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Author

Mills, C.

Publication Date

1977-08-01

Submitted to Journal of Natural History

UC-48
LBL-6398 C.1
Preprint

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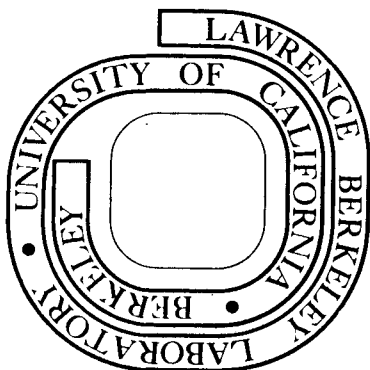
Claudia Mills and John T. Rees

August 1977

Prepared for the U. S. Energy Research and
Development Administration under Contract W-7405-ENG-48

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Running head: A new hydromedusa from California

Bythotiara stilbosa, new species,

(Anthomedusae: Calycopsidae)

from neritic waters in central

California

by

Claudia Mills¹ and John T. Rees²

Bodega Marine Laboratory
Box 247
Bodega Bay, California 94923

1. Present address: Department of Biology
University of Victoria
Victoria, British Columbia
Canada V8W 2Y2
2. Present address: Energy and Environment Division
Lawrence Berkeley Laboratory
University of California
Berkeley, California 94720

INTRODUCTION

Medusae in the hydrozoan family Calycopsidae are rarely encountered in collections and infrequently seen alive. Little is known about the biology of this anthomedusan family, although the distribution of the medusae suggests that they are basically oceanic in habitat (Kramp, 1959, 1961, 1968). Calycopsid medusa have usually been collected in oceanic plankton tows with non-closing nets; thus, the general notion that they are bathypelagic is not known with certainty.

Newly released calycopsid medusae, which later proved to be a new species of Bythotiara, were collected while nightlighting in Bodega Harbor in central California. The medusae were subsequently raised for 4 weeks in the laboratory to sexual maturity. Previously, Edwards (1967) has described the young stages of a single calycopsid medusa collected in Scotland and maintained in the laboratory for several weeks. He presumed this immature medusa to be Bythotiara murrayi Gnther 1903.

Calycopsid medusae are distinguished by hollow tentacles terminating in an enlarged manatocyst bulb. The tentacles arise from the bell without a basal bulb. The jelly of the bell is thick and dome-shaped, and both an apical projection of the bell and gastic peduncle are lacking. No polyps of the family are known.

METHODS AND MATERIALS

Newly released medusae of Bythotiara stilbosa n. sp. were collected in Bodega Harbor, Sonoma County, central California, on 19 July 1973, 11 October 1974, and 15 October 1974. Medusae were individually pipetted from the top few centimeters of water at Mason's Marina by nightlighting, using a light suspended about twelve centimeters below the water surface alongside a floating pier. The marina in which the B. stilbosa n. sp. medusae were collected is 2 to 5 m. deep with a silty mud bottom and a locally and seasonally dense float-fouling community. The marina is situated about 2 km from the open ocean in Bodega Harbor, a shallow, sandy natural harbor which is largely exposed at low tide.

A total of fourteen newly released medusae of Bythotiara stilbosa n. sp. were collected. The medusae were maintained in the laboratory in 600 ml. beakers of filtered sea water. Gentle aeration, which provided water circulation, was supplied through glass pipettes fitted to surgical tubing. The beakers were placed in a shallow water table and maintained at the ambient sea water temperature of approximately 12°C. The water in the beakers was changed every 2 days, at which time the medusae were fed enough 2-day old Artemia salina nauplii (2 to 4 concentrated drops) so that a few nauplii remained until the water was next changed.

Twelve medusae were raised to sexual maturity. Planulae were obtained in the laboratory from mature medusae. Small numbers of eggs were released daily for several hours during the morning. Planulae were placed in a 10 cm diameter bowl of cooled, aerated, double-filtered sea water. The medusae were preserved in the formalin when 27 days old, at which time they showed signs of becoming moribund.

Bythotiara stilbosa, new species

Diagnosis: Adult medusa with 4 marginal tentacles and 4 unbranched radial canals; with bell broader than high. The largest medusa reared in the laboratory measured 4.8 mm in bell height and 5.4 mm in diameter in life. Gonads with weak irregular transverse folds.

Description: Newly released medusae (Fig. 1A) with intact umbilical canals were about 1.3 mm in bell height and 1.4 mm in bell diameter. The bell was nearly spherical and the jelly thicker apically than laterally. The exumbrella was studded with microbasic mastigophores. The manubrium hung down about two-thirds the length of the subumbrellar cavity and terminated in a simple round mouth. There was no peduncle. The 4 radial canals and ring canal were narrow and unbranched. The velum was broad. There were 4 perradial tentacles which were, in live medusae, characteristically contracted and held upwards against the bell. The relaxed tentacles of anesthetized specimens were approximately as long as the bell was high. Each tentacle terminated in an oval shaped knob containing a few macrobasic euryteles. The base of each tentacle was slightly swollen and contained orange pigment, as did the tentacle tips. The radial canals of newly released medusae also contained a few microbasic euryteles and macrobasic euryteles.

In 10 day old medusae (Fig. 1B), the jelly had thickened considerably and the bell was noticeably wider than high. The mouth had developed cruciform lips which were bordered by clumps of nematocysts, giving the

lips a crenulated appearance. No gonads were evident. The pigmentation in the basal and terminal portions of the tentacles had deepened to a red-brown color. The tentacles were usually held upwards and next to the bell, occasionally wrapping sideways and encircling the base of the bell.

Gonad development was first observed in 12-day old medusae. In both males and females the gonads were whitish and opaque, covering all but the distal portion of the manubrium. Transverse folds of the gonads, characteristic of the genus Bythotiarra, developed within a few days after the initial appearance of the gonads. Eggs could be seen in the gonads of 13-day old females. At this stage of development, the bell was about 3.2 mm high and 3.6 mm in diameter (Fig. 1C).

Females were first observed shedding eggs when 17 days old. Eggs were released for several hours each morning. Eggs and sperm were released through the walls of the gonads. Both the ovaries and testes were a translucent white, through which could be seen the orange-yellow coloration of the manubrial lining.

Developmental changes observed in 27-day old medusae primarily involved increased in bell size and thickness (Fig. 2A,B). The bases of the tentacles became imbedded in the bell as the jelly enlarged and thickened (Fig. 3A). The tentacles were hollow, their interiors continuous with the ring and radial canals. The tips of the tentacles appeared as oval-shaped knobs that were slightly lobed when contracted. The walls of the tentacle interior were white and appeared

as distinct white streaks terminating in enlarged whitish spaces in the proximal portion of the tentacle knobs. The solid distal two-thirds of the tentacle knobs contained orange and red pigment, while the tentacles bases were red-brown. The gonad also possessed a red-brown pigment. The bell was transparent. The tentacles were contracted and held upward against the bell while the medusa was swimming. When anesthetized, the relaxed tentacles of the mature medusa were up to 3 times as long as the bell was high.

Viewed from below, mature gonads were separated perradially and interradially (Fig. 3B). The mouth was cruciform with 4 crenulated lips which were bordered by an irregular band of microbasic euryteles (Fig. 3 B,C). The lips were folded when the mouth was closed (see Fig. 1C), but flared outward when the mouth was open (see Fig. 2A). The velum was narrow. The exumbrella was sprinkled with microbasic euryteles and microbasic mastigophores, the former being about 3 times as common. The subumbrella was sparsely studded with microbasic euryteles and microbasic mastigophores. Microbasic euryteles extended along the length of the tentacles in about the same density as on the exumbrella. The tentacle knobs were armed with macrobasic euryteles, while macrobasic euryteles were sprinkled sparsely along the length of the tentacles (Fig. 3A). Nematocyst dimensions are given in Table I. Nematocysts are illustrated in Figure 4.

The eggs of Bythotiara stilbosa were spherical, whitish in color, and approximately 75 μ in diameter. The planulae were hollow, pear-shaped, and sparsely ciliated. No nematocysts were seen in either eggs or planulae. The planulae were vigorous swimmers, rotating on their longitudinal

axes as they swam forward, a behavior commonly seen in hydrozoan planulae. They were active for several days, but none were seen to settle.

Type locality: Bodega Harbor, Sonoma County, California
(38° 20' North Latitude, 123° 03' West Longitude).

Type material: The holotype, (preserved 7 November 1974) is a 27-day old male medusa with preserved bell dimensions of 2.9 mm (height) and 4.2 mm (diameter) and is deposited at the National Museum of Natural History (Smithsonian Institution), NMNH # , along with four paratypes, also 27-days old, NMNH # . Additional specimens have been deposited in the Bodega Marine Laboratory Invertebrate collection and the British Museum (Natural History), London.

Etymology: The name stilbosa is taken from the Greek stilbose, meaning glistening, in reference to the effect produced by light reflecting from the exumbrellar nematocysts.

DISCUSSION

There are 8 genera in the family Calycoptidae (Kramp, 1961) distinguished briefly as follows. In the mature medusae of four of these genera, Bythotiara, Calycoptis, Eumedusa, and Sibogita, the wall of the gonad exhibits more or less conspicuous transverse folds. Sibogita is the only calycoptid genus described having radial canals which branch repeatedly at various levels. Calycoptis and Eumedusa possess centripetal canals, not present in Bythotiara. The remaining four calycoptid genera, Bythocellata, Heterotiara, Kanaka, and Meator lack transverse folds of the gonad.

Three species of Bythotiara have previously been described: (1) Bythotiara murrayi, which is known from the Atlantic Ocean, Mediterranean Sea, Indian Ocean, and West Pacific (Kramp, 1961; Edwards, 1967); (2) B. drygalskii Vanhöffen, 1912, collected only near Antarctica (Kramp, 1961), and (3) B. depressa Naumov 1960 collected only from the Northwest Pacific, including the Bering Sea and Sea of Okhotsk (Naumov, 1960). No collection records other than the present are known for B. stilbosa. None of the geographic ranges of the known species of Bythotiara (including B. stilbosa) are known to overlap.

In Table II Bythotiara stilbosa is separated morphologically from the three other described species of Bythotiara. Bythotiara depressa possesses prominent irregular folds on the manubrium and the bell is laterally compressed. In B. drygalskii, described from 3 specimens, the transverse folds are regularly spaced and prominent.

In addition, internally the manubrium exhibits 8 ridges at the inter-radii and perradii. In mature B. stilbosa medusae the transverse folds of the gonad are irregularly spaced, and no internal perradial and interradiial ridges are evident. Mature B. stilbosa and B. drygalskii have 4 unbranched radial canals and 4 perradial tentacles, whereas in B. murrayi the radial canals may branch several times with at least as many tentacles present as radial canal branches. B. depressa has 4 unbranched radial canals and 8 marginal tentacles.

The cnidoms have to date been described for only 4 species of calycopsid medusae (Table III). In Bythotiara murrayi, Russell (1940, 1953) reports desmonemes and a type of larger nematocyst that was never seen exploded but were assumed to be microbasic euryteles. The primary marginal tentacles had desmonemes, located only in the large terminal nematocyst cluster. The secondary tentacles had both kinds of nematocysts distributed over their entire length. In Heterotiara anonyma Maas 1905, Russell (1940) reports that the terminal clusters of the tentacles contain desmonemes and perhaps microbasic euryteles, although none of the latter were seen discharged. Renshaw (1965), reports seeing only desmonemes in the tentacles and lips of Calycopsis nematophora Bigelow 1913, and similarly Petersen (1957) found only desmonemes in Calycopsis gara. Bythotiara stilbosa possesses microbasic euryteles, macrobasic euryteles, and microbasic mastigophores. It is unusual that the cnidom of B. stilbosa is so unlike that of other calycopsids.

Nematocyst types within a hydrozoan genus are usually identical, although capsule sizes may vary. Closer inspection of live caly-copsid medusae could reveal larger nematocyst compliments. Morpho-logical similarities between B. stilbosa and other medusae in the genus Bythotiara, however, justified placement of the new species in this genus.

Both juvenile and adult medusae of B. stilbosa were weak swimmers. While swimming, the tentacles were usually contracted and held vertically against the sides of the bell. Adult medusae were frequently seen on the bottom of the culture beakers with their tentacles expanded and their bells pulsating weakly. The swimming and inactive postures described above are similar to those described by Edwards (1967) for young B. murrayi, although that medusa became an active swimmer after some days in the laboratory.

Kramp (1968, p. 174) refers to members of the Calyropsidae as "slope species", i.e., medusae which are neither truly neritic or oceanic, and further speculates that calyropsid hydroids are to be found on continental shelves. The presence of newly released Bythotiara stilbosa medusae in Bodega Harbor suggests that the polyp is present in the immediate vicinity. The medusae were considered to have been newly released due to the presence when collected of the umbilical canal, which connects the developing medusa to the parent hydroid. This canal usually disappears a few hours after the

medusa has been released. No adult B. stilbosa medusae have been collected in Bodega Harbor despite monthly plankton tows from 1971-1973 (Rees, 1975). Since at least one-half of the water in Bodega Harbor is exchanged with exposed coastal water on every neap tide (Boyd, 1971) it is possible that medusae released in the harbor would not remain and mature there.

SUMMARY

Bythotiar stilbosa, a new species of hydrozoan in the family Calyropsidae, is described. Newly released medusae were collected from Bodega Harbor, a shallow embayment in Central California, and raised to sexual maturity in the laboratory. Planulae were obtained from adults, but none were seen to settle.

Adult medusae of Bythotiar stilbosa are separable from other species of Bythotiar by having irregularly spaced transverse folds of the gonad and possessing four tentacles. Calyropsid medusae are considered to be oceanic in habitat. That newly released medusae of B. stilbosa were collected in Bodega Harbor indicates that the polyp occurs there as well. Thus, B. stilbosa can be considered a neritic, rather than oceanic species. The cnidom of B. stilbosa, consisting of microbasic euryteles, macrobasic euryteles, and microbasic mastigophores, is unique, as far as is known, for the entire family.

ACKNOWLEDGMENTS

The authors wish to thank the Bodega Marine Laboratory for the use and co-operation of their staff and facilities. Typing and illustration facilities were made available by ERDA.

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TABLE 1. Cnidom of Bythotiara stilbosa. Nematocysts were measured undischarged in two living adult specimens, one measuring 4.8 mm high and 5.4 mm diameter of the bell, and second, 3.0 mm high and 3.3 mm in diameter.

| <u>Nematocyst type</u> | <u>Location in medusa</u> | <u>Size range in μ</u> |
|--------------------------|----------------------------|---------------------------------------|
| macrobasic euryteles | shaft and tip of tentacles | 9.5-10.5 x 4.0 |
| microbasic euryteles | shaft of tentacles | 8.5-9.5 x 6.5-7.5 |
| | lips of manubrium | 6.5-9.0 x 6.0-6.5 |
| | exumbrella | 10.0-10.5 x 6.5-7.5 |
| | subumbrella | 7.5-9.0 x 5.0-7.5 |
| microbasic mastigophores | exumbrella | 20.5-21.0 x 18.0-19.0 |
| | subumbrella | 18.0-20.0 x 17.5 |

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TABLE 2. Comparison of major morphological features
the four described species of mature medusae
of the genus Bythotiara.

| Species | Tentacle Number | Gonad and Manubrium | Radial canal number; presence or absence of branching on the radial canal |
|----------------------|-----------------|--|---|
| <u>B. depressa</u> | 8 | prominent irregularly spaced folds. | 4; unbranched |
| <u>B. drygalskii</u> | 4 | prominent regularly spaced transverse folds, perradial and interrarial ridges on interior wall of manubrium. | 4; unbranched |
| <u>B. murrayi</u> | more than 4 | prominent transverse folds | more than 4; branched |
| <u>B. stilbosa</u> | 4 | irregularly spaced transverse folds; no perradial or interrarial ridges on interior wall of manubrium. | 4; unbranched |

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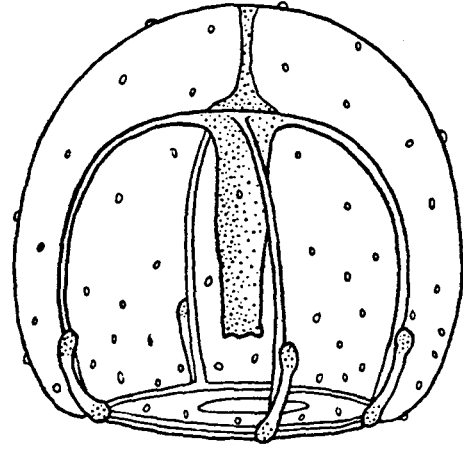
TABLE 3. Occurrence of different nematocyst types in the Anthomedusan family Calycopsidae. (?) indicates that no nematocysts of this type were seen exploded, but they appeared to be microbasic euryteles. See text for sources of data.

| | macrobasic euryteles | microbasic euryteles | microbasic mastigophores | desmonemes |
|-------------------------------|-------------------------|-------------------------|-----------------------------|------------|
| <u>Bythotiara stilbosa</u> | x | x | x | |
| <u>Bythotiara murrayi</u> | | x (?) | | x |
| <u>Calycopsis gara</u> | | | | x |
| <u>Calycopsis nematophora</u> | | | | x |
| <u>Heterotiara anonyma</u> | | x (?) | | x |

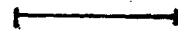
FIGURE 1. Bythotiara stilbosa. Developmental stages of the medusa, all drawn from life.

- (A) Newly released medusa, collected from the plankton. Note the presence of the umbilical canal.
- (B) Ten day old medusa.
- (C) Thirteen day old medusa with developing gonad.

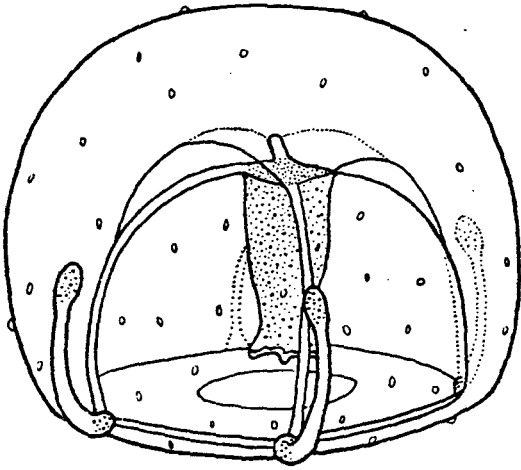
A



0.5 mm



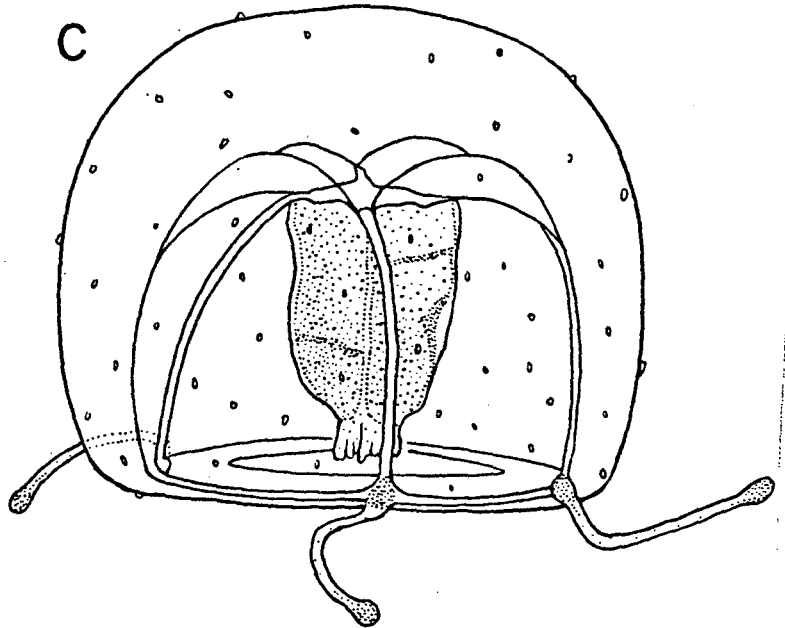
B



1.0 mm



C



1.0 mm



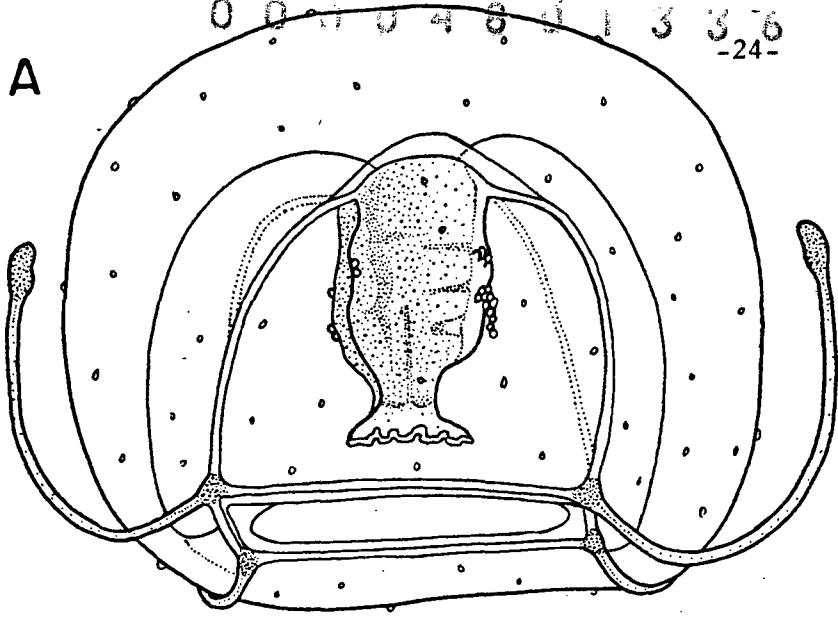
Figure 1

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FIGURE 2. Bythotiara stilbosa, adult medusa

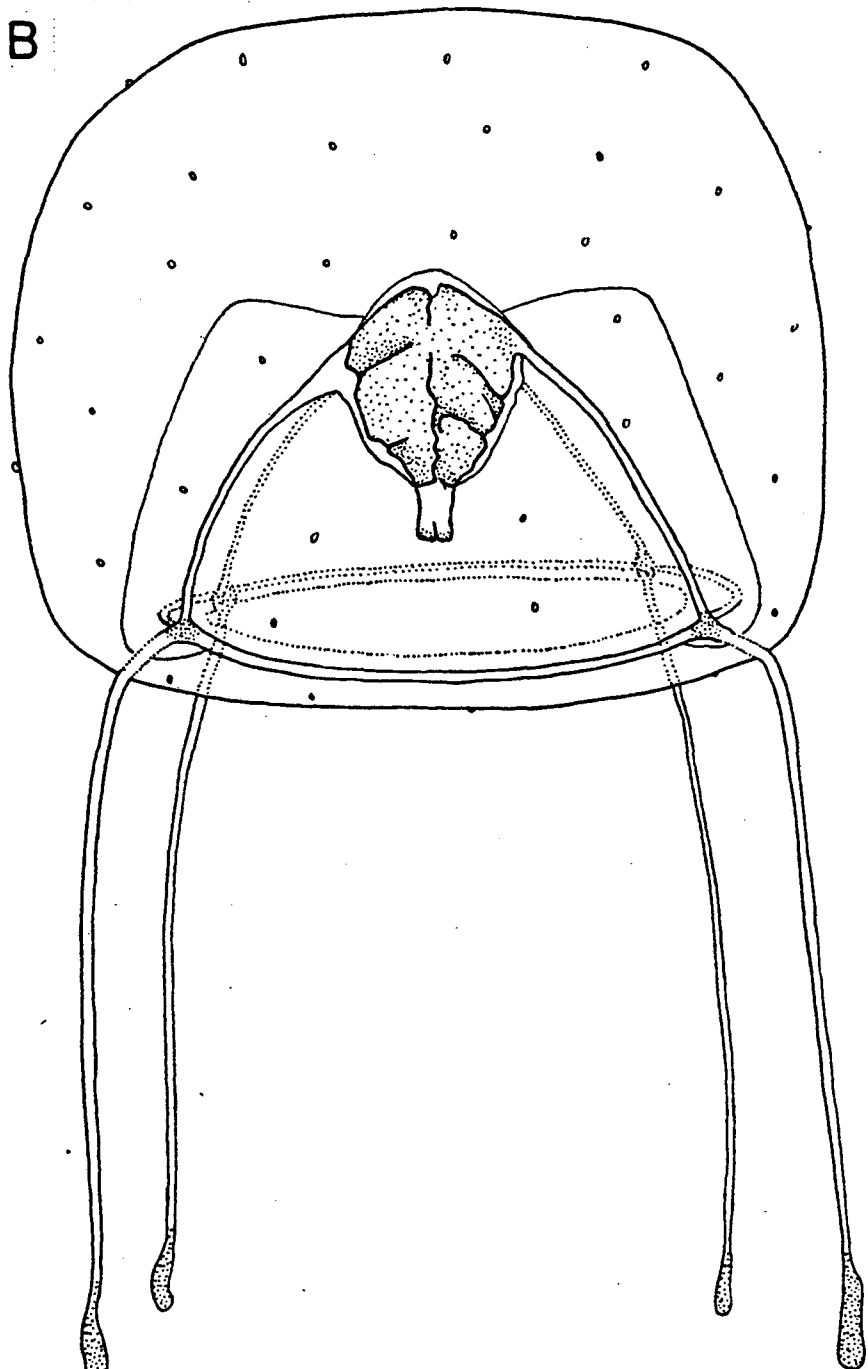
- (A) A female, 3.6 mm high and 4.8 mm wide, extruding eggs. Note tentacles held upwards against the sides of the bell, a typical swimming posture. Drawn from life.
- (B) A male, 3.6 mm high and 4.8 mm wide, drawn from a preserved specimen. The transverse folds of the gonads are more evident in preserved material.

A



1 mm

B



1 mm

Figure 2

XBI 778-1605

FIGURE 3. Bythotiara stilbosa.

- (A) Tentacle and exumbrella of mature medusae.
Nematocysts on tentacle shaft and exumbrella are drawn to approximate actual abundance.
- (B) Oral view of mouth, gonads and manubrium.
- (C) Detail of crenulated band of nematocysts bordering lips of manubrium. EX, exumbrella; G, gonad; L, lips of manubrium; N, nematocysts; RA, Radial canal; RC, ring canal; V, velum.

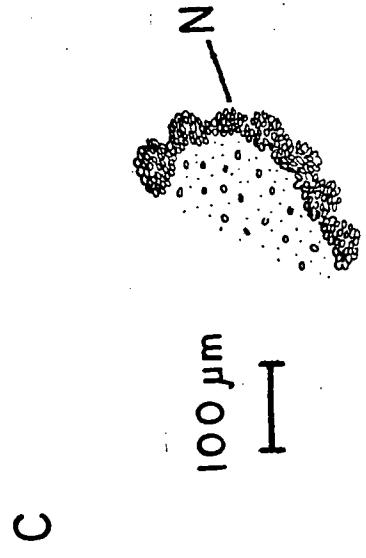
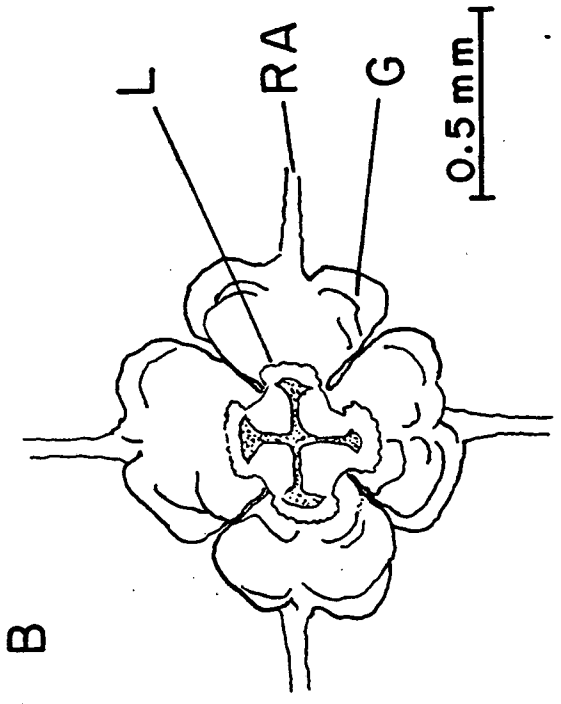
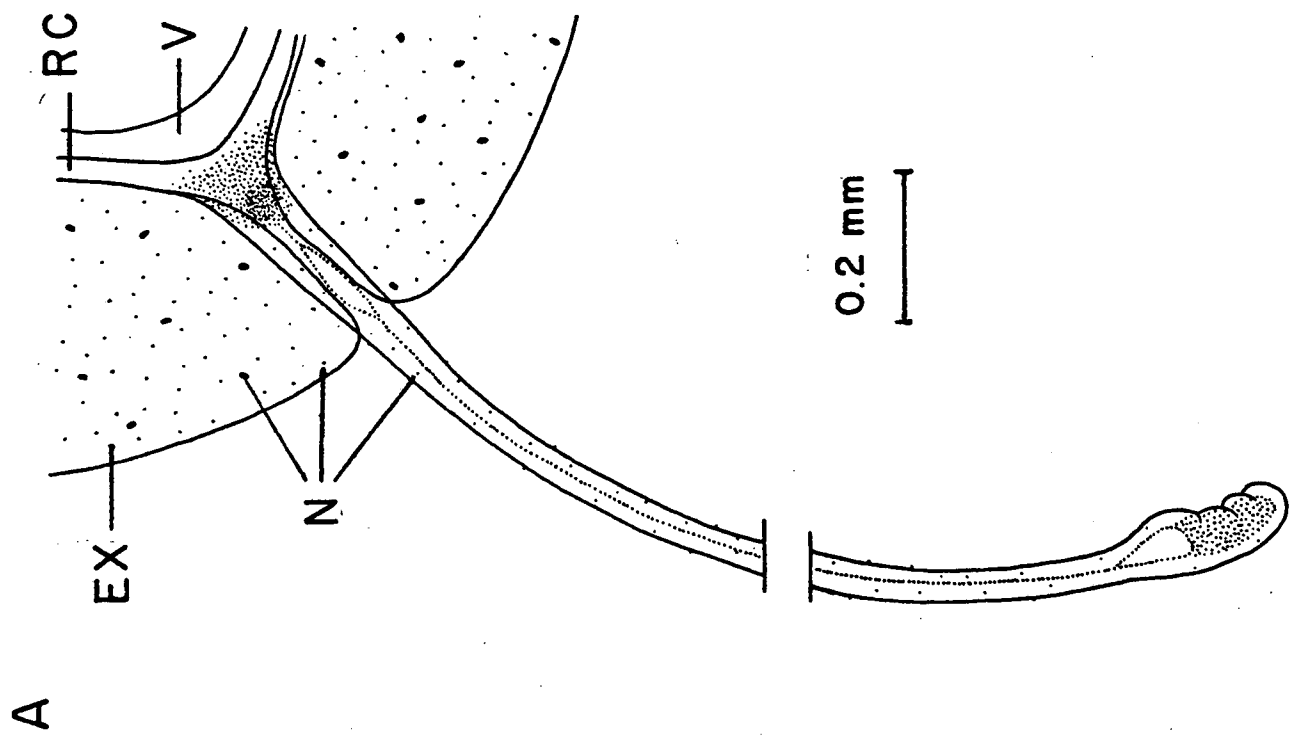
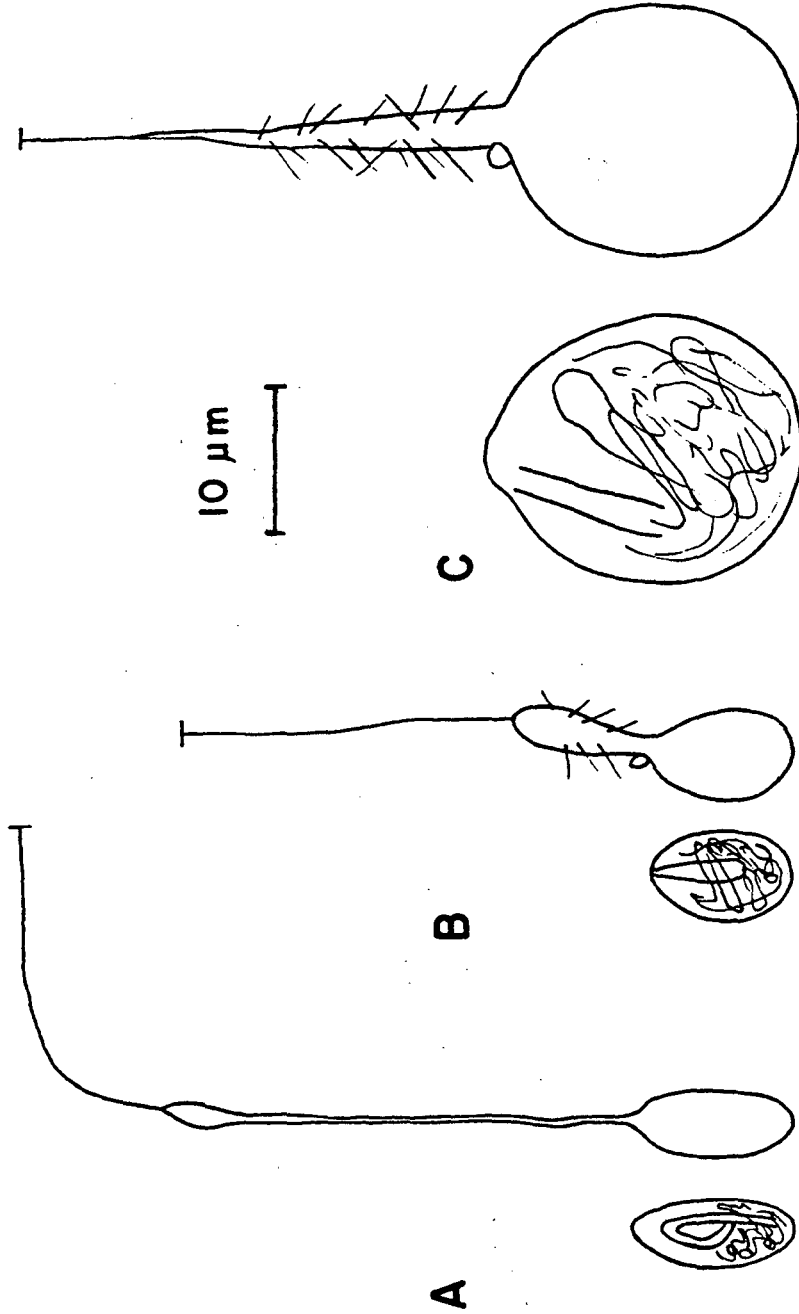


Figure 3

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FIGURE 4. Bythotiara stilbosa. Cnidom, drawn to scale.

- (A) Macrobasic euryteles
- (B) Microbasic euryteles
- (C) Microbasic mastigophores



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Figure 4

0 0 1 0 0 0 0 0 1

This report was done with support from the United States Energy Research and Development Administration. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the United States Energy Research and Development Administration.

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