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THE LIFE HISTORY OF *EPERETMUS TYPUS* BIGELOW (LIMNOMEDUSAE, OLINDIADIDAE)[1)]

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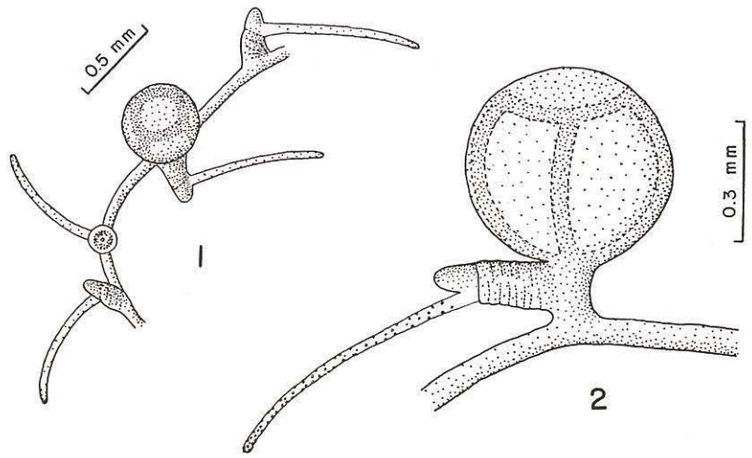
Although the medusa of *Eperetmus typus* has sometimes been reported from the northern Pacific (Bigelow, 1915, 1920; Foerster, 1923; Uchida, 1929, 1940; Mackie and Mackie, 1963), the hydroid remains unknown and little is known of the medusan development.

In Akkeshi Bay the medusae of *Eperetmus typus* are common from August to October. On July 10 1965, the author found a small colony of one-tentacled hydroid with several medusa buds on a tube of the sedentary polychaete, *Hydroides ezoensis* attached to a dead shell of *Crassostrea gigas* which was obtained by dredging from 3–4 m depth in the innermost part of Akkeshi Bay. On July 22, a colony of this hydroid was again found on a dead shell surface of a gastropod, *Fusitriton oregonensis* inhabited by a hermit-crab, *Pagurus pectinatus* in the same locality. The colony first obtained was reared in the laboratory and four young medusae were set free from 17 to 25 July 1965. In the next year, the colony again began to bear several medusa buds after the end of May and it released about ten young medusae from June 8 to August 9. These young medusae were reared up to the beginning of the development of the gonad, and were revealed to be *Eperetmus typus*. The hydroids and medusae were fed with *Artemia* larvae. Since the first and the second findings of the hydroid colony, the colonies of this hydroid were occasionally found mostly on tubes of *Hydroides ezoensis* which were attached to dead oyster shells. On the other hand, from May to November in 1966 and 1967, many medusae of *Eperetmus typus* in various developmental stages were obtained by surface tow in the bay. The young medusae obtained by the surface tow coincided with the young medusae liberated from the hydroid above mentioned. At the end of April, 1966, water temperature in the bay was 2.5°–7.5°C (average 4.9°C) and gradually rose to 13°–19.5°C (average 17.0°C) in late August and then gradually fell

1) Contributions from the Marine Biological Station of Asamushi, Aomori Ken, No. 372



Figs. 1 and 2. Hydroid of *Eperetmus typus*.
1. A part of colony. 2. A polyp with a fully grown medusa bud.

to 11.0°–6.0°C (average 8.4°C) in Novembr.

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THE HYDROID

In a colony (Fig. 1) several to about ten polyps arise singly at intervals from a creeping stolon which gives rise to a few branches but does not form a network. The stolon is comparatively thick, about 0.1 mm in diameter, and is invested by a very thin membranous perisarc. It is often buried in mud particles or other deposit.

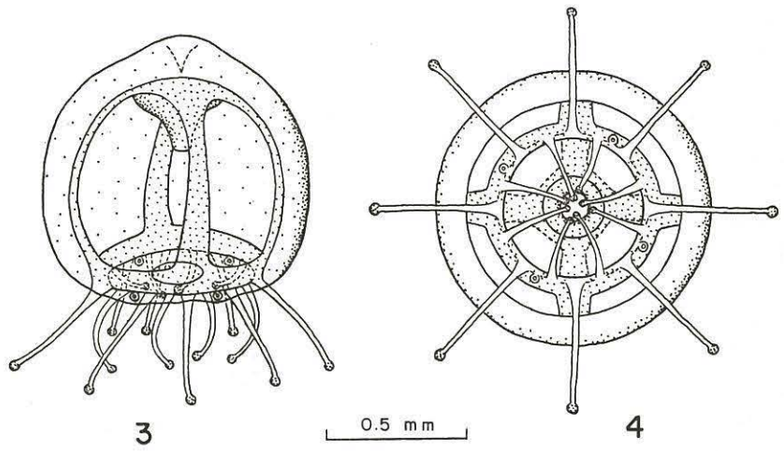
The polyp (Fig. 2) is short-cylindrical in shape slightly widening toward the base, unbranched, and very small in size, 0.3–0.5 mm high and 0.12–0.15 mm wide. The hypostome is blunt conical in shape with a terminal mouth. The only one tentacle comes out from the base of the hypostome almost at right angle to the stem. The tentacle is comparatively long and thick, attaining three times or more longer than the polyp when well extended, and 0.04–0.05 mm in diameter. On the whole surface of it nematocysts are irregularly and sparsely distributed, and are located more densely at the terminal end. The hydranth occupies about a half to a fourth the whole length of the polyp. Below the tentacle the polyp is invested by a thin membranous perisarcal sheath which is often wrinkled by contraction of the polyp, and is often encrusted with mud particles or other small ones. The body of the polyp is milky white or yellowish grey in color and the

tentacle is nearly transparent.

From late April to late July medusa buds were found on the hydroids both reared in the laboratory and collected from the sea. The medusa bud is borne on a short peduncle at the junction of the polyp with the stolon. Below the peduncle the basal part of the polyp grows longer and thicker and, at a glance, it looks as if the polyp and the medusa bud were borne on a common thick stem. Only one bud is seen on one polyp at a time. The medusa bud is of ellipsoidal form in early stage, and gradually increases in size. The fully grown bud (Fig. 2) is nearly spherical, 0.4—0.5 mm in diameter, yellowish grey or pale yellow in color. Twenty to thirty days after appearance of buds, the young medusae were liberated from the hydroid in the laboratory.

THE MEDUSA

Young medusae newly liberated (Figs. 3, 4): When newly liberated from the hydroid the umbrella is bell-shaped, about as high as wide or slightly wider than high, 0.7–1.0 mm high and about 1.0 mm wide. The jelly is moderately thick, and nematocysts are scattered over the exumbrellar surface. The stomach is funnel-shaped or evaporating-dish-shaped, 1/5–1/6 the height of subumbrellar cavity and sometimes the mouth part protrudes. The radial canal is broad and slightly widened toward the ring canal. The ring canal is very broad. There are 4 perradial, 4 interradial and 8 adradial marginal tentacles. Among them the perradial and the interradial tentacles are older and larger than the adradial ones. The tentacles arise directly from the umbrellar margin and there are not yet seen any



Figs. 3 and 4. Young medusa newly liberated.
3. Side view. 4. Oral view.

indications of centripetal canals which are characteristics of the adult medusae. Each tentacle has one nematocyst cluster only at the terminal end. There are four marginal vesicles, each with a concretion. When viewed the bell margin from the oral side each of the marginal vesicles is located, in clockwise order, between the first adradial tentacle and the interradial one in each quadrant (Fig. 4). The adradial tentacles near by the marginal vesicles are not located precisely on the adradii but slightly nearer to the perradii and those on the sides which lack the marginal vesicle are located slightly nearer to the interradii. The velum is wide. The subumbrellar surface, the stomach, the radial and the ring canal and the tentacles are pale yellow or yellowish grey in color.

Metamorphosis of medusae: The observations on the metamorphosis of the medusae were made mostly on the specimens obtained by the surface tow. The marginal tentacles increase in number with age one by one in each quadrant in the order of cyclic symmetry with the interradii as the center. The sequence, however, gradually becomes irregular after the 13th tentacle's (52 in total number) stage. In well grown medusae 22–40 tentacles are counted in each quadrant. The development of the marginal vesicles is very slow and lags far behind that of the tentacles in early stages. After the 18th to the 20th tentacle's stage the marginal vesicles increase rapidly in number and become located nearly in alternate position with the tentacles.

The umbrella increases rapidly in size with age, and gradually becomes flattened. When fully grown it attains 15–26 mm in diameter and the average ratio between the height and the width is about 2 : 3.

About at the 10th tentacle's (40 in total number) stage the mouth part becomes thickened and forms a four-sided lip. Later the perradial corners of the lip spread outside and the surface of the lip gradually becomes frilled. Consequently the complete lip with crenulated margin is formed at the 18th to the 20th tentacle's stage.

The first sign of gonadal rudiments appears as a translucent zone at the proximal end of the radial canals about at the 10th tentacle's stage and the rudiment gradually becomes longer along the radial canal and thickened along its middle line. At the 18th to the 20th tentacle's stage the gonad extends to 2/3—5/6 the length of the radial canal, and hangs down as a ribbon-like form, and begins to fold several times transversely.

The second nematocyst cluster of the tentacles is formed slightly proximal to the middle of the tentacles and further clusters gradually appear mostly in the proximal half in early stages. Thus increasing, they become distributed on the whole shaft. The tentacles gradually shift upward from their base and old ones become free from the exumbrella at some height. On the other hand, the basal end of the tentacle begins to thicken, and gradually assumes a pair of spindle shaped pad. Consequently the characteristic centripetal canals and the basal pads are formed at the base of the tentacles.

In Akkeshi Bay, in 1966 and 1967, the young medusae recently liberated from the hydroid were found from early May to late July and more grown medusae began to appear from late May. The well grown mature medusae occurred from late July to middle November.

THE NEMATOCYSTS

The hydroids, the young medusae and the adult medusae show different figures in their nematocysts as summarized below.

Hydroid: One kind.
  Microbasic euryteles: 11.0–13.5×6.0–7.0μ (undischarged)
Young medusae shortly after liberation: Three kinds.
  Microbasic euryteles: 10.5–13.0×6.0–8.0μ (undischarged)
  Macrobasic euryteles: 14.0–20.0×11.0–14.0μ (undischarged)
  Isorhizes: 7.0–9.0×3.5–5.0μ (undischarged)
Adult medusae: Two kinds.
  Microbasic euryteles:
    Large type (tentacles) 13.5–16.0×6.5–8.0μ (undischarged)
    Small type (lip) 9.0–10.0×5.0–6.0μ (undischarged)
  Isorhizes: (tentacles, exumbrella) 7.0–10.5×3.5–4.5μ (undischarged)

The isorhizes correspond to the heterotriches observed by Mackie and Mackie (1963).

DISCUSSION

As described above the hydroid of *Eperetmus typus* has only one tentacle, and is of very characteristic shape. Only one similar species, *Monobrachium parasitum* Mereschkowsky 1877 is hitherto known as the one-tentacled hydroid from the circum boreal region and the northern Pacific (see Hand, 1957), but the latter species shows more specialized characters; namely, the colony has tentacle-less defensive zooids and the medusae mature before liberation. On the other hand, the number and the arrangement of the tentacles and the marginal vesicles of such attached medusae observed by Hand (1957) agree precisely with those of the youngest medusae of *Eperetmus typus*. Such a resemblance in the medusae of both species seems to adduce an evidence to support the Hand's opinion that *Monobrachium* should be assigned to the Olindiadidae.

In the Olindiadidae the hydroid of *Eperetmus typus* is more reduced than that of *Gonionemus* which has mostly 4 tentacles, and shows more advanced characters than the tentacle-less hydroid of *Craspedacusta*. On the other hand, the hydroids of *Gonionemus* and *Craspedacusta* multiply asexually by budding, and show complicated life cycles (Perkins, 1903; Joseph, 1925; Reisinger, 1957; etc.), but there

was not observed any indication of polyp buds in the hydroid of *Eperetmus typus*.

Among the hydroids of the Olindiadidae above referred the present species is characteristic in having a thin membranous perisarcal sheath.

SUMMARY

1) The hitherto unknown hydroid of an olindiadiid medusa, *Eperetmus typus* has been found from Akkeshi Bay, and is described for the first time.

2) The polyp is very small and unbranched. It has only one filiform tentacle at the base of the blunt conical hypostome, and is invested by a thin membranous perisarcal sheath below the tentacle. The medusa bud is borne at the junction of the polyp with the stolon.

3) The young medusa newly liberated has 16 tentacles and 4 marginal vesicles. The metamorphosis and the seasonal occurrence of the medusae are briefly described.

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