

CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA

XVI. ON SOME ASCIDIANS FROM THE NORTHERN WATERS OF JAPAN AND THE NEIGHBOURING SUBARCTIC WATERS¹⁾

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With Plates XX-XXV

In this paper are treated three small collections of ascidians gathered respectively in the following areas:

1. St. Lawrence Island in the Bering Sea. Four forms are included in the collection. They were washed ashore during an unusually severe storm in October, 1958.
2. The king crab fishing ground off the western coast of Kamchatka Peninsula. Five forms were found in the samples collected with the gill net by the fifth Katura-maru in July-August, 1957.
3. Matusima Bay on the north-eastern coast of Japan. Seven species of ascidians were found in the benthonic samples collected in the years 1952-1957.

The first collection was made by Dr. Robert RAUSCH of the Arctic Health Research Center, Alaska and forwarded to me for identification, the second was submitted to my examination by courtesy of Dr. T. KINOSITA of the Hokkaidō Fisheries Experimental Station, and the third was offered me for examination by Prof. G. YAMAMOTO of the Yamagata University.

Before going further, I want to express my hearty thanks to these gentlemen for their kindness in giving me chances to study such precious specimens.

I. Collection from St. Lawrence Island.

The following four forms were identified.

1. ? Polycitoridae form A
2. *Synoicum turgens* PHIPPS
3. *Synoicum pulmonaria* (ELLIS & SOLANDER)
4. *Styela macreteron* RITTER

1) Contributions from the Seto Marine Biological Laboratory, No. 350.

1. ? Polycitoridae form A

(Pl. XXI, fig. 11)

A portion of a certain large colony, consisting of three groups of elongate and sausage-shaped cormidia. Cormidia are about 10 mm in diameter, up to 52 mm in length and obtusely pointed at the distal end. Three, seven or nine cormidia are gathered at the end of a common peduncle and further three tufts of cormidia, thus formed, unite into one stem which is 14 mm in diameter. The test is hard cartilaginous, translucent and milky white in colour. The surface is generally smooth, but some parts of the peduncle and stem are covered by hydrozoan or bryozoan colonies. Pale grayish brown spherical bodies, about 2 mm in diameter, are distributed densely in cormidia and sparsely in the distal half of the peduncle, but the stem is quite devoid of such bodies. In cormidia, these spherical bodies are packed so densely that they assume the polygonal outline. They are arranged in a single layer beneath the surface of the cormidium and peduncle, and about ten bodies are counted in a transverse section. As they are extremely fragile in consistency, it is quite impossible to examine the inner structure of these bodies.

It is very difficult to identify the present curious colony. However, this is probably a form belonging to the family Polycitoridae and in a resting stage, as some subarctic species of *Polycitor* or *Distaplia* resemble superficially the present specimen in the shape of the colony and also in the arrangement of zooids.

2. *Synoicum turgens* PHIPPS, 1774

(Pl. XX, figs. 1-4)

The colony is about 60 mm by 50 mm in extent and consists of 63 cormidia which are each roughly cylindrical in shape, up to 22-25 mm in length and 7 mm in diameter. Cormidia are obtuse at the distal end and two to four cormidia, most frequently two, are united at their somewhat narrowed basal ends in bundles. These bundles are then united one another to form a larger colony. The cormidium may be branched as shown in fig. 2. The test is hard leathery, grayish in colour and quite free from foreign matters excepting the basal portion of the colony, which is covered by sponges. The surface is smooth in most parts, but the distal end of each cormidium is folded irregularly. Although the actual arrangement of zooids or the apertures of respective zooids can not be observed on the distal surface, it is very probable that zooids are arranged there surrounding a central common cloacal aperture. Several sausage-shaped bodies are found in each cormidium. Evidently these are zooidal bodies in a resting stage. They are 3 to 8 mm in length and yellowish orange in colour. The rudimentary thorax is very small, only 300 μ in length, and attached to the anterior

end of the zooidal body. The present colony is identified as *S. turgens* because of the close resemblance in the appearance and the structure of colony.

3. *Synoicum pulmonaria* (ELLIS & SOLANDER), 1786

(Pl. XX, figs. 5-6)

A single nearly spherical massive colony, 32 mm × 40 mm in extent and 23 mm in height and attached to the substratum by a small central part of the underside of the colony, about 8 mm in diameter. It is grayish in colour and nearly smooth on the surface. The test is soft cartilaginous and translucent, but it is impregnated with fine sand grains. Thus, the system of the arrangement of zooids is indiscernible, although zooids can be seen faintly through the test.

Zooid: The abdomen is about half as long as the thorax and the postabdomen is one and a half to a few times as long as the thorax and abdomen measured together. Zooids are not in a good state of preservation, they are so fragile that only a slight touch might break them. About eighteen stigmatal rows are present. The surface of stomach is smooth. Ovary is situated just below the intestinal loop and contains up to a dozen ova. Incubatory chamber contains up to twenty eggs. The typical colonies of the present species are described to be divided into lobes. Thus, the appearance of the present colony differs slightly from that of the typical ones, although the structure of zooids of the present colony conforms well to that of the typical specimens.

4. *Styela macreteron* RITTER, 1913

(Pl. XXI, figs. 7-10)

A 65 mm long, 55 mm wide (dorso-ventral) and 40 mm thick (lateral) specimen. The body is roughly triangular in outline and attached to the substratum by the central portion of the basal end where the body shows the largest width. Both apertures open at the tip of low prominences situated side by side at the anterior end of the body. The test is thin and leathery, less than 1 mm in thickness, but very tough in consistency; it is dark purplish black in colour and finely wrinkled transversely on the surface, partly with irregularly formed elevations. Sponges and hydrozoan colonies cover the basal portion and some other parts of the specimen. The section and the inner surface of the test are grayish white. The mantle is thick and up to 4 mm in thickness at most parts, although it is extremely thin at the basal attachment place; generally it are coloured dark purplish brown. There are many small endocarps over the inner surface of the mantle. The area enclosed by the second intestinal loop on the left side and the postero-ventral portion on the right side are provided with only a few endocarps or quite devoid of them.

Branchial sac: Inner longitudinal vessels are arranged as follows:

Left D. 6 (40) 9 (32) 9 (38) 9 (20) ? V.
 Right D. 5 (39) 8 (32) 10 (38) 10 (19) 10 V.

Up to fifteen thinner transverse vessels between each pair of thicker ones, in some parts the following arrangement is observable—1 5 4 5 3 5 4 5 2 5 4 5 3 5 4 5 1—, parastigmatic vessels are absent. Meshes rather small, 6 to 8 stigmata in a mesh. The edge of dorsal lamina is quite plain. Tentacles about 25, including some smaller ones occurring at some parts of the tentacular ring. Dorsal tubercle is comparatively small, ciliated groove is U-shaped with both horns incurled.

Alimentary system: The gastric region is very long and voluminous, it seems to occupy the whole proximal branch of the first intestinal loop and passes to the intestine gradually diminishing the thickness; the rectum is very long, but rather thin. The second intestinal loop is very deep and its axis seems to pass through the middle of the gastric region. Anus is cut into 25 lobules. There is a remarkable U-shaped crook near the middle of the rectum, but it is uncertain whether this structure is natural one or it is formed by strong contraction of the animal.

Gonad: A single elongate undulating ovary on each side, fifteen testicular masses on the right and eleven ones on the left side. They are arranged surrounding the posterior half of the ovary and consist each of a few lobes.

Remarks: The colour of the test and the appearance of the voluminous alimentary canal of the present specimen conform exactly to those of *S. macrenteron* described by previous authors.

II. Collection from the king crab fishing ground off western Kamchatka.

The following five forms were identified:

5. *Aplidiopsis pannosum* (RITTER)
6. ? Polycitoridae form B
7. *Dendrodoa aggregata* (RATHKE)
8. *Dendrodoa pulchella* (VERRILL)
9. *Boltenia ovifera* (LINNAEUS)

5. *Aplidiopsis pannosum* (RITTER), 1899

(Pl. XXII, figs. 12-14)

A lying cylindrical colony, 100 mm in length and ca. 40 mm in diameter, attached to the substratum by the middle narrow part of the underside, about half as long as the colony. The test is very soft, translucent and grayish purple

in colour; the surface is nearly smooth, although it is grooved irregularly as shown in fig. 12, and quite free from foreign matters. Many roundish common cloacal apertures, about 0.5 mm in diameter, are found scattered over the surface, but the system seems not to be formed regularly.

Zoid: Thorax is about twice as long as abdomen and usually 5 mm in length, postabdomen attains the length of thorax and abdomen measured together. There is a slight constriction between the thorax and abdomen, the proximal portion of postabdomen is considerably narrowed and issued from the left posterior side of the intestinal loop.

Thorax: Branchial aperture 6-lobed, atrial languet is very distinct and simply pointed or bifid distally. There is a small prominence on the dorsomedian line just posterior to the atrial aperture. About nine very delicate longitudinal muscles on each side of the thorax. Seventeen to eighteen stigmatal rows and ca. 18 stigmata in each row, of which about three ventral ones diminish the size towards the endostyle. Dorsal languets are displaced from the dorso-median line to the left side for the distance of two to three stigmata. Tentacles about twenty, they are slender and differentiated into larger and smaller ones. Ciliated groove is a minute roundish opening. Anus is bilobed, eight stigmatal rows are found below the level of the attachment point of the anus. Nine to thirteen fertilized eggs were found in the incubatory chamber.

Abdomen: Stomach is situated approximately at the middle of the abdomen. It is oval in outline and smoothly surfaced, oesophagus enters it near its middle. Both hind-stomach and mid-intestine are defined distinctly. The proximal end of rectum is swollen, but no coeca are formed there.

Postabdomen: Ovary is found in the posterior half of the postabdomen and situated along the testis. Heart at the distal end of the postabdomen.

Remarks: The present specimen resembles closely both *A. pannosum* (RITTER) from the William Sound of the Pribilof Group and *A. helenae* REDIKORZEV 1927 from Tanjskaya Bay of the Sea of Okhotsk and Volok Bay, although it has a little more stigmatal rows than the previously described species. In RITTER's specimens there are 11-14 stigmatal rows, each comprising 18 stigmata, zooids are up to 5 mm excluding postabdomen which is 5-6 mm in length, and gonads are situated in the posterior part of the postabdomen. In zooids of *A. helenae*, thorax is 6 mm, abdomen 3 mm and postabdomen is 5.5 mm; there are 15 stigmatal rows, each comprising 16-18 stigmata; tentacles are 16 and differentiated into three sizes. Most probably these three forms belong to a single species and thus *A. helenae* may safely be treated as a synonym of *A. pannosum*.

Loc.: Off the western coast of Kamchatka at the latitude of 57°32' N, 66 m deep.

6. ? Polycitoridae form B

(Pl. XXV, fig. 34)

A colony complicatedly ramified as shown in fig. 34, it comprises about a dozen cormidia which occupy the distal part of respective branches, mostly finger-shaped and up to 40 mm in length and 12 mm in diameter. Many small spherical bodies, ca. 1.5 mm in diameter, fill the cormidia and are seen through the test as reddish brown bodies. Test is brownish, translucent, hard cartilaginous and nearly smooth over the surface, although somewhat wrinkled irregularly on other portions else than cormidia. Possibly this is a form belonging to the family Polycitoridae and in a resting stage. This colony differs from the form A from Alaska in the style of ramification, colouration and the size of spherical bodies, but it is very difficult, at present, to estimate the significance of such differences exactly.

Loc.: 55°02' N × 155°10' E.

7. *Dendrodoa aggregata* (RATHKE), 1806

(Pl. XXIII, fig. 24)

Two specimens, respectively 9 mm and 25 mm in length, were found attached to the surface of a specimen of *Boltenia ovifera*. The larger one is elongate antero-posteriorly, while the smaller one is dome-shaped. Test is less than 1 mm in thickness, leathery and grayish brown in colour; in the smaller individual it is paler and rather translucent. Mantle is considerably thick and purplish black in the larger specimen, but dark purplish brown in the smaller one. Tentacles 20-25. Inner longitudinal vessels are arranged in the smaller individual as follows:

Left D. 0 (8) 0 (2) 0 (5) 0 (2) 0 V.

Right D. 0 (9) 0 (3) 0 (5) 0 (4) 0 V

Anus is plainly margined. Gonad is constituted of five branches and immature in the smaller individual. In the larger one, however, it is fully mature and broken into several pieces as shown in the figure, this is probably due to the strong contraction of the body.

8. *Dendrodoa pulchella* (VERRILL), 1871

(Pl. XXII, figs. 15-16; Pl. XXIII, figs. 17-23)

About sixty small specimens attached to some specimens of *Boltenia ovifera*. They are roughly spherical in shape and mostly less than 4 mm in length, though a few of them attain 6.5-10 mm. The animal attaches to the substratum by the

left ventral side. Test is of a considerable thickness, reaching 800μ in the largest 10 mm long individual, but it is very thin on the attachment side. It is leathery and very tough, translucent and milky white in colour in smaller specimens, but yellowish brown in larger ones. Apertures are situated side by side on the dorsal side, quite sessile and furnished with several irregular lobes around them. The surface of the test is wrinkled or divided into a number of small areas by irregularly formed shallow grooves. Mantle is of a moderate thickness and reddish brown in larger specimens, but purplish brown in smaller ones. Endocarps are present on the inner surface of the mantle, though not abundant. Atrial tentacles distinct.

Branchial sac: Inner longitudinal vessels are arranged as follows:

Specimens less than 4 mm in length:

Left D. 0 (4) 0 (1) 0 (4) 0 (2) 0 V.

Right D. 0 (4-5) 0 (0-1) 0 (4) 0 (2) 0 V.

Left D. 0 (4) 0 (1) 0 (2) 0 (1) 0 V.

Right D. 0 (3) 0 (1) 0 (2) 0 V.

6.5 mm long individual;

Left D. 0 (7) 0 (2) 0 (5) 0 (3) 0 V.

Right D. 0 (8) 0 (4) 0 (7) 0 (3) 0 V.

10 mm long individual;

Left D. 0 (11) 0 (3) 0 (9) 0 (5) 0 V.

Right D. 0 (13) 0 (5) 0 (8) 1 (7) 0 V.

There are 6-13 stigmatal rows in smaller specimens less than 4 mm in length. Transverse vessels and parastigmatic vessels alternate regularly or partly the following arrangement—thick p thin p thick—can be seen, where p represents parastigmatic vessel. Four to ten stigmata in a mesh in smaller specimens, but up to 20 in meshes along the endostyle in larger ones. Edge of dorsal lamina plain. Tentacles 8-15 in examined small specimens, but they attain 23 in the 6.5 mm long individual and 32 in the 10 mm long specimen: larger and smaller ones are differentiated. Ciliated groove is a curved longitudinal slit.

Alimentary system: Stomach is marked with 18-20 very distinct longitudinal plications in smaller specimens, but with ca. 25, somewhat obscure ones in larger individuals. A prominent hook-shaped pyloric coecum is present, a vessel is issued from the base of the coecum towards the intestine (fig. 16). The second intestinal loop is very shallow. Anus is plainly margined.

Gonad: Always only three branches are defined. Gonad was not found in specimens smaller than 4 mm, excepting only a single one shown in fig. 18, it was fully matured in the 10 mm long specimen (fig. 22).

Remarks: In the present collection, *D. pulchella* and *D. aggregata* could be separated easily from each other by the colouration.

9. *Boltenia ovifera* (LINNAEUS), 1767

(Pl. XXIV, figs. 25-33)

Five specimens in the collection, they are 45-62 mm in length of the body proper and with the peduncle approximately twice as long as the body, actually 90-132 mm in a perfectly preserved state. The body is ovoid in shape and supported by the peduncle at the anterior end. Both apertures are subterminal, 4-lobed and sessile. The branchial aperture is situated near the antero-dorsal and the atrial near the postero-dorsal corner. Test is cartilaginous or leathery, up to 3 mm in thickness at thickened places, grayish brown in colour and somewhat translucent. The surface is roughly even, but marked with a few irregularly formed grooves. It is densely covered with minute spinules which seem to increase the size towards the dorsal and anterior side. Sponges and some ascidians such as *Dendrodoa pulchella*, *D. aggregata* and young specimens of own species are found attached to the surface in some specimens. Occasionally the postero-ventral part of the body may be provided with a few rooty protuberances. Probably the body was touching the substratum at this portion when the animal was alive. The peduncle is rather thin, dark brownish in colour and very hard. It is about 2.5 mm in diameter, its distal end continues to a thickened projection from the anterior end of the body, about 20 mm in length in a specimen with 60 mm long trunk. The surface of the peduncle is densely covered with spinules (fig. 26) which become larger near the body, attaining 0.5 mm in length. They are, however, generally small on the anterior projection of the body. The younger individual found attached to a 60 mm long (in body length) specimen is 8 mm in body length and with 7 mm long peduncle, the whole surface is covered with spines which are especially prominent at the posterior portion. Mantle is thin, the musculature is characterized by well developed transverse muscles, about thirty of them are arranged very neatly on the dorsal half and each branched into 3-5 thinner bands on the ventral half on each side. Longitudinal muscles are not developed so well as transverse ones, running beneath the latter and confined to the dorsal half of the body.

Branchial sac: Inner longitudinal vessels are arranged as follows:
60 mm long (in body length) individual;

Left	D.	2	(30)	3	(22)	3	(26)	4	(26)	4	(23)	4	(21)		
				4	(20)	3	(16)	3	(11)	3	(7)	1	(3)	0	V.

Eleven plications on both sides, the second fold is slightly smaller than others, IX-XIth folds on the left and X-XIth on the right side do not reach the posterior end of the branchial sac. The 15 mm long young individual has eight plications on each side at the anterior end of the branchial sac. Transverse vessels are arranged as thick thin medium thin thick..., 5-10 stigmata in each interval between transverse vessels. Tentacles 11 in a 60 mm long (in body length)

specimen, including large and medium sized ones, but excluding small ones intervening between them; they are arranged as...large small medium small large...; branches in five orders, those of the last order are finger-shaped, but others of higher orders are markedly flattened. Branches of 1-2nd orders are not abundant, but those of 3-5th orders are very numerous and resultantly larger tentacles assume an appearance like a cauliflower. Ciliated groove is C-shaped opened towards the left and both horns are incurled in larger specimens (figs. 29 and 32).

Alimentary system: Oesophagus is long, the gastric region is elongate and occupies nearly a half of the ventral branch of the first intestinal loop. Liver is divided into several lobes scattered in the proximal half of the gastric region, the largest one is found near the middle of the dorsal side of the region; lobes are coloured greenish brown. Anus is a crescent slit enclosing a semicircular swelling of the intestinal wall on the side of the attachment. The margin is cut into lobules, up to ca. 20 in number in larger specimens.

Gonad: Gonad is elongate, very voluminous and divided into a number of small lobes; ovary is pinkish and testicular follicles are grayish purple. The 15 mm long (body+peduncle) specimen has gonads already, though they are not yet matured.

Remarks: The existence of eleven branchial plications seems to be a new record for this species.

Loc.: 55°02' N×155°10' E.

III. Collection from Matusima Bay.

This includes the following seven species:

10. *Ciona intestinalis* (LINNAEUS)
11. *Ascidia sydneyensis samea* (OKA)
12. *Ascidia zara* OKA
13. *Ascidia gamma* TOKIOKA
14. *Corella japonica* var. *asamusi* OKA
15. *Cnemidocarpa fertilis* f. *minor* TOKIOKA
16. *Styela clava* HERDMAN

10. *Ciona intestinalis* (LINNAEUS), 1767

(Pl. XXV, fig. 35)

Two specimens from St. G, Bizyo-ura, on Sept. 13, 1952 and a single mantle specimen from St. 6 on May 27, 1954. The latter is 14.5 mm in length and the muscles are very finely stained black by the cork substance. There are six thick longitudinal muscles on each side, besides a very fine longitudinal one along each side of the endostyle. The dorsal-most muscle consists of 2-3 bands on the left,

while of 4 bands on the right side, other five muscles on each side are each constituted of three bands. The whole body is covered by the net work of fine transverse muscles.

11. *Ascidia sydneyensis samea* (OKA), 1935

(Pl. XXV, figs. 36-37)

Five, 14-55 mm long, specimens from St. G, Bizyo-ura, on Sept. 13, 1952 and two, respectively 34 and 45 mm long, specimens from Sts. 18 and 23. The test is rather thin and provided with many irregular protuberances on the surface. The anterior end of the intestinal loop does not reach beyond the anterior base of the atrial siphon in most specimens. Ciliated groove is cut into pieces arranged irregularly (fig. 36), except for the smallest 14 mm long specimen which has a simple U-shaped groove (fig. 37). The axis of the second intestinal loop passes through the pyloric end of the oval stomach or near it. About 35 inner longitudinal vessels on each side of the branchial sac of a 34 mm long specimen and 29 vessels in the 14 mm long individual.

12. *Ascidia zara* OKA, 1935

A 24 mm long specimen from St. 13 and a 35 mm long specimen from St. 28. The anterior end of the intestinal loop reaches far beyond the anterior base of the atrial siphon. The axis of the second intestinal loop passes through the middle or the pyloric end of the globular stomach.

13. *Ascidia gamma* TOKIOKA, 1954

(Pl. XXV, fig. 38)

A single 45 mm long specimen found in the samples collected from Sts. 18 and 23. The animal is attached to a 45 mm long specimen of *A. sydneyensis samea*. Test is considerably thick and the surface is quite smooth. Longitudinal muscles are prominent on the right side of the mantle. The atrial siphon is situated slightly anteriorly to the middle of the body. The anterior end of the intestinal loop reaches the middle of the range between the bases of both siphons. The axis of the second intestinal loop passes through the intestine just near the pyloric end of the stomach. Tentacles ca. 60, larger and smaller ones are differentiated. Twenty-eight longitudinal vessels on one side of the branchial sac. The vessels seem to be fairly fewer than in *A. ahodori* OKA of the same body length. Ciliated groove is S-shaped turned towards the right. Gonads fully matured. The intestinal loop is inclined conspicuously to the dorsal side from the sagittal axis of the body, though the inclination is not so prominent as in

the original specimen of the species. It is, however, questionable that this inclination is a natural feature. It is not impossible that this is only an unusual deformation.

14. *Corella japonica* var. *asamusi* OKA, 1927

Three specimens, 30–33 mm in length, collected from the station off Hutago in September 1957 and other three, 35–45 mm in length, from the station off Sige-ura on Aug. 16, 1957. They are all provided with many conspicuous rooty protuberances on the right side and with a well-developed musculature on the left side of the mantle.

15. *Cnemidocarpa fertilis* f. *minor* TOKIOKA, 1954

(Pl. XXV, figs. 39–41)

A 14 mm long specimen collected from St. 40 on Sept. 12, 1952 and also a 14 mm long individual collected in Bizyo-ura on Sept. 13, 1952. The animal is attached to the substratum by the right ventral side. Both apertures are nearly sessile and situated side by side near the anterior end of the body. Test itself is soft leathery, but tough in consistency. It is generally yellowish white and translucent, but coloured dark red in the anterior portion around the apertures. The surface is densely incrustated with fine sand grains and provided with a number of irregularly formed small prominences in the anterior portion and marked with a few irregular grooves in the posterior portion; such features are evidently due to the contraction of the body. Test is rather thick, but less than 1 mm in thickness. Mantle is thick in the anterior portion, but very delicate in the posterior half. Endocarps are not abundant. Atrial tentacles distinct. Inner longitudinal vessels of the branchial sac are arranged in a specimen as follows:

Left	D.	0	(9)	2	(7)	1	(9)	1	(6)	1	V.
Right	D.	1	(9)	1	(9)	1	(8)	1	(2)	1	V.

Transverse vessels are arranged as thick thin medium thin thick in the posterior part of the sac. Transverse vessels and parastigmatic vessels alternate regularly. Up to 8 stigmata in meshes along the endostyle. Tentacles 32 in an examined specimen, larger and smaller ones are differentiated. Ciliated groove is simple U-shaped. Stomach is shorter than a half of the ventral branch of the intestinal loop, the second loop is very deep and its axis passes through the middle of the ventral branch of the first loop. Anal margin is nearly plain, although faint lobation might be seen. Five to six gonads on the right and four gonads on the left side. Although the external appearance of the present specimens differs slightly from that of previously described three specimens of f.

minor and the former are slightly larger than the latter (up to 10 mm), the former are considered to be treated as f. *minor* rather than the typical form of *C. fertilis*.

16. *Styela clava* HERDMAN, 1881

A single 27 mm long specimen collected from the station off Sige-ura on Aug. 16, 1957. The basal portion of the animal is narrowed, but no peduncle is formed yet. Only a few follicular appendages are found on the rectum. Four gonads on the left and seven on the right side, one of them is forked distally into two branches.

EXPLANATION OF PLATES XX-XXV

PLATE XX

Figs. 1-4. *Synoicum turgens* PHIPPS.

- 1...Three cormidia, enlarged.
- 2...A branched cormidium, enlarged.
- 3...Zooidal body in a resting stage, enlarged. th...rudimentary thorax.
- 4...Right side (?) of the rudimentary thorax, magnified.

Figs. 5-6. *Synoicum pulmonaria* (ELLIS & SOLANDER).

- 5...Upper side of the colony, slightly enlarged.
- 6...Right side of a zooid, enlarged.

PLATE XXI

Figs. 7-10. *Styela macreteron* RITTER.

- 7...65 mm long specimen.
- 8...Right half of the mantle body, inner side.
- 9...Left half of the mantle body, inner side.
- 10...Ciliated groove, magnified.

Fig. 11. Polycitoridae (?) form A, a part of the colony, slightly enlarged.

PLATE XXII

Figs. 12-14. *Aplidiopsis pannosum* (RITTER).

- 12...100 mm long colony.
- 13...Right side of the thorax and abdomen, enlarged.
- 14...Right side of the postabdomen, enlarged.

Figs. 15-16. *Dendrodoa pulchella* (VERRILL).

- 15...4 mm long specimen.
- 16...Stomach of the same individual, enlarged.

PLATE XXIII

- Figs. 17-23. *Dendrodoa pulchella* (VERRILL).
17...4 mm long specimen, left half of the mantle body, inner side.
18...Right half of the mantle body of another 4 mm long specimen, inner side.
19...Ciliated groove of the specimen shown in Fig. 15, magnified.
20...Right half of the mantle body of a 6.5 mm long specimen.
21...10 mm long specimen.
22...Right half of the mantle body of the same specimen, inner side.
23...Ciliated groove of the same specimen, magnified.
- Fig. 24. *Dendrodoa aggregata* (RATHKE). Right half of the mantle body of a 25 mm long specimen, inner side; showing an unusual arrangement of the gonad.

PLATE XXIV

- Figs. 25-33. *Boltenia ovifera* (LINNAEUS).
25...The specimen with 60 mm long body and 132 mm long peduncle, right side. (31)...Younger individual.
26...A part of the peduncle, enlarged.
27...Left half of the mantle body of the same specimen, inner side.
28...Right half of the mantle body, inner side.
29...Ciliated groove of the same specimen, magnified.
30...Anus of the same specimen, enlarged.
31...15 mm long young specimen, right side.
32...Ciliated groove of the same specimen, magnified.
33...Right gonad of the same specimen, enlarged.

PLATE XXV

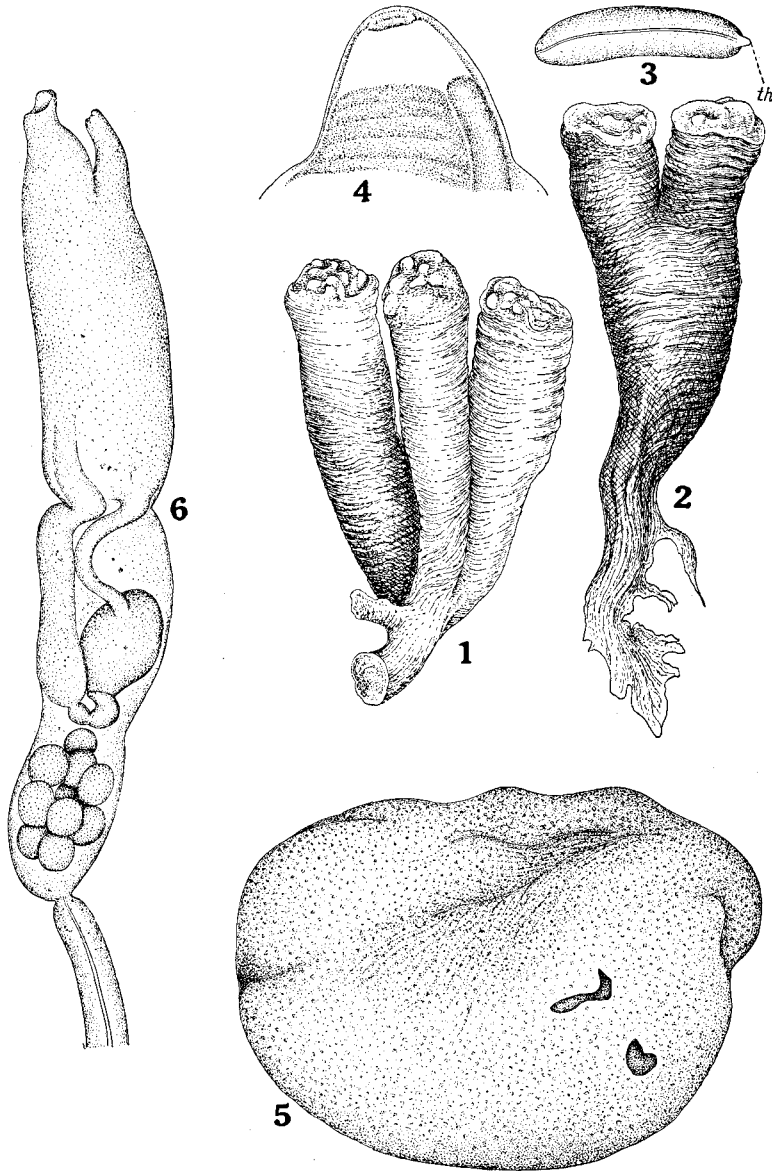
- Fig. 34. Polycitoridae (?) form B, slightly enlarged.
- Fig. 35. *Ciona intestinalis* (LINNAEUS). Right side of the 14.5 mm long contracted mantle body from Matusima Bay, showing the musculature.
- Figs. 36-37. *Ascidia sydneyensis samea* (OKA).
36...Ciliated groove of a 34 mm long specimen, magnified.
37...Ciliated groove of a 14 mm long specimen, magnified.
- Fig. 38. *Ascidia gamma* TOKIOKA. Ciliated groove of the 45 mm long specimen, magnified.

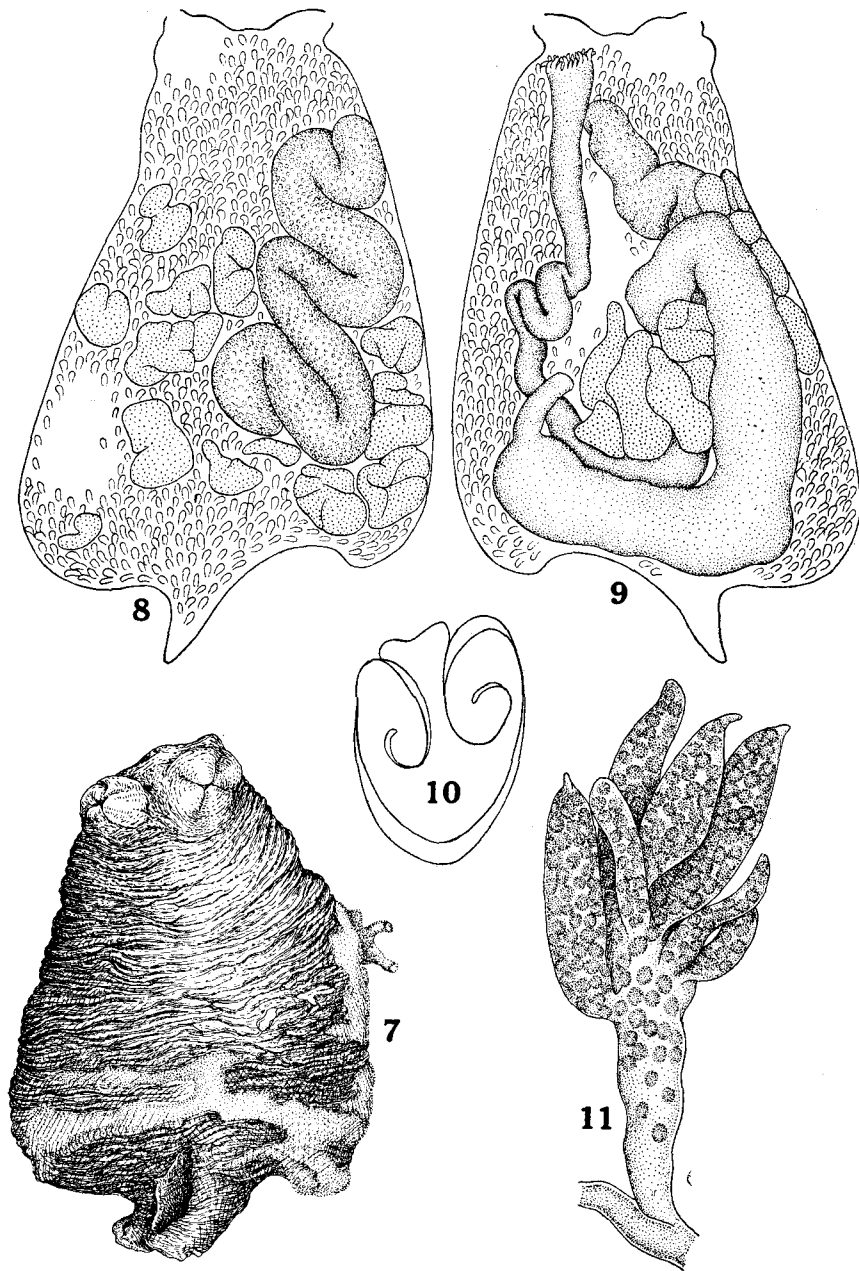
Figs. 39-41. *Cnemidocarpa fertilis* f. *minor* TOKIOKA.

39...14 mm long specimen, left side.

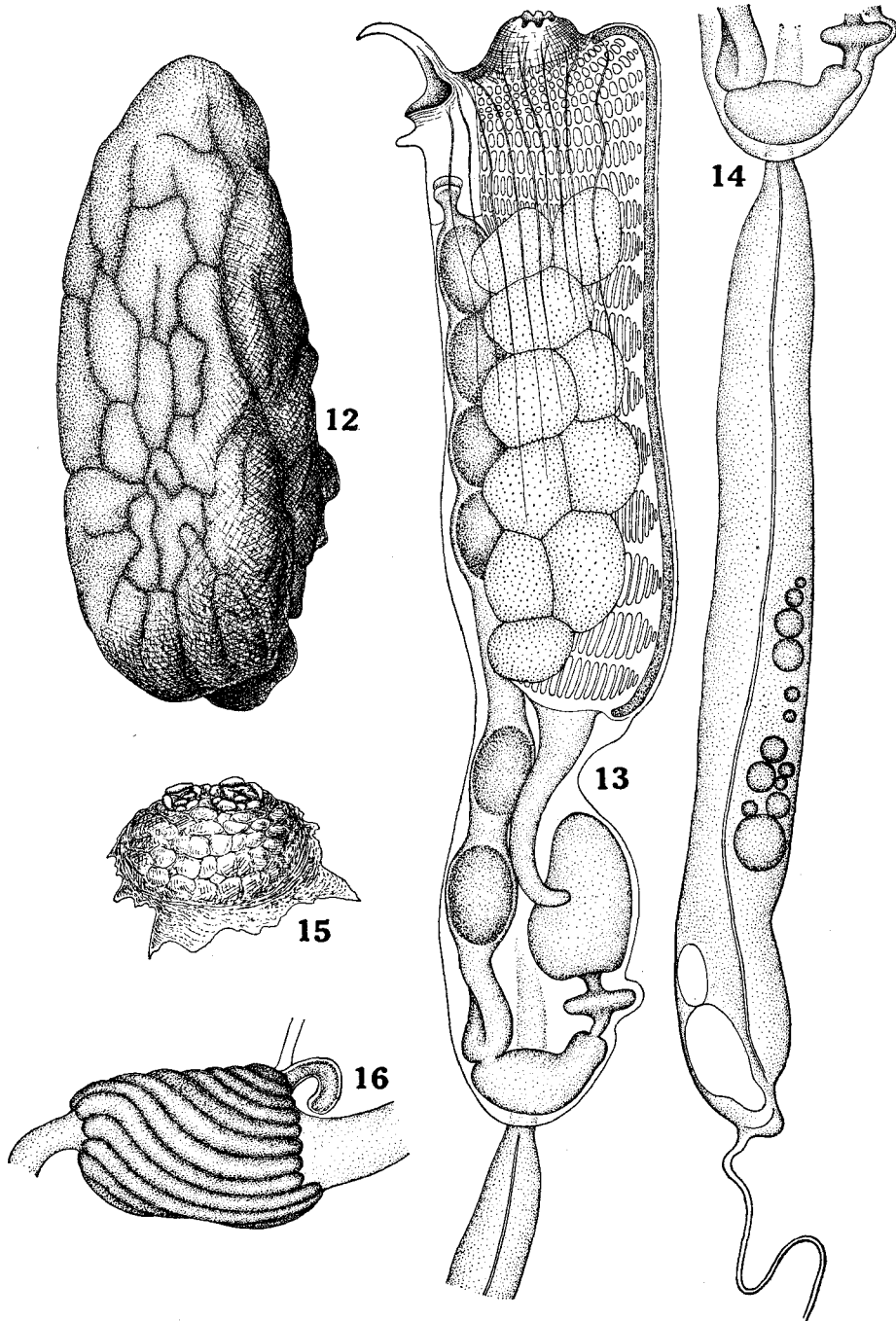
40...Left half of the mantle body of the same specimen, inner side.

41...Right half of the mantle body, inner side.

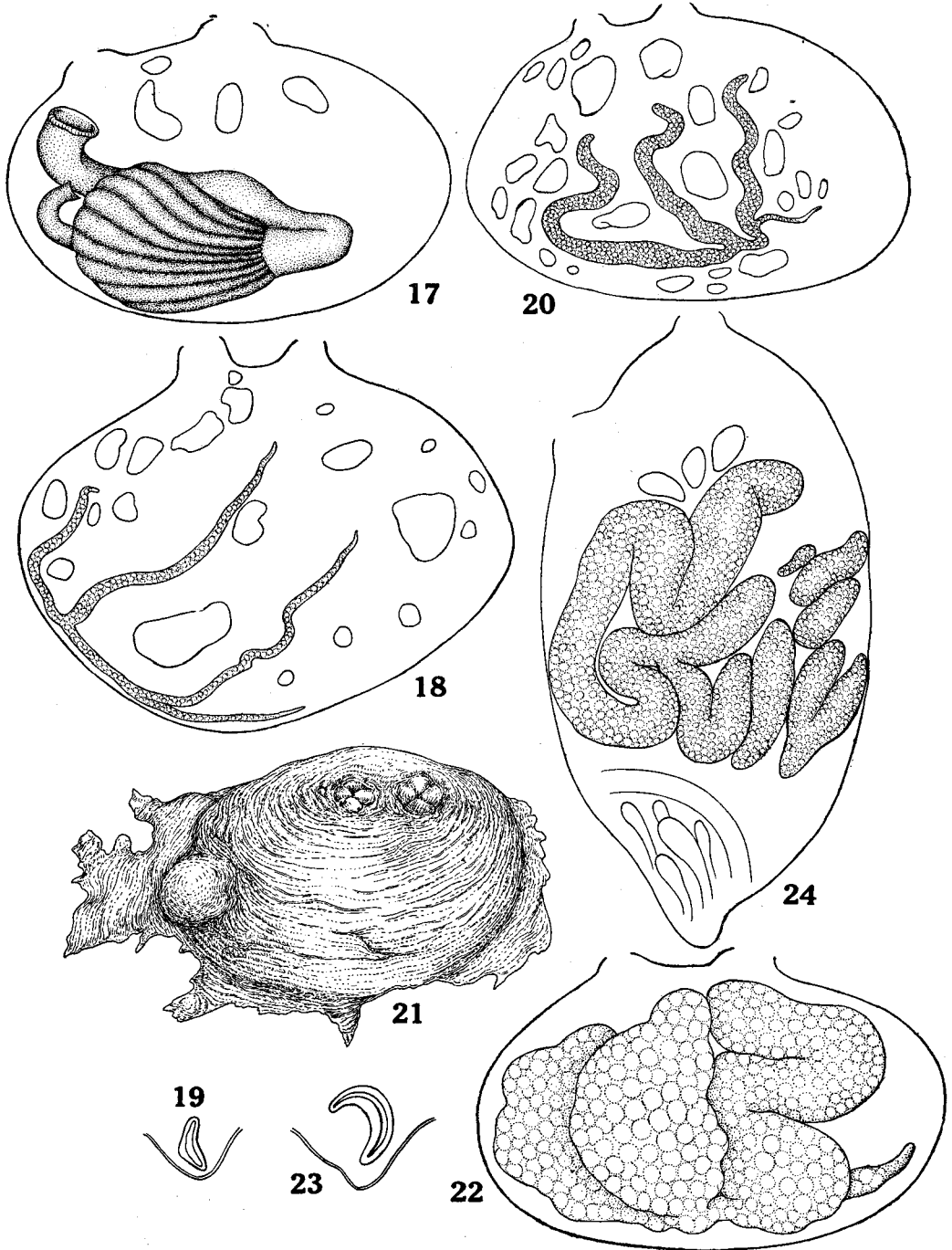




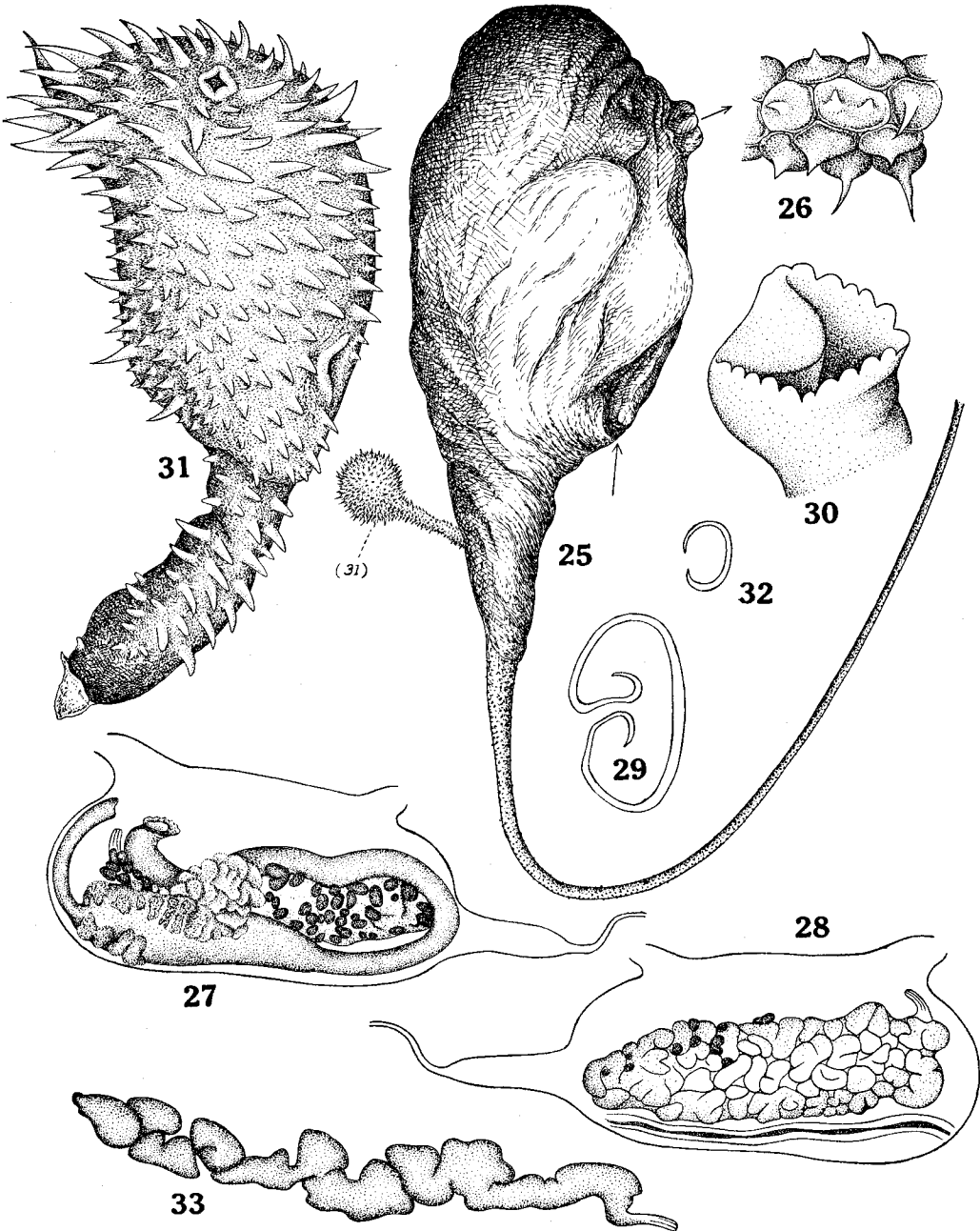
T. TOKIOKA: CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA, XVI.



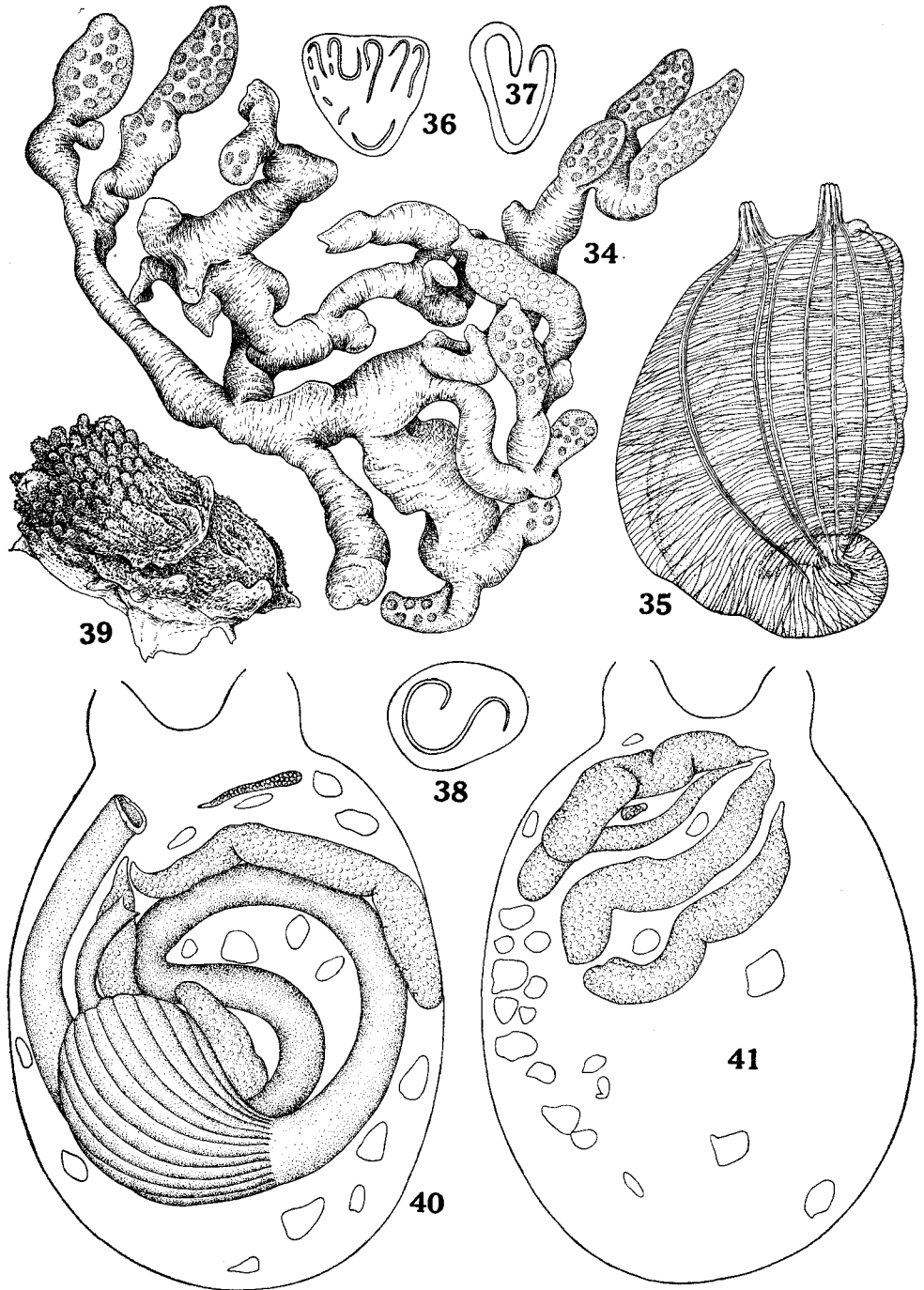
T. TOKIOKA: CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA, XVI.



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