STUDIES ON THE FAUNA OF CURAÇAO AND OTHER CARIBBEAN ISLANDS, No. 156

SERPULINAE (POLYCHAETA) FROM THE CARIBBEAN: III - THE GENUS PSEUDOVERMILIA

(INCLUDING SPECIES FROM OTHER REGIONS)

by

H. A. TEN HOVE

(Zoölogisch Laboratorium, Utrecht)

In 1969 the author's attention was caught by the variability of some species of the genus *Vermiliopsis, sensu lato,* so extreme, that at the time it was impossible to distinguish the various species. The present review is the third in a series of revisionary studies on the former genus *Vermiliopsis.* The first one dealt with the genus *Metavermilia* Bush (ZIBROWIUS, 1971), the second with the genus *Bathyvermilia* Zibrowius (ZIBROWIUS, 1973a). A study on the genus *Vermiliopsis, sensu stricto,* is in preparation.

The material was collected mainly by dr. P. WAGENAAR HUMMELINCK, when sampling on various islands, in a number of habitats from the tidal zone down to a depth of about 2 m (1930, 1948/49, 1955, 1963/64, 1967); by the "Onderzoekingen Continentaal Plat Suriname Expedities" in 1966 and 1969 (shelf of Surinam, 27–130 m); and by the author in 1970 in the Netherlands Antilles (down to a depth of 46 m). This material, as a rule, was preserved with formaldehyde and after a short period transferred to alcohol. These specimens are deposited for the greater part in the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH) or in the author's collection (tHU). As far as possible, small series have been presented to other museums, which sent material on loan; these are indicated with an exclamation mark in the acknowledgements below.

The author is indebted to Dr. P. WAGENAAR HUMMELINCK (Zoölogisch Laboratorium, Utrecht) for his material, as well as his valuable criticisms, suggestions and stimulation. A grant of the Netherlands Foundation for the Advancement of Tropical Research (WOTRO) enabled the author to collect and study living specimens in the Netherlands Antilles. He wishes to express his thanks for the loan of specimens

to Dr. Julie H. Brock, University of Hawaii, Honolulu; Dr. J. H. Day, University of Cape Town, Rondebosch (UCT); Dr. K. Fauchald and Dr. Dale Straughan, University of Southern California, Allan Hancock Foundation, Los Angeles, (AHF!); Dr. J. D. George, British Museum Natural History, London (BMNH!); Dr. W. D. Hartman, Peabody Museum of Natural History, New Haven (YPM!); Dr. Gesa Hartmann-Schröder, Zoologisches Staatsinstitut, Hamburg (ZMH!); Dr. Pat Hutchings, The Australian Museum, Sydney; Dr. J. B. Kirkegaard, Zoologiske Museum, København (ZMK!); Dr. E. Kirsteuer, American Museum of Natural History, New York (AMNH!); Dr. E. Kritscher, Naturhistorisches Museum, Wien (NHMW); Dr. J. van der Land and Dr. W. Vervoort, Rijksmuseum van Natuurlijke Historie, Leiden (RMNH!); Mr. W. Martindale, Grant Institute of Geology, Edinburgh (GIG); Dr. R. Oleröd, Naturhistoriska Riksmuseet, Stockholm (NRS); Dr. Marian H. Pettibone, United States National Museum, Washington (USNM!); Dr. F. Puylaert, Museum van Midden Afrika, Tervuren (MRAC); Dr. R. Robertson, The Academy of Natural Sciences of Philadelphia (ANSP!);'Dr. F. Rullier, Université Catholique de l'Ouest, Angers (RA); Dr. G. Scheer, Hessisches Landesmuseum, Darmstadt (HLD); Dr. S. van der Spoel, Instituut voor Taxonomische Zoölogie, Amsterdam (ZMA!); Dr. B. A. Vittor, Dauphin Island Sea Lab., Alabama (DISLA!).

In addition to the museums indicated above, some material was sent to the Gray Museum, Duke University, Beaufort; the Zoologisches Museum, Berlin, DDR (ZMB) and the Zoölogisch Museum, Rijksuniversiteit, Utrecht (ZMU). It is possible that part of the material, listed as SME, in the meantime has been transferred to the USNM or Musée Nationale d'Histoire Naturelle (MNHN) in Paris.

Dr. H. Zibrowius, Station marine d'Endoume, Marseille (SME!), not only sent serpulids, but provided valuable information and additional comments. Dr. Eve C. Southward, Marine Biological Association, Plymouth, kindly read part of the manuscript. Dr. Marian H. Pettibone, of the Smithsonian Institution, Washington, helped by her suggestions and critically reading the English text.

Plates I–VIII were executed by Mr. H. van Kooten, Mr. E. van der Vlist and other staff at the Zoölogisch Laboratorium, Rijksuniversiteit, Utrecht. Drawings are by Mr. H. R. Koster (Utrecht) and by the author. Drawings of opercula were made from photographs (contours only) and by using a grid in one ocular of the stereo-microscope and lined paper. Drawings of setae and uncini were made with a camera lucida. Measurements (unless stated otherwise) are given in mm; n stands for number of measurements, for example n = 10 means that 10 specimens were checked, and further checks were in agreement.

LIST OF LOCALITIES

Station numbers of Wagenaar Hummelinck (*1017–1620*) collected in 1930, 1948/49, 1955, 1963/64, 1967, are listed below. More detailed information for the localities sampled in 1930 and 1948/49 may be found in Wagenaar Hummelinck (1953).

Station numbers of ten Hove (*2020–2136*) refer to collections made in the Netherlands Antilles in 1970. Descriptions of localities are to be published in a forthcoming publication on Serpulinae from the Caribbean.

The stations of the "Onderzoekingen Continentaal Plat Suriname Expedities" (O.C.P.S. Exp.) I and II, in 1966 and 1969, were taken by two vessels of the Royal Netherlands Navy: "Snellius" (Sta. *C 3–E 66*) and "Luymes" (Sta. *I 67A–I 122*). More exact localities of the samples, all between 06°13′ to 07°35′ N and 53°48′ to 56°54′ W on the shelf of Surinam, are reported by Vervoort (1967, 1971). Nearly all serpulids were taken from molluscs or ectoprocts. Grab-samples are exactly located on the bottom, while trawl- and dredge-samples cover some distance. Therefore the character of the bottom is given between brackets in the latter case.

The stations of the cruise of "Président Théodore Tissier" (*PTT 167–211*) in the Antilles in 1951, from Bourdillon's collections, are partly reported by Fauvel (1951).

Stations of the cruise of the "Calypso" (*Cal 39–45*), in the Atlantic in 1960, are reported by Bellan (1964), from the Station Marine d'Endoume (SME).

Florida

1413	E of Soldier Key (S of Miami), 0.3 km offshore, 1.5–2.5 m, muddy sand, scattered *Thalassia*, 5.IX.1963.
1414	E of Elliot Key, 3 km offshore, 2–6 m, small coral reef on sand, *Thalassia*, 5.IX.1963.

Puerto Rico

2135	La Parguera, Isla Magueyes, E, 1.X.1970. Glade in mangroves, *Thalassia*-bed muddy sand; 20–30 cm. From between boulders.
2136	8 mi off Isla Matei, near buoy of Marine Institute, 2.X.1970. Horizontal reef, nearly no sand; 60–75 ft. From living corals (*Agaricia*).
2136A	8 mi off Isla Matei, near buoy of Marine Institute, 2.X.1970. Vertical reef with surge-channels, no sand; 95–110 ft. From living corals.

St. Thomas

Cal 39	Botany Bay, 30 m, rocky cliff, on Hydrocorallia, Bryozoa, etc., dive, X.1959 (= SME 1504).

Anguilla

1142	N of Sandy Ground, N coast, up to 1.5 m, rocky beach with sandy reef, 19.VI.1949.

La Fourche (W of Saint-Barthélemy)

1124	Five Island Bay, NE shore, up to 1.5 m, rocky shore, andesite debris, 2.VI.1949.

Sint Eustatius

1116B	S part of Gallows Bay, 1–2 m, rocky beach, andesite, 15.VII.1949.
1119	S of Tumble Down Dick Bay, 0–½ m, rocky andesite shore with magnetite sand, 10.VII.1949.

Guadeloupe

Cal 42f	Basse-Terre, Pigeon, W coast, tidal zone, isolated rock, X.1959 (= SME 1508, Bellan leg.).
Cal 45	Basse-Terre, Goyaves Islands, 20 m, cliff, on corals, dive, X.1959 (SME 1511).
PTT 169	SE off Basse-Terre, 15°58′ N, 61°27.30′ W, 65–70 m, calcareous algae, corals & sponges, dredge, 18.III.1951.

La Désirade

PTT 175	S off La Désirade, 16°14.30′ N, 61°03′ W, 36 m, calcareous algae, corals, etc., dredge, 15.III.1951.

Marie-Galante

PTT 170	Off Saint-Louis, 15°57.7′ N, 61°21.3′ W, 78 m, dredge, 8.III.1951.
PTT 172	N off Pointe du Nord, 16°04′ N, 61°16.30′ W, 30–80 m, corals, dredge, 19.III.1951.

Iles-des-Saintes

PTT 167A	Ilet-à-Cabrit, Bay of Terre de Haut, 2–5 m, sand and corals, 17.III.1951.
PTT 167B	Pain-de-Sucre, about 3 m, sandy bottom, corals, 17.III.1951.

Martinique

PTT 187	NE off Martinique, 15°15′ N, 60°57′ W, 90 m, calcareous algae, dredge, 22.III.1951.
PTT 188	Off St.-Pierre, depth ?, on gastropods, 23.III.1951.
PTT 189	Fort-de-France, bottom of ship in harbour, together with tunicates, sabellids and hydroids, 23.III.1951.
PTT 206	NE off Rocher de la Caravelle, 14°49′ N, 60°51′ W, 58 m, corals & coral fragments, dredge, 1.IV.1951.
PTT 211	Fort-de-France, shipwreck outside harbour, fragments of rock and corals obtained with net, 6/7.IV.1951.

Barbados

1442	½ mi. off Holetown, 100 m, muddy sand, shell debris, sponge bottom, dredge, 19.II.1964.
1443	1 mi. off Holetown, 200 m, muddy sand, shell debris, dredge, 19.II.1964.

TOBAGO

1387	Buccoo Reef, about sea level, reef flat, 16.I.1955.
1388	Red Point, SW of Scarborough, about sea level, rather exposed cliff, volcanic boulders and pebbles, 14.I.1955.

BONAIRE

1068	Lac, Boca, behind reef, 1–2 m, sandy reef with debris, strong wave action, 5 & 9.X.1930.
1068a	Lac, Boca, behind reef, 1–2 m, sandy reef with debris, strong wave action, 1.X.1948.
2112Ge	Santa Barbara (near Hato), 5.VII.1970. Reef with sandy areas; 40–50 ft. From corals.
2117B	250 m N of Witte Pan, 3.VII.1970. Sand-flat below reef; 150 ft. Mainly from sides of boulders in sand, partly above sand.

KLEIN BONAIRE

1049B	At landing, up to 1.5 m, reef debris on sandy beach, 13.IX.1948.
1369	North coast, W, about sea level, rocky beach, sandy reef, 30.III.1955.
1372	SE coast, about sea level, rocky beach with coral shingle, sand, 13.IV. 1955 (Zaneveld leg.).
2105A	N, ½ mi E of Westpunt, 1.VII.1970. Reef, little sand; 115 ft. From corals.
2105B	N, ½ mi E of Westpunt, 1.VII.1970. Basis of reef, little sand; 160 ft. From limestone and corals.
2105C	N, ½ mi E of Westpunt, 1.VII.1970. Below reef, sand-flat, scarce corals; 160 ft. From coral debris in sand.

CURAÇAO

1017	Knip Baai, S side, up to 1.5 m, rocky cliff, 8.I.1949.
1020A	Boca Lagoen, about sea level, rocky beach with small tidal pools, 13.XI.1948.
1020C	Boca Lagoen, S side, 2–3 m, sand, rock debris, 27.XI.1948.
1020D	Boca Lagoen, S side, 0.3–1.5 m, rocky shore, *Porites*, 27.XI.1948.
1023a	Plaja Hoeloe, 0.3–1.5 m, sandy reef, debris, 19.III.1949.
1029A	Piscadera Baai, swimming pool, up to 1.5 m, on fence and piles, 29.I.1949.
1038a	Fuik Baai, Duitse Bad, up to 1.5 m, rock, sandy mud, 17.IV.1949.
1039	Fuik Baai, SE of Newport Bath, up to 1.5 m, rocky shore, muddy sand, *Thalassia*, 20.XI.1948.
1218	Venezuelan Destroyer in Schottegat, 0–4 m, serpulids and balanids on antifouling-paint of 15 months before, 3.III.1955.
1334	Caracas Baai, 10 m or more deep, submarine iron buoy, 9.II.1955.
1334A	Caracas Baai, on chain, about 15 years under water, 22.IV.1955.
1458	Piscadera Baai, Boca, W, 1–1½ m, sandy, 5.I.1964.
1460	Piscadera Baai, Boca, W, about sea level, *Rhizophora*, 14.XII.1963.

1504A	St. Marie Baai, seepage in wall of coral debris between boulders, 22.XII. 1963.
1620	Piscadera Baai, outer bay, 0–1 m, iron and wooden poles, 14.X.1967.
2037B	Playa Kalki, W, 28.V.1970. Reef with small sandy areas; 40–50 ft. From coral debris in sand.
2038B	Playa Kalki, E, 28.V.1970. Limestone with little sand; 5–7 m. From underside of living brain coral.
2049B	Vaarsenbaai, E, 27.IV.1970. Reef with little sand; 50–60 ft. From in and under living corals.
2101A	Savonet, E of Boca Braun, 28.IX.1970. Reef, two small sand-spots; 60–80 ft. From coral debris.

ARUBA

2020	Spaans Lagoen, W, sheet-piling of old bridge, sea-side, 5.VIII.1970. Limestone boulders, *Halimeda*; 30–60 cm.
2025Aa	Pos Chikitu, 13.VIII.1970. Reef with many sandy areas; 60 ft. From limestone and corals.
2035	Gatu, cape near Boca Mahos, 28.VIII.1970. Non calcareous rockpool, 3 m above sea level, regularly inundated; 50 cm. From non calcareous boulders.

SHELF OFF SURINAM (O.C.P.S. Exp.)

C 3	36 m, sandy clay with many Bryozoa, 4.IV.1966.
D 4	48 m, sandy clay with many Bryozoa and dead Mollusca, 5.IV.1966.
F 6	33 m [mud and fine sand, some clay fragments] 12.IV.1966.
G 7	64 m [hard sandy bottom] 13.IV.1966.
C 19B	about 37 m [sand with fine shell fragments] 26.IV.1966.
C 21*	70–63 m, 26.IV.1966.
B 23	99–101 m, rock fragments, 27.IV.1966.
A 27	41 m [sandy mud with clay and shell fragments] 28.IV.1966.
D 30	40–34 m [heavy clay with some mud and fine sand] 3.V.1966.
D 31	39 m [sandy clay with superficial worm tubes and shell fragments] 3.V.1966.
D 32	49.5 m [sandy mud with many shell fragments] 3.V.1966.
F 38	81 m [sand with shell fragments] 5.V.1966.
F 40	58 m [sand with some fine mud and fine shell fragments] 6.V.1966.
F 43	38–37 m [sand with mud at surface, covering blue-black clay] 6.V.1966.
G 56	68–67 m [coarse sand with some mud, shell fragments] Bryozoa, Porifera, 10.V.1966.
H 57	94–97 m [coarse sand] calcareous rock fragment, 11.V.1966.
H 58	66–69 m [coarse sand with some mud and coarse shell fragments] 11.V.1966.
E 66	65 m [coarse sand with shell fragments] 13.V.1966.
I 67A	30 m, dark blue mud, covered by sandy mud, 21.III.1969.
A 68	36 m [coarse sand with many shell fragments] 24.III.1969.
N 79	27 m, coarse sand with many empty shells, Bryozoa, 9.IV.1969.
M 86	42 m [sandy mud with worm tubes] 11.IV.1969.
M 88	46 m, muddy sand with worm tubes, 12.IV.1969.

M 97	130 m [coarse sand with some mud and many shell fragments] 16.IV.1969.
M 98	85 m [coarse sand with reef fragments and many shell fragments] 16.IV.1969.
K 101B	93 m, coral reef, 17.IV.1969.
J 110	46.5 m [grey, soft, muddy sand with shell fragments and Bryozoa] 22.IV.1969.
J 112	89 m [sandy, greyish-green mud with shell fragments] 22.IV.1969.
I 115	81 m, coral reef, 24.IV.1969.
I 119	42 m [grey-greenish sandy mud with many shell fragments] 25.IV.1969.
I 120	36–37.5 m [soft, sandy mud with inclusions of hard clay, small pebbles and Bryozoa] 25.IV.1969.
I 121	32.5–33 m, coral reef and rock fragments, 25.IV.1969.
I 122	33 m, 26.IV.1969.

Genus **Pseudovermilia** Bush, 1907

Type-species: *Spirobranchus occidentalis* McIntosh, 1885, by original designation. Gender: feminine. – Synonym: *Crosslandiella* Monro, 1933, type-species: *C. multispinosa* Monro, 1933, by monotypy. Gender: feminine.

Diagnosis. – Bush, 1907a: "The uncini with about 13 closely appressed teeth, the last one prominent, large and bifid on end. The abdominal setae bent, with long, angular abruptly tapered blades. Thoracic membrane forming a 3-lobed collar only, without lateral and posterior border." This diagnosis is emended by Zibrowius (1970b: 9), and is emended further below.

Tube generally white, not transparent, irregularly sinuous; slowly increasing in diameter and more or less triangular in cross-section; mostly regularly ornamented.

Thoracic segments 7, with 6 uncinigerous. Collar setae limbate and capillary, not differing from other thoracic setae. "*Apomatus*-setae" occurring from setiger 2 or 3 onward. Thoracic uncini saw-shaped, with 9–17 teeth, including anterior gouged tooth. Uncinigerous tori placed in two, nearly parallel rows. Abdominal setae geniculate, with denticulate edge. Abdominal uncini rasp-shaped, with 2–6 rows of teeth, 8–15 teeth when seen in profile, including anterior apparently bifurcate tooth. Posterior abdominal segments with capillary setae and dorsal glandular area.

Operculum consisting of bulbous fleshy part, terminated by a horn-cap, usually with thorn(s); peduncle smooth, without filaments or wings, clearly separated from opercular bulb by constriction. No pseudo-operculum present.

Collar with unpaired medio-ventral flap, and two latero-dorsal flaps continuous with short thoracic membranes, continuing to setiger 2. No tonguelets between ventral and lateral collar flaps. Branchiae in pectiniform arrangement; filaments not united by branchial membrane. Pair of ventral mouth-palps present.

KEY TO PSEUDOVERMILIA

Since the opercula and tubes show extreme intraspecific variability, it will be necessary to use the figures, plates and descriptions for a more certain identification.

1. Operculum black (exceptionally dark brown) 2
1a. Operculum not black. 3

2. Tube white, with longitudinal rows of pits (Pl. VIIIf, g). Operculum usually terminated by arborescent outgrowth, sometimes encircled by branched spines (Pl. IV) . . *P. multispinosa*
2a. Tube white, with longitudinal row(s) of tubercles and/or transverse ridges (Pl. VII). Operculum generally terminated by bent thorn (Pl. I–II), sometimes by a bunch of thorns originating from common base (Pl. III). . . . . *P. occidentalis*

3. Entrance of tube with two conchiform wings. Tube smooth, white (Pl. VIIIe, h, i). Operculum with relatively smooth surface, semi-transparent/opaque, golden to tan coloured (Pl. VIa, d) . . . . *P. conchata*
3a. Entrance of tube otherwise; tube regularly ornamented. . . 4

4. Operculum with smooth surface, transparent, colourless to yellowish (Pl. VIe–h). Tube white, with (or without) transverse ridges, with longitudinal grooves (Pl. VIIIc, d) . . . . *P. holcopleura*
4a. Operculum with outward flanges 5

5. Tube white, with transverse brown bands (exceptionally entirely brownish), heavily ornamented with rows of pits and denticulate keels (Pl. VIIIa, b). Operculum with distinct diabolo-like tiers, (semi-)transparent, yellowish to brownish (Pl. V) . . . . *P. fuscostriata*
5a. Tube white, with three denticulate longitudinal keels. Operculum with obscure diabolo-like tiers, semi-transparent/opaque, yellowish (Pl. VIi) . . . . *P. babylonia*

DISCUSSION

Within the group of *Vermiliopsis*-like genera, ZIBROWIUS (1972: 116; 1973a: 429; 1973b: 47–49) distinguished four genera and a group of aberrant species under [?*Vermiliopsis*]. For the latter group, a fifth genus is herein erected, *Semivermilia* new genus (See Table 1).

Often species of *Neovermilia* Day, 1961, though definitely not *Vermiliopsis*-like by the absence of "*Apomatus*-setae", have been confused with *Vermiliopsis, sensu lato.* Therefore the main differences between the six genera concerned are given in Table 1.

As stated above, and as is apparent from the figures, the opercula of *Pseudovermilia* species show large, but more or less gradual, variations in form. However, three of the species (viz.: *P. occidentalis, multispinosa* and *fuscostriata*) show such gradually varying opercula, as well as a more or less discontinuous phenotype. The latter apparently may be due to lack of material, although this is not likely, since the numbers of specimens studied are about 800, 240 and 150, respectively. At present it is not possible to ascertain the real status of the three forms. Therefore they have been diagnosed briefly in order to facilitate further study.

Not aware of the latest developments towards the use of the variety in zoological literature (MAYR, 1969), the author (1970: 38–39) described for a similar case *Spirobranchus polycerus* var. *augeneri.* A study in the field revealed that this "variety" most probably is an ecophenotype, occurring in the intertidal zone only, while the main form of the species concerned may occur down to a depth of several meters.

In her Catalogue, HARTMAN (1959: 608–609; 1965: 82) lists 24 species of *Vermiliopsis*, most of which are mentioned in Table 1. Not listed, however, are: *V. biformis* Hartman (= *Hyalopomatus*), *V. dubia* (Schmarda) (= *Spirobranchus* or *Pomatoceros*), *V. glacialis* Monro (see below), *V. hawaiiensis* Treadwell (= *Pseudovermilia occidentalis*), *V. nigropileata* (Ehlers) (= *Hyalopomatus*) and *V. notialis* Monro (see below).

All non-mediterranean species of the *V. infundibulum/glandigera* group (see Table 1) are extremely similar and are probably synonymous (in study).

More recently the following new species of *Vermiliopsis, sensu lato*, have been described:
babylonia DAY, 1967: 813, = *Pseudovermilia*, see below;
dewae STRAUGHAN, 1967: 37, as *Calcareopomatus*, = *Neovermilia* fide ZIBROWIUS (pers. comm.);
? *eliasoni* ZIBROWIUS, 1970a: 121, see below;
leptochaeta PILLAI, 1971: 93, = *V. infundibulum/glandigera* group;
minuta STRAUGHAN, 1967: 35 = doubtful, see below;
monodiscus ZIBROWIUS, 1968a: 1202, = *V., sensu stricto;*
pomatostegoides ZIBROWIUS, 1969: 129, = *Semivermilia*, see Table 1;
undulata ZIBROWIUS, 1968b: 134, = synonym of *Semivermilia crenata*, see Table 1.

ZIBROWIUS (1972: 117–120) redescribed some species of COSTA (1861) and DELLE CHIAJE (1822), mentioned by HARTMAN (1959: 593, 595, 598) as *Serpula*, viz.:
crenata, as [*Vermiliopsis*?] = *Semivermilia*, see Table 1
cribrata, as [*Vermiliopsis*?] = *Semivermilia*, synonym: *Josephella carenata* Zibrowius, 1968, see Table 1;
labiata, as *Vermiliopsis*; synonym: *V. richardi* Fauvel, 1908, see Table 1;
torulosa, as [*Vermiliopsis*?] = *Semivermilia*, synonym: *Vermilia rugosa* Langerhans, 1884, see Table 1.

TABL

COMPARISON OF *Pseudovermilia* BUS

including the diagnosis of a ne

	Pseudovermilia Bush, 1907a, emended ZIBROWIUS, 1970b, emended TEN HOVE, this paper. Syn.: *Crosslandiella* Monro, 1933.	*Semivermilia* new genus.	*Bathyvermilia* Zibrowius, 1973a.
Type-species:	*Spirobranchus occidentalis* McIntosh, 1885, by original designation. Gender:feminine.	*Vermiliopsis pomatostegoides* Zibrowius, 1969 herein designed. Gender: feminine.	*Bathyvermilia challengeri* Zibrowius, 1973a, by original designation. Gender: feminine.
Other species:	*P. babylonia* (Day, 1967) *P. conchata* n. sp. *P. fuscostriata* n.sp. *P. holcopleura* n.sp. *P. multispinosa* (Monro, 1933)	*S. agglutinata* (Marenzeller, 1893) *S. crenata* (Costa, 1861; syn.: *V. undulata* Zibrowius, 1968b) *S. cribrata* (Costa, 1861; syn.: *Josephella carenata* Zibrowius, 1968b) *S. torulosa* (delle Chiaje, 1822; syn.: *V. rugosa* (Langerhans, 1884)	*B. langerhansi* (Fauvel, 1909)
Tube:	gradually increasing in diameter, triangular to semicircular in cross-section, usually with regular transverse ornamentation; without flaring peristomes.	gradually increasing in diameter, triangular to subquadrangular in cross-section, otherwise variable; without flaring peristomes.	gradually increasing in diameter, subtriangular to subquadrangular in cross-section, otherwise variable; without flaring peristomes.
Peduncle: a) insertion:	just below and between first and second normal filament.	is second filament (maybe sometimes just below and between first and second normal filament).	is second filament [?] (from literature; doubtful: no material studied).
b) shape:	cylindrical.	cylindrical.	cylindrical.
Arrangement of branchial filaments:	long pectiniform.	short pectiniform.	long pectiniform.
Thoracic membrane:	ending at setiger 2.	ending at setiger 2.	ending at setiger 2.
"*Apomatus*-setae":	present.	present.	present.
Thoracic uncini:	saw-shaped, with gouged/bifurcate anterior tooth.	saw- to rasp-shaped with gouged anterior tooth (Fig. 185-186).	saw-shaped with simple anterior tooth.

ND ASSOCIATED GENERA

enus *Semivermilia.*

Vermiliopsis Saint-Joseph, 1894, *sensu stricto*, Zibrowius, 1970b (incl. *Paravermilia* Bush, 1905).	*Metavermilia* Bush, 1905, emended Zibrowius, 1971.	*Neovermilia* Day, 1961 (incl. *Calcareopomatus* Straughan, 1967).
Vermilia multivaricosa Mörch, 1863, designated by Bush (1905: 223) [syn: ***Vermiliopsis infundibulum*** (Philippi, 1844)]. Gender: feminine.	***Vermilia multicristata*** Philippi, 1844, by original designation. Gender: feminine.	***Neovermilia capensis*** Day, 1961, by original designation. Gender: feminine.
V. infundibulum/glandigera group: ***amblia, annulata, bermudensis, leptochaeta, multiannulata, pluriannulata, pygidialis, torquata*** ***V. labiata*** (Costa, 1861; syn.: ***V. richardi*** Fauvel, 1909) ***V. monodiscus*** Zibrowius, 1968a ***V. striaticeps*** (Grube, 1862; p.p.syn.: ***V. infundibulum, sensu auct.***)	***M. acanthophora*** (Augener, 1914) ***M. annobonensis*** Zibrowius, 1971 ***M. nates*** Zibrowius, 1971 ***M. taenia*** Zibrowius, 1971	***N. falcigera*** (Roule, 1898) ***N. globula*** (Dew, 1959) ***N. sphaeropomatus*** (Benham, 1927) ? ***N. dewae*** (Straughan, 1967)
markedly increasing in diameter, circular to subquadrangular in cross-section, generally with 3–7 smooth longitudinal keels;	gradually increasing in diameter subtriangular to semicircular in cross-section, generally with 2–7 keels;	more or less markedly increasing in diameter, triangular to subcircular in cross-section, otherwise variable;
with flaring peristomes.	without flaring peristomes; sometimes with annular peristomes.	without flaring peristomes.
at base of branchial crown, covering 3–6 normal filaments.	is second filament.	at base of branchial crown, covering 3–4 normal filaments.
cylindrical, wrinkled.	ribbon-like, flat.	subcylindrical, with laterodorsal winglets.
more or less circular.	short pectiniform.	circular with distinct branchial membrane.
ending at setiger 3 or 4.	at least up to setiger 4, sometimes forming "apron".	forming "apron".
present.	present.	absent.
saw-shaped, with simple anterior tooth.	saw-shaped with simple anterior tooth.	saw-shaped with simple anterior tooth.

HARTMAN (1959: 606–607) retained two names under the heading *Vermilia*, whereas all other *Vermilia* species are to be attributed to a weird variety of genera or are indeterminable, viz.:

contorta; this apparently is a misunderstanding of GRUBE's *Serpula contorta* (1850: 340), new name for *Serpula contortuplicata*, *non* L., GRAVENHORST (1831: 46, etc.); judging by the remarks of the latter author, it might be a synonym of *V. "infundibulum"*;

rugosa LANGERHANS (1884: 280), placed in *Vermiliopsis* by ZIBROWIUS (1968b: 132), which is a synonym of *Semivermilia torulosa* (ZIBROWIUS, 1972: 119), see Table 1.

It is not certain if the following species, attributed to *Vermiliopsis*, do belong to this genus:

V. eliasoni Zibrowius and *V. glacialis* Monro: thoracic membranes ending at setiger 2; operculum with calcareous endplate; insertion of peduncle not exactly known.

V. minuta Straughan: apparently composed of two different species, as the tube is far too small for the operculum; single fragmentary specimen studied (Australian Museum).

V. notialis Monro: thoracic membranes ending at setiger 2; peduncle is first filament; only 5 thoracic segments.

V. prampramiana Augener: see ZIBROWIUS (1973b: 49).

Yet unpublished records of the author indicate that at least two species have been confused under *Vermiliopsis infundibulum*, *sensu auct.*, from the Mediterranean and Atlantic. One of them is characterised by some sort of pseudo-operculum, and has longitudinal grooves in the opercular cap; it needs to be redescribed, but it is almost certainly *V. striaticeps* (GRUBE, 1862: 65).

A complete revision of *Vermiliopsis*, *sensu lato*, at present is extremely difficult owing to many unreliable identifications. For instance the specimens identified as *Vermiliopsis*? *pygidialis* (Willey) by HARTMAN (1967: 178), in reality include a species of *Protis*, some large Spirorbinae and perhaps an abdomen of [*Vermiliopsis*?] *notialis*. *Vermiliopsis acanthophora* Augener from Australia is placed in the genus *Metavermilia* (see Table 1 and p. 69). However, the

V. acanthophora, sensu auct., from places other than Australia is a different story: the specimens of DAY (1962: 654; 1967: 814, *not* figures) belong to an undescribed species of *Vermiliopsis, sensu stricto* (unpublished data TEN HOVE); the record of NONATO & LUNA (1970: 100–101) is *Pseudovermilia fuscostriata* (see below); the record of MONRO (1933: 1085) is *P. occidentalis* (see below); the remaining records of *V. acanthophora* nearly all deal with a species of the *V. infundibulum/glandigera* group (unpublished data TEN HOVE). A similar confusion has been clarified by ZIBROWIUS (1973a: 431) for *V. langerhansi, sensu auct.*

Pseudovermilia occidentalis (McIntosh, 1885)

(Fig. 114–123, 144, 145, 155, 156, 159, 161–164, 170–172); Pl. I, II a-e, III, VII)

Spirobranchus occidentalis MCINTOSH, 1885, p. 529–530, pl. 55 fig. 10, pl. 29A fig. 31–32. [Off the Bermudas, 435 fms? – Description; material studied.]

Pseudovermilia occidentalis (McIntosh) BUSH, 1907a, p. 54. [Bermuda. – Name only; mat. stud.]

Pseudovermilia occidentalis: BUSH, 1907b, p. 135–136. [Bermuda. – Descr.; mat. stud.]

Pseudovermilia pileum BUSH, 1907b, p. 136. [Bermuda. – Descr.; mat. stud.]

Pomatostegus [?] *galeatus* FAUVEL, 1909, p. 68–69. [Off Cape Verde Islands, 91 m. – Short descr.; material lost, fide ZIBROWIUS, 1973: 51.]

Pseudovermilia occidentalis: BUSH, 1910, p. 500, fig. 2. [Name and figs. only.]

Pomatostegus galeatus: FAUVEL, 1914, p. 350–351, pl. 30 fig. 12–17. [Same specimen as above, more ext. descr.]

Vermiliopsis acanthophora: MONRO, 1933, p. 1085 (*non* Augener, 1914). [Galapagos. – Name only; mat. stud., see Discussion.]

p.p. *Vermiliopsis bermudensis*: HARTMAN, 1942, p. 90, fig. 154 (*non* Bush, 1907). [See Discussion.]

Vermiliopsis occidentalis (McIntosh) HARTMAN, 1942, p. 90, fig. 156. [Name and fig. of operculum only.]

Vermiliopsis hawaiiensis TREADWELL, 1943, p. 3, fig. 14–15. [Hawaii. – Short descr.; mat. stud., see Discussion.]

Vermiliopsis cornuta RIOJA, 1947, p. 525–526, fig. 14–21. [La Paz (Gulf of California). – Descr.; material not in México, apparently lost.]

Vermiliopsis sp. FAUVEL, 1950, p. 390–391. [Fann, Sénégal. – Descr.; material studied, labelled *Vermiliopsis clavigera*?, Dakar. Anse Bernard, R. Sourie.]

Vermiliopsis sp. SOURIE, 1954, p. 253, 258. [Sénégal. – Name only, same as FAUVEL, 1950.]

p.p. *Vermiliopsis multiannulata* HARTMAN, 1956, p. 300–301 (*non* Moore, 1923). [Hawaii. – Diagnosis of types of *V. hawaiiensis* and *V. torquata*; however, *V. torquata* and *V. multiannulata* do belong to *Vermiliopsis, sensu stricto*.]

"tubes vides" FAUVEL & RULLIER, 1959, p. 196. [Sta. 47, Sao Tomé, Golfe de Guinée. – Material in MNHN; fide ZIBROWIUS, 1973: 50.]

Vermiliopsis cornuta: HARTMAN, 1961, p. 45 [California. – Name in checklist only.]

Vermiliopsis agglutinata: RULLIER, 1964, p. 206 (*non* Marenzeller, 1893). [Iles du Cap Vert. – Material in MNHN; fide ZIBROWIUS, 1973: 50.]

Pomatoceros triqueter: RULLIER, 1964, p. 207 (*non* Linnaeus, 1767). [Iles du Cap Vert. – Material in MNHN; fide ZIBROWIUS, 1973: 50.]

? *Pomatostegus polytrema*: RULLIER, 1964, p. 207 (*non* Philippi, 1844). [Iles du Cap Vert. – Material not located; fide ZIBROWIUS 1973: 51.]

Vermiliopsis cornuta: HARTMAN, 1966b, p. 354, 409. [California. – Name in checklist only, part of material studied.]

? *Vermiliopsis multiannulata*: HARTMAN, 1966c, p. 239 (*non* Moore, 1923). [Hawaii. – Diagn.]

Vermiliopsis occidentalis and *cornuta*: ZIBROWIUS, 1968b, p. 120. [Discussion of relationship.]

p.p. *Vermiliopsis multiannulata*: HARTMAN, 1969, p. 781–782, fig. 1–2 (*non* Moore, 1923). [C. & S. California. – Material, at least partly, studied. See Discussion.]

Vermiliopsis hawaiiensis: STRAUGHAN, 1969, p. 234–235, fig. 2c. [Hawaii. – Diagn.; part of mat. studied.]

not *Vermiliopsis occidentalis*: MCCLOSKEY, 1970, p. 28. [Off Beaufort, N.C. – Name only; see *Metavermilia multicristata*, fide DAY, 1973: 134.]

Pseudovermilia occidentalis: ZIBROWIUS, 1970a, p. 125, fig. 2 a–f. [Banc Joséphine, 36°N, 14°W, 225 m. – Descr., synonymy; mat. Naturhistoriska Museet, Göteborg.]

p.p. *Pseudovermilia occidentalis*: ZIBROWIUS, 1970b, p. 9–11, pl. 2 fig. 1–11, 15–16. [Quintana Roo, Georgia, several localities off the coast of Brasil, Tobago, Banc Joséphine. – Ext. descr.; material studied. The spec. from Sta. 1779 (2) and Sta. 1824 (1), figured in fig. 12, 13 & 14, belong to *P. holcopleura* nov. spec.]

Pseudovermilia occidentalis: ZIBROWIUS, 1971, p. 1374. [Name only, synonymy.]

Pseudovermilia occidentalis: ZIBROWIUS, 1973b, p. 49–51. [Several localities in W. Africa. – Discussion of synonymy; greater part of material studied.]

CALIFORNIA. – ROCKY POINT, n. 2788, 5.X.1941, 50 fms, rocks (1 spec.); DUME CANYON, Sta. 11–58 (1 spec.); SANTA MONICA BAY, Sta. 3542–55, 42–31 fms, sand (1 spec.); off Long Point, SANTA CATALINA ISLAND, Sta. 1426–41 & 2853–54, 21–40 fms, sand, rock (3 spec.). All specimens AHF, under *Vermiliopsis* sp., *V.* (?) *infundibulum*, *V.* cf. *cornuta* and forming part of *V. multiannulata*, O. Hartman det.

GALÁPAGOS. – JAMES ISLAND, James Bay, 5–6 fms., Crossland coll. (2 spec. under *Vermiliopsis acanthophora*, BMNH 1933.7.10.432); "St. George" Pacific Cruise sta. 6, on *Astrangia* sp., Crossland coll. (3 spec., BMNH 1972: 35).

PANAMÁ. – Gulf of Panama, TABOGA Is., 1–2 fms., Crossland coll. (1 juv. spec. on *Crucigera websteri*, BMNH 1933.7.10.444).

BERMUDA. – Off the BERMUDAS, 32°21′ N, 64°35′ W, 435 fms (?), 4.IV.1873, HMS Challenger Sta. 33 (TYPE, BMNH 1885.12.1.421); 13 mi. off Bermuda, 30–32 fms, 23.IV.1873, HMS Challenger Sta. 36, on *Madracis* sp. (3 spec., BMNH 1972: 38); BERMUDA, A. E. Verrill & party coll., W. G. van Name coll.: material identified as *Pseudovermilia pileum* by K. J. Bush, erroneously renamed *Vermiliopsis bermu-*

densis (by Hartman, 1942?), YPM 1403–1405 and as *P. occidentalis* renamed *V. occidentalis* (by Hartman?), YPM 1105 & 1406. Also 1 spec. as *P. occidentalis* AMNH 583 (from YPM 1105) and 1 empty vial as *P. pileum* AMNH 584 (from YPM 1108). 18 specimens in all among which the Type of *P. pileum* and the "material upon which the genus *Pseudovermilia* Bush, 1907 was based" (YPM 1108, 1105, respectively).

Georgia. – Sapelo Island, 31°06′ N, 80°24′ W, 27.II.1961, 20 fms, M. Gray coll., Zibrowius det. (5 spec., USNM 39301); 30°53′ N, 80°29′ W, 18.VII.1958, 34m, J. Teal coll. (2 spec., USNM 46494).

Florida. – Sta. *1413* (1 tube with operculum, RMNH 04478); *1414* (2 spec., tHU 56).

Gulf of Mexico. – 25°33′ N, 84°21′ W, 101 fms, US Coast Survey, Gulf Stream and Gulf of Mexico Explor. "Blake", Agassiz, 1877–78, no. 45 (1 spec., together with type of *Placostegus incomptus* Ehlers, MCZ 811).

México. – Isla Mujeres, Quintana Roo, Smithsonian Bredin Exp., 30.III.1960, Zibrowius det. (1 spec., USNM 39303).

Honduras. – North coast of Honduras, just south of Isla Roatan, 132 ft, on *Phyllangia americana* (dry tubes, SME).

Bahamas. – Grand Bahama, Freeport, Hydrolab, 50 ft., on coral, 28.I.1974, B. A. Vittor coll. (2 spec.).

Jamaica. – Discovery Bay, 300 ft., growing with *Stromatospongia vermicola* Hartman, 14.X.1965, P. & R. Chapman coll. (2 spec., YPM 2824).

Puerto Rico. – Roosevelt Roads, pier, biofouling test panels, U.S. N. Oceanogr. Office (4 spec., Zibrowius det., SME); Sta. *2135* (50 spec., RMNH 04485); *2136, 2136A* (40 spec., tHU 138, 2 spec., empty tubes, Gray Museum).

St. Thomas. – Cal. *39* (1 spec., SME).

Anguilla. – Sta. *1142* (1 spec., tHU 114).

La Fourche. – Sta. *1124* (1 spec., tHU 57).

St. Eustatius. – Sta. *1119* (2 spec., ZMA); *1116B* (9 spec., tHU 55).

Guadeloupe. – Cal. *45* (12 spec., SME); Cal. *42f* (tubes, SME); PTT *169* (3 spec., SME).

La Désirade. – PTT *175* (3 spec., SME).

Marie-Galante. – PTT *172* (9 spec., SME).

Iles-des-Saintes. – PTT *167B* (1 doubtful spec., SME).

Dominica. – N. end of Prince Rupert Bay, Sta. 65–56, coral encrusted rocks in 5 ft., D.V. Nicholson coll., 28.III.1956, Zibrowius det. (2 spec., USNM 43243).

Martinique. – PTT *187* (1 spec., USNM 51503); PTT *206* (16 spec., SME); PTT *188* (3 spec., SME); PTT *211, 189* (8 spec., USNM 51504, SME).

Barbados. – Sta. *1442* (1 spec., MCZ); *1443* (20 spec., tHU 62); 1 km off Holetown, submerged bank reef, about 12–25 m, W. Martindale coll. (2 tubes, GIG).

Tobago. – Man of War Bay, Sta. 20–59, 6–11 fms, W. Schmidt coll., 8.IV.1959, Zibrowius det. (1 spec., USNM 39302); *1387* (4 spec., DISLA); *1388* (3 spec., tHU 58). Little Tobago, Landing, 18.I.1955, Hummelinck coll. (1 spec., RMNH 04477).

Margarita. – 25 mi. N. off Margarita, dredge, 20 fms, 9.XII.1954, Teun Blok coll. (1 spec., tHU 54).

Bonaire. – Sta. *1054* (1 spec., RMNH 04481); *1068, 1068a* (3 spec., YPM, tHU 60); *2112Ge* (11 spec., SME); *2117B* (1 spec., tHU 144); Slagbaai, side of reef, 42–47 m, 10.XII.1953, Georg Scheer coll., Xarifa Exp. 1953/54, Sta. XI-57-10 (1 spec., HLD).

Klein Bonaire. – Sta. *1049B* (3 spec., tHU 59); 1369 (20 spec., YPM); *1372* (1 spec., tubes, RMNH 04480); *2105A, B, C* (6 spec., RMNH 04479, ZMB 10676, tHU 143).
Curaçao. – Sta. *1017* (2 spec., ZMU); *1020A, C, D* (4 spec., RMNH 04482, ANSP, ZMA); *1023a* (2 spec., RMNH 04483); *1029A, 1458, 1460, 1620* (22 spec., ZMU, ZMH, BMNH 1972.91, AHF); *1038a, 1039* (6 spec., BMNH 1972.91, 7 spec., AMNH); *1218* (5 spec., ANSP); *1334, 1334A* (18 spec., tHU 61); *1504A* (5 spec., tubes, USNM 51493); *2037B, 2038B* (10 spec., tHU 140, 13 spec., RMNH 04484); *2049B* (13 spec., tHU 141); *2101A* (11 spec., tHU 142); Caracas Baai, from coral, 7.IV., 23.IV & 13.V.1920, van der Horst coll. (5 spec. on tubes of *Vermiliopsis annulata* and on *Diploria*, ZMA V.Pol.1470, 1175, ZMH V.10371); Spaansche Water, on bivalves, 18.V.1920, v.d. Horst coll. (10 spec., ZMA V.Pol.1366).
Aruba. – *2025Aa* (5 spec., tHU 139); *2035* (3 spec., ZMK).
Suriname. – Continental shelf, OCPS I Exp.: *C 3* (empty tubes); *D 4* (tubes); *F 6* (tubes); *G 7* (10 spec., many tubes with opercula); *C 19*^{B} (3 spec., many tubes); *C 21** (1 spec., tube); *B 23* (10 spec.); *A 27* (3 spec., tubes); *D 30* (5 spec.); *D 31* (5 spec., tubes); *D 32* (4 spec., tubes); *F 38* (tubes); *F 40* (2 spec., tubes); *F 43* (7 spec., tubes); *G 56* (4 spec., many tubes, some with opercula); *H 57* (35 spec.); *H 58* (2 spec., tube); *E 66* (tubes); OCPS II Exp.: *I 67*^{A} (tubes); *A 68* (30 spec., tubes); *N 79* (14 spec.); *M 86* (7 spec., tube); *M 88* (3 spec.); *M 97* (135 spec.); *M 98* (4 spec., tube); *K 101*^{B} (3 spec., tubes); *J 110* (100 spec.); *J 112* (tubes); *I 115* (12 spec.); *I 119* (14 spec., tubes); *I 120* (20 spec., maybe more); *I 121* (many tubes); *I 122* (tubes). All RMNH 04432–39, 04441–65, tHU 53.
Brasil. – Coast, various localities, "Calypso" cruise 1960/61. Part of Zibrowius' 1970b material, unfortunately without data about the exact localities (13 spec., tubes, SME); ? off São Sebastião, 24°53.5′ S, 44°38.1′ W, on living *Cladocora debilis* M. Edw. & Haime (Zibrowius det.), 250 m (1 spec. in tube; since 250 m is unusual for living *Cl. debilis*, this locality may be due to label error fide Zibrowius, pers. comm.).
? Azores. – Off Flores, 39°23.6′ N, 31°19.2′ W, "Jean Charcot" Sta. 114, 720 m, roche (1 ? spec., SME).
?Portugal. – "Thalassa" Sta. Y 403, 426, 427, 40°37′ – 41°22′ N, 9°10′ – 20′ W, 400–620 m, Zibrowius det. (3 empty tubes, SME, see Discussion).
Josephine Bank. – 36°40.2′ N, 14°17.5′W, "Meteor-Atlant. Kuppenf. 1967, 9c–AT.50, 4.7.67, Agassiz trawl, 235–240 m, auf *Dendrophyllia*" (2 spec., ZMH).
Sénégal. – Dakar, Anse Bernard, Sourie coll. [Sourie, 1954: 253, 258]. Labelled *Vermiliopsis clavigera*?, according to label by Zibrowius Fauvel's 1950 material as *Vermiliopsis* sp., relabelled *P. occidentalis* by Zibrowius (3 spec., tubes, RA 63–26).
Gulf of Guinea. – Annobón, E. side, between San Antonio and San Pedro, on shells (*Arca*) from rocks and boulders, 3–10 m; Tortuga Island, N. side, on oyster, cave, 25 m; "Nizery" Sta. 1 & 3, 18 & 19.I.1971, J. Laborel coll., dives, Zibrowius det. (8 spec., MRAC nrs. 35046/7).
St. Helena. – Dredging down to 10 fms, on coral *Sclerhelia hirtella* (Zibrowius det.), W. H. Turton coll. (1 spec., tube, BMNH ZB 1974.1410); ½ mile NW Horse Pasture Point, on *S. hirtella* (Zibrowius det.), Dana Sta. 79, 24.II.1930, Th. Mortensen coll. (3 spec., tubes, ZMK); "Reine Pokov" Sta. 8, on corals, 100 m (3 tubes, SME); probably St. Helena, on *S. hirtella* (Zibrowius det.) (4 dried spec., tubes, BMNH ZB 1974.1405–9).
Red Sea. – Crossland coll. (2 spec., see Discussion, BMNH 1924.6.13.225–226);

northern part, 26°34′07″ N, 34°14′07″ E, Austrian "Pola" Exp. 1895/98, Sta. 179, 490 m, on syntype of *Dasmosmilia valida* Marenzeller (1 ? tube, NHMW).
HAWAIIAN ISLANDS. – HAWAII, labelled *Vermiliopsis hawaiiensis* Treadwell ("Holotype" and 3 spec., AMNH 3263, 3268); OAHU, Coconut Is., fouling plates, June 1968, Straughan coll., det. as *V. hawaiiensis* (5 spec., tHU 128); Oahu, various localities, shallow, Brock coll., det. as *V. hawaiiensis* (11 spec., tHU 187).

Tube: The tube is white, usually flatly triangular in cross-section; often it has a flattened area of attachment, which may be chambered. There is a median tooth above the mouth of the tube. The most anterior part of the tube may be free from the substrate (Pl. VIId, e). The coarse, sometimes very high, medial keel is flanked at both sides by a smaller keel, usually looking like a string of pearls, which may extend into sinuous transverse ridges, fading towards the sides. Sometimes the lateral keel is replaced by a longitudinal depression, or by two small pearly keels (Pl. VIIa).

In some of the deeper samples, the tube is coiled on itself, while the terminal part is erect and may be helically twisted. This free part of the tube is equilateral in cross-section at the base, its three angles being connected with each other by transverse flatly U-shaped ridges. This part may be followed by a three-lobed peristome, and by a nearly cylindrical tubular part, having a much thinner wall with circular ridges (Pl. VIIg, k).

Although the general form of the tube is fairly constant, the ornamentation may be indistinct or exceptionally absent, leaving a tube like a very small one of *Pomatoceros triqueter* (Linnaeus) (*cf.* Pl. VIIh). Nevertheless the species could be distinguished without difficulties by the tube alone in most of the samples studied (see also Discussion).

Branchiae: Branchial filaments usually number about 8 pairs (3–17; n = 20). The branchiae arise from paired lobes, inserted dorsally, with a pectiniform arrangement. The filaments are shorter towards the distal end of the lobe and are not connected by a branchial membrane (Pl. IIe). There is a pair of filiform mouth-palps at the ventral base of the branchial lobes.

Peduncle: The peduncle is smooth, faintly wrinkled in the dorsoventrally flattened expanded area just below the bulb of the operculum. It is about twice as broad as a normal filament and is clearly separated from the bulb of the operculum by a constriction (Pl. IIe, Fig. 114–118). It is inserted to the left or to the right (20/10, n = 30) at the base of the branchial lobe, just below and between the first and second normal filament. There is no pseudo-operculum on the opposite side.

Operculum: The operculum has a fleshy bulbous part, terminating in a black horn-cap (deep brown in juvenile specimens), usually bearing a bent thorn. This cap, however, is never enclosed by a fleshy layer. The thorn may be well developed, minute or even absent (Pl. I, IIa–e, Fig. 114–119); it is placed eccentrically, somewhat nearer to the dorsal margin of the terminal plate; usually it is bent ventrally.

The terminal plate may look like an inverted saucer or a high dome (Pl. Id, l), a flat coin or a cylinder (Pl. Ib, f). It may also be an oblique (sometimes truncated) cone with 0–7 internal "septa"; in this form the thorn may be especially minute or absent. All types of intermediate forms can be found (see also Discussion).

The diameter of the horn-cap is usually 0.2–0.4 mm (0.11–0.53); its height, including thorn usually 0.2–0.4 mm (0.1–0.6; n = 35, Caribbean material only).

Collar and thoracic membranes: The collar has an entire or sinuate edge, and is divided into three regions: an unpaired medioventral triangular flap (sometimes three-lobed), which may be medially pointed; paired rounded laterodorsal lobes, which are continuous with the thoracic membranes, the latter ending just posterior to the first row of uncini (setiger 2, Pl. IIe). There are no tonguelets between the ventral and lateral lobes as in *Spirobranchus* (cf. TEN HOVE, 1970).

Thorax: The thorax has 7 segments, 6 of which are uncinigerous (Pl. IIe). The small bundles of collar setae contain only few setae of two types (Fig. 144). The following bundles of setae are larger and placed in two, nearly parallel rows. The setae are of three types, as is usual in the genus (Fig. 145). "*Apomatus*-setae" occur from setiger 3 onwards (Caribbean material, n = 18; see also Discussion). The thoracic uncinigerous tori are arranged in two, nearly parallel rows. The uncini have a single row of teeth (13–16), the most anterior tooth gouged, apparently bifurcated (Fig. 162–164).

Abdomen: The number of abdominal segments is usually 30–40 (12–45; n = 10). The anterior two or three segments are apparently without setae or uncini. The following segments have very few uncini (about 5). The number of uncini per row slowly increases in the anterior two-thirds of the abdomen (25–40), then rapidly decreasing towards the pygidium (about 5). The abdominal uncini (Fig. 170–172) are all rasp-shaped, with 3–4 rows of teeth, with about 10 teeth visible in profile, including the anterior one, which is faintly bifurcated (gouged). Abdominal setae are geniculate (Fig. 155, 156, 159), the posterior 7–10 segments having only capillary setae (Fig. 161), and sometimes having a dorsal glandular field.

Size and colour: The length, including operculum, is usually about 6 mm (1.7–10.5); the breadth of the thorax is usually 0.4 mm (0.16–0.64; Caribbean material, n = 10). The branchiae and the operculum make up to one third of the entire length of the animal.

The branchial crown of living animals is rose or red.

VARIATIONS

Special attention should be given to a form differing in operculum. Perhaps it is an ecophenotype limited to the reefs of at least 13 m deep.

BAHAMAS. – GRAND BAHAMA, Freeport, Hydrolab, 50 ft, on coral, 28.I.1974, B. A. Vittor coll. (1 spec.).
BONAIRE. – Sta. *2112Ge* (1 spec., SME); *2117B* (2 spec., tHU 144).
KLEIN BONAIRE. – Sta. *2105C* (2 specimens, tHU 143).
CURAÇAO. – Sta. *2037B* (7 spec., tHU 140); *2049B* (3 spec., tHU 141); *2101A* (4 spec., tHU 142).
ARUBA. – Sta. *2025Aa* (3 spec., tHU 139).

This spinous form is diagnosed as follows: Opercular peduncle inserted as in stem-form, to left (4) or to right (6); it widens gradually towards bulb, expanded area being only two-thirds as wide as bulb. Black terminal plate of operculum may show same variation in height as stem-form (Pl. III, Fig. 120–123). However, instead of one bent thorn, there is a cluster of thorns, resembling that of *Pseudovermilia multispinosa*; but in the latter species, the operculum is partly enclosed in a fleshy layer, and the spines are thicker and more branched (Fig. 124–126). Number of abdominal segments usually about 40 (18–52), of which posterior about 11 segments (5–12) bear capillary setae only.

About 20 of these aberrant specimens were found in sandy areas in the vertical reef and below (40–160 ft), together with about 50 normal specimens. Both forms show the same type of tube: more or less normal, generally with a wide striated area of attachment and with conical teeth forming the median ridge (Pl. VIIb, c).

As "*Apomatus*-setae" occur from setiger 3 onwards (from setiger 2 onwards in *P. multispinosa*), and as the width of the peduncle is only two-thirds of that of the opercular bulb (equal in width in *P. multispinosa*), it seems best to regard these aberrant specimens as a form of *P. occidentalis*.

DISCUSSION

The holotype of *Pseudovermilia occidentalis* (BMNH 1885.12.1.421) from off the Bermudas is in poor condition. The author did not try to study the setae, for fear of causing further damage. Based on the few tube-fragments, the form of the thoracic membranes (up to the first row of uncini), the pectinate arrangement of the branchiae and the form of the operculum it is clearly the same as the material described herein. The horny disc of the operculum is very flat, slightly raised towards the dorsal side, with three eccentric circlets around the small apex. Thus it is not the most common opercular form, but it can still be recognised easily.

The depth of the type locality, that of 895 meters, is doubtful. According to McINTOSH (1885: 529) the tube of the type "was attached to a tube of *Placostegus assimilis*", a really deep water form (ZIBROWIUS, pers. comm.). According to the present study the species is very common in depths down to 200 m, in fact it is one of the most common serpulid species in the Caribbean (unsorted material, tHU). Moreover, MOSELEY (1881: 184) mentions *Cladocora arbuscula*, a typically shallow-water Caribbean coral species, from the same Challenger Sta. 33 (895 m!), as well as from the Cape of

Good Hope. Both coral identifications are confirmed by Zibrowius, and both localities can only be explained by label error (Zibrowius, 1973b: 50).

The author tried in vain to find a clear correlation between the form of the operculum (and the form of the tube) and the geograph-

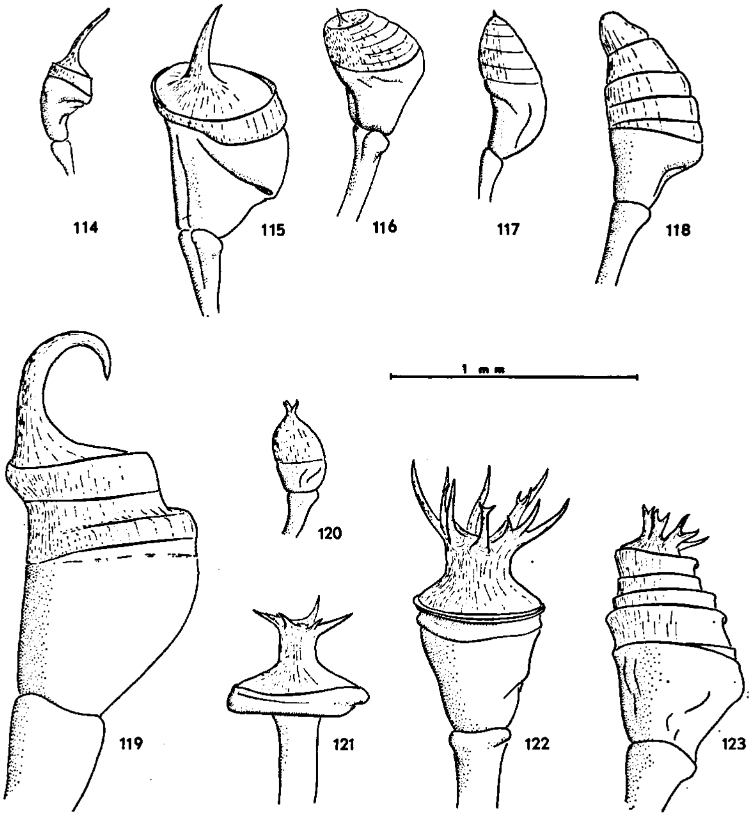


Fig. 114–123. *Pseudovermilia occidentalis*, opercula, in right lateral view. – 114–116, from Barbados (off Holetown, tHU 62); 117–118, from Suriname (*H 57*, *D 31*, RMNH 04433, 04437); 119, from California (Los Angeles, AHF); 120, spiny from from Bonaire (Witte Pan, tHU 144); 121–122, spiny form from Curaçao (Playa Kalki, tHU 140; Savonet, tHU 142); 123, spiny form from Aruba (Pos Chikitu, tHU 139).

ical and bathymetrical distribution. The percentages of occurrence of opercular forms, as illustrated in Pl. Ia–l, are respectively 5.6, 16.2, 0.4, 3.3, 7.7, 6.5, 2.7, 4.9, 9.8, 9.4, 16.2, 16.2 (1.1 otherwise; n = 553). Individual local populations may show considerably differing percentages. For instance, a deep sample off Puerto Rico shows only opercula as figured in Pl. Ig–l (n = 30); a shallow sample from the same island has 13 opercula like Pl. Ia, b, e, 38 like h–l (mainly k). Opercula like Pl. Ih, i are common in Surinam (n = 205) and the deep samples off Puerto Rico and the French Antilles (n = 70), where they form 25% of the entire number (only 5% in the remaining samples, n = 278).

The ratios of the opercula like Pl. Ia–f, to opercula like g–l are roughly 2 : 3 in Surinam (n = 205), 1 : 1 in Aruba, Bonaire and Curaçao (n = 146), 1 : 2 from Puerto Rico to and including Martinique (n = 141) and 3 : 4 in the Bermudas (n = 21).

It is remarkable that opercula from off Sapelo Island, off the Bermudas, off Puerto Rico and off Martinique may be black-brown, while all other opercula are black. Moreover, at least half of the specimens from off Puerto Rico (about 20), most of the material from off the French Antilles and a few specimens from off California (Pl. IIc) showed a dorsal non-horny triangle in the opercular cap, leaving a cap more or less formed like a sou'wester. The remaining specimens are more or less normal in this respect.

Some of the tubes from off Puerto Rico are slightly aberrant, as they are extremely flattened, with indistinct medial keel and very delicately built. These tubes, however, may fade into normal ones, with a toothed medial keel and transverse ridges.

The vial labelled *Vermiliopsis pygidialis* (Willey) (BMNH 1924.6. 13.130), from the Red Sea, identified by PIXELL (1913), contained two worms of the *V. infundibulum/glandigera* group and two tubes much too small for the specimens. Fragmentation of the small tubes revealed two more specimens. The material is diagnosed as follows: tube triangular in cross-section, with high medial keel flanked by sinuous transversal ridges; branchiae with pectiniform arrangement; peduncle inserted just below and between first and second normal filament, to left or to right; operculum is black annular cone (similar to Pl. Il), with tip broken; thoracic membranes ending at setiger 2; "*Apomatus*-setae" from setiger 3 onwards, thoracic uncini with bifurcated anterior tooth. The worms do not differ from *P. occidentalis* from the Caribbean, and therefore they are classified with this species.

The two specimens from the Galápagos, identified by MONRO (1933) as *Vermiliopsis acanthophora* agree in detail with the description of *P. occidentalis* as given above. The opercula are similar to Pl. Ie, f. The thoracic membranes end at setiger 2, whereas in the holotype of *V. acanthophora* Augener (ZMH 8296) these membranes run along the entire thorax and form an apron across the first abdominal segment. The branchiae have a pectinate arrangement in MONRO's specimens, less clearly so in *V. acanthophora*. The peduncle is rounded in the former specimens, flattened in the latter species. The thoracic uncini have a bifurcated tooth in the former, but a simply rounded one in the latter material. It is clear that the two specimens from the Galápagos belong to *P. occidentalis*, while *V. acanthophora* Augener should be placed in the genus *Metavermilia*.

HARTMAN (1942: 90) is mistaken in stating "there is only a single, minute specimen, so labelled [*Pseudovermilia pileum*] in the collections" [of the YPM]. There are 12 specimens now labelled *Vermiliopsis bermudensis*, but with older labels *Pseudovermilia pileum*. They agree in detail with *P. occidentalis*, including form of tube, form and colour of the operculum, thoracic membranes ending at setiger 2, pectinate arrangement of branchiae and with an operculum like Pl. Ik, l. The type and other specimens of *Paravermilia bermudensis* BUSH, 1907a are larger, with a transparent brown operculum, and with thoracic membranes ending at setiger 5; they belong to *Vermiliopsis s.str.* It is evident that HARTMAN wrongly synonymized *P. pileum* with *Paravermilia bermudensis* on the vague resemblance of the opercula only.

The vial with the holotype of *Vermiliopsis hawaiiensis* Treadwell, 1943 (AMNH 3263) contains two loose opercula and a damaged worm; the smaller operculum apparently belonging to this specimen. These two opercula, as well as those of most of the remaining material from Hawaii, have a general resemblance to the one figured in Pl. Il, but are larger and may be truncated, sometimes bearing a single distal spine (Pl. IIa). Further differences from the operculum of *P. multispinosa* of the form *inarmata* are that the horny opercular lid of the latter is enclosed by a fleshy layer, which is not so in *V. hawaiiensis*; the dilation of the peduncle is half to two-thirds of the width of the bulb, while it is equal in width the form *inarmata*. *V. hawaiiensis* has "*Apomatus*-setae" from setiger 2 or 3 onwards. The thoracic uncini have a single row of teeth (about 20), the most anterior one gouged. Abdominal uncini are rasp-shaped, with at least 4 rows of teeth, about 12 when seen in profile. The thoracic membranes end at setiger 2. The branchiae have a pectinate arrangement. The "four-lobed collar" (TREADWELL, 1943: 3) is due to injury, as is shown by more material. The tube is "relatively heavy with prominent longitudinal ridges" (AMNH 3268) and exactly like Pl. VIIa. Thus it is clear that *V. hawaiiensis* belongs to *Pseudovermilia occidentalis*, and not to *V. multiannulata*, as stated by HARTMAN (1956: 301); the type material of the latter "species" belongs to two entirely different species, see below.

As regards the Californian material, MOORE (1923: 251–253) based his description of *Metavermilia multiannulata* upon the type (USNM 17399), which is a species of the *Vermiliopsis infundibulum/glandigera* group. However, his 4 cotypes (ANSP 3303) belong to *Pseudovermilia conchata*. Thus *Protula arafurensis* TREADWELL (1906: 1179; USNM 5493) is correctly listed as a synonym of *V. multiannulata* by HARTMAN (1969: 781), but the greater part of her *V. multiannulata* (and *V.? cornuta*, HARTMAN 1961, 1966b and 1969; AHF) belongs to *Pseudovermilia occidentalis* or *P. conchata* nov. spec. (see also ZIBROWIUS 1971: 1374). The specimens belonging to *P. occidentalis* differ from the Caribbean material in the following respects. Tube: with very faint transverse ridges, if ridged at all; orifice of one tube with two lateral "ears", similar to that of *P. conchata* and *Pseudochitinopoma occidentalis* (Bush, 1905); "ears" medially notched (Pl. VIIi, j). Peduncle: about 3 times as broad as normal filament, expanded area below opercular bulb being two-thirds the size of bulb. Operculum (Pl. IIc, d, Fig. 119): all 6 opercula with high black horny cap, terminated by a hooked thorn, with diameter of 0.6–0.8 and height of 0.9–1.3 mm. Thorax: "*Apomatus*-setae" occurring from setiger 2 onwards. Abdomen: number of abdominal segments 54–83. The length of the animals is 17–20 mm.

RULLIER's (1964: 206) description of *Vermiliopsis agglutinata* (*nec* Marenzeller) and his figure of ? *Pomatostegus polytrema* (*nec* Philippi) from Iles du Cap Vert indicate a synonymy with *P. occidentalis*. ZIBROWIUS (1973b: 50) checked part of the material and confirms this synonymy, as well as that of *Pomatoceros triqueter* (*nec* Linnaeus) RULLIER (1964: 207). Eastern Atlantic material studied by the present author contains FAUVEL's 1950 material, and new records from Annobón and Josephine Bank (Pl. IIb). The tubes from Annobón and Sénégal may have two pairs of lateral pearly keels, while the sinuous transverse ridges may cross the medial keel (Pl. VIIf). Specimens from Puerto Rico and Hawaii may show the same ridges.

The two specimens from Josephine Bank have completely atypical tubes, which look exactly like tubes of *Pomatoceros triqueter* (L.). The oldest part of the tube shows a faint lateral depression and some transverse striations. The tube of the specimen from the Azores is also aberrantly formed: extremely flattened, coiled, with pronounced wavy ridges. Two triangular original mouth-teeth are present, as well as two lateral channels in the wall of the tube. Nevertheless the specimens inside are typical *P. occidentalis*, with opercula (Pl. IIa) similar to Pl. If, 1, pectinate branchiae, thoracic membranes ending at setiger 2, thoracic uncini bifurcate, etc.

As for *Vermiliopsis nigropileata, sensu auct.*, this species was described by EHLERS (1900: 222; 1901: 219–222) as *Vermilia* and mentioned by MCINTOSH (1926: 412); it was transferred to *Metavermilia* by BUSH (1905: 176, 220) and later (1907b: 136) to *Pseudovermilia*; the species was referred to *Vermiliopsis* by HARTMAN (1966a: 133; 1967: 178; AHF, material studied) and by RINGUELET (1969: 215). ZIBROWIUS (1970b: 10–11, 1971: 1374) assumed a synonymy with *Pseudovermilia occidentalis*. The two syntypes (NRS 1365) and HARTMAN's 1967 material (AHF), however, showed some details which are not evident from EHLERS' description: 6 setigerous thoracic segments (and not 7, as stated by EHLERS and HARTMAN), 5 of them being uncinigerous; thoracic membranes short (ending at setiger 2); collar setae roughly limbate, but lack special setae; "*Apomatus*-setae" absent although sickle setae are present; thoracic uncini rasp-shaped, with 4–5 rows of teeth, anterior tooth apparently bifurcated; abdominal uncini with 8 rows of teeth. Although the collar-setae are atypical, it seems best to classify these worms with *Hyalopomatus*.

DISTRIBUTION

Hawaii, Southern California, Gulf of California and Galápagos. Tropical and subtropical Atlantic, from Sapelo Island and the Bermudas to Southern Brasil; Azores, Josephine Bank, Cape Verde Islands, St. Helena and Sénégal. Red Sea. – Common from subtidal zone down to 250 meters, rarely and somewhat doubtful below.

Pseudovermilia multispinosa (Monro, 1933)

(Fig. 124–127, 142, 143, 147, 148, 152, 157, 166, 173, 174; Pl. IIf, IV, VIIIf, g)

Crosslandiella multispinosa Monro, 1933, p. 1085–1088, fig. 28A–K. [Gorgona Island, 20 fms. – Description; material studied.]

Pseudovermilia multispinosa (Monro) Zibrowius, 1970b, p. 11–12, pl. 2 fig. 17–23. [Abrolhos Arquipelago, Recife, 30–75 m. – Extensive descr. and discussion; mat. stud.]

Pseudovermilia multispinosa: Zibrowius, 1971, p. 1374. [Name only.]

Gulf of Panamá. – Gorgona Island, dredge, 20 fms, 8.X.1924 (types; 3 specimens and 2 anterior fragments, two of them as var. *inarmata*, BMNH 1933.7.10. 269–272).

Florida. – Fort Lauderdale, biofouling test panels, 30 ft., U.S.N. Oceanogr. Office, J. R. DePalma ref. no. 17 (1 spec., USNM 46478).

Bahamas. – E. of Andros Island, Tongue of the Ocean, 24°54′ N, 77°49′ W, 18 m, U.S.N. Oceanogr. Office, J. R. DePalma ref. no. 21 (1 spec., USNM 51491).

Jamaica. – Discovery Bay, 150–300 ft., growing with *Stromatospongia vermicola* Hartman and with *Ceratoporella nicholsoni* (Hickson), P. & R. Chapman, T. F. Goreau and E. A. Graham coll., 14.X.1965, 25.XII.1964, 24.VII.1966 & 14.VII.1965 (about 35 spec., YPM 2824, 2826, 2825 & 2823); Runaway Bay, 100–120 ft., growing with *Ceratoporella nicholsoni* and *Stromatospongia norae* Hartman, T. F. Goreau coll., 31.III & 4.VII.1965 (8 spec., YPM 2822, 2827).

Puerto Rico. – Sunken reef off La Parguera, 25 m, underside of *Agaricia fragilis*, 5.IV.1968 (1 dry spec., RMNH 04486); Sta. *2136*, *2136A* (3 spec., Gray Museum; 6 spec., tHU 148); biofouling test panels, 50 ft, 18°13–18′ N, 65°26–37′ W, U.S.N. Oceanogr. Office, J. R. DePalma ref. no. 17 (3 spec., USNM 51490).

St. Thomas. – Cal *39* (1 fragment, SME).

Guadeloupe. – PTT *169* (3 spec., 2 opercula in tubes, SME); Cal *45* (3 opercula, SME).

Barbados. – Sta. *1442* (10 spec., tHU 63); 1 km. off Holetown, submerged bank reef, about 12–25 m, mainly on underside of corals, W. Martindale coll. (several tubes, GIG).

Bonaire. – Slagbaai, side of reef, 42–47 m, 10.XII.1953, Dr. Georg Scheer coll.,

Xarifa Exp. 1953/54, Sta. XI-57-10 (1 spec., 1 operculum in tube, tubes, HLD); *2112Ge* (7 spec., DISLA); *2117B* (14 spec., tHU 145).
KLEIN BONAIRE. – Sta. *2105A, B* (4 spec., ZMH; 20 spec., tHU 147).
CURAÇAO. – Sta. *1334* (80 spec., mainly tHU 65/66; also ZMA, ZMU, AMNH, YPM, BMNH 1972.90, USNM 51489, AHF); *1334A* (4 spec., RMNH 04440); *2049B* (4 spec., SME).
ARUBA. – Sta. *2020* (1 spec., tHU 146).
BRASIL. – ABROLHOS ARQUIPELAGO, about 30 m, "Calypso" Sta. SME 1819 (1 spec., SME); off RECIFE, about 75 m, Sta. Mus. 23 (1 operc., SME). Both spec. ZIBROWIUS 1970b, pl. 2 fig. 17, 20.

Tube: The tube (Pl. VIIIf, g) is white, triangular in cross-section, occasionally with a flattened area of attachment. The most anterior part of the tube may be free from the substrate. There is a median tooth above the mouth of the tube. There are 4 (exceptionally 3 or 5) longitudinal rows of circular pits on either side of the coarse, median keel, which consists of hummocks, formed by former median teeth. The most lateral pits are very deep, forming a segmented channel in the lateral walls of the tube; they may fade into or may be followed by a row of transverse slits. Sometimes there are low keels between the rows of pits, the surface of the tube being ornamented as follows: large median keel, 1 row of moderately sized pits, (low keel), 2 rows of small pits close together, (low keel), row of deep large pits and/or transverse slits.

When the anterior part of the tube is free and erect, the lateral transverse slits are sinuous and cross the entire lower surface. In this case, there are three teeth at the mouth of the tube, placed at regular intervals, the original tooth being the larger. Sometimes there are faint peristomes (Pl. VIIIf).

In small specimens all these structures are far less pronounced.

Branchiae: Branchial filaments usually number about 16 pairs (4–22; n = 10). The branchiae arise from paired lobes, inserted dorsally, with a pectiniform arrangement (Pl. IIf). The filaments shorten towards the distal end of the lobe. There is no branchial membrane. The pinnules shorten towards the distal ends of the filaments, which may be devoid of pinnules. There is a pair of filiform mouth-palps at the ventral base of the branchial lobes.

Peduncle: The peduncle is smooth, not wrinkled. It is 2–3 times as broad as a normal filament and is laterally expanded into a pair of elongated cushionlike "wings" near the opercular bulb, from which it is separated by a distinct constriction (Pl. IV, Fig. 124–126). It is inserted to the left or to the right (13/7; n = 20), at the base of the branchial lobe, just below and between the first and second normal filament. There is no pseudo-operculum on the opposite side.

Operculum: The operculum has a fleshy bulbous part and is terminated by a black horn-cap (dark brown in juveniles), which bears an arborescent outgrowth. The fleshy part is usually higher and wider than the horn-cap. The latter may be a slightly convex plate (Pl. IVb), a low cylinder (often of a diabolo-like appearance, Pl. IVd), or even a high annular truncated cone (form inarmata, Pl. IVg). In the latter case, the horny part is higher than the fleshy bulb. This cylinder or cone is enclosed by a thin transparent fleshy layer, ending at the terminal plate.

The terminal outgrowth, though of variable shape, usually has the following form: a stem – situated somewhat eccentrically near the dorsal margin of the terminal plate – with an irregularly branched end, bearing two or three semicircles of spines on the dorsal side. The ventral side of the stem is usually devoid of spines, at the most bearing a few very small ones (Fig. 124–125). The most common form of operculum (30% of the material) is shown on Plate IVc and Fig. 124. The material from Jamaica, however, is not included in this description, see Discussion.

The diameter of the horn-cap is usually 0.5–0.6 mm (0.18–0.85); its height, including outgrowth, usually 0.8–1.2 mm (0.25–1.41; n = 25).

Collar and thoracic membranes: The collar has an entire edge, and is divided into three parts: an unpaired triangular or lanceolate ventral flap, sometimes sharply pointed medially; paired latero-dorsal rounded lobes, which are continuous with the thoracic membranes, the latter ending just posterior to the first row of uncini (setiger 2, Pl. IIf). There are no tonguelets between the ventral and lateral lobes.

Thorax: The thorax has 7 setigerous segments, 6 of which are uncinigerous. The small bundles of collar setae contain only few setae, of two types (Fig. 142, 143). The following bundles of setae are much larger, placed in two, nearly parallel rows, slightly approaching each other posteriorly. The setae are of three types (Fig. 147, 148, 152), as is usual in the genus. "*Apomatus*-setae" occur from setiger 2 onwards (n = 10). Thoracic uncinigerous tori are arranged in two, nearly parallel rows. The uncini have a single row of teeth (16–17), the most anterior tooth gouged (bifurcated, Fig. 166).

Abdomen: The number of abdominal segments is usually 70–80 (28–93; n = 10). There appears to be a short asetigerous region of 3–5 segments anteriorly. The anterior abdominal uncinigerous tori have very few uncini (3–12), their number slowly increasing along the anterior two-thirds of the abdomen (40–70), then rapidly decreasing (to 3–6 uncini) towards the pygidium. Geniculate setae (Fig. 157) appear two or three segments posterior to the uncini. The posterior 8–15 segments have only capillary setae, and may have a dorsal glandular field. In some specimens it has been observed that the change from geniculate to capillary setae is not an abrupt one: in segments 10–13 (starting from the pygidium) both types may be placed alternate. The abdominal uncini are all rasp-shaped, with 3–4 rows of teeth, 9–12 teeth when seen in profile, including the anterior tooth, which is faintly gouged (Fig. 173–174).

Size and colour: The length, including operculum, is generally about 15 mm (3–19); the breadth of the thorax is usually 0.7 mm (0.2–1.1; n = 10). The branchiae and the operculum make up to one half of the entire length of the animal.

The colours of the living animal (taken from notes and a colour-slide of few animals only) vary to some extent. The opercular cap is intensely black, the part which is covered by a fleshy layer greenish. The branchiae and peduncle are white with orange-red transverse bands. The remaining parts of the animal show shades of red and orange.

VARIATIONS

Special attention should be given to a form strikingly differing in operculum.

JAMAICA. – DISCOVERY BAY, 185–190 ft., growing with *Hispidopetra miniana* Hartman, R. Chapman coll., 21.VII.1966 (5 spec., YPM 2828b); RUNAWAY BAY, Pear Tree Bottom, 175 ft., growing on surface of *Hispidopetra miniana*, E. A. Graham coll., 23.VII.1966 (2 spec., YPM 2829).
KLEIN BONAIRE. – Sta. *2105A, B* (3 juveniles, ZMH, 50 spec., tHU 147).
CURAÇAO. – Sta. *1334* (1 spec., SME; 7 spec., tHU 64).

This crowned form is diagnosed as follows: Opercular peduncle inserted as in stem-form, to left (13) or to right (7). However, 3 specimens showed duplicity of opercula. Peduncle gradually widens towards bulb of operculum; but cushionlike "wings" may be not as clear as in stem-form. Width of opercular bulb is larger than height. Terminal black horn-cap low and convex, partially enclosed by fleshy layer; where the latter ends, there is a row of simple spinelets, encircling crown of numerous dichotomously branched slender spines. In centre of both circlets arises a long stem, with short spines basally, smooth distally, terminally divided into three main branches (1 dorsally, 2 lateroventrally at equal angles from each other), more or less dichotomously branched, dorsal one being the shortest (Pl. IVh, Fig. 127).

The specimens from Jamaica have more spines on the base of the central stem, and about halfway of the stem there is a pair of laterodorsal dichotomously branched spines. Moreover, the terminal ramification is more branched than in the remaining material, sometimes with an axial continuation of the stem beyond the ramification.

Based on 5 specimens of this crowned form, it appeared that the tubes might be slightly different from the stem-form: the 4 pairs of rows of pits are of equal size in the former and usually of different size in the latter. Unfortunately this aspect could not be checked in more material, since specimens and tubes already had been separated.

The length of the animals is generally about 14 mm (7–19); the breadth of the cap of the operculum is up to 1.1 mm. The crown of spines is fairly flexible, and may extend beyond the cap. This form has a very typical operculum, but all other characters (including locality and substrate) are the same as in the stem-form. Therefore it seems best to consider it tentatively as a form of *multispinosa*, and not as a separate (sub)species. It might prove to be an ecophenotype.

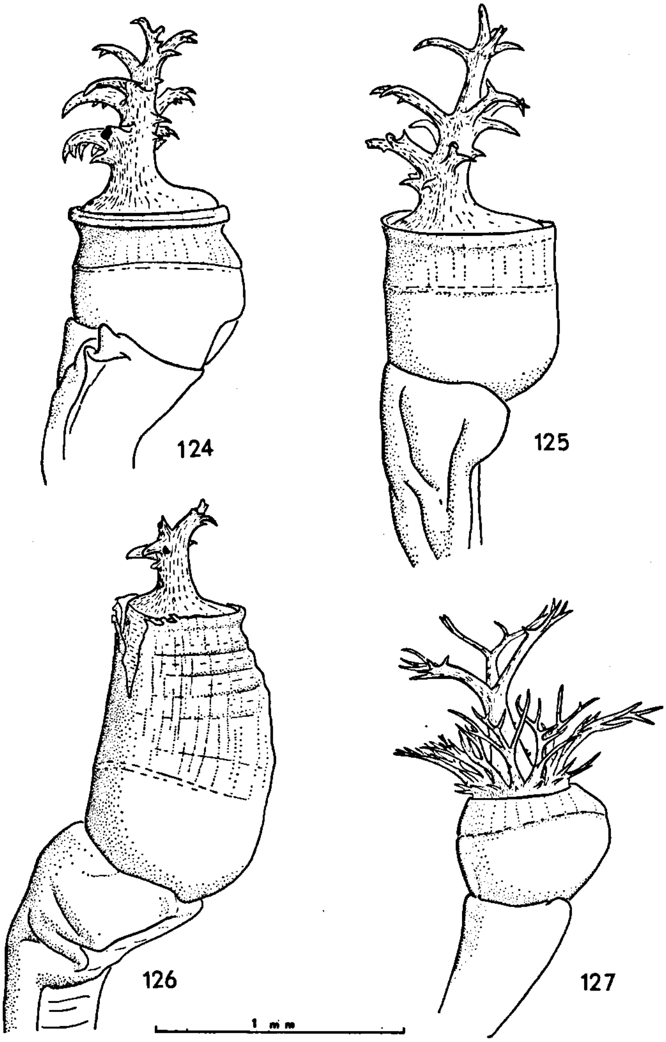


Fig. 124–127. *Pseudovermilia multispinosa*, opercula, in right lateral view. – 124–125, stem-form; 126, form inarmata; 127, crowned form, all from Curaçao (Caracasbaai, tHU 66 & 64).

DISCUSSION

In the type material (BMNH 1933.7.10.269–272) a complete specimen has been designated as LECTOTYPE, an incomplete one as PARALECTOTYPE. Both have an operculum similar to Pl. IVc, d, as found in at least 30% of the present material. A specimen with a damaged operculum and the two specimens of the form inarmata have been left out of the type-series.

In 30% of the specimens, the operculum is terminated by a long black chitinous cone, which is clearly annular and enclosed in a fleshy layer (Pl. IVg). Transverse septa can be seen when damaging this cone. Although most of these opercula have a damaged tip (including the two types) there are some complete ones, showing an irregular bunch of spines (Pl. IVg) or an outgrowth, as in the more common opercula (Fig. 126, *cf* Pl. IVb, c, e). These specimens are very similar to var. ***inarmata***, as described by MONRO (1933: 1087–1088, fig. 29). Since many specimens in the present material form a complete series from low chitinous cap to high annular cone, as illustrated in Pl. IV, it does not seem realistic to consider this form as a distinct taxon, but rather one of the extremes of a continuous variable series.

The material from Jamaica was studied after completion of the manuscript of this paper. All opercula are slightly different from the material, upon which the description above was based. The stem-form shows three types of opercula, diagnosed as follows: terminal black horn-cap higher than fleshy part, of diabolo-like appearance, or extremely high annular cone; terminal outgrowth either with smooth stem terminated by few branched spines (type 1), or with stem entirely covered with short unbranched spines (type 2); in case of an operculum with a high annular cone, the terminal outgrowth is short, ending in a spiny boss (type 3).

HARTMAN (1969: 6, 11) and HARTMAN & GOREAU (1970: 213–215) assume that the association of *Stromatospongia vermicola* with the serpulid (*Pseudovermilia multispinosa*) is obligatory for the sponge, while the association is accidental for *S. norae*. The association is not obligatory with respect to *P. multispinosa*, since this species may occur on other sponges, on the underside of corals and other hard substrates too. However, the 8 samples from Jamaica suggest an interaction between sponge and form of operculum. Type 1 occurred in *Ceratoporella nicholsoni* mainly, types 2 & 3 in *Stromatospongia vermicola* and *S. norae*, while the crowned form (see above) is associated with *Hispidopetra miniana*. The latter form is associated with a sponge in the Netherlands Antilles too. It would be worthwhile to study this problem more in detail.

DISTRIBUTION

Gulf of Panamá (Gorgona Island); Caribbean Sea and W. Atlantic Ocean (Florida to Southern Brasil). – Almost exclusively from 10–100 m.

Pseudovermilia fuscostriata nov. spec.

(Fig. 128, 134, 146, 149, 151, 160, 165, 175; Pl. V, VIIIa, b)

Vermiliopsis acanthophora: NONATO & LUNA, 1970, p. 100–101, fig. 110–111 (*nec* Augener, 1914). [NE Brasil, 21–50 m. – Description.]

FLORIDA. – Sta. *1414* (3 spec., tube fragment, tHU 172); FORT LAUDERDALE, biofouling test panels, 30 ft., U.S.N. Oceanogr. Office, J. R. DePalma ref. no. 18 (1 spec., USNM 51495).
HONDURAS. – North Coast, just S. of ISLA ROATAN, 132 ft. (1 dry spec., SME).
BAHAMAS. – E. of ANDROS ISLAND, Tongue of the Ocean, 24°54′ N, 77°49′ W, biofouling test panels, 18 m, U.S.N. Oceanogr. Office, J. R. DePalma ref. no. 96 (2 dried spec. in tubes, USNM 51500).
JAMAICA. – DISCOVERY BAY, 300 ft., growing with *Stromatospongia vermicola* Hartman, 14.X.1965, P. & R. Chapman coll. (1 tube, YPM 2824); RUNAWAY BAY, Pear Tree Bottom, 175 ft., growing on surface of *Hispidopetra miniana* Hartman, 23.VII.1966, E. A. Graham coll. (1 tube, YPM 2829); S. off ALLIGATOR POND, 17°38.6′ N, 77°26.7′ W, sand, on *Cladocora arbuscula* encrusted with calcareous algae, H.M.S. Vidal coll., 11.IV.1956 (tube fragments, BMNH 1972: 36).
PUERTO RICO. – Sta. *2136*, *2136A* (14 spec., tHU 176; 3 spec., RMNH 04497); VIEQUES SOUND, 18°18.5′ N, 65°26′ W, biofouling test panels, U.S.N. Oceanogr. Office, J. R. DePalma ref. no. 22 (2 spec., tube fragments, USNM 51492, 51501).
GUADELOUPE. – PTT *169* (3 spec., USNM 51498).

LA DÉSIRADE. – PTT *175* (4 spec., tHU 183).
MARIE-GALANTE. – PTT *170* (2 spec., USNM 51502); PTT *172* (1 spec., USNM 51496).
ILES-DES-SAINTES. – PTT *167A* (1 spec., USNM 51499).
MARTINIQUE. – PTT *189* (1 tube, USNM 51494); PTT *206* (1 spec., SME).
BARBADOS. – Sta. *1442* (16 spec., tHU 174). 1 km off Holetown, submerged bank reef, about 12–15 m, mainly in crevices, W. Martindale coll. (3 tubes, GIG).
BONAIRE. – Sta. *1068a* (1 spec., RMNH 04498); *2112Ge* (TYPESERIES + RMNH 04496); *2117B* (6 spec., AHF); KRALENDIJK, pier, 20.VIII.1955, Hummelinck coll. (1 spec., RMNH 04499).
KLEIN BONAIRE. – Sta. *2105B* (4 spec., tHU 175).
CURAÇAO. – Sta. *1029A* (1 spec., RMNH 10702); *1334* (5 spec., ZMH); *2037B*, *2038B* (2 spec., RMNH 10700/1); *2049B* (2 spec., DISLA); *2101A* (15 spec., ZMA).
ARUBA. – Sta. *2025Aa* (5 spec., tHU 173).
SURINAME. – CONTINENTAL SHELF, OCPS I Exp: *G 56* (1 spec.); *H 58* (3 spec.); *E 66* (1 doubtful tube); OCPS II Exp.: *I 67*^{A} (1 tube); *K 101*^{B} (7 tubes). All RMNH 04489, 04491–94.
BRASIL. – FERNANDO DO NORONHA ISLAND, on *Madracis*, coll. "Challenger". 1/9/1873 (2 spec., BMNH 1972: 37).

Holotype: Bonaire, BMNH 1972: 88. – Paratypes 10: 3 BMNH 1972.89, 3 RMNH 04495, 3 USNM 51488, 1 tHU 171.

Tube: The tube (Pl. VIIIa) is white with transverse brown bands (exceptionally entirely light-brown), usually semicircular/triangular in cross-section, with a median tooth above the mouth of the tube. Free anterior tubular parts have not been observed. The coarse medial ridge may have coarse teeth, flanked on both sides by 3 (1–4) small keels, usually provided with slender teeth. Alternating with the keels are rows of circular to oblong pits, the most lateral of which extend as transverse slits. This ornamentation is far less pronounced in small specimens.

Usually the lumen of the tube has a lining of horny material, which may stick to the animal and is very hard to remove.

Branchiae: Branchial filaments usually number about 10 pairs (3–15; n = 10). The branchiae arise from paired lobes, inserted dorsally, and have a pectiniform arrangement. Towards the distal end of the lobe, there are some shorter filaments. There is no branchial membrane. The pinnules shorten towards the distal end of the filaments, which may be devoid of pinnules. There is a pair of filiform mouth-palps at the ventral base of the branchial lobes.

Peduncle: The peduncle is smooth, but may be faintly wrinkled in the slightly expanded area just below the bulb of the operculum. It is about twice as broad as a normal filament, and is separated from the bulb of the operculum by a constriction (Fig. 128–134). It is inserted to the left (n = 20) at the base of the branchial stem, just below and between the first and second normal filament. There is no pseudo-operculum on the opposite side.

Operculum: The operculum has a fleshy bulbous part, terminating in a horny cap, which may show interference colours. The horn-cap is usually longer than the fleshy part and is very variable in shape, though usually composed of 2–6 diabolo-like tiers (Pl. Vf–i), sometimes up to 15 (Pl. Vc, d). The top of the caps of half of the specimens had a more or less developed hook, usually bent ventrally (unfortunately Pl. V suggests a dorsal direction). In the rest of the specimens the top of the cap is formed by a simple hemisphere or it is broken away (Pl. Va–d, Fig. 128–132).

The diameter of the horn-cap is usually 0.3–0.5 mm (0.17–0.67); its height, including hook, usually 0.4–0.8 (0.2–2.0; n = 30).

Collar and thoracic membranes: The collar has a sinuate edge, and is divided into three regions: an unpaired rounded/triangular medioventral flap with several indentations; paired rounded laterodorsal lobes (with sometimes an indentation), which are continuous with the thoracic membranes, the latter ending just posterior to the first row of uncini.

There are no tonguelets between the ventral and lateral lobes.

Thorax: The thorax has 7 segments, 6 of which are uncinigerous. The small bundles of collar setae contain only a few setae of two types; they are marked basally by a small circular gland (brownish in fresh specimens). The following bundles of setae are larger and placed in two, nearly parallel rows. The setae are of three types (Fig. 146, 149, 151), as is usual in the genus. "*Apomatus*-setae" occur from setiger 3 onwards (n = 10). The thoracic uncinigerous tori are arranged in two, nearly parallel rows. The uncini, up to 100 per row, have a single row of teeth (9–11), the most anterior tooth gouged, apparently bifurcated (Fig. 165).

Abdomen: The number of abdominal segments is usually 40–50 (29–54; n = 10). There appears to be a short anterior asetigerous region of 2–3 segments. The following segments have very few uncini (about 9). The number of uncini per row increases along the anterior one-third of the abdomen (30), then slowly decreasing towards the pygidium (last segment with 5 uncini). Geniculate setae appear simultaneously with the uncini.

The posterior 6–13 segments have only capillary setae (Fig. 160), and may have a dorsal glandular field. Some specimens may have the geniculate and capillary setae alternately, or both types may be present in segments 9–11 (starting from the pygidium). All abdominal uncini are rasp-shaped, with 2–4 rows of teeth more anteriorly (Fig. 175) and 4–6 rows posteriorly; with 8–11 teeth visible in profile, including the anterior tooth, which is faintly gouged.

Size and colour: The length, including operculum, is usually 8–12 mm (2.1–15.4; n = 10); the breadth of the thorax is usually about 0.5 mm. The branchiae and operculum make up to one half of the entire length of the animal.

The colour of the living animal (taken from notes on few specimens only) vary to some extent. Most striking are the greenish-brown transverse bands of the tube. The animal itself is predominantly orange, with bright red branchiae and opercular bulb; the branchiae may have vague white bands. At the base of the yellowish horn-cap of the operculum there is a white belt.

VARIATIONS

Special attention should be given to a form differing in operculum and tube.

PUERTO RICO. – Sta. *2136* (2 spec., tHU 176).
GUADELOUPE. – Cal *45* (1 tube, SME 1511); PTT *169* (1 tube, USNM 51498).
MARTINIQUE. – PTT *189* (1 tube, USNM 51494); PTT *206* (4 spec., SME).
BARBADOS. – Sta. *1442* (1 spec., tHU 174).
SURINAME. – CONTINENTAL SHELF, OCPS I Exp.: *B 23* (3 spec., RMNH 04488); *H 57* (10 spec., RMNH 04490, tHU 179).
BRASIL. – Au large de RÉCIFE, "Calypso" 1961–1962 Sta. Mus. 23, 75 m (1 ? tubefragment, SME).

This spinous form is diagnosed as follows: Tube (Pl. VIIIb) white with transverse brown bands or entirely brownish, usually semi-

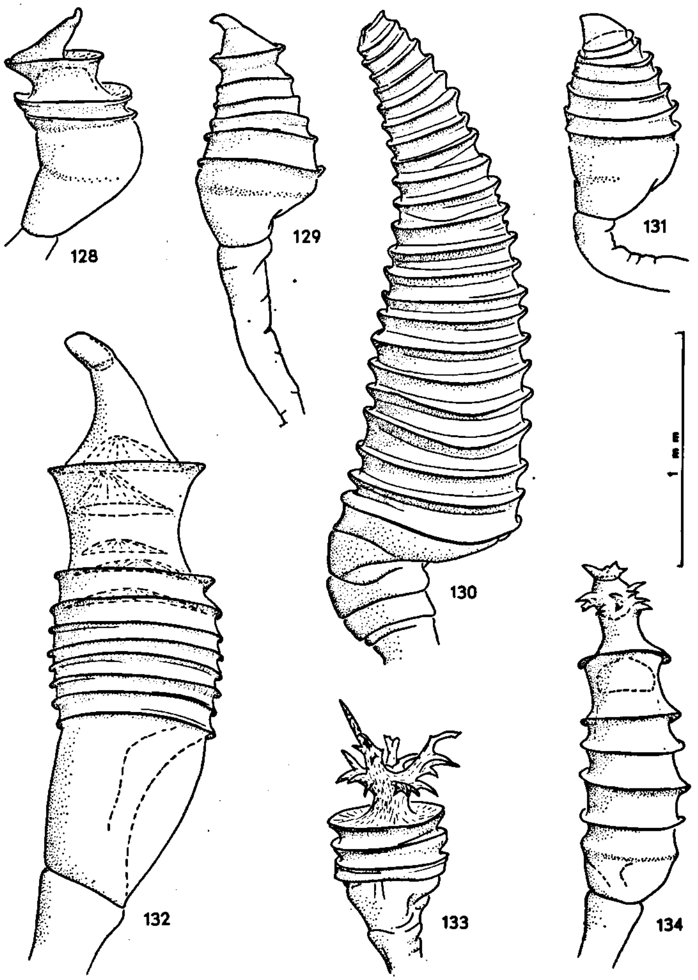


Fig. 128–134. *Pseudovermilia fuscostriata*, opercula, in right lateral view. – 128 & 131, from Aruba (Pos Chikitu, tHU 173); 129, from Barbados (off Holetown, tHU 174); 130 & 132, from Guadeloupe (USNM 51448); 133, spiny form from Suriname (*H 57;* tHU 179); 134, spiny form from Puerto Rico (off Isla Matei, tHU 176).

circular to trapezoidal in cross-section, sometimes showing flattened area of attachment. Teeth and ridges or keels absent, but medial and two lateral longitudinal grooves present. Free anterior tube parts rounded quadrangular in cross-section, with 3-6 longitudinal grooves, and 3–5 rows of circular pits on either side of median longitudinal groove, and 1–2 rows of transverse slits along most lateral part of tube.

Opercular peduncle inserted to left (6) or to right (4). Operculum may show the same variation in number of tiers as stem-form (Fig. 133–134); however, it is yellowish to brown in colour and usually crowned with irregular bunch of spines, arising from common stem (Pl. Vj–l), thus resembling *P. multispinosa.*

"*Apomatus*-setae" occur from setiger 2 or 3 onwards (8/2), thoracic uncini with 14–15 teeth.

Number of abdominal segments usually 45–55 (35–70; n = 7). Abdominal uncini with 12 teeth visible in profile (4–6 rows).

It remains uncertain whether these specimens are only individual variants, or if they have any taxonomic status. It will be noted that many of the characters of this spinous form are intermediate between *P. multispinosa* and *P. fuscostriata.* However, on account of the brown-banded tubes and the transparent operculum, it seems best to regard these specimens as a form of the latter species. It is possible that in reality we are dealing with intermediate hybrids.

DISCUSSION

The tube of *Pseudovermilia fuscostriata* differs from all other known species of the genus by its transverse brown bands. As regards its ornamentation, with longitudinal rows of pits, alternating with keels, the species resembles *P. multispinosa,* although keels are usually absent in the latter; it resembles the tubes of *Pomatoceros minutus* Rioja, 1941 and *Spirobranchus polytrema* (Philippi, 1844), which have coarse and non-dentated keels, fewer rows of pits (up to 3 only) and a pink or white colour (material studied from Shelf of Surinam and Marseille). The operculum of *P. fuscostriata* resembles that of *P. babylonia* (Day, 1967), *Semivermilia pomatostegoides* (Zibrowius, 1969) and *S. crenata* (Costa, 1861), as well as some undescribed Caribbean species of *Semivermilia.* However, it differs from mentioned species in its tube.

Etymology: The name *fuscostriata* has been derived from the Latin *fuscus* = dark (brown) and *striatus* = banded, ribbed, describing the very characteristic brown bands of the tube.

DISTRIBUTION

Caribbean Sea and Western Atlantic Ocean (Florida to S. Brasil). – From subtidal to 100 meters.

Pseudovermilia holcopleura nov. spec.

(Fig. 135–138, 150, 158, 167, 176–184; Pl. VIe–h, VIIIc–d)

p.p. *Pseudovermilia occidentalis*: ZIBROWIUS, 1970b, p. 9–11, pl. 2, fig 12–14. (Brasil. – The three specimens from Sta. 1779 & 1824, discussed on p. 10, belong to *P. holcopleura*, the remaining ones to *P. occidentalis*. – Material studied).

? GUADELOUPE. – PTT *169* (11 spec., SME, tHU 195).
BARBADOS. – Sta. *1442* (20 spec., TYPESERIES + tHU 196); *1443* (17 spec., USNM 51492, AHF).
SURINAME. – CONTINENTAL SHELF, OCPS I Exp.: *B 23* (12 spec., RMNH 10703, tHU 198); OCPS II Exp.: *M 97* (17 spec., RMNH 10704).
BRASIL. – ABROLHOS ARQUIPELAGO, 8–20 m [?], Sta. SME 1824; off SÃO SEBASTIÃO, 120 m, Sta. SME 1779. (Three specimens mentioned by ZIBROWIUS, 1970b, SME).

Holotype: Barbados, BMNH ZB 1974.1401. – Paratypes 10: 3 BMNH ZB 1974.1402–4, 3 RMNH 10705, 3 USNM 51487, 1 tHU 197.

Tube: The tube is white. The attached part of the tube is usually flatly triangular or semicircular in cross-section, the free part rounded trapezoidal. Nearly all tubes have a longitudinal groove (Fig. 178–183) or thin transparent line on both sides (Pl. VIIIc, d); many tubes have a faint medial keel (or groove, Pl. VIIIc). The medial keel may be denticulate, especially in the oldest part of the tube. A small tooth projects over the entrance of the tube; free tubular parts have 3 teeth. The transverse ribs, prominent on tube shown on Pl. VIIIc, d, are generally less pronounced and sometimes even absent. Often the lumen of the tube has a lining of horny material, which may stick to the animal and is very hard to remove.

Branchiae: Branchial filaments usually number 7–8 pairs (4–10; n = 20). The branchiae arise from paired lobes, inserted dorsally, with a pectiniform arrangement. The filaments are shorter towards the distal end of the lobe and are not connected by a branchial membrane (Fig. 184). It was not possible to establish the presence of a pair of filiform mouth-palps with certainty, owing to the small size of the animals, although one specimen apparently had them.

Peduncle: The peduncle is smooth, circular in cross-section, and has an expanded area just below the bulb of the operculum. It is up to twice as broad as a normal filament and is clearly separated from the bulb by a constriction (Fig. 135–138). It is inserted to the left (n = 25) at the base of the branchial lobe, just below and between the first and the second normal filament, covering the first filament completely (seen from dorsal side); thus it appears as if the peduncle is the first filament. There is no pseudo-operculum on the opposite side.

Operculum: The operculum has a fleshy bulbous part, terminating in a transparent yellowish or colourless, often iridescent horn-cap. The opercula of about half of the specimens have a spine on top, generally bent dorsally. The horn-cap may greatly vary in form, from a very flat saucer to a long cone, generally with up to 10 annuli, caused by internal septa in some cases but apparently lacking in others; the surface of the horn-cap is fairly smooth (Pl. VIe–h, Fig. 135–138). The diameter of the horn-cap is usually about 0.38 mm (0.23–0.44); its height, including thorn usually 0.4–0.5 mm (0.20–0.58).

Collar and thoracic membranes: The collar has an entire edge and is divided into three regions: an unpaired subrectangular medioventral flap, usually with medial incision; much larger, rounded triangular paired laterodorsal lobes which are continuous with the thoracic membranes, the latter ending just posterior to the first row of uncini (setiger 2). There are no tonguelets between the ventral and lateral lobes.

Thorax: The thorax has 7 segments, 6 of which are uncinigerous. The small bundles of collar setae contain only few (4–7) setae of two types. The following bundles of setae are larger and placed in two, nearly parallel, rows. The setae (Fig. 150) are of three types, as is usual in the genus. "*Apomatus*-setae" occur from setiger 2 onwards in the types (see also Discussion). The thoracic uncinigerous tori are arranged in two, nearly parallel, rows. The uncini (Fig. 167) have a single row of teeth (10–11, exceptionally 14), the most anterior tooth gouged, apparently bifurcated.

Abdomen: The number of abdominal segments is usually 24–32 (20–40; n = 15). An asetigerous region of 1–2 segments may or may not be present. The number of uncini per row slowly increases in the anterior four-fifths of the abdomen (4–12 anteriorly, 18–25 posteriorly), then decreases again towards the pygidium (4–10). The abdominal uncini (Fig. 176–177) are all rasp-shaped, with 2–6 rows of teeth (mostly 4); about 10–13 teeth are visible in profile, including the anterior one, which is faintly bifurcated (gouged). Abdominal setae are geniculate (Fig. 158). The posterior 0–7 segments have capillary setae only; a posterior abdominal glandular field was not observed, perhaps owing to the small size of the specimens.

Size: The length, including operculum, is usually about 6 mm (4.0–11.0); the breadth of the thorax is usually 0.25 mm (0.23–0.31; n = 10). The branchiae and the operculum make up to one third of the entire length of the animal.

DISCUSSION

Although the types are very homogeneous in appearance, the remaining material is more variable. The opercula of 9 of the types are like Fig. 138, 2 are like Fig. 137. In the entire material the ratio of opercula like Fig. 135, 136, 137 and 138 is 1 : 2 : 1 : 3.

All opercula, however, agree in their smooth surface, unlike those of *P. fuscostriata*, which are very clearly ribbed.

"*Apomatus*-setae" occurring in the types from setiger 2 onwards, may be present from setiger 3 onwards in 3 specimens from Barbados (Sta. *1443*) and Surinam (*M 97*). In this case, sickle-shaped setae are generally present in setiger 2, however without the apical teeth as in "*Apomatus*-setae".

The tube of *Pseudovermilia holcopleura* is fairly homogeneous in the material from Barbados. In that from Guadeloupe and Surinam

(*M 97*), however, the tube may resemble *P. occidentalis* or *fuscostriata*. Some specimens from Surinam (*B 23*) may even have faint pits as in *P. multispinosa*, while others (*M 97*) may have faded browns bands as in *fuscostriata*.

Etymology: *holcos* (Gr.) = furrow, groove; *pleura* (Gr.) = side of body. The name is pertinent to the grooved tube.

DISTRIBUTION

Western Atlantic: ?Guadeloupe and Barbados to Southern Brasil. – Exclusively between 100 and 200 meters, except for two doubtful records (Guadeloupe and Abrolhos Arquipelago).

Pseudovermilia conchata nov. spec.

(Fig. 27, 71–73; Pl. VI a–d, VIII e, h, i)

p.p. *Metavermilia multiannulata* MOORE, 1923, p. 251–253, pl. 18 fig. 48 [S California. – Description; material studied. The holotype (USNM 17399) belongs to *Vermiliopsis* s. str. of the *infundibulum*-group, the remaining specimens (ANSP 3303) are *P. conchata*.]

p.p. *Vermiliopsis multiannulata* (Moore) HARTMAN, 1969, p. 781–782, *not* fig. 1. [C & S California. – Material, at least partly, studied. See Discussion, also *P. occidentalis*.]

CALIFORNIA. – SANTA MONICA CANYON, 11/58, 40 fms (1 spec., PARATYPE); DUME CANYON, 11/58 (8 spec., 2 PARATYPES BMNH, 1974.1440/1, 1 tHU 199); off Long Point, SANTA CATALINA ISLAND, Sta. 1426–41 & 2128–52, 21–40 fms and 42–67 fms, sand, brachiopods (3 spec., PARATYPES AHF Poly 1095, 6 tubes & animal fragment); off SAN NICOLAS ISLAND, "Albatross" Sta. 4420, 32–33 fms, fine gray sand, 12.IV.1904 (4 spec., "cotypes of *Metavermilia multiannula* [sic!] Moore"); off SAN CLEMENTE ISLAND, Sta. 911–39, 60–85 fms, sand, broken shell (2 spec., HOLOTYPE, and 1 PARATYPE USNM 52036). All specimens originally AHF, with the exception of the "Albatross' material, under *Vermiliopsis* sp., *V.* (?) *infundibulum* and *V.* (?) *cornuta* and forming part of *V. multiannulata*, O. Hartman det.

Holotype: California, San Clemente Island, AHF Poly 1094. – Paratypes 8: 4 AHF Poly 1095, 2 BMNH 1974.1440/1, 1 USNM 52036, 1 tHU 199.

Tube: The tube is white, usually equilateral or flatly triangular in cross-section, and very thick walled. At both sides of the coarsely toothed medial ridge (flange), there is a faint longitudinal depression. All 7 tube mouths have the same form, with a projecting medial tooth, and two lateral conchiform wings. In the centre of this structure there is a raised ring around the lumen of the tube, with two lateral teeth (Pl. VIIIe, i). Former conchiform wings may still exist as "peristomes" (Pl. VIIIh). There are no transverse ridges or rows of pits, as in other *Pseudovermilia* species, the tube being smooth.

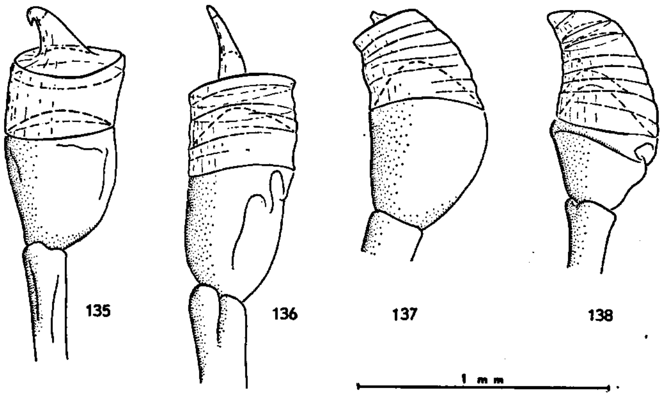
Branchiae: Branchial filaments usually number about 12 (6–14; n = 14). The branchiae arise from paired lobes, inserted dorsally, with a pectiniform arrangement. The filaments are shorter towards the distal end of the lobe and are not connected by a branchial membrane. There is a pair of filiform mouth-palps at the ventral base of the branchial lobes (well preserved in 4 specimens).

Peduncle: The peduncle is smooth, circular in cross-section, with an expanded area just below the bulb of the operculum, clearly separated by a constriction and extending dorsally in a median indentation, giving this part of the peduncle a winged appearance (Fig. 139–141). It is twice as broad as a normal filament, and inserted to the left or to the right (9/8, n = 17) at the base of the branchial lobe, just below the first and second normal filament. There is no pseudo-operculum on the opposite side.

Operculum: The operculum (Pl. VIa–d) has a fleshy bulbous part, terminating in a more or less transparent golden to tan horn-cap; 7 out of the 17 opercula have a spine on top, bent ventrally (Fig. 139–140), the others lack spines (Fig. 141). The horn-cap is at least as large as the bulb, cylindrical to elongate conical, with up to 18 internal septa. The base of the horn-cap may be finely ribbed (Fig. 139, 141).

The diameter of the horn-cap is usually 0.5–0.7 mm (0.33–0.84); its height, including thorn usually 0.7–1.2 mm (0.42–1.4; n = 17).

Collar and thoracic membranes: The collar has an entire edge and is divided into three regions: an unpaired three-lobed medio-ventral flap, with elongated medial lobe; paired much larger, rounded latero-dorsal lobes, which are continuous with the thoracic membranes, the latter ending just posterior to the first row of uncini (setiger 2). There are no tonguelets between ventral and lateral lobes.



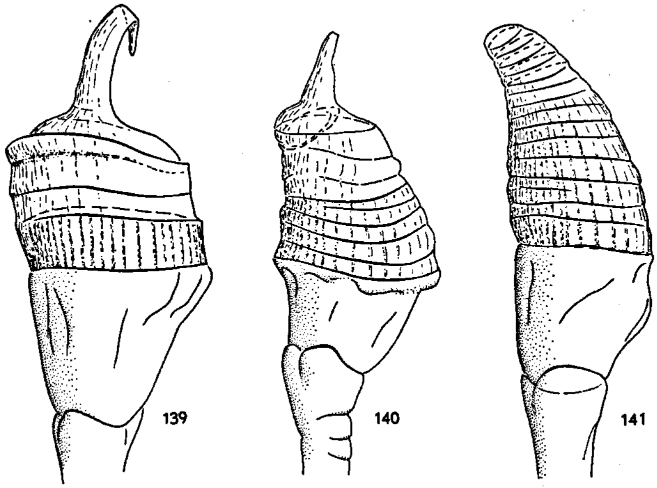


Fig. 135–138. ***Pseudovermilia holcopleura***, opercula in right lateral view. – 135–137, from SURINAME (*M 97*, RMNH 10704); 138, from BARBADOS (off Holetown, USNM 51492).

Fig. 139–141. ***Pseudovermilia conchata***, opercula in right lateral view. – Paratypes from CALIFORNIA (Santa Catalina Island, AHF Poly 1095).

Thorax: The thorax has 7 segments, 6 of which are uncinigerous. The small bundles of collar setae contain only few (4–6) setae of two types. The following bundles of setae are larger and placed in two, nearly parallel rows. The setae are of three types, as is usual in the genus. "*Apomatus*-setae" occur from setiger 2 onwards (n = 12).

The thoracic uncinigerous tori are arranged in two, nearly parallel rows. The uncini (Fig. 168) have a single row of teeth (13–15), the most anterior tooth gouged, apparently bifurcated.

Abdomen: The number of abdominal segments is 70–80 (about 70–100; n = 6). There may be an asetigerous region of up to 6 segments. The number of uncini per row slowly increases in the anterior three fourths of the abdomen (from 5–8 uncini anteriorly to about 45), decreasing again towards the pygidium (3–10).

The abdominal uncini are all rasp-shaped, with 4 rows of teeth (3–6), with about 11–13 teeth visible in profile, including the anterior one, which is faintly bifurcated (gouged). Abdominal setae are geniculate, the posterior 9–11 segments have capillary setae only. There is a dorsal glandular field, covering the last 13–20 segments.

Size: The length, including operculum is usually about 14 mm (12–26; n = 8); the breadth of the thorax is usually about 0.6 mm (0.33–0.90; n = 14). The branchiae and the operculum make up to one fourth of the entire length of the animal.

DISCUSSION

As stated in the discussion of *Pseudovermilia occidentalis*, MOORE (1923: 251–253) confused two different species in the type-material of *Metavermilia multiannulata*: the holotype (USNM 17399) belongs to *Vermiliopsis* s.str.; the tubes containing the remaining specimens (ANSP 3303) belong to *P. conchata*; the worms were taken out of the tubes by the present author and apparently were not examined by MOORE. To avoid nomenclatural difficulties the cotypes of *Metavermilia multiannulata* have been left out of the type-series.

A similar tube mouth, as displayed by *P. conchata*, may occur in the Californian specimens of *P. occidentalis* (Pl. VIIi, j). A comparable one occurs in *Pseudochitinopoma occidentalis* (Bush, 1905); this is annoying for their separation, since both species may occur together; their tubes and opercula also have a superficial resemblance. Furthermore two species of the genus *Semivermilia*, viz. *agglutinata* (Marenzeller, 1893) and a yet undescribed species from Madagascar, shown to me by ZIBROWIUS, may show a similar tube mouth.

Etymology: *concha* (Latin, from Greek) = shell, mussel. The name is pertinent to the tube mouth.

DISTRIBUTION

Southern California. – In 40–150 meters.

Pseudovermilia babylonia (Day, 1967)

(Fig. 153, 154, 169; Pl VIi)

Vermiliopsis pygidialis: DAY ,1961, p. 552 (*nec* Willey, 1905). [False Bay. – Material studied.]
Vermiliopsis babylonia DAY, 1967, p. 813, fig. 38.6.a–f. [Vema Seamount. – Mat. stud.]
Vermiliopsis babylonia: DAY, FIELD & PENRITH, 1970, p. 35 [Name only, same as above.]
p.p. *Pseudovermilia babylonia*: ZIBROWIUS, 1973b, p. 51–52 [The material from Madagascar apparently belongs to a species of the genus *Semivermilia*, see Discussion.]

SOUTH AFRICA. – CAPE, Vema Seamount, 32° S, 10° E, 33–60 m, J. H. Day, coll. (HOLOTYPE and 1 spec. BMNH 1966.26.8–9); Cape, False Bay, 34°22.5′ S, 18°37′ E, 11-9-53, 77–82 m, on rock (2 spec., UCT).

According to DAY, (1967: 813) the holotype is in the British Museum (N.H.) (1966.26.8). The vial, however, contains two specimens, which can be discerned by their operculum: one with "seven successive cylindrical towers" as indicated by DAY for the *holotype*; the operculum of the other specimen has only 5 "towers". As DAY's diagnoses are somewhat incomplete, a short description based on personal observations is given below.

Tube: The tube is white, rounded triangular in cross-section; the side-walls are firmly attached to the substrate; three longitudinal ridges each bear a series of delicate teeth, slanting towards the mouth of the tube. There are transverse ridges between the keels, and between keels and substrate; the latter ridges may have a very small knob in the middle, giving the tube a 5-keeled appearance (material from False Bay).

Branchiae: Branchial filaments number 7 (holotype) to 12 pairs. The branchiae arise from rather short paired lobes, inserted dorsally, with a pectiniform arrangement. They are not connected by a branchial membrane. There is a pair of filiform mouth-palps at the ventral base of the branchial lobes.

Peduncle: The peduncle is smooth, thick and circular in cross-section, with a slightly expanded area just below the bulb of the operculum. It is about two to three times as broad as a normal filament and is separated from the bulb of the operculum by a constriction (Pl. VIi). It is inserted to the left, at the base of the branchial lobe, covering the first 2–3 normal filaments.

Operculum: The operculum has a fleshy bulbous part, terminating in a long yellowish horn-cap. The latter has 4–9 internal septa, sometimes marked on the outside by a small flange. The diameter of the horn-cap is about 1 mm (Pl. VIi).

Collar and thoracic membranes: The collar has a crenulate edge, and is divided into three rounded flaps, the laterodorsal ones are continuous with the thoracic membranes, the latter ending just posterior to the first row of uncini (setiger 2).

Thorax: The thorax has 7 segments, 6 of which are uncinigerous. "*Apomatus*-setae" occur from setiger 3 onwards (Fig. 153–154). The thoracic uncini (Fig. 169) have a single row of teeth; however, directly above the most anterior gouged tooth, there may be one or two transverse rows of 2–3 teeth. There are about 13 teeth visible in profile. Thoracic uncini from the first row do not differ essentially from those in the last row.

Abdomen: The number of abdominal segments is 30–60. Abdominal uncini are rasp-shaped, with 3 (anteriorly) to 6 (posteriorly) rows of teeth, with about 10–11 teeth visible in profile. Abdominal setae are of the usual geniculate type. Although all setae in the most posterior segments are broken, they apparently were of the capillary type. There may be a dorsal glandular field.

Size: The length, including operculum, is up to 13 mm, the breadth of the thorax is about 1 mm.

DISCUSSION

Most of the characters of *P. babylonia* justify its place in the genus *Pseudovermilia*. However, the form of the thoracic uncini and the

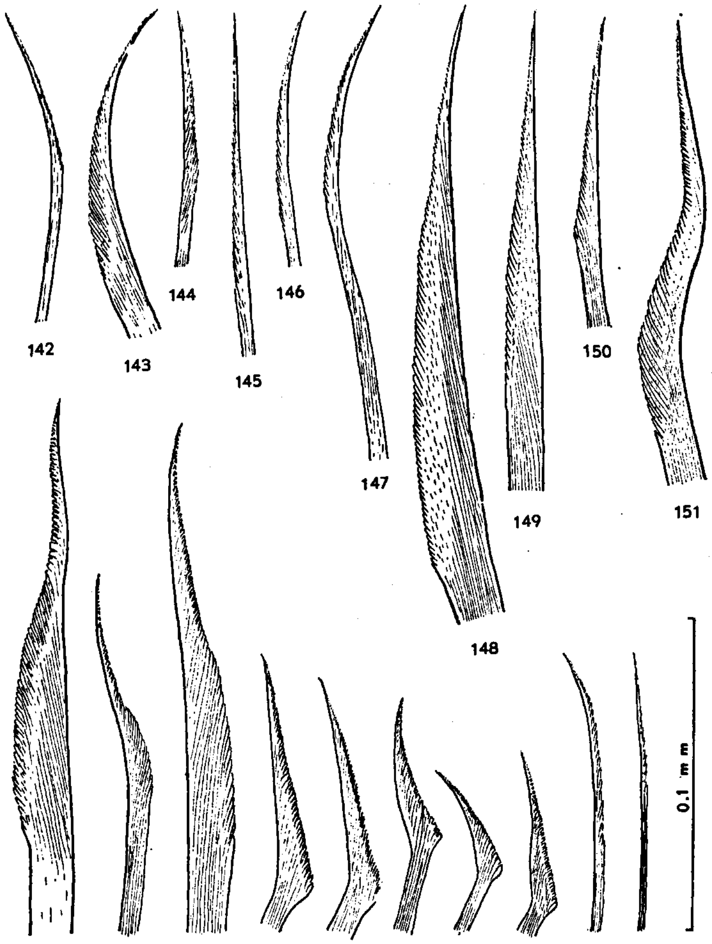
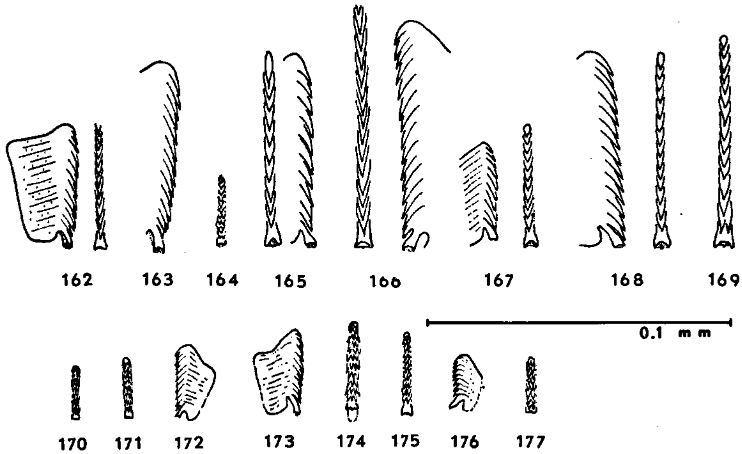
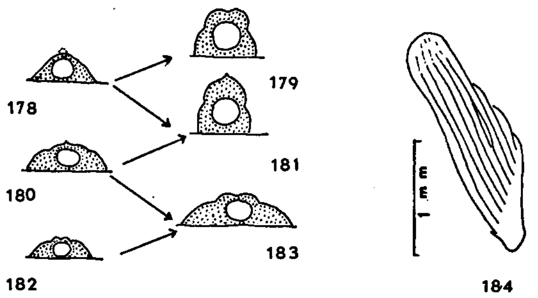


Fig. 142–161. *Pseudovermilia* spp., setae. – *P. multispinosa* from CURAÇAO (Caracasbaai, tHU 66): 142–143, 147–148, 152 & 157. – *P. occidentalis* from BARBADOS (off Holetown, tHU 62): 144–145; spiny form from CURAÇAO (Playa Kalki, tHU 140; Savonet, tHU 142): 155–156, 159 & 161. – *P. fuscostriata* from BONAIRE (Santa Barbara, USNM 51488): 146, 149, 151 & 160. – *P. holcopleura* from BARBADOS (off Holetown, USNM 51492): 150 & 158. – *P. babylonia* from SOUTH AFRICA (Vema Seamount, BMNH 1966.26.8): 153; (False Bay, UCT): 154. – 142–144, collar setae (142–143, two types from same specimen; 144, large type from other species); 145–147, capillary thoracic setae from setiger 2, 3 and 2; 148–150, limbate thoracic setae from setiger 2, 7 and 2; 151–154, "*Apomatus*-setae" from setiger 5, 7, ?, 6; 155–159, geniculate abdominal setae; 160–161, capillary abdominal setae.





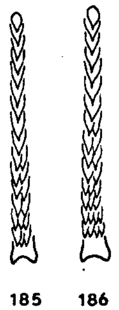


Fig. 162–177. *Pseudovermilia* spp., uncini. – *P. occidentalis* from CURAÇAO (Piscaderabaai, ZMU): 162; from BARBADOS (off Holetown, tHU 62): 163 & 172; from TABOGA ISLAND (BMNH 1933.7.10.444): 164. – *P. multispinosa* from CURAÇAO (Caracasbaai, tHU 66): 166, 173–174. – *P. occidentalis*, spiny form, from CURAÇAO (Savonet, tHU 142): 170–171. – *P. fuscostriata* from BONAIRE (Santa Barbara, USNM 51488): 165 & 175. – *P. holcopleura* from BARBADOS (off Holetown, USNM 51492): 167, 176–177. – *P. conchata* from CALIFORNIA (Santa Catalina Island, AHF Poly 1095): 168. – *P. babylonia* from SOUTH AFRICA (False Bay, UCT): 169. – 162–169, thoracic uncini, various views, from various setigers (164 from juvenile specimen); 170–177, abdominal uncini from anterior (170, 173 & 175), middle (172, 174 & 176), and posterior regions (171 & 177).

Fig. 178–184. *P. holcopleura*. – 178–183, schematic cross-sections through tube (arrows indicating that e.g. cross-sections 178 and 179, or 180 and 181 may occur within the same tube; 184, right half of branchial crown.

Fig. 185–186. *Semivermilia*. – Thoracic uncini from anterior and posterior setigers.

insertion and form of the peduncle are somewhat aberrant. The form of the uncini, especially the most anterior tooth (teeth) in 2–3 rows, reminds one of the genus *Semivermilia*, the insertion of the peduncle of *Vermiliopsis* s.str.

The material from Madagascar reported by ZIBROWIUS (1973b: 52; SME) agrees more or less with the type material in regard to the tube. However, the thoracic uncini are entirely of the type common in the genus *Semivermilia* (see Fig. 185–186, schematic). The insertion of the peduncle is also different from the types; the peduncle is the second filament on the left. The Madagascar specimens (up to 4.3 mm in length; 0.25 mm in breadth) are considerably smaller than the types. Furthermore, it is not very probable that *P. babylonia* from temperate/cold waters of southwest Africa, should occur also in tropical Madagascar, although it is not impossible. More material from both localities and areas in between should be studied to ascertain the variability of *P. babylonia*. For the time being, it is thought unlikely that the material from Madagascar belongs to *P. babylonia*.

DISTRIBUTION

South Africa. – In 33–82 meters.

REFERENCES

AUGENER, H., 1914. Polychaeta II, Sedentaria. In: MICHAELSEN & HARTMEYER. *Die Fauna Südwest-Australiens* *5* (1), 170 pp., 19 figs., 1 pl.

BELLAN, G., 1964. Annélides polychètes. In: Résultats Scientifiques des campagnes de la "Calypso" *6*, 24. Campagne Atlantique 1960. *An. Inst. océanogr.* *41*: 301–314, 1 fig.

BUSH, K. J., 1905. Tubicolous annelids of the tribes Sabellides and Serpulides from the Pacific Ocean. *Harriman Alaska Exp.* *12*, 1904 [publ. 1905?]: 169–355, pl. 21–44.

BUSH, K. J., 1907a. Notes on the relation of two genera of tubicolous annelids, Vermilia Lamarck, 1818 and Pomatoceros Philippi, 1844. *Amer. J. Sci. New Haven* (*4*) *23*: 52–58.

BUSH, K. J., 1907b. Descriptions of the two genera of tubicolous annelids, Paravermilia and Pseudovermilia, with species from Bermuda referable to them. *Amer. J. Sci. New Haven (4) 23*: 131–136, pl. 36.

Bush, K. J., 1910. Description of new serpulids from Bermuda with notes on known forms from adjacent regions. *Proc. Ac. Nat. Sci. Phila. 62*: 490–501, pl. 36.

Day, J. H., 1961. The Polychaete fauna of South Africa. Pt. 6. Sedentary species dredged off Cape coasts with a few new records from the shore. *J. Linn. Soc. London 44*: 463–560, 18 figs.

Day, J. H., 1962. Polychaeta from several localities in the western Indian Ocean. *Proc. Zool. Soc. London 139*: 627–654, 5 figs.

Day, J. H., 1967. *A monograph on the Polychaeta of Southern Africa.* Part *2, Sedentaria.* Brit. Mus. (Nat. Hist.): 459–878, figs.

Day, J. H., 1973. New Polychaeta from Beaufort, with a key to all species recorded from North Carolina. *NOAA Techn. Rep. NMFS CIRC–375*, 140 pp., 18 figs.

Day, J. H. & Field, J. G. & Penrith, M. J., 1970. The benthic fauna and fishes of False Bay, South Africa. *Trans. roy. Soc. S. Afr. 39*: 1–108, 1 fig.

Ehlers, E., 1900. Magellanische Anneliden gesammelt während der schwedischen Expedition nach den Magellansländern. *Nachr. K. Ges. Wiss. Göttingen (Math.) 1900*: 206–223.

Ehlers, E., 1901. *Die Polychaeten des magellanischen und chilenischen Strandes. Ein faunistischer Versuch.* Festschr. 150 j. Bestehens K. Gesells. Wiss. Göttingen, 232 pp., 25 pls.

Fauvel, P., 1909. Deuxième note préliminaire sur les polychètes provenant des campagnes de l'Hirondelle et de la Princesse-Alice, ou déposées dans le Musée Océanographique de Monaco. *Bull. Inst. océanogr. Monaco 142*: 1–76, 7 figs.

Fauvel, P., 1914. Annélides polychètes non pélagiques provenant des campagnes de l'Hirondelle et de la Princesse-Alice (1885–1910). *Rés. Camp. Sci. Monaco 46*, 432 pp., 31 pls.

Fauvel, P., 1950. Contribution à la faune des annélides polychètes du Sénégal. *Bull. Inst. Franc. d'Afr. Noire 12*, 2: 335–394, 3 figs.

Fauvel, P., 1953. Annélides polychètes de la Croisière du "Président Théodore Tissier" aux Antilles (1951). *Bull. Inst. océanogr. Monaco 1033*: 1–23.

Fauvel, P. & F. Rullier, 1959. Annélides polychètes. In: Résultats scientifiques des campagnes de la "Calypso" *4*, 10. Campagne 1956 dans le Golfe de Guinée et aux îles Principe, Sao Tomé et Annobon. *Ann. Inst. océanogr. 37*: 143–205, 6 figs.

Gravenhorst, I. L. C., 1831. *Tergestina, oder Beobachtungen und Untersuchungen über einige bei Triest im Meere lebende Arten der Gattungen Octopus, Dorus, Pinna, Ascidia, Serpula* ... Breslau, ix : 166 pp.

GRUBE, A. E., 1850. Die Familien der Anneliden. *Arch. Naturg. Berlin 16* (1): 249–364.

GRUBE, A. E., 1862. Mittheilungen über die Serpulen, mit besonderer Berücksichtigung ihrer Deckel. *Jahresber. Abh. Schles. Ges. Breslau 39*: 53–69, 6 figs.

HARTMAN, O., 1942. A review of the types of polychaetous annelids at the Peabody Museum of Natural History, Yale University. *Bull. Bingham Oceanogr. Coll. Coll. 8*, 98 pp, 161 figs.

HARTMAN, O., 1956. Polychaetous annelids erected by Treadwell 1891–1948, together with a brief chronology. *Bull. Am. Mus. Nat. Hist. 109*: 239–310.

HARTMAN, O., 1959. Catalogue of the polychaetous annelids of the world. Part II. *Allan Hancock Found. Occas. Paper 23*, 2: 354–628.

HARTMAN, O., 1961. Polychaetous annelids from California. *Allan Hancock Pac. Exp. 25*, 226 pp., 34 pls.

HARTMAN, O., 1965. Catalogue of the polychaetous annelids of the world. Supplement 1960–1965 and Index. *Allan Hancock Found. Occas. Paper 23, Suppl.*, 197 pp.

HARTMAN, O., 1966a, Polychaeta Myzostomidae and Sedentaria of Antarctica. *Antarctic Res. Ser. 7*, 158 pp., 46 pls.

HARTMAN, O., 1966b. Quantitative survey of the benthos of San Pedro Basin, Southern California. Part II. Final results and conclusions. *Allan Hancock Pac. Exp. 19*, 2: 187–456, 13 pls., 2 maps.

HARTMAN, O., 1966c. Polychaetous Annelids of the Hawaiian Islands. *Occ. Pap. Bernice P. Bishop Mus. Hawaii 23*, 11: 163–252, 2 figs.

HARTMAN, O., 1967. Polychaetous annelids collected by the USNS Eltanin and Staten Island cruises, chiefly from Antarctic Seas. *Allan Hancock Monogr. Mar. Biol. 2*, 387 pp., 51 pls.

HARTMAN, O., 1969. *Atlas of the sedentariate polychaetous annelids from California.* Allan Hancock Found., Los Angeles, 812 pp., ill.

HARTMAN, W. D., 1969. New genera and species of coralline sponges (Porifera) from Jamaica. *Postilla 137*, 39 pp., 32 figs.

HARTMAN, W. D. & T. F. GOREAU, 1970. Jamaican coralline sponges: their morphology, ecology and fossil relatives. *Symp. Zool. Soc. London 25*: 205–243, 22 figs.

HOVE, H. A. TEN, 1970. Serpulinae (Polychaeta) from the Caribbean: I. The genus Spirobranchus. *Stud. Fauna Cur. 32*: 1–57, fig. 1–124, 5 pls.

HUMMELINCK, see: WAGENAAR HUMMELINCK.

LANGERHANS, P., 1884. Die Wurmfauna von Madeira. IV. *Z. wiss. Zool. 40*: 247–285, pl. 15–17.

MAYR, E., 1969. *Principles of systematic zoology*. New York, London, 1969, xi + 428 pp., ill.

MCCLOSKEY, L. R., 1970. The dynamics of the community associated with a marine scleractinian coral. *Int. Revue ges. Hydrobiol. 55*, 1: 13–81, 13 figs.

MCINTOSH, W. C., 1885. Report on the Annelida Polychaeta collected by H.M.S. Challenger during the years 1873–1876. *Challenger Rep. 12* (*Zool.*), 554 pp., pl. 1–55 & 1a–39a.

MCINTOSH, W. C., 1926. Notes from the Gatty Marine Laboratory, St. Andrews. No. XLIX. 1. On the structure and functions of the operculum and neighbouring parts of Mercierella enigmatica Fauvel, and other Serpulids. *Ann. Mag. Nat. Hist. London* (*9*) *18*: 402–424, 1 fig., pl. 13–17.

MONRO, C. C. A., 1933. The Polychaeta Sedentaria collected by Dr. C. Crossland at Colón in the Panama region and the Galapagos Islands during the expedition of the S. Y. St. George. *Proc. Zool. Soc. London 2*: 1039–1092, 31 figs.

MOORE, J. P., 1923. The polychaetous annelids dredged by the U.S.S. Albatross off the coast of southern California in 1904. Spionidae to Sabellariidae. *Proc. Ac. Nat. Sci. Phila. 75*: 179–259, pl. 17–18.

MOSELEY, M. N., 1881. Report on certain Hydroid, Alcyonarian, and Madreporarian Corals procured during the Voyage of H.M.S. Challenger, in the years 1873–1876. *Challenger Rep. 2* (*Zool.*), 248 pp., 32 pls.

NONATO, E. F. & LUNA, J. A. C., 1970. Anelídeos poliquetas do nordeste do Brasil. I. Poliquetas bentônicos da costa de Alagoas e Sergipe. *Bolm. Inst. oceanogr. S. Paulo 19*: 57–130, 111 figs.

PILLAI, G., 1971. Studies on a collection of marine and brackish-water polychaete annelids of the family Serpulidae from Ceylon. *Ceylon J. Sci.* (*Bio. Sci.*) *9*, 2: 88–130, 10 figs.

PIXELL, H. L. M., 1913. Polychaeta of the Indian Ocean, together with some species from the Cape Verde Islands. The Serpulidae, with a classification of the genera Hydroides and Eupomatus. *Trans. Linn. Soc. London* (*Zool.*) *16*: 69–92, pl. 8–9.

RINGUELET, R. A., 1969. Clave o llave para el reconocimiento de familias y géneros de poliquetos del litoral Atlántico Argentino. *Acta Zool. Lilloana 24*: 193–218.

RIOJA, E., 1947. Estudios anelidológicos XVIII. Observaciones y datos sobre algunos anélidos poliquetos del Golfo de California y costas de Baja California. *An. Inst. Biol. Méx. 18*: 517–626, 21 figs.

RULLIER, F., 1964. Annélides polychètes. In: Résultats Scientifiques des campagnes de la "Calypso" *6*, 21. Campagne aux îles du Cap Vert 1959. *Ann. Inst. océanogr. N.S. 41*: 113–218, 23 figs.

SOURIE, R., 1954. Contribution à l'étude écologique des côtes rocheuses du Sénégal. *Mém. Inst. franç. Afr. Noire 38*, 342 pp., 46 figs., 23 pls.

STRAUGHAN, D., 1967. Some Serpulidae (Annelida: Polychaeta) from Heron Island, Queensland. *Univ. Queensl. Papers 1, 2*: 25–45, 5 figs.

STRAUGHAN, D., 1969a. Serpulidae (Annelida, Polychaeta) from Oahu, Hawaii. *Bull. So. Calif. Acad. Sci. 68*, 4: 229–240.

TEN HOVE, see: HOVE, TEN.

TREADWELL, A. L., 1906. Polychaetous Annelids of the Hawaiian Islands collected by the steamer Albatross in 1902. *Bull. U.S. Fish Comm.* (1903) *23*, 3: 1145–1181, 81 figs.

TREADWELL, A. L., 1943. New species of polychaetous annelids from Hawaii. *Amer. Mus. Novitates 1233*, 4 pp., 17 figs.

VERVOORT, W., 1967. Zoological exploration of the continental shelf of Surinam. *Hydrogr. Newsletter, Spec. Publ. 5*, 9: 61–81, fig. 25–34.

VERVOORT, W., 1971. Zoological exploration of the continental shelf of Surinam. II. Scientific investigations on the shelf of Surinam, H.NL.M.S. Luymes 1969. *Hydrogr. Newsletter, Spec. Publ. 6*: 37–50, fig. 51–57.

WAGENAAR HUMMELINCK, P., 1953. Description of new localities. *Stud. fauna Cur. 4*: 1–108, fig. 1–26, pl. 1–8.

ZIBROWIUS, H., 1968a. Description de Vermiliopsis monodiscus n. sp. espèce Méditerranéenne nouvelle de Serpulidae. (Polychaeta, Sedentaria). *Bull. Mus. Nat. Hist. Nat.*, (*2*), *39*, 6: 1202–1210, 2 figs.

ZIBROWIUS, H., 1968b. Étude morphologique, systématique et écologique, des Serpulidae (Annelida Polychaeta) de la région de Marseille. *Rec. Trav. St. Mar. End., Bull. 43* (59): 81–252, 14 pls.

ZIBROWIUS, H., 1969. Quelques nouvelles récoltes de Serpulidae (Polychaeta Sedentaria) dans le Golfe de Gabès et en Tripolitaine. Description de Vermiliopsis pomatostegoides n. sp. *Bull. Inst. Océanogr. Pêche, Salambo 1*, 3: 123–136, 10 figs.

ZIBROWIUS, H., 1970a. Serpulidae (Annelida Polychaeta) des campagnes du "Skagerak" (1946) et du "Faial" (1957) au large du Portugal. *Bolm. Soc. Portug. Ciênc. Nat.* (*2a*), *12*: 117–131, 2 figs.

ZIBROWIUS, H., 1970b. Contribution à l'étude des Serpulidae (Polychaeta sedentaria) du Brésil. *Bolm. Inst. océanogr. S. Paulo 19*: 1–32, 4 pls.

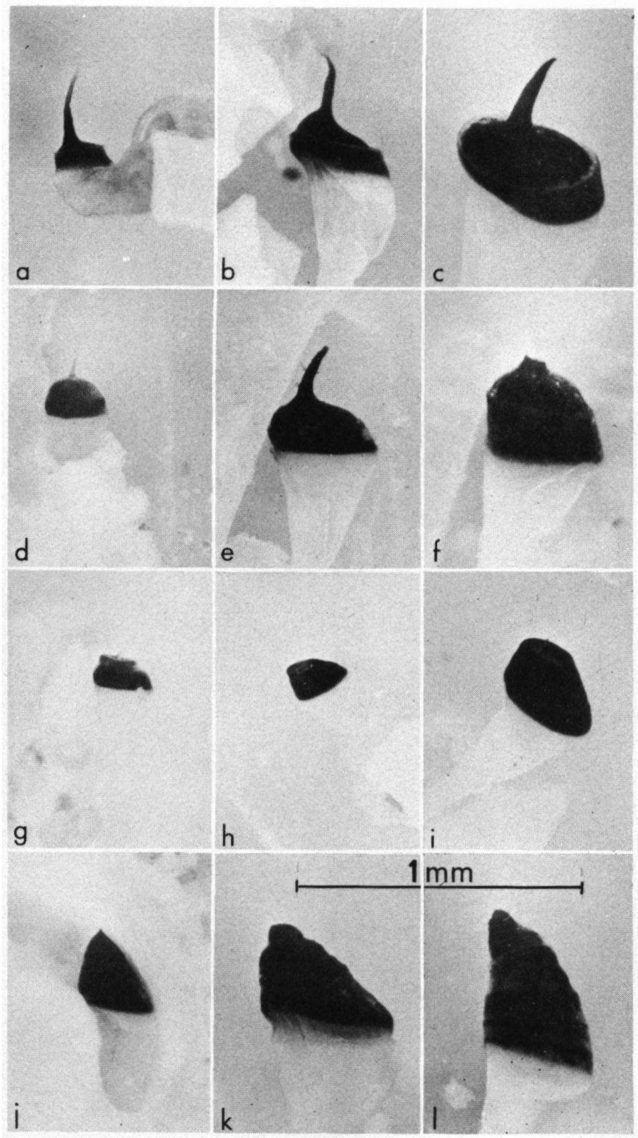
ZIBROWIUS, H., 1971. Revision of Metavermilia Bush (Polychaeta, Serpulidae), with descriptions of three new species from off Portugal, Gulf of Guinea and Western Indian Ocean. *J. Fish. Res. Board Canada 28*, 10: 1373–1383, 4 figs.

ZIBROWIUS, H., 1972. Mise au point sur les espèces Méditerranéennes de Serpulidae (Annelida Polychaeta) décrites par Stefano dell Chiaje (1822–1829, 1841–1844) et Oronzio Gabriele Costa (1861). *Tethys 4*, 1: 113–126, 2 figs.

ZIBROWIUS, H., 1973a. Revision of some Serpulidae (Annelida Polychaeta) from abyssal depths in the Atlantic and Pacific, collected by the "Challenger" and Prince of Monaco Expeditions. *Bull. Brit. Mus.* (*N.H.*) *Zool. 24*, 9: 427–439, 2 figs.

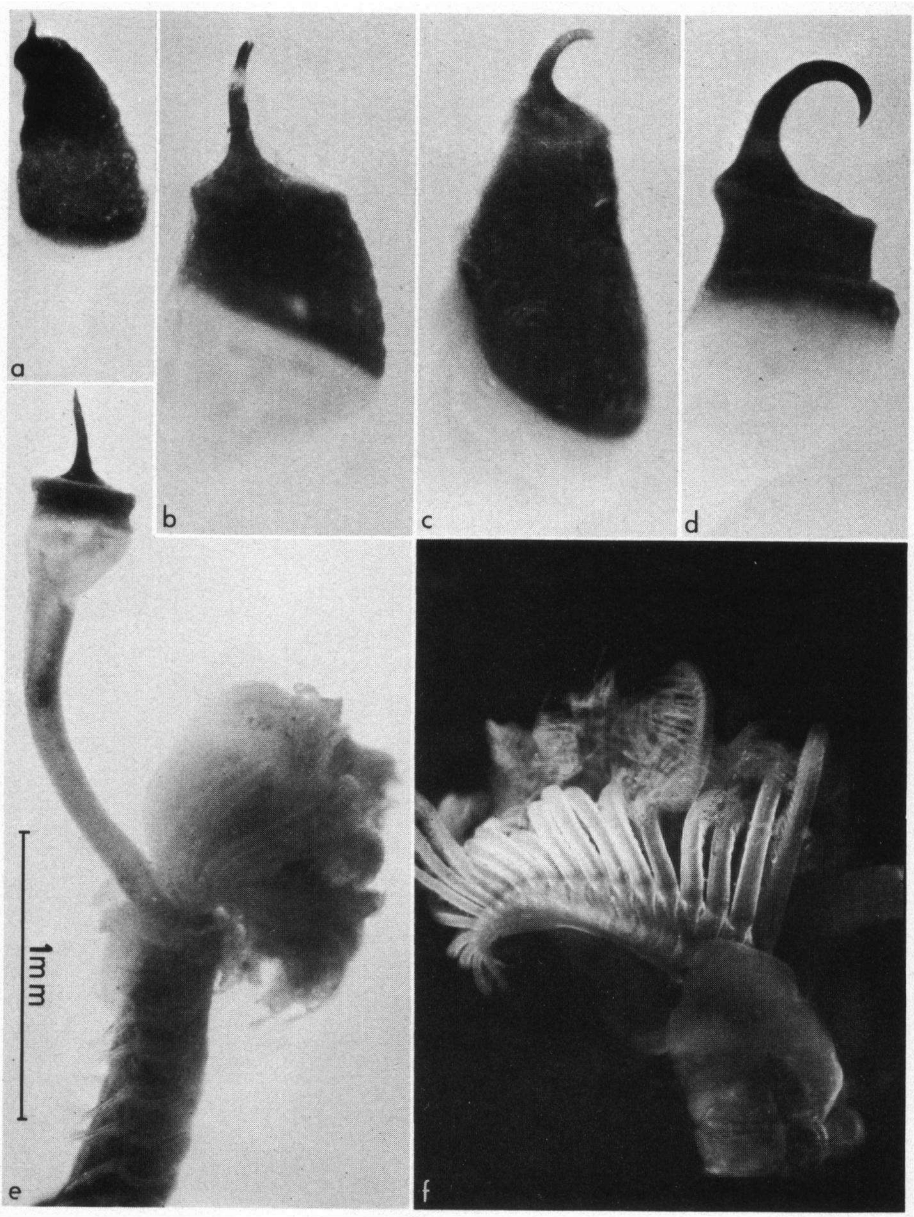
ZIBROWIUS, H., 1973b. Serpulidae (Annelida Polychaeta) des côtes ouest de l'Afrique et des archipels voisins. *Ann. Musée Afr. Centr. Tervuren* (*oct.*) *Zool. 207*, 93 pp., 6 figs.

PLATE I

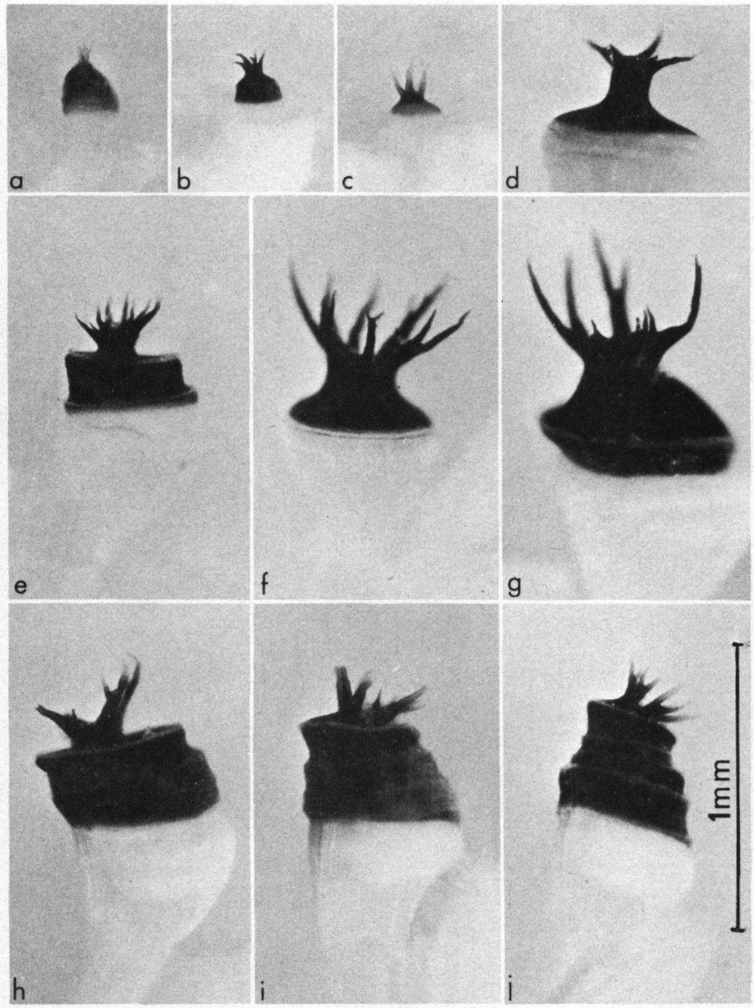


Pseudovermilia occidentalis. — Opercula in right lateral view. From top to bottom increasing height of terminal plate and decreasing size of spine; from left to right increasing size of operculum. b, f, h, j & l, from SURINAME (Sta. *H57*, *D30*, *H57*, *D31*, tHU 53a, RMNH 04433, 04437); others from BARBADOS (off Holetown, tHU 62). – All to same scale.

PLATE II

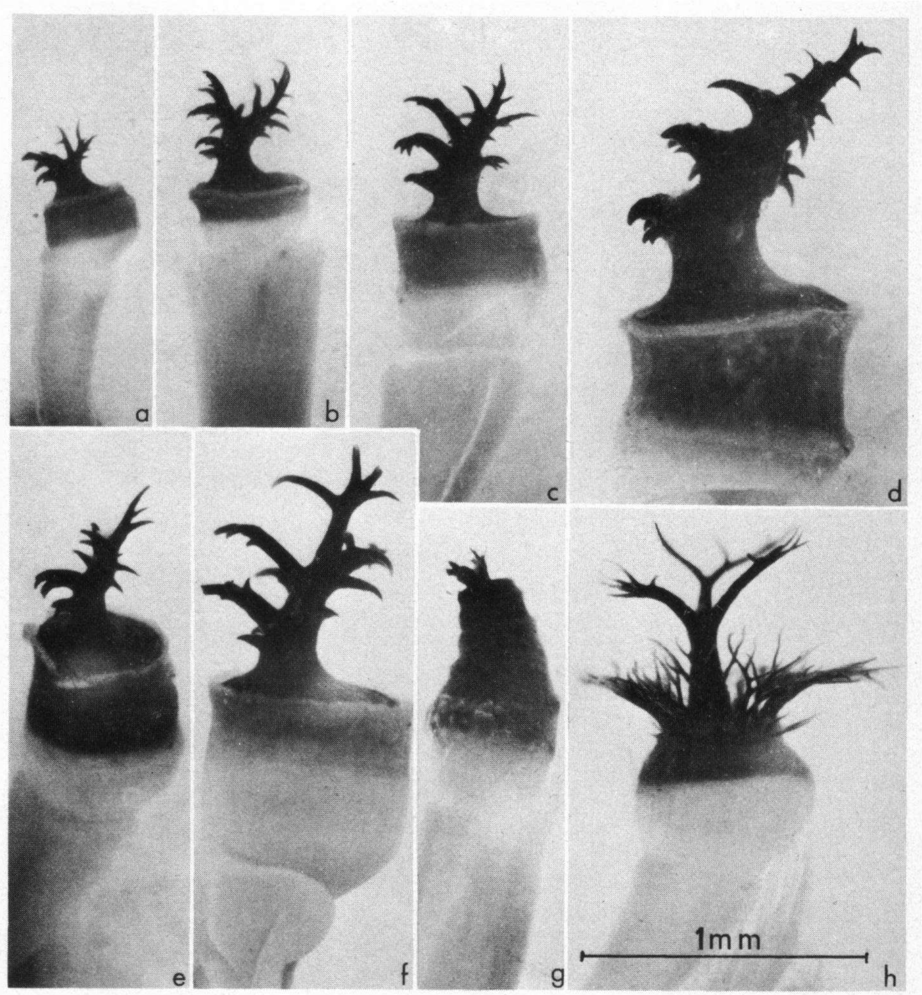


a–e. *Pseudovermilia occidentalis.* — a–d. Opercula in right lateral view. a. from Hawaii (Oahu, tHU 128); b. from Bank Josephine (ZMH); c–d. from California (Santa Catalina Island, Rocky Point, AHF). – e. Anterior part of worm in right lateral view, from Curaçao (Caracasbaai, tHU 61). – All to same scale.
f. *Pseudovermilia multispinosa.* Branchiae and thoracic membrane in left lateral view, from Curaçao (Caracasbaai, tHU 66).

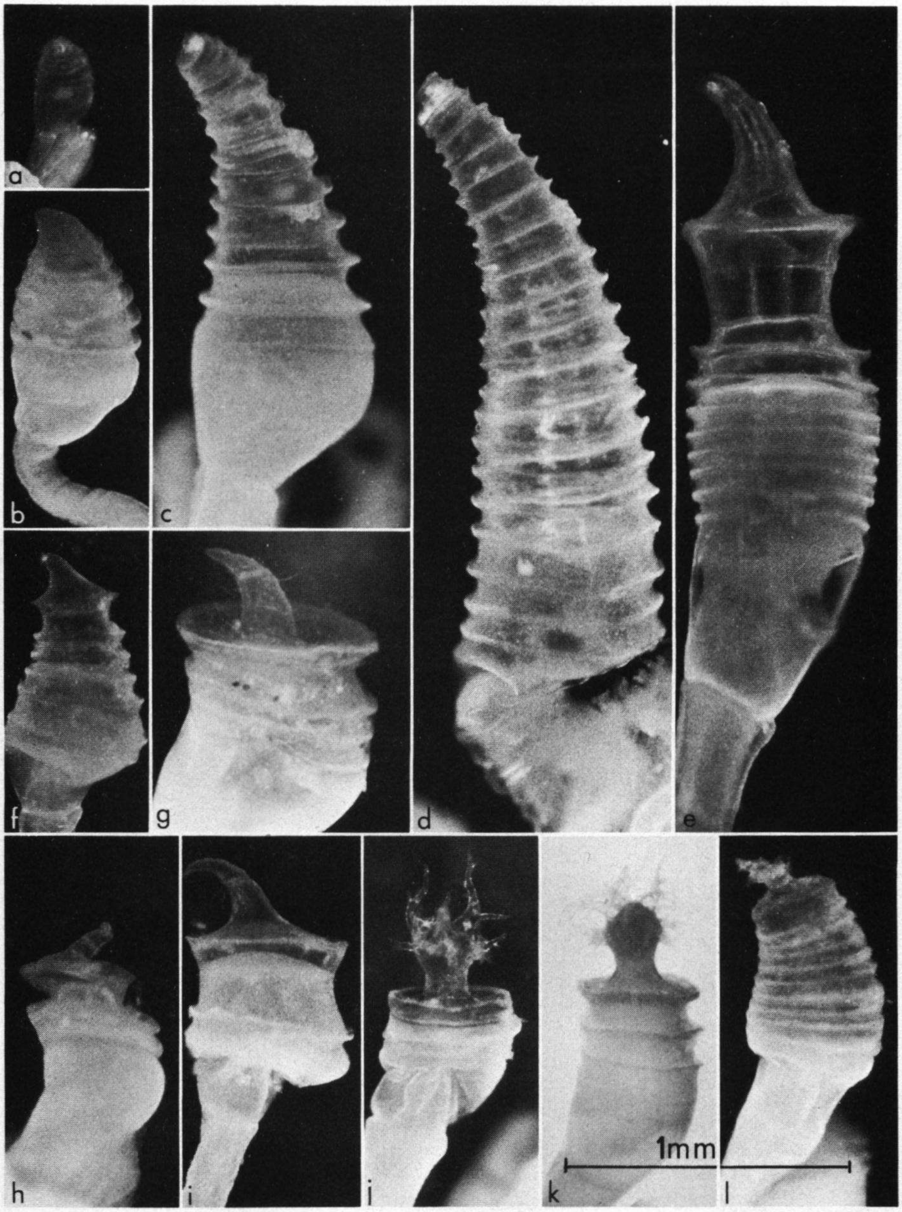


Pseudovermilia occidentalis, spiny form. — Opercula in right lateral view. a. from Bonaire (Witte Pan, tHU 144); b. from Curaçao (Vaarsenbaai, tHU 141); c. from Klein Bonaire (tHU 143); d–e. from Curaçao (Playa Kalki, tHU 140); f–h. from Curaçao (Savonet, tHU 142); i–j. from Aruba (Pos Chikitu, tHU 139)l – All to same scale.

PLATE IV

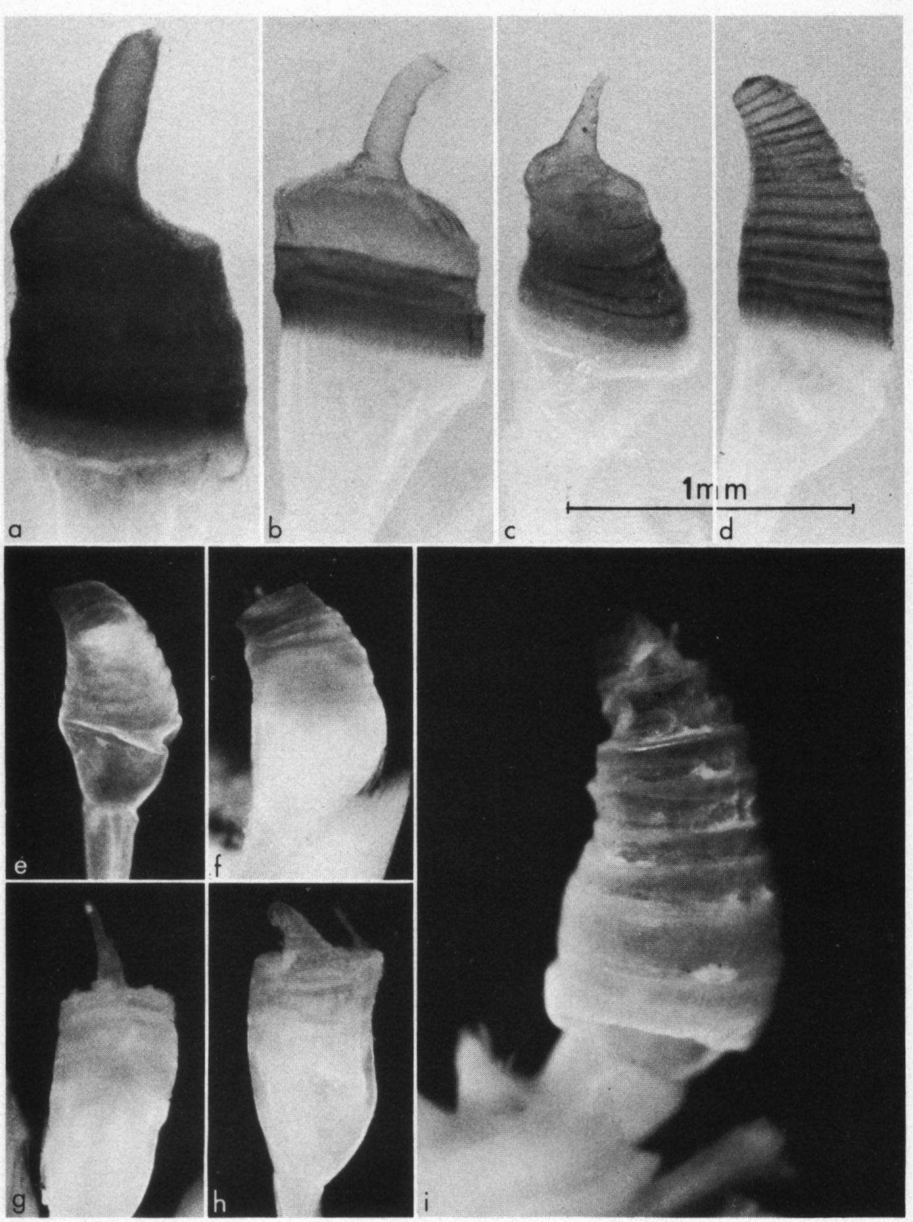


Pseudovermilia multispinosa. — Opercula in right lateral view, h: crowned form. a. from Bonaire (Slagbaai, HLD); d. type from Gorgona Island (BMNH 1933. 7.10.269–271); remaining opercula from Curaçao (Caracasbaai, mainly tHU 64–66). – All to same scale.



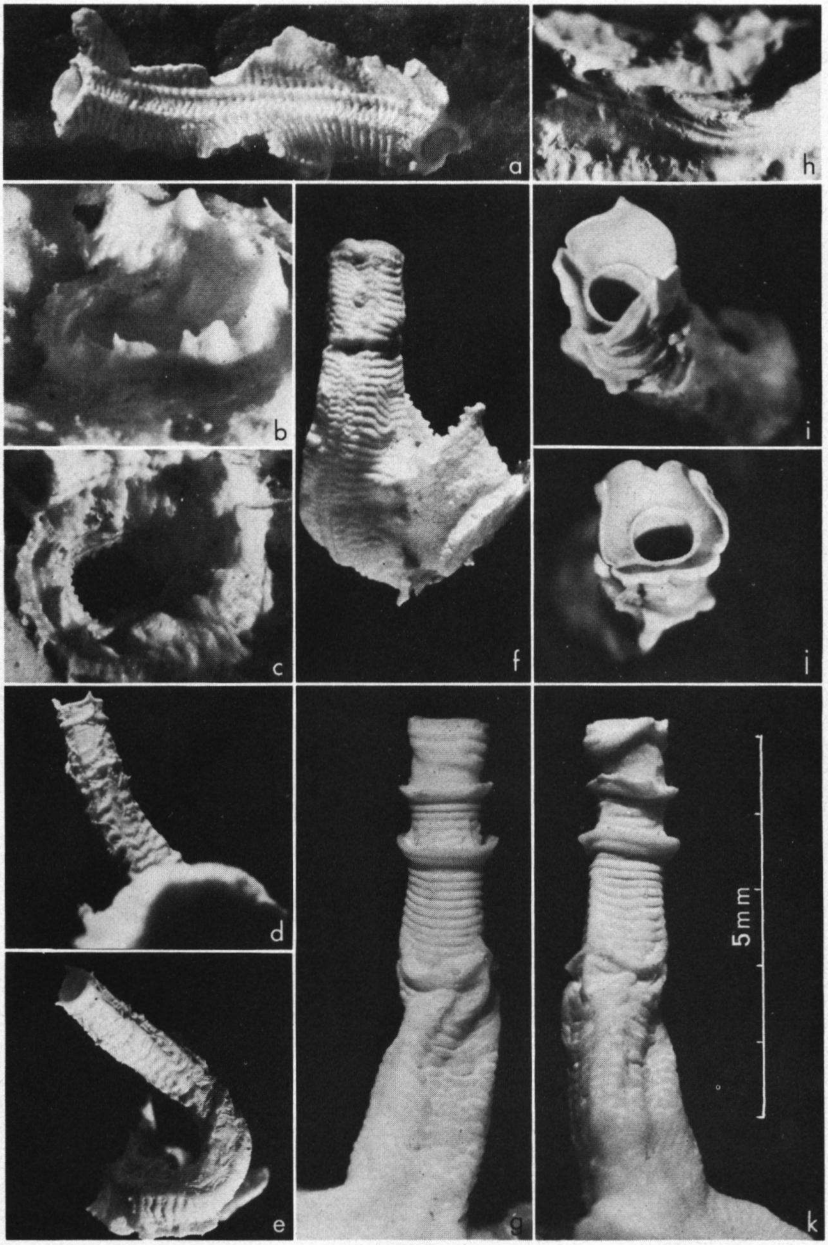
Pseudovermilia fuscostriata. — Opercula in right lateral view, j, k & l: spiny form. a & g. from CURAÇAO (Caracasbaai, ZMH); b & h. from ARUBA (Pos Chikitu, tHU 173); c, f, i & k. from BARBADOS (off Holetown, tHU 174); d–e. from GUADELOUPE (USNM 51498) and j& l. from SURINAME (*H57*, RMNH 04490). – All to same scale.

PLATE VI



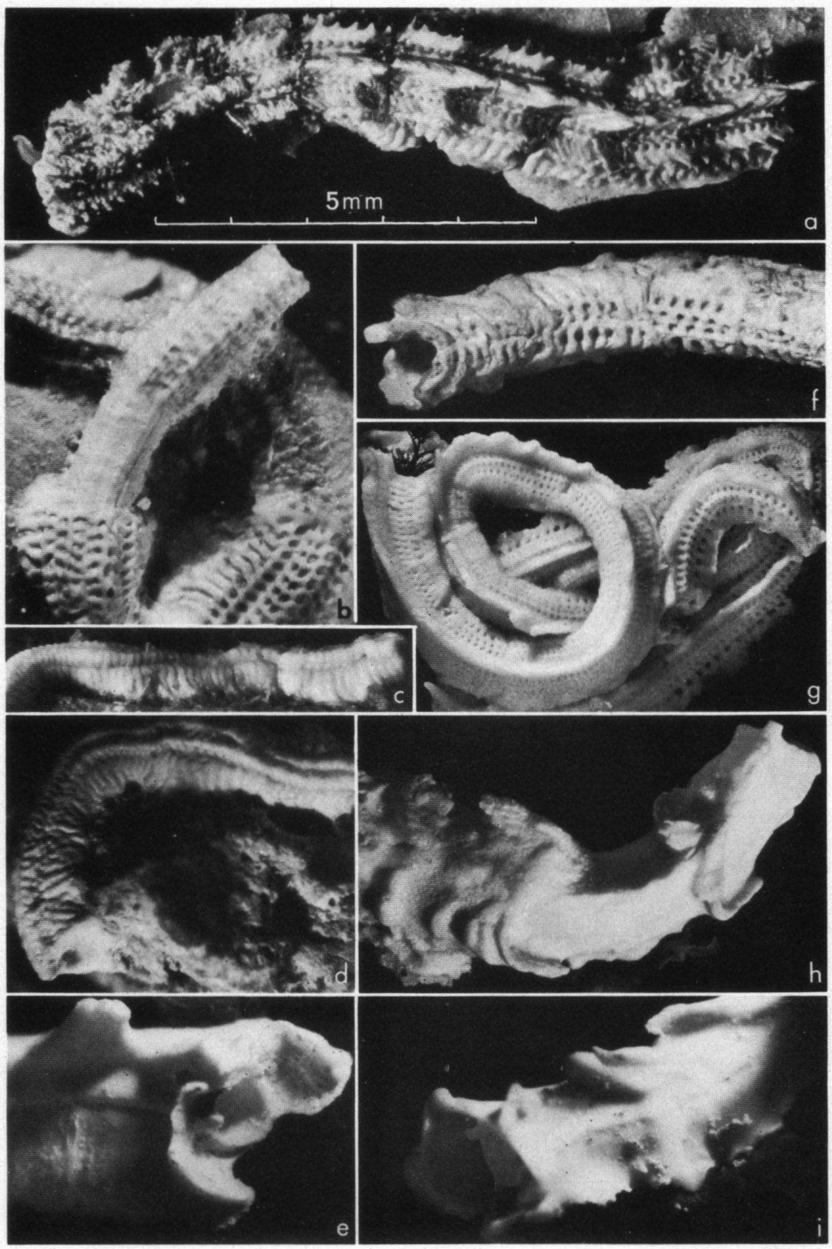
a–d. *Pseudovermilia conchata.* — Opercula in right lateral view, paratypes from CALIFORNIA. a. from Santa Monica (AHF); b–d. from Santa Catalina Island (AHF Poly 1095).
e–h. *Pseudovermilia holcopleura.* — Opercula in right lateral view. e. from BARBADOS (off Holetown, USNM 51492); f–h. from shelf of SURINAME (*M97*, RMNH 10704).
i. *Pseudovermilia babylonia.* – Operculum in right lateral view, paratype from SOUTH AFRICA (False Bay, UCT). – All to same scale.

PLATE VII



Pseudovermilia occidentalis. — Tubes showing intraspecific variation. a. from Hawaii (Oahu, tHU 139); b–c. different views of one specimen from Aruba (Pos Chikitu, tHU 139); d–e. different views of one specimen from Curaçao (Playa Kalki, RMNH 04484); f. from Annobón (SME); g & k. different views of one specimen from Barbados (off Holetown, tHU 62); i–j. different views of one specimen from California (Los Angeles, AHF). – a & f. are the common type, all others are more or less aberrant. – All to same scale.

PLATE VIII



Pseudovermilia spp. — Tubes showing inter- and intraspecific variations.
a–b. *P. fuscostriata*. a. typical form from Bonaire (Sta Barbara, RMNH 04496); b. spiny form (scale slightly exaggerated) from Suriname (*H57*, RMNH 04490).
c–d. *P. holcopleura*. c. from Barbados (off Holetown, USNM 51492); d. from Suriname (*H57*, RMNH 04490).
e & h–i. *P. conchata*, from California; e & i. paratypes from Catalina Island (AHF Poly 1905); h. from off San Nicolas Island (ANSP).
f–g. *P. multispinosa*, typical form and crowned form, from Curaçao (Caracasbaai, tHU 66 & 64). – All to same scale.