CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA. V

ASCIDIANS COLLECTED NEAR THE MARINE BIOLOGICAL LABORATORY OF HIROSIMA UNIVERSITY IN THE INLAND SEA (1)[1][2]

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With 16 Text-figures

Many specimens of ascidians have been collected by Prof. IWAO TAKI of Hirosima University in the neighbourhood of the Marine Biological Laboratory of the University. The laboratory is situated on the south-west coast of Mukô-zima, a large island opposite the town of Onomiti near Hirosima. These specimens were offered me for examination by the courtesy of Prof. TAKI, to whom I express here my hearty thanks for his kindness. I have fininished to examine a part of them and give some notes in the following.

1. *Didemnum (Didemnum) tigrinoides* n. sp.

(Fig. 1)

A small colony, 24 mm×10 mm in extent and 1 mm in thickness. The surface of the colony shows a complex pattern consisting of wider dark brownish areas and narrower yellowish-white areas. The former is the part containing zooids beneath, while the latter is the part covering the well-developed cloacal lacunae system.

Spicules: Calcareous spicules are distributed as shown in Fig. 1-*2*. They are found around the thorases of zooids, most densely near the neck region, and in the covering layers and the bottom layers of cloacal canals. Spicules around the zooids are completely concealed superficially by pigment cells in the surface layer. Large spicules 50–75 μ in diameter, with ca. 13 rays on the equatorial plane. Rays not thick, pointed acutely at the tip.

1) A part of the study promoted by the financial aid from the Ministry of Education.
2) Contributions from the Seto Marine Biological Laboratory, No. 198.

Zooid: Thorax ca. 360 μ in length in contracted state. Abdomen ca. 430 μ and neck considerably long. Branchial aperture 6-lobed. Retractile muscle short. Atrial aperture as in *Did.* (*Did.*) *moseleyi* (HERDMAN)?; its accurate appearance is quite unknown, because of the strong contraction of the body. Alimentary canal courses as in common species of the subgenus *Didemnum*. No gonad is found in any zooid examined.

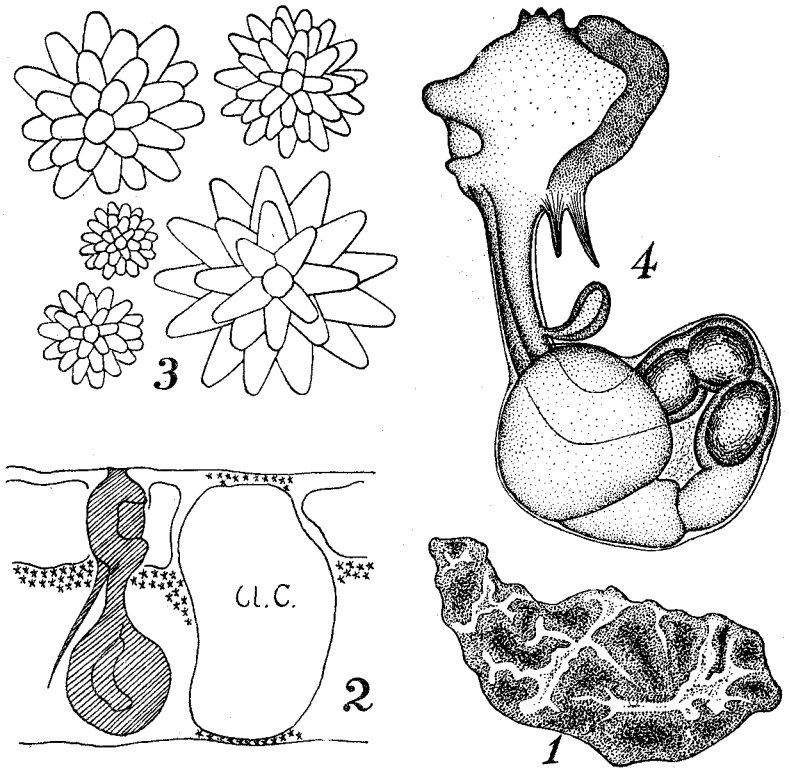

Fig. 1. *Didemnum* (*Didemnum*) *tigrinoides* n. sp. 1—Colony, ×2: 2—A schema representing a section of the colony; 3—Calcareous spicules, ×440; 4—Zooid, ×70.

Remarks: The present species resembles superficially *Did.* (*Did.*) *areolatum* TOKIOKA and *Didemnoides tigrinum* OKA (MS.) in Figuraro de Japanaj Bestoj (1927, p. 498, Fig. 960), the latter of which is revealed by the re-examination of the type specimen to be a species of the genus *Leptoclinides*. *Did.* (*Did.*) *areolatum* differs distinctly from the present species in having much smaller calcareous spicules, less than 34 μ in diameter, with merely 6-8 rays on the equatorial plane and distributed evenly throughout the colony from the surface

to the bottom. *Did.* (*Did.*) *partitum* TOKIOKA is related to the present species in that it has large calcareous spicules in the test, although they have each usually merely 6–8 rays on the equatorial plane instead of ca. 13 in the present new species. For convenience to record the material, I prefer to name provisionally the present specimen *Did.* (*Did.*) *tigrinoides* on its superficial resemblance to *Didemnoides tigrinum* OKA (MS.).

2. *Ciona intestinalis* (LINNAEUS), 1767

(Figs. 2 and 3)

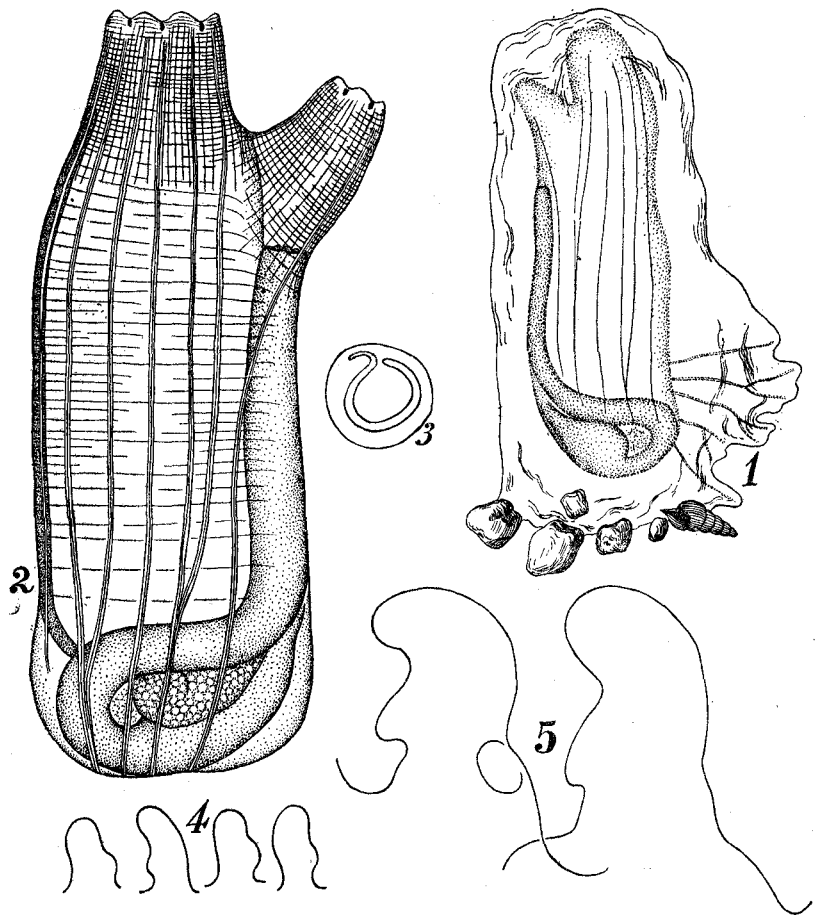

Fig. 2. *Ciona intestinalis.* (L.) 30 mm long individual. 1—Entire animal, 2—Mantle body from left side, 3—Ciliated groove, enlarged; 4—Supporting papillae of the inner longitudinal vessel, ×70; 5—Supporting papillae of the inner longitudinal vessel of a large specimen collected at Uwazima, Sikoku. ×70.

As an example, a finely preserved 30 mm long individual (Fig. 2) was dissected for description. Test soft, gelatinous and transparent. There are many processes near the posterior end of the body, by which the animal attached to the substratum or to gravels or shell fragments. These processes are pierced through with vessels. Branchial aperture terminal and 8-lobed, atrial aperture slightly behind the branchial aperture and 6-lobed. Seven longitudinal muscles on each side of the body, the dorsal-most one of which runs anteriorly into the atrial siphon, while others go into the branchial siphon. The ventral-most muscle is very thin. These muscles are united into 5 bundles near the posterior end of the body on each side. Twenty-two inner longitudinal vessels on each side of the branchial sac; ca. 60 rows of stigmata. Large and small transverse vessels alternate rather regularly in the central part of the sac; small ones pass across the stigmata. Four to five stigmata in a mesh. Tentacles ca. 30. Ciliated groove simple horse-shoe-shaped with an arm slightly curled outwards. Supporting processes of inner longitudinal vessels at crosses with transverse vessels are rather slender. Stomach orange brown, it and the beginning part of the intestine are situated behind the branchial sac. Anus opens near the base of the atrial siphon and plainly margined. Testis whitish and covers the surface of the stomach and the part of the intestine forming a loop.

A larger, 45 mm long×30 mm wide, contracted specimen (Fig. 3) was found in a curious appearance differing distinctly from that of the preceding specimen. It is roughly ovoid in outline, most part of the body is covered by many small processes which are penetrated by vessels, ramified and carrying many sand grains or mud as in *Corella japonica* HERDMAN. The test of the anterior 1/3–1/4 of the body is very soft, gelatinous and transparent. Branchial aperture 8-lobed and atrial aperture 6-lobed; a yellow ocellus at each interval between lobes. Mantle very soft and pale flesh in colour. Five longitudinal muscles on each side of the body, the dorsal-most one is extended anteriorly into the atrial siphon, the second muscle ramified in the anterior part into three branches which are all running toward the branchial siphon. The ventral-most one is very thin. Transverse muscles very weak. Plications absent. Twenty-six inner longitudinal vessels on the left side and twenty-three on the right. Transverse vessels 80–120, of which larger ones are ca. 40 in number and bear each a long triangular dorsal languet on the dorso-median line. One to three (small-medium-small) thinner transverse vessels between a pair of thicker ones. Parastigmatic vessels present. Eight~ten stigmata in a mesh. Supporting papillae of inner longitudinal vessels are very broad. Tentacles 50–60. Dorsal tubercle situated at just the anterior end of the dorsal ganglion. Ciliated groove inverted *Ω*-shaped.

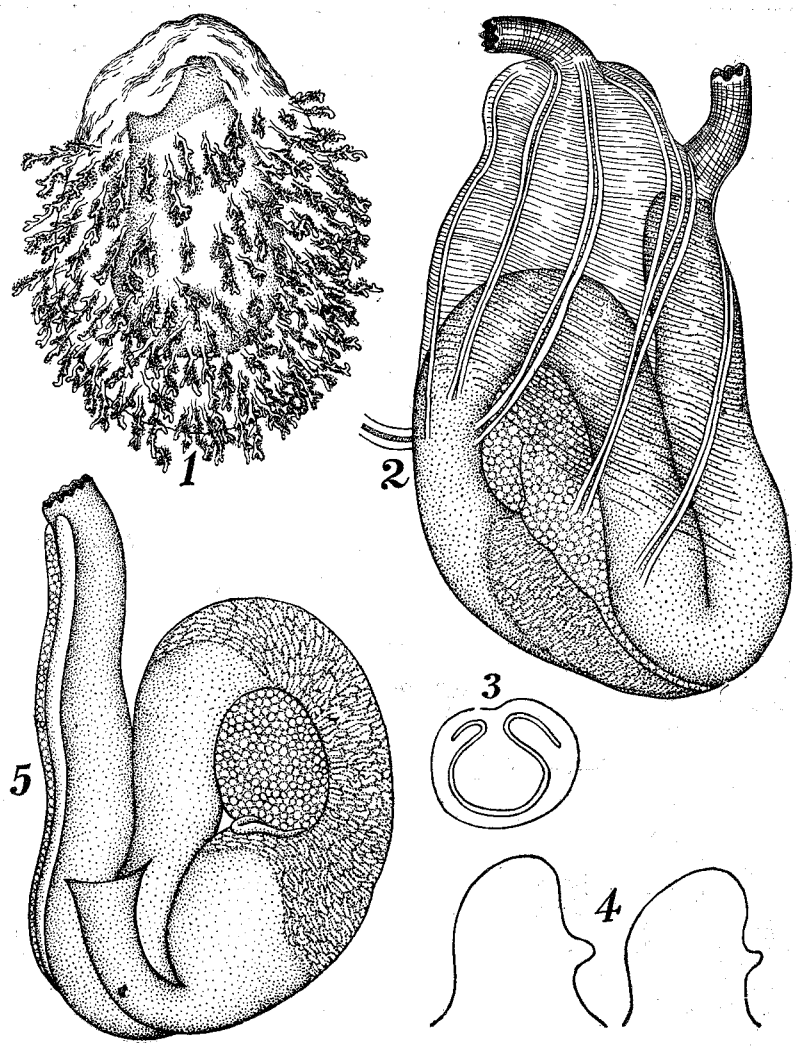

Fig. 3. *Ciona intestinalis* (L.) 45 mm long individual. 1—Entire animal, 2—Mantle body from left side, 3—Ciliated groove, enlarged; 4—Supporting papillae of the inner longitudinal vessel, ×70; 5—Alimentary canal, right side.

The anterior end of the intestinal loop reaches fairly beyond the middle of the body. Oesophagus opens at the dorso-posterior corner of the branchial sac, consequently the globular stomach is situated behind the branchial sac. Anus irregularly lobed. Ovary in the intestinal loop. Testicular follicles are spread over the surface of the intestinal wall.

Remarks: There are many distinct differences between two specimens, as mentioned above. Differences found in number of the vessels of the branchial

sac are apparently considered as variations in age. The difference found in the situation of the alimentary canal is due to the degree of contration after preservation. Lastly, differences found in the arrangement of the longitudinal muscles and the shape of the supporting papillae of inner longitudinal vessels of the branchial sac seem to belong to the individual variation, although at a glance the larger specimen shows a close resemblance to *Ciona pulchella* (ALDER)* in the appearance of the broad papillae.

3. *Ascidia zara* OKA, 1935

(Fig. 4)

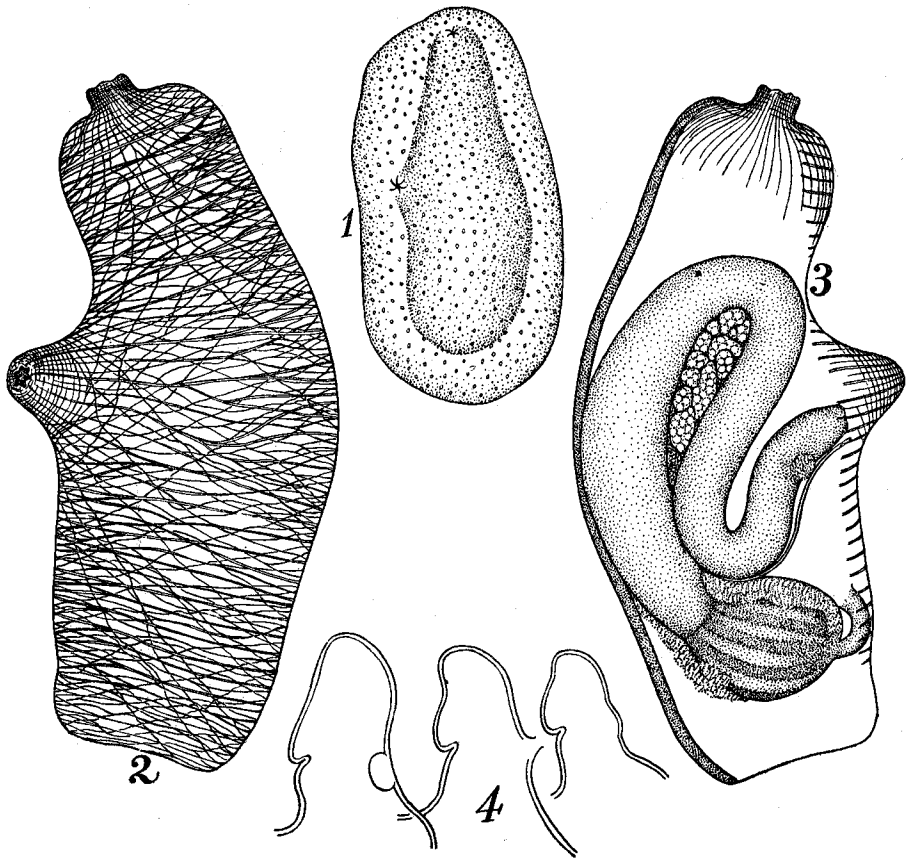

Fig. 4. *Ascidia zara* OKA. 1—Entire animal, from right side; 2—Mantle body from right side, 3—Mantle body from left side, 4—Supporting papillae of inner longitudinal vessels, ×70.

* ALDER & HANCOCK (1927): The British Tunicata, Vol. II, pp. 14-15, Pl. I figs. 6-8.

A 40 mm×32 mm individual in the material, elongate oval in outline and having many hairy processes on the left side, along this side the animal lies on the muddy bottom. Both apertures sessile, the branchial aperture terminal and 7-lobed, and the atrial aperture situated near the middle of the body and 6-lobed. The musculature on the right side of the mantle body consists mainly of transverse muscles.

Branchial sac: Plications present. Thirty-two inner longitudinal vessels on the left side and 35 vessels on the right. Transverse vessels ca. 90 on the left side and 105 on the right; they are arranged as—thick-thin-thick-thin—. Intermediate papillae found in various places, especially abundantly in the posterior portion. Seven to ten stigmata in a mesh. Tentacles ca. 50, excluding minute ones of about the same number. Ciliated groove shallow U-shaped and situated in front of the dorsal ganglion about the length of the ganglion apart. Dorsal lamina tall.

Alimentary system: The anterior end of the intestinal loop reaches beyond the atrial aperture about a 1/3 of the distance between both siphons. Anus situated slightly in front of the middle of the loop. The axis of the second intestinal loop passes the pyloric end of the stomach.

Gonad: Ovary in the intestinal loop. Testis pinkish, covering the whole surface of the alimentary canal on the inner side.

Remarks: Differences found between the present specimen and others described by OKA (1935) and TOKIOKA (1953) are all considered as individual variations or differences due to the state of preservation.

4. *Ascidia ahodori* OKA, 1927

(Fig. 5)

OKA, A. (1927) in: Figuraro de Japanaj Bestoj, p. 493, Fig. 950.

Two individuals in the collection, each 35 mm in length. Body roughly oval in outline, 24 mm wide and 8 mm thick, and attached to the substratum by the whole left side. Branchial aperture terminal and 7-lobed, atrial aperture situated at the 1/3 of the body length from the anterior end of the body and 6-lobed. Both apertures sessile.

Test: Rather thick, cartilaginous, translucent and yellowish-white in colour. The surface smooth and quite free from foreign matters. Vessels running through the test are thin; their terminals are not swollen.

Mantle: Yellowish brown. The right side covered thoroughly with delicate muscles. Both siphons short. Atrial siphon situated at the middle of the mantle body.

Branchial sac: Plications present. Inner longitudinal vessels 38–45 on each side at the middle part of the sac. Transverse vessels 140–149 on the left side; they are arranged as 1 4 3 4 2 4 3 4 1..., here numerals represent the order of the thickness. Four to five stigmata in a mesh. Supporting papillae of inner

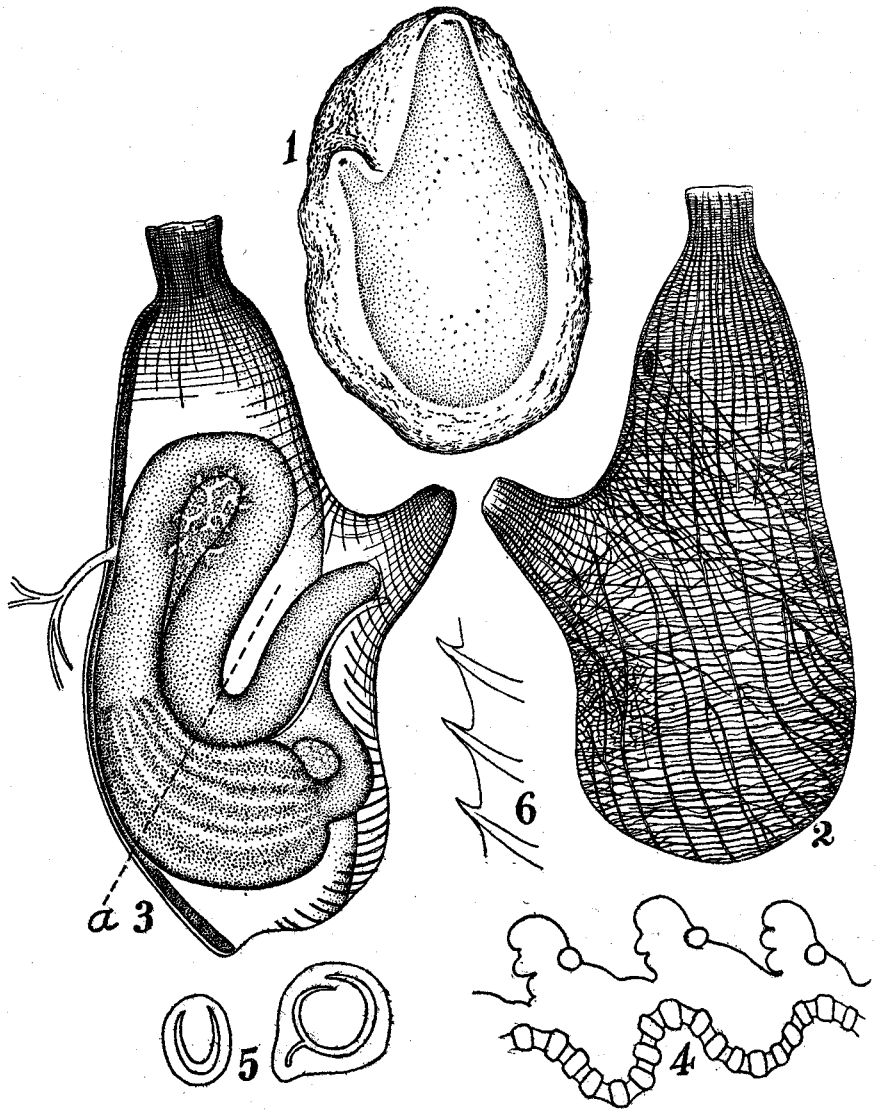

Fig. 5. *Ascidia ahodori* OKA. 1—Entire animal from right side, 2—Mantle body from right side, 3—Mantle body from left side, 4—Supporting papillae of inner longitudinal vessels, ×70; 5—Dorsal tubercles, enlarged; 6—A part of dorsal lamina. *a*—Axis of the second intestinal loop.

longitudinal vessels have each a distinct prominence on the dorsal margin. Tentacles 42–50 including large and small ones. The dorsal tubercle situated in front of the dorsal ganglion about 2–3 times the length of the ganglion apart. Ciliated groove simple U-shaped. Dorsal lamina ribbed, distal ends of ribs protrude beyond the margin of the lamina.

Alimentary system: The anterior end of the intestinal loop reaches beyond the atrial aperture about a third of the distance between the bases of both siphons. Anus is situated at the 1/3 of the visceral mass from the anterior end of the intestinal loop and plainly margined. Oesophagus opens to the branchial sac about a 1/3 of the length of the sac from the posterior end. The axis of the second intestinal loop passes through the stomach about 1/3 to 1/2 of its length from the pyloric end. Stomach large, elongate oval and faintly striated. Gonad immature.

Remarks: I considered, at first, that the present specimens represent young individuals of *As. longistriata* HARTMEYER which differs, however, distinctly from the former in the following three points: 1)—Transverse vessels of the branchial sac less than 120 in individuals as long as these specimens, 2)—Stomach small and globular in outline, 3)—Found previously only from the deep waters. Next, *As. matoya* TOKIOKA resembles closely the present species in the appearance of the mantle body; the former shows, however, a characteristic appearance of the body covered externally with many hairy processes which hold muddy sand on the surface. *As. ceratodes* (HUNTSMAN) from the western coast of North America is also related to the present specimens. This American species is, however, provided with much more tentacles, 150–200 ones instead of ca. 50 in the latter.

The original description given by OKA (1927) for *As. ahodori* is only brief and imperfect, as follows:—

"Body elongate oval in outline, considerably flattened laterally, 40 mm long ×22 mm wide, and attached to the substratum by the left side. Branchial aperture terminal and 8-lobed, atrial aperture situated at 1/3 of the body length from the branchial aperture and 6-lobed. Both apertures sessile. The surface of the test is almost smooth and free from foreign matters. A few root-like protuberances are issued from the margin of the body. Test soft cartilaginous, translucent and pale yellowish in colour. Mantle thin; the right side with musculature, while the left side is devoid of muscle and quite transparent. Intestine forms double loops on the left side. Loc.: Along the coasts of Hokkaidô, Honsyû and Sikoku."

From the figure given by OKA, the following point may be accepted that

the atrial siphon is situated at the middle of the mantle body. Details of the branchial sac and the arrangement of the alimentary canal are quite unknown. I have searched the type specimen of this species to reexamine carefully the internal structure of the animal, but I have not been able to find it at any place nor specimen labelled as. *As. ahodori*, except one in the material in the Biological Laboratory in the Imperial Palace. The only single specimen identified by OKA as *As. ahodori* was, unfortunately, dried completely and consequently I could not ascertain whether the specimen represented a young, ca. 30 mm long, individual of *As. longistriata* or an independent species. The locality, Amadaiba 60 fathoms in Sagami Bay, seems rather to emphasize the idea that the specimen belongs to *As. longistriata*, a deep-sea ascidian. Notwithstanding these circumstances, I prefer to call the present specimen *Ascidia ahodori* by the following reasons: 1)—The present specimens fit to the brief descriptions given by OKA, 2)—*As. ahodori* seems to be widely distributed along Japanese coasts. I intend to use in future the name *Ascidia ahodori* for specimens which show characteristics indicated in the description given above.

5. *Ascidia alpha* n. sp.

(Fig. 6)

Two 35 mm long individuals are attached to the substratum side by side. The body roughly oval in outline. Branchial aperture terminal and 7–8 lobed, atrial aperture situated slightly behind the branchial and 6–lobed.

Test: Cartilaginous, translucent and milky-white in colour. The surface is smooth and free from foreign matters, although it is slightly coarse to the touch.

Mantle: Yellowish brown. Atrial siphon fairly long and situated at 1/4–1/3 of the body length from the anterior end of the body. The right side is wholly covered by muscles.

Branchial sac: Plications found in contracted parts. Inner longitudinal vessels 40–50 on each side, transverse vessels 132–133 on the right side. Six to eight thinner vessels between each pair of thicker ones. Supporting papillae of inner longitudinal vessels not so long. Four to five stigmata in a mesh. Tentacles ca. 60, including large and small ones. Ciliated groove nearly circular, interrupted anteriorly. Dorsal tubercle situated in front of the dorsal ganglion about a half of the length of the tubercle apart. Dorsal lamina as in the preceding species.

Alimentary system: The anterior end of the intestinal loop never reaches beyond the base of the atrial siphon. Anus situated near the anterior end of the loop, the margin is thickened but not lobed. Oesophagus opens to the branchial

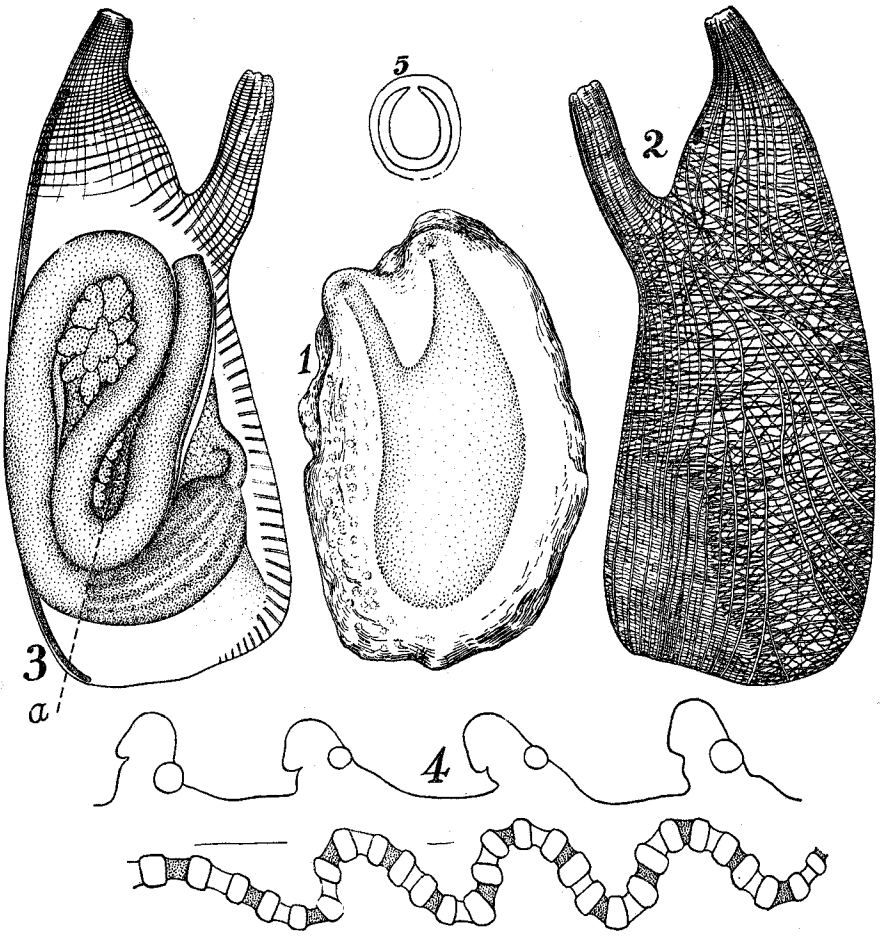

Fig. 6. ***Ascidia alpha*** n. sp. 1—Entire animal from right side, 2—Mantle body from right side, 3–Mantle body from left side, 4—Supporting papillae of inner longitudinal vessels, ×70, 5—Dorsal tubercle, enlarged. *a*—Axis of the second intestinal loop.

sac at about 1/3 of the length of the branchial sac from the posterior end. The axis of the nearly closed second intestinal loop passes the pyloric end of the stomach which is elongate oval in shape.

Gonad: As in common species of *Ascidia.*

Remarks: The present species differs from the preceding species in the position of the atrial siphon and in the arrangement of the alimentary canal.

6. *Botryllus communis* OKA, 1927

A thin, ca. 1 mm thick, colony. Systems consist each of 4–9 zooids. Zooids, vessels and bulbs are all dark purplish in colour.

7. *Botrylloides violaceum* OKA, 1927

(Fig. 7)

Colonies dark purplish or reddish brown in colour and may reach ca. 5 mm in thickness. Stomach with 8–9 plications, most frequently with 9 plications. Prof. TAKI alludes in his letter to me to the probability that this compound ascidian is food for *Erato callosa* ADAMS et REEVE.

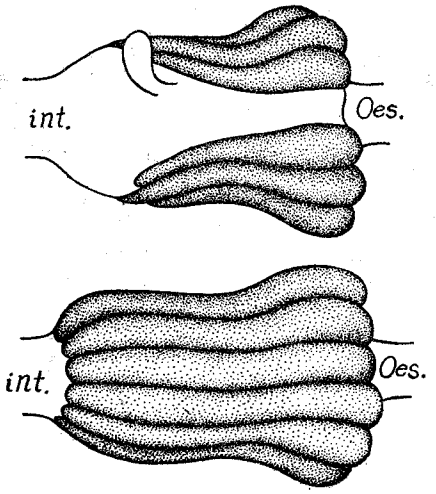

Fig. 7. *Botrylloides violaceum* OKA. Stomach, enlarged.
oes.—oesophagus, *int.*—intestine.

8. *Symplegma connectens** TOKIOKA, 1949

(Fig. 8)

A spatulate colony in the material. It is 45 mm long×15 mm wide×7 mm thick, dark purplish brown in colour and embraces a flat object as an axis. Zooids slightly oblique and occupy the whole surface of the colony.

Branchial sac: Ten~eleven (or more) rows of stigmata. Parastigmatic vessels found very sparsely. Stigmata arranged between 4 inner longitudinal vessels as follows:

D. 6 (1) 4–5 (1) 4–5 (1) 4 (1) 6 V.

Tentacles about a dozen. Dorsal lamina a plain membrane.

Alimentary system: The anterior end of the intestinal loop may reach slightly beyond the 7th transverse vessel. Anus situated at the 5th transverse vessel and plainly margined. The axis of the second intestinal loop passes the

* I revise here the former name *connectans* to *connectens* on the kind advice of Prof. TAKI.

oesophagus. Stomach large, globular and with ca. 13 longitudinal plications on the surface. Pyloric coecum practically absent. A thick vessel connecting the anterior pyloric corner of the stomach to the intestine.

Gonad: Ovaries and testes in the same arrangement as in *Symplegma reptans*. Testis consists of two testicular lobes which are usually divided each into two lobules.

Larva: 1.3–1.7 mm in length. The structure is quite the same as in *Sym. reptans*.

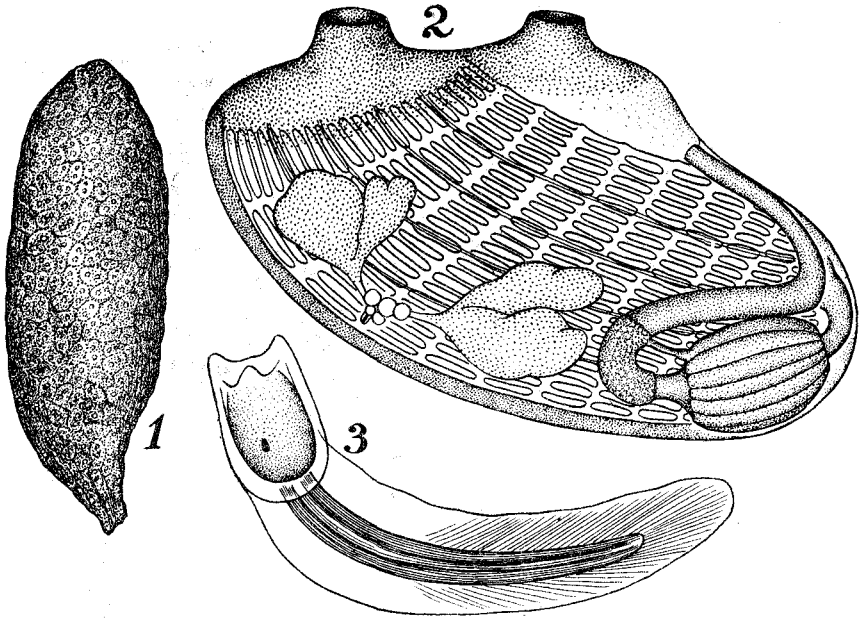

Fig. 8. *Symplegma connectens* TOKIOKA. 1—Colony, ×1.5; 2—Zooid from left side, much enlarged; 3—Larva, ×45.

Remarks: I indicated in my previous paper (1949) 4 characteristics differentiating the present species from *Sym. reptans*, 2 of which seem, however, to be withdrawn. The remaining two characteristics are common to the present specimen and that described in my previous paper; they are: 1)—Rows of stigmata are more numerous in *Sym. connectens* than in *Sym. reptans*, 2)—Stomach with more numerous plications in *Sym. connectens* than in *Sym. reptans* and has merely a connecting vessel in the former in place of a pyloric coecum in the latter.

Diandrocarpa brakenhielmi MICHAELSEN var. *ceylonica* HERDMAN resembles closely the present species in the number of the rows of stigmata (10–12), but it differs distinctly from the latter in having a distinct pyloric coecum.

9. *Cnemidocarpa areolata* (HELLER), 1878

(Fig. 9)

Three specimens, 22–24 mm long, in the collection. Test whitish, atrial aperture situated at the middle of the body or slightly anterior to it. About 25 large atrial tentacles are found in the 23 mm long individual.

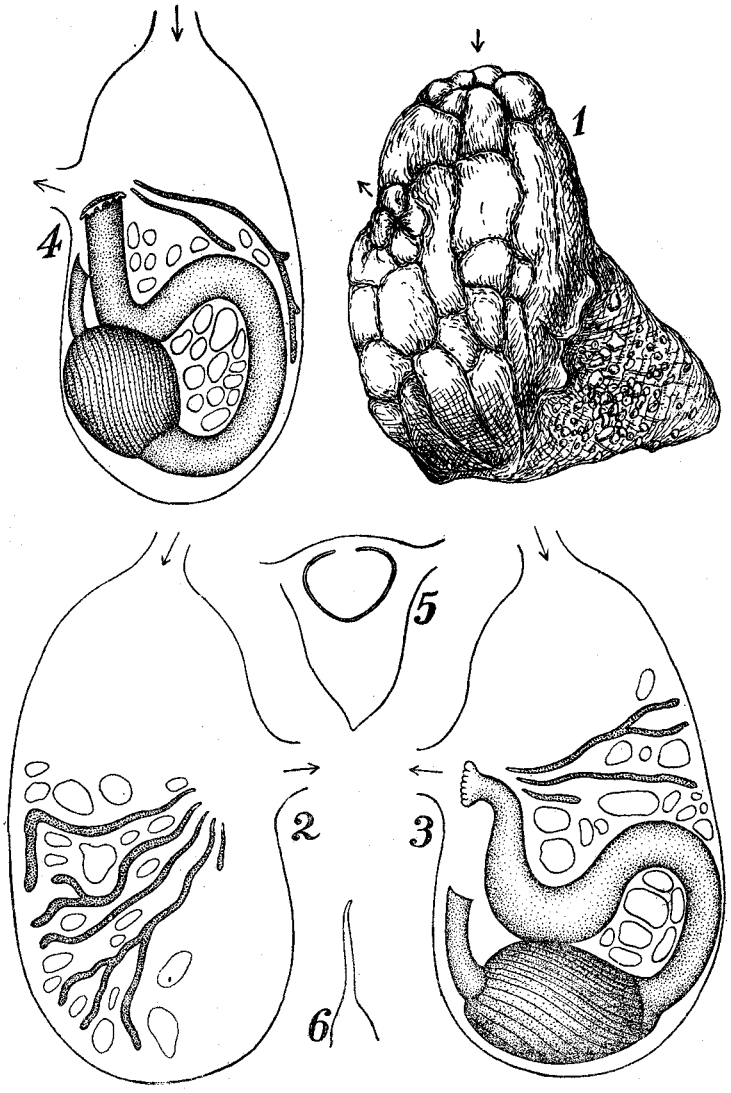

Fig. 9. ***Cnemidocarpa areolata*** (HELLER). 1-3, 5-6—23 mm long individual; 4—24 mm long individual. 1—Entire animal from right side, 2—Mantle body, right half from inside; 3, 4—Mantle body, left half from inside; 5—Dorsal tubercle, magnified. 6—Atrial tentacle, magnified.

Branchial sac: Inner longitudinal vessels arranged in the 23 mm long individual as follows:

Left	D.	0	(12)	3	(13)	3	(13)	3	(9)	3	V.
Right	D.	0	(12)	3	(13)	3	(13)	3	(10)	3	V.

Transverse vessels arranged as—thick-thin-medium-thin-thick—. Parastigmatic vessels present in most part. Usually 5–7 stigmata in a mesh, although they may reach 10 in some wide meshes. Tentacles ca. 25 including minute ones in the 23 mm long individual.

Alimentary system: The axis of the second intestinal loop passes the middle of the stomach which is provided with 10–15 longitudinal plications on each side. Seven~thirteen endocarps in the first intestinal loop. Pyloric coecum absent.

Gonad:

22 mm long individual.....	Left	2	Right	6
23 mm long individual.....	„	3	„	5
24 mm long individual.....	„	2	„	4

Remarks: These specimens are related more closely to those reported by HERDMAN (1906) from Ceylon than to those reported by VAN NAME (1918) from the Philippine waters in the number of gonads.

10. *Cnemidocarpa macrogastra* (OKA), 1935

Two specimens in the collection; they are respectively 27 mm and 17 mm in length. The former is ca. 10 mm in thickness (laterally). Test milky white to yellowish white. Mantle yellowish white. Inner longitudinal vessels of the branchial sac arranged as follows:—

17 mm long individual

Left	D.	3	(17)	3	(10)	3	(15)	3	(10)	2	V.
Right	D.	2	(20)	3	(13)	3	(12)	3	(9)	2	V.

27 mm long individual

Left	D.	1	(19)	2	(15)	1	(16)	3	(10)	3	V.
Right	D.	1	(20)	2	(16)	2	(15)	2	(10)	2	V.

Transverse vessels arranged as: thick-thin-medium-thin-thick—. Stigmata in a mesh usually 6–7, although they may reach ca. 10. Tentacles 28–35, including minute ones. Dorsal lamina plainly edged or partially serrated. Stomach very long occupying 3/4 of the ventral branch of the first intestinal loop. About seven endocarps in the first intestinal loop.

Gonad:

27 mm long individual.....Left 7 Right 8
17 mm long individual..... „ 6 „ 8

Remarks: These specimens are figured in "Ascidians of Sagami Bay" in Text-fig. 18, p. 122.

11. *Styela partita* (STIMPSON), 1852

(Fig. 10)

Four specimens in the material. They are 15 mm-22 mm in length. Body

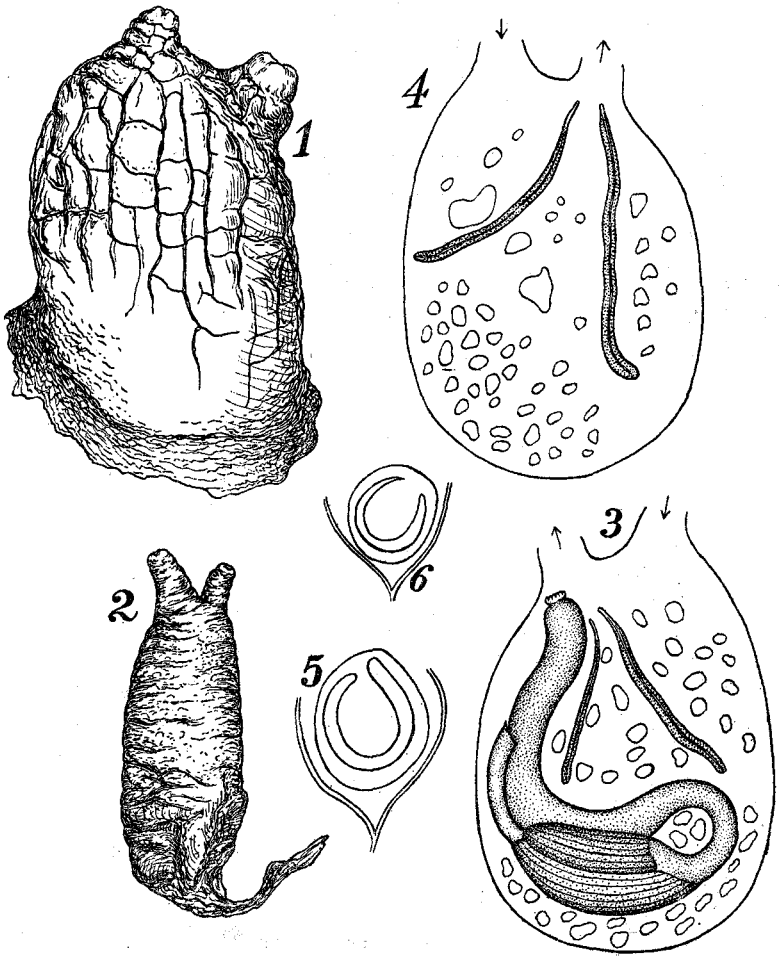

Fig. 10. *Styela partita* (STIMPSON). 1—22 mm long individual from left side, 2—15 mm long×6 mm wide individual, 3—Mantle body of 22 mm long individual, left half from inside; 4—Mantle body, right half from inside; 5—Dorsal tubercle of 22 mm long individual, 6—Dorsal tubercle of 20 mm long individual.

roughly oval, attached to the substratum by the right posterior side. Branchial aperture terminal, atrial aperture subterminal. Both siphons short but distinct. Two of the four specimens are very elongate, respectively 20 mm long×8 mm wide and 15 mm long×6 mm wide (Fig. 10-*2*). They are attached by the posterior end and each provided with both siphons at the anterior end of the body. Test yellowish white, leathery; the surface is grooved irregularly and in the anterior half it is divided roughly into many small quadrate areas.

Branchial sac: Inner longitudinal vessels are arranged in the 22 mm long individual as follows:

Left	D.	1	(19)	3	(13)	3	(17)	3	(15)	2 V.
Right	D.	1	(18)	4	(16)	4	(15)	4	(13)	2 V.

Transverse vessels arranged as thick-thin-medium-thin-thick—. Parastigmatic vessels present, four to six elongate stigmata in a mesh. Tentacles less than 46 in number, large and small ones alternate regularly. Ciliated groove simple U or C-shaped.

Alimentary system: Alimentary canal figures a S-shaped course in the posterior half of the body. The axis of the wide second intestinal loop passes the oesophagus. The stomach rather large, nearly horizontal and provided with ca. 30 longitudinal plications on the surface. Anus finely lobed.

Gonad: Two on each side. They are all immature.

12. *Styela clava* HERDMAN, 1881

(Fig. 11)

Two small specimens, each 17 mm long×5.5 mm wide. Body elongate cylindrical, attached to the substratum by the posterior end. Both apertures 4-lobed and open on short siphons situated at the anterior end of the body; the atrial siphon slightly anterior to the branchial. Test thin, translucent and yellowish-white in colour. The surface nearly smooth, with only a few faint wrinkles. Mantle adheres firmly to the test. There are many endocarps on the inner surface of the mantle, of which those near the posterior end of the body are much larger than others.

Branchial sac: Inner longitudinal vessels arranged as:—

Left	D.	2	(11)	2	(9)	2	(10)	3	(7)	2 V.
Right	D.	3	(11)	3	(9)	3	(11)	3	(8)	3 V.

Transverse vessels arranged as:—thick-thin-medium-thin-thick—, or thick-parastigmatic vessel-thick—; parastigmatic vessels intervene between some vessels

in the former case. Four to six stigmata in a mesh, they may be ca. 10 in meshes along the endostyle and the dorsal lamina. Stigmata comparatively large and elongate in form. Tentacles ca. 30 excluding minute ones. Ciliated groove C-shaped, opened anteriorly.

Alimentary system: Stomach descending, about half as long as the ascending branch of the intestine, and provided with ca. 30 longitudinal plications on the surface and a small pyloric coecum. Rectum swollen remarkably along a considerable length. Anus finely lobed.

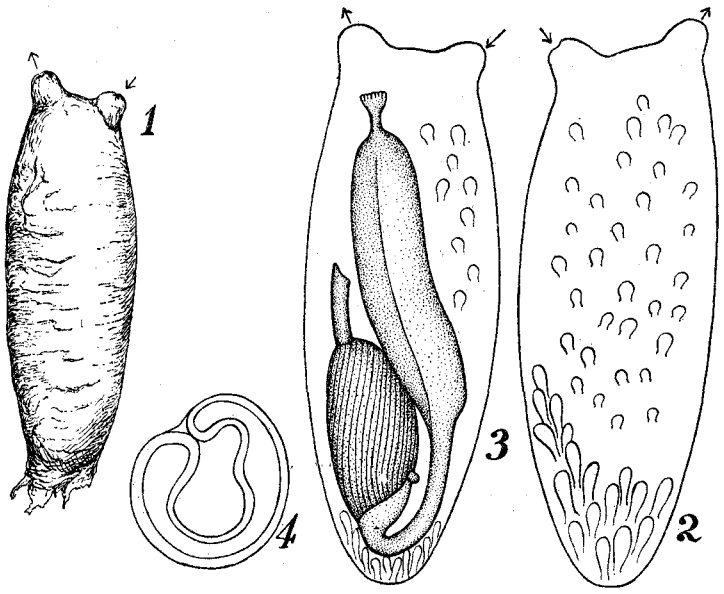

Fig. 11. *Styela clava* HERDMAN. 1—17 mm long individual from right side, 2—Mantle body, right half from inside; 3—Mantle body, left half from inside; 4—Dorsal tubercle, magnified.

Gonad: Quite immature.

Remarks: The external appearance of these specimens differs fairly from the general appearance of young individuals of *St. clava* in the following features: 1)—Test rather thin and translucent, 2)—The neighbourhood of siphons is quite devoid of irregular protuberances found characteristically in *St. clava*. I prefer, however, to treat these specimens as young individuals of *St. clava*, since the internal structure of these specimens conforms well to that of the typical forms of this species, excepting the swollen appearance of the rectum.

13. *Pyura lepidoderma* TOKIOKA, 1949

(Fig. 12)

This species seems to be rather common in the vicinity of the Laboratory. Two specimens were dissected for descriptions. They are respectively 13 mm long×13 mm wide and 12 mm long×9 mm wide and attached to the substratum by the left side. Test cartilaginous, 1.5-2 mm in thickness and yellowish-white in colour. The surface is divided into a number of polygonal areas by many conspicuous crests and assumes an appearance as if it were covered with many scales. Branchial aperture subterminal at the anterior end of the body and surrounded by 6 small areas, atrial aperture subterminal at the posterior end and with 4 small marginal areas.

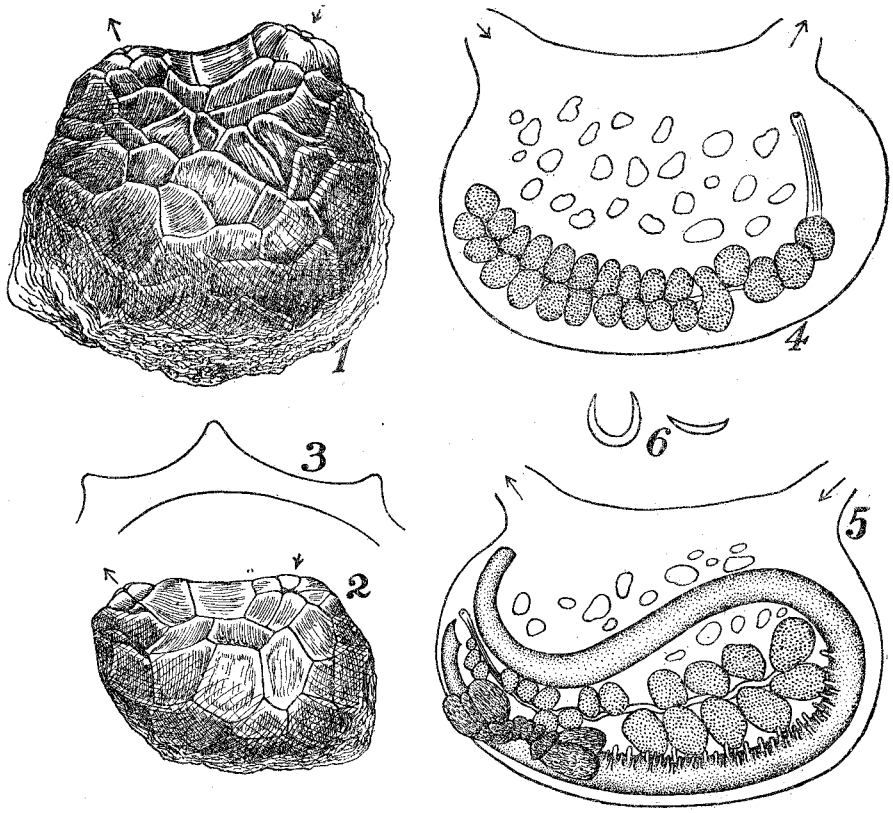

Fig. 12. *Pyura lepidoderma* TOKIOKA. 1—13 mm long individual from right side, 2—12 mm long individual from right side, 3—Section of test, enlarged; 4—Mantle body, right half from inside; 5—Mantle body, left half from inside; 6—Ciliated grooves, magnified.

Mantle: Thin and with coarse musculature consisting of muscles arranged regularly in cross stripes. Many endocarps on the inner surface.

Branchial sac: Inner longitudinal vessels arranged as follows:—

13 mm long specimen

Left D. 1 (10) 2 (8) 2 (12) 2 (13) 2 (11) 2 (6) 2 V.

Right D. 1 (12) 2 (10) 2 (14) 2 (13) 2 (11) 2 (6) 2 V.

Thick and thin transverse vessels alternate rather regularly, parastigmatic vessels present. Three~five stigmata in a mesh. The arrangement of stigmata may be slightly irregular in some parts. Tentacles 20–25 including minute ones; branches in 2 orders, branches of the first order are very long and thin. Ciliated groove simple U-shaped or crescent. Dorsal lamina a series of languets.

Alimentary system: Alimentary canal figures a wide loop in the ventral half of the left side. Liver yellowish white in colour. Anus plainly margined. Many minute follicular appendages arranged densely along the inner side of the first intestinal loop.

Gonad: The right gonad consists of ca. 25 genital capsules and the left one consists of ca. 20 capules. Each gonad nearly straight, the duct of the right gonad turns sharply dorsads. Ovary occupies the side of attachment of each capsule.

Remarks: The present description in given as the supplement of the original diagnosis based on a single small individual found in Matoya Bay. This species resembles closely *Cynthia squamulosa* ALDER in the European waters. The latter differs, however, from the former in having lesser longitudinal vessels on the branchial folds, 6–7 instead of 5–14 in *P. lepidoderma*, and contrarily more intermediate vessels, 3–4 instead of 0–2 in *P. lepidoderma*. More crucial comparison is desirable between these two species in the range of variation of the number of inner longitudinal vessels.

14. *Halocynthia igaguri* n. sp.

(Fig. 13)

A globular 12 mm long×11 mm wide individual in the collection, attached to the substratum by the posterior end. Branchial aperture terminal, atrial aperture near the middle of the body. Test thin but tough, yellowish white in colour; the surface is dispersed with minute papillae and armed thoroughly with many short spines, some of which are larger than others and may be 2.5 mm in length. Mantle extremely delicate and adheres firmly to the test.

Branchial sac: Seven folds on each side. Inner longitudinal vessels arranged

as follows:—

Left D. 1 (10) 2 (15) 2 (15) 2 (14) 2 (11) 2 (8) 1 (5) 0 V.
Right D. 1 (9) 1 (15) 2 (14) 2 (13) 2 (12) 2 (10) 1 (5) 1 V.

The seventh (ventral-most) fold is smallest. One to three thinner transverse vessels between each pair of thicker ones. Parastigmatic vessels present in the ventral half of the sac. About five elongate stigmata in a mesh. Tentacles 8, excluding small ones; branches in 2 orders, rarely with minute branches of the third order. Ciliated groove simple U-shaped. Dorsal lamina a series of languets.

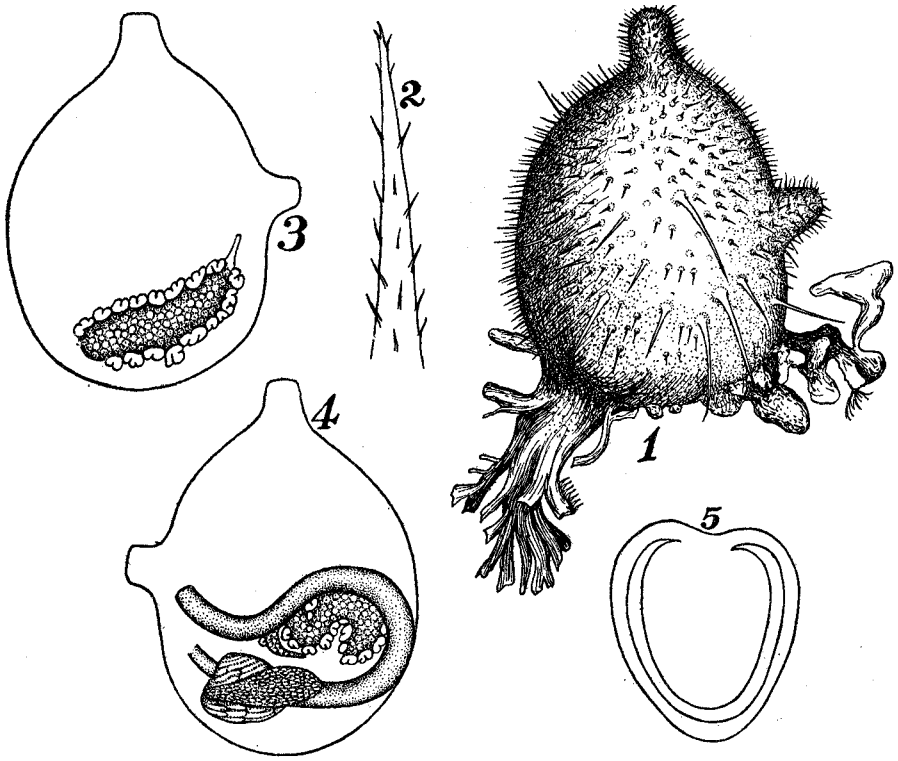

Fig. 13. *Halocynthia igaguri* n. sp. 1—Entire animal from left side, 2—Spine, enlarged; 3—Mantle body, right half from inside; 4—Mantle body, left half from inside; 5—Dorsal tubercle, magnified.

Alimentary system: Alimentary canal forms a simple wide loop in the posterior half on the left side. Liver is whitish and divided into anterior and posterior parts, the former consists of linear plications and the latter consists of follicular lobules. Anus plainly margined.

Gonad: One gonad on the right and two in the intestinal loop on the left side, the dorsal one of which is much smaller than the ventral one. Testicular

lobules marginal.

Remarks: The fewness of branchial folds and gonads is the characteristic of the present new species, besides the smaller size of the animal.

15. *Microcosmus multitentaculatus* n. sp.

(Fig. 14)

A 22 mm long×14.5 mm wide individual in the material. The animal is roughly oval in shape and attached to the substratum by the left ventral side.

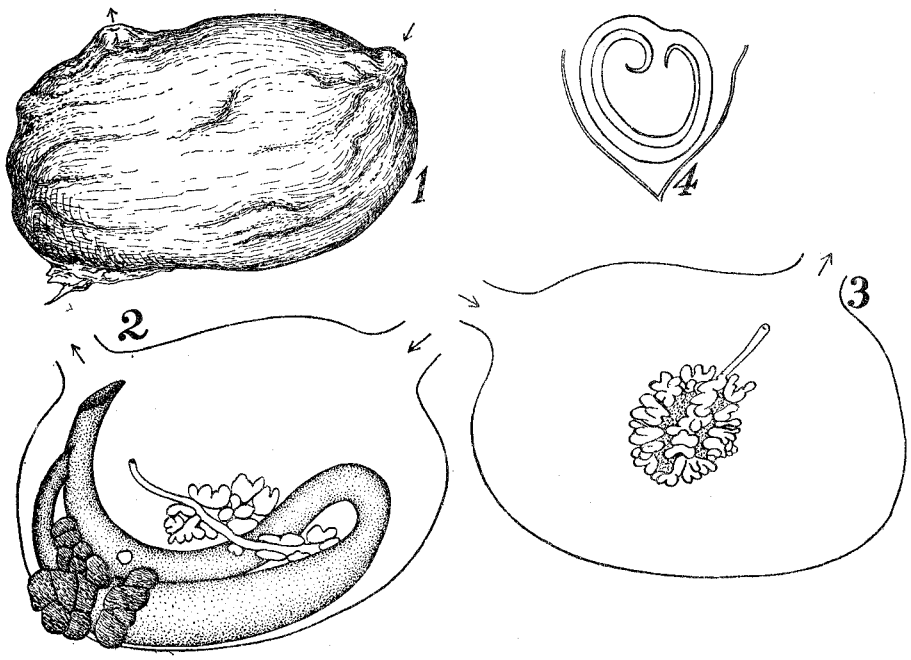

Fig. 14. *Microcosmus multitentaculatus* n. sp. 1—Entire animal from right side, 2—Mantle body, left half from inside; 3—Mantle body, right half from inside; 4—Dorsal tubercle, magnified.

Branchial aperture terminal. Atrial aperture slightly behind the middle of the body. Both apertures 4-lobed; siphons very short, but distinct.

Test of considerable thickness, leathery and yellowish brown in colour. The surface is roughly smooth except the neighbouring areas of siphons, which is somewhat wrinkled.

Mantle considerably thick, yellowish-white in colour. Longitudinal and transverse muscles arranged regularly.

Branchial sac: Seven folds on each side. Inner longitudinal vessels arranged as follows:

Left	D.	2	(21)	1	(18)	1	(18)	2	(18)	2	(15)	2	(13)	1	(7)	1	V.
Right	D.	1	(19)	1	(20)	1	(18)	1	(18)	2	(16)	1	(16)	1	(12)	0	V.

Three thinner transverse vessels between thicker ones. Parastigmatic vessels present. Five to seven elongate stigmata in a mesh, they may be 10 in meshes along the endostyle. Tentacles ca. 30 including large and small ones, branches in 3 orders. Ciliated groove U-shaped with terminals curled in. Edge of dorsal lamina plain.

Alimentary system: Intestinal loop very narrow. Liver yellowish white. Anus attached to the dorsal edge of the branchial sac, its margin plain.

Gonad: The right gonad consists of one oval mass and the left one consists of two masses, the dorsal one of which is situated dorsal to the dorsal branch of the intestinal loop, while the ventral one is in the loop.

Remarks: It is certain that the present specimen does not represent a young individual of *Microcosmus hartmeyeri* OKA, because the former has more tentacles, ca. 30 instead of 14-30 (usually ca. 15) in the latter, and the U-shaped ciliated groove opened anteriorly instead of C-shaped one opened toward the right in the latter.

16. *Eugyrioides glutinans* (MOELLER), 1842

(Figs. 15-16)

Eugyra (*Eugyrioides*) *asamusi*—TOKIOKA (1949): Publ. Seto Mar. Biol. Lab. Vol. 1, pp. 12—13.

Eugyra sp.—TOKIOKA (1951): Publ. Seto Mar. Biol. Lab., Vol. 1, No. 4, p. 182, Pl. XI fig. 7.

Eugyrioides glutinans—TOKIOKA (1953): Ascidians of Sagami Bay, pp. 291-293, Pl. LXXVII figs. 7-9.

A 19 mm long, nearly globular, individual was dissected for descriptions. Branchial aperture 6-lobed. Test soft cartilaginous, transparent and thicker on the left side than on the right side. The surface is covered with hairy processes which carry mud or fine sand grains. Mantle contains sparsely small spherical bodies, 50-70 μ in diameter and consisting of many delicate crystalline substances arranged radially, which are not calcareous, because they are insoluble in acid. Six inner longitudinal vessels on each side of the branchial sac. The dorsal-most vessel is divided into 3 branches on the left side and into 2 branches on the right. The formation of infundibula is more conspicuous in the ventral half than

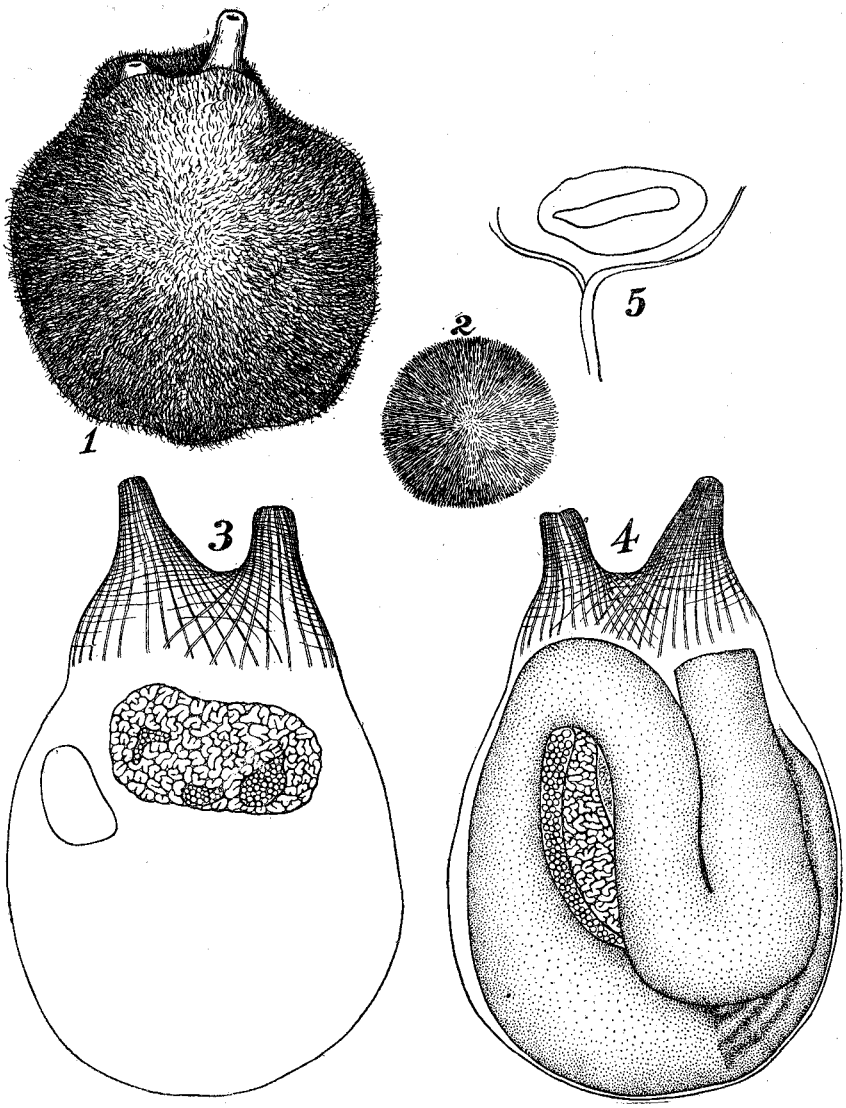

Fig. 15. *Eugyrioides glutinans* (MOELLER). 19 mm long individual. 1—Entire animal from left side, 2—Spherical body in mantle, ×440; 3—Mantle body from right side, 4—Mantle body from left side, 5—Dorsal tubercle, magnified.

in the dorsal half of the sac. Each infundibulum consists of two stigmata coiling 7–8 times. About 10 large tentacles, branches in 3 orders. Ciliated groove a short transverse slit. The second intestinal loop narrow, its axis passes the pyloric end of the gastric portion. Oesophagus opens to the branchial sac slightly in front of the middle of the body. The right side of the gastric portion

is plicated conspicuously and forms a yellowish hepatic region. Anus plainly margined. The right gonad rather massive, testis occupies the side of attachment and the ovary situated on the free surface.

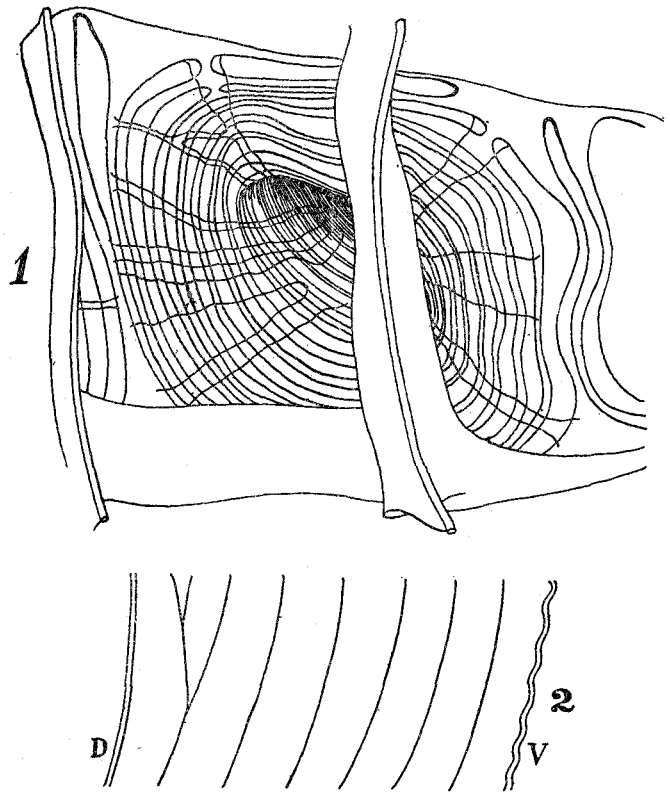

Fig. 16. *Eugyrioides glutinans* (MOELLER). 1—An infundibulum from inside, ×33; 2—Schema of inner longitudiual vessels on the left side.

Remarks: The differences found between the present large specimen and those described previously are considered as individual variations and of no specific importance.