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Some New Scyphomedusæ of Japan.

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With two plates.

Having been engaged for several years in collecting and studying the Scyphomedusæ of the waters around Japan, no less than twenty-two species of the group have thus far become known to me from the region mentioned. The majority of them are new to science, many showing noteworthy peculiarities in their structure. Some of them have already been described by me in the "Zoological Magazine" (Tokyo). In the present paper I propose to deal with a few forms that have come under my observation and which differ remarkably from the related forms hitherto known.

STAUROMEDUSÆ.

Stenoscyphidæ, nov. fam.

Stauromedusæ with simple, undivided umbrella margin, without adradial lobes; the eight principal tentacles are transformed

to adhesive anchors. Secondary tentacles are clustered in eight adradial groups. Coronal muscle ring-shaped. Adhesive peduncle at the aboral end of the umbrella.

This new family is proposed for a medusa which stands between *Tesseridæ* and *Lucernaridæ* and which thus serves to connect these two families. More precisely speaking, the medusa is closely allied to the subfamily *Depastridæ* on the one hand and to the subfamily *Halicylistidæ* on the other; at the same time it can not well be placed under either of these.

Stenoscyphus, nov. gen.

Stenoscyphidæ with four-chambered peduncle and eight separate genital glands.

Stenoscyphus inabai.

(Figs. 1, 2.)

Depastrum inabai, KISHINOUE, 1893. In: Zool. Mag. Tokyo, Vol. V, pp. 416-418, with woodcuts. (In Japanese).

The umbrella or the calyx is very narrow and elongate, generally widening somewhat abruptly at the oral end, so that it presents the shape of a long prism or rather of a funnel with a long and wide tube. It is more or less quadrate in cross-section. The length (or height) is from two to three times the breadth at the umbrella margin. The latter is not divided into lobes or arms.

The peduncle is more or less quadrate like the umbrella and possesses four interradial grooves (fig. 2). Its length is

from one half to one-fifth that of the umbrella. The adhesive surface at the aboral end is wide. The cavity of the peduncle or the basal stomach is divided into four chambers by the union of the interradial tæniola. In young specimens of a length under 9 mm., the peduncle is not divided into separate chambers. The interradial tæniola begin to unite near the pyloric portion.

The exumbrella is generally smooth. It is furnished here and there with small groups of nematocysts. It is very thin and consists of three layers: the ectoderm, the gelatinous layer and the endoderm.

The whole surface of the subumbrella is beset with very large, spherical groups of nematocysts, each group opening by a small pore at the end of a little neck. This neck projects only a little above the surface of the subumbrella.

The coronal or marginal muscle is ring-shaped; it is not divided, but well developed. In preserved specimens, this muscle is generally contracted so that the animal is rather narrow at the oral end.

The interradial, longitudinal muscles are divided into two heads at the oral end. Each head of the muscle is attached to the root of the adradial bunch of tentacles. These muscles are well developed and run through the whole length of the animal, from the base of the peduncle to the umbrella margin.

The eight principal tentacles are transformed into the adhesive marginal bodies, generally known as anchors. They are large, round and sessile. They are about half as long as the diameter of the peduncle.

The secondary tentacles, the "Succursal Tentakeln" of HAECKEL, are grouped into eight adradial bunches, in each of which are to be counted about twenty-five tentacles in four or five

longitudinal, and five or six transverse, rows. These tentacles are short, capped, and are found in the subumbrella. They nearly disappear from sight, when the coronal muscle is contracted. They are highly adhesive. In a very small specimen, only 2 mm. in length, the secondary tentacles were six in number, arranged in two longitudinal rows; in another, 4.5 mm. long, from nine to ten tentacles were present in three rows, and in still another of 7 mm. length, eleven tentacles in three rows. Generally new tentacles are added outside the group of older ones.

The central stomach cavity is very long and columnar. It is four-lobed in transverse section. The manubrium or the buccal stomach is short and nearly as long as broad. It presents a cross-like shape in transverse section. The gastral filaments are long, simple and numerous, being arranged in two longitudinal rows, which run very close to each other on the internal axial wall of each infundibulum. They are found in the central stomach only.

The coronal umbrella cavity is conical and occupies from one-third to one-fourth of the length of the calyx; its wall is entirely covered with groups or glands of nematocysts. The four inter-radial infundibular deepenings reach the aboral end of the calyx. They are tolerably uniform in diameter throughout their whole length. Two longitudinal, ectodermal thickenings run along the abaxial side of these deepenings and are connected at the aboral end. These thickenings consists of very high ectoderm cells, rich in nematocysts.

The genital glands, eight in number, are band-like. They run side by side in twos along the interrarial muscles. Each gland consists of numerous sacs, of which there are in old specimens about forty, arranged approximately in two rows. In young specimens the sacs are less in number and are arranged

in a single row. New genital sacs are added at the distal end of the genital gland.

The color is generally dark brown flecked with white. The adhesive anchors and the base of the peduncle are light red. The genital glands and the tip of the secondary tentacles present a dark brown color. The manubrium is yellowish, while the subumbrella is pale green.

The size of a full-grown animal measures 25 mm. in length, excluding the peduncle.

A specimen of this interesting medusa was first discovered by Mr. MASAMARU INABA in 1893 at Kata-ura in the Province of Kii. It was kindly given me for examination, together with the sketches and notes made by the discoverer. On account of the peculiar shape and movements of the animal Mr. INABA at first took it for a worm. Some years since the same medusa was found near the Marine Station at Misaki during winter months.

The animal hangs down from the frond of *Sargassum* on which it is attached. It can detach itself of its own accord, but is devoid of swimming power. Being remarkably contractile in both umbrella and peduncle, the body-length is reduced by almost one half when contracted. As the body has adhesive apparatus at both its extremities, it can effect a locomotion very much like that of a leech.

Lucernaridæ.

Schizodiscus, nov. gen.

Lucernaridæ without mesogonial pouches and without adhesive anchors. Umbrella deeply divided. Peduncle four-chambered,

without muscular fibres in the tæniola. Structure of the genital gland not simple.

Schizodiscus nagatensis.

(Figs. 3-6.)

Lucernaria nagatensis, OKA, 1897. In: Zool. Mag. Tokyo, Vol. IX, pp. 1-4, pl. I; Annot. Zool. Jap. Vol. I, pp. 141-145, with woodcuts.

The umbrella is of an extraordinary form. It is not goblet-shaped, but quite flat and deeply divided. The animal, when fully expanded, is about five times as broad as long. The eight adradial lobes or arms are somewhat recurvate. They are united in pairs and the four perradial arches are about twice as deep and wide as the four interradial arches.

The peduncle is short, being subequal in length to the umbrella, and more or less conical in shape. It is four-chambered; but in young specimens it is one-chambered, the tæniola being separate. These begin to unite near the pyloric portion. In the peduncle we find no muscle, as we do in the case of *Craterolophus tethys*. The adhesive surface of the peduncle is more or less quadrate and has many small furrows beside four large interradial furrows (fig. 5).

The exumbrella is quite smooth in the calyx, but shows a slight rugosity in the peduncle owing to the presence of many small groups of nematocysts. In an old specimen, I have found that the surface of the peduncle is divided into numerous small areas by a network of grooves. The surface looks as if paved. The exumbrella consists of three layers: a layer of columnar ectoderm cells, a firm gelatinous layer and a layer of glandular

endoderm cells. The gelatinous layer is thickest in the pyloric portion.

The subumbrella is broader than the exumbrella. Its surface is wavy for the greater part, but rugose near the umbrella margin as well as in the perradial regions. The rugose portion near the umbrella margin is often turned over towards the aboral side. The rugosity is caused by large groups or glands of nematocysts lying underneath. The subumbrella also consists of the three layers. Its ectoderm cells are higher than those of the exumbrella and many of them are in possession of nematocysts. The gelatinous layer is exceedingly thin.

The umbrella cavity is hardly distinguishable. The very small interradianal concavities found in the central disc of the body may be compared to the infundibular deepenings of other *Stauromedusæ*.

The interradianal, longitudinal muscles are well developed. They run between the adradial bunch of tentacles and the pylorus, without extending into the peduncle.

The coronal or marginal muscle is cut into eight separate pieces, each of which is shaped either like the letter U or V. The perradianal pieces are much longer and broader than the interradianal pieces.

The eight adradial lobes are united in pairs, giving to the animal the form of a Greek cross. The distal end of each adradial lobe is pointed, bent at a right angle to the remaining part and turned towards the oral side. Each united pair of the adradial lobes may be longitudinally folded, as it were, on the oral side. Moreover it may be bent towards the mouth. It is longer than the diameter of the central undivided portion of the umbrella.

Primary tentacles are not present; in place of them we see a dark pigment for each.

The secondary tentacles are short, capped and situated on the abaxial side of the bent extremity of each adradial lobe. They are adhesive. The tentacular tract is somewhat triangular, having two long sides and a short base. The tentacles, about five in number and situated at the base of the triangular tract, have each a thick, flattened disc on the abaxial side of its stalk.

The central stomach cavity is very short, about equal in length to the buccal stomach. The latter is likewise short and presents a cruciate form in the transverse section.

The gastral filaments (fig. 6) are rather few in number but well developed, branched and crowded together in eight short phacelli at the axial end of the genital glands. Apart from the phacelli I have found a few, large and simple filaments at the pylorus.

The genital glands are represented by eight long and broad bands, each of which consists of numerous large, laterally oblong sacs and extends from the tip of the adradial lobes nearly to the margin of the pylorus, where the longitudinal muscle terminates.

The color is variable, simulating that of the environment. It is sometimes dark brown, sometimes dark green. The nematocysts-groups are generally colorless.

The diameter of the umbrella in a full-grown individual is about 30 mm.; total height of the body, about 7 mm.

A single specimen of this medusa was discovered by Mr. OKA in April, 1896, at Kogushi in the Province of Nagato. He proposed to name it *Lucernaria nagatensis*, should the species prove new to science. The somewhat popular description given by him of the medusa as also his rather diagrammatic figures

are not entirely satisfactory. Some years since, this medusa was found also at Misaki in winter.

DISCOMEDUSÆ.

SEMOSTOMÆ.

Pelagidæ.

Kuragea,* nov. gen.

Pelagidæ with fifty-six tentacles and sixty-four marginal lobes.

Kuragea depressa, nov. sp.

(Fig. 7.)

The umbrella is flat, discoidal, about three times as broad as high. The sixty-four marginal lobes are oblong and of unequal size. The ocular lobes and the lobes by the sides of the adradial tentacles are larger than any other, while those next to the ocular lobes are the smallest. The sixteen ocular pouches are long and oval in form, their distal ends being about half as broad as those of the tentacular pouches. The oral arms are broad and rich in folds. The tentacles are unequal in thickness, those at the sides of the ocular lobes being slender. The total length of both the oral arms and the tentacles can not be determined, as they are but incompletely preserved in the single type-specimen examined.

The exumbrella shows a sixteen-rayed, stellate marking. On

* *Kuragé*, the Japanese name for meduse.

its oral side is to be seen the peculiar figure formed by the combination of several grooves, which is of such general occurrence in medusæ of the Pelagidæ and the Cyaneidæ. Centrally there is a sixteen sided polygon, the diameter of which is about half that of the central gastric cavity. From each angle of the polygon a groove radiates toward the umbrella margin. These radial grooves alternate with the partition walls between the radial pouches.

The genital glands are four in number. Each gland is much folded and bent like the Greek letter ω .

The gastral filaments are many and long.

Diameter of the umbrella 85 mm.; its height 30 mm. The unique specimen, on which this new species is based, was obtained at Misaki in 1900.

RHIZOSTOMÆ.

Cepheidæ.

Rhizostomæ with cup-shaped umbrella which consists of a central dome, generally covered with warts or furnished with radial furrows, of a circular groove and a broad brim. Radial muscle-fibres conspicuous. Subgenital cavities generally four in number, but sometimes coalesced into one. Subgenital ostia to the cavity are very small. Network of the canal system narrow. Radial canals numerous. No circular canal. Oral arms generally one-winged.

It was necessary to make some alterations in the family character in order to receive the new forms of medusa next to be described. Notwithstanding that these show many novel points

in their structure, I believe it but proper to range them under the Cepheidæ.

Microstylus, nov. gen.

Cepheidæ with a four-lobed subgenital cavity and very small appendages among oral frills. Oral arms one-winged.

Microstylus setouchianus.

(Figs. 8-10.)

Cotylorhiza setouchiana, KISHINOUE, 1899, in litteris Mus. Zool. Univ. Tokyoensis.

Umbrella hood-shaped. Central dome covered with fifty or more warts; separated from the broad brim by a circular groove; its central portion is generally thin, especially in young specimens. The dome surface with numerous minute brown dots, arranged in radial lines, converging towards the apex of each wart. The umbrella is very thick, but becomes suddenly thin in the brim (fig. 9).

The umbrella margin is divided into from fifty to sixty lobes, *i. e.*, each octant of it is furnished with from six to eight oblong velar lobes between every two smaller ocular lobes.

The straight, uniformly distributed radial muscles seen in the subumbrella gradually become fainter peripherad, finally to disappear altogether before reaching the brim (fig. 10).

The oral disc is a little depressed and octagonal in shape. From it hang down eight oral arms. On each interradian abaxial side of the disc there is a small round opening communicating with the subgenital cavity (figs. 8, 9). The sides of the disc are

covered with numerous brown dots, of which those on the per-radial sides differ in form and arrangement from those on the interradial sides.

The subgenital cavity is flat; though not divided into four separate cavities, it is four-lobed, being separated by four per-radial septa. The length of each of these septa is about one fourth that of the broadest part of the cavity (fig. 9). In continuation of these septa there are narrow gelatinous thickenings in the gastrogenital membrane or the roof of the subgenital cavity. Naturally these gelatinous thickenings form a cross. This cross is a little curved and is not much separated from the upper surface of the oral disc, while the remaining portion of the gastrogenital membrane is very thin and loose.

The canal system in general resembles that of *Netrosoma typhodendrium* L. SCHULTZE. Of the interocular radial canals there are twenty-four. The eight ocular canals are larger than other radial canals and run straight to the umbrella margin (fig. 10). So do likewise the eight adradial canals, but these are not so distinct. The sixteen remaining canals are branched just outside the oral disc and together with other canals form a complicated network. The meshes are mostly polygonal near the central portion of the subumbrella, but become rectangular near the periphery. Near the margin of each marginal lobe, the network ends with only one mesh, which sends a very short, blind canal towards the umbrella margin. For about one-third its length at the axial portion, the ocular canal is free from side branches. There is no circular canal. The eight brachial canals originate from depressions on each side of the perradial septa of the subgenital cavity. These adradial depressions in the central stomach cavity correspond to the pillar canals of other monodemniate

Rhizostomæ. The brachial canal gives off a horizontal branch towards the axis of the body. Such horizontal canals reunite and form a very short crucial canal at the centre of the oral disc (fig. 9).

The oral arms are one-winged and curved abaxially at the lower half (figs. 8, 9). They are a little longer than the umbrella radius. They are divided into two at the distal end and give off many branchlets in a feather-like manner. The upper arm is nearly equal in length to the lower arm. Among sucking frills, there are many small, short appendages. Those at the junction of the oral suture are longer, triangular in cross-section, and have prickly appearance.

The umbrella diameter measures 10-20 cm.

The central dome of the umbrella and the sides of the oral disc have many dark brown dots. Genital glands pinkish; oral frills brown. A specimen which I have obtained at Senzaki, on the coast of the Japan Sea, had a very beautiful light blue color.

This medusa is known thus far from Setouchi-umi (Inland Sea) as well as from Misaki and Senzaki. It is found in August and September and is known among fishermen by the name of *Yebi-kuragé* (shrimp medusa), since a commensal shrimp is often present under its umbrella.

This medusa is closely related to *Cephea*, *Cotylorhiza* and *Netrosoma*.

Perirhiza, nov. gen.

Cepheidæ with a deeply divided subgenital cavity, small subgenital ostia and long, numerous appendages among oral frills.

Gelatinous wall of the oral disc entirely destitute of gastrovascular canals. Oral arms three-winged.

Perirhiza nematophora, nov. sp.

(Figs. 11-13.)

The umbrella is hood-shaped. Its central dome is very high and covered with many large and numerous small conical warts, about thirty in number. Many of the warts are bent or crooked near the apex. Larger warts are situated in the centre of the umbrella, while smaller ones are chiefly found near the foot of the dome and sometimes also scattered between or upon the larger warts. The umbrella is thickest at the groove separating the central dome from the peripheral hanging portion.

The umbrella margin is divided into from eighty to ninety lobes, *i. e.*, there are eight or nine oblong velar lobes between every two ocular lobes, which are very small and much receded from the general umbrella margin. The velar lobes in each octant are united by a thin membrane as is the case in some species of the genus *Cephea* (fig. 13).

In the subumbrella we find thickly crowded and well developed muscular ridges running radially. At the axial part of the brim the radial muscles disappear, while instead circular muscles present themselves (fig. 13).

The oral disc, octagonal in outline, is not distinct, as the subgenital ostia are very small and compressed and the oral pillars, short, broad and inconspicuous. Its oral side is strongly vaulted upwards; the gelatinous wall forming it is destitute of the gastrovascular system, which is a remarkable fact. The central portion of the oral side of the disc is free of the sucking frills.

Those on the axial side of each two oral arms unite in perradial planes and form four perradial wings of sucking frills. The wings are very short (fig. 12). At each junction of the oral suture ("Pfeiler-gabel" of HÆCKEL) there hangs down an appendage of very large size.

The subgenital cavity lies between the umbrella and the oral disc. It is divided into four large lobes, separated from one another by as many long perradial septa. The length of each septum is about three-eighths the greatest breadth of the cavity. We do not find crucial gelatinous thickenings continuous to these septa. The gastrovascular membrane is not loose. There are four interradianal gelatinous ridges which run directly from the lower lip of the subgenital ostia. The latter are very small and of crescent shape.

The oral arms are short, thick and stout. They belong to a primitive type of the three-winged arms and show many characteristic features. They are shorter than the umbrella radius and do not project out of the umbrella margin. The upper arms are nearly coalesced and form a large part of the octagonal oral disc. The upper arms project from both sides of the oral disc, axially as well as abaxially. The lower arms are also very short, being of nearly the same length as the upper arms. The axial wing of the oral arms is very well developed, giving out a profuse quantity of branches which completely cover the axial portion of the oral arm. The abaxial wings are wide; they are developed upwards. Appendages of the oral arms are very long, numerous and circular in cross-section. There are from six to eight of them on each abaxial wing; much more numerous are they on the axial wing. They are canalled and many of them are longer than the umbrella diameter. Specially long and large appendages

are found at the junction of the oral suture and near the lower end of the oral arms.

The gastrovascular system is remarkable in many points. It forms a very fine network in the subumbrella (fig. 13). The eight ocular canals run straight and are easily distinguishable from others, though there exists no special difference in calibre. Between each two ocular canals we find five or six canals which soon divide into numerous smaller ones. Radial muscular ridges receive many small blind branches from the network of the canal system. The circular canal is wanting. Each velar lobe receives a very minute network of the canal system. The central stomach cavity is nearly circular, not cruciate. No canal is contained in the oral disc, but in its lower surface a canal is seen in each of the adradial ridges or keels of the oral crisps (fig. 12).

The umbrella in the preserved state measures 14 cm. in diameter.

The animal is colorless, with the exception of the margins of the velar lobes which are brown.

The medusa is known from Misaki. It is found in the colder months of the year.

Tokyo, 25 Jan., 1902.



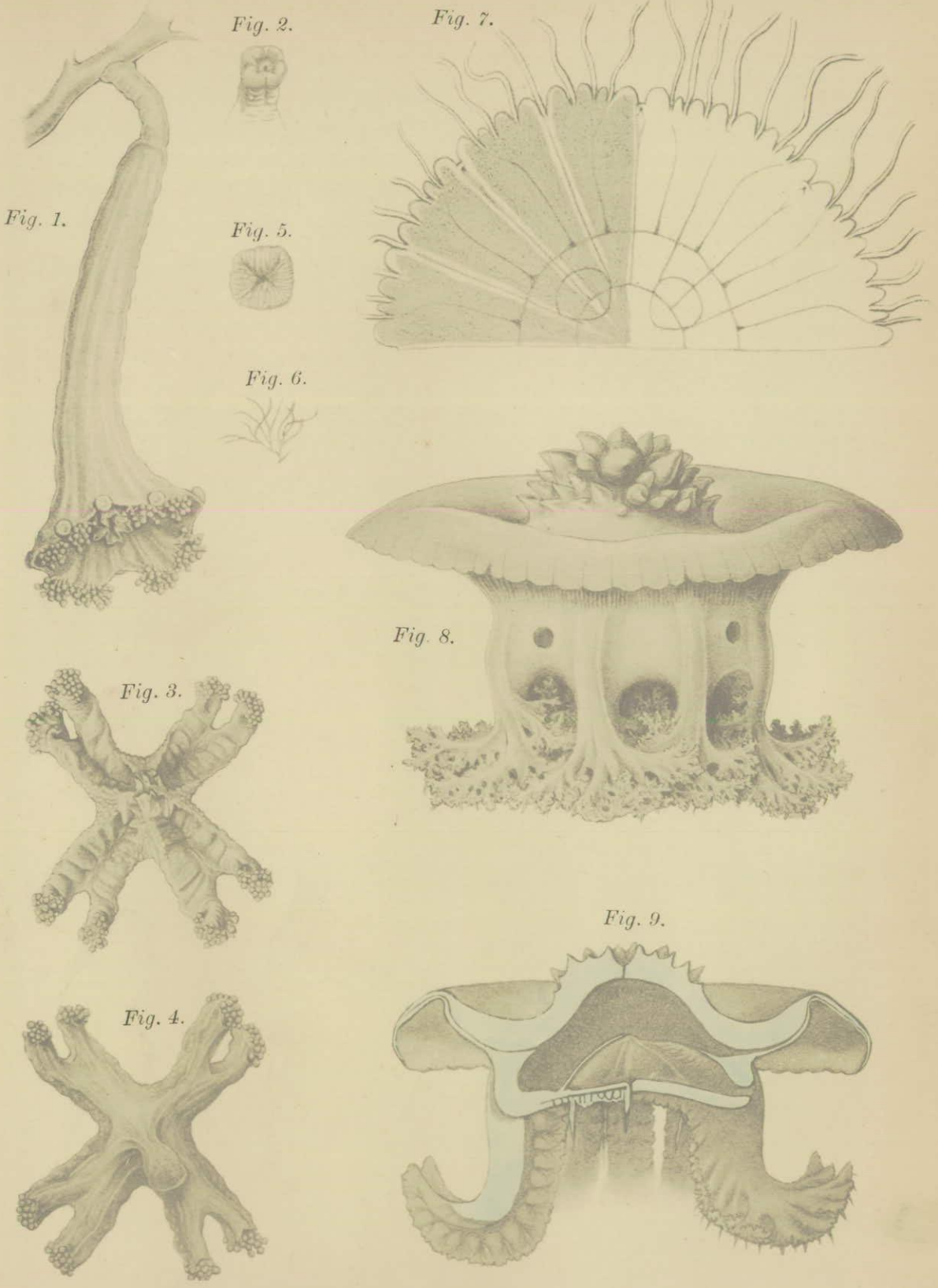
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PLATE I.

Plate I.

- Fig. 1.—*Stenoscyphus inabai*. 3× natural size.
- Fig. 2.—Peduncle of *Stenoscyphus inabai*, showing its adhesive surface.
- Fig. 3.—*Schizodiscus nagatensis*. 2× natural size. Oral view.
- Fig. 4.—*Schizodiscus nagatensis*. 2× natural size. Aboral view. The peduncle is bent aside.
- Fig. 5.—Peduncle of *Schizodiscus nagatensis*. Adhesive surface.
- Fig. 6.—Gastral filament of *Schizodiscus nagatensis*.
- Fig. 7.—*Kuragea depressa*. Natural size.
- Fig. 8.—*Microstylus setouchianus*. $\frac{1}{2}$ natural size.
- Fig. 9.—Longitudinal section of *Microstylus setouchianus*. The left half represents a section through a perradial plane, and the right half that through an interradial.



1—2, *Stenoscyphus inabai*.

7, *Kuragea depressa*.

3—6, *Schizodiscus nagatensis*.

8—9, *Microstylus setouchianus*.

PLATE II.

Plate II.

Fig. 10.—Portion of the umbrella of *Microstylus setouchianus*, showing the canal system and the radial muscle.

Fig. 11.—*Perirhiza nematophora*. $\frac{1}{2}$ natural size.

Fig. 12.—Longitudinal section of *Perirhiza nematophora*. The left half represents a section through a perradial plane, and the right half that through an interradial.

Fig. 13.—Portion of the umbrella of *Perirhiza nematophora*, showing the canal system and the muscles.

Fig. 11.

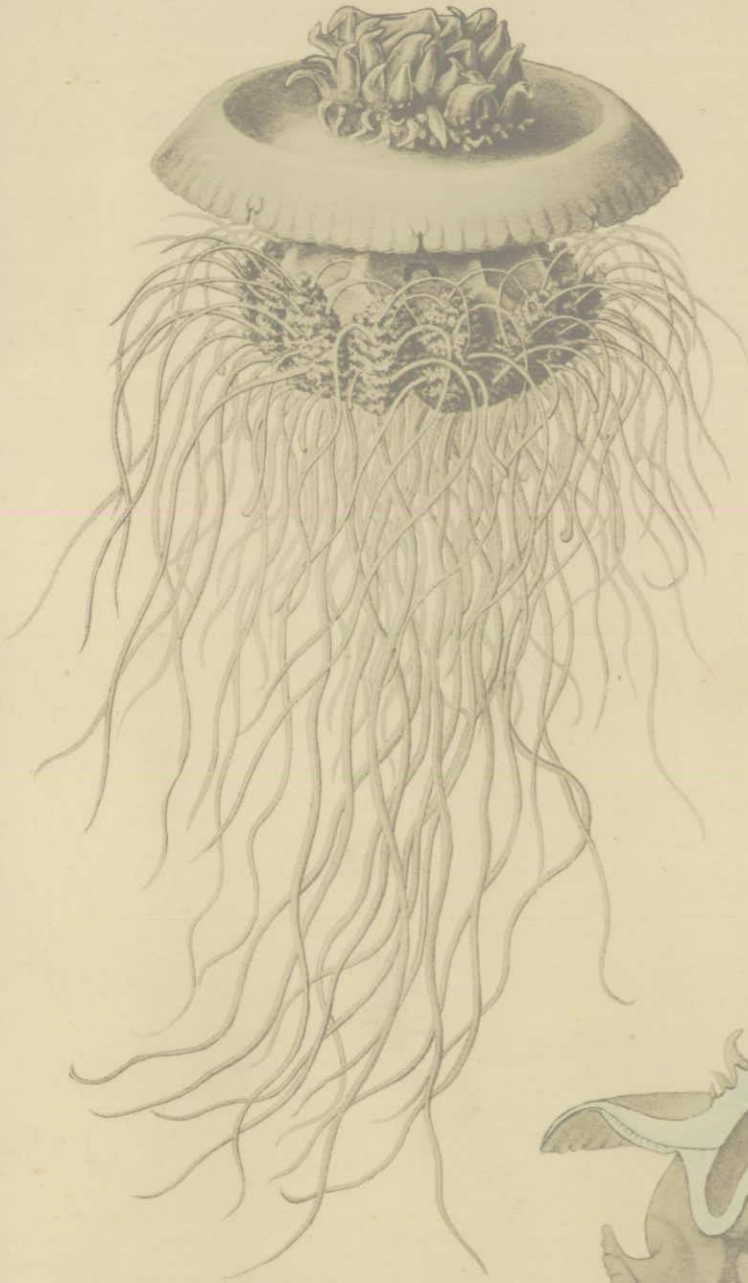


Fig. 10.

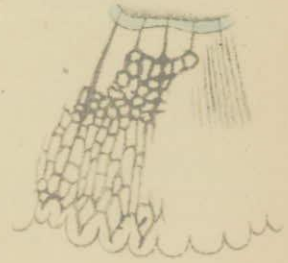


Fig. 13.



Fig. 12.

