

ASCIDIANS FROM THE NORTH-WESTERN PACIFIC REGION

6. DIDEMNIDAE

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ABSTRACT

Among the 13 species of didemnid ascidians collected during several expeditions in the NW Pacific, 8 are species of the genus *Didemnum*. Only *D. papillatum* Romanov and *D. pseudobiglans* Romanov from Commander Islands and *D. vermiforme* Romanov from the Sea of Japan were represented by many specimens. Most other species of the family were represented in the present material only by a few specimens. Two new species of *Didemnum* are described from the Alaska Gulf, 79 to 195m. One of these, as well as some colonies of *Polysyncraton crassum* Redikorzev, are devoid of spicules.

Key words: Ascidiacea, North-western Pacific, Didemnidae, *Trididemnum*, *Didemnum*, *Polysyncraton*, *Diplosoma*.

INTRODUCTION

Only three Didemnidae species were previously known from the central and eastern part of the Bering Sea and Alaska. They are *Didemnum albidum* (Verrill, 1871), *Trididemnum tenerum* (Verrill, 1871) and *Trididemnum strangulatum* (Ritter, 1901). Didemnidae from the Asiatic coasts are better known. Romanov (1989) gives descriptions of 52 species, of which 29 are known to occur in Russian waters; nearly all of them were collected in shallow waters. The genus *Didemnum* is most diverse in the region and represented by 17 species.

The present collection is small, but contains specimens from regions where Didemnidae are poorly known (Alaska Bay, the Sea of Okhotsk) and from the intertidal zone to relatively deep water (75 to 560m). *Didemnum papillatum* Romanov and *D. pseudobiglans* Romanov predominate in Commander Islands and *D. vermiforme* Romanov is abundant in the Peter the Great Bay (Sea of Japan).

The following collections were examined:

From the Zoological Institute, St. Petersburg (ZIN)

(A) RV *Lebed*, 1954, North Kurile Islands (mainly Paramushir and Shumshu); dredging, coll. A. Spirina.

(B) RV *Academic Oparin*, 1986, Sea of Okhotsk and Kurile Islands; dredging, coll. A. Smirnov.

(D) RV *Academic Oparin*, 1991, Alaska, Aleutian, Commander and Kurile Islands, East Kamchatka; dredging and SCUBA diving, coll. A. Smirnov.

From the Kamchatka Institute of the Ecology and Environment, Petropavlovsk-Kamchatsky (KIE).

(E) Collection of the Far East State Sea Reservation (FESSR), 1980-1991, Sea of Japan. Additional specimens collected by Dr. A. Chernyshev, autumn 1994.

(F) Collection of 1984-1995, Commander Islands, East Kamchatka and Atlasov Island (North Kurile Group); SCUBA diving and dredging, coll. collaborators of the Lab. of Benthic Communities. Additional specimens collected by Dr. B. Sheiko: RV *Volkanolog*, Sea of Okhotsk, Shantare Islands, 1995.

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Trididemnum strangulatum (Ritter, 1901)

Fig. 1

Didemnum strangulatum Ritter, 1901: 247.

Trididemnum strangulatum: Van Name 1945: 107.

Material examined. – (D) Alaska Gulf, near Sanak Island, st.38, 54°5.6'N, 162°09.6'W, 114m, 17.8.1991, 1 colony; st.39, 54°05'5N, 162°10.0'W, 115m, 17.8.1991, 1 colony.

Description. – Colony flat and encrusting, largest about 8x4cm and 2-3mm thick, whitish to greyish white (in preservative), soft. Surface nearly smooth, but with weak depressions above zooids, where there are fewer spicules and the test is darker (owing to the transparent test) than in the spaces between zooids where spicules are more crowded. Common cloacal apertures few, randomly distributed. A thick superficial spicule-free layer is present. A spacious hypozooidal cloacal cavity divides the colony into two layers, upper and lower (basal), connected by occasional columns of test (Fig.1, B). Zooids are embedded in the upper layer, and the lower layer contains embryos and large eggs. Tailed larvae were not found.

Spicules distributed densely and evenly throughout the colony or slightly more abundant in superficial part. They are up to 50 μ in diameter with nearly even size distribution, with prominent conical rays, 7 to 10 rays in the equatorial plane. The lateral thoracic organ is 0.2-0.25mm in greatest diameter. Zooids are 1.5-2mm in contracted state, the thorax almost as long as the abdomen. The atrial opening is on a short plain-edged siphon. The pharynx has 9 to 11 stigmata in each half of 3 rows, two long dorsal languets, a wide imperforate area anterior and posterior to the perforated area. Testis is large and undivided with the vas deferens coiled 7-9 times around it.

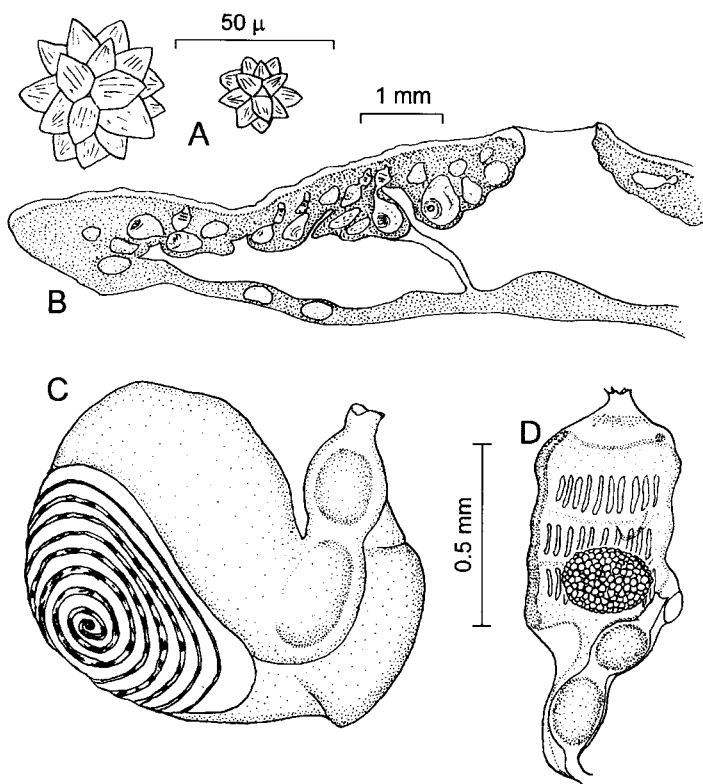


Fig. 1. *Trididemnum strangulatum*— A, spicules; B, cross section through colony to show cloacal cavity; C, abdomen; D, thorax.

Remarks. — The present colonies were found near the Sanak Island, not far from the type locality of *T. strangulatum* which is Kodiak Island, Alaska. However, they have a few more coils of vas deferens than *T. strangulatum* (4) and are only tentatively assigned to this species. The spicules of the present specimens resemble in the shape but are larger than those of *T. opacum* Ritter, 1907, a closely related species from California which Romanov (1989) proposed as a synonym of *T. strangulatum*. However other features, such as the number of vas deferens coils and different geographic distribution appear to separate these two species (see Van Name 1945). Although Van Name (1945, p.106) reported that *T. opacum* had zooids “arranged in extensive branching systems whose limits are not usually determinable” the cloacal cavities of both *T. opacum* and *T. strangulatum* are not known. Additional material is required to determine the exact relationships of *T. strangulatum*, *T. opacum* and the present specimens.

Distribution. — Kodiak Island (Ritter 1901), Chignik Bay (Van Name 1945), Sanak Island (present study).

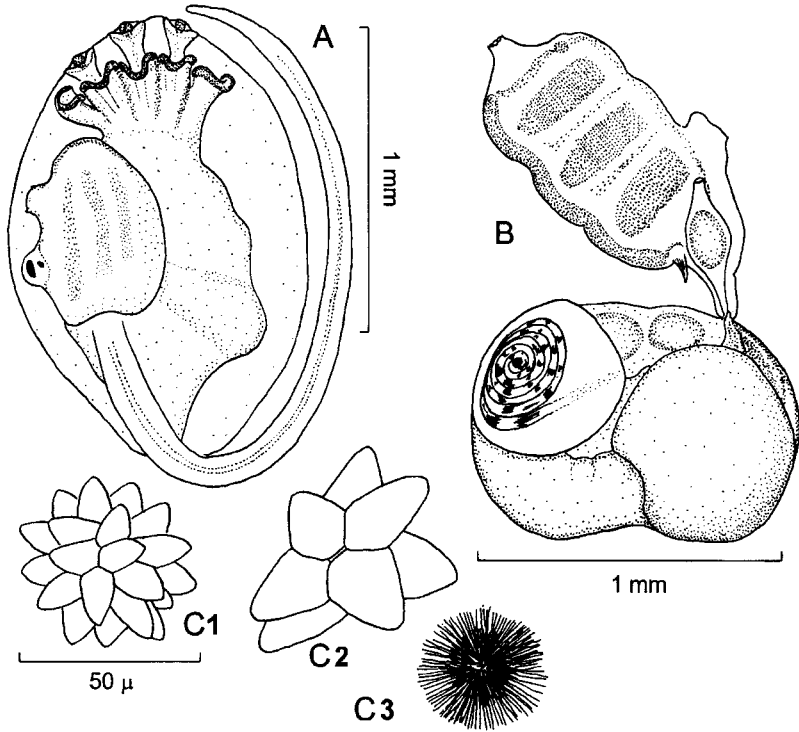


Fig. 2. *Trididemnum* aff. *tenerum* – A, larva; B, zooid; C, spicules.

Trididemnum aff. *tenerum* (Verrill, 1871)

Fig. 2

Material examined. – (F) FV *Gefest*, East Kamchatka, Karaginsky Bay, 58°35.9'N, 164°18.8'E – 58°35.9'N, 164°15.0'E, 330-560m, 6.07.1994, 1 colony.

Description. – Soft, damaged colony, 4.5x1.5cm in extent and 2-2.5mm thick. Test gelatinous, transparent and yellowish, zooids clearly seen through colony surface. Cloacal cavity apparently hypozooidal. Test layer below hypozooidal lacunae thin furnished with fecal pellets. Common cloacal apertures not detected. Superficial aspicular layer thick. Spicules up to 65 μ , occasionally asymmetrical. They are diverse, some with longer and others with shorter conical rays (about 10-13 rays in the equatorial plane) with somewhat rounded tips. Burr-like spicules with long, narrow, needle-like rays also present. Spicules are distributed sparsely, and mainly in surface layer.

Zooids are about 1.7-2.2mm in contracted state. Thoraces are up to 1.2mm long. The oral siphon has 6 well-marked lobes and the atrial opening is on a short siphon. A short retractor is present. In many zooids thoracic organs were

not detected, in others they appear as small aggregations of spicules with unclear margins on both sides of thorax. About 10(?) stigmata in each half of 3 rows of stigmata. Abdomen 0.75-1.5mm long. The gut loop usually is horizontal, but may also be vertical. There is no secondary loop and the stomach is large and globular. The testis is undivided; proximal end of vas deferens coiling 6-7 times.

Three larvae are found embedded in the test. The larval trunk is 1.3-1.5mm long, with 3 adhesive organs and an ocellus and otolith. Lateral ampullae have unusual straight terminal ends with a rounded, slightly curved edge (Fig.2, A). Two larvae have 5 lateral ampullae on one side and 4 on the other, while the third has 4 on each side.

Remarks. – The present specimen appears to be similar to *T. tenerum* (Verrill, 1871) in most respects except for the size of the larval trunk, which is only 0.4-0.6mm long instead of 1.3-1.5mm. *Trididemnum tenerum* is a widely distributed species in arctic and boreal waters. In the Pacific it was recorded from Alaska (Van Name 1945) and the Sea of Okhotsk (Redikorzev 1908). Most colonies of *T. tenerum* lack spicules, but some have “few stellate masses of sharp rods” or sometimes also “regular and solid spicules” (Millar 1966, p.29), as in the present specimen. The structure of larvae from the present colony is identical with that of a mounted larva of *T. tenerum* from the English Channel recently sent to me by Dr. Patricia Mather. In describing this larva, Kott (1952, Fig.3, D) overlooked the unique lateral ampullae present in four of the best developed larvae of the 8 on Kott’s slide. Apparently these unique lateral ampullae also were overlooked by Berrill (1950) and Millar (1966). The difference in larval size may be a significant species difference. Additional material is required to resolve this question.

Trididemnum strangulatum from Alaska also might be related, some colonies containing few spicules, and others being entirely aspicular. The present specimen differs from this species in number of vas deferens coils and shape and size of spicules. The larva of *T. strangulatum* is not known.

Two colonies from Sanak Island, provisionally assigned to *T. strangulatum* (see above) have more crowded spicules than the present colony, lack spicules with needle-like rays and have larger thoracic organs. The lack of spicules with needle-like rays probably is a significant difference.

Polysyncraton adenale Romanov, 1977

Fig. 3

Polysyncraton adenale Romanov, 1977: 58; 1989: 185.

Material examined. – (D) Alaska Gulf, near Sanak Island, st.40, 54°15.6'N, 161°46.6'W, 75m, 17.8.1991, stones, 1 colony.

Description. – Colony encrusting, 18x13mm in extent and 5mm thick in the cen-

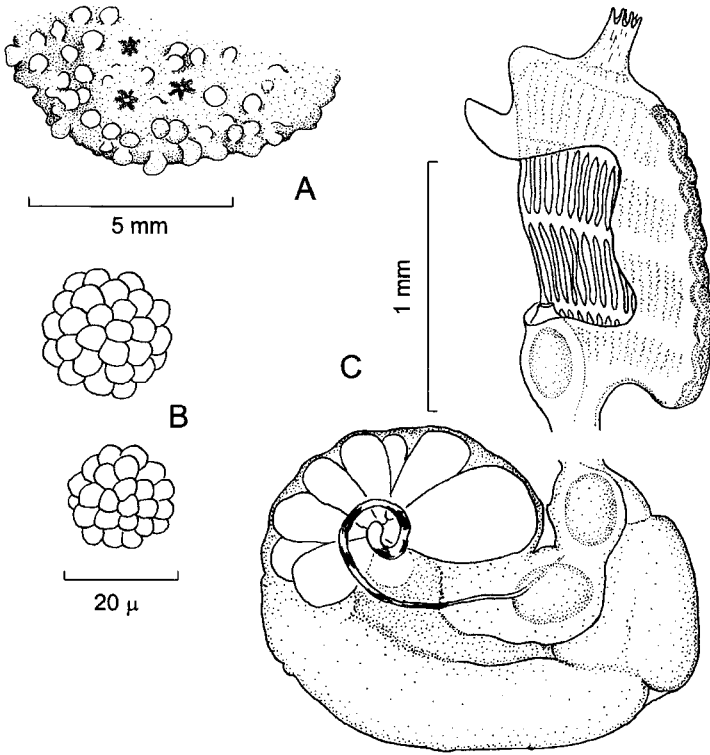


Fig. 3. *Polysyncraton adenale* – A, part of colony; B, spicules; C, zooid.

tre. Surface greyish white, covered by solid spherical tubercles, about 0.5mm in diameter, usually on short stalks. Superficial aspicular layer absent or thin. Oral apertures conspicuous, surrounded by six thick tunic lobes crowded with spicules. Single common cloacal aperture on a low elevation is in the centre of colony. Cloacal cavity extensive, thoracic; no hypoabdominal spaces.

Spicules almost spherical, up to 26 μ in diameter, distributed densely and evenly throughout the test, including tubercles on surface of colony. Rays numerous, short, rounded, about 12-15 in the equatorial plane.

Zooids up to 3mm long, fully expanded thorax up to 1.7mm long, abdomen about 1.5x1.2mm. Shape of thorax varies according to position in colony. In marginal zooids thoraces usually have wide atrial aperture with a short but distinct atrial languet. In zooids surrounding the common cloacal orifice the atrial aperture is narrow and the atrial languet is very wide and long (more than 1mm). The oral siphon is long, always with six narrow and long pointed lobes around the rim of the aperture. About 15 long, narrow stigmata are in each half of four rows. Oval lateral thoracic organs 0.15-0.25mm in diameter are firmly at-

tached to the test at level of second or third row of stigmata. No retractor muscle detected.

The short oesophageal neck sometimes has buds. The gut loop is nearly horizontal, with a distinct secondary loop and a small stomach. The testis is large, composed of at least 8 follicles. The proximal end of the vas deferens coils 1-1.5 times. A conspicuous yellowish green V-shaped mass of cells in the abdomen. No larvae were found.

Remarks. – *Polysyncraton adenale* is the first *Polysyncraton* recorded from north-eastern Pacific waters. The type specimens were bright red becoming light yellow after long storage in alcohol. The here recorded specimen differs from the type in the size of its thoracic organ, which is only 0.15-0.25mm, while in the type specimen it was about one third of the thorax, at least 0.4mm in diameter (Romanov 1989). Further, Romanov reported slightly more turns of vas deferens (2-3) and red glandular cells in the abdomen (which he referred to as an extremely large red pyloric gland). The latter feature was specially noted by Romanov (1989), as one of the characteristics of his species; in the present specimen this mass of cells is light greenish or yellowish and not large, as in other species of many genera (see *D. nekozita* Tokioka, 1967). The common cloacal cavity in Romanov's specimens is at oesophageal level, rather than the thoracic cavity of the present specimen. Nevertheless, the here recorded specimen appears to belong to Romanov's species, having the same papillated test, a small number of vas deferens coils and a relatively large number of stigmata per half row. These are the characteristics of the present species. The differences referred to above are considered infraspecific variations.

Distribution. – Two specimens were collected from North Kurile Islands (Romanov 1989) and another single from Sanak Island (present study).

Polysyncraton crassum Redikorzev, 1913

Fig. 4

Polysyncraton crassum Redikorzev, 1913: 209.

Material examined. – (A) South Kamchatka, near Lopatka Point, st.111, 50°46.9'N, 157°13.4'E, 103-104m, 22.7.1954, muddy sand, 1 colony. (B) The Sea of Okhotsk, Bolshou Shantar Island, st.20, 54°43.5'N, 137°22.8'E, 2.8.1986, 2 colonies. (D) Alaska Gulf, near Sanak Island, st.40, 54°15.6'N, 161°46.6'W, 75m, 17.8.1991, stones, 1 colony; Small Kurile Islands, st.91, 43°23.5'N, 146°25.4'E, 10.9.1991, muddy sand, 1 colony. (F) North Kurile Islands, Atlasov Island, 20m, 16.7.1989, rock (lava), 1 colony. Sea of Okhotsk, Feklistova Island, FV *Volcanolog*, 16m, mud, sand, 1 colony.

Description. – The specimen from Feklistova Island is a massive upright brownish colony, 5cm in largest diameter. Common cloacal apertures are few and placed on small elevations of the tunic. The surface is smooth and with thick superfi-

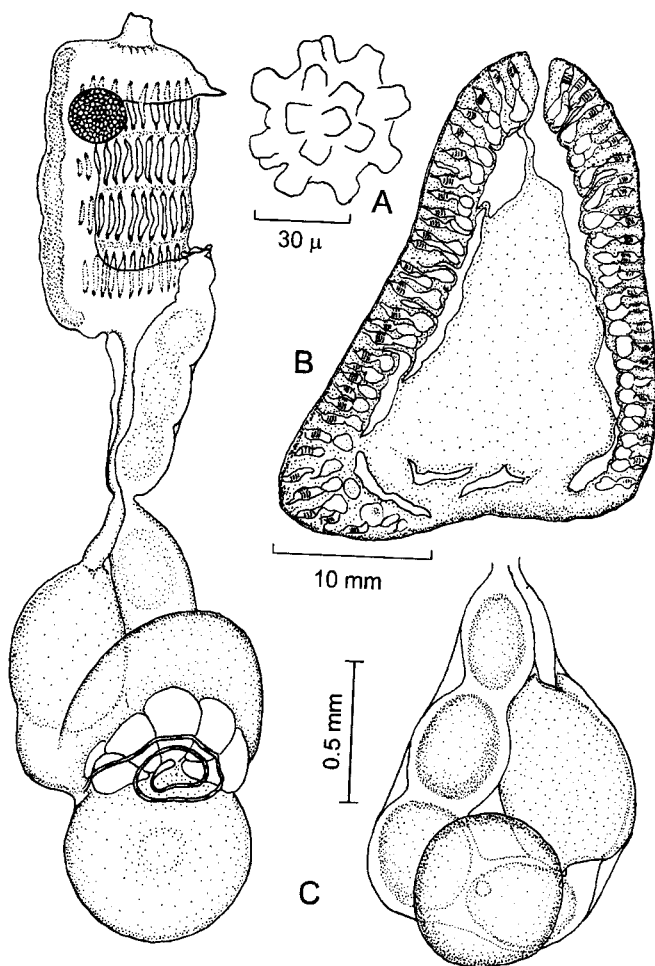


Fig. 4. *Polysyncraton crassum* (specimen from Lopatka Point) – A, spicula; B, cross section through colony; C, zooid.

cial spicule-free layer. Zooids, which are clearly seen through surface, form a solid and relatively thin peripheral layer, whereas the central part of the colony is filled with soft, gelatinous tunic. An extensive hypozooidal cloacal cavity surrounds the soft central test core and, here and there, extends up into narrow spaces between zooids. Spicules are crowded in a single layer at the level of the oral siphons and sparse internally. They are up to 65μ in diameter, with 6-8 short flat-ended rays on the equatorial plane. Zooids are up to 3mm, the abdomen longer than the thorax. Oral siphon is long with 6 small lobes around the rim of the apertures. The atrial aperture is narrow, with short atrial languet. The thoracic organ is up to 0.2mm in diameter, and is near the anterior end of

the atrial aperture. About 10 stigmata in each half of 4 rows. The gut loop is vertical. The testis divided into 5 or 6 follicles with the proximal end of vas deferens coiling 2-4 times around them. The specimen from Atlasov Island is similar, but zooids are immature, and a gonad with one vas deferens coil was seen in only one zooid.

The specimen from Lopatka Point (Fig. 4, A-C) is also similar to those described above, but differs in the absence of a superficial aspicular layer, all examined zooids have a wide atrial orifice, all the 4 stigmatal rows being exposed, the thoracic organ of about 0.25mm in diameter is situated in the antero-ventral corner of atrial orifice and spicules are up to 75 μ .

Specimens from Shantar, Small Kurile Islands and Sanak Island are roundish-oval colonies, similar to the others described above, but they are completely aspicular and have a more spacious cloacal cavity. Zooids are up to 2.4mm, the atrial orifice is narrow, with a short languet. The thoracic organ is narrow and elongate, up to 0.15mm long, without spicules, and in many zooids indiscernible. Very large ova, up to 1mm in diameter are in many zooids.

Remarks. – The original description of this species was based on four colonies from the northern part of the Sea of Okhotsk (59°17'N, 145°4'E), 95-110m (Redikorzev 1913). The cloacal cavity was not described. In all other features, viz. structure of zooid, distribution and size of the spicules and external appearance, the present specimens, especially the one from Feklistova Island, are in agreement with the original description. Presence of a large atrial orifice in zooids of the colony from Lopatka Point probably results from good narcotization of this material – thoraces of all zooids are well expanded.

The absence of spicules in these specimens, including the thoracic organs, appears to be an infraspecific variation, the differences seen in the size and shape of the thoracic organ possibly being associated with the aspicular condition.

Polysyncraton fadeevi Romanov, 1989, from Iturup Island (Kurile Islands) closely resembles and might be conspecific with *P. crassum*. Differences are in the size (20 μ m) and shape of spicules and the size of zooid (1.5mm).

Distribution. – Sea of Okhotsk (Redikorzev 1913; present study), Alaska Gulf, South Kamchatka, Kurile Islands (present study).

Didemnum gayanae n.sp.

Fig. 5

Material examined. – Holotype KIE 1/895- (D) Alaska gulf, near Sanak Island, st.39, 54°5.5'N, 162°10.0'W, 115m, 17.8.1991, 1 colony. Paratype KIE 2/896- (D) Alaska gulf, near Kodiak Island, st.13, 58°14.0'N, 149°32.9'W, 79m, 11.8.1991, 1 colony.

Description. – The holotype colony is oval, 27mm long, 18mm wide, 5mm thick

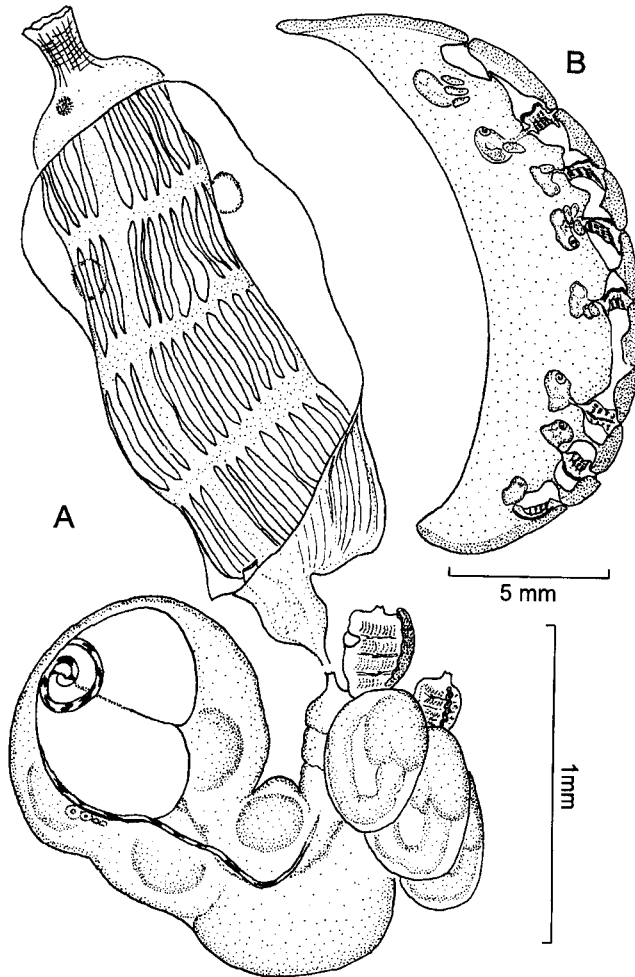


Fig. 5. *Didemnum gayanae* n.sp. – A, zooid; B, cross section through colony.

in the central part, attached to a small stone. The surface is smooth and glossy, the oral and common atrial apertures seen only after staining. The test is soft, translucent, colourless, composed of spongy aspicular tissue, the superficial layer is firmer and with more crowded bladder cells and differs in consistency from the remainder of the test. The hypoabdominal test is relatively thick, especially in the centre.

Zooids 2.5-3.2mm long, clearly seen from the surface, arranged in small (9-11 zooids) circular systems with central cloacal orifices which open into spacious thoracic cloacal cavity.

Thoraces usually fully expanded, 1.7-2.2mm long. Oral siphon long, plain-edged or with 5-8 indistinct pointed lobes. Atrial opening wide, exposing all 4 rows of stigmata. No atrial languet. Ten or eleven long, narrow stigmata in each half row. Tentacles are numerous. Lateral aspicular thoracic organs are spherical, 0.18-0.2mm in diameter, situated at level of second row of stigmata. Retractor muscle not detected.

Abdomina 1.2-1.5mm wide and 1.0-1.2mm long, usually smaller than thorax. Up to 3 thoracic and up to 4 abdominal buds are attached to the short oesophageal neck in two longitudinal rows (Fig. 5, A). Stomach occupies nearly one third of abdomen; axis of the primary gut loop at right angles to the oesophagus. The testis consists of two large follicles with the proximal end of vas deferens coiled 2-2.5 times around them. Several small ova sometimes present in the ovary. The glandular material in the abdomen was golden or bright greenish yellow when the specimen was first examined (after several months of storage in formalin), but after 5 years it had faded to a pastel colour.

The specimen from Kodiak Island (paratype) is similar to the holotype, but is smaller and contains only abdomina with numerous juvenile thoracic and abdominal buds. The glandular material in the abdomen is of the same greenish yellow colour as in the holotype.

Larvae were not found in any colony.

Remarks. – The present species is distinguished from other aspicular *Didemnum* species by its small number of vas deferens coils and divided testis. *Didemnum pacificum* Tokioka, 1953, once recorded from the Pacific coast of Japan (Tokioka 1953) is aspicular with a spongy test (see Tokioka 1953, pl. 13, fig. 3), large thoraces and a wide atrial opening but it has (probably) an undivided testis, more coils of the vas deferens and spacious hypoabdominal lacunae. Further, the Japanese species is from much warmer water. *Didemnum (Didemnum) sp. cf. okudai*: Nishikawa, 1990 lacks spicules, but has undivided testis, 8-9 coils of vas deferens and only 6 stigmata per half row. *Didemnum okudai* Tokioka, 1951, was originally recorded from the Pacific coast of Hokkaido, but the testis and vas deferens were not described, and the type material has been lost (Nishikawa 1990).

Presence of biserially placed buds in the present species (one row containing abdominal and the other thoracic buds) is an unusual but not a unique feature for the genus. It was reported for *D. gemmiparum* by Romanov (1989).

Didemnum papillatum Romanov, 1974

Didemnum papillatum Romanov, 1974: 237; 1989: 174.

Didemnum beringense Romanov, 1977: 53; 1989: 150.

Didemnum gemmiparum Romanov, 1977: 54; 1989: 166.

Didemnum transparentum Romanov, 1977: 56; 1989: 162.

Material examined. – (F) More than 60 lots with about 200 colonies and fragments from Bering and Medny Islands, 0-20m.

Description. – Colony encrusting, up to 20cm in extent and 1.5-5mm thick. Surface usually yellow, sometimes light orange or rarely red, often covered by papillae. Distribution of the papillae varies even within the same specimen. They may arise only near branchial orifices or be crowded over whole colony surface and many specimens bear papillae only on a few limited parts of the colony. Cloacal cavity extensive, thoracic. Superficial aspicular layer absent or thin. Spicules almost spherical, up to 35 μ in diameter, crowded, but sometimes sparse above zooids. Rays short and rounded, 8-12 on the equatorial plane.

Zooids 1.5-2.9mm long. Atrial languet present. Size of thoracic organs vary from 0.1 to 0.4mm (usually 0.2-0.35mm). No retractor muscle detected. The testis consists of two large follicles with the proximal end of vas deferens coiled 5-7 times around them.

Remarks. – Romanov (1989) distinguished between *D. papillatum* (colony 2-7mm thick, zooids 3-5mm long, thoracic organ about 0.1mm in diameter), *D. beringense* (colony 1.5-2mm thick, zooids 1.5mm or less, thoracic organ 0.1mm), *D. transparentum* (colony 2-8mm, zooids 2.3-2.5mm, thoracic organ 0.1mm) and *D. gemmiparum* (colony 2-3mm, zooids 2-3mm, thoracic organ 0.3-0.4mm) mainly by sizes of zooids and thoracic organs. Colony of *D. papillatum* is reported being wholly covered by crowded papillae, in *D. gemmiparum* papillae are present only near branchial orifices of zooids whereas the two other species lack papillae.

Further, Romanov (1989, p.140), in his “key to species”, placed *D. gemmiparum* in the group of species with a retractor muscle, a character that distinguished it from *D. beringense*, *D. transparentum* and *D. papillatum*. However, his description of the species refers to the lack of a retractor muscle. In all other features, including size and shape of spicules, subdivided testis and the number of vas deferens coils these species are similar, and all were recorded from the Commander Islands.

Didemnidae from the Commander Islands are represented in the KIE collections by many specimens and I had the chance to examine most of them alive. It appears that the features used by Romanov to separate these species are more variable than he believed. For example, some colonies with crowded papillae (characteristic of *D. papillatum*) have thoracic organ ranging from 0.2-0.35 or 0.3-0.4mm as reported for *D. gemmiparum* and (or) have small zooids as in *D. beringense*. Thus, these four species are treated here as conspecific.

Distribution. – Commander and North Kurile Islands, Anadir Bay, West Sakhalin (Romanov 1989).

Didemnum pseudobiglans Romanov, 1989

Didemnum pseudobiglans Romanov, 1989: 154.

Material examined. – (F) Thirty six lots with more than 80 colonies and fragments from Bering and Medny Islands, 0-20m.

Description. – Colony encrusting, up to about 20cm in extent and 1.5-4mm thick. Surface smooth, devoid of papillae, dark-orange or even brownish. The superficial aspicular layer of the test is thick. Spicules up to 40 μ in diameter. Rays short and rounded, 6-8 in the equatorial plane.

Zooids 1.75-2.5mm long, arranged in double rows along the narrow branching cloacal canals and forming more or less distinct, long or short, or even oval, systems. Atrial languet present. Thoracic organs 0.2-0.4mm in diameter. The testis consists of two follicles with the proximal end of vas deferens coiled 4-5 times around them. No retractor muscle detected.

Remarks. – Common in the Commander Islands. This species was often found growing side by side with *D. papillatum*, from which it can easily be separated by the thick aspicular surface layer of test, darker colour and zooids arranged in double rows, while in *D. papillatum* they are evenly distributed.

I was unable to find a retractor muscle in this species, although in the original description Romanov (1989) stated, that a short transparent one was present in rare cases.

Distribution. – From the Commander Islands to South Sakhalin (Romanov 1989).

Didemnum risirense Nishikawa, 1990

Fig. 6, D-E

Didemnum (Didemnum) risirense Nishikawa, 1990: 109.

Material examined. – (E) The Sea of Japan, Peter the Great Bay, Butakova Point, 2-5m, 20.8.1988, 2 colonies; Furugelm Island, 0-2m, 23.8.1988, 2 colonies.

Description. – The largest colony is 10x10mm and 2mm thick. The superficial aspicular layer is thick. Spicules are sparse, up to 35 μ in diameter, and of diverse shapes, some having conical rays and others with hemispherical or short needle-like rays. Only few zooids were found in one colony, the other colonies being without zooids. The zooids are strongly contracted and possibly degenerated. The thorax is 0.25mm long, a retractor muscle is present, the abdomen is 0.4mm long, the testis is undivided (?), and the vas deferens coils 8 times. Numerous larvae were found in the test of all colonies. The trunk is 0.5mm long and only two adhesive organs and three pairs of large lateral ampullae are present.

Remarks. – The species was originally described from Rishiri Island, Hokkaido. All the present specimens were found among colonies of *D. vermiforme* and superficially resemble them, although test surface is smooth, without elevations above zooids, which are characteristic for *D. vermiforme*. The colonies are larger than the type material in which the largest of 120 colonies was only 11x3mm (Nishikawa 1990). Nishikawa's colonies have thin spicule-free layer. I was un-

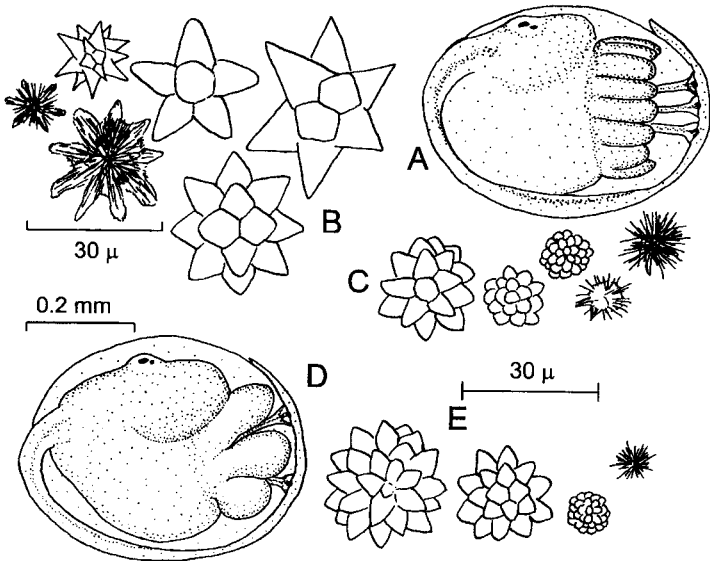


Fig. 6. A-C, *Didemnum vermiforme* – A, larva; B-C, spicules from two colonies. D & E, *Didemnum rishirense* – D, larva; E, spicules.

able to exactly determine the number of testicular follicles, but the newly recorded specimens resemble the type in the size and shape of the spicules, number of the vas deferens coils, the presence of retractor muscle and in the size and structure of larva. Several other *Didemnum* species have larvae with 2 adhesive organs, but all of them have more than 3 pairs of lateral ampullae.

Distribution. – Rishiri Island, Hokkaido (Nishikawa 1990), Peter the Great Bay (present study).

Didemnum vermiforme Romanov, 1989

Fig. 6, A-C

Didemnum vermiforme Romanov, 1989: 180.

Material examined. – (E) The Sea of Japan, 15 lots with about 25 colonies and numerous fragments from Peter the Great Bay, Bolshou Pelis Island, Furugelm Island, Pempzovaya Bay and Possjet Bay, 0-32m, July-August, 1986-1991.

Description. – Colonies are white and encrusting, 2-5mm thick, with distinct hemispherical or conical elevations above zooids. The superficial aspicular layer is thick. A spacious thoracic common cloacal cavity extends into more restricted abdominal spaces. The hypozooidal test varies in thickness, generally being thin, but sometimes becoming thicker in some parts of the colony. Spic-

ules are very crowded in most colonies, but sometimes sparse to very sparse in part of or whole colony and zooids and white thoracic organs are distinctly seen through surface; spicules always much more abundant in surface layer than in rest of the test. They are variable in shape, up to 50 μ in diameter, some with 5-12 conical rays with pointed tips in the equatorial plane and others with either numerous short round-tipped or needle-like rays; intermediate forms also present (Fig.6, B,C). Usually all types of spicules are abundant. Contracted thorax is 0.5mm long. In some colonies lateral organs attain only 0.1-0.2mm, in others 0.2-0.4mm, or even 0.15-0.7mm long and 0.1-0.15mm wide. A long retractor muscle originates from posterior portion of oesophageal neck. The abdomen is 0.5-0.6mm long. The testis is divided into two follicles. The proximal end of vas deferens coils 5-8 times.

Several larvae are found in colonies from Peter the Great Bay. The trunk is 0.55-0.7mm long, with 3 adhesive organs on short stalks and 5-7 lateral ampullae on each side. An otolith and ocellus present.

Remarks. – Size and shape of thoracic organ and density of spicules in upper layer of the colony vary considerably in this species, but because these variations often occur within the same colony I have no doubt that all the specimens belong to one species. Zooids in Romanov's colonies are somewhat larger than in the present ones (1.1-1.2mm long when contracted) and have slightly more coils of vas deferens (8-10). In all other features, including external appearance, thick aspicular layer, large thoracic organs, long retractor muscle, subdivided testis, variability in the shape of the spicules, the present material is in agreement with the original description. Romanov (1989) distinguished his species from all other *Didemnum* species by its large thoracic organ and unusual variability in the shape of the spicules within the same colony.

This species made up to 70% of all didemnids from Peter the Great Bay and Possjet Bay of the Sea of Japan loaned me by Dr. Osolinsh. Romanov (1989) does not report it from these locations, but he did report *D. translucidum* Tokioka, 1953, from the Peter the Great Bay. The latter species resembles the present one, especially in the sparse distribution of spicules in some specimens, their size and shape, large thoracic organs (up to 0.3-0.4mm) and the absence of an atrial languet. However, in *D. translucidum* the testis is undivided and the retractor muscle usually is absent, although Tokioka (1962) described several colonies with retractor muscles. Identity of Romanov's specimens with *D. translucidum* was questioned by Nishikawa (1990), as well as by Romanov himself.

Didemnum caudiculatum Romanov, 1989 is another related species, although the thoracic organ is always 0.1mm long and does not vary in size as it does in the present species.

Distribution. – Kunashir Island (South Kurile Islands) (Romanov 1989), Peter the Great Bay and Possjet Bay (Sea of Japan) (present study).

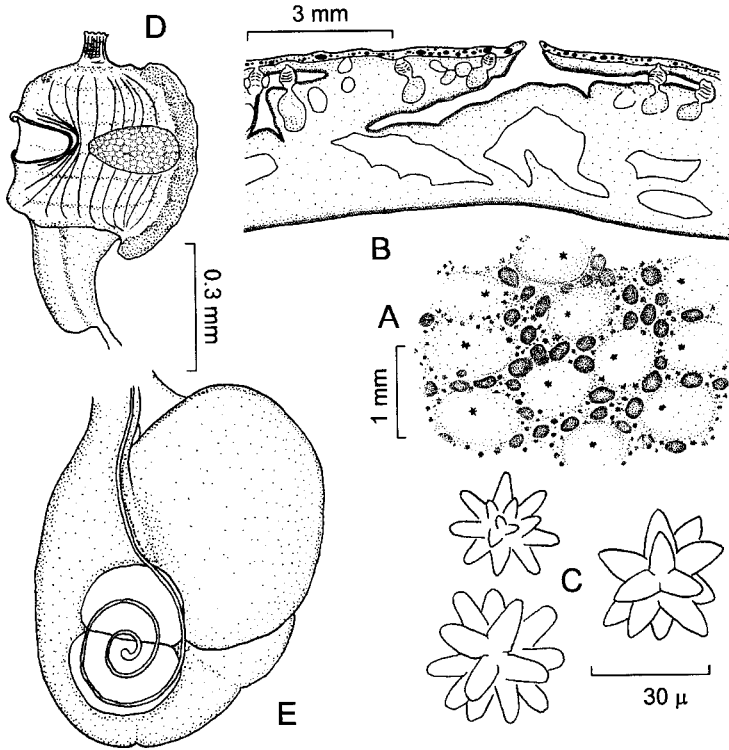


Fig. 7. *Didemnum sanakiense* n.sp. – A, upper surface of the colony to show pigment bodies around zooids; B, cross section through colony; C, spicules; D, thorax; E, abdomen.

Didemnum sanakiense n.sp.

Fig. 7

Material examined. – Holotype KIE 1/769- (D) Alaska Gulf, near Sanak Island, st.39, 54°5.5'N, 162°10.0'W, 115m, 17.8.1991, 1 colony. Doubtful specimens: (A) 4-th Kurile Strait, st.164, 49°51'N, 155°14'E, 190-195m, 8.7.1954, 2 colonies.

Description. The holotype colony, encrusting a thick cylindrical branch of a sponge, is about 55mm long, 18mm in greatest diameter and 2-4mm thick. The surface is smooth, dark brown (in formalin), with white spots over each zooid. Superficial aspicular layer thick, containing large, ovoid, dark brown crowded pigment bodies, up to 0.2mm in diameter, between the zooids (Fig.7, A, B). These are absent from the rest of the tunic, although minute pigment granules distributed sparsely throughout are of the same colour. These pigment granules stain intensely in methylene blue. Apart from pigment granules, the tunic is translucent to transparent.

Common cloacal openings are few. They are on low elevations of the tunic. The cloacal cavity is represented by well branched, relatively narrow thoracic and more extensive hypoabdominal spaces.

Spicules up to 40 μ in diameter, are sparse throughout most of the colony, and crowded in the surface layer of test and around common cloacal canals. Spicule rays long, with conical more or less pointed tips or almost cylindrical with rounded tips. About 8 spicule rays in the equatorial plane.

The contracted thorax is about 0.5-0.8mm long. The atrial opening is narrow with or without a low, wide atrial languet. The lateral organ is roundish oval or triangular, 0.2-0.25mm in greatest extent, at the centre of thorax closer to ventral side. Eight to 10 stigmata are in each half of 4 rows. A retractor muscle was not observed. The abdomen is up to 1mm. The gut loop usually is vertical and the stomach is large. Testis occasionally present, composed of 2 follicles, with the proximal end of vas deferens coiled 2.5 times.

Numerous spherical bodies, probably sporozoic parasites, are present in the thoraces of some zooids and occasionally are embedded in the tunic.

No larvae were observed.

Remarks. – Among North Pacific *Didemnum* species, *D. immundum* Romanov, 1974 from the Kurile Islands resembles this new species in the presence of red spherical bodies (Romanov 1989) in the superficial aspicular layer of the test. They possibly are the same as the ovoid pigment bodies in *D. sanakiense*. Both species have similar vertical gut loop, two testicular follicles and a small number of vas deferens coils. The cloacal system was not detected in *D. immundum* which also appears to lack thoracic organ and which has different spicules.

The pigment bodies in the superficial layer of test do not appear to be fecal pellets, but may be algal symbionts.

Two small colonies from 4-th Kurile Strait are identified with some doubt with the present species. They closely resemble *D. sanakiense* in the distribution pattern of the pigment bodies over colony surface, the structure of cloacal cavity and the size of thoracic organs (up to 0.3mm), but zooids are poorly preserved and lack gonads. They are not designated as paratypes.

Didemnum sp. 1.

Material examined. – (F) Bering Sea, Litke Strait (North Kamchatka), 59°05.5'N, 163°41' E, 23.9.1988, 49m, 1 colony on *Chebyosoma orientale*.

Description. – White encrusting colony, 2.5mm in thickness. The superficial aspicular layer of test is thick and transparent. Spicules are up to 100 μ in diameter, with 6-8 low hemispherical rays in the equatorial plane. They are sparse throughout most part of colony, but crowded in surface layer.

The thorax is strongly contracted, 0.4-0.5mm long, abdomen 0.8mm. Seven or eight stigmata are in each half row. The small atrial opening has an atrial lan-

guet. A retractor muscle was not observed. Two large testis follicles. Vas deferens coils 3-3.5 times.

Remarks. – It is difficult to identify this single poorly preserved colony with confidence. It may be related to *D. albidum*, although most colonies of this species from northern seas have crowded spicules and 4-8 vas deferens coils. Spicules from the present colony are similar to those figured by Van Name (1945, fig.33).

Nishikawa (1990) referred *D. candidum* Romanov, 1974, *D. grande* Romanov, 1974, and *D. studeri* Romanov, 1976 to *D. albidum* (the two latter as “doubtful synonyms”). In these species all specimens lack atrial languets and have much smaller spicules than in the present specimen and in specimens from northern seas. Nishikawa stated that apparently they represent local forms of *D. albidum*. In my opinion several species are represented.

My record (Sanamyan 1992) of *D. albidum* from the Sea of Okhotsk is erroneous. Reexamination of this material showed that at least some zooids have more than two testis follicles and probably it is a *Polysyncraton* rather than a *Didemnum*.

Didemnum sp. 2.

Fig. 8

Material examined. – (F) North Kurile Islands, Atlasov Island, 6 lots with several colonies and fragments from 17-20m, collected during July-August 1989.

Remarks. – The specimens strongly resemble *D. vermiforme* in most features, but the spicules are evenly crowded and the colony surface may be elevated above the zooids. The lateral thoracic organs are 0.25-1.5mm long and 0.1-0.3mm wide. A single larva was found, the trunk 1.1mm long with 3 adhesive organs on long stalks and 16 (8 pairs) long lateral ampullae with rounded tips. The larva is larger than in *D. vermiforme* and therefore the present specimens probably belong to a different species.

Diplosoma listerianum (Milne Edwards, 1841)

Diplosoma listerianum: Romanov, 1989: 115 (and synonymy).

Material examined. – (E) The Sea of Japan, Peter the Great Bay, 2-5m, 20.8.1988, 2 colonies; Bolshou Pelis Island, 1-3m, 27.7.1986, 1 colony. Possjet Bay, 5-7m, 13.7.1988, 1 colony.

Description. – Test glassy transparent and colourless. Zooids 0.8-1.2mm long, whitish or sometimes sprinkled with brownish pigment. Two testis follicles. Several larvae in the colony from Possjet Bay, the trunk 0.8mm long, 3 adhesive organs and 4 lateral ampullae.

Distribution. – One of the most widely distributed species of ascidians. On the

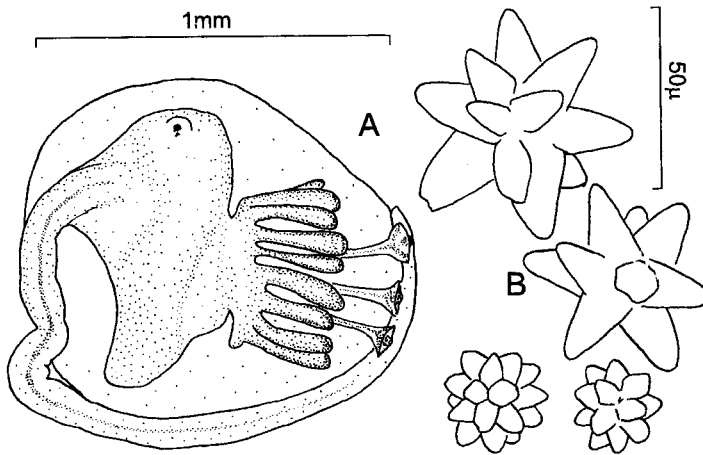


Fig. 8. *Didemnum* sp.2 – A, larva; b, spicules.

Russian Pacific coast it is common in shallow waters (0-5m) in the Peter the Great Bay and Vostok Bay (Romanov 1989).

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