

Further notes on Leptolida (Hydrozoa: Cnidaria) from Canadian Pacific Waters

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Key words: taxonomy; Leptolida; Anthoathecatae; Bythotiaridae; Pandeidae; Trichydridae; *Paragotoea*; *Paulinum*; *Euphysa*; Tiarannidae.

This paper includes new data on Anthoathecatae and Tiarannidae. *Paulinum* gen. nov., *Paulinum lineatum* spec. nov., and *Euphysa vervoorti* spec. nov. are described. A single specimen was assigned tentatively to the Trichydridae as *incertae sedis* gen., *incertae sedis* spec. nov. An additional four species (*Calycopsis bigelowi*, *Merga reesi*, *Paragotoea bathybia* and *Modeeria rotunda*) are recorded from Canadian Pacific and adjacent waters for the first time. The species *Bythotiara depressa* Naumov, 1960 is re-described and its relationship to other Calycopsidae is discussed. Other data are briefly summarized to update the Anthomedusae portion of Arai & Brinckmann-Voss (1980: 1).

Introduction

The inshore fauna of the Leptolida (medusa stage) from Puget Sound and off British Columbia is fairly well known (summarized in Arai & Brinckmann-Voss, 1980: 1; Mills, 1987: 33). However, there are few published data on the deep water fauna from Canadian and adjacent waters of the northeast Pacific Ocean. Recent collections have provided specimens of such offshore Hydrozoa. The present paper uses this material to update the Anthoathecatae and Tiarannidae of our previous monograph.

Materials and methods

The majority of the samples were supplied by the groundfish section of the Pacific Biological Station, Nanaimo, B.C., particularly from cruises January-April 1987 and January-April 1988. A 1 m² Tucker sampler was used with three 335 μ m nets which were opened and closed at specific depths. Stations occupied at this time were in three parallel rows off Pachena Point and Barkley Sound, west of Vancouver Island from inshore to beyond the 1200 m contour line (Arai et al., 1993: 1). Their earlier, 1980 and 1986, samples off the Canadian west coast were obtained by oblique bongo tows (Fulton et al., 1982: 1; Arai et al., 1993: 2). For other samples collected by ourselves or supplied by other workers, see the section "Material" of the species accounts and "acknowledgements".

Specimens were fixed in 5% formaldehyde solution buffered in sodium borate, and stored in this solution or 70% alcohol. Preliminary sorting was done at the Pacific

Biological Station, and final sorting at the Department of Biological Sciences, University of Calgary, Calgary, Alberta.

The material referred to in this paper will be mostly deposited in the Royal British Columbia Museum, Victoria, B.C., Canada. Accession numbers refer to specimens already deposited; the remaining specimens are still in our collections for further study.

The photographs of *Modeeria rotunda* were taken by M.N.A., and all other original illustrations were done by A. B.-V.

Abbreviations:

- ROM = Royal Ontario Museum, Toronto, Ont. Canada;
 ZMC = Zoological Museum, Copenhagen, Denmark;
 RBCM = Royal British Columbia Museum, Victoria, B.C. Canada.
 ZISTP = Zoological Institute St Petersburg, Russia.

List of species

Class Hydrozoa Owen, 1843

Subclass Leptolida Haeckel, 1879

Order Anthoathecatae Cornelius, 1992

Suborder Filifera Kühn, 1913

Superfamily Pandeoidea Haeckel, 1879

Family Bythotiariidae Maas, 1905 (= Calycopsidae Hartlaub, 1913)

Genus *Bythotiara* Günther, 1903

Bythotiara depressa Naumov, 1960

Bythotiara huntsmani (Fraser, 1911)

Genus *Calycopsis* Fewkes, 1882

Calycopsis bigelowi Vanhöffen, 1911

Calycopsis nematophora Bigelow, 1913

Family Halimedusidae Arai & Brinckmann-Voss, 1980

Genus *Halimedusa* Bigelow, 1916

Halimedusa typus Bigelow, 1916

Family Pandeidae Haeckel, 1879

Genus *Amphinema* Haeckel, 1879

Amphinema platyhedos Arai & Brinckmann-Voss, 1983

Genus *Geomackiea* Mills, 1985

Geomackiea zephyrolata Mills, 1985

Genus *Merga* Hartlaub, 1913

Merga reesi Russell, 1956

Genus *Pandea* Lesson, 1843

Pandea rubra Bigelow, 1913

Family Trichydridae Hincks, 1868

Genus and species *incertae sedis*

Suborder Capitata Kühn, 1913

Superfamily Sphaerocorynoidea Prévot, 1959

Family Paragotoeidae Ralph, 1959

Genus *Paragotoea* Kramp, 1942

Paragotoea bathybia Kramp, 1942

- Family *incertae sedis*
 Genus *Paulinum* gen. nov.
Paulinum lineatum spec. nov.
- Superfamily Corymorphoidea Allman, 1872
 Family Corymorphidae Allman, 1872
 Genus *Euphysa* Forbes, 1848
Euphysa verwoorti spec. nov.
- Superfamily Corynoidea Johnston, 1836
 Family Corynidae Johnston, 1836
 Genus *Sarsia* Lesson, 1843
Sarsia cliffordi Brinckmann-Voss, 1989
- Order Leptothecatae Cornelius, 1992
 Superfamily Laodiceoidea L. Agassiz, 1862
 Family Tiarannidae Russell, 1940
 Genus *Modeeria* Forbes, 1848
Modeeria rotunda (Quoy & Gaimard, 1827)

Account of species

- Order Anthoathecatae Cornelius, 1992
 Suborder Filifera Kühn, 1913
 Superfamily Pandeoidea Haeckel, 1879
 Family Bythotiaridae Maas, 1905 (= Calycopsidae Harlaub, 1913)

Pandeoidea medusae without apical projection; with simple or crenulate lips; with or without branching of radial canals; with or without centripetal canals; with four or more hollow marginal tentacles with proximal part of tentacles adnate to base of exumbrella, rather thick in most species; without significant thickening at base of tentacle (marginal bulb). Cnidocysts often concentrated in terminal swellings of tentacle; with or without rudimentary tentacles; with or without ocelli.

Type genus: *Bythotiara* Günther, 1903.

Remarks.— The Family Bythotiaridae is greatly in need of revision, which is outside the scope of a paper on species from the Northeast Pacific. However, the distinction between *Heterotiara anonyma* Maas, 1905 and *Bythotiara depressa* Naumov, 1960 is clarified. The variability of other species is discussed and new collecting records are included. The family name Bythotiaridae Maas, 1905 has priority over Calycopsidae Harlaub, 1913 (not Bigelow, 1913 as cited by several recent papers).

Genus *Bythotiara* Günther, 1903

Bythotiaridae with four simple, or irregularly bifurcate, radial canals, no centripetal canals. Gonads smooth or with folds when mature.

Type species: *Bythotiara murrayi* Günther, 1903.

Remarks.— This genus is distinguished from *Heterotiara* Maas, 1905 only by the folding of the mature gonads. As discussed below, this is a very variable character. In a future familial revision these genera should therefore probably be merged.

Bythotiara depressa

(fig. 1a, 1c)

Heterotiara anonyma Bigelow, 1913: 25 (in part); 1919: 287 (in part); Arai & Brinckmann-Voss, 1980: 69 (in part) (not *Heterotiara anonyma* Maas, 1905: 19, pl. 3).

Bythotiara depressa Naumov, 1960: 191; Arai & Brinckmann-Voss, 1980: 64; Bouillon, 1980: 316 (in part).

Material.— *Bythotiara depressa*: 2 specimens 20.v.1906, 53°05'N 138°31'W, 1 specimen, 3–4.vi.1906, Bowers Bank, Bering Sea, and 1 specimen, 20.vi.1906, off Startschkof Island, E. of Kamchatka, coll. H.B. Bigelow; 3 specimens, 13.vii.1966 "Vitiaz" Pacific Station No. 5600, 3500–600 m, coll. ZISTP; 3 of the following 5 specimens deposited: RBCM 998-225, RBCM 998-226, RBCM 998-227: 5 specimens, ii–iv.1980, 49°30'–54°00'N 127°34'–133°48'W, 0–610 m (preliminary record Fulton et al., 1982: 23) 223 specimens during ii–iv.1982–1988, at outer shelf stations off the west coast of Vancouver Island, depths sampled with closing nets 300–700 m; 1 specimen, 19.vi.1990, 47°57'N 129°05'W, 0–1750 m, coll. B.J. Burd, R.E. Thomson & G.S. Jamieson. Immature *Bythotiara depressa*: RBCM 998-228: 1 specimen, 27.ii.1982, 48°43'N 126°40'W, 0–1180 m; RBCM 998-229: 1 specimen, 16.ii.1987, 48°26'N 126°14'W, 300–0 m; *Heterotiara anonyma*; RBCM 998-230: 3 of 30 specimens deposited; Bay of Hansa, off Laing Island, Papua New Guinea, coll. J. Bouillon.

Specific characters.— Umbrella laterally flattened. Four unbranched radial canals. Eight tentacles, each with terminal nematocyst cluster thicker than diameter of distal part of tentacle, spherical with few exceptions.

Description.— Umbrella up to 20 mm high, with thick mesoglea, especially at apex, laterally flattened. Manubrium half length of bell cavity or less; gonads with varied degree of folding. Eight tentacles thick at base, becoming very thin before terminal nematocyst clusters; without secondary tentacles. Terminal nematocyst clusters of adult specimens mostly spherical, rarely ovate but still arising abruptly from a narrow portion of the tentacle (fig. 1a).

Remarks.— *Bythotiara depressa* has frequently been confused with *Heterotiara anonyma* Maas 1905, originally described from off Indonesia, but widely distributed in warm oceans. Based on the literature descriptions of *B. depressa* and his own abundant material of *H. anonyma* from Papua New Guinea, Bouillon (1980: 316) suggested that the two species might be conspecific. However, for reasons given below they should be kept separate.

Bythotiara depressa was described by Naumov (1960: 191) on the basis of 31 specimens from 20 locations in the northwest Pacific. The type, from 51°53.1'N 161°49.6'E, is preserved in the Zoological Institute, St Petersburg (Savitskaya, 1977: 135). Further specimens from the Kuril-Kamchatka Trench were examined by Naumov (1971: 10). We have examined 232 specimens of *B. depressa* from the northeast and northwest Pacific (Arai & Brinckmann-Voss, 1980: 64; material listed above). These have been compared with 30 specimens of *Heterotiara anonyma* from Papua New Guinea.

The two species resemble one another. Each specimen has four unbranched radial canals and tentacles with terminal nematocyst thickenings. The tentacle number is normally eight. Although placed in different genera based on degree of gonad folding, the species are in fact very similar in this respect; in both the gonads may be smooth or show loose folding as the manubrium contracts.

A distinguishing character is that the terminal nematocyst clusters of the tentacles are usually spherical in *Bythotiara depressa*, and always arise abruptly from a very thin

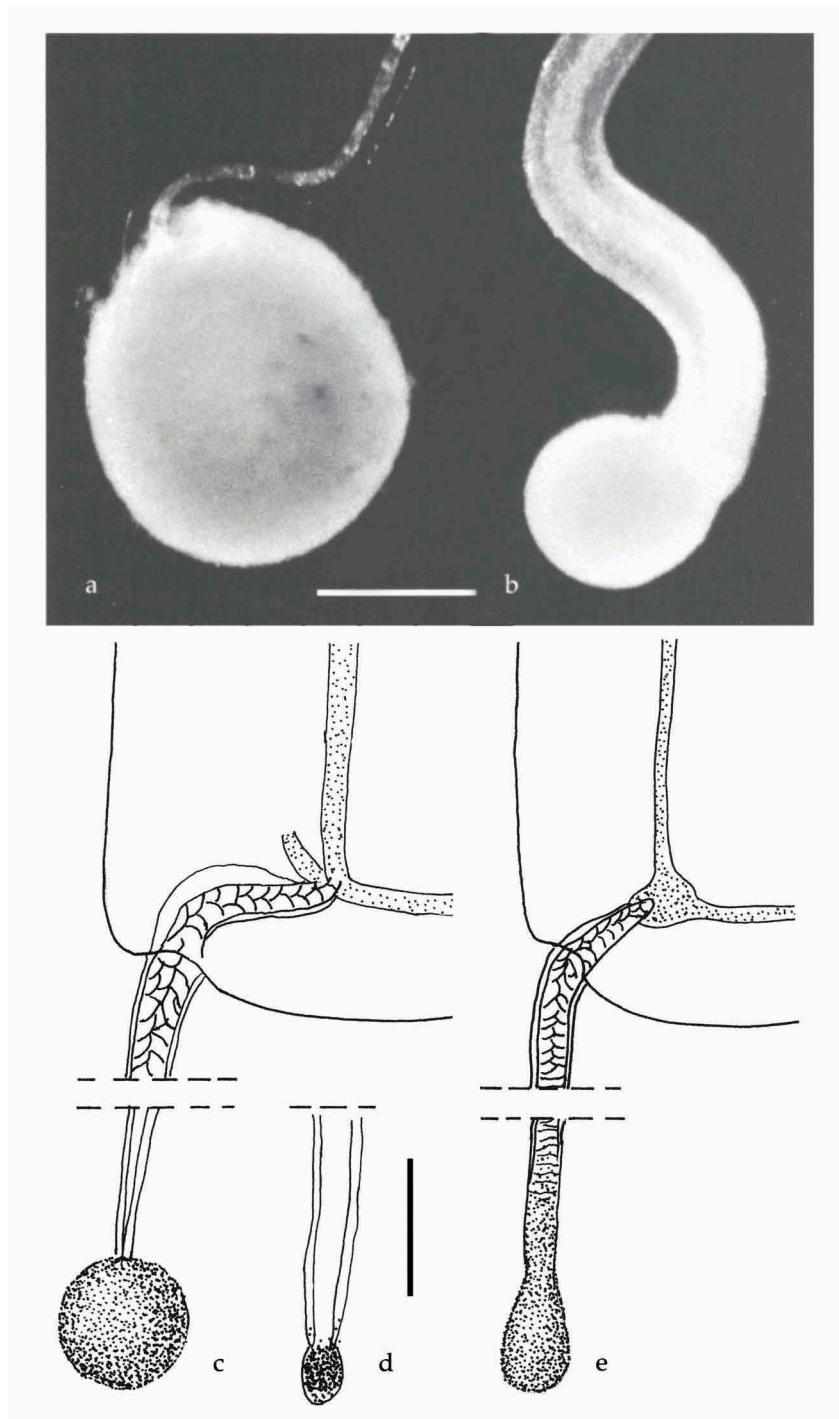


Fig. 1. Structures in, a. *Bythotiara depressa* tentacle tip (recent collection), b. *Heterotiara anonyma* tentacle tip (South Pacific, courtesy J. Bouillon), scale bar a,b: 0.15 mm, c. *Bythotiara depressa* margin and tentacle tip, adult, d. same species, juvenile, e. *Heterotiara anonyma*, scale bar c-e: 0.3 mm.

portion of the tentacle, whereas they are more elongate in *Heterotiara anonyma* (see Bouillon et al., 1988: 94) (fig. 1). Developing tentacles in young *B. depressa* are more like *H. anonyma*, but in adult specimens the difference is quite marked. Radial canals of *B. depressa* are twice the thickness of comparably sized *H. anonyma*. *B. depressa* does not show any thickening at the junction of radial and ring canals, whereas *H. anonyma* shows a slight thickening at that point. The vacuolated portion of endodermal cells in the adnate tentacle base is thicker in *B. depressa* than in *H. anonyma* (fig. 1c & e). Another distinctive character of *B. depressa* is the laterally compressed umbrella described by Naumov (1960: 191) and verified by us, which is lacking or less developed in *H. anonyma* (see Bouillon, 1980: 316; present work).

The above description of *Bythotiara depressa* was based on adult specimens. In addition we have examined two smaller (4 and 4.8 mm high, both 4 mm wide) specimens which we have tentatively assigned to the same species. Both specimens have smooth gonads, and some of the tentacles have spherical terminal clusters, whereas other shorter tentacles have no distinct terminal cluster but only thickened tips (fig. 1d). Since smooth gonads are typical of developing gonads in the similar species *Bythotiara huntsmani* (Brinckmann-Voss, 1979: 1228), we assume that gonads of *Bythotiara depressa* develop in the same way, and that these smaller specimens are young *Bythotiara depressa*. They are however, distinguished from *Bythotiara huntsmani* by the different number and structure of the tentacles.

The original description of *Heterotiara anonyma* by Maas (1905: 19) was based on two specimens lacking tentacles, from 0°18'S 129°15'E, Halmahera Sea. The two syntypes are in the Zoological Museum of Amsterdam (van Soest, 1975: 30). In 1909 two specimens with 11 and 12 tentacles respectively were assigned to the species from collections off Peru (Bigelow, 1909: 216). This identification was questioned by Vanhöffen (1911: 211), who reported another specimen of *H. anonyma* from the Indian Ocean. In 1913 Bigelow reported *H. anonyma* from several localities in the North Pacific. We examined four of Bigelow's specimens (deposited in the Smithsonian Museum as *Heterotiara anonyma*), and found them identical with *Bythotiara depressa* Naumov.

The above incorrect identifications of *H. anonyma* have resulted in a very confused literature to the present day. The species has been reported in a variety of warm water locations, but usually with insufficient details to allow a confirmation of identity. In 1980 we reported *Heterotiara anonyma* from the Gulf of Alaska based on Bigelow's incorrect records. We now believe that it has never been correctly identified in the Northern Pacific. Since we had no material at the time, the specimen illustrated (Arai & Brinckmann-Voss, 1980: 70) was obtained from R.J. Larson's collection off Mona Island, Puerto Rico.

Against the above background, reports of *Bythotiara depressa* outside the North Pacific must also be treated with scepticism until the details are known. Phillips (1972: 98) described a single specimen from the Gulf of Mexico which was very crumpled, unlike typical specimens with thick mesogloea. Although we have not checked material, we suggest that the records of *Bythotiara depressa* from the Yucatan Shelf and Mexican Caribbean by Segura-Puertas (Segura-Puertas, 1992: 357; Segura-Puertas, L. and Ordóñez-López, 1994: 108) may also be referable to *Heterotiara anonyma*.

Bythotiara huntsmani (Fraser, 1911)

Crypta huntsmani Fraser, 1911: 19, pl. 1.

Endocrypta huntsmani Fraser, 1912: 216; 1914: 109, pl. 1; Rees, 1980: 48; (? Briggs & Gardner, 1931: 181); (not *Endocrypta huntsmani* Trebilcock, 1928: 1 = *Bythotiara parasitica* (Kirk, 1915)); (not *Endocrypta huntsmani* Ralph, 1953: 66 = *Bythotiara parasitica* (Kirk, 1915)).

Bythotiara huntsmani Brinckmann-Voss, 1979: 1226; Arai & Brinckmann-Voss, 1980: 66; (?Bouillon, 1995a: 224; Bouillon et al. 1995: 8 = *Bythotiara parasitica* (Kirk, 1915)).

Material.— 1 specimen, 28.iv.1976, Departure Bay, surface, coll. M.N. Arai; RBCM 998-231: 1 specimen, 22.iv.1984, Cumshewa Inlet, Hecate Strait, surface, coll. J. Purcell.

Specific Characters.— Umbrella deep bell-shaped in adult specimens. Four unbranched radial canals. Eight adradial gonads with degree of folding varying from rather marked folds to nearly smooth surfaces. Four perradial tentacles with terminal cnidocyst clusters not thicker than diameter of contracted tentacles.

Description of Medusa.— Umbrella up to 7.1 mm high, up to 6.5 mm wide, with scattered cnidocysts on exumbrella. Stomach occupying about half of subumbrellar cavity. Lips four-cornered with numerous cnidocyst patches. Radial and ring canals smooth. Without ocelli. Manubrium, junction of radial canals and ring canal, and tentacle tip orange to dark brown. Gonads of male specimens milk white, female more transparent. Remainder of medusa colourless.

Hydroid.— The hydroid has four to five irregular whorls of filiform tentacles. Its morphology and budding have been described by Fraser (1911: 19; 1914: 109), Brinckmann-Voss (1979: 1227) and Rees (1980: 48).

Remarks.— *Bythotiara huntsmani* has been obtained from ascidians collected in the Strait of Georgia and off the west coast of Vancouver Island, British Columbia and near Friday Harbour, Washington (Fraser, 1911: 20; 1913: 149; 1914: 110; Rees, 1980: 48; Brinckmann-Voss, 1979: 1226). Most observed medusae have been raised from the hydroids. However Mills (1981: 12) collected two free-living specimens from Saanich Inlet. Our present material includes another specimen from the Strait of Georgia area in Departure Bay, and one from Cumshewa Inlet, Hecate Strait.

Bythotiarid hydroids living in the prebranchial zone of ascidians have been described from several locations in the Pacific. Medusae have been raised from these hydroids or juvenile medusae, and (rarely) adults have also been collected in the field. There is need for further research on life cycles and variability to clarify the number of species present. In the above synonymy we have taken the conservative approach that *Bythotiara stilbosa* Mills & Rees, 1979 and *B. parasitica* (Kirk, 1915) are distinct species (Mills & Rees, 1979: 285; Schuchert, 1996: 23).

Calycopsis Fewkes, 1882

Bythotiaridae with four primary radial canals, either with centripetal canals blindly ending, or joining the base of the stomach, or with secondary canals forming branches of the primary canal. Base of stomach broad, often extending along radial canals forming a cross.

Type species: *Calycopsis typa* Fewkes, 1882

Remarks.— We consider the above definition of the genus *Calyropsis* to be provisional until a complete revision of the family can be made. The type species, *Calyropsis typa*, was the first bythotiarid described (Fewkes, 1882: 304). As other species have been discovered, a number of subsequent authors have attempted to distinguish the genus by the extent of branching of the radial canals and/or the presence of centripetal canals. Unfortunately branching of several bythotiarids is highly irregular (e.g. *Bythotiara murrayi* (see Russell, 1953: 217) and *Calyropsis borchgrevinki* (Browne, 1910) (see Moore, 1984: 250)). Blind ended centripetal canals can be clearly distinguished. However, those canals which connect the ring canal to the base of the stomach or the four primary radial canals can not be differentiated into centripetal or centrifugal canals (as noted by Kramp, 1959: 27). In some species only occasional centripetal canals are observed, and these have been interpreted as aberrations (eg. *B. murrayi* (see Kramp, 1926: 97)) or as indication of an centripetal origin of other canals (eg. *Calyropsis nematophora* Bigelow, 1913 (see below)). The genus *Sibogita* can therefore not be clearly distinguished from *Calyropsis* by a lack of centripetal canals, at least until development of the canals has been described and shown to be centrifugal.

Calyropsis bigelowi (?) Vanhöffen, 1911
(fig. 2)

Calyropsis bigelowi Vanhöffen, 1911: 218, fig. 12;
Kramp, 1957: 21; van der Spoel & Bleeker,
1988: 181; ?Schuchert, 1996: 26.

Material.— RBCM 998-232: 1 specimen, 1.ii.
1987, 48°32'N 126°37'W, 500 m.

Specific characters.— Four radial canals, four interradial centripetal canals and eight perradial and interradial tentacles with two to three smaller tentacles between them.

Description.— Deep bell-shaped exumbrella and more conical subumbrella. Exumbrella 20 mm high, 14 mm wide, subumbrella 12 mm high. Four radial canals and three visible blind interradial centripetal canals (the fourth quadrant is badly damaged). Deeply cleaved gonads in upper part of manubrium, leaving lower part of manubrium gonad free. Large mouth with sparsely folded lips, without nematocyst clusters. Eight fully developed tentacles with base adnate to exumbrella. Tips of tentacles broken off. Between each of large tentacles one

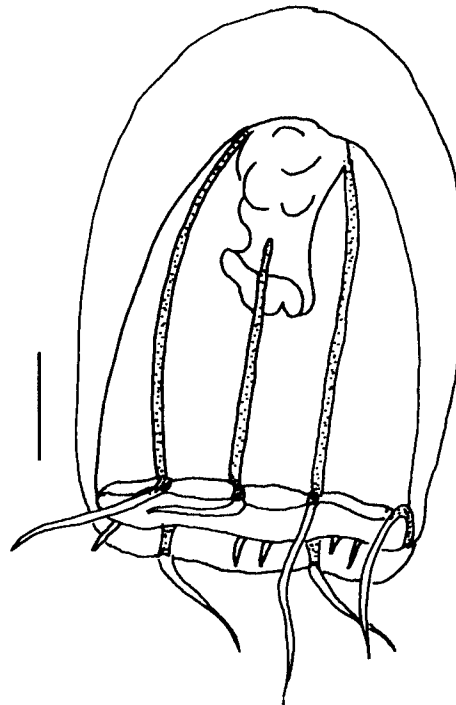


Fig. 2. *Calyropsis bigelowi* (recent collection); small tentacles could not be seen in all quadrants, because margin was partly damaged. Scale bar: 4 mm.

to three developing tentacles.

Remarks.— Although the tentacle tips of this specimen were broken off, we could assign it tentatively to *Calycopsis bigelowi* because of the tentacle arrangement and a blind centripetal canal in each of the three undamaged quadrants.

Although rarely recorded, *C. bigelowi* is widely distributed. It was originally described from the Gulf of Aden (Vanhöffen, 1911: 219). It has since been collected in the Atlantic west of the Cape of Good Hope (Kramp, 1957: 21) and off Scotland (Fraser, 1974: 13), and in the Pacific in the Malayan Archipelago (Kramp, 1965: 46), in the Banda and Aru Seas (van der Spoel & Bleeker, 1988: 167) and off New Zealand (Schuchert, 1996: 26).

Calycopsis nematophora Bigelow, 1913
(fig. 3)

?*Sibogita simulans* Bigelow, 1909: 213 (in part).

?*Calycopsis typha* Vanhöffen, 1911: 214, pl. 22 (in part, not *Calycopsis typha* Fewkes, 1882: 301, pl. 1).

Calycopsis nematophora Bigelow, 1913: 23, pl. 2, 3; 1940: 290; Naumov, 1956: 37; 1960: 211, pl. 29; Renshaw, 1965: 841; Arai & Brinckmann-Voss, 1980: 68; van der Spoel & Bleeker, 1988: 167, fig. 15.

Perigonimus nematophora Naumov, 1955: 53, pl. 7.

Material.— RBCM 998-233: 1 specimen, 16.iii.1980, 54°00'N 133°48'W, 0-620 m; RBCM 998-234: 1 specimen, 19.iv.1980, 53°20'N 133°19'W, 0-610 m; each preliminary record Fulton et al. (1982: 23); 1 specimen, 25.i.1987, 48°15'N 126°40'W, 500 m; RBCM 998-235: 1 specimen, 15.ii.1987, 48°26'N 126°20'W, 0-700 m.

Specific characters.— Mouth with labial nematocyst clusters.

Description.— Umbrella up to 30 mm high, nearly as wide as high in preserved specimens. Mesoglea about 1/5 - 1/4 diameter of exumbrella. Upper portion of stomach broad, extended on four primary radial canals forming a cross as seen from above. In recent collections length of stomach less than half of the subumbrella, although Bigelow (1913: 23) reported the length of the manubrium as up to the length of the bell cavity. Lips intensively folded, provided with oblong cnidocyst clusters of which the larger ones are stalked. Four primary radial canals thick, forming trunks at their base near the stomach, forking into thinner radial canals a short distance from the stomach, with a maximum number of 17 canals (16 in our specimens). Each canal bordered by a band of longitudinal muscles. Gonads interradial with several rows of slit-like pits (rather than folds as described by some earlier authors). Rarely up to 60 (33 in our specimens) tentacles of different sizes; 2-8 thick hollow longer tentacles, with majority of remaining tentacles much shorter and stump-like. Each tentacle with a terminal cnidocyst cluster (often damaged in the longer tentacles). Gonads and manubrium dark red to purple in living specimens, often remaining red-brown after formalin preservation.

Remarks.— Although the genus *Calycopsis* is defined partly as having centripetal canals, *C. nematophora* may have all its canals extending from the ring canal to the four trunk-like primary radial canals. The only exceptions described in the literature are 1 to 3 blind canals connected to the ring canal in 2 of Bigelow's specimens (Bigelow 1913: 24) and one of Renshaw's 40 specimens (Renshaw, 1965: 846). In all speci-

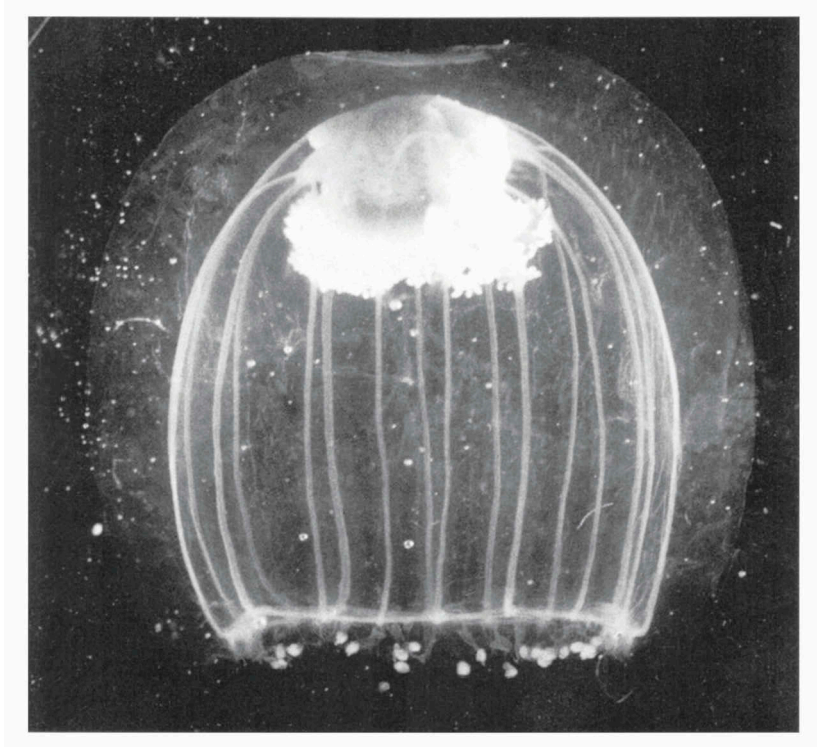


Fig. 3. *Calyropsis nematophora* (collected 1959, Gulf of Alaska), specimen height 17 mm.

mens from our collections canals connect the ring canal to the primary radial canals, without any blind canals. Nevertheless the canals have been assumed to be developed centripetally (Bigelow, 1913: 24), and we have followed previous authors in including the species in this genus.

The above specimens are the first collected in Canadian waters, although the species had been collected in adjacent areas. Previous records from the North Pacific were summarized by Arai & Brinckmann-Voss (1980: 69). More recent records from this area include those of Alvariño (1980: 153), Mills (1981: 12), Cooney (1981: 960), Chuchukalo & Babich (1981: 51) and van der Spoel & Bleeker (1988: 167), extending the range south to California and the Philippine Archipelago.

Family Halimedusidae Arai & Brinckmann-Voss, 1980

Pandaeoidea medusae with four radial canals; with subumbrella protruding into stomach giving a peduncle-like appearance; mouth cruciform with row of nematocysts; with four perradial tentacles and four interradial groups of tentacles, each hollow and lacking adhesive organs; with marginal bulbs with abaxial ocelli.

Genus *Halimedusa* Bigelow, 1916

Halimedusidae with characters of the family.

Halimedusa typus Bigelow, 1916

Halimedusa typus Bigelow, 1916: 91, pl. 1; Arai & Brinckmann-Voss, 1980: 62.

Specific characters.— With the characters of the genus.

Remarks.— A detailed description of this species was given in Arai & Brinckmann-Voss (1980: 62). At that time the only record of this species in the research area was the original one of three specimens off Amphitrite Point, British Columbia (Bigelow, 1916: 91). It had been recorded further south, and we illustrated a specimen from Yaquina Bay, Oregon. More recently we have examined four other specimens from Masset Inlet, British Columbia (Arai, 1987: 110).

Family Pandeidae Haeckel, 1879

Pandeoidea medusae with or without apical projection. Manubrium more or less quadratic with a four cornered mouth (except in *Octotiarra*), with lips simple to complexly folded. Four radial canals (except in *Octotiarra*) either smooth or jagged. Gonads interradial or adradial on manubrium, rarely extending to upper part of radial canals, smooth or with warts and pits, or cleaved or complexly folded. Radial canals with smooth walls, or jagged. Marginal bulbs with or without ocelli. Filiform tentacles with or without tentaculæ between them. Hydroids where known stolonial or small upright colonies, with single whorl of tentacles in the majority of species, or rarely with two whorls or scattered tentacles.

Type genus: *Pandea* Lesson, 1837.

Remarks.— Since 1980 two new species of pandeids have been described from this area; *Amphinema platyhodos* Arai & Brinckmann-Voss, 1983, and *Geomackiea zephyrolata* Mills, 1985. We include brief descriptions of these species here, together with new records of *Merga reesi* Russell, 1956 and *Pandea rubra* Bigelow, 1913.

Genus *Amphinema* Haeckel, 1879

Pandeidae medusae with not more than two opposite, perradial tentacles; with marginal warts or tentaculæ; without gastric peduncle; with or without mesenteries; mouth with four simple or wavy lips; gonads adradial or interradial or extending along radial canals; with or without ocelli.

Type species: *Amphinema dinema* (Peron & Lesueur, 1809).

Amphinema platyhodos Arai & Brinckmann-Voss, 1983

Amphinema platyhodos Arai & Brinckmann-Voss, 1983: 2179; Bouillon, 1985b: 254.

Specific characters.— Very broad marginal bulbs, long tentaculæ between bulbs and large pointed apical projection.

Remarks.— Detailed descriptions of three specimens were given by Arai & Brinckmann-Voss (1983: 2179). These specimens had damaged lips, but Bouillon (1985b: 254, fig. 4) illustrated a four cornered mouth with slightly curved lips.

The three Northeast Pacific specimens were collected from the Strait of Georgia and Burke Channel (Arai & Brinckmann-Voss, 1983: 2179). The species has also been observed from a submarine in Jervis Inlet (Mackie, 1985: 761). The fourth collected specimen was from Hansa Bay, Bismarck Sea, Papua New Guinea (Bouillon, 1985b: 254; Bouillon et al., 1986: 136). The specimens are deposited in the Canadian Museum of Nature (Frank et al., 1985: 28), the Royal British Columbia Museum, and l'Institut Royal des Sciences Naturelles de Belgique (Bouillon et al., 1995: 14).

Genus *Geomackiea* Mills, 1985.

Pandeidae with four perradial tentacles having tapering conical bases and with four broad, interradial bulbs, each rimmed by a cluster of short tentaculæ.

Type species: *Geomackiea zephyrolata* Mills, 1985.

Geomackiea zephyrolata Mills, 1985.

Geomackiea zephyrolata Mills, 1985: 2172.

Specific characters.— With the characters of the genus.

Remarks.— Mills (1985: 2172) gave detailed descriptions of both adult and juvenile specimens. The species has to date only been recorded from the Northeast Pacific area, in the upper 130 m of Saanich Inlet and Friday Harbor.

Genus *Merga* Hartlaub, 1913

Pandeidae medusae with perradial sides of stomach connected to radial canals at least to one third of stomach length. With gonads not in folds; with four, eight, or more tentacles with or without rudimentary tentacles between them.

Type species: *Merga violacea* (Agassiz & Mayer, 1899).

Remarks.— *Merga treubeli* Schuchert, 1996 should perhaps be removed from the genus *Merga* and the family Pandeidae, because the structure of the proximal part of the tentacles and the absence of marginal bulbs seems more likely of calycopsid than a pandeid character (Schuchert, 1996: 74, fig. 44c).

Merga reesi Russell, 1956
(fig. 4)

Merga reesi Russell, 1956b: 493.

Material.— RBCM 998-236 (slightly damaged): 1 specimen collected 15.ii.1980, 50°30'N 128°36'W, depth 523 m; preliminary record Fulton et al. (1982: 23).

Specific characters.— Medusae with no apical projection, with gonads interradial in warts and grooves; with four tentacles with swollen proximal section.

Description of medusa.— Umbrella bell shaped, height up to 10 mm, width 8 mm. Stomach flask shaped with broad base. Mouth with slightly crenulated lips armed

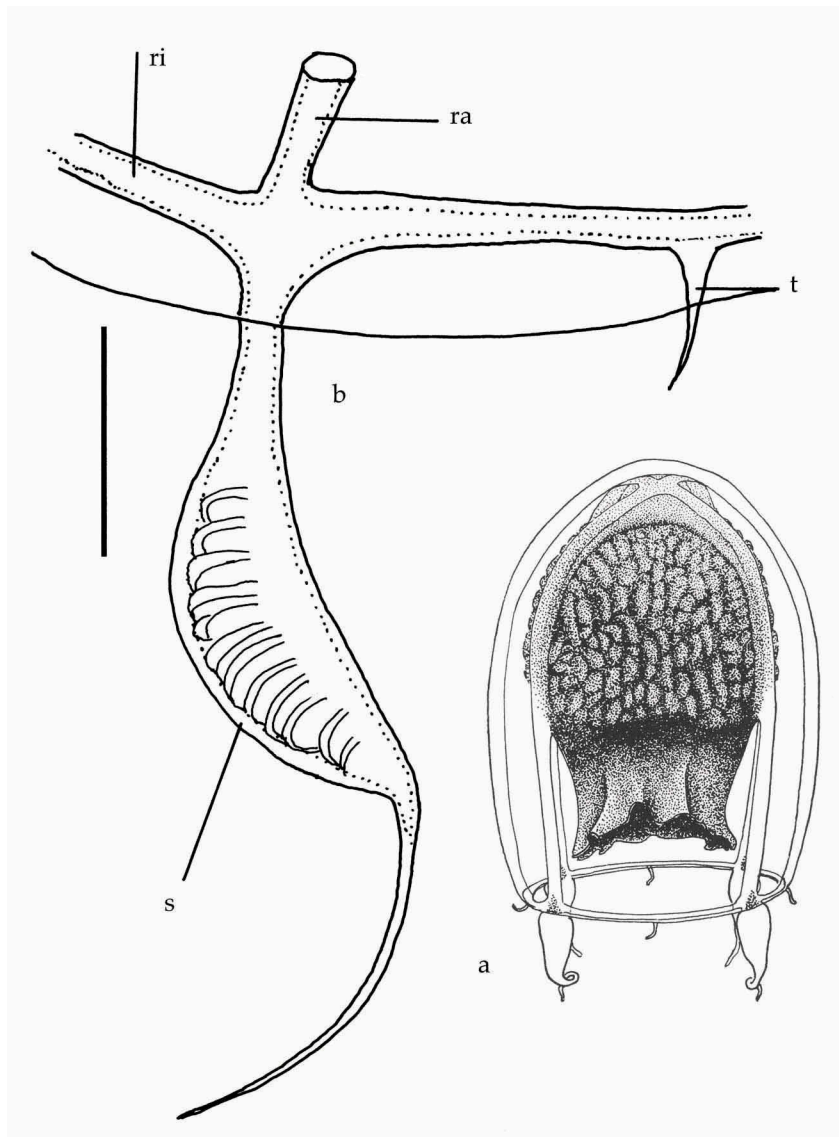


Fig. 4. *Merga reesi*, a. after Russell (1956), with permission of Cambridge University Press, b. detail of basal bulb and proximal part of tentacle (recent collection). ra: radial canal, ri: ring canal, t: tentacula, s: thickened proximal part of perradial tentacle, scale bar: 0.5 mm.

with a band of nematocysts. Gonads interradial with warts and grooves.. Radial canals attached to stomach over more than half its length, forming mesenteries. Radial canals smooth, about twice as wide as ring canal. Four tentacles with swollen basal part, with enlarged endoderm (fig. 4b), leaving actual marginal bulb rather small. One small tentacula in each interradius. No ocelli. Colour of stomach and gonads brown red, fading in alcohol preservation.

Hydroid not known.

Remarks.— In the above description “Warts and grooves” is more accurate than “irregularly folded to form numerous raised corrugations” as described by Russell (1956: 493) in his text. His figure (Russell 1956: 493, fig. 1) however, shows a gonad with warts and grooves, which concurs with our specimen. *Merga reesi* and *Amphine-ma krampi* Russell, 1956, have been placed in different genera because of their tentacle numbers. However, *Merga reesi*, *M. bulbosa* Bouillon, 1980 and *A. krampi* share the reduced marginal bulbs, and the thickened proximal part of tentacles (Russell, 1956a: 371; 1956b: 493; 1958: 81; Bouillon, 1980: 333). *Merga reesi* and *A. krampi* also have similar gonads. In future revisions of the family these latter two species should be placed in the same genus for structural reasons, rather than being separated due to numerical characters such as tentacle numbers.

The three collections, each of single specimens of this species, have been widely distributed: at the mouth of the English Channel, (Russell, 1956b: 493); in the Bay of Bengal, (Navas, 1971: 8; Navas-Pereira & Vannucci, 1991: 45); and the Northeast Pacific, present specimen.

Genus *Pandea* Lesson, 1843

Pandaeidae medusae with umbrella with or without conical apical projection; with mesenteries; with gonads forming an irregular network of ridges with pits in between.

Type species: *Pandea conica* (Quoy & Gaimard, 1827).

Pandea rubra Bigelow, 1913 (fig. 5)

Pandea rubra Bigelow, 1913: 14, pl. 2; Kramp, 1926: 96, pl. 2; Bigelow, 1938: 107; Kramp, 1957: 18; 1965: 41; Russell, 1970: 252; Arai & Brinckmann-Voss, 1980: 61; Bleeker & van der Spoel, 1988: 231, fig. 14.

Material: 1 specimen, 2.iii. 1986, 48°11'N 125°56'W; RBCM 998-237: 2 specimens, 12.ii.1988, 48°11'N 125°56'W, 500-700 m; RBCM 998-238: 1 specimen, 19.vi.1990, 47°57'N 129°05'W, 1-1750 m, coll. B.J. Burd, R.E. Thomson & G.S. Jamieson.

Specific characters.— Without exumbrellar nematocyst tracts, without apical process; radial canals jagged, manubrium deep brown (may fade in preserved specimens), densely folded, frilly lips.

Description.— Umbrella broad bell-shaped, up to 75 mm high and wide, with soft walls, no apical projection. Manubrium barrel shaped, wide, about half as long as bell cavity, attached to perradial canals for about 4/5 of its length, mouth with frilly, delicate and complexly folded lips; gonads close network on upper 2/3 of manubrium, leaving lowest part gonad free. Radial canals of present specimens distally broad with wavy or jagged outline; ring canal smooth, about half the width of radial canals. Up to 32 tentacles with large, not laterally depressed bulbs; with thin exumbrellar spur (fig. 5a, b).

Remarks.— Specimens from recent collections were between 5 and 30 mm high

and 5 to 28 mm wide, with up to 18 tentacles. Due to the extremely delicate exumbrella specimens are often torn (Bigelow, 1913: 15) so that precise measurements are impossible to achieve. As a result of the torn exumbrella the exumbrellar spur is difficult to see in many specimens and has been omitted in illustrations such as those of Arai & Brinckmann-Voss (1980: 61, fig. 34c). However, in our recent material we could confirm Kramp's illustration (1926: pl. 2, fig. 15) (fig. 5a & b).

These are the first records of *Pandea rubra* from Canadian waters since the original description of Bigelow (1913: 14), west of Cape St. James, Queen Charlotte Islands. It has, however, been collected at widely separated locations in the North Pacific and other oceans (see summaries by Arai & Brinckmann-Voss, 1980: 62, Alvarino, 1988: 107 and Navas-Pereira & Vanucci, 1990: 111).

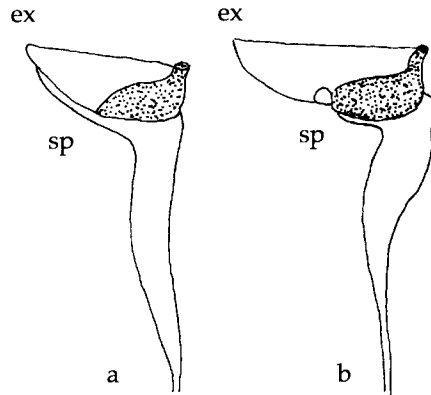


Fig. 5. *Pandea rubra* detail of marginal bulb with abaxial spur: a. from recent collections, b. after Kramp (1926: pl. 2, fig. 15). ex: exumbrella, sp: abaxial spur.

Family Trichydridae Hincks, 1868

Pandeoidea medusae without exumbrellar cnidocyst tracts or abaxial spurs; manubrium cruciform with four perradial simple to flared lips; gonads smooth, interradial; four smooth radial canals, with or without fine branch canals connecting to the ring canal; four or more round or elongate marginal bulbs; tentacles, where known, solid; without ocelli. Hydroid, where known, *Trichydra*.

Type genus: *Trichydra* Wright, 1858.

Remarks.— The family Trichydridae was introduced by Hincks (1868: 215) for the hydroid *Trichydra pudica* Wright, 1858. Edwards (1973a: 87) showed that the medusa was *Pochella polynema* Hartlaub, 1917, which had previously been placed in the Proboscidiactylidae. In addition Edwards transferred *Pochella oligonema* Kramp, 1955, also with a cruciform manubrium, to *Trichydra*. He placed the family in the Anthomedusae. Schuchert (1996: 87) re-examined the type specimens of Kramp (1955: 270, pl. 2) and placed *Trichydra oligonema* in the genus *Fabienna*, returning it provisionally to the Proboscidiactylidae based on tentacle structure. The family Trichydridae became a monotypic family of the Anthoathecatae.

Trichydra pudica has been described from this research area (Arai & Brinckmann-Voss, 1980: 75; Mills, 1981: 16). A single specimen of a similar species has recently been collected, and is described below.

Trichydridae incertae sedis gen., *incertae sedis* spec. (fig. 6)

Material.— RBCM 998-239: 1 specimen, 11.v.1986, 48°22'N 125°35'W, 0-148 m.

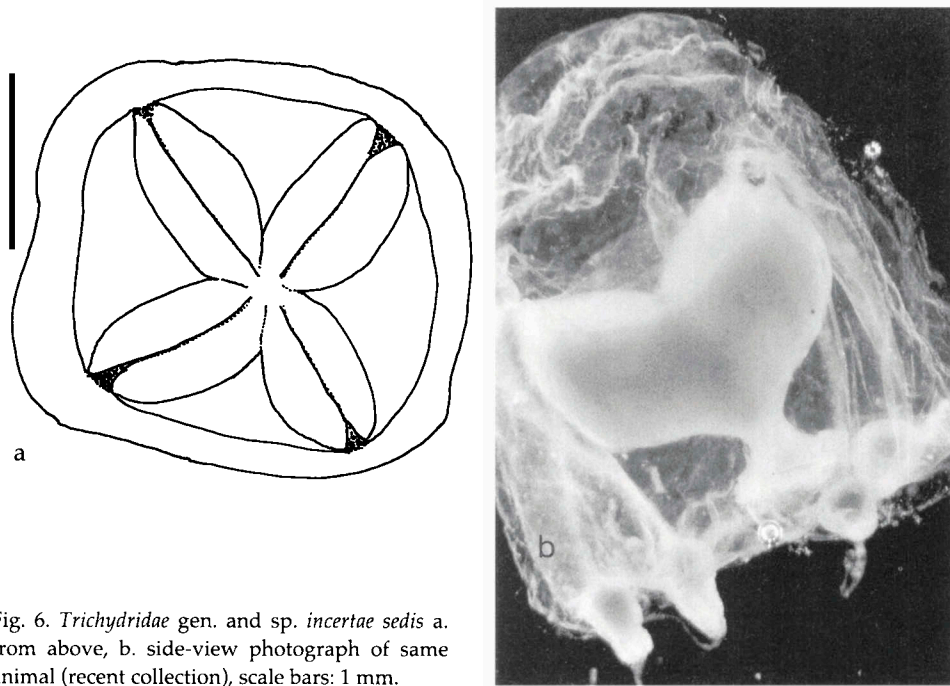


Fig. 6. *Trichydridae* gen. and sp. *incertae sedis* a. from above, b. side-view photograph of same animal (recent collection), scale bars: 1 mm.

Description of the medusa.— Umbrella 3.2 mm high and 3 mm wide; manubrium extended into four pouches, forming a wide peduncle (fig. 6); manubrium forming a neck-like constriction above the flaring four cornered lips (manubrium 1.6 mm at its widest upper part, 0.24 mm at its “neck”); gonads smooth, cushion-like, on interradial sides of stomach with a deep interradial cleft; radial canals smooth (width 0.08 mm) with no additional fine branches observed, ring canal hardly visible (0.04 mm); four pear-shaped marginal bulbs (length 0.52 mm, diameter 0.36 mm) thinner part of each tapering into the tentacles. Four perradial tentacles; no additional bulbs or tentaculae; tentacles filiform, no visible cnidocyst clusters (tentacles damaged). Nematocysts not checked because only a single specimen was available. Colour of gonads and endoderm of marginal bulbs bright orange; otherwise colourless.

Remarks.— We have placed this species provisionally in the family *Trichydridae*. It closely resembles adult *Trichydra pudica* because of the distinctive flaring of the lips beneath the manubrium, as well as the characters listed in the family diagnosis above. It differs in the presence of only four tentacles, and in the deep interradial clefts of the gonad.

Suborder Capitata Kühn, 1913
Superfamily Sphaerocorynoidea Prévot, 1959

Remarks.— This superfamily was introduced by Petersen (1990: 130). It unites the families *Sphaerocorynidae*, *Zancleopsidae*, and *Paragotoeidae*. Because Petersen (1990: 101) used a cladistic approach his arrangement of families deviates significantly from previous arrangements such as Petersen (1979: 105) and Bouillon (1985a: 29).

We agree with Petersen (1990: 118) that synapomorphic characters in the medusae link the Family Paragotoeidae with the Sphaerocorynidae.

Family Paragotoeidae Ralph, 1959

Anthomedusae with at least one stiff tentacle with solid endoderm and a terminal cnidocyst bulb. With broad manubrium with gonad encircling it in a wide girdle. With four-cornered, rather wide mouth, with slightly flaring lips. Without ocelli.

Type genus: *Paragotoea* Kramp, 1942.

Remarks.— The genus *Paragotoea* was originally included in the Family Tubulariidae by Kramp (1942: 29; 1959: 5). It was placed in its own family by Ralph (1959: 176) but most other authors have included it in the Corymorphidae (Brinckmann-Voss, 1970: 22; Bouillon, 1985a: 108; Boero & Bouillon, 1993: 261). It was returned to the Family Paragotoeidae by Petersen (1990: 133), which we consider justified. Recently Pagès and Bouillon (1997:487) moved the genus again to the Corymorphidae; however, we still maintain that the genus *Paragotoea* should remain in a separate family (see below).

Genus *Paragotoea* Kramp, 1942

With characters of the family.

Type species: *Paragotoea bathybia* Kramp, 1942.

Remarks.— The genus *Paragotoea* was established by Kramp (1942: 26) for *P. bathybia*. As discussed below some specimens which have been assigned to *P. bathybia* by subsequent authors should probably be referred to other species. In addition Margulis (1989: 127) added *P. elegans* to the genus. Except for some folds on the exumbrella of *P. elegans*, which may be the result of preservation, and a longer manubrium in some of Margulis' specimens, the species are strikingly similar.

Paragotoea bathybia Kramp, 1942 (fig. 7)

Paragotoea bathybia Kramp, 1942: 26, fig. 1-2; 1959: 5; (not *Paragotoea bathybia* Ralph, 1959: 171 (see discussion below); not *Paragotoea bathybia* Brinckmann-Voss, 1970: 21, fig. 20 and 21 = undescribed species; not *Paragotoea bathybia* Goy, 1972: 972, fig.3 = undescribed species); Pagès and Bouillon, 1997: 487, fig.2.

Material.— 1 specimen, 4.iv.1986, 48°19'N 126°27'W, 500-700 m; deposited in ZMC, no number.

Specific characters.— Exumbrella smooth; manubrium not longer than exumbrella; one tentacle with its terminal cnidocyst bulb not faceted.

Description.— Exumbrella approximately as high as wide; specimen 1.9 mm high, 2.1 mm wide in widest part of exumbrella, slightly less at margin. Mesoglea thin. One tentacle, 0.8 mm long, broad at base, thinning to about a third of its width distally. With large, almost spherical terminal bulb, diameter 0.3 mm. Four elongate, triangular cnidocyst pads of different size clasping the margin of the bell, the largest reaching approximately halfway up the exumbrella. Manubrium barrel-shaped with wide

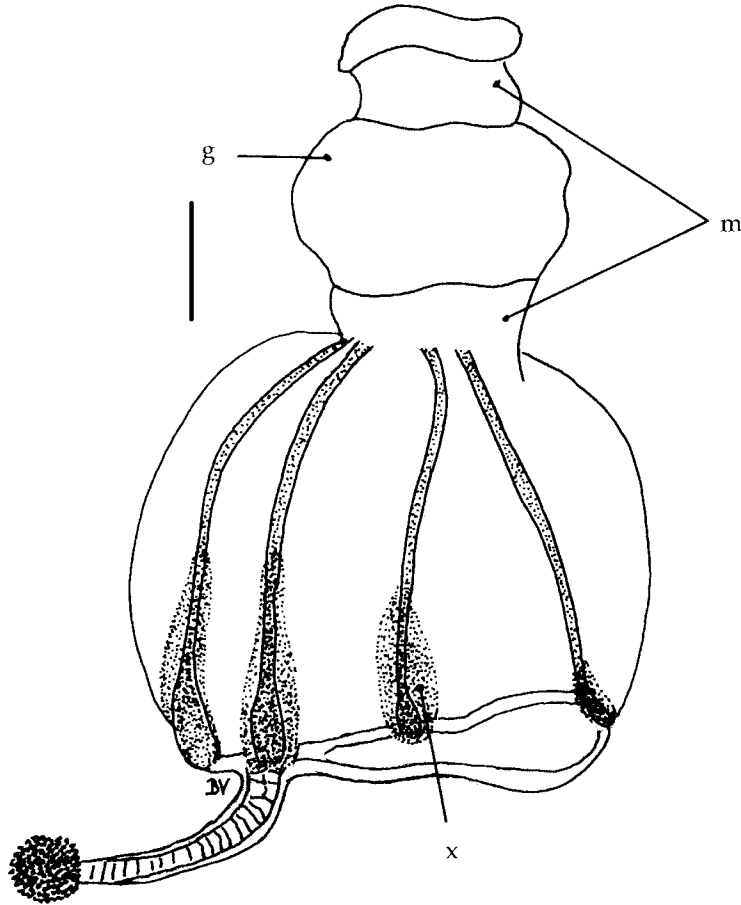


Fig. 7. *Paragotoea bathybia* (recent collection); specimen turned inside-out. g: gonad, m: manubrium, x: exumbrella pad, scale bar: 0.5 mm.

quadratic mouth and slightly flared lips. Gonads forming a girdle around the manubrium, with no interradial or perradial division or pouches. Radial canals 0.05 mm thick, ring canal slightly broader. No mesenteries. (fig. 7).

Remarks.— Kramp (1942: 26) described this species from a specimen from the NW Atlantic, off SW Greenland, and confirmed the morphological details with a specimen from off the Cape of Good Hope which was slightly bigger than the type (Kramp, 1959: 5). Our specimen agrees with the type, which was also examined. Because our specimen was inside-out it was possible to see the manubrium more clearly.

A number of other specimens have been assigned to this species. Ralph (1959: 171) examined three specimens from west of the English Channel. One of these specimens corresponded to Kramp's two specimens in bearing a single tentacle. The second (her fig. 1 B, C) possessed one complete tentacle and the stump of a second in the perradial position. She tried to link these with a four-tentacled "adult" specimen,

from which, however, the tentacles had been broken off, so that the typical terminal cnidocyst bulbs of *Paragotoea* could not be verified. Her figure d is a reconstruction of her "adult" specimen of figure a, with tentacles added in the reconstruction. Her argument was that the one-tentacled specimens of *P. bathybia* have rather thick mesoglea on the tentacle bases, a feature shared with the four tentacle stumps of the "adult" specimen. However, in other respects Ralph's four-tentacled "*Paragotoea*" differs from the *P. bathybia* described by Kramp. Neither Kramp's type specimen nor his second specimen from the South Atlantic (Kramp 1959: 5) has stomach pouches as shown in Ralph's specimens, instead gonads encircle the stomach in "simple annular gonads" (Kramp 1959: 90). Neither Kramp's two specimens nor our specimen have any sign of additional tentacles as do Ralph's specimens. We therefore consider Ralph's "*Paragotoea bathybia*" (Ralph, 1959: 171) to probably belong to another species or even genus. Unfortunately Ralph's material was not available to us.

"*Paragotoea bathybia*" has also been reported from the Mediterranean (Brinckmann-Voss, 1970: 21; Goy, 1971: 399; Goy, 1972: 972; Brinckmann-Voss, 1987: 133; Dallot et al. 1988: 197). Where clear descriptions are given, these specimens differ from the type of *Paragotoea bathybia*, as has already been mentioned by Brinckmann-Voss (1970: 21) and Margulis (1989: 129).

After the present paper was reviewed and in press we received a copy of "Pagès, F. and Bouillon J., 1997. A redescription of *Paragotoea bathybia* Kramp 1942 (Hydrodomeuse: Corymorphidae) with a new diagnosis for the genus *Paragotoea*. Sci. Mar. 61 (4): 487-493". Pagès and Bouillon (1997: 488) examined nine new specimens of the species from the Antarctic whereas we had examined one new specimen from the Pacific and the Kramp (1942: 26) holotype. Full discussion is not possible here. We would need to examine Pagès' and Bouillon's specimens in order to interpret the morphology of the manubrium; for instance the vacuolated cells at the base of the manubrium, which were not present in our specimen, nor have they been mentioned by Kramp (1942: 26; 1959: 5). We agree with Pagès and Bouillon (1997: 492) that the four-tentacled specimen reconstructed by Ralph (1959: 173) is not *Paragotoea bathybia*, however we also maintain that the Mediterranean form should not be included in that species (see above). We conclude that *Paragotoea bathybia* does not belong in the Corymorphidae, but in a separate family based on the characteristics of the restricted species.

Family *incertae sedis*

Genus *Paulinum* gen. nov.

Sphaerocorynoidea with cone-shaped exumbrella. Wide stomach, with a conical extension of the base into the mesoglea; manubrium not tubular at mouth end. Four thick radial canals and ring canal present; four marginal bulbs with adaxial thickenings, at least two of which bear stiff tentacles terminating in a round cnidocyst bulb.

Type species: *Paulinum punctatum* (Vanhöffen, 1911)

Remarks.— Several authors have considered *Dicodonium* Haeckel, 1879 a doubtful genus (Kramp, 1959: 83; Brinckmann-Voss, 1970: 47; Bouillon, 1985a: 89; Petersen, 1990: 210). It contains species with two well-developed tentacles. Two rudimentary

tentacles may be present or lacking. The species, where recognizable, may belong to different families or even suborders. The type species *Dicodonium cornutum* Haeckel, 1879, is poorly described. Nevertheless *D. punctatum* (fig. 8) clearly differs from the type in possessing a very short manubrium, four tentacle bulbs, and tentacles each terminating in a round cnidocyst bulb. It is therefore separated as the type of a new genus.

In addition to *Paulinum punctatum* the new genus includes *P. lineatum* spec. nov. The latter species is very similar to *P. punctatum*, differing in the arrangement of the mesogloal inclusions, and probably in the presence of four tentacles (see below) whereas *P. punctatum* has two fully developed tentacles and two rudiments.

The broad manubrium and two to four stiff tentacles may justify the referral of this genus to the Sphaerocorynoidea. If more specimens of either of the two species of *Paulinum* become available, and more morphological details, as for instance the presence or absence of stenoteles (see below) are then verified, the genus may have to be moved accordingly to another superfamily or even suborder. The adaxial thickenings on the marginal bulbs shows a relationship to the Sphaerocorynidae, however it is not clear if the cone-shaped extension of the stomach base into the mesoglea is homologous with the "apical chamber" of the Sphaerocorynidae.

Eymology.— The genus was named in honour of Dr Paul Cornelius, The Natural History Museum, London, who has written a number of detailed and extensive papers on the systematics and nomenclature of hydrozoans and thus clarified the taxonomy of numerous families, genera and species in this class.

Paulinum lineatum spec. nov.
(figs 9 & 10)

Material.— holotype, RBCM 998-151-001: 1 specimen, 16.ii.1980, 52°30'N 131°53'W, off west coast Moresby Island, B.C., 0-550 m; coll. T.C.Mullin.

Specific Characters.— Lines of inclusions (zooxanthellae?) in the mesoglea, mainly along radial canals.

Description.— Medusa deep bell shaped, 2.25 mm high and 1.6 mm wide (preserved in 4% formaldehyde solution). Stomach about one third of subumbrella with a large base, mouth rather wide with slightly wavy lips. Stomach extending into conical apical projection. Gonads can be seen as thickenings on stomach, but as the mesoglea is opaque further details could not be determined. Mesoglea thin, not more than one tenth of the diameter of the medusa peripherally, about triple that thickness apically. Within exumbrella eight irregular adradial lines of rounded yellow groups of cells, each group with a darker

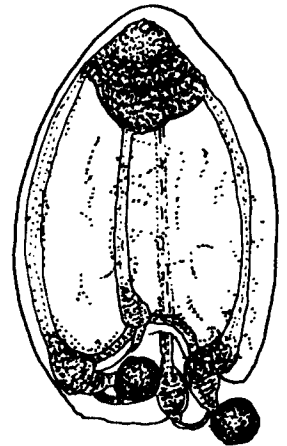


Fig. 8. *Paulinum punctatum* after Vanhöffen (1911: 6), slightly modified. Scale bar approximately 0.5 mm (Vanhöffen gave only approximate measurements).

unstructured center (fig. 10a). Four simple rather broad radial canals, ring canal about half the width of radial canals. Four very thick, slightly triangular marginal bulbs, each with an adaxial thickening. Ocelli absent. Two adjacent marginal bulbs bear rather stiff tentacles with a large terminal nematocyst cluster. The endoderm of the tentacles seemed hollow in their proximal, solid in their distal, parts, though it was difficult to see in the single specimen. The remaining two bulbs carry only stumps, probably broken off tentacles so that there were possibly four tentacles. Cnidae of the margin and marginal bulbs are microbasic euryteles; those of the terminal cluster of tentacular cnidocysts are atrichous (fig. 10b). Because we could not use the single whole animal for cnidae identification, the possibility of other cnidocyst types such as stenoteles remains open.

Remarks.— Although we had only one specimen, its good state of preservation allowed us to assess its morphological characters, so that a description of a new species is justified. *Paulinum lineatum* bears a striking resemblance to *P. punctatum* (Vanhöffen) (fig. 8), except that *P. punctatum* has its mesogleal inclusions more scattered than in *P. lineatum*, and probably in that *P. lineatum* has four tentacles.

Superfamily Corymorpoidea Allman, 1872

Family Corymorphidae Allman, 1872

Medusae with simple, circular mouth, one to four hollow tentacles mostly moniliform, or seldom with nematocyst clusters spaced out along the tentacles, without ocelli. Gonads encircling manubrium undivided. Hydroids, where known, with one or more aboral whorls of moniliform or filiform tentacles, and one or more oral whorls of moniliform, capitate, or filiform tentacles.

Type genus: *Euphysa* Forbes, 1848

Genus *Euphysa* Forbes, 1848

Medusae without apical canal, with evenly rounded exumbrella; with one to four

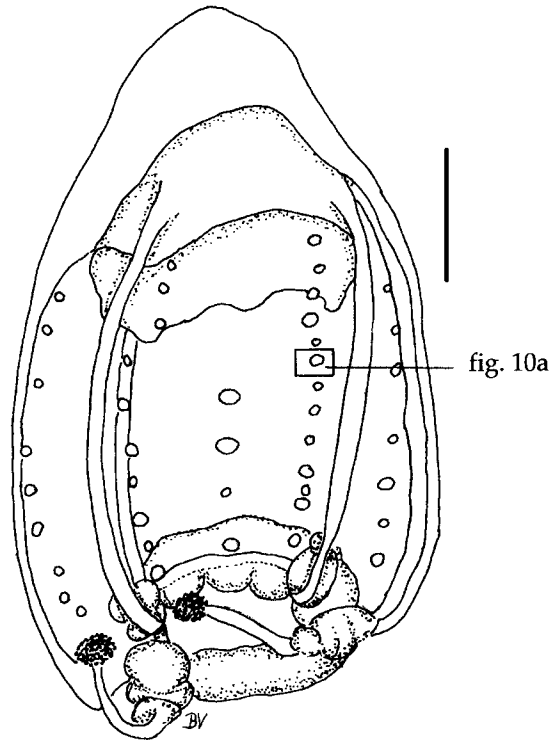


Fig. 9. *Paulinum lineatum* spec. nov. (recent collection), margin of specimen folded inwards. Scale bar: 0.5 mm.

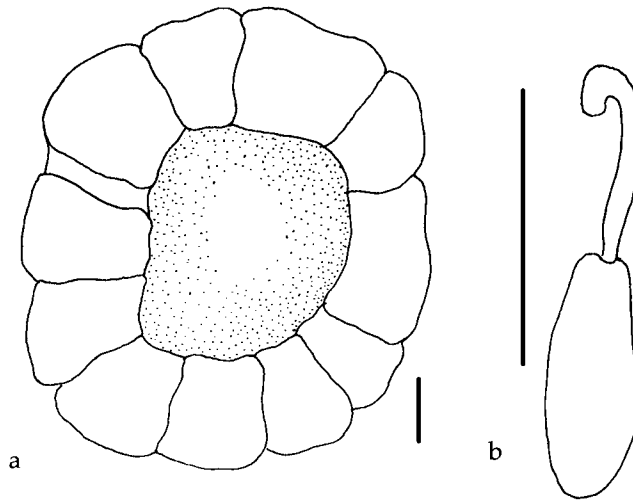


Fig. 10. *Paulinum lineatum* spec. nov., a. detail of inclusions in mesoglea, see square in fig. 9 for location, b. nematocyst from terminal cnidocyst bulb on tentacles. Scale bars each 10 μ m.

tentacles unevenly developed but all of same structure. Hydroids, where known, solitary with anchoring filaments, with short oral capitate or moniliform tentacles, and one or more whorls of long aboral moniliform tentacles.

Type species: *Euphysa aurata* Forbes, 1848.

Remarks.— The medusae *Euphysa japonica* (Maas, 1909) and *E. tentaculata* Linko, 1905, and the hydroid *E. ruthae* Norenburg & Morse, 1983, have been reported from the research area (Arai & Brinckmann-Voss, 1980: 6; Mills, 1981: 13; Norenburg & Morse, 1983: 1). Arai & Mason (1982: 8, fig. 2) collected apart from typical *E. japonica*, specimens from the Strait of Georgia with diverticulae on the radial canals which they suggested to belong to another species. However, subsequent examination of over 200 specimens from waters off British Columbia show a considerable variation in the radial canals from smooth through rather jagged to such specimens with diverticulae. In other respects these specimens cannot be distinguished from *E. japonica*. In addition, specimens of a *Euphysa* which do not possess the morphological characters of the already described species of the genus, have been found in the research area since 1980, and we consider them to belong to a new species described below.

Euphysa vervoorti spec. nov.
(fig. 11)

Material.— paratype ROMIZ B-3012: 1 specimen, 29.vi.1982, 48°42'N 125°03'W, 0-140 m, coll. M.N. Arai; 1 specimen, 3.iv.1986, 48°36'N 125°8'W, 0-105 m; 1 specimen, 29.iii.1987, off Secretary Island, B.C., Juan de Fuca Strait, 1m; holotype RBCM 998-152-001: 1 specimen 30.vi.1994, off Secretary Island, B.C., Juan de Fuca Strait, 1 m, coll. A Brinckmann-Voss.

Specific Characters.— High, dome shaped exumbrella, delicate, often damaged in plankton collections. Moniliform tentacles. Marginal bulbs of differing sizes with

thick endodermal swelling, and with large, often protruding abaxial nematocyst pads.

Description of medusa.— Umbrella up to 6 mm high and 5 mm wide. Manubrium slightly shorter than bell cavity, completely surrounded by gonad leaving only short part in mouth region free. Lips simple, round. Adult specimens with ripe gonads (eggs visible) in specimens 4 mm high or larger. No peduncle. One very large marginal bulb, with a large endodermal chamber and abaxially protruding nematocyst pad. Three smaller marginal bulbs of gradually diminishing size. Moniliform tentacles rather thick proximally, thinning distally. Tentacles of differing sizes even in fully mature specimens, however the one originating from the largest marginal bulb always being the longest. Colour of manubrium and endoderm of marginal bulbs deep orange-red. Umbrella colourless.

Remarks.— There are currently seven other species of the genus *Euphysa* of which the medusa stage has been adequately described: *Euphysa aurata* Forbes, 1848, *E. brevia* (Uchida, 1947), *E. flammea* (Linko, 1905), *E. japonica* (Maas, 1909), *E. problematica* Schuchert, 1996, *E. tentaculata* Linko, 1905, and *E. tetrabrachia* Bigelow, 1904. *Euphysa monotentaculata* Zamponi, 1983, is too poorly described to be identified. *Euphysa brevia*, *E. problematica*, and *E. tetrabrachia* differ from the other species because the tentacle structure is not moniliform. In fact they may be better removed from the genus based on the tentacle structure and some other morphological characters. The remaining species all have moniliform tentacles as *E. vervoorti* does, however they lack the thick endodermal swellings in the marginal bulbs and the extensive nematocyst pads of that species. Of the moniliform species only *E. tentaculata* shares with *E. vervoorti* the character of having tentacles of different length when adult. However, *E. tentaculata* is distinguished from the latter species by the presence of a small peduncle, much thinner radial canals, small round endodermal

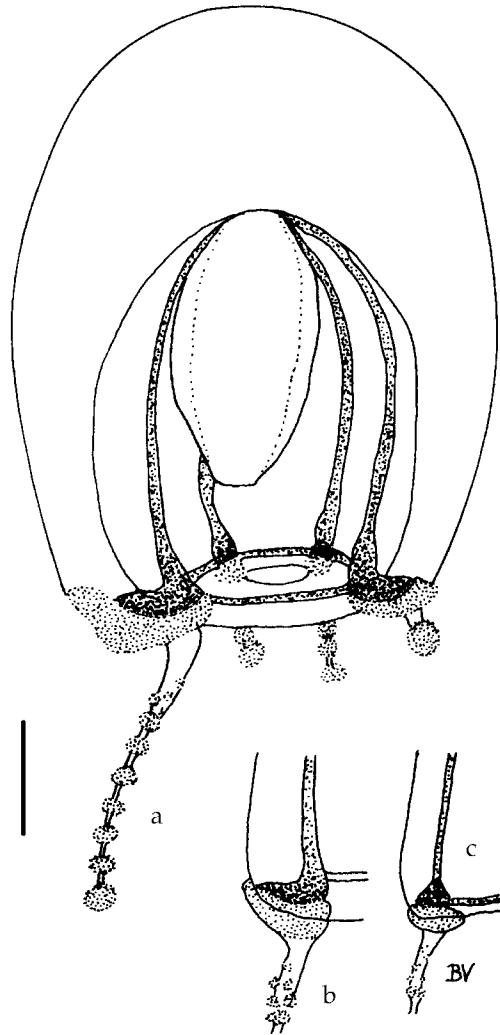


Fig. 11. a. *Euphysa vervoorti* spec. nov., a. type specimen (recent collection), b. marginal bulb *Euphysa japonica*, c. marginal bulb *Euphysa tentaculata* (a, b and c in specimens of the same size). Scale bar: 1.1 mm.

swellings in the marginal bulbs, and thinner proximal parts of the tentacles (compare fig. 11a with 11c).

E. japonica and *E. flammea* are not distinguishable in adult stages (see discussion Arai & Brinckmann-Voss, 1980: 7). *Euphysa japonica* medusae are released regularly from its hydroid with four equal tentacles (Brinckmann-Voss, unpublished data). This species is definitely present in the research area. Mills (1981: 13) also collected very young medusae with only one tentacle at Friday Harbour and identified them tentatively as *E. flammea*. However, until the life cycles of *E. verwoorti* spec. nov. and *E. tentaculata* are established, it is more probable that the single-tentacled juveniles belong to one of these known local species than to *E. flammea*.

Etymology.— This species was named in honour of Prof. Wim Vervoort, Nationaal Natuurhistorisch Museum, Leiden, to whom this volume is dedicated. We wish to honour him for his extensive and erudite publications on the taxonomy of Hydrozoa, including his bibliography of Leptolida, and thank him for his assistance and encouragement of many other scholars in the field.

Superfamily Corynoidea Johnston, 1836

Family Corynidae Johnston, 1836.

Medusae, when present, with higher than wide umbrella; with simple, circular mouth; with gonads ring like; four radial canals and four equally developed tentacles; with abaxial ocellus. Hydroid colonies erect with stems branched or unbranched, with a more or less firm perisarc; with whorl of capitate tentacles around mouth, with additional capitate tentacles below; with or without tentacle like additional structures (Tardent & Stössel, 1971: 682).

Type genus: *Coryne* Gaertner, 1774.

Remarks.— There have recently been a number of papers on this family, and controversy on the importance of generic characters, the extent of the family, and on the grouping of the medusae and hydroids into genera (see Calder, 1988: 63; Brinckmann-Voss 1989: 688; Petersen, 1990: 205; Bouillon, 1995b: 305; Schuchert, 1996: 119).

Research on the genus *Sarsia* of this region is ongoing (Miller, 1982: 153; Brinckmann-Voss, 1985: 673) and will be further reported elsewhere. One new species has been reported since 1980; *Sarsia cliffordi* Brinckmann-Voss, 1989 (Brinckmann-Voss, 1989: 685).

Order Leptothecatae Cornelius, 1992

Superfamily Laodiceoidea L. Agassiz, 1862

Remarks.— The distinguishing feature of the medusae in the superfamily is the presence of marginal cordyli (Bouillon, 1985a: 143), although these structures may not be homologous in the different families. A clear definition of the more diverse hydroid stages is difficult.

Family Tiarannidae Russell, 1940

Laodiceoidea with hemispherical to slightly flatter bell; with large stomach

attached to subumbrella along perradial furrows. With four simple radial canals, without centripetal canals; with simple folded gonads situated either adradially on upper part of stomach or along radial canals on extended stomach pouches; without ocelli; with hollow marginal tentacles with more or less conical bulbs; with spindle-shaped cordyli with terminal nematocysts. Hydroid, where known, *Stegopoma*.

Type genus: *Tiaranna* Hartlaub, 1914.

Remarks.— The family Tiarannidae was introduced by Russell (1940: 518) for medusae of the genera *Tiaranna* (now *Modeeria*) and *Chromatonema*. The hydroid genera *Stegopoma* and *Stegolaria* have also been included (see discussion by Bouillon 1985a: 145). Most recently the medusan genus *Margalefia* Pagès, Bouillon & Gili, 1991 has provisionally been added (Pagès et al., 1991: 92).

Genus *Modeeria* Forbes, 1848

Medusa.— Tiarannidae with gonads regularly and laterally folded on upper part of stomach, adradial with interradial connections in young specimens, adradial in adult medusae with short extension onto radial canals in largest specimens.

Type species: *Modeeria formosa* Forbes, 1848.

Modeeria rotunda (Quoy & Gaimard, 1827) (fig. 12)

Dianaea rotunda Quoy & Gaimard, 1827: 181, pl. 6A, figs. 1-2.

Modeeria formosa Forbes, 1848: 70, pl. 7, fig. 1.

Campanularia fastigiata Alder, 1860: 73-74, pl. 5, fig. 1.

Tiara (*Tiaranna*) *rotunda* Haeckel, 1879: 57, pl. 3, figs. 9-10.

Stegopoma fastigiatum Levinsen, 1893: 180, pl. 6, fig. 8.

Tiaranna rotunda Hartlaub, 1914: 266-8, figs. 218-219.

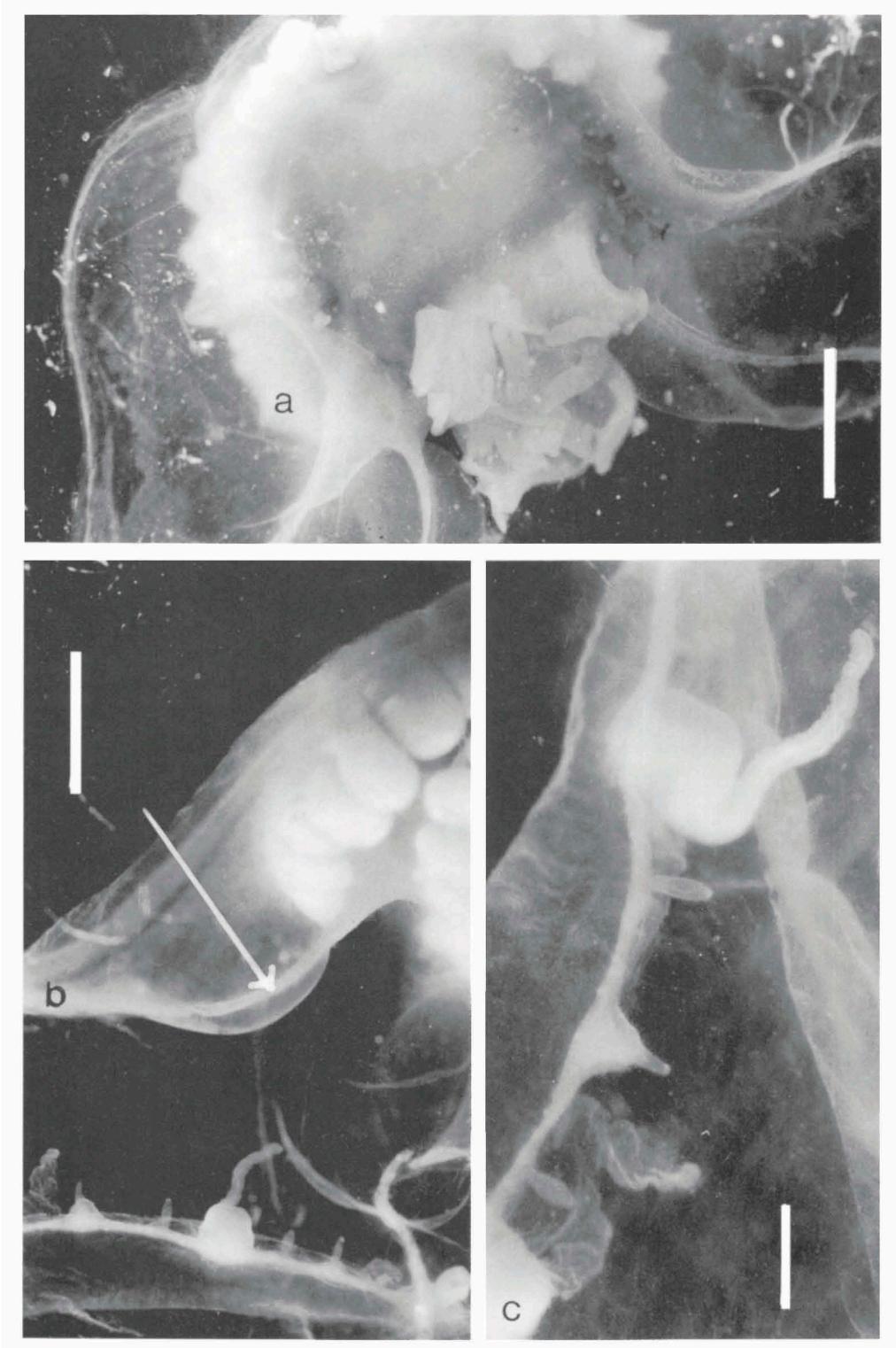
Modeeria rotunda Edwards, 1963: 464, fig. 1; 1973: 573, figs. 1-3.

For the extensive synonymy of this species see Edwards (1973b: 588), Ramil & Vervoort (1992: 29), Cornelius (1995: 109), and Hirohito (1995: 88).

Material of medusae.— BCPM (= RBCM) 976-1126-2: 1 specimen, 24.iii.1976, 52°N 128°W, Mathieson Channel, off Hecate Strait, 0-319 m, coll. A. Peden; RBCM 998-240: 1 specimen, 27.ii.1982, 48°43'N 126°40'W, 0-1180 m; 5 specimens, 24.i.1987-21.iii.1987, 47°56'-48°26'N 126°14'-126°40'W, 500 m.

Specific characters.— With the characters of the genus.

Description.— Umbrella hemispherical, slightly wider than high in most specimens, in present material 10-20 mm wide and 5-17 mm high; jelly very thick, often more than one third of height of bell apically, thinning out peripherally. Stomach shaped like a four sided pyramid in its upper part; with gonads as folds on the edges of the pyramidal part of the stomach. Lower part of the stomach extending about one third into subumbrellar space (fig. 12a) with four cornered mouth with slightly crenulate margins; radial canals smooth, entering middle of manubrium while bending inwards and raised to form deep pockets in subumbrella (fig. 12b). Margin with rather broad conical bulbs with up to 6 marginal tentacles per quadrant in specimens



from recent collections. One (in most specimens) to 3 spindle shaped cordyli between each two tentacles (fig. 12c). Manubrium bright red, fading in preserved specimens; mesoglea transparent except more whitish and thick in area of subumbrellar pockets.

Remarks.— All our specimens are medusae. For descriptions of the hydroid see Ramil & Vervoort (1992: 30), Cornelius (1995: 110), and Hirohito (1995: 88).

This is the first record of this species from the northeast Pacific Ocean. However, it is widely recorded from the world's oceans. The hydroid has been recorded in the northwest Pacific Ocean from Japan (Hirohito, 1995: 88) and Korea (Park, 1988: 62). As noted by Edwards (1973b: 582) *Tiaranna sagamina* Uchida, 1948, was described from a damaged immature medusa from Sagami Bay, Japan (Uchida, 1948: 334); however, since there are no cordyli mentioned and gonads are not developed, the identity of this species is doubtful. (Although often quoted as 1947, Uchida's paper was actually published in July 1948, with an attached strip of paper recording the correct date).

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Fig. 12. *Modeeria rotunda* (recent collections) a. manubrium, scale bar: 1.4 mm, b. connection of radial canal to manubrium forming subumbrellar pocket, arrow shows bend of radial canal towards manubrium, scale bar: 1 mm, c. margin to show cordyli and tentacles, scale bar: 0.5 mm.

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