacospongia camera* De Laubenfels, 1936, judging from a fragment of the holotype (USNM 22405), either belongs to *Dendrilla* or to *Aplysilla,* as the peripheral anastomoses seem few in number. It is definitely not conspecific with *D. nux,* as the colour in preservative of the former is pale yellow and its fibres show far less anastomosing.

The family Darwinellidae, although it is doubtless a monophyletic group, consists of two or more groups of genera, which might be given taxonomic rank. There are two genera (viz. *Darwinella* and *Igernella*) which possess the unique character of horny spicules. The remaining genera are united only in not possessing this character; thus a clear subdivision of the Darwinellidae into two (sub-)families is as yet impossible.

DISCUSSION OF THE DENDROCERATIDA

The family Halisarcidae (characterized by the absence of any skeleton) is not represented in the present material. One or two species are known from the West Indies, viz. *Halisarca purpura* Little, 1963 and *Halisarca* spec. Bergquist & Hartman, 1969 (indicated as a new species, but description not given).

DISCUSSION OF THE WEST INDIAN KERATOSA

In all, the present collections have been found to contain 33 species out of a total of roughly 52 well established species of

Keratosa known from the West Indies up till now. Of the 21 West Indian genera 14 are represented, of the 5 known families only the Halisarcidae were not represented. This collection is judged to present enough coverage to make some general remarks on the taxonomy of the Keratosa.

Whether or not the Keratosa must be considered a monophyletic group, characterized by absence of proper skeletal spicules, is still an undecided matter, and will largely depend on the results of a comparable survey of the orders Poecilosclerida and Haplosclerida, both of which are regarded as closely related to the Keratosa. Any proposals for a change in the classification of the Keratosa and its suborders will have to depend on analysis of the relationships with these orders. It is long since known that certain Haplosclerida show striking skeletal resemblance with the Dictyoceratida. LÉVI (1953) and REID (1963) have proposed a phylogenetic classification in which Dictyoceratida and Dendroceratida are considered to have evolved independently. Parallel development has to be assumed as a common enough phenomenon in Ceratinomorph evolution, judging from the numerous examples in the Keratosa alone. For instance, in the current classification the possession of large sack-shaped choanocyte chambers is assumed to have evolved independently in the family Dysideidae of the order Dictyoceratida and in the whole of the order Dendroceratida (they are the only Ceractinomorph groups to possess them and they are not considered to belong together in one monophyletic group); another example is the development of a reticulate skeleton by *Igernella* of the order Dendroceratida.

A reconsideration of the position of the Aplysinidae, as has been suggested above, seems to be necessary. A compromise would be to regard it as a separate suborder of the Keratosa pending a forthcoming revision of this group together with the Poecilosclerida and the Haplosclerida.

ZOOGEOGRAPHIC REMARKS

With the aid of literature data (BURTON, 1956; LÉVI, 1952, 1956; VACELET, 1959; BOURY-ESNAULT, 1969, 1973; TOPSENT, 1925; TSURNAMAL, 1967; DE LAUBENFELS, 1954, 1956; POLÉJAEFF, 1884; HECHTEL, 1976; PRONZATO, 1975) the world distribution of all West Indian Keratosa species, has been assessed.

The species have been subdivided (TABLE 2) into cosmopolitan species (occurring in all oceans), tropical Atlantic-Mediterranean species, tropical Western Atlantic species (including the Brazilian coastal waters) and true West Indian species. The last category includes a group of species which have only been reported from a single locality. It appears, that the West Indian region holds a high degree of endemism: over 60% of the well established species does not occur outside the region. If we extend the region to include also Brazilian coastal waters the degree of endemism is raised to 80%. The data presented in TABLE 2, however, must be treated as preliminary. First of all, neighbouring areas as the Brazilian coastal waters and West African waters are far less intensively investigated than the West Indies. Secondly, the systematics of the Keratosa are by no means wholly trustworthy.

A close comparison between West Indian and Mediterranean specimens of closely related species is still badly needed. Many West Indian species have twin species in the Mediterranean: e.g. *Spongia obliqua – Spongia officinalis*, *Spongia virgultosa* (and *S. nitens*) may be quite close to *Hyattella intestinalis*, *Oligoceras violacea – O. collectrix*, *Ircinia felix – I. fasciculata*, etc. On the other hand, it could also come out, that presumed tropical Atlantic-Mediterranean species will be found to belong to two separate twin species. Presumed cosmopolitan species like *Dysidea fragilis* and *Ircinia* cf. *dendroides* may well prove to be consisting of different subspecies or vicariating twin species; WIEDENMAYER (1974) convincingly listed a group of sponges showing such phenomena.

HECHTEL (1976) in his preliminary analysis of the relationship of the sponge faunas of Brazil and the West Indies found, next to a considerable portion of shared species, also a large group of Brazilian

TABLE 2

WORLD DISTRIBUTION OF SPECIES OF KERATOSA OCCURRING IN THE WEST INDIES

*) indicates uncertain identification.

	Bermuda	North Carolina	Florida	Gulf of Mexico	Yucatán-Campêche	Panamá	Leeward Group	Windward Group	Virgin Islands	Greater Antilles	Bahama Islands	N.Brazil (3–10° S)	S.Brazil (13–23° S)	Mediterranean	W. Africa	Tropical Pacific	Tropical Indian Ocean
A. Cosmopolitan species:																	
Hyattella intestinalis	—	—	×	×	—	×	×	—	—	×	×	×	×	—	—	×	×
Ircinia dendroides	—	—	—	—	—	—	—	×	—	—	—	—	—	×	—	×	—
Ircinia ramosa	×	—	—	—	×	—	—	—	—	—	—	—	×	—	—	×	×
Dysidea fragilis	—	×	×	—	—	—	—	—	—	×	×	×	×	×	×	×	×
Aplysilla glacialis	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—
Aplysilla sulfuera	×	×	—	—	—	—	—	—	—	—	—	—	—	×	×	×	—
B. Tropical Atlantic – Mediterranean species:																	
Ircinia variabilis	×	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
Chelonaplysilla erecta	—	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—
Darwinella rosacea (= *? intermedia*)	—	—	—	—	—	—	—	—	—	×	—	—	—	×	—	—	—
C. Tropical Western Atlantic species:																	
Spongia pertusa	—	—	×	—	—	—	—	×	—	×	×	×	—	—	—	—	—
Hippospongia lachne	—	—	×	×	—	—	×	—	—	—	—	×	—	—	—	—	—
Ircinia felix	×	—	×	×	—	—	×	×	×	×	×	×*)	—	—	—	—	—
Ircinia campana	—	—	×	×	×	×	×	—	×	×	×	×	—	—	—	—	—
Aplysina fistularis insularis	—	—	×	—	—	—	—	—	×	×	×	×*)	×*)	—	—	—	—
Aplysina fistularis fulva	—	—	×	×	—	—	×	×	×	×	×	×	×	—	—	—	—
Aplysina cauliformis	—	—	×	—	—	—	—	×	×	×	×	—	×*)	—	—	—	—
"Psammaplysilla camera" (= *Dendrilla*)	—	—	+*)	—	—	—	—	—	—	—	—	×*)	—	—	—	—	—
Igernella notabilis	—	—	—	—	×	—	×	—	×	—	—	×	—	—	—	—	—
Darwinella muelleri	×	—	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—
D. West Indian Endemics:																	
Spongia obliqua	—	—	—	—	—	—	×	—	×	—	×	—	—	—	—	—	—
Spongia tubulifera	×	—	×	×	—	—	×	—	—	—	×	—	—	—	—	—	—
Spongia obscura	—	×	×	×	—	—	×	—	—	×	—	—	—	—	—	—	—
Spongia barbara	—	—	×	×	—	×	—	—	×	—	×	—	—	—	—	—	—
Spongia tampa	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
Hippospongia gossypina	—	—	×	×	—	—	—	—	×	—	×	—	—	—	—	—	—

	Bermuda	North Carolina	Florida	Gulf of Mexico	Yucatán-Campêche	Panamá	Leeward Group	Windward Group	Virgin Islands	Greater Antilles	Bahama Islands	N.Brazil (3–10° S)	S.Brazil (13–23° S)	Mediterranean	W. Africa	Tropical Pacific	Tropical Indian Ocean
Oligoceras violacea	—	—	×	—	×	—	×	—	×	×	×	—	—	—	—	—	—
Ircinia strobilina	×	—	×	—	—	—	×	×	×	×	×	—	—	—	—	—	—
Hyrtios caracasensis	—	—	—	—	—	—	×	—	—	—	×	—	—	—	—	—	—
Hyrtios proteus	—	—	—	—	—	—	×	—	×	—	—	—	—	—	—	—	—
"Thorecta horridus"	—	—	×	—	—	—	—	—	—	×	×	—	—	—	—	—	—
Dysidea janiae	×	—	—	—	—	—	×	×	×	—	×	—	—	—	—	—	—
Dysidea variabilis	—	—	×	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Dysidea etheria	×	—	×	—	—	—	×	—	—	—	×	—	—	—	—	—	—
Aplysina fistularis fistularis	—	—	—	—	—	—	×	—	—	—	×	?—	—	—	—	—	—
Aplysina archeri	—	—	×	—	×	—	×	—	×	×	—	—	—	—	—	—	—
Aplysina lacunosa	—	—	×	—	—	—	×	—	×	×	×	—	—	—	—	—	—
Aiolochroia crassa	×	—	—	—	—	—	×	—	×	×	×	—	—	—	—	—	—
Verongula rigida	—	—	×	×	—	—	×	—	×	×	×	—	—	—	—	—	—
Verongula gigantea	×	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—
Smenospongia aurea	—	—	×	—	—	—	—	—	×	×	×	—	—	—	—	—	—
D.1. Known from a single locality only:																	
Spongia solitaria	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—
Spongia sterea	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Spongia graminea	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
? *Coscinoderma musicalis*	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Coscinoderma lanuga	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ircinia hummelincki	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—	—
Fasciospongia cerebriformis	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—	—
Hyrtios chromogenia	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pleraplysilla spinifera	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Pleraplysilla stocki	—	—	—	—	—	—	—	—	—	×	—	—	—	—	—	—	—
Igernella spec.	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—
Megalopastas nux	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Halisarca purpurea	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—

endemics, which, however, are for a large part seemingly closely related to West Indian species. A further comparison of Brazilian and West Indian "twins" is badly needed.

Brazilian keratose endemics are: *Cacospongia amorpha* Poléjaeff, 1884, *Cacospongia cincta* Boury-Esnault, 1973, *Cacospongia levis* Poléjaeff, 1884, *Dysidea cana* (Hyatt, 1877), *Ircinia compacta* (Poléjaeff, 1884), *Ircinia pauciarenaria* Boury-Esnault, 1973, *Spongia bresiliana* Boury-Esnault, 1973, *Verongia janusi* Boury-

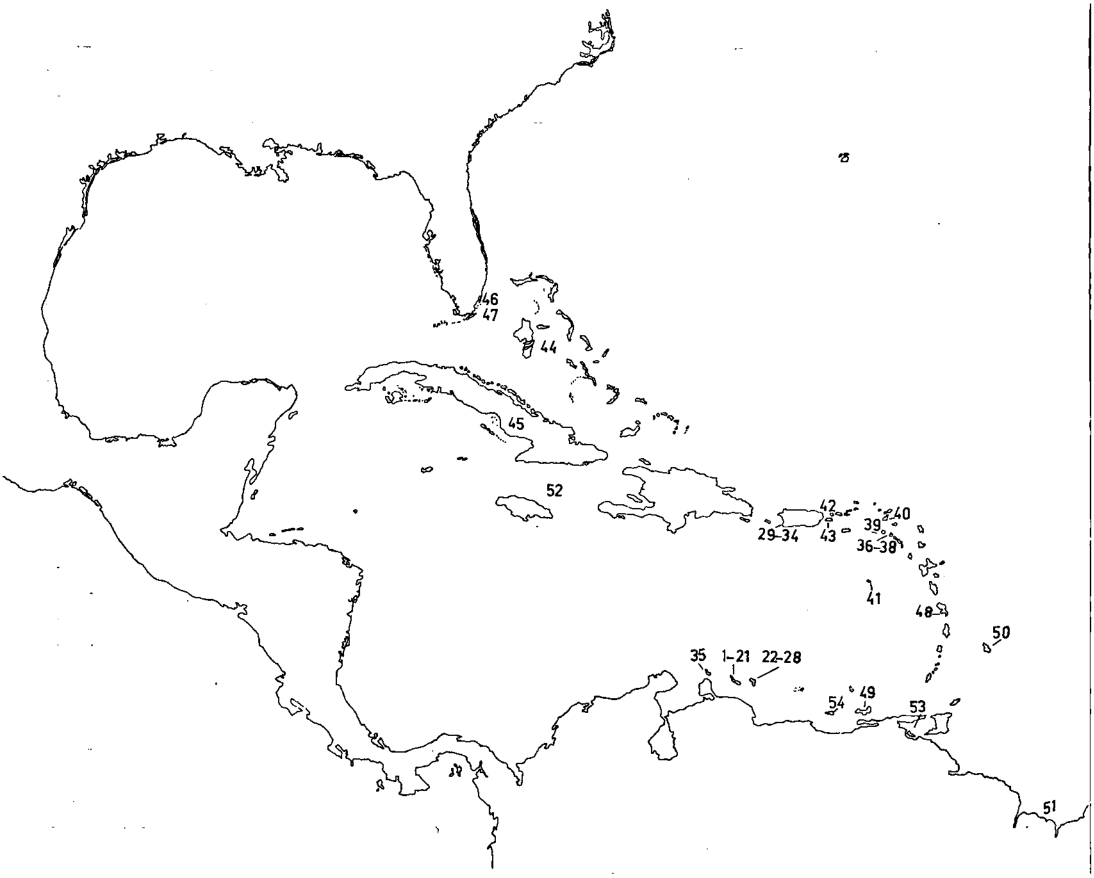


FIGURE 27. Sketch map of the Caribbean area; numbers refer to stations of which data are given in the text.

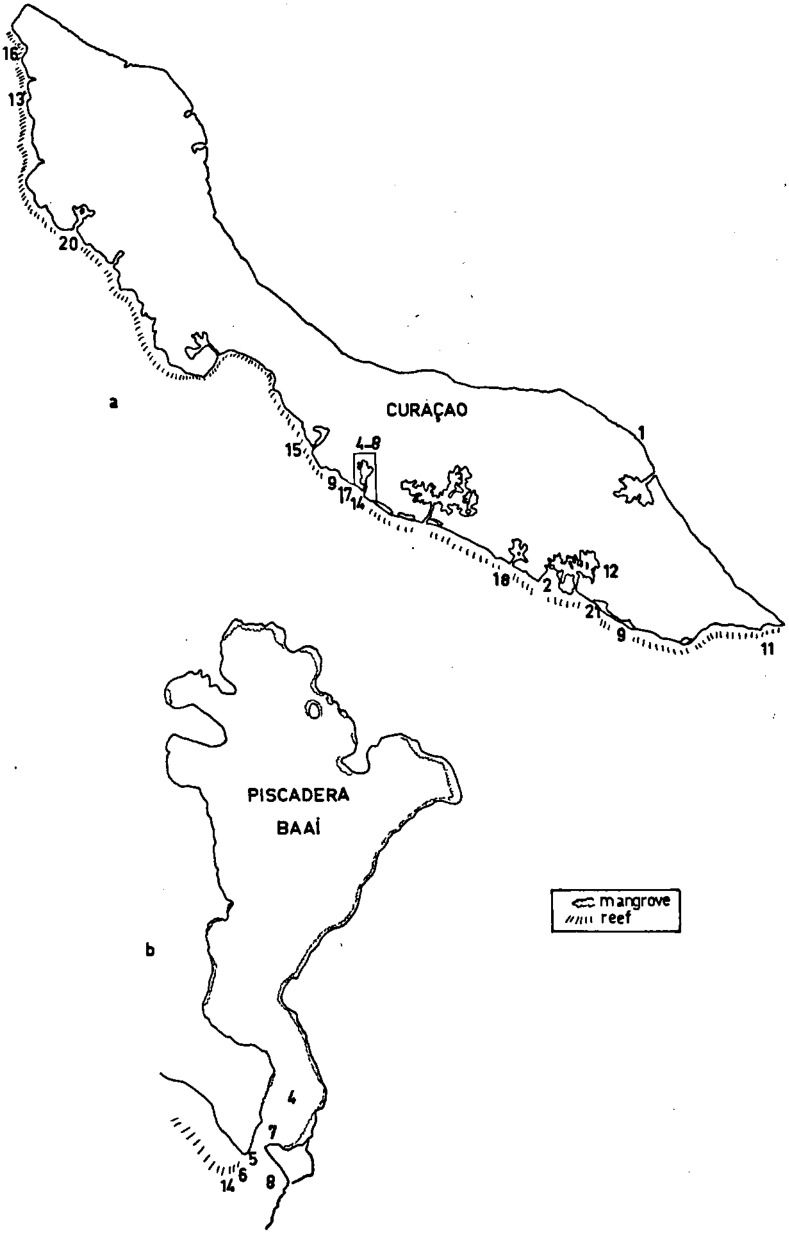


Figure 28. Sketch map of Curaçao (a) and detail of Piscadera Bay (b) (altered after Wagenaar Hummelinck, 1977).

Esnault, 1973 (and two unnamed *Verongia* species considered endemics by HECHTEL, 1976). Of these *Cacospongia amorpha* Poléjaeff is essentially unrecognizable (it could be a *Hyrtios* or a *Polyfibrospongia*); *Cacospongia cincta* Boury-Esnault, 1973 seems to be a true endemic; *Cacospongia levis* Poléjaeff is described from deep water (400 fathoms) and shows affinities to *Hyattella intestinalis*; *Dysidea cana* (Hyatt, 1877) is unrecognizable; *Ircinia compacta* (Poléjaeff) is an *Ircinia* of uncertain identity, it could be a valid species or it could belong to *I. felix* or *I. dendroides*; *Ircinia pauciarenaria* Boury-Esnault, 1973 needs comparison to the former species; *Spongia bresiliana* Boury-Esnault, 1973 is synonymous with the cosmopolitan *Hyattella intestinalis*; *Verongia janusi* Boury-Esnault, 1973 seems a valid species.

So, in all two species of Keratosa seem to be unquestionable endemics, a further two are possible endemics, and the remainder very probably belong to known, more wide spread species.

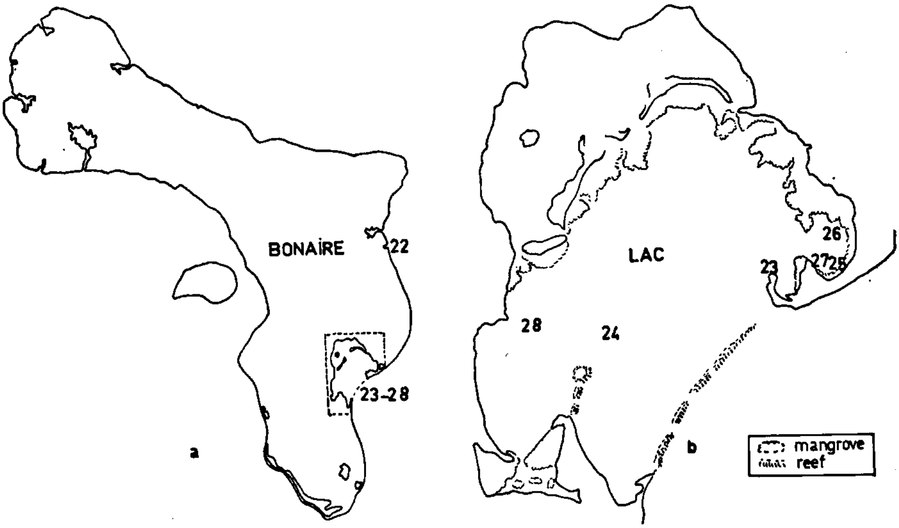


FIGURE 29. Sketch map of Bonaire (a) and detail of Lac (b) (altered after WAGENAAR HUMMELINCK, 1977).

ECOLOGICAL REMARKS

The present material originated from various biotopes within the West Indies. In order to get an impression of ecological preferences of the species the following biotopes are accompanied by a list of species found to occur in them:

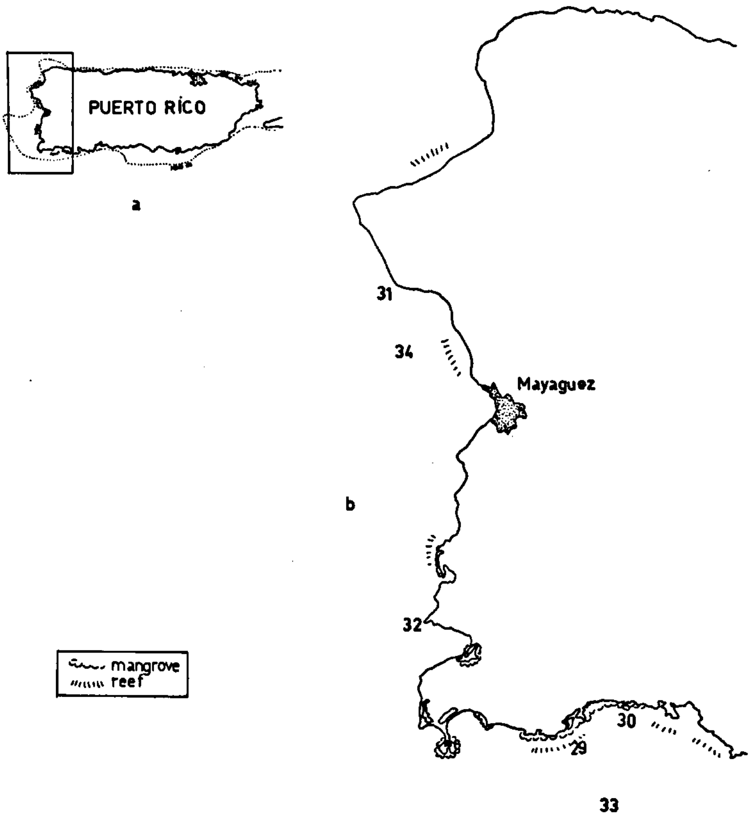


FIGURE 30. Sketch map of Puerto Rico (a) and detail of west coast (b).

Intertidal rocks: *Oligoceras violacea.*

Mangrove forests: *Oligoceras violacea, Pleraplysilla stocki, Chelonaplysilla erecta.*

Rocky substrates or buoys in lagoons: *Spongia tubulifera, S. obscura, Hyattella intestinalis, Oligoceras violacea, Ircinia felix, I. campana, Hyrtios caracasensis, Dysidea janiae, D. etheria, Aplysina fistularis fulva, A. cauliformis, Verongula rigida, Chelonaplysilla erecta.*

Reef localities: *Spongia obliqua,* ? *S. pertusa, S. barbara, Hippospongia gossypina, H. lachne, Hyattella intestinalis, Ircinia felix, I. campana, I. strobilina, Dysidea variabilis, Hyrtios protea, Aplysina fistularis insularis, Aplysina archeri, Aplysina lacunosa, Aplysina cauliformis, Aiolochroia crassa, Verongula rigida, Igernella notabilis.*

Muddy sandflats in deeper water: *Hyattella intestinalis, Ircinia felix, I. dendroides, I. hummelincki, I. strobilina, Aplysina fistularis fulva, Aplysina lacunosa.*

No data were available in the case of *Fasciospongia cerebriformis, Spongia tampa* and *S. solitaria* and ? *Coscinoderma musicalis.*

From the above lists it can be concluded that quite a number of species seem to be euryoecious in varying degrees. Some of them, however, show distinct ecophenotypes, e.g. *Hyattella intestinalis, Aplysina lacunosa, Ircinia strobilina,* which may eventually prove to be different taxa. Stenoecious species seem to be *Spongia obliqua, S. tubulifera, Aplysina archeri, Aiolochroia crassa, Igernella notabilis.* The remaining species which have been found to occur in one biotype only are insufficiently known as to their ecological preferences.

REFERENCES

ARNDT, W., 1927. Kalk- und Kieselschwämme von Curaçao. *Bijdr. Dierk.*, *25*, p. 133–158, 18 figs., 3 pls.

BERGQUIST, P. R., 1965. The Sponges of Micronesia, Part I. The Palau Archipelago. *Pac. Sci.*, *19* (2), p. 123–204, 34 figs.

BERGQUIST, P. R. & HARTMAN, W. D., 1969. Free amino acid patterns and the classification of the Demospongiae. *Mar. Biol.*, *3* (2), p. 247–268, 14 figs.

BERGQUIST, P. R. & MORTON, J. E. & TIZARD, C. A., 1971. Some Demospongiae from the Solomon Islands with descriptive notes on the major sponge habitats. *Micronesica*, 7 (1–2), p. 99–121, 3 figs., 4 pls.

BOURY-ESNAULT, N., 1969 (?). *Les Spongiaires des fonds rocheux de Banyuls-sur-Mer. Écologie et systématique.* Thèse Univ. Paris, 152 pp., 8 pls. (mimeogr.).

BOURY-ESNAULT, N., 1973. Campagne de la Calypso au large des côtes atlantiques de l'Amérique du Sud (1961–1962). I, 29. Spongiaires. *Rés. sci. Camp. Calypso*, *10*, p. 263–295, 49 figs., 3 pls.

BURTON, M., 1934. Sponges. *Great Barrier Reef Exped.*, *1928–1929*, *sci. Rep.*, *4* (14), p. 513–621, 33 figs., 2 pls.

BURTON, M., 1956. The sponges of West Africa. *Atlantide Rep.*, *4*, p. 111–147, 4 figs.

CARTER, H. J., 1876. Descriptions and figures of deep sea sponges and their spicules, from the Atlantic Ocean, dredged up on board H. M. S. Porcupine, chiefly in 1869. *Ann. Mag. nat. Hist.*, (*4*) *18*, p. 226–240, pls. 12–16.

CARTER, H. J., 1882. Some sponges from the West Indies and Acapulco in the Liverpool Free Museum described, with general and classification remarks. *Ann. Mag. nat. Hist.*, (*5*) *9*, p. 266–301, 346–368, pls. 11–12.

CECIL, J. T. & STEMPIEN, M. F. & RUGGIERI, G. D. & NIGRELLI, R. F., 1976. Cytological abnormalities in a variety of normal and transformed cell lines treated with extracts from sponges. In: F. W. HARRISON & R. R. COWDEN, eds. *Aspects of Sponge biology*, Academic Press New York, 354 pp.

DENDY, A., 1905. Report on the Sponges collected by Professor Herdman at Ceylon in 1902. *Rep. Pearl Oyster Fisheries Gulf of Manaar*, *3*, *suppl. 18*, p. 57–246, 16 pls.

DUCHASSAING DE FONBRESSIN, P. & MICHELOTTI, G., 1864. Spongiaires de la mer Caraibe. *Natuurk. Verh. Holl. Mij. Wetensch. Haarlem*, (*2*) *21* (*3*), p. 1–124, 25 pls.

EHLERS, E. H., 1870. *Die Esperschen Spongien in der zoologischen Sammlung der K. Universität Erlangen.* E. Th. Jacob, Erlangen, 36 pp.

ESPER, E. J. C., 1794. *Die Pflanzenthiere in Abbildungen nach der Natur mit Farben erleuchtet, nebst Beschreibungen, Zweiter Teil.* Raspe, Nürnberg, 303 pp., 109 pls.

GEORGE, W. C. & WILSON, H. V., 1919. Sponges of Beaufort (N.C.) Harbor and vicinity. *Bull. Bur. Fish.*, *36*, p. 130–179, pls. 56–61.

GRANT, R. E., 1826. Observations and experiments on the structure and functions of the sponge. *Phil. J. Edinburgh*, *14*, p. 336–341.

GRANT, R. E., 1827. Observations on the structure and functions of the sponge. *New Phil. J. Edinburgh*, *1826–1827*, p. 121–141, pl. 2.

HARTMAN, W. D., 1955. A collection of sponges from the West coast of the Yucatan Peninsula with descriptions of two new species. *Bull. mar. Sci. Gulf Caribbean*, *5*, p. 161–189, 10 figs.

HECHTEL, G. J., 1965. A systematic study of the Demospongiae of Port Royal, Jamaica. *Bull. Peabody Mus. nat. Hist.*, *20*, p. i-iv, 1–103, 15 figs., 8 pls.

HECHTEL, G. J., 1976. Zoogeography of Brazilian marine Demospongiae. In: F. W. HARRISON & R. R. COWDEN, eds. *Aspects of Sponge biology*. Academic Press, New York, 354 pp.

HIGGIN, T. H., 1875. On a new sponge of the genus Luffaria, from Yucatan, in the Liverpool Free Museum. *Ann. Mag. nat. Hist.*, (*4*) *16*, p. 223–227, pl. 6.

HYATT, A., 1875. Revision of the North American Poriferae; with remarks upon foreign species. Part I. *Mem. Boston Soc. nat. Hist.*, *2*, p. 399–408, pl. 13.

HYATT, A., 1877. Revision of the North American Poriferae; with remarks upon foreign species. Part II. *Mem. Boston Soc. nat. Hist.*, *2*, p. 481–554 pls. 15–17.

KELLER C. 1889. Die Spongienfauna des Rothen Meeres (I. Hälfte). *Z. wiss. Zool.*, *48*, p. 311–405, pls. 20–25.

LAMARCK, J. B. P. A. DE, 1814. Sur les polypiers empâtés. *Ann. Mus. Hist. nat. Paris*, *20*, p. 294–312, 370–386, 432–458.

LAMOUROUX, J. V. F., 1816. *Histoire des polypiers coralligènes flexibles, vulgairement nommés zoophytes*. Poisson, Caen, lxxxiv + 559 pp., 19 pls.

LAUBENFELS, M. W. DE, 1934. New sponges from the Puerto Rican deep. *Smithson. Miscel. Coll.*, *91* (*17*), p. 1–28.

LAUBENFELS, M. W. DE, 1936a. A discussion of the sponge fauna of the Dry Tortugas in particular, and the West Indies in general, with material for a revision of the families and orders of the Porifera. *Papers Tortugas Lab.*, *30*, p. i-iii, 1–225, 22 pls.

LAUBENFELS, M. W. DE, 1936b. A comparison of the shallow water sponges near the Pacific end of the Panama Canal with those at the Caribbean end. *Proc. U.S. nation. Mus.*, *83*, p. 441–466.

LAUBENFELS, M. W. DE, 1948. The order Keratosa of the phylum Porifera. A monographic study. *Occas. Papers Allan Hancock Found.*, *3*, p. 1–217, 31 figs., 30 pls.

LAUBENFELS, M. W. DE, 1949. Sponges of the western Bahamas. *Amer. Mus. Novitates*, *1431*, p. 1–25, 1 fig.

LAUBENFELS, M. W. DE. 1950. The Porifera of the Bermuda Archipelago. *Trans. zool. Soc. London*, 27, p. 1–154, 65 figs., 2 pls.

LAUBENFELS, M. W. DE, 1953. Sponges from the Gulf of Mexico. *Bull. mar. Sci. Gulf Caribb.*, *2*, p. 511–557, 17 figs.

LAUBENFELS, M. W. DE, 1954. The sponges of the West Central Pacific. *Oregon State Monogr. Zool.*, *7*, p. i-x, 1–306, 200 figs., 12 pls.

LAUBENFELS, M. W. DE, 1965. Preliminary discussion of the sponges of Brasil. *Contr. Avulsas Inst. Oceanogr. Univ. São Paulo, Oceanogr. Biol.*, *1*, p. 1–4.

LAUBENFELS, M. W. DE & STORR, J. F., 1958. The taxonomy of American commercial sponges. *Bull. mar. Sci. Gulf Caribb.*, *8*, p. 99–117, 7 figs.

LENDENFELD, R. L. VON, 1889. *A monograph of the horny sponges*. Trübner & Co., London, iv + 936 pp., 50 pls.

LÉVI, C., 1952. Spongiaires de la côte du Sénégal. *Bull. Inst. franç. Afr. noire*, *14*, p. 34–59, 20 figs.

Lévi, C., 1953. Sur une nouvelle classification des Démosponges. *C. R. hebd. Séances Acad. Sci. Paris, 236* (*1*), p. 853–855.

Lévi, C., 1956. Spongiaires de la région de Dakar. *Bull. Inst. franç. Afr. noire,* (*A*) *18,* p. 391–405, 8 figs.

Lévi, C., 1958. Spongiaires de Mer Rouge recueillis par la "Calypso" 1951–1952. *Rés. sci. Camp. Calypso, 3,* p. 3–46.

Lévi, C., 1973. Systématique de la classe de Demospongiaria (Démosponges). *Traité de Zoologie, 3* (*1*), p. 577–631.

Linnaeus, C., 1767. *Systema naturae ... ed. 12.* Salvius, Stockholm, vol. *1* (2), p. 533–1327.

Little, F. J., 1963. The sponge fauna of the St. George's Sound, Apalachee Bay, and Panama City Regions of the Florida Gulf Coast. *Tulane Stud. Zool., 11,* p. 31–71, 33 figs.

Moore, H. F., 1910. The commercial sponges and the sponge fisheries. *Bull. Bur. Fish., 28,* p. 399–511, 4 figs., pls. 28–66.

Pallas, P. S., 1766. *Elenchus zoophytorum....* Van Cleef, The Hague, 451 pp.

Poléjaeff, N. N., 1884. Report on the Keratosa collected by H. M. S. Challenger during the years 1873–1876. *Rep. sci. Res. Voyage Challenger, 11,* p. 1–88, pls. 1–10.

Pronzato, R., 1975. Nota tassonomiche sul genere Darwinella (Porifera). *Boll. Mus. Ist. Univ. Genova, 43,* p. 5–20.

Reid, R. E. H., 1963. A classification of the Demospongia. *Neues Jahrb. Geol. Palaeont., 4,* p. 196–207, 2 figs.

Ridley, S. O., 1884. Spongiida. *Rep. zool. Coll. Alert, 1881–82, 1,* p. 366–482, 582–630, pls. 39–43, 53–54.

Schmidt, O., 1862. *Die Spongien des Adriatischen Meeres.* Engelmann, Leipzig, viii + 88 pp., 7 pls.

Schulze, F. E., 1878. Untersuchungen über den Bau und die Entwicklung der Spongien. Vierte Mittheilung. Die Familie der Aplysinidae. *Z. wiss. Zool., 30,* p. 379–420, pls. 21–24.

Schulze, F. E., 1879. Untersuchungen über den Bau und die Entwicklung der Spongien. Siebente Mittheilung. Die Familie der Spongidae. *Z. wiss. Zool., 32,* p. 593–660, pls. 34–38.

Seba, A., 1760. *Locupletissimi rerum naturalium thesauri ... 3.* Janssen-Waesberg, Amsterdam, 212 pp., 116 pls.

Smith, H. M., 1898. The Florida commercial sponges. *Bull. U.S. Fish Comm.* (1897), *17,* p. 225–240, pls. 13–31.

Storr, J. F., 1964. Ecology of the Gulf of Mexico commercial sponges and its relation to the fishery. *U.S. Fish Wildlife Serv., Spec. sci. Rep., Fish., 466,* p. i-iv, 1–73, 21 figs.

Topsent, E., 1889. Quelques spongiaires du Banc de Campêche et de la Pointe-à-Pitre. *Mém. Soc. Zool. France, 2,* p. 30–52, 12 figs.

Topsent, E., 1905. Étude sur les Dendroceratida. *Arch. Zool. exp. gén.,* (*4*) *3, notes et revue,* p. clxxi-cxcii, 3 figs.

Topsent, E., 1925. Étude des Spongiaires du Golfe de Naples. *Arch. Zool. exp. gén., 63,* p. 623–725, 27 figs., pl. 8.

Topsent E. 1928. Spongiaires de l'Atlantique et de la Méditerranée provenant des croisières du Prince Albert 1^er^ de Monaco. *Rés. Camp. Sci. Albert 1^er^ Monaco, 74,* p. 1–376, 11 pls.

TOPSENT, E., 1930. Éponges de Lamarck conservées au Muséum de Paris. *Arch. Mus. nation. Hist. nat. Paris*, (6) *5*, p. 1–56, 4 figs. 4 pls.

TOPSENT, E., 1932 (1931). Éponges de Lamarck conservées au Muséum de Paris. Deuxième Partie. *Arch. Mus. nation. Hist. nat. Paris*, (6) *8*, p. 61–124, 2 figs., 6 pls.

TSURNAMAL, M., 1967. Chelonaplysilla erecta n.sp. (Demospongiae, Keratosa) from Mediterranean coast of Israel. *Israel J. Zool.*, *16*, p. 96–100, 3 figs.

VACELET, J., 1959. Répartition générale des Éponges et systématique des Éponges cornées de la région de Marseille et de quelques stations Méditerranéennes. *Rec. Trav. Stat. mar. Endoume*, *26* (16), p. 39–101.

VACELET, J., 1961. Quelques éponges remarquables de Méditerranée. *Rec. Trav. Inst. Pêches marit.*, *25* (3), p. 351–354, 3 figs.

VACELET, J. & VASSEUR, P. & LÉVI, C., 1976. Spongiaires de la pente externe des récifs coralliens de Tuléar (Sud-Ouest de Madagascar). *Mém. Mus. nation. Hist. nat.* (*n.s.*), (*A, Zoologie*), *99*, p. 1–116, 78 figs., 10 pls.

VERRILL, A. E., 1907. The Bermuda Islands. Part IV: Geology and paleontology, and part V: An account of the coral reefs. *Trans. Connecticut Acad. Arts Sci.*, *12*, p. 45–348, 181 figs., pls. 16–40.

WAGENAAR HUMMELINCK, P., 1977. Marine localities. *Stud. Fauna Curaçao Caribb. Islands*, *51* (167), p. 1–68, 55 pls.

WELLS, H. W. & WELLS, M. J. & GRAY, J. E., 1960. Marine sponges of North Carolina. *J. Elisha Mitchell Sci. Soc.*, *76*, p. 200–245, 63 figs.

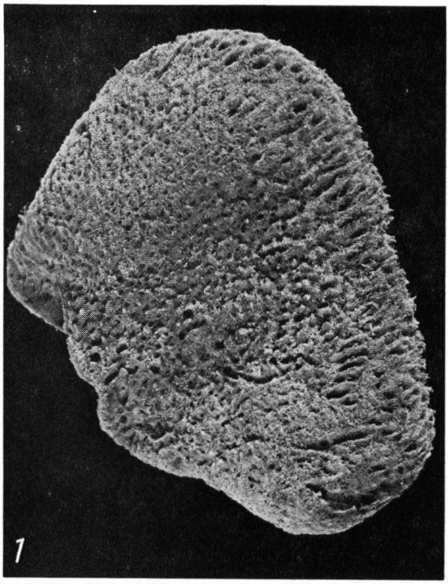
WIEDENMAYER, F., 1976. Recent marine shallow-water sponges of the West Indies and the problem of speciation. *Verhandl. Naturf. Gesellsch. Basel*, *84* (*1*), p. 361–375, 3 pls.

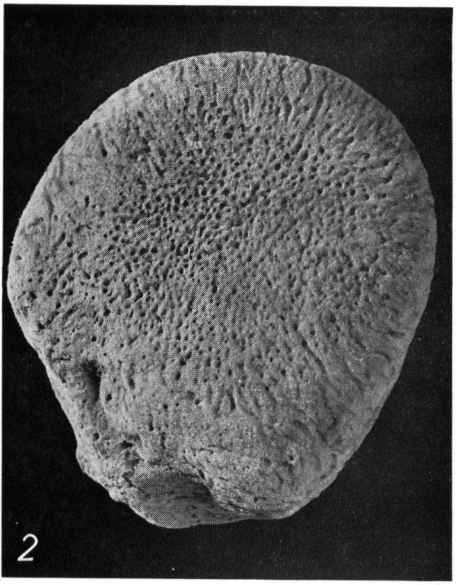
WIEDENMAYER, F., 1977. *A monograph of the shallow-water sponges of the Western Bahamas*. Birkhäuser Verlag, Basel und Stuttgart, 287 pp., 43 pls. (*Experientia Supplementum 28*)

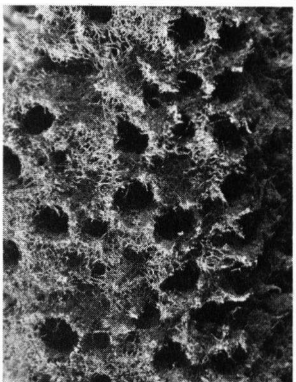
WILSON, H. V., 1902. The sponges collected in Porto Rico in 1889 by the U.S. Fish Commission Steamer Fish Hawk. *Bull. U.S. Fish Comm.*, *2*, p. 375–411, 30 figs.

PLATE I

1. Lectotype of *Spongia obliqua* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 2099 (× $^2/_3$).
2. Lectotype of *Spongia discus* Duch. & Mich., 1964, from ST. THOMAS, ZMA POR. 2077 (= *S. obliqua*) (× $^2/_3$).
3. *Spongia discus*, lectotype, detail of the surface (× 10).
4. *Spongia tubulifera* Lamarck, 1814, a non-tubuliferous specimen from Caracas Bay, CURAÇAO, ZMA POR. 3449 (× $^2/_5$).


1


2


3

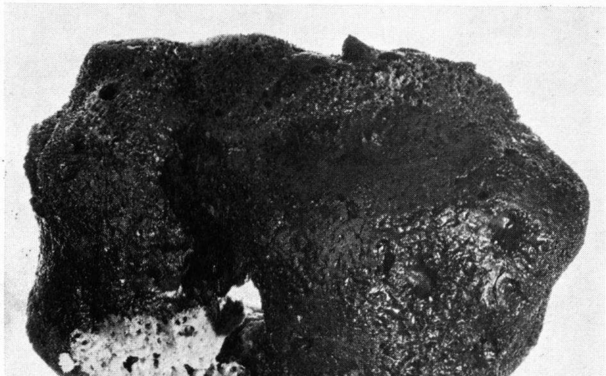
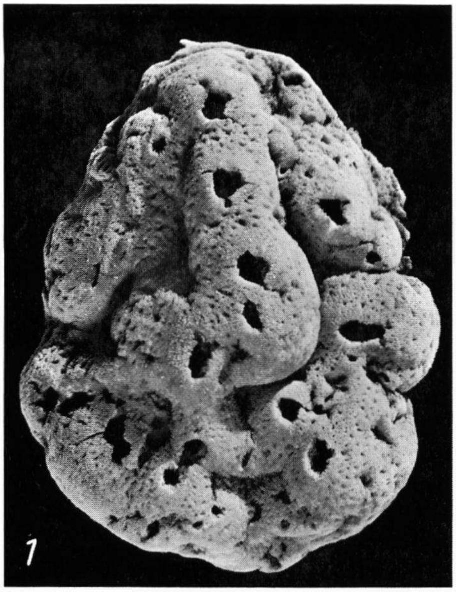
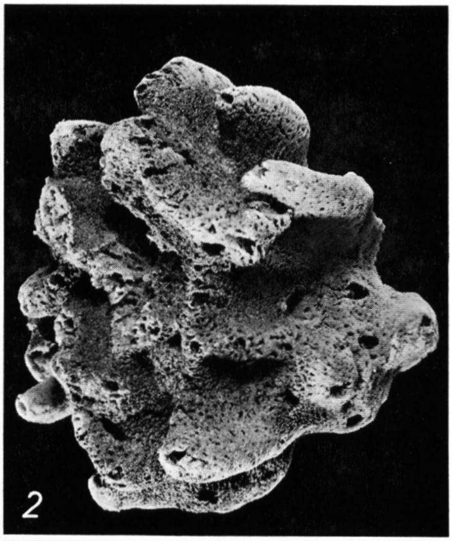

4

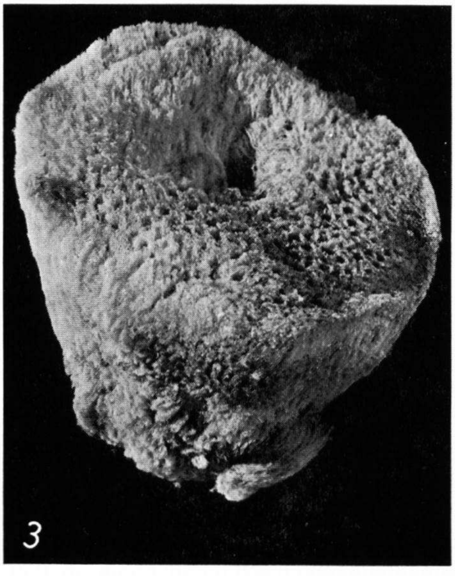
PLATE II

1. *Spongia pertusa* Hyatt, 1877, the Duch. & Mich.-specimen labeled "*Sp. tubulifera* Lam." from St. Thomas, ZMA POR. 2257 (× $^1/_2$).
2. *Spongia tubulifera* Lamarck, 1814, a tubuliferous specimen from Caracas Bay, Curaçao, ZMA POR. 3421 (× $^1/_3$).
3. *Spongia obscura* Hyatt, 1877, a specimen from Curaçao, ZMA POR. 1663 (× $^1/_2$).
4. *Spongia tampa* De Laubenfels & Storr, 1958, ZMA POR. 4229 (× $^1/_5$).

Pl. II


1


2

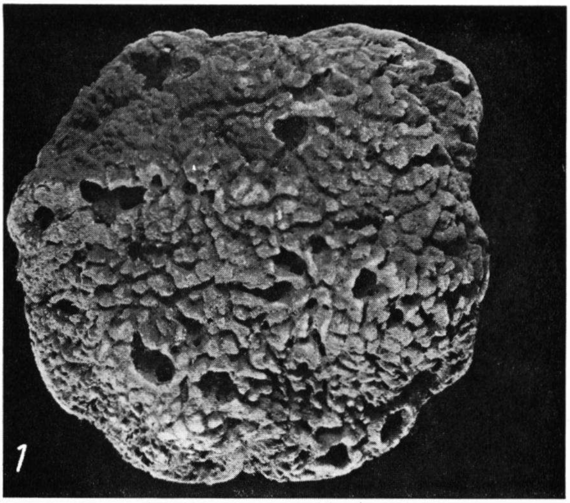

3

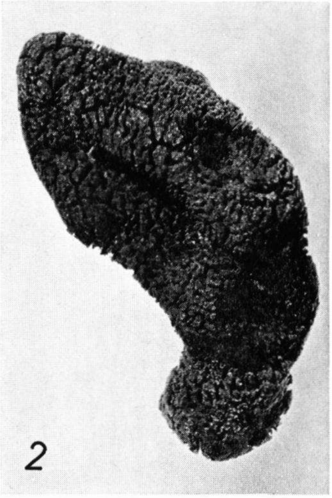

4

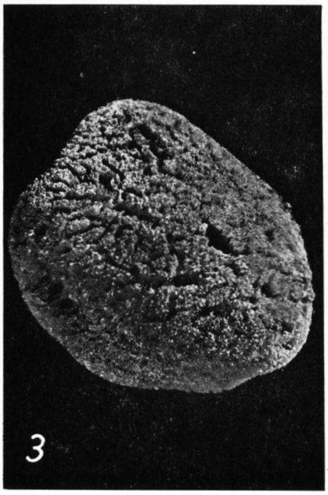
PLATE III

1. Paralectotype of *Spongia barbara* Duch. & Mich., 1864, from VIEQUES, ZMA POR. 2074 (× $^2/_3$).
2. Lectotype of *Spongia vermiculata* Duch. & Mich., 1864 (= *S. barbara*), from ST. THOMAS, ZMA POR. 2256 (× $^2/_3$).
3. Paralectotype of *Spongia meandriformis* Duch. & Mich., 1864 (= *S. barbara*) from VIEQUES, ZMA POR. 2096 (× $^4/_5$).
4. *Spongia solitaria* Hyatt, 1877, from CURAÇAO, ZMA POR. 3416 (× $^1/_2$).

Pl. III


1


2


3

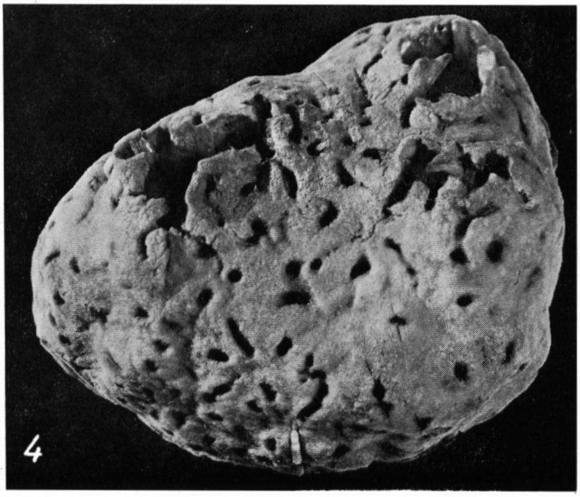

4

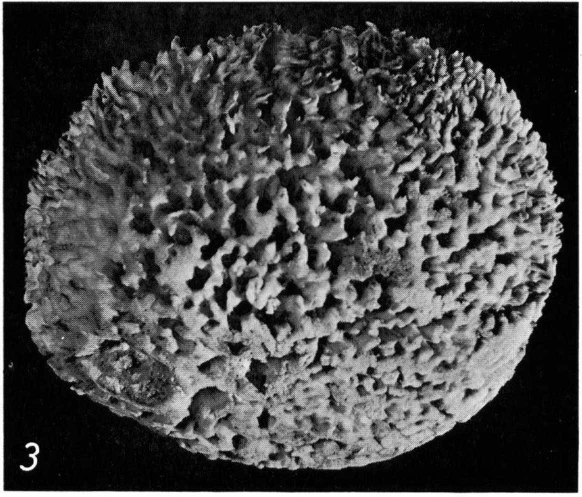
PLATE IV

1. Detail of the surface of *Spongia solitaria* Hyatt, 1877 (× 10).
2. Branched form of *Hyattella intestinalis* (Lamarck, 1814) from PUERTO RICO, ZMA POR. 3886 (× $^1/_4$).
3. *Hippospongia lachne* De Laubenfels, 1936, a specimen from CURAÇAO, ZMA POR. 1325 (× $^2/_5$).
4. Paralectotype of *Spongia* (= *Hippospongia*) *gossypina* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 2087 (× $^1/_2$).

Pl. IV


1

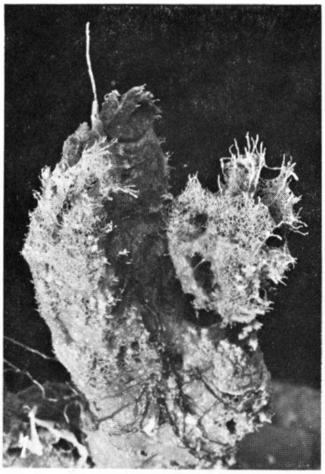

2

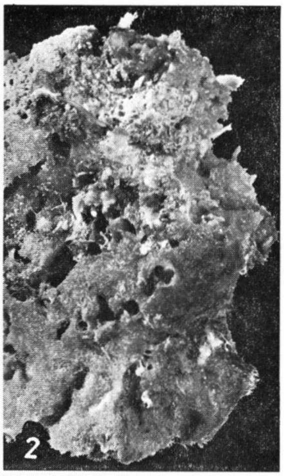

3

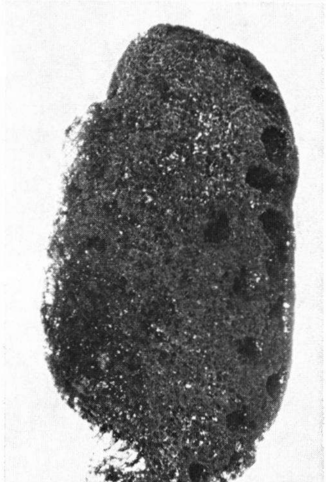

4

PLATE V

1. Branched form of *Hyattella intestinalis*, detail of peripheral parts. (× 4).
2. Massive form of *Hyattella intestinalis* from CURAÇAO, ZMA POR. 3958 (× $^1/_2$).
3. Lectotype of *Spongia* (= ? *Coscinoderma*) *musicalis* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 2097 (× $^2/_3$).
4. Lectotype (fragmented) of *Acamas* (= *Oligoceras*) *violacea* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 615 (× 1).


1


2


3

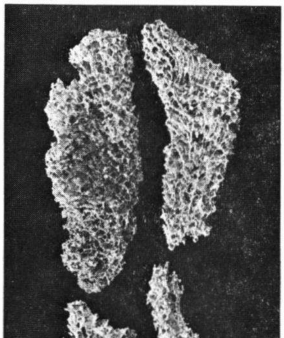
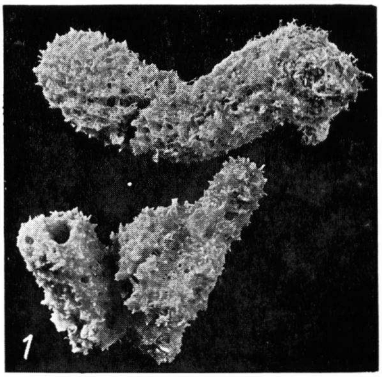
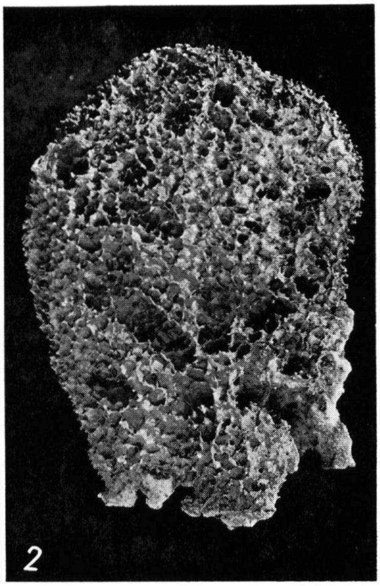

4

PLATE VI

1. *Oligoceras violacea* (Duch. & Mich.), specimen from CURAÇAO, ZMA POR. 3643 (× $^2/_3$).
2. Lectotype of *Polytherses* (= *Ircinia*) *felix* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 1854 (× $^4/_5$).
3. Lectotype of *Polytherses armata* Duch. & Mich., 1864 (= *Ircinia felix* D. & M.)), from ST. THOMAS, ZMA POR. 1851 (× $^3/_4$).
4. *Ircinia* cf. *dendroides* (Schmidt, 1862), a specimen from deeper water off PUERTO RICO, ZMA POR. 3529 (× $^1/_2$).


1


4


2

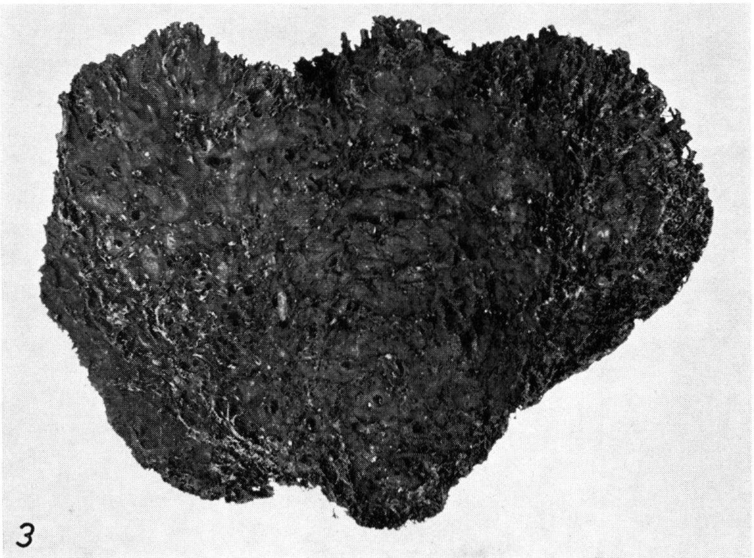
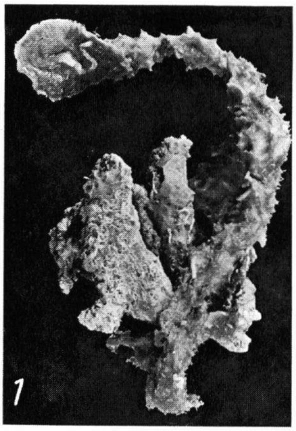
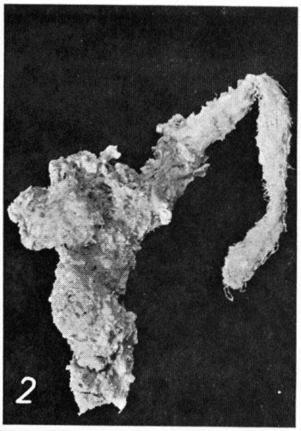

3

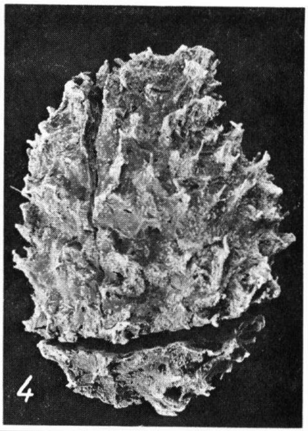
PLATE VII

1. *Ircinia* cf. *dendroides* (Schmidt, 1862), specimen from deep water off BARBADOS, ZMA POR. 3812 (× $^4/_5$).
2. Holotype of *Ircinia hummelincki* nov. spec., from deep water off BARBADOS, ZMA POR. 4309 (× $^4/_5$).
3. *Ircinia campana* (Lamarck, 1814), a specimen from CURAÇAO, ZMA POR. 3285 (× $^1/_{10}$).
4. Lectotype of *Polytherses longispina* Duch. & Mich., 1864 (= *Ircinia strobilina* (Lam., 1816)), from ST. THOMAS, ZMA POR. 1855 (× $^2/_3$).

Pl. VII


1


2


4

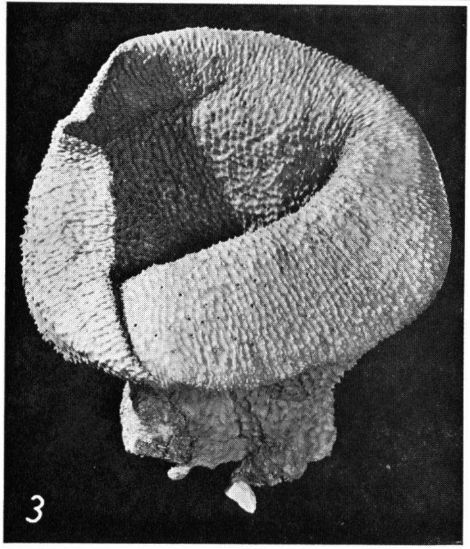
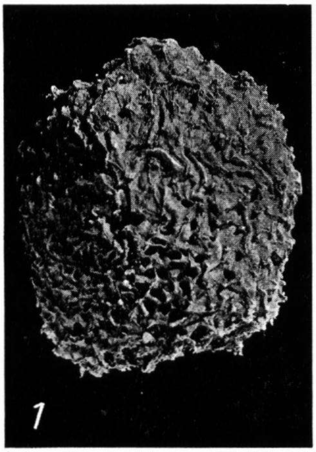
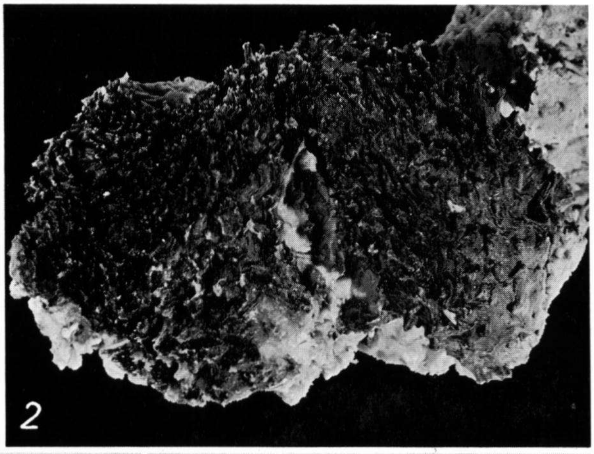
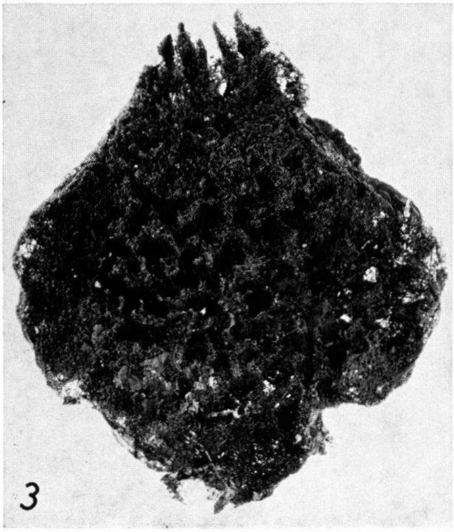

3

PLATE VIII

1. Paralectotype of *Polytherses capitata* Duch. & Mich., 1864 (= *Ircinia strobilina* (Lam., 1816), from St. Thomas, ZMA POR. 1853 (× $^3/_4$).
2. *Ircinia strobilina* (Lamarck, 1816), a specimen from Curaçao, ZMA POR. 3654 (× $^1/_3$).
3. Paralectotype of *Spongia* (= *Fasciospongia*) *cerebriformis* Duch. & Mich., 1864, from St. Thomas, ZMA POR. 2075 (× $^4/_5$).
4. *Hyrtios proteus* Duch. & Mich., 1864, a specimen from Curaçao, ZMA POR. 3880 (× $^2/_3$).


1


2


3

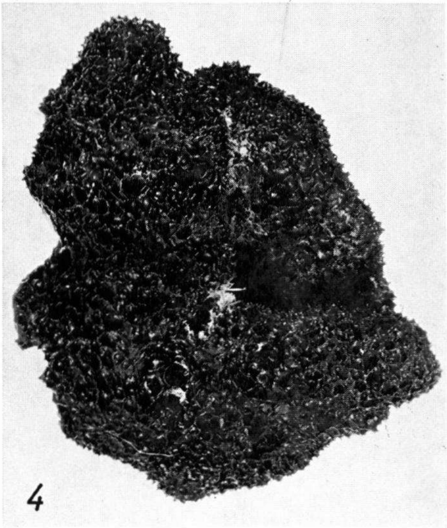
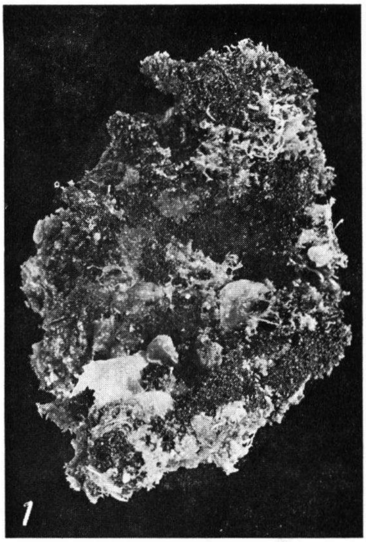
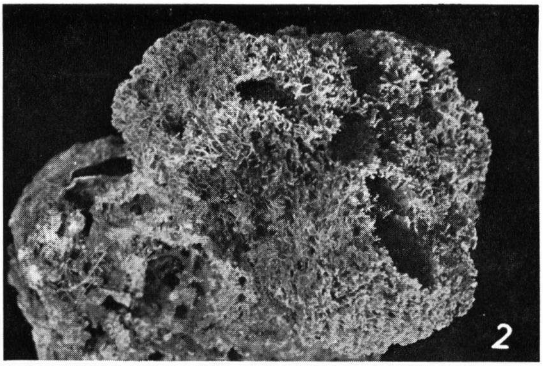
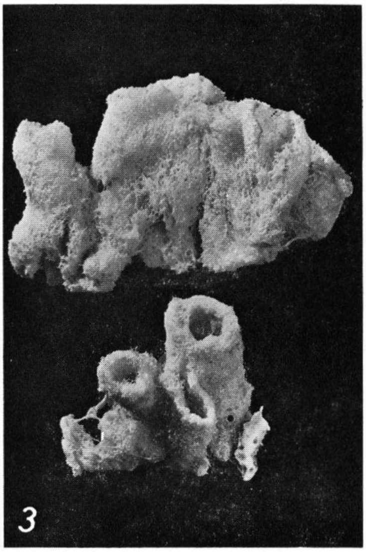

4

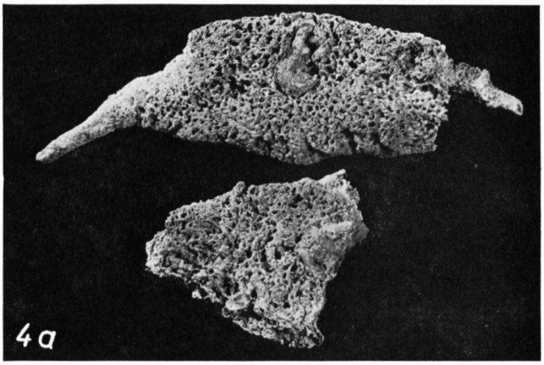
PLATE IX

1. *Hyrtios caracasensis* (Carter, 1882), a specimen from MARGARITA, ZMA POR. 3978 (× 1).
2. Lectotype of *Terpios* (= *Dysidea*) *janiae* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 2292 (× 2).
3. *Dysidea janiae* (Duch. & Mich., 1864), a specimen from CURAÇAO, ZMA POR. 3954 (× 1).
4. Paralectotypes (fragmented) of *Amphimedon* (= *Dysidea*) *variabilis* Duch. & Mich., 1864, from ST. THOMAS, ZMA POR. 614 (× 1), 616 (× 1).


1


2


3


4a

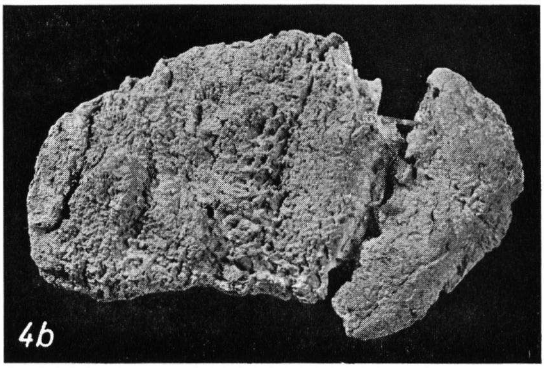
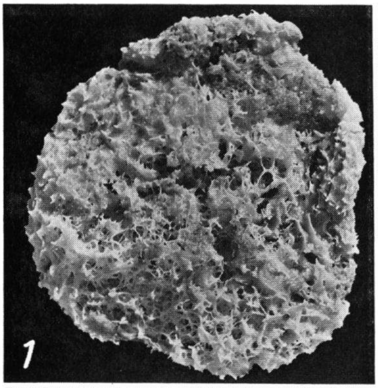
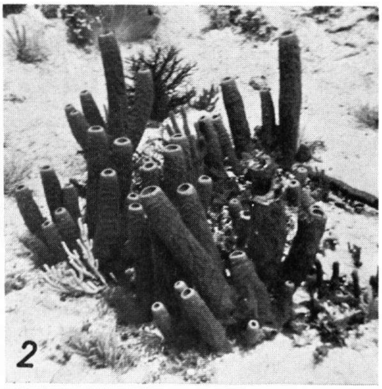

4b

PLATE X

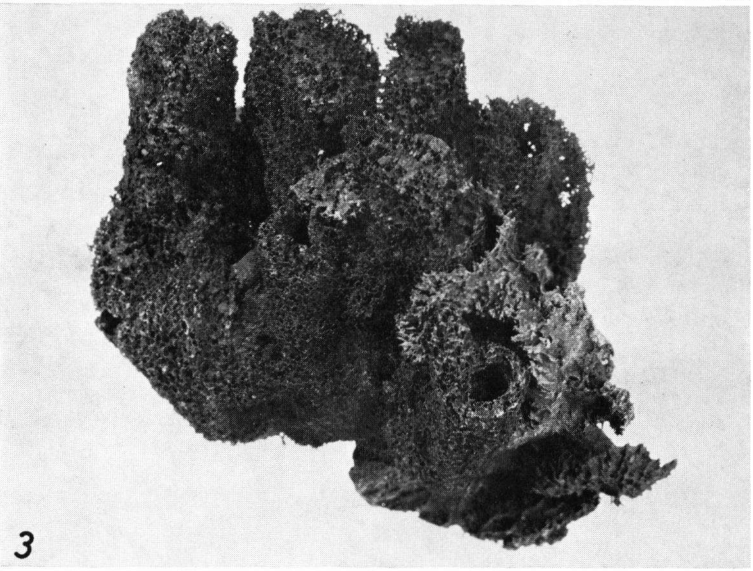
1. *Dysidea etheria* De Laubenfels, 1936, a specimen from Curaçao, ZMA POR. 3951 (× 1).
2. *Aplysina fistularis fistularis* (Pallas, 1766), specimens living on the Curaçao reefs (Photograph E. Westinga).
3. Lectotype of *Luffaria insularis* Duch. & Mich., 1864 (= *Aplysina fistularis insularis*), from St. Thomas, ZMA POR. 1475 (× 4/5).
4. *Aplysina fistularis insularis* (Duch. & Mich.), a specimen from Puerto Rico, ZMA POR. 3326 (× 2/3).



1



2

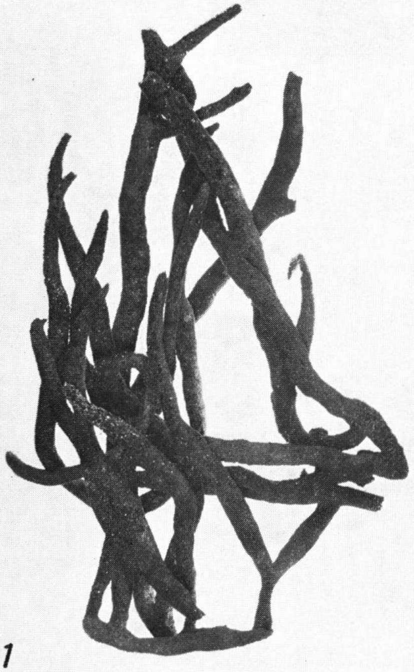


3

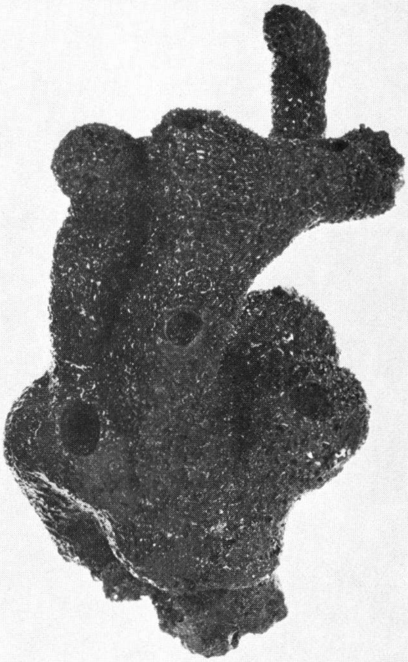
4

PLATE XI

1. Duchassaing & Michelotti – specimen labeled "*Spongia fulva*" (= *Aplysina cauliformis* (Carter)), from ST. THOMAS, ZMA POR. 2085 (× $^{3}/_{20}$).
2. *Aplysina fistularis fulva* (Pallas, 1766), a specimen from PUERTO RICO, ZMA POR. 3326 (× $^{1}/_{2}$).
3. *Aplysina archeri* (Higgin, 1875), specimens from CURAÇAO (× $^{1}/_{10}$).
4. *Aplysina archeri* (Higgin, 1875), a specimen from CURAÇAO (× $^{1}/_{20}$).

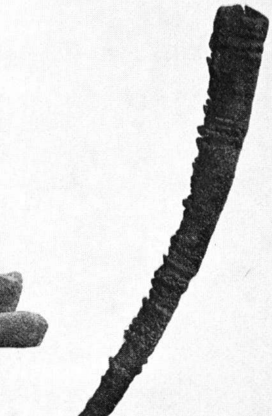


1



2

3

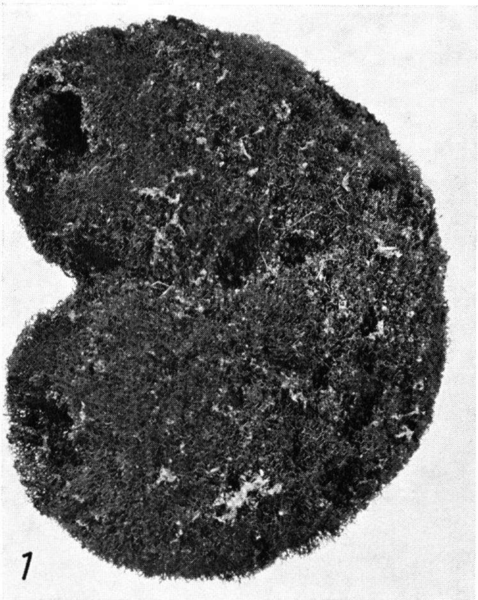


4

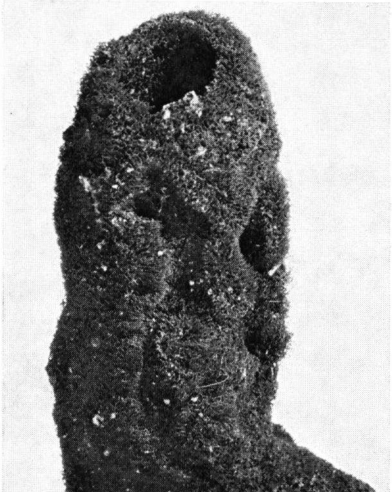
PLATE XII

1. Lectotype of *Luffaria nuciformis* Duch. & Mich., 1864 (= *Aplysina lacunosa* (Lam.)), from ST. THOMAS, ZMA POR. 1476 (× $^5/_6$).
2. A paralectotype of *Luffaria sebae* Duch. & Mich., 1864 (= *Aplysina lacunosa*), from ST. THOMAS, ZMA POR. 1478 (× $^2/_3$).
3. Another paralectotype of *Luffaria sebae* Duch. & Mich., 1864 (= *Aplysina lacunosa*), from ST. THOMAS, ZMA POR. 1479 (× $^1/_2$).
4. *Aplysina lacunosa* (Pallas, 1766), a yellow-coloured specimen from CURAÇAO, ZMA POR. 3580 (× $^1/_3$).

Pl. XII


1

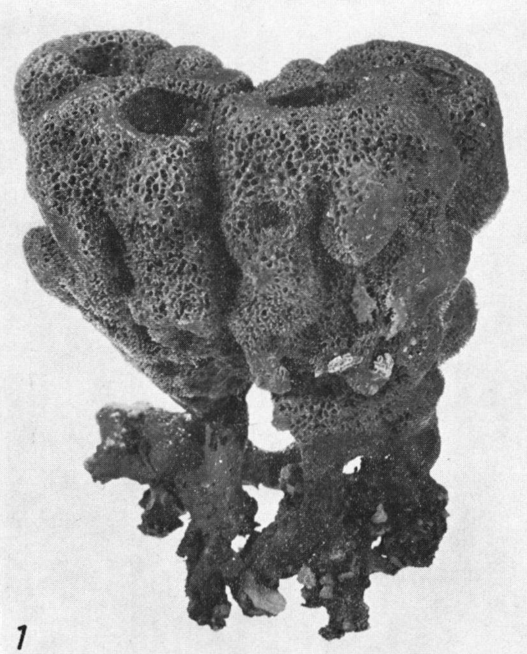

4


3

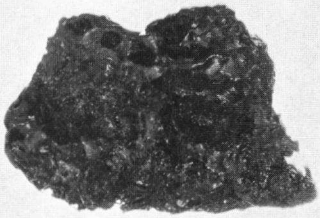

2

PLATE XIII

1. *Aplysina lacunosa* (Pallas, 1766), a pink coloured specimen from PUERTO RICO, ZMA POR. 3349, showing "roots" (× $^1/_2$).
2. *Aplysina cauliformis* (Carter, 1882), a Duch. & Mich. fragment, from ST. THOMAS, ZMA POR. 2291 (× 1).
3. *Aiolochroia crassa* (Hyatt, 1875), a specimen from CURAÇAO, ZMA POR. 4080 (× $^1/_2$).
4. *Verongula rigida* (Esper, 1794), a specimen from CURAÇAO, ZMA POR. 3499 (× 1).

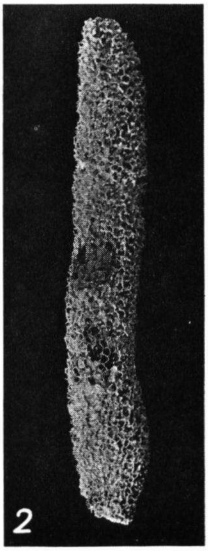


1



4

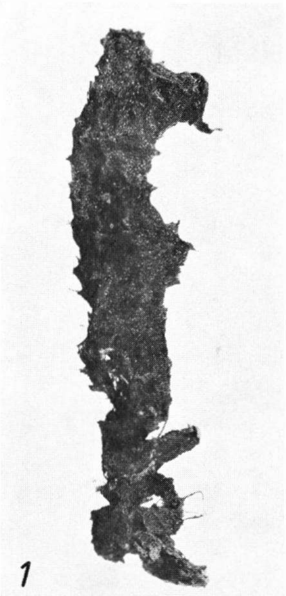
3

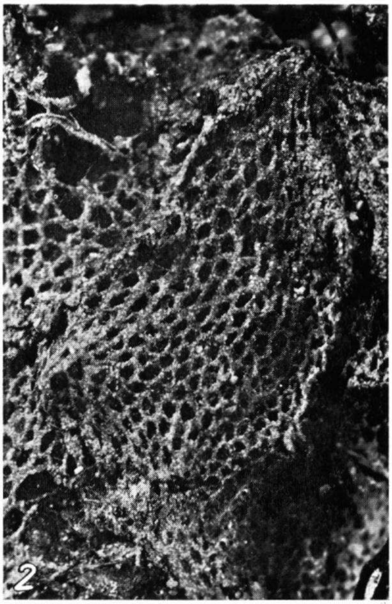


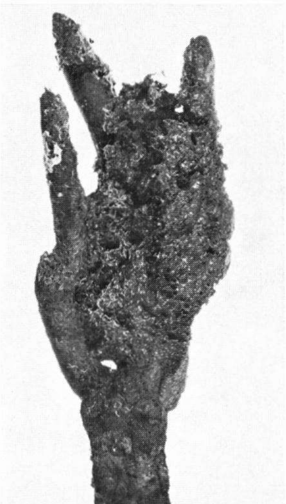
2

PLATE XIV

1. *Chelonaplysilla erecta* Tsurnamal, 1967, a specimen from Curaçao. ZMA POR. 4322 (× 2).
2. *Chelonaplysilla erecta* Tsurnamal, 1967, a detail of dermal membrane (× 15).
3. Holotype of *Pleraplysilla stocki* n. sp. from Puerto Rico, ZMA POR. 3322 (× $^{1}/_{3}$).
4. Holotype of *Pleraplysilla stocki* n. sp., detail of the surface (× 2½).


1


2


3

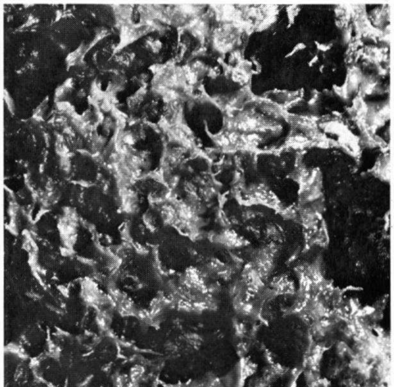
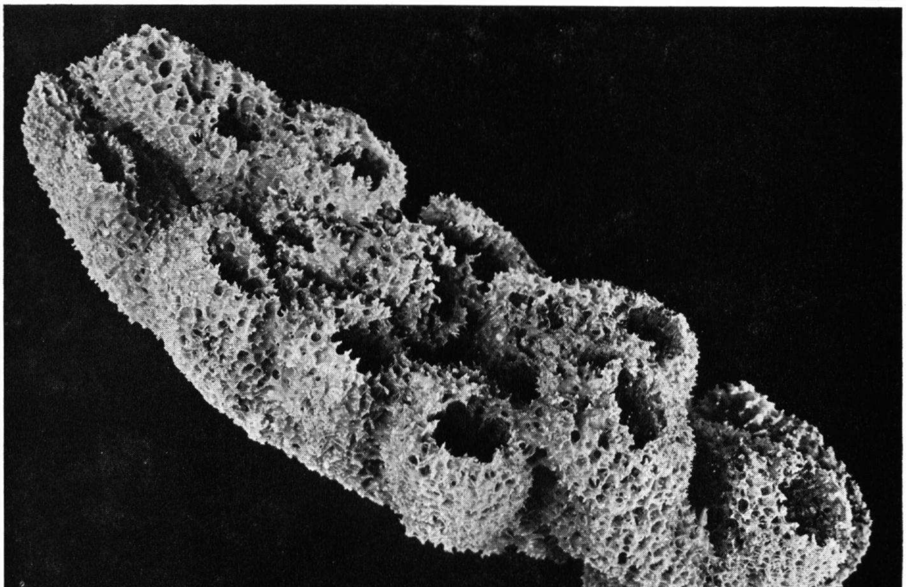

4

PLATE XV

1. Lectotype of *Euryades* (= *Igernella*) *notabilis* Duch. & Mich., 1864, from St. Thomas, ZMA POR. 1044 (× 1).
2. *Igernella notabilis* (Duch. & Mich), a specimen from Curaçao, ZMA POR. 3611 (× $^{2}/_{3}$).


1


2