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On Another Form of *Stephanoscyphus*, found in the Waters of Japan

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With 4 Text-figures

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Introduction

As has been stated in my former paper (1935), *Stephanoscyphus*, the scyphostome stage of the primitive peromedusa *Nausithoë*, has various highly characteristic features. First, it forms an extensive colony much like that of the hydrozoön. The colony is furnished with a well-developed chitinous periderm covering all the soft parts. Each polyp has the essential structure of the scyphostome of Discomedusae; but it has a number of tænioles arranged all round the central gastral cavity, instead of only four, that is, one at the base of each mesentery. Eggs of very large size, or male germ cells of fairly advanced stage, are formed in mesenteries. These, however, seem to degenerate completely without being discharged. It has also been demonstrated that strobilation of the polydisc type occurs in these polyps.

This curious cœlenterate is found in large quantities in the shallow waters around our Seto Marine Biological Laboratory. In other localities it was recorded a long time ago from certain regions of the Mediterranean, but from nowhere else, nor ever since. This is a rather striking fact because the medusoid stage *Nausithoë* has been reported from various parts of the tropical and subtropical seas of both hemispheres.[1]

1) In a personal letter Sir Sidney F. Harmer has kindly informed me of the fact that among the specimens sent to him from the Siboga collection, he found various organisms which he thinks were certainly *Stephanoscyphus*. These were sent back to Prof. Weber to be examined by some other specialist. However, as far as I have been able to find, nothing has been published concerning these materials in the reports of the Siboga Expedition. According to Sir Sidney, the locality where those materials were collected was the Malay Archipelago, which is undoubtedly one of the most promising place for hunting for *Stephanoscyphus*.

Observations on the New Material

Recently, some specimens of apparently another form of this cœlenterate collected from new localities have come into my hands for examination. These specimens are in the possession of the Biological Laboratory in the Imperial Palace in Tokyo, and I am indebted to Dr. H. HATTORI for the privilege of examining them. There are four specimens mounted in toto on slides. One of them was collected from Sagami Bay ca. 3 miles off Arasaki at a depth of ca. 50 fathoms and was found attached to the hydroid *Clathrozoön*. The remaining three were found from the Japan Sea off Ukagawa, Morihasi-mura, Hugesi-gun, Isikawa-ken, at a depth of 32–35 fathoms, being attached to the dead shell of a bivalve. Crucial examination of these specimens has made it clear that they are thecae of *Stephanoscyphus*, and probably of another species than that found in Seto. The specimens (Figs. 1, 2) are chitinous membraneous tubes, horn-like in shape, open at the broader end and closed at the narrower end where a small disc-like appendix for fixation is attached. Numerous circular rims which apparently serve for support something like the cartilageous rings of tra-

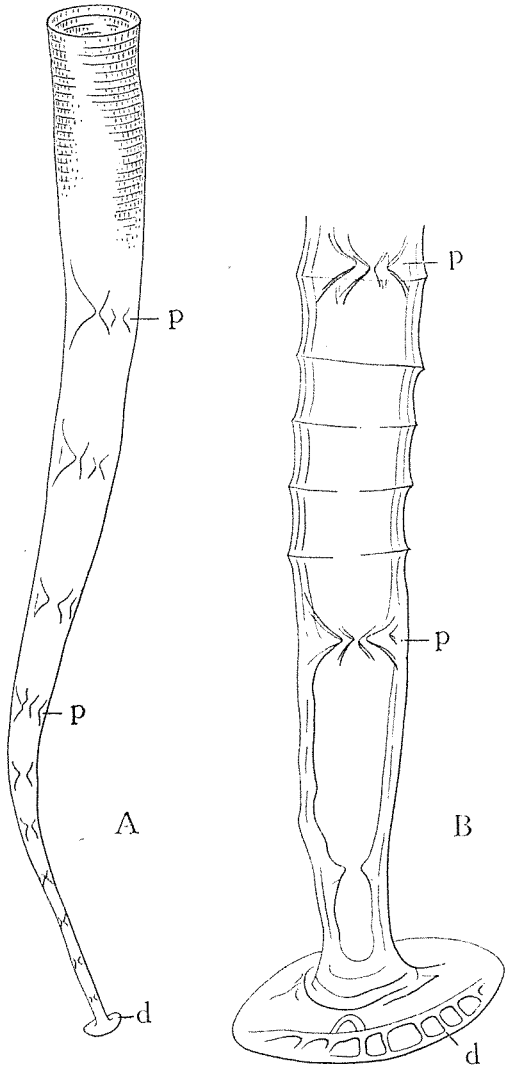

Fig. 1. *Stephanoscyphus corniformis* n. sp. A specimen from Japan Sea. A. Entire specimen ×8. p.... set of conical processes. B. Basal portion with the fixing disc (d). ×50.

chea, are arranged at regular distances on the surface. The tube thus appears to be made up of a number of rings superposed upon one another. As regards size, there is a considerable difference between the specimen from Sagami Bay and those from the Japan Sea. The former is ca. 6 mm. in length, while the diameters of the distal and basal ends are ca. 0.6mm. and 0.15mm. respectively

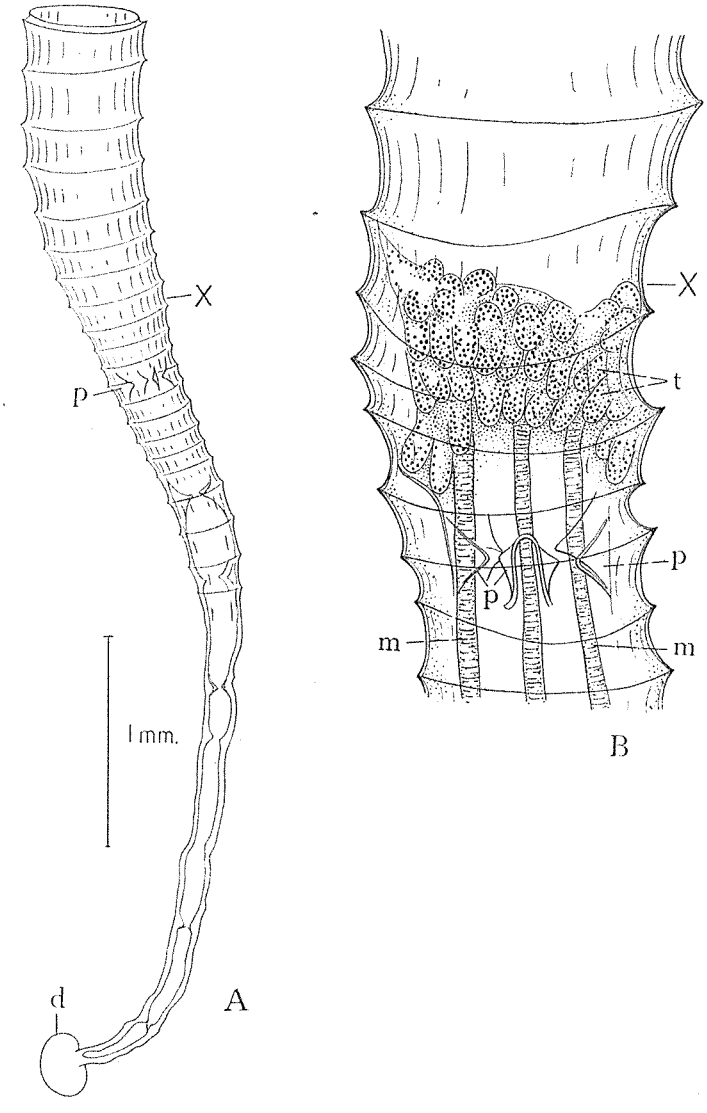

Fig. 2. *Stephanoscyphus corniformis* n. sp. The specimen from Sagami Bay. A. Entire specimen. ×20. B. The portion marked × in A. ×100. m . . . mesentery, t . . . tentacles.

(Fig. 2). Of the latter specimens, two are both ca. 17.5mm. in length, 1.5mm. in diameter at the distal end and 0.15mm. in diameter at the basal end (Fig. 1). The third specimen lacks the basal portion; but it was obviously of about the same size as the others. It is highly probable that the smallest specimen represents a younger stage of the larger specimens, though it has come from a different locality. The specimen consists of about twenty rings which are all relatively high, while the larger specimens consist of much more numerous rings all of which are, relatively, very low. Further, in the larger specimens each ring is marked with inconspicuous and irregular longitudinal striae, so that the tube appears to be scaly, especially in the distal parts.

Inside the tube a rather conspicuous structure is found in all of the specimens (Figs. 1—4). This is a set of conical processes occurring at fairly regular intervals along the length of the tube. The process is hollow and resembles the thorn of a rose but has a blunt tip, varying in size considerably as shown in Fig. 3. In each set there are 4–6 of such processes situated on nearly the same level, so that the lumen of the tube in this region is restricted to a cruciform or stelliform passage. Seven of such sets are found in the smallest specimen, while the larger ones are provided with more than ten sets. These processes probably serve as mechanical support to the membraneous tube, holding it erect.

The basal disc is ca. 0.3mm. in diameter and consists of a chitinous substance deposited in somewhat network-like manner (Fig. 1, B).

All of the specimens contain soft parts, of which the exact condition is hard to make out owing to poor preservation. Still it is apparent that they contain four longitudinal strands running throughout the length around an axial gastral cavity. These are mesenteries without doubt (Fig. 2, B, m). In the distal regions they are folded very thickly, and furnished with nematocysts which correspond in size and shape precisely what I called macronematocysts in my former paper. Hardly any other internal structure can be made out in the larger specimens. In the smallest specimen, however, a cluster of finger-like processes can be seen at the distal end of the soft part retracted into the tube (t). Obviously these processes are contracted tentacles.

Remarks

In view of the scantiness of the material as well as of the poor preservation of the soft parts, it is hard to decide the identity of the specimens. Still there seems to be no room for doubting that they are thecae of *Stephanoscyphus*. This is clear from the general structure of the periderm and the presence of four mesenteries in the soft parts. Especially noteworthy is the presence of the sets of thorn-like processes on the internal wall of the periderm. Full descriptions of this structure are given by both ALLMAN (1874) and SCHULZE (1877), who were practically the only workers on this cœlenterate for many years. Thus ALLMAN states, "At rather irregular distances along its length its inner surface sends off remarkable processes, which project far into the interior. At four equidistant points, situated on the same level, a thin chitinous lamina separates from the inner surface of the tube, and forms a hollow pyramidal process. The four processes thus formed radiate towards the axis, pushing before them the soft parts, and forming a stelliform constriction of the body. Between each of these four radiating processes a much smaller one is sometimes present, thus raising to eight the number of processes in a set, and indicating an increase in number by consecutive intercalations of younger ones between those previously formed" (ALLMAN, 1874, p. 63). SCHULZE's description of the same structure is as follows: — „Viel auffallender aber als diese inconstanten Ringfalten sind gewisse wirtelförmig gestellte und oft auch symmetrisch geordnete Vorsprünge, welche an gewissen Stellen in das Lumen der Skeletröhre vorspringen. Meistens finden sich vier symmetrisch gestellte Vorsprünge in einem Wirtel, seltener 6 oder 8, von denen dann 4 kreuzweise gestellt sich durch Grösse auszeichnen, während die kleineren in der Mitte zwischen zwei grösseren auftreten. Die merkwürdigen Bildungen bestehen aus den innersten Lamellen des ge-

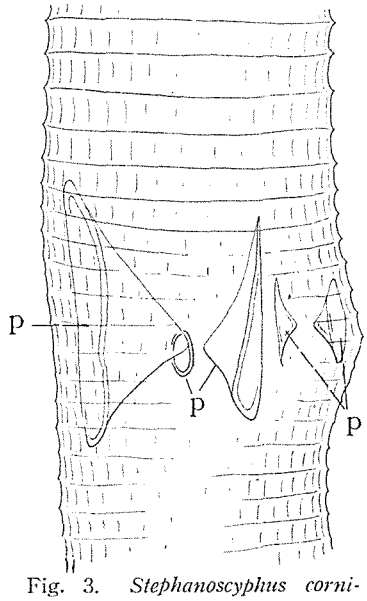

Fig. 3. *Stephanoscyphus corniformis* n. sp. A part of theca including a set of conical process (p) of a specimen from Japan Sea. ×30.

schichteten Chitinrohres, welche sich in Form eines hohlen Buckels nach innen in das Röhrenlumen vorbauchen, und pflegen die Gestalt einer menschlichen Nase zu haben " (SCHULZE, 1877, p. 803). Moreover, both of the authors give very clear figures of this curious structure (ALLMAN, figs. 3, 5, 6; SCHULZE, figs. 6, 9, 10; KOMAI, 1935, figs. 1, 2). Rather singularly, the corresponding structure is missing in the specimens from Seto. This fact impressed me while I was working on the material from this locality. Since the specimens under description first came to my observation I examined more material from Seto for comparison. And the result was to confirm my previous finding. It is true that among the Seto specimens there are some—especially small ones—in which similar processes are found. But these are scattered here and there on the inner wall of the tube, and are never in the form of such regular sets as mentioned above. Besides, the theca in the Seto specimens has a thicker wall than that in the present specimens. This difference may have caused the presence or absence of the sets of processes apparently serving as supports.

Further, as pointed out in my former paper, the specimens occurring in Seto show a mode of branching different from that in the previously described specimens. The former undergo racemose branchings three or four times consecutively in well-developed colonies, so that the entire periderm system appears not unlike the inflorescence of an umbelliferous plant. SCHULZE's specimen seems to form a colony similar to the former. The mode of branching however is apparently more irregular; a new branch is formed from the side of the older branch, so that the entire colony has a dendritic appearance. ALLMAN's specimen has another configuration. The theca project direct from a network of stolon, and the entire colony appears somewhat like a creeping herb. In all the specimens mentioned thus far, the colony is imbedded in a mass of some kind of sponge. The present specimens, however, are all isolated, and are attached to the substratum by means of a fixing disc. Further, they are entirely naked, and without any sponge tissue coating them.

To summarize, all of the specimens mentioned above show such similarities with one another that there seems to be no question that they belong to the same genus, *Stephanoscyphus*. Next, as to the question whether they belong to the same species or not, the discrepancies among them pointed out above, seem to be sharp enough. Moreover, the Seto specimens seem to have many more

tentacles than the Mediterranean specimens; whereas in the former there are usually 100–200 tentacles, the latter have only about 40 tentacles according to both ALLMAN and SCHULZE. But there is the possibility that the specimens of *Stephanoscyphus* hitherto found—at least some of them—represent different stages of development of one and the same form. Especially the new Japanese specimens under description seem to show a rather close similarity to ALLMAN's form in the structure of the thecae.

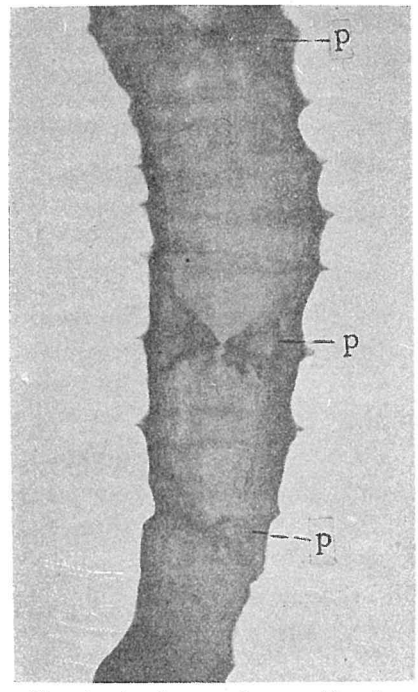

Fig. 4. *Stephanoscyphus corniformis* n. sp. A part of theca including three sets of conical processes (p) of the specimen from Sagami Bay. ×40.

In this connection, the medusoid stage may well be taken into consideration. Of the medusoid, there is a single well-known species, *Nausithoë punctata*, recorded from the Mediterranean as well as from the tropical and subtropical seas. The form of this medusa occurring in Seto, as mentioned in my former paper, is smaller in size and more irregular in organization, and has usually more elongate gonads, as compared with the specimens from other localities. But some Japanese specimens are hardly distinguishable from the Mediterranean specimens in any of these respects. It is possible that no distinctive feature has yet been developed in the medusoid stage which is of very primitive organization and only short-lived, even if the corresponding scyphostome stage are differentiated from one another. At the same time the discovery of *Stephanoscyphus* in rather deep regions of the sea seems to be of some interest, in view of the fact that there are four or five species of deep-sea medusae which have been assigned to the genus *Nausithoë* or to the closely related genus *Nauphanta*. (MAYER 1910, KRUMBACH, 1925).

As should be clear from the above statements, the identity of the various forms of *Stephanoscyphus* recorded thus far is still rather obscure. Yet on the basis of our present knowledge, the following

tentative classification of the Genus *Stephanoscyphus* seems warranted.

Classification of the Genus *Stephanoscyphus*

Solitary (?), naked, theca provided with several sets of conical processes on the inner wall.
. . . . . *S. corniformis* n. sp. Sagami Bay (50 fathoms) and Japan Sea (32–35 fathoms).

Colony creeping, thecae project direct from stolon, and provided with sets of conical processes. Tentacles ca. 36 in number.
. . . . . *S. mirabilis* ALLMAN (1874). Antibes, south coast of France (littoral).

Colony erect, branching lateral; thecae provided with sets of conical processes. Tentacles up to 40 in number.
. . . . . *S. fistularis* (F. E. SCHULZE) (1877) (described as *Spongicola fistularis*). Adriatic.

Colony erect, branching racemose; thecae without the regular sets of internal processes. Tentacles 100–200 in number.
. . . . . *S. racemosus* n. sp. Seto, coast of Kii Peninsula (littoral).

Summary

Some specimens apparently belonging to *Stephanoscyphus* and probably specifically different from the form common in the vicinity of Seto have been discovered in rather deep regions of the Japan Sea and Sagami Bay. These are isolated thecae without a coating of sponge. They are provided with sets of conical projections on the inner wall at rather regular intervals, exactly as in the forms previously described by ALLMAN and SCHULZE from the Mediterranean. These projections are missing in the Seto specimens; moreover the latter undergo racemose branchings, in contrast with the irregular lateral branchings of SCHULZE's specimen and also the creeping colony of ALLMAN's specimen. Hence the tentative classification of the Genus *Stephanoscyphus* into *S, corniformis* n. sp., *S. mirabilis* ALLMAN, *S. fistularis* (SCHULZE) and *S. racemosus* n. sp. seems warranted.

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