

STUDIES ON THE FAUNA OF CURAÇAO AND OTHER
CARIBBEAN ISLANDS: No. 110.

ASCIDIANS OF THE FAMILY STYELIDAE
FROM THE CARIBBEAN

by

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During a voyage to the West Indies undertaken in 1963-1964 Dr. P. WAGENAAR HUMMELINCK collected many specimens of marine organisms from Piscadera Baai, Curaçao, as a basis for the compilation of a preliminary list of the local fauna and flora. This paper deals with the styelid ascidians which dr. HUMMELINCK entrusted to me and whose study has formed the subject of a student's nine-month practical course in taxonomy.

Only three species, amongst the material collected from Piscadera Bay, seemed to be well enough characterized for them not to need revision. They are *Styela partita* (Stimpson), 1852, *Polyandrocarpa* (*Eusynstyela*) *tincta* (Van Name), 1902, and *Symplegma viride* Herdman, 1886. It has, therefore, been necessary to compare my material with earlier collections.

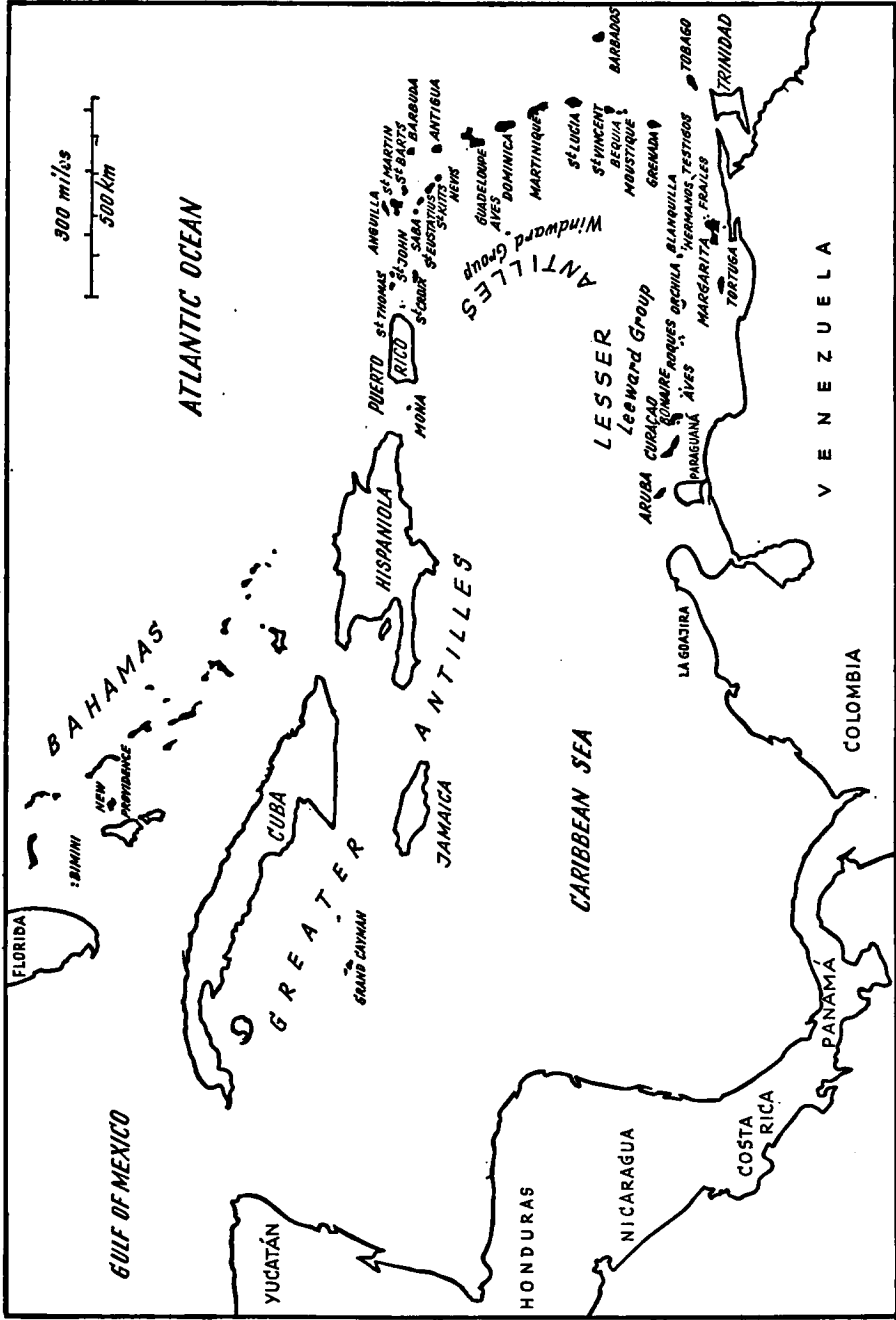


Fig. 1. Sketch map of the Caribbean.

The Museums by whose courtesy I have been able to examine such collections are:

AMSTERDAM, Zoölogisch Museum (A)
 KØBENHAVN (Copenhagen), Univ. Zoologiske Museum (K)
 LEIDEN, Rijksmuseum van Natuurlijke Historie (L)
 NEW YORK, American Museum of Natural History (N)
 WIEN (Vienna), Naturhistorisches Museum (W)
 YALE, Peabody Museum of Natural History (Y)

The deposition of the specimens is indicated in the text by the abbreviations given above. (U) stands for the Zoölogisch Museum of the State University at UTRECHT which was presented with a small collection of Piscadera specimens.

The following material has been examined from these earlier collections:

<i>Polycarpa spongiabilis</i> Traustedt, 1883	syntypes and other specimens (A, K, N)
<i>Polycarpa rugosa</i> von Drasche, 1884	type specimen (W)
<i>Polycarpa tumida</i> Heller, 1878	type specimen (W)
<i>Styela (Polycarpa) obtecta</i> (Traustedt), 1883	SLUITER's specimens (A)
<i>Styela (Polycarpa) nivosa</i> Sluiter, 1898	syntypes (A)
<i>Styela (Polycarpa) fuliginea</i> Sluiter, 1898	type specimen (A)
<i>Styela (Polycarpa) friabilis</i> Sluiter, 1898	type specimen (A)
<i>Styela (Polycarpa) insulsa</i> Sluiter, 1898	syntypes (A)
<i>Styela (Polycarpa) brevipedunculata</i> Sluiter, 1898	type specimen (A)
<i>Styela (Polycarpa) cartilaginea</i> Sluiter, 1898	type specimen (A)
<i>Styela (Polycarpa) asiphonica</i> Sluiter, 1898	syntypes (A)
<i>Styela (Polycarpa) seminuda</i> Sluiter, 1898	type specimen (A)
<i>Polycarpa multiphiala</i> Verrill, 1900	type and other specimens (Y)
<i>Polycarpa crossogonima</i> Millar, 1962	paratype specimen (L)
<i>Styela circumerata</i> Sluiter, 1904	type specimen (A)
<i>Polycarpa obtecta</i> Traustedt, 1883	a number of VAN NAME's specimens (A, N)
<i>Polycarpa circumerata</i> (Sluiter), 1904	a number of VAN NAME's specimens (A)
<i>Polyandrocarpa sabanillae</i> Van Name, 1921	a number of VAN NAME's specimens (A)
<i>Pandocia (Polycarpa) spongiabilis</i> (Traustedt), 1883	a not earlier described specimen (A)

As a result of my studies the following ten species of Styelidae could be recognized for the Caribbean, six of which (indicated with an asterisk) are present in the Piscadera Bay collection:

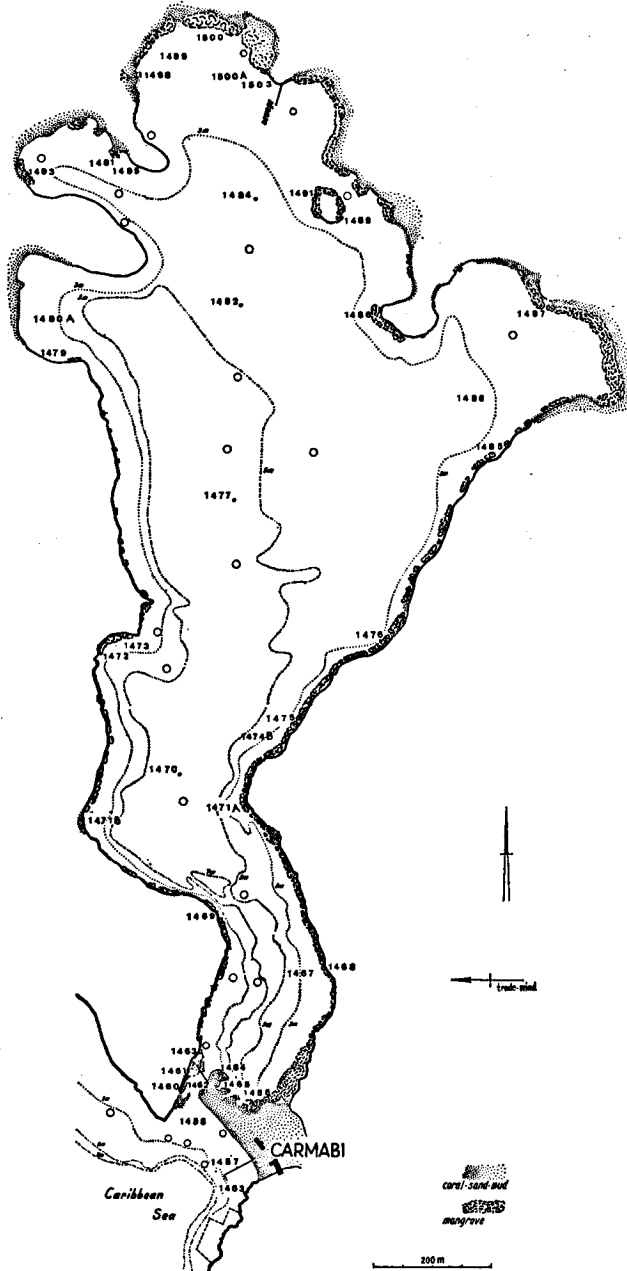


Fig. 2. Sketch map of Piscadera Baai, CURAÇAO, with Station numbers.

- **Styela partita* (Stimpson), 1852
- **Polycarpa arnoldi* Michaelsen, 1915
- **Polycarpa cartilaginea* (Sluiter), 1898
- Polycarpa nivosa* (Sluiter), 1898
- Polycarpa appropinquata* (Sluiter), 1898
- **Polycarpa spongiabilis* Traustedt, 1883
- Polycarpa insulsa* (Sluiter), 1898
- **Polyandrocarpa tumida* (Heller), 1878
- **Polyandrocarpa (Eusynstyela) tincta* (Van Name), 1902
- **Symplegma viride* Herdman, 1886

At almost every station in Piscadera Baai Dr. HUMMELINCK divided his samples and preserved half in formaldehyde and half in alcohol. In the lists which follow I have distinguished between the two (abbreviated form. and alc.), since ascidians are usually much easier to study when preserved in formaldehyde. The localities are indicated by station numbers in Fig. 2; a short description of habitats will be published by Dr. HUMMELINCK in a forthcoming paper. Figures 3 and 4 show the distribution of the styelid species in Piscadera Baai according to the samples examined.

Since *Styela partita*, *Polyandrocarpa tincta* and *Symplegma viride* are adequately characterized I have confined myself to giving a short diagnosis of these three species, with a list of material from Piscadera Bay and some notes on their distribution. VAN NAME (1945) and KOTT (1951) give more complete descriptions and lists of synonyms. The remaining seven species are treated more fully, with lists of synonyms, diagnoses, comparison of specimens and descriptions and figures supplementing the accounts by earlier workers, together with notes on distribution where this is possible.

I should like here to express my thanks to Dr. P. WAGENAAR HUMMELINCK under whose supervision the study was executed, for his constant interest and useful advice. My sincere thanks are also due to Dr. D. B. CARLISLE for critically reading the manuscript of this paper.

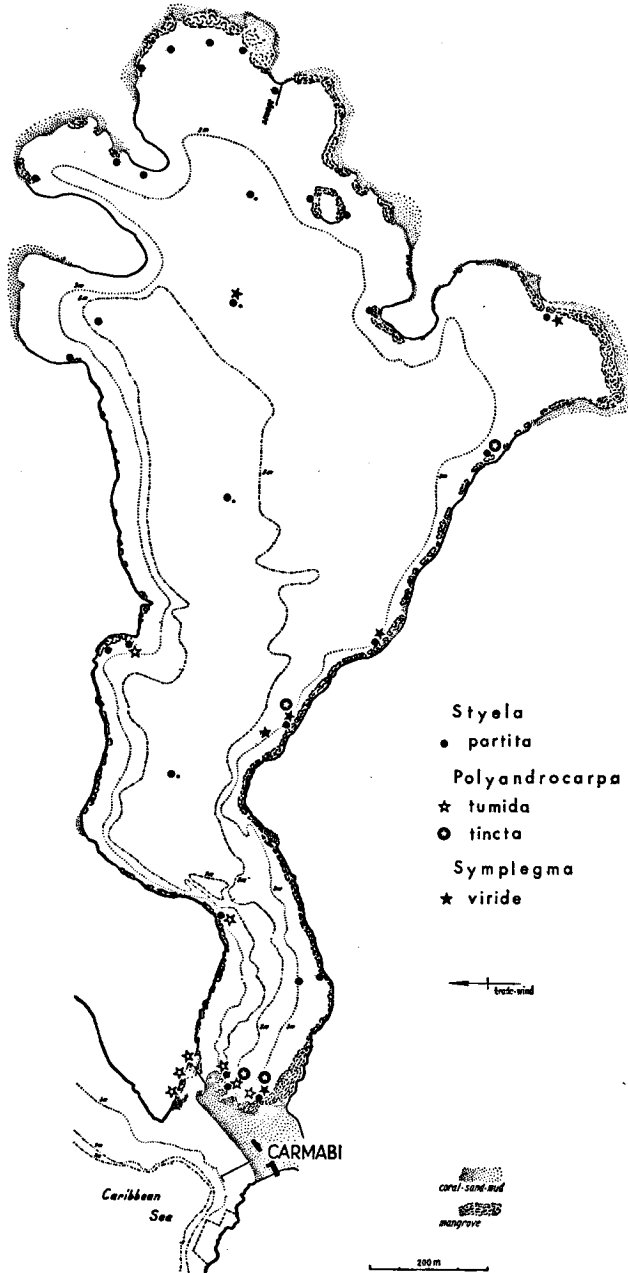


Fig. 3. Distribution of *Styela partita*, *Polyandrocarpa tumida*, *Polyandrocarpa (Eusynstyela) tinctoria* and *Symplegma viride* in Piscadera Baai, CURAÇAO, according to dr. HUMMELINCK's sampling in 1963/64.

Styela partita (Stimpson), 1852**DIAGNOSIS**

A solitary rather small styelid attached on solid substrates, usually forming crowded groups of several or many individuals of different sizes. Appearing especially in shallow water close to low-water mark.

Branchial sac with four folds on each side with a total number of about 150 internal longitudinal vessels, the first folds with the largest and the fourth fold with the smallest number.

Number of tentacles: about 45.

Alimentary canal occupies about $\frac{1}{2}$ the left side of the body and forms a closed loop. Stomach barrel-shaped, the outer wall transparent, through which the internal folds are clearly seen. Margin of the anus lobed, or sinuous, without a distinctive typhlosole plug.

Endocarps small and numerous, scattered on both sides of the inner surface of the mantle. No large endocarps in gut loop.

Gonads two on each side, each comprising an elongated ovary, which is bordered along each edge by about 20 often lobed testis follicles. Upon the surface of the ovary is found a long common sperm duct into which all the follicle ducts empty.

MATERIAL

CURAÇAO, Piscadera Baai, collected by P. Wagenaar Hummelinck, Oct. 1963–Jan. 1964, with exception of Sta. 1472a, 1476, 1476a, 1481a, 1488, 1491 and 1491a, which were sampled by Louise J. van der Steen, July–Sep. 1962 (Fig. 2).

Sta. 1460. – 7 specimens (form.) (A) and 2 spec. (alc.) (L) on roots of *Rhizophora*, together with other ascidians (depth 0– $\frac{1}{2}$ m).

Sta. 1460a. – 5 spec. (form.) (A) on stones and debris together with algae, porifera, and other ascidians ($\frac{1}{2}$ m).

Sta. 1461. – More than 10 spec. (form.) (A) on *Rhizophora*, together with other ascidians, pelecypods, balanids and algae (0– $\frac{1}{2}$ m).

Sta. 1462. – More than 25 spec. (form.) (A) and 20 spec. (alc.) (A) together with *Microcosmus exasperatus* and *Didemnum* on iron poles (0–1 m).

Sta. 1463. – More than 30 spec. (form.) (A) together with *Microcosmus exasp.* on *Rhizophora*, often overgrown by *Didemnum* (0– $\frac{1}{2}$ m).

Sta. 1464. – More than 80 spec. (alc. and form.) (A) together with *Microcosmus exasp.* and other ascidians on *Rhizophora*, often overgrown by *Didemnum* (0– $\frac{1}{2}$ m).

Sta. 1465. – 9 spec. (alc.) (A) together with *Polyandrocarpa tumida*, *Microcosmus exasp.* and other ascidians on *Rhizophora* (0– $\frac{1}{2}$ m).

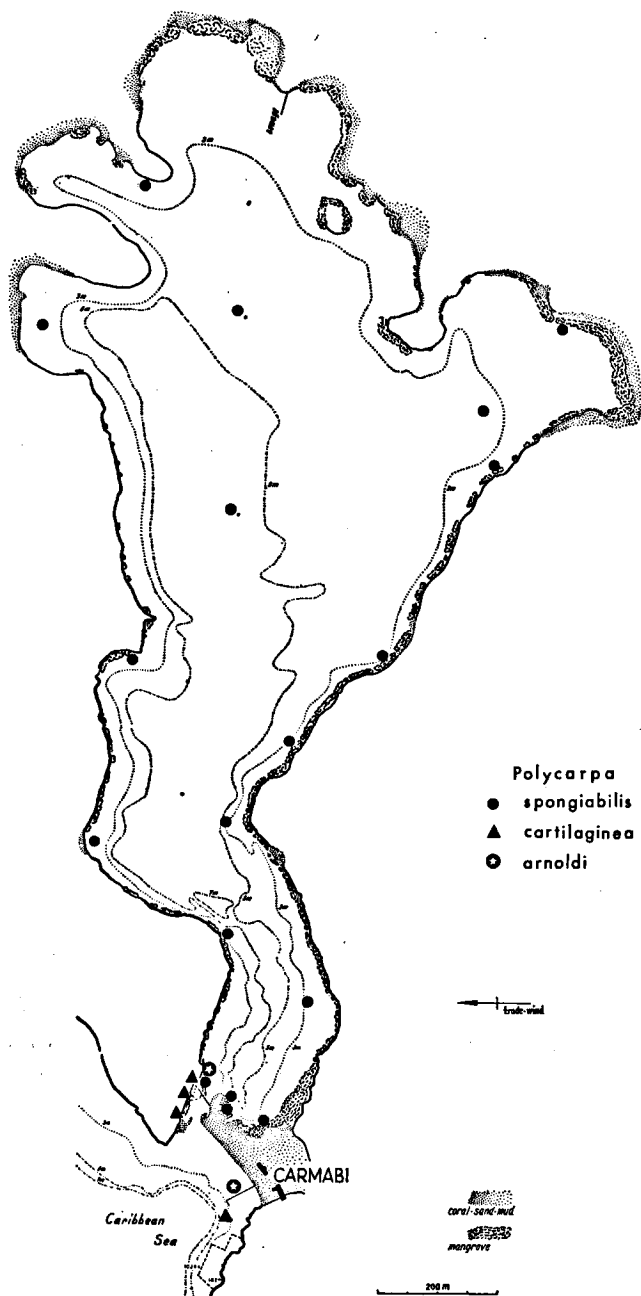


Fig. 4. Distribution of *Polycarpa spongiabilis*, *Polycarpa arnoldi* and *Polycarpa cartilaginea* in Piscadera Baai, CURAÇAO, according to dr. HUMMELINCK's sampling in 1963/64.

- Sta. 1466. - More than 50 spec. (alc. and form.) (A) together with *Microcosmus exasp.* and other ascidians on *Rhizophora* often overgrown by *Symplegma viride*, *Perophora bermudensis* and *Didemnum* (0-1 m).
- Sta. 1467. - 4 spec. (form.) (A) attached to *Polycarpa spongiabilis* together with 4 small specimens of *Microcosmus exasp.* ($1\frac{1}{2}$ m).
- Sta. 1468. - 5 spec. (alc.) (A) and 10 spec. (form.) (A) attached to pelecypods together with *Microcosmus exasp.* on *Rhizophora*. (0-1 m).
- Sta. 1468A. - 1 very young spec. (form.) (A) ($\frac{1}{2}$ m).
- Sta. 1469. - More than 50 spec. (alc. (L) and form. (A)) together with *Microcosmus exasp.*, *Polycarpa spong.* and other ascidians on *Rhizophora*, often overgrown by *Didemnum* (0-1 m).
- Sta. 1469A. - 1 spec. (form.) (A) attached to the margin of a shell ($1-1\frac{1}{2}$ m).
- Sta. 1470. - More than 40 spec. (alc. and form.) (A) together with *Microcosmus exasp.* on a buoy, overgrown by *Didemnum* ($0-\frac{1}{2}$ m).
- Sta. 1472a. - 2 spec. (form.) (A) together with *Microcosmus exasp.* and *Didemnum* on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1473. - More than 80 spec. (alc. (L) and form. (A)) together with *Microcosmus exasp.*, *Ascidia interrupta* (?) and other ascidians on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1473A. - 1 spec. (alc.) (A) attached to *Polycarpa spong.* (0-1 m).
- Sta. 1475. - More than 40 spec. (alc. and form.) (A) together with other ascidians on *Rhizophora* (0-1 m).
- Sta. 1475A. - 5 spec. (alc.) (L) attached to *Microcosmus exasp.* (0-1 m).
- Sta. 1476. - 10 spec. (form.) (A) together with other ascidians on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1476a. - 5 spec. (form.) (A) together with other ascidians on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1477. - Many spec. (alc. (L) and form. (A)) between and on *Microcosmus exasp.* and *Polycarpa spong.* on buoy ($0-\frac{1}{2}$ m).
- Sta. 1479. - More than 50 spec. (alc. and form.) (A) with other ascidians on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1480A. - 4 spec. (alc.) (A) attached to *Microcosmus exasp.* and *Polycarpa spong.* (2 m).
- Sta. 1481a. - 1 spec. (form.) (A) together with *Microcosmus exasp.* on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1482. - More than 80 spec. (alc. (L) and form. (A)) together with *Microcosmus exasp.* and other ascidians, often overgrown by *Symplegma viride*, on buoy ($0-\frac{1}{2}$ m).
- Sta. 1484. - More than 80 spec. (alc. (A) and form. (A+U)) together with *Microcosmus exasp.* on buoy ($0-\frac{1}{2}$ m).
- Sta. 1485. - More than 80 spec. (alc. (L) and form. (A)) between *Microcosmus exasp.* and *Ascidia interrupta* (?) often overgrown by *Didemnum* and *Symplegma viride*, on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1487. - More than 70 spec. (alc. (A) and form. (A+U)) between *Polycarpa spong.* and *Microcosmus exasp.*, often overgrown by *Symplegma viride* and *Ecteinascidia conclini*, on *Rhizophora* (0-1 m).
- Sta. 1488. - 2 spec. (form.) (A) together with some other ascidians on *Rhizophora* ($0-\frac{1}{2}$ m).
- Sta. 1489. - 4 spec. (form.) (A) with *Microcosmus exasp.* on *Rhizophora* ($0-\frac{1}{2}$ m).

- Sta. 1491. - 2 spec. (form.) (A) on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1491a. - 3 spec. (form.) (A) together with *Microcosmus exasp.* on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1493. - More than 20 spec. (alc. and form.) (A) on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1495. - 3 spec. (alc.) (L) together with *Polycarpa spong.* and *Microcosmus exasp.* in sandy mud with *Thalassia* and *Ulva* (2 m).
 Sta. 1498. - 1 spec. (alc.) (A) and 2 spec. (form.) (A) on oysters, together with balanids on *Rhizophora* (0-1 m).
 Sta. 1499. - 1 spec. (alc.) (A) attached to *Ulva* in sandy mud with *Ulva* and *Caulerpa* (1 $\frac{1}{2}$ -2 m).
 Sta. 1500. - 1 spec. (alc.) (A) attached to a shell in sandy mud with *Ulva* (1 $\frac{1}{2}$ m).
 Sta. 1500a. - 1 spec. (alc.) (A) attached to a shell in mud with *Caulerpa* (1 $\frac{1}{2}$ -3 m).
 Sta. 1501. - 2. spec. (form.) (A) attached to a shell on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1503a. - More than 30 spec. (alc. and form.) (A) attached to shells on iron beam at mouth of sewer-pipe (0- $\frac{1}{2}$ m).

REMARKS

For lists of synonyms and detailed descriptions, see VAN NAME (1945) and KOTT (1952).

One specimen (Sta. 1464, form.) exceptionally had 3 instead of 2 gonads on the left side of the body wall.

DISTRIBUTION

According to VAN NAME (1945) the species appears to be one of the most common in the Caribbean, along large stretches of the American eastern coast and the Bermudas. It is also common along Atlantic coasts of Europa and Africa. KOTT (1961) does not report it from Australia.

VAN NAME (1945) considered it as a strictly shallow-water species, occurring close to low-water mark. This is confirmed by the distribution in Piscadera Bay. There are only two species of ascidians which colonize the whole of the inner bay, *Diplosoma macdonaldi* and *Styela partita*, both of which occur also in the outer bay. We may conclude that these species are not very particular in the choice of their residence. The occurrence in the outermost part of the northern section of the bay, which has rather extreme conditions in the environment, points to a great tolerance to such conditions or to a great ability to recover lost territories (Fig. 3). Wherever in the bay *Styela partita* can find a more or less solid substrate (in depths of 0-3 m) it is established. Yet the favourite substrates are the roots of *Rhizophora*, where it can be found in large clusters among other ascidians such as *Microcosmus exasperatus*, *Polycarpa spongabilis*, *Ascidia interrupta*(?) with *Didemnum* sp. or *Symplegma viride* growing over it. In this way the species takes part in an ascidian community which seems to be typical for the roots of *Rhizophora* in Piscadera Bay.

Polycarpa arnoldi Michaelsen, 1915

- Styela (Polycarpa) oblecta*, SLUITER 1898, p. 11. [Santa Marta, Col.; pro parte.]
Polycarpa Arnoldi MICHAELSEN, 1915, p. 407-413, Taf. XVI, fig. 2, Taf. XVIII, fig. 40-44. [Annobon, W. Afr.]
Polycarpa arnoldi, VAN NAME 1921, p. 424. ["Very close allied to *P. oblecta*, if really distinct from it".]
Polycarpa oblecta, VAN NAME 1924, p. 31. [Westpunt, Curaçao.]
Polycarpa oblecta, VAN NAME 1945, p. 257-259. [Tortugas, Flor.; pro parte.]
Polycarpa crossogonima MILLAR, 1962, p. 71-73, fig. 55. [Bonaire; St. Martin.]

DIAGNOSIS

A rather small solitary styelid, growing on solid substrates. Apparently a shallow water species.

Branchial sac with four folds on each side and about 120-160 internal longitudinal vessels, equally divided amongst the folds; usually 6-10 stigmata per mesh.

Number of tentacles somewhat variable, usually about 50.

Alimentary canal occupies $\frac{1}{4}$ - $\frac{1}{2}$ of the left side of the body wall, forming a closed loop, and only attached to the body wall in the region of the stomach. Stomach barrel-shaped with a transparent outer wall, thus clearly showing the internal folds. Rectum not attached to body wall or to the branchial sac. Anus margin lobed or smooth, with a distinctive typhlosole plug.

Small endocarps not present. One large endocarp enclosed by stomach and intestine.

Gonads numerous on both sides of the body, more or less distinctive in rows, embedded in the body wall. They are more or less rounded, having testis follicles separated from the ovary, forming a crescent around the proximal side of the rounded ovary, and sending their ducts into a very small common sperm duct. Number of testis follicles usually about 8-10.

MATERIAL

- COLOMBIA, Santa Marta, Exp. "Chazalie", leg. J. W. Versluys. - Identified by SLUITER in 1898 as *Styela (Polycarpa) oblecta*. 1 specimen (A).
 TORTUGAS (Florida), coll. T. W. Vaughan[?]. - A bottle with 12 spec. of which several attached to each other. Identified by VAN NAME as *Polycarpa oblecta*. 8 specimens are *Polycarpa arnoldi*, 2 *Pyura vittata*, 1 *Styela partita* and one test is empty (N;414).

- ST. MARTIN, Sta. 1127, Great Bay, coll. P. Wagenaar Hummelinck, 16. V. 1949. – Paratype of *Polycarpa crossogonima* Millar, 1962. 1 spec. (L).
- CURAÇAO, Westpunt, coll. C. J. van der Horst, 14. V. 1920. – Identified by VAN NAME in 1924 as *Polycarpa oblecta*. 2 spec. (A).
- Piscadera Baai (Fig. 4). Sta. 1457, coll. Hummelinck, 5. I. 1964, on sandy pebbles with a sparing algae vegetation (3¼–4 m deep). – 1 spec. (alc.) (A).
- Piscadera Baai, Sta. 1463, coll. Hummelinck, 14. XII. 1963, together with other ascidians, pelecypods and balanids on roots of *Rhizophora* (0–1 m). – 1 spec. (form.) (A).

DESCRIPTION

Body more or less rounded, the dorso-ventral diameter sometimes exceeding the length; often covered with sand grains, shell debris and calcareous algae, sometimes only covered with mud. Apertures distinctly four-lobed, on small conical elevations or nearly flush with the external surface. The branchial aperture is situated on the anterior end, the atrial in the dorsal region, both rather close together. Attachment by a ventral area.

Size of the specimen from Sta. 1463: length 20 mm; width 20 mm; dorso-ventral diameter 22 mm.

Size of the specimen from Sta. 1457: length 17 mm; width 16 mm; dorso-ventral diameter 12 mm.

Test. – Rather thin, except in the dorsal region around the apertures, where it becomes thicker; not transparent, in some specimens incrustated with many foreign bodies, in others, stained with mud. Test substance soft and flexible, tougher in material which has been in alcohol for a long time. Colour of the outer surface grey, sometimes purplish brown around the apertures, which may be overgrown by hydroids or other organisms (Fig. 13).

Mantle. – Thin, delicate and transparent, with muscle fibers in longitudinal and transversal directions, forming a thin network. No bands of any size (Fig. 5). Colour of the mantle brown, more or less dark, due to small pigment cells which are also scattered about some internal organs.

Tentacles. – The number is somewhat variable, usually about 50. In 9 specimens in which I counted them I found 36, 52, 48, 40, 48, 48, 58, 54 and 78. They seem to be of alternating sizes, sometimes the smallest being no more than small papillae (Fig. 12).

Dorsal tubercle. – Not very prominent and varying in shape, having an orifice which is C-shaped or horseshoe-shaped, but never very complicated. The open interval is usually directed forwards or more or less turned towards the left (Fig. 7–11).

Dorsal lamina. – Plain edged membrane, more or less rolled over to the right.

Endostyle. – Narrow and prominent.

Branchial sac. – With four well-developed folds on each side. The total number of longitudinal vessels varies from about 110 up to 150. The following counts give an impression of the distribution (length of specimens after removing the test):

One of the Florida specimens of VAN NAME, length 14 mm

left:	dorsal lamina	2	(12)	3	(15)	4	(17)	4	(15)	5	endostyle
right:	dorsal lamina	2	(14)	4	(18)	3	(16)	4	(16)	4	endostyle

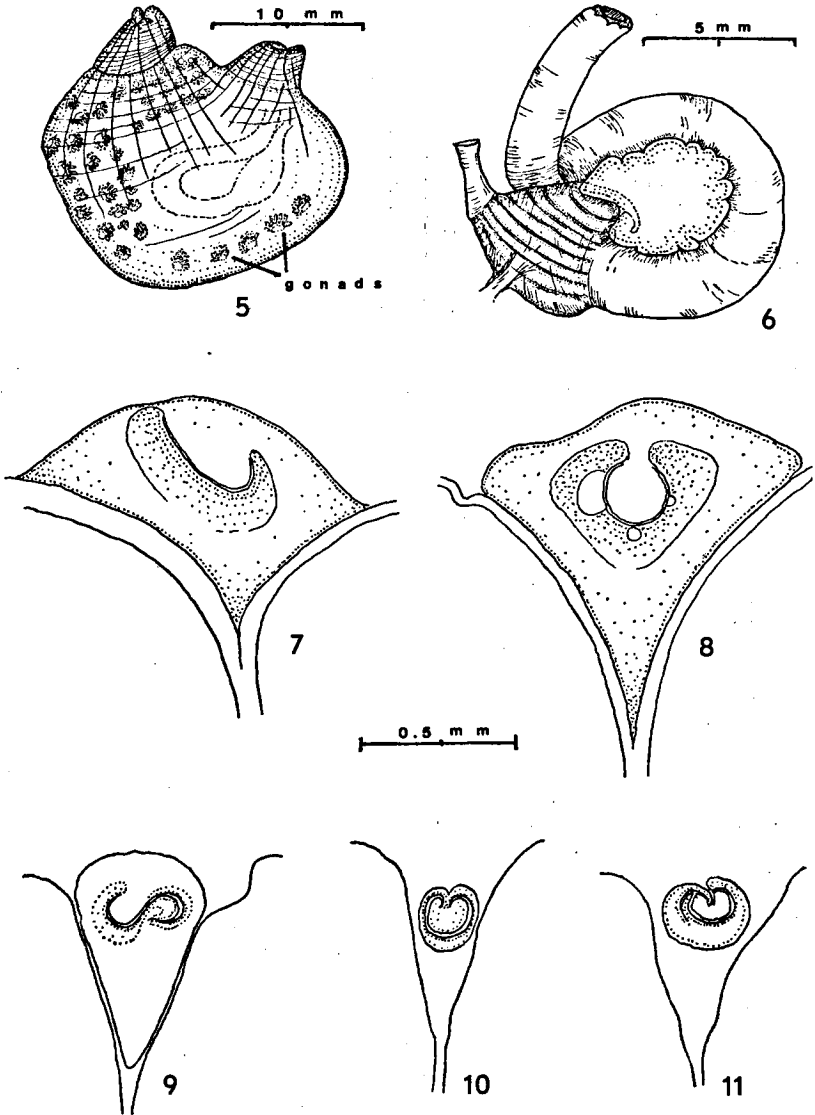


Fig. 5-11. *Polycarpa arnoldi* Michaelsen. — Specimen from Sta. 1463, with test removed (5), alimentary canal with endocarp (6), dorsal tubercle (7). — Dorsal tubercles from Sta. 1457 (8); VAN NAME'S *P. oblecta*, N-414 (9), N-414 (10), A. 1924 (11).

One of SLUITER's *P. oblecta*, length 14 mm

left: dorsal lamina 1 (11) 2 (13) 3 (13) 2 (13) 2 endostyle

right: dorsal lamina 1 (12) 3 (12) 3 (13) 3 (12) 3 endostyle

One of the Westpunt specimens of VAN NAME, length 12 mm

left: dorsal lamina 2 (10) 4 (16) 3 (15) 4 (14) 4 endostyle

right: dorsal lamina 2 (12) 4 (14) 4 (14) 4 (13) 5 endostyle

MILLAR's paratype of *P. crossogonima*, length 8 mm

left: dorsal lamina 1 (10) 3 (14) 4 (13) 3 (13) 3 endostyle

right: dorsal lamina 1 (13) 3 (11) 3 (10) 4 (10) 3 endostyle

Specimen from Sta. 1463, length 15 mm

left: dorsal lamina 1 (10) 3 (12) 4 (13) 3 (10) 3 endostyle

right: dorsal lamina 3 (10) 3 (11) 4 (10) 4 (11) 4 endostyle

The number of stigmata in the flat parts of the sac is usually about 6-8 per mesh, but near the endostyle and dorsal lamina the number may reach 15-16.

Alimentary canal. - Forming a closed loop in the posterior part of the body, taking up about $\frac{1}{3}$ - $\frac{1}{2}$ of the left body wall. Only the stomach is attached to the body wall, the intestine and rectum hang free in the peribranchial cavity. This character seems specific for the species. Stomach more or less triangular or barrel-shaped, with a smooth wall which is sometimes transparent (then showing about 16 internal folds), sometimes more opaque. A hooked pyloric caecum is present, although sometimes difficult to find because it is embedded in one of the two ligaments by which the stomach is attached (Fig. 6). Rectum not attached, with the margin usually lobed, but always with a distinctive typhlosole plug.

Endocarps. - The one large fleshy endocarp, which lies within the gut loop is often more or less indented and covers parts of the stomach and intestine (Fig. 6).

Gonads. - The following counts give the number of the gonads:

Specimen from Colombia	left side 37	right side 53
Specimen from Florida	left side 46	right side 49
Specimen from Florida	left side 74	right side 82
Specimen from Florida	left side 40	right side 62
Specimen from St. Martin, Sta. 1127	left side 17	right side 24
Specimen from Curaçao, Westpunt	left side 52	right side 54
Specimen from Curaçao, Sta. 1457	left side 27	right side 32
Specimen from Curaçao, Sta. 1463	left side 41	right side 66

Often they are clearly arranged in rows (usually 3 rows), a characteristic which I did not find in any of the other species which I have examined.

The gonads have a peculiar form (Fig. 14-15). Both ovary and testis follicles are embedded in the gelatinous inner mantle wall, the testis distinctly separated from the ovary. The ovary, with a diameter of about 0.5-0.8 mm, is always found at the foot of a ligament which attaches the branchial sac to the body wall and has a rounded form, protruding into a short, wide, finger-like oviduct. Around the proximal side of the ovary, 8-10 testis follicles are arranged in a crescent. The follicles are pear-shaped with a length of about 0.6 mm and send their individual ducts into a very small common sperm duct whose orifice is situated in a small but conspicuous papilla on the surface of the oviduct some distance behind its opening.

The total diameter of the gonads is usually 0.5-1.0 mm, sometimes as large as 1.5 mm. The sheath consists merely of a thin membrane of the same tissue as covers the inner mantle wall. Pigment cells are scattered over the surface of the gonads.

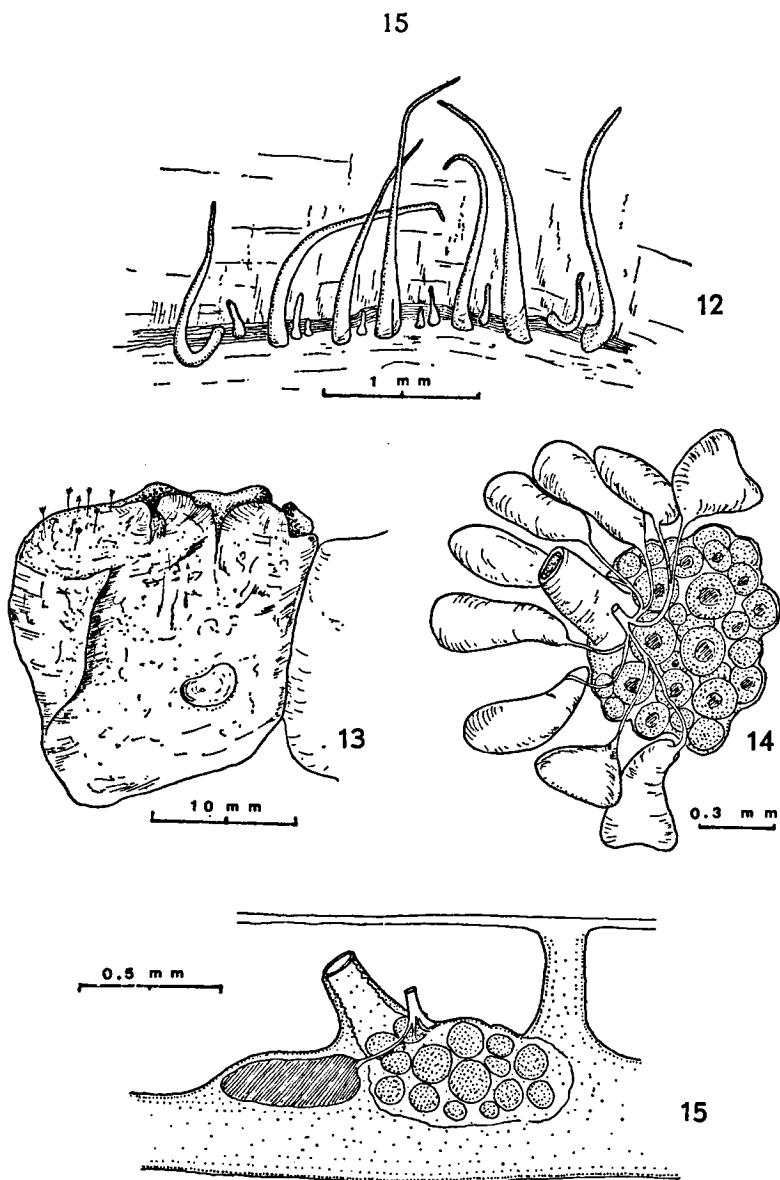


Fig. 12-15. *Polycarpa arnoldi* Michaelsen. — Specimen from Sta. 1463, branchial tentacles (12), test (13), gonad as seen from peribranchial cavity (14), longitudinal section through gonad (15).

REMARKS

In spite of the differences in locality, it does not seem correct to distinguish the West Indian specimens from *P. arnoldi* Michaelsen of Annobon, as MILLAR did when describing his new species *P. crossogonima* in his 1962 publication. MICHAELSEN's excellent description and pictures correspond in all respects with the characteristics of the specimens which I have seen, including the paratype of *P. crossogonima*.

Although SLUITER (1898) described an additional fold in his specimen of *P. obtecta*, I was not able to find it. Careful study of SLUITER's material showed that only in *S. (P.) brevipedunculata* an additional fold was present. Since all characteristics of this specimen fit very well with TRAUSTEDT's description of *P. obtecta*, it seems possible that some mistakes have been in the past concerning proper labelling of the specimens. This assumption is supported by the discrepancies which exist between the statements of the localities of *S. (P.) nivosa* and *S. (P.) insulsa* in SLUITER's publication and those on the labels in the museum bottles. On account of the descriptions of SLUITER (1898), it appeared impossible to correct any possible mistakes in labelling his specimens. I therefore confined myself to the names which are presently on the museum labels, and I had to dismiss the claim that the species should be named *P. brevipedunculata*, although this might have been the original intention of SLUITER.

Because the gonads of the species are very distinctive from these in *P. spongiabilis*, and since TRAUSTEDT (1883) reported that the gonads of *P. obtecta* were identical with those of *P. spongiabilis*, there is no reason to suppose that *P. arnoldi* could be a synonym of *P. obtecta*.

DISTRIBUTION

In view of the synonymy of the species we may expect that it would occur on the coasts of all warmer parts of the Atlantic. Also, since it is likely to have incorrectly identified in the past as *Polycarpa obtecta* (as SLUITER and VAN NAME did with some of their specimens) we may expect that the records from Santa Marta (Colombia), Curaçao, Bonaire and St. Martin will be supplemented by records from the entire West Indian region. The species seems to be quite common.

The absence of the species from the Piscadera inner-bay (Fig. 4) makes it seem that *Polycarpa arnoldi* prefers more open waters, not too near to low-water mark.

It mostly seems to be solitary, but under favourable conditions it may form groups of several individuals (c.q. Florida).

***Polycarpa cartilaginea* (Sluiter), 1898**

Styela (Polycarpa) cartilaginea SLUITER, 1898, p. 16–17, pl. I, fig. 13–15. [Gairaca, Santa Marta, Col.]

Styela (Polycarpa) oblecta, SLUITER 1898, p. 11. [Santa Marta, Col.; pro parte.]

Pandocia cartilaginea, HARTMEYER 1909–1911, p. 1363. [Name only.]

Polycarpa cartilaginea, VAN NAME 1921, p. 487. ["Apparently related to *P. oblecta*."]

Polycarpa oblecta, VAN NAME 1924, p. 31. [Caracasbaai, Curaçao; pro parte.]

Polyandrocarpa sabanillae, VAN NAME 1945, p. 247. [As possible synonym.]

Polycarpa oblecta, VAN NAME 1945, p. 257. [As possible synonym.]

Polycarpa oblecta, KOTT 1952, p. 242. [As possible synonym.]

Polycarpa cartilaginea, MILLAR 1962, p. 73–75, fig. 56A–D. [Curaçao.]

DIAGNOSIS

A rather small solitary styelid, attached to solid substrates, but also able to settle in bottoms of shell debris or coarse sand. Apparently a shallow water species.

Branchial sac with four folds on each side, with a total number of about 80–120 internal longitudinal vessels, equally divided amongst the folds. Usually 6–10 stigmata per mesh in the flat parts of the sac. Number of tentacles rather constant, about 60.

Alimentary canal takes about $\frac{1}{3}$ – $\frac{2}{3}$ of the left side of the body. It forms a closed loop and is attached by ligaments to the mantle wall except for the distal part of the stomach and the first part of the intestine. Stomach elongated, tapered at both ends, with a transparent outer wall through which the internal folds can clearly be seen. The long transparent rectum is attached to the body wall as far as the anus, with a smooth, lobed or crenate margin, which does not show a typhlosole plug.

Small endocarps not present. One large endocarp in gut loop. Gonads numerous on both sides of the body, freely extending into the peribranchial cavity, attached to the body wall by means of a small short ligament. They are ovoidal, blunt at the base and somewhat acute at the proximal end, where the oviduct and sperm duct empty. The sheath is rather transparent, consisting of a membrane with numerous small vesicles giving the gonad a more or less pimply character. (The same type of membrane covers the

inner mantle wall.) The ovary covers the testis nearly completely. In the base of the gonad 4–8 pear-shaped or lobed testis follicles are found, sending their individual ducts on both sides of the ovary into the very small common sperm duct.

MATERIAL

COLOMBIA, Santa Marta, Gairaca, 0–15 m, 29.II.1896, Exp. "Chazalie", leg. J. W. Versluys. – Holotype of *Styela (Polycarpa) cartilaginea* Sluiter, 1898. 1 specimen (A).

Santa Marta, Exp. "Chazalie", leg. J. W. Versluys. – Identified by SLUITER in 1898 as *Styela (Polycarpa) oblecta*. 1 spec. (A).

CURAÇAO, Caracasbaai, 5.V.1920, coll. Van der Horst. – Bottle with 4 spec. of *Polycarpa cartilaginea* and 1 colony (with 3 zooids) of *Polyandrocarpa tumida*, all identified by VAN NAME in 1924 as *P. oblecta* (A).

Piscadera Baai, coll. P. Wagenaar Hummelinck, Oct. 1963–Jan. 1964 (Fig. 2).

Sta. 1453. – 1 spec. (alc.) (A) on sandy pebbles and a sparse algae vegetation (3½–4 m).

Sta. 1460. – 1 spec. (form.) (A) on roots of *Rhizophora*, completely overgrown by *Didemnum* sp. (0–1 m).

Sta. 1460a. – 1 spec. (form.) (L) on sandy bottom with *Rhizophora* decay and algae (1 m).

Sta. 1461. – 1 spec. (form.) (U) on incrusting algae on *Rhizophora* (0–1 m).

Sta. 1463. – 1 spec. (form.) (A) on oyster shell between other ascidians, pelecypods and balanids on *Rhizophora* (0–1 m).

DESCRIPTION

Body more or less oval or rounded; sometimes the dorso-ventral diameter exceeds the length, but more often the body is somewhat flattened (Fig. 16). Some specimens are covered with foreign bodies, others are smooth or overgrown by colonies of *Didemnum*. The branchial aperture is terminal on the anterior end with the atrial aperture on the dorsal surface, about ¼ of body length farther backwards. Both are indistinctly lobed and in any case in specimens which have been in alcohol for a long time, difficult to find on the outside. Attachment by a large part of the ventral posterior side, sometimes by a broad short process.

Size of the specimen from Sta. 1463: length 25 mm; width 14 mm; dorso-ventral diameter 12 mm. Size of the type specimen of SLUITER: length 16 mm; width 9 mm; dorso-ventral diameter 26 mm.

Test. – Moderately thick, sometimes opaque, sometimes semi-transparent, more or less rough, slightly thickened in the posterior ventral region, where the attachment takes place. Incrustations may be present or absent. Test-substance leathery or of a more gelatinous appearance when it is soft and flexible. Colour of the outer surface whitish or greenish grey.

Mantle. – Smooth, rather thin and not very transparent, its muscles forming a rather thin continuous sheet or network (Fig. 17), the siphons showing many longitudinal fibers. Colour of the mantle yellowish brown, somewhat deeper at the apertures. Siphons characteristically bowed (Fig. 17).

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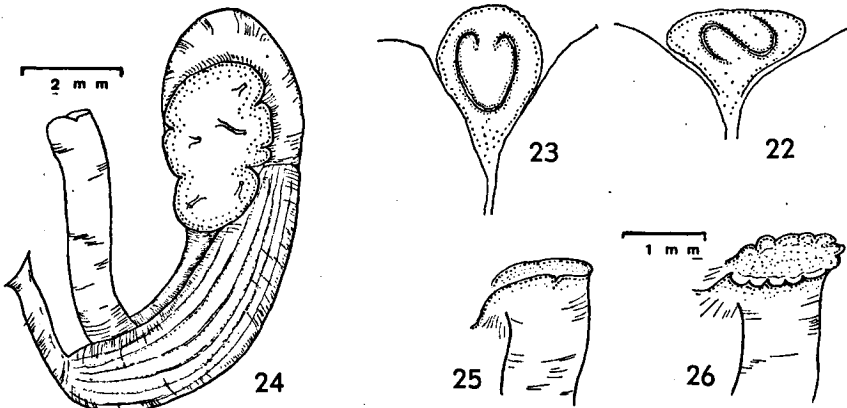
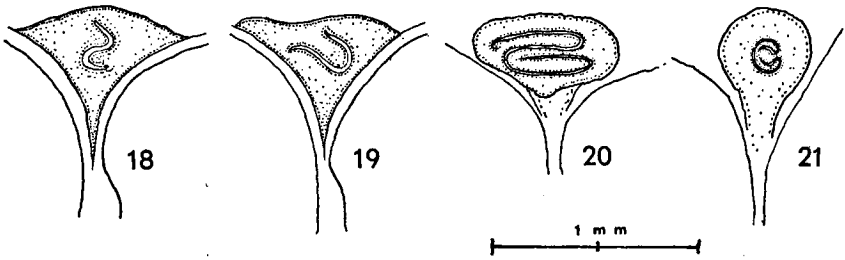
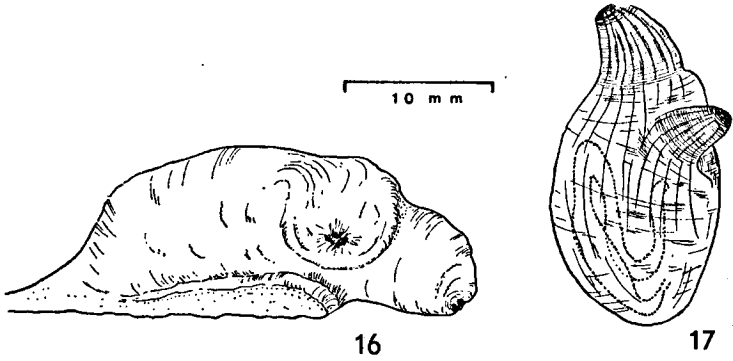


Fig. 16-26. *Polycarpa cartilaginea* (Sluiter). — Specimen from Sta. 1463 with test (16), with test removed (17). — Dorsal tubercles from Sta. 1463 (18), Sta. 1460A (19); VAN NAME'S *P. oblecta*, A-1924 (20, 22); SLUITER'S type specimen (21); SLUITER'S *S. (P.) oblecta* (23). — Alimentary canal with endocarp from Sta. 1463 (24). — Part of rectum with anus from Sta. 1463 (25) and 1460A (26).

Tentacles. — The number is rather constant. In 7 specimens in which I counted them I found 60, 64, 59, 50, 54, 57, and 60. They seem to be of alternating sizes: about 16 large, 18 small and 26 very small.

Dorsal tubercle. — Having usually a S-shaped orifice, but sometimes circular or C-shaped, with the open interval towards the right. Never I found very complicated forms (Fig. 18–23).

Dorsal lamina. — A rather broad, plain edged membrane.

Endostyle. — Wide but not prominent or high and not wide.

Branchial sac. — With four rather well developed folds on each side. The total number of longitudinal vessels is usually not exceeding 120, although I counted 138 in one of the Caracasbaai specimens. In 4 Piscadera specimens the total number varies from 74 to 86. In the type specimen I counted 120. The distribution of the folds is nearly equal (length of specimens measured after removing the test):

Type specimen of SLUITER, length 20 mm

left: dorsal lamina 1 (10) 2 (12) 3 (13) 3 (12) 3 endostyle

right: dorsal lamina 1 (11) 2 (13) 4 (12) 3 (12) 3 endostyle

Specimen from Santa Marta, identified by SLUITER as *P. oblecta*, length 12 mm

left: dorsal lamina 1 (7) 2 (9) 2 (9) 2 (8) 2 endostyle

right: dorsal lamina 1 (10) 2 (9) 2 (8) 2 (9) 1 endostyle

Specimen from Caracasbaai, length 21 mm

left: dorsal lamina 1 (10) 5 (12) 6 (14) 4 (16) 4 endostyle

right: dorsal lamina 1 (12) 3 (16) 4 (14) 3 (10) 3 endostyle

Specimen from Sta. 1460, length 13 mm

left: dorsal lamina 1 (7) 2 (7) 2 (9) 2 (9) 1 endostyle

right: dorsal lamina 1 (9) 2 (8) 3 (9) 2 (6) 2 endostyle

Specimen from Sta. 1463, length 18 mm

left: dorsal lamina 0 (6) 2 (7) 2 (8) 2 (7) 3 endostyle

right: dorsal lamina 0 (7) 2 (8) 2 (8) 2 (7) 1 endostyle

Between the folds the number of stigmata is usually 6–10 per mesh in the flat parts of the sac, but along endostyle and dorsal lamina as many as 12 may be found.

Alimentary canal. — Forming a characteristic closed loop in the posterior part of the body, with the intestine partly disappearing under the stomach, taking up about $\frac{1}{3}$ – $\frac{1}{4}$ of the left body wall. Only the distal part of the stomach and the first part of the intestine are not attached to the body wall. The stomach is elongated and tapered at both ends, a characteristic of the species. About 14 longitudinal folds glimmer through the transparent stomach wall (Fig. 24). Pyloric caecum rudimentary or absent. Rectum with a very thin, transparent wall attached up to the anus. Anus margin usually indistinctly lobed, sometimes smoothly edged or crenate. A typhlosole plug is never found (Fig. 25–26).

Endocarps. — No small endocarps on the inner body wall. But one, more or less large, fleshy endocarp present in gut loop, enclosed by stomach and intestine (Fig. 24).

Gonads. — The following counts give an impression of the numbers:

Specimen from Sta. 1463 left side 35 right side 68

Specimen from Sta. 1461 left side 23 right side 46

Specimen from Sta. 1460A left side 20 right side 33

The estimation of the number in SLUITER's type specimen is yet higher.

They are ovoidal, coming to a point where the ducts end, not embedded in the body wall but loosely attached by the base only through a short peduncle-like ligament (Fig. 27-34).

The size of the polycarps is rather variable, but usually they are small, not exceeding 1.0 mm. In SLUITER's type specimen, however, they are larger: length up to 2.0 mm, width to 1.1 mm, height to 0.8 mm. The sheath is rather transparent. The striking pimply appearance is caused by the vesiculous membrane which sometimes has a more or less milky colour (Fig. 34).

The ovary occupies the upper part of the gonad, while the testis lies at the bottom, consisting of a number of 4-6 (once I counted 10, Fig. 27) pear-shaped follicles which send their individual ducts along the sides of the ovary to the head of the gonad. The common sperm duct is very small, ending in the same protruding papilla as the wide oviduct.

REMARKS

MILLAR (1962) examined SLUITER's type specimen and compared it with two specimens from Curaçao. He concluded that VAN NAME's suggestion that *Styela (Polycarpa) cartilaginea* was a specimen of *Polycarpa obtecta* or of *Polyandrocarpa sabanillae* must not be followed. I agree fully with that opinion. Alimentary canal, endocarp and gonads show characteristics which are different from those in all the species mentioned by VAN NAME.

I believe that further investigations will show a close relationship of the present species with *Styela reniformis* Sluiter, 1904 (A).

DISTRIBUTION

It may be expected that the species occurs throughout the entire West Indian region, but at the moment it is only recorded from Santa Marta (Colombia) and Curaçao. It is likely to have been named *P. obtecta*, as VAN NAME did with some of his 1924 specimens.

Just like *Polycarpa arnoldi*, *P. cartilaginea* is limited to the outer bay and the entrance of Piscadera Baai, yet it seems that it can maintain itself better in the ascidian community on the roots of *Rhizophora*, a habitat from which *P. arnoldi* has been collected only once. Some preference for the entrance of the bay may be noticed (Fig. 4).

***Polycarpa nivosa* (Sluiter), 1898**

Styela (Polycarpa) nivosa SLUITER, 1898, p. 12, pl. I, fig. 9, pl. III, fig. 46. [Gairaca, Santa Marta (Col.).]

Pandocia nivosa, HARTMEYER 1909-1911, p. 1364. [Name only.]

Polycarpa nivosa, VAN NAME 1921, p. 487. [Name only.]

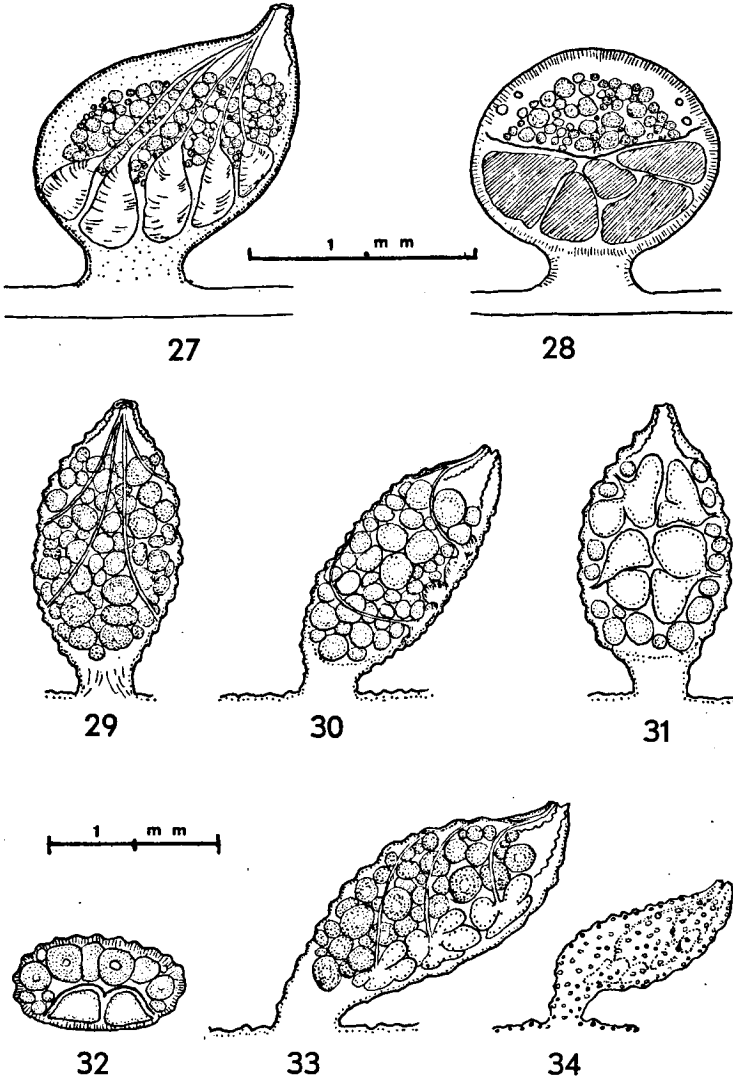


Fig. 27-34. *Polycarpa cartilaginea* (Sluiter). — Gonads from Sta. 1463 in side view (27), transverse section (28); one of SLUITER'S *S. (P.) oblecta* upper side (29), side view (30), underside (31), transverse section (32); type specimen of SLUITER, side view (33); in side view to show the pimply character (34).

- Polycarpa oblecta*, VAN NAME 1945, p. 257. [As possible synonym.]
Polycarpa spongiabilis, VAN NAME 1945, p. 259. [As possible synonym.]
Polycarpa oblecta, KOTT 1952, p. 242. [As possible synonym.]
Polycarpa nivosa, MILLAR 1962, p. 73-75, fig. L.

DIAGNOSIS

A rather small solitary styelid, probably embedded in sand and apparently a deeper water species.

Branchial sac with four folds on each side, with a total number of about 200 internal longitudinal vessels, the folds beside the dorsal lamina being the lowest. Maximum 3-4 stigmata per mesh.

Number of tentacles: about 25.

Alimentary canal takes about $\frac{1}{2}$ of the left side of the body, forming a wide open loop. Stomach barrel-shaped with a transparent outer wall through which the internal folds can clearly be seen.

Endocarps not at all present.

Few gonads on both sides of the body, freely hanging in the peribranchial cavity, connected with the body wall and the branchial sac by short, slender threadlike ligaments. They are of a cigar-shaped form, reaching the largest diameter near the proximal end. The sheath consists of a very thin transparent membrane. The oviduct does not form a tube but ends on the upper side of the proximal part. The 7-8 strongly lobed testis follicles on each side of the gonad are situated under and partly beside the ovary and send their ducts to one common sperm duct which runs forward to end into a small papilla some distance behind the orifice of the oviduct.

MATERIAL

COLOMBIA, Santa Marta, Gairaca, from 30 m depth, Exp. Chazalie - according to SLUITER, 1898, p. 12. According to label in museum bottle: Los Testigos, W.I. - 3 syntypes, examined and described by SLUITER, 1898, and MILLAR, 1962 (A).

DESCRIPTION

The dorsal region is depressed making both the anterior and the posterior ends seem raised. From side to side the body is rounded.

The entire surface is covered with sand grains, bits of coral, calcareous algae and shell debris. Branchial aperture on a small but distinct and wartlike elevation on

the anterior end of the body; atrial aperture dorsal, halfway along the body, in the sunken region and less distinct. Both apertures are four-lobed. Attachment not certain, probably by a ventral anterior area.

Size of the largest specimen: length 30 mm; width 13 mm; dorso-ventral diameter 16 mm.

Test. – Thin and rather fragile owing to numerous incrusting bodies; not transparent. Colour of the material yellowish grey.

Mantle. – Very thin and delicate, with slender muscles, only the siphons are a little firmer, showing some transverse fibers. Because of the condition of the specimens further examination of the mantle was not possible (Fig. 35).

Tentacles. – About 25 vermiform tentacles of small proportions, larger and smaller ones alternating more or less regularly.

Dorsal tubercle. – Small, not prominent, more or less horseshoe-shaped, its orifice as a horseshoe- or C-shaped slit, with the open interval forwards, the right horn somewhat longer than the left one and curved outwards (Fig. 36–37).

Dorsal lamina. – Plain edged membrane rolled up into a tube. Prominent transverse ribs running on as far as the base of the lamina.

Endostyle. – Not very prominent, but wide.

Branchial sac. – With four folds on each side. The condition of the specimens does not permit an exact counting of the longitudinal vessels, but in a reconstruction from parts of the sac, the following numbers may be a fairly close approximation:

left: dorsal lamina 6 (15) 7 (22) 6 (21) 7 (18) 6 endostyle

right: dorsal lamina 5 (15) 7 (20) 7 (18) 7 (18) 6 endostyle

The largest number counted on one fold was 23, the smallest number 11. In one part of a branchial sac I could count the number on the left side exactly:

left: dorsal lamina 3 (14) 5 (18) 5 (17) 4 (15) 4 endostyle

But in the other parts 6–7 vessels between the folds are the rule, while on the folds a number of 18–22 seems to be normal.

Small parastigmatic vessels are present. The number of stigmata is usually 3–4 per mesh.

Alimentary canal. – Only fragments are present. The reconstruction is done partly with the help of the descriptions of SLUITER 1898 and MILLAR 1962, partly from my own examinations. Forming a wide open loop in the posterior part of the body. Oesophagus moderately long and wide. Stomach ovoid, not very elongated, longitudinally plicated by about 20 folds. Pyloric caecum not present. Intestine rather long, following the ventral line till about the middle of the body, then bending back in an S-shape towards the atrial siphon. Anus according to MILLAR possibly with two lips and without a typhlosole plug.

Endocarps. – Due to the damage of the internal structure of the specimens I could not definitely decide about the presence or absence of endocarps. I could not find any indication that they were present, neither large fleshy, nor small ones. SLUITER did not mention them either.

Gonads. – Not numerous. In the material the gonads are loose, so that I only could count the total number of the three specimens. Moreover it is possible that some gonads have disappeared during former examinations. The number of 50 must therefore be divided by 3 to value an approximate number of each specimen. The form of the polycarps is cigar-like (Fig. 38–41), they are somewhat higher in the anterior part, hanging free in the peribranchial cavity, connected with the body wall and the branchial sac by slender tissue strands. The oviduct not forming a tube,

but ending on the upper side of the thickened anterior part of the gonad. The sperm duct ending more posteriorly and apart from the orifice of the oviduct.

Size of the largest gonads: length 2.0 (—2.5) mm; width 0.7 (—0.8) mm; height 0.8 (—1.2) mm. The sheath is very transparent, showing the internal organs excellently. The ovary lies in the upper part, the testis in the base section. On each side 7–8 strongly lobed testis follicles send their ducts across the surface of the ovary into one common sperm duct which opens into a small papilla, about 0.5 mm behind the orifice of the oviduct. In younger stage of development, testis-follicles are less lobed, more pyriform. Colour of the gonads bright yellow.

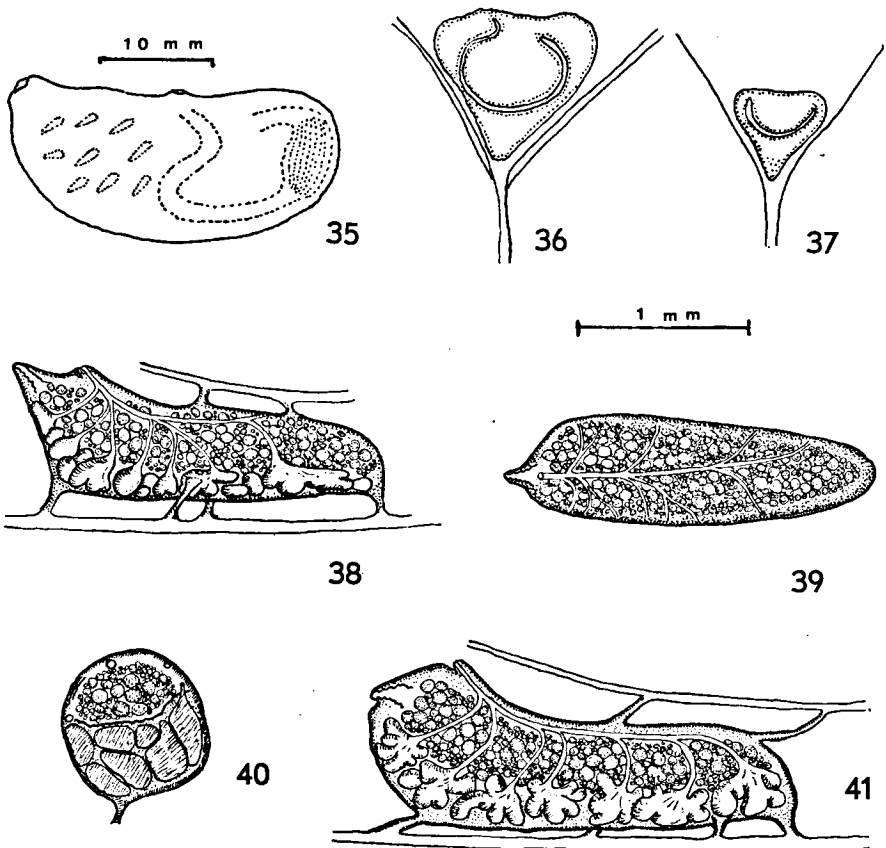


Fig. 35–41. *Polycarpa nivosa* (Sluiter). — Reconstruction of specimen with test removed (35). — Dorsal tubercles from two of the type specimens (36–37). — Gonads in side view, as suspended in the peribranchial cavity (38), and upper side (39); transverse section (40); another gonad in side view (41).

REMARKS

As the descriptions (more or less supplementary to SLUITER's in 1898) show, there is a close relation between *P. nivosa* and *P. appropinquata*. However, although there are only 3 damaged specimens of *P. nivosa* and 1 well preserved specimen of *P. appropinquata*, I hesitate to follow MILLAR (1962) in uniting the specimens into one species named *P. nivosa*. The external characters, the number of tentacles, the number of longitudinal vessels and especially the probable absence of endocarps, the form and size of the gonads, the lobation and number of testis follicles make *P. nivosa* differ enough from *P. appropinquata* to convince me that the species as yet must remain separated until more material has been collected and studied.

The specimens should be compared with examples of the genus *Cnemidocarpa* since VAN NAME (1945) mentioned an attachment of the gonads both to the body wall and to the branchial sac in *Cn. ohlini*. The small number and the form of the gonads points to the possibility that these specimens belong to that genus.

DISTRIBUTION

Only one locality is recorded. Three specimens were dredged by the Chazalie-Expedition, according to SLUITER's publication near Gairaca, Santa Marta (Colombia); but according to the museum label near Los Testigos (Venezuela). Following SLUITER I noted in the diagnosis that the species occurs apparently in somewhat deeper waters.

***Polycarpa appropinquata* (Sluiter), 1898**

Styela (Polycarpa) appropinquata SLUITER, 1898, p. 18, pl. I, fig. 19-21. [La Tortuga Id., Ven.]

Pandocia appropinquata, HARTMEYER 1909-1911, p. 1363. [Name only.]

Polycarpa appropinquata, VAN NAME 1921, p. 486. [Name only.]

Polycarpa oblecta, VAN NAME 1945, p. 257. [As possible synonym.]

Polycarpa oblecta, KOTT 1952, p. 242. [As possible synonym.]

Polycarpa nivosa, MILLAR 1962, p. 74-75, fig. 56M and N.

DIAGNOSIS

A rather small solitary styelid, probably attached to solid substrates and apparently a deeper water species. Remarkable is the

area around both apertures, which is smooth and free from foreign matter.

Branchial sac with four folds on each side, with a total number of about 275 internal longitudinal vessels, the folds beside the endostyle being the lowest. Maximum 2-3 stigmata per mesh.

Number of tentacles: 11.

Alimentary canal takes about $\frac{3}{4}$ of the left side of the body, forming a wide open loop. Stomach somewhat elongated with a transparent outer wall, through which the internal folds can clearly be seen. Anus without a distinctive typhlosole plug.

Endocarps small and numerous, scattered on both sides of the inner surface of the mantle, especially in the posterior part of the body and between the gonads.

Gonads not numerous, on both sides of the body, freely hanging in the peribranchial cavity, connected with the body wall and the branchial sac by short, slender threadlike ligaments. They are of torpedo-like form, straight-sided for most of their length, and protruding at the proximal end. The sheath consists of a very thin transparent membrane. Often more than 20 pear-shaped testis follicles on each side of the ovary send their ducts into one common sperm duct which runs forward over the surface of the ovary to end together with the oviduct in the protruding part of the gonad.

MATERIAL

TORTUGA, "La Tortuga Island, Ven.", "Chazalie"-Exp., I.II.1896, depth 45 m, holotype, examined and described by SLUITER, 1898, and MILLAR, 1962 (A).

DESCRIPTION

Body dorsally oval in shape and more or less flattened, ventrally more compressed from side to side, the dorso-ventral diameter exceeding the length; covered with sand grains, shell debris and calcareous algae; concentrically furrowed in the dorsal half, except for an oval area in the flattened region, which is naked, free from foreign matter and smooth. In this area the two four-lobed, small apertures raise on very small tubes, only 5 mm apart (Fig. 42). Attachment by rootlike processes on the entire ventral side.

Size of the only specimen: length, 15 mm; width, 13 mm; dorso-ventral diameter, 20 mm.

Test. - Moderately thick, tough, leathery and opaque with a deep yellow cast internally. Colour whitish or yellowish; according to SLUITER the colour of the smooth area around the apertures may be reddish during life.

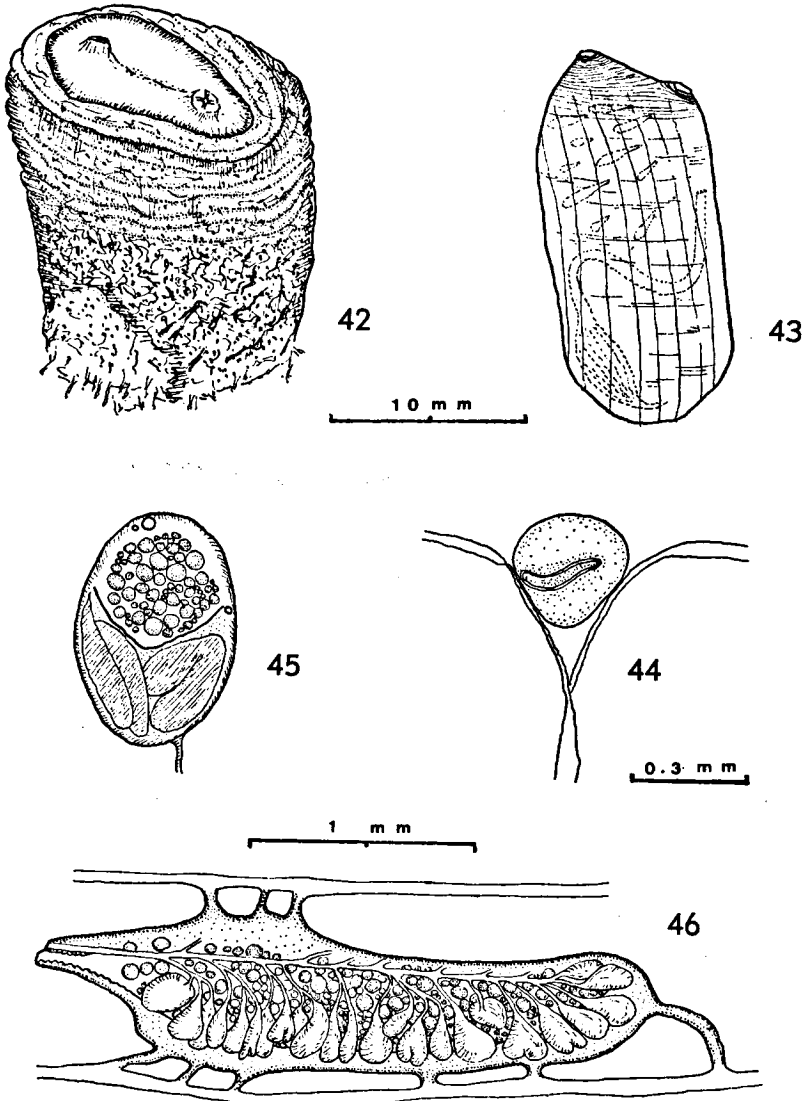


Fig. 42-46. *Polycarpa appropinquata* (Sluiter). — Specimen showing the naked area with the apertures (42), and with test removed (43). — Dorsal tubercle (44). — Gonads in transverse section (45), and in side view, as suspended in the peribranchial cavity, showing protruding orifices (46).

Mantle. — Rather thin, orange brown, not very transparent due to the broad, thin longitudinal muscle bands; these are covered by slender transverse fibers, which are developed especially in the dorsal region (Fig. 43).

Tentacles. — Small and rather thick, situated in two groups: 5 near the dorsal lamina and 6 near the endostyle.

Dorsal tubercle. — Small, oval, having a slightly curved slit, somewhat S-shaped. According to SLUITER, pl. I, fig. 20, the S-shape is very distinct, but I could not verify that (Fig. 44).

Dorsal lamina. — Plain edged membrane, rolled in to the left.

Endostyle. — Wide and prominent.

Branchial sac. — The four folds on each side are not very high, but a notable number of longitudinal vessels is present. On several places of the sac the folds are totally flat and can only be recognised by the accumulation of the vessels. This and the condition of the specimen makes exact counts rather difficult. The following numbers show the distribution of the vessels:

left: dorsal lamina 10 (22) 12 (18) 12 (21) 13 (16) 10 endostyle

right: dorsal lamina 12 (25) 12 (19) 13 (20) 13 (16) 11 endostyle

Transverse vessels of three or four orders. Very small parastigmatic vessels are present. The number of stigmata is 2–3 per mesh at the most.

Alimentary canal. — Forming a wide open loop in the posterior half of the body. Because of the damage to the specimen the details are not all apparent. Oesophagus very short. Stomach situated posteriorly, somewhat elongated and longitudinally plicated with 16–20 folds. Pyloric caecum not present. Intestine long, rather narrow, perhaps somewhat flattened, following the ventral line for some distance, then bending dorsally, while the rectum follows the dorsal line forward till $\frac{3}{5}$ of the body. According to SLUITER the anus is entire, not lobed. According to MILLAR the anus probably has two lips and no typhlosole plug.

Endocarps. — No fleshy endocarps are found in gut loop, but many small endocarps are scattered on the body wall, especially in the posterior part of the body, both on the left and on the right side. Fig. 20, pl. I of SLUITER shows the endocarps as large as the gonads, but according to my own investigations the endocarps are much smaller, no bigger than 1 mm. Also I cannot agree that endocarps are absent between the gonads shown by SLUITER in his figures. Although not in large numbers they are present in the anterior part of the body.

Gonads. — Not numerous. I counted 15 on the right and 10 on the left side of the body, but it is possible that some are lost. They are distributed especially in the anterior part of the body. They are torpedo-like polycarps, hanging free in the peribranchial cavity, connected with the body wall and branchial sac by slender tissue strands, the straight protruding orifices directed toward the atrial siphon.

Size of the largest ones: length 2.5 (—3.0) mm, width 0.7 mm, height 1.0 mm.

The sheath is very transparent, showing excellently the internal construction of the gonad. The upper part is given over to the ovary, which covers the testis partly, on both sides the testis follicles are seen. Often more than 20 hardly lobed, pyriform follicles on each side of the gonad send their ducts to one common sperm duct which runs over the entire length of the ovary, ending in the orifice tube of the gonad above the oviduct, not into a separate papilla (Fig. 45–46) Colour of the gonad bright orange.

REMARKS

MILLAR (1962) considered *Polycarpa appropinquata* a synonym of *P. nivosa*, but the differences in external characters, in gonads and the absence of endocarps in the latter species convinced me that the species would be better separated pending further study.

Although several characteristics are distinctly different, there is undoubtedly a close relation with *P. angola* Michaelsen, 1915, because of the construction and attachment of the gonads. It is possible that MICHAELSEN's small specimens were young, a suggestion which is reinforced by the description of the branchial sac of *P. angola*. Moreover MICHAELSEN did not reach any clear conclusion about the presence of endocarps.

It seems possible that *P. appropinquata* has been determined in the past as *P. oblecta*.

DISTRIBUTION

Only one locality is recorded. By the "Chazalie" expedition a single specimen was dredged near the island of Tortuga (Ven.).

***Polycarpa spongiabilis* (Traustedt), 1883**

Polycarpa spongiabilis TRAUSTEDT, 1883, p. 125-126, 134, pl. V, fig. 9. [West Indies; Brasil.]

Polycarpa oblecta TRAUSTEDT, 1883, p. 126-127, 134, pl. V, fig. 7-8, pl. VI, fig. 15. [St. Thomas.]

Polycarpa rugosa VON DRASCHE, 1884, p. 380, pl. VII, fig. 3-4. [Rio de Janeiro (Brasil).]

Polycarpa spongiabilis, HERDMAN 1891, p. 583. [Name only.]

Polycarpa oblecta, HERDMAN 1891, p. 583. [Name only.]

Styela (Polycarpa) fuliginea SLUITER, 1898, p. 12, pl. I, fig. 10, pl. III, fig. 45. [near la Tortuga Island (Ven.).]

Styela (Polycarpa) friabilis SLUITER, 1898, p. 13, pl. I, fig. 11. [Kingston (Jamaica).]

Styela (Polycarpa) brevipedunculata SLUITER, 1898, p. 15, pl. I, fig. 12. [Schottegat (Curaçao).]

Styela (Polycarpa) seminuda SLUITER, 1898, p. 19, pl. II, fig. 22-23. [La Tortuga Island (Ven.).]

Polycarpa multiphiala VERRILL, 1900, p. 591. [Bermuda.]; 1901, pl. IX, fig. 7 (p. 62).

Polycarpa oblecta, VAN NAME 1902, p. 386, pl. LVII, fig. 88, 89, 92-94, pl. LXIII, fig. 140, 144, pl. LXIV, fig. 151, 153. [Coney Island and Long Bird Island.]

Polycarpa oblecta, HARTMEYER 1908, p. 111. [Tortugas (Flor.).]

Pandocia oblecta, HARTMEYER 1909-1911, p. 1111, 1364, 1630, 1633. [Name and distribution only.]

- Pandocia spongiabilis*, HARTMEYER 1909–1911, p. 1364, 1630, 1633. [Name only.]
- Polycarpa oblecta*, MICHAELSEN 1915, p. 412–413. [Relation with *P. arnoldi*.]
- Pandocia oblecta*, VAN NAME 1918, p. 103. [“allied to *P. ovata*.”]
- Polycarpa oblecta*, VAN NAME 1921, p. 420–424, fig. 90. [West Indies, Bahamas and Florida.]
- Polycarpa spongiabilis*, VAN NAME 1921, p. 424–428, fig. 91–95. [Puerto Rico.]
- Polycarpa brevipedunculata*, VAN NAME 1921, p. 486. [Name only.]
- Polycarpa friabilis*, VAN NAME 1921, p. 487. [“Apparently related to *P. oblecta*”.]
- Polycarpa fuliginea*, VAN NAME 1921, p. 487. [Name only.]
- Polycarpa seminuda*, VAN NAME 1921, p. 487. [“Apparently related to *P. oblecta*.”]
- Polycarpa brevipedunculata*, VAN NAME 1924, p. 24. [As possible synonym of *P. oblecta*.]
- Polycarpa oblecta*, VAN NAME 1930, p. 486–488, fig. 53–54. [Guánica Harbour (Puerto Rico).]
- Polycarpa spongiabilis*, VAN NAME 1930, p. 488, fig. 55. [Puerto Rico.]
- Polycarpa oblecta*, BERRILL 1932, p. 78. [Bermuda.]
- Polycarpa oblecta*, BERRILL 1935, pt. 3, p. 257, 270, fig. 3h.
- Polycarpa oblecta*, PLOUGH & JONES 1937, p. 101. [Name only.]
- Polycarpa spongiabilis*, PLOUGH & JONES 1937, p. 101. [Name only.]
- Polycarpa oblecta*, VAN NAME 1945, p. 257–259, fig. 156, pl. 14, fig. 2–3. [West Indies.]
- Polycarpa spongiabilis*, VAN NAME 1945, p. 259–261, fig. 157, pl. 19, fig. 3. [West Indies.]
- Polycarpa oblecta*, KOTT 1952, p. 242–244, fig. 55–57. [Australia.]
- Polycarpa spongiabilis*, KOTT 1952, p. 244. [relation with *P. oblecta*.]
- Polycarpa oblecta*, MILLAR 1962, p. 62, 73–75, fig. 56E–K. [Dry Tortugas.]

DIAGNOSIS

A large solitary styelid, attached to solid substrates, but also capable of settling in beds of shell debris, coarse sand or even mud. A shallow water species also collected occasionally from deeper localities.

Branchial sac with four folds on each side, but an additional small fifth fold may be present on the right side. A total of 100–160 internal longitudinal vessels. Usually 10–12 stigmata per mesh.

Number of tentacles variable: usually about 50.

Alimentary canal takes $\frac{1}{4}$ – $\frac{1}{2}$ of the left side of the body wall. It forms a closed loop and is attached to the mantle wall over the complete length. Stomach spindle-shaped, with the outer wall opaque except for the area near the pyloric caecum where some internal folds may show through. Rectum attached on body wall up to the anus, which has a smooth or lobed margin and a distinctive typhlosole plug.

Small endocarps not present. In gut loop mostly 3 endocarps,

sometimes 2, of which the largest is situated in the distal part of the loop, the second one between stomach and intestine and the smallest between oesophagus and rectum. The last two endocarps may be united to form a single narrow, long one.

Gonads numerous on both sides of the body, somewhat buried into the inner mantle wall, only protruding from it at the oviduct. They are flask-like, comprising usually about 16 testis follicles, nearly completely covered by the ovary; protruding into a shorter or longer neck in which the oviduct is situated. Upon this neck a small papilla can usually be found, in which the common sperm duct ends. The latter is branched into two main vessels into which the separate follicle ducts unite on each side of the gonad body.

MATERIAL

- WEST INDIES, 9.VII.1870; coll. Børgesen. – Syntypes described by TRAUSTEDT in 1883. One bottle with 7 specimens: 5 spec. of *Polycarpa spongiabilis*, 1 of *Styela partita* (small one growing together with a spec. of *P. spongiabilis*), 1 of *Ascidia interrupta* (?). Specimens of *P. spongiabilis* overgrown by *Symplesma viride* (K).
- BERMUDAS, April–May 1898; coll. A. E. Verrill. – Holotype of *Polycarpa multi-phiala* Verrill, 1898–1900. 1 spec. (Y; YPM 2204). Coney Island, under stones, 28. IV.1901; coll. A. E. Verrill and party. – Identified by VERRILL as *P. multi-phiala*. 2 spec. (Y; YPM 2205).
- GULF OF MEXICO, "Albatross" Sta. 2405, depth 30 fathoms, grey sand and broken coral. – 5 spec. identified by VAN NAME, 1945, as *P. oblecta*. They are now in a poor state and nothing can be said about the internal characteristics (N; 602).
- JAMAICA, Kingston, depth 2 m, Exp. "Chazalie", leg. J. W. Versluys. – Holotype of *Styela (Polycarpa) friabilis* Sluiter, 1898. 1 spec. (A).
- HISPANIOLA, Santo Domingo, Barahona Harbor, behind Piedra Prieta, reef, depth 1–8 ft. – 2 spec. identified by VAN NAME as *P. oblecta* (N; 1809).
- PUERTO RICO, Ivonico Harbor; coll. Julio Core. – 1 spec. identified by VAN NAME as *P. oblecta* (N; 252).
Ivonico Harbor. – 1 spec., identified by VAN NAME as *P. spongiabilis*? (N; 263).
Off Guánica Playa, 29.V.1915. – 1 spec. identified by VAN NAME as *P. oblecta* (N; 196).
Puerto Rico. – 3 spec. identified by VAN NAME as *P. spongiabilis* (N; 293).
Puerto Rico, leg. Gray. – 1 spec. identified as *Pandocia (Polycarpa) spongiabilis* (A).
- TORTUGA, near Tortuga Id. (Ven.), 1.II.1896, Exp. "Chazalie", leg. J. W. Versluys, depth 45 m. – Holotype of *Styela (Polycarpa) fuliginea* Sluiter, 1898. 1 spec. (A).
Tortuga Id, (Ven.), 1.II.1896, Exp. "Chazalie", leg. J. W. Versluys. – Holotype of *Styela (Polycarpa) seminuda* Sluiter, 1898. 1 spec. (A).

- CURAÇAO, Schottegat, on the shores, 1.I.1896, Exp. "Chazalie", leg. J. W. Versluys.
 - Holotype of *Styela (Polycarpa) brevipedunculata* Sluiter, 1898. 1 spec. (A).
 Piscadera Baai, collected by P. Wagenaar Hummelinck, Oct. 1963 - Jan. 1964, with exception of Sta. 1476a which was sampled by Louise J. van der Steen, Sep. 1962 (Fig. 2).
 Sta. 1463A. - 1 spec. (form.) (A) between *Halimeda* and *Thalassia* on sandy bottom (depth 1 m).
 Sta. 1464. - 4 spec. (form.) (A + U) and 2 spec. (alc.) (L) between *Microcosmus exasperatus*, *Styela partita* and *Didemnum* on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1465. - 3 spec. (alc.) (A) between other ascidians, among oysters on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1466. - 1 spec. (form.) (A) between other ascidians, oysters, actinians, bryozoans and hydroids on *Rhizophora* in very muddy water (0-1 m).
 Sta. 1467. - 1 spec. (form.) (A) on muddy sand with pelecypods (1 $\frac{1}{2}$ m).
 Sta. 1469. - 6 spec. (alc.) (L) and 3 spec. (form.) (A) between *Microcosmus exasp.* and *Styela partita*; often overgrown by *Didemnum*; together with oysters on *Rhizophora* (0-1 m).
 Sta. 1469B. - 1 spec. (alc.) (A) on rock debris, with chitons and gastropods (0- $\frac{1}{2}$ m).
 Sta. 1471A. - 3 spec. (form.) (A + U) on sandy mud with shell debris (2 m).
 Sta. 1471B. - 3 spec. (alc.) (L) on muddy sand with shell debris, with chitons and echinids (2 m).
 Sta. 1473. - 6 spec. (alc.) (A) and 2 spec. (form.) (A) with *Microcosmus exasp.*, *Styela partita* and pelecypods on *Rhizophora* (0- $\frac{1}{2}$ m).
 Sta. 1473A. - 1 spec. (alc.) (A) on sandy debris with chitons and gastropods (0-1 m).
 Sta. 1475. - 4 spec. (form.) (A) between *Microcosmus exasp.* and *Styela partita* on *Rhizophora*; overgrown by *Symplegma viride* and *Ecteinascidia turbinata* (0-1 m).
 Sta. 1476a. - 1 spec. (form.) (A) between *Microcosmus exasp.* and *Styela partita* on roots of *Rhizophora*; overgrown by *Didemnum* and bryozoans ($\frac{1}{2}$ m).
 Sta. 1477. - 10 spec. (form.) (L) and 6 spec. (alc.) (A) between *Microcosmus exasp.* and *Styela partita* on a buoy (0- $\frac{1}{2}$ m).
 Sta. 1480A. - 1 spec. (alc.) (A) on muddy sand with pelecypods and algae, (*Dictyota*) (2 m).
 Sta. 1482. - 5 spec. (form.) (A) and 1 spec. (alc.) (A) between *Microcosmus exasp.*, *Styela partita*, hydroids, balanids, actinians, bryozoans; overgrown by *Symplegma viride*; many algae (*Ulva* and *Enteromorpha*) (0- $\frac{1}{2}$ m).
 Sta. 1485. - 4 spec. (alc.) (A) and 4 spec. (form.) (A) between other ascidians and pelecypods on *Rhizophora* (0-1 m).
 Sta. 1486. - 2 spec. (alc.) (L) on sandy mud (3 $\frac{1}{2}$ m).
 Sta. 1487. - 20 spec. (form.) (A) together with *Microcosmus exasp.*, *Styela partita* and pelecypods on *Rhizophora*; almost completely overgrown by *Ecteinascidia conclini*, *Symplegma viride* and serpulid species (0-1 m).
 Sta. 1495. - 2 spec. (alc.) (A) and 1 spec. (form.) (A) on sandy mud in a vegetation of *Thalassia* and *Ulva* (2 m).
- BRASIL, 1836; coll. Lund. - Identified by TRAUSTEDT as *P. spongibilis*. 3 spec. (K).
 Rio de Janeiro. - Holotype of *Polycarpa rugosa* von Drasche, 1884, 1 spec. (W).

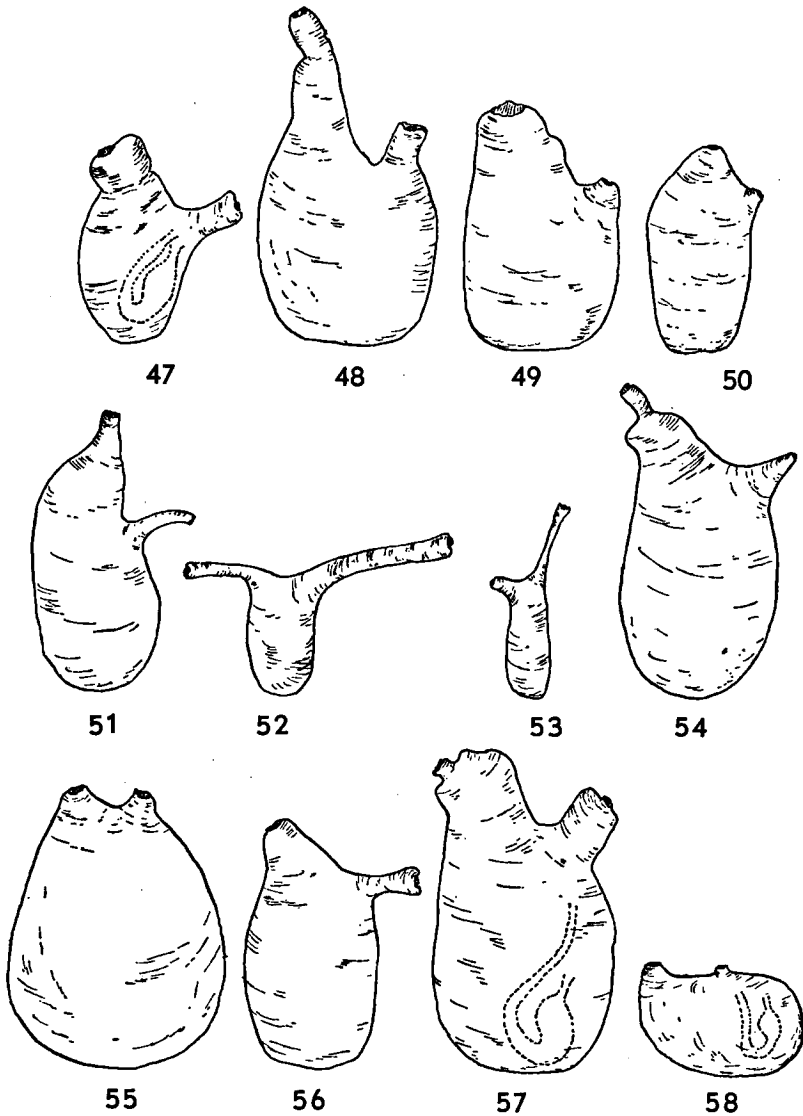


Fig. 47-58. *Polycarpa spongiabilis* Traustedt. — Specimens with test removed, showing variability in size, shape and length of siphon ($\times \frac{1}{2}$). — One of TRAUSTEDT's type specimens (47); of TRAUSTEDT's Brazilian specimens (48); one of VERRILL's *P. multiphiala* (Y, YPM-2205) (49); SLUITER's *Styela* (*Polycarpa*) *fuliginea* (50); SLUITER's *Styela* (*P.*) *friabilis* (51); two of VAN NAME's *Polycarpa spongiabilis* (N-293) (52-53); specimens from Sta. 1465 (55), Sta. 1464 (54, 56-57), and of Sta. 1463A, not adult (58).

DESCRIPTION

Examination of TRAUSTEDT's specimens of *Polycarpa spongiabilis* showed that the dark, nearly black colour, which TRAUSTEDT mentioned in his description, is due to overgrowth by *Symplegma viride*, and that the real colour of these *Polycarpa* is now greyish. The sponge-like appearance of the test is only more or less evident at the base of the specimens. Obviously this is the area by which the animals were attached to their substrates. In this way in some specimens "a short or rudimentary peduncle" or "root-like processes or irregular projections to assist in the attachment" (VAN NAME 1945, p. 257-259) may be spoken of.

The size of the specimens is usually about 30-40 mm, but under favourable ecological circumstances they may reach sizes of 70-80 mm, as I found some specimens in Piscadera Bay did (e.g. from Sta. 1485).

Test. - From Piscadera Bay I examined specimens with a rather thick test, like the specimens of TRAUSTEDT, but also a very thin test may be found sometimes. I do not agree with VAN NAME's notes about the non-contractile character of the tubes and aperture in *P. spongiabilis*. In TRAUSTEDT's types I did not find it. Only in some of the Piscadera specimens, which are preserved in alcohol, uncontracted tubes were sometimes found, never in specimens preserved in formalin. I think that contraction is due to the manner of fixation. In all other respects the descriptions of VAN NAME (1945) of the external characters of *P. oblecta* and *P. spongiabilis* fit very well.

Mantle. - Also in this characteristic variation is possible. Between the Piscadera specimens I found very thin, transparent mantles, but usually the mantle is smooth and of a somewhat gelatinous appearance, brown in colour, due to many pigment granules. The shape of the animals, after removing test is illustrated in Fig. 47-58.

Tentacles. - In 3 of TRAUSTEDT's types I counted 60, 65 and 52; in *P. multiphiala* 48, 40; in two of VAN NAME's specimens 50 and 55; in *S. (P.) fuliginea* 20; in *S. (P.) friabilis* 36; in *S. (P.) brevipedunculata* 60 and in three of the Piscadera specimens 72, 82 and 53. Counting many other specimens I found usually 50-60, but rather large variability appears (Fig. 59).

Dorsal tubercle. - In the past this character is used as essential in distinguishing *P. oblecta* and *P. spongiabilis*. TRAUSTEDT attached much value to it, inserting it in his key to both species. However, even in some of the syntypes of *P. spongiabilis* (TRAUSTEDT did not dissect them all) the horns of the orifices are both curved in. I think age and environment are the responsible factors for the great variability in shape of tubercle and its orifice (Fig. 64-84).

Branchial sac. - A specific characteristic seems to be the presence of an additional small fifth fold on the right side of the sac, but this is not always present. The number of internal longitudinal vessels is usually about 150. Amplifying VAN NAME's description of *P. oblecta* (1945) and *P. spongiabilis* (1921) the following distributions are given (length is measured after removing test):

3 specimens of TRAUSTEDT's type material (length respectively 36, 28 and 35 mm)

left: dorsal lamina 2 (14) 5 (13) 3 (18) 5 (13) 4 endostyle
right: dorsal lamina 2 (2) 2 (11) 4 (15) 3 (15) 4 (14) 3 endostyle

left: dorsal lamina 3 (11) 2 (14) 3 (16) 4 (15) 4 endostyle
right: dorsal lamina 0 (2) 3 (12) 2 (15) 3 (16) 4 (14) 4 endostyle

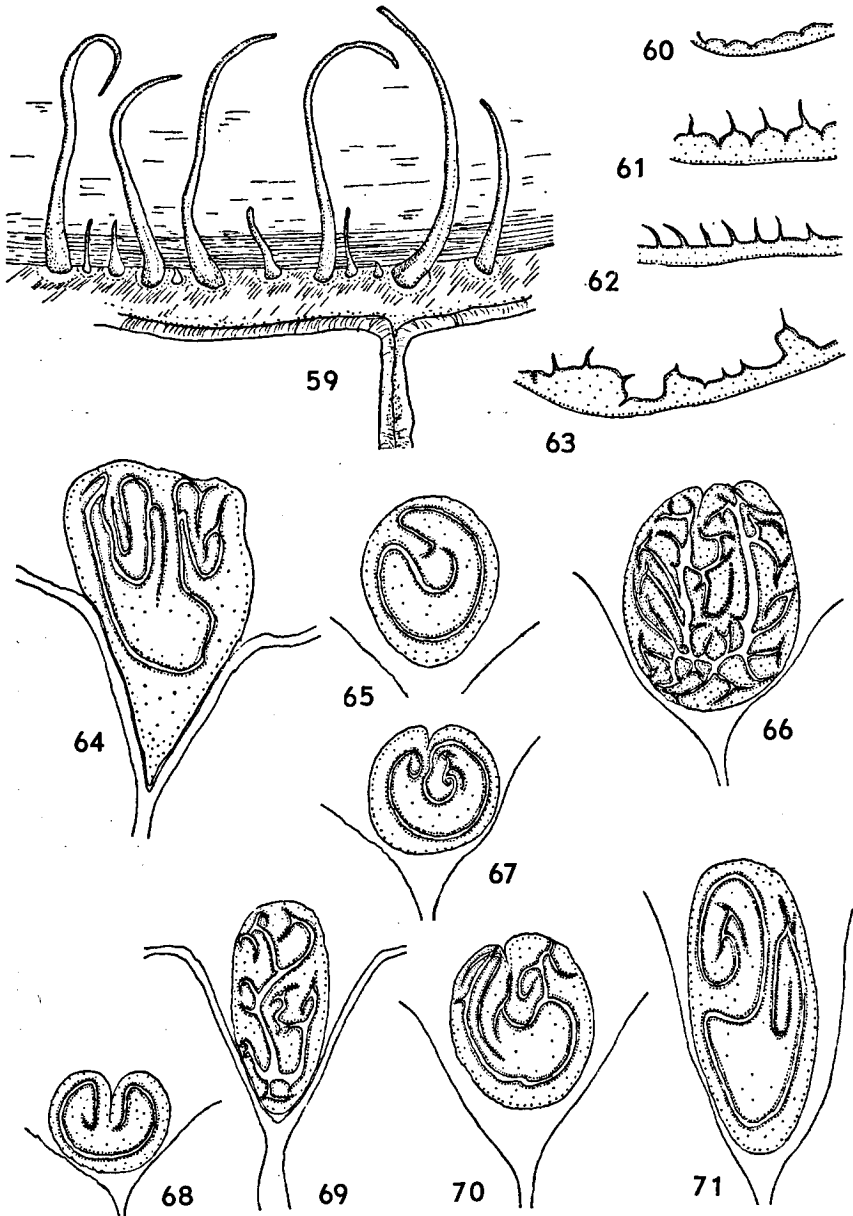


Fig. 59-71. *Polycarpa spongiabilis* Traustedt. — Branchial tentacles near endostyle in one of TRAUSTEDT's type specimens (59). — Atrial velum of one of TRAUSTEDT's type specimens (62), and of TRAUSTEDT's Brazilian specimens (61); of VERRILL's *P. multiphiala* (Y, YPM-2205) (60) and of VAN NAME's *P. oblecta* (N-196) (63). — Dorsal tubercles, of five of TRAUSTEDT's type specimens (64-68), and of three of TRAUSTEDT's Brazilian specimens (69-71).

left: dorsal lamina 2 (11) 4 (15) 3 (18) 4 (14) 4 endostyle
 right: dorsal lamina 0 (2) 2 (12) 2 (15) 4 (16) 4 (15) 3 endostyle

2 specimens from Brasil (TRAUSTEDT) (length respectively 35 and 34 mm)

left: dorsal lamina 2 (11) 5 (15) 4 (17) 4 (13) 4 endostyle
 right: dorsal lamina 0 (3) 2 (15) 4 (17) 4 (15) 5 (15) 4 endostyle

left: dorsal lamina 2 (11) 3 (13) 3 (15) 4 (12) 4 endostyle
 right: dorsal lamina 0 (3) 1 (11) 3 (15) 3 (14) 4 (14) 3 endostyle

Specimen of *P. multiphiala* Verrill (registered as 2204) (length 26 mm)

left: dorsal lamina 3 (11) 3 (15) 3 (15) 3 (15) 3 endostyle
 right: dorsal lamina 3 (12) 3 (15) 3 (15) 3 (15) 4 endostyle

Specimen of *P. spongiabilis*, VAN NAME (registered as 263) (length 18 mm)

left: dorsal lamina 2 (10) 3 (11) 3 (12) 3 (12) 3 endostyle
 right: dorsal lamina 0 (2) 2 (10) 3 (10) 3 (9) 3 (10) 3 endostyle

Type specimen of *Styela (Polycarpa) fuliginea* Sluiter (length 21 mm)

left: dorsal lamina 3 (12) 6 (19) 3 (22) 4 (21) 5 endostyle
 right: dorsal lamina 3 (15) 4 (20) 3 (22) 4 (20) 4 endostyle

Type specimen of *Styela (Polycarpa) friabilis* Sluiter (length 25 mm)

left: dorsal lamina 2 (8) 2 (11) 3 (12) 3 (12) 3 endostyle
 right: dorsal lamina 2 (9) 2 (10) 3 (11) 3 (8) 3 endostyle

Type specimen of *Styela (Polycarpa) brevipedunculata* Sluiter (length 33 mm)

left: dorsal lamina 3 (13) 3 (12) 4 (16) 4 (16) 4 endostyle
 right: dorsal lamina 0 (3) 2 (9) 4 (17) 4 (15) 3 (13) 3 endostyle

2 specimens of *P. obtecta*, VAN NAME (no 252 and 196) (length respectively 27 and 14 mm)

left: dorsal lamina 2 (9) 3 (13) 4 (14) 3 (11) 3 endostyle
 right: dorsal lamina 0 (2) 1 (10) 3 (13) 3 (12) 3 (11) 4 endostyle

left: dorsal lamina 1 (9) 3 (11) 3 (13) 2 (9) 3 endostyle
 right: dorsal lamina 0 (2) 1 (9) 2 (10) 2 (9) 2 (9) 3 endostyle

3 of the *Piscadera* specimens (Sta. 1476a, 1469 and 1467) (length 38, 34 and 28 mm)

left: dorsal lamina 3 (12) 3 (18) 4 (19) 4 (16) 3 endostyle
 right: dorsal lamina 4 (12) 3 (15) 3 (17) 3 (13) 3 endostyle

left: dorsal lamina 2 (11) 3 (15) 2 (15) 3 (14) 3 endostyle
 right: dorsal lamina 4 (12) 4 (14) 3 (16) 3 (13) 3 endostyle

left: dorsal lamina 1 (10) 2 (13) 2 (14) 3 (12) 2 endostyle
 right: dorsal lamina 0 (3) 1 (9) 1 (13) 2 (13) 2 (11) 2 endostyle

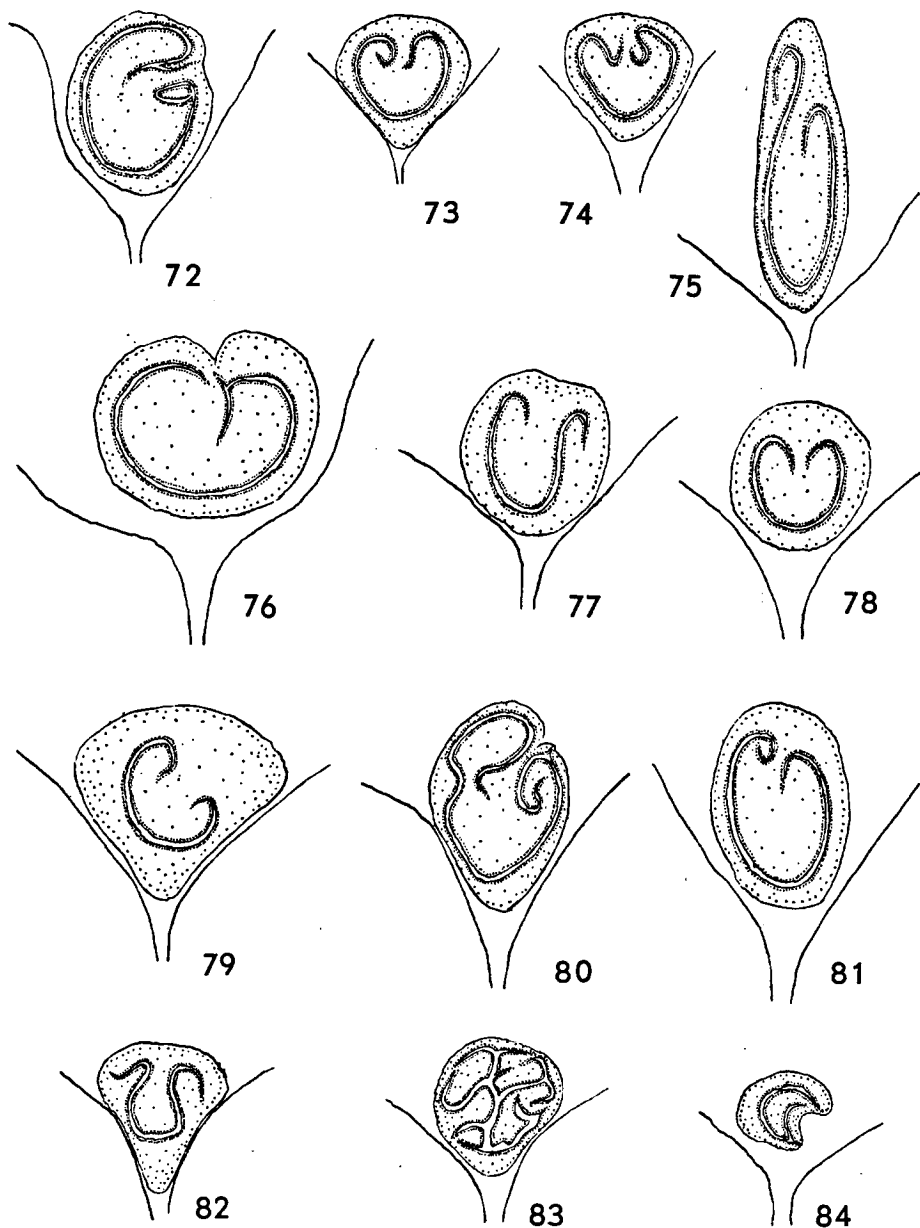


Fig. 72-84. *Polycarpa spongiabilis* Traustedt. — Dorsal tubercles: holotype of VERRILL's *P. multiphiala* (Y, YPM-2204) (72), other specimens of VERRILL's *P. multiphiala* (Y, YPM-2205) (73-74); of VAN NAME's *P. oblecta* (N-252, N-1809) (75-76); of VAN NAME's *P. spongiabilis* (N-293) (77-78); of SLUITER's *Styela* (*P.*) *fuliginea* (79); of SLUITER's *Styela* (*P.*) *friabilis* (80); of SLUITER's *Styela* (*P.*) *brevipedunculata* (81); from Sta. 1464 (82-84).

Usually the number of stigmata is about 8–14 stigmata per mesh on the flat parts of the sac, but along the endostyle much larger numbers may be found as e.g. 20–30.

Alimentary canal. – Forming a closed loop in the posterior part of the body, occupying usually about $\frac{1}{3}$ of the left body wall and is attached to the mantle wall over its complete length. Stomach spindle-shaped, smooth and more or less opaque. Near the thick smooth intestine the stomach wall is more transparent, showing the (about 16) internal folds. A pyloric caecum is usually present, but often hardly seen, hidden by the endocarps and enclosed by a ligament which connects the stomach with the mantle wall (Fig. 85–90). Rectum rather short and in comparison with the intestine narrow. Margin of the anus generally lobed and with a distinctive typhlosole plug (Fig. 91–92).

Endocarps. – One of the most characteristic features of the species seems to be the presence of more than one large fleshy endocarp in the gut loop. Small endocarps on the inner mantle wall are absent. The largest endocarp appears in the most distal part of the loop and is comparable with those in *P. arnoldi* and *P. cartilaginea*. It covers part of the stomach and intestine, as does the smaller second one, while the smallest third one rises up between the oesophagus and rectum (Fig. 85–90). In some cases I found the last two being united into a single long narrow one (Fig. 89–90). The endocarps are connected with the branchial sac by small ligaments.

Gonads. – The number of gonads is variable and seems to be dependent on size and age of the animals. In well-developed, adult animals (such as TRAUSTEDT's) the gonads become very numerous (L = length, D = dorso-ventral diameter, both of specimens measured after removing test):

Syntype of TRAUSTEDT (L = 36 mm, D = 40 mm)	left side 42	right side 82
Syntype of TRAUSTEDT (L = 35 mm, D = 34 mm)	left side 41	right side 96
Brasilian specimen of TRAUSTEDT (L = 35, D = 43 mm)	left side 37	right side 92
<i>P. multiphiala</i> , no. 2204 (L = 26 mm, D = 34 mm)	left side 33	right side 42
<i>P. obtecta</i> , VAN NAME, no 252	left side 23	right side 48
Piscadera Baai, Sta. 1464 (L = 32 mm, D = 40 mm)	left side 14	right side 44
Piscadera Baai, Sta. 1464 (L = 36 mm, D = 58 mm)	left side 48	right side 72
Piscadera Baai, Sta. 1463A (L = 32 mm, D = 21 mm)	left side 21	right side 27

In very large specimens even as many as 120 gonads may be counted on the right side of the body.

The gonads are scattered on the more or less gelatinous inner mantle wall in an irregular way, always embedded at their base. They are flask-like, protruding into a proximal neck formed by the oviduct which varies from a mere small papilla to a tube as long as the rest of the gonad. Depending on the state of egg production, the gonad is more or less swollen (Fig. 93–110). The size of the polycarps is variable even in ripened state and in any one specimen. On average they are long: 3.5–4.0 mm, sometimes exceeding 5.0 mm; width, dependent on egg production, 0.4–0.2 mm.

The sheath is transparent, showing very well the organisation of the gonad, the testis lies in the embedded part and is covered by the ovary which bulges out more or less into the peribranchial cavity.

Testis consisting of usually about 14–16 more or less strongly lobed follicles (Fig 95, 111). In some cases the follicles are pear-shaped and the number may then exceed 30. There are 2 sperm ducts into which the follicle ducts empty, running forwards on both sides of the surface of the ovary, uniting into a small common sperm duct which ends in a small papilla on the oviduct. (Sometimes right near the

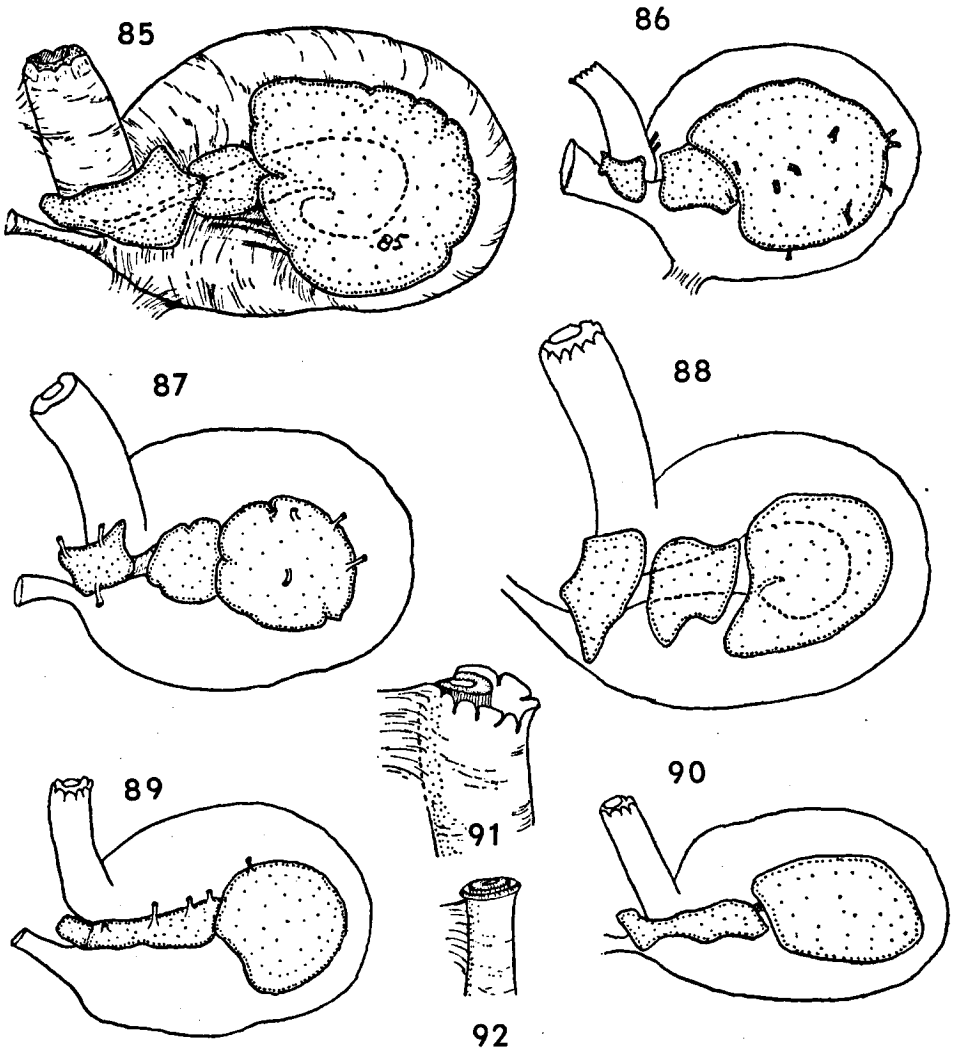


Fig. 85-92. *Polycarpa spongiabilis* Traustedt. — Alimentary canal and included endocarps: one of TRAUSTEDT's Brazilian specimens (85); one of TRAUSTEDT's type specimens (86); holotype of VERRILL's *multihiata* (Y, YPM 2204) (87); SLUITER's *Styela* (*P.*) *friabilis* (88); one of VAN NAME's *P. oblecta* (N-1809) (89); SLUITER's *Styela* (*P.*) *fuliginea* (90). — Part of rectum with anus: one of TRAUSTEDT's type specimens (91); specimen from Sta. 1464 (92).

orifice of the latter, in other cases more behind). In aberrant specimens (Sta. 1466) I have seen oviducts splitted up into 2 or 3 orifices (Fig. 105-106).

REMARKS

Since the specimens from Piscadera Bay fitted equally well VAN NAME's descriptions of both *Polycarpa spongiabilis* as *P. obtecta*, I

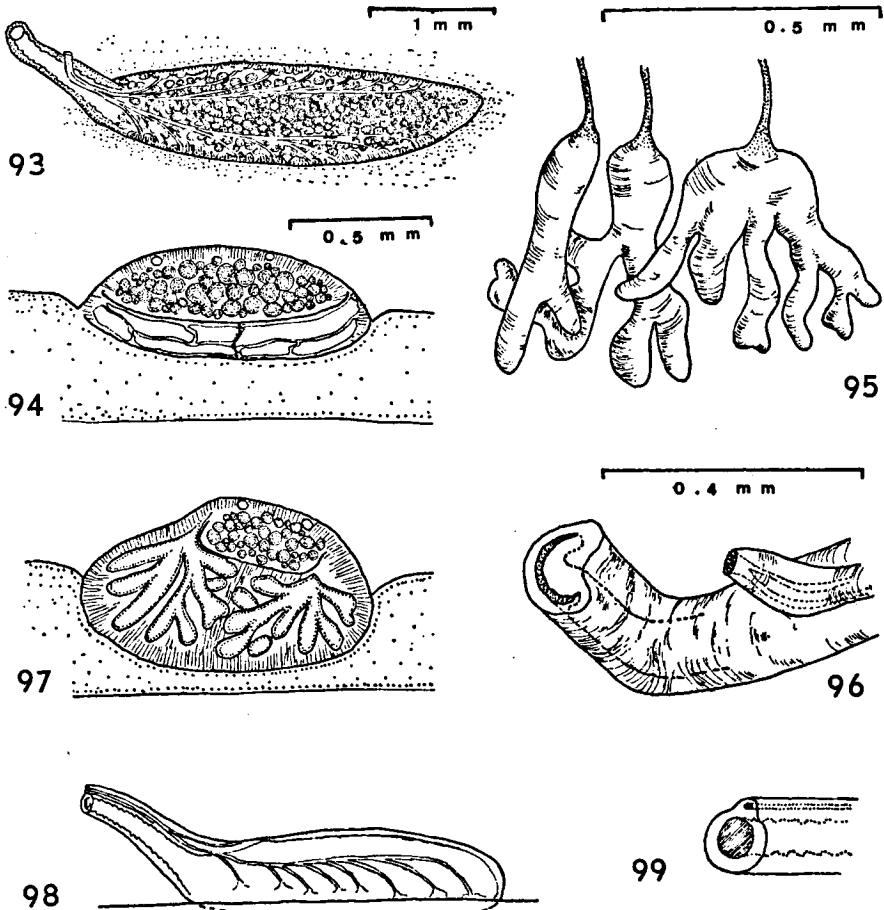


Fig. 93-99. *Polycarpa spongiabilis* Traustedt. — Gonads and parts of gonads: gonad as seen from peribranchial cavity (93), transverse section (94), testis follicles (95), and orifices of oviduct and sperm duct (96) in one of TRAUSTEDT's type specimens; transverse section of gonad (97), side view (98), and orifices of oviduct and sperm duct (99) in one of TRAUSTEDT's Brazilian specimens.

could not initially make firm decisions in identifying the specimens. Dr. JENSENIUS MADSEN, of the København Zoologiske Museum, informed me that the type material of TRAUSTEDT's *Polycarpa obtecta* should be considered lost. However, of *P. spongiabilis* he sent me the syntypes and the Brazilian specimens.

Comparison of TRAUSTEDT's specimens with *Polycarpa rugosa* von Drasche, *P. multiphiala* Verrill, *Styela (Polycarpa) fuliginea*, *S.(P.) friabilis*, *S.(P.) brevipedunculata*, all described by SLUITER, a number of specimens identified by VAN NAME as both *P. spongiabilis* as *P. obtecta* and the specimens of Piscadera Bay, showed a fair resemblance in essential characteristics.

Since I found in the Piscadera specimens all kinds of intermediate forms concerning test, mantle, length of the siphons and the shape of the orifice of the dorsal tubercle, all the above species must be considered as synonyms of *P. spongiabilis*.

As VAN NAME wrote in 1945 he separated *P. spongiabilis* from *P. obtecta* on its external characteristics. Especially the sponge-like appearance he thought an important difference. It is my conviction that differences in test are due to ecological circumstances of the localities in which the specimens are collected.

Miss KOTT suggested in 1952 that on further examination the differences between *P. spongiabilis* and *P. obtecta* might be negligible.

Since TRAUSTEDT himself hesitated to separate *P. obtecta* from *P. spongiabilis* and since the characteristics on which he did so, seemed to be inessential (in particular he described the gonads of *P. obtecta* as identical to those in *P. spongiabilis*), I could not find any reason to keep the species separated. Because TRAUSTEDT mentioned *P. spongiabilis* first this should be the correct name. It is a very fortunate circumstance, that while the material of *P. obtecta* is lost, the syntypes of *P. spongiabilis* are available and in such a perfect condition.

DISTRIBUTION

Polycarpa spongiabilis has been reported from Brasil, "West Indies", Venezuela, Florida, North Carolina and Bermuda (TRAUSTEDT, VON DRASCHE, SLUITER, VERRILL, VAN NAME, BERRILL and MILLAR), and also from Australia (KOTT). It seems to be one of the commonest styelids on the American eastern coasts, in the warmer

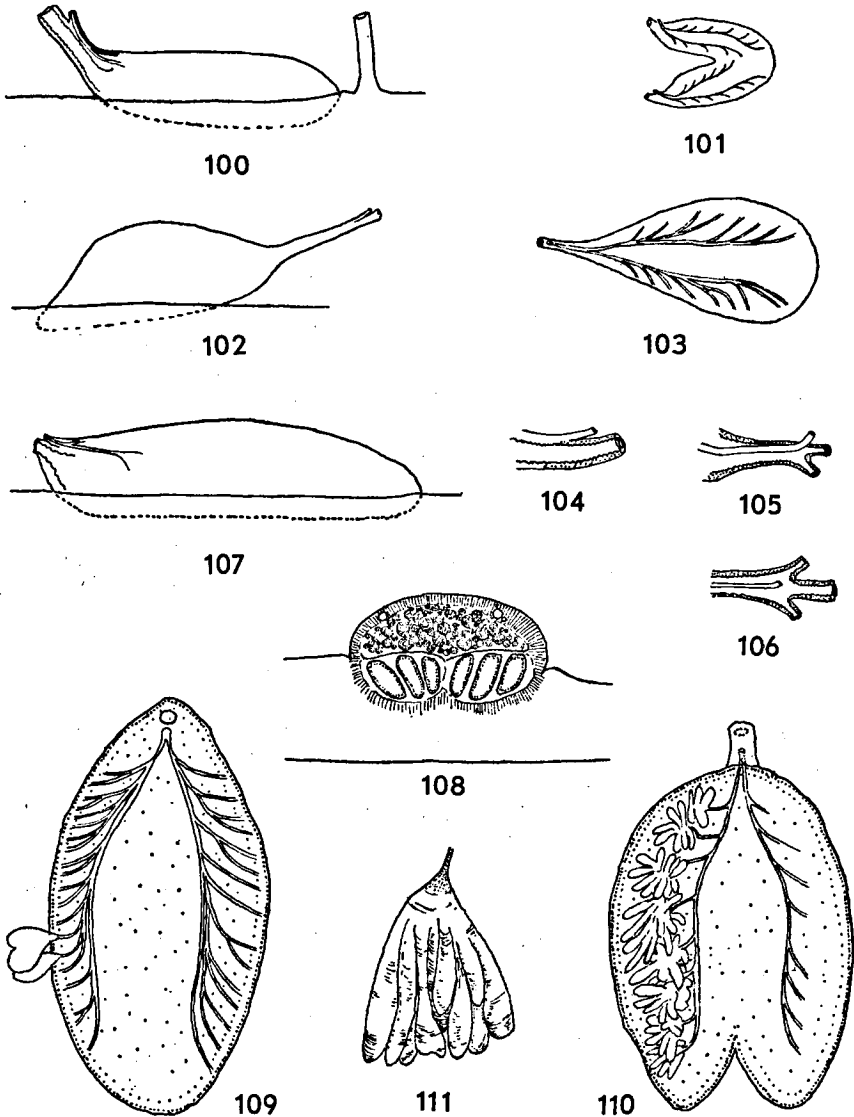


Fig. 100-111. *Polycarpa spongiabilis* Traustedt. — Gonads and parts of gonads: side view of gonad and connective between inner mantle wall and branchial sac (100), and two gonads united posteriorly, seen from the peribranchial cavity (101) in VAN NAME'S *P. spongiabilis* (?) (N-263); gonad at side view (102) and as seen from the peribranchial cavity (103), with three orifices of oviduct, two of them aberrant (104-106) from Sta. 1464; gonad at side view (107), transverse section (108) and roof as seen from the inner side, showing the two branches of the sperm duct (109) in SLUITER'S *Styela* (*Polycarpa*) *fuliginea*; roof of a gonad as seen from the inner side (110) and testis follicle in SLUITER'S *Styela* (*P.*) *friabilis*.

seas. VAN NAME (1945, p. 259) noted: "Though a shallow water species, it appears to be commoner in water a few feet deep than near low-water mark". In addition to this the appearance of the *Piscadera* specimens suggests that the species shies away from open waters, especially from surf. The biggest specimens have been collected in very quiet waters or on screened places.

The species is only found in the inner bay as distinct from *P. arnoldi* and *P. cartilaginea* (Fig. 4). Many times it occurs as one of the accompanying species of the *Microcosmus exasperatus-Styela partita* community on the roots of the mangroves. In proportion to the latter species only a few specimens have been collected in those localities, except in the northeastern part of the bay, where *Microcosmus exasperatus* seems to be replaced by *P. spongiabilis* (Sta. 1487).

Although preferring the mangrove-roots, the species is able to colonize a sandy or even muddy bottom, provided that there are some more or less solid points (coarse sand, shell debris, pelecypods, algae etc.) (Sta. 1463A, 1467, 1469B, 1471A, 1471B, 1473A, 1480A, 1486 and 1495). In the latter localities it seems that after colonizing the bottom by *P. spongiabilis*, *Microcosmus* is finding a substrate to settle also, because I found small specimens of *M. exasperatus* attached on larger *P. spongiabilis* in the material from Sta. 1467, 1471B, 1480A, 1486 and 1495. Sometimes *Styela partita* and *Ascidia interrupta*(?) also are found together with the above species in these localities.

Why *P. spongiabilis* does not appear in the material of the most upper part of the bay (around the sewage) I cannot explain. Perhaps it is due to the seasonal input of fresh water, especially in the northern part of the bay, perhaps to the larger degree of pollution, or to the pH which is a little lower.

Polycarpa insulsa (Sluiter), 1898

- Styela (Polycarpa) insulsa* SLUITER, 1898, p. 14, pl. III, fig. 43. [Los Testigos.]
Styela (Polycarpa) asiphonica SLUITER, 1898, p. 17, pl. I, fig. 16-18. [Rio Hacha, Goajira (Col.)]
Styela circumerata SLUITER, 1904, p. 70, pl. I, fig. 4, pl. IX, fig. 1. [Sta. 99 "Siboga" expedition.]
Pandocia circumerata, HARTMEYER 1909-1911, p. 1363. [Name only].
Pandocia circumerata, VAN NAME 1918, p. 92, fig. 46, pl. XXVI, fig. 7-8. [Philippines.]
Polycarpa circumerata, VAN NAME 1921, p. 428, fig. 96-97. [Gulf of México.]
Polycarpa circumerata, VAN NAME 1945, p. 261-262, fig. 158, pl. 11, fig. 2. [La Tortuga Id. (Ven.) and Colón (Isthmus of Panamá).]
Polycarpa circumerata, MILLAR 1962, p. 62. [Name only.]
Polycarpa asiphonica, MILLAR 1962, p. 75. [As synonym of *P. obtecta*.]
Polycarpa insulsa, MILLAR 1962, p. 75. [As possible well-defined species.]

DIAGNOSIS

A large solitary styelid, attached to solid substrates in sandy and coral bottoms. Apparently a species from deeper water, which may occasionally occur in shallow localities.

Branchial sac with four folds on each side, with a very large total number (200–370) of internal longitudinal vessels. About 4–10 stigmata per mesh.

Number of tentacles: about 30.

Alimentary canal occupies about $\frac{1}{5}$ of the left posterior side of the body, forming a nearly completely closed loop and attached by ligaments to the mantle wall over the whole length. Stomach barrel-shaped with the outer wall opaque. Rectum attached to the body wall up to the anus, which has a lobed or more or less smooth margin. A distinctive typhlosole plug is present.

Endocarps small and numerous, scattered on both sides of the inner surface of the mantle. Several small endocarps in gut loop.

Gonads numerous on both sides of the body, deeply buried in the tough tissue of the inner mantle wall, so that they are apt to be overlooked, especially since the surrounding tissue is opaque. They are elongated, sometimes probably forked and situated close to each other. Testis completely covered by the ovary and consisting of two rows of about 15 or more testis follicles, which are pear-shaped or more or less lobed. The follicles send their ducts into one common sperm duct which runs forward over the surface of the ovary. Sperm duct and oviduct end together in a small papilla, which juts out inconspicuously into the peribranchial cavity.

MATERIAL

LOS TESTIGOS. According to SLUITER (1898, p. 13): Iles de Los Testigos (Ven.). According to label in museum bottle: St. Martha (Col.), Gairaca, from 30 m depth, 29.II.1896; leg. J. W. Versluys. – 2. syntypes of *Styela (Polycarpa) insulsa* Sluiter, 1898 (A).

LA GOAJIRA (Col.), Río Hacha, from 6–7 m depth, 2.III.1896, Exp. "Chazalie" leg. J. W. Versluys. – 2 syntypes of *Styela (Polycarpa) asiphonica* Sluiter, 1898 (A).

PHILIPPINES, from 16–23 m depth, Exp. "Siboga" Sta. 99, *Lithothamnion* bottom. – Holotype of *Styela circumerata* Sluiter, 1904 (A).

DESCRIPTION

Test. – Very thick; furrowed in thick folds.

Tentacles. – In one of the syntypes I counted 24; the same number in *S. circumerata*, while *S. (P.) asiphonica* shows 60.

Branchial sac. – The number of longitudinal vessels seems to be very high. The distribution is as follows (largest diameter measured after removing test):

Specimen of *Styela (Polycarpha) asiphonica* (largest diameter 25 mm)

left: dorsal lamina 3 (23) 5 (20) 5 (17) 5 (17) 4 endostyle

right: dorsal lamina 2 (22) 5 (20) 5 (18) 5 (15) 3 endostyle

Styela circumerata Sluiter, 1904 (largest diameter 90 mm)

left: dorsal lamina 7 (33) 10 (30) 7 (27) 10 (20) 6 endostyle

right: dorsal lamina 7 (29) 10 (29) 10 (30) 8 (20) 6 endostyle

Between the folds the number of stigmata in the specimens is respectively 4-5 and 8-10 stigmata per mesh.

A l i m e n t a r y c a n a l. - Forming a closed loop in the posterior part of the body (Fig. 112-114), taking about $\frac{1}{5}$ of the body wall. (In *S. circumerata* it takes $\frac{2}{9}$, in *S. (P.) asiphonica* up to $\frac{1}{2}$, in *S. (P.) insulsa* $\frac{1}{3}$). The number of internal folds of the stomach seems to be about 14-16. In *S. (P.) insulsa* and *S. circumerata* a pyloric caecum is present, but in *S. (P.) asiphonica* I could not find it. In *S. circumerata* and *S. (P.) asiphonica* a typhlosole plug is present, but the anus of the specimens of *S. (P.) insulsa* is damaged and a typhlosole plug cannot be demonstrated. In all cases the tract is attached to the body wall by solid membranes. The margin of the anus, where seen, is lobed (Fig. 117).

E n d o c a r p s. - Numerous, scattered on the inner mantle wall (Fig. 120) No larger endocarps, but a number of small ones may be present in gut loop.

G o n a d s. - The characteristics of the gonads in *S. circumerata* and *S. (P.) insulsa* are quite the same. Almost completely buried in the mantle wall and hardly seen. In *S. (P.) asiphonica* they project more, bulging into the peribranchial cavity.

Often the gonads are found growing under or close to each other. Sometimes they are crooked or forked. Usually the length is about 2.0-2.5 mm, but larger (up to 3.5 mm) and smaller ones may be found.

The ovary covers the testis completely. Testis follicles numerous (more than 2×30) when pear-shaped as in *S. (P.) insulsa* and *S. circumerata*, less numerous (about 15 on each side of the gonad) when lobed as in *S. (P.) asiphonica*. They seem to send their ducts into one common sperm duct which runs forwards on the surface of the ovary. Both sperm duct and oviduct end in a small papilla, which juts out very inconspicuously into the peribranchial cavity (Fig. 118-122).

REMARKS

The syntypes of *Polycarpha insulsa* are in a very poor state of preservation. However, careful study of the characteristics which can still be examined, and comparison with the descriptions of SLUITER (1898 and 1904) and VAN NAME (1918, 1921 and 1945) seem to leave little doubt that *Styela (Polycarpha) insulsa* and *Styela circumerata* are in fact one and the same species, named here *Polycarpha insulsa* according to the rules of nomenclature.

Things are more complicated as far as the specimens of *Styela (Polycarpha) asiphonica* are concerned. Certainly there are differences with the above specimens viz. the larger number of tentacles,

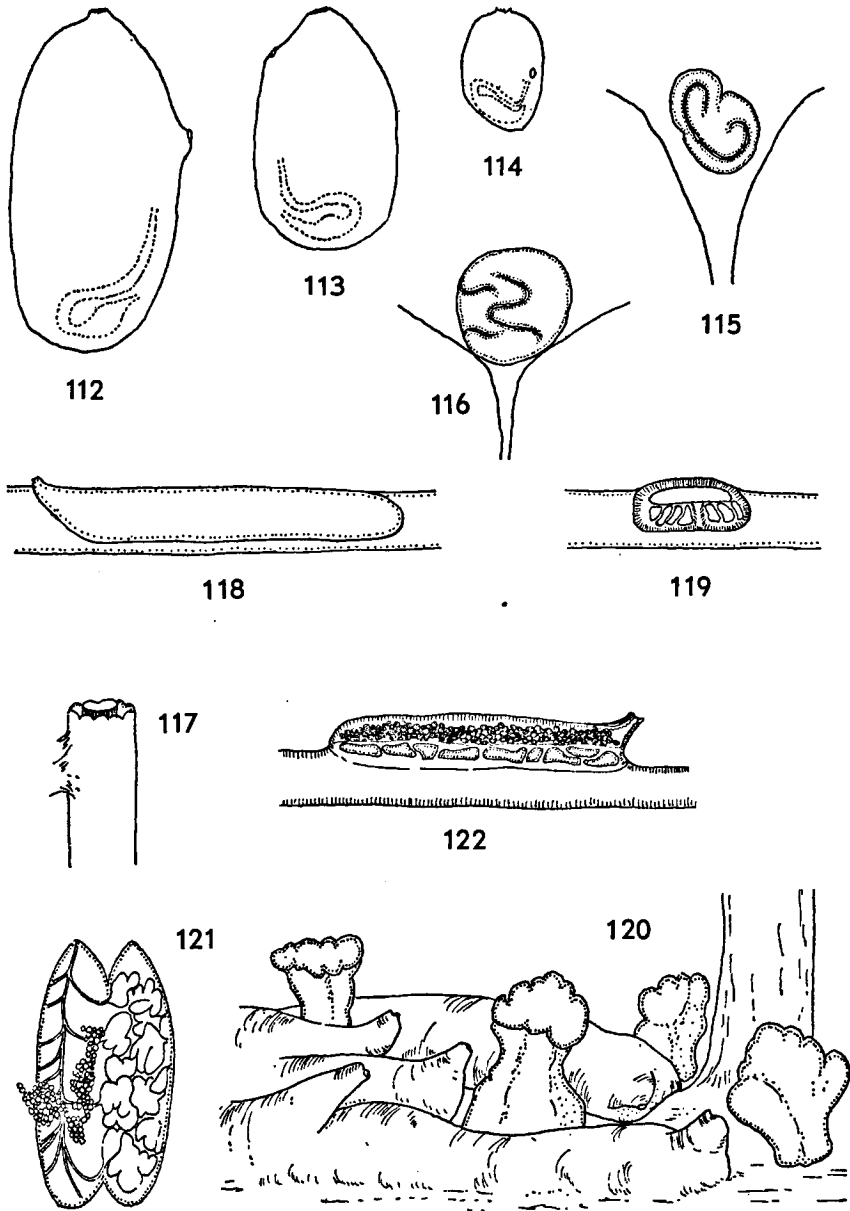


Fig. 112-122. *Polycarpa insulsa* (Sluiter). — Specimens with test removed (to the same scale): SLUITER's *Styela circumerata* (112); one of SLUITER's *Styela (P.) insulsa* (113); one of SLUITER's *Styela (P.) asiphonica* (114). — Dorsal tubercles: SLUITER's *Styela circumerata* (115); SLUITER's *Styela (P.) asiphonica* (116). — Anus of SLUITER's *Styela circumerata* (117). — Gonads: side view (schematically) to show the deep embedding in the inner mantle wall (118), and transverse section (no eggs were seen) (119) in one of SLUITER's type specimens; part of the inner mantle wall with gonads, small endocarps and connective ligament (120), gonad in horizontal section to show the single sperm duct in the roof of the ovary (121), gonad in sagittal section (122) in one of SLUITER's specimens of *Styela (P.) asiphonica*.

the smaller number of longitudinal vessels, the probable absence of a pyloric caecum, the more projecting gonads, and the lobed testis follicles.

Since my studies on the numerous specimens of *Polycarpa spongiabilis* showed a large degree of variability in these characteristics, it seems justified to conclude that the differences mentioned above are not decisive for distinguishing the *S. (P.) asiphonica* specimens from *P. insulsa*. In my opinion they could easily be due to ecological circumstances, life cycle stages, etc.

The most decisive points in lumping *S. (P.) asiphonica* together with *P. insulsa* as a single species seem to be the presence of numerous endocarps, the tough opaque sheath of both the inner wall and the gonads, the essentially similar construction of the gonads, and the single common sperm duct. Nevertheless, classification of these two specimens as belonging in fact to *P. insulsa* still remains a somewhat doubtful question. Comparison with further material will probably lead to a more certain decision.

Polyandrocarpa tumida (Heller), 1878

- Polycarpa tumida* HELLER, 1878, p. 103, pl. 2, fig. 15. [Jamaica.]
Polyandrocarpa sabanillae VAN NAME, 1921, p. 409–412, fig. 77–81. [Sabanilla (Col.)]
Polyandrocarpa sabanillae, VAN NAME 1924, p. 31. [Curaçao.]
Polycarpa obiecta, VAN NAME 1924, p. 31. [Curaçao; pro parte.]
Polycarpa circumerata, VAN NAME 1924, p. 31. [Curaçao.]
Polyandrocarpa sabanillae, PLOUGH & JONES 1937, p. 101. [Tortugas (Flor.)]
Polyandrocarpa sabanillae, VAN NAME 1945, p. 247–248, fig. 148. [Sabanilla (Col.)]
Polyandrocarpa sabanillae, KOTT 1952, p. 247. [Name only.]
Polyandrocarpa sabanillae, MILLAR 1962, p. 62. [Name only.]

DIAGNOSIS

A colonial styelid with the larger zooids sometimes separated from the colony; attached on solid substrates. Appearing in shallow water close to low-water mark.

Branchial sac with four folds on each side, with a total number of about 80–90 internal longitudinal vessels. Between the folds there are usually 6–10 stigmata per mesh.

Number of tentacles: about 30.

Alimentary canal takes about $\frac{1}{2}$ – $\frac{1}{3}$ of the left side of the body. Forming a closed loop and attached to the body wall by numerous ligaments. Attachments to the branchial sac are also found. Stomach barrel-like with the outer wall rather opaque, sometimes showing the 10 internal folds. Rectum attached to body wall up to the anus which has a margin with 8 lobes and a more or less inconspicuous typhlosole plug.

Endocarps small and numerous. Those in gut loop somewhat larger than between the gonads, and on the margins connected with the branchial sac by slender ligaments.

Gonads numerous on both sides of the body, but mostly accumulated in the ventral region. They are not much embedded in the mantle tissue, but sheathed by tough, opaque membranes, as the inner mantle wall does. The gonads are pear-shaped, proximally protruding into a short neck with a rather large diameter, thus forming the oviduct. The 6–8 testis follicles, being unequally distributed in the embedded part of the gonad, send their ducts on to the top of the ovary (which forms the more projecting part of the gonad) there to assemble into a more or less small common sperm duct, which ends in a small papilla a little behind the orifice of the oviduct.

MATERIAL

JAMAICA. – Holotype of *Polycarpa tumida* Heller. Only one single zooid (W).

CURAÇAO, Spaanse Water, 14.V.1920; coll. C. J. van der Horst. – One single zooid identified by VAN NAME, 1924, as *Polycarpa obtecta* (A).

Spaanse Water, 19.IV.1920; coll. Van der Horst. – One colony with 3 zooids identified by VAN NAME, 1924, as *Polyandrocarpa sabanillae* (A).

Spaanse Water, 6.V.1920; coll. Van der Horst. – Two single zooids, identified by VAN NAME, 1924, as *Polycarpa circumerata* (A).

Caracasbaai, 5.V.1920; coll. Van der Horst. – One colony with 3 zooids, together with 4 specimens of *Polycarpa cartilaginea*, all identified by VAN NAME, 1924, as *Polycarpa obtecta* (A).

Piscadera Baai, collected by P. Wagenaar Hummelinck, Oct. 1963.–Jan. 1964 (Fig. 2).

Sta. 1460. – 2 colonies (form.) (A) and 1 colony (alc.) (L) on pelecypods and *Microcosmus exasperatus*, together with calcareous algae on *Rhizophora* (0–1 m).

Sta. 1460A. – 1 colony (form. (A) between the siphons of *Microcosmus helleri* ($\frac{1}{2}$ m).

Sta. 1461. – 2 colonies (form.) (A+U), one with very small zooids, attached

to a shell, the other one with larger zooids among ascidians, calcareous algae, pelecypods and balanids on *Rhizophora* (0- $\frac{1}{2}$ m).

Sta. 1463. - 1 colony with several separated individuals (form.) (A), together with one specimen of *Polycarpa arnoldi*, attached to oyster shells and *Microcosmus exasp.*, among other ascidians, pelecypods and balanids on *Rhizophora* (0- $\frac{1}{2}$ m).

Sta. 1464. - 2 colonies (form.) (A) and 1 colony (alc.) (L) on mussels and oysters, together with other ascidians on *Rhizophora* (0- $\frac{1}{2}$ m).

Sta. 1465. - Several colonies (alc.) (L), on shells, together with *Microcosmus exasp.* and *Styela partita* on *Rhizophora* (0- $\frac{1}{2}$ m).

Sta. 1466. - 3 colonies (form.) (A) on oysters or mangrove roots, together with actinians, bryozoans, hydroids and other ascidians in very muddy water (0-1 m).

Sta. 1469. - 1 colony and several separated individuals (form.) (A), on oysters and mussels, together with other ascidians on *Rhizophora* (0-1 m).

Sta. 1473. - 2 or 3 colonies (alc.) (L) and 1 colony (form.) (A) on pelecypods and *Microcosmus exasp.* on *Rhizophora* (0- $\frac{1}{2}$ m).

DESCRIPTION AND REMARKS

Usually the colony consists of a group of about 3 or 4 zooids which are growing together more or less closely and one or two larger zooids which are separated from or only connected with the colony by a small piece of test tissue. In fact, this seems the reason why the specimen of HELLER and the specimens of VAN NAME's *Polycarpa circumerata* were described as solitary styelids, and thus not assigned to the genus *Polyandrocarpa*. Nevertheless, in all other respects the type specimen of HELLER fits very well the descriptions of VAN NAME's *Polyandrocarpa sabanillae* and there cannot be any doubt in uniting them into one species, according to the rules of nomenclature, named *Polyandrocarpa tumida*.

The following is meant for addition to VAN NAME's 1945 description of *Polyandrocarpa sabanillae*.

Mantle. - After dissecting the test, the specimens are often immediately recognised, because of the dark pigmented apertures and the absence of root-like processes on the outer mantle wall, so that the zooids can be skipped out of their test like beans out of their pods (Fig. 123-124).

Tentacles. - The number is variable, usually about 30, but 40 can be counted also. They are often of different sizes, more or less alternating.

Dorsal tubercle. - Often rather prominent and large, sometimes heart-shaped. Its orifice is a slit with a rather variable form, possibly in origin C-shaped, but later more complicated (Fig. 125-131).

Branchial sac. - Usually the number of longitudinal vessels is about 80-90, but numbers of 60 or 120 may occasionally be counted. In two of the Piscadera

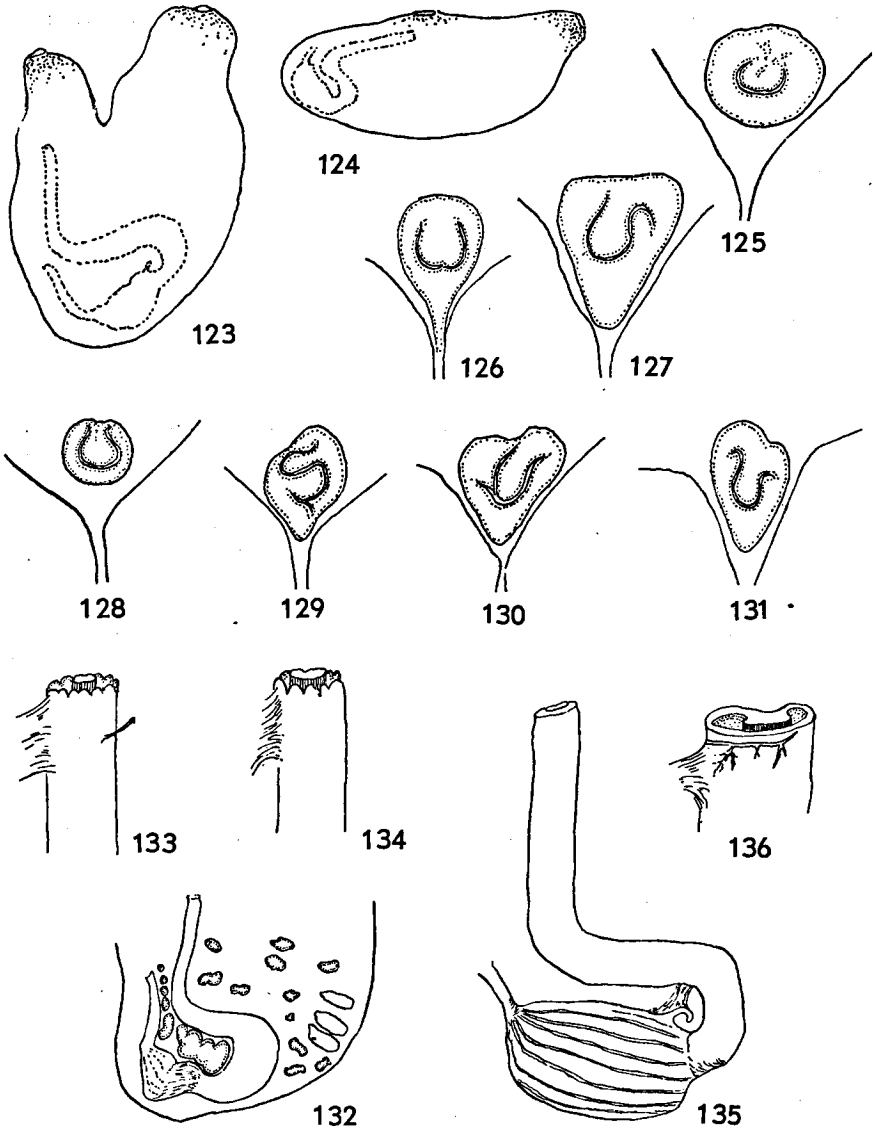


Fig. 123-136. *Polyandrocarpa tumida* (Heller). — Specimens with test removed from Sta. 1460 (123) and Sta. 1466 (124). — Dorsal tubercles: one specimen of VAN NAME's *Polycarpa obtecta* (A, 1924) (125); VAN NAME's *Polycarpa circumerata* (A, 1924) (126-127); specimens from Sta. 1460 (128), 1460A (129), 1463 (130) and 1466 (131). — Alimentary tract and anus margin: with inner mantle wall, endocarps and gonads from Sta. 1460 (132); from Sta. 1460A (133) and 1473 (134); VAN NAME's *Polycarpa circumerata* (A, 1924) (135-136).

specimens the distribution was as follows (length measured after removing test):

Specimen from Sta. 1463 (length 15 mm)

left: dorsal lamina 1 (11) 2 (6) 2 (10) 2 (7) 1 endostyle
right: dorsal lamina 1 (12) 1 (9) 2 (9) 2 (9) 1 endostyle

Specimen from Sta. 1468 (length 14 mm)

left: dorsal lamina 1 (11) 1 (8) 1 (9) 2 (7) 1 endostyle
right: dorsal lamina 1 (12) 1 (9) 2 (9) 1 (8) 1 endostyle

Between the folds the number of stigmata is 4–10 per mesh, but along the dorsal lamina and especially along the endostyle the meshes are much larger, containing 15 or more stigmata.

Alimentary canal. – Attached by ligaments and membranes both to the body wall and to the branchial sac; the rectum is attached up to the anus. Stomach barrel-shaped, smooth but firm, sometimes the wall more or less transparent, showing the internal folds (Fig. 132, 135). In all specimens examined 10 folds were counted. A small pyloric caecum is present but sometimes difficult to find. The anus has an inconspicuous typhlosole plug; the margin is usually lobed, the lobes sometimes secondarily indented (Fig. 133–134, 136).

Endocarps. – Numerous small ones scattered on the body wall, those in gut loop sometimes enlarged.

Gonads. – In the adult condition they are rather large in proportion to the body. Therefore the number cannot be as large as in *Polycarpa spongiabilis* or *P. insulsa* for example. In a zooid from Sta. 1463 I counted 22 gonads on the left and 31 on the right side. In a zooid from Sta. 1466 the numbers were respectively 18 and 23. The average length of the gonads is 1.5–2.0 mm, but 2.5 mm is not unusual. They bulge out of the inner mantle wall, in which they are embedded by the entire base. The sheath is mostly opaque, but sometimes more transparent. Testis follicles (4–) 6–8, are unequally distributed in the halves of the testis which form the basal, embedded part of the gonad (Fig. 138, 143). The individual ductules unite upon the ovary to form a single common sperm duct, which ends in a small papilla separated from the orifice of the oviduct, which lies on a larger papilla forming the protruding part of the gonad. The sperm duct is often very difficult to find (Fig. 137–144).

DISTRIBUTION

Except from Curaçao, where the species seems to be rather common, there are records from Colombia, Jamaica and Florida, so that we may expect to find the species in the whole West Indian region.

According to the localities in Piscadera Baai (Fig. 3), the species seems to prefer the mangrove roots, where it occurs in the fauna of *Microcosmus exasperatus* and *Styela partita*, overgrowing solid substrates. It does not shun very muddy water (Sta. 1466).

Polyandrocarpa (Eusynstyela) tinctoria (Van Name), 1902

DIAGNOSIS

A colonial styelid of the flat incrusting type, each zooid with its

own atrial aperture. Incrusting solid substrates especially in shallow water, but also collected from deeper water.

Branchial sac with four folds on each side, with a total number of about 55 internal longitudinal vessels, the first fold showing the largest numbers. Maximum 12–15 stigmata per mesh.

Number of tentacles: about 40.

Alimentary canal occupies about $\frac{1}{3}$ of the left side of the body, forming a nearly closed loop and loosely attached to the body wall. Stomach elongated and tapered in the distal region, with the outer

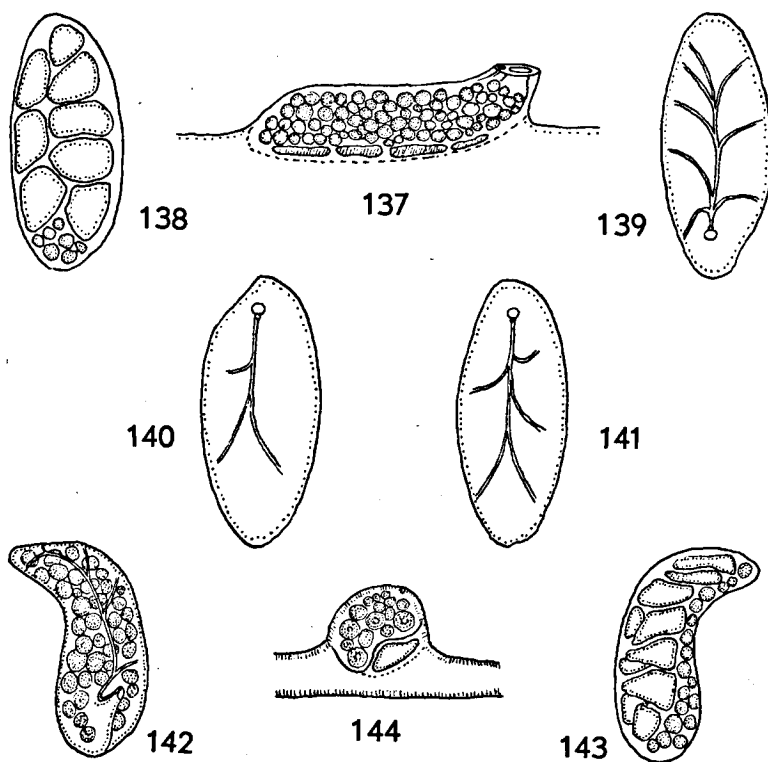


Fig. 137–144. *Polyandrocarpa tumida* (Heller). — Gonads: sagittal section (137), under side after cutting the mantle wall (138), roof of the ovary as seen from the innerside of gonad (139), from Sta. 1460A; roof of the ovary, seen from inner side of gonad in different zooids (140–141), from Sta. 1463; gonad seen on upper side (142), on under side after cutting the mantle wall (143), and transverse section (144) of one of VAN NAME's *Polycarpa circumerata* (A, 1924).

wall transparent, showing clearly the longitudinal folds. The rather long rectum is not attached to the body wall. The anus consists of two slightly lobed lips, without a typhlosole plug.

Endocarps small and not numerous on both sides of the body wall. Gonads not numerous, attached to the inner mantle wall, but projecting out into the test substance as knob-like evaginations at the ventral side of the body. They are of a rounded form and consist of two, sometimes lobed, pear-shaped testis follicles, covered by the ovary. The two follicle ducts are united in a small common sperm duct, which ends together with the oviduct into a small papilla.

MATERIAL

CURAÇAO, Piscadera Baai; coll. P. Wagenaar Hummelinck, December 1963 (Fig. 2).

Sta. 1465. - 1 colony (alc.) (L) overgrowing *Microcosmus exasperatus* on *Rhizophora* (0- $\frac{1}{2}$ m).

Sta. 1466. - 1 colony of 3 zooids (form.) (A) overgrowing *Microcosmus exasp.* on *Rhizophora* (0-1 m).

Sta. 1475. - 2 colonies (form.) (A), one partly on *Microcosmus exasp.* partly on oyster, the other overgrowing a mangrove root (0-1 m).

Sta. 1485. - 2 colonies (alc.) (L) and 1 colony (form.) (A), on pelecypods and *Microcosmus exasp.* on *Rhizophora* (0-1 m).

REMARKS

The species is very easily recognised because of the red colour and the peculiar form and situation of the gonads. For a list of synonyms and a more complete description, see VAN NAME, 1945, p. 249-251.

DISTRIBUTION

The species is reported from Bermuda and Florida. The present record is the first for Curaçao. VAN NAME mentioned MICHAELSEN's suggestion of including several specimens from the Red Sea, Mozambique, Ceylon and the Malay region into the species after comparing the material. This was not yet been done.

In Piscadera Baai the species seems to prefer the mangrove roots of the inner bay (Fig. 3). Solid substrates such as pelecypods, the tough test of *Microcosmus*, or the mangrove root itself can be colonized. The species seems not to be very common: it is not often recorded and in Piscadera Bay it never occurs in large numbers.

Symplegma viride Herdman, 1886**DIAGNOSIS**

A colonial styelid of the flat incrusting type, each zooid with its own atrial aperture. Incrusting rather solid but also more soft substrates. Appearing especially in shallow water, but also found in deeper water.

Branchial sac without folds and with only 4 internal longitudinal vessels on each side of the sac. Maximum 10–11 stigmata per mesh. Number of tentacles: about 25.

Alimentary canal occupies about $\frac{1}{2}$ of the left side of the body, forming a closed loop. Stomach barrel-like with the outer wall transparent, showing the internal folds. Rectum attached to the body wall up to the anus, which has a smooth margin.

Endocarps not present.

Gonads one on both sides, taking about $\frac{1}{4}$ of the body wall and with a transparent sheath. They consist of a central ovary with a lobed testis follicle on each side. These send their ducts into a very small common sperm duct at the upper surface of the ovary, in this way bridging over it.

MATERIAL

WEST INDIES, coll. Børgesen, 9.VII.1870.— Several colonies (alc.), incrusting type-specimens of *Polycarpa spongiabilis* (K).

CURAÇAO, Piscadera Baai; coll. P. Wagenaar Hummelinck, Oct.–Dec. 1963, with exception of Sta. 1476a which was sampled by Louise J. van der Steen, Sep. 1962 (Fig. 2).

Sta. 1466. — Several colonies (alc.) (A), incrusting roots of *Rhizophora* and ascidians, together with *Didemnum* (0–1 m).

Sta. 1474B. — One zooid (form.) (A) (2 m).

Sta. 1475. — 2 colonies (alc.) (L) and several colonies (form.) (A), incrusting roots of *Rhizophora*, pelecypods and other substrates (0–1 m).

Sta. 1476a. — Several colonies (form.) (A), incrusting *Polycarpa spongiabilis* and bryozoans on *Rhizophora* (0– $\frac{1}{2}$ m).

Sta. 1482. — Very abundant (alc. (L) and form. (A+U)), in larger and smaller colonies, incrusting more or less solid substrates (as algae, serpulids, shells and other ascidians) on buoy (0–1 m).

Sta. 1485. — Rather abundant (alc. (L) and form. (A+U)), together with *Ecteinascidia conclini* and *Didemnum*, incrusting *Microcosmus exasperatus*, shells and other substrates on *Rhizophora* (0–1 m).

Sta. 1487. — Very abundant (alc. (L) and form. (A)), forming large and smaller colonies, together with *Ecteinascidia conclini* incrusting many substrates (as serpulids, shells and other ascidians), on *Rhizophora* (0–1 m).

REMARKS

The species is easily recognized, because of the structure of the branchial sac and the form of the gonads. For descriptions in more detail see VAN NAME, 1945, p. 232-233, and KOTT, 1952, p. 252.

DISTRIBUTION

The species seems to appear in tropical and sub-tropical seas all over the world, being common in the West Indian region and the eastern coast of southern United States of America, included the Bermuda's.

In Piscadera Bay, *Symplegma viride* has been only collected from the inner bay, becoming more abundant in the northern part of the bay (Fig. 3). It occurs especially on the roots of *Rhizophora*. In the southern and middle part of the bay overgrowing of the pelecypod-ascidian communities on the mangrove roots takes place especially by *Didemnum* species, while in the northern part *Didemnum* is crowded out by *Symplegma viride* and *Ecteinascidia conclini*. According to the data of VAN NAME and the distribution in Piscadera Bay, the species seems rather tolerant to diverse ecological circumstances.

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