To Dr A. K. Totton
with the best compliments
of the author.

A Report on Japanese Siphonophores with Special References to New and Rare Species.

By

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A REPORT ON JAPANESE SIPHONOPHORES WITH SPECIAL REFERENCES TO NEW AND RARE SPECIES

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Tamiji Kawamura

(With Plates I—VII)

Introduction

A considerable number of Siphonophores were found rather frequently at the Misaki Marine Biological Station where the author spent some vacation time in collecting and studying this animal group in the years 1907–1910. Such smaller forms as Calycophorae were obtained by horizontal surface hauls of a plankton net in day time or at night. Most of the larger forms, however, were hunted from a small row boat on a calm sea surface off the station and taken up together with some quantity of water by dipping a bucket or a large glass jar by human hands. Various kinds of anaesthetics were used for stupi~~di~~fying the animals. Slow but very good result was experienced with magnesium sulphate. Being thus enabled to study fresh and perfect colonies, the author believes he was in rather favorable condition to study the Japanese Siphonophores.

Some more specimens, which had previously been taken at various places on the Pacific coast by various zoologists and kept in the Zoological Institute of the Tokyo University, were put under my disposal by the kindness of the lamented Professor I. Ijima. The results thus obtained were partly reported in my previous papers published between 1910 and 1922 in the Japanese language, since there were no new species to be recorded for the world.

The Japanese Siphonophores referred to in the present report comprises not only the above-mentioned specimens, but also many more important materials from other sources, for instance, the Seto Marine Biological Station of Kyoto University which was open in 1922. Some Calycophorae were captured in March, 1915 by myself at Tomo Harbor on the north shore of the Inland Sea, while some other Calycophorae were found within the materials from certain regions of Hokkaido which were collected by a cruiser boat of the Fishing Station of Hokkaido Prefecture and were kindly sent by Mr. E. Kajiyama for the author's study.

Upon visiting the United States of America in 1919–1920, the author was so fortunate as to get permission to examine many specimens of Siphonophores kept, both in the Museum of Comparative Zoology, Harvard University and in the U. S. National Museum, Washington D.C.. The specimens thus studied were found very interesting, being always favorable to support the author's views which he had built by the former studies of Japanese Siphonophores. Moreover, the complete library of the Harverd University was also beneficial to him for deciding some ambiguous points from which his previous reports could not be free.

The most interesting and very important species belonging to Forskaliidae, Anthophysidae, and Rhodaliidae dealt with in the present report were captured by His Majesty the Emperor's Collecting Boat in the Sagami Bay and adjacent waters during the last twenty years. Most of these specimens were skillfully killed and have been carefully preserved until now in the Tokyo Palace.

The Bay of Sagami is celebrated in supplying to us enormous kinds of pelagic animals, because some branch streams of the Black Current find, from time to time, their way into this region. It is also famous in producing many deep sea forms, since an abyssal groove runs northward into this bay.

A great number of species of Siphonophores hitherto reported from the Pacific Ocean, are very imperfectly characterized owing to the incompleteness of the original descriptions given by old collectors. Neverthless the identifications of such old forms have often been ventured by many European as well as American students. It is needless to say that these works have added many new forms of great interest and have succeeded in valuable comparison of the anatomical and embryological features of many Siphonophores. But in the same time, it must be recognized that some of these works have introduced much confusion in regard to the systematics by their too positive decisions on many ambiguous forms. In this respect Bigelow's works (especially that of 1911.) must be highly appreciated, having been done most thoughtfully and identified moderately.

In the present report an enumeration of all Siphonophores from Japanese coasts is attempted.

Some of the recent authors have been too hasty in uniting many old species, neglecting many reasonable differential characters given in the original descriptions of them. So far as the species here dealt with, many such characters are considerably good and definite enough to retain their distinction.

Of numerous families of Siphonophores, Agalmidae and its allies include many important species that have been repeatedly studied on account of their common occurence as well as of their complicated structure. But there lies a

great difficulty in the study of these groups. Being the most delicate and weakest of all Siphonophores, they are usually obtained in a very poor, disturbed state, compared with another families of Siphonophores. This is especially true with the specimens collected by a big expedition in open seas. Under such circumstance it is clear that a closer examination of living individuals or carefully preserved specimens are indispensable in order to settle many questions as to the systematics as well as the morphology.

The aim of the present report, therefore, is rather manifest, namely: in the first part, to appoint Japanese coasts as new localities of some species, to undertake a systematic revision of some families; in the second part, to try a morphological comparison of many families based upon a new idea obtained by my own studies.

Here I must register my indebtedness to the lamented Professor I. Ijima of the Tokyo Imperial University under whose supervision my study of Siphonophorae was started. My sincere thanks is expressed to Dr. H. B. Bigelow of the Museum of Comparative Zoology, Harvard University who, not only enabled me to investigate numerous specimens from the whole world, but also was so kind as to give much helpful advises and suggestions. Thanks are also expressed for the kindness of Mr. E. Kajiyama and many other friends of mine to send specimens from various regions of Japan. My obligation is also due to Dr. A. H. Clark of the U. S. National Museum who was very kind when I was in that museum and permitted me to examine some of the preserved specimens. It is the greatest honour that I was allowed to study many good spcimens kept in His Majesty the Emperor's Biological Laboratory in the Tokyo Palace.

A list of Siphonophorae from Japanese coasts

Order CALYCOPHORAE Leuckart

Family **MONOPHYIDAE** Claus

Subfamily MUGGIINAE Bigelow

Genus Muggiaea Busch, **1851.**

(1). *Muggiaea atlantica* Cunningham, 1892.

Very common at Misaki, especially so in winter. The nectophore 3.5–4 mm. in height and 1.3–2 mm. in dorso-ventral width.

(2). *Muggiaea spiralis* (Bigelow), 1911.

Captured at Misaki in February, 1911. The nectophore was 5 mm. in height.

Genus Doromasia Chun, **1888.**

(3). *Doromasia picta* Chun, 1888.

First found in December 29, 1907 at Misaki. The nectophore was 9.5 mm. in height and 3 mm. in dorso-ventral breadth.

Family **DIPHYIDAE**

Tribe **OPPOSITAE** (Prayomorphae).

Subfamily PRAYINAE

Genus Praya Brainville, **1834.**

(4). *Praya cymbiformis* Delle Chiaje, 1842.

Common at Misaki, especially in spring and summer. The larger second nectophore was ca. 35 mm. high and ca. 24 mm. wide.

The largest specimen from off Hayama, the Sagami Bay is kept in His Majesty the Emperor's Biological Laboratory. Its first and second nectophores are 32 and 36 mm. high respectively.

Genus. Rosacea Quoy et Gaimard, **1827.**

(5). *Rosacea plicata* Quoy et Gaimard, 1827.

Found in winter at Misaki. The larger nectophore 25 mm. in height and 18 mm. in breadth.

Subfamily STEPHANOPHYINAE

Genus Stephanophyes Chun, **1891.**

(6). *Stephanophyes superba* Chun, 1891.

Of two colonies from Misaki, one captured in January, 1910 by the author himself had the largest nectophore measuring 8.5 mm. in height and 5 mm. in breadth and a special nectophore of the cormidia 10 mm. in length and 4.5 mm. in height.

Tribe **SUPERPOSITAE** (Diphymorphae)

Subfamily GALEOLARIINAE

Genus Galeolaria Huxley, **1859.**

(7). *Galeolaria truncata* (Sars) Huxley, 1859.

A single specimen of the upper nectophore obtained in the winter, 1910

was 6.5 mm. high and 3 mm. wide dorso-ventrally.

Subfamily DIPHYINAE

Genus **Diphyes** Cuvier, 1817.

(8). *Diphyes appendiculata* Eschscholtz, 1892.

Common at Misaki. More common around Hokkaido. The upper nectophore is 4–10 mm. high and 2–4 mm. wide.

(9). *Diphyes chamissonis* Huxley, 1859.

Common at Misaki, known also from Hokkaido and Seto. The upper nectophore is 4.5–10 mm. high and 1.5–3 mm. wide. The eudoxid nearly as high as the upper nectophore.

(10). *Diphyes bojani* (Eschscholtz), 1829.

Very common at Misaki. The upper nectophore is more than 15 mm. in height.

(11). *Diphyes dispar* Chamisso et Eysenhardt, 1821.

Often captured at Misaki. The whole height of the colony including both the upper and lower nectophores are 12–17 mm. The eudoxid is 6.3 mm. in whole length.

(12). *Diphyes contorta* Lens et Van Riemsdijk, 1908.

A single upper nectophore obtained at Misaki in February 1910, was 5 mm. high and 2 mm. wide. One more specimen of the same size was obtained by the present author at Tomo harbour, Inland Sea in March, 1914.

Subfamily ABYLINAE

Genus **Abyla** Quoy et Gaimard, 1827.

(13). *Abyla haeckeli* Lens et Van Riemsdijk, 1908.

Occasionally found at Misaki, 15 mm. in whole height. The upper nectophore is 6 mm. high and 3 mm. wide. The bract of the eudoxid 5 mm.× 6 mm. on its upper surface.

(14). *Abyla trigona* Quoy et Gaimard, 1827.

This species appears to be common at the southern half of the Pacific coast of Japan. The upper nectophore is 5 mm. high, and the bract of the eudoxid 5 mm.×6 mm. on its upper surface.

(15). *Abyla leuckartii* Huxley, 1859.

Occasionally found at Misaki and Seto. Usually the lower nectophore

missing. The whole height excluding the cormidia is ca. 15 mm. The upper nectophore 6 mm. high and 3 mm. wide.

(16). *Abylopsis tetragona* (Otto), 1823.

The most common species of Diphyid Siphonophores in Japanese coasts, 10–30 mm. in whole height. The eudoxid with the bract 4–5 mm. high. In usual specimens from Misaki, the upper nectophore is 3 mm. high along the median axis and the lower 14 mm. high, hence the ratio 1 : 4.5, while of a gigantic specimen from Futami harbor of the Bonin Islands, now kept in His Majesty the Emperor's Biological Laboratory in Tokyo, the upper 4 mm. and the lower 31 mm. respectively, hence the ratio is 1 : 8.

(17). *Abylopsis eschscholtzii* (Huxley), 1859.

Not rare on the Pacific coast of Japan. Contrary to the foregoing, the upper and the lower nectophores are nearly equal in height, and do not differ so much in dimension. The colony is 8–10 mm. in whole height. The bract of the eudoxid is 5.5 mm. high and 6 mm. wide on its upper surface.

Genus Bassia Quoy et Gaimard, **1827.**

(18). *Bassia bassensis* (Quoy et Gaimard), 1827.

Common on the Pacific coast of Japan, ca. 9 mm. in the whole height including both nectophores. The eudoxid also common, the bract of which 3–5 mm. in height along the vertical median axis, and the largest gonophore about 3 mm. in length.

Family **DIMOPHYIDAE**

Subfamily DIMOPHYINAE

Genus Dimophyes Moser, **1926.**

(19). *Dimophyes arctica* (Chun), 1897.

This species with the nectophores in which all ridges and teeth have been completely reduced and with relatively large nectosac, was first recorded from the Arctic region, then the Antarctic region, and later from the Tropical Atlantic Ocean. This seems to be rather common around Kuriles and in the Cold Currrnt in the Japan Sea.

Specimens caught at a station off Muroran, Hokkaido in 1917 had the upper nectophore 12 mm. high and 5 mm. wide and the lower 3–5 mm. high and 1.5–2 mm. wide. The tiny eudoxid with a mitra-shaped bract was also obtained.

Family **HIPPOPODIIDAE** (Polyphyidae)

Genus Hippopodius Quoy et Gaimard, **1827.**

(20). *Hippopodius ungulatus* (Haeckel, 1888)

In the first two specimens captured by the author himself at Misaki, the largest nectophore was 8 mm. high and 8 mm. wide. Another specimen of nearly same size is kept in His Majesty the Emperor's Biological Laboratory, labelled, "Locality: Futami Harbour, Bonin Islands, Date of collection: July 31, 1927."

Order PHYSOPHORAE

Suborder PHYSONECTAE

Family **APOLEMIIDAE**

Genus Apolemia Eschscholtz, **1829.**

(21). *Apolemia uvaria* (Lamarck) Eschscholtz, 1829.

A specimen of this species is kept in the Museum of Comparative Zoology, Harvard University (Specimen No. 1875). It was obtained by the "Albatross" in the Straight of Tsugaru between Honshu and Hokkaido (Station No. 4810, depth 100–0 fathoms).

In this specimen, I noticed five individuals of Sagitta sp. attached to the cormidia, sticking tightly with their head end deeply thrust into the mass of cormidial group, so that the mere posterior end of their body was visible among the palpons. It has some resemblance in form as well as in transparency to the palpons and was to be easily confused at first glance, if its characteristic fins were overlooked. It is not clear whether this Sagitta had any ecological connection with this Siphonophore if it had only accidentally intermingled with the latter. Neverthless, I record this matter here because such an identical centripetal position of all five Sagitta can hardly be explained as a matter of accident, and also because a figure that looked like the posterior part of the body of Sagitta is given in the original drawing of the siphons of *Apolemia uvaria* by Brainville (1834, pl. III, fig. 1a).

Family **FORSKALIIDAE**

Genus Forskalia Koelliker, **1853.**

More than five species of Forskalia have been recorded from the Atlantic,

the Pacific and the Indian Ocean. According to Bedot (1893) and Schneider (1898), they are to be distiguished by differences in colour of the netophore, the tints of the radial canals as well as the vellum of the nectosac. Such characteristics, however, can hardly be confirmed in preserved materials. In the author's opinion, there may be some other characteristics available for the diagnosis, for instance the general contour of the nectosome, the shape of the single nectophore and the form of the bracts. Two species from Japan were thus identified and determined as follows:

(22). *Forskalia tholoides* Haeckel, 1888.

(Plate I. figs. 1, 3–6)

This species was first described by Haeckel from a material that he had obtained at Lanzerote, Canary Island in 1866. Later it was captured in the "Sudpolar Expedition"; also it was recorded from Tortugas, Florida of Tropical America. It is well-marked by the nectosome of campanulate form or cupola-shape, a long slender conical nectophore, and a foliate bract with incised margins. The present specimen was caught by the boat of His Majesty the Emperor of Japan on January 5, 1953, on the surface water at Samejima, off Hayama, Kanagawa Prefecture. It was narcotized and fixed very skillfully so that the siphosome was kept until now in a very good condition, although the entire nectosome is missing.

Each single bract, though variable in size, shows the shape agreeing with the original description by Haeckel.

(23). *Forskalia misakiensis* n. sp.

(Plate I, figs. 2, 7–11)

A very fine specimen was captured by His Majesty the Emperor of Japan on January 9, 1952 on a calm sea near the wharf of the Misaki Marine Bislogical Station at the mouth of the Aburatsubo Bay. Besides the well-preserved magnificent siphosome, it has the very shortened nectosome with ten younger nectophores sticking to the stem at the zone of proliferation just below a small ovate pneumatophore. Five more full-grown nectophores were found remaining in the bottle. They are quadrangular in general contour viewed from above, nearly 7–8 mm. in depth, 8–9 mm. in width, and very flat in the vertical view, being rhomboidal in the frontal section. The nectosac is relatively small. The other most characteristic feature is seen in the form of the bract, which is lobate, or spoon-shaped, with smooth margins, no denticulation at all. The tentillum is represented by a simple

cnidoband turning spirally without any campanulate involucre, and with a long slender terminal filament. In regard to the general contour of the nectosome, His Majesty the Emperor explained to the author that it was long and cylindrical.

Family AGALMIDAE

Genus Agalma Eschscholtz, 1829.

(24). *Agalma okenii* Eschscholtz, 1829.

(Plate II, figs. 1—7)

This is the most common Agalmid in the Sagami Bay, most abundant during winter and spring. In August 1907, the author met with a large school of this species in the Pacific near the volcanic island Oshima, Izu. The late Professor Mitsukuri told me that he had frequently observed it on the sea off Yaizu, in the Suruga Bay. Perhaps it is rather densely distributed in the Pacific coast of Japan all through the year.

The colony is composed of compact grouping of zooids and is in the form of a cylidrical rod with rounded upper and lower ends, of 8 cm. long and 2 cm. broad in the smallest and more than 13 cm. long and more than 3 cm. broad in the largest specimens which have been measured while swimming in a basin. The axial stem of the body is usually in a straight line, but not seldom it is found so curved as to compose an arc line, convex to the ventral side. In this case the stem of the siphosome is bent stronger and more frequently than that of the nectosome. In natural circumstance the colony is usually floating with its longitudinal axis situated obliquely, but sometimes in vertical and very rarely in nearly horizontal position with its ventral side directed downwards. It gives a splendid appearance with its tentacles with numerous tentilla expanded many feet long and its rigid nectophores and bracts glistening in the sunshine. If the sea is calm, it often comes up to the surface of the water, so high that its pneumatophore is nearly exposed in the air. If it becomes wavy even in the slightest degree, it soon sinks down to a considerable depth. Often it seems to respond to an artificial agitation of water. The contraction of the nectophores as well as the withdrawal of the pneumatophore into the upper end of nectosome occur irregularly with indefinite intervals. The tentacles are very extensile, sometimes extended as long as 1 meter, but can be withdrawn entirely into the carapace of bracts in a short time.

As for the form and arrangements of zooids of this species, a detailed

account will be published right after this, so that at present the author shall limit himself in relating the following fact that appears to be special to this genus.

At a glance to the top of the nectosome of the colony, we easily recognize two paired diverticula or blind canals in course of the lateral canals of the nectosac of the younger nectophores. These diverticula are formed in a very early stage, about when a bottle-shaped bud is going to be differentiated into two portions, a main body of nectophore and a stalk. While the nectophore performs its further growth, an obliteration takes place in this diverticulum and assumes the form of a tubular process whose long axis is directed from the proximal summit of the lateral portion of the nectosac towards the lateral proximal corner of the nectophore. This process, however, does not persist permanently in that state, but gets shorter and thinner and at last diminishes when the nectophore becomes large enough to take its regular position in the pile of nectophores. Such structure is never known in another Agalmids.

It is rather surprising that no student of Siphonophorae since Eschscholtz paid any attention to this feature in the development of nectophore, for it is a character easily visible even with the naked eye and is a character on which Eschscholtz placed much weight and illustrated in his figure (1829, p. 51), although he mis-understood this process a diverticulum of the nectosac, instead of its lateral canal.

In 1908 Lens and Van Riemsdijk found a nectophore of similar structure in the bottle of *Erena bedoti* belonging to the next family, Forskaliidae. They believed that "it surely belonged to the same specimen". But judging from their drawings (Pl. 11, figs. 85–90) it has a striking resemblance to the nectophore of *Agalma okenii*.

Genus Crystallodes Haeckel, 1869.

(25). *Crystallodes rigidum* Haeckel, 1869.

(Plate II. figs. 8—12)

This is also one of the common Agalimids at the Sagami Bay, though rarer than the foregoing *Agalma okenii* which it resembles in general appearance and in the habitat in nature too. The average size measured in a considerable number of specimens was smaller than *A. okenii*, a whole colony being about 5 to 8 cm. in length and 1.5 to 2 cm. in the greatest breadth. Haeckel's *Crystallodes vitrea* is identical with this species. The

scientific name, *Crystallodes polygonata* Dana, which has hitherto been used in the author's Japanese descriptions should be abandoned, since carefull examination of Dana's original report convinced the author with that it is rather identical with *Agalma okenii*.

The systematical differences of this species from the foregoing was much discussed, but seems to the present author to be not yet fixed satisfactorily. The problem shall be referred to in detail in the author's next account to be published after this, hence some important characters, that mark good contrast between the two species, will be mentioned here preliminarily.

1). The nectosome in this species is almost equal in length and breadth to the siphosome, while in *A. okenii* the siphosome is always longer and broader than the nectosome.

2). The flat, wedge-shaped nectophore in this species has on one side a single vertical ridge, instead of two as in *A. okenii*, so that the entire nectosome has 8 vertical ridges, instead of 12 as in *A. okenii*.

3). The lateral canal of the nectosac of the young nectophore has no such blind diverticulum that is produced into the jelly mass of the proximal lateral corner, as it is distinctly seen in *A. okenii*.

4). Each cormidium has 6 bracts, 3 on one side, so that the entire siphosome is covered by 6 longitudinal rows of bracts. In *A. okenii* it has 8 rows of bracts.

5). The truncated distal face of the bract has four facettes only i.e. distitute of two smaller infelo-lateral facettes which are indispensable in the bract of *A. okenii*.

6). The cnidoband of the tentillum is coiled spirally 3-4 times, which is 8-9 times in *A. okenii*. Of three terminal appendages of the tentillum, the paired lateral filaments are shorter than the unpaired central ampulla, while the former is much longer than the latter in *A. okenii*. In *C. rigidum* that filament is armed with nematocysts on one side only, so that it is curled into a helical spiral in the preserved specimen. In *A. okenii* the filament is armed on all sides, so that it does not take such a spiral form when contracted.

Although many students later than Schneider (1898) were of the opinion that *Crystallodes rigidum* and *C. vitrea* of Haeckel are synonymous to *Agalma okenii*, it is clear from the above-mentioned diagonosis that they must be distinguished from each other.

Genus Agalmopsis Sars, 1846.

(26). *Agalmopsis elegans* (Sars), 1846.

Two complete colonies of this species were obtained, besides many decomposed fragmentary materials. Of these two, one was captured in a healthy condition by the author in January 1910. The other was caught by a boat of the Fisheries Station of Hokkaido in July 1917 in the sea off Muroran, Hokkaido. The sketches of the first specimen were done from life and then it was killed in an extrordinarily good state, although it was throughly dissected by the author in course of his closer examination. The nectosome of this specimen in life was 4.5 cm. in height and 1.5 cm. in lateral breadth. The siphosome was very long, more than 5 times as long as the nectosome. While alive, it was very mobile and contractile. When measured in a middle state between contracted and fully expanded, it gave a length of 21 cm. It had twelve distinct cormidia besides younger buds at the zone of proliferation just below the nectosome. The fullgrown bract is lobate, convex in the upper surface and concave in the lower, 10 mm. long and 6 mm. broad in average. More detailed description will be given in the other account. The specimen from Muroran exceeds in size the foregoing, the bract, for instance, was 12 mm. long and 9 mm. broad. The tentillum of this species has very long lateral horns.

Genus Stephanomia Peron et Lesueur, 1907.

(27). *Stephanomia bijuga* (Delle Chiaje) Bigelow, 1911.

Eight complete and many incomplete specimens of this species were obtained at Misaki mostly in January and February, 1910. Besides, the Zoological Institute kept a beautiful specimen from Misaki fixed by Professor I. Ijima some years earlier. The specimens examined varied considerably in size, the largest one having a nectosome 25 mm. long and 7.5 mm. wide.

This is one of ths commonest Agalmid at Misaki. Fragmentary pieces of this animal are found frequently mixed in the every day's hauls of surface plankton. The complete colony, however, is not captured so often, because it is pretty difficult to detect this animal while swimming the open sea-surface on account of its small size. The siphosome is very extensible and contractile and is withdrawn vertically with a considerable rapidity.

(29). *Stephanomia amphitridis* Peron et Lesueur, 1807.

A small siphosome bearing five cormidia was obtained at Misaki in January, 1910. It was detected mixed in the morning hauls of plankton materials.

The nectophore was looked for, but in vain. The stem of the siphosome in question was 5 cm. long and 1 mm. wide. Five large cormidia were represented by five well-developed siphons accompanied by numerous palpons, bracts and gonodendra of both sexes.

The largest bract is 2 cm. long and 9 mm. broad. The bracteal lamella is a semilunar longitudinal fold of the stem and fits to the bract at the middle portion of the inner side of the bract so that the upper end of the bract is more or less freely projected. Such feature has never been known in Agalma or Crystallodes, and not positively so in Agalmopsis and the foregoing *Stephanomia bijuga.*

In the internodial portions of the axial stem between two succeeding siphons, there are found usually five bracts, one dorsal and four lateral. Their arrangement is well shown by the position of the bracteal lamellae on the stem. Four lateral bracts are apparently divided into two pairs, one pair being located upper and a little dorsal than the other pair. The unpaired dorsal bract is not on the strictly dorsal side, but always deviated from the median line either to the right or to the left. As has already been noticed by Bigelow (1911), the bracts form five somewhat regular rows around the stem. Strictly speaking, no two of the bracts are identical in the shape, since this bract may more or less be modified in such way that one bract must harmonize with all neighbouring bracts and since the arrangement of the bracts into the rows is not so regular as in Agalma and Crystallodes.

In four specimens of this species kept in the Museum of Comparative Zoology, Havard College (specimen No. 498, 28303, 28304, 28305), I could ascertain many of the above-mentioned characteristics of this species; for instance, the arrangement of the bracts, one-sided position of the tentacles and the development of the tentilla. These specimens were already thoroughly studied and reported by Bigelow (1911, p. 287). His illustrations (Pl. 18, figs. 1–8) are so true that we can see in them all of the characteristics here referred to, although he does not give detailed explanations about them. The only slight difference I could see in foreign specimens from Japanese is that both the male and female gonodendra were so close to each other that they often stood almost side by side at the same level.

This species is already known from many different seas. It is queer, however, that the nectosome of this species has never been obtained. Huxley's specimens, the material of the Siboga Expedition, the same of the Albatross,

and my own material were equally destitute of the nectosome. But judging from my specimen there is no doubt that the animal ought to have it, as Bigelow (1911 c, p. 287) has reasonably inferred from his specimens.

(29). *Stephanomia cupulita* (Lens et Van Riemsdijk), 1908.

A single specimen caught in a somewhat disturbed state at Misaki in April 1909, had a nectosome with six full-grown and many younger necophores and a siphosome composed of six cormidia besides some younger at the upper end. The bract was 10 to 13 mm. long and 6 to 8 mm. broad.

In this species the terminal filament has at its distal extremity a spherical ampulla, distal half of which is covered by larger nematocysts than the proximal half. Lens and Van Riemsdijk illustrate this dilation with an oval figure, calling "a small acorn-shaped appendage. In my specimen it was beautiful spherical. It is interesting that a rudiment of this organ is to be seen in a younger tentillum of *Stephanomia rubra*. I ascertained this in a specimen kept in the Harvard Museum (Grampus specimens, Station No. 10166). It is distinctly shown in Bigelow's drawing (1918, Pl. 8, fig. 5), although he does not mention it.

Family **PHYSOPHORIDAE** (Discolabidae)

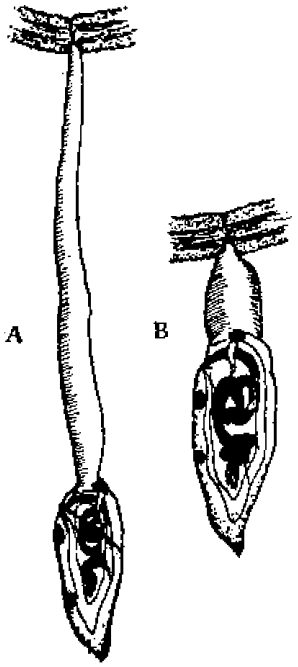
Genus Physophora Forskal, 1775.

(30). *Physophora hydrostatica* Forskal, 1775.

This species seems to be rather common in the Sagami Bay, judging from the specimens hitherto taken up by several zoologists of Japan. The descriptions of our specimens may have a place in other accounts of the author, so that he confines himself now in reporting that there are two subspecies of Physophora, which can easily be distinguished by the difference of size as well as as the form of the tentillum.

(A) *Physophora hydrostatica minor*.

A typical specimen of this dwarf form was obtained at Misaki in July, 1907. It was found swimming near the surface, fished up carefully and carried to the laboratory of the Biological Station thereby. It was still active, showing a



Textfigure 1.
The tentillum of *Physophora hydrostatica minor* (A) and *P. h. major* (B)

rhythmic contraction of the nectosacs and a convergent bending movement of the corona of siphons and palpons. It measured in life ca. 30 mm. from the top of the pneumatophore to the lower end of the cormidial groups and ca. 15 mm. in the greatest width. The nectophore was 5 mm. long along the sagittal axis and 2.5 mm. in the horizontal lateral axis. The tentillum in this form has a long slender pedicle compared with the cnidosac.

(B) *Physophora hydrostatica major.*

The larger colony of this species, of which many fresh or preserved specimens were studied by the author, were in average 60 mm. high and 30 mm. broad, i. e. twice as big as the foregoing smaller form. The tentillum in this form has a short and very thick pedicles as it is clearly shown in accompanying text-figure.

The arrangement of the cormidia exhibits some difference between two subspecies, which will be discussed in another paper.

Family **ANTHOPHYSIDAE**

Of the four genera adopted by Haeckel (1888b), two (Melophysa and Rhodophysa) are not recognized by the recent students on account of the lack of necessary description in detail, neither with any figures. The other two, Athorybia and Anthophysa are well marked and distinguishable from each other by many sound characters, of which the tentillum is most distinct. In Anthophysa two kinds of tentillum are found, an oridinary tricornuate one and the other with dendritic appendages, while in Athorybia no such tentillum of the latter type exists.

Genus Athorybia was established by Kölliker after a specimen he had obtained at Missina Strait in 1852 which was then recorded as *A. rosacea*, appreciating an old description given by Forskal in 1775, as *Physophora rosacea*. Numerous other species were reported by later students, but most of them are at present regarded synonymous with *A. rosacea* of Kölliker.

Genus Anthophysa was first recorded by Brandt in 1835, with a species he called *A. rosea*. Only other species *A. formosa* (Fewkes) Haeckel survives now among many neglected species recorded by later students.

Genus Athorybia Brandt, **1835.**

(31). *Athorybia longifolia* n. sp.

(Plate III. figs. 1-7)

A single specimen of the colony was captured by the boat of His Majesty,

the Emperor of Japan, on Feb. 19 1950, off Hayama, Sagami Bay (Surface). It was skillfully fixed and has been kept in alcohol until it was put to the author's disposal. The specimen is colourless except that the contents of the siphon is more or less yellowish brown, and that the apex of the pneumatophore as well as the coiled cnidoband of the tentillum within the campanulate involucre retains some faded red pigments.

In dimension, the entire colony with majority of its full-expanded bracts upturned is about 22 mm. high and 20 mm. long along the median line from the dorsal end to the ventral end.

The much inflated corm contains in its interior a very large pneumatophore, the apex of which is conceivable by the distribution of pigments. Its general contour is obliquely oval, bilaterally symmetrical, the ventral margin being very long and strongly curved. But this shape of the corm is not easily obvious since it is covered densely on all sides by various zooids of cormidia namely, bracts, palpons, siphons, gonodendra and tentacles.

The apex of the pneumatophore is round and smooth, containing in its ectoderm numerous polygonal pigment-cells that compose eight radiating rows. The narrow naked area of the corm near the apex is surrounded by dense bundles of the palpons. The ventral median corner of this area is occupied by younger buds of the cormidia. Close to these buds and on the both lateral sides, arise a number of the muscular lamellae of the bracts. These lamellae of detached bracts of the anterior group are seen in the figure (Pl. III, figs. 3, 5,) like the pages of a book.

The bracts offers the most characteristic feature of the present species. Instead of being spatulate in form as illustrated by Bigelow (1911, Pl. 23, fig. 3) on *Anthophysa rosea*, or lanceolate sickle-shaped as reported by Haeckl (1888b, Pl. XI, figs. 1, 2) on *Athorybia ocellatea*, it is in this species a very long flat tape-like structure, so soft and flexible that it floats freely in water. The length of the bract is more or less variable, usually exceeding 12 mm. The bract is completely destitute of any longitudinal ridge, or of any nematocyst ribs on its surface, as known in the other species.

A simple bracteal canal runs within the jelly mass along the median line and terminates blindly near to the distal end where it is slightly inflated.

In regard to the function carried by the bracts in Anthophysidae, Haeckel (1888b, p. 271) considered it "organs of protection as well as of locomotion", relating as follows: "When freely swimming at the surface of the tranquil sea, the corona of bracts is alternately closed and opened by slowly elevating and depressing the single bract." "But when the animal is alarmed,

the bracts are contracted closely together and surrounded a subspherical, nearly closed cavity in which the retracted palpons, siphons, tentacles, and gonodendra are hidden." The bracts in the present species is no doubt an organ of protection but can hardly be an organ of locomotion, owing to its softness and flexibility.

Both lateral faces of the corm are occupied by numerous palpons which form a series of the bunch of palpons corresponding to each cormidia. Fundamentally this series ought to run dorso-ventrally along a line between the series of bracts and that of siphons. But the palpons are so numerous and gregarious that some of them are shifted in position to free spaces around the gonodendra and the siphons. Each palpon is a cylindrical thick-walled tube with its pointed distal end armed with mighty nematocysts. Its size is variable, 4 to 6 mm. in length, and 0.5 to 1 mm. in width.

Eight siphons, beside some younger one in the zone of proliferation, are so situated in a ventral median line of the corm as to form a single line, although the distal half of the siphons is directed towards the left and the right alternately one after the other, presumably due to the relation of space. Each single siphon is composed of a short basigastric portion, a thick spindle-shaped gastric portion, and a dilatable distal aperture.

On both sides of the vesicular corm and inbedded among the palpons, are found another series of the gonodendra. Each gonodendron is composed of two gonostyles, a male and a female, arising very close to each other. The male gonodendron contains spindle-shaped androphores while the female gonodendron pear-shaped gynophores.

The tentacle starts from the face of the corm on the upper, or proximal side of each siphon, near to its basigastric portion. It is a rather thick string provided with numerous tentilla. In the present specimen the tentacle was extremely contracted so that the tentilla were crowded into an entangled mass as it is visible in the photograph picture accompanying this report (Pl. III, figs. 1, 2).

Each tentillum is composed of three portions, namely, a long cylindrical pedicle, a campanulate involucre embracing a spirally-coiled cnidoband, and three terminal structures, i. e. an ovoid median ampulla and two paired lateral horns. This is an ordinary type of tricornuate tentillum that is seen in many Agalmid siphonophorae, a fact that suggests to us the intimate affinity between Anthophysidae and Agalmidae. Any tentillum with dendric appendages was carefully looked for, but in vain.

Family RHODALIIDAE (Auronectidae)

This family, established by Haeckel in 1888 and comprising the other family Stephaliidae of the same author, contains at present five genera: Stephalia (Stephanolia), Rhodalia, Angelopsis (Auralia), Archangelopsis, and Dromalia. The author proposes herewith to add a new genus Sagamalia based upon many distinct characters that will be explained below.

Key to the 6 genera of Rhodaliidae.

A. Aurophre is a smooth-walled bag-like structure, opening to exterior by a single pore
  A′ siphosome solid bulbous mass.
    a_1) Corm penetrated by a axial central canal; tentilla absent ..... *Stephalia*
    a_2) Corm perforated with irregular network of canals, tentilla present. *Angelopsis*
    a_3) Corm without distinct canals, without hypocystic cavity; tentilla present ..... *Rhodalia*
  A″ Siphosome composed of many pyramidal cormidia radiating from narrow stalk; tentilla absent ..... *Sagamalia*
B. Aurophore provided with numerous papilliform appendages on its surface.
    b_1) Corm a voluminous thin-walled sac ..... *Archangelopsis*
    b_2) Corm a bulbous gelatinous mass ..... *Dromalia*

Genus Sagamalia nov.

(32). *Sagamalia hinomaru* n. g., n. sp.

(Plate IV, figs. 1-9).

A single specimen of this animal was captured by the boat of His Majesty the Emperor of Japan on August 23, 1935, at Minami-Amadaiba in the Sagami Bay, ott Kurosaki, Kanagawa Prefecture, at the depth of 450 meters. The colony was prefect and has since been kept in the best condition until it was entrusted to the author for study.

At a first glance, the specimen appeared to be allied to Stephalia, being composed of a nectosome in which a large central pneumatophore is surrounded by numerous nectophores horizontally so arranged as to form a single corona and a siphosome in which many siphons and tentacles are protruded from a gelatinous mass. But a still closer examination convinced the author with that the siphome is in a very unique constraction, quite different from all known cases. It consists of a bush of numerous cormidia not yet so compactly fused together as to compose a bulbous mass.

Viewed from above, the nectosome in the alcoholic specimen is elliptical, being 23 mm. and 20 mm. in dorsoventral and lateral diameter respectively.

The pneumatophore is a thin-walled elliptical sac, measuring 12 mm. in length and 8 mm. in breadth.

Under the pneumatophore, and close to its dorsal edge, there is a tiny aurophore, spherical in form, smooth all over its surface, and provided with an indistinct pore opening to the exterior.

The nectophore is a long ovate structure, 6–8 mm. wide in the most inflated part and more than 9 mm, long in longitudinal diameter. Each of them is attached to the outer ventral surface of the pneumatophore by means of a thin muscular lamella. A few younger nectophores are found at the budding zone, hidden between two full-grown nectophores.

The bract is a long pyramidal gelatinous mass with pointed apex, the base of which is triangular with three powerfully-armed corners. The lateral margins of the bract are usually so produced as to form two triangular wing-like portions which bend and approach to each other from both sides and construct between them a more or less deep groove along the longitudinal axis of the bract. The cormidium composed of a siphon and a tentacle accompanying a gonodendron, runs along the base of this groove, entirely or partly embraced by those triangular wing-like portions.

The bracts are attched with its apex to a common axial stem that starts from the lower surface of the pneumatophore. All bracts, therefore, are arranged so as to diverge from the common stem toward various directions, giving a false appearance of a massive body of the siphosome. It is supposed that these bracts, or rather cormidial structures in all, ar connected with the stem one after the other in a spiral manner, since a similar fact was detected by Bigelow (1911, Pl. 23, fig. 11) in Dromalia.

The siphon is big and thick-walled with a large dilatable mouth. The tentacle is extraordinarily thick and muscular without any tentillum-like appendages. It is not necessarily accompanied with the siphon but very often bears a lump of the gonodendra near its distal end. This is a clustered mass of the male or female gonodendra destitute of any medusoid appendages.

The specimen at present is almost colourless in all parts, but fortunately a very good colour sketch of the living animal, painted by an assistant immediately after the capture, is left and shows us that the pneumatophore, both the circular and the radial canals of the nectosac,and the distal half of the siphons were equally brilliant red in colour.

As it is visible in the foregoing description or the key, the present Rhodaliid

agrees with the other allied genera in possessing an aurophore, but differs from all hitherto described genera in that the siphosome is composed of a bundle of bracts embracing the other structures of the cormidium, instead of being an united bulbous solid mass. Hence is proposed a new genus, Sagamalia, meaning a corona from Sagami.

The specific name of the present species, "hinomaru" means in Japanese a red circle in the centre of a white area, as in the national flag of Japan, and was adopted to register the colour of the colony seen from above.

Suborder RHIZOPHYSALIAE

Family **RHIZOPHYSIDAE**

Genus Rhizophysa Peron et Lesueur, **1807.**

(33). *Rhizophysa filiformis* (Forskal) Lamarck, 1775.

In the first time, the author was able to examine three perfect specimens of this species. The one was obtained at Misaki in April, 1908 and has a pneumatophore, about 5 mm. long and a little less than 4 mm. broad. The other two had been kept in the Zoological Institute of Tokyo University and were labelled as collected off Jōgashima, Misaki in 1889. Many more specimens were obtained at various places on the Pacific coast of Japan. The gonodendron in this species is situated immediately below the siphon. The tentacle is provided with complicated appendages, i. e. a long pedicle and triconuate tentillum with unpaired terminal ampulla and paired lateral horns.

(34). *Rhizophysa eysenhardtii* Gegenbaur, 1860.

Of the first six complete specimens put at disposal, the best one had been caught by the late Mr. Uchiyama who fixed it very fairly; three others by Mr. K. Ishida, and the last two by Mr. M. Tawara, then a classmate of the author. All were found at Misaki in April, 1907. This is a common Rhizophysa in the Sagami Bay and adjacent seas, so that the author could examine many specimens since that time. The pneumatophore in preserved condition is from 10 to 17 mm. high and from 5 to 9 mm. broad, while the stem ranges in breadth from 0.5 to 1.5 mm. The younger cormidia in the budding zone below the pneumatophore show a somewhat conspicuous biserial arrangement.

This species differs from the foregoing in that the gonodendron is situated at the internodial portion of the stem, or midway between each two siphons,

and that the tentillum is a single thin cylindrical filament with scattered nematocysts on one side, destitute of tricornuate appendages.

As for the colour of this species, the author keeps his own picture sketched from life at Habu harbour, Oshima of Izu in July 1909. It was pale reddish brown all over the colony with dark brown pigments at the apex of the pneumatophore.

Eamily **BATHYPHYSIDAE**

Genus Bathyphysa Studer, 1878.

There have been recorded six species of Bathyphysa, namely:

1). *Bathyphysa abyssorum* Studer 1879. The original specimen obtained by an English boat "Faraday" in the N. Atlantic Ocean (depth: 1780 and 1000 fathoms) was only a single siphon and a single gonodendron clusted to a piece of the stem.

2). *B. grandis* Fewkes, 1880. From the Gulf Stream in the N. Atlantic Ocean (depth: 3458 meter). Later the "Siboga" brought another specimen supposed to be identical to this. In 1908 this species was transferred to genus Pterophysa by Lens and Van Riemsdijk.

3). B. gigantae Haeckel, 1888. Recorded in the "Challenger Report" after a piece of the bract from the S. Atlantic, but without any illustrations.

4). *B. grimaldii* Bedot, 1893. Captured five times by the "l'Hirondelle" in 1888 at the west of Azores (depth: minium 1372 fathoms; maximum 2000 fathoms). Also obtained by the "Princess Alice" eight times in the voyage between years 1892 and 1902 (depth 924 m.—5440 m.). All specimens, however, were inperfect, best one being mere an upper portion of the colony, or the pneumatophore with a few deformed siphons, and no gonophores.

5). *B. sibogae* Lens and Van Riemsdijk, 1908. Caught by the "Siboga Expedition" at S. of Borneo (depth 521m.) and E. of Celebes (depth 2081 m.). A broken piece of the stem with a few tentacles and some siphons.

6). *B. sp.* Bigelow, 1911. Obtained from the Tropical Pacific Ocean three times by the "Albatross" in her voyage during 1904–1905 (depth: 300 f. 300 f. and 800 f. respectively). All specimens were too poor to be identified.

Thus all the specimens hitherto captured are very incomplete, so that the following description of two specimens from Japan should be very usefull in solving many questions concerning the construction of the colony as well as

the taxonomical position of these species.

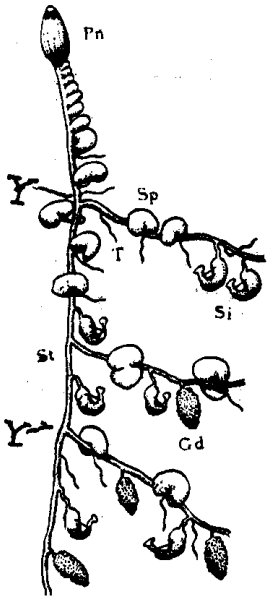
(35). ***Bathyphysa grimaldii*** Bedot, 1893.

(Plate V, figs. 1-3; Plate VI, figs. 1, 2; Plate VII, figs. 1-7)

One day in December, 1941 the author visited the Mitsui Oceanographical Laboratory at Simoda, Shizuoka Prefecture and happened to detect a specimen of Siphonophora, that appeared to the author to be this rare species, so that it was carried, under the keeper's permisson, to the author's laboratory in the Kyoto Imperial University. Indeed, it was a perfect specimen of *Bathyphysa grimaldii*. A full description of this specimen was given in Japanese in 1942 in the Zoological Magazine of Japan, Vol. 55, No. 2.

The specimen was kept in a narrow tube and was highly contorted and entangled. It measured in whole length more than 40cm., provided with numerous siphons and gonodendra on the stem.

Of 38 detached siphons, 26 were of bladder form or pneumatosiphon, "pneumatozoide" of Bedot (Plate V. fig. 2, Pl. VII, fig. 4.), while 13 were of hook-shaped siphon, "gastrozoide" of Bedot (Pl. V., figs. 3, 4, Pl. VII, figs. 2, 3.) and two more of a transitory type between the foregoing two, i. e. bladder-form siphon. Four gonodendra was also found in the bottle.



Textfigure 2.
A diagram showing *Bathyphysa grimaldii* in life.
Pn. Pneumatophore, St. Stem,
Sp. Pneumatosiphon,
Si. Hook-shaped siphon,
T. Tentillum, Gd. Gonodendron

There was no label denoting when, where, or how it was captured. It was announced by the keeper of the Mitsui Oceanographical Laboratory that the specimen is one of the collections hauled up at a certain station in the Suruga Bay, presumably off Heta of Izu, Shizuoka Prefecture, some years earlier than 1940.

As to the colour of the specimen in formaline fluid, all elements of the cormidia are of light salmon colour; the pneumatophore and the nectophores somewhat paler. The contents of the siphons in its gastric portin is dark brown.

The apical pneumatophore is spindle-shaped, 20 mm. in height and 6 mm. in maximum breadth, with some minute polygonal pigments of faded red

near the apex. It is opaque pelucid and it can easily be recognized the absence of hypocystic villi in the interior, a character distinguishing this genus from allied genus Rhizophysa.

The breadth of the stem differs here and there according to the degree of contraction of the stem. At the thickest portion it measures 3 mm. in diameter. On the ventral side of the stem immediately below the pneumatophore, there are many younger bladder-form siphons clustered densely with each other. The gonodendra, the tentacles and the hook-shaped siphons are situated more or less remote, or at lower zones, from above-mentioned (Pl. VII, fig. 1).

The most remarkable fact is that the stem branches at the portion where many gonodendra attach to (Text-figure 2). Such branching may occur in another point of the stem, but is hard to confirm on account of the strong contortion of the colony.

As explained above, the siphons in this genus are modified or deformed secondarily into various types, namely:

(1). Hook-shaped siphon. Composed of a long slender pedicular portion, an inflated gastric portion with hepatic villi in its interior, and a cylindrical proboscis with a distal aperture, the latter two of which are so curved in U-form, that the siphon take the shape of a fishing hook. On both sides of this siphon, a thin membrane is stretched to connect the gastric portion with the proboscis-like portion, so as to fix the curvature of the siphon constant. In the natural situation of the animal, this hook-shaped siphon may from time to time float in the water with its curved part up in order to diminish the weight of siphon, by means of a gas bubble secreted and kept between the membranes.

(2). The bladder-like siphon or "pneumatosiphon". The pedicular portion extremely shortened, the terminal tubular portion perfectly diminished, while the kidney-shaped gastric portion is converted to an airbladder-like structure, embracing a gas bubble in their interior.

(3). Some siphons situated rather remote from the apical pneumatophore often take a form that shows some transitory stages, the bladder-like form with a short pedicle or a distal aperture.

(4). Two or three pneumatosiphons united together. Usually this twin form is attached to the stem in the point of union. The dimension of these siphons varies exceedingly, for instance the kidney-shaped pneumatosiphon has its longer diameter changing from 10 to 18 mm.

The tentacle is a simple cylindrical string, varying much in length and 0.5 to 1 mm. in diameter. Its arrangement on the stem seems to be quite irregular.

The single gonodendron is composed of 10–20 gonophores, a medusoid appendage, and a single spindle-shaped gonopalpon. Numerous gonodendra are arranged over the surface of an oval body which is 0.3 mm. in length and 0.25 mm. in average breadth. This body when young is oval in the female gonodendron, and spindle-shaped in the male gonodendron.

The gonodendron is very similar in construction with that of Rhizophysa, but the arrangement on the stem is not so regular as in the latter, in which the cormidia take a very constant arrangement.

Bathyphysa japonica Kawamura, 1942.

(Plate VI, fig. 3; Plate VII, figs. 8, 9)

At about 11 o'clock a. m. of November 19, 1940, His Majesty the Emperor's collecting boat was dredging in the Sagami Bay at a station N73 W, 2.7 miles off Arazaki, 80 meters in depth. When the wire rope of the dredge was drawn up a unique siphonophora was found winding to the rope. That was this Bathyphysa. The lowest part of the colony was unfortunately broken and sank down. This is the shallowest record for Bathyphysa ever reported. Presumably it had been carried up by the Black Current, as many oceanic plankton animals were observed on the sea surface at the same time.

The specimen when delivered to the author's examination, was white in all portion except a coloured apex of the pneumatophore. According to the record made by an assistant on board the boat when caught, the entire colony was colourless and pelucid except that the apex of the pneumatophore was ornamented with reddish brown pigments, the interior of the siphon deep green, the distal aperture of the same yellowish green in tint.

The pneumatophore is spindle-shaped, 18 mm. in height and 6 mm. in maximal breadth.

The stem branches, as in the foregoing species, at three points (Pl. VII, Figs. 8, 9. Y), the first branching occurs immediately below the budding zone, the second at a point 80 mm. from the first and the third at 50 mm. from the second.

The stem differs in thickness at different positions owing to the degree of contraction.

Eleven siphons in all have been left on the stem, of which five are hook-shaped gastrozoid with a long pedicle and a distal aperture, the other six

are bladder-shaped. The latter one is not kidney-shaped but in the form of a curved spindle. The third and fifth siphons from the lower end are twin, cocoon-shapd, or two shiphons united together (fig. 9. Sp.).

The tentacle is a simple short cylindrical string (figs. 8, 9, T). The gonodendron is missing.

This species is distinguishable from the foregoing by (1) its lesser dimension of several zooids, and (2) form of the siphons and the pneumatosiphons. It does not agree with any hitherto known Bathyphysa, so that it was registered as a new species in 1942 in the Zoological Magazine of Japan.

By the study of these two species of Bathyphysa, the author is compelled to propose some new idea on the structure, a short reference of which shall be given herewith.

1). Lens and Van Riemsdijk's classification of Pterophysa and Bathyphysa relying upon the absence or presence of the pedicle in the siphon is unreasonable.

2). The repeated branching of the stem is the most remarkable fact in Siphonophora. The multiplication of the cormidia has rendered the colony very large and complicated, so that it has become necessary that the secondarily modified pneumatosiphon serves as an accessory float beside the single apical pneumatophore.

3). The author's idea is that, in the most cases, the tentacle is not a zooid to be ranked on the same level with the other zooids as many students of Siphonopha believes, or an organ of the other zooide as older authors maintained, but it is nothing other than a branch of the stem. Accordingly each tentillum must be regarded as it corresponds to the ordinary zooids.

4). The possibility of union of two different zooids distinctly exhibited in Bathyphysa, suggests a simple solution for the long-discussed puzzles, for instance, the tentacle in Agalmidae is accompanied by a siphon, while in Physaliidae by a palpon. The medusoid appendage and gonopalpon found in the gonodendron of Rhizophysa etc. are nothing other than the nectophore and palpon united with an ordinary gonodendron.

Family **PHYSALIIDAE**

Genus Physalia Lamarck, **1801.**

(37). *Physalia physalis var. utriculus* (La Martiniere) Escholtz, 1829.

A considerable number of specimens, large and small, had been kept not only in the Tokyo University but also in several institutes, laboratories and

specimen-seller's shops, many of which were carefully examined. A typical one was captured by myself near the Island of Oshima. Izu Province in August 1907. The float was from 40 to 65 mm. in horizontal length and from 12 to 20 mm. in the greatest horizontal breadth and had five to seven primary septa and corresponding weakly-developed secondary septa. In life the crests of septa and the distal lip of siphons were greenish yellow, while the remaining structures were all blue, being darker in the basal portion of siphons and the tentacular knobs.

Of seven good specimens, one had four main tentacles, the other two, and the remaining four only one. Among the other, preserved specimens examined, those from the provinces of Shima and Awa, and Island of Miyakejima, and the Bonin Islands were in the best condition; the largest of them had a float 80 mm. long and 38 mm. broad.

Chun (1897b) regards the Pacific Physalia a different species from the Atlantic species, since the former has only a single main tentacle while the latter is provided with many of them. Schneider (1898), on the contrary, united those forms into one, believing that they are mere varieties of one species. Bigelow (1911) adopted Chun's view according to "the fact among a considerable number of specimens of the Pacific species which have now been studied, not only by the earlier authors, but recently by Chun (1897), Agassiz and Meyer (1902), Lens and Van Riemsdijk (1908) and by myself, none had more than one main tentacle". In his previous paper (1910) the present author followed Schneider, because his four specimens had equally been provided with two or more main tentacles. It is true, that the Pacific form can be distinguished more or less distinctly from the Atlantic form, in number of the main tentacle; even though more than one is present, are never developed in equal degree as it is the case with the Atlantic form; one main tentacle being strongly developed and the other being rather subordinate in size and age.

All of specimens from the Bonin Islands and Miyakejima of Izu have only one main tentacle, inspite of their greater size and advanced age. Even my careful examination failed to prove the artifical loss of them. It will be justified to separate the Pacific species, as a variety, from the Atlantic, since the status in the adult colonies is distinctly different between them.

Suborder CHONDROPHORAE

Family **PORPITIDAE**

Genus Porpita Lamarck, **1801.**

(38). *Porpita umbella* O. F. Müller, 1776.

This is occasionally found stranded on the Seven Islands of Izu and certain places on the Pacific coast of Japan. In the first time (1907) 22 fairly perfect specimens were examined. The disc of the adult animal was 20 to 30 mm. in diameter.

Family **VELELLIDAE**

Genus Velella Lamarck, **1801.**

(39). *Velella lata* Chamisso and Eysenhardt, 1821.

Numerous specimens preserved in the Misaki Marine Biological Station as well as several institutes of Japan were examined and it was found all of them represent a single species *V. lata*. In regard to the arrangement of palpons, siphons and tentacles some detailed discussion will be given in the author's future account.

Postscriptum

While this report was under press, the author learned that a revision of the Abylinae was published by Sears (Bull. Mus. Comp. Zool., Harvard Coll. 109 (1), 1953) who separated many new species from the old known types. It is probable that our specimens identified as one species in this report really include such new forms as Sears established. Most of our specimens, however, are not at present in the author's laboratory so that he is unable to fix this question immediately.

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EXPLANATION OF PLATES

Plate I.

Forskalia tholoides Haeckel

Fig. 1. Side view of siphosome. ×2/2
Fig. 3. Bract with less denticulation. × 4
Fig. 4. Bract with numerous denticulation. × 4
Fig. 5. Gonodendron with androphores (♂), gynophores (♀) and gonopalpons (Gp). × 4
Fig. 6. Tentillum × 5

Forskalia misakiensis n. sp.

Fig. 2. Side view of siphosome and nectosome (this specimen has been kept upside down, so that in this picture the nectosome is seen at the lower end). ×3/4
Fig. 7. Apical view of detached nectophore. × 3
Fig. 8. Bract with pointed end. × 4
Fig. 9. Bract with round end. × 4
Fig. 10. Cormidium composed of of a slphon and a gonodendron × 4
Fig. 11. Tentillum. × 5

Plate II.

Agalma okenii Eschscholtz.

Fig. 1. Left side view of the entire colony. ×2/3
Fig. 2, 3. Two stages of younger nectophore with diverticular process of the radial canal of nectosac. × 2
Fig. 4. Full-grown nectophore. × 2
Fig. 5. Younger bract with a bracteal canal. × 2
Fig. 6. Full-grown bract. × 2
Fig. 7. Tentillum. × 10

Crystallodes rigidum Haeckel.

Fig. 8. Left side view of the entire colony. ×2/3
Fig. 9. Very young nectophore. × 2
Fig. 10. Full-grown nectophore. × 2
Fig. 11. Frontal view of bract. × 2
Fig. 12. Tentillum. × 10

Plate III.

Athorybia longifolia. n. sp.

Fig. 1. Right sied view of colony. × 2
Fig. 2. Left side view of the same. × 2
Fig. 3. The same to Fig. 1. B-bract, P-palpon, S-siphon, T-tentacle. × 3
Fig. 4. Obliquely lower side view of colony. ×2.5

Fig. 5. Zone of proliferation. Pn-pneumatophore, Bl-bracteal lamella, P-palpon. × 6
Fig. 6. Palpon (P) and gonodendron (G). × 10
Fig. 7. Tentillum. × 15

Plate IV.

Sagamalia hinomaru n. g., n. sp.

Fig. 1. Apical view of nectophore. ×3/2
Fig. 2. Obliquely lower side view of siphosome. ×3/2
Fig. 3. Entire colony after a sketch made while the animal was still alive. ×3/2
Fig. 4. The same to Fig 1. Pn-pneumatophore, N-nectophore. ×3/2
Fig. 5. Aboral view of nectosome. A-aurophore, NL-Lamella connecting the nectophore to the stem. × 2
Fig. 6. Aboral view of siphosome. B-bract, S-siphon, T-tentacle, G-gonodendron. × 2
Fig. 7. Two bracts attached to the stem (St) with a common stalk. × 3
Fig. 8, 9. Bract embracing a siphon (S) and a gonodendron (G). × 3

Plate V.

Bathyphysa grimaldii Bedot

Fig. 1. Entire colony. × 2/3
Fig. 2. Detached siphons of pneumatophore type. × 1
Fig. 3. Siphons of hook-shaped type. × 1

Plate VI.

Bathyphysa grimaldii Bedot

Fig. 1. Entire colony viewed from the opposite side from that of Plate V. Fig. 1. × 2/3
Fig. 2. Gonodendra. One of them is combined with a pneumatosiphon. × 1

Bathyphysa japonica Kawamura

Fig. 3. Whole specimen. × 1

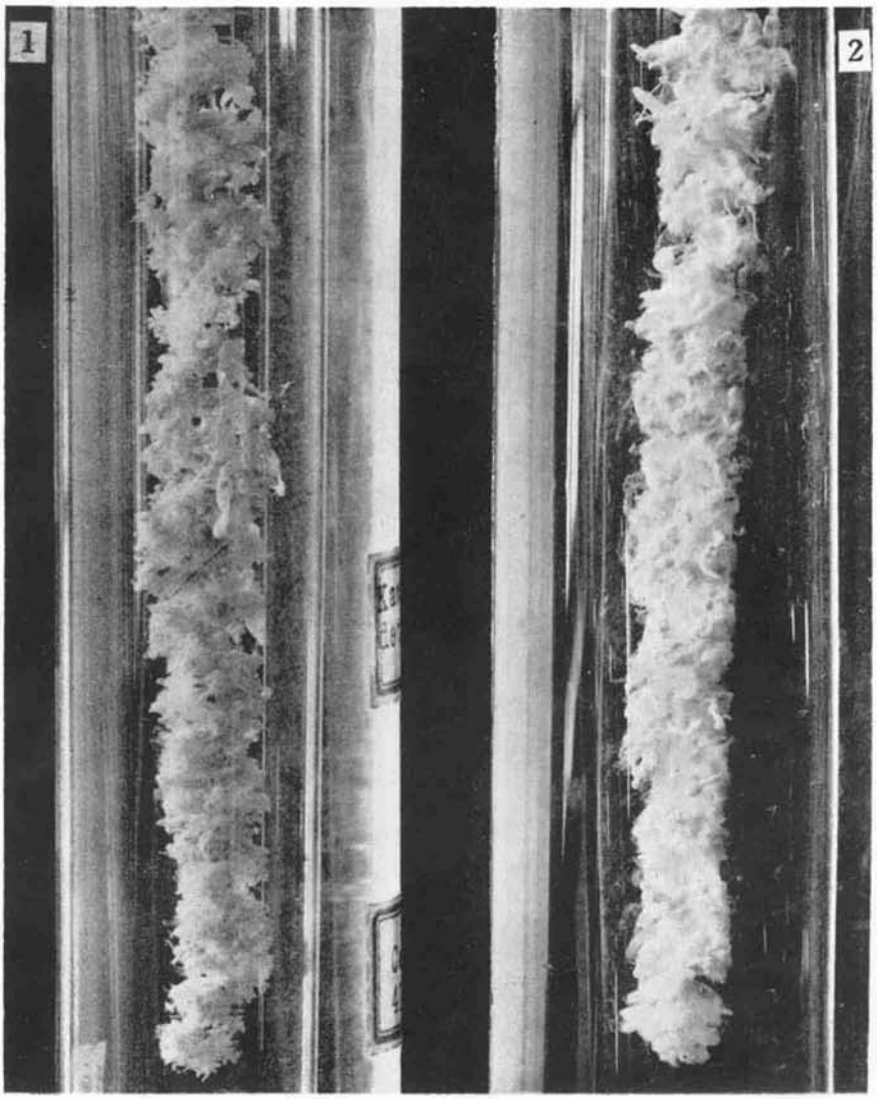
Plate VII.

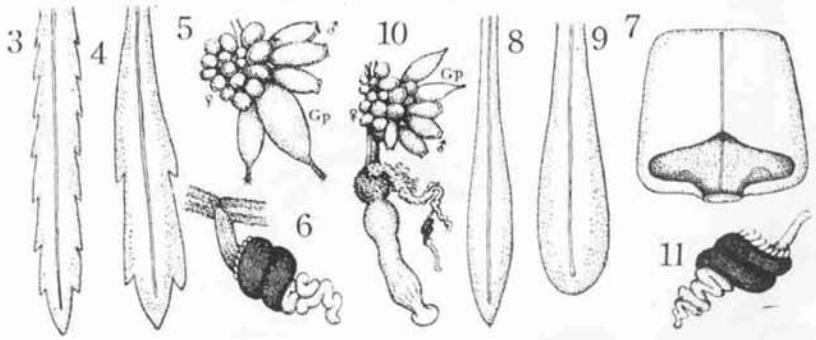
Bathyphysa grimaldii Bedot

Fig. 1. The upper portion of the specimen. Pn-pneumatophore, Sp-Pneumatosiphon, Si-hookshaped siphon, T-tentacle, G-gonodendron, Y-point of branching of the stem. ×1.5
Figs. 2, 3. Siphons of hook-shaped type. × 2
Fig. 4. Siphon of pneumatophore type. ×1.5
Fig. 5. Three pneumatosiphons fused together with a reduced distal aperture. ×1.5
Fig. 6. Gonodendron accompanied by a pneumatosiphon. × 2
Fig. 7. Single gonodendron. × 6

Bathyphysa japonica Kawamura

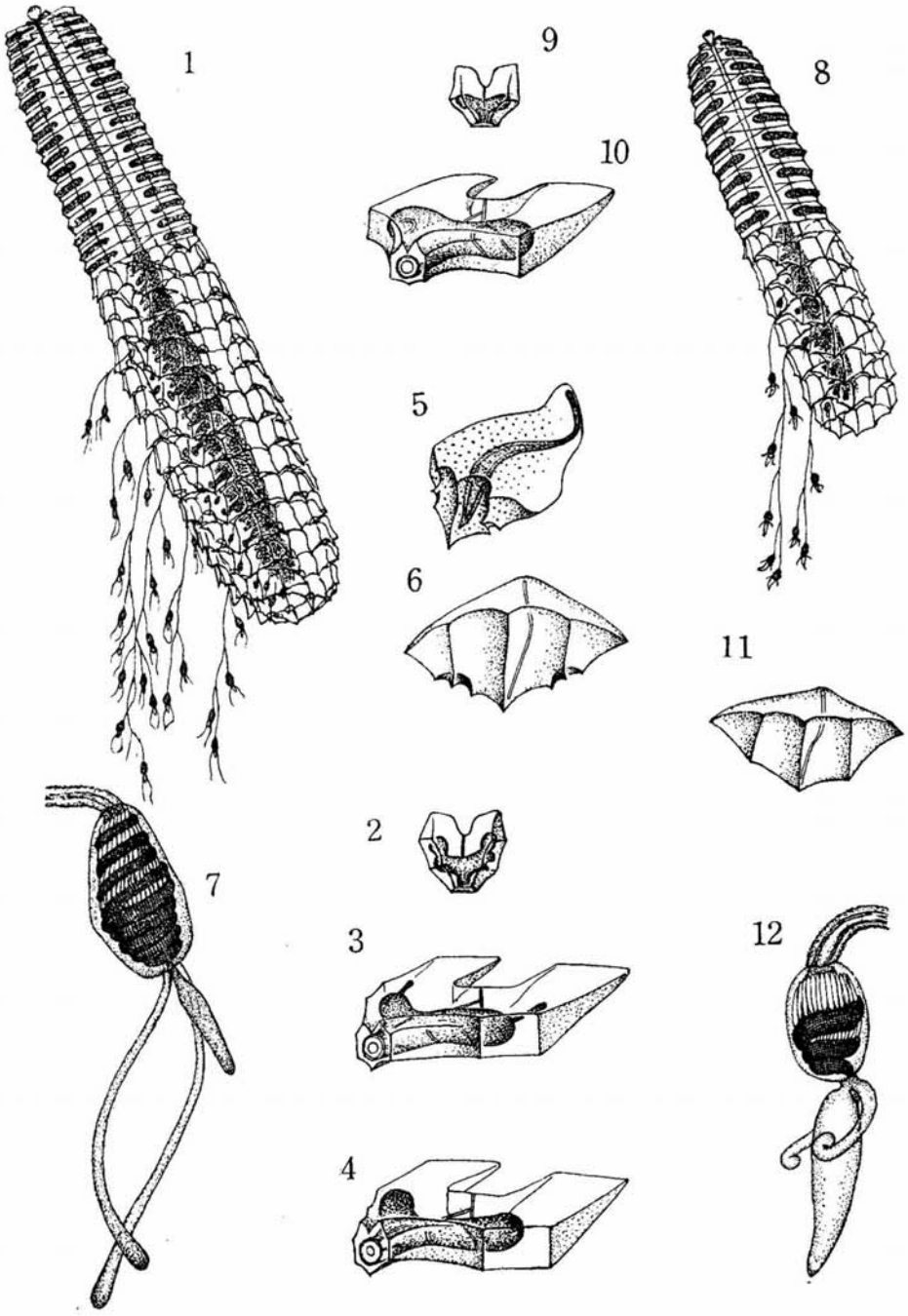
Figs. 8-9. Upper and lower portions of the specimen (figuration same as in Fig. 1). ×1.5





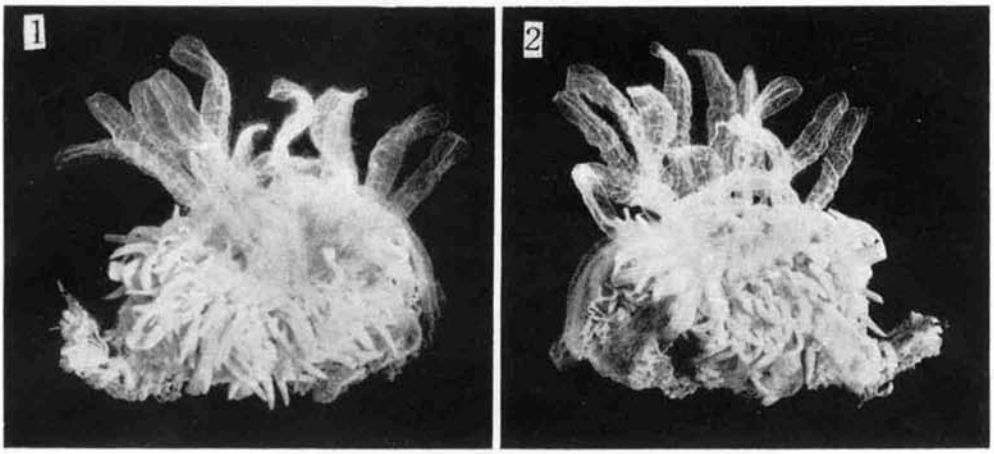
T. Kawamura photo. & del.

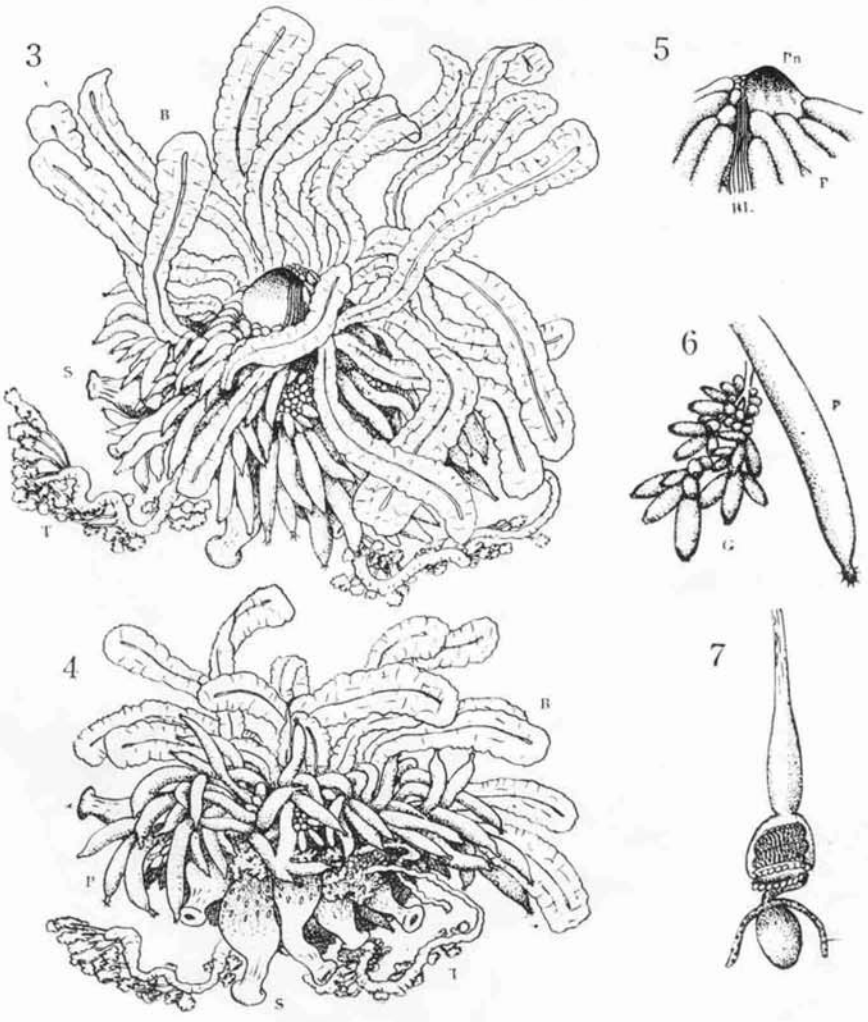
Forskalia tholoides & *F. misakiensis*



After T. Kawamura (1911b)

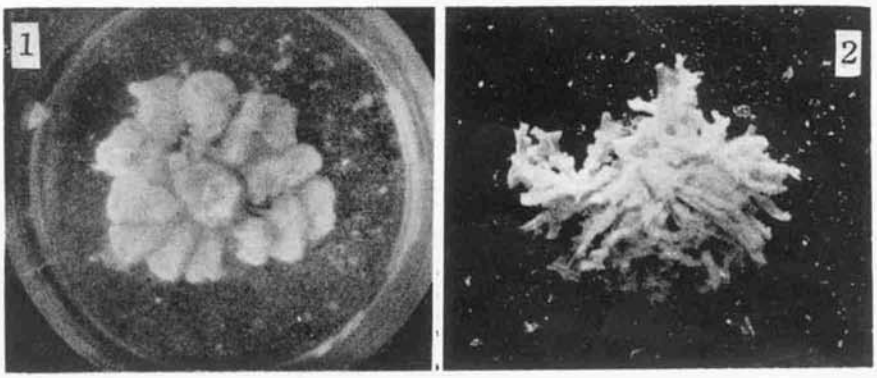
Agalma okenii & Crystallodes rigidum

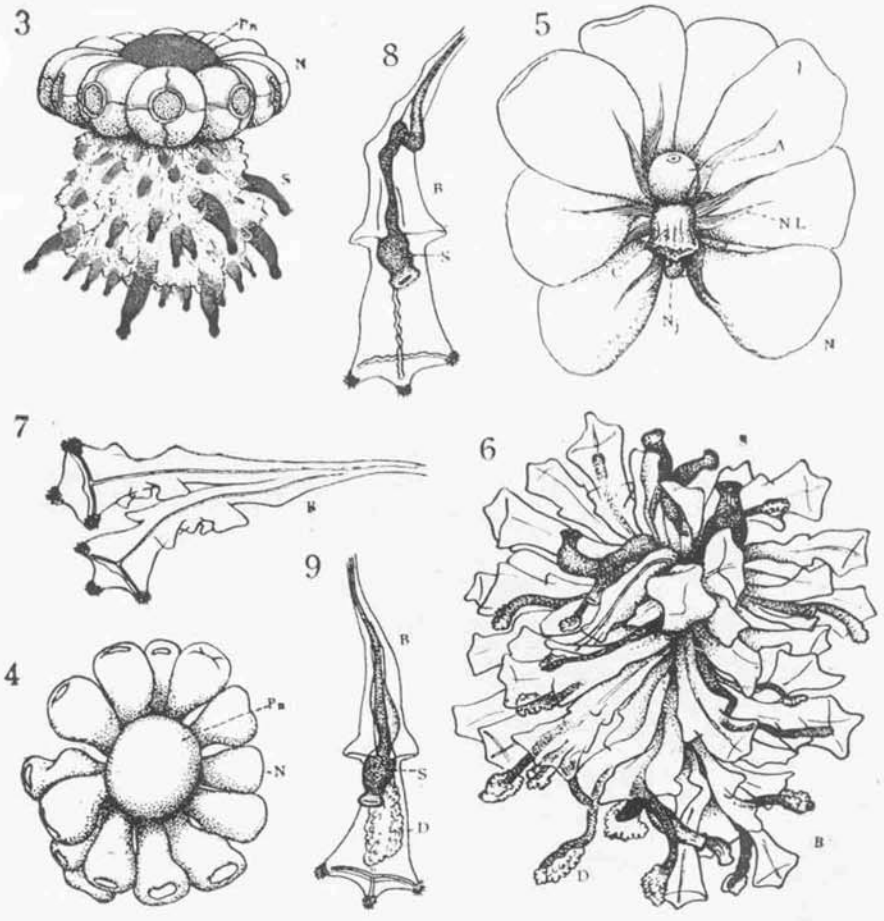




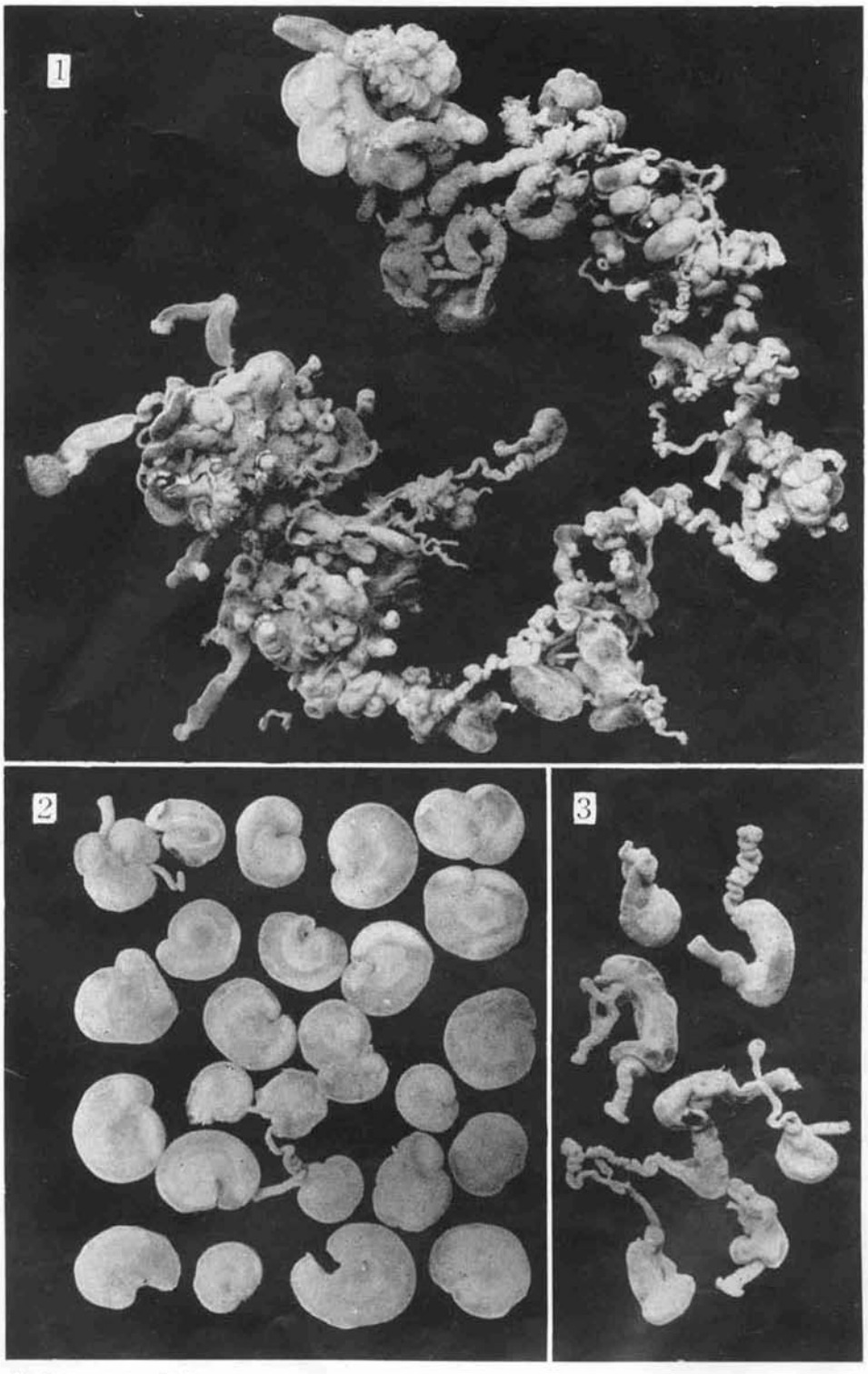
T. Kawamura photo. & del.

Athorybia longifolia



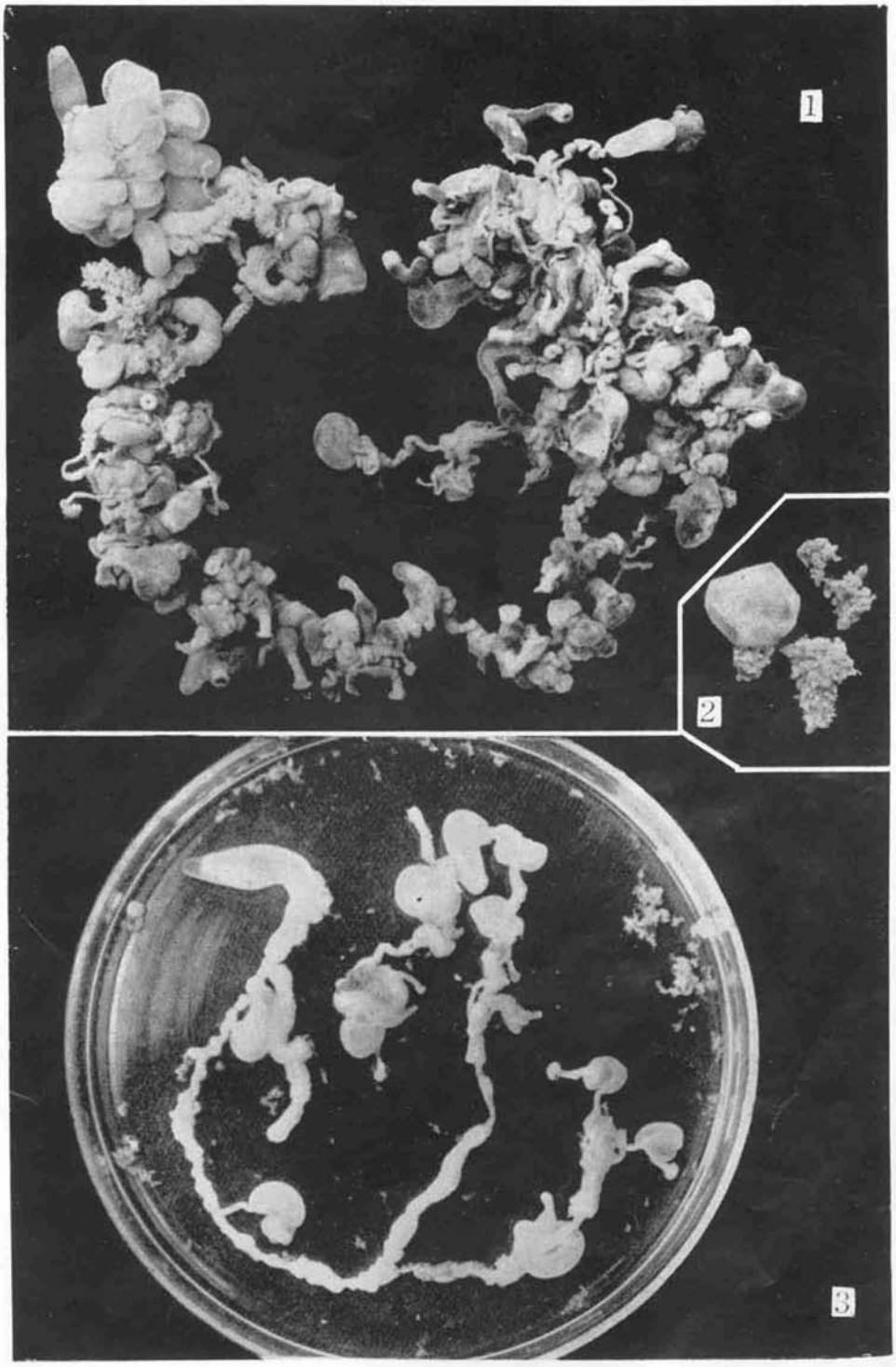


Sagamalia hinomaru



T. Kawamura photo

Bathyphysa grimaldii



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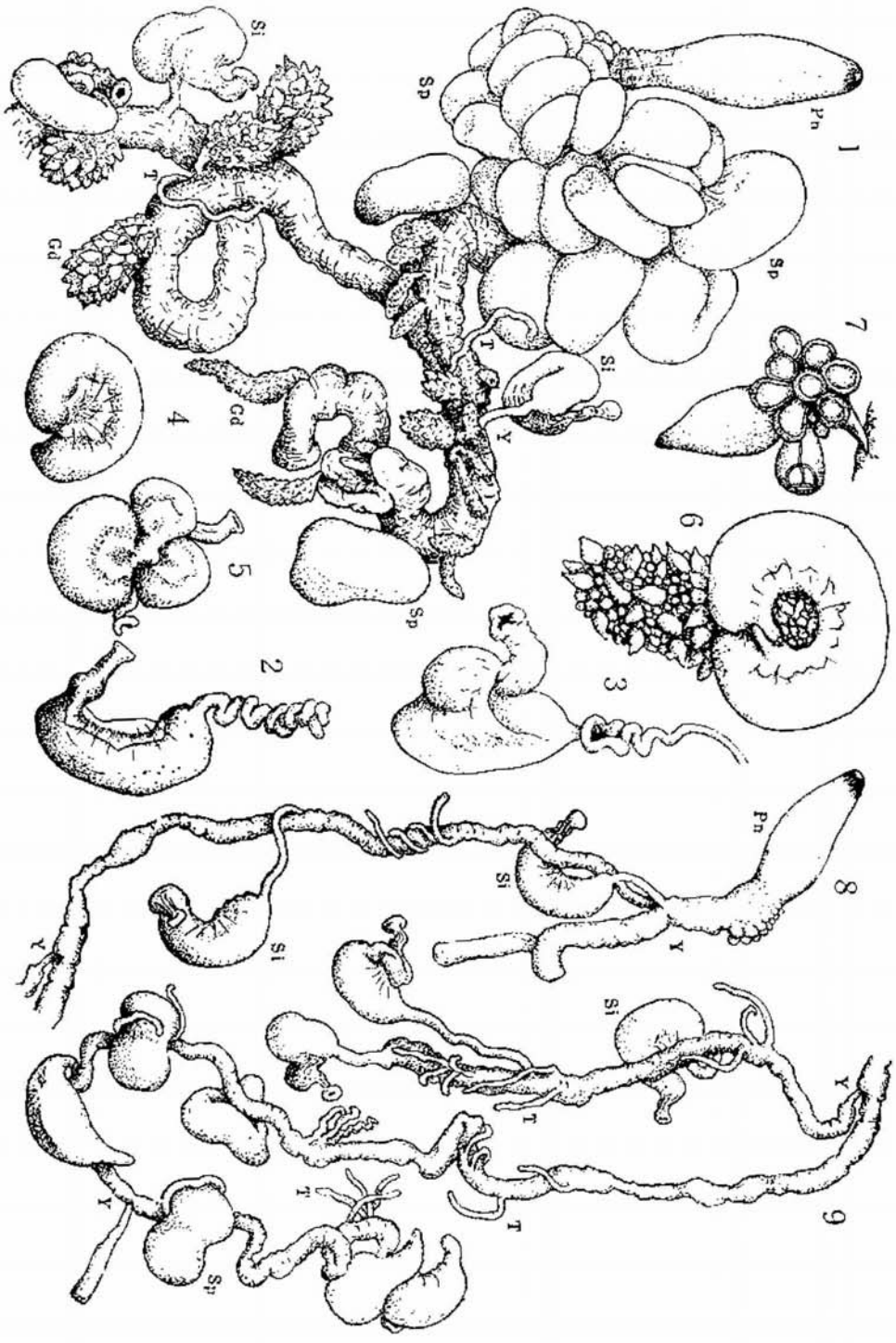
Bathyphysa grimaldii & B. japonica



Bathyphysa grimaldii & B. japonica.