

ZOOLOGISCHE MEDEDELINGEN

UITGEGEVEN DOOR HET

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN
(MINISTERIE VAN CULTUUR, RECREATIE EN MAATSCHAPPELIJK WERK)

Deel 45 no. 10

15 Februari 1971

THE ASCIDIAN GENERA *PTERYGASCIDIA* SLUITER, 1904 AND *CIALLUSIA* VAN NAME, 1918

by

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I was strongly impressed by the striking resemblance between the ascidian genera *Ciallusia* Van Name, 1918 and *Pterygascidia* Sluiter, 1904 when in 1957 I examined some specimens of *Ciallusia longa* Van Name, 1918, collected from Philippine waters and deposited at the United States National Museum (Tokioka, 1967: 136). *C. longa* is closely related with *Pterygascidia mirabilis* Sluiter, 1904, collected from off Timor by the Siboga Expedition, in general appearance of the pedunculate body, situation of the branchial and atrial apertures, structure of the branchial siphon, arrangement of body muscles divided into parts, and in the essential structure of the branchial sac, alimentary canal and gonads. The former, however, seemed to differ distinctly from the latter in the absence of a pair of remarkable fin-like semicircular extensions of the dorsal lobes of the atrial aperture and in having a series of dorsal languets instead of the dorsal lamina of a narrow, plainly edged membrane. Especially the last difference seemed very significant from a systematic point of view in Ascidiacea, because the plain membranous dorsal lamina is generally considered to be exceptional in the order Phlebobranchia.

Recently, I had the opportunity to examine twenty specimens of *C. longa* collected by the Snellius Expedition on 5 September 1929 at Station 60*, 6°58.0'N 121°52.5'E, in the Basilan Strait between the islands of Basilan and Mindanao, 72-80 m deep. To my surprise, the pair of wing-like elliptical extensions of the dorsal lobes of the atrial aperture which are supposed to be unique to *P. mirabilis* were found very clearly on 19 of the 20 specimens (fig. 1 A, B). I thought that I found a structure of uncertain meaning on the dorsal side of the body just posterior to the atrial siphon in the specimens of *C. longa* deposited at the United States National Museum, but I could not

make out at that time whether the structure was natural or was nothing but a part of the test torn from the general surface of the body, because the test of the examined specimens was gelatinous and soft. Thus, I did not refer to this peculiarity in the descriptions of those specimens. Now it has become evident that the wing-like appendages are of normal occurrence.

It is highly improbable that such a strange structure occurs convergently in two species of systematically very different genera. *Ciallusia* must be closely related to *Pterygascidia*, most probably the former is identical with the latter. Then, the only significant difference between the genera *Ciallusia* and *Pterygascidia* is found in the morphology of the dorsal lamina. In the family Perophoridae, the dorsal lamina is represented by a series of dorsal languets. In the family Ascidiidae the dorsal lamina forms a membrane, which is, however, ribbed at the sites of the transverse vessels, exactly corresponding to the dorsal languets in Perophoridae. In many species of *Ascidia*, the distal end of the ribs protrudes a little from the edge of the membrane, especially in the posterior half of the dorsal lamina. This condition may be regarded as intermediate between the plain membrane and the series of languets. Further, in some species of *Phallusia*, the dorsal lamina to some extent may become a plain membrane in the anterior portion, though it is ribbed posteriorly. However, it seems impossible that the dorsal lamina becomes a plain membrane or a series of languets in different species of the same genus. Very possibly, the dorsal lamina of *P. mirabilis* has been wrongly described and figured. For this reason, the dorso-median line on the inner surface of the branchial sac was very carefully examined in the specimens of *C. longa* of the Snellius Expedition, and it was found that the peripharyngeal bands together form a short lamellar structure (fig. 1 F, l) just posterior to the ciliated groove, though it is followed by a series of languets (fig. 1 F, d.l.). If *P. mirabilis* is provided with a similar structure, the short lamellar structure might have been regarded by Sluiter as the anterior part of the plain dorsal lamina. Thus, re-examination of a specimen of *P. mirabilis* was urgently desirable. Moreover, re-examination of a specimen of *P. mirabilis* was essential to prove the existence of two distinct species, which both are provided with the pair of very peculiar, fin-shaped appendages mentioned above. Very fortunately the type specimens of *P. mirabilis* were still available at the Zoological Museum, University of Amsterdam, and further, the privilege was granted me to re-examine the type specimens.

It then became apparent that the dorsal lamina of *P. mirabilis* is really represented by a series of languets (Tokioka, 1971). Thus, there is now no significant difference between *Ciallusia* and *Pterygascidia*, and the former has to be suppressed as a junior synonym of the latter. Another important

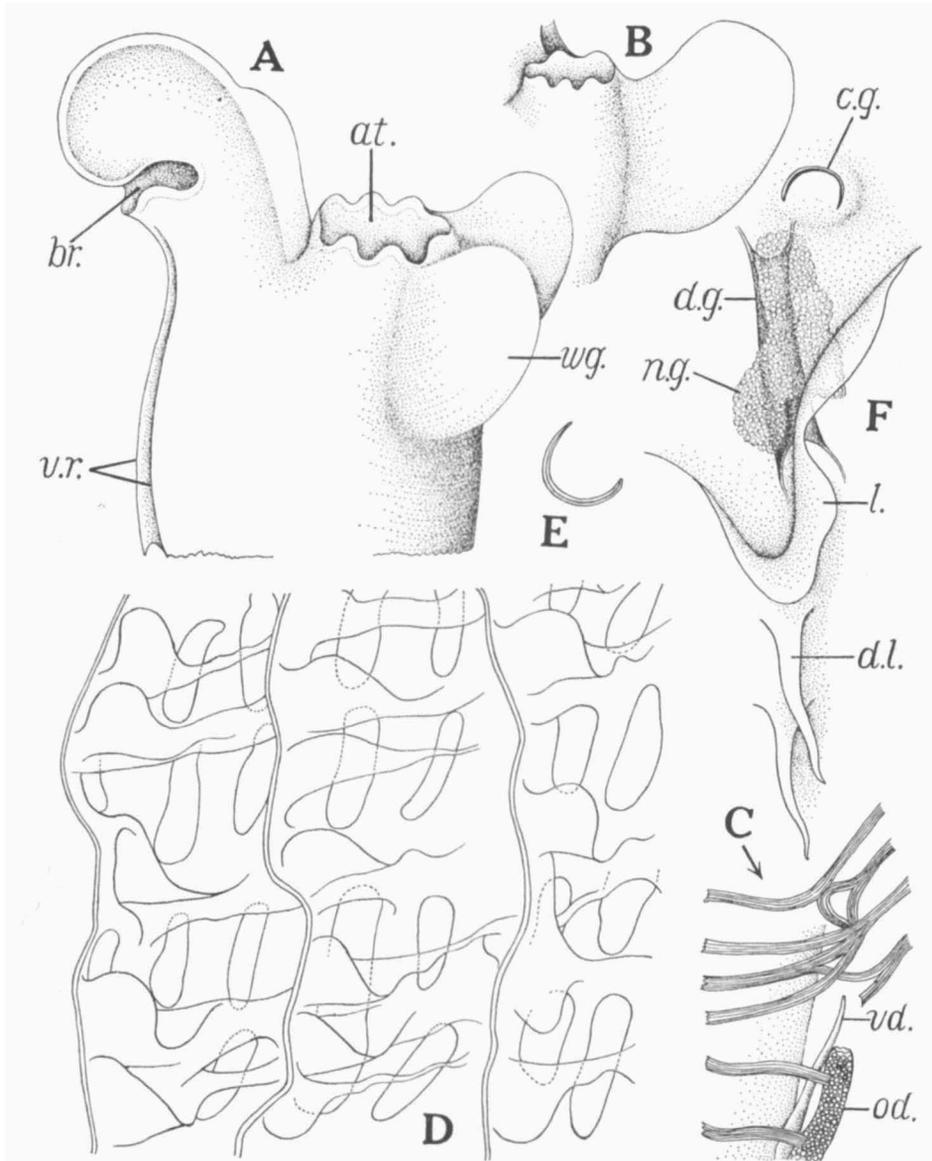


Fig. 1. *Pterygascidia longa* (Van Name). A, anterior part of trunk, left side; B, wing-like extension of dorsal lobe of atrial aperture, extended to show its outline; C, distal parts of genital ducts; D, part of branchial sac, x 73; E, ciliated groove; F, ciliated groove and anterior two dorsal languets. *at.*, atrial aperture; *br.*, branchial aperture; *c.g.*, ciliated groove; *d.g.*, dorsal ganglion; *d.l.*, dorsal languet; *l.*, lamellar plate; *n.g.*, sub-neural gland; *od.*, oviduct; *vd.*, vas deferens; *v.r.*, ventral ridge; *wg.*, wing-like appendage.

amendment to the characters of *P. mirabilis* is necessary concerning the morphology of the alimentary canal; the oesophagus is actually very short and the stomach is really descending. In addition to those mentioned above, the following features were newly observed: (1) the distal end of the vas deferens is divided into several branches, each leading to an orifice and (2) the heart is an elongate tubular organ as in *C. longa*, curved and situated between stomach and endostyle. For other details of *P. mirabilis*, I refer to Tokioka (1971). The following is to show the results of observations made on the Snellius specimens of *C. longa*, to give the definite diagnosis of the genus *Pterygascidia*, and to present the characters of the two distinct species, *P. mirabilis* and *P. longa*, in a table.

SOME FEATURES OF THE SNELLIUS SPECIMENS OF *C. LONGA*

All the specimens are preserved in formalin. The trunk is 100 to 150 mm long and 21 to 37 mm wide, and the peduncle is 125 mm long and 13 mm thick at its maximum. The test is a little thicker in the posterior part of the trunk, especially on the dorsal side, and also on the dorsal side of the proximal portion of the branchial siphon (fig. 1 A). The branchial aperture (fig. 1 A, *br.*) is surrounded by the lower lip and the larger upper lip as in *P. mirabilis*. The pair of fin-shaped extensions (fig. 1 A, *wg.*) of the dorsal lobes of the atrial aperture are roughly elliptical in outline, about 14 mm long and 9 mm wide at their maximum and the distance between the free edges of the paired fins attains 20 mm when they are extended laterally. As the atrial lobes are not so prominent as in *P. mirabilis* and usually are more strongly contracted, the relation between the wing-like appendages and the atrial lobes is rather obscure. However, a relation similar to that in *P. mirabilis* may be present here, because the atrial aperture is clearly six-lobed as in *P. mirabilis*. It is not known whether or not the following structure is natural, but in some specimens there is seemingly a pair of longitudinal ridges along the ventral edge of the trunk (fig. 1 A, *v.r.*); the ridges are indistinct in very weak specimens. This structure may only be an artefact, being a fold occurring on the rather flexible test surface.

The mantle body is very easily detachable from the test. The peculiarities of the peduncle have been accurately studied by Millar (1963: 623). No special remarks are needed concerning musculature and alimentary canal, because these structures were in detail and properly described by Van Name (1918), Millar (1963) and Tokioka (1967).

The branchial tentacles are about 30 in number, much larger in the dorsal half than in the ventral. The ciliated groove is roughly C-shaped, open anteriorly (fig. 1 E) or posteriorly (fig. 1 F), considerably more simple

than in the specimens of the United States National Museum. The peripharyngeal bands form a lamellar structure posterior to the ciliated groove (fig. 1 F, l.). The branchial sac is devoid of any plications, 57 inner longitudinal vessels are present on the right side of the sac in a 130 mm long specimen (trunk length). There are two to three stigmata in each mesh, that are seemingly not furnished with ciliated cells along the margin. The transverse vessels are arranged roughly in the order: thick, thin, medium thin, thick; parastigmatic vessels may occur quite irregularly.

The reproductive organs too have sufficiently been described by Van Name (1918) and Millar (1963). The genital ducts proceed anteriorly beyond the anus for a distance of about ten muscle segments along the intestine, and thus the apertures are situated near the posterior-most continuous muscle band on the dorsal side of the trunk, posterior to the atrial siphon (fig. 1 C). The vas deferens (fig. 1 C, *vd.*) ends more anteriorly than the oviduct (fig. 1 C, *od.*); the male genital aperture is always simple. The terminal swelling of the oviduct noted by Millar (1963: 625; fig. 1 D, o.s.) was not found in any examined specimen. The heart is strongly elongate as described in detail by Miller (1963: 626; fig. 2, h).

Pterygascidia Sluiter, 1904

Pterygascidia Sluiter, 1904: 21.

Ciallusia Van Name, 1918: 124.

Type species: *Pterygascidia mirabilis* Sluiter, 1904.

A study of the morphology of the two species *P. mirabilis* and *P. longa*, shows that the diagnosis of the genus *Pterygascidia* may be given definitely as follows: Solitary. The body consists of an elongate trunk and a long peduncle. The test is soft, gelatinous and transparent. Both apertures are situated at the anterior end of the trunk. The branchial siphon is bent dorsad and the aperture is surrounded by the smaller lower lip and the larger upper lip. The atrial aperture is six-lobed; each of the two dorsal lobes ending on the ventral side into a large fin-shaped appendage of the test substance, extending posteriorly on either side of the dorso-median line of the anterior part of the trunk.

The mantle is thin and transparent. All body muscles are divided into parts, which are arranged in two main longitudinal rows on each side.

The branchial tentacles are simple. The dorsal lamina is represented by a series of finger-shaped languets. There are no plications on the wall of the branchial sac. The fenestrae on the wall are not bordered with ciliated cells. Inner longitudinal vessels are present; the processes supporting the vessels never protrude beyond the edge of the vessel to form special prominences.

The stomach is elliptical and furnished with longitudinal plications on the surface. The intestine runs anteriorly nearly straight from the posterior end of the trunk on the left side along the dorso-median line. The ovary is tubular and continues as the oviduct without any demarcation between the two parts. The testicular follicles are scattered over the surface of the proximal part of the alimentary canal. Both genital apertures open on the dorso-median line of the branchial sac anterior to the anus. The heart is pronouncedly elongate, situated on the right side of the trunk between stomach and endostyle.

So far, only two species are known from the Indo-Pacific; Philippine waters and the waters of the Malay Archipelago. They are: *P. mirabilis* Sluiter, 1904 (*Pterygascidia mirabilis* Sluiter, 1904: 21-24, pl. 2 fig. 3, pl. 7 figs. 1-5; Tokioka, 1971: 3 figs.) and *P. longa* (Van Name, 1918) (*Ciallusia longa* Van Name, 1918: 124-126, figs. 79-81; Millar, 1963: 623-628, figs. 1-3; Tokioka, 1967: 133-136, fig. 48).

TABLE 1

Main characters of the two species of *Pterygascidia*

	<i>P. mirabilis</i>	<i>P. longa</i>
Maximal trunk length	55 mm	93 mm
Atrial lobes	Very prominent	Not prominent
Body muscles	Oblique row of muscle segments present	Oblique row of muscle segments absent
Branchial tentacles	Up to 100, of similar size throughout	Up to 40, larger in dorsal half than in ventral
Fenestrae on wall of branchial sac	Larger, usually 1 between each pair of inner longitudinal vessels	Smaller, 2-3 in most meshes
Stomach	Descending	Ascending
Vas deferens	Distally divided into several tubules	Simple throughout
Locality	Near Timor	Philippine waters
Depth	216 m	70-135 mm

SYSTEMATIC POSITION OF THE GENUS

Sluiter suggested that *Pterygascidia* might be included in the subfamily Corellascidiinae Hartmeyer of the family Corellidae, because of the structure of the branchial sac of *P. mirabilis*, which is quite devoid of true stigmata bordered with ciliated cells. Thus, he greatly emphasized the characters of the branchial sac (Sluiter, 1904: 23-24). Van Name, on the contrary, placed *Ciallusia* in the family Cionidae because of a close resemblance with other

members of the family in general characters (Van Name, 1918: 124). Millar noticed that *Ciallusia* is devoid of epicardia and concluded that *Ciallusia* should probably not be included in the Cionidae and might have to be placed in a new family occupying a position between *Ciona* and the perophorids (Millar, 1963: 626-627). He presented this suggestion on account of the peculiar structure of the peduncle of *Ciallusia*, which has the same structural elements as the perophorid stolon, although it is unable to bud.

As the two species of *Pterygascidia* are confined to somewhat deep waters, it is very possible that the branchial sac has undergone some reduction. Actually, the structure of the branchial sac of *P. longa* seems to show an intermediate state between *Ciona* and *P. mirabilis*, which is known so far from water deeper than the habitats of *P. longa*. Bearing in mind the great variability in ability and way of budding in ascidians, especially in some styelids, I want to attach only little importance to budding and existence of the peduncle in considering the systematic position of ascidians. If the significance of the complete absence of epicardia in *Pterygascidia* could be reasonably explained, I would like to place this genus in the Cionidae. In aspects other than epicardia, *Pterygascidia* seems fundamentally to be nothing but a *Ciona* having a peduncle and a pair of fin-shaped appendages and living in deeper waters.

I want to express my hearty thanks to the authorities of the Rijksmuseum van Natuurlijke Historie, Leiden, for the privilege of studying the tunicates collected by the Snellius Expedition.

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