



Shallow-water species of the genus *Aplidium* (Asciidiacea) from Kamchatka and Commander Islands

KAREN SANAMYAN & NADYA SANAMYAN

Kamchatka Branch of the Pacific Institute of Geography, Far-Eastern Branch of the Russian Academy of Sciences, Partizanskaya 6, Petropavlovsk-Kamchatsky, 683000, Russia. E-mail: ascidiacea@sanamyan.com

Abstract

Four shallow-water colonial ascidians of the genus *Aplidium* (Aplousobranchia: Polyclinidae) are identified in the material collected by SCUBA divers off the coast of East Kamchatka and Commander Islands. Three species from Kamchatka were previously known from this region but were wrongly identified and two of them (*A. dissectum* n. sp. and *A. eborinum* n. sp.) are now redescribed as new species. *Aplidium redikorzevi* nom nov. (for *Amaroucium fragile* Redikorzev, 1927) is recorded on Commander Islands first time from its original description.

Key words: *Aplidium*, Kamchatka, Commander Islands, NW Pacific

Introduction

The samples were collected by SCUBA divers down to 35 m depth and preserved in 4% formalin upon surfacing. Nearly all collected colonies were photographed in vivo to document colour, form and structure of colonies, especially the shape of the systems and position of zooids, a feature clearly seen on living colonies but often difficult to observe on preserved material. The shape of systems and the form of colonies appear to be more stable and therefore more important species specific features than was thought previously. Certain records of species with very wide geographic distribution and nearly identical zooids actually may belong to several different species. Careful hand collecting of undamaged colonies and quality macrophotographs of living specimens may be very helpful to sort out some problematic colonial ascidians.

All described specimens are deposited in the Kamchatka Branch of the Pacific Institute of Geography (KBPIG). All underwater photos were taken by N. Sanamyan.

Descriptions

Aplidium oculatum (Beniaminson, 1974)

(Figure 1)

Amaroucium oculatum Beniaminson, 1974: 318.

Aplidium pliciferum: Sanamyan, 1998: 121 (part, specimens with massive colonies and white spots on thoraxes); Sanamyan, Sanamyan, 2010: 241.

Material examined. Kamchatka, Avacha Bay, Starichkov Island, 7 m, 15.10.2006, one colony (Figure 1 A,B); 7m, 28.07.2004, one colony (Figure 1 C), and many other colonies from Avacha Bay.

Description. The species forms large thick cushions not divided to lobes. The largest available colony is about 15x10 cm in extent and 6 cm high. The test is always clear, without sand on surface or in internal layers, gelatinous, moderately soft and muddy translucent. Zooids are not visible through the test on living specimens. Colour varies from yellowish-orange to reddish.



FIGURE 1. *Aplidium oculatum*. A, zooids; B colony (2006-10-15-04); C, colony (2004-07-28-03).

Zooids are in typically small, crowded circular or short oval systems around common cloacal openings. Sometimes systems are somewhat depressed and separated by low ridges of the test, a condition seen in many *Aplidium*

spp. (Figure 1B). In many other specimens, and in almost all preserved colonies there are no borders of elevated test between the systems and the surface is almost smooth (Figure 1C). Zooids are up to 30 mm long. Always simple atrial languet arises from the upper rim of the atrial aperture. Branchial sac has 12 or 13 rows of about 13 stigmata. Each row of stigmata is marked by prominent yellow spot on the thoracic wall on each side of the endostyle. A similar single pigment spot is at the upper end of the endostyle. In preserved specimens the colour of the spots fades to white, but spots are still recognizable in the specimens kept for more than 10 years in formaline. Stomach has 22–25 not quite regular folds. Postabdomen very long, contains several large ova just below the gut loop and serially arranged testis follicles along the whole length. Zooids in some colonies have embryos in atrial cavity, but no fully developed larva are found.

Remarks. Original description of *A. oculatum* based on two colonies from Paramushir Island (off south end of Kamchatka) is too superficial, but as it appears from the original figure the zooids have generally simple atrial languet, numerous stomach folds and 11 rows of stigmata marked by pigment spots near the endostyle, as in the present specimens (Beniaminson, 1974, Figure 1). Sanamyan (1998) synonymized *A. oculatum* with *A. pliciferum* (Redikorzev, 1927), although *A. pliciferum* was originally described from much warmer waters (in original description the locality listed as "Japanisches Meer, Missaki", see Redikorzev, 1927) and hardly could be identical with the species from Kamchatka. We reexamined the holotype of *Amaroucium pliciferum* (Zoological Institute, St. Petersburg, ZIN957). Zooids are rather fragile and difficult to extract, but otherwise still in a perfect condition. They correspond fully to original description and figure, including fully expanded thorax with a simple atrial languet and two unusually long rectal caeca figured by Redikorzev (1927, Figure 10). Colony contains no larvae, and no pigment spots along the endostyle. We do not think *A. oculatum* and *A. pliciferum* are conspecific and treat here *A. oculatum* as a valid species.

Despite large number of specimens collected we failed to find fully developed larva and its structure is not known. A larva described for this species by Sanamyan (1998, Figure 7A) comes from a colony composed of several cushion-like lobes, a feature not characteristic for *A. oculatum*, so it may belong to another species. *Aplidium oculatum* is fairly common on the hard bottom on diver accessible depths in the vicinity of Petropavlovsk-Kamchatsky.

Aplidium dissectum n. sp.

(Figures 2,3)

Material examined. Kamchatka, Avacha Bay: Starichkov Island, 10m, 15.09.2002 (Holotype KBPIG 1439/1); 13m, 20.06.2006, two colonies (Paratypes KBPIG 1440/2, 2006-06-20-01); Vilucha Bay, Laperusa Rock, 12m (Paratype KBPIG 1441/3, 2006-07-25-04).

Description. Each colony is a group of low cushions or lobes closely adherent to each other. Each lobe is about 2 or 3 cm in the greatest diameter, but occasionally up to 8 cm. On preserved material the upper surface of the lobes is concave but more rounded on living specimens (Figure 3D). Basally the lobes are joined and a colony is attached to substratum by not very large area. Sand grains may present on the sides of the lobes and at the base of the colony, but generally foreign particles are sparse and completely absent inside, and the upper surface of the colony is always clear. Living specimens are dull yellow-reddish, preserved in formaline are brownish with slight reddish tint. The common test of the living specimens is slightly translucent, but not transparent, and zooids are not visible through the test on underwater photographs. In preservative it becomes more clear, but still dull and foggy. Zooids arranged along branched but rather short cloacal canals converging to the cloacal openings. Short transparent cloacal siphons, several on each lobe, are visible on living specimens but retract completely in preservative and the surface become quite smooth, without any kind of depressions indicating systems.

Zooids are up to 15–20mm long with rather short thorax and abdomen and long postabdomen. They are mostly parallel to each other. Short branchial aperture has usual six small pointed lobes. Upper rim of small atrial aperture is drawn into occasionally simple but usually three-lobed atrial languet. Zooids with simple and three-lobed languets may occur together within the same lobe of colony and the shape probably depends on the position of a particular zooid in the system. About dozen of fine longitudinal muscles are in the thoracic wall. The branchial sac has usually 11, sometimes 10 or 12 rows of about 12–14 stigmata.

The abdomen is shorter than thorax. A short cylindrical stomach located in the middle of abdomen has 24–28 rather irregular and shallow folds which can be counted with reasonable degree of certainty only on transverse

cross-sections. Subdivision of the post pyloric part of the gut loop on typical for *Aplidium* regions is quite clear: there is rather long duodenum, mid-intestine with oval posterior stomach and noticeable rectal valves.

The posterior abdomen is long and in many zooids looks empty. Several large ova may be located just below the gut loop or some distance from it, in the upper third of the posterior abdomen.

Numerous larva and embryos incubated in the atrial cavity of many zooids. The trunk of the larva is 0.7–0.75mm long. Three adhesive organs alternate with four median ampullae (which often have forked ampullaceous ends) and four large bulbous lateral ampullae on each side of the trunk. Several small epidermal vesicles are along mid-dorsal and mid-ventral lines but not around the anterior end of the trunk.

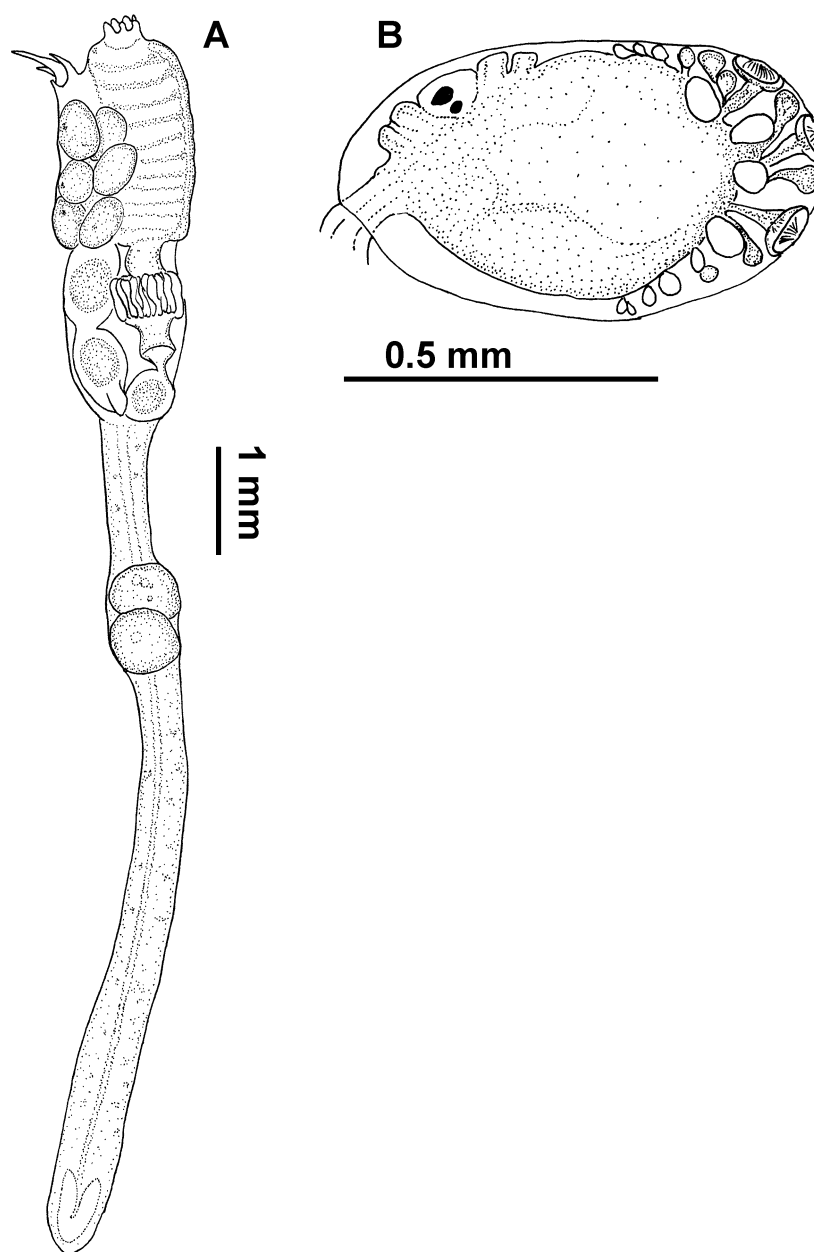


FIGURE 2. *Aplidium dissectum* n. sp. A, zooids; B larva (2006-10-15-04); C, colony (2004-07-28-03).

Remarks. The species belongs to a difficult group of *Aplidium* species with numerous stomach folds and relatively few rows of stigmata. Initially it was identified as *Aplidium translucidum* Ritter, 1901 originally described from "Orca, Prince William Sound, Alaska, on reefs at low tide" (Ritter, 1901: 251). According to Ritter (1901) *A. translucidum* has very regular inverted cone shaped colonies attached by a short peduncle. Ritter (1901) especially mentions unusually transparent test through which the zooids are seen very clearly. Van Name (1945) also mentioned great transparency of the test. Zooids, according to Ritter's (1901) description are similar to those of the

present species, although the thoraces are slightly wider, he counted 18–20 stigmata in each half row. Material identified as *A. translucidum* by Sanamyan (1998) is a mixture of several species and certainly contains at least several specimens of the present species, although the larva on his figure 7E differs distinctly from larvae of the present species.

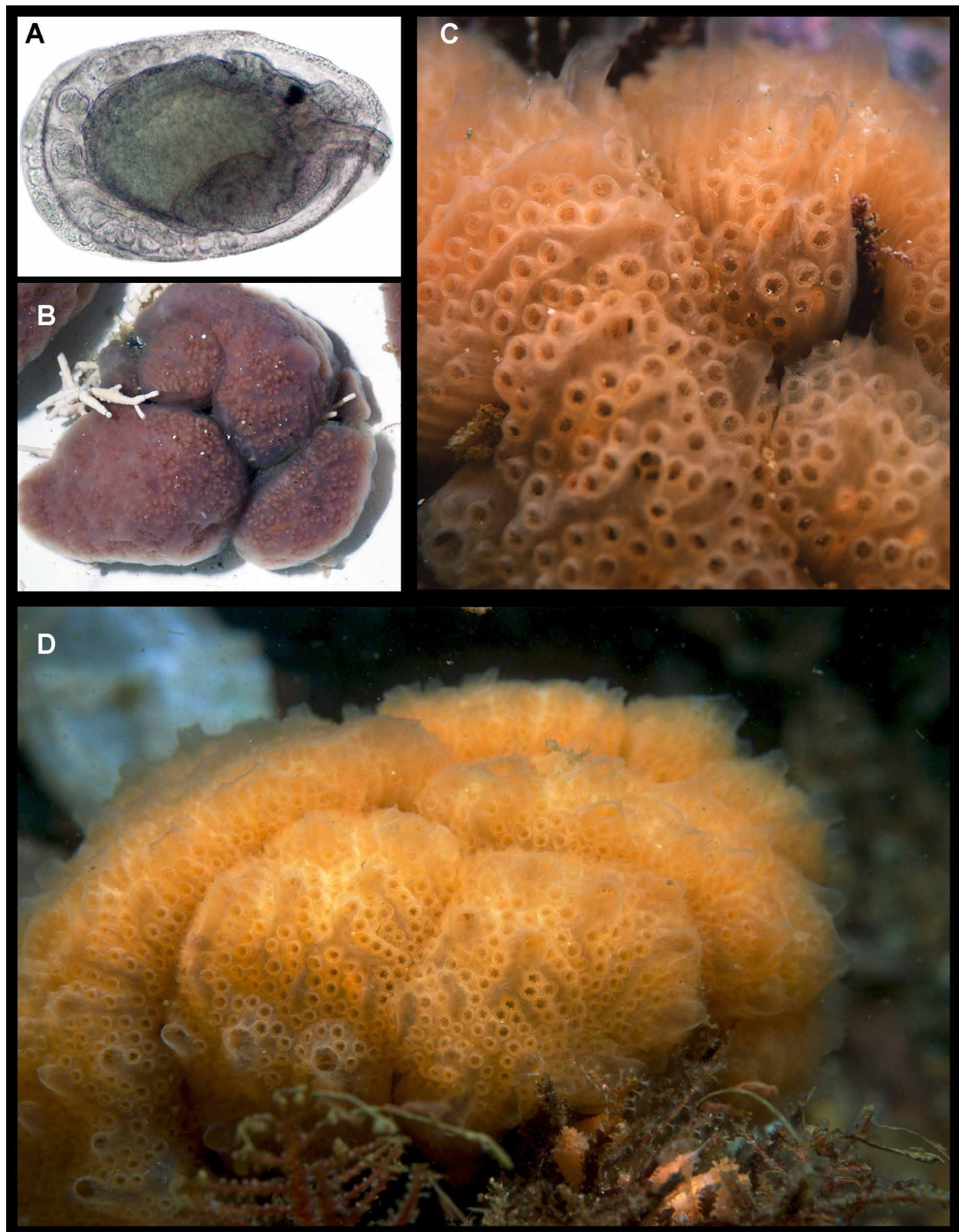


FIGURE 3. *Aplidium dissectum* n. sp. A, larva (holotype); B, colony, preserved (holotype); C, D, colony underwater (2006-07-25-04 and 2006-07-25-01 respectively).

Aplidium strandi Redikorzev, 1937 was regarded as a probable synonym of *A. translucidum* by Van Name (1945). This species is known from only one inverted cone shaped cormidium collected at the north of the Sea of Okhotsk. The zooid has triffid atrial languet and numerous stomach folds, but only seven rows of stigmata. Although it is hard to identify the species based on a single cormidium and without larvae we do not think *A. strandi* is conspecific with *A. translucidum* or with the present species.

Several species having numerous stomach folds and relatively few rows of stigmata were described by Beniaminson (1974) from Kurile Islands. *Aplidium oculatum* is valid species (see above). It differs from the present species by the shape of systems and the presence of white spots along the endostyle. *Aplidium tenuicaudum* (Beniaminson, 1974) has different larva with about 50 small epidermal vesicles dorsally and ventrally on each side (see Sanamyan, 1998), and taxonomic relationship of *A. kurilense* (Beniaminson, 1974) and *A. vinogradivae* (Beniaminson, 1974) is hard to access, both species are based on a single and remarkably featureless colonies.

Aplidium confusum Sanamyan, 2000 known from several lots of specimens collected in the intertidal zone of South Kurile Islands has very similar zooids and similar, although somewhat smaller, larva. The shape of system in this species is not known and not possible to access from the existing material, but zooids with constantly simple atrial languet suggest that the systems possibly differ from those of the present species. We reexamined available material and confirm that atrial languet is always simple in specimens from South Kurile Islands assigned to *A. confusum*.

***Aplidium eborinum* n. sp.**

(Figures 4,5)

Aplidium glabrum: Sanamyan, 1998: 119; 2000: 213 (part, specimens from Kamchatka); Sanamyan, Sanamyan, 2010: 242.

Material examined. Kamchatka, Avacha Bay: Bezimanny Point, 6–8m, 7.08.2004 (Holotype KBPIG 1442/1); Kekkurny Point, 19m, 26.07.2006 (Paratype KBPIG 1443/2, 2006-07-26-02); Piramidny Point, 18m, 14.02.2007, several large colonies; Starichkov Island, 10–11m, 18.10.2008, one colony (Paratype KBPIG 1444/3).

Description. The colonies are thick encrusting masses with the surface raised into large domes or rounded stumpy lobes with large common cloacal apertures on the top. Sometimes the lobes are more separated and connected to each other only by thick anastomoses of the basal test (Figure 5A). The largest collected colony is about 10 cm in extent and up to 5 cm thick. The colour is rather constant and varies in a limited degree from light yellow-grayish to white, sometimes with a light bluish opalescence on the underwater photographs. In preservative (formaline) all colonies are light grayish or brownish. The test is gelatinous and rather opaque, zooids are not visible well through it. The surface is always clear from foreign particles but sparse sand grains may present internally. Zooids are arranged along rather thick branching cloacal canals converging to sessile common cloacal apertures. In preservative the surface of the lobes is smooth, without depressions or ridges indicating systems.

Zooids are rather short and in most preserved specimens strongly contracted, being no more than 7 mm long. They are almost parallel to each other and open at angle to the surface of the colony lobes. Branchial siphon has six lobes. Small atrial aperture has always simple and usually short atrial languet. Numerous closely set thin longitudinal muscles are on each side of the thorax. The branchial sac has 14 rows of stigmata. Cylindrical stomach has 13–15 wide and usually very regular and prominent folds. Post pyloric part of the gut loop has usual duodenum, mid-intestine, posterior stomach and short wide rectal valves. Ovary consisting of one or two large ova is in the middle of postabdomen and testis follicles are confined to the posterior half or third of postabdomen.

Up to six larvae incubated in the atrial cavity of some zooids in holotype. The trunk is 0.9mm long. There are three adhesive organs on long thin stalks and an arch of rather large and closely set epidermal vesicles arranged in a single row around each side of the anterior half of the larval trunk, but no median or lateral ampullae.

Remarks. Colonies of this species from Avacha Bay were identified previously as *A. glabrum* (Verrill, 1971) described originally from Atlantic coast of North America. Indeed, they have similar zooids with almost the same number of rows of stigmata and stomach folds, although atrial languet in *A. glabrum* usually has additional lateral lobes completely absent in the specimens from Kamchatka. Colonies of *A. glabrum* are described as consisting of club-shaped flat-topped heads with abrupt sides which in larger colonies may have wide bases. We had a chance to examine colonies referable to *A. glabrum* from Norway, they consist of low flat-topped lobes with parallel vertical zooids open perpendicularly to the upper surface. These colonies correspond exactly to a schematic but quite pre-

cise figure provided by Millar (1966, Figure 14a) and differ substantially from the colonies of the present species. It seems that *A. glabrum* is restricted to North Atlantic and European seas and probably not occurs in Pacific.

Specimens from South Kurile Islands identified by Sanamyan (2000) as *A. glabrum* appear to be distinct from the present species, the structure of systems is not recognizable, the larva is very similar but smaller, and zooids have only 9 or rarely 10 rows of stigmata. However, the specimens from Kamchatka described in the same paper belong to *A. eborinum* n. sp., although Sanamyan (2000, Figure 2D) misinterpreted the shape of systems in preserved colony and figured them as irregularly oval or circular.

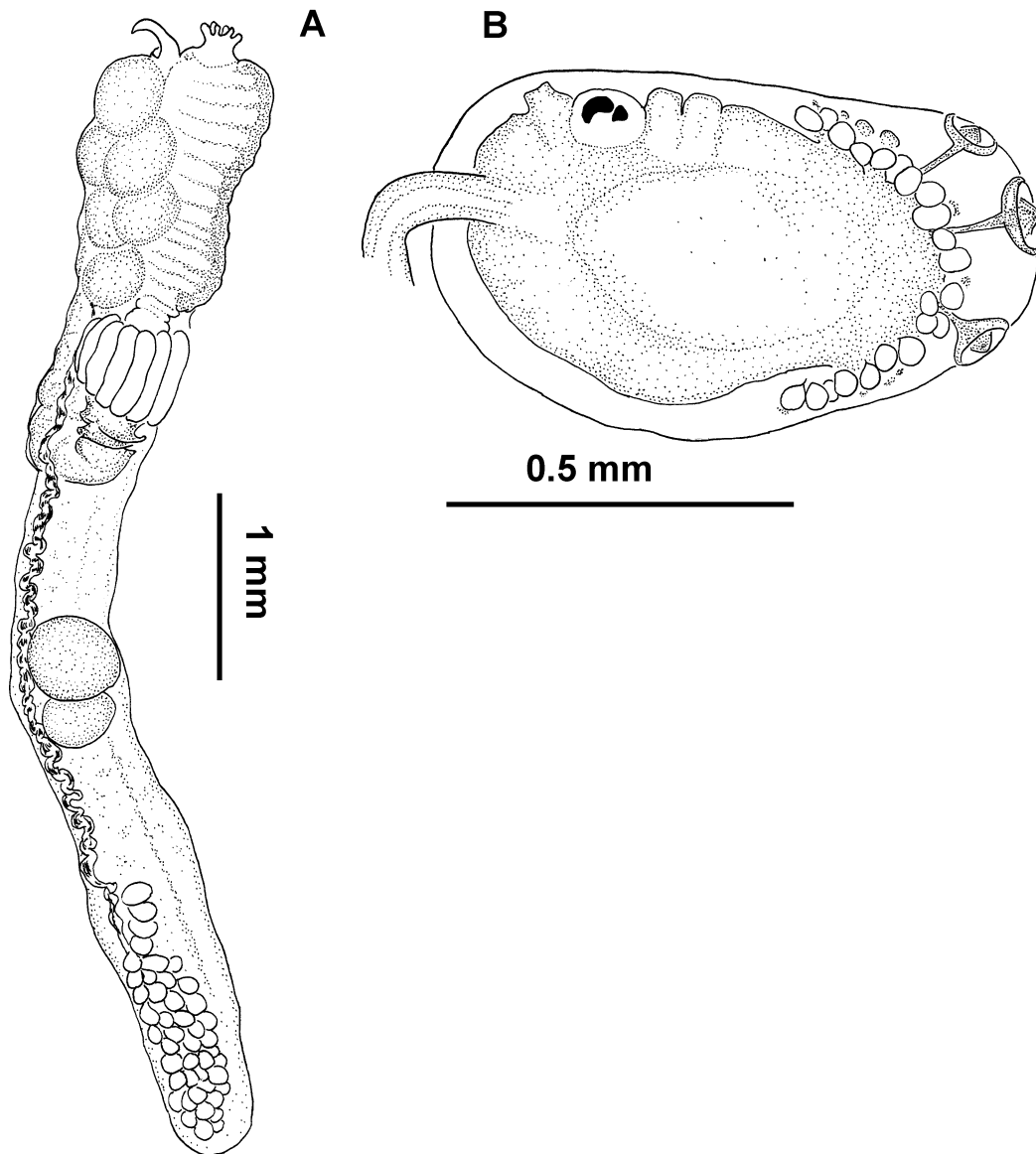


FIGURE 4. *Aplidium eborinum* n. sp. A, zooid; B, larva.

***Aplidium redikorzevi* nom. nov.**

(Figures 6,7)

Amaroucium fragile Redikorzev, 1927: 384.

Material examined. Commander Islands, Medny Island, about 10 colonies and fragments from 5 to 20m collected in Summer 1992 and 1995.

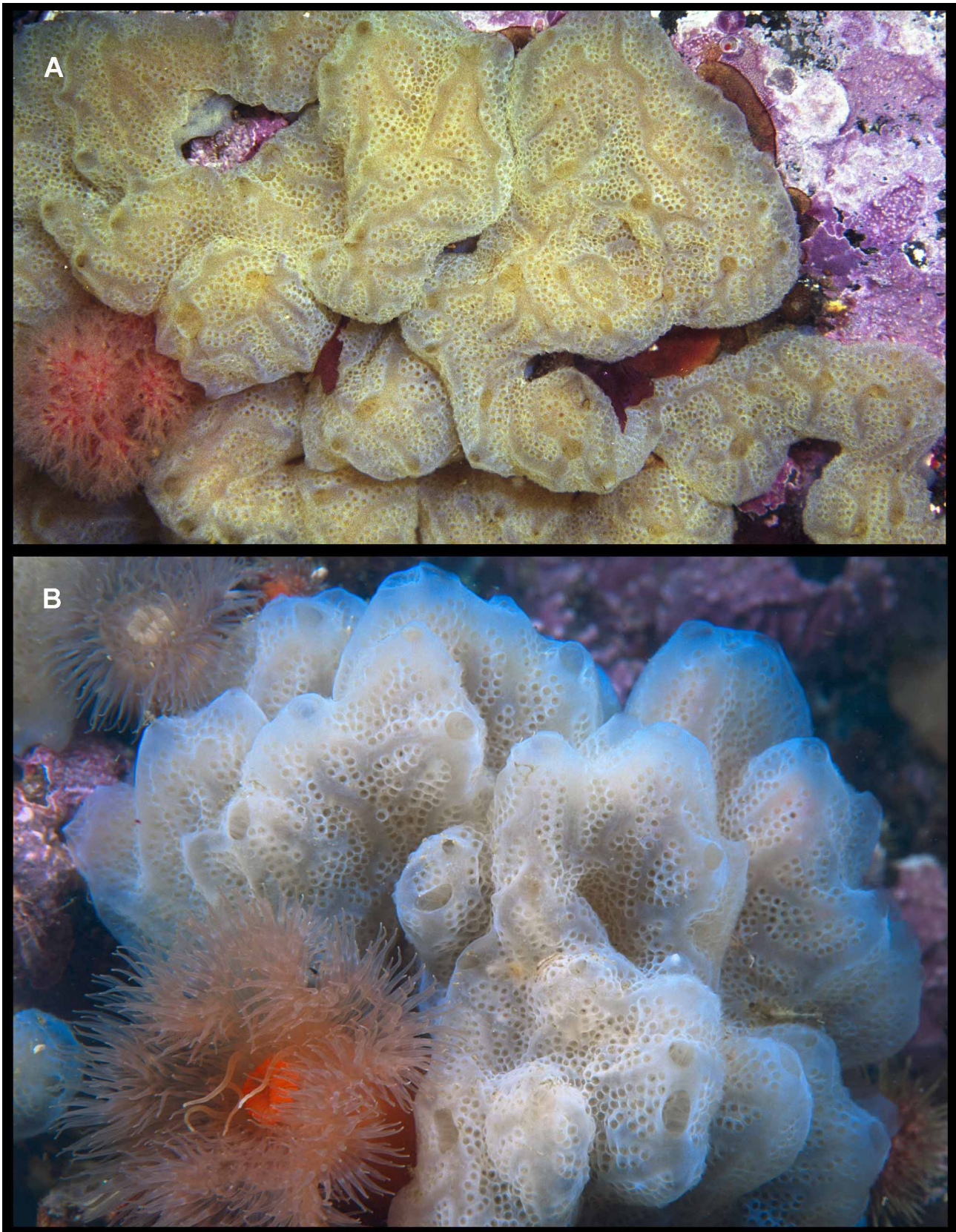


FIGURE 5. *Aplidium eborinum* n. sp., underwater. A, specimen 2004-06-03-01; B, specimen 2006-07-26-02.

Description. Colonies are composed of numerous crowded upright sandy lobes, each is 5–6 mm in diameter and up to 35 mm long but often much shorter. The lobes arise from a basal mass attached to substratum (Figure 7).

The sand is present internally and densely covers the surface making the colonies very cryptic and difficult to recognize underwater. Zooids are parallel to each other and vertical, they open on the flattened top of the lobes. Each lobe probably contains a single system of a few zooids arranged in a circle.

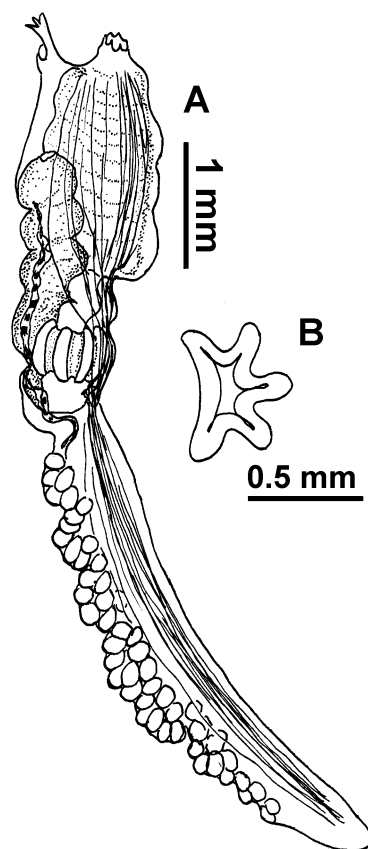


FIGURE 6. *Aplidium redikorzevi* nom. nov. A, zooid; B, cross section of the stomach.

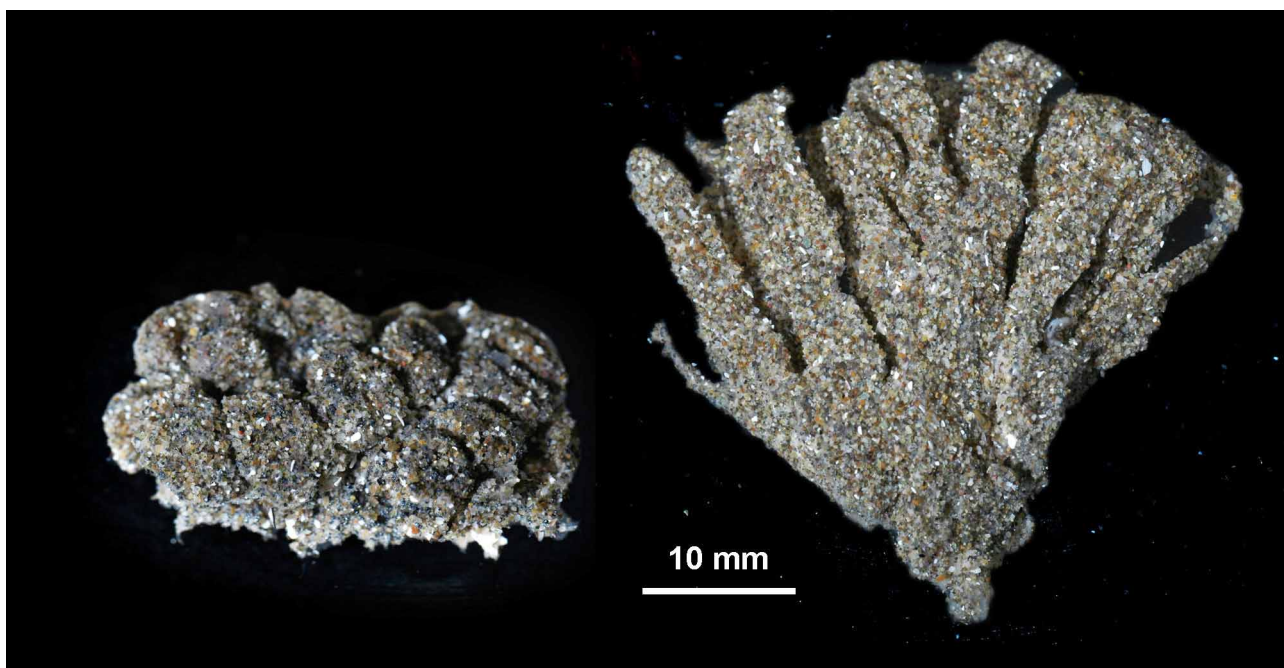


FIGURE 7. *Aplidium redikorzevi* nom. nov., two colonies, preserved.

The zooids in all colonies are strongly contracted and small, typically about 3mm long, occasionally up to 7mm. Numerous thick longitudinal muscles arising on the thorax join together to form a strong ventrolateral band on each side of the ventral line of abdomen and run to the end of postabdomen. Atrial languet is simple but has three short indentations at the end. The branchial sac has 12 rows of about 15 stigmata. The stomach has five very prominent folds. Ovary, when present, is just below the gut loop, testis follicles fill the whole length of postabdomen.

Remarks. *Amaroucium fragile* Redikorzev, 1927 is a junior secondary homonym of *Psammaphidium fragile* Herdman, 1899, so new name is here proposed for this species. The species was known only from the original description based on specimens from Shantar Islands, Sea of Okhotsk. The species still has not been recorded in Kamchatka.

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