



## Deep-water Ascidiacea from the Sea of Japan

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### Abstract

Four solitary ascidians are recorded in the deep-water material from the Sea of Japan. Two species, *Agnezia orthenteron* and *Pelonaia bursaria* are recorded for the first time since original descriptions, a third species, *Styela squamosa*, is a widely distributed deep-water species not known previously from the Sea of Japan. A fourth species was identified only to a genus level.

**Key words:** Ascidiacea, Sea of Japan, SoJaBio

### Introduction

Deep-sea basin of the Sea of Japan is well isolated from adjacent deep-sea areas by rather shallow straits; its deep-water fauna is poorly studied but the species diversity is expected to be low (Zenkevich, 1963). Redikorzev (1941) described two ascidians from the depths greater than 1000m in the Sea of Japan: *Agnezia orthenteron* (Redikorzev, 1941) and *Pelonaia corrugata bursaria* Redikorzev, 1941 (the latter taxon is raised to a species level in the present work and redescribed as *Pelonaia bursaria*). Nishikawa (1990) added a third species, *Aplidium rhabdocormi* Nishikawa 1990 to a list of deep-water species of the Sea of Japan. There is also a record of Zenkevich (1963), who mentioned *Goniocarpa rustica* (= *Styela rustica* (Linnaeus, 1767)) at the depths greater than 2000m in this sea, although the source of this record it is not known and the identification probably not correct (it could be misidentified *Styela squamosa* for instance, a species recorded in the present study).

The present study is based on the material collected by joint Russian-German expedition *SoJaBio* (Sea of Japan Biodiversity Studies) on the board of RV Akademik Lavrentjev in 2010. The material contains only four solitary species of Ascidiacea but gives an opportunity to redescribe poorly known species. Expected low species diversity is confirmed. It is interesting to note total absence of minute styelids which are diverse and numerous in other deep-water basins (especially in Atlantic). Their absence appear to be real rather than a result of inadequate sampling – the material collected by the expedition contains numerous small species of other taxons (e.g. edwardsiid anemones, minute holothurians) so it is hardly possible that small ascidians were overlooked by collectors.

### List of stations

**St. A6-7**, Gear: EBS- S, 16.08.2010, 2511–2534m, 44°00.2607N, 137°31.1584E - 44°19.2650N, 137°24.1206E.

**St. A6-8(1)**, Gear: EBS-Epi, 16.08.2010, 2545–2555m, 44°18.6270N, 137°24.4079E–44°18.4712N, 137°24.3985E.

**St. A6-8(2)**, Gear: EBS-Supra, 16.08.2010, 2545–2555m, 44°18.6270N, 137°24.4079E–44°18.4712N, 137°24.3985E.

**B2-6**, Gear: small bottom trawl, 20.08.2010, 1705m, 42°33.9916N, 136°16.1348E–42°33.8376N, 136°16.6237E.

**St. B5-8**, Gear: EBS- Supra, 23.8.2010, 2609–2655m, 43°01.3064N, 135°05.9562E–43°00.9363N, 135°06.5366E.

**St. B5-10**, Gear: AGT, 24.08.2010, 2676m, 43°01.7149N 135°04.5451E–43°01.5378N 135°04.3950E.

**St. B5-11**, Gear: AGT, 24.08.2010, 2651m, 43°01.7306N, 135°05.0794E–43°01.6169N, 135°04.9673E.

**St. B7-8**, Gear: AGT, 25.08.2010, 532m, 43°13.5215N 135°04.3071E–43°13.6778N 135°04.4447E.

**St. D2-8**, Gear: EBS-Epi, 01.09.2010, 2653-2683m, 42°06.6051N, 131°21.0149E–42°06.4555N, 131°20.9308E.

## Descriptions

### *Agnesia orthenteron* (Redikorzev, 1941)

(Figure 1)

*Agnesia orthenteron* Redikorzev, 1941: 199. Nishikawa, 1991: 60.

**Material examined.** **St. A6-8(1)**, 2545–2555m, 1 specimen; **St. A6-8(2)**, 2545–2555m, 2 specimens; **St. A6-7**, 2511–2534m, 2 specimens; **St. B5-8**, 2609–2655m, 1 specimen.

**Description.** The specimens are oval in outline and laterally flattened. The largest is about 15mm diameter. The test is colourless, clear and transparent. Few fine test processes may present on the posterior end of the body along with sparse spicules of sponges attached to them, otherwise the surface of the test is smooth. Most specimens have epibionts (probably bryozoans) on the test around siphons.

Siphons short, the branchial is terminal and the atrial one third down along mid dorsal line of the body. Body wall, as in most species of the genus, is very thin and transparent (Fig. 1A). Muscles almost equally developed on both sides of the body. Thick circular muscle fibers are on the body wall around the atrial siphon, and circular muscles on the branchial siphon are limited to the wall of the siphon and do not extend beyond the branchial velum. Eight to ten thin short radial muscles radiating from the branchial siphon, the same number of longer and thicker muscles radiate from the atrial siphon. No muscles crossing intersiphonal area. Rather long parallel transverse muscles form a band on each side of the endostyle and cross the dorsal surface posterior to the atrial siphon.

Numerous branchial tentacles of different lengths are arranged in several cycles and situated halfway between the branchial aperture and strong muscular branchial velum. Prepharyngeal band runs close to the velum without any noticeable undulations and makes a prominent dorsal V around the long ganglion. The dorsal tubercle was not detected.

Each side of the branchial sac has six double rows of ten or eleven spiral stigmata (Fig. 1B). The stigmata are not interrupted, mostly with four coils, and form perfectly rectangular meshes, although several polygonal figures are also present. Typically four, occasionally more radial parastigmatic vessels present on each mesh. Double rows of stigmata are separated by five transverse vessels. Each vessel has 10 or 11 simple papillae on the right side of the body and 9 or 10 on the left, and a dorsal languet displaced slightly to the left from mid-dorsal line.

The gut forms slightly curved loop at posterior part of the left side of the body. The gonads consisting of ramified testis and the ovary are in the gut loop and male and female ducts run along the rectum to open together near the anus.

**Remarks.** So far the species was known from only one specimen described from the Sea of Japan, 2090m. The present specimens come from similar depths and correspond well to the original description. According to Redikorzev (1941) the species has 5 transverse vessels and the space between transverse vessels and above the first and the last vessel is divided into six "fields" making seven "rows". This sentence is hard to understand, but the whole detailed description suggests that the branchial sac of Redikorzev's specimen had six double rows separated by five transverse vessels (see also Nishikawa, 1991), and thus the branchial sac has the same structure as in the present material. Redikorzev (1941) recorded nine papillae on each transverse vessel and the newly recorded specimens are larger and have nine to 11 papillae. Gut loop is not straight and J-shaped as figured by Redikorzev, but slightly curved along postero-dorsal corner of the body, but the difference is not enough to doubt conspecificity the present specimens with *A. orthenteron*.

The species is known only from the Sea of Japan, from 2090 to 2655m.

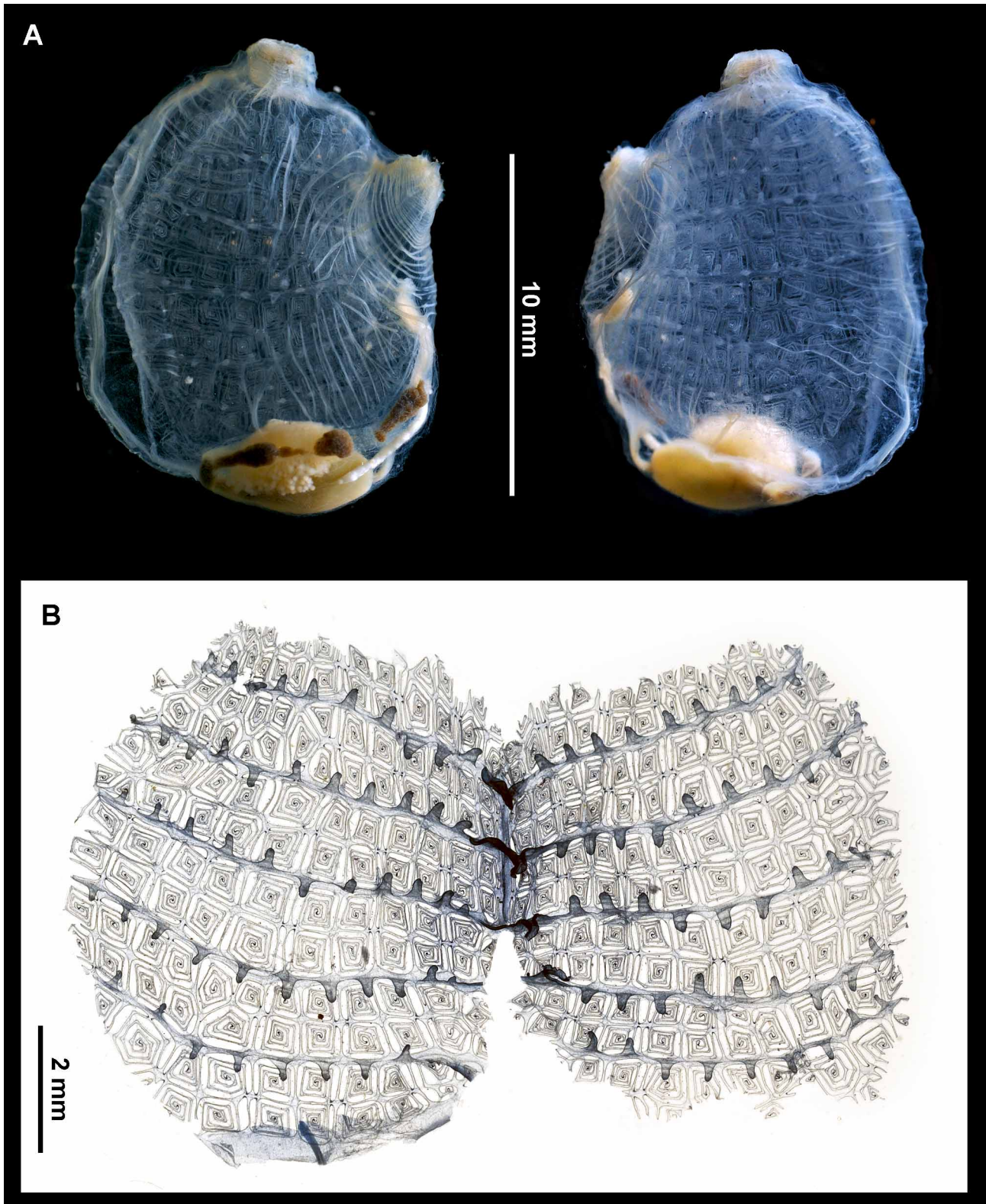
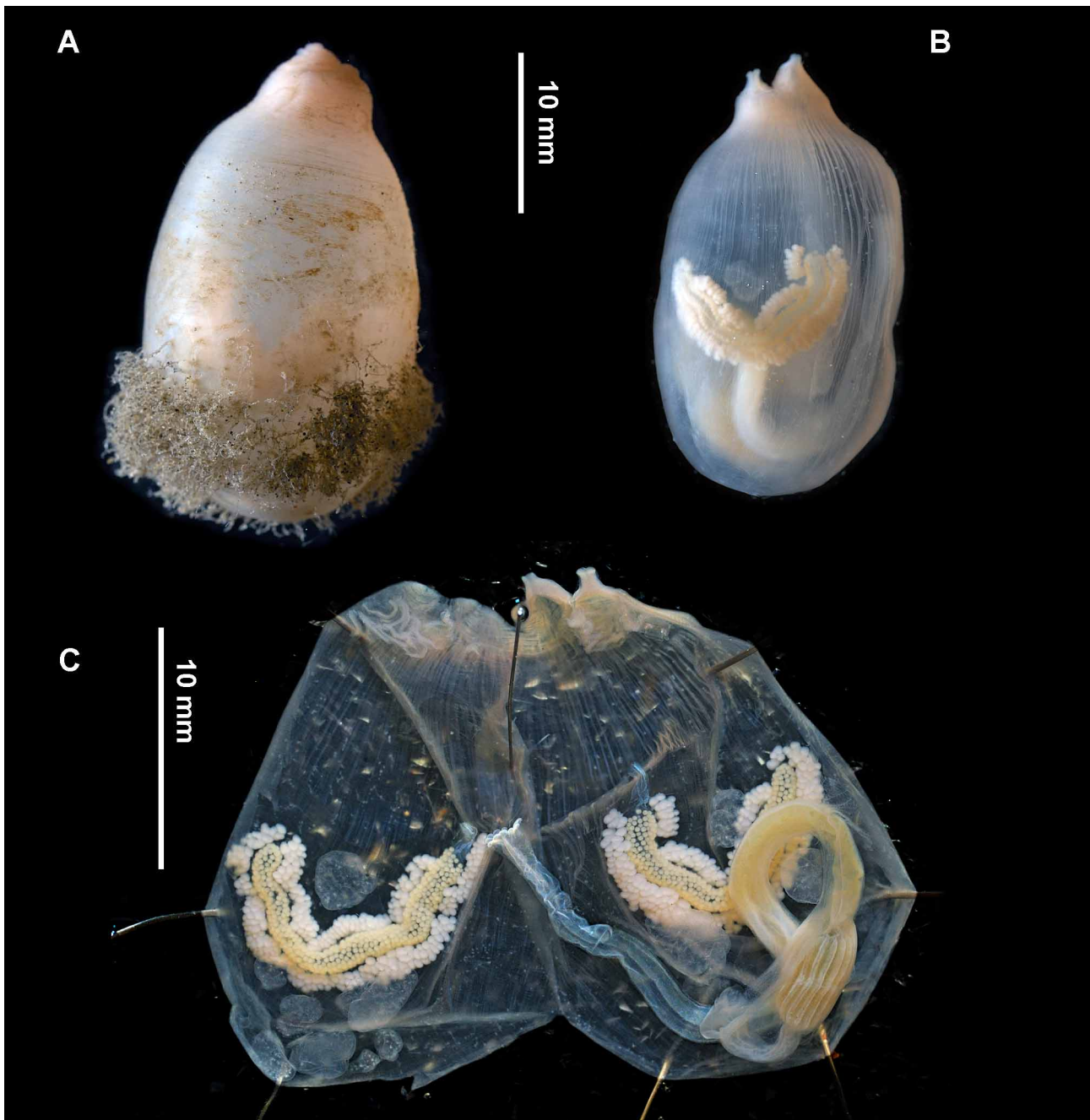


FIGURE 1. *Agnesia orthenteron*. A, body with tunic removed from left and right side; B branchial sac.



*Pelonaia bursaria* Redikorzev, 1941

(Figure 2)

*Pelonaia corrugata* forma *bursaria* Redikorzev, 1941: 188.*Pelonaia corrugata bursaria*: Nishikawa, 1991: 129.

**FIGURE 2.** *Pelonaia bursaria*. A, intact specimen; B, specimen with tunic removed, showing left gonad and gut loop; C, specimen opened ventrally.

**Material examined.** St. B7-8, 532m, 1 specimen.

**Description.** The single specimen is about 2.5 cm long and 1 cm diameter. The posterior end is rounded and an anterior extremity of the body has an abrupt narrowing where branchial and atrial orifices are set close together. The test is thin and firm. Hair-like processes with few attached sand grains are present only around the posterior end of the body and form a wide ring around it (Figure 2A). Otherwise the test is smooth and not wrinkled (as in typical *P. corrugata*) and almost free from foreign matter with only occasional minute grains of sediment attached. Thick crowded circular muscles are present only on siphons while on the whole rest part of the body wall only

occasional thin transverse muscle fibers can be detected after staining. In contrast the longitudinal muscles are well developed and continue to the end of the body, although muscle fibers are much thicker on its anterior half.

About 18–20 branchial tentacles arise from the branchial velum. Prepharyngeal band runs close to the velum and draws a circular line with shallow dorsal V around large oval dorsal tubercle which has C-shaped opening. Dorsal lamina is a high plain-edged membrane. The branchial sac has one shallow but distinct fold on each side running on some distance from the dorsal lamina, otherwise its wall is quite smooth. Internal longitudinal vessels are very numerous and closely set, with no more than one stigmata between two adjacent vessels.

The gut forms a deeply curved loop along postero-ventral end of the body, the secondary loop widely open and long rectum curves anteriorly at a right angle to the descending part of the loop. The stomach occupies about half of the length of the ascending limb of the gut loop, it has 22 prominent internal longitudinal folds and a small straight caecum on distal end.

One gonad is on each side of the posterior half of the body wall. Long tubular ovary makes a widely open arc so that in most its way it runs more or less transversely in relation to the body axis. The ovary is surrounded by numerous crowded small oval testis follicles.

The endocarps are rather large and present only on posterior half of the body: one endocarp is within the arc forming by each ovary, and several are on the body wall below (posterior) to gonads, including one endocarp in the gut loop.

**Remarks.** The taxon was originally established by Redikorzev (1941) as a forma *bursaria* of *Pelonaia corrugata* Goodsir et Forbes, 1841 and then raised to a subspecies status by Nishikawa (1991). Original description is based on several specimens from the Sea of Okhotsk and Sea of Japan and no other specimens referable to this taxon were recorded until now. Redikorzev (1941) distinguished his 'forma' by several features which he thought are connected with the less elongated body in comparison with the typical *P. corrugata*, e.g. position of the gut loop and L-shaped instead of U-shaped gonads. However, as it become clear after examining of newly collected specimen, the differences appear to be more pronounced and Redikorzev's taxon probably deserves a rank of a separate species. The differences in the general shape of gonads in *P. corrugata* and *P. bursaria* are too prominent to be explained by different proportions of the body wall, and gonads differ not only in the shape but also in the form of male follicles, these are small, rounded or oval in *P. bursaria* and long sausage-shaped, mostly parallel to each other in *P. corrugata*. The stomach of *P. bursaria* is much shorter than in *P. corrugata* where it occupies almost entire ascending limb of the gut loop (see, for example Monniot, 2011, Fig.6). *Pelonaia corrugata* has perfectly flat wall of the branchial sac, while *P. bursaria* has low but quite distinct branchial fold on each side. We reexamined several available small and large (2–8 cm) specimens of *P. corrugata* from the Sea of Japan and the mentioned features (flat branchial sac, very long stomach, the shape of gonads and endocarps) appear to be stable and not depending on the size of the specimens.

### *Styela squamosa* Herdman, 1881

(Figure 3)

*Styela squamosa* Herdman 1881, p 66. Sanamyan, Sanamyan, 2006: 321 (synonymy).

**Material examined.** St. B5-11, 2651m, 6 specimens; St. B5-10, 2676m, 1 specimen; St. D2-8, 2653–2683m, 1 specimen.

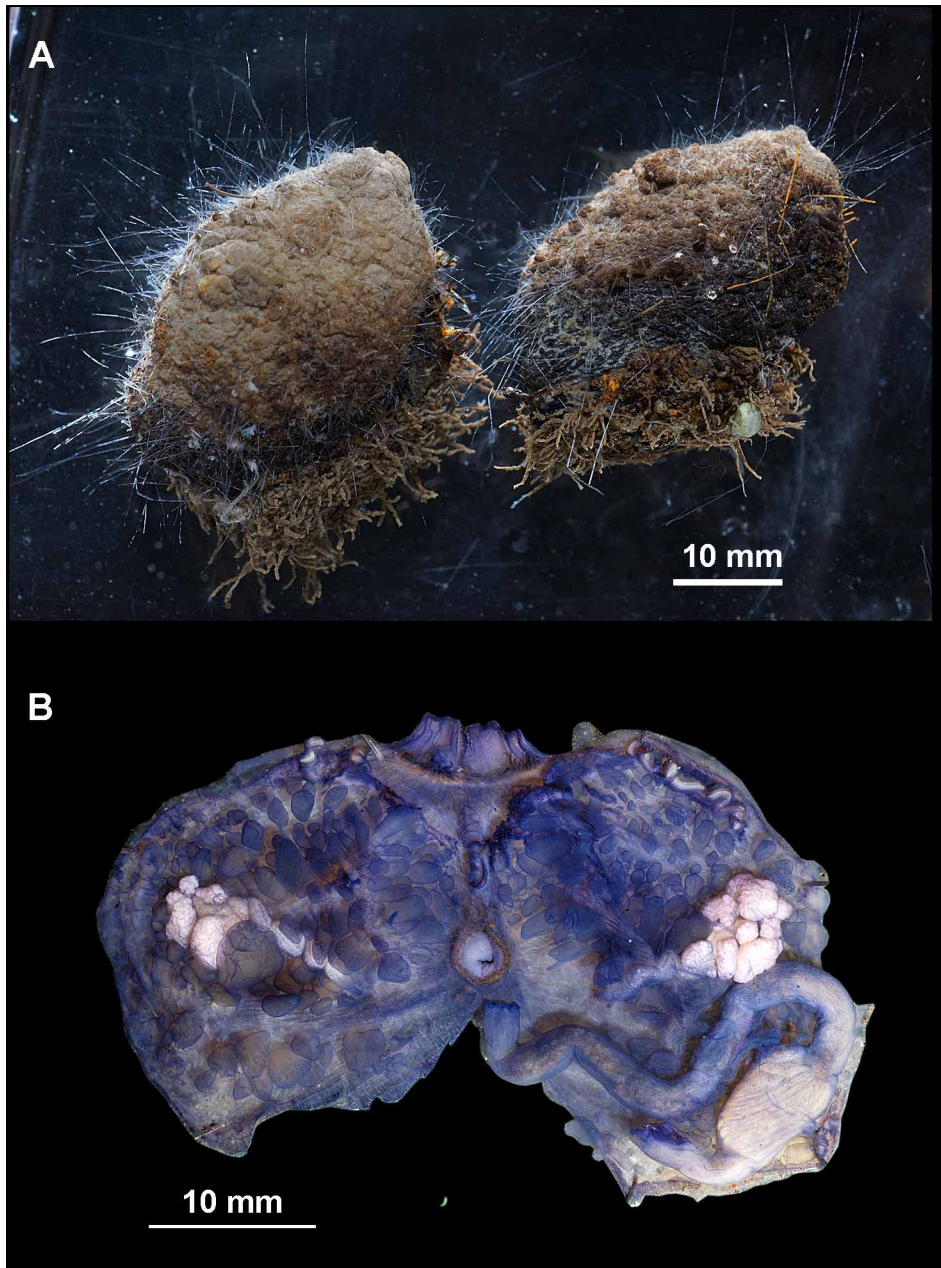
**Remarks.** Oval, dark brown or almost black specimens are up to 2cm in greatest diameter. Thick short rhizoids are on the proximal end. The tunic is firm, warty, often covered by bryozoans and hydroids. External appearance and internal features correspond well to previous descriptions. *Styela squamosa* has wide range of distribution and is known from many deep-water localities in Pacific and around Antarctic. There are several records of this species from North Pacific, although the species has not been known from the Sea of Japan until the present record.

### *Styela* sp.

**Material examined.** St. B2-6, 1705m, many specimens.

**Remarks.** Small, 3–6mm, flattened specimens which were probably attached by the wide area on the ventral

side to a solid object are now in a too poor condition with the internal organs torn away. They appear to have one gonad on each side. Several features resemble *S. coriacea* (Alder et Hancock, 1848), however the recorded depth is too large for this species and due to the condition of the material the species cannot be identified.



**FIGURE 3.** *Styela squamosa*. A, intact specimens; B, specimen opened ventrally.

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