CONTRIBUTIONS TO JAPANESE ASCIDIAN FAUNA

XVII. ASCIDIANS FOUND IN THE BENTHONIC SAMPLES DREDGED IN THE ARIAKE SEA 1957–58[1]

TAKASI TOKIOKA

Seto Marine Biological Laboratory, Sirahama

With Plates XXVI–XXX and 2 Text-figures

The Ariake Sea is a large embayment located on the western coast of Kyûsyû Island, Japan and being embraced by Simabara Peninsula on the western side, separated by Amakusa Island from the open sea on the south-western side and continued southward to the Yatusiro Sea where many islets are scattered. In 1957–58, several series of dredgings were made by the Hama Experimental Station of the Seikai Regional Fisheries Research Laboratory for the purpose to survey the benthonic communities of the Sea and the ascidian specimens found in that collection were submitted to my examination. There are 13 forms in all, which belong mostly to the simple ascidians, excepting two forms respectively belonging to the social and compound ascidians. They are: —

1. *Synoicum tukusii* n. sp.
2. *Perophora* sp.
3. ? *Ascidia ahodori* OKA
4. *Rhodosoma turcicum* (SAVIGNY)
5. *Polycarpa döderleini* var. *siranuhi* nov.
6. ? *Cnemidocarpa* sp.
7. *Styela plicata* (LESUEUR)
8. *Styela partita* (STIMPSON)
9. *Pyura vittata* (STIMPSON)
10. *Pyura lepidoderma* TOKIOKA
11. *Microcosmus multitentaculatus* TOKIOKA
12. *Boltenia echinata* (LINNAEUS) f. *iburi* (OKA)
13. *Boltenia transversaria* (SLUITER)

Of these, a form belonging to the genus *Synoicum* seems to be new to science, a form belonging to the genus *Polycarpa* seems to represent a new variety of *P. döderleini* HARTMEYER, and the record of the last *B. transversaria* (SLUITER) is new to Japanese ascidian fauna. Among the 13 samples dealt with here, the sample came from St. 65 contained the following seven species.

1) Contributions from the Seto Marine Biological Laboratory, No. 351.

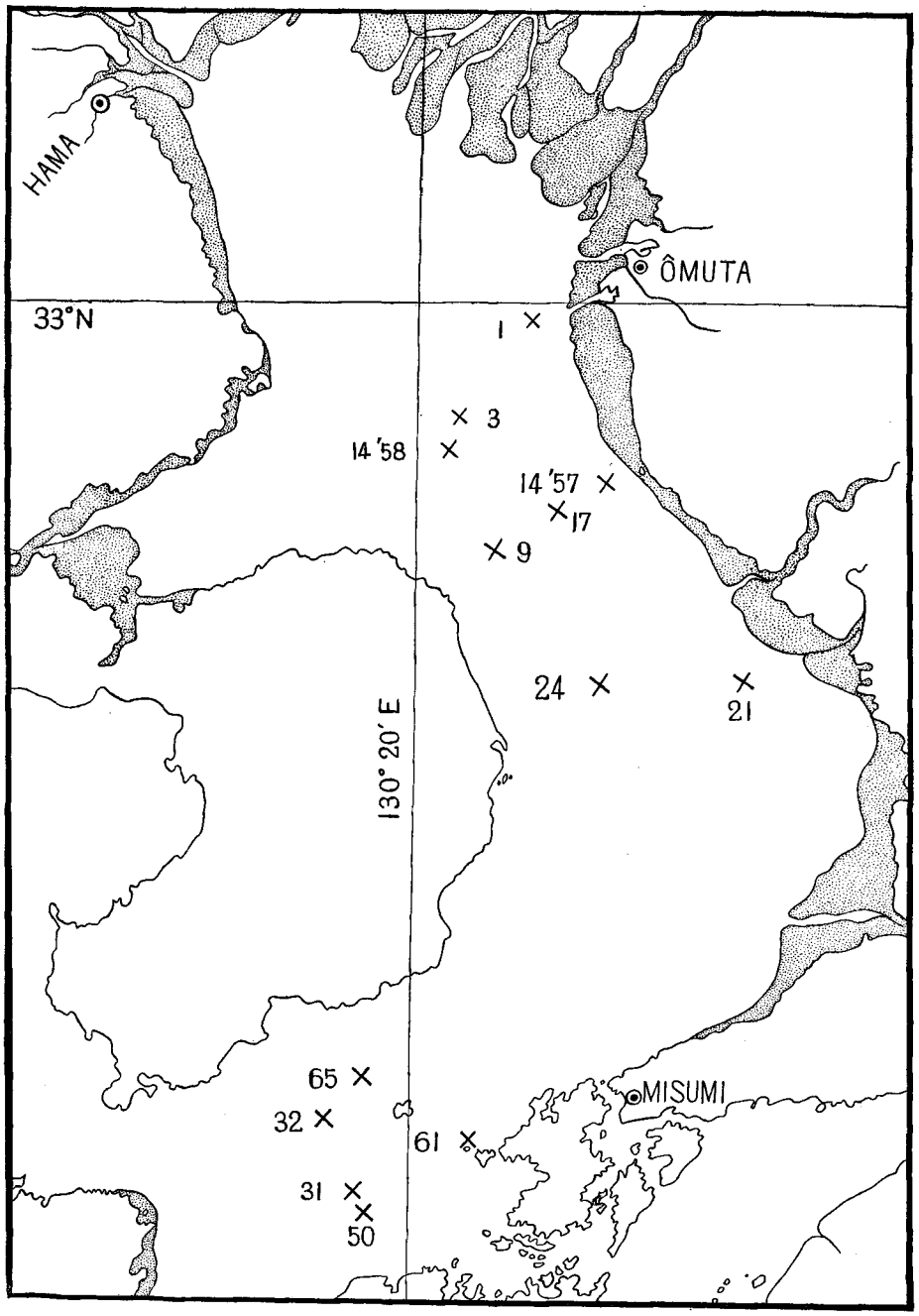


Fig. 1. Map of the Ariake Sea, showing the stations where ascidians were collected.

Synoicum tukusii
Perophora sp.
? *Cnemidocarpa* sp.
Slyela partita
Pyura vittata
Microcosmus multitentaculatus
Boltenia transversaria

Of these, ? *Cnemidocarpa*, *Pyura* and *Boltenia* resemble one another so closely in their external appearance that at first it was quite impossible to separate them from one another. They are all encrusted heavily and nearly of the same size. After dissecting them, their external appearance was examined again very carefully and it was found that the three species could be separated by the following characteristics.

1. Test with purplish tint
   a···purplish tint over the whole body ·····*B. transversaria*
   b···purplish tint confined to the areas around the apertures
   ····· ? *Cnemidocarpa* sp.
2. Test without purplish tint·····*P. vittata*

This reminds us of OKA's paper treating the mimetism observed among *Molgula hartmeyeri* OKA, *Cynthia snaboja* OKA and *Ascidia dolosa* OKA.*

Before going further, I want to express my hearty thanks to Mr. H. IKESUÉ, chief of the Hama Experimental station of the Seikai Regional Fisheries Research Laboratory, who gave me generously a chance to examine the present material.

1. *Synoicum tukusii* n. sp.

(Pl. XXVI, figs. 1–4)

A single colony in the material. It is elongate, 23 mm long, 7 mm wide and attains 7 mm in height at the thickest portion. It consists of three groups of zooids, of which two are much smaller than the rest. The test is soft gelatinous on the upper part of cormidia, this word is applied here to the groups of zooids, but tough enough and quite free from the foreign materials on the surface. It is translucent and milky white in colour, the reddish brown zooids being seen through. The common basal portion is, however, hardened slightly and heavily encrusted with fine sand grains over the surface. The underside of the colony shows some yellowish tint. The soft upper surface of the colony is somewhat injured by dredging. So the system of the arrangement of zooids is quite obscure, although on two smaller cormidia, most probably, 6 to 10 zooids are arranged surrounding respective common cloacal apertures.

Zooid: Thorax is about 2 mm in length, abdomen is about half as long as

* OKA, A. (1926): A striking case of mimetism in simple ascidians. Proc. Imp. Acad., 2 (8), pp. 423–425.

thorax and postabdomen is nearly as long as abdomen. Both abdomen and postabdomen are strongly contracted, because a prominent longitudinal muscle band is running through on each side of these portions.

Thorax: Branchial aperture 6-lobed, atrial languet is very prominent and ending in a single tip or furcated distally into 4 prominences. About a dozen longitudinal muscles on each side, several ventral ones of which are rather oblique, besides there are a longitudinal muscle band (fig. 3, *l.m.b.*) along each side of the endostyle and transverse bands (fig. 3, *tr.m.b.*) at the intervals between the stigmatal rows. The latter are laid beneath the longitudinal muscles. Fourteen stigmatal rows are present and about twelve stigmata in each row, a few ventral ones diminish the size towards the endostyle. Anus is bilobed, usually 4 to 5 stigmatal rows are found below the level of the attachment place of the anus. Tentacles ca. 15, dorsal languets are displaced slightly to the left side.

Abdomen: The natural position of the stomach seems to be at the middle of the abdomen. Hind-stomach has a slight depression near the middle. Mid-intestine is constricted off from both of the hind-stomach and the rectum. Especially the distal end of this portion forms a kind of sphinctor (fig. 4 *sph.*). The proximal end of the rectum is swollen, but no coeca are formed there. No gonad is developed yet in the postabdomen. *Loc.*: St. 65.

Remarks: The structure of zooids of this new species resembles somewhat that of *Synoicum clavatum* (OKA), but the latter shows a quite different arrangement of thoracic muscles and has more stigmata in each row. Moreover the shape of the colony differs distinctly between these two forms.

2. *Perophora* sp.

A colony consisting of a number of empty tests was found attached to the basal portion of *Synoicum tukusii*. Loc. St. 65.

3. ?*Ascidia ahodori* OKA

(Pl. XXVI, fig. 5)

A 60 mm long, 31 mm wide and 20 mm thick specimen. Test is cartilaginous, translucent and milky white. It is rather thick, attaining 4 mm in thickness at some posterior portion. The surface is generally smooth, though irregularly grooved by contraction. The branchial siphon is torn out, the atrial aperture is sessile and situated slightly posteriorly to the middle of the body. The right side of the mantle body is wholly covered with muscles, transverse muscles predominate in the anterior half, while the longitudinal ones are prominent in the posterior half. Some patches of reddish pigments are found on the right side. Atrial aperture is furnished with 6 ocelli consisting each of 1-4 orange spots. Tentacles 42.

About 40 longitudinal vessels on each side of the branchial sac and up to 250 transverse vessels. Intermediate papillae absent, plications of the branchial sac are remarkable and up to 4 stigmata are contained in a mesh on each plication. Dorsal lamina is supported by ribs and tips of which are protruded beyond the laminary edge in the area anterior to the opening of the oesophagus, while a series of languets are set along the dorso-median line in the area posterior to the oesophageal opening. The anterior end of the intestinal loop reaches slightly beyond the middle of the range between the bases of both branchial and atrial siphons. The second intestinal loop is deep and its axis passes through near the pyloric end of the voluminous stomach. Gonads fully mature. As the specimen is in a considerably injured state, it is very difficult to make the specific identification decidedly. Most probably, however, this may be a fully grown up individual of *A. ahodori* OKA, because the arrangement of the alimentary organs and the structure of the branchial sac in the present specimen seem to conform to those of OKA's species. Loc. St. 1.

4. *Rhodosoma turcicum* (SAVIGNY)

(Pl. XXVI, fig. 6)

A single 21 mm long specimen from St. 61, having about 8 mm long lid.

5. *Polycarpa döderleini* var. *siranuhi* nov.

(Pl. XXVI, figs. 7–10; Pl. XXVII, figs. 11–15)

Five specimens in the material, two from St. 14 '58 and three respectively from Sts. 24, 32 and 50. They are elongate oval in shape, 32–48 mm long and lying on the sandy bottom with the left side of the body down. The body is usually compressed laterally as shown in the following measurements:

Length (antero-posterior) 48 mm, height (dorso-ventral) 22 mm, lateral thickness 12 mm
Length (antero-posterior) 42 mm, height (dorso-ventral) 18 mm, lateral thickness 9.5 mm

The 42 mm long specimen from St. 24 is, however, ellipsoidal in shape and shows the section round and with a 20 mm diameter near the middle of the body. The branchial aperture subterminal, the atrial is 10–14 mm apart from the branchial in 42–48 mm long individuals. Each aperture opens on the tip of low prominences. The posterior part of the body is narrowed slightly in some specimens (fig. 7). The whole body is densely encrusted with fine sand grains. Some of the specimens have a few small tufts of short rooty filaments along the margin of the body on the sagittal plane. The test itself is translucent, but it is impregnated with sand grains and becomes somewhat brittle; the thickness is less than 1 mm. The mantle varies remarkably in thickness according to the degree of contraction.

It is usually coloured grayish yellow green, the apertures are fringed by orange colouration. Many endocarps on the inner surface of the mantle. The margin of the atrial velum is furnished with atrial tentacles.

Branchial sac: Four plications on the left and three on the right side. The first (dorsal-most) fold on the left side is placed just beside the dorsal lamina. Intermediate inner longitudinal vessels are very numerous, especially the first (dorsal-most) intermediate area on the right side is provided with very abundant vessels.

42 mm long individual;

Left	D.	0	(23)	14	(30)	16	(22)	15	(17)	21 V.
Right	D.	41	(30)	15	(30)	13	(28)	16	V.	

48 mm long individual;

Left	D.	0	(26)	18	(36)	16	(37)	15	(28)	21 V.
Right	D.	42+	(40)	20	(29)	20	(28)	24	V.	

Transverse vessels are arranged as ··· 1 3 2 3 2 3 2 3 1 ··· or ··· 1 2 1 ···, where the numerals show the orders of vessels' thickness. Parastigmatic vessels regularly intervene between the vessels. Two to three stigmata in a mesh. Tentacles 38 to 61 including both large and small ones, they are not always proportional to the body size. The dorsal tubercle (figs. 9–10) is divided into a number of small ones, each containing a longitudinal or U-shaped ciliated groove; they are 11–26 in examined specimens.

32 mm	long	individual	15 pieces
38	”	”	17
42	”	”	11
42	”	”	12
48	”	”	26

Alimentary system: The alimentary canal is nearly straight along the whole length (fig. 15) or the stomach may be situated at some angles to the intestine (fig. 11). The stomach is very small and longitudinally plicated, plications on the right free surface are 8–10. The anal margin is cut into 13–20 lobes, some of them are subdivided into a few lobules.

Gonad: Many ellipsoidal gonads are arranged in a single row along each side of the endostyle. They are:

32 mm	long	individual	left 11	right 29
38	”	”	33	34
42	”	”	21	29
42	”	”	19	22
48	”	”	24	37

Longer ones attain 7 mm in length and some gonads may be branched, testicular

follicles are arranged roughly in two rows on the attachment surface of each gonad.

Remarks: The present specimens resemble very closely *Polycarpa döderleini* HARTMEYER 1906 from the 100–200 m deep of Sagami Bay. In *P. döderleini*, the ciliated groove is divided into ca. 5 pieces in specimens up to 46 mm in length and the branchial folds are four on each side. These folds are very low, each including at least 20 inner longitudinal vessels and separated by intermediate areas furnished respectively with more than 12 longitudinal vessels; two stigmata are found in a mesh. Fewness of the divided pieces of the dorsal tubercle and the existence of four folds on each side of the branchial sac are characteristics of the HARTMEYER's species in contrast with the abundance of the divided pieces of the dorsal tubercle and the existence of four folds on the left and three ones on the right side of the branchial sac in the present specimens. In spite of the existence of such distinctions, the resemblance of the general structure between the present specimens and HARTMEYER's species is so close that it seems unnatural to treat the former as a distinct species differing from the latter. Rather the former may be treated as a variety of the latter.

P. procera (SLUITER) and *P. tinctor* (QUOY & GAIMARD) known from the southern seas resemble closely the present specimens, too. They are encrusted on the body surface, with nearly straight alimentary canal and provided with a number of elliptical gonads arranged in a row along each side of the endostyle. However, these species have the ciliated groove fundamentally U-shaped, and the former has four plications on the right and three ones on the left side of the branchial sac (HARTMEYER, 1919) and the latter with four well-marked folds on each side. These characteristics are considered to be significant enough to separate those southern species distinctly from HARTMEYER's species and its new variety.

6. ? *Cnemidocarpa* sp.

(Pl. XXVII, figs. 16–20)

A single 11 mm long specimen found in the sample from St. 65. The animal is attached to the substratum by the ventral side, both apertures are situated on the dorsal side. The test is soft leathery, of a considerable thickness, irregularly grooved and incrusted with fine sand grains over the surface. It is translucent, milky white and with a purplish tint around the apertures. The mantle body is mutilated so much that the internal structure cannot be studied perfectly. The alimentary canal is completely torn out leaving a short distal portion of the rectum. The anal margin is undulating and cut into seven indistinct lobes. There are endocarps on the inner surface of the mantle. Atrial tentacles are very fine and set rather sparsely. Three gonads remain on the left and 6 ones on the right

side, besides another one found quite detached from the mantle surface. They are elongate, up to 3.5 mm in length, and contain testicular follicles arranged roughly in two rows on the attachment surface. The ciliated groove C-shaped, opened towards the left anterior side. Tentacles ca. 20, larger and smaller ones alternate regularly, some of them are found branched as shown in fig. 18. The arrangement of inner longitudinal vessels found on the piece of the branchial sac is D 1 (13) 2 (9) 2 (11) 3 (11) 2 V on the left side. Transverse vessels are arranged as···thick thin thick thin···, sometimes thinner ones are replaced by parastigmatic vessels. About five stigmata in a mesh, they may be up to 9 in meshes along the endostyle. Evidently this is a styelid and the arrangement of elongate gonads alludes that this may belong to the genus *Cnemidocarpa*. Very probably this is a mutilated specimen of *C. fertilis* (HARTMEYER) or *C. macrogastra* (OKA).

7. *Styela plicata* (LESUEUR)

(Pl. XXVIII, figs. 21–22)

A 22 mm long individual attached to the shell fragment of *Pinna* by the whole left side. The test is soft leathery, translucent and milky white in colour, the surface is divided into a number of small areas by irregularly formed grooves. Endocarps are comparatively large. Fine atrial tentacles are found along the atrial velum. Ciliated groove is ∪-shaped. Tentacles ca. 50, arranged in the order of···large small medium small large···or partly···large small large···. Inner longitudinal vessels of the branchial sac are arranged as: ···

Left	D.	4	(11)	6	(9)	5	(11)	5	(8)	3 V.
Right	D.	6	(10)	7	(10)	6	(10)	7	(8)	4 V.

Transverse vessels are arranged as···thick thin medium thin thick···, parastigmatic vessels present; about five stigmata in a mesh, they may be up to 10 in meshes along the endostyle. Two gonads on the left and five on the right side, they are all fully mature. Besides this specimen came from St. 21, a small 12 mm long, rather mutilated specimen was found in the sample from St. 61. The animal is attached to the substratum by the left side. The test is rather gelatinous, translucent and milky white in colour, and nearly smooth on the surface. The branchial aperture is nearly terminal and the atrial is situated in front of the middle of the body. Endocarps present, atrial tentacles are very fine. Four larger and the same number of smaller tentacles are present. Ciliated groove ∪-shaped, dorsal lamina is a plain membrane, and four plications on each side of the branchial sac. No gonad is developed yet. It is possible that this represents a young individual of *S. plicata* or *Cnemidocarpa* sp., probably *C. fertilis*. As the minor forms of *C. fertilis* attains the full maturity at the body length less than 10 mm, this 12 mm long and still immature specimen is considered reasonably to belong

to *S. plicata*. *C. areolata* (HELLER) can be left out of consideration, because it has much stouter atrial tentacles.

8. *Styela partita* (STIMPSON)

(Pl. XXVIII, figs. 23–26)

A 15 mm long individual from St. 65. It is attached to the substratum by the left posterior side. The test is leathery and yellowish brown. The neighbourhood of respective apertures is coloured dark brown and wrinkled irregularly, while other parts assume a scaly appearance. At a glance of this feature, I thought at first this specimen might belong to *Pyura lepidoderma* TOKIOKA, but closer examination revealed that this scaly appearance was caused by a number of small barnacles attached to the surface. The mantle is of a moderate thickness and light yellowish brown in colour. Endocarps are very numerous and widely distributed, atrial tentacles are very fine and set very densely. Inner longitudinal vessels of the branchial sac are arranged as:

Left	D.	2	(9)	4	(13)	2	(12)	3	(15)	1 V.
Right	D.	6	(14)	3	(15)	3	(13)	4	(6)	2 V.

Transverse vessels and parastigmatic vessels alternate regularly. Four to seven very elongate stigmata in a mesh. Tentacles 35, arranged roughly in the order of···large small large···. Ciliated groove is U-shaped. The arrangement of alimentary organs resembles that found in the preceding species. Stomach is elongate and with about 15 plications on the right side and a small coecum at the inner pyloric corner. The second intestinal loop is very deep, its axis passing through the middle of the stomach. The anus is cut into 11 lobules. Several endocarps of the usual size are found in the first intestinal loop. A pair of elongate gonads on each side. Testicular follicles surround the posterior two thirds or more of the ovaries.

9. *Pyura vittata* (STIMPSON)

(Pl. XXVIII, figs. 27–34; Pl. XXIX, figs. 35–37)

A single 13 mm long individual (fig. 27) from St. 17 and five, 9–21 mm long, specimens from St. 65 (figs. 31 and 33). The specimen from St. 17 is ovoid in shape, attached to the substratum by the left side, and quite free from any foreign matters on the body surface; while the specimens from St. 65 are attached by the posterior side and most parts of the body excluding the neighbourhood of both apertures are densely incrusted with fine sand grains. Both apertures are nearly sessile on the specimen from St. 17, but opened at the tip of short siphons in specimens from St. 65. The test is leathery, dark yellowish brown or grayish

brown in colour and wrinkled on the surface. The inner surface is whitish. It is rather thick in the speciment from St. 17 except for the attachment place, while it is relatively thin, less than 1 mm, in specimens from St. 65. The mantle is of a moderate thickness, pale brownish, brownish orange or reddish brown in colour. Siphons are indistinct in the specimen from St. 17, but very distinct in the specimens from St. 65.

Branchial sac: Six folds on each side. Inner longitudinal vessels are arranged as:

13 mm long individual from St. 17;

Left	D.	0	(14)	1	(13)	2	(14)	3	(10)	3	?			V.
Right	D.	0	(11)	1	(12)	3	(12)	5	(11)	3	(9)	2	(8)	1 V.

21 mm long individual from St. 65;

Left	D.	2	(19)	2	(16)	2	(21)	2	(16)	3	(15)	3	(7)	2 V.
Right	D.	2	(20)	2	(17)	2	(21)	2	(16)	2	(13)	3	(9)	2 V.

Transverse vessels are arranged in the order of···thick thin medium thin thick··· or thick thin thin thin thick···, parastigmatic vessels are found regularly. Up to 5 stigmata in a mesh in the specimen from St. 17, while they are up to 6–7 in a specimen from St. 65. Tentacles are up to 13 in the specimen from St. 17 when smaller ones are counted together; but they attain 19 in a specimen from St. 65, in which one to three tentacles of the smaller ~medium sizes intervene between larger ones, besides minute ones at some intervals. Branches in 2 orders; those of the second order are very fine and finger-shaped, they are practically absent in smaller specimens from St. 65. Ciliated groove is U-shaped.

Alimentary system: The gastric region is provided with 3–4 hepatic lobes. The intestinal loop is very wide and the second intestinal loop is quite indistinct in the specimen from St. 17, while the second loop is considerably deep in specimens from St. 65. It is evident that the appearance of the alimentary canal varies considerably according to the shape of the specimen and also to the degree of contraction of respective specimens. The anus is plainly margined or the margin may be cut into several indistinct lobes (fig. 37).

Gonad: Gonads are fully mature even in the smallest 9 mm long specimen. Genital capsules are 9–17 on the left and 13–22 on the right side. Testicular follicles occupy the distal portion of the free surface of each capsule.

Remarks: The arrangement of the alimentary canal of the 13 mm long specimen from St. 17 reminds us of those of *Pyura subuculata* (SLUITER) and *P. shiinoi* TOKIOKA. These are, however, provided with seven branchial folds on each side and their tentacles are not so stout as those of *P. vittata*, being always quite devoid of the branches of the second order. It is very strange that such small specimens as 9–13 mm in length are already matured fully. The encrusted external appearance also seems rather exceptional for *P. vittata*. It is not impossible that these small incrusted specimens may represent a variety or a special

ecological form of *P. vittata*. However, the ultimate decision is reserved till much more specimens of such a form are collected and examined in detail.

10. *Pyura lepidoderma* TOKIOKA

A single 18 mm long specimen from St. 3. The test is soft leathery, very tough, translucent and milky white in colour.

11. *Microcosmus multitentaculatus* TOKIOKA

(Pl. XXIX, figs. 38–41)

Three specimens in the material, respectively from Sts. 14 '57, 31 and 65. The 27 mm long specimen from St. 14. '57 is attached to the substratum by the right posterior side of the body; the test is leathery, light reddish brown and irregularly grooved over the surface, but quite free from the foreign materials. The 15 mm long specimen from St. 65 and 18 mm long one from St. 31 are attached by the left or the left ventral side; the test is soft leathery, pinkish or light brownish in colour, marked with irregularly formed grooves on the surface and encrusted on the ventral half of the body. The test is always pretty thick and attains 3 mm in thickness at some basal portions; the inner surface is pale rosy. The branchial aperture is terminal and the atrial is situated near the middle of the dorsal side slightly posteriorly to the middle. Both apertures are opened on the tip of low prominences and surrounded by irregularly formed folds. The mantle is of a considerable thickness and pale yellowish brown in colour. Endocarps are very scarce, only six small ones are found on the left side of the specimen from St. 14 '57. Tentacles are 25 in the 18 mm long specimen, larger and smaller ones alternate regularly; while in the 27 mm long larger specimen ones attain 12, being intervened with smaller and minute ones. Branches of tentacles in three orders. Ciliated groove is ∪-shaped, opened anteriorly (fig. 41) in two smaller specimens or very slightly inclined to the right side (fig. 40). Inner longitudinal vessels of the branchial sac are arranged as:

27 mm long individual;

Left D. 3 (18) 2 (19) 2 (19) 2 (16) 2 (14) 2 (11) 2 (5) 0 V.
Right D. 2 (18) 1 (18) 2 (19) 2 (17) 2 (15) 2 (15) 2 (10) 0 V.

The VIIth fold on the left side disappears in the posterior portion. Transverse vessels are arranged in the order of 1 4 3 4 2 4 3 4 1, where the numerals indicate the orders of the thickness; parastigmatic vessels are present. About five stigmata in a mesh. In the 27 mm long specimen, the liver consists of three lobes, the two anterior ones of which are constituted of lobules without papillae, while the other posterior one is made of lobules furnished with many papillae. The anus

is plainly margined. Gonads are fully mature in all specimens. Testicular follicles are very small and spread over the attachment side of the gonad; on the left side, however, they extend widely beyond the margin of the ovary which is situated on the dorsal side of the intestinal loop, covering the whole intestinal loop and moreover attaining nearly the endostyle (fig. 38).

12. *Boltenia echinata* f. *iburi* (OKA), 1934

(Pl. XXIX, figs. 42–43; Pl. XXX, figs. 45–47)

Cynthia iburi—OKA, A. (1934): Ueber *Cynthia iburi* n. sp., eine *Cynthia*-Art mit quergerichteten Kiemenspalten. Proc. Imp. Acad., X (10), pp. 695–697, figs. A and B.

OKA, A. (1935): Report of the Biological Survey of Mutsu Bay. 28 Ascidiae Simplices. Sci. Rep. Tôhoku Imp. Univ. Biol., Vol. X, pp. 440–442, figs. 10–11.

Boltenia echinata—TOKIOKA, T. (1959): Contributions to Japanese Ascidian Fauna. XIII Sporadic memoranda (4). Publ. Seto Mar. Biol. Lab., VII (2), pp. 232–233, Pl. XVI figs. 32–37.

A 23 mm long specimen from St. 19. The body is somewhat elongate and attached to the substratum by the ventral side, from which a number of stout rooty protuberances are issued. The test is leathery, yellowish brown in colour and about 1 mm in thickness. The inner surface is whitish. The surface is furnished with many irregularly formed grooves and prominences, some of the latter are considered to represent reduced spines characteristic to *B. echinata*. In addition, there are a number of minute spinules all over the body surface, of course including the prominences mentioned above. Apertures are subterminal. The mantle is thick and yellowish in colour, the apertures are coloured orange. A bundle of stout transverse muscles encircles the body outside the regular longitudinal musculature (fig. 42). Eight folds on each side of the branchial sac. Inner longitudinal vessels are arranged as follows:

Left D. 2 (22) 3 (15) 1 (21) 3 (20) 4 (17) 4 (15) 4 (10) 4 (4) 0 V.
Right D. 1 (21) 3 (13) 3 (17) 4 (20) 2 (22) 3 (15) 3 (12) 2 (3) 1 V.

The VIIIth fold is rudimentary on each side and represented by a group of vessels. Three thinner transverse vessels are present between each pair of thicker ones. Ten to twenty stigmata in respective intervals. Tentacles ca. 20, larger and smaller ones alternate regularly; branches in two orders, those of the second order are small and finger-shaped. Ciliated groove is U-shaped, with both horns incurled. Anus is plainly margined. Gonads are fully mature and very voluminous; testicular follicles are spread on the attachment side of the gonad. A very prominent elongate vesicle is found along the ventral side of the right gonad. Spines on the body surface are more reduced than in the specimen from Wakasa Bay (TOKIOKA, 1959). It is evident that the present specimen and the specimen from Wakasa Bay are quite identical with *Cynthia iburi* OKA known from the

district of Iburi of Hokkaidô Island and Mutu Bay situated at the northernmost part of Honsyû, Japan. As it is known that the spinous processes of *B. echinata* are better developed in Arctic specimens than in those from the southern parts of its distributional range and that a great diversity is found in the size and number of the spinous processes of *Halocynthia hilgendorfi* (TRAUSTEDT), it is very probable that the above-mentioned specimens armed with very short spinous processes may represent a special ecological form of *B. echinata* rather than they represent a distinct species, as mentioned already in my previous paper dealing with the specimen from Wakasa Bay.

13. *Boltenia transversaria* (SLUITER), 1904

(Pl. XXIX, fig. 44; Pl. XXX, figs. 48–52; Text-fig. 2)

Halocynthia transversaria—SLUITER, C. PH. (1904): Siboga-Exped. Monogr. 56 a, pp. 48–49, Taf. XI figs. 1–4.

Three specimens in the sample from St. 65. They are respectively 11, 12 and 14 mm in length. The animals are attached to the substratum by the ventral side. The test is leathery, of a considerable thickness, with a purplish tint and heavily

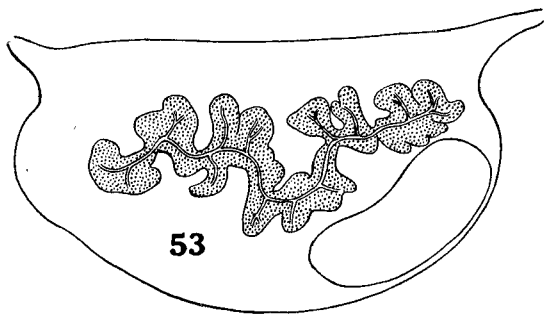


Fig. 2. *Boltenia transversaria* (SLUITER) Right half of the mantle body of the 12 mm long specimen, inner side.

encrusted with fine sand grains over the surface excepting the regions surrounding the apertures which are subterminal, nearly sessile and tinted deeply. The mantle is of a moderate thickness, brownish orange in colour and with a well-developed musculature consisting of longitudinal muscles (outside) converging on the apertures and transverse ones (inside), these muscles are crossing one another to form neatly arranged meshes. Both siphons are rather prominent on the mantle body; they are deep orange in colour, especially their inner wall is coloured deep crimson. There is a reniform vesicle near the postero-ventral corner on the right inner surface of the mantle body.

Branchial sac: Six folds on each side. Inner longitudinal vessels are arranged as:

12 mm long specimen—

Left	D.	0	(13)	2	(9)	3	(12)	2	(13)	1	(8)	1	(5)	1	V.
Right	D	2	(9)	2	(12)	2	(13)	3	(9)	4	(10)	3	(5)	2	V.

14 mm long specimen—

Left	D.	2	(16)	1	(16)	3	(15)	3	(15)	2	(12)	3	(5)	1	V.
Right	D.	2	(12)	3	(16)	1	(16)	3	(14)	3	(13)	3	(11)	1	V.

Fifteen to twenty-five stigmata between transverse vessels. Tentacles 16 in the 14 mm long specimen, including larger and smaller ones; branches in 2 orders, those of the second order are practically absent in smaller specimens. Ciliated groove is a longitudinal slit.

Alimentary system: Intestinal loop is very narrow and the gastric region furnished with the liver is very short. The anal margin is plain.

Gonad: One gonad on each side. The left gonad is situated along the dorsal side of the distal branch of the intestinal loop instead of being located in the loop. The 14 mm long specimen is quite devoid of the right gonad, this is probably a very unusual case.

Remarks: This is the first record of this rare species from the Japanese waters.

EXPLANATION OF PLATES XXVI–XXX

PLATE XXVI

Figs. 1–4 *Synoicum tukusii* n. sp.
1···Colony, enlarged.
2···Right side of a zooid, enlarged.
3···A part of the thorax, showing the arrangement of various muscles, enlarged. ed.···endostyle, l.m.···longitudinal muscle, l.m.b.···longitudinal muscle band, tr.m.b.···transverse muscle band.
4···Alimentary canal, enlarged. h.st.···hind stomach, m.int.···mid-intestine, r···rectum, sph.···shinctor between the mid-intestine and rectum, st.···stomach

Fig. 5. ? *Ascidia ahodori* OKA. Ciliated groove, enlarged.

Fig. 6. *Rhodosoma turcicum* (SAVIGNY). Ciliated groove, enlarged.

Figs. 7–10. *Polycarpa döderleini* var. *siranuhi* nov.
7···48 mm long specimen.
8···42 mm long specimen.
9···Dorsal tubercle of the 48 mm long specimen, enlarged.
10···Dorsal tubercle of the 42 mm long specimen, enlarged.

PLATE XXVII

Figs. 11–15. *Polycarpa döderleini* var. *siranuhi* nov.
11···Left half of the mantle body of the 48 mm long specimen, inner side.
12···Right half of the mantle body of the same specimen, inner side.
13···Stomach of the same specimen, enlarged.
14···A gonad from the same specimen, attachment surface, enlarged.
15···Left half of the mantle body of the 42 mm long specimen, inner side.

Figs. 16–20. ? *Cnemidocarpa* sp.
16···11 mm long specimen, dorsal side.
17···Ciliated groove, magnified.
18···A branched tentacle, magnified.
19···Left half of the mantle body, inner side.
20···Right half of the mantle body, inner side.

PLATE XXVIII

Figs. 21–22. *Styela plicata* (LESUEUR).
21···Ciliated groove of the 22 mm long specimen, enlarged.
22···Ciliated groove of the 12 mm long specimen, enlarged.
Figs. 23–26. *Styela partita* (STIMPSON).
23···15 mm long specimen. bcl.···a pedunculate barnacle attached near the aperture.
24···Left half of the mantle body, inner side.
25···Right half of the mantle body, inner side.
26···Ciliated groove, enlarged.
Figs. 27–34. *Pyura vittata* (STIMPSON).
27···13 mm long individual from St. 17.
28···Left half of the mantle body, inner side.
29···Right half of the mantle body, inner side.
30···Ciliated groove of the same specimen, enlarged.
31···12 mm long individual from St. 65.
32···Ciliated groove of the 11 mm long specimen from St. 65, enlarged.
33···21 mm long individual from St. 65.
34···Ciliated groove of the same specimen, enlarged.

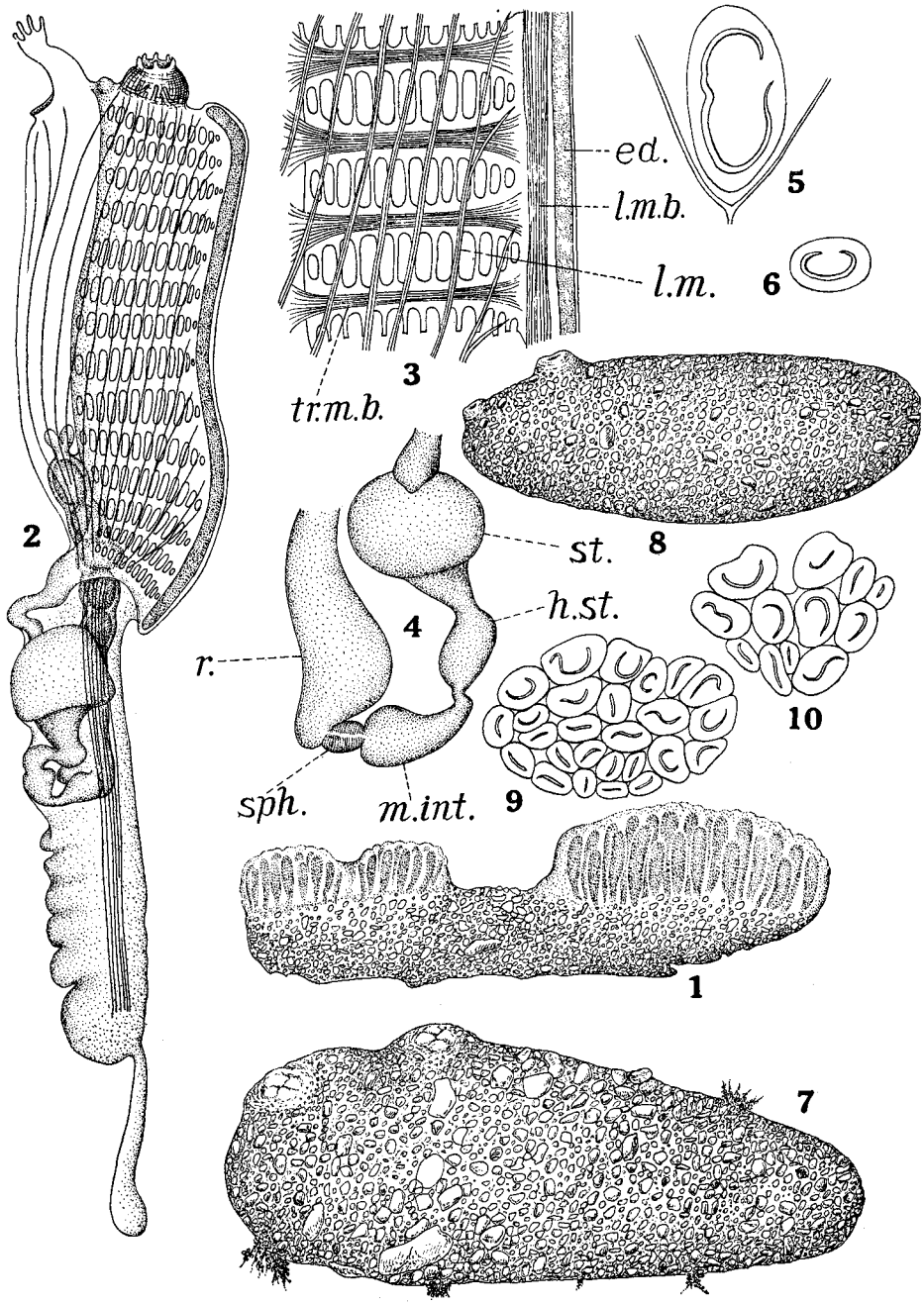
PLATE XXIX

Figs. 35–37. *Pyura vittata* (STIMPSON).
35···Left half of the mantle body of the 21 mm long individual, inner side.
36···Right half of the mantle body, inner side.
37···Anus of the same specimen, enlarged.
Figs. 38–41. *Microcosmus multitentaculatus* TOKIOKA.
38···Left half of the mantle body of the 27 mm long individual from St. 14 '57, inner side. ov.···ovary, tes.···testis.
39···Right half of the mantle body, inner side. ov.···ovary.
40···Ciliated groove of the same specimen, enlarged.
41···Ciliated groove of the 18 mm long individual from St. 31.
Figs. 42–43. *Boltenia echinata* f. *iburi* (OKA).
42···Mantle body of the 23 mm long specimen.
43···Ciliated groove, enlarged.
Fig. 44. *Boltenia transversaria* (SLUITER). 12 mm long individual.

PLATE XXX

Figs. 45–47. *Boltenia echinata* f. *iburi* (OKA).
45···23 mm long specimen.
46···Left half of the mantle body, inner side.
47···Right half of the mantle body, inner side.

Figs. 48–52. *Boltenia transversaria* (SLUITER).
48···14 mm long individual.
49···Left half of the mantle body of the same specimen, inner side.
50···Right half of the mantle body, inner side.
51···Ciliated groove of the same specimen, enlarged.
52···Left half of the mantle body of the 12 mm long specimen, inner side.



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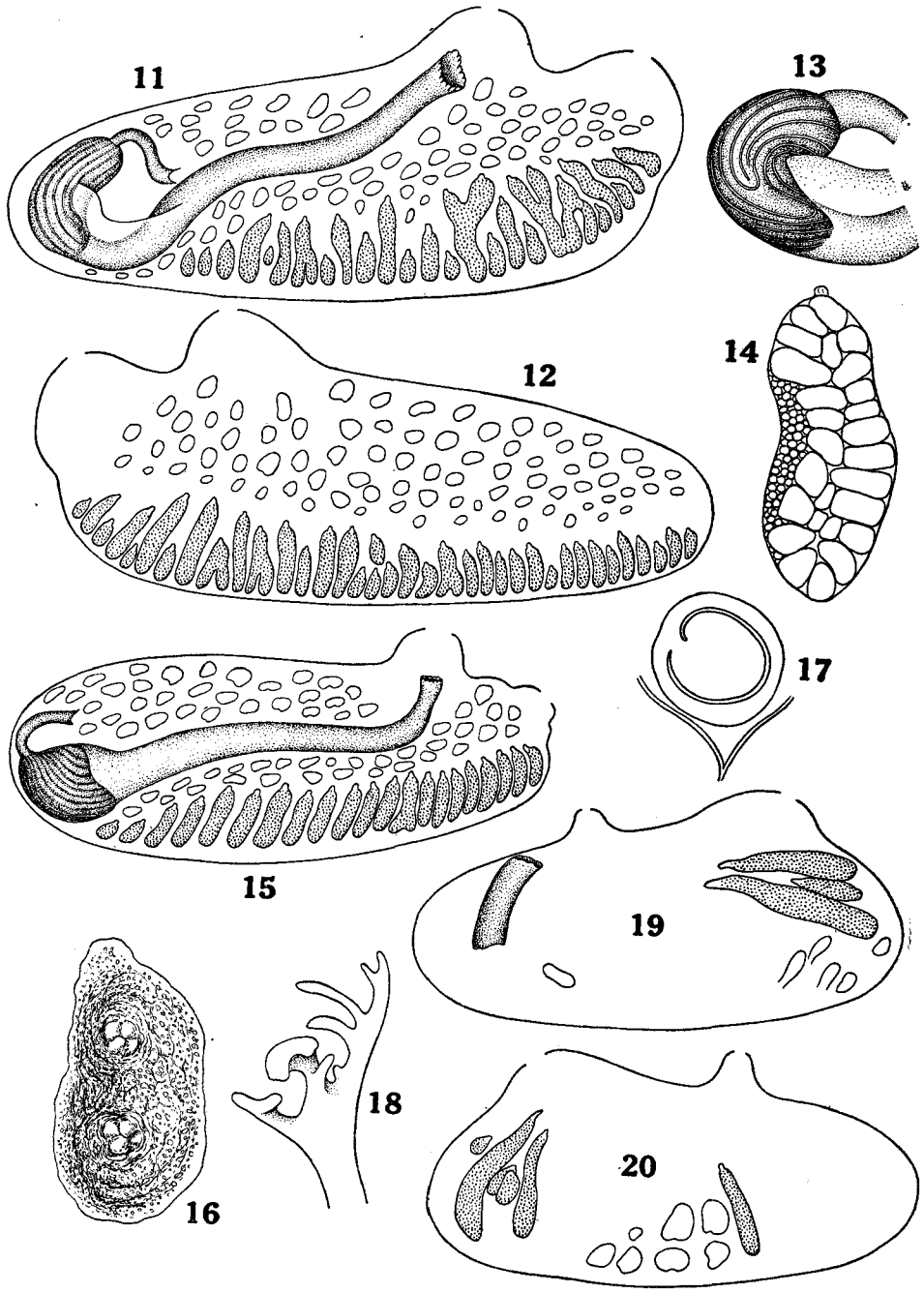

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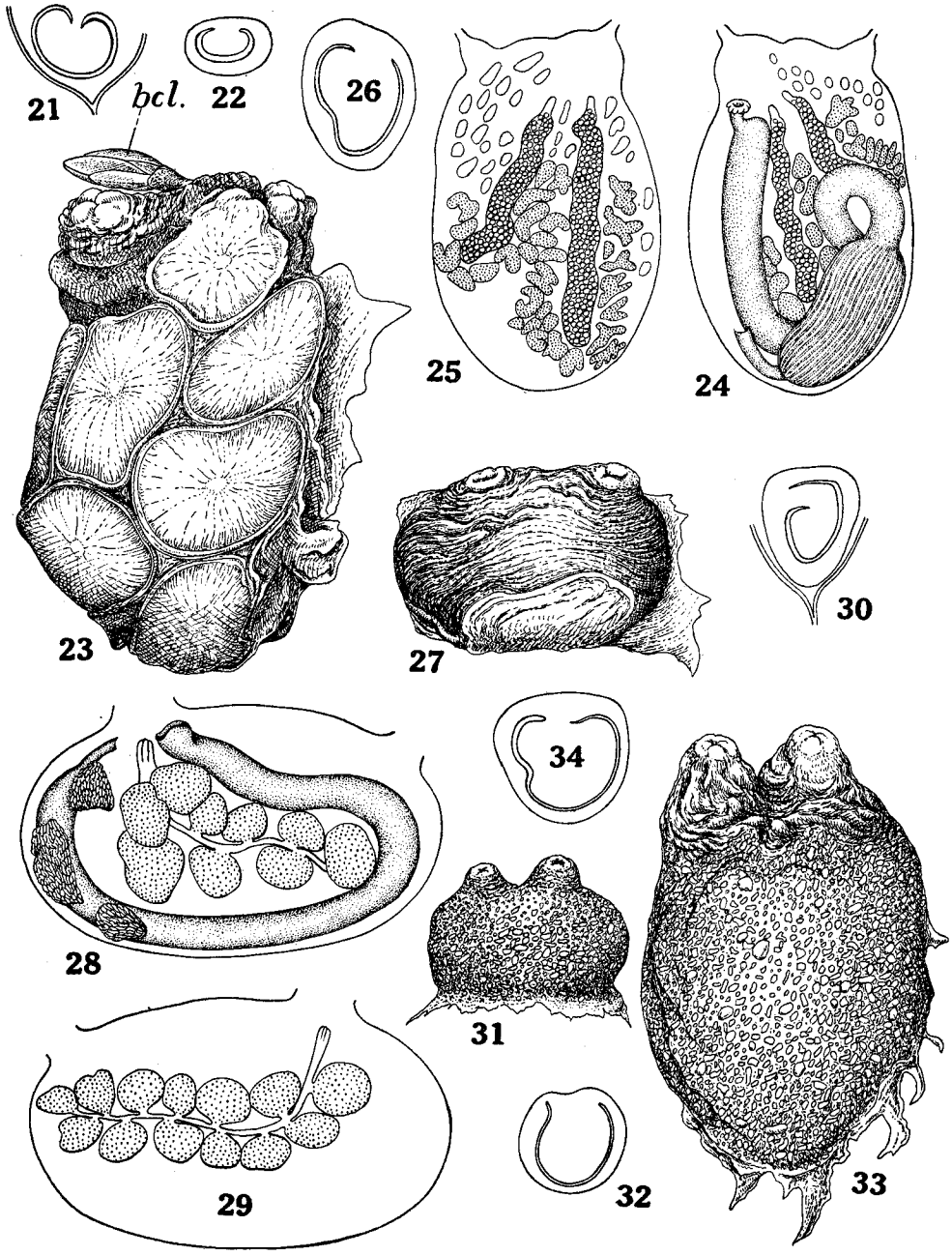

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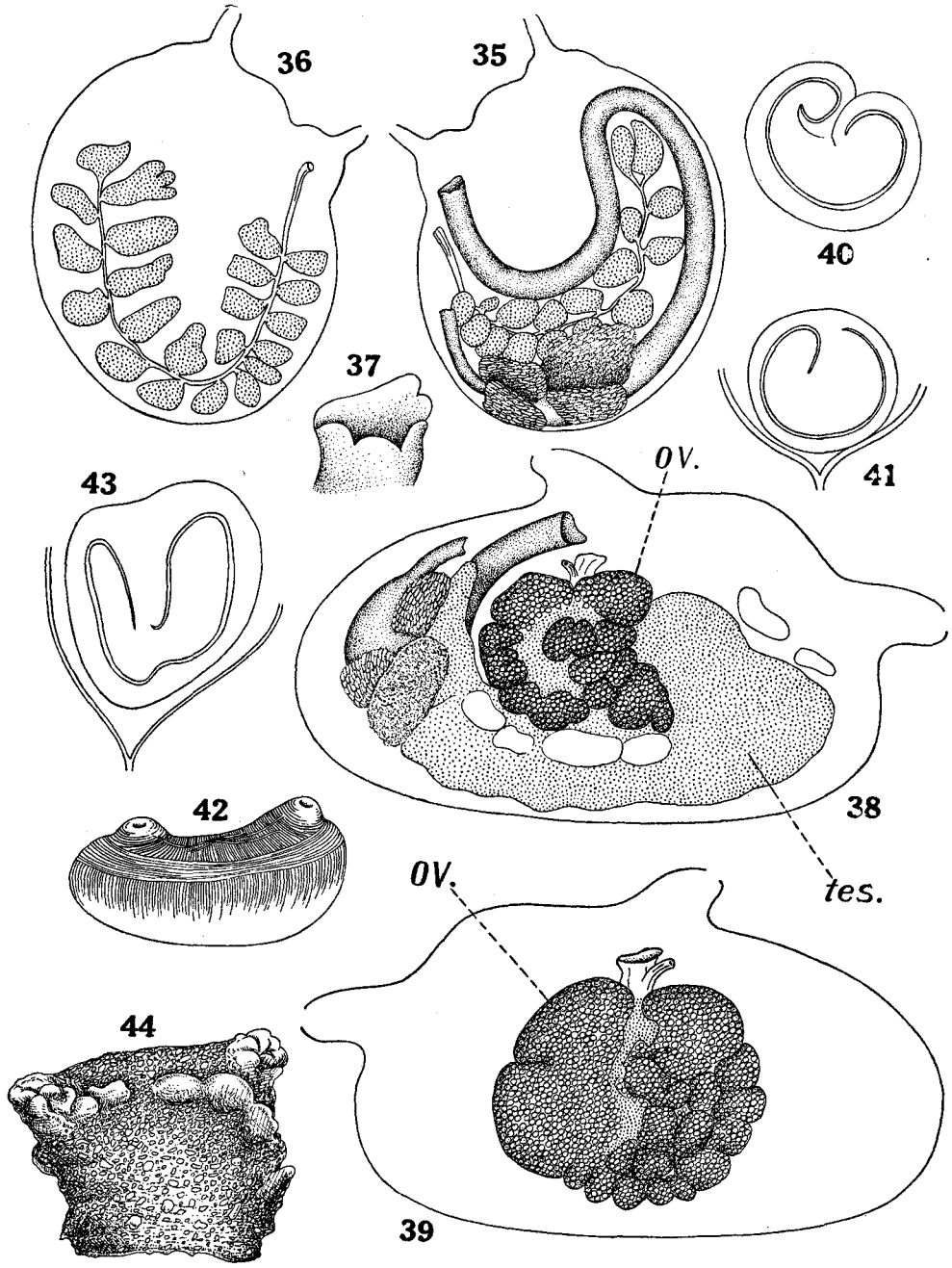

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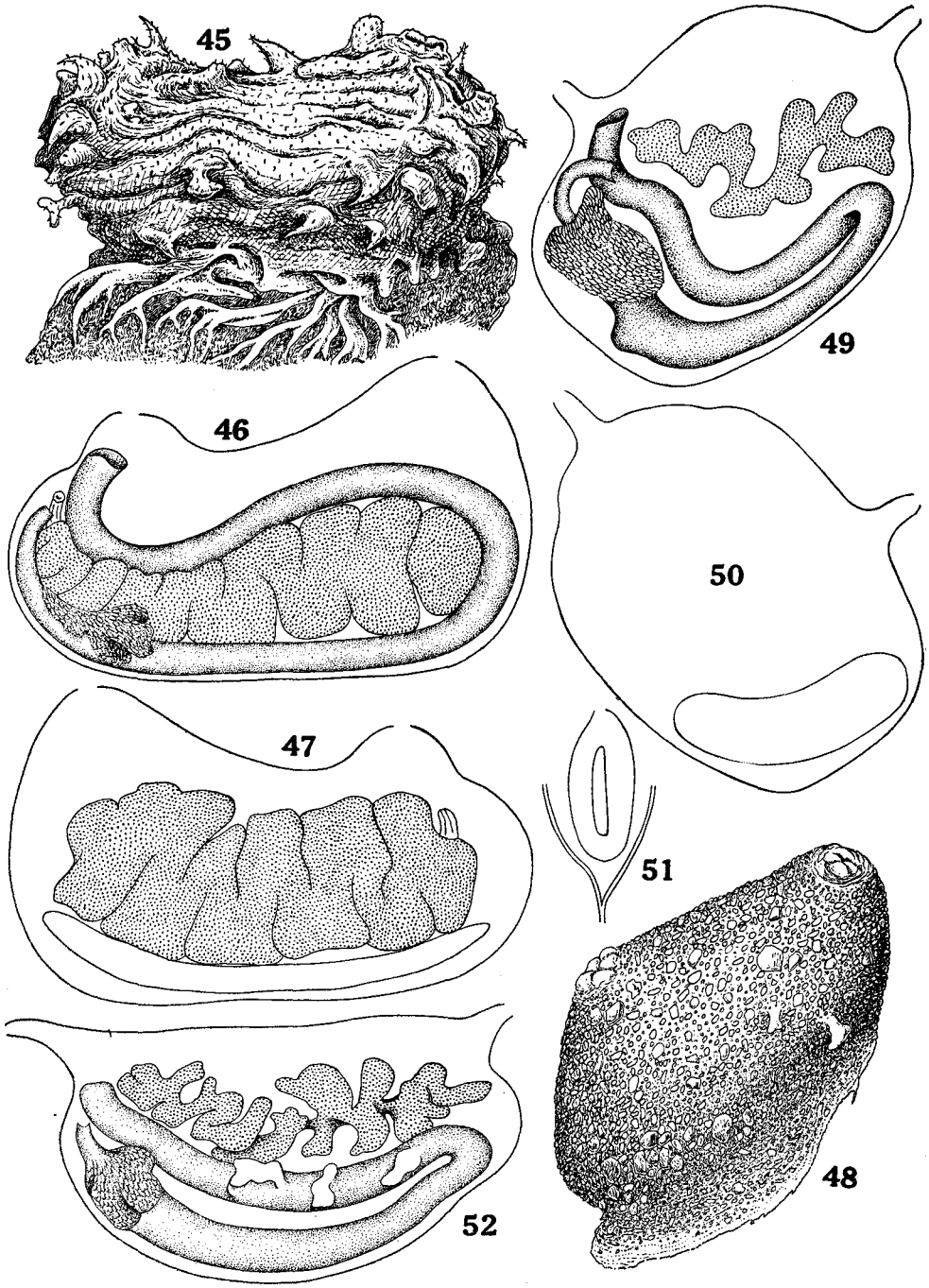

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