

Dimeatidae, a new family of the Ascidiacea, with description of a new species of the genus *Dimeatus*

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Sanamyan, K.E. 2001. Dimeatidae, a new family of the Ascidiacea, with description of a new species of the genus *Dimeatus*. *Zoosystematica Rossica*, 9(1), 2000: 37-41.

The aberrant abyssal genus *Dimeatus* Monniot & Monniot has gonads with gonoducts penetrating the tunic and opening directly to the exterior. Dimeatidae fam. n. is characterized by the position of the gut loop under the branchial sac and the unique structure of the gonads.

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Introduction

During 43th cruise of RV "Dmitry Mendeleev" in 1989 many specimens of the aberrant abyssal genus *Dimeatus* Monniot & Monniot, 1982 were collected from 6145-5680 m in the Orknean trench. According to record in the expedition journal, about 150 specimens were collected in the station 4090. Most specimens are represented only by pieces of various sizes. They are in so poor condition, that now it is not possible even to count them exactly, but among them were found about 10 specimens in unusually good state and with well-developed gonads, and the present study is based on these specimens.

The genus *Dimeatus* was originally described from southern Pacific from 4978-5043 m and until now it was known only from the original description of its sole species *D. minis* Monniot & Monniot. The following features were included in the diagnosis of the genus by Monniot & Monniot (1982: 110): "Dorsal lamina in languets, one oral and two cloacal apertures, gut under the branchial sac, gonad in the digestive loop, simple tentacles, longitudinal bars more or less complete and T-shaped papillae, and no true stigmata (transverse bars connected by longitudinal strips)". Of these features, most unusual is the presence of two large atrial openings while all other ascidians have one. On the basis of the presence of well-separated dorsal languets and position of the gut loop under the branchial sac, this genus was provisionally assigned to the family Cionidae. In the Monniots' specimens, the gonads were

poorly developed and their structure was not recognized; it was reported only that they are in the gut loop. The specimens from the present collection all have well-developed gonads and their structure does not correspond to the structure of Cionidae gonads being unique among Ascidiacea. The male and female ducts in the present specimens enter to the tunic and open directly to the exterior by multiple opening while in all other ascidians gonoducts always open into the peribranchial cavity. A new family is erected to accommodate this genus.

Order PHLEBOBRANCHIA

Family DIMEATIDAE fam. n.

Type genus: Dimeatus Monniot & Monniot, 1982.

Diagnosis. Gut loop under the branchial sac. Gonoducts penetrate the tunic and open directly to the exterior.

Discussion. The affinity of Dimeatidae is difficult to ascertain. The shape of the gut loop and its position under the branchial sac most closely resembles the genus *Ciona*, although in this genus the rectum runs along mid-dorsal line, under the row of dorsal languets, while in *Dimeatus* the rectum, although parallel to the vertical row of dorsal languets, is distinctly displaced to the left side of the body. The branchial sac is different. The absence of true stigmata is not a very important feature. In several abyssal genera belonging to different families, the branchial sac lacks stigmata and is composed of longitudinal and transverse vessels, which form wide rectangular meshes. This fea-

ture is treated as convergent. Usually, despite loss of stigmata, the branchial sac retains some features characteristic of the family and order. In *Culeolus* (Pyuridae), *Fungulus* (Molgulidae) and *Bathyoncus* (Styelidae), longitudinal branchial vessels are grouped and form branchial folds, a feature characteristic of the order Stolidobranchia. In *Pterygascidia* (assigned to Cionidae by Monniot & Monniot (1982) and to Agneziidae by Kott (1985)), *Clatripes* (Corellidae) and *Dimeatus*, internal longitudinal vessels are supported by papillae projecting from transverse vessels, as in some genera of Diazonidae, Agneziidae and Corellidae, particularly *Corynascidia*. In Diazonidae, however, the gut loop is vertical and situated in a well-developed abdomen, which is not present in *Dimeatus*. In Agneziidae and Corellidae, the gut loop is on a side of branchial sac. *Corynascidia* has simple gut loop, which is almost dorsal or only slightly displaced to the right side. In *Dimeatus*, mid-dorsal and mid-ventral lines divide the gut loop in such a way that its ascending limb is on the right side of the body and descending limb with the rectum is on the left, the situation somewhat resembling *Corynascidia*. In Octacnemidae, the gut loop has a similar position on the bottom of branchial sac, with ascending limb on the right and descending limb on the left, but other characters of this family are very different.

Thus, in the shape and position of the gut loop Dimeatidae are related to Cionidae, while according to the structure of the branchial sac they may be related to Agneziidae or Corellidae. The main feature separating Dimeatidae from Cionidae (to which *Dimeatus* was initially assigned) and also from all other ascidian families is the structure of gonads. Gonoducts in *Ciona* run along the rectum and open near the anus, in *Dimeatus* they do not extend along rectum and open directly to the exterior by multiple openings. Gonads are embedded in the test in several genera (*Plurella*, *Seriocarpa*), but in all cases their ducts open into the peribranchial cavity. Multiple openings of the ovary (suggesting that there are several closely aggregated ovaries) is also a feature unusual for Phlebobranchia, although in some genera of this order (*Plurella*, *Mysterascidia*) two or more ovaries are present.

***Dimeatus attenuatus* sp. n.**

(Figs 1-3)

Holotype. KIE 1/1025, RV "Dmitry Mendeleev", 43th cruise, St. 4090, 4.III.1989, 6145-5680 m, 60°52'S, 40°58'W - 60°52.7'S, 40°55.8'W.

Paratypes: as holotype, but KIE 2/1026 (2 specimens), KIE 3/1027 (3 specimens), and KIE 4/1028 (8 specimens). In addition, there are fragments of many other specimens (in total, about 150 specimens were collected).

The types are kept in the Kamchatka Institute of Ecology (KIE).

Description. Body soft, more or less cylindrical over most of its length, up to 8 cm in length and 4 cm in diameter. A stalk, of about same length and 0.3-1 cm in diameter, arise from anterior end of body, from ventral corner of branchial aperture. Its proximal end somewhat expanded and attached to substratum (small stones); there are no root-like processes of test. Body wall extends along the whole length of stalk. Test thin and transparent, covered sparsely by minute (0.05 mm) papillae, which are seen only after staining, otherwise test is smooth. Branchial aperture of the same diameter as body; its ventral edge extends into triangular expansion, which further narrows to peduncle. On dorsal edge, branchial aperture expanded into small protrusion. Two large atrial orifices symmetrically situated on sides of posterior half of body. They have triangular expansions on anterior edges; these expansions are smaller than aperture diameter. Margin of branchial and atrial apertures undulated. Body muscles weak. Circular muscles form a sphincter around branchial and atrial apertures. Few weak, transversely directed muscle bands are on sides of body between branchial aperture and atrial apertures, they apparently belong to circular muscles of atrial apertures. No muscles cross mid-dorsal or mid-ventral line of body. About 25-30 thread-like branchial tentacles situated close to margin of branchial orifice. Prepharyngeal band runs close to tentacles. Dorsal tubercle indiscernible; neural ganglion elongate and large. Branchial sac lacks stigmata and is composed of following elements.

(1) Nine or ten transverse vessels attached by their ends to ventral and dorsal lines of body.

(2) Five thin longitudinal strips connecting transverse vessels and forming rectangular fields, about 4 x 6 mm, and also attached to body wall only by their ends. (3) T-shaped papillae protruding from transverse vessels, whose branches sometimes connected into usually incomplete longitudinal vessels. On each transverse vessel are about 10 such papillae. Papillae more or less correspond to branchial fields, i. e. usually only one papilla arise between two adjacent longitudinal strips, but several papillae present between the most ventral strip and endostyle. Simple large dorsal languets arranged in a row along mid-dorsal

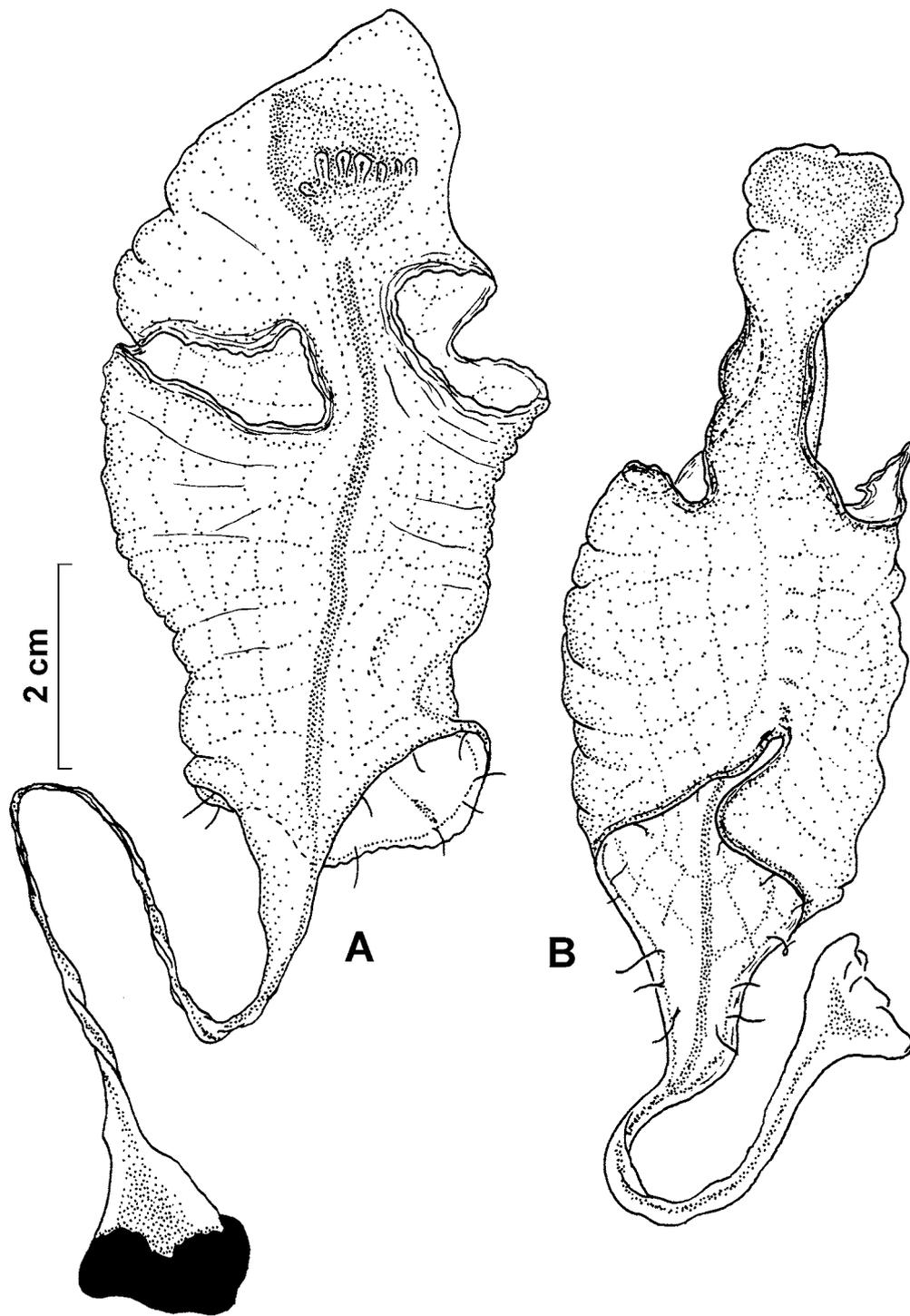


Fig. 1. *Dimeatus attenuatus* sp. n., two specimens from ventral (A) and dorsal (B) sides.

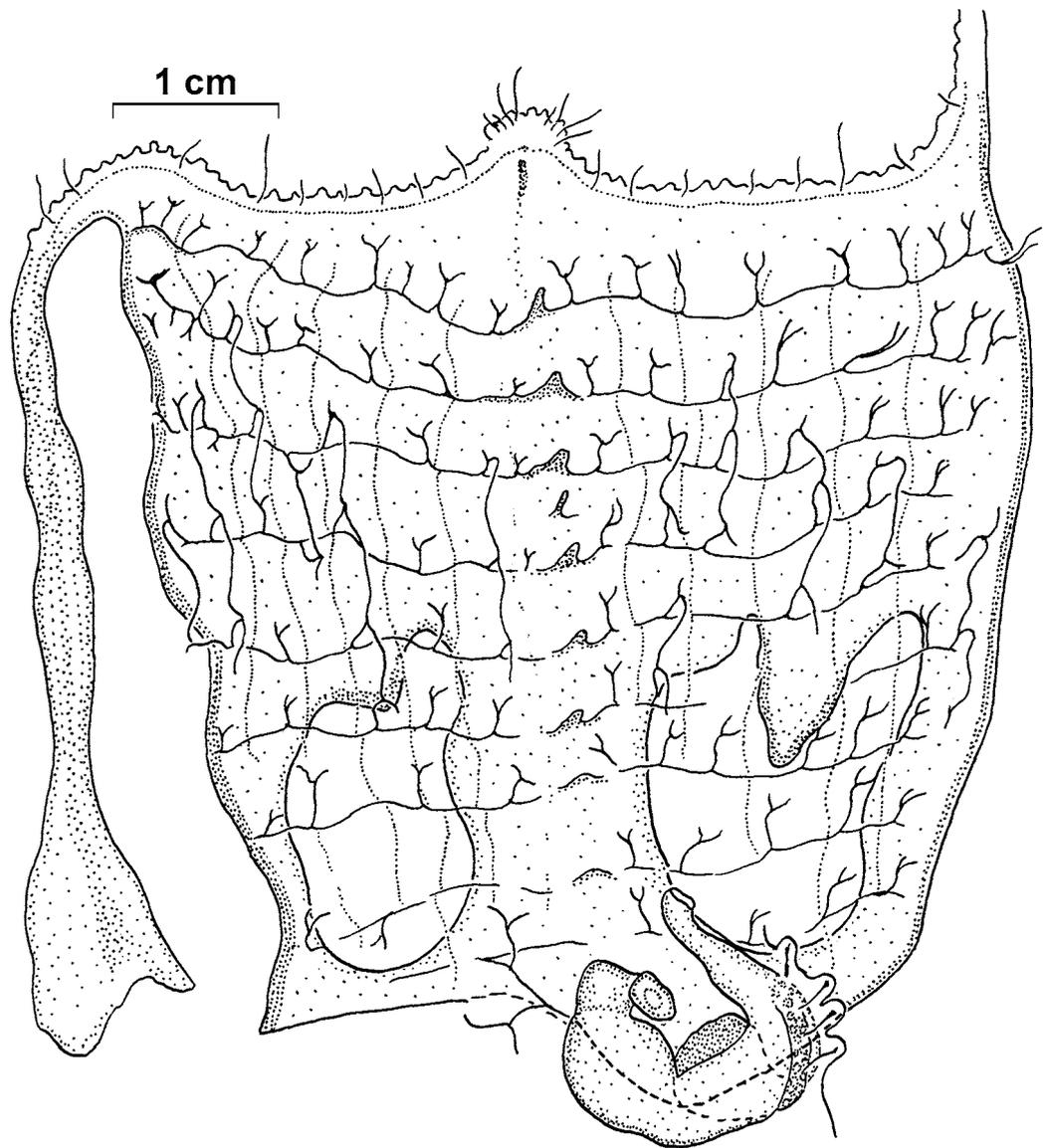


Fig. 2. *Dimeatus attenuatus* sp. n., internal structure.

line and more or less correspond to transverse branchial vessels. Straight endostyle begins near pole of gut loop and continues to end of triangular expansion of branchial siphon. Gut forms a closed, narrow, horizontal loop situated clearly under branchial sac. Small thin-walled stomach not distinctly demarcated from intestine and oesophagus. Longitudinal axis of gut loop oriented in dorso-ventral direction (Fig. 3 D). Rectum ascends vertically at right angle to gut loop. It is on the left side of body and opens close to left atrial orifice. Anal margin smooth. Gonad is an oval sac in the gut loop. Close to pole of gut loop, the gonad narrows, curves around inside of gut loop and then runs between test and intestine, along the latter, but does not reach the vertically ascending portion of intestine (rectum). Seven to nine papillae arise from this portion of gonad. Each papilla divided into two branches on the end:

short male and long female ducts. Male and female ducts penetrate test and open directly to the exterior on the tops of long female and short male papillae on test. Papillae on test are in two regular transverse rows: posterior "female row" and anterior "male row". Female papillae connected by thin lamellar expansion of test (Fig. 3, C).

Remarks. *D. attenuatus* sp. n. is very similar to or even may be identical with the type species of the genus, *D. mirus* Monniot & Monniot, 1982. However, the present specimens show certain differences from the original description of *D. mirus*, and it was decided to describe them as a new species. Monniot & Monniot (1982) described "knoblike structures" on the body wall and on the test, which somewhat resemble gonoduct openings of the present specimens. In *D. minis*, these papillae are distributed along mid-ventral line and some of

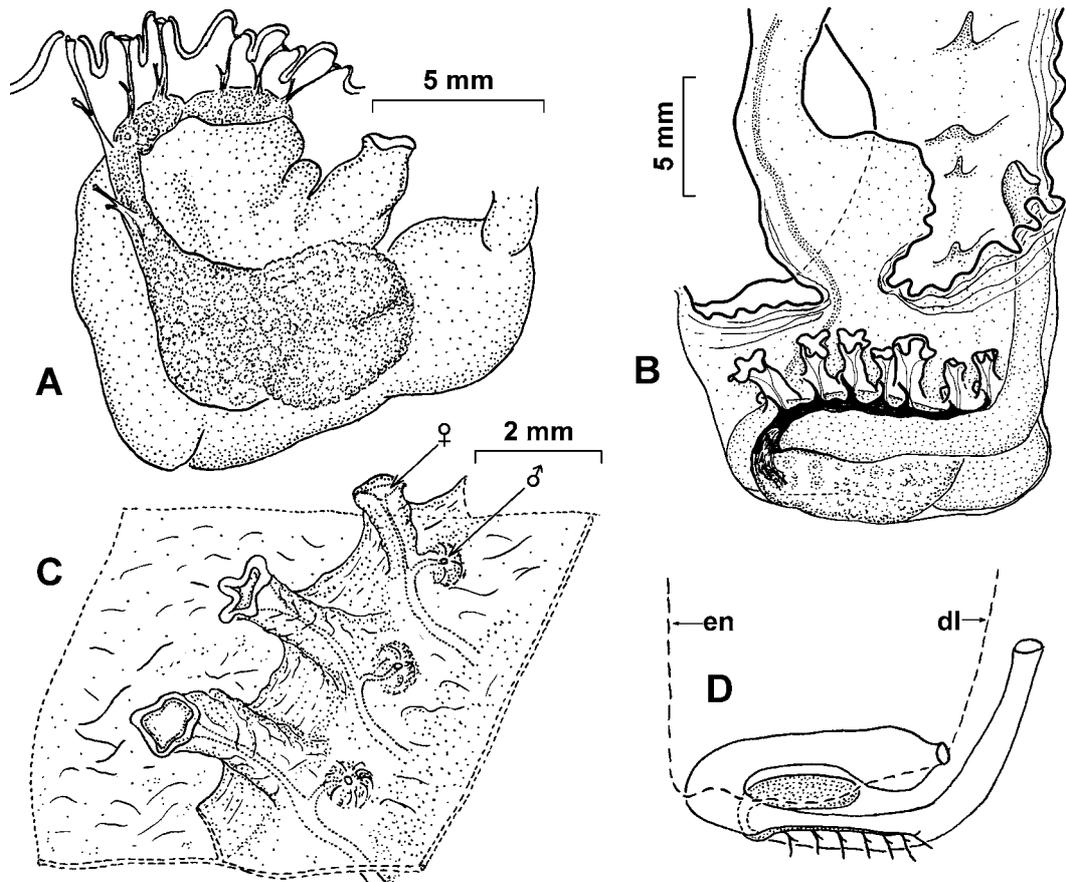


Fig. 3. *Dimeatus attenuatus* sp. n.: A, gut loop and gonad with mature eggs from outside body wall; B, posterior part of the body of another specimen, gonad with mature male part, test not removed; C, row of female and male papillae on the test; D, position of the gut loop in relation to the endostyle (*en*) and mid-dorsal line (*dl*).

them are close to the branchial orifice, they are absent in the region of gut loop and gonad, while in the present specimens papillae are in a short row on the posterior part of the body. I failed to find such papillae on other parts of the body. Despite superficial similarity, it is unlikely that papillae in *D. minis* and those in the present specimens are homologous. The second difference, which may be valid, is the number of longitudinal strips connecting the transverse vessels. In the present specimens, there are always five longitudinal strips on each side of the branchial sac, in *D. mirus*, as it appears from the Monniots' figures 14 and 18, there are seven such strips.

There are also several other minor differences, which, however, are not very important. In *D. attenuatus* sp. n., atrial orifices are much larger than in *D. mirus*, the present species has fewer tentacles and fewer dorsal languets. The structure of gonads in *D. mirus* is not known. The large space separating the digestive mass

from the bottom of the test, as described by Monniot & Monniot (1982), is an artifact.

It is interesting, that the present species was found only on one station, but in many specimens. The same is true for *D. minis*. Apparently, they form rare compact settlements of many specimens.

Acknowledgements

I am grateful to Dr. A.N. Mironov and Dr K. Tabachnik (Institute of Oceanology) for the material provided. This work was partly supported by personal grant No. 00-04-48727 from the Russian Foundation for Basic Research.

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- Received 9 June 1999