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On Ctenophores of the Neighbourhood of Misaki.

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With Plate VII.

During the last two years I have had several opportunities to collect ctenophores in the neighbourhood of the Misaki Marine Station. The sketches and notes taken on those occasions have formed the basis of this report. To supplement my observations I have also examined the preserved materials in custody of the Zoological Institute, Science College, and of the Tokyo Higher Normal School, all which materials were collected chiefly at Misaki and to some extent at Tateyama in Prov. Awa. In all eleven species have come under my observation. The number includes two *Cœloplana* species, of which I have prepared a special report to be published in another journal. The present paper deals with the remaining nine species. The descriptions are based exclusively on my own observation of the specimens at my disposal.

Genus **Hormiphora**, L. Agassiz.

1. ***Hormiphora palmata*** Chun. (Pl. VII, fig. 1.).

Hormiphora palmata, Chun, 1898, p. 17, Pl. iii, figs. 1, 2.——Moser, 1903, p. 11, Bestimmungstabelle.——Bigelow, 1912, p. 381, Pl. i, figs. 1-6.

Lampetia fusiformis, Agassiz and Mayer, 1902, p. 171, Pl. xiii, figs. 59, 60.

Hormiphora fusiformis, Moser, 1903, p. 12, Bestimmungstabelle.——Mayer, 1903, p. 1141, Pl. iii, fig. 12.

Hormiphora japonica, Moser, 1907, p. 450.——Moser, 1908, p. 10, Pl. i, figs. 6-8.

? *Euplokamis californensis*, Torrey, 1904, p. 46.

? *Mertensia ovum*, Torrey, 1904, Pl. i, fig. 1.

The ovoid body is slightly compressed, the tentacular axis being a little longer and the pharyngeal axis slightly shorter than half the vertical axis. In large specimens (length over 30 mm.) the body is relatively more slender. The ribs are of equal length, beginning close to the apical sense-organ and terminating below usually a short distance above the level of the oral end of tentacle-basis. The comb-plates are closely set; in individuals of 20–30 mm. length, they number 40–50 in each rib. The perradial intercostal spaces are about equally wide, and somewhat wider than the interradial intercostal spaces. The pharynx is nearly 2/3 as long as the vertical axis. Adradial canals open into meridional canals slightly above the level of the infundibulum. The meridional canals are all of the same length; they are distinctly longer than the ribs, their oral end nearly reaching the level of the oral end of tentacle-sheaths, or somewhat farther beyond. The tentacle-basis is situated quite close to pharyngeal canals; it is nearly straight or slightly curved and sometimes even double-curved. The tentacle-sheaths open at a level of between 1/2 and 2/3 the distance from infundibulum to apex; very rarely they open nearer the former than the latter. The tentacles are long and are provided only with simple filiform branches. The sexual products develop in the entire length of meridional canals excepting a small part at their oral end.

Colour.—When living, the animal is colourless, only the tentacle-basis being whitish. In preserved specimens, the branches of tentacles are yellowish, due to the presence of colloblasts.

Specimens examined.—At Misaki, during the interval of Dec. 27, 1917 and Jan. 9, 1918, I have examined twelve individuals of 18.5–43 mm. length in the living state. Also the following specimens, all in the preserved state, were at my disposal: One (l. 26 mm.), Misaki, in formalin; three (l. 14.5–30.5 mm.), Misaki, April, 1901, in formalin; six (l. 18–31 mm.), Bonin Islands, Feb.–March, 1894, in alcohol; three (l. 29–43.5 mm.), Tateyama, April, 1909–1912, in formalin.

Some of the specimens which I obtained at Misaki in the winter

of 1917, contain a number of Cercariæ in the jelly of the body. The Cercariæ, apparently all of the same species, are provided with a pair of eye-spots and a tail bearing long setæ.

Remark.—MOSER described the ctenophore in question as a new species under the name of *H. japonica* holding it distinct from the Atlantic *H. palmata*. According to that authoress, the Japanese form should differ from the species just mentioned, chiefly in the length of ribs and meridional canals, and in the configuration of tentacle-basis. It was given by her that in *H. japonica* the ribs are considerably shorter than the meridional canals, which latter stop some distance short of the margin of mouth, and that the tentacle-basis describes a simple curve, so that its middle point, whence issues the stem, is situated farthest away from the pharyngeal vessel. In *H. palmata*, on the other hand, the ribs and meridional canals should be nearly equally long, and both should reach down very close to the mouth; the tentacle-basis should present a double curvature, placing its middle point very close to the pharyngeal vessel. However, BIGELOW found (1912, p. 381), after careful examination of the characters referred to, that these are subject to much variations and do not form decisive differential criterion between the two forms in question. So far as concerns the tentacle-basis, my observations on the Japanese material stand decidedly in agreement with BIGELOW's view, inasmuch as I have found that structure to be sometimes simply curved and at other times doubly curved or to run nearly or quite straight in different individuals. With respect to the length of ribs and meridional canals, the material before me conform to MOSER's account rather than to BIGELOW's, the ribs being very much shorter than the canals and the latter ending distinctly short of the mouth margin. Under the circumstances and in view of the very close agreement in all other respects of structure, I deem it advisable to unite the Japanese and Atlantic forms under one species, though a more extented knowledge than we have at present concerning the latter may possibly necessitate making racial distinction

between the two. The specific identity of the Japanese form with *H. fusiformis* (originally named *Lampetia fusiformis*) of A. AGASSIZ and MAYER, which was described from the Eastern Pacific, seems to be nearly certain, especially since the larger examples of the former tend to be of a relatively more slender shape than the smaller and thus approach the latter form.

Genus **Bolinopsis,** L. Agassiz.

(*Bolina*, Mertens.)

2. ***Bolinopsis mikado*** (Moser) (Pl. VII, fig. 2).

Bolina mikado, Moser, 1907, p. 451.—Moser, 1908, p. 56, Pl. ii, fig. 1.

The body is ovoid, moderately compressed; at the level of the base of lappets, the tentacular axis is about 2/3 the length of pharyngeal axis and about 1/2 that of body proper. The body narrows gradually towards the rounded aboral extremity. The lappets are of medium size and usually occupy a little more than half of the entire body-length. The auricles in full-grown animals are 1/3–1/2 as long as the length of body proper, their end reaching somewhat beyond the margin of mouth. The deeply sunken aboral sense-organ is situated at the bottom of a cleft which is 1/5 as deep as the length of body proper. The comb-plates of the ribs begin to exist at the apical end of meridional canals; the last comb-plate of subtentacular ribs lies at base of auricles, that of subpharyngeal ribs close to lappet margin. The pharynx is long and nearly half as long as the total length of body including lappets. The pharyngeal folds are 1/4–1/3 as long as the pharynx. The interradial canals divide at the level of the sense-organ into the adradial canals which run alongside the wall of the aboral cleft. The lappet-canals make some winding which is rather simple and resembles the condition represented by BIGELOW for *Bolinopsis vitrea* (1912, p. 391). The tentacles are small and inconspicuous.

Colour.—Transparent and almost colourless; only the canals are rosy when living.

Specimens examined.—A number of specimens were obtained at Misaki and in the Gulf of Tokyo.

This species may be said to be the commonest ctenophore in those localities. In the Gulf of Tokyo, during late-summer, the species sometimes swarms in such abundance that the fishermen are compelled to give up using their nets, owing to the meshes becoming choked up with the ctenophores. At Misaki, this species appears in large quantities generally during summer and winter. After stormy weather, individuals showing mark of injury in the aboral region are very commonly met with.

Remark.—MOSER, the original describer of the species, established it on the basis of a single preserved specimen taken by DOFLEIN in the Sagami Bay. Of the characters pointed out by her as distinctive of the species, the deep situation of the sense-organ is apparently the most striking. This, taken together with the unusual length of subpharyngeal ribs, seems to afford the most important distinctive criterion between this species and allied forms. The size of lappets and of auricles in relation to that of the entire body varies considerably with age of the animal, as in other species of the same genus.

Genus **Leucothea,** Mertens.

(*Eucharis*, Eschscholtz.)

3. ***Leucothea japonica,*** n. sp. (Pl. VII, fig. 3).

Body compressed, rectangular in cross-section. Tentacular axis about 2/3 as long as pharyngeal axis, and slightly over 1/4 the length of body proper. Lappets moderately large and about as long as body proper. Auricles very long and worm-like, often coiled into helices; attached to the oral 1/4–1/3 of body. Aboral sense-organ deeply sunken; being situated at the bottom of a cleft as deep as 1/4 the length

of body proper. Prominences above the sense-organ tolerably conspicuous, passing over into the intercostal ridges at interradial corners of body. Surface of body beset with conical papillæ. All ribs originate at the same level and at that of the aboral end of meridional canals. Subtentacular ribs reach somewhat beyond base of auricles, subpharyngeal ribs a little beyond margin of mouth. Combs fairly numerous; in a specimen 80 mm. in length of body proper, they numbered about 75 in each subtentacular, and about 110 in each subpharyngeal, rib Pharynx about 2/3 as long as body proper; pharyngeal folds not so long as in *L. multicornis*, being restricted to the aboral 2/5–1/2 of pharyngeal wall. Subtentacular adradial canals open into meridional canals at a point somewhat below the aboral end of latter, as is usual in the genus. The course of the internal branches of lappet-canals could not be followed out, owing to damages of those parts in all specimens at my disposal. Sexual products develop in blind-sacs of meridional canals, a pair of which sacs occur to each comb. Both primary and secondary tentacles are present; the former is simple, without branches. The long blind sacs on either side of the broader surface of body is similar to the same in other species of the genus.

Colour.—Body faintly brick-red; pharyngeal canals and lateral blind-sacs of meridional canals somewhat more deeply so than other parts. Margin of lappets tinged with amber-yellow, generally deeper in tone in lateral than in inferior parts.

Specimens examined.—Four specimens, 53–120 mm. in length of body proper, were examined at Misaki between Dec. 30, 1917 and Jan. 9, 1918.

The ctenophore is extremely delicate in texture and becomes very readily injured by influences of disturbed water. It comes to the surface of water only when the sea is smooth after a succession of some days of calm weather.

Remark.—Without doubt this ctenophore is very closely related to the Atlantic *L.* (*Eucharis*) *multicornis*. However, all the ribs seem to

be somewhat longer, and the pharyngeal folds are distinctly shorter than in the latter; and moreover, the yellowish hue of lappet margin is peculiar to the former. These facts, coupled with distinctness in their geographical distribution, may suffice to specially distinguish the two forms. ESCHSCHOLTZ (1829, p. 30, Pl. I, fig. 2) has recorded a form which he referred to the genus *Eucharis* from the North Pacific, east of Japan. But his description as well as the accompanying figure are too imperfect to form any clear idea of that form. Some recent authors (among whom is MOSER, 1908, p. 47) have expressed the view that the ctenophore is nearer to *Lesueuria* rather than to *Eucharis*. This view is not unwarranted, since the ctenophore in question was represented by him to be without lappets though provided with well-developed auricles. And yet there seem to be sufficient grounds left for the assumption that ESCHSCHOLTZ may have been quite right in referring his form to *Eucharis*. The colour of the body, the papillæ on the surface, and also the dimensional proportions of the body, apparently stand in favour of this assumption. Moreover, his description of the auricules as "vier vierkanntige zolllange Fortsätze, die sehr schmal sind, in ihrer ganzen Länge eine gleiche Dicke behalten, und an ihren Kanten mit Reihen von Schwimmfäden besetzt sind," conforms precisely to the condition of the same organ in *Eucharis*, but not to that in *Lesueuria*. Furthermore, the lappets in *Eucharis* are, as CHUN (1880, p. 297) has remarked, body parts which present a high degree of variation as regards development. Thus, an individual (l. 53 mm.) came under my examination in which the lappets were merely represented by a pair of inconspicuous processes. Also it should not be forgotten that the lappets are extremely liable to damages and are easily torn off unless handled with great care. It is therefore not altogether impossible that ESCHSCHOLTZ had before him really an *Eucharis* but with the lappets either torn off or not normally developed. As to the question whether or not ESCHSCHOLTZ's *E. tiedemanni* is specificially identical with the form under treatment, no positive answer

can be given. In spite of this uncertainty, I have deemed it advisable for the present to describe the latter as a new and distinct species.

Genus **Ocyropsis,** Mayer.

(*Ocyroë*, Rang.)

4. ***Ocyropsis fusca*** (Rang.) (Pl. VII, fig. 4).

Ocyroë fusca, Moser, 1903, p. 17.——Moser, 1908, p. 65.

Ocyroë crystallina, Mayer, 1900, p. 81, Pl. xxxi, fig. 105.——Moser, 1903, p, 17.——Moser, 1908, p. 65.

Ocyropsis crystallina, Mayer, 1912, p. 38, Pl. x, figs. 55, 56.

Ocyroë maculata, Fewks, 1881, p. 137, Pl. iv, figs. 1-4.——Moser, 1903, p. 18.——Moser, 1908, p. 66.

Ocyropsis maculata, Mayer, 1912, p. 40.

The body is strongly compressed in the direction of tentacular axis; this is especially marked in large specimens (body proper over 40 mm. high), in which the pharyngeal axis is nearly three times as long as the tentacular axis, while in smaller ones, the former is only about twice as long as the latter. Vertical axis is moderately shorter than pharyngeal axis. The aboral pole is subtruncate, presenting but a slightly arched surface of a considerable extent. The sense-organ is situated at the bottom of a shallow depression. The polar plates are very narrow and unusually long, being only slightly shorter than half the length of subpharyngeal rib. All ribs run parallel with one another and with the pharyngeal plane of body. They begin close to the sense-organ and terminate at base of lappets. The subpharyngeal ribs are nearly twice as long as the subtentacular and may comprise twice as many comb-plates as the latter. The comb-plates in large individuals number 60–75 in a subpharyngeal and 30–40 in a subtentacular rib. Lappets are well-developed, somewhat longer than 1.5 times the body height, and nearly 1.5 times broader than long. They contain powerful muscles which enable the ctenophore to swimm very actively by flapping movements of the lappets. The lappet margin is simply rounded,

not divided into two wings as was said to be by some authors. Auricules are roughly cylindrical; their distal end falls usually somewhat short of the margin of mouth, probably never reaching beyond it. The pharynx is very long, occupying nearly 4/5 the height of body, and is strongly constricted at a point about 3/5 the pharyngeal length from mouth. Pharyngeal folds present at aboral end of pharyngeal wall as a pair of transverse semilunar areas of a whitish colour. The meridional canals are provided with lateral branches, which occur not only in the parts beyond the oral end of subpharyngeal ribs but also in those parts which underlie ribs, subpharyngeal as well as subtentacular. As a rule, a branch occurs on either side below each comb-plate. All these branches are thin and very delicate, showing only a few furcations in their course. The branches departing from subpharyngeal canals in the parts not covered by the rib, are much better developed than those more superiorly situated, and are more conspicuous on account of the milky colour of the genital element lodged in them. In all the individuals examined, the branches in question showed considerable difference both in length and breadth on the two sides of the canal, being much longer and broader on perradial than on interradial side. The winding of lappet canals as well as of the branches of pharyngeal canals are highly complicated as shown in the figure. A diversity of opinion prevails among the previous authors concerning the presence or absence of the tentacle apparatus in *Ocyropsis*. MOSER stood for its presence (1908, p. 66), but this fact was denied by MAYER (1912, p. 40); whereas, FEWKS has given a rather ambiguous statement that, "the tentacles, if present, are short and inconspicuous" (1881, p. 138). The result of my examination stands in confirmation of MOSER's view. The tentacle apparatus is certainly very small and inconspicuous for the size of the animal; nevertheless, its presence can be ascertained without difficulty with the naked eye. It is situated a little below the level of the constricted point of the pharynx, presenting itself as a tiny knob-like body, connected as usual with the infundibulum by the

tentacular canal. Sections show that the knob consists of the terminal bifurcated part of the tentacular canal and of a rudimentary tentacle basis intercalated between the canalar branches. The tentacle apparatus is thus in a very reduced condition in the adult; in younger stages, however, it is more typically represented, as will be described further on.

Colour.—Judging from the statements of previous authors, the three species of *Ocyropsis* originally described by RANG, viz., *O. fusca*, *O. crystallina* and *O. maculata*, seem to have been distinguished exclusively on the basis of colouration. According to my observation, however, this seems to be a very variable character. Among more than twenty fresh specimens taken from a great swarm which appeared at Misaki on April 1 of this year, I have met with some representatives of all the above three forms. All the individuals observed on that day showed a suffusion of chestnut-brown colour on the entire inner surface of lappets. This suffusion varied considerably in degree. In many cases it was fairly deep, making the individuals referable to "*O. fusca*." In other cases the suffusion was so slight as to be barely discernible, apparently representing the state of colouration ascribed to "*O. crystallina*." Finally, a few individuals bore two conspicuous dark patches on the suffused ground, a condition which without question identifies them with "*O. maculata*." The fact that all the three states of colouration are represented in individuals of the same swarm, makes it highly probable that we have here to do merely with individual variations within a species. The above specimens were 15–55 mm. in the height of body proper. In individuals smaller than 20 mm. in height, the gonads are not yet developed, but the winding of lappet-canals and of the branches of pharyngeal canals have nearly attained the condition seen in the adult.

Of the three alcoholic adult specimens from Tateyama Bay, which were examined, two showed clearly the chestnut-brown suffusion, one with and the other without the patches, while the third showed neither the suffusion nor the patches.

A very young specimen closely approaching both in size and in structure the one figured by MAYER (1912, Pl. X, fig. 55) was captured at Misaki, Dec. 29, 1916. It measures about 10 mm. from end to end of horizontally extended lappets. The auricles are short and semilunar in shape. In each octant of the body only a single comb is fully developed; the second exists but in a rudimentary state, although it may bear a few cilia in some octants. The condition of lappet-canals is nearly precisely the same as depicted in the figure above referred to. The tentacles are distinct and are furnished with a few number of branches. The tentacular canals are also very distinct. These proceed from the infundibulum and terminate each in two branches at the base of tentacle. The animal was perfectly colourless in the fresh state. In sections of this specimen I have ascertained the presence of colloblasts in the tentacles.

Genus **Cestum,** Lesueur.

(*Cestus*, Chun.)

5. ***Cestum amphitrites*** Mertens.

Cestum amphitrites, Bigelow, 1912, p. 396.
Cestus amphitrites, Moser, 1908, p. 14.
Cestus veneris, Chun, 1880, p. 301 (partim).
Cestum veneris, Mayer, 1912, p. 44 (partim).
Cestus pectinalis, Bigelow, 1904, p. 267, Pl. viii, fig. 30.——Moser, 1908, p. 13.

There seems to exist no important structural difference between this species and *C. veneris*, as far as can be judged from the existing descriptions of the latter species. The body is long and ribbon-shaped, slightly narrowing towards both extremities which are broadly rounded. The aboral margin is vaulted, and is 2.5 times as wide as the oral margin which is pronouncedly concave. The body is thickest midway between the oral and aboral margins along the line of subtentacular canals. The apical sense-organ is slightly depressed beneath the level

of the aboral body surface. The condition of the polar plates as well as of the crest-like prominences on either side of them seems to be precisely the same as in *C. veneris*. The comb-plates are very numerous and closely set; their number in a subtentacular rib is 12–14 in the larger individuals and 8 or less in the smaller. The pharynx in large individuals is about six times and in smaller ones about three times as long as the infundibular canal. The arrangement of gastrovascular canals are perfectly similar to the condition described from *C. veneris*. Primary tentacles are absent.

Colour.—The tentacle sheath and the area adjoining it are generally tinged with amber-yellow. Frequently a line of the same colour runs along the subtentacular meridional canals. More rarely, the lateral extremities of body show each a patch of the same colour. The surface of the body, especially near the lateral extremities, is besprinkled with minute dots of a light-bluish colour which displays iridescence. In large individuals, the subpharyngeal meridional canals are faintly brick-red, and the areas between the branches of pharyngeal canal and the basal edge of body are of a bright vermilion colour.

Specimens examined.—Eight (length 15–50 cm.) from Misaki, Dec. 28, 1917; one (length about 60 cm.) from the same locality, April 1, 1918.

Remark.—As stated above and also remarked by BIGELOW (1912, p. 396), scarcely any structural difference seems to exist between *C. amphitrites* and *C. veneris*. As the only noticeable point of difference between them, it was pointed out by the author just mentioned (p. 397), that the oral margin of the band-like body is about as broad as the aboral margin in the former, instead of being very much narrower as in the latter. But in all the individuals of *C. amphitrites* examined by me, I found the aboral margin to be considerably broader than the oral margin, precisely as is the case with *C. veneris*. It may not be superfluous to note that the number of comb-plates representing a subtentacular rib is somewhat larger than that usually given for *C. veneris*. While both CHUN (1880, p. 83, Pl. xiii, figs. 4, 8) and MAYER (1912,

p. 44) have given the number of combs in the rib in question in that species to be four, I find it to be 12–14 in the larger, and 8 or less in the smaller, specimens of *C. amphitrites* at my disposal, It appears that in *C. veneris* also, the number is not constant, since DELAGE and HÉROUARD mention it to be 4–6 (1901, p. 751), while FOL has represented 6–7 combs in his figure (1869, Pl. ii, fig. 6). Thus, it seems futile to lay much weight on this point. The difference of colouration between the two species probably affords a more reliable criterion for distinguishing them. As remarked by BIGELOW (1912, p. 397), the occurrence of the yellowish tint in various parts of the body, coupled with the presence of a vermilion band along the oral margin on either side of body, constitutes a characteristic feature of *C. amphitrites*.

Cestum amphitrites has hitherto been recorded exclusively from the Eastern Tropical Pacific. BIGELOW described a form from the Maldives under the name of *C. pectinalis* (1904, p. 267, Pl. viii, fig. 30), but this is probably specifically identical with the form just mentioned. It is doubtful if ESCHSCHOLTZ's *C. najadis* (1829, p. 23, Pl. i, figs. 1–1 c) from the South Seas can likewise be referred to *C. amphitrites*, since he has mentioned the occurrence of primary tentacles in his form and has given clear figures of these.

Genus **Beroë**, Browne.

6. ***Beroë cucumis*** Fabricius (Pl. VII, fig. 5).

Beroë cucumis. Eschscholtz, 1829, p. 36.——Vanhöffen, 1903, p. 7.——Moser, 1903, Bestimmungstabelle.——Römer, 1903, p. 81.——Moser, 1907, p. 453.——Moser, 1908, p. 24.——Mortensen, 1912, p. 83 (partim).——Mayer, 1912, p. 52, Pl. xv, fig. 67, Pl. xvii, fig. 76.

Idya roseola, L. Agassiz, 1860, pp. 270, 296, Pls. i, ii.——A. Agassiz, 1865, p. 36.

The body is fleshy and mitre-shaped, compressed in the direction of the tentacular axis. It varies markedly in the ratio of length and breadth ; the pharyngeal axis may be 3/4 as long as the vertical axis,

but may fall under 1/3 of the latter. The length of tentacular axis measures generally about half the pharyngeal axis. Viewed at on the pharyngeal plane, the body is broadest at some distance below the aboral pole and gently narrows towards the oral end which is about half as broad as the greatest width of body. The ribs are all roughly of the same length, although the subtentaculars are really slightly shorter than the subpharyngeals ; they occupy the aboral 3/4–5/6 of the entire length of meridional canals. The comb-plates are very numerous and closely set ; in large individuals as many as 300 of them occur in each rib. The distance between subtentacular ribs measures usually about twice that between subpharyngeal ribs. The sabre-shaped cilia on the wall of pharynx are rather short and inconspicuous (length about 25 μ, breadth about 2.5 μ). The meridional canals send out on either side several branches, which in large examples, show some anastomoses among them. These branches do not join with the pharyngeal canal, except in large specimens which may exhibit such communication at a few places. This communication usually numbers only one or two to each pharyngeal canal, though in a single case there existed eight communications to one of the canals and nine to the other. In small specimens the branches of meridional canals anastomose neither among themselves nor with pharyngeal canals. The sexual products develop in the wall of meridional canals alone.

Colour.—Small specimens are transparent and dotted with dark reddish spots ; the larger ones are translucent and faintly rosy, covered all over with minute pinkish dots.

Specimens examined.—This is one of the commonest ctenophores in the vicinity of Misaki. The following specimens were studied either in the living state or after preservation :—One (l. 75 mm.), Dec. 26, 1916 ; one (l. 50 mm.), Feb. 24, 1917 ; four (l. 45—88 mm.), between Dec. 30, 1917 and Jan. 9, 1918 ; five (l. 78–127 mm.), April 1, 1918 ; one (l. 142 mm.).

Remarks.—Most of the recent authors have accepted CHUN'S view

in making distinction between *B. cucumis* and *B. ovata*. According to that view, the branches of meridional canals in the latter species should show communications not only among themselves but also with the pharyngeal canal; whereas, in the former such communications should be altogether lacking. MORTENSEN (1912, p. 83) alone has stood against this distinction and has maintained that the character in question is too variable to rely on and that the two "species" only represent two phases of one and the same species. In the specimens of *B. cucumis* examined by me, as already described, the lateral branches of meridional canals do show a small number of anastomosis among themselves and a few communications with pharyngeal canal. Thus, it is clear that the distinction set up by CHUN can not be held up, indicating that MORTENSEN is probably right in his opinion. Possibly a point of difference between the two forms referred to consists in the size of eggs. One morning in the beginning of April, 1918, some individuals of *B. cucumis*, kept alive in a glass jar at Misaki, were found to have laid eggs. These measured 0.4–0.5 mm. in diameter. AGASSIZ should have given 0.5–0.6 mm. for the size of eggs of the same species (called by him *Idya roseola*) of the coast of North America (known to me through CHUN, 1880, p. 100). Now the eggs of *B. ovata*, according to YATSU (1912, p. 2) should have a diameter of 1–1.2 mm. CHUN (1880, p. 100) also has mentioned that the largest ova of that species measured 1.2 mm. in diameter. It must then be said that the egg of *B. cucumis*, in comparison with that of *B. ovata*, is half as small or even smaller.

7. ***Beroë campana,*** n. sp. (Pl. VII, figs. 6, 6 a).

The body is mitre-shaped, and distinctly compressed, the ratio of the three main axes being on the average approximately 10 : 7 : 2. The apex is rather acute; the polar plates are exposed. The mouth is large, being almost as wide as the body itself, and is without lip-like projections. The distance between subtentacular ribs is greater

than that between subpharyngeal ribs, the ratio being usually 5 : 4 and sometimes 3 : 2. The subtentacular ribs are almost always shorter in varying degrees than the subpharyngeal ribs, the difference of length being very slight in large individuals but fairly marked in the smaller. As will be seen from the following table, the degree of difference in the length of the two kinds of ribs is, roughly speaking, inversely proportional to the size of body.

Body length.	Ratio of the length of subtentacular rib to that of meridional canal.	Ratio of the length of subpharyngeal rib to that of meridional canal.
Over 30 mm.	(Subpharyngeal rib only slightly longer than subtentacular rib).	
20–30 mm.	3 : 4	4 : 5
15–20 mm.	2 : 3	4 : 5
5–10 mm.	Less than 1 : 2	2 : 3

The comb-plates are very numerous and closely set; I have counted as many as 200 of them in each rib of an individual of 62 mm. length. The area of sabre-shaped cilia on the pharyngeal wall is not prominent. The cilia are small, measuring 25 μ in length and 2.5 μ in breadth on the average. The meridional canals are provided with a number of side-branches, which, in large specimens, repeatedly divide and present a dendritic appearance; but no anastomosis occurs, excepting a few near the oral margin of body. The level of the origin of side-branches from meridional canal differs in the same way as MQSER has described for *B. cucumis* (1908, p. 24, figs. 1, 2): on the perradial side, the branches arise from the parts near body-surface, and on the interradial side from deeper parts of the canal. The pharyngeal canals never send out branches. The marginal canal of oral aperture sends out numerous branches on both aboral and oral sides; some of these, on the narrower sides of body, join with the side-branches of meridional

canals. The location of gonads is noteworthy. The ovaries, situated on the perradial side of meridional canals, are developed on the wall of those canals as well as on that of the basal parts of the canalar branches of the same side. The testes develop on the interradial side of the canals and also in special simple or branched blind-tubes arising at positions more external than ordinary canalar branches of the side. Some of the branches from the marginal canals around the mouth also contain sexual elements; this is especially the case in those branches occurring on the narrower sides of body. All the parts of canalar branches, in which the gonads are contained, become swollen and are conspicuous on account of their milky colour.

Colour.—Transparent and almost colourless, or slightly pinkish, especially along meridional canals and their larger branches. The gonads appear milky white, as indicated above.

Specimens examined.—A number of specimens were studied in the living state and also after preservation: One (l. 62 mm.) from Misaki, Dec. 30, 1916; thirty eight (l. 1.5–42 mm.) from Tokyo Bay, Sept. 2, 1917; one large specimen from Tateyama Bay, April, 1913.

This seems to be one of the commonest ctenophores in the waters of the neighbourhood of Misaki. On Sept. 2 of last year, very large swarms of the species were met with in the Gulf of Tokyo.

Remark.—It is not impossible that MOSER'S *B. hyalina* (1907, p. 450; 1908, p. 27, Pl. i, figs. 4, 5) is identical with this species, sharing, as it does, with the latter the identity of locality, the simpleness of pharyngeal canals as well as the delicacy of body texture. Nevertheless, the description given by her of that species does not accord well with the characters of the present form in the following important points: The location of gonads, as given by her for *B. hyalina*, is entirely different; all the intervals between ribs are said to be nearly equal, all the ribs to be of the same length, and the marginal canals to be without branches. Now, eight specimens before me of about the same size (l. 10–16 mm.) as those which were at MOSER'S disposal (l. 11–

15 mm.), stand at variance with her description in the strongly compressed body-form, in the striking diversity of the length of ribs, in the unequalness of the intervals between ribs, and in that the marginal canals send out a number of branches. It thus seems necessary to specifically separate the present form from *B. hyalina*.

8. ***Beroë forskålii*** Milne-Edwards (Pl. VII, figs. 7, 7 a).

Beroë forskalii Chun, 1880, p. 309, Pl. xiv, figs. 3-5.——Moser, 1903, Bestimmungstabelle.——Torrey, 1904, p. 47, Pl. i, fig. 2.——Moser, 1908, p. 26.——Bigelow 1912, p. 387.

Beroë australis, Agassiz and Mayer, 1898, p. 177, Pl, xvi, figs. 49, 50.

The body is subconical and very strongly compressed, the width along tentacular axis being 1/3 or somewhat less than 1/3 that along pharyngeal axis, which is 3/5–2/3 as long as the vertical length of body. Subpharyngeal ribs of each pair are disposed very close together, especially in the aboral region where the two almost touch each other; the greatest distance between them measures somewhat less than half that between subtentacular ribs forming a pair. Superiorly the body is moderately narrowed toward the pointed apex; the mouth is very wide, its margin looking like two lips of fair thickness. The area of sabre-shaped cilia is precisely similar in outline to that shown in CHUN's monograph (1880, Pl. xiv a, fig. 8). The cilia are large (l. about 45 μ., b. about 4.5 μ) and visible to the naked eye. The ribs are all of nearly the same length and are made up of very closely set comb-plates bearing unusually stiff cilia. I have counted as many as about one hundred plates in each rib of an individual of 28.5 mm. long. The meridional canals send out numerous branches on either side; these make anastomoses profusely between them, and also communicate with pharyngeal canals, bringing about a fine-meshed network of canal-system. The branches of meridional canals are less numerous on the narrower sides of body than on the broader; and those which occur in the aboral quarter of the former scarcely undergo anastomosis. The

gonads develop in the lateral branches of meridional canals to the extent of 1 mm. at their base. In two young specimens before me (l. 8.5 mm. and 10 mm.), the subtentacular ribs are moderately shorter than the subpharyngeal ribs; some ten branches arise from either side of subtentacular canal and many of them join with the pharyngeal canal.

Colour.—An individual which I could examine in the fresh state showed a conspicuous colouring. The ground colour of the entire animal was faintly pinkish, which colour deepened towards the aboral pole; the narrower sides of body were dotted all over with conspicuous round spots of a reddish brown; the mouth was bordered by a band of the same colour lighter in tone. On the broader body surface, the aboral one-third was thickly dotted with round dark-orange spots, which area gradually passed over, both above and below, into that of the general ground colour. In formalin, the colours have entirely faded away.

Specimens examined.—One in the living state (l. 36.5 mm.), Misaki, Dec. 30, 1917; one (l. 47 mm.) in alcohol, Tateyama Bay, April, 1899; one (l. 56 mm.) in alcohol, Tateyama Bay. April, 1898; one (l. 28.5 mm.) in formalin, Misaki, Dec., 1917; two (l. 8.5 mm. and 10 mm.) in formalin, Misaki, Dec., 1917.

Remark.—In agreement with MOSER (1908, p. 27), it is with some degree of hesitation that I refer the form under consideration to *B. forskålii*. At any rate, there can be no question of its very close relationship to that species. The fineness of the network of canalar branches in relation to the smallness of body, and the deep tone of colouration are points in which the Japanese form does not seem to agree quite with the descriptions of *B. forskålii*. However, since this species is known to vary considerably in those characters, it may be advisable to have the Japanese form referred to it until definitely disproved in the future.

9. *Beroë mitrata* (Moser) (Pl. VII, fig. 8).

Pandora mitrata, Moser, 1907, p. 451.——Moser, 1908, p. 34, Pl. i, figs. 1-3.——Bigelow, 1912, p. 389.

Two specimens obtained at Misaki on April 1, 1918, agree fairly well with MOSER's description and figures of the species from Hokkaido. The following description is based on the larger (l. 28 mm.) of the two. The body is mitre-shaped and much compressed, the ratio of three axial lengths being 10 : 5 : 2. The aboral pole is moderately pointed; the polar plates are exposed and provided on the margin with the usual papilliform processes. The interval between paired subpharyngeal canals is about 2/3 that between the subtentacular. The ribs are all very short; the subpharyngeals being nearly half, and the subtentaculars about 1/3, as long as the meridional canals. The former consists of abont 50 comb-plates and the latter of about 30. The mouth is large and the pharynx very spacious. The sabre-shaped cilia on the wall of pharynx are of an enormous size, being nearly as long and thick as those found in *B. forskålii*. The branches of meridional canals are not very numerous. They are rather simple, showing only a few furcations and run in the main obliquely towards the mouth. No anastomosis occurs among them. Further, there exist branches which, issuing from the deeper parts of meridional canals, are distributed on the surface of pharynx and unite with pharyngeal canals. Such branches occur mainly in the oral parts of body, forming a coarse-meshed network in the pharyngeal wall. The gonads develop from the wall of meridional canals, except for a short stretch at their oral end.

Colour.—This individual was faintly rosy-coloured along the meridional canals. A patch of orange colour occurred on either broad surface of body between subtentacular canals.

The second smaller specimen (l. 17 mm.) agrees with the above-described in all essential features.

This ctenophore is very active in movement. One of the specimens

tried to swallow an *Ocyropsis*, several times larger in size. It was further observed that the animal sometimes turned itself inside out, to return to the normal condition after some time.

Remark.—B. mitrata, first described by MOSER under the name of *Pandora mitrata*, may be distinguishable from all allied species by the two sets of ribs differing considerably in length, by the characteristic distribution of branches of meridional canals, and by the presence of a network of canals in the oral parts of pharyngeal wall. The genus *Pandora*, first established by ESCHSCHOLTZ, was later merged into *Beroë* by CHUN, and has recently been reinstated by MOSER. According to the last-named authoress, the genus comes very near to *Beroë*, but is distinguishable from it chiefly by the shortness of ribs and by the subpharyngeal ribs being longer than the subtentacular ribs. Such a condition of the ribs, however, is very commonly presented by various species of *Beroë*, especially in their young stages, as for instance, by half-grown individuals of *B. campana*. In the species just mentioned, I may say, on the basis of my own observation, that the shortness and unequalness of ribs in length is a normal character in the young. The same apparently holds true for *B. forskålii* also. MAYER has likewise pointed out (1912, p. 54) that the same condition is very often met with in the young of *B. ovata*. Now *Pandora* was made to comprise three species besides two doubtful ones, all of which have been described from animals of a small size (*P. flemmigii*, 3–25 mm.; *P. pandorina*, 2–6 mm.; *P. mitrata*, 5–28 mm.). From this it may be assumed that all the forms stand represented by young individuals with ribs of unequal length, which character later diminishes considerably or disappears altogether. If that be so, *Pandora* would lose almost all grounds for being held separate from *Beroë*.

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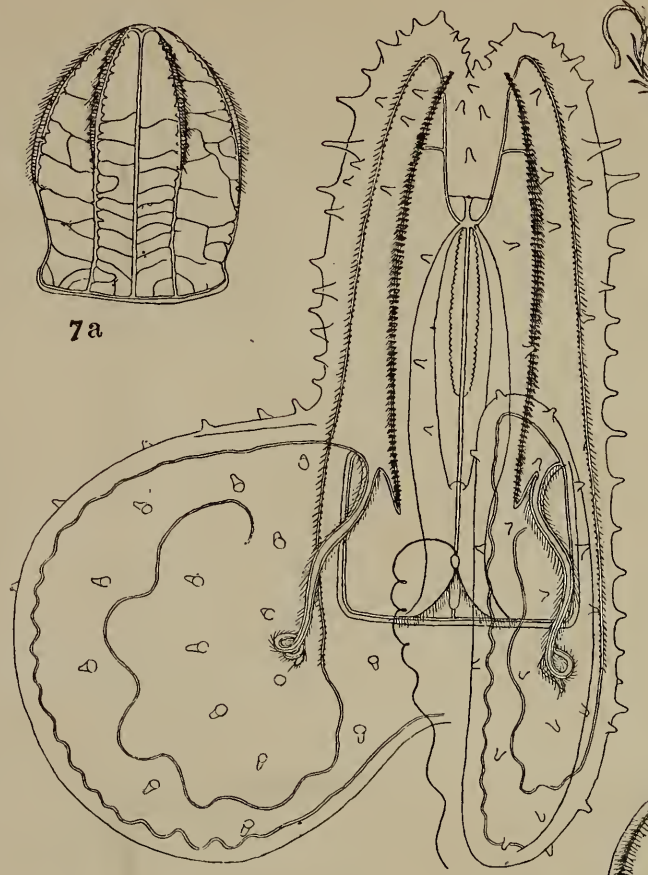
Explanation of Plate VII.

Fig. 1. *Hormiphora palmata* Chun. ×2.
Fig. 2. *Bolinopsis mikado* (Moser). ×6/5.
Fig. 3. *Leucothea japonica*, n. sp. ×1.
Fig. 4. *Ocyropsis fusca* (Rang). ×4/5.
Fig. 5. *Beroë cucumis* Fabricius. ×1.
An individual with some anastomoses among branches of meridional canals and with one communication between one of such branches and a pharyngeal canal.
Fig. 6. *Beroë campana*, n. sp. ×1.5.
Fig. 6 a. The same, young individual. ×3.
Fig. 7. *Beroë forskâlii* Milne-Edwards. ×2.5.
Fig. 7 a. The same, young individual. ×4.
Fig. 8. *Beroë mitrata* (Moser). ×1.5.

7a



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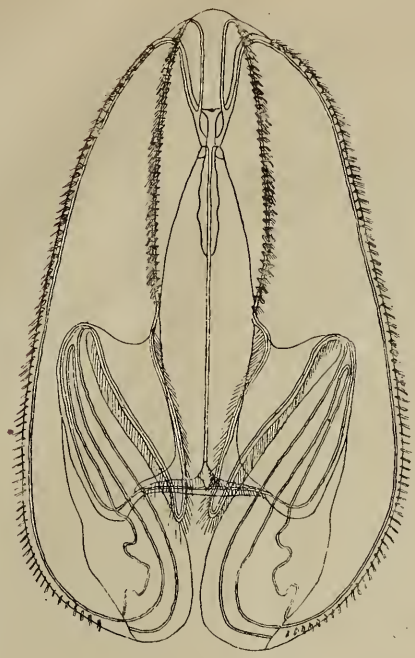

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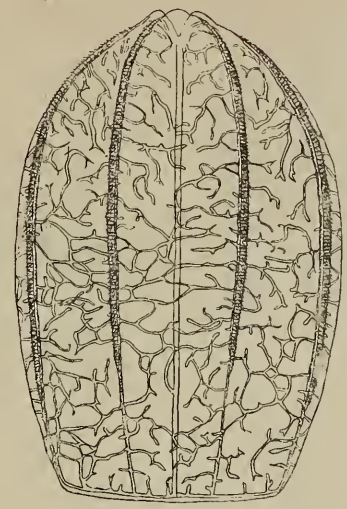

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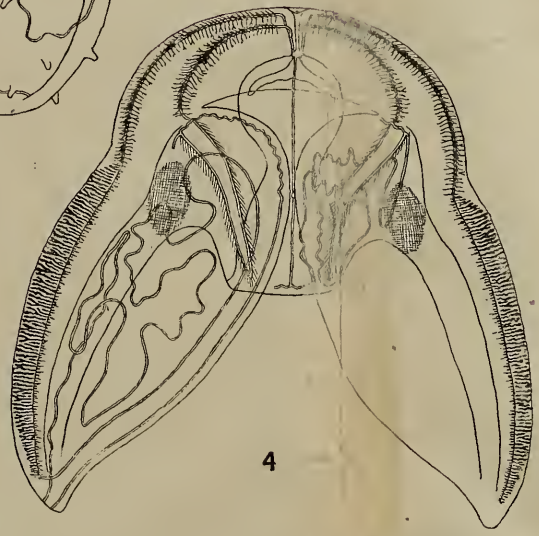

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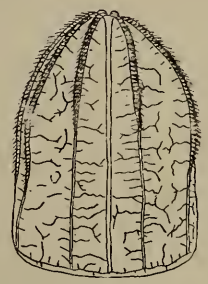

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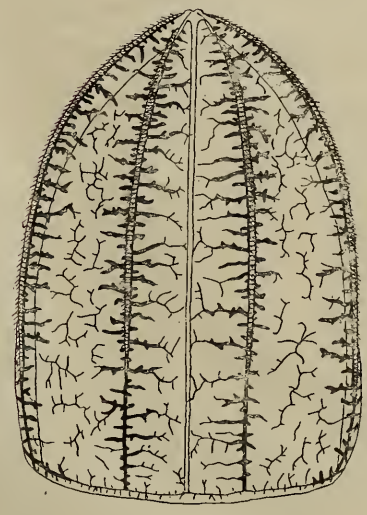

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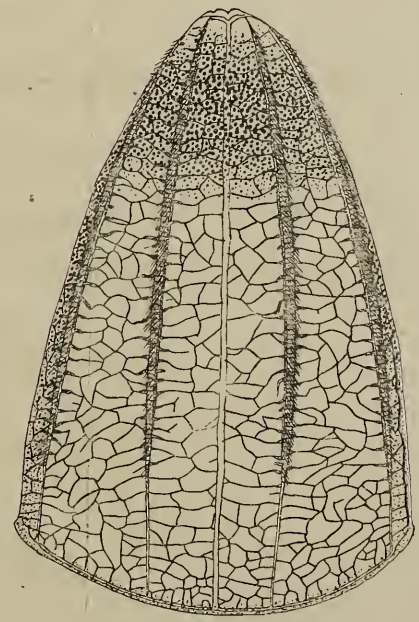

7

T. Komai: *Ctenophores of Misaki.*