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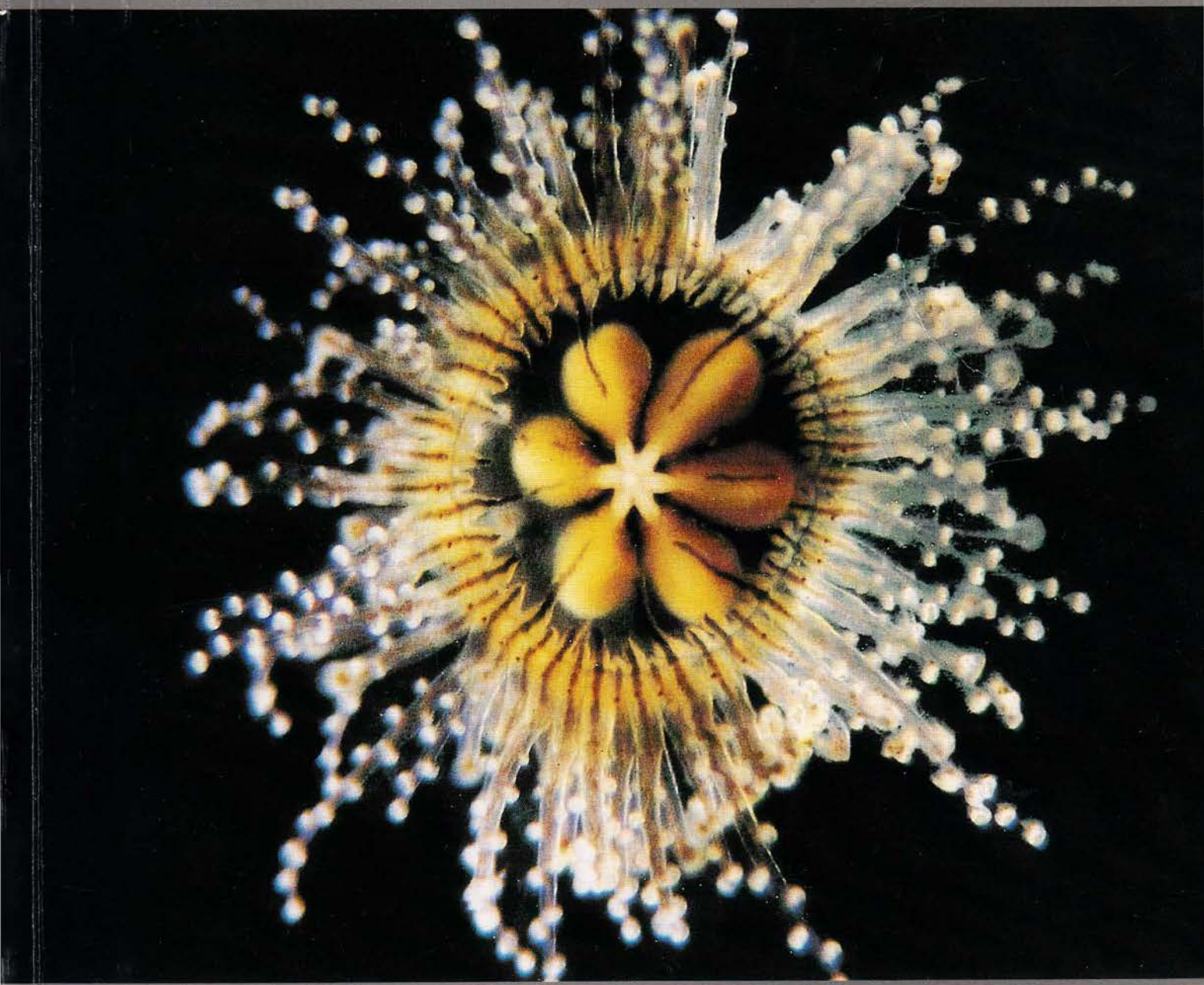

The Marine Fauna of New Zealand:

Athecate Hydroids and their Medusae (Cnidaria : Hydrozoa)

Peter Schuchert

New Zealand Oceanographic Institute Memoir 106

COVER PHOTO: *Staurocladia wellingtoni,* a new crawling medusa from Wellington's south coast, diameter approximately 5 mm.

NATIONAL INSTITUTE OF
WATER AND ATMOSPHERIC RESEARCH LTD

The Marine Fauna of New Zealand: Athecate Hydroids and their Medusae (Cnidaria : Hydrozoa)

by

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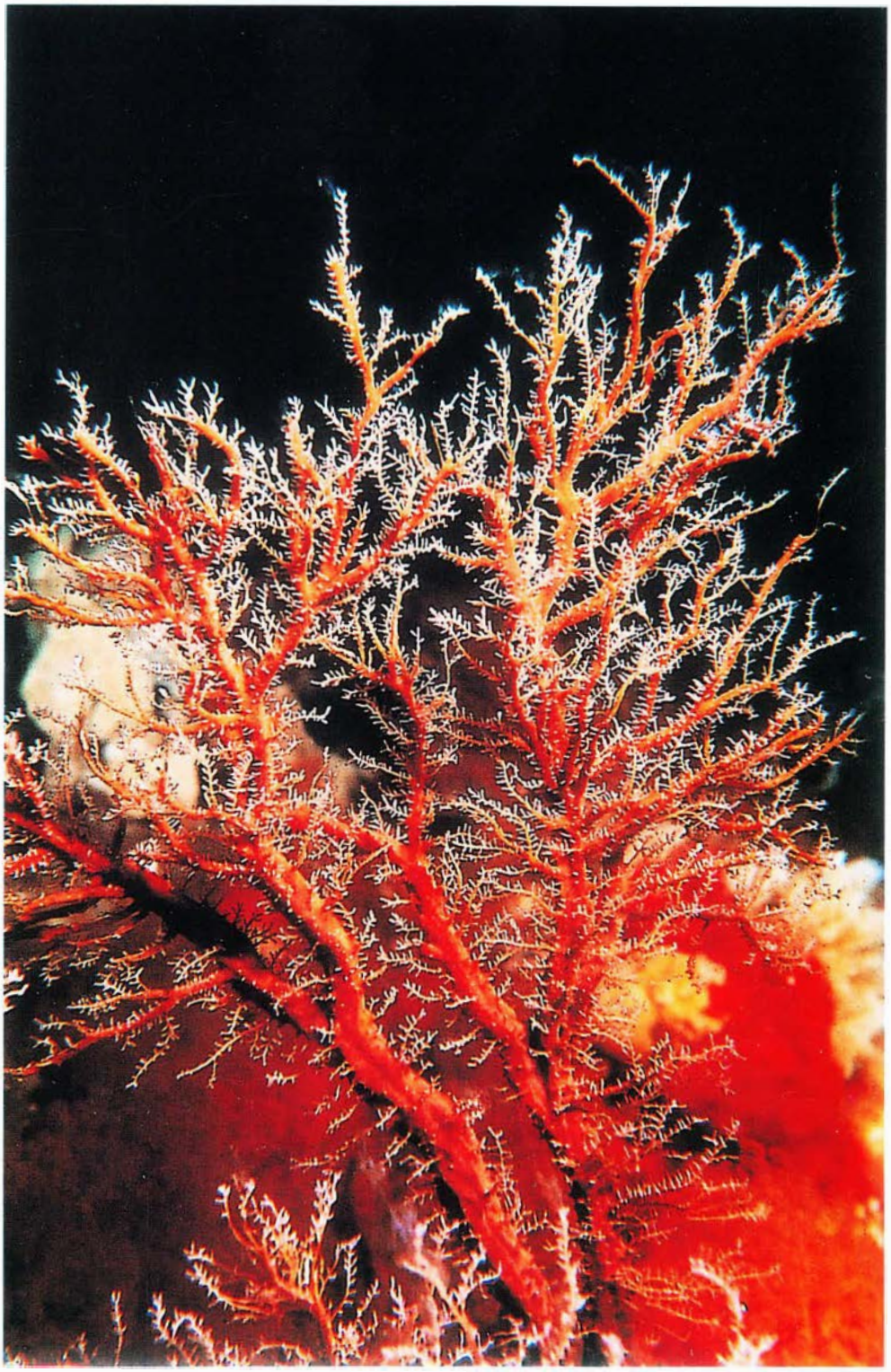

Frontispiece:
Solanderia ericopsis (Carter), height approximately 55 cm, from 5 m, Riko Riko Cave, Poor Knights Islands.
Photographed by Dr C.N. Battershill.

The Marine Fauna of New Zealand: Athecate Hydroids and their Medusae (Cnidaria : Hydrozoa)

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ABSTRACT

The 79 species of athecate hydroids and Anthomedusae known from New Zealand are surveyed. Their systematic revision is based on preserved museum material, newly collected living material, and life-cycle observations. Three new genera, seventeen new species, and fourteen new records are described. Full definitions are given for all taxa and almost all species are illustrated. One new family, Eucodoniidae, is defined and incorporated into the order Filifera. The new family includes only *Eucodonium brownei* Hartlaub, 1907. The three new genera are *Fiordlandia* (Hydractiniidae), *Barnettia* (Pandeidae), and *Fabienna* (Proboscidactylidae). The genus definition of *Zanclea* is widened to include *Zanclella* and *Halocoryne*. The new species are: *Barnettia caprai*, *Bougainvillia dimorpha*, *Corymorpha intermedia*, *Coryne tricycla*, *Ectopleura multicirrata*, *Eudendrium maorianus*, *Euphysa problematica*, *Fabienna sphaerica*, *Fiordlandia protecta*, *Hydractinia novaezelandiae*, *H. rubricata*, *Merga treubeli*, *Podocoryna australis*, *Rhizogeton conicum*, *Staurocladia wellingtoni*, *Stylactaria otagoensis*, and *Zanclea polymorpha*. Two possible new species of the family Corynidae are not named specifically due to insufficient life-cycle information. The life cycles of *Bougainvilla vervoorti* Bouillon, 1995, *Bougainvillia dimorpha* n. sp., *Podocoryna australis* n. sp. and *Zanclea polymorpha* n. sp. are described. *Ascidioclava parasitica* Kirk, 1915 is referred to *Bythotiara parasitica* n. comb. and its life cycle partially revealed. *Cladonema novaezelandiae* Ralph, 1953 is referred to *Cladonema radiatum* Dujardin, 1843. *Tubiclava rubra* Farquhar, 1895, *Corydendrium rubra* Stechow, 1924, and *C. zelandicum* Stechow, 1924 are recognised as new synonyms of *Turritopsis nutricula* McCrady, 1857. *Coryne tenella* Farquhar, 1895 is redescribed from its type locality and synonymised with *Sarsia eximia*. Based on the examination of new living material of *Solanderia ericopsis* (Carter, 1873), the genus *Chitina* Carter, 1873 is again sunk into synonymy with *Solanderia* Duchassaing & Michelin, 1846. *Pochella oligonema* Kramp, 1955 is referred to *Fabienna oligonema* n. comb. Life-cycle observations were made on other species to confirm their identity. New records are: *Calycopsis bigelowi* Vanhoeffen, 1911, *Dicoryne conybearei* (Allman, 1864), *Amphinema dinema* (Péron & Lesueur, 1809), *Halitholus pauper* Hartlaub, 1914, *Cladocoryne floccosa* Rotch, 1871, *Ectopleura crocea* (L. Agassiz, 1862), *Coryne pusilla* Gaertner, 1774, and *Sarsia japonica* (Nagao, 1962). Several other possible new records were not assigned to a species due to insufficient life-cycle information.

Keywords: Anthomedusae, Athecata, systematics, life cycle, review, revision, new species, New Zealand, marine fauna

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INTRODUCTION

General Remarks

The detailed studies of Ralph (1957–1961) made the thecate hydroids of New Zealand comparatively well known. In contrast, the hydromedusae and the athecate hydroids are much less known. Kramp (1965, 1968) and more recently Barnett (1985) and Bouillon (1995) have made major contributions to our knowledge of the hydromedusae of New Zealand, whereas investigations on most groups of athecate hydroids are still fragmentary. Short reviews were provided by Farquhar (1896), Bale (1924), and Ralph (1953). Ralph's review also dealt with the history of earlier investigations on New Zealand Athecata and their medusae. Since Ralph's (1953) study only few published contributions have been made. Hand (1961) described *Podocoryna bella*, more information was published on the peculiar hydroid *Pelagohydra mirabilis* (Pilgrim 1967a, 1967b; Rees & Ralph 1970), Watson (1987) reviewed the Eudendriidae, Bouillon and Cornelius (1988) redescribed the endemic *Chitina ericopsis*, and recently Cairns (1991) revised the Stylasteridae and described many new species.

A complete review and revision of the athecate hydroids and their medusae was therefore much needed and the present work aims to provide this at least in part. It was intended from the very beginning that this study should be written not only for the use of specialists, but also offer other biologists, e.g., ecologists, specialists of other groups, and health officers, a tool for identifying the known New Zealand species. Therefore, almost all the species are figured and described, whenever possible from living samples. Where known, information on the life cycle is given and occasionally figures from the literature have been reproduced, especially where these publications are difficult to obtain for the average institution. This was done to allow identifications of life-history stages so far not known from New Zealand. An identification key for all the species is not provided. The reasons for this are: many life-history stages are still unknown, for many species complete life-cycle information is necessary, and more species than recorded here can certainly be found in New Zealand. A general key would therefore in many cases be not applicable or lead to an incorrect identification. As almost all species are figured here, the beginner will be able to go quickly through all illustrations and find a suitable taxon for an animal to be identified. Diagnostic characters of the New Zealand taxa are provided below the family level. They are intended to highlight important diagnostic characters.

The taxonomic range treated in this work does not include one complete monophyletic group. This is due to the exclusion of the Stylasteridae, which have been revised recently (Cairns 1991), and the restriction to marine or brackish-water animals. The Proboscidactylidae, which some authors include in the Limnomedusae, are here included in the Anthoathecata (Anthomedusae and Athecatae). Other marine Limnomedusae are not known from New Zealand (for the freshwater genus *Craspedacusta*, see Fish 1971). With the exception of the above-mentioned Proboscidactylidae, the overall taxonomic system adopted in the present work mostly follows the system of Bouillon (1985a) for the Filifera and Petersen (1990) for the Capitata.

During the last decades, many efforts have been made by hydroid taxonomists to overcome the separate systematic treatment of the polyp and medusa stages and to present a unified system (e.g., Naumov 1969; Brinckmann-Voss 1970; Bouillon 1985a; Petersen 1990). Although many systematists, mostly for practical reasons, still continue to work with one stage only, such a separation of two life stages is very unbiological. Additionally, especially in the Anthoathecata, only information on the complete life cycle is often sufficient to identify species (cf. *Sarsia* and *Dipurena* species). In accordance with other authors (e.g., Edwards 1973b; Boero *et al.* 1992), the polyp is seen here as a second larval stage (for an opposing view see Cornelius 1990). There is nothing particular in its ability to propagate vegetatively as this is also well known in other invertebrates, e.g., parasitic Platyhelminthes. Therefore, the life cycle of the hydromedusae is not exactly a metagenetic cycle with alternating vegetative and sexual propagation of an adult (cf. discussion in Cornelius 1990). In this work, both medusa and polyp stage, and also young medusa stages, are presented together to underline their biological unity, and many efforts were made to elucidate life cycles.

The work of Petersen (1990) has clearly shown that many hydrozoan taxa are para- or even polyphyletic. This is certainly not only true for the Capitata examined by him. A completely new system, based on phylogeny, is very much needed and the revisions made by Petersen (1990) are a desirable step towards

that goal, but not all of his proposals can be followed. One problem in hydrozoan systematics is the relative simplicity of the animals combined with their phenotypic variability. A cladistic analysis will always rely on few and simple characters and therefore present very tentative phylogenies. An analysis of phylogenetic relationships using sequence comparisons might help to resolve many ambiguities.

Many hydrozoans, and especially most athecate hydroids, are rather inconspicuous animals. It is therefore not surprising that their ecology is rather poorly known (cf. Boero 1984; Gili & Hughes 1995). Their ecological and economic importance might nevertheless be quite considerable, especially for the medusa phase. Some hydromedusae can occur in high densities and may consume significant amounts of fish larvae or compete for the same food resource (e.g., van der Veer 1985; Purcell 1986; Matsakis & Conover 1991). It may also be that owing to their intense feeding on primary consumers like copepods, occasional algal blooms may be promoted by them.

From the viewpoint of evolutionary ecology, hydrozoans also offer other interesting, unsolved questions. Despite many attempts (cf. Boero *et al.* 1992; Schuchert 1993), it is still not known why some species within the same genus have lost their medusa and others still spend most of their life cycle in this phase. Most probably there will be no single answer for all species, but the results might offer instructive views on life-history evolution in marine invertebrates. The present work hopes to promote such studies by providing the necessary systematic framework without which serious ecological studies are not possible (cf. Boero 1984). No systematic work can ever be complete and in this monograph many gaps of knowledge remain. Wherever possible, the author tried to point out these gaps and it is hoped this will motivate others to fill them.

Area of Study

This study reviews all records of marine Anthomedusae and athecate hydroids from New Zealand, including the Kermadec Islands and the subantarctic islands under New Zealand jurisdiction (Fig. 1). This geo-graphic range includes subtropical to subantarctic waters. Around the main islands sea temperatures show a marked gradient and in summer reach around 21°C in the far north and 9°C in the far south. Despite this difference the main islands are rather homogeneous from a biogeographic viewpoint (Morton & Miller 1968). The Kermadec Islands in contrast are more tropical and the small islands south of Stewart Island belong fully to the subantarctic zone. More information and references on the marine biogeography of New Zealand can be found in, for example, Ekman (1953), Morton and Miller (1968), Cairns (1991), Adams (1994).

Terminology

The general morphology of an anthomedusan, an athecate hydroid, general terminology, and nematocyst types are explained in Figure 2. Following the functional arguments of Bouillon *et al.* (1988b), the macrobasic eurytele is here also defined as a eurytele with a shaft length of more than 2.5 times the capsule length. Other authors use a minimal shaft length of 4 times capsule length. In the present work, the ratio of shaft length to capsule length is give as an *s* value for all heteronemes.

For more terms see Russell (1953), Naumov (1969), Millard (1975), and O' Sullivan (1982).

Explanation of technical terms used in this work:

abaxial: position in a medusa facing away from main axis.
abaxial spurs: processes on abaxial side of marginal bulbs that extend onto exumbrella.
aboral: away from mouth.
adaxial: position or direction in a medusa facing towards main axis.
adradial: position in a medusa between perradial and interradial.
apical canal: canal or chamber that originates from the top of the manubrium and projects into the apical jelly.
apical funnel: funnel-like depression at the apex of a medusa.
apical: top of a medusa.
atrichous: nematocyst without spines.
autoepizooism: settlement and growth of colonies on older animals of the same species.
blastostyle: structure carrying gonophores. Not all blastostyles are homologous organs – in the Eudendriidae the reduced hydranths bearing gonophores are also called blastostyles.
capitate: tentacle structure with nematocysts concentrated in a large, terminal cluster.
caulus: stem-like support of a hydranth.
chordoid: arrangement of gastrodermal cells in a tentacle; cells are arranged in a single row like a roll of coins.
claviform: club-shaped.
cnidocysts: synonym of nematocysts.
coenosarc: living tissue of a colony.
colony: assemblage of polyps that have a common gastric system, mostly connected by a system of stolons. The term colony is frequently used incorrectly by referring to an upright stem (cormoid), which may be a part of a colony only (e.g., in colonies that form feather-like upright stems).
cormoid: erect, branching elements of a colony, e.g., one single feather-like structure of a *Pennaria* colony.

cryptomedusoid: gonophores with no radial canals, gastrodermis present only as a lamella.

dactylozooid: modified polyps with a defensive function, comprising tentaculozooids, spiral zooids, etc.

diaphragm: protrusion of gastrodermis partitioning the gastric cavity of polyps of the Corymorphidae (in some thecate hydroids also, a perisarcal shelf occurs near the base of a hydrotheca).

dichotomous: branching pattern in which the youngest hydranths are distal and branches are forked (see also monopodial).

distal: position away from centre.

ectodermis: outer germ layer, but often used instead of epidermis, which should be avoided (see Fautin & Mariscal 1991).

endodermis: inner germ layer; but often used instead of gastrodermis, which should be avoided (see Fautin & Mariscal 1991).

epidermis: outer epithelial layer, derived from ectodermal germ layer, see also ectodermis.

eumedusoid: gonophore that still has radial canals, but lacks tentacles; some eumedusoids may be released and live independently for a short time.

exumbrella: outer part of the bell of a medusa.

fascicled: erect stems composed of several tubes (stems).

filiform: tentacle structure in which nematocysts are evenly distributed over tentacle.

gastrodermis: inner layer of cells, derived from entodermal germ layer, see also endodermis.

gastrozooid: normal feeding polyps with mouth and normally with tentacles, without reproductive organs.

gonangium: enclosed reproductive organ composed of several gonophores.

gonophores: reproductive structures formed during polyp stage, which may develop into free medusa or remain fixed, phylogenetically derived from one medusa bud only. In this work the term is used as in Rees (1957) or Bouillon (1985a). Some authors incorrectly use the term in a different sense, applying it to all sessile repro-ductive structures (here referred to as sporosacs).

gonozooid: reproductive polyps bearing gonophores, usually modified gastrozooids that show various stages of reduction and loss of tentacles.

heterotrichous: nematocyst with spines that vary in size.

holophyletic: monophyletic taxon that includes all descendants of an ancestral species.

holotrichous: nematocyst with spines along the whole shaft or thread.

hydranth: actual polyp, consisting of hydranth body, tentacles, and hypostome.

hydroid: polyp stage of hydrozoans.

hydrophores: perisarcal structures at the base of hydranths in the family Solanderiidae. Often as two parallel triangular processes.

hydrorhiza: all structures by which polyps are attached to the substratum.

hypostome: region around mouth of polyp, mostly between mouth and first whorl of tentacles.

interradial: position in a medusa between radial canals.

manubrium: feeding organ of medusae, often composed of stomach and mouth part.

marginal bulbs: tentacle bulbs of hydromedusae.

merotrichous: nematocyst with spines confined to one, distal, region of its thread.

moniliform: refers to an arrangement of nematocyst clusters on tentacles; clusters are arranged in bead-like rings of tall epidermal cells and in a terminal knob.

monopodial: branching pattern of stems in which the oldest hydranth remains at the distal end.

nematocysts: stinging capsules, see Figure 2.

oral: towards mouth.

paraphyletic: group of taxa that does not include all descendents of one taxon.

parenchymatic: arrangement of gastrodermal cells in a tentacle, cells are irregularly arranged, no central lumen present.

pedicel: stem.

peduncle: bulge of the jelly in the centre of the subumbrella bearing the manubrium, cf. Fig. 27.

perisarc: horny substance covering stolons or stems.

perradial: position in a medusa where radial canals occur.

planula: larva of cnidarians.

plesiomorphy: nonderived character, not suitable for deducing phylogenetic relationships.

proximal: position closer to centre.

pseudofiliform: tentacles with scattered nematocysts in a relatively low epidermis along one side and a concentration of nematocysts in a tall epidermis on the other side (Petersen 1990).

pseudohydrotheca: covering of hydranth body by a film-like, flexible periderm.

spiral zooid: modified polyps without mouth or tentacles but with a gastral cavity, characteristic of some Hydractiniidae, typically performing writhing movements and tending to twist into a spiral.

sporosacs: reduced medusae or gonophores that mostly remain fixed to the hydranth and release gametes from there; there is no further implication on its structure (see also styloid, eumedusoid). See also Millard (1975).

stem: any erect structure bearing hydranths arising from a hydrorhiza.

stolon: tubular organ at base of polyps by which it adheres to the substratum.

stolonal: polyps arise from stolons; they may have a caulus; used here in the sense of colonies without branching stems. Some authors use this term in a more restricted sense and apply it to colonies in which polyps arise from the hydrorhiza without stems (cauli).

styloid: gonophores without radial canals, without gastrodermis lamella, and without rudiment of subumbrella. Some authors (e. g., Werner 1984) incorrectly synonymise this term with sporosac.

subumbrella: bell cavity of a medusa.

synapomorphy: derived character that is shared by several taxa and is useful to deduce phylogenetic relationships.

tentaculozooids: polyp similar to tentacle in structure, mostly with a solid core of gastrodermis and no mouth or gastral cavity. More delicate and slender than spiral zooids.

vasiform: shaped like a vase, with broad base and slender top.

velum: iris-like membrane at the bell opening of hydromedusae.

METHODS

Synonyms and References

Not all synonyms and references to a species are cited in this study. Only synonyms cited in earlier publications dealing with New Zealand species, important for the understanding of the scope of the taxon, or used in the references are given here. Lists of synonyms can in most cases be found in one of the references given. The references given for a species are also not intended to reflect a complete record. Only references used for the identification or otherwise important contributions are given. The thesis of Barnett (1985) is not an officially recognised systematic publication, therefore her species names are not synonyms. They are, however, treated as valid records.

Collection of Material

Live material used for this study was collected mainly from the Wellington area. Living specimens were also obtained from near Leigh, Kaikoura, and Portobello (Dunedin). Hydroids were collected by snorkelling, SCUBA diving, and once by dredging (Kaikoura). Depths are usually given as below low-tide mark.

Smaller polyps were mostly detected by collecting pieces of rock, shells, ascidians, or seaweeds and examining them in the laboratory under a dissecting microscope. Where possible, polyps were either cultivated attached to their original substratum or growing on 5 ml plastic petri dishes. These were kept in a shallow plastic container (60 x 40 x 10 cm^3) with running, sand-filtered seawater (3 to 6 litres/min. flow). The hydroids were fed at least every second day with living *Artemia* nauplii or copepods caught with a plankton net.

Medusae were collected by towing a plankton net (60 cm diameter opening, 200 µm mesh size) along jetties for a total length of approximately 300 metres. Samples were taken regularly (at least every second week) from jetties near Greta Point and Seatoun (Wellington Harbour, see Fig. 1). Occasional live plankton was obtained from Whangateau Harbour (Leigh) and Portobello. Medusae were cultivated individually in 5 ml petri dishes or 20 ml bowls at room temperature or at sea temperature. The water was changed daily. The medusae were fed every day (if possible) with *Artemia* nauplii or pieces of calanoid copepods. Spawning was induced, where necessary or possible, by a change from dark (12 h) to light.

Nematocysts were examined using live material where available. At least ten capsules of each type were drawn with the help of a camera lucida (CL, tracing tube). Measurements were then made from the drawings after the scale had been established by calibration. Measurements could also be made in increments of 0.5 µm, which is in a sensible relation to the resolving power of light microscopes. Where possible, preserved material was also examined. Some material was cleared by immersion in 50% lactic acid. For the nomenclature of the capsules see above.

Preserved material of hydroids and medusae were made available from various institutions (see list below: Abbreviations). The most significant collection of Anthomedusae was provided by Mrs Treffery Barnett (Auckland). These were collected by herself and others and were the basis of her 1985 thesis.

All new type material was registered and deposited at the N.Z. Oceanographic Institute of NIWA in Wellington. Most other newly collected material was also deposited there, but without individual access numbers.

Drawings were made whenever possible using living animals, otherwise formalin-fixed specimens were used. The bells of preserved medusae can be distorted and crumpled; in figures depicting preserved medusae, the umbrella is here shown without crinkles and corrected for obvious distortions. Such reconstructions are normally not difficult where more than one specimen is available.

Abbreviations

Abbreviations in figures are explained in the captions, *CL* indicates that these figures were originally drawn using a camera lucida. The abbreviation m.w. means metres of wire (cable length for plankton tows).

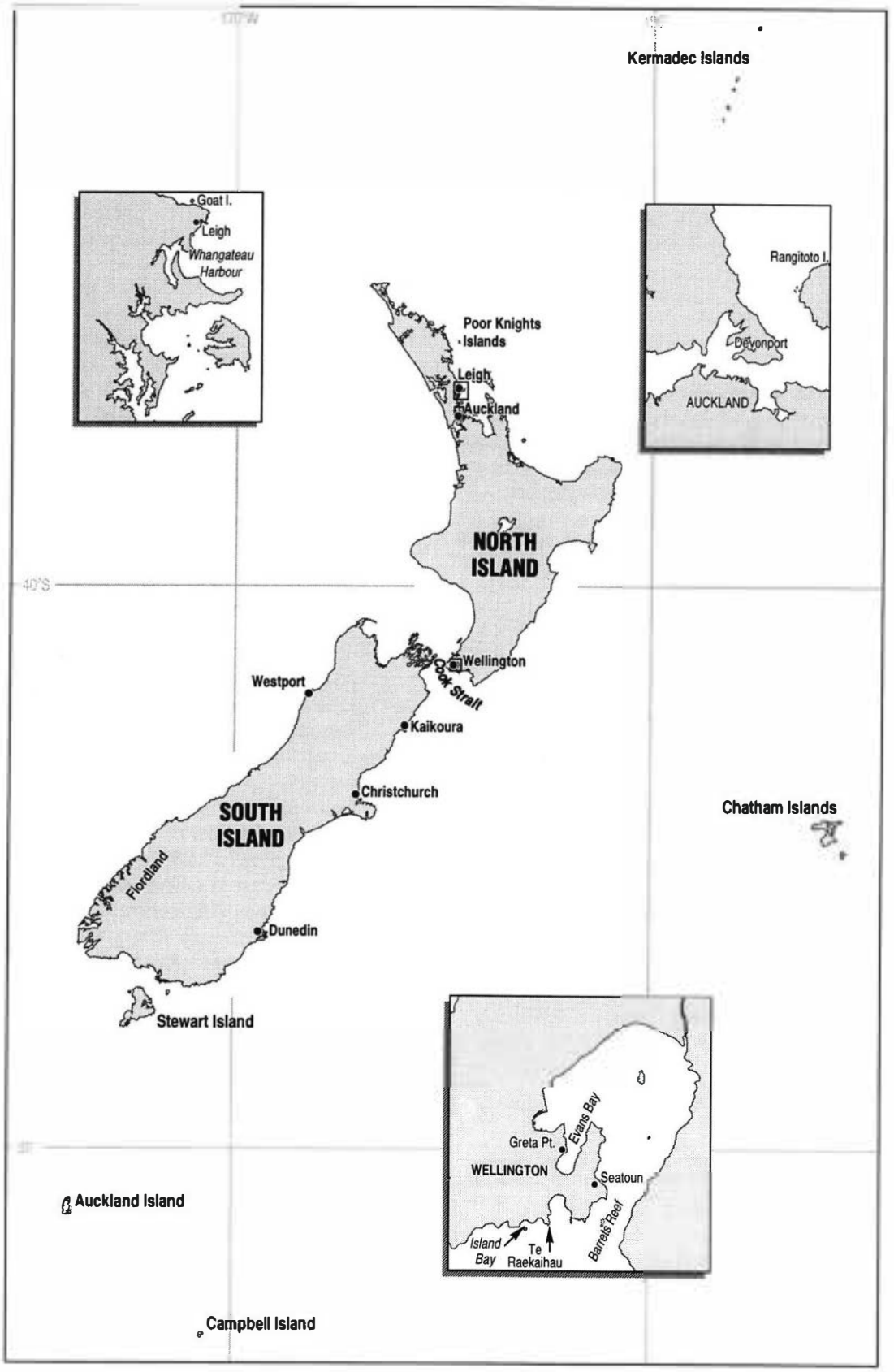


Fig. 1. Overview maps for study area.

Abbreviations of institutions:

MCC: Museum of Canterbury, Christchurch, New Zealand
NIWA: National Institute of Water and Atmospheric Research, Greta Point, Wellington
NMNZ: National Museum of New Zealand, Wellington now Museum of New Zealand Te Papa Tongarewa (MoNZ).
NZOI: New Zealand Oceanographic Institute, Wellington (now part of NIWA)
ROM: Royal Ontario Museum, Toronto, Canada
MVM: Museum of Victoria, Melbourne, Australia
ZMC: Zoological Museum Copenhagen, Denmark

LIST OF STATIONS

Stn No	Date	Latitude (°S)	Longitude	Depth (m)
New Zealand Oceanographic Institute Stns				
A439	4.10.58	40°59.6'	174°27.2'	140–160
A414	28.3.58	23°16'	177°12.5'	surface
B706	13.9.62	41°17.4'	174°41.1'	9
C814	25.2.62	37°40'	178°56.4'	194
C380	28.10.59	38°50'	174°21.5'	37
E251	6.4.65	34°35'	172°35'	9
E413	11.10.65	45°12'	171°44'	594
I69	14.5.75	36°11.2'	175°17.7'	23
I357	20.11.77	35°27.8'	174°44.1'	0–10
I378	23.11.77	34°09.5'	172°08.7'	0–24
J673	7.9.74	36°26.37'	175°45.60'	2
J674	8.9.74	36°41.85'	175°55.20'	20–30
J698	10.7.74	37°49.8'	176°51.8'	6–10
J705	11.9.74	37°16'	176°51'	190
J899	22.1.76	35°51.0'	174°28.0'	intertidal
N356	7.12.74	36°31.3'	175°17.6'	0–50
N371	10.12.74	34°23'	171°55'	0–200
N400	16.12.74	40°26.8'	175°9.2'	0–53
N401	16.12.74	40°24'	174°52'	100
N404	17.12.74	41°38'	175°19'	0–51
N413	18.12.74	42°32.5'	173°49.9'	500
N421	19.12.74	41°24.4'	174°45'	0–100
N433	30.1.75	41°46.1'	171°25.9'	0–25
N449	1.2.75	44°28.9'	167°38.6'	0–200
N453	2.2.73	46°00.8'	166°36.4'	351
N465	5.2.75	47°40.7'	167°01.2'	0–154
Q725	5.3.82	42°25'	171°06'	35
Q726	5.3.82	41°25.50'	172°01.20'	47
U796	6.8.90	42°34'	170°34.4'	428
U799	7.8.90	42°33.8'	170°34'	434
X480F	17.10.93	41°20.4'	179°05.8'	200–400
Z1060	17.8.54	Devonport Wharf, Auckland ship's hull		
Z7840	19.2.60	77°42.15'	166°19.5'E	351–432
Z7863	Mar. 94	Evans Bay, Wellington		0
Z7864	3.8.94	Goat Island, Leigh		0
Z7865	6.10.94	Te Raekaihau Pt, Wellington		0
Z7866	26.2.94	Te Raekaihau Pt, Wellington		2
Z7867	1.3.94	South Bay, Kaikoura		1
Z7868	Feb. 81	Whangateau Harbour		0
Z7869	1984	Leigh Marine Reserve		0
Z7870	26.11.93	Doubtful Sound, Fiordland		7
Z7871	18.1.94	Seatoun, Wellington		0
Z7872	7.1.94	Narrow Neck Beach, Auckland		1
Z7873	10.5.94	Aquarium Point, Dunedin		0
Z7874	1.11.59	Aquarium Point, Dunedin		0
Z7875	13.3.94	Houghton Bay, Wellington		0
Z7876	5.9.94	Greta Point, Wellington		0.5
***Dana* Stns**				
3624IX	10.12.28	28°19.5'	176°56' E	100
3626VIII	13.12.28	27°00'	177°41' W	1500
3627II	14.12.28	30°08'	176°50' W	4000
3627VIII	14.12.28	30°08'	176°50' W	300
3630V	17.12.28	34°24'	178°42.5' E	600
363III	18.12.28	35°40'	176°40' E	1000
3809	4.9.29	6°14.5'	105°06.5' E	600
3844V	11.10.29	12°05'	96°45' E	1000

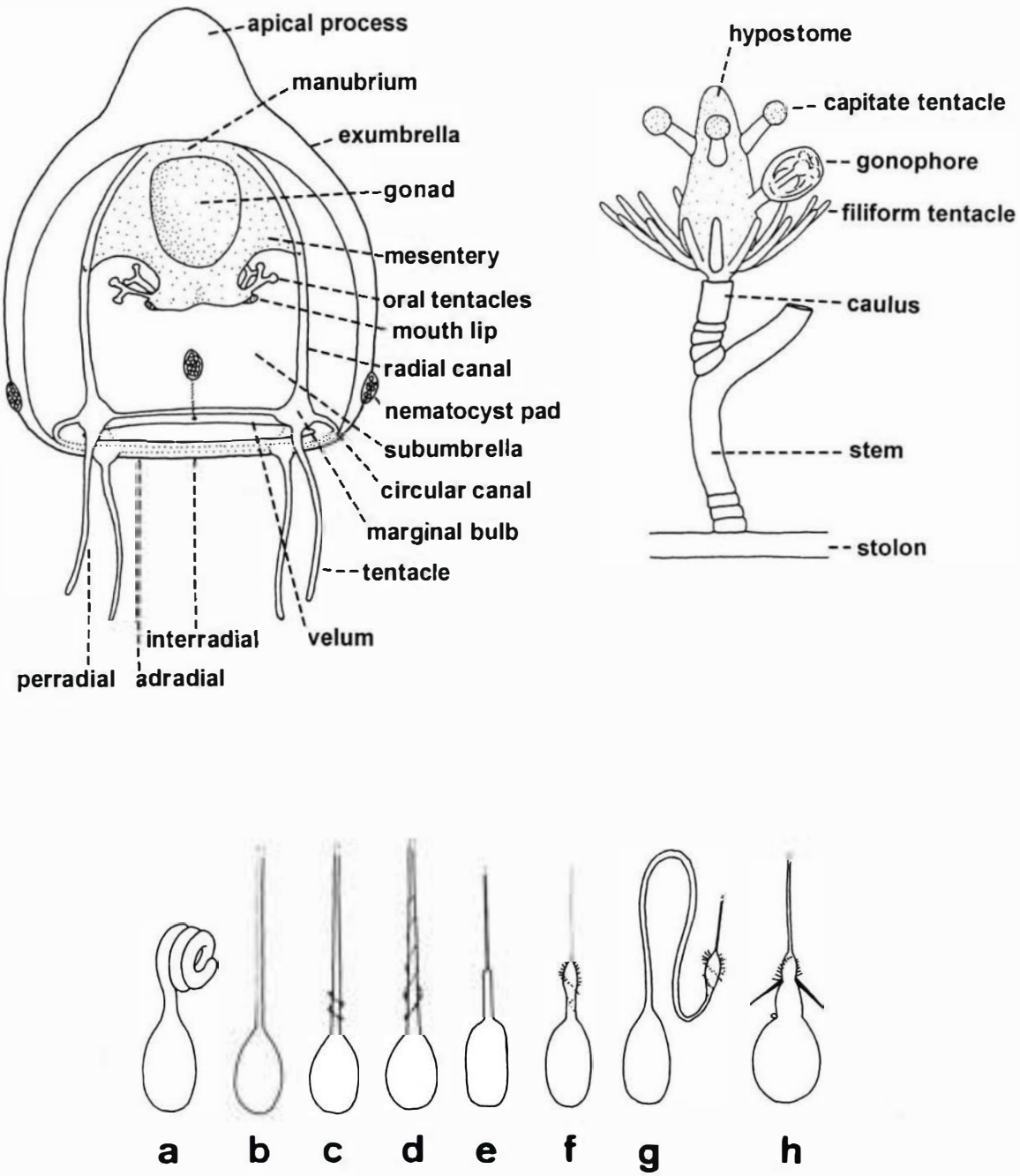


Fig. 2. Anatomical terms used in this study. Top left: hypothetical anthomedusa. Top right: hypothetical polyp stage. Below: nematocyst types found in this study, all discharged. **a)** desmonemes, **b)** atrichous isorhiza, **c)** basitrichous anisorhiza, **d)** heterotrichous anisorhiza, **e)** microbasic mastigophore, **f)** microbasic euryteles, **g)** macrobasic eurytele, shaft longer than 2.5 times capsule length, **h)** stenotele.

REMARKS: The arrangement of taxa does not imply a phylogeny, although for the capitate families a phylogenetic arrangement as proposed by Petersen (1990) is adopted. Taxa within families are mostly arranged alphabetically, with new taxa at the end. Within a species, the more distinctive stage is described first.

SUBCLASS ANTHOATHECATA

Hydrozoans that always have a polyp stage. Hydranth body not covered by rigid perisarc. Medusae not colonial, without statocysts, with gonads on manubrium, with radial canals, with tentacles arising from bell margin. Cnidome normally includes desmonemes.

REMARKS: Following Cornelius (1992), the name Anthoathecata is here preferred instead of the compound name Anthomedusa-Athecata in order to avoid vestiges of the old dual classification. The Anthoathecata is a well-defined group that is easy to recognise. Problems arise only when the group has to be characterised by cladistic methodology (Wiley 1981). There is no obvious synapomorphy that solely delimits this group as a holophyletic taxon. Affinities with the Siphonophora and Laingiomedusae are not established. All three taxa have gonads on the manubrium as a possible synapomorphy. Desmonemes occur only in the Siphonophora and Anthoathecata and may indicate a closer relationship. A taxon Hydroidomedusae (Bouillon *et al.* 1992a) which includes all Hydrozoa except the Siphonophora is therefore most probably not a natural taxon.

Order FILIFERA

Athecate hydroids with filiform tentacles; only exceptionally are capitate tentacles present in tentaculozooids (family Ptilocodiidae). Gonophores remain either fixed or are released as free medusae. Manubrium of medusa normally with pronounced tetraradial symmetry. Cnidome does not include stenoteles.

REMARKS: The absence of stenoteles is an important synapomorphy that separates the Filifera from the Capitata (Petersen 1990). Some rare reports of stenoteles in otherwise typical filiferan polyps like *Bimeria australis* Watson, 1978 require a re-investigation. They are probably of foreign origin (cf. Calder 1993: 1001) or a convergently evolved capsule (cf. Bouillon *et al.* 1986). If real stenoteles should nevertheless be present in *B. australis*, then its systematic position must be re-evaluated thoroughly. The tetraradial symmetry of the medusa mouth is a plesiomorphy and it is also present in a few little-derived Capitata. But the tetraradial symmetry is a useful diagnostic character to separate most medusae of the Filifera. In this group the tetraradial symmetry of the manubrium can be rather pronounced by oral tentacles, oral arms, perradial lips, or mesenteries.

The Stylasteridae (hydrocorals) are nowadays also included in the Filifera. They are related to the Hydractiniidae. Because Cairns (1991) recently revised the Stylasteridae of New Zealand this group is not included here.

Family **CLAVIDAE** McCrady, 1859

Solitary or colonial hydroids. Colonies stolonial or branching, arising from tubular, ramifying hydrorhiza. Growth in erect colonies monopodial with terminal hydranths. Perisarc soft or firm, investing hydrorhiza only or covering both hydrorhiza and hydrocaulus, occasionally forming cones into which hydranths can retract. Hydranths elongate, spindle- to club-shaped, with scattered filiform tentacles. Hypostome conical. Nematophores present or absent. Gonophores fixed sporosacs or free medusae, developing from hydrorhiza, hydrocaulus, branches, pedicels, or entire or reduced hydranths. Medusae bell-shaped. Mouth of medusa surrounded by four lips, margins of lips with clusters of nematocysts. With four radial canals and circular canal. Marginal tentacles solitary, numerous in adult. Ocelli present. Gonads on interradial walls of manubrium.

REMARKS: The above diagnosis was slightly modified after Calder (1988) to accommodate *Merona* and the new species *Rhizogeton conicum* which both have the ability to retract into the perisarc cone enveloping the caulus.

Until recently, polyps with scattered filiform tentacles lacking stenoteles could quite securely be allocated to the family Clavidae, but Boero and Bouillon (1989) described the polyp of the pandeid medusa *Stomotoca atra*. This polyp has scattered

filiform tentacles and, in the absence of life-cycle information, would have been classified as a member of the Clavidae. However, the typical bend-back behaviour of the closely related genus *Amphinema* is also shown by this polyp (Boero & Bouillon 1989, and also p. 62). This shows on the one hand how important live observation and complete life-cycle information are, and on the other that the present system is still far from satisfactory.

Characteristics of New Zealand genera:

Cordylophora: erect, branching colonies, sessile gonangia, in brackish water.

Oceania: clavid medusa, without large vacuolated cells on manubrium base.

Rhizogeton: stolonial colonies with sessile gonophores arising from stolons.

Turritopsis: erect, branching hydroid colonies, free medusae, often red or orange colours, medusa with large vacuolated cells on top of manubrium.

Cordylophora Allman, 1844

Erect, branching hydroid colonies with monopodial growth and terminal hydranths. Hydranths naked, spindle-shaped, provided with scattered filiform tentacles. Gonads in gonangia which grow singly on cauli of hydranths. The larvae may develop within the gonangia to a quite advanced stage, sometimes even young polyps (after Bouillon 1985a).

TYPE SPECIES: *Cordylophora caspia* (Pallas, 1771).

REMARKS: Only one species is known from New Zealand.

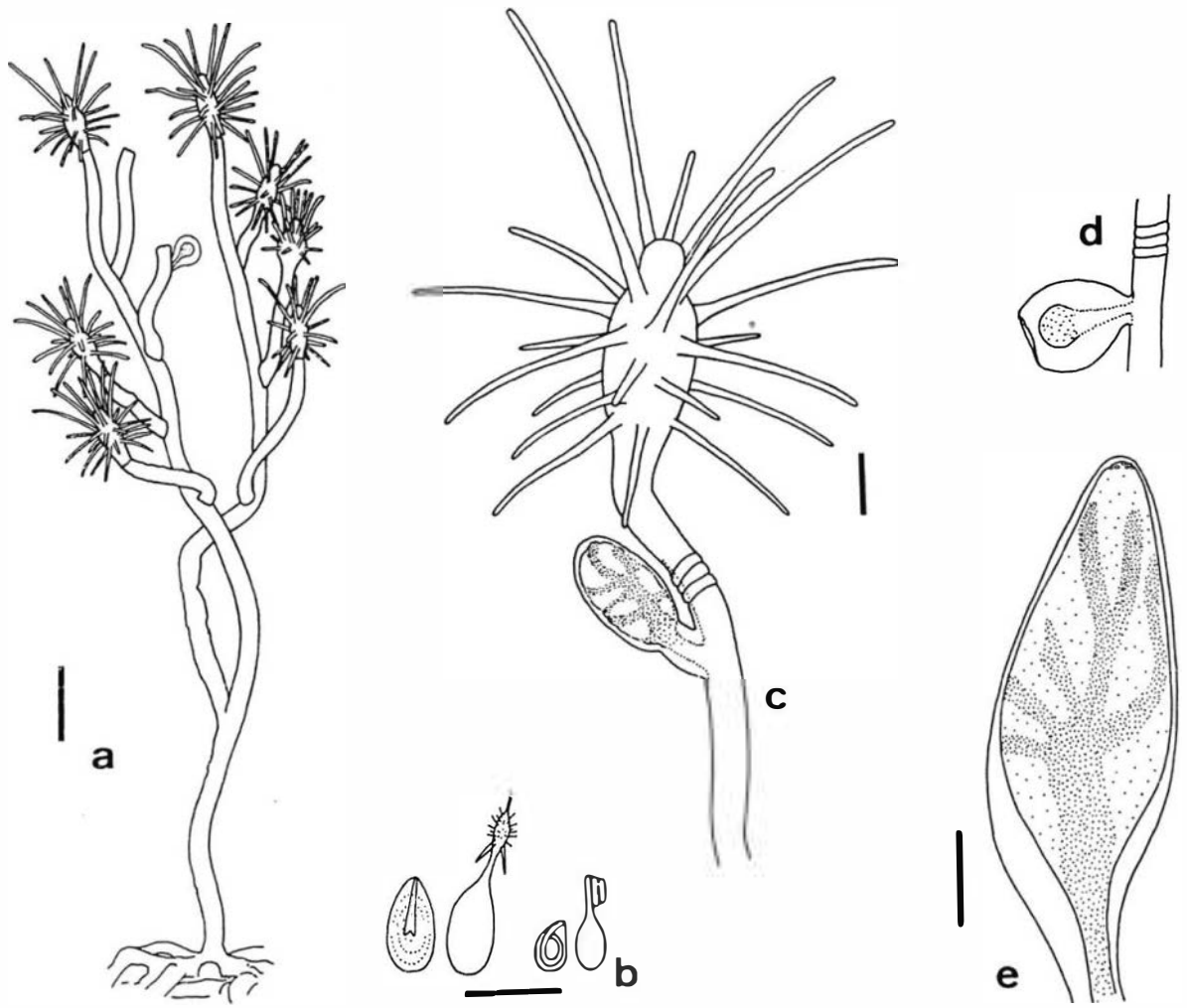


Fig. 3. ***Cordylophora caspia*** from life. **a)** erect colony; scale bar 2 mm. **b)** nematocysts: microbasic eurytele, same discharged, desmoneme, same discharged; scale bar 10 µm. **c)** hydranth with young female gonangium; scale bar 0.4 mm. **d)** spent gonangium, same scale as c). **e)** mature male gonangium, note branching of blastostyle (shaded) and nematocysts at distal end; scale bar 0.2 mm.

Cordylophora caspia (Pallas, 1771) (Fig. 3a-e)

Tubularia caspia Pallas, 1771: 433.
Cordylophora lacustris Allman, 1844: 395.
Cordylophora lacustris: Hamilton 1883: 419.
Cordylophora lacustris var. *otagoensis* Fyfe, 1929: 813, figs 2–10.
Cordylophora lacustris otagoensis: Ralph 1953: 64, fig. 6.
Cordylophora caspia: Naumov 1969: 196, fig. 66.

MATERIAL EXAMINED:
Several living colonies from Tomahawk Lagoon, Dunedin, growing on the underside of stones, collected 14.5.94, material deposited.

DESCRIPTION: Erect, branching hydroid colonies, up to 30 mm, arising from ramified and anastomosing stolons. Occasional autoepizooism is present. Erect stems with monopodial growth, branching several times irregularly at various angles, ending in up to 10 hydranths. Perisarc thick, smooth, only occasionally annulated. Hydranths spindle-shaped, up to 1.4 mm long, with distinct hypostome, which can be nipple-shaped. Tentacles filiform, 20–27 in number, scattered over hydranth body. Tentacles of varying length (up to 1.4 mm), tapering slightly to three-quarters of basal diameter, gastrodermis composed of chordoid cells. Gonads in ellipsoid gonangia arising at the base of hydranths, covered with perisarc. Initially they possess a branched blastostyle, which may be reduced to a simple one later in development. Gametes are released through distal hole. Male gonangia have a distal cluster of nematocysts. Nematocysts:

a) microbasic euryteles of very variable size, shaft in unexploded capsule with conspicuous notch at end (Fig. 3b), (8–11) x (3.5–5.5) µm, s = 0.9.
b) desmonemes, discharged with 3 coils and bristles inside of coils, (5–5.5) x (3–3.5) µm.

Colours: Basal parts of stems and branches black, turning distally into amber; hydranths white; gonangia opaque.
Tentacle numbers: Median 22, range 19–27, n = 5.
Hydrorhiza diameter: 270–425 µm.
Stems at origin: 320–344 µm.

RECORDS FOR NEW ZEALAND: Esk River, Napier (Hamilton 1883); Tomahawk Lagoon, Dunedin (Fyfe 1929, this study); Lake Ellesmere, Canterbury (Ralph 1953).

OTHER RECORDS: Very wide spread in brackish waters, originated most probably from the Caspian Sea.

REMARKS: The height of colonies can reach 100 mm (Naumov 1969). This species has a high phenotypic variability which can in part be correlated with the degree of salinity (Roch 1924; Kinne 1956). Considering the effect of salinity on morphology, creation of form names or even subspecies seems inappropriate.

Fyfe (1929) and Miller (1973) described the development of the reproductive organs. Miller interpreted the branching structure in the gonads as a blastostyle rather than as a spadix (vestigial medusa manubrium), making the whole structure a gonangium, which is an organ composed of several gonophores. This gonangium corresponds to the one in *Corydendrium* (see Fioroni 1977 for discussion of terminology). Eggs of *C. caspia* can develop within the gonangia into planulae (Fyfe 1929).

Oceania Koelliker, 1853

Colonial hydroids with tentacles dispersed over hydranth body. Clavid medusae with eight or more marginal tentacles not grouped in clusters. Manubrium upon a simple, solid, gelatinous peduncle, never vacuolated.

TYPE SPECIES: *Oceania armata* Koelliker, 1853.

REMARKS: Only one species is known from New Zealand.

Oceania armata Koelliker, 1853 (Fig. 4a-c)

Oceania armata Koelliker, 1853: 323; Metschnikoff 1886: 78, pl. 1, figs 32–39; Mayer 1910: 147, figs 80–81; Kramp 1959: 99, fig. 63; Kramp 1961: 65 (*cum syn.*); Kramp 1968: 27, fig. 67; Brinckmann-Voss, 1970: pl. 4, fig. 2; Bleeker & van der Spoel 1988: 230, fig. 6; Bouillon 1995: 224.

MATERIAL EXAMINED:
Two medusae from NZOI Stn N404, 41°38'S, 175°19'E, 0–51 m deep, 7–8 mm high, 80 and 120 tentacles, ocelli almost completely lost.

DESCRIPTION: Medusa stage: Medusa up to 10 mm high, bell-shaped with flat top, jelly uniformly thin. Manubrium on a shallow peduncle without vacuolated cells. Manubrium large, up to two-thirds of subumbrellar height, flask-shaped, with large stomach and funnel-shaped mouth region. Stomach cruciform in cross section. Mouth rim crenulated, with 4 prominent perradial lips. Margin of mouth with a continuous row of spherical nematocyst clusters. Gonads on interradial surface of stomach. Four quite broad radial canals, margins occasionally jagged, ending in circular canal. Up to 120 tapering marginal tentacles, longer than bell (preserved sample), gastrodermis chordoid. Each tentacle with a slight proximal swelling beginning shortly after origin.

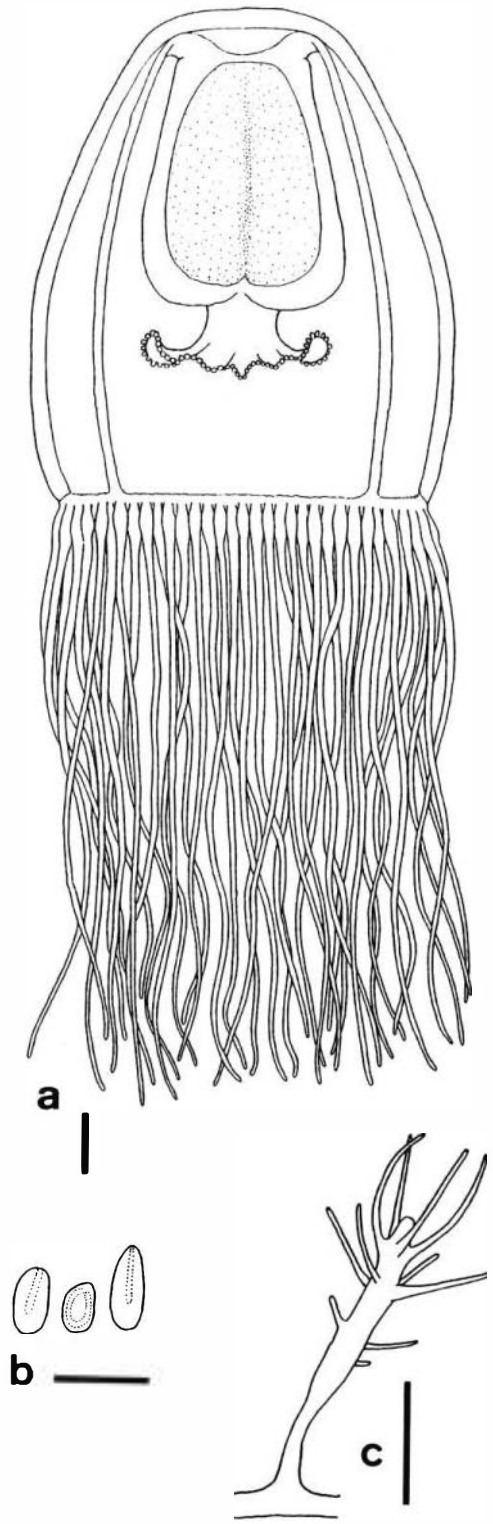


Fig. 4. *Oceania armata*. **a)** mature medusa from preserved Cook Strait samples; scale bar 1 mm. **b)** nematocysts of medusa: heteroneme, desmoneme, microbasic eurytele from mouth clusters; scale bar 10 µm. **c)** polyp stage redrawn from Metschnikoff (1886); note: the polyp stage has not yet been found in nature; scale bar 0.5 mm.

Origins of tentacles alternately slightly displaced adaxially and abaxially. With adaxial ocelli.
Nematocysts:

a) heteronemes (microbasic eurytele?), not seen discharged, (6–7) x (3–3.5) µm.
b) desmonemes, (5–5.5) x (3–3.5) µm.
c) microbasic euryteles from mouth clusters, (8.5–9) x (3–3.5) µm.

Polyp stage (after Metschnikoff 1886): Hydroid colonies arising from ramifying stolons. Hydranths on short, periderm-covered caulus. Hydranth spindle-shaped with conical hypostome. With around 13 filiform tentacles in up to 4 whorls.

TYPE LOCALITY: Mediterranean.

REMARKS: The polyp of *Oceania armata* is only known from the rearing experiments of Metschnikoff (1886) and has never been found in nature. The origin of medusae buds is also not known.

RECORDS FROM NEW ZEALAND: Numerous records from north of East Cape, Kermadec Islands, east of North Island, Coromandel Peninsula, Tasman Sea (Kramp 1965), Cook Strait (Bouillon 1995).

DISTRIBUTION: Medusa present in coastal waters in the tropical and subtropical parts of the Pacific and Indian Oceans, Mediterranean, Eastern Atlantic from Portugal to Cap Verde, Azores, West Indies (Kramp 1965).

Turritopsis McCrady, 1857

Hydroids forming erect, branching colonies. In well-developed colonies base of hydrocauli adnate for some distance. Hydranths with irregularly scattered filiform tentacles. Gonophores develop on the hydrocauli and are liberated as medusae. The medusae are characterised by an apical mass of vacuolated cells on top of the manubrium (after Bouillon 1985a).

TYPE SPECIES: *Turritopsis nutricula* McCrady, 1857.

REMARKS: Only *T. nutricula* is known from New Zealand.

Turritopsis nutricula McCrady, 1857 (Fig. 5a-e)

Turritopsis nutricula McCrady, 1857: 56, pl. 4, figs 1–10, 12–15, 28a, pl. 5, figs 11, 16–18, 28b; Mayer 1910: 143, figs 10–13, pl. 14–15; Ralph 1953: 64, figs 10 & 18; Russell 1953: 115, figs 54A–C, 55, 56, pl. 5, figs 1–5, pl. 29; Kramp

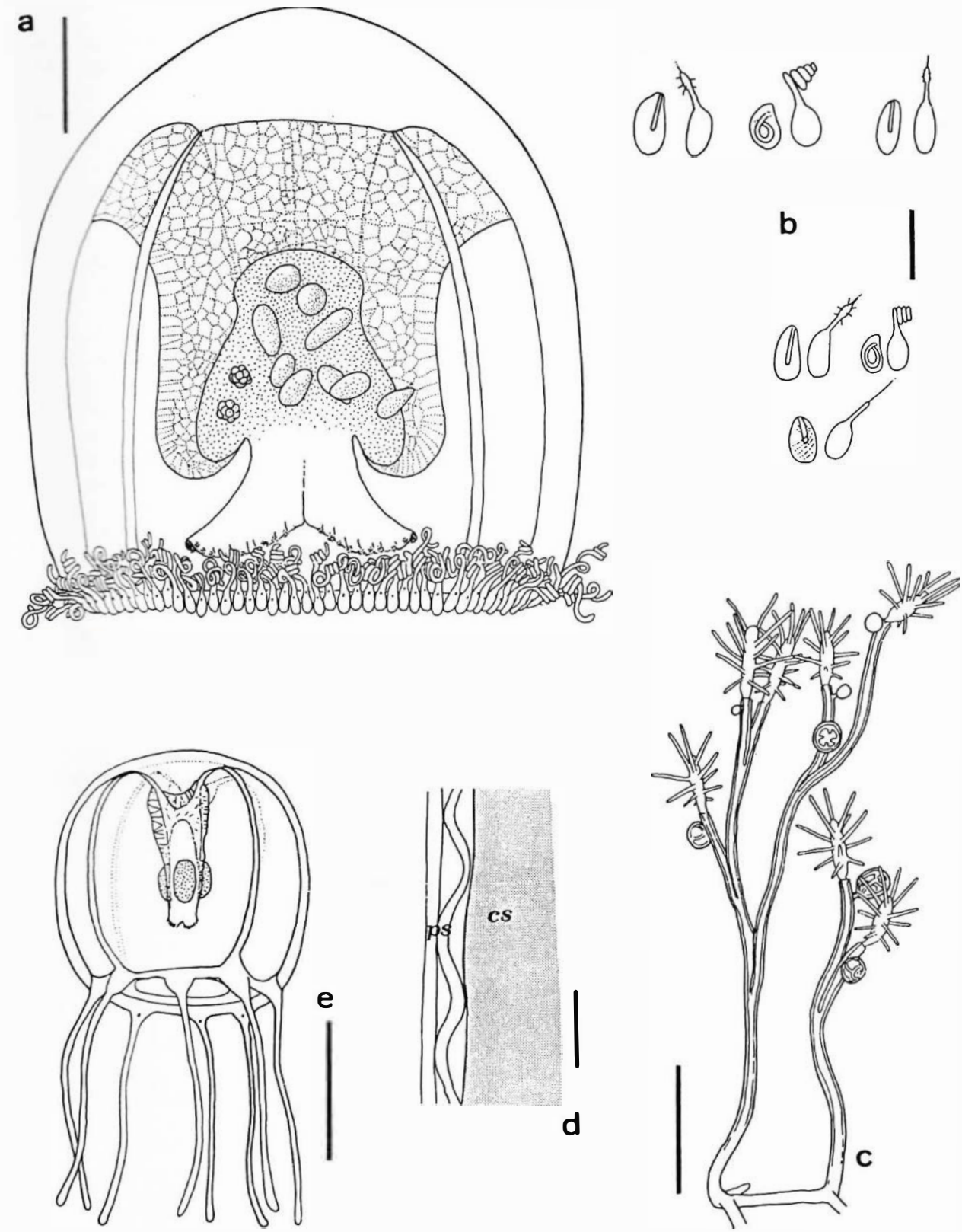


Fig. 5. *Turritopsis nutricula* from life. **a)** adult medusa with developing embryos on the manubrium, shaded area is red-coloured; scale bar 1 mm. **b)** nematocysts in pairs of undischarged and discharged capsules, top row from medusa: eurytele from tentacle, desmoneme, and eurytele from manubrium; lower row from polyp stage: eurytele, desmoneme, and rare mastigophore; scale bar 10 mm. **c)** polyp colony with medusa buds; scale bar 2 mm. **d)** CL-drawing of the stem region showing the double-layered structure of the perisarc (*ps*), *cs*: coenosarc; scale bar 50 mm. **e)** newly hatched medusa; scale bar 0.5 mm.

1959: 100, fig. 64; Kramp 1961: 66 (*cum syn.*); Kramp 1968: 27, fig. 66; Millard 1975: 76, figs 24F-G; Calder 1988: 8, figs 5-6 (*cum syn.*); Hirohito 1988: 71, figs 23c-d; Ramil & Vervoort 1992: 17; Bouillon 1995: 224.

Tubiclava rubra Farquhar, 1895: 209, pl. 13, fig. 6 (new synonym).

Tubiclava fructicosa: Hilgendorf 1898: 201, pl. 16, figs 1, 1a.

Turritopsis pacifica Maas, 1909: 722.

Tubiclava rubra: Bale 1924: 228.

Corydendrium zelandicum Stechow, 1924: 57 (new synonym).

Corydendrium rubra: Stechow, 1924: 58.

[? Not *Tubiclava rubra*: Ralph 1953.]

MATERIAL EXAMINED:

Polyps:

Numerous colonies from Wellington Harbour (Queens Wharf and Evans Bay), reaching up to 5 cm with hundreds of hydranths, present throughout all seasons, reduced in summer.

Some living, infertile colonies from Portobello, Dunedin (May 1994); preserved sample of fertile colony from same locality, collected 22.11.53 by P. Ralph (in collection of Marine Laboratory).

Type of *Tubiclava rubra* Farquhar, 1895, Canterbury Museum, Christchurch, type no. AO 32733, type locality Wellington Harbour.

Living Mediterranean material from Ischia (Italy), kindly provided by Dr S. Piraino.

Medusae:

Living adult medusae, found near Ti Point, Leigh (August 1991); Rangitoto Island, Auckland (August 1991, October 1993); Scorching Bay, Wellington (27.1.1994, many). Juveniles of all stages could be found in the plankton of Evans Bay regularly during spring and summer.

About 10 preserved medusae collected by T. Barnett, 1983-1984, Leigh Marine Reserve.

Life cycle:

Medusae released from polyp colonies from Evans Bay were cultivated up to the 16-tentacle stage, when the adult characters become evident.

DESCRIPTION:

Polyp stage: Hydroids forming initially stoloial, later erect colonies, arising from attached, ramified stolons. Branching of stems irregular, reaching 15 mm (up to 50 mm in very large colonies). Branches originate at acute angles and are adnate for some distance afterwards, then curving away and becoming free. Branches 160-200 µm in diameter, some few expanding distally; perisarc firm, mostly heavily infested with detritus and algae, without annulations, terminating below hydranths. Perisarc double-layered, inner layer corrugated. Hydranths in material from New Zealand intensively orange-red. Relaxed hydranths are spindle-shaped and reach 0.8 mm in height, with 12-20 filiform tentacles of different length (max. 0.6 mm), highly contractile, scattered over distal three-quarters of hydranth; hypostome conical, hydranth not retractable into perisarc, stressed hydranths contract to egg-shape. Medusae buds arise below hydranths in perisarc- covered region, mostly one bud, occasionally more. The medusae buds arise from short stems which may also be adnate for some distance after their origin. Also hydranths arising directly from stolons but belonging to a branching colony can bear medusae buds. Nematocysts:

a) microbasic euryteles, (7-8) x (3-4) µm, s = 0.9.
b) microbasic mastigophores, rare, in body and cauli of larger polyps, (5.5-7) x (3-4) µm, s = 0.7.
c) desmonemes, discharged with four coils, (4.5-5.5) x (2.5-3) µm.

Young medusa: Newly released medusa spherical, light orange in New Zealand material, manubrium with 4 perradial lips with nematocyst clusters, manubrial peduncle present, base of manubrium and transition to radial canals with very large vacuolated gastrodermal cells, 4 interradial orange pads on distal part of manubrium. With 4 radial canals and circular canal. With 8 tentacles, arising from bulbs with an inconspicuous adaxial ocellus. The exumbrella appears granulated and is slightly opaque. Nematocysts:

a) microbasic euryteles in tentacles, (7-8) x (3-4) µm.
b) microbasic euryteles of manubrium, (8.5-10) x (3-3.5) µm.
c) desmonemes, discharged with four coils, (5-6.5) x (2.5-3.5) µm.

Adult medusa: Up to 7 mm high, bell-shaped, higher than wide, jelly thin, at apex thicker. Stomach cross-shaped in axial view, manubrium not longer than bell cavity. Manubrium with intensively red colour. Four radial masses of large vacuolated gastrodermal cells form a compact mass above stomach. Mouth with 4 lips with nematocyst clusters along margin. Four radial canals which continue through vacuolated gastrodermal masses to manubrium. Gonads on interradial walls of manubrium, in mature females with developing embryos and planulae. Many tentacles (up to 120), arising from closely spaced tentacle-bulbs, these with adaxial ocelli. Nematocysts:

a) microbasic euryteles in tentacles, (8-9) x (4-5) µm, s = 0.9.
b) microbasic euryteles from manubrium, (7-9.5) x (3-4) µm, s = 0.7.
c) desmonemes of tentacles, (5.5-7) x (3.5-4.5) µm.

TYPE LOCALITY: Charleston Harbour, South Carolina, USA.

REMARKS: *Turritopsis nutricula* is a cosmopolitan species and frequently found in intertidal (polyp) and coastal waters (medusa). The medusae, even young ones, are readily recognised by their vacuolated gastrodermal cells at the base of their manubrium. Additionally, the

size and red colour of the adult make the medusa conspicuous and they can even be discerned from small boats. Also young medusae are intensively orange. Colouring, however, may depend on food sources.

The polyp was found all year round in Wellington Harbour, often in rather dense populations and often with mussels. The characteristic double-layered structure of the perisarc of the cauli (Fig. 5d) makes them identifiable even when the hydranth is not well preserved (Ramil & Vervoort 1992). This structure is, however, not everywhere as obvious as given in the figure.

The examined material from New Zealand agrees well with descriptions provided by other authors (see synonymy). Only the presence of microbasic mastigophores in the polyp stage has not been reported so far. These nematocysts occur in the hydranth body and cauli, sometimes in a cluster of up to 20 capsules. They do not occur in the tentacles and it may be that not all polyps have them, especially young polyps. The present material from New Zealand was compared to living *T. nutricula* hydroids from the Mediterranean (Ischia, Italy). These specimens likewise do have the mastigophores. There are nevertheless some differences between these populations. The Mediterranean polyps were much lighter coloured and showed a broader branching. The newly hatched medusa was quite colourless and its vacuolated cells much less developed. Their tentacles showed a unique trembling behaviour not seen in medusae from New Zealand. While most of these characters can be explained by differences in the environment, a closer examination of the life cycle of the Mediterranean population seems appropriate to test whether they are a different species as recently postulated by Calder (1988).

After examination of the type specimens of *Tubiclava rubra* Farquhar, 1895 it became evident that this sample belongs to *Turritopsis nutricula*. Although fragmented, the type material of *Tubiclava rubra* is well preserved. The sample consists of pieces of macroalgae (presumably holdfasts of *Macrocystis pyrifera* as given in the original publication) covered with hydroids, mostly by a clavid type. They form erect colonies that are branched 2-3 times. The cauli are tubular, not dilating distally, branching at acute angles with the new branch being adnate to the other for some distance. The hydranths are typical clavids with up to 16 scattered filiform tentacles. The perisarc shows the characteristic double-layered structure. Few gonophores are present, arising below hydranths in perisarc-covered region, up to 3 in one row along the caulus. They arise on short stems, which are also adnate for some distance. The gonophores are obvious incipient free medusae as the manubrium, 4 radial canals and the tentacles are visible. It is not possible to distinguish Farquhar's sample from *Tur-ritopsis nutricula*. The general abundance of this species at the type locality also argues in favour of this interpretation. Stechow (1924) has already noted that *Tubiclava* cannot be the correct genus for Farquhar's hydroid, as *Tubiclava* is not branching, if the genus is valid at all. Stechow's proposed name *Corydendrium rubra* therefore becomes a synonym of *Turritopsis nutricula*. Similarly, Stechow (1924) and Bale (1924) proposed that Hilgendorf's (1898) *Tubiclava fructicosa* from Dunedin should better be referred to *T. rubra*. Stechow's proposed new name of *Corydendrium zelandicum* is therefore another synonym of *Turritopsis nutricula*. *Tubiclava rubra* depicted by Ralph (1953, fig. 5A) cannot belong to the genus *Tubiclava* because it has branched hydrocauli. Her illustration shows a quite robust hydroid (from Christchurch ?) which may be not *Turritopsis nutricula*, as she described it as having fixed gonophores on separate stems. This description was, however, copied from Farquhar (1895). Therefore, it remains unclear what material she had in hand.

RECORDS FROM NEW ZEALAND: Hydroid: Wellington Harbour (Ralph 1953; this study); Portobello, Dunedin (Ralph 1953; this study). Medusa: Bare Island, Hawke Bay (Kramp 1928, as *T. pacifica*); Cook Strait (Kaberry 1937); Auckland (Kramp 1965; Jillett 1971; this study); Leigh (Barnett 1985; this study); Wellington Harbour (this study).

DISTRIBUTION: Circumglobal in warm to temperate waters, e.g., Northeast Pacific (Fraser 1948), South Africa (Millard 1975), North Atlantic (Russell 1953), Pacific (Kramp 1965), Papua New Guinea (Bouillon 1980).

Rhizogeton Agassiz, 1862

Stolonal hydroid colonies, either sessile or with a perisarc-covered caulus; hydranths with scattered filiform tentacles. Nematophores absent. Gonophores arise from hydrorhiza and are sessile sporosacs.

TYPE SPECIES: *Rhizogeton fusiforme* L. Agassiz, 1862.

REMARKS: The diagnosis as given by Bouillon (1985a) was modified to accommodate *Rhizogeton sterreri* (Calder, 1988) and *Rhizogeton conicum* n. sp. The emendation now also allows the presence of perisarc-covered cauli. Mainly based on shape of the hypostome, Calder (1988) split the genus as defined above into two genera (*Rhizogeton* and *Rhizodendrium*). Because the gonophores of the type species for *Rhizodendrium* are not yet known, Calder's proposal is not

followed here.

Two species are known from New Zealand with the following distinguishing characters:

Rhizogeton conicum: base of hydranth with conical perisarc tube into which hydranth can retract.

Rhizogeton sp.: hydranths sessile, with very short perisarc collar at hydranth base; with elongated vegetative propagules.

Rhizogeton conicum n. sp. (Fig. 6a-d)

MATERIAL EXAMINED:

1 colony from western side of Te Raekaihau, 30.1.1994, subtidal, on sponge.

1 hydranth from western side of Te Raekaihau, 26.2.1994, subtidal, on barnacle, infertile.

1 colony from western side of Te Raekaihau, 13.3.1994, 1-2 m, on sponge, fertile, part of it used for slide preparation, deposited as holotype H-652, remainder as paratype P-1082.

1 colony from Houghton Bay, Wellington, 13 m, on ascidian, infertile, hydranths up to 4 mm, deposited.

DESCRIPTION: Hydroid colonies arising from sparingly ramified, loosely adhering stolons. Stolons covered with perisarc. Hydranths on unbranched cauli. Perisarc smooth or wrinkled, thin and filmy on caulus of hydranth where it forms an inverted cone up to 2 mm long into which hydranths can partially or completely retract; size of cone is variable. Hydranths cylindrical, 1-4 mm long and 0.3 mm diameter, with up to 20 filiform tentacles. Tentacles organised in distal 3 to 4 whorls with 4 tentacles in each whorl, additionally few more irregularly scattered tentacles below. Tentacle gastrodermis chordoid. Hypostome dome-shaped. Gonophores sessile sporosacs, arising directly from stolons, spherical, with larger filmy perisarc, up to 4 eggs embedded in tissue with many nematocysts. Nematocysts:

a) microbasic euryteles of polyp, shaft projecting at an angle of 45° or less, (10-14) x (4-5.5) µm, s = 0.8.
b) microbasic euryteles of gonophores, more bean-shaped than other eurytele, shaft discharges sideways, (11-13) x (4.5-5) µm, s = 0.7.
c) desmonemes, (5-7) x (3-4) µm.

Colour: white and transparent, gonophore white and opaque.

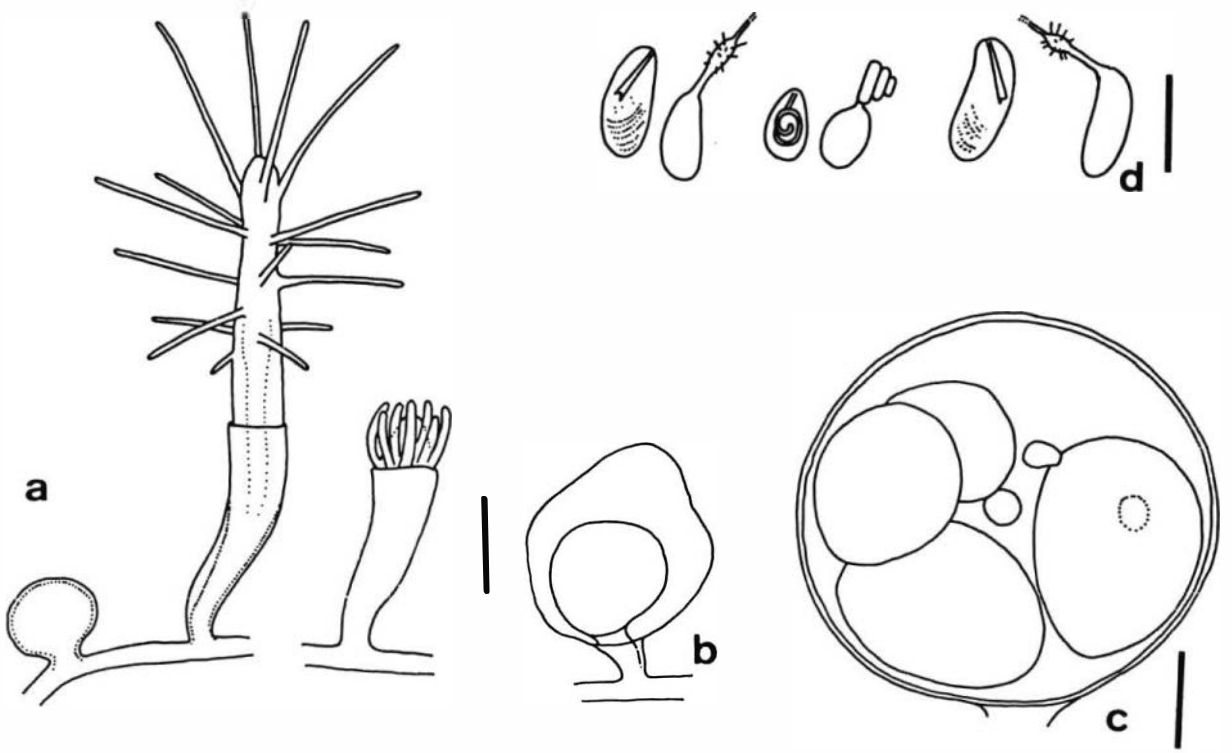


Fig. 6. ***Rhizogeton conicum*** n. sp., from life. **a)** incipient gonophore (left) arising from stolon, fully expanded (middle) and contracted (right) hydranth; scale bar 0.5 mm. **b)** mature gonophore enclosed in thin, flexible perisarc, same scale as a). **c)** female gonophore tissue treated with lactic acid to make it transparent, CL; scale bar 0.2 mm. **d)** nematocysts in pairs of native and discharged capsule: euryteles of polyp, desmonemes, euryteles of gonophore; scale bar 10 µm.

TYPE LOCALITY: West of Te Raekaihau, Wellington.

REMARKS: *Rhizogeton conicum* is somewhat unique within its genus as it has a conical perisarc covering of the caulus into which the polyp can withdraw completely, or occasionally in older polyps at least partially (the cone may not always be large enough to accommodate the whole polyp). Within the genus *Rhizogeton* the polyps of *R. conicum* are similar to those of *R. sterreri* (Calder, 1988). Unfortunately the gonophores of the latter are not known, but *R. conicum* is distinct from *R. sterreri* by the longer perisarc cone and its ability to retract into it. *Rhizogeton sterreri* is not able to do so (D. Calder, pers. comm.). Other similar species are *Rhizogeton ezoense* Yamada, 1964 from Japan and *R. fusiforme* Agassiz, 1862. But both of them have markedly oblong gonophores. The polyps of *R. conicum* also resemble polyps of the genera *Merona* or the little known *Tubiclava*. There is indeed some potential to mistake *R. conicum* for a *Merona* species, because occasionally a few folliculinid ciliates are attached to the stolons. Although smaller, the thecae of these ciliates have a deceptively similar morphology like a perisarc covering of a nematophore as found in *Merona* (cf. Millard 1975). An examination of the soft tissues with a compound microscope, however, reveals the difference.

No males have been found so far, although the species seems to occur quite regularly at its type locality. The living tissue of the female gonophore was very opaque and internal structures could be made visible only by clearing them with lactic acid.

RECORDS FROM NEW ZEALAND: Known only from Wellington's south coast.

Rhizogeton sp. (Fig. 7 a-b)

MATERIAL EXAMINED:
Several colonies (1-2 cm² each) on oysters collected intertidally near Portobello Marine Laboratory, 10.5.1994, colonies transferred and cultivated on plastic petri dishes for three months, no gonophores developed, vegetative propagules developed abundantly and colonies spread to other objects.
2 colonies on mussel and sponge collected 28.6.1994 near Greta Point, Wellington, 0.5 m, infertile.

DESCRIPTION: Hydroid colonies with hydranths arising directly from attached, ramified stolons. Stolons covered by perisarc. Hydranths up to 4 mm high, with shallow basal collar of perisarc, conical hypostome and up to 20 filiform, tapering tentacles scattered in distal half of polyp body. With small red pigment granules in epidermis of hydranth body and tentacle bases.

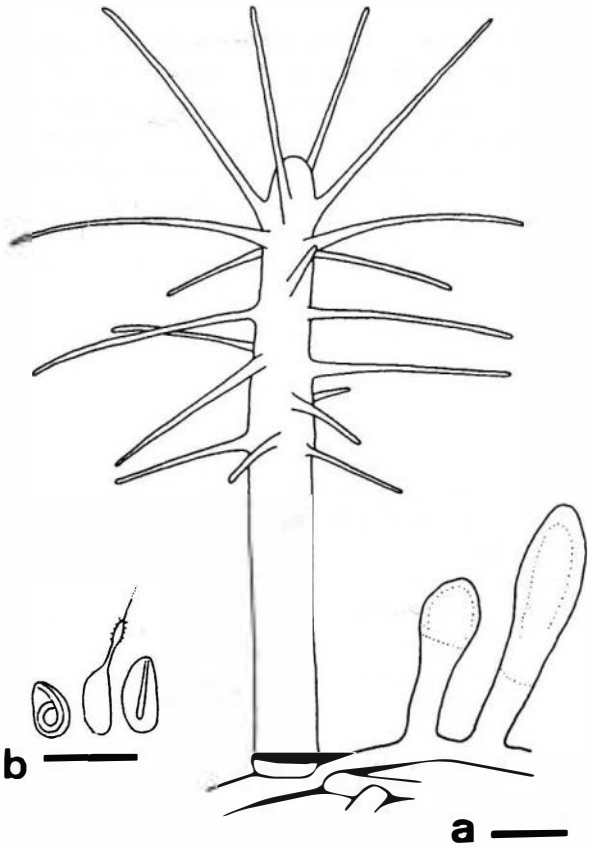


Fig. 7. ***Rhizogeton*** sp. from life. **a**) part of polyp colony with two propagules growing from stolons (right); scale bar 0.5 mm. **b**) nematocysts: desmoneme, microbasic eurytele discharged, same undischarged; scale bar 10 µm.

Spherical to elongated (2 mm long) structures with a perisarc-covered caulus can develop from stolons. These structures (propagules) can detach and are able to re-attach at other sites where they first turn into stolons and later into new colonies. Nematocysts:
a) microbasic euryteles, (7.5-8) x (3-3.5) µm, s = 1.
b) desmonemes, (5.5-6) x (3-3.5) µm.

REMARKS: Because no information on gonophores could be obtained, this species was not given a specific name. The hydranths are very similar to those of *Rhizogeton nudum* Broch, 1909 (cf. Millard 1975; Jones 1992, but these authors disagree on gonophore morphology). The propagules observed in the present study are not known for *R. nudum*. These propagules or their younger stages can easily be mistaken for incipient gonophores. Several of them from various colonies were checked thoroughly with the help of a compound microscope, but gametes or similar cells were never detected. The propagules are hollow and have the same basic organisation as a hydranth body. They are

very sticky and re-attach rather easily. After a short time, the cultivated colony had spread to various points in the aquarium, although the individual colonies remained quite small. The species was rather abundant near Portobello and was also found by P. Ralph around 1955 (unpublished notes kept by Portobello Marine Laboratory).

RECORDS FROM NEW ZEALAND: Portobello; Wellington (this study).

Family CALYCOPSIDAE Bigelow, 1913

Hydroids, where known, living in the prebranchial cavities of ascidians. Polyps colonial, cauli not branching, arising directly from hydrorhiza. Hydrorhiza formed as a plate. Polyps with up to five irregular whorls of filiform tentacles. Gonophores arise from polyps and are liberated as free medusae. Medusae without apical projection and without gastric peduncle. Mouth with four simple or crenulated lips. Gonads on manubrium, simple or folded. Four or eight radial canals, simple or branching. Blindly ending centripetal canals may be present. Marginal tentacles hollow, four, eight, or more in number. Tentacles lack basal bulbs or basal swellings but have terminal swellings with nematocysts. There may also be small or rudimentary tentacles. The basal portion of the tentacle is often adnate to the exumbrella. Ocelli only exceptionally present (Bouillon 1985a).

REMARKS: Characteristics of genera known from New Zealand:

Bythotiara: medusa with four primary radial canals that may branch distally, no centripetal canals.

Calycopsis: medusa with blindly ending centripetal canals.

Bythotiara Guenther, 1903

Hydroids as given in family diagnosis. Medusae as in family diagnosis but with four radial canals which may branch, without centripetal canals. Gonads interradial, with transverse furrows. With or without secondary tentacles.

TYPE SPECIES: *Bythotiara murrayi* Guenther, 1903

REMARKS: Pagès *et al.* (1992) provided a table with the characteristics of all known *Bythotiara* medusae.

Characteristics of species known from New Zealand:

Bythotiara murrayi: medusa up to 20 mm, radial canals branching.

Bythotiara parasitica: hydroids living in ascidians.

Bythotiara sp.: medusa up to 4 mm, radial canals not branching.

Bythotiara murrayi Guenther, 1903 (Fig. 8)

Bythotiara murrayi Guenther, 1903: 424, pl. 10, figs 4–5; Russell 1940: 515; Russell 1953: 215, pl.13, fig. 1, text-figs 113a-b, 114a-b, 115–116; Kramp 1959: 125, figs 1, 132; Kramp 1961: 118; Kramp 1968: 54, fig. 142; van der Spoel & Bleeker 1988: 167, fig. 17; Pagès *et al.* 1992: 7, fig. 7.

MATERIAL EXAMINED:

1 medusa from *Dana* Stn 3627VIII, 30°08'S, 176°50'W, 14.12.1928, 300 m wire, identified by P. Kramp *as Bythotiara murrayi*, very damaged.

1 medusa from *Dana* Stn, 3844V, 12°05'S, 96°45'E, 11.10.1929, 1000 m wire, identified by P. Kramp as *B. murrayi*, very damaged, not recognisable.

DESCRIPTION (after Kramp 1968): Medusa up to 20 mm high, with thick walls; stomach small, with 4 interradial gonads with transverse furrows; radial canals generally 4, bifurcate (but additional branching may occur); long tentacles as many as ends of radial canals; some small secondary tentacles and minute tentacles. Long tentacles ending in terminal swellings. Nematocysts (after Russell 1940):

a) ? euryteles, (17–20) x (10–11) µm.

b) desmonemes, on tentacle tips, discharged with 5 coils, (13–14) x (6) µm.

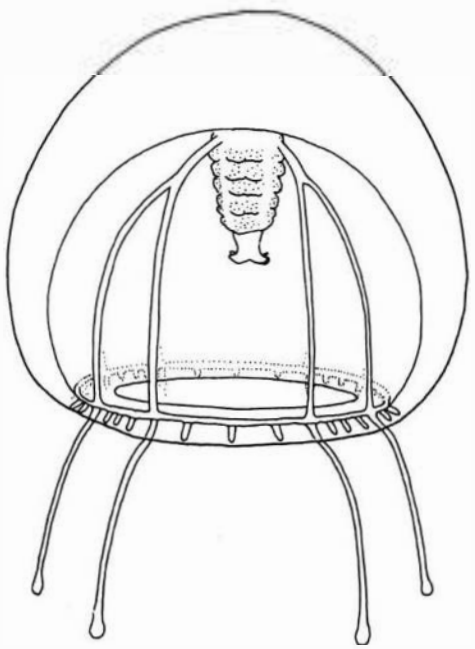


Fig. 8. *Bythotiara murrayi*, modified after Guenther (1903) and other sources; no scale given, rear tentacles and radial canals not shown for reasons of clarity.

TYPE LOCALITY: 52°18.1'N, 15°53.9'W (SW of Ireland).

RECORDS FROM NEW ZEALAND: Near Kermadec Islands (Kramp 1965).

DISTRIBUTION: Eastern parts of Atlantic from Norway to South Africa; Mediterranean; tropical parts of the Indian Ocean; Papua New Guinea (Kramp 1968; Pagès *et al.* 1992).

Bythotiara parasitica (Kirk, 1915) n. comb.
(Fig. 9 a-d)

Ascidioclava parasitica Kirk, 1915: 146, pl. 1, figs 1–6.
Endocrypta huntsmani: Trebilcock 1928: 1; Ralph 1953: 66, fig. 4.
[Not *Endocrypta huntsmani* Fraser, 1911]
? *Endocrypta parasitica*: Briggs & Gardiner 1931: 186.

MATERIAL EXAMINED:
1 colony found in 1 out of 10 *Pyura rugata* Brewin, 1948 (cf. Millar 1982) collected in Scorching Bay,Wellington Harbour, 3 m, 13.9.1994, medusae buds present.
5 colonies found in 5 out of 6 *Pyura rugata* collected in Eve Bay (outside Wellington Harbour), 4–7 m deep, 10.10.1994, medusae buds present, but only the two most advanced were liberated and could be cultivated for a few days only, polyp material deposited.

DESCRIPTION:
Polyp stage: Hydroids living in ascidians, especially *Pyura rugata*. Colonies loosely attached to the feather-like buccal tentacles and also around their base. Polyps with non-branching cauli, arising directly from a plate-like hydrorhiza which is not covered by perisarc. Polyps up to 3 mm high. Larger, relaxed polyps with a cylindrical caulus, egg-shaped body, and a conical to spherical hypostome (depending on state of contraction). On distal part of hydranth body 3 (max. 4) whorls of filiform tentacles, total number 20–30, up to 1 mm long, all of similar length, rather thick. Caulus can be as long as body, transparent, with large gastrodermal cells, not covered by perisarc.
Gonophores (1–4) arise at the basal end of the hydranth body where it turns into the caulus. Gonophores not covered by perisarc, and liberated as medusae. Nematocysts:
a) microbasic euryteles, (10–13) x (4–5) µm, s = 0.9.
b) desmonemes, discharged with 3 coils, (6–9.5) x (3–5) µm.
c) atrichous isorhizas, rare, (13–16) x (6–8) µm.
Colours: hydranth body pink to purple, opaque.

Newly released medusa: Bell-shaped, 1 mm high, higher than wide. Jelly moderately thick. Exumbrella covered with nematocysts which are lost during the following development. Dilated velum spanning one-third of radius. Manubrium somewhat less than half of subumbrellar height, cruciform in cross-section, mouth simple, cruciform. Four radial canals and ring canal present. Tentacle bulbs absent. With 4 perradial tentacles, these shorter than bell height, ending in an intensively orange-coloured terminal swelling. No ocelli present. Nematocysts:
a) microbasic mastigophores, some almost like euryteles, only onexumbrella, (18–20) x (17–19) µm, s = 0.7.
b) microbasic euryteles with long shaft, very faint distal swelling, (7.5–10) x (4–5.5) µm, s = 1.7.
c) microbasic euryteles with short shaft, (6–8.5) x (4–6) µm, s =1.
d) desmonemes, undischarged thread with ropy texture, discharged with 5 to 6 coils, (10–14) x (4–6.5) mm.

TYPE LOCALITY: Wellington Harbour.

REMARKS: *Bythotiara parasitica* very much resembles *B. huntsmani* (Fraser, 1911), but according to Brinckmann-Voss (1979) and Rees (1979b), *B. huntsmani* medusae do not have desmonemes and they are released at a size of 2–2.5 mm, whereas *B. parasitica* medusae are released at a size of 1 mm. Therefore, they are seen here as different species. Also the medusa of *B. stilbosa* Mills & Rees, 1979 does not have desmonemes. *Bythothiara stilbosa* can, furthermore, be distinguished by the possession of macrobasic euryteles. Briggs and Gardiner (1931) reported *B. parasitica* (as *Endocrypta parasitica*) from the Great Barrier Reef in Australia. They give no information on nematocysts and therefore this record has to be verified.

Brinckmann-Voss (1979) and Rees (1979b) found *B. huntsmani* in various ascidian species. During the present study, many dozens of various solitary ascidians were examined from different localities around Wellington, but infected animals could be found only outside or near the harbour entrance and in waters below 3 m deep. Infected animals were confined to one species, identified with some hesitation as *Pyura rugata*, a very abundant ascidian around Wellington. Kirk (1915) also reported a rare occurrence in *Pyura pachydermatina* (syn. *Boltenia pachydermatina*). As for some *Hydractinia* species (Buss & Yund 1989), it should be tested whether the various ascidian species host not different but morphologically indistinguishable species.

As experienced by Brinckmann-Voss (1979) with *Bythotiara huntsmani*, *B. parasitica* polyps can be cultivated only for a short time outside their host. Polyps from nature had their stomachs filled with uni-

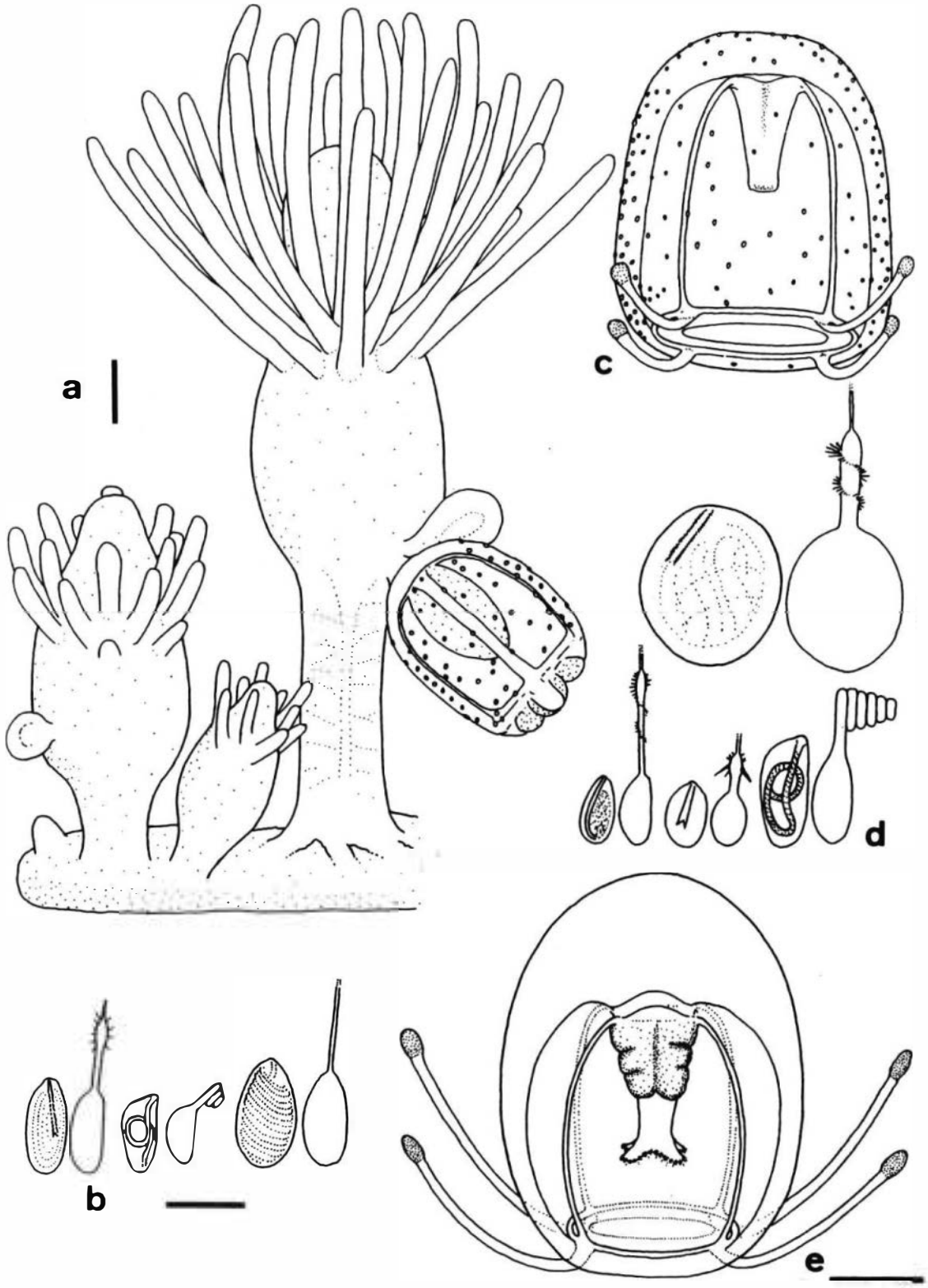


Fig. 9. ***Bythotiara parasitica***, from life. **a)** polyp colony with medusae buds, the two polyps to the left are contracted; scale bar 0.2 mm. **b)** nematocysts of polyp phase in pairs of native and discharged capsules: microbasic euryteles, desmonemes, atrichous isorhiza; scale bar 10 µm. **c)** newly released medusa, same scale as a). **d)** nematocysts of newly released medusa: microbasic mastigophores (top), microbasic euryteles with long shaft, microbasic euryteles with short shaft, desmonemes; same scale as b). **e)** ***Bythotiara*** sp., male, most probably the adult of *B. parasitica*, cultivated from medusae taken from the plankton near Seatoun; scale bar 1 mm.

cellular algae, predominantly diatoms. But in culture they occasionally also fed on *Artemia* nauplii which were brought close to their mouth. Medusae released from the polyps could not be cultivated for more than a few days.

The polyp colonies collected near the Wellington Harbour entrance released medusae which were identical to ones regularly found in the plankton of the harbour and which could be grown to maturity. These medusae were very likely *B. parasitica*. But as long as the medusae of *B. parasitica* have not been cultivated to maturity, it seems more correct to describe these medusae separately as *Bythotiara* sp. (see below).

RECORDS FROM NEW ZEALAND: Polyps known only from Wellington (Kirk 1915, and this study).

OTHER RECORDS: ?Great Barrier Reef, Australia (Briggs & Gardiner 1931).

Bythotiara sp. (Fig. 9e)

MATERIAL EXAMINED:

Fairly regularly present in plankton taken at Seatoun (Wellington Harbour entrance), dates and numbers (in brackets): 8.12.93 (1), 13.1.94 (5), 14.4.94 (4), 18.7.94 (10), 29.8.94 (2), 30.8.94 (5), 11.10.94 (4). All were infertile, ranging in size from 1 mm (morphology as in fig. 9c) to a size of 2.5 mm. The medusae from July could be cultivated to maturity. They were fed on *Artemia* and parts of fish larvae and kept at room temperature. Some material deposited.

1 juvenile medusa collected 15.5.1994 in plankton near Portobello Marine Laboratory (Dunedin).

DESCRIPTION: Mature medusae 3–3.8 mm high, bell-shaped umbrella with thick apical jelly (thickness one-quarter of height), lateral jelly moderately thick. Dilated velum spanning one-third of radius. In younger stages there may be some nematocysts on exumbrella. Manubrium half as long as subumbrellar height, cruciform in cross-section, with 4 simple perradial lips. Mouth margin provided with many tightly set nematocyst clusters and long cilia. Gonads on upper half of manubrium, only slightly separated in perradial position, with an interradial furrow and in males with 2-3 horizontal folds. These folds are quite variable from animal to animal and can be absent in females. Four simple, smooth radial canals and a circular canal are present. No tentacle bulbs present. Perradial tentacles 4, without basal swelling. Basal part adnate to exumbrella for some distance. Tentacles shorter than bell height, terminating in an intensively orange-coloured knob with nematocysts. No ocelli present. Nematocysts:

a) microbasic mastigophores, present on exumbrella of younger animals, (14–18) x (11–15) µm, s = 0.8.
b) microbasic euryteles with long shaft, very faint distal swelling, (7–9) x (3–4) µm, s = 2.
c) microbasic euryteles with short shaft, on manubrium, (6.5–10) x (4–7.5) µm, s = 0.9.
d) desmonemes, on tentacle tips, undischarged thread with ropy texture, discharged with 5 to 6 coils, (9.5–13) x (4–6) µm.

REMARKS: The orange tentacle tips make this medusa rather conspicuous and easy to recognise. As indicated above, this medusa is almost certainly the adult medusa of *B. parasitica*. The medusae were grown from specimens which looked like young ones of *B. parasitica* and their morphology did not change much. Also their nematocysts are identical. However, it seems more correct to wait for a successful rearing experiment before it is definitely allocated to *B. parasitica*. The distinction from the very similar *Bythotiara huntsmani* is again possible through the presence of desmonemes and the smaller size of the bell.

Young stages of this medusa are very difficult to cultivate. Only when they become older are they easier to feed. In contrast to *B. huntsmani*, however, they seem not very temperature-sensitive as they could be maintained at room temperature. Medusae show an interesting feeding reaction — upon contact with prey the tentacles bend into the subumbrella, which closes by contracting not only the velum but the margin.

RECORDS FROM NEW ZEALAND: Cook Strait (Bouillon 1995, as ?*B. huntsmani*); Wellington and Portobello (this study).

OTHER RECORDS: Not known outside New Zealand.

Calycopsis Fewkes, 1882

Calycopsid medusae with mainly four unbranched radial canals and with four or more centripetal canals arising from the ring canal, blindly ending or joining the cruciform base of the stomach. Gonads transversely folded, frequently forming eight adradial rows of deep transverse furrows. Basal portion of tentacles adnate to umbrella margin; all tentacles hollow, nematocysts only in the terminal knob (Kramp 1961).

TYPE SPECIES: *Calycopsis typa* Fewkes, 1882.

REMARKS: An overview of the genus is given in Kramp (1959). No polyp stages are known. At present there is only one species known from New Zealand waters.

Calycopsis bigelowi Vanhoeffen, 1911 (Fig. 10a-b)

Calycopsis bigelowi Vanhoeffen 1911: 218, fig. 12; Kramp 1957a: 21, map fig. 4; Kramp 1959: 127, fig. 136; Kramp 1961: 119; Kramp 1968: 56, fig. 149; van der Spoel & Bleeker 1988: 167, fig. 16.

MATERIAL EXAMINED:

1 medusa, 16 mm high, from NZOI Stn X480F, 41°20.4'S, 179°05.8'E (east of Cape Palliser), 17.10.1993, 200–400 m.

For comparison, 17 medusae from *Dana* Stn 3809 (near Sumatra & Java, 6°14.5'S, 105°06.5'E), 4.9.1929, 600 m wire, up to ~1 cm in size, det. P. Kramp.

DESCRIPTION: Mature medusa up to 16 mm high, diameter 16 mm, spherical. Jelly thick (3 mm), soft and adhesive. Velum somewhat sunken into bell. Manubrium length two-thirds of bell cavity, with cross-shaped base. Mouth with slightly undulating margin and with 4 small perradial lips. With 4 large interradial gonads leaving only perradial parts of manubrium visible. Gonads with 8 adradial rows of up to 16 horizontal folds. With 4 complete radial canals, those near manubrium dilated and thus forming mesenteries. With 4 additional centripetal canals which almost reach manubrium base but end blindly, terminal region somewhat broadened. All radial canals are rather broad and are connected to the equally broad circular canal. There are no tentacular bulbs present. With 4 perradial, 4 interradial, and 8 adradial tentacles. Perradial and interradial tentacles are all fully developed, most of the adradial tentacles are also fully developed but some are shorter and developing. In addition to these 16 long tentacles there are 16 very short tentacles, one in between each pair of longer tentacles. All tentacles are hollow and at their base adnate to the exumbrella. All full-length tentacles end in a terminal swelling with a distal concentration of nematocysts. Tentacles shorter than full-length ones have no distal swelling, but a concentration of nematocysts is present distally. No ocelli present. Nematocysts:

a) desmonemes, on tentacle tips, discharged with 5 coils, thread with spiral pattern of small bristles, (11–12) x (5–6) µm.
b) heteronemes, rare, not seen discharged (14–15) x (7–8) µm.

TYPE LOCALITY: Gulf of Aden.

REMARKS: *Calycopsis* medusae are quite rare and are known only from a few individuals from few locations (Kramp 1959). Therefore little is known about their morphological variation and development. The single medusa collected from New Zealand is rather well preserved, but differs somewhat from the existing descriptions and also the examined specimens from

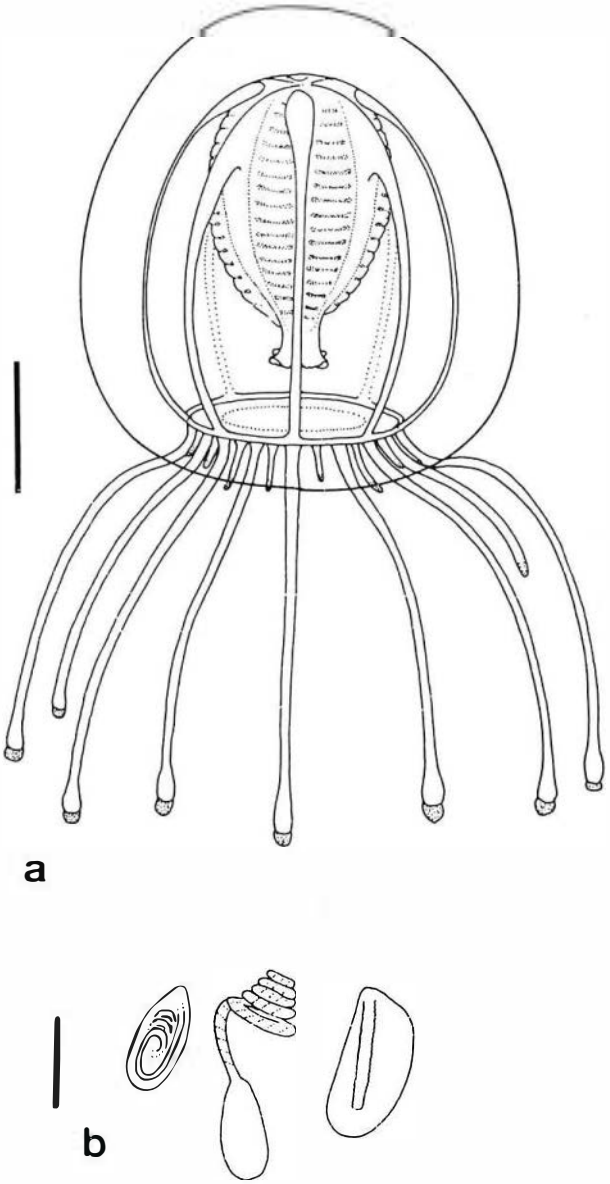


Fig. 10. ***Calycopsis bigelow***, from Cape Palliser. **a)** medusa, only frontal tentacles shown; scale bar 5 mm. **b)** nematocysts: desmoneme, same discharged, rare heteroneme; scale bar 10 µm.

Indonesia. The major difference was in the bell size and morphology of the gonads. While the other medusae had fewer (around 10) and looser gonad folds, the medusa from New Zealand had up to 16 folds which were very tightly set. They resembled the gonads of the other large *Calycopsis* medusae. The other difference concerned the tentacles. While other *C. bigelowi* are known with 8 fully grown tentacles (Kramp 1968; van der Spoel & Bleeker 1988), the present samples also had most of the adradial tentacles fully grown. However, a few of them were not fully grown and some did not yet have the terminal swelling. The very

short tentacles were again as described by others. These differences are not seen as sufficient to create a new species, and the medusa from New Zealand appears to be an older, more developed specimen. The examined material from Indonesia had gonads with visible eggs. It may therefore be that *C. bigelowi* continues its growth after gonads have become mature. Such a post-mature growth is known in other medusae and has been the cause of some taxonomic problems (cf. Kubota 1992).

Another species of calycopsid medusa with four blindly ending centripetal canals is *Calycopsis borchgrevinki* (Browne, 1910). This species most probably also occurs in southern parts of New Zealand due to its circumpolar occurrence in subantarctic waters. However, this species has a very different gonad structure, with the gonads sunken into the manubrium with many circular openings (cf. Browne 1910; Moore 1984; van der Spoel 1992). Kramp (1968, fig. 146) copied the somewhat atypical figure of Vanhoeffen (1911).

RECORDS FROM NEW ZEALAND: Cape Palliser (this study).

OTHER RECORDS: Gulf of Aden; Cape of Good Hope; Indo-Malayan region; tropical Indian Ocean; in deeper waters down to 600 m (Kramp 1965; van der Spoel & Bleeker 1988).

Family **BOUGAINVILLIIDAE** Luetken, 1850

Stolonal or branching hydroid colonies, exceptionally sessile. Branches covered with perisarc. The perisarc terminates either at the base of the hydranths or continues over them as a thin, filmy pseudohydrotheca. The polyps have one or more distal whorls of filiform tentacles. The gonophores are either fixed sporosacs or are liberated as medusae. Gonophores develop mostly from cauli or branches, occasionally from hydrorhizae or rarely from modified hydranths. Medusae have a simple circular mouth with oral tentacles inserted above it. Oral tentacles are either simple or branched. Gonads differentiate either in interradial, adradial, or perradial positions, or encircle the manubrium. Four radial canals and a circular canal are always present. Marginal tentacles are simple, either two, four, or more solitary tentacles, or groups of tentacles arising from four, eight or sixteen bulbs. With or without ocelli.

REMARKS: The Bougainvilliidae are an assemblage of quite different hydroids and difficult to delimit from other families (Calder 1988). Future revisions will certainly be quite extensive. Therefore, the more usual classification of Bouillon (1985a) is used here and not that of Calder (1988). Bougainvilliid polyps without reproductive structures are often not distinguishable from those of the family Pandeidae.

Characteristics of genera known from New Zealand:

Bougainvillia: free medusae with four groups of marginal tentacles.

Dicoryne: dimorphic polyps, gonophores develop on gonozooids as sporosacs that are liberated.

Gravelya: monomorphic polyps with gonophores reduced to sporosacs arising also from stolons.

Koellikerina: free medusae with 8 groups of marginal tentacles.

Bougainvillia Lesson, 1836

Colonial hydroids, branching or not. Hydranths may be covered by thin, wrinkled perisarc called pseudohydrotheca. Hydranths with one whorl of filiform tentacles, which are never enveloped by perisarc. The gonophores are liberated as free medusae. Medusae with four oral tentacles which may be branched or not, attached above level of mouth. Marginal tentacles all alike and set into four perradial groups. Normally with ocelli. The gonads are either in perradial, interradial, or adradial positions (after Bouillon 1985a).

TYPE SPECIES: *Bougainvillia macloviana* (Lesson, 1830).

REMARKS: With the exception of *B. inaequalis*, most *Bougainvillia* polyp colonies are not identifiable alone and information on the adult medusa is needed. For a review of *Bougainvillia* species see Vannucci and Rees (1961).

Characteristics of species present in New Zealand:

B. aurantiaca: medusa small, up to 4 tentacles per bulb, without ocelli.

B. fulva: medusa less than 14 mm high, 15–20 short tentacles per bulb, with 8 adradial gonads, well separated interradially.

B. inaequalis: polyp colonies with wrinkled perisarc throughout, medusa unknown.

B. macloviana: medusa up to 15 mm high, with large peduncle, bulbs with 30–60 tentacles.

B. muscus: small medusa, up to 3 mm, with not more than 5 tentacles per bulb.

B. platygaster: medusa up to 12 mm high, with flat and quadrangular stomach, up to 10–13 tentacles per bulb, crescent-shaped ocelli, oral tentacles with very short trunk.

B. vervoorti: medusa up to 7 mm, up to 30 tentacles per bulb, large cross-shaped base of stomach bearing gonads.

B. dimorpha: medusa up to 5 mm, not more than 10 tentacles per bulb, sexually dimorphic, male with gonads.

Bougainvillia aurantiaca Bouillon, 1980 (Fig. 11)

Bougainvillia aurantiaca Bouillon, 1980: 309, fig. 1; Goy *et al.* 1991: 107, fig. 19.

MATERIAL EXAMINED:
2 medusae, 1.2–1.5 mm, collected by Treffery Barnett in June to July 1984, Leigh Marine Reserve.

DESCRIPTION: Medusa with bell-shaped umbrella, up to 1.5 mm, with slightly thicker jelly at apex. Manubrium simple, conical, length half to two-thirds of bell cavity, with or without a very slight peduncle (preserved material), with simple mouth and 4 perradial oral tentacles. Oral tentacles branching 2 to 3 times and ending in nematocyst clusters. Basal trunk of each oraltentacle very long, up to half of total length. Gonads as 4 separated elongated pads in interradial position on manubrium, may contact each other in perradial position. Radial canals and circular canal rather narrow. Four perradial tentacle bulbs, each bearing 2–3 tentacles. Ocelli absent. Nematocysts:
a) heteronemes (microbasic euryteles ?), (6.5–7) x (3.5–4) µm.
b) desmonemes (5.5–6) x (3.5–4) µm.
Polyp stage: unknown.

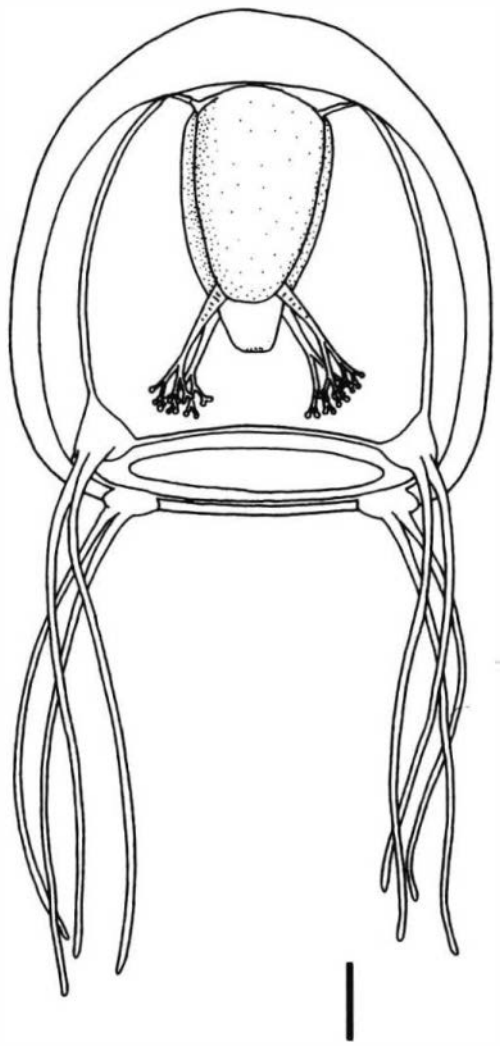


Fig. 11. ***Bougainvillia aurantiaca*** from Leigh; scale bar 0.2 mm.

TYPE LOCALITY: Laing Island, Papua New Guinea.

REMARKS: The medusa may reach 1.9 mm in height (Bouillon 1980) or even 2.5 mm (Barnett 1985). The tentacle bulbs are intensively orange in living animals (Bouillon 1980).

The absence of ocelli and the long basal trunks of the oral tentacles make this species rather distinctive. A similar species is *Bougainvillia muscoides* which also has no ocelli, but can be two times as large and has short basal trunks. Bouillon (1995) reported this species for New Zealand, although with a query. His material was re-examined for this study (NZOI collection, Stn N449). All other *Bougainvillia* medusae from this collection have lost their ocelli because of fixation. It is therefore impossible to identify the small *Bougainvillia* species because no information on the ocelli can be obtained. It seems better therefore to disregard the record of *B. muscoides* from New Zealand.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985).

OTHER RECORDS: Papua New Guinea (Bouillon 1980), Mediterranean (Goy *et al.* 1991).

Bougainvillia fulva Agassiz & Mayer, 1899 (Fig. 12)

Bougainvillia fulva Agassiz & Mayer, 1899: 162, pl. 2, fig. 6; Maas 1905: 10, pl. 1, fig. 8, pl. 2, figs 9–10; Vanhoeffen 1911: 207; Kramp 1928: 47, figs 21–23; Kramp 1961: 77; Kramp 1968: 33, fig. 84; Bouillon 1995: 223.

MATERIAL EXAMINED:
3 medusae from NZOI Stn N421, 41°24.4'S, 174°45'E, 0–100 m, 19.12.1974.

DESCRIPTION: Medusa bell-shaped, up to 11 mm, higher than wide. Jelly thick (one-fifth bell height), bell margin lobed through 4 perradial furrows. Manubrium broad, cruciform in cross section, length about one-quarter to one-third of bell cavity, with 4 perradial oral tentacles. Each oral tentacle branched up to 5 times and all endings with a nematocyst cluster. Basal trunks of oral tentacles very short. Gonads as 8 oblong adradial pads on manubrium wall, well separated interradially and perradially. Four moderately broad radials and a ring canal. Four broad, V-shaped per-

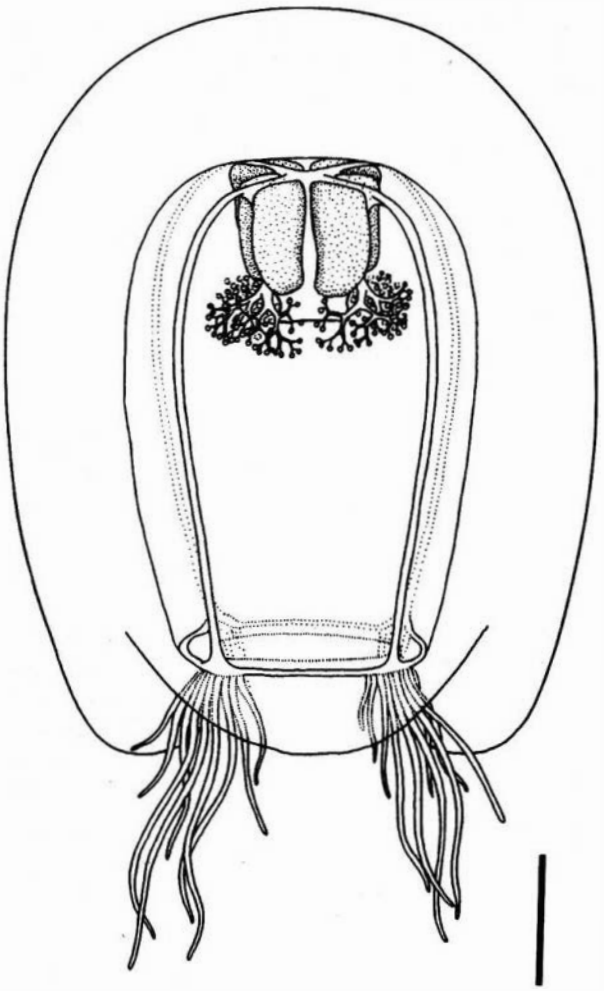


Fig. 12. ***Bougainvillia fulva***; scale bar 2 mm.

radial tentacle bulbs with up to 10 short tentacles. Polyp stage unknown.

TYPE LOCALITY: Fiji Islands.

REMARKS: Ocelli occur at tentacle bases and are slightly elongated (Vannucci & Rees 1961); the stomach may bud medusae (Kramp 1965) and the eggs are not covered by a layer of nematocysts (Hartlaub 1909b).

The bell margin of New Zealand *Bougainvillia fulva* was found to be lobed due to perradial notches in the bell margin which allow the tentacles more freedom to move. Vanhoeffen (1911) also described the same morphology. The existing descriptions and figures of *B. fulva* are not satisfying and some are even contradictory (e.g., Agassiz & Mayer 1902, and Bigelow 1909 on jelly). *Bougainvillia fulva* as described by Uchida (1927: 221, fig. 40) may not be this species because its gonads are interradial.

RECORDS FROM NEW ZEALAND: Off Christchurch (Kramp 1965); Cook Strait (Bouillon 1995).

DISTRIBUTION: Tropical parts of the Indian Ocean and eastern Pacific Ocean (Kramp 1968; map in van der Spoel & Bleeker 1988).

Bougainvillia cf. ***inaequalis*** Fraser, 1944

(Fig. 13a-b)

Bougainvillia inaequalis Fraser 1944: 51, pl. 5, fig. 20; Ralph 1953: 63, fig. 3; Vannucci & Rees 1961: 67, table 4.

MATERIAL EXAMINED:

1 colony on shell from NZOI Stn E251, 34°35'S, 172°35'E, (North Cape), 6.4.1965, 9 m, dredged on sand, infertile, not fascicled, only tentatively assigned to this species.

DESCRIPTION (after Vannucci & Rees 1961): Erect, branching colonies. The stem and sometimes the main branches fascicled. Stems 7 mm high and straight, there are only small branches or pedicels given off singly or in clusters. The perisarc is very much wrinkled and extends up to the base of tentacles on the hydranth. The latter has from 8–10 tentacles. Medusa buds are borne singly or in clusters on the pedicels of the hydranths. Medusa unknown.

TYPE LOCALITY: Louisiana, USA.

REMARKS: As long as its life cycle remains unknown, *Bougainvillia inaequalis* is an insufficiently described

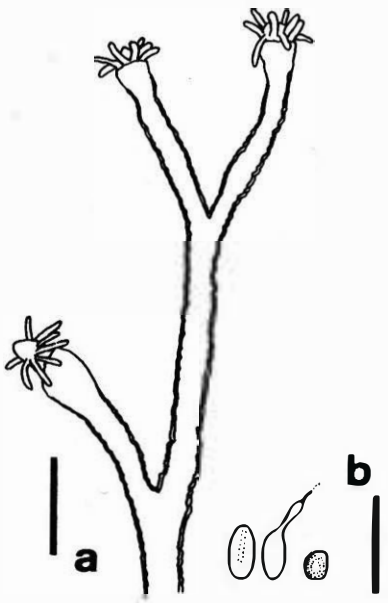


Fig. 13. ***Bougainvillia*** cf. ***inaequalis*** from Stn E251. **a**) terminal portion of colony showing wrinkling of perisarc, CL; scale bar 0.2 mm. **b)** nematocysts: microbasic eurytele, same discharged, desmoneme; scale bar 10 µm.

species and should not be used for identifications outside its type locality. Its main characteristic is the strong wrinkling of the perisarc, which in other species, however, is always to some extent dependent on the environment. While the figures given by Ralph (1953) agree well with Fraser's (1944) description, the sample examined in the present study (Fig. 13a) differs in being non-fascicled. Only the strong wrinkling of the perisarc was used to allocate it tentatively to this species. More observations from the type locality and New Zealand are needed to resolve the doubtful status of this species.

RECORDS FROM NEW ZEALAND: Lyttleton Harbour (Ralph 1953); ?North Cape (this study).

OTHER RECORDS: Louisiana, USA.

Bougainvillia macloviana (Lesson, 1830)
(Fig. 14a-c)

Cyanea macloviana Lesson, 1830: 118, pl. 14, figs 3D-D".
Hippocrene macloviana: Haeckel 1879: 90, pl. 5, figs 1-2.
Hippocrene: Benham 1909: 306, pl. 12, figs 1-2.
Perigonimus maclovianus: Vanhoeffen 1910: 284, fig. 10a-c.
Bougainvillia macloviana Mayer 1910: 160; Hartlaub 1911: 156, fig. 139; Russell 1953: 173, figs 86-88B (*cum syn.*); Kramp 1959: 109, fig. 85; Kramp 1961: 78; Kramp 1968: 32, fig. 78; Millard 1975: 96, fig. 33A-C; O'Sullivan 1982: 38, fig. 16, map 15; Pagès *et al.* 1992: 3, fig. 1; Bouillon 1995: 223.

MATERIAL EXAMINED:
About 6 preserved medusae collected by K. Westerkov (obtained through T. Barnett), Perseverance Harbour, Campbell Island, March 1984, size range 8-11 mm high with up to 60 tentacles per bulb.
2 medusae from NZOI Stn N453, 46°00.8'S, 166°36.4'E, off Puysegur Point, Fiordland.

DESCRIPTION:
Medusa: Diameter 8 -11 mm (maximally up to 15 mm), bell as high as wide or slightly higher than wide, with quadrangular margin, with 4 broad interradial longitudinal furrows, jelly moderately thick, thickened at apex. Stomach short, on a well-developed cone-shaped peduncle. Four narrow perradial lobes of stomach extend along peduncle. Manubrium with 4 perradial oral tentacles, not extending beyond umbrella margin, each branching 5-7 times, all endings with a nematocyst cluster. Basal trunks of oral tentacles rather short. Gonads on perradial lobes of manubrium that extend along peduncle. With fairly narrow radial canals and ring canal. Four crescent- or V-shaped perradial marginal bulbs, about half as wide as interradial space, with 30-60 solid tentacles on each tentacle bulb, arranged in a double row. Adaxial ocelli corresponding in number to the tentacles present on bulbs at base

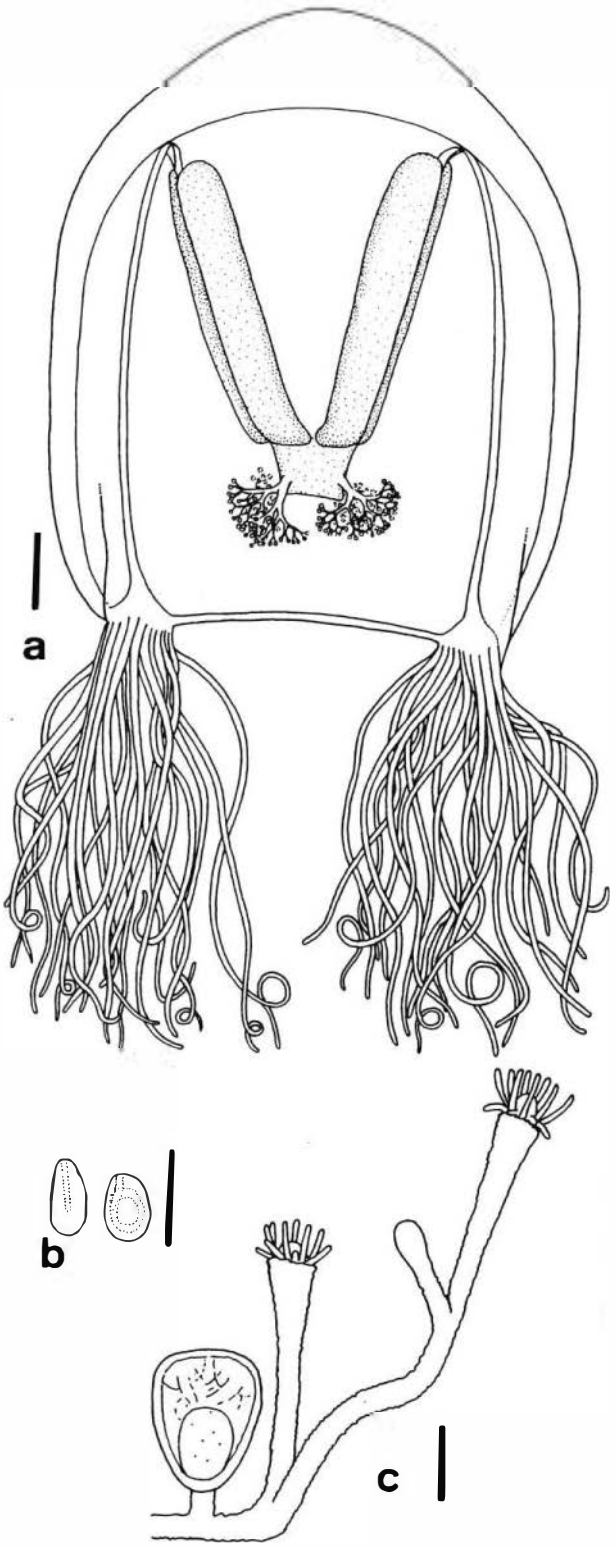


Fig. 14. ***Bougainvillia macloviana***. **a)** mature medusa from Campbell Island, scale bar 1 mm. **b)** nematocysts of medusa: microbasic eurytele and desmoneme, scale bar 10 µm. **c)** polyp stage redrawn from Vanhoeffen (1910); note: the polyp stage is not yet known from New Zealand; scale bar 0.5 mm.

of each tentacle, shape round, colour red. Eggs covered with euryteles. Nematocysts:
a) microbasic euryteles, on tentacles and eggs, (7–8) x (3–4) mm, s = 0.8.
b) desmonemes, (6–7) x (4–4.5) mm.

Polyp stage (after Vanhoeffen 1910, not known from NZ): Stolonial hydroid colonies, infrequently branched, cauli several millimetres high, but often low-lying. Perisarc smooth or wrinkled, but not annulated, continued as thin pseudohydrotheca over hydranth. Hydranth small, with up to 16 tentacles. Medusa buds reach 1 mm in diameter and originate from stolons or stems. Medusae may be released with more than 2 tentacles per bulb (not in South Africa, *see* Millard 1975).

TYPE LOCALITY: Falkland Islands.

REMARKS: *B. macloviana* is restricted to cold, subantarctic waters. There it may occur in rather high numbers. It also occurs in the North Atlantic, where it has most probably been transported on ship hulls.

RECORDS FROM NEW ZEALAND (MEDUSA): Auckland and Campbell Island (Benham 1909; Roberts 1972), south tip of South Island (Bouillon 1995).

OTHER RECORDS: Falkland Island, Kerguelen, North Sea (Russell 1953), South Africa (Millard 1975), Mozambique, Benguela Current (Pagès *et al.* 1992).

Bougainvillia muscus (Allman, 1863) (Fig. 15a-e)

Eudendrium ramosum: van Beneden, 1844: 56, pl. 4.
[not *Eudendrium ramosum* (Linnaeus, 1758)]
Perigonymus muscus Allman, 1863: 12.
Bougainvillia ramosa: Russell 1938a: 152; Ralph 1953: 63, fig. 9, not fig. 25; Russell 1953: 153, pl. 8, fig. 1, pl. 9, figs 4–5, text-figs 74A–C; Kramp 1959: 109, fig. 91; Kramp 1961: 81 (*cum syn.*); Vannucci & Rees 1961: 53; Kramp 1968: 34, fig. 87; Millard 1975: 97, figs 33E–H; Hirohito 1988: 97, figs 34b-f.
Bougainvillia muscus: Calder 1988: 24, figs 19–20 (*cum syn.*).

MATERIAL EXAMINED:
Several living polyp colonies, up to 50 mm high, fascicled, from Mahanga Bay, Wellington Harbour, 4 m, collected 30.3.94, medusae released and cultivated to maturity, some material deposited.
Adult living medusa, from plankton from Evans Bay, 18–27.4.1994, 7 specimens, 1–2.5 mm, up to 4 marginal tentacles, oral tentacles once- or twice-branched, some material deposited.
Preserved colony, 70 mm, fascicled, fertile, from Doubtful Sound, collected 26.11.1993, 7 m, only tentatively assigned to *B. muscus*.
Preserved colonies from fouling panels, collected by S. Turner from Waitemata Harbour, Auckland, 4 m, fascicled, up to 30 mm high, most probably this species.
Approx. 5 preserved medusae collected by T. Barnett, Leigh Marine Reserve, 1984.

DESCRIPTION:
Polyp stage: Hydroids forming erect, branching colonies reaching 50 mm in height, arising from attached, ramified stolons. Stem fascicled (depending on age), branching profusely and irregularly. Branches forming a pointed angle with stem. Perisarc in colonies from nature infested with detritus, may be wrinkled but not regularly annulated. Perisarc may continue as thin film over body of hydranth as a pseudohydrotheca. Stolonisation (search stolons) common in all parts of colony, especially in cultivated material. Hydranths with conical hypostome and 1 whorl of about 12 tentacles. Medusa buds arise singly or in groups from hydranth cauli and smaller branches, smaller than hydranths, with short stalks, conical when young. Nematocysts:
a) microbasic euryteles, (7–8) x (4–4.5) mm, s = 0.8.
b) desmonemes, discharged with 4 coils, (4–5) x (2.5–3) mm.

Young medusa: Medusa after release approximately 0.6 mm high, bell-shaped, apical canal may be present. Tubular manubrium with 4 very short, unbranched oral tentacles. With 4 marginal bulbs, each with a pair of slightly beaded tentacles. Marginal bulbs with 2 adaxial red ocelli. There are no exumbrellar nematocysts present. Nematocysts:
a) microbasic euryteles, (5.5–8) x (2.5–4) mm, s = 0.7.
b) desmonemes, (4–5.5) x (2.5–3) mm.

Mature medusa: Up to 2.5 mm, bell as broad as high, jelly slightly thicker apically. Bulbous manubrium, length approximately half of subumbrellar height. Oral tentacles once- or twice-branching. With 4 marginal bulbs, each with up to 4 tentacles and ocelli. Ocelli round. Gonads interradial but reaching perradius, bulging. Mature eggs are covered with a layer of euryteles. Nematocysts:
a) microbasic euryteles, (5.5–7) x (3–4) mm.
b) desmonemes, (4–4.5) x (2.5–3) mm.

TYPE LOCALITY: Torquay, Devon, Great Britain.

REMARKS ON VARIATION: *Bougainvillia muscus* is a very variable species. From the literature (e.g., Russell 1953; Vannucci & Rees 1961; Edwards 1966b) the medusa can reach 4 mm in size with up to 9 tentacles per bulb, and the oral tentacles may branch up to 4 times. However, mature animals of only 1 mm size can also be found. More than 5 tentacles per bulb are rare

(Vannucci & Rees 1961). Barnett (1985) reported sizes up to 3.5 mm and 9 tentacles per bulb. Only a few of Barnett's *Bougainvillia* medusae could be re-examined. While the mature animals having fewer than 5 tentacles per bulb are doubtless *B. muscus*, the ones having up to 9 are other species (some of them have crescent-shaped ocelli). Unfortunately not enough material and information became available to identify and describe them properly. Younger females of *B. dimorpha* n.sp. may be also be mistaken for *B. muscus*. Therefore, especially for New Zealand material, *Bougainvillia* medusae with more than 5 tentacles per bulb most probably do not belong to *B. muscus*.

In the present life-cycle study, maturity was attained even at 0.8 mm (cultivated animal) with 2 tentacles per bulb only. Adults from the plankton in Wellington were found to be not larger than 2.5 mm, 4 tentacles per bulb maximally.

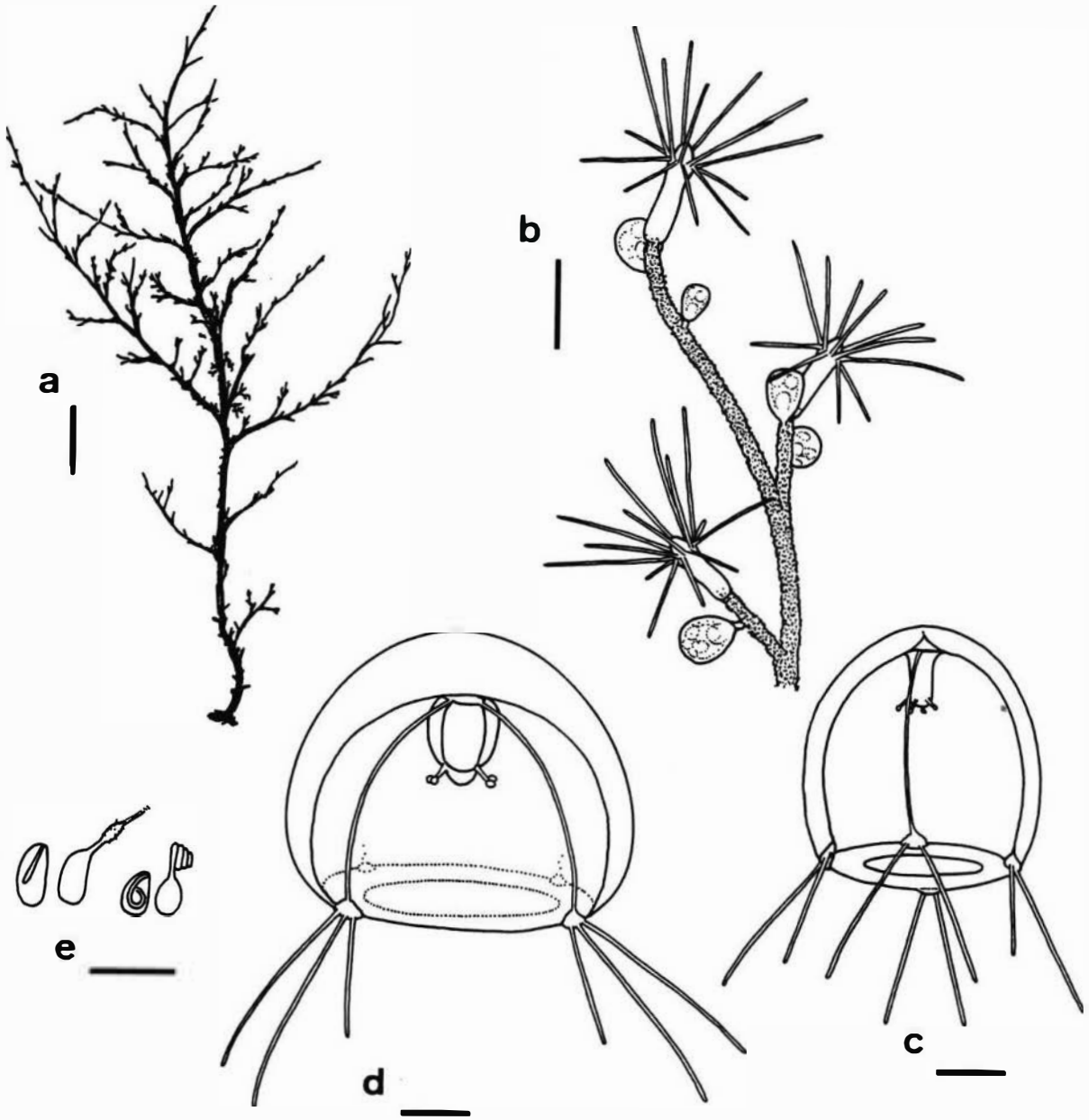


Fig. 15. ***Bougainvillia muscus***, all from life. **a)** colony from Wellington Harbour; scale bar 5 mm. **b)** terminal branch of a colony with medusa buds which has been kept in culture for about four days. Compared to samples directly from nature, cultivated colonies tend to have larger hydranths without a pseudohydrotheca, scale bar 0.5 mm. **c)** newly released medusa; scale bar 0.2 mm. **d)** adult male medusa grown from hydroid shown above, 8 days old, scale bar 0.2 mm. **e)** nematocysts of polyp or medusa: microbasic eurytele, same discharged, desmoneme, same discharged; scale bar 10 µm.

GENERAL REMARKS: *Bougainvillia muscus* is better known under its synonym *B. ramosa*, but Calder (1988) showed that only the former name is valid. Although for a correct identification the medusa must be grown to maturity, large, fascicled *Bougainvillia* colonies originating from harbours where the medusa is known can quite reliably be referred to *B. muscus* (in New Zealand). One sample of large, fascicled *Bougainvillia* was obtained from Doubtful Sound. It differed from the other samples in lacking a detritus cover. Because the mature medusa is not known and also almost no information on medusae from Fiordland is available, the identification is very tentative.

The medusa depicted by Ralph (1953, fig. 25) is not *B. muscus*, but *B. britannica* copied from Mayer (1910). Ralph admitted, however, that the medusa was not known from New Zealand.

Bougainvillia muscus hydroids are very easy to cultivate and will produce many medusae, which are also easy to cultivate. Especially in culture, but also in natural samples, stolons (search stolons) often issue from terminal branches. By this, detached parts of the colony can rapidly fix themselves to any substratum. The search stolons also help to colonise neighbouring erect structures like other hydrozoans. *Bougainvillia muscus* can spread very rapidly in an aquarium.

RECORDS FROM NEW ZEALAND: Polyp known from Portobello; West Coast; Coromandel (Ralph 1953); Wellington Harbour; Waitemata Harbour (Auckland); ?Doubtful Sound (this study). The medusa is known from near Goat Island, Leigh (Barnett 1985) and Wellington Harbour (this study).

OTHER RECORDS: East Australia (the hydroid in Australia, Amboina, China and Japan). Northwestern Europe, Mediterranean, Black Sea, West Africa, New England, Brazil (all after Kramp 1968), Papua New Guinea (Bouillon 1980, medusa), ?South Africa (Millard 1975).

Bougainvillia platygaster (Haeckel, 1879) (Fig. 16)

Hippocrene platygaster Haeckel, 1879: 91.
Bougainvillia platygaster Kramp 1957: 9, text-fig. 1, pl. 3, figs 1–6; Kramp 1959: 109, fig. 89; Kramp 1961: 80; Kramp 1968: 34, fig. 86; Bleeker & van der Spoel 1988: 230, figs 89; Pagès *et al.* 1992: 4, fig. 2; Bouillon 1995: 227, fig.1.

MATERIAL EXAMINED:
1 medusa, NZOI Stn N404, 41°38'S, 175°19'E, 0–51 m, 17.12.1974, 7 mm high, well-preserved but no ocelli visible.

DESCRIPTION (after present material and Kramp 1957): Medusa with globular umbrella 4 –7 mm (up to 12 mm) high, with slightly flattened apex, jelly very thick, sub-

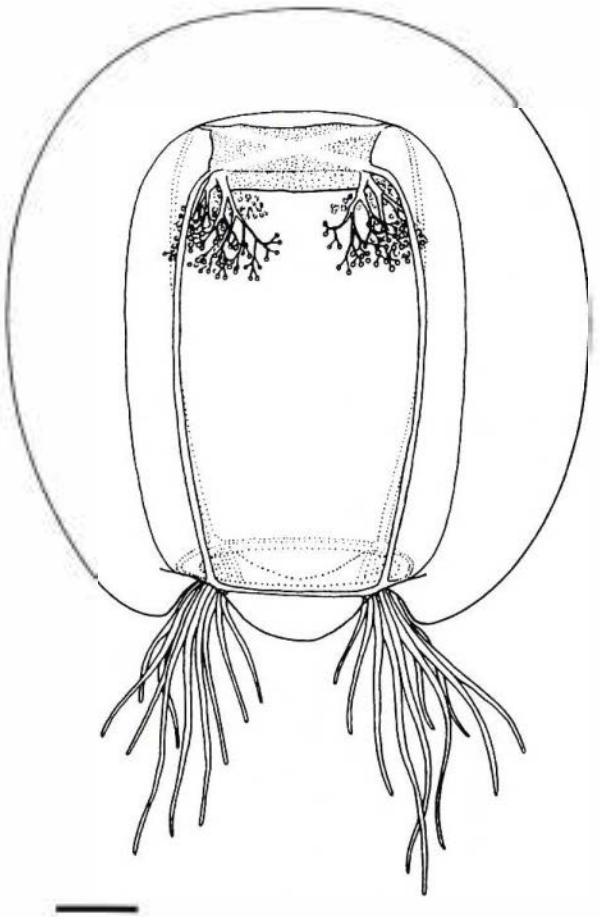


Fig. 16. ***Bougainvilla platygaster*** from Cook Strait; scale bar 1 mm.

umbrella cylindrical, bell margin with perradial notches. No peduncle present. Manubrium very broad but very short and quadrangular, with 4 perradial oral tentacles. Oral tentacles arising close to radial canals and branching dichotomously up to 6 times immediately from their point of origin, no basal trunk present. Oral tentacles end in nematocyst clusters. Medusae may be budded from manubrium or from polypoid structures arising from the corners of the manubrium. Gonads interradial pads, flat, not divided interradially. With 4 small but broad triangular marginal bulbs with 10–13 short tentacles. With adaxial ocelli, crescent-shaped with concavity turned outwards. Polyp stage unknown.

TYPE LOCALITY: Island of Trinidade (Brazil) (Neotype after Kramp 1957).

REMARKS: The bell margin of *Bougainvillia platygaster* was lobed due to clefts in the perradial position allowing the tentacles to move more freely (see also p. 29).

RECORDS FROM NEW ZEALAND: Cook Strait (Bouillon 1995).

OTHER RECORDS: Tropical parts of the Atlantic and Indian Oceans, Malayan Archipelago, Bismarck Sea, Fiji Islands, Benguela Current (Bouillon 1995).

Bougainvillia vervoorti Bouillon, 1995
(Fig. 17a-e, 18a-e)

Bougainvillia vervoorti Bouillon, 1995: 228, figs 2, 3a.

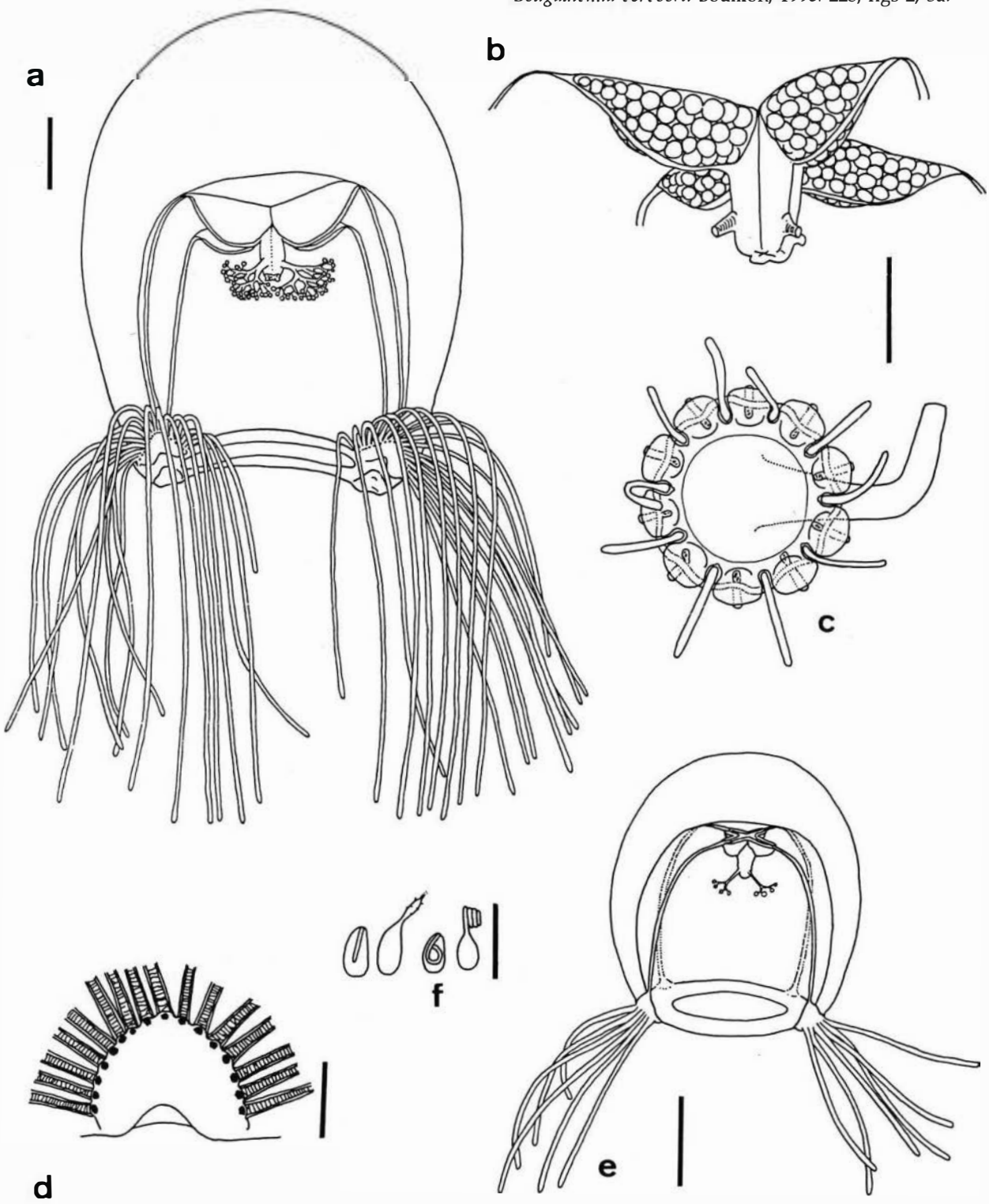


Fig. 17. ***Bougainvillia vervoorti***, from life. **a)** adult male medusa, rear tentacles not shown; scale bar 1 mm. **b)** manubrium and gonads of a female medusa, oral tentacles removed; scale bar 0.5 mm. **c)** frequently found juvenile parasitic Narcomedusa; scale bar 0.5 mm. **d)** tentacle bulbs of adult, CL; scale bar 0.2 mm. **e)** juvenile medusa from the plankton; scale bar 1 mm. **f)** nematocysts; microbasic eurytele, desmoneme; scale bar 10 µm.

MATERIAL EXAMINED:

Holotype H-619, NZOI Stn B706, 41°17.4' S, 174°47.1'E, (end of Clyde Quay, Wellington Harbour), 9 m, female, collected 13.9.62, kept in NIWA type collection.

Paratypes P-970, same locality, 20.9.62, 2 damaged specimens; P-971, same locality, collected 28.9.62, 4 specimens.

Ca. 50. living adult medusae, plankton Evans Bay and Seatoun, Wellington Harbour, collected November to December 1993, some deposited.

1 male medusa collected at Portobello, Dunedin, 13.5.94.

Polyp colonies grown from planulae produced by medusae, cultivated for more than 4 months, material deposited.

Polyp colony from Evans Bay, growing on tube of serpulid polychaete, collected 30.11.93, 1 m; colonies released medusae which were cultivated for 16 days until specific characters became evident (see Appendix), material deposited.

DESCRIPTION:

Medusa: Adult medusa bell-shaped, 4–10 mm high and slightly smaller diameter. Umbrella with no or shallow interradial furrows. Jelly thick, at apex one-third or more of bell height; a slight peduncle may be present; basal part of bell quadrangular, bell margins between bulbs concave. Manubrium with large, perradial extension of base, heights of extensions increase up to the middle then taper. Manubrium length one-quarter of bell cavity, with 4 long oral tentacles, branching 5–7 times, ending in nematocyst knobs,

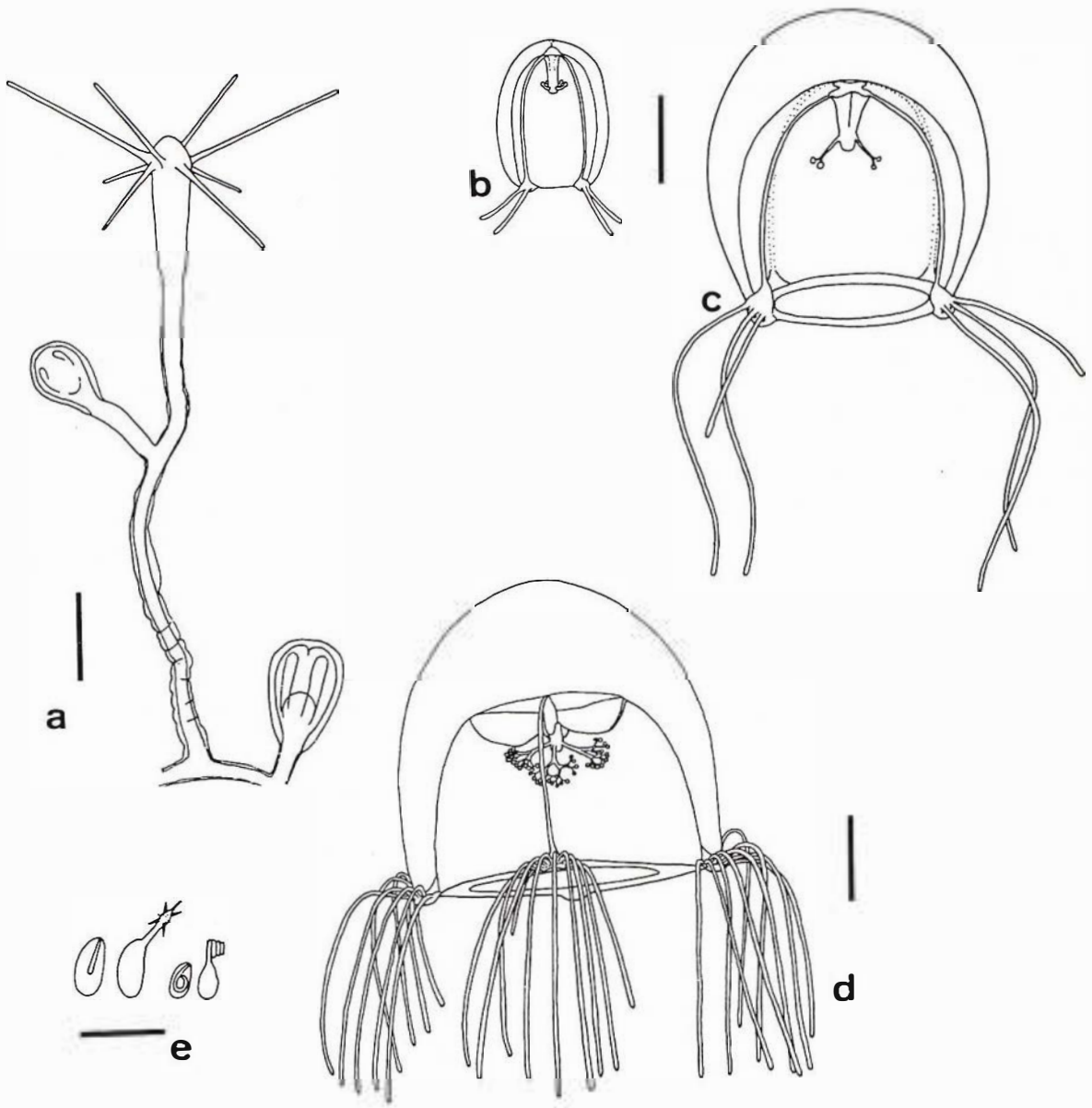


Fig. 18. ***Bougainvillia vervoorti***, from life. **a)** polyp stage with medusae buds found on tubes of serpulid polychaete, scale bar 0.3 mm. **b)** newly liberated medusa; scale bar 0.5 mm. **c)** 8-day old medusa; same scale as b). **d)** 16-day old medusa, gonads are visible but not fully developed; scale bar 1 mm. **e)** nematocysts: microbasic eurytele, desmoneme; scale bar 10 µm.

branching not always dichotomous. Gonads in 4 pairs on adradial sides of basal extensions of manubrium, not contacting each other perradially, in contact interradially, bulging slightly towards interradial. Eggs covered with nematocysts. Basal manubrial extensions continue as 4 radial canals. With 4 tentacle bulbs facing downward, with U-shaped epidermis, each with 18–30 long and flexible tentacles and corre-sponding number of ocelli. Ocelli adaxial, dark-red, round, on tentacle bulb near base of tentacle.

Nematocysts:

a) microbasic euryteles, shaft shorter than capsule, leaving approx. 45° to main axis, (5–7.5) x (2.5–3) µm.
b) microbasic euryteles of eggs, (6.5–8) x (3–4) µm.
c) desmonemes, (5.5–6.5) x (3–4) µm.

Other observations: Egg size 160 µm, including nematocyst layer. Colours: specimens not fully mature have an intensively emerald green manubrium.

Polyp and young medusa: Hydroid colonies arising from attached, ramified stolons. Polyps mostly stolonal, cauli rarely branched once, perisarc covering of cauli slightly wrinkled, may extend as thin, adhering film over hydranth body. This pseudohydrotheca may be absent in older polyps. Hydranths with conical hypostome and one whorl of 8–10 (up to 12) filiform tentacles of unequal lengths, projecting alternately up- and downwards. Medusae buds arise on short stems either from cauli or stolons. Young medusa oval, jelly evenly thick, base quadrangular, apical canal present, manubrium cylindrical with no basal extensions, with 4 unbranched oral tentacles with terminal capitae, 4 thin radial canals, 4 marginal bulbs each with 2 tentacles and 2 ocelli, these dark brown-red, adaxial. Growth stages, see Appendix 6.1. Nematocysts of polyps:

a) microbasic euryteles, (6.4–8) x (2.5–3.5) µm.
b) desmonemes, (4–5) x (2.5–3) µm.

Hydranth length: 500 µm (culture), 270–400 µm (fertile colonies from nature); hydranth diameter 100 µm; caulus length 0.36–1.2 mm (culture), up to 2 mm (nature); stolon diameter 60–124 µm; caulus diameter 80–100 µm; tentacle length up to 0.6 mm.

Type Locality: Clyde Quay, Wellington Harbour, 9 m.

Remarks on Life-Cycle Observations: The life cycle of *B. vervoorti* was observed in two ways. Adult male and female medusae from the plankton (they spawned after reaching the size of 4.2 mm and 16 tentacles per bulb) were kept in finger bowls at room temperature. The resulting eggs developed into planulae which swam for more than one week without metamorphosis. Metamorphosis was then induced by adding a small piece of *Corallina* alga (5 times the size of a planula). Three planulae could be followed as they settled and metamorphosed on the fragment. The primary polyps fed vigorously on parts of *Artemia* and grew stolons to an underlying microscope slide. The colony was kept in running filtered seawater and fed daily. After 28 days post-metamorphosis, the colony had spread to a diameter of 20 mm and the first medusa bud on a caulus was observed. Later, more developed on stolons also. No branching of cauli was observed.

A colony of *Bougainvillia* growing on a tube of a serpulid polychaete collected from Evans Bay was cultivated in running seawater. The colony was mostly stolonal: stems were only rarely branched once. The polyps initially fed well on *Artemia* and many medusae buds developed on stolons and cauli (Fig. 18a) while the hydranths became increasingly smaller. After some time they were unable to feed on *Artemia* (reproductive exhaustion). The released medusae (Fig. 18b) were cultivated at room temperature with daily feeding. The development of a representative animal is given in Appendix 6.1. After 16 days the medusae had developed to a stage where it was evident that it was *B. vervoorti* (Fig. 18d, Appendix 6.1). The maximal size was 3.6 mm with 10 marginal tentacles per bulb. The gonads had just started to develop.

Some size differences were found between the polyps from nature and those grown from medusae gametes. Such differences can be explained by different degrees of reproductive exhaustion.

General Remarks: *Bougainvillia vervoorti* medusae seem to be seasonal in Wellington Harbour. Their main occurrence in this study, and also in earlier samples, was during spring time. They were not found after January. Up to 80% of the *B. vervoorti* medusae were parasitised by several young narcomedusae (*Cunina* sp., Fig. 17c). The narcomedusae have an elongated manubrium which they insert into the mouth of *B. vervoorti*. Apparently they parasitise on the stomach content. The narcomedusae attach themselves to the subumbrella with their tentacles. In such parasitised *B. vervoorti*, the gonad development is severely retarded or inhibited, but the bell size reaches comparable sizes as in non-parasitised ones.

Although they are very different, by following a formal diagnosis as given by Kramp (1968), *B. vervoorti* can be confused with *B. fulva* Agassiz & Mayer, 1899. *Bougainvillia fulva* (p. 20) differs from *B. vervoorti* in having only half as many tentacles per bulb, short tentacles, ocelli on the tentacle base and not the bulb, lacking large basal extension of the stomach, and lacking nematocysts on its eggs.

Records from New Zealand (medusa): Wellington Harbour (Bouillon 1995 and this study), near Kaikoura (Bouillon 1995), near Cape Foulwind (Bouillon 1995), Portobello (this study). Polyp known only from Wellington Harbour.

Other Records: Not known outside New Zealand.

Bougainvillia dimorpha n. sp. (Fig. 19a-h)

Material Examined:
Ca. 100 medusae collected in Evans Bay, February–April 1994. One male medusa; collected 7.3.94 deposited as holotype H-638, several males and females as paratype P-1065.
3 crosses made between typical male and female forms, all 3 resulting in planulae which settled and metamorphosed; ten released medusae of this colony (second generation) were cultivated, but only 2 females reached maturity.

Description:
Medusa stage: Adult medusa bell-shaped, normally 3–4 mm high, exceptionally up to 6 mm high, about as broad as high, side walls only slightly curved, apical jelly up to one-third of height, shallow peduncle may be present, otherwise top of subumbrella flat, bell base quadrangular, dilated velum spanning approximately half of radius. Manubrium distally cone-shaped, shorter than one-third of bell height, less in males, with 4 mostly dichotomously branching capitate oral tentacles, each with about 8 capitae. Stomach base with 4 perradial, laterally compressed extensions. In females extension short, bearing on each side the 8 gonads. Female gonads are in contact in interradial position; eggs are covered by a layer of euryteles and arranged mostly in one layer in the gonads. Male gonads typically well separated from centre, located on lateral sides of basal extensions of manubrium. Basal extensions of male manubrium a narrow tube at origin then increasing in height where gonads are located. With 4 radial canals and circular canal, all narrow. With triangular- to heart-shaped marginal bulbs, these much smaller than space in-between them, each bulb with 7–10 tentacles and a corresponding number of round, dark-red ocelli. Ocelli on bulbs. Tentacles expanded longer than twice bell size. Nematocysts:
a) microbasic euryteles of marginal and oral tentacles, (7–8) x (3.2–4) mm, s = 0.8.
b) microbasic euryteles of eggs, (6.5–7) x (2.5–3) mm.
c) desmonemes of tentacles, with 4 coils, (5–5.5) x (3–3.5) mm.

Polyp stage and young medusa: Hydroid colonies arising from attached, ramified stolons. Cauli only occasionally branching once, reaching a height of up to 3 mm. Perisarc can form a pseudohydrotheca over hydranth body. Hydrocauli up to 2 mm. Hydranths spindle-shaped, about 0.4 mm long, with a conical hypostome, with 6–10 filiform tentacles in one whorl but pointing alternatingly up- and downwards, length about 0.5 mm. Medusae buds arise at right angles from stolons and from cauli, up to 3 per caulus, bud diameter up to 0.2 mm. Newly released medusa bell-shaped, 0.8 mm high, diameter 0.6 mm; evenly thin jelly, bell base quadrangular, very slight interradial furrows present; no apical canal present, with 2 tentacles and 2 red ocelli per marginal bulb; manubrium short, oral tentacles unbranched and very short. Nematocysts of polyps and additional measurements:
a) microbasic euryteles, (7–8) x (3–4) µm, s = 0.8.
b) desmonemes, (3.6–4) x (2.5–3) µm.
Stolon diameter 40–50 µm; caulus diameter 40–60 µm.

Variations: One male medusa with a manubrium and gonad morphology of normal females was observed. The length of the basal extensions of the gonads in females can also vary between individuals by approximately a factor of two.

Type Locality: Greta Point, Wellington Harbour.

Live-Cycle Observations: Three pairs of adult medusae showing the typically different morphologies of the gonads were used for crossing experiments. All three crosses resulted in many larvae. The planulae were induced to settle on very small (1 square mm) flakes of oyster shell. Settlement and metamorphosis was very rapid and could be followed. The polyps were fed daily and grew very rapidly. The colony remained mostly stolonal and cauli branched only occasionally (Fig. 19h). Medusae buds appeared after 18 days, from both stolons and cauli. The released medusae were quite difficult to cultivate and most did not attain maturity. Only two females reached maturity (one spawned). They reached 2.6–3 mm in height in 19 days, had oral tentacles three times branched, and more than 5 marginal tentacles per bulb. At the time of spawning all marginal tentacles had been lost. The gonads were on a cruciform extension of the manubrium base. They were within the range of morphologies observed in nature.

Remarks: Male and female medusae of *Bougainvillia dimorpha* were first believed to be separate species. However, their co-occurrence at high densities in Evans Bay over a short time period indicated a dimorphic species. This was then shown by the crossing experiments which resulted in good fertilisation success and many larvae. The cultivation of second-generation medusae was difficult. More observations are needed to demonstrate the development of the male gonads.

Females of *B. dimorpha* are quite similar to those of *B. muscus*. But, in the material from Wellington, they were quite distinct as *B. muscus* never had more than 4 tentacles per bulb and were much smaller. Young stages of *B. vervoorti* are also similar to *B. dimorpha*. But the latter has fewer tentacles (< 10) at maturity, whereas *B. vervoorti* with 10 tentacles are not yet mature. Most males of *B. dimorpha* are quite distinct with their gonads separated from the manubrium. The male medusa bears some resemblance to *B. pyramidata*

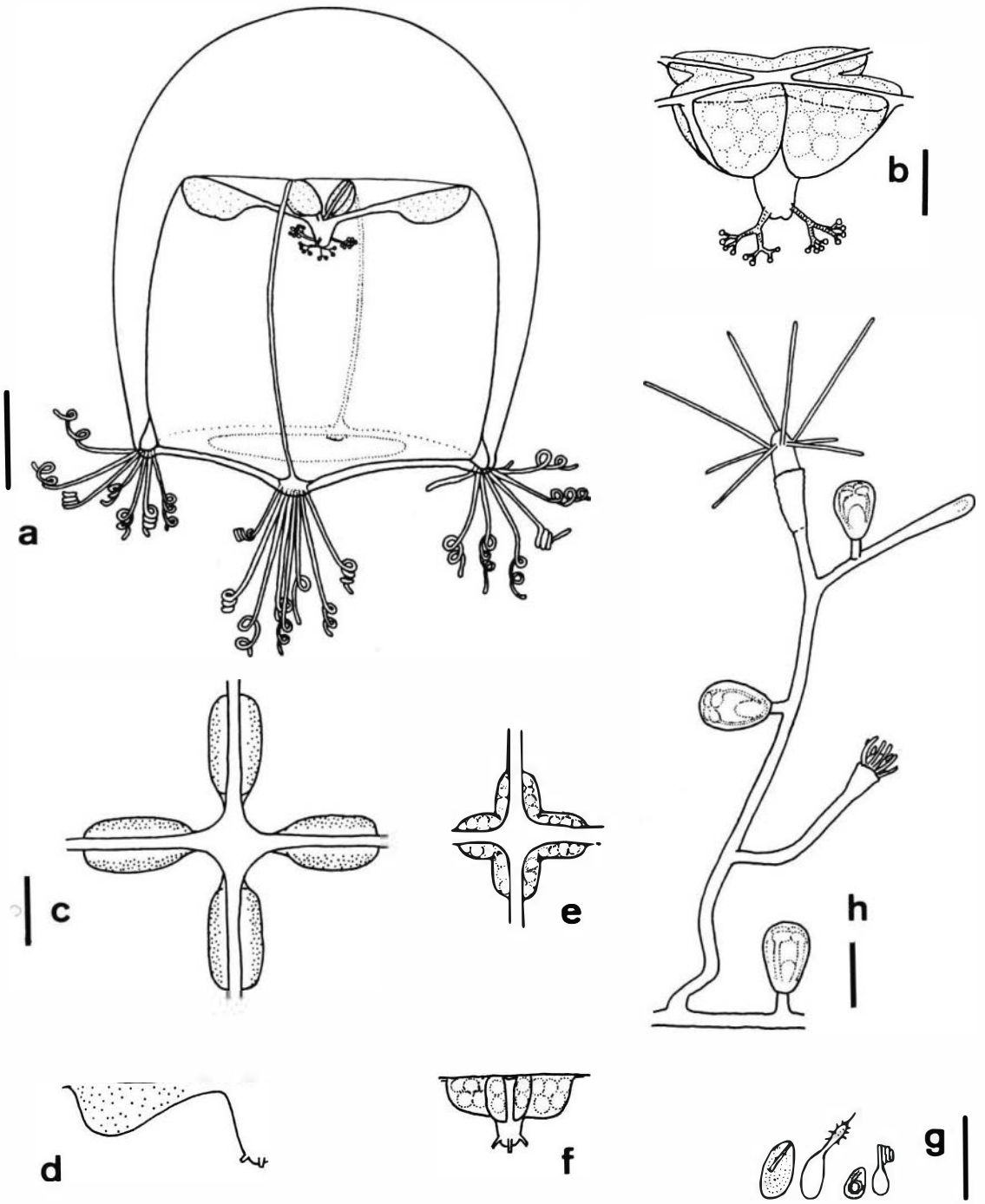


Fig. 19. ***Bougainvillia dimorpha*** n. sp., from life. **a)** Adult male medusa, very similar to type specimen; scale bar 1 mm. **b)** manubrium of a female medusa of similar size as animal in a); scale bar 0.2 mm. **c)** to **f)** aboral and side view of a gonads of a typical male (c, d) and female (e, f) medusa of the same size (4 mm, seven tentacles per bulb); scale bar 0.4 mm. **g)** Nematocyst of polyp and medusa, in pairs of intact and discharged capsules: microbasic euryteles, desmonemes; scale bar 10 µm. **h)** Part of polyp colony, branching and with medusae buds, grown from crosses of typically dimorphic medusae; scale bar 0.2 mm.

(cf. Edwards 1964, figs 3-4). In contrast to the latter, *B. dimorpha* medusae have no or a much smaller peduncle. The polyp stage also very different, *B. pyramidata* having a large, fascicled colony (Edwards 1964).

RECORDS FROM NEW ZEALAND: Known only from Evans Bay, Wellington.

Dicoryne Allman, 1859

Polyps polymorphic, forming erect colonies, branching or not, covered by perisarc which terminates on hydranth body or its base. Hydranths with one whorl of filiform tentacles which are never enveloped by perisarc. Gonophores are produced on modified hydranths (gonozooids) and are liberated as ciliated sporosacs that swim freely (after Bouillon 1985a).

TYPE SPECIES: *Dicoryne conferta* (Alder, 1856).

Dicoryne conybearei (Allman, 1864) (Fig. 20a-d)

Heterocordyle conybearei Allman, 1864: 365.
Dicoryne conybearei: Ashworth & Ritchie 1915: 257, fig. 3, pls 6-8, figs 1-15; Hirohito 1988: 99, fig. 35; Cornelius *et al.* 1990: 124, fig. 4.7.

MATERIAL EXAMINED:
1 female and 1 male colony, Greta Point, 1 m, on gastropod shell, 15.12.1993.
1 female and 1 male colony on a shell of *Penion* sp. inhabited by hermit crab, 8.2.1994, Greta Point.
2 female colonies on two gastropod shells inhabited by hermit crabs, coll. 5.9.1994, Greta Point; colonies removed from shell and cultivated in small dishes until sporosacs were released in large numbers (12.9.94).

DESCRIPTION: Hydroid colonies arising from attached, ramified stolons, erect stems up to 5 mm high, only occasionally branched once or twice. Stolons and cauli covered by perisarc which in younger hydranths con-

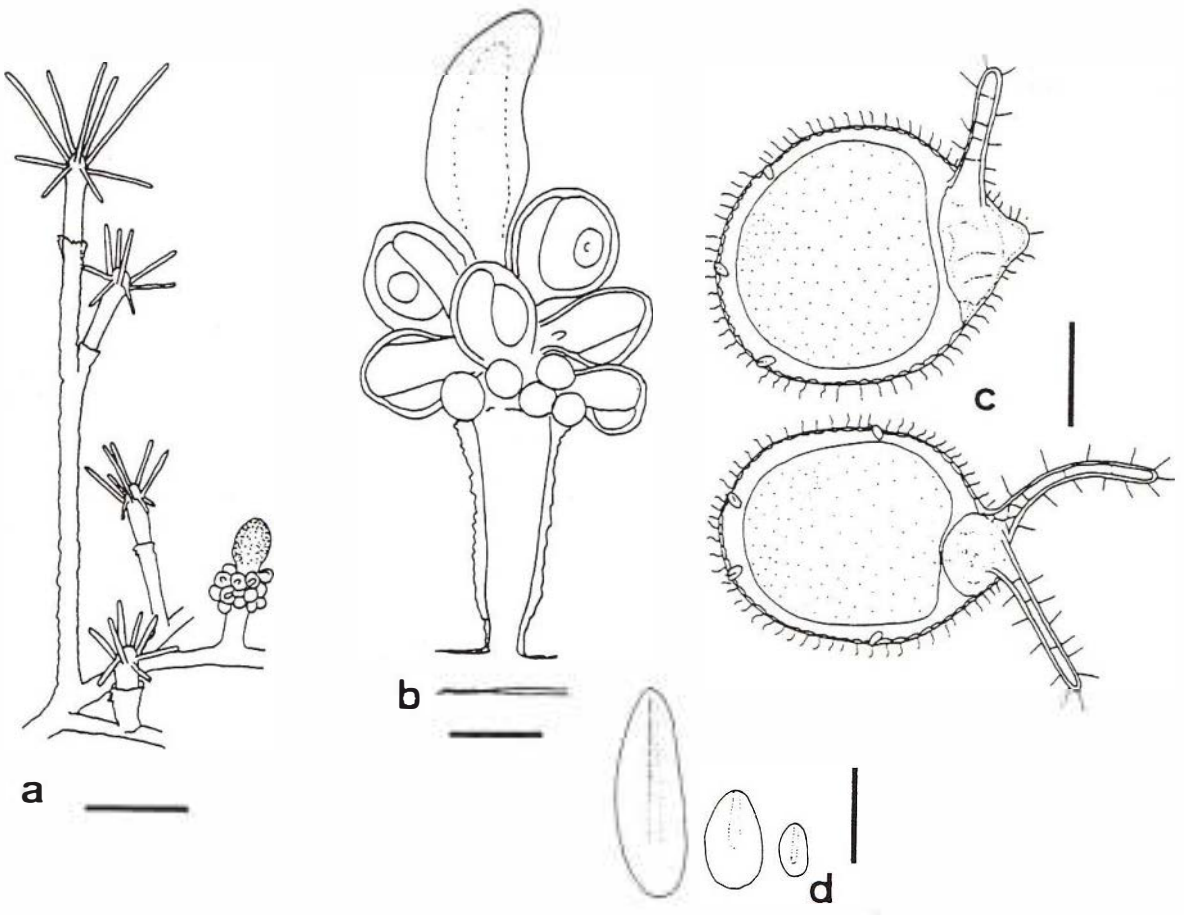


Fig. 20. *Dicoryne conybearei*, from life. **a)** part of colony with gastrozooids and gonozooid (right); scale bar 1 mm. **b)** female gonozooid, CL; scale bar 0.2 mm. **c)** two free-swimming female sporosacs, upper with one tentaculozooid, lower with two tentaculozooids; scale bar 50 mm. **d)** nematocysts: microbasic euryteles of three sizes (desmoneme not shown); scale bar 10 mm.

tinues over hydranth body as thin pseudohydrotheca up to tentacle base, in larger hydranths it terminates at base of hydranth body as a delicate cup-like expansion. Hydranths of gastrozooids cylindrical with conical hypostome. Below hypostome one whorl of 12 (11–14) thin filiform tentacles of very different length, pointing alternately up- and downwards. Gonozooids arise from stolons or as side branches from cauli, basal portions covered by perisarc as in gastrozooids. Body cylindrical with a large distal swelling studded with nematocysts. No tentacles or mouth present. Below terminal swelling a zone where gonophores are produced. Up to 20 or more gonophores per gonozooid, but number varies considerably. Gonophores spherical to oblong. Gonophores develop into sporosacs which are liberated. Female and male sporosacs originate on separate colonies. Liberated sporosacs oblong, up to 0.15 mm, covered by a ciliated layer of cells which also contains some nematocysts. This layer surrounds the gametes. Mature female sporosacs contain one egg only. A spadix of variable size may be present. In the population from Wellington the majority of sporosacs have 2 ciliated tentaculozooids filled with a chordoid gastrodermis. Some of the sporosacs with one tentaculozooid only, or the second one reduced to a variable degree. Nematocysts:

a) larger microbasic euryteles, in gonozooids, (18–23) x (6–8) µm, s = 0.8.
b) medium sized microbasic euryteles, in gastro- and gonozooids, (7–9.5) x (4–6) µm, s = 0.8.
c) smaller microbasic euryteles, on gonophores, (4.5–6) x (2.5–3.5) µm.
d) desmonemes, in tentacles only, discharged with 4 coils, (4–4.5) x (2–3) µm.

Measurements: gastrozooid hydranths around 1 mm long and 0.2–0.25 mm diameter; tentacles 1 mm long and 40–50 mm diameter, gonozooids up to 1.2 mm.

TYPE LOCALITY: Ireland.

REMARKS: *Dicoryne conybearei* normally liberates sporosacs having one egg and one tentaculoid only. This makes them quite distinct from *Dicoryne conferta* which has sporosacs with two eggs and two tentaculoids. The sporosacs of the investigated population from Evans Bay, however, had one egg and 1–2 tentaculoids (even within the same colony). In some cases it was rather difficult to decide whether they were really 2 tentacles or only one together with the elongated remainder of the original stalk. Ashworth and Ritchie (1915) also observed rare aberrant sporosacs of *D. conybearei* with 2 tentaculoids. Although it may be that the present population is not *D. conybearei*, a separation based on a single, variable character does not seem justifiable. Thus the population from Wellington was assigned to *D. conybearei*. The other characters agree rather well with the good descriptions given by Ashworth and Ritchie (1915).

Lendenfeld (1884) described *Dicoryne annulata* from the south coast of Australia. Unfortunately, Lendenfeld's description is entirely unsatisfactory and this species is at present not recognisable. Therefore it cannot be compared here to the population from New Zealand.

RECORDS FROM NEW ZEALAND: Greta Point, Wellington Harbour (first record by this study).

OTHER RECORDS: Great Britain; Ireland; Western Mediterranean (Ashford & Ritchie 1915); Japan (Hirohito 1988).

Gravelya Totton, 1930

Colonial hydroids arising from ramified stolons. Hydrocauli rarely branching, covered by perisarc. Hydranths fusiform with a dome-shaped hypostome and with one whorl of filiform tentacles. Hydranth covered by pseudohydrotheca that does not envelop tentacles. Gonophores develop on stolons and cauli and remain fixed as sporosacs.

TYPE SPECIES: *Gravelya antarcticum* (Hickson & Gravely, 1907).

REMARKS: Generic separation in the families Bougainvilliidae and Pandeidae is most readily based on their distinctive medusae. Where this medusa phase is reduced, systematic difficulties arise because independent reductions within different genera may often produce almost identical species (an intermediate step is described by Calder 1993). To fit these groups into a workable system based on phylogeny seems almost impossible.

Rees (1938) re-erected the genus *Rhizorhagium* M. Sars, 1874 and included in it all unbranched, colonial polyps with one whorl of filiform tentacles and with fixed sporosacs. The type species is *R. roseum* M. Sars, 1874. Similar hydroid genera like *Parawrightia* Warren, 1907, *Gravelya* Totton, 1930, and *Aselomaris* Berrill, 1948 were later also referred to *Rhizorhagium* (e.g., Millard 1975; Bouillon 1980). Calder (1988) again separated from this group members with a nipple-shaped hypostome, namely *Parawrightia* and the type species of *Rhizorhagium* (*R. roseum*). Both genera were united by Calder (1988) in a new subfamily Rhizorhagiinae. Because the reduction of medusae to fixed sporosacs alone is not a reliable synapomorphy as it may have

occurred several times independently (see Petersen 1990), such a separation makes sense. The nipple-shaped hypostome may indicate an origin other than from typical bougainvillids. But not all members of *Rhizorhagium* sensu Rees (1938) have a nipple-shaped hypostome and these species must be placed into other genera. These remaining species are here distributed into the genera *Gravelya* Totton, 1930 and *Aselomaris* Berrill, 1948. At present, *Gravelya* is distinguished from *Aselomaris* by the development of sporosacs only from the cauli in the latter species (Berrill 1948). Whether *Aselomaris* also has nematocysts on its eggs is not known. The small difference in the origin of the gonophores in these two species makes generic separation very debatable. At present it seems preferrable to retain these genera until a broader revision disentangles the family Bougainvilliidae and allows a more natural grouping. For this also the genus *Garveia* must be considered (this genus is similar to *Gravelya*, but has branching stems).

Only *Gravelya antarcticum* is known from New Zealand.

Gravelya antarcticum (Hickson & Gravely, 1907)
(Fig. 21a-d)

Perigonimus antarcticum Hickson & Gravely, 1907: 4, pl. 1, figs 1-3, pl. 4, fig. 32.
Atractylis antarctica: ?Vanhoeffen 1910: 283, fig. 8.
Gravelya antarcticum: Totton 1930: 139, fig. 1a-b.
Rhizorhagium antarcticum: Millard 1971: 401, fig. 3A-D.
Perigonimus antarcticus: Stepanjants 1979: 10, pl. 1, fig. 1.

MATERIAL EXAMINED:
2 living colonies from Steeple Rock Beacon (Wellington Harbour entrance), 10 m, 30.3.1994. One fertile female colony covering several square cm on ascidian (*Pyura* sp.). One other colony small, on oyster shell, few gonophores present. Cultivated for few days only.

DESCRIPTION: Hydroid colonies reaching a height of 3 mm, arising from attached, ramified stolons. Hydrocauli only rarely branching, covered by a single-layered perisarc which extendsas filmy pseudohydrotheca over body of hydranth, but does not envelop tentacles. Perisarc and pseudohydrotheca infested with detritus.

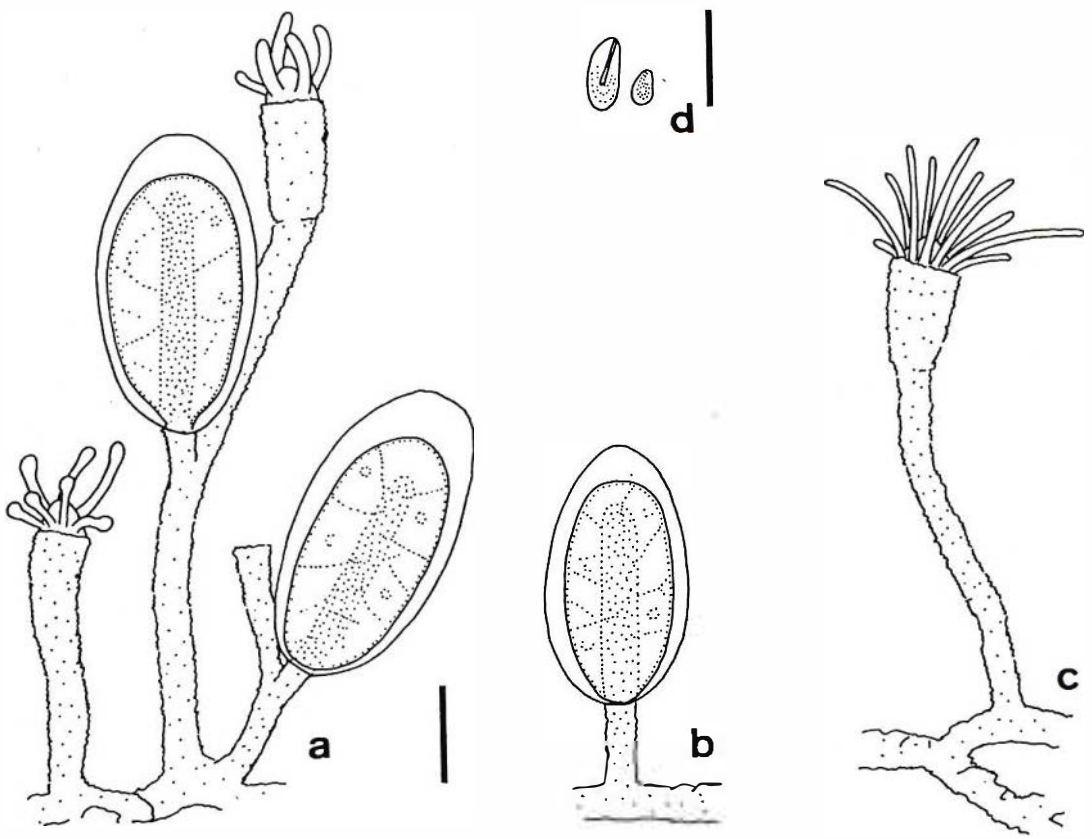


Fig. 21. ***Gravelya antarcticum***, all from life and CL. **a)** part of colony with gonophores arising from cauli, hydranth at left has pseudocapitate tentacles; scale bar 0.2 mm. **b)** gonophore arising from stolon, same scale as a). **c)** single hydranth, same scale as a). **d)** nematocysts: microbasic eurytele, desmoneme; scale bar 10 µm.

Younger hydranths can almost completely retract into pseudohydrotheca. Hydranths fusiform, up to 0.5 mm long, with conical hypostome, with one whorl of 6–12 filiform tentacles. Older hydranths bearing gonophores on their cauli often have reduced tentacle numbers or even reduced hydranths (reproductive exhaustion). Gonophores arise from stolons and from cauli, up to 2 gonophores per caulus. Gonophores remain fixed as sporosacs. Female gonophores oblong (0.5 x 0.3 mm), covered by thin transparent perisarc, with long, red spadix, without radial canals or circular canals. Up to 20 eggs per sporosac, very opaque, mature eggs covered with a layer of nematocysts.
Nematocysts:
a) microbasic euryteles, (6–8) x (2.5–4) µm.
b) desmonemes, (4–5) x (2.5–4) µm.
Measurements: stolon diameter 60–90 µm; caulus diameter 70–80 µm.

TYPE LOCALITY: McMurdo Bay, Antarctica.

REMARKS: The available samples of *Gravelya antarcticum* were of somewhat shorter stature than the ones described by Hickson and Gravely (1907) and Millard (1971), but otherwise fit these descriptions well. The shape of the gonophore seems to be somewhat variable. A similar species is *Aselomaris sagamiense* (Hirohito, 1988) n. comb. This Japanese species is characterised by a double-layered perisarc, which was not found in the New Zealand material. Hirohito's species is here assigned to *Aselomaris* because it develops gonophores from cauli only.

The covering of the eggs with a layer of nematocytes underlines the close affinity of *Gravelya antarcticum* with the genus *Bougainvillia*, where such a covering is very frequent. Some of the younger hydranths showed an unusual behaviour – they were able to contract the terminal region of the tentacles to a swelling, thus giving the impression of capitate tentacles. This pseudo-capitate state was maintained for quite a long time. Pennycuik (1959) described similar behaviour in a doubtfully identified *Aselomaris arenosa*.

RECORDS FROM NEW ZEALAND: Wellington Harbour (new record from this study).

OTHER RECORDS: Antarctica; Marion Island (Prince Edward Island, South Africa).

Koellikerina Kramp, 1939

Colonial hydroids, erect and branching, covered by perisarc infested with foreign material. Perisarc also envelops hydranth body and basal part of tentacles as pseudohydrotheca. Hydranths with one irregular whorl of filiform tentacles. Gonophores with a stalk arise singly from hydrocauli and are liberated as free medusae. Medusa with eight groups of marginal tentacles of similar structure. With or without ocelli. Four dichotomously branching oral tentacles present. Gonads in perradial or adradial position (Bouillon 1985a).

TYPE SPECIES: *Koellikerina fasciculata* (Péron & Lesueur, 1809).

REMARKS: The only life cycle known in this genus is that of the type species (Petersen & Vannucci 1960). Only one species is known from New Zealand.

Koellikerina maasi (Browne, 1910) (Fig. 22)

Koellikeria maasi Browne, 1910: 22, pl. 4, figs 1–5.
Koellikeria maasi: Vanhoeffen 1912: 361, pl. 25, fig. 2.
Koellikerina maasi: Kramp 1959: 112, fig. 100; Kramp 1961: 85; Kramp 1968: 36, fig. 93; O'Sullivan 1982: 36, fig. 15, map 14; Bouillon 1995: 229.

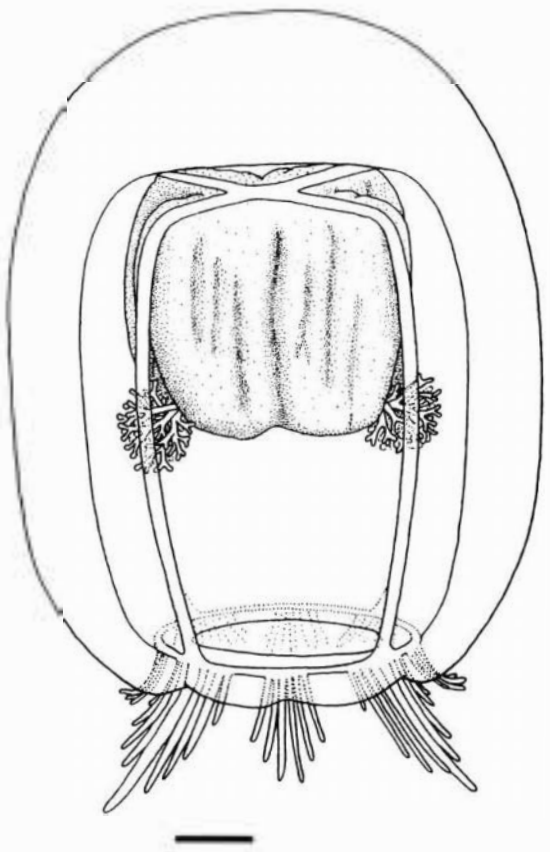


Fig. 22. ***Koellikerina maasi*** from Stn N465; the length of the tentacles may not be accurate; scale bar 1 mm.

MATERIAL EXAMINED:
2 medusae from NZOI Stn N465, 47°40.7'S, 167°01.2'E, 0–154 m, 5.2.1975, 9 mm diameter.

DESCRIPTION: Medusa with cylindrical bell, top rather flat, jelly thick, apical jelly twice as thick as lateral, bell-margin in 8 slight lobes due to furrows at the site of tentacles. No gastric peduncle present. Manubrium very large, length half of subumbrellar height, cross-shaped in section. With 4 perradial oral tentacles branching dichotomously 5–6 times and ending in only very small terminal swellings. Four voluminous gonads, interradial in position, covering almost the whole manubrium, separated perradially, with irregular vertical folds. Four broad radial canals and a thinner circular canal present. Marginal tentacles arranged in 8 groups, 4 perradial and 4 interradial. In each perradial group 7–9 tentacles, in the interradial groups ca. 6. Tentacles without bulbs and of varying length. The tentacle in the middle of each perradial group is longer and about twice as thick as the others. Polyp stage unknown.

TYPE LOCALITY: McMurdo Sound, Antarctica.

ADDITIONAL INFORMATION: There are no ocelli present and the stomach has a red colour in life (Vanhoeffen 1912).

REMARKS: The gonads have previously been described as smooth, but in the present samples they had irregular vertical folds. Some of these may have been caused by the fixation however.

RECORDS FROM NEW ZEALAND: Between Stewart Island and Snares Islands (Bouillon 1995).

OTHER RECORDS: Antarctica.

Family HYDRACTINIIDAE L. Agassiz, 1862

Hydroid colonies with sessile hydranths arising either from a reticulate hydrorhiza with stolons covered by perisarc, or from a hydrorhiza consisting of an encrusting layer of coenosarc not covered by perisarc, or from a calcified encrusting hydrorhiza. Chitinous spines, tubes, or calcareous spines may be present. Hydranths polymorphic with gastrozooids, dactylozooids and gonophore bearing gonozooids. Gastrozooids with one to several filiform tentacles below hypostome. Dactylozooids may be present, either without or with capitate tentacles. Reproduction by sessile sporosacs or free medusae. Exceptionally, sporosacs may be produced by the hydrorhiza or in specialised cavities of the calcareous skeleton. Medusae with or without a gastric peduncle, mouth with four simple or ramified lips with terminal nematocyst clusters. With four radial canals and circular canal. The gonads differentiate on the manubrium in interradial positions, occasionally they extend onto the proximal part of the radial canals. Exceptionally, the gonads can be in an adradial position (genus *Hansiella*). Marginal tentacles solid and not in groups. Ocelli present or not.

REMARKS: Bouillon's (1985a) diagnosis is here amended to accommodate *Fiordlandia* n.gen. The emendation concerns the skeletal structures: not only spines are possible, but also tubes like the protective stolons seen in *Fiordlandia*. *Fiordlandia* is placed in the Hydractiniidae on account of its sessile, dimorphic zooids.

It is rather obvious that the family Hydractiniidae is in need of revision. Generic limits should be redefined based on phylogeny, which may be rather complicated and difficult to assess with morphological methods (cf. Cunningham & Buss 1993). However, the present publication cannot deal with such a major revision and a provisional system as defined by Bouillon (1985a) is used.

Characteristics of New Zealand genera:

Hydractinia: sessile sporosacs, with encrusting hydrorhiza not covered by perisarc.

Podocoryna: with a free, well-developed medusa having oral lips studded with nematocysts.

Stylactaria: sessile sporosacs or degenerate medusae, and reticulate hydrorhiza covered with perisarc.

Fiordlandia: sessile sporosacs, gastrozooids with tentacles scattered in region below hypostome, and erect tubular stolon-like structures.

Hydractinia van Beneden, 1841

Colonial hydroids with hydrorhiza composed initially of tubes covered with perisarc which form a tight meshwork and ultimately coalesce into an encrusting layer covered by naked coenosarc (basal plate). This layer often forms spines which can be simple or branched. Hydranths are polymorphic with gastrozooids, gonozooids, and dactylozooids. Gastrozooids with one or two closely set whorls of filiform tentacles. Dactylozooids of various types may be present, lacking mouth and tentacles. The gonophores remain fixed as sporosacs and arise from normal hydranths, reduced hydranths, or directly from the hydrorhiza (Bouillon 1985a).

TYPE SPECIES: *Hydractinia lactea* van Beneden, 1844.

REMARKS: *Hydractinia* is often rather difficult to dis-

tinguish from *Stylactaria* (p. 54) because the encrusting layer without a perisarc covering is only formed in well-grown colonies. Therefore, only fertile material can be readily identified.

Many *Hydractina* species live on gastropod shells, especially ones inhabited by hermit crabs. This association may be a symbiosis as shown by Brooks and Gwaltney (1993). *Hydractinia* species can form sibling species which may not be identifiable using ordinary morphological characters (Buss & Yund 1989). As some of these cryptic species may be host-specific for one hermit-crab species, the crab species hosting the *Hydractinia* colony should be identified if possible. An excellent key to the hermit crabs of the Otago region is provided by Schembri and McLay (1983). Their key is also useful for the remaining parts of New Zealand.

Ralph (1961c) recorded a *Hydractinia* species from the Chatham Islands. Ralph's material was infertile and therefore not identifiable. This record is not treated here again.

Characteristics of species present in New Zealand:

Hydractinia parvispina: on rocks, with around 8 eggs in female gonophores.

Hydractinia novaezelandiae: on hermit-crab shells or other substrata; with branching spines, 2 eggs in female gonophores, and small hydranths.

Hydractinia rubricata: on shells inhabited by hermit crabs; with groups of spines on elevation of basal plate, basitrichous anisorhiza, with 5–7 eggs in female gonophore, and large hydranths.

Hydractinia parvispina Hartlaub, 1905 (Fig. 23a-b)

Hydractinia parvispina Hartlaub 1905: 518, fig. a; Jaederholm 1905: 5, pl. 3, figs 4–5; Ralph 1953: 63, fig. 1; Millard 1971: 402, fig. 4; Stepanjants 1979: 14, pl. 1, fig. 8.

MATERIAL EXAMINED:
No material seen.

DESCRIPTION (After Millard 1971): Hydroids colonial, growing mostly on rocks or on gastropod shells. Hydrorhiza covered with a layer of naked coenosarc. Spines smooth and hollow, closed or open at the tip, the largest reaching 0.5 mm in height but most of them smaller. Polyps polymorphic with gastrozooids and gonozooids; no tentaculozooids or spiral zooids present. Gastrozooids in life up to 6 mm high, with 11–16 tentacles, which in contracted individuals appear to arise in 2 alternating whorls. Gonozooids smaller than gastrozooids, up to about two-thirds of the size of gastrozooids, with well-developed conical hypostome and 4–6 tentacles. Male gonophores borne in a circle on distal half of gonozooid, usually about 8

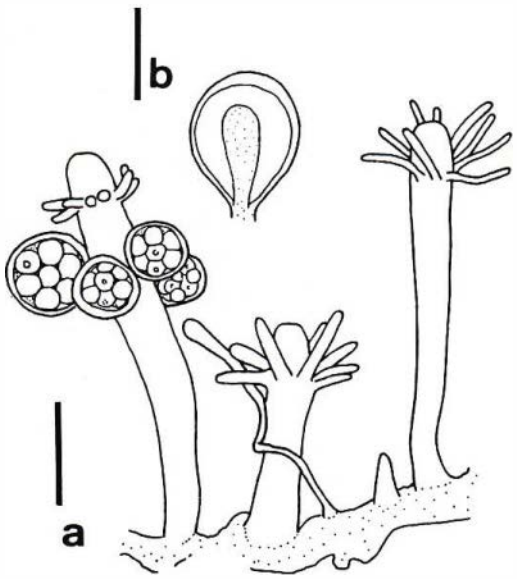


Fig. 23. ***Hydractinia parvispina*** after Ralph (1953), redrawn with kind permission of the publisher. **a)** colony with female gonozooid, tentaculozooid and spine; scale bar 0.5 mm. **b)** male gonophore; scale bar 0.2 mm.

large gonophores per gonozooid, but up to 18 have been found including immature buds. Male gonophores subspherical, with short pedicel and no radial canals, reaching a maximum size of 0.41 x 0.37 mm. Nematocysts:

a) elongated capsule, 9.5 x 3.6 µm.
b) small bean-shaped capsules, 6 x 3 µm.

According to Hartlaub's (1905) description, the female gonophores have a number of eggs. Judging from his figures (Fig. A, C) they must contain at least 6, probably more. According to Ralph (1953) they have approximately 8 eggs.

TYPE LOCALITY: Tierra del Fuego and the Falkland Islands.

REMARKS: *Hydractinia parvispina* is not a well-defined species. The best description was given by Millard (1971), but details on nematocysts and growth substrates are inadequately known. Ralph (1953) reported this species with a query from Portobello where it was growing on rocks. Although Millard (1971) considered this record as doubtful, Ralph's (1953) short diagnosis and figure are compatible with the present concept of *H. parvispina* as given by Hartlaub (1905) and Millard (1971). The major discrepancy is the presence of tentaculozooids in the material from New Zealand. However, the presence of tentaculozooids is not diagnostic for individual colonies as in other species they may also be absent in a majority of colonies. The best support for Ralph's material having been *H. parvi-*

spina is its occurrence on intertidal rocks. The sampling site of Ralph's material (intertidal near Portobello Marine Biological Station) was re-examined for this study, but no *Hydractinia* species could be found at that time. The only abundant hydractiniid found was *Stylactaria otagoensis* n. sp. (see p. 54). *Hydractinia parvispina* and *Stylactaria otagoensis* appear very similar, differing mainly in the structure of the hydro-

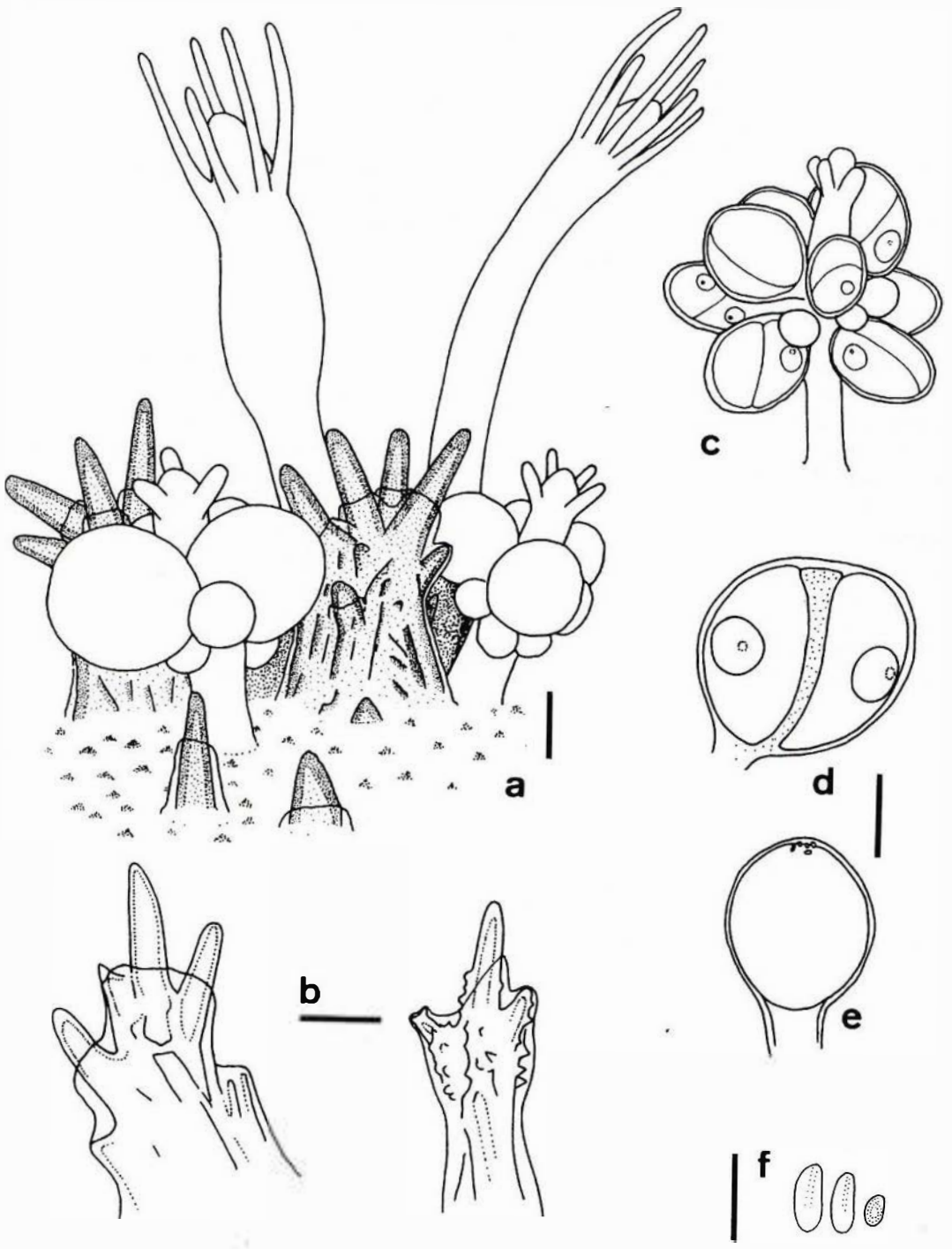


Fig. 24. ***Hydractinia novaezelandiae*** n. sp., from preserved type material. **a)** part of colony with gastrozooids, gonozooids and spines; scale bar 0.2 mm. **b)** two typical spines showing distal branching, scale bar 0.2 mm. **c)** female gonozooid, same scale as b). **d)** female gonophore, spadix shaded; scale bar 0.1 mm. **e)** male gonophore, with distal patch of nematocysts, same scale as d). **f)** nematocysts: microbasic eurytele from hypostome, heteroneme from tentacles, desmoneme; scale bar 10 µm.

rhiza only. The naked coenosarc in *Hydractinia* is not always easy to see and it may be that Ralph actually observed *S. otagoensis*. The presence of tentaculozooids argue in favour of this interpretation. At present, it seems better to maintain Ralph's identification until more observations can either confirm or exclude the presence of *Hydractinia parvispina* in New Zealand.

RECORDS FROM NEW ZEALAND: Intertidal reef near Portobello Marine Biological Station.

OTHER RECORDS: Tierra del Fuego, Falkland Islands, South Georgia, Paulet Island (Graham Land), Prince Edward Islands.

Hydractinia novaezelandiae n.sp. (Fig. 24a-f)

MATERIAL EXAMINED:

Holotype from NZOI Stn Q725 (off Westport), 4.3.1982, dredged material from 35 m, colonies (male and females) on shell of *Amalda australis*, ~2 cm shell size; colony also in siphonal canal therefore most probably not inhabited by gastropod at time of sampling, but no hermit crab visible either. Deposited as holotype H-646.

NZOI Stn Q726, 41°25.50'S, 172°01.20'E, dredged from 47 m, 5.3.1982, on ~5 mm fragment of calcareous tube, colony infertile. Deposited as paratype P-1072.

NZOI Stn J899, 35°510'S, 174°28.0'E (Bay of Islands), collected intertidally, 22.1.1976, fertile male colony on shell of *Amalda australis*, shell empty. Deposited as paratype P-1079.

DESCRIPTION: Hydroid colonies with hydrorhiza forming a network of perisarc-covered tubes which is open at the colony periphery but coalesces towards the centre to form an encrustation covered with a layer of naked coenosarc, bearing spines, gastrozooids, gonozooids and tentaculozooids. There are regularly scattered knobs in the basal plate. Spines elevated up to 0.5 mm, distal parts smooth, basal parts with smaller spines and prickles. The spines are either simple, but often distally branched with up to 8 ends. Coenosarc may cover a large part of the spines but polyps do not arise from them. The morphology and size of spines depend on their location on the shell. Gastrozooids reaching up to 1 mm in height (preserved material), with 4-8 tentacles in one whorl. Gonozooids shorter than gastrozooids, about as high as largest spines, with 3-4 tentacles, these short and stubby; with up to 8 gonophores in one whorl. Gonophores without radial or circular canals. Nematocysts present in a distal patch in gonophores of both both sexes. Female gonophores with 2 eggs and asymmetrically placed spadix. Males without spadix. Tentaculozooids present at shell lips, 0.4 mm long, with distal swelling.

Nematocysts:

a) microbasic euryteles (?) from hypostome and body, (7-8) x (3-3.5) µm.
b) heteronemes from tentacles, (6-7) x (2.5-3) µm.
c) desmonemes, (3.5-4) x (2-2.5) µm.

Colours: spines amber, otherwise no original colours preserved.

TYPE LOCALITY: 42°25.5'S, 171°05.5'E (off Westport), depth 35 m.

ETYMOLOGY: The species name refers to New Zealand where this species seems to have a quite broad distribution.

REMARKS: The distally branching spines of *H. novaezelandiae* make this species rather distinct. Similar spines are known from *H. echinata* (cf. Broch 1916). But *H. echinata* has gonozooids without tentacles. The spines are also somewhat similar to those of *H. rubricata*, but in the latter species the spines are more like tufts on a elevation of the basal plate, while in *H. novaezelandiae* they resemble more large spines with several endings. Besides this difference, *H. novaezelandiae* and *H. rubricata* are distinct in many other characters: overall size of polyps, tentacle numbers, number of eggs in female gonophores, spadix of male gonophores. Also the nematocysts are different, but because only preserved samples were available for *H. novaezelandiae*, the nematocysts could not be examined precisely.

RECORDS FROM NEW ZEALAND: Off Westport and Bay of Islands.

Hydractinia rubricata n. sp. (Fig. 25a-c)

MATERIAL EXAMINED:

3 living colonies on shells inhabited by *Pagurus rubricatus* (Hendersen, 1888), collected by dredging, 100 m, off Kaikoura Peninsula, 4.5.1994. One male colony on a ~ 5 cm large shell of *Austrofusus glans* (Gastropoda) was selected as holotype and deposited as H-647. The other two, both females, one on shell of *A. glans*, the other on *Argobuccinum tumida* (Gastropoda) were deposited as paratypes P-1074 and P-1075.

3 living colonies in public aquarium, Portobello Marine Laboratory (Dunedin), May 1994, collected near Dunedin, shell size 6-7 cm, all inhabited by *P. rubricatus*, all three fertile males. Several other hermit crab species were examined, but none had hydroids on them.

DESCRIPTION: Hydroid colonies epizooic on shells inhabited by hermit crabs. Hydrorhiza forms network of perisarc-covered tubes which is open at the colony periphery but coalesces towards the centre to form an

encrustation covered with a layer of naked coenosarc, bearing spines, gastrozooids, gonozooids, and spiral zooids. There are regularly scattered prickles in the basal plate. Spines elevated up to 1.5 mm, distal parts smooth, basal parts prickly as basal plate. The spines are either single or often grouped together. Very often they are grouped on a conical elevation of the basal plate which may also bear polyps. The type and size of spines depends on their location on the shell.

Gastrozooids reaching in life up to 10 mm in height, slender, with 16–20 tentacles in one whorl. Tentacles long, thickest part somewhat distal from origin.

Gonozooids much shorter than gastrozooids, about as high as spines, with up to 4–6 (max. 10) tentacles, these short and stubby; below tentacles a zone with 1–4 gonophores in one whorl. Gonophores without radial or circular canals, with darkly coloured spadix. Nematocysts mostly absent in gonophores. Female gonophores with 5–7 eggs with obvious germinal vesicle. Female gonozooids have a belt of very conspicuous oogonia in the gastrodermis of the gonophore budding region. Spiral zooids are present along outer lip of shell opening, isodiametric and expandable. They often uncoil and recoil synchronously. Nematocysts:

a) microbasic euryteles, (7.5–13.5) x (3–5.5) µm, s = 1.
b) basitrichous anisorhizas, on hydranth body, (6–8) x (2–2.5) µm.
c) desmonemes, discharged with 4 coils (5–8) x (3–5) µm.

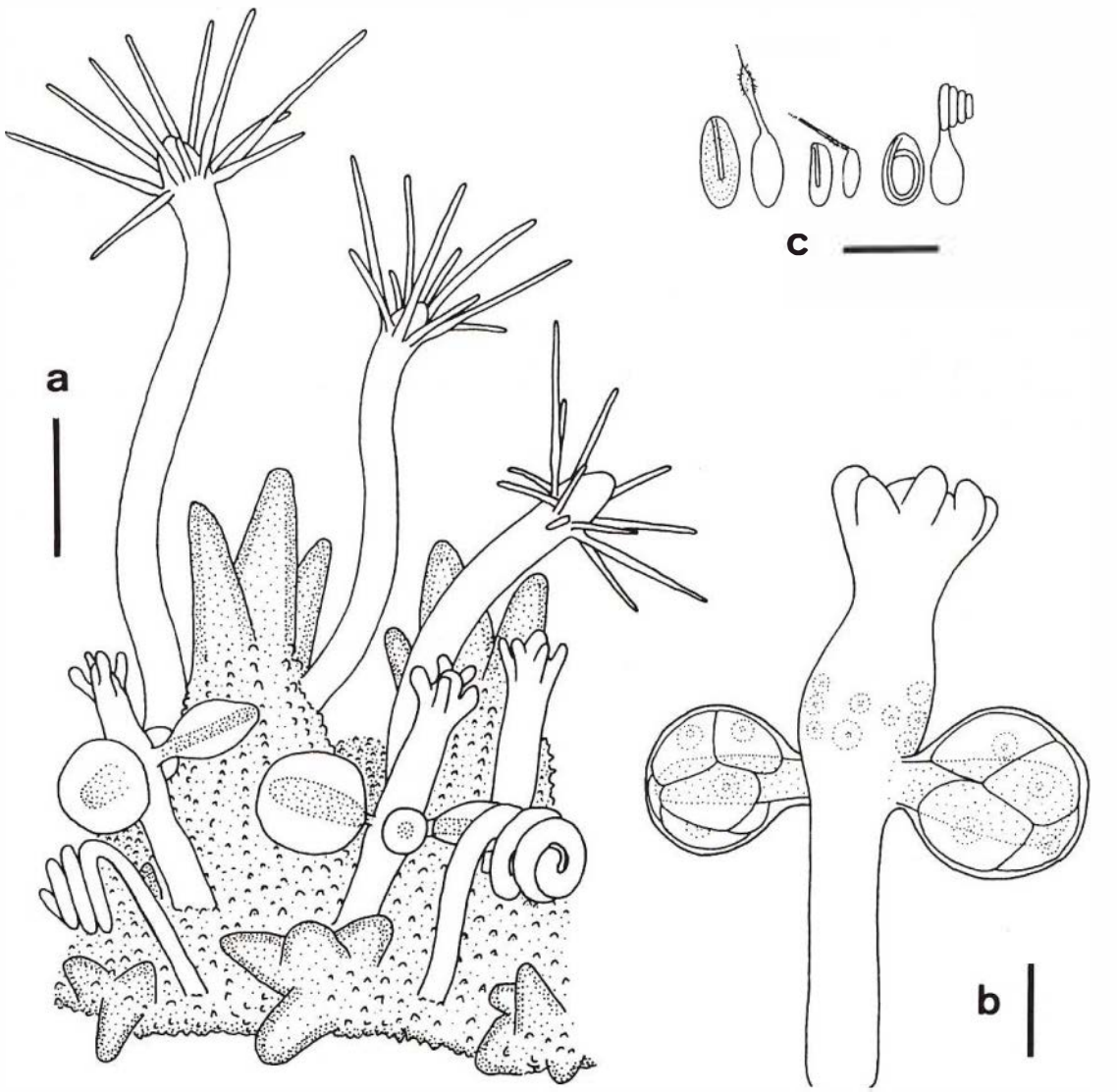


Fig. 25. *Hydractinia rubricata* n. sp., all from life. **a)** part of paratype colony on outer lip of shell opening with gastrozooids, gonozooids, spiral zooids and spines; scale bar 0.5 mm. **b)** female gonozooid with two gonophores and oogonia visible in budding zone; scale bar 0.2 mm. **c)** nematocysts in pairs of native and discharged: microbasic euryteles, basitrichous anisorhizas, desmonemes; scale bar 10 µm.

TYPE LOCALITY: 42°28'S, 173°42'E (off Kaikoura).

ETYMOLOGY: The species name is derived from the hermit crab host *Pagurus rubricatus*.

REMARKS: *Hydractinia rubricata* is quite distinct from all other better-known species of the genus. The basitrichous anisorhiza is especially unusual. Unfortunately, the nematocysts of few species are known (cf. Bouillon 1985a). Also the conspicuous oocytes in the gastrodermis of the gonophore budding region are unusual. Although in hydrozoans the germ cells are located in the epidermis, they may originate in the gastrodermis as in the other cnidarians (Schuchert 1993).

All examined living colonies were found on shells inhabited by the hermit crab *Pagurus rubricatus* (Hendersen, 1888), which has a wide distribution in New Zealand, mostly between 20 and 200 m (Schembri & McLay 1983). Other living hermit crabs examined from the same catches that yielded *P. rubricatus* did not bear hydroids. But due to the few samples examined, an association with other species cannot be ruled out at present.

The spine morphology and especially their size varied considerably, depending on their position on the shell. The region adjacent to the inner lip of the shell-opening had the largest spines. This is also the region which is presumably most exposed to mechanical impacts from the crab and the bottom. The spines may therefore protect the gonozooids from abrasion. It would be worthwhile to test this hypothesis with experiments.

The function of the spiral zooids is unclear. They were quite regularly found along the outer lip of the shell opening (Fig. 25a). Many of them uncoiled and rapidly recoiled synchronously. Spiral zooids occur only in hydractiniids associated with hermit crabs (cf. Mills 1976a).

RECORDS FROM NEW ZEALAND: Kaikoura and Dunedin.

Podocoryna M. Sars, 1846

Colonial hydroids with hydrorhiza composed of perisarc-covered tubes forming a tight meshwork which may persist as such, or coalesce into a mesh-like encrusting layer which may be covered by naked coenosarc, or occasionally by a very thin periderm. The hydrorhiza can form small spines. Hydranths are polymorphic with gastrozooids, gonozooids, and occasionally dactylozooids. The gonozooids are mostly similar to gastrozooids, but generally smaller and often with reduced number of tentacles. Gonophores arise below the whorl of tentacles and are generally covered by a thin film of periderm; gonophores liberated as free medusae. Medusae with four or more solid, simple marginal tentacles, never in groups. Marginal bulbs present, with or without ocelli. There are four or eight oral arms which are outgrowths of the lip only; they are simple or branched and provided with a tight cover of nematocysts. Four radial canals and circular canal always present. The gonads are interradial, occasionally extending on proximal parts of radial canals. In some species the medusae may reproduce asexually by budding new medusae (Bouillon 1985a).

TYPE SPECIES: *Podocoryna carnea* M. Sars, 1846.

REMARKS: The above diagnosis certainly does not reflect a monophyletic group. The presence of a medusa must be considered a plesiomorphy that cannot reveal a monophyletic taxon. The encrusting layer of hydrorhiza might be one of the few convincing synapomorphies within the Hydractiniidae, which is, however, not used by the present system to delimit a taxon. Thus, grouping together species with and without such an encrusting layer generates a paraphyletic taxon. A future revision of the Hydractiniidae might thus abandon this genus, as proposed, for example, in Broch (1916) and Naumov (1969) (cf. also Cunningham & Buss 1993). For the same reasons as given in the family diagnosis, however, a revision is not made here. Calder (1988) showed that the correct spelling is *Podocoryna*, and not the more frequently used *Podocoryne*.

To identify a *Podocoryna* colony correctly, the adult medusa stage must be grown from them (except for *P. bella*).

Characteristics of New Zealand species:

Podocoryna bella: polyps growing on Pigfish (*Congiopodus leucopaecilus*), hydrorhiza reticulate, adult medusa unknown.

Podocoryna minima: polyp stage unknown, medusae with medusae buds on manubrium, with peduncle, and four marginal tentacles.

Podocoryna minuta: polyp stage unknown, medusae with medusae buds on manubrium, with peduncle, and eight marginal tentacles.

Podocoryna australis: polyps with encrusting hydrorhiza, adult medusa with 8–14 marginal tentacles, no medusae buds on manubrium, and without distinct peduncle.

Podocoryna bella Hand, 1961 (Fig. 26a-d)

Podocoryne bella Hand 1961: 91, fig. 1; Kramp 1968: 29, fig. 73.

MATERIAL EXAMINED:

Preserved fin of Pigfish (*Congiopodus leucopaecilus*) with *P. bella* collected and identified by C. Hand near Portobello Marine Laboratory, 12.1.1960, colony without medusae buds, material kept by Portobello Marine Laboratory (Dunedin). Type material could not be obtained.

Preserved medusae kept by Portobello Marine Laboratory: label reads: young medusae of *Podocoryne bella* from pigfish from Aquarium (collected Otago Harbour), released 24–29 October, fixed 2.11.1962. Collector unknown.

DESCRIPTION:

Polyp stage (from own observations and Hand 1961) : Hydroid colonies growing on Pigfish (*Congiopodus leucopaecilus*), with gastrozooids and gonozooids. Hydranths sessile, arising from ramified, loosely adhering stolons. Stolons covered by very thin (1 µm) perisarc only, not forming a basal plate, polyps without perisarc cup at base. Spines or dactylozooids not observed. Gastrozooids up to 2 mm high, columnar, with conical hypostome. With one whorl of 10–12 (6–15 range) filiform tentacles. Gonozooids scattered in centre of colony, similar to gastrozooids but about half the size and with 6–8 tentacles only. Gonophores (1–7) in the middle of hydranth body. Gonophores are released as free medusae with 8 tentacles.

Nematocysts:

a) microbasic euryteles (?), some on body but concentrated on hypostome, not seen discharged, (8–9.5) x (3–3.5) µm.
b) smaller microbasic euryteles, on tentacles, (6–7) x (2–3) µm, s = ~0.7.
c) desmonemes, discharged with four coils, (5–6) x (2–3) µm.

Colour: pale, translucent white.

Young medusae: Hemispherical, 0.8 mm high and 1 mm broad, with rather thin jelly (0.08 mm) of uniform thickness. No peduncle present. Manubrium length half of bell cavity, cylindrical, mouth with 4 perradial clusters of elongated euryteles. Lips not elongated to oral arms. No incipient gonads visible. Four radial canals and ring canal present, these rather thin. Four perradial tentacles and 4 interradial tentacles, all of similar length. All 8 tentacles with a tentacle bulb. No ocelli observed.

Adult medusa: Unknown.

TYPE LOCALITY: Otago Harbour.

REMARKS: *Podocoryna bella* is not a sufficiently described species. The adult medusa remains unknown and there are also not enough data available on its ecology. It would be very important to know whether *Congiopodus leucopaecilus* is the sole host or not. *Congiopodus* can support quite a number of epizooic animals. Several Pigfish were examined alive for this study. Although none had *P. bella*, some were found to bear rather large colonies of the thecate hydroid *Phialella* sp. and also bryozoans. As noted by Hand (1961) *Turritopsis* also occurs on Pigfish. Therefore, *P. bella* might not be restricted to *Congiopodus* and may occur on other substrata too. The medusa resembles that of *Podocoryna australis* (p. 51). In the available medusae of *P. bella*, however, the jelly was thinner and there

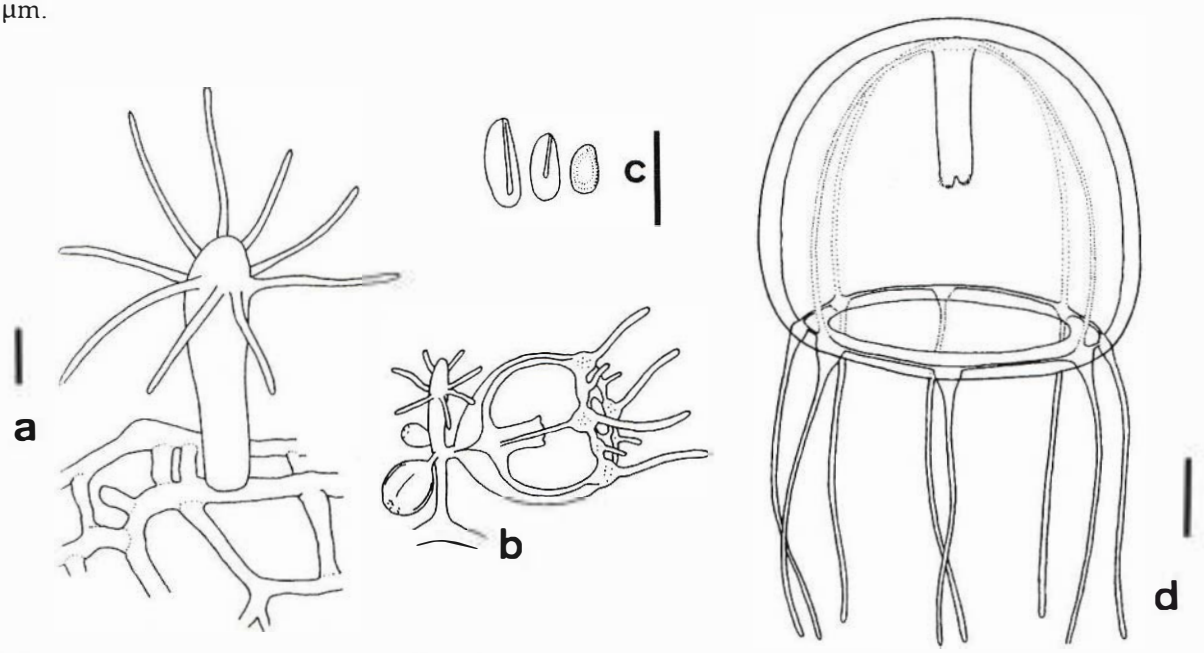


Fig. 26. ***Podocoryna bella*** from preserved samples. **a)** gastrozooid and hydrorhiza, CL; scale bar 0.2 mm. **b)** gonozooid with medusa buds, redrawn from Hand (1961) with kind permission of the publisher, same scale as a). **c)** nematocysts of polyp stage: microbasic euryteles and desmoneme; scale bar 10 µm. **d)** 6 to 10-day old medusa; scale bar 0.2 mm.

was no trace of gonads visible. This may also result from cultivation. More data are needed for a discussion of the identity of *P. bella* and its relation to other *Podocoryna* species growing on fish (cf. Komai 1932; Hirohito 1988).

RECORDS FROM NEW ZEALAND: Only known from Otago Harbour.

OTHER RECORDS: Not known outside New Zealand.

Podocoryna minima (Trinci, 1903) (Fig. 27)

Cytaeis minima Trinci, 1903: 1, pl. 1, figs 1-30.
Podocoryne simplex Kramp, 1928: 45, fig. 20.
Podocoryne minima: Russell 1953: 134, figs 63-64; Kramp 1961: 69; Kramp 1968: 28, figs 69-70; Brinckmann-Voss 1970: pl. 7, fig. 1; Uchida & Sugiura 1977: 53, figs 12; Barnett 1985: 81, fig. 8D, pl. 3, fig. C; Goy *et al.* 1991: 107, fig. 17.

MATERIAL EXAMINED:
No material seen: identified and described after photograph and figure in Barnett (1985).

DESCRIPTION: Medusa with globular bell, 0.3–0.9 mm high. Apical jelly slightly thickened. Manubrium on a well-developed peduncle. Manubrium length half of bell cavity, cylindrical with perradial lip margins elongated to oral arms terminating in a spherical knob of nematocysts. With interradial medusae buds on manubrium. Four radial canals and ring canal, rather narrow. With 4 perradial tentacle bulbs and tentacles. No ocelli present.
Polyp stage unknown.

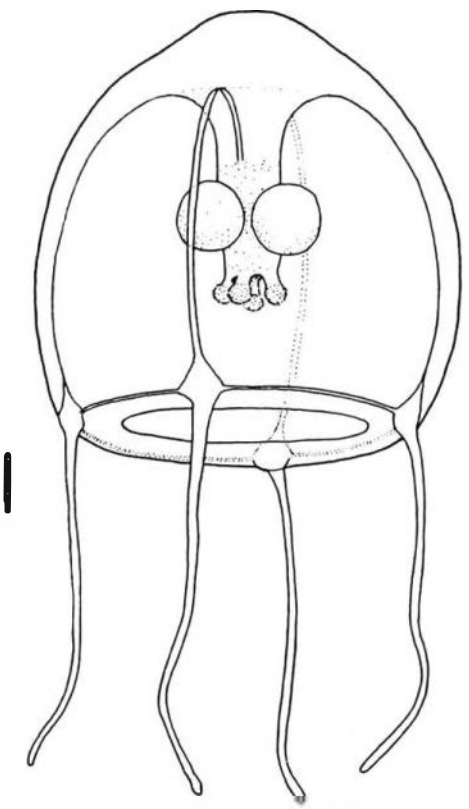


Fig. 27. ***Podocoryna minima***, drawn after photograph from Barnett (1985); scale bar 0.1 mm.

TYPE LOCALITY: Gulf of Naples, Mediterranean.

REMARKS: No material of this species could be examined, but the photograph and figure given by Barnett (1985) are clear enough to recognise this species. A detailed description including also developmental stages are given by Uchida and Sugiura (1977).

From the literature, gonads are initially interradial, but when mature encircle the manubrium. The size of sexually mature medusae is not different from asexually reproducing ones. The colour of marginal tentacle bulbs and stomach yellowish-brown or brown (Russell 1953; Uchida & Sugiura 1977).

The descriptions of *Podocoryna minima* (Trinci, 1903) and *Podocoryne simplex* Kramp, 1928 are very similar and both species are not objectively separable at present. Therefore, following Uchida & Sugiura (1977), *P. simplex* is here also included in the synonymy of *P. minima*. *Podocoryna minima* is a very simple medusa without many distinctive characters. However, it may well be that characters of the polyp stage will allow a separation of the two species as soon as their life cycles become known.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985).

OTHER RECORDS: Mediterranean, Great Britain, Japan, east coast of USA.

Podocoryna minuta (Mayer, 1900) (Fig. 28a-b)

Dysmorphosa minuta Mayer, 1900b: 41, pl. 18, fig. 42.
Podocoryne minuta: Mayer 1910: 140, pl. 14, fig. 1; Kramp 1959: 102, fig. 68; Kramp 1961: 69; Goy 1972: 978; Goy *et al.* 1991: 107, fig. 18.

MATERIAL EXAMINED:
4 medusae collected by T. Barnett in Leigh Marine Reserve, 1984, all animals without mature gonads but all budding medusae, one animal deposited.

DESCRIPTION: Medusa with bell-shaped umbrella, 0.5-0.7 mm high, slightly higher or as high as broad. With apical projection. Manubrium on well-formed peduncle. Manubrium length half of subumbrellar height, simple, cylindrical. Four perradial lips elon-

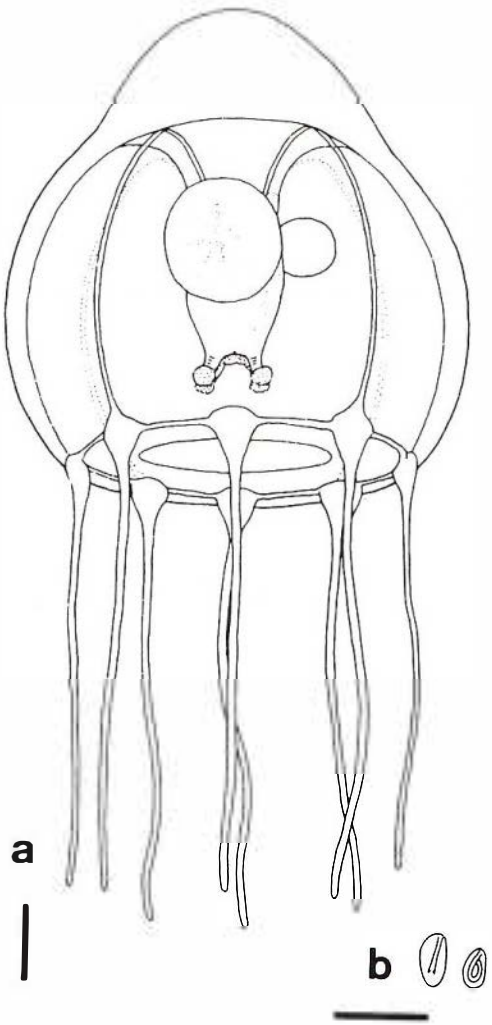


Fig. 28. *Podocoryna minuta* after preserved specimens from Leigh. **a)** Medusa with medusae buds; scale bar 0.1 mm. **b)** nematocysts: microbasic eurytele, desmoneme; scale bar 10 mm.

gated to tentacle-like oral arms terminating in spherical knobs with nematocysts. Medusae buds on interradial wall of manubrium. With narrow radial canals and ring canal. Four perradial and 4 interradial tentacular bulbs and tentacles present. All 8 tentacles flexible and of equal length, evenly covered with nematocysts. No ocelli present. Newly budded medusae are released with 8 tentacles. Nematocysts:

a) microbasic euryteles, on tentacles and mouth clusters, (5.5–6.5) x (2.5–3) µm, s = 0.9.
b) desmonemes, (3.5–4) x (1.5–2.5) µm.

Polyp stage unknown.

TYPE LOCALITY: Tortugas, Florida.

REMARKS: According to Goy (1972) the gonads may mature even with continued medusae budding. The gonad encircles the manubrium below the medusae buds. *Podocoryna minuta* from New Zealand is larger than described by Mayer (1900b) (up to 0.7 versus 0.3 mm). But as it otherwise agrees well with other descriptions, and size alone cannot be used for a specific separation, the population from New Zealand is here assigned to this species. Goy *et al.* (1991) even reported a maximal size of 2 mm for this species. Another similar species is *P. tenuis* (Browne, 1902) from the Falkland Islands, but this species has very short oral arms. More information on life cycles and ecology is needed for all populations for properly delimiting the species.

Podocoryna minuta is a rarely reported species with a patchy distribution, but it may often have been overlooked owing to its small size.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985, as *Podocoryne* sp. 1).

OTHER RECORDS: Florida, West Africa, Mediterranean (Kramp 1961).

Podocoryna australis n.sp. (Fig. 29a-g)

MATERIAL EXAMINED:

1 colony on shell of hermit crab, collected 16.12.1993, Evans Bay, depth 1 m, with dactylozooids, medusae grown to maturity (male), material deposited.

10 colonies on shells of living *Cominella maculosa* (Gastropoda), collected 31.12.1993, Narrow Neck Beach, Auckland, 1 m, medusae grown to maturity. One female medusa with 13 tentacles deposited as holotype H-649, remaining medusa deposited as paratype P-1077, 4 shells with polyp colonies deposited as paratype P-1078.

3 colonies on shells, one with gastropod, two with hermit crabs, collected 28.1.1994, 0.3–1 m, Mahanga Bay, Wellington Harbour, one infertile.

2 colonies on shells with hermit crabs, collected 8.2.1994, Evans Bay, depth 0.5 m, fertile.

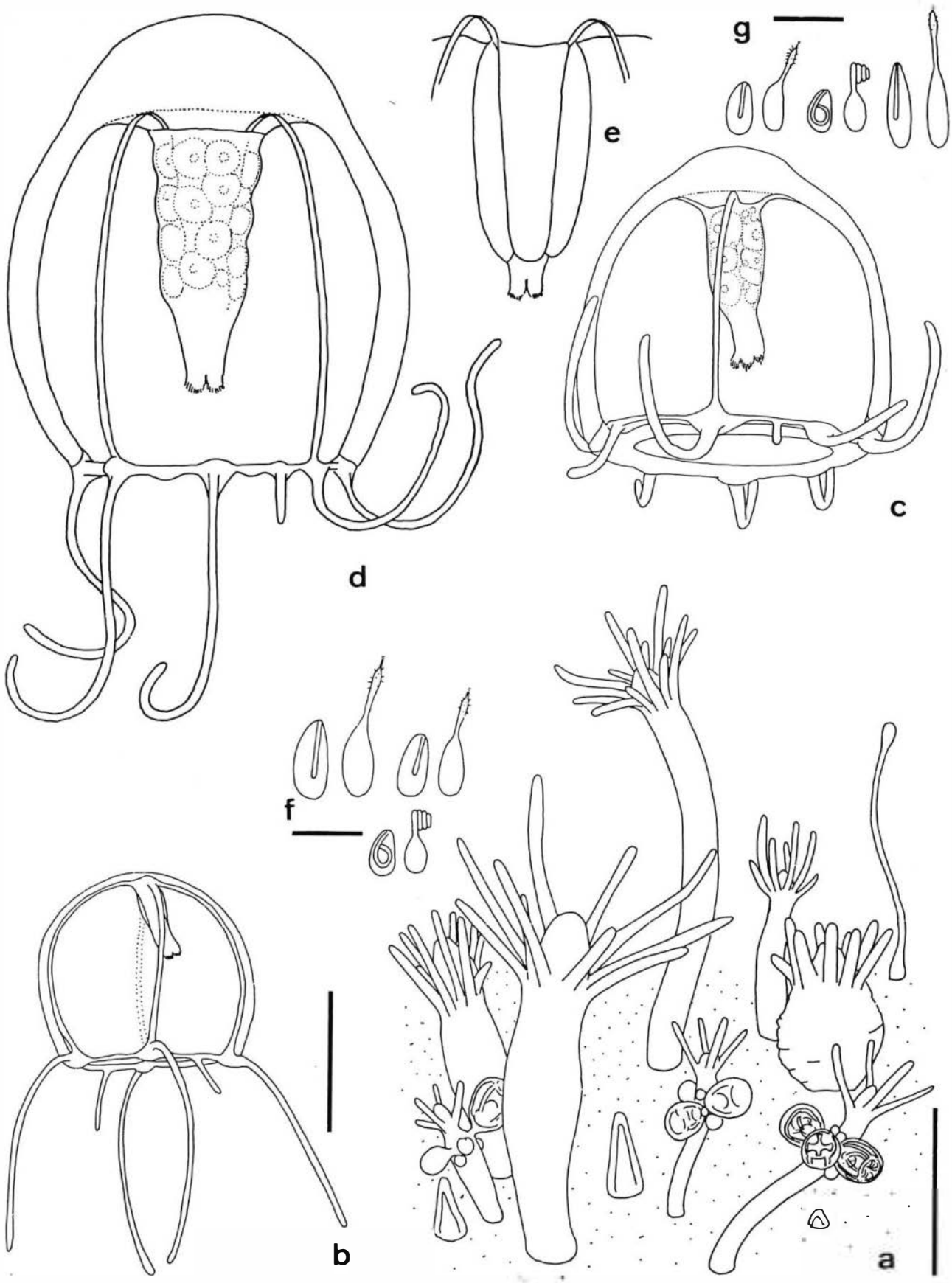
Approx. 12 adult medusae from plankton sampled in Evans Bay from November 1993 to January 1994, up to 16 tentacles, medusae spawned and produced planulae, some material deposited as paratype P-1079.

Several medusae collected by T. Barnett from Leigh Marine Reserve, 1983–1984, labelled *Podocoryne* sp. 2.

Several living polyp colonies and medusae of *P. carnea* originating from the Mediterranean and Atlantic, for comparison.

DESCRIPTION:

Polyp stage: Hydroid colonies growing on gastropod shells inhabited by gastropods or hermit crabs. Hydranths arise from encrusting hydrorhiza covered with a layer of naked perisarc, hydranths with no basal collar of perisarc. Hydranths polymorphic with larger gastrozooids, smaller and thinner gonozooids, and



rarely with tentaculozooids. Gastrozooids tubular to fusiform, shape varies considerably in samples from nature, 1-4 mm high (normally 2 mm; 0.3-0.4 mm diameter), with bluntly conical hypostome, 10-14 (max. 20) filiform tentacles of unequal length in one whorl below hypostome. Gonozooids 0.8-2 mm high, with 3-6 tentacles and somewhat below to them a zone of medusae buds (1-8 buds). Tentaculozooids rare, only seen in specimens from hermit crabs, long and slender, very extensible, thickened at origin. Spines present, 0.2-0.6 mm high, with smooth surface, amber coloured, not in groups. Nematocysts:

a) larger microbasic euryteles, mainly on body, (11-12) x (3-5) µm, s ~1.
b) smaller microbasic euryteles, mainly in tentacles, (8.5-9) x (3-4) µm.
c) desmonemes, in tentacles, four coils when discharged, (5.5-7) x (3-4) µm.

Newly liberated medusa: Spherical, 0.6-0.8 mm high, with thin mesogloea, apical canal, no peduncle. Manubrium tubular, length approximately half of bell height, with 4 perradial nematocyst clusters on mouth margin. Incipient gonads sometimes visible in females (at this stage egg size around 40 µm). Four radial canals ending in large marginal bulbs and 4 perradial tentacles and 0-4 shorter interradial tentacles with bulbs. Tentacles directed upwards when contracted. Mostly no or only very few (< 5) scattered nematocysts on exumbrella. No medusa budding during later development. Nematocysts:

a) microbasic euryteles of tentacles, (7-8.5) x (3-3.5) µm, s ~1.
b) microbasic euryteles of mouth clusters, (9.5-11) x (3-3.5) µm, s ~1.
c) desmonemes from tentacles, discharged with four coils, (5-6.5) x (3-4) µm.

Adult medusa: With bell-shaped umbrella, up to 1.6 mm, higher than wide to as wide as high, jelly thicker at apex, velum when dilated half radius width, slight peduncle (up to one-tenth of manubrium length) may be present or not. Manubrium tubular, length half to two-thirds of bell cavity, with 4 simple perradial clusters of elongated euryteles at mouth margin. Gonads interradial. Four radial canals ending in conspicuous bulbs. Four interradial bulbs mostly present. Tentacle number normally 10-14 (8-16 range). Nematocysts:

a) microbasic euryteles of tentacles, (7-7.5) x (3-3.5) µm.
b) microbasic euryteles of lip clusters, (9-10) x (2.5-3.5) µm.
c) desmonemes, (4.5-5) x (2.5-3) µm.

Size of spawned eggs (from medusa grown from polyps): 131 µm (s.d. 6.8 µm, n = 7).

TYPE LOCALITY: North end of Narrow Neck Beach, Devonport, Auckland.

ETYMOLOGY: The species name *australis*, Latin, southern, was chosen to contrast the species from similar ones occurring in the northern hemisphere.

REMARKS ON LIFE CYCLE: Medusae released from colonies collected at Wellington and Auckland were grown to maturity (spawning), attained after one week. The shape of the bell was somewhat variable, but corresponded to medusae found in the plankton. Tentacle numbers in mature cultivated specimens were 8-13 (Fig. 29c). Fertilised eggs from medusae found in the plankton resulted in many planulae which, however, failed to metamorphose.

REMARKS ON ECOLOGY: *Podocoryna australis* polyps were found in shallow water (1-2 m) on shells of *Cominella maculosa* (Gastropoda) living on a sand/mud bottom (Auckland, Wellington), and also on other shells inhabited by hermit crabs (Wellington Harbour).

REMARKS: *Podocoryna australis* closely resembles *P. carnea* M. Sars, 1846, *P. selena* Mills, 1976b, and *P. hyamensis* Hirohito, 1988. The only character distinguishing the latter from *P. australis* and the other species is the granular surface of its spines. *Podocoryna carnea* as defined by Edwards (1972) is very variable, its medusa forming a morphological cline from northern Europe to the Mediterranean, varying in size, tentacle number, and timing of maturity (cf. Bénard-Boirard 1962). The polyp stage shows considerable variation in size and proportions depending on growth condition (unpublished observations on cultures). *Podocoryna carnea*, however, very rarely has more than 8 tentacles and never more than 10 (Edwards 1972).

Fig. 29. (opposite) ***Podocoryna australis*** n. sp., all from life. **a)** part of a polyp colony with spines, gastrozooids, gonozooids with medusae buds, and tentaculozooids (right margin). Gastrozooids are shown in various degrees of contraction and stomach filling; scale bar 1 mm. **b)** newly released medusa with 6 tentacles; scale bar 0.5 mm. **c)** cultivated 8-day old female medusa which was able to spawn, same scale as b). **d)** adult female medusa from plankton, not all tentacles shown, the slight peduncle shown in this specimen is not always present; same scale as b). **e)** manubrium of an adult male medusa from the plankton, same scale as b). **f)** nematocysts of polyp: two sizes of microbasic euryteles and desmonemes; scale bar 10 µm. **g)** nematocysts of medusa: microbasic euryteles, desmonemes, microbasic eurytele of lips; scale bar 10 µm.

In addition, its exumbrella at liberation is covered with dozens of nematocysts, and a peduncle may be present only during early development. *Podocoryna australis* in contrast has regularly more than 8 tentacles and often more than 10; at liberation there are no or < 5 nematocysts on the exumbrella and occasionally a shallow peduncle maybe present in mature animals. *Podocoryna selena* from Florida is even more similar to *P. australis* because the former has 8–14 tentacles and lacks nematocysts on the exumbrella at liberation. The only difference between the two species is that in *P. australis* the gonads are not developed at liberation and it may reach a 16-tentacle stage. The male gonads of *P. australis* are even invisible just after liberation and develop only later.

Podocoryna carnea, *P. selena*, and *P. australis* polyps are not distinguishable from existing descriptions. Admittedly, the differences between the medusae are small and splitting into different species is debatable. The short life span of *Podocoryna* medusae (ca. three weeks) and the wide geographic separation (North Atlantic, Florida, New Zealand) make it more plausible that these populations do not belong to the same species. Some initial molecular analysis (Cunningham & Buss 1993) indicate that *P. selena* and *P. carnea* show a few differences. It would be very rewarding to examine the systematics of hydractiniids by methods used for population genetics (e.g., Thorpe *et al.* 1992; Thorpe & Sole-Cava 1994).

RECORDS FROM NEW ZEALAND: Polyp from Auckland and Wellington Harbours. Medusa from Goat Island, Leigh (Barnett 1985, as *Podocoryne* sp. 2), and Wellington Harbour (this study).

Stylactaria Stechow, 1921

Colonial hydroids with hydrorhiza formed by stolons that are completely covered by perisarc, no layer of naked coenosarc, with or without spines. Polyps polymorphic with gastrozooids, gonozooids, and sometimes dactylozooids. Gastrozooids with one or rarely several whorls of filiform tentacles. Gonozooids similar to gastrozooids but often smaller and with reduced number of tentacles; gonophores either remain fixed as sporosacs or are liberated as degenerated medusae. Medusae have four simple radial canals and an elongated manubrium without mouth opening; no oral arms with nematocysts; gonads surround the manubrium. With four to eight marginal bulbs, exceptionally with marginal tentacles (after Bouillon 1985a).

TYPE SPECIES: *Stylactaria inermis* (Allman, 1872).

REMARKS: The genus *Stylactaria* has been reviewed by several authors (Iwasa 1934; Bouillon 1971; Namikawa 1991). The generic name was recently modified by Calder (1988) from the commonly used *Stylactis*, which was shown to be a synonym of *Hydractinia*, to *Stylactaria*.

There is only one species of *Stylactaria* known from New Zealand.

Stylactaria otagoensis n. sp. (Fig. 30a-d)

MATERIAL EXAMINED:

Holotype H-651 (NIWA), part of larger female colony growing on holdfast of *Macrocystis pyrifera*, from reference collection of Portobello Marine Biological Laboratory (Dunedin), collected 1.11.1959, from Aquarium Point, (Portobello, Dunedin, collector unknown. The original sample consisted of more than one colony, as patches of female and male gonozooids could be found. Additional data from label: *Hydractinia* sp., collected at low tide, female sporosacs pink, male sporosacs white.

Several living colonies, relatively abundant on *Macrocystis* holdfasts and stems of *Pyura pachydermata* (Ascidiacea) at low tide around Portobello laboratory, all infertile, collected May 1994. One clone cultivated for 5 months in running sea water. Original colony deposited as paratype P-1081.

DESCRIPTION: Stolonal hydroid colonies, with much-ramified stolons forming a tight meshwork which is always covered by perisarc. Spines present but rare, smooth, 0.2–0.3 mm high. Hydranths arise directly from stolons and have no basal perisarc collar, size of polyps up to 4 mm when fully grown and expanded, normally around 2 mm, diameter around 0.3 mm. Polyps polymorphic with gastrozooids, gonozooids and tentaculozooids.

Gastrozooids columnar with conical to dome-shaped hypostome and one whorl of 12–16 filiform tentacles of varying length (up to 2 mm). Tentacles tapering and directed alternately upward, horizontal, and downward. Hypostome with a conspicuous white ring of larger microbasic euryteles. Gastrodermal cells of hydranth body are very large. Colour orange to pink.

Gonozooids very similar to gastrozooids in size and shape, only with fewer tentacles (up to 8), also with broad ring of nematocysts on hypostome. Gonophores are sessile sporosacs arising in the middle region of the hydranth, 4–6 per hydranth, spherical to oblong. Females and males in separate colonies. Females with approximately 14–16 eggs with conspicuous germinal vesicle, spadix present but no radial or circular canals. Colour, pink. Male gonophores white, similar to female ones in shape, with spadix, no radial or circular canals visible, gonads with no

visible compartmentation. Gonophores bear no nematocysts.

Few tentaculozooids present, arising directly from stolons, contracted 1 mm, expanded up to 10 mm, slightly knobbed at distal end. Nematocysts:

a) microbasic euryteles from hypostome, (11–13) x (3.5–4.5) µm, s = 1.
b) microbasic euryteles from tentacles, (9–11.5) x (3.5–4) µm.
c) microbasic mastigophores, rare, only frequent in tentaculozooids, (8–9.5) x (3.5–4.5) µm, s = 0.8.
d) desmonemes, thread in undischarged capsule with rope like structure, discharged with 4 to 5 coils, (5.5–7) x (3–4) µm.

Additional measurements: stolon diameter 70–80 µm, gonophore diameter 0.4–0.5 mm (in preserved material).

TYPE LOCALITY: Aquarium Point, near Portobello Marine Laboratory, Dunedin.

ETYMOLOGY: The species name *otagoensis* refers to the occurrence in the Otago region, South Island.

REMARKS: All *Stylactaria* species differ in minute details only, but *S. otagoensis* does not fit any of the other described species (cf. Namikawa 1991). The most similar species is *S. conchicola* (Yamada, 1947) from Japan. It is distinct in lacking mastigophores, and in the substratum, occurring specifically on one gastropod species only (Namikawa *et al.* 1992a). Other similar species are *S. betkensis* Watson, 1978 from Australia, the widely spread *S. inermis* (Allman, 1872), and *S. reticulata* Hirohito, 1988 from Japan. *Stylactaria betkensis* differs from *S. otagoensis* in its nematocysts and in having gonophores with radial canals. *Stylactaria inermis* also has eumedusoids, and *S. reticulata* one egg per gonophore only.

Stolons of *S. otagoensis* can form a rather tight meshwork. In fertile colonies, however, the stolons did not coalesce, and were covered by perisarc, verified by hand-made thin sections. In culture, no basal-plate formation (as in *Hydractinia*) was observed. In fertile

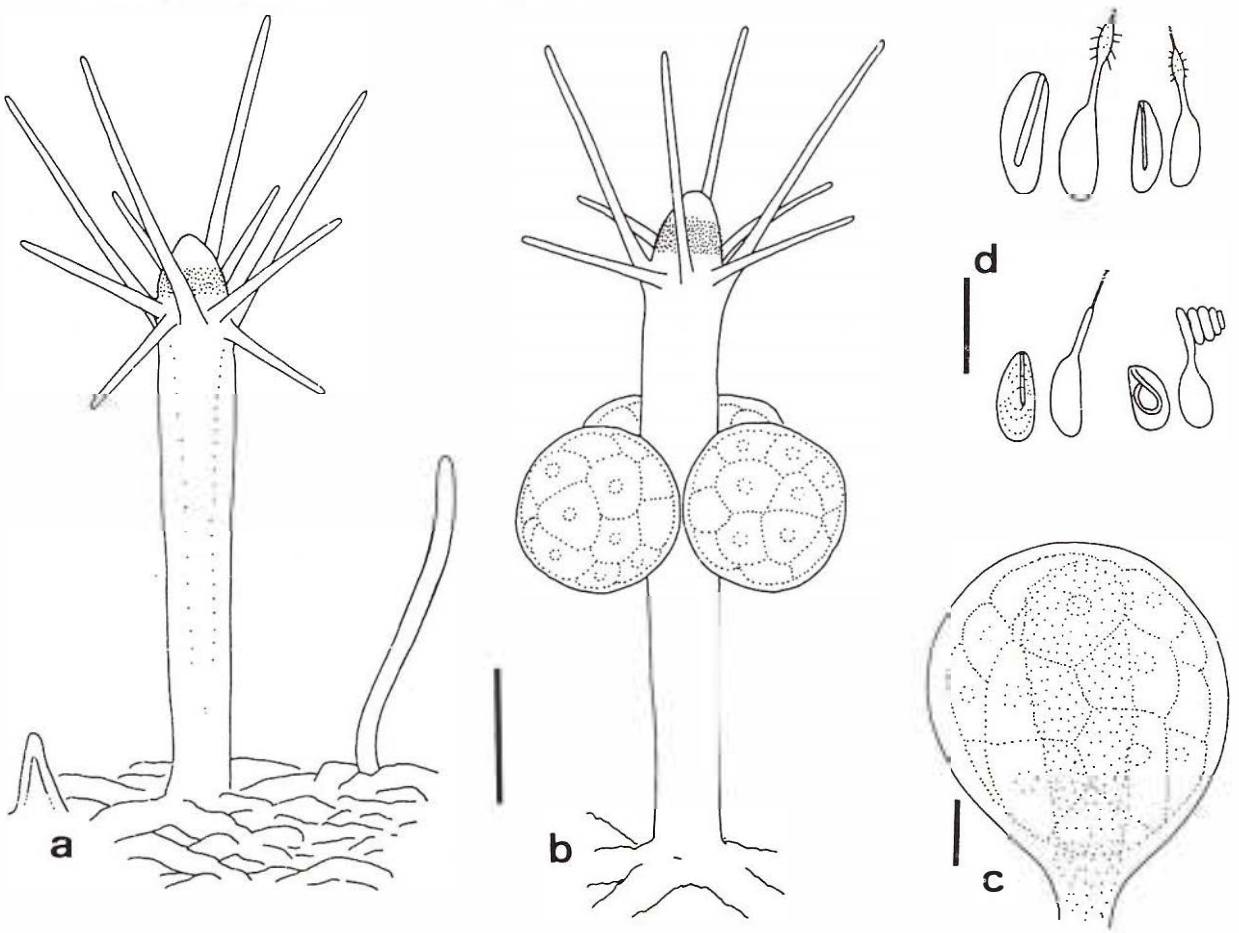


Fig. 30. *Stylactaria otagoensis* n. sp., from type and living material. **a)** gastrozooid and tentaculozooid; scale bar 0.5 mm. **b)** female gonozooid, same scale as a). **c)** female gonophore; scale bar 0.1 mm. **d)** nematocysts in pairs of undischarged and discharged capsules: microbasic euryteles from hypostome, microbasic euryteles from tentacles, microbasic mastigophores and desmonemes; scale bar 10 µm.

colonies almost all hydranths were gonozooids. This suggests that there is actually no functional differentiation into gastro- and gonozooids, but all gastrozooids might turn into gonozooids. Reproduction may be seasonal as no fertile colonies in about six separate samples could be found in May. Fertile material was collected in November.

The function of the tentaculozooids has been shown to be defensive (Namikawa *et al.* 1992b).

RECORDS FROM NEW ZEALAND: Portobello, Dunedin.

Fiordlandia n.gen.

Stolonal, sessile hydroid colonies arising from ramified and anastomosing stolons always covered by perisarc. Polyps dimorphic, with gastrozooids and gonozooids. Gastrozooids with filiform tentacles scattered in a band below hypostome. Gonozooids with one whorl of reduced tentacles and below them gonophores in several whorls. Gonophores sessile sporosacs. The hydrorhiza forms erect, branching tubular structures overarching the gonozooids.

TYPE SPECIES: *Fiordlandia protecta* n.sp.

REMARKS: The special staghorn-like structures overarching the gonozooids, and the scattered tentacles of the gastrozooids, make it necessary to create a new genus. The genus name is derived from the region where the species was first found: Fiordland, southwest South Island. The genus is currently monotypic.

Fiordlandia protecta n.sp. (Figs 31, 32a-f)

MATERIAL EXAMINED:

Several well-preserved colonies growing on *Symplectoscyphus johnstoni* (Hydrozoa, Thecata), collected by M. Page, 26.11.1993 in Doubtful Sound, 7 m, scuba, preserved in isopropanol. The *Symplectoscyphus* was partially overgrown by the bryozoan *Fenestrulina thyreophora* and a foliose red alga; *F. protecta* was overgrowing both of them; several colonies present. One part of a male colony was deposited as holotype H-645, the remainder of the material was deposited as paratype P-1071 (NIWA).

DESCRIPTION: Epibiontic hydroid colonies growing on *Symplectoscyphus johnstoni*, bryozoans, and red algae. Polyps stolonal, sessile, arising from attached, ramified stolons. Hydrorhiza covered with perisarc. Polyps dimorphic with gastropods and gonozooids. Gastrozooids large, up to 3 mm high, club-shaped with tentacular region swollen, with large dome-shaped hypostome, 10–20 filiform tentacles of different length in 3–4 indistinct whorls, or scattered in a band below hypostome. Tentacles with chordoid gastrodermis. Gastrozooids more frequently found at periphery of colony. Gonozooids small, not higher than 1 mm, mostly below 0.5 mm (preserved material), body tubular with conical hypostome, with 3–4 tentacles in one whorl. Tentacles with distal concentration of nematocysts. Below tentacles 3–10 gonophores in one to several whorls. Gonophores spherical, up to 250 µm in diameter, without radial or circular canals, without tentacles, no or few nematocysts present, with bulbous spadix and one egg in female, with cylindrical spadix in male. Male gonad not compartmented. The gonozooids occur in dense aggregations, touching each other. Between such aggregations of gonozooids, tubular branching structures like stolons arise and overarch gonozooids. They have a vertical stem which then branches horizontally 1–3 times. The horizontal ends of 2 erect structures can fuse and thus form bridges. The erect tubes have open distal ends. The coenosarc reaches to these openings but does not protrude, and does not contain more nematocysts than in normal stolons. Nematocysts of both zooids:

a) microbasic euryteles, (8–9.5) x (3.5–4) µm, s = 0.8.
b) desmonemes, discharged with 4–5 coils, (5–6.4) x (3–4) µm.

Stolon diameter 60–100 µm; protective stolon diameter: stem 110–160 µm, branches 70–100 µm.
Colours: some orange colour left in the gonophores.

TYPE LOCALITY: Ranson Head, Crooked Arm, Doubtful Sound, Fiordland, New Zealand.

ETYMOLOGY: The species name *protecta* refers to the erect branching stolons.

REMARKS: The erect, staghorn-like structures (Figs 31, 32c) arising from the hydrorhiza and overarching the gonozooids are a very special, hitherto unknown structure. Presumably they are comparable to spines as found in other Hydractiniidae. These structures are regarded here as protective stolons. At first, they were taken as parts of another hydroid, but after dissection and careful examination of several such elements it became clear that their coenosarc was continuous with the remainder of the colony. Their peculiar branching pattern and their distribution indicated that they occurred only where the gonozooids grew in dense aggregations (Fig. 31). They were rare or absent from the more peripheral parts where more gastrozooids occur. The examined material certainly contained more than two colonies because female and male gonozooids were observed in separate patches. Unfortunately, no other material became available and therefore it is not known whether such protective

stolons are always present in mature colonies. The function of these structures seems quite obvious, as they can protect the gonophores from mechanical disturbance and abrasion. For colonies growing in shallow water on flexible substrata like branched thecate hydroids this would be advantageous.

The gonophores or even the whole colony may be intensely coloured when alive as some colour was left and the fixative (alcohol) was stained dark orange.

RECORDS FROM NEW ZEALAND: Known only from the type locality.

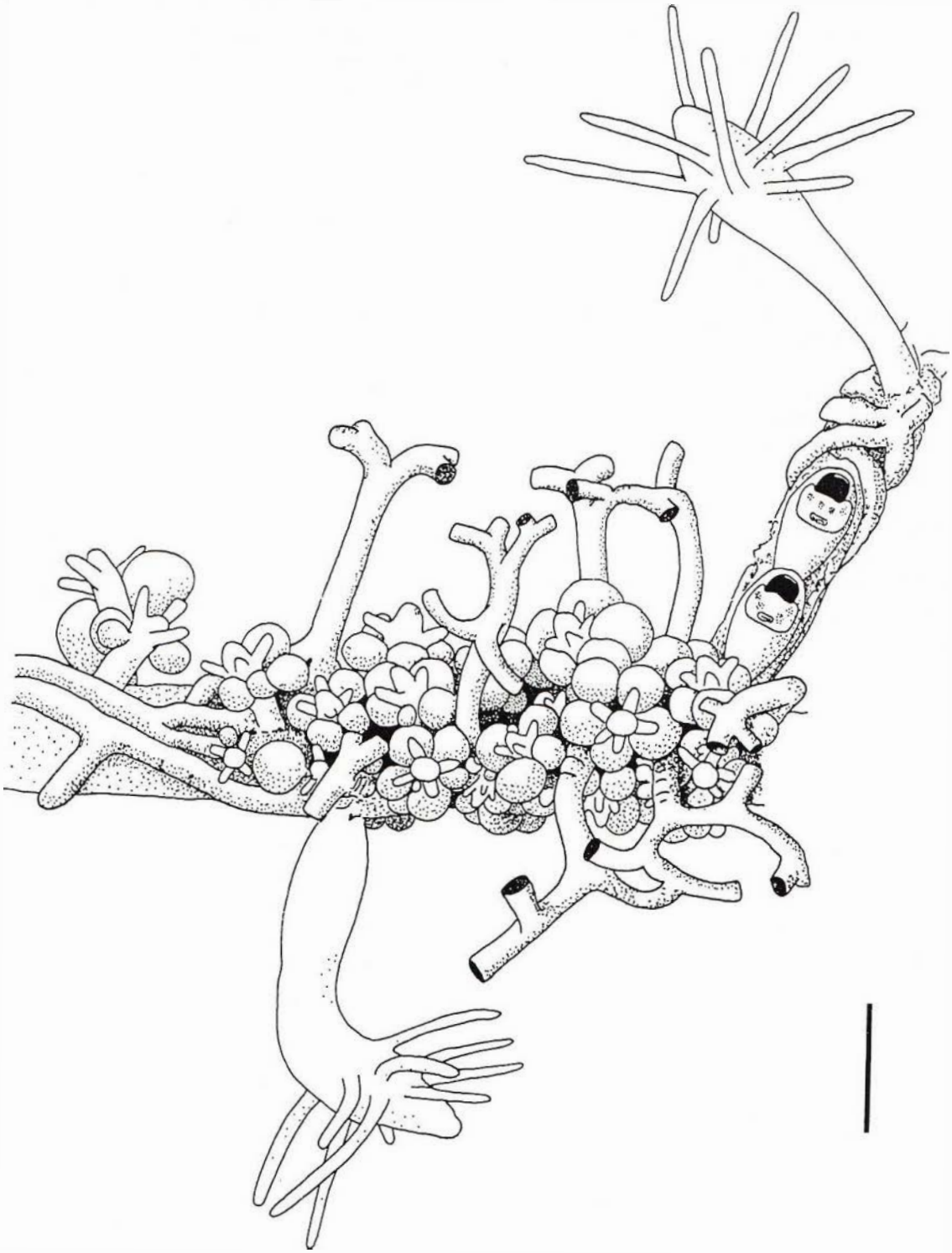


Fig. 31. *Fiordlandia protecta* n. sp., from preserved material, view of colony; note the characteristic, erect, stolon-like structures; scale bar 0.5 mm.

Family RATHKEIDAE Russell, 1953

Colonial hydroids arising from ramified stolons. Hydranths all alike, very extensible, without a caulus, with one whorl of filiform tentacles. Gonophores arise from stolons, or more rarely from base of hydranths. Gonophores liberated as free medusae. Medusa with four elongated lips forming oral arms, these either simple or branched, with terminal knobs, mostly also with lateral nematocyst knobs. With four or eight radial canals and a circular canal. Marginal tentacles in eight groups. Ocelli absent. Gonads encircle manubrium completely (after Bouillon 1985a).

REMARKS: Only the genus *Rathkea* is known from New Zealand.

Rathkea Brandt, 1838

Polyps with the characteristics of the family. Medusae with the characteristics of the family but only four radial canals.

TYPE SPECIES: *Rathkea octopunctata* (M. Sars, 1835).

REMARKS: The characteristics of all *Rathkea* species have been reviewed by O'Sullivan (1984). Only the life cycle of the type species is known (Rees & Russell 1937). Two species are known from New Zealand:

R. formosissima: oral arms simple, with one terminal cluster and several lateral clusters.

R. octopunctata: oral arms bifid, each end with a terminal nematocyst cluster.

Rathkea formosissima (Browne, 1902) (Fig. 33)

Lizzia formosissima Browne, 1902: 278.

Rathkea formosissima: Browne & Kamp 1939: 281, pl. 14, fig. 5, pl. 19, fig. 1; Kramp 1959: 104, fig. 76; Kramp 1961: 72; O'Sullivan 1982: 33, fig. 14, map 13; O'Sullivan 1984: 868; Barnett 1985: 86, fig. 9B, pl. 3, fig. 3F.

MATERIAL EXAMINED:
No material seen.

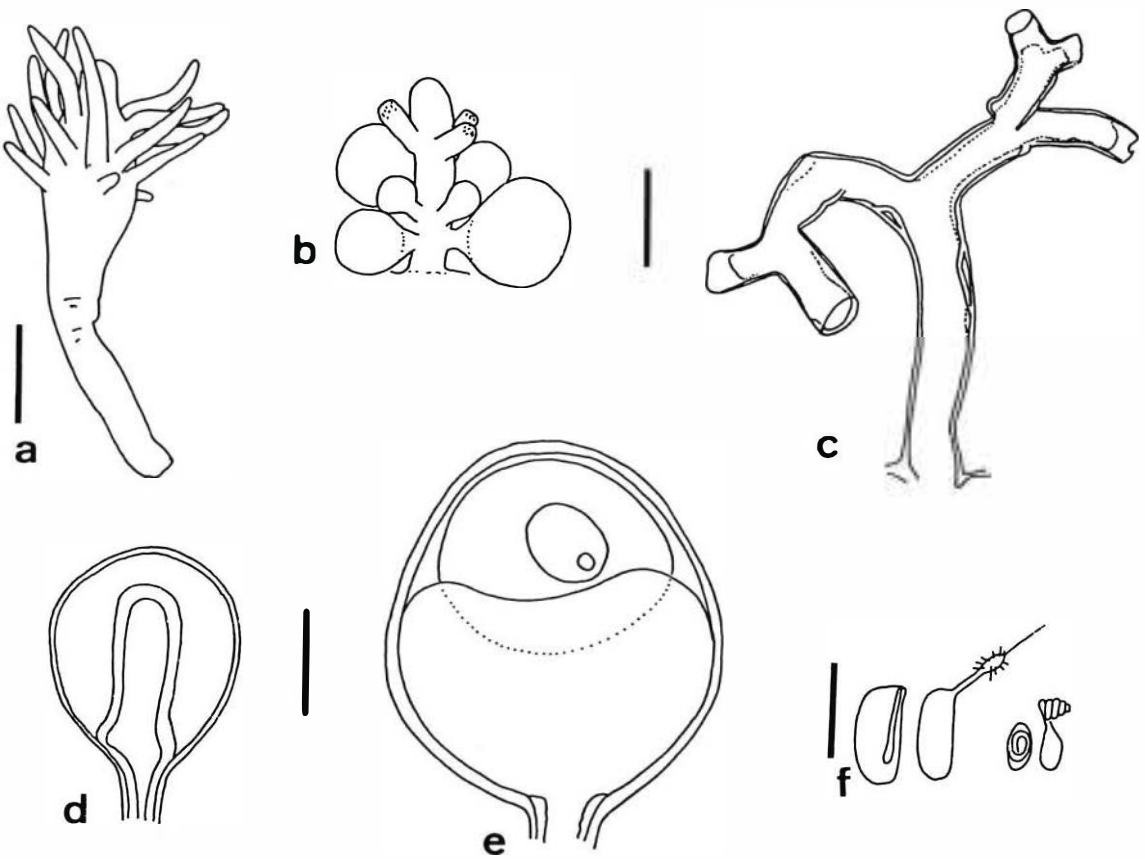


Fig. 32. ***Fiordlandia protecta*** n. sp., from preserved samples. **a)** gastrozooid, CL; scale bar 0.5 mm. **b)** male gonozooid with several gonophores and a concentration of nematocysts in tentacle tips, CL; scale bar 0.5 mm. **c)** most frequent type of protective stolon, CL, same scale as in b) **d)** young male gonophore, CL; scale bar 50 µm. **e)** female gonophore, same scale as d). **f)** nematocysts: microbasic eurytele, same discharged, desmoneme, same discharged; scale bar 10 µm.

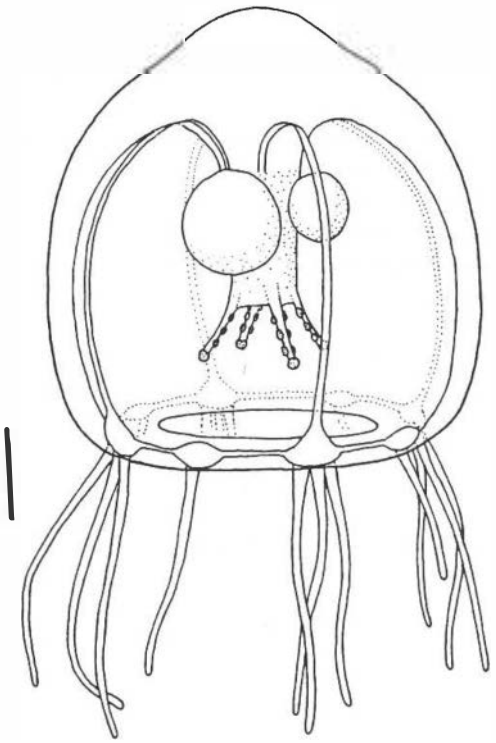


Fig. 33. ***Rathkea formosissima,*** after a photograph of T. Barnett; tentacle numbers are uncertain; scale bar 0.2 mm.

DESCRIPTION (after Browne & Kramp 1939): Medusa with bell-shaped umbrella, slightly higher than wide, size up to 3 mm, with a dome-shaped apical projection, lateral walls thin. Manubrium small, quadrangular, length about one-third of bell cavity, on a broad peduncle of similar length in older animals, smaller in younger animals. Mouth with 4 perradial oral arms, each with 7–11 opposite clusters of nematocysts on its sides and always with one terminal cluster. Younger stages with medusae buds on interradial sides of stomach. Mature animals with gonads on stomach, in female completely covering stomach, in males divided by 4 narrow perradial furrows. With 4 narrow radial canals and 8 tentacular bulbs. Perradial bulbs with 3–5 tentacles, interradial bulbs with3 tentacles. No ocelli present.
Polyp stage unknown.

TYPE LOCALITY: Falkland Islands.

REMARKS: *Rathkea formosissima* was previously known from its type locality only and nothing is known about variations in other populations. Barnett (1985) recorded *R. formosissima* from Leigh, which is the first record of this species outside its type locality. She obtained only five animals in June 1983, none of which could be re-examined for this study. Barnett's photographs and figure, however, allow a tentative identification. The medusae from Leigh were smaller than 1 mm which is about the smallest size documented by Browne and Kramp (1939). The figures in Barnett (1985) show medusae with one interradial tentacle only, which is different form Browne and Kramp (1939) who observed three tentacles per interradial bulb. This discrepancy may be explained by the frequent loss of tentacles during collection, but new observations should re-investigate this. O'Sullivan (1984) described *Rathkea lizzioides* from inland marine waters of Antarctica. This species is very similar to *R. formosissima* and is distinguished from it by characters normally considered too variable for discrimination (more oval marginal bulbs, more nematocyst clusters on oral arms, up to 7 tentacles on the perradial bulbs). But *R. lizzioides* belongs to a well-isolated population and it is at least plausible that it has developed into a separate species. A re-investigation using allozyme analysis would be very instructive.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985).

OTHER RECORDS: Stanley Harbour, Falkland Islands.

Rathkea octopunctata (M. Sars, 1835) (Fig. 34a-c)

Cytaeis octopunctata M. Sars, 1835: 28, pl. 6 figs 14a-g.
Rathkea octopunctata: Mayer 1910: 177, pl. 20, fig. 11; Rees & Russell 1937: 71, figs 7–8; Russell 1953: 137, pl. 7, figs 3–4, text-figs 65A–E, 66, 67A–B; Werner 1958: 138, figs 1–13; Kramp 1959: 103, fig. 75; Kramp 1961: 72 (*cum syn.*); Bouillon & Werner 1965: 137, figs 1–7; Kramp 1968: 30, fig. 74; Naumov 1969: 212, figs 80–81; Arai & Brinckmann-Voss 1980: 33, fig. 16; O'Sullivan 1984: 868, table 2; Werner 1984: fig. 93.

MATERIAL EXAMINED:
6 living medusae from surface plankton near Ti Point (Leigh), collected 7.8.1991, bell ~1 mm high.
10 preserved medusae from Leigh Marine Reserve, collected by T. Barnett, bell up to 1 mm, some deposited.

DESCRIPTION:
Medusa stage with asexual budding: With spherical umbrella and a rounded apical projection, bell diameter around 1 mm. With a gastric peduncle. Dilated velum spanning half of radius. Manubrium quadrangular, half as long as bell cavity, mouth margin with 4 perradial extensions that form oral arms. Bases of oral arms continued on manubrium for some distance as perradial ridges. Oral arms distally branched and both ends with a nematocyst cluster; 1 pair of lateral clusters can be present. Medusae buds present on stomach. With 4 narrow radial canals and

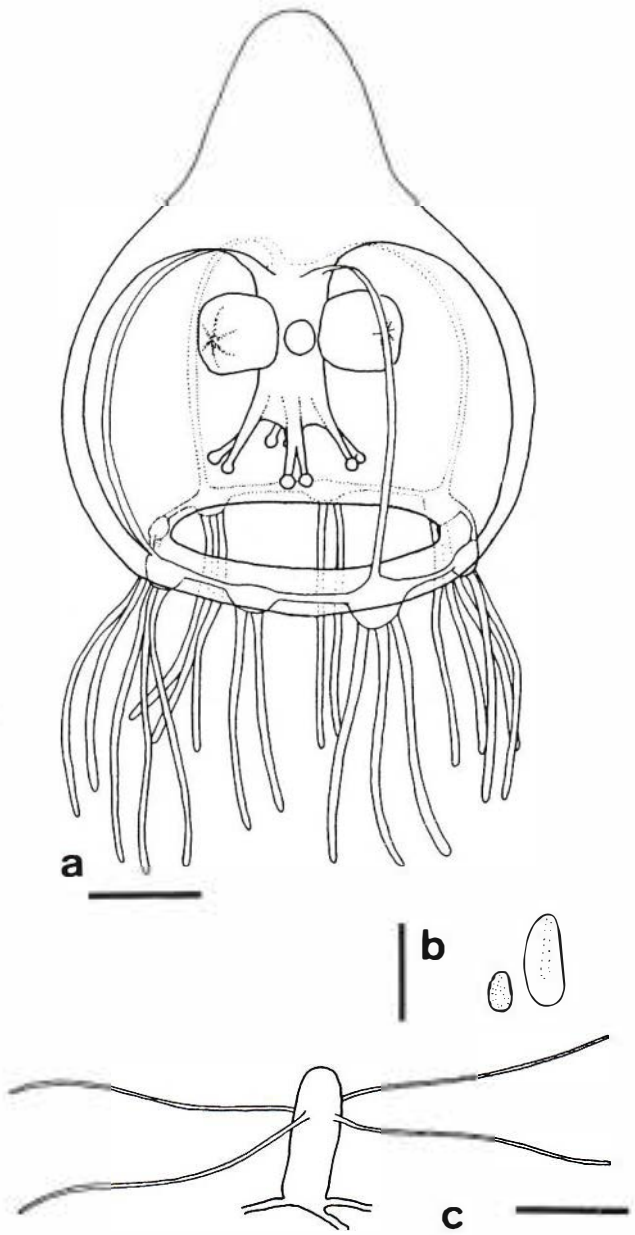


Fig. 34. *Rathkea octopunctata.* **a)** Medusa from Leigh Marine Reserve; scale bar 0.2 mm. **b)** nematocysts: desmoneme, heteroneme; scale bar 10 mm. **c)** polyp stage, modified after Rees and Russell (1937) with permission of Cambridge University press. Note: the polyp stage is not yet known from New Zealand; scale bar 0.2 mm.

8 marginal bulbs, 4 perradial, 4 interradial. Each perradial bulb with 3 tentacles, each interradial bulb with 2 tentacles. Tentacles thin. No ocelli present. Nematocysts:

a) heteronemes, (6.5–9) x (2.5–3.5) µm.
b) desmonemes, 4 x 2 µm.

Mature medusa (after Russell 1953): As above but 3–4 mm, with up to 5 tentacles per perradial group and up to 3 per interradial group. Oral arms with 1 or 2 lateral pairs of nematocyst clusters and 1 between the 2 branches. Gonads completely surround the stomach. Nematocysts:

a) microbasic euryteles, sometimes like mastigophores, in oral arms (10–12) x (3–4) µm.
b) microbasic euryteles, sometimes like mastigophores, in marginal tentacles (6–10.5) x (2–3) µm.
c) desmonemes, in marginal tentacles only, (3–5) x (2–3) µm.

Polyp stage (after Rees & Russell 1937; Werner 1958): Hydroid colonies arising from ramified stolons. Hydranths uniform, up to 0.6 mm high, sessile, without caulus, base with thin gelatinous perisarc, one whorl of 4–6 tentacles, hypostome conical. Tentacles very thin and long. Medusae bud arise from stolons or rarely from base of hydranth.
Nematocysts (after Bouillon 1985a): microbasic euryteles, desmonemes.

TYPE LOCALITY: Norway.

REMARKS: The examined *Rathkea octopunctata* medusae from New Zealand agree well with other descriptions. No mature medusae or polyps are so far known from New Zealand. The polyp has only rarely been reported from nature, because it is very difficult to find owing to its small size. *Rathkea octopunctata* is one of the few hydromedusae for which a lot of morphological, physiological, and ecological information is available (see Kramp 1961; Arai & Brinckmann-Voss 1980, for references). The life cycle of *R. octopunctata* is determined by seasonal temperature changes. Falling temperatures in autumn induce the polyps to develop medusae which then appear in the winter plankton. The young medusae multiply by budding more medusae until rising water temperatures in late spring induce the development of gonads and later sexual reproduction. The medusae then disappear from the plankton by late summer (Russell 1953; Werner 1958). Barnett (1985) observed *R. octopunctata* near Leigh in large numbers mostly during winter months. This is in accordance with observations from the northern hemisphere.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve, Whangateau Harbour (Barnett 1985; this study).

OTHER RECORDS (MEDUSA): Northwestern Europe; Mediterranean; Black Sea; Barents Sea and White Sea; Iceland; Greenland; Hudson Strait; Newfoundland; New England; Bermuda; Aleutian Islands; Kamchatka; northern Japan; British Columbia; Victoria, Australia (Kramp 1959; Arai & Brinckmann-Voss 1980; O'Sullivan 1984).

Family CYTAEIDIDAE L. Agassiz, 1862

Hydroids forming non-polymorphic colonies arising from reticulate stolons covered by perisarc. Hydranths are without caulus (sessile), with one whorl of filiform tentacles below conical hypostome. Base of hydranths often with a perisarc collar. Spines absent. Gonophores develop from stolons and are liberated as medusa or remain fixed as sporosacs. Medusa with simple, circular mouth. With non-branching oral tentacles near mouth. Gonads develop in interradial position on manubrium or encircle manubrium. With four, rarely eight, solid marginal tentacles without lumen. Ocelli lacking (after Millard 1975; Bouillon 1985a; Calder 1988).

REMARKS: Rees (1962) provided a review of this family. Only *Cytaeis* is known from New Zealand.

Cytaeis Eschscholtz, 1829

Polyp stage as in family diagnosis. Medusa typical of Cytaeididae with four marginal tentacles.

TYPE SPECIES: *Cytaeis tetrastyla* Eschscholtz, 1829.

REMARKS: Only one species is known from the literature to occur in New Zealand waters.

Cytaeis cf. *tetrastyla* Eschscholtz, 1829 (Fig. 35a-b)

Cytaeis tetrastyla Eschscholtz, 1829: 104, fig. 2.
Cytaeis tetrastyla: Kramp 1959: 99, fig. 62; Kramp 1961: 63 (*cum syn.*); Kramp 1968: 26, fig. 64; Brinckmann-Voss 1970: pl. 7, fig. 4; Bouillon 1980.

MATERIAL EXAMINED:
No material from the New Zealand region was available; 4 preserved medusae occurred at NZOI Stn A414, 23°16'S, 177°12.5'E (south of Fiji Islands), 28.3.1958, surface.

DESCRIPTION: (Material from Stn A414): Medusa bell-shaped, widest near base, up to 4 mm high (up to 6 *fide* Kramp 1961), 3 mm wide. Apical jelly about twice as thick as lateral walls, without or with very slight peduncle. Manubrium very voluminous, pear-shaped, length four-fifths of bell cavity. Manubrium with up to 20 simple, capitate tentacles scattered in a band near the mouth, adnate at origin. Stomach base with many medusae buds. With 4 broad radial canals and thin circular canal. Epidermis of tentacle bulbs triangular, flat, attached to exumbrella above tentacles. With 4 tentacles of about bell length when contracted. Tentacles thick, tapering. Nematocysts:

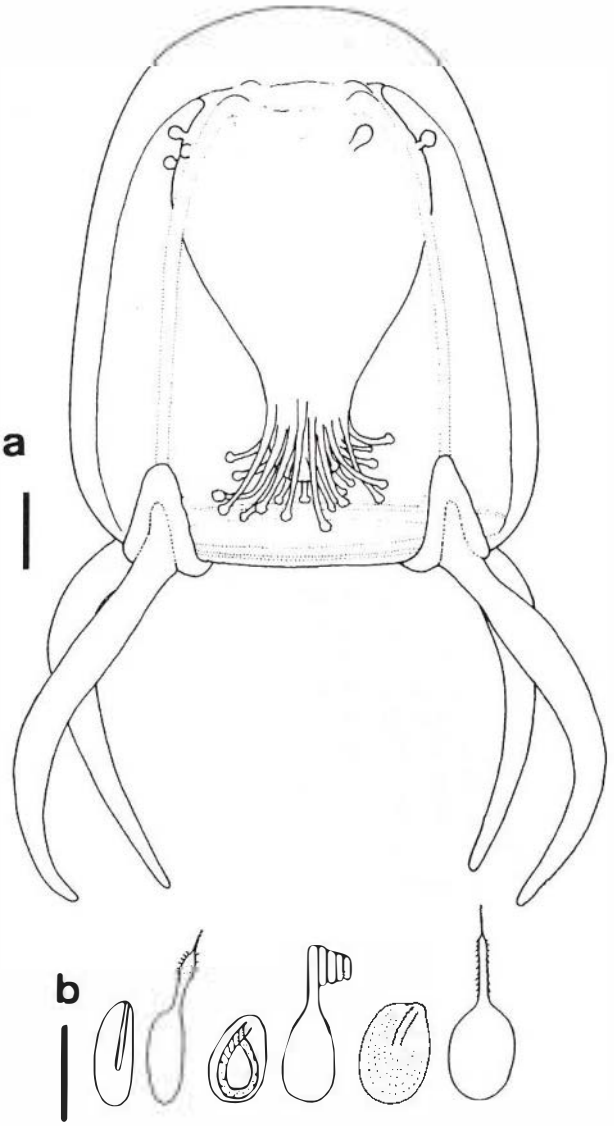


Fig. 35. *Cytaeis* cf. *tetrastyla* from south of Fiji Islands. **a)** medusa; scale bar 0.5 mm. **b)** nematocysts: microbasic eurytele, same discharged, desmoneme, same discharged, microbasic mastigophore, same discharged; scale bar 10 µm.

a) microbasic euryteles, (10.5–11.5) x (3.5–4) µm, s = 0.7.
(b) desmonemes, discharged with 5 coils, (7–10.5) x (4.5–5.5) µm.
(c) microbasic mastigophores, (9.5–11) x (7–8) µm, s = 0.7.
Polyp stage unknown.

TYPE LOCALITY: First described from the Atlantic Ocean south of the Equator (Haeckel 1879).

REMARKS: There are several *Cytaeis* species known from their polyp stage only and many of them seem to produce similar medusae. It may therefore be that the

current concept of *Cytaeis tetrastyla* includes more than one species (cf. Rees 1962; Pagès *et al.* 1992). Therefore *C. tetrastyla* was here identified only tentatively. Kramp (1965) recorded *C. tetrastyla* near the Kermadec Islands. Probably it does not occur near the main islands of New Zealand, being a warm-water species distributed between 40°N and 30°S (Kramp 1965).

RECORDS FROM NEW ZEALAND: Kermadec Trench (Kramp 1965).

DISTRIBUTION: Tropical to subtropical seas (Kramp 1965; van der Spoel & Bleeker 1988).

Family PANDEIDAE Haeckel, 1879

Hydroid stage normally stolonal, not branching, with spindle-shaped hydranths bearing one whorl of filiform tentacles (exceptionally two whorls, scattered tentacles or no tentacles). Perisarc developed to a variable degree, occasionally missing completely, but often also enveloping hydranth as a filmy pseudohydrotheca. Reproduction is by free medusae (except in some genera of questionable affinity). Medusae with or without an apical projection. Manubrium large, mounted or not on a peduncle; mouth with either four simple, or crenulated, or complexly folded lips. With four (rarely eight as in *Octotiara*) radial canals, often broadened to a band; exceptionally centripetal canals can be present. Mesenteries are frequent. Gonads either with a smooth surface or complexly folded; they differentiate on the manubrium in adradial or interradial positions; in a few species they extend onto the radial canals. Tentacles hollow, originating from conical tentacle bulbs, tapering, often laterally compressed. The tentacles never have terminal nematocyst clusters (capitation). There may be rudimentary tentacles, cirri-like tentacles, or marginal protuberances. Ocelli may be present or absent (after Bouillon 1985a).

REMARKS: The above definition is rather vague and complex. It is probable that this group is not monophyletic and future revisions will become necessary (see also under families Clavidae and Bougainvilliidae). A synapomorphy for this family may be the presence of only two opposite tentacles in newly released medusae. However, at present only a fraction of the life cycles are known and it is premature to promote this character as a synapomorphy. Characteristics of genera known from New Zealand:

Amphinema: adult medusae with two tentacles, polyps bend head when stressed.

Annatiara: medusa with nematocyst tracks on exumbrella, without apical process, with broad, cruciform stomach.

Halitholus: medusae with four to eight tentacles that are not laterally compressed, without mesenteries.

Leuckartiara: medusae with laterally compressed tentacles, with mesenteries between radial canals and manubrium, gonad folds directed towards perradial.

Neoturris: medusa with gonad folds directed towards interradial, with mesenteries, small apical process, tentacles compressed laterally.

Pandea: medusae with reticulate gonads, with exumbrellar nematocyst tracks, tentacles compressed laterally, polyps on pteropod snails.

Pandeopsis: medusa with broad, quadrangular stomach, smooth gonads, with mesenteries, without cirri.

Merga: medusa with cruciform base of stomach, smooth gonads, more than four fully developed tentacles, without cirri-like tentacles, with mesenteries.

Barnettia: medusa with smooth gonads, eight fully developed tentacles, cirri-like small tentacles.

Amphinema Haeckel, 1879

Stolonal hydroid colonies, hydranths with a well-developed caulus, caulus longer than hydranth, covered by perisarc. Hydranths without a pseudohydrotheca, spindle-shaped, with one whorl of filiform tentacles, with conical hypostome. Gonophores arise either from cauli, stolons or both. Gonophores are released as free medusae. Medusae with two tentacles in opposite position. Gastric peduncule absent. Generally with a considerable apical projection. There may be marginal cirri or protuberances. With or without mesenteries. With or without ocelli. Gonads on manubrium in adradial or interradial position, occasionally extending to the radial canals.

TYPE SPECIES: *Amphinema dinema* (Péron & Lesueur, 1809).

REMARKS: The above diagnosis was slightly modified after Bouillon (1985a). *Amphinema* polyps are rather inconspicuous and very similar to other polyps in the Pandeidae and Bougainvilliidae. But many *Amphinema* polyps, if not most, show a characteristic reaction to stimuli: they bend back their hydranths so that the mouths face towards the substratum (cf. also Boero & Bouillon 1989). This reaction was seen in both species occurring in New Zealand (Figs 36a, 37a) and differs from other similar polyps that retract or contract upon disturbance. The gastrodermis of the hydranth body

is composed of large, vacuolated cells. Although not diagnostic, it can help to identify *Amphinema* polyps. Characteristics of species known from New Zealand:

Amphinema dinema: Medusae buds on short stalks on stolons only. Medusae without folds in gonads, green manubrium, no short tentacles between long ones.

Amphinema rugosum: Medusae buds on short stalks on stolons and cauli. Medusae with gonads in three folds, yellow manubrium, short tentacles between long pair.

Amphinema dinema (Péron & Lesueur, 1809)
(Fig. 36a-d)

Oceania dinema Péron & Lesueur, 1809: 346.
Perigonimus serpens Allman, 1863: 10.
Stomotoca dinema: Mayer, 1910: 109, pl. 9, figs 8-10, pl. 10, figs 1-4.
Amphinema dinema: Rees & Russell 1937: 62, figs 1-4; Russell 1953: 180, pl. 10, figs 1, 2, 4, pl. 11, figs 1, 3, text-fig. 89 (*cum syn.*); Kramp 1959: 117, fig. 109; Kramp 1961: 93; Kramp 1968: 42, fig. 108; Goy *et al.* 1991: 109, fig.24.

MATERIAL EXAMINED:
Fertile colony collected beneath Queens Wharf, Wellington Harbour, 25.1.1994, subtidal, growing mainly on *Watersipora subtorquata* (Bryozoa) and sponges; more than 100 hydranths with at least 30 medusae buds; part of colony deposited.
Medusae released from above colony grown to maturity, material deposited.
Several mature medusae collected from plankton at Seatoun, Wellington Harbour, some deposited.

DESCRIPTION:
Polyp stage: Stolonal hydroid colonies arising from attached, ramified stolons. Cauli not branched. Polyps up to 1.5 mm high, with cauli covered by perisarc. Perisarc at proximal origin only occasionally annulated, becoming very thin distally and the distal perisarc margin on hydranth body difficult to observe. Perisarc can be infested with detritus. Hydranth spindle-shaped with a dome-shaped hypostome. Below hypostome one whorl of 8-11 filiform tentacles alternately pointing up- and downwards. Medusae buds arise from stolons only, with stems shorter than

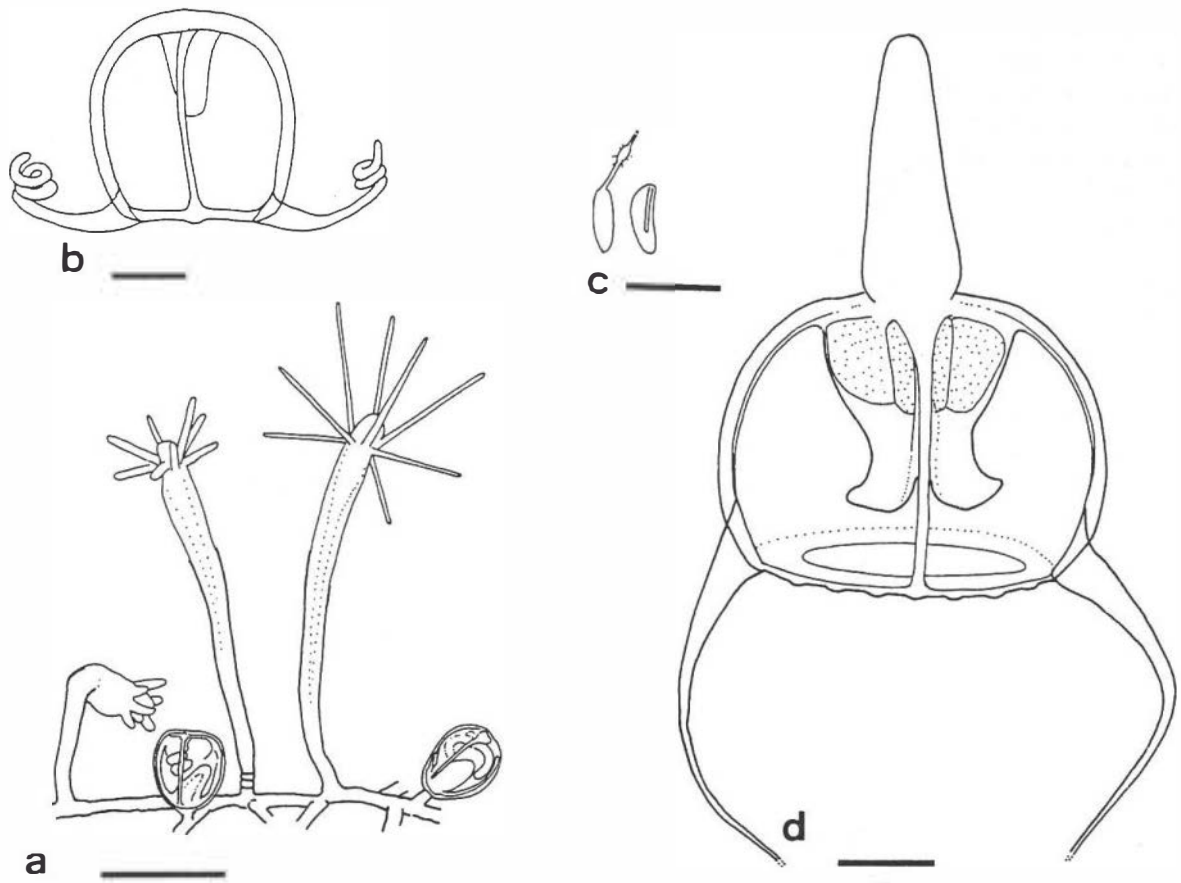


Fig. 36. ***Amphinema dinema*** all from life. **a)** hydroid colony with medusae buds; scale bar 0.5 mm. **b)** newly hatched medusa; scale bar 0.2 mm. c) nematocysts of medusa: microbasic euryteles; scale bar 10 µm. **d)** mature medusa grown from polyp, identical animals were also found in the plankton, gonads shaded; scale bar 0.5 mm.

bud height. Nematocysts and additional observations:
a) microbasic euryteles, (7.5–8) x (2–2.5) mm, s = 1.1.
b) desmonemes, discharged with 3 coils, (4–4.5) x (2–2.5) mm.

Colour of hydranths and medusae buds intense red-orange; medusa bud height 280–340 mm, stems of medusae buds 55–60 mm, caulus diameter proximally 50–75 mm, distally 120 mm.

Newly hatched medusa and juvenile stages: Newly released medusa 0.6 mm high and 0.5 mm in diameter, jelly thin, without apical process, exumbrella with scattered nematocysts. Velum spanning three-quarters of radius. Manubrium length half of bell height, conical, red in colour. With 4 radial canals and circular canal. One pair of opposite tentacles, with broad base, then rapidly tapering. The other 2 radial canals end in a very reduced tentacle bulb.

Interradial rudimentary bulbs may grow after a few days; an apical projection starts to grow as well, the manubrium develops an intensive green colour, becoming cruciform, tentacles turn red or purple.

Mature medusa (animals from plankton and culture): Up to 2.5 mm inclusive of large apical projection, bell slightly wider than high, jelly of uniform thickness besides top. With slight perradial furrows in top of umbrella. Dilated velum spanning half of radius. Manubrium with intensive green colour, manubrium length three-quarters of subumbrella, cruciform in section, mouth with 4 prominent, slightly recurved lips. Eight gonads in adradial pairs, with smooth surface. With 4 broad radial canals. Two diametrically opposed tentacles with thick base, tapering and very long (10 times bell size), deep purple to violet colour; additionally ca. 12 marginal warts, but no short tentacles. Ocelli not present. Nematocysts and additional observations:
a) only microbasic euryteles, (6.5–7) x (2–2.5) µm.

Size of spawned eggs 173 µm (n = 5, s.d. = 12.5 µm).

Remarks on Variation: According to Russell (1953) the medusa can attain 6 mm in height. Shape and size of the apical projection of the medusa vary considerably.

General Remarks: It was possible to grow medusae liberated from polyp colonies to full maturity (spawning) (Fig. 36d). The cultivated medusae corresponded exactly to those found in the plankton and also to descriptions in the literature. The presence of *A. dinema* has not been noted in New Zealand before. It is possible that it is a recently introduced species.

Records from New Zealand: Wellington Harbour (new record of polyp and medusa).

Other Records: NE Australia; Vietnam; India; Mediterranean; Gulf of Guinea; NW Europe; North America from Florida to Cape Cod (Kramp 1968).

Amphinema rugosum (Mayer, 1900a) (Fig. 37a-d)

Stomotoca rugosa Mayer, 1900a: 4, pl. 2, fig. 5.
Stomatoca rugosa: Uchida 1927: 202, fig. 32; Ralph 1953: 74, fig. 17.
Amphinema rugosum: Rees & Russell 1937: 67, figs 5–6; Russell 1953: 183, pl. 10, fig. 3, pl. 11, figs 2 & 4, text-figs 90A–B; Kramp 1959: 117, fig. 110; Kramp 1961: 94 (*cum syn.*); Kramp 1968: 43, fig. 110; Roper *et al.* 1983: table 2; Bouillon 1995: 224.

Material Examined:
Polyp colony on tube of serpulid polychaete, collected 28.2.1994 near Greta Point, subtidal, with many medusae buds, medusae released and cultivated for 9 days, lost by accident before reaching maturity, some polyp material deposited.
Living medusae from plankton near Seatoun, Wellington, 15.4.1994, several juvenile and one mature female.
Ca. 5 medusae collected by T. Barnett, Leigh Marine Reserve, Leigh, 1983–1984.

Description:
Polyp stage: Stolonal hydroid colonies arising from attached, ramified stolons. Polyps up to 3.5 mm high, on cauli up to 2.5 mm long covered by perisarc. Perisarc at proximal origin annulated in all polyps, expanding at distal end. Perisarc ends in the middle of the hydranth body, where it adheres to polyp with a well-marked end. The perisarc can be infested with detritus. Hydranth around 1 mm high, spindle-shaped with a dome-shaped hypostome. Below hypostome one whorl of 10–12 filiform tentacles reaching a length of 1 mm, alternately pointing up- and downwards. Medusae buds arise from stolons and from cauli, with stems shorter than bud height, up to 3 buds per caulus. Nematocysts and additional observations:
Ocelli not present. Nematocysts:
a) microbasic euryteles, (9–10) x (3) µm, s = 1.3.
b) desmonemes, (5) x (3) µm.

Colour of hydranth white to slightly orange, stems of medusae buds 100 µm, caulus diameter proximally 80–100 µm, distally 200 µm.

Newly hatched medusa and juvenile stages: Newly released medusa 0.6 mm high and 0.5 mm in diameter, jelly thin, a little apical process is mostly present, exumbrella with scattered nematocysts. Manubrium length half of bell height, conical, yellow colour. With 4 radial canals and circular canal. One pair of opposite tentacles with broad base then rapidly tapering, yellow colour; the other 2 radial canals end in small tentacle bulbs.

After a few days short tentacles (50 µm) grow from the rudimentary bulbs and in the 4 interradial positions; apical projection grows as well, manubrium remains yellow-brown.

Mature medusa (from plankton: Up to 4 mm inclusive of large apical projection, bell slightly higher than wide, jelly uniformly thin besides top. With slight perradial furrows in top umbrella. Manubrium yellow-coloured, reaching almost to velum, cruciform in section; mouth with 4 prominent, slightly recurved lips. Eight gonads in adradial pairs, with 3 characteristic folds directed interradially. Four broad radial canals with jagged and smooth margins. Two diametrically opposed tentacles with thick base, tapering and very long (ten times bell size), yellow colour. Additionally ca. 14 shorter (one-tenth bell length) reduced tentacles. Ocelli not present. Nematocysts:
a) microbasic euryteles, (9–10) x (3) µm, s = 1.3.
b) desmonemes, (5) x (30 µm

TYPE LOCALITY: First described from Atlantic coast of the USA (Mayer 1900a).

REMARKS: According to Russell (1953) the medusa can reach 5 to 6 mm in height, and there may be up to 24 small tentacles. Although the New Zealand medusae released from the polyps could not be grown to full maturity, the polyp can reliably be referred to *A. rugosum* as it matched very well the description given by Rees and Russell (1937). The apical process of the newly-hatched medusa, the yellow colour, and the

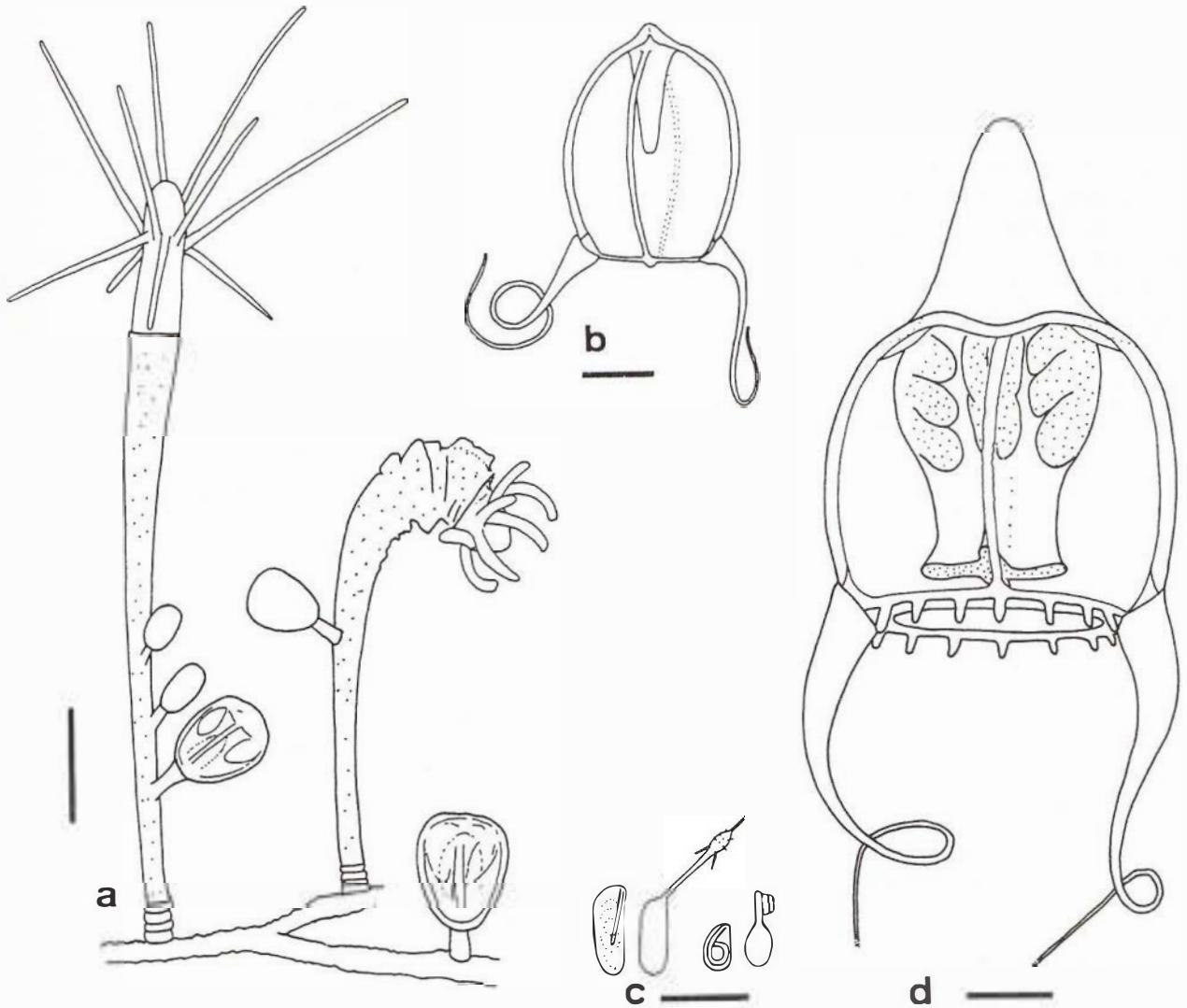


Fig. 37. *Amphinema rugosum*, all from life. **a)** hydroid colony with medusae buds; hydranth at right shows the typical bend-back reaction; scale bar 0.5 mm. **b)** newly liberated medusa; scale bar 0.2 mm. **c)** nematocysts of polyp and medusa, microbasic euryteles and desmonemes; scale bar 10 µm. **d)** mature medusa from plankton, gonads shaded; scale bar 0.5 mm.

short tentacles of the juveniles are also in accordance with the descriptions of Rees and Russell (1937). The adult medusae from the plankton near the same locality also agreed well with other descriptions.

RECORDS FROM NEW ZEALAND: Polyp: Wellington Harbour (first record by this study). Medusa: Cook Strait (Kaberry 1937; Ralph 1953, as *Stomotoca rugosa*); off Chatham Islands (Kramp 1965); Avon-Heathcote estuary in Christchurch (Roper *et al.* 1983); Goat Island, Leigh (Barnett 1985); Coromandel, Cook Strait (Bouillon 1995); Wellington Harbour (this study).

OTHER RECORDS: New Caledonia; Sumatra; China Sea; Madagascar; Caribbean; Florida to Cape Cod; Adriatic Sea; north western Europe (Kramp 1968).

Annatiara Russell, 1940

Pandeid medusae with umbrella lacking an apical process, with exumbrellar nematocyst tracks. Broad manubrium, not extending beyond umbrella margin, mouth with much crenulated lips. With four radial canals. Gonads as folds on interradial sides of stomach. Many marginal tentacles with elongated, laterally compressed conical bases, without well developed abaxial spurs. Rudimentary tentacles present, without marginal warts or marginal tentaculae. Each tentacle with an abaxial ocellus.

TYPE SPECIES: *Annatiara affinis* (Hartlaub, 1914).

REMARKS: No polyp stages are known in this genus. Contrary to the descriptions of other authors (e.g., Kramp 1959, 1961, 1968; Bouillon 1985a) the medusa of *Annatiara affinis* has ocelli (Russell 1953; Schuchert pers. obs.). Only one species is known from New Zealand.

Annatiara affinis (Hartlaub, 1914) (Fig. 38)

Tiaranna affinis Hartlaub, 1914: 269, figs 221–222.
Tiaranna affinis: Kramp 1926: 68, pl. 1, figs 156–17, map 11.
Annatiara affinis: Russell 1953: 200, figs 101–103; Kramp 1959: 122, fig. 123; Kramp 1961: 96; Kramp 1965: 34; Kramp 1968: 48, fig. 125; O'Sullivan 1982: 41, fig. 18, map 17; Bleeker & van der Spoel 1988: 231, figs 10–12, map; Bouillon 1995: 224.

MATERIAL EXAMINED:
1 medusa from *Dana* Stn 3631II, 18.12.1928, 35°40'S, 176°40'E, 1000 m wire, very damaged.
1 medusa from *Dana* Stn 3630V, 17.12.1928, 34°24'S, 178°42.5'E, 600 m wire, very damaged.
1 medusa from *Dana* Stn 3626VIII, 13.12.1928, 27°00'S, 177°41'W, 1500 m wire, very damaged.
1 medusa from NZOI Stn N371, 10.12.1974, 34°23'S, 171°55'E, 0–200 m, damaged, 12 mm, yellow gonads as folds and pits present, margin very damaged.
1 medusa from NZOI Stn U799, 7.8.1990, 42°33.8'S, 170°34'E, depth of haul not known, 10 mm high, some tentacles well preserved, with abaxial ocelli.

DESCRIPTION: Medusa with bell-shaped umbrella, up to 12 mm high and 15 mm wide, without apical projection, jelly uniformly thick, thickness moderate. Exumbrella with meridional tracks of nematocysts that originate from each marginal bulb. Manubrium short but very broad, cross-shaped, attached to subumbrella along the 4 perradial arms of the cross. Walls of manubrium rather thin. Mouth with crenulated margins. Gonads in irregular fold and pits along perradial side of stomach. Four broad radial canals and circular canal; 16 full tentacles and 16 short rudimentary tentacles; all tentacles have a laterally compressed base that clasps the umbrella margin, all with an abaxial brown ocellus. Large tentacles rather short, with broad elongated base, then tapering.

TYPE LOCALITY: 48°29'N, 13°55'W (southwest of Ireland).

REMARKS: The diameter of the bell may reach 23 mm with up to 44 large tentacles (Russell 1953).

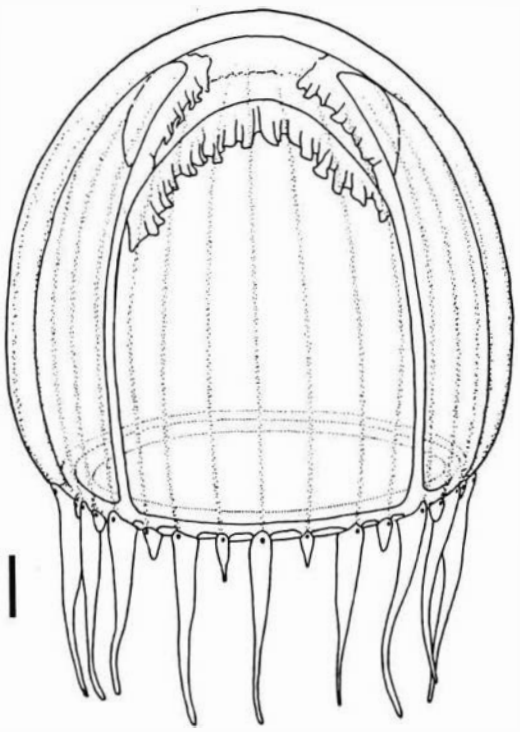


Fig. 38. ***Annatiara affinis***, after preserved sample from Stn U799, posterior tentacles not shown, some tentacles reconstructed; scale bar 1 mm.

RECORDS FROM NEW ZEALAND: East of North Island (Kramp 1965), SW of Three King Islands (Bouillon 1995), off Greymouth (Westland) (this study).

OTHER RECORDS: Atlantic Ocean between 60°N and the equator; Southwest Africa; central Indian Ocean; Sri Lanka; East of Australia; Indonesia; Papua New Guinea; generally in deeper waters (Kramp 1965; Bouillon 1980; Bleeker & van der Spoel 1988).

Halitholus Hartlaub, 1913

Pandeid medusae bearing a large, dome-shaped apical projection, with quadrangular manubrium, with gonad folds directed outwardly. Mouth margin crenulated. Mesenteries absent. With four or more tentacles.

TYPE SPECIES: *Halitholus pauper* Hartlaub, 1913.

REMARKS: Probably only the life cycle of *Halitholus cirratus* Hartlaub, 1913 is known (Naumov 1969, as *Perigonimus yoldia-arcticae*), although it is not clear whether this life cycle was really revealed through rearing experiments. Rees and Thursfield (1965) attributed a "*Perigonimus*" type of hydroid to the medusa *Halitholus intermedius*. This was solely based on the occurrence at the same locality (Stanley Harbour, Falkland Islands). Although the hydroid might well have been *H. intermedius*, the uncertainty is too great and the life cycle of *H. intermedius* is better regarded as still unknown.

As noted by Arai and Brinckmann-Voss (1980), *Halitholus* species are often difficult to distinguish from *Leuckartiara* species, especially when immature.

Only one *Halitholus* species is known from New Zealand.

Halitholus pauper Hartlaub, 1913 (Fig. 39)

Halitholus pauper: Hartlaub 1913: 272, figs 223–224; Kramp 1926: 71, pl. 2, figs 1–3; Kramp 1959: 119, fig. 116; Kramp 1961: 101; Arai & Brinckmann-Voss 1980: 46, fig. 22.

MATERIAL EXAMINED:

3 medusae, size approx. 5 mm, but shrunken, from MoNZ, in two tubes, apparently females as eggs visible. Label tube 1: "Zool. Dep. Victoria University Wellington, *Leuckartiara octona*, WHP." Label tube 2: "N.Z. Oceanographic Institute Wellington, *Leuckartiara octona*, Wgtn Hbr, Dec 1962."

DESCRIPTION:

Medusa ca. 5 mm high, bell-shaped, with low, rounded apical process, lateral walls thin. Manubrium massive, reaching two-thirds of subumbrellar height, cross-shaped in section. Mouth cruciform, margin moderately crenulated. Four gonads on interradial sides of stomach in the form of a horseshoe, opening directed downwards. Gonads with folds, the openings directed perradially and upwards. Four radial canals, rather broad, margins partly smooth, partly jagged. No mesenteries. Ring canal smooth. Four perradial tentacles, with thick base, then tapering, not laterally compressed, clasping bell margin. Four larger interradial bulbs and 8 smaller adradial bulbs, all without tentacles. All bulbs with an small, abaxial, red ocellus.

TYPE LOCALITY: Western Greenland.

REMARKS: The present samples closely resemble Hartlaub's (1913) figures of *Halitholus pauper* with 4 tentacles (although the tentacle bases in Hartlaub's figure are drawn incorrectly as noted by Kramp 1926). In the formal diagnosis given by Kramp (1959, 1961,

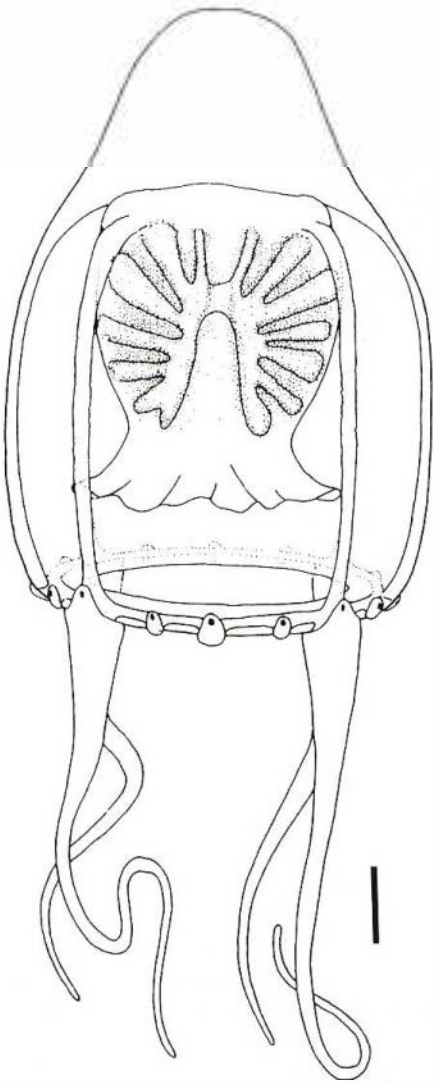


Fig. 39. ***Halitholus pauper***, from Wellington Harbour; scale bar 1 mm.

1968), there should be 4 interradial tentacles of smaller size. According to Kramp (1926) these do not develop until the medusa becomes 5 mm high. At this size the gonads are already fully developed (Hartlaub 1913). The description of the gonad as horse-shoe shaped was taken from Hartlaub (1913) and has also been used by later authors. The shape of the gonads of the present material corresponds with Hartlaub's figures, but they are better described as pairs of adradial gonads connected by a transverse interradial bridge. This interradial connection was found in the majority of the gonads observed in the present study. With hesitation, the medusae from Wellington were therefore assigned to *H. pauper*. Some caution must be stated because Arai and Brickmann-Voss (1980) noted that there may be more unknown *Halitholus* species that are difficult to separate.

It is rather surprising to find *H. pauper* in the southern hemisphere, where one would rather expect to find *H. intermedius* (Browne, 1902), known from the Falkland Islands and South Africa (Kramp 1961). This species is not easily separated from *H. pauper*. The main distinctions are: pairs of adradial gonads or a horse-shoe shape that is merely indicated, a large, pointed apical projection, and larger ocelli (Browne & Kramp 1939).

RECORDS FROM NEW ZEALAND: Wellington Harbour (new record).

OTHER RECORDS: Arctic parts of Atlantic; Iceland, Puget Sound (Canada); Japan.

Leuckartiara Hartlaub, 1913

Hydroids colonial, arising from stolons. Hydrocauli not or sparingly branched, covered by perisarc and not fascicled. Perisarc extends onto hydranth body as a more or less gelatinous pseudohydrotheca which does not envelop the tentacles. Hydranths with a conical hypostome and one whorl of filiform tentacles. Gonophores develop on cauli or hydrorhiza and are covered by thin perisarc, liberated as free medusae. Medusa typically pandeid, mostly with an apical projection of variable size. Manubrium voluminous, connected to radial canals by mesenteries. Mouth with extensively folded and crenulated margin. Gonads on interradial walls of manubrium in the shape of a horseshoe, with folds directed towards outside. Radial canal very broad, often jagged. With many tentacles arising from elongated bulbs, laterally compressed, rudimentary tentacles often present. With or without ocelli (Bouillon 1985a).

TYPE SPECIES: *Leuckartiara octona* (Fleming, 1823).

REMARKS: Younger specimens of *Leuckartiara* may lack mesenteries and are often difficult to distinguish from *Halitholus* species. Only one species of *Leuckartiara* is known from New Zealand with certainty, more may occur (see below).

Leuckartiara octona (Fleming, 1823) (Fig. 40a-b)

Geryonia octona Fleming, 1823: 299.
Leuckartiara octona: Hartlaub 1914: 285, figs 238–214, figs 244–253; Uchida 1927: 211, fig. 37; Rees 1938: 11, figs 3–5; Russell 1953: 188, pl. 11, figs 5–6, pl. 12, fig. 3, pl2 30–31, text-figs 91–96; Kramp 1959: 121, fig. 119; Kramp 1961: 105 (*cum syn.*); Kramp 1968: 47, fig. 121; Millard 1975: 123, figs 41a-d; Arai & Brinckmann-Voss 1980: fig. 29; Pagès *et al.* 1992: 10, fig. 11; Bouillon 1995: 224.

MATERIAL EXAMINED:
1 medusa from NZOI Stn N356, 36°31.3'S, 175°17.6'E (Hauraki Gulf), depth 0–50 m, with 14 tentacles, 6 mm bell and 2 mm process.
1 medusa collected by T. Barnett, 1983, Leigh Marine Reserve, 6 mm high, 8 tentacles, damaged, mesenteries not seen, identification uncertain.

DESCRIPTION:
Medusa stage: Adult up to 8 mm high (up to 20 mm from literature), higher than wide, with conical or spherical apical projection. Lateral walls thin. Manubrium large, length up to two-thirds of bell cavity, connected to radial canals by mesenteries for half of its length. Mouth large, with much folded margin. Four gonads covering whole interradial area, bipartite but connected interradially, with many folds directed towards perradial. Four very broad radial canals and a much thinner circular canal; radial canals often with jagged margins. Up to 14 (up to 24 from literature) long tentacles. Tentacles with a long conical base, laterally compressed, clasping umbrella margin and forming an abaxial spur which bears an ocellus. In between each pair of long tentacles a rudimentary tentacle bulb.
Nematocyst (after Russell 1938):
a) microbasic euryteles (8–10.5) x (3–3.5) µm.
b) mastigophore (7) x (3.5–4) µm.

Polyp stage (after Millard 1975, not known from NZ): Hydroid colonies reaching a maximum height of 5 mm. Stems increasing in diameter from base distally, bearing a terminal hydranth and occasionally 1–3 laterally. Perisarc firm, often annulated or wrinkled, especially at base, expanding to form a gelatinous pseudohydrotheca over base of hydranth, usually covered with adherent silt. Hydranth with 6–12 ten-

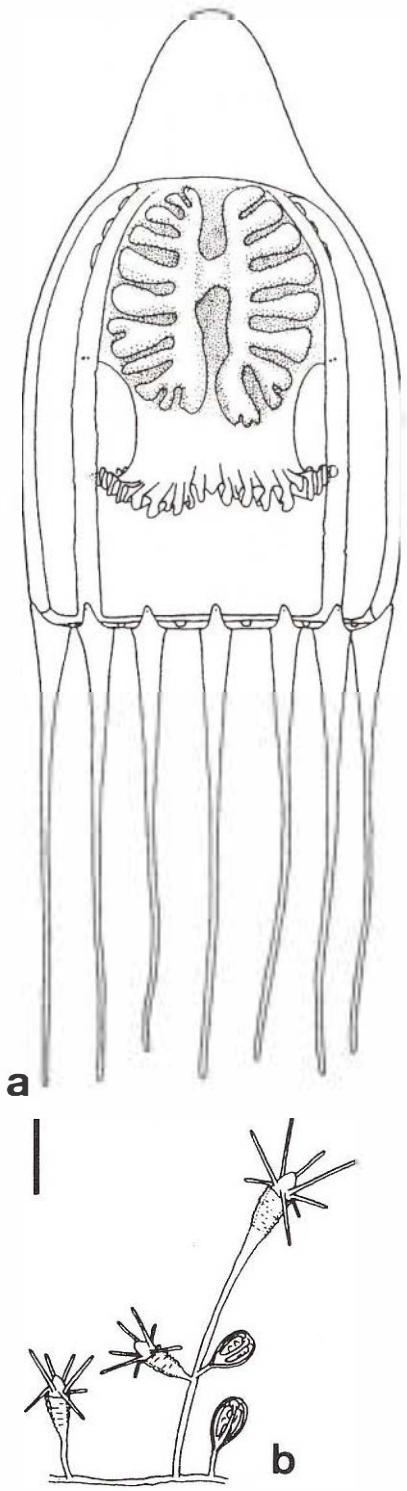


Fig. 40. *Leuckartiara octona*. a) preserved from Stn N356; scale bar 1 mm. b) polyp colony with medusae buds, redrawn from Rees (1938) with permission of Cambridge University Press. Maximal height 2.5 mm. Note: the polyp stage of *L. octona* has not yet been found in New Zealand.

tacles. Medusa buds with short stems on cauli of hydranths, rarely on hydrorhiza, reaching a diameter of 0.45 mm. Newly released medusa with 2 opposite marginal tentacles. Nematocysts (after Bouillon 1985a): desmonemes and microbasic euryteles.

TYPE LOCALITY: Bell Rock, Scotland.

REMARKS: The life cycle of *Leuckartiara octona* was revealed by Rees (1938), who also gave additional numeric data. Although not fully grown, the medusa from Stn N356 agreed rather well with the existing description and figures. The first record of this species for New Zealand was by Kaberry (1937, as *Turris vesicaria*). He found his animals in the plankton near Wellington during late autumn. His detailed description and figure leave no doubt that he actually had *L. octona*. Kaberry's medusae reached the size of 25 mm and had up to 24 long tentacles and as many rudimentary ones, therefore appearing much more like the forms known from Europe. Ralph (1953, fig. 19) copied Kaberry's figure and incorrectly named it *Neoturris vesicaria*.

The medusae found by Barnett (1985) were very small and did not have more than 8 tentacles. This identification is therefore somewhat uncertain as her medusae may belong to a different species.

The polyp of *L. octona* is not known from New Zealand, but should occur here. It often occurs epizoically on gastropod shells (Rees 1938a; Millard 1975) or on parapodia of the polychaete *Aphrodite* (Latham 1963; Schuchert pers. obs.)

RECORDS FROM NEW ZEALAND: Cook Strait (Kaberry 1937), east of Kaikoura (Kramp 1965), ? Leigh Marine Reserve (Barnett 1985), Hauraki Gulf (Bouillon 1995).

OTHER RECORDS: Polyp: England; South Africa (Millard 1975). Medusa: European coasts from Portugal to Lofoten; Iceland; North America from Labrador to Cape Cod; Mediterranean; west Coast of Africa; Tristan du Cunha; India; Malayan Archipelago; northeastern Australia; Low Archipelago; China; Japan; Vancouver; Chile (Kramp 1959).

Neoturris Hartlaub, 1913

Colonial hydroids arising from stolons, stems not branching. Hydranths on simple cauli, these covered by perisarc that continues up to the hydranth body as a pseudohydrotheca but does not envelop the tentacles. One whorl of filiform tentacles. Gonophores developing from hydrocauli, sometimes from stolons. Gonophores completely covered by thin perisarc and

liberated as free medusae. Pandeid medusae with an apical process of variable size, often reduced. With a very voluminous manubrium connected to radial canals by mesenteries. Eight gonads in adradial position on stomach, with folds directed towards interradial. Interradial part of stomach may have additional isolated pits of gonads. Eight or more hollow marginal tentacles with a laterally compressed base. No marginal warts . Mostly without ocelli (after Bouillon 1985a).

TYPE SPECIES: *Neoturris pileata* (Forsskål, 1775).

REMARKS: Only the life cycle of the type species is known (Edwards 1965). *Neoturris* may appear similar to *Leuckartiara*, but both genera are readily distinguished by the direction of the gonad folds. Only *N. papua* is known from New Zealand.

Neoturris papua (Lesson, 1843) (Fig. 41)

Turris papua Lesson, 1843: 283.
Neoturris papua: Uchida 1927: 210, fig. 36; Ranson 1929, 209, figure; Kramp 1961: 108; Kramp 1968: 49, fig. 126; van der Spoel & Bleeker 1988: 167, figs 11–12; Bouillon 1995: 229, fig. 4.

MATERIAL EXAMINED:
1 medusa from NZOI Stn N400, 40°26.8'S, 175°9.2'E (Cook Strait, near Levin), 16.12.1974, 0–53 m, well-preserved female, 11 mm high, 12 tentacles, no ocelli visible.

DESCRIPTION: Large medusa, 11 mm high (may be up to 18 mm high from literature), much higher than wide, conical bell, with small apical projection containing an apical canal. Bell wall uniformly thin. Exumbrella with longitudinal ridges containing nematocysts. As many ridges as normal tentacles, ridges are a continuation of the abaxial spurs of the tentacle bulbs. Manubrium very voluminous, two-thirds as long as bell cavity, connected to radial canals by long mesenteries. Mesenteries as long as half bell height. Lips extraordinarily complexly folded. Eight gonads in adradial position on manubrium, covering three-quarters of its length. Interradial position of manubrium free of gonads. Gonads with a series of horizontal folds which are directed towards interradial. Four very broad radial canals and a much narrower circular canal. Radial canals with smooth margins. Up to 12 large marginal tentacles, the perradial ones longer than the others. Tentacle bulbs long, conical, laterally compressed and clasping umbrella margin. Between each pair of these marginal tentacles 3 thin and short tentaculae with reduced bulbs.
Polyp stage unknown.

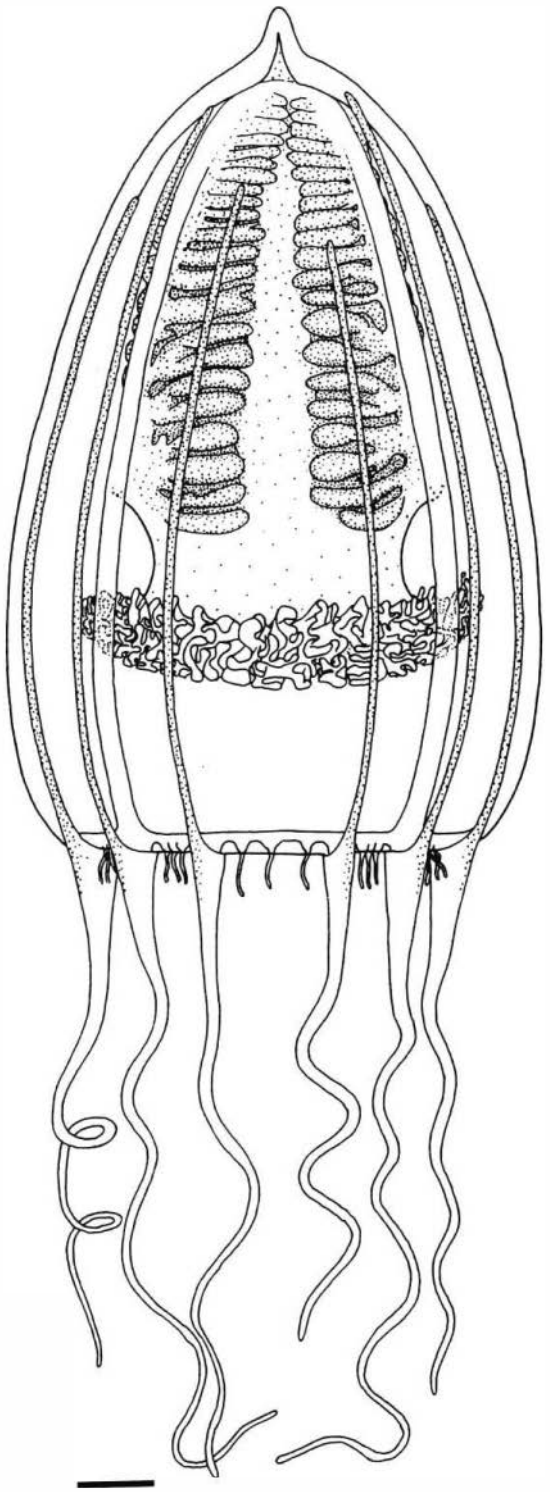


Fig. 41. *Neoturris papua* from Stn N400, rear tentacles not shown; scale bar 1 mm.

REMARKS: All normal tentacles and also the tentaculae have an abaxial ocellus on their bulbs (Bouillon 1995).

TYPE LOCALITY: Originally described as *Turris papua* from Waigiou Island, Indonesia.

RECORDS FROM NEW ZEALAND: Greater Cook Strait, off Horowhenua coast (Bouillon 1995).

DISTRIBUTION: Widely distributed in the coastal waters of the tropical parts of the Indo-West-Pacific region (Kramp 1968).

Pandea Lesson, 1843

Hydroids, where known, forming stolonial colonies with naked hydranths on a very short caulus. Hydranth with filiform tentacles. Medusae buds arise from hydrorhiza. Medusae with the characteristics of Pandeidae, with or without apical projection, with or without longitudinal ridges on exumbrella. Lips large and folded. Gonads at first in the adradii and eventually covering the manubrium, forming a complex reticulated network. Radial canals band-like. More than eight tentacles.

TYPE SPECIES: *Pandea conica* (Quoy & Gaimard, 1827).

REMARKS: So far only the life cycle of *P. conica* is known (Picard 1956). Only this species is known from New Zealand.

Pandea conica (Quoy & Gaimard, 1827)

(Fig. 42a-c)

Diamaea conica Quoy & Gaimard, 1827: 182, pl. 6A, figs 3–4.
Pandea conica: Mayer 1910: 118, fig. 63; Uchida 1927: 214, fig. 38; Russell 1953: 207, figs 107–110; Picard 1956: 1, figs 1–3; Kramp 1959: 123, fig. 127; Kramp 1961: 111 (*cum syn.*); Kramp 1968: 51, fig. 134; Brinckmann-Voss 1970: pl. 11, fig. 2; Lalli & Gilmer 1989: 127, fig. 47b; Pagès *et al.* 1992: 14, fig. 13; Bouillon 1995: 224.

MATERIAL EXAMINED:
1 medusa from NZOI Stn N449, 44°28.9'S, 167°38.6'E, 1.2.1975, 0–200 m.
3 medusae from NZOI Stn X480F, 41°20.4'S, 179°05.8'E, 17.10.1993, 25–50 m.
1 medusa from NZOI Stn X480F, 200–400 m.

DESCRIPTION:
Medusa stage: Adult up to 21 mm high, higher than wide, lateral walls oblique, rather straight, with a small conical process at apex the tip of which is covered by opaque epidermis. Exumbrella with many longitudinal nematocyst tracks that originate from each tentacle. Jelly moderately thick, thicker at top. Manubrium very large, up to two-thirds of height of bell cavity. Mouth with four perradial lips with folded or crenulated margin. Manubrium connected to radial canals by long mesenteries. Gonads large, filling entire interradial walls of stomach, forming a coarse-meshed network of ridges with pits between. Four broad radial canals with jagged margins, circular canal narrower and smooth. Up to 24 smooth, hollow, marginal tentacles, each with conical, laterally compressed bulb clasping the umbrella margin. Each tentacle with an abaxial ocellus. Lacking rudimentary tentacles.
Nematocysts:
a) basitrichous isorhizas (?), only few present, (20–21) x (19–21) µm.
b) microbasic euryteles, (9.5–11) x (4.5–5) µm, s ~ 0.9.
c) atrichous isorhiza, diameter 5 µm.

Polyp and young medusa (after Picard 1956): Colonial hydroids living on the planktonic gastropod *Clio cuspidata*, arising from attached, ramified stolons. Stolons fine, covered by thin perisarc. Polyps with a very short caulus, almost sessile. Hypostome conical. Eight filiform tentacles of variable length in 2 closely-set whorls. Medusae buds arise directly from stolons and have a short caulus, buds covered with thin perisarc. Newly released medusa as high as wide, bell-shaped with moderately thick jelly. Jelly at apex interrupted by remains of the connection with the caulus. Manubrium length half of bell cavity, conical with 4 very inconspicuous lips, no gonads visible. Four broad, smooth radial canals and circular canal. Two opposite larger and two smaller tentacle bulbs present; only larger bulbs bear a tentacle. Ocelli not present, but a dispersed red pigment present in bulbs. Above bulbs on exumbrella patches of tissue with nematocysts that later grow towards top. Nematocysts of polyp:
a) microbasic euryteles, (8–10) x (3.5–5) µm.
b) desmonemes, 5 x 3.5 µm.

TYPE LOCALITY: Gibraltar.

REMARKS: According to Russell (1953) the manubrium may be reddish, brownish, or yellowish and the size of the bell can attain 30 mm. The polyps of this species occur on the shell of the euthecosome pteropod *Clio cuspidata* (see Picard 1956, Lalli & Gilmer 1989). New Zealand lies within the high abundance area of *C. cuspidata* (van der Spoel & Heyman 1983, fig. 48) and therefore the polyps of *P. conica* might be expected here.

The nematocysts found in the medusae from New

Zealand were more varied than reported by Picard (1956). He did not mention the large capsule, probably an isorhiza, and the small isorhizae. They were not abundant, however, were difficult to analyse in preserved material, and he had rather young animals. Desmonemes seem to occur in the polyp stage only.

RECORDS FROM NEW ZEALAND: SE of Banks Peninsula, Christchurch (Kramp 1965); off Fiordland (Bouillon 1995, medusa); 300 km east of Cape Palliser (this study); polyps not recorded yet.

OTHER RECORDS (MEDUSA): Mediterranean; Atlantic Ocean from Bermuda to South Africa and Patagonia; East Africa; Sri Lanka; Central North Pacific, California; southern Japan; Vietnam; Philippines; Rarotonga; east of Australia (Kramp 1968, map in Bleeker & van der Spoel 1988).

Pandeopsis Kramp, 1959

Small, colonial hydroids with three filiform tentacles. Medusa with the characteristics of the family, and voluminous, quadrangular manubrium with large base attached to subumbrella. Long mesenteries. Gonads on interradial walls of stomach, smooth, sheet-like. Mouth with four simple lips. Up to 12 marginal tentacles and up to 24 rudimentary bulbs. Tentacular cirri or reduced tentacles absent. Tentacle bulbs without spur, with abaxial ocelli.

TYPE SPECIES: *Pandeopsis ikarii* (Uchida, 1927).

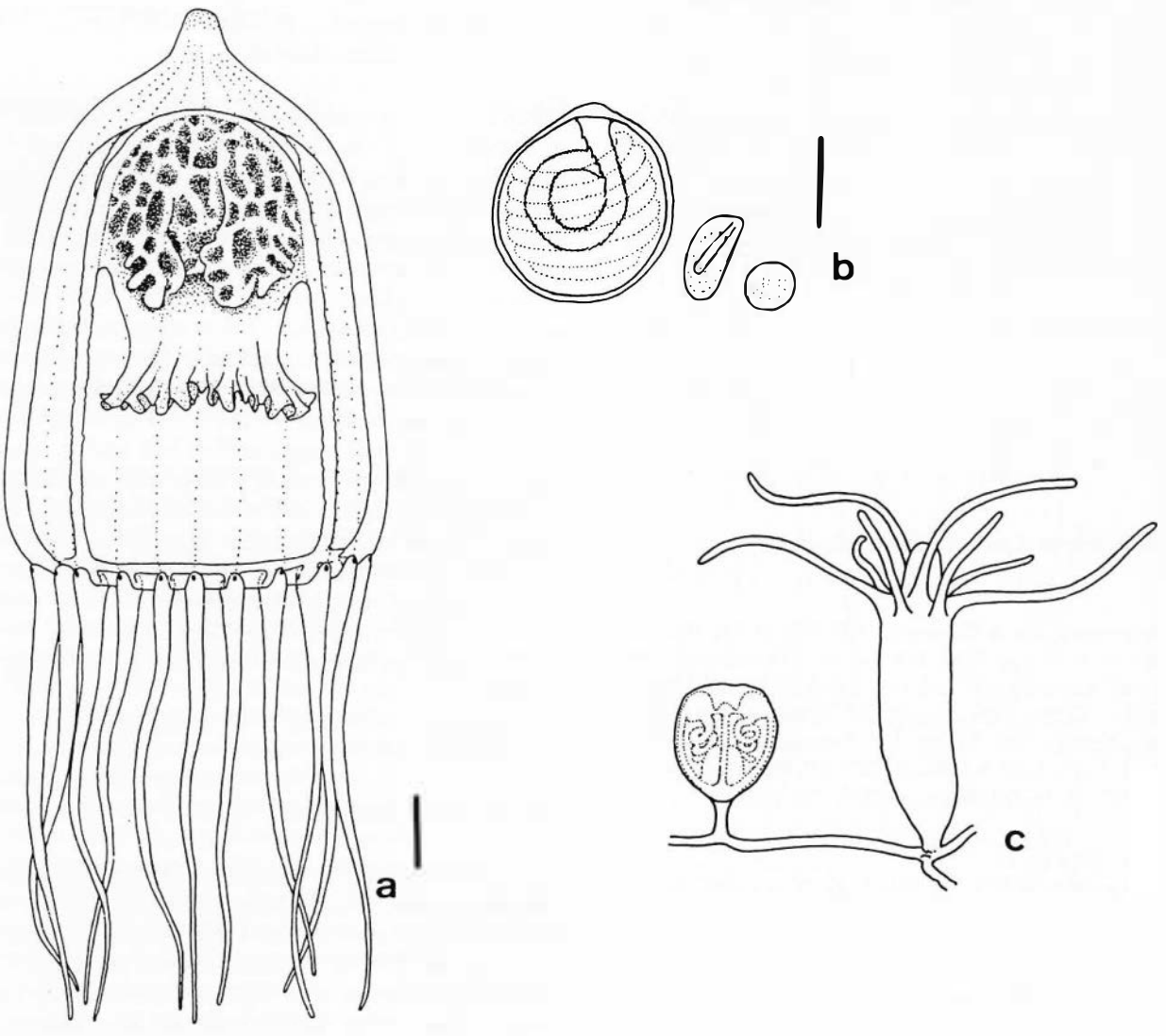


Fig. 42. ***Pandea conica.*** **a)** adult medusa after preserved material; scale bar 2 mm. **b)** nematocysts of medusa: basitrichous isorhiza (?), microbasic eurytele, atrichous isorhiza; scale bar 10 µm. **c)** polyp stage, redrawn after Picard (1956), no scale given; note: this polyp has not yet been found in New Zealand waters.

REMARKS: The life cycle of the only species of this genus was revealed by Bouillon (1985b).

Pandeopsis ikarii (Uchida, 1927) (Fig. 43a-b)

Tiaranna ikarii Uchida, 1927: 208, fig. 35.
Pandeopsis scutigera Kramp, 1959: 232, fig. 7.
Pandeopsis scutigera Kramp 1961: 113.
Pandeopsis ikarii: Kramp 1961: 444; Kramp 1968: 41, fig. 105; Bouillon 1985b: 257, fig. 6.

MATERIAL EXAMINED:
No material from New Zealand seen.

DESCRIPTION:
Medusa stage (after Uchida 1927 and Kramp 1961): Medusa up to 4.5 mm high, almost globular, jelly thick, especially in apical region. Manubrium about half height of bell cavity. Stomach short and very broad, quadrangular, its entire surface attached to the subumbrella. The perradial edges of the stomach in their entire length adnate to the radial canals, thus forming mesenteries. Mouth rim almost smooth, with 4 simple lips. Four interradial gonads on stomach, each like a flat sheet with trapezoid outlines, completely smooth. The distal, free portions of the radial canals short and narrow. Circular canal and velum narrow. Eight marginal tentacles, each with an elongated pear-shaped abaxial ocellus; no abaxial spur; with 8 small, adradial rudimentary bulbs also bearing ocelli. In living specimens each gonad is provided with 3 or 4 small red spots. Nematocysts (after Bouillon 1980):
a) reniform microbasic euryteles, (7–9) x (3.5–4.6) µm.
b) elliptic microbasic euryteles, (10) x (4.6) µm.

Polyp stage (after Bouillon 1985b, not known from NZ): Planulae aggregate and attach to the substratum with one end, thus forming a common hydrorhiza. The other ends of the planulae each form a small polyp (up to 0.4 mm). These with conical hypostome and below it 1 whorl of 3 filiform tentacles. Polyps from aggregates multiply by budding from the common hydrorhiza. This hydrorhiza also forms long stolons that form dispersal buds at their end. Single planulae form solitary polyps only. Medusae buds unknown.

TYPE LOCALITY: Seto, Japan.

REMARKS: The description of Uchida (1927) and Kramp (1961) slightly disagree on the surface structure of the gonads. Uchida described them as complicated and irregular. This discrepancy may eventually be explained by the younger stages examined by Uchida. Bouillon (1980) found this medusa in very large numbers in Papua New Guinea.

RECORDS FROM NEW ZEALAND: Kermadec Islands (Kramp 1965, medusa).

OTHER RECORDS: Japan; Philippines; Gulf of Siam; Java Sea; Papua New Guinea (Kramp 1968; Bouillon 1980).

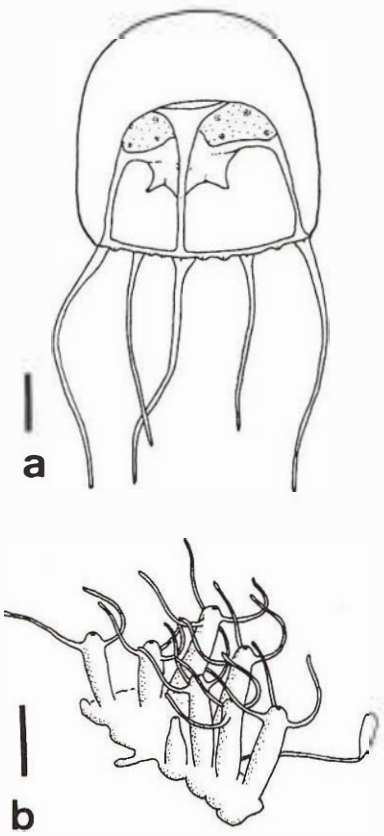


Fig. 43. *Pandeopsis ikarii*. **a)** medusa, modified after Uchida (1927); scale bar 1 mm. **b)** polyp stage with stolon and developing dispersal bud (right); redrawn from Bouillon (1985b) with permission of the publisher; scale bar 0.2 mm.

Merga Hartlaub, 1913

Hydroids (where known) colonial, arising from tubular ramifying hydrorhiza, cauli slightly branched or not; with or without pseudohydrotheca which, when present, not enveloping tentacles; one whorl of filiform tentacles. Medusae buds arise from stems or stolons. Pandeid medusae with perradial edges of stomach connected with radial canals by mesenteries, stomach with cross-shaped base, manubrium not twisted, with simple or faintly crenulated oral lips. Smooth adradial or interradial gonads. Four to eight or more long tentacles, with or without rudimentary bulbs or tentaculae, with or without ocelli (after Bouillon 1980, 1985a).

TYPE SPECIES: *Merga violacea* (Agassiz & Mayer, 1899).

REMARKS: The difference between the diagnoses of *Merga* and *Pandeopsis* is rather small and relies mostly on the shape of the stomach.

Only one species is known from New Zealand.

Merga treubeli n.sp. (Fig. 44a-d)

MATERIAL EXAMINED:

2 juvenile medusae from Evans Bay, surface plankton, taken 12.1.1994 and 25.3.1994, cultivated to maturity.

5 juvenile specimens from surface plankton at Seatoun (Wellington Harbour), 13.1.1994, cultivated to maturity, females and males obtained; gametes were spawned and developed into planulae which did not metamorphose. One female selected as holotype H-648, remaining material deposited as paratypes, P-1076.

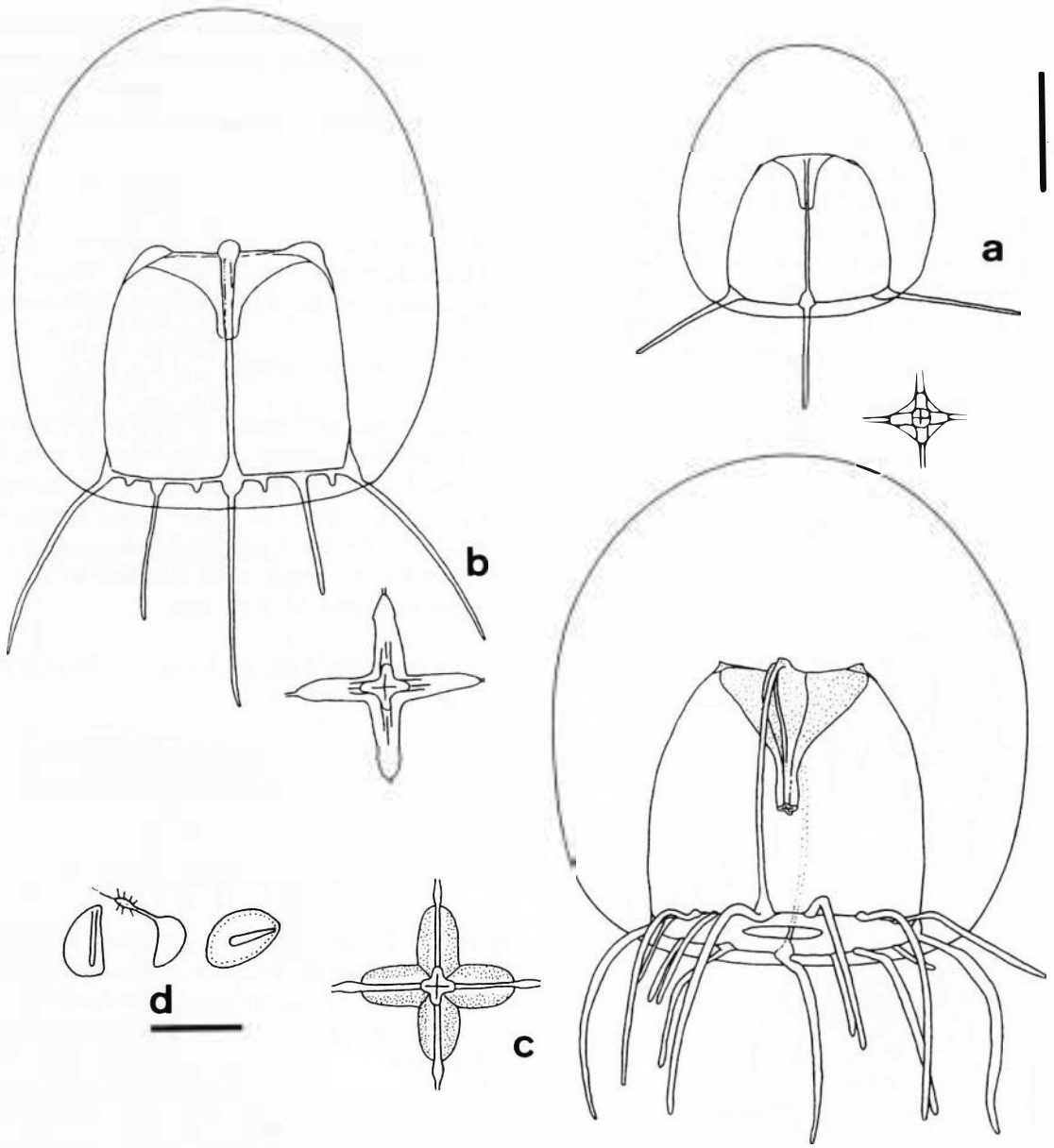


Fig. 44. ***Merga treubeli*** n. sp., from life, **a)** to **c)** all the same scale, also oral view of manubrium. **a)** youngest stage found in the plankton, below oral view of manubrium; scale bar 1 mm. **b)** immature female from plankton, most frequently found stage. **c)** mature male medusa cultivated from a similar stage as given in b). **d)** nematocysts: microbasic eurytele from tentacles, same discharged, microbasic eurytele from mouth margin; scale bar 10 µm.

DESCRIPTION: Medusae with spherical umbrella, up to 4 mm high and wide, with very thick jelly; apical jelly can reach half of the total height, dilated velum spans two-thirds of radius. Manubrium half as long as bell cavity, mouth small and cruciform. Base of manubrium with 4 triangular, laterally compressed perradial extensions which continue as radial canals. At beginning of each radial canal a triangular process of variable height projecting upwardly into apical mesogloea. Radial canals smooth. With 4 perradial, 4 interradial, and 8 shorter adradial tentacles; in adults no rudiments of bulbs or tentaculae. Tentacles hollow, evenly covered with nematocysts, bulbs small, without ocelli. Gonads cover basal extensions of stomach in 8 adradial sheets which are in contact interradially but are separated perradially. Nematocysts:

a) microbasic euryteles from tentacles, (6.5–7) x (3–3.5) µm, s = 1.
b) microbasic euryteles from mouth, only few present, (8.5–9) x (4.5–5) µm.

Size of spawned eggs: 102 µm (n = 5, one animal). Colour: orange bulbs in nature.

TYPE LOCALITY: Seatoun jetty, Wellington, New Zealand.

REMARKS: With its small mouth and the triangular projections at the proximal end of the radial canals *M. treubeli* is quite distinct from all other *Merga* species. The extensions of the stomach base were here interpreted as mesenteries, although they are not typical. Normally the stomach is more voluminous. It may be necessary, therefore, to transfer this species to another genus in the future, but further life-cycle information is needed to substantiate this.

ETYMOLOGY: The species name *treubeli* was chosen to honour and thank the Treubel Foundation (University of Basel) for financing this study.

RECORDS FROM NEW ZEALAND: Wellington Harbour.

Barnettia n. gen.

Pandeid medusa with eight hollow, long tentacles between each pair of which are cirri-like small tentacles without bulbs, with chordoid gastrodermis. The cirri-like tentacles are evenly spaced and not associated with the larger tentacles. Manubrium small, with four simple perradial lips. Gonads interradial, smooth. Four radial canals present, without mesenteries. Apical projection may be present. Ocelli lacking. Cnidome includes microbasic euryteles.

TYPE SPECIES: *Barnettia caprai* n.sp.

REMARKS: See below under *Barnettia caprai*, the only species of this genus.

Barnettia caprai n. sp. (Fig. 45a-b)

MATERIAL EXAMINED:
20 medusae collected by T. Barnett during March to July 1983 and 1984. One medusa selected as holotype and deposited as H-639; some of the remaining material deposited as paratype P-1067.

DESCRIPTION: Medusae up to 2 mm but mostly smaller, bell shape variable from as broad as high to higher

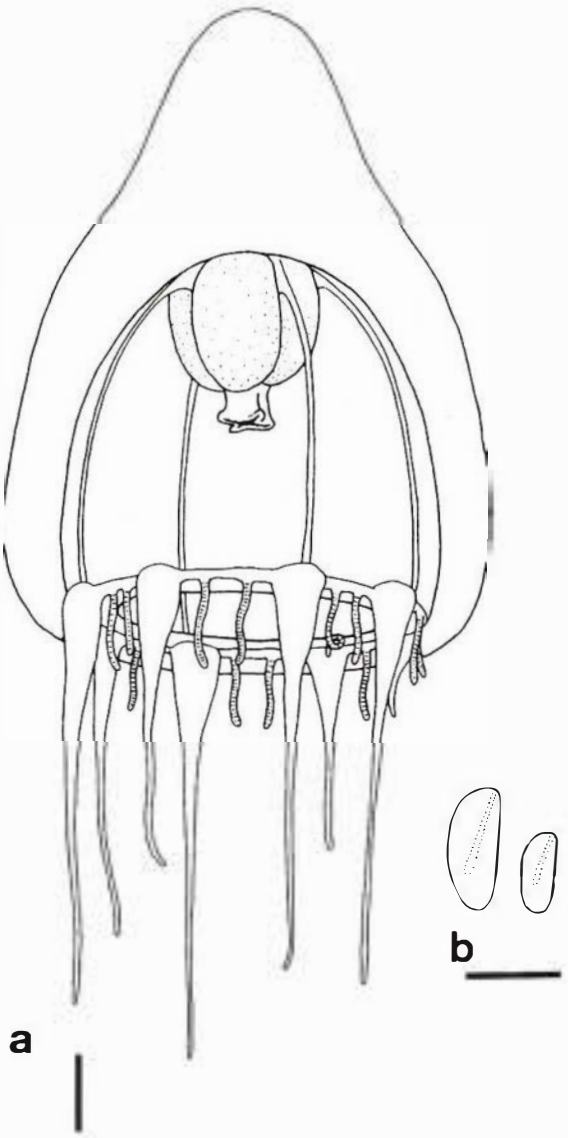


Fig. 45. *Barnettia caprai* n.gen. n.sp., from preserved material. **a)** mature medusa; scale bar 0.2 mm. **b)** nematocysts: larger microbasic heteroneme, microbasic eurytele; scale bar 10 µm.

than broad. Jelly thick, forming a blunt apical projection. Manubrium about half length of bell cavity, with 4 simple perradial lips without nematocysts. Four large, interradial gonads covering almost the whole manubrium. Gonads with a smooth surface and margin. Four radial canals, moderately thin and smooth. Ring canal broader than radial canals. No mesenteries present, or these only indicated. In adults 4 perradial and 4 interradial long tentacles, length up to 1 mm (preserved material). Tentacles with large conical bulbs tapering into the tentacles which are proximally hollow and distally filled with parenchymatic gastrodermis. Between each pair of these large tentacles 2 (sometimes 3) evenly spaced, small, cirri-like tentacles with chordoid gastrodermis. No ocelli present. Nematocysts:

a) larger microbasic heteronemes (mastigophores or euryteles), (11.5–13.5) x (4–5) µm.
b) smaller microbasic euryteles, (6.5–7.5) x (2–3) µm, s = 1.

Polyp stage: unknown.

TYPE LOCALITY: Surface plankton near Goat Island, Leigh Marine Reserve, New Zealand.

REMARKS: With its cirri-like tentacles and smooth gonads, the morphology of *Barnettia caprai* n.gen. n.sp. superficially resembles medusae of the genus *Halitiara*. *Barnettia caprai* always has more than 4 large tentacles, although in juveniles the interradial ones are present as bulbs only. *Halitiara* belongs to the family Protiaridae (see p. 76 and Bouillon 1985a), characterised by having only 4 normal perradial tentacles. Additionally, the examined species of this family have a cnidome and polyps that are quite different from the ones found in the Pandeidae (Bouillon 1980, 1985a, 1988). It appears that the Protiaridae are not closely related to the Pandeidae. Because *B. caprai* has more than 4 normal tentacles and microbasic euryteles, the genus is included in the Pandeidae. In this family the only genus that has cirri-like tentacles is *Cirrhitiara* Hartlaub, 1913, which is, however, otherwise well distinguished by its folded gonad, mesenteries, and ocelli. A new genus is thus required.

Barnettia caprai seems to be a rather abundant medusa near Leigh as Barnett (1985) collected about 130 animals. Barnett's data indicate that they are seasonal as the medusae were found in late summer to autumn only (February to July).

The life cycle of this species has yet to be revealed. Information on the polyp stage will also be needed to confirm its affinities with the family Pandeidae.

ETYMOLOGY: The genus name was chosen to honour and thank Mrs Treffery Barnett for the generous loan of her collection of Anthomedusae and allowing the new species to be described here. The species name *caprai* refers to the type locality of Goat Island (*capra*, Latin, goat).

RECORDS FROM NEW ZEALAND: Goat Island (Leigh), Whangateau Harbour (Barnett 1985, as *Haliterella* sp.)

Family PROTIARIDAE Haeckel, 1879

Medusa with only four fully developed tentacles, arising from well-developed hollow tentacular bulbs. Manubrium with four simple lips. Four interradial gonads with smooth surface. With or without mesenteries. With four simple radial canals and a circular canal. Margin may have small cirri-like tentacles, exceptionally with ocelli (after Bouillon 1985a).

REMARKS: Only *Halitiara* is known from New Zealand.

Halitiara Fewkes, 1882

Protiarid medusae with four simple perradial tentacles and in between them numerous solid cirri-like tentacles. With or without mesenteries, with or without apical projection. Lacking ocelli (after Bouillon 1985a).
TYPE SPECIES: *Halitiara formosa* Fewkes, 1882.

REMARKS: The life cycle of only *H. inflexa* is known (Bouillon 1985b). Two species of *Halitiara* have been recorded from New Zealand. Characteristics are:

H. formosa: with apical projection, without mesenteries.
H. inflexa: lacking apical projection, mesenteries present.

Halitiara formosa Fewkes, 1882

Halitiara formosa Fewkes 1882: 267, pl. 4, fig. 2.
Protiara formosa: Mayer 1910: 107, pl. 6, figs 4–6.
Halitiara formosa: Kramp 1959: 115, fig. 103; Kramp 1961: 102; Kramp 1965: 28; Kramp 1968: 40, fig. 102; Brinckmann-Voss 1970: pl. 11, fig. 1; Goy 1972: 982, figs 5, 7; Bouillon 1995: 230, fig. 5.

MATERIAL EXAMINED:
Several medusae from NZOI Stns N401 and N413, identified by Prof. J. Bouillon as including *H. formosa* (see Bouillon 1995).

DESCRIPTION (after Kramp 1968, Bouillon 1995): Medusa up to 3 mm high, pear-shaped, with solid apical projection; manubrium pyriform, about half as long as

bell cavity; 4 long, hollow and 24–35 short, solid tentacles, tightly coiled, cirrus-like; no ocelli; gonads interradial, smooth; no mesenteries.

TYPE LOCALITY: Tortugas, Florida.

REMARKS: Kramp (1965) was the first to record *Halitiara formosa* from New Zealand. He found only one medusa, that did not entirely accord with other populations owing to its crenulated lips. He therefore considered this identification as doubtful. Kramp's sample is no longer available. Bouillon (1995) identified several medusae from New Zealand as *H. formosa* and illustrated one of them. His samples were re-examined for this study and I conclude that they do not contain *H. formosa*. Some of the medusae resemble *H. formosa* in general appearance, including the cirri-like tentacles, but their gonads are in obvious folds which are directed perradially. A closer examination additionally revealed remainders of nematocyst tracks on the exumbrella. The medusae thus resemble some *Leuckartiara* species. The samples are not in good condition and a more precise identification was not possible. The presence of *H. formosa* in New Zealand cannot therefore be confirmed and all records must be considered uncertain. Judging from the distribution of the species, however, it may be expected to occur in New Zealand waters.

RECORDS FROM NEW ZEALAND: ? some distance off the east coast of South Island (Kramp 1965); ? off Foxton, Cook Strait; ? south of Kaikoura (Bouillon 1995).

OTHER RECORDS: Tortugas, Florida; Bahamas; Mediterranean; Japan; India; Papua New Guinea; ? Fiji (Kramp 1961, Goy *et al.* 1972, Bouillon 1980).

Halitiara inflexa Bouillon, 1980 (Fig. 46a-b)

Halitiara inflexa Bouillon 1980: 324, fig. 9; Bouillon 1985b: 259, fig. 7; Bouillon *et al.* 1988b: 212, fig. 8; Goy *et al.* 1991: 110, fig. 27; Bouillon 1995: 230, fig. 6.

MATERIAL EXAMINED:
4 medusae from NZOI Stn N404, 41°38'S, 175°18.8'E, (Cape Palliser), 17.12.1974, 0–51 m.

DESCRIPTION:
Medusa stage: Umbrella bell-shaped, 1.6 mm high and 1.2 mm in diameter. Jelly moderately thick, gradually thickening towards top to about twice the thickness of the lateral walls. Manubrium voluminous, quadrangular, length about two-thirds of bell cavity, joined to radial canals by mesenteries for half of their length. Mouth with 4 simple lips. Gonads large, bulging, fill-

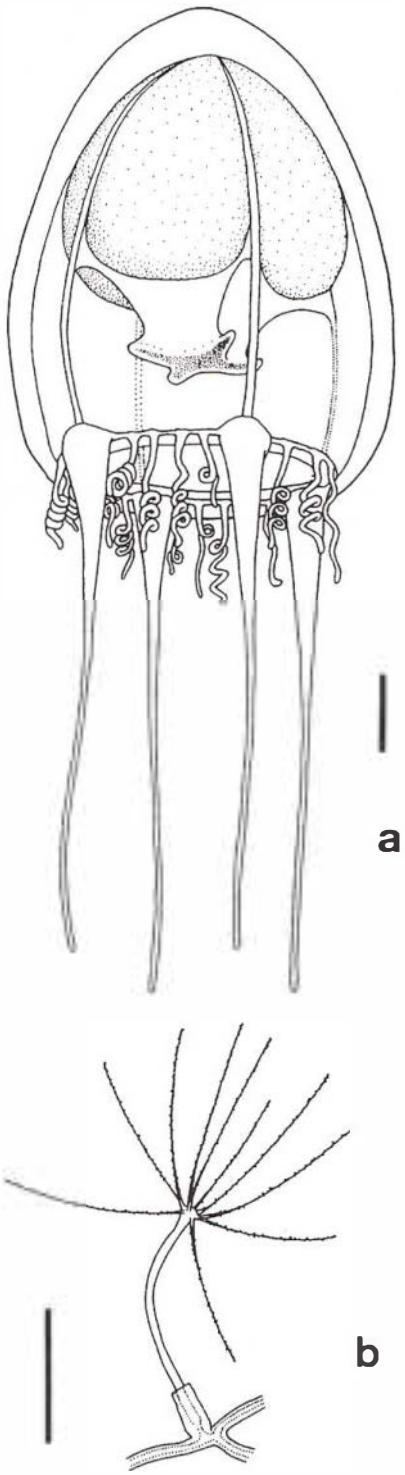


Fig. 46. *Halitiara inflexa.* a) medusa from Stn N404; scale bar 0.25 mm. b) polyp stage, redrawn from Bouillon (1985b) with permission of the publisher. Note: the polyp stage has not yet been found in New Zealand. Scale bar 1 mm.

ing interradial position completely, leaving free only a small perradial band of stomach and the mouth region. Four radial canals and circular canal, all narrow and with smooth margins. Four long perradial tentacles. Tentacles with broad conical base then tapering, base not laterally compressed. Nematocysts evenly distributed on tentacles. Between each pair of long tentacles 3–6 short, cirri-like tentacles, without bulbs, often coiled. Cirri with chordoid endodermis, tips with nematocysts (haplonemes). Nematocysts (after Bouillon 1980, Bouillon *et al.* 1988b):

a) larger atrichous isorhizas, (10) x (4.5) µm.
b) smaller atrichous isorhizas, (7) x (2) µm.
c) merotrichous isorhizas, (15) x (9) µm.
d) mastigophores, (7) x (2.5) µm.

Polyp stage (after Bouillon 1985b, not known from NZ): Hydroid colonies arising from attached, ramified stolons. Stolons covered by perisarc. Polyps up to 1 mm, with a very short caulus (80 mm), a long, narrow cylindrical body and a short conical hypostome. Below hypostome one whorl of 10 long, filiform tentacles (0.7 mm) with irregular clusters of nematocysts. Alternating with the tentacles are large nematocysts. Caulus and base of polyp body are covered by a perisarc cup (height 0.17 mm) into which the polyp can almost completely retract.

TYPE LOCALITY: Laing Island, Papua New Guinea.

REMARKS: *Halitiara inflexa* from New Zealand agrees well with the original description by Bouillon (1980), only the size is somewhat smaller. The nematocysts were examined for this study but, owing to poor preservation, it was not possible to recognise them clearly. It was evident however, that the cirri contain a concentration of larger haplonemes at their tips.

RECORDS FROM NEW ZEALAND: Cape Palliser (Bouillon 1995).

OTHER RECORDS: Papua New Guinea, Mediterranean (Bouillon 1980; Goy *et al.* 1991).

Family EUDENDRIIDAE L. Agassiz, 1862

Colonial hydroids with an erect, usually branched stem enclosed by firm perisarc up to the base of the hydranth body. Hydranths large, with trumpet-shaped hypostome and one or more whorls of filiform tentacles immediately below it. Reproduction by fixed sporosacs borne on the hydranth body below the tentacles, reproductive hydranth often reduced to a blastostyle. Male gonophores usually with several chambers in linear series. Young female gonophore with a single egg encircled by a spadix (after Millard 1975).

REMARKS: Members of this family are easily distinguished from all other families of the Athecata by their wide, trumpet-shaped hypostome. The hydranths in this family are comparatively large and urn-shaped. The perisarc originates in a circular grove with larger cells at the base of the hydranths (basal furrow). Initially the perisarc is very thin, becoming thicker only on the cauli (Fig. 48b). The gonophores of this family show no trace of a medusa stage (Wasserthal 1973).

The family comprises the genera *Myrionema* and *Eudendrium*, which differ in the number of tentacle whorls. Only the genus *Eudendrium* is known in New Zealand.

Eudendrium Ehrenberg, 1834

Colonial hydroids with monopodial growth, hydrocaulus enclosed by perisarc. Hydranths on perisarc-covered cauli, radially symmetrical with large, undercut hypostome and only one whorl of filiform tentacles. Microbasic euryteles always present in tentacles, other kinds of nematocysts may be present on hydranth body, hypostome, or gonophores. Gonophores fixed sporosacs, borne on hydranth body below tentacles. Reproductive hydranth often reduced to a blastostyle. Male gonophores with one or more chambers in linear series. Young female gonophores with a single egg encircled by a spadix.

TYPE SPECIES: *Eudendrium ramosum* (Linnaeus, 1758).

REMARKS: *Eudendrium* is easy to recognise, but identification to species can be difficult. Earlier authors often based species distinctions on traits that are now known to be too variable or dependent on the environment (see Millard 1975). The use of nematocyst characters has improved the situation.

Most *Eudendrium* species have limited larval dispersal (Sommer 1992). Possibly speciation rates have been high, for many endemic species exist (cf. Watson 1985; Hirohito 1988; Marinopoulos 1992).

The New Zealand *Eudendrium* species were recently revised by Watson (1987). Watson (1985) reviewed the Australian *Eudendrium* species some of which may yet occur in New Zealand. For the identification of *Eudendrium* species nematocysts must always be examined. The four known species of *Eudendrium* occurring in New Zealand can be distinguished with the help of nematocysts only, and more species may

be expected to occur. Characteristics of known New Zealand species:

Eudendrium novaezelandiae: normally large colonies, fascicled, two sizes of nematocysts in hydranth, the larger eurytele more than twice as large as the smaller, its shaft not longer than capsule.

Eudendrium ritchiei: completely annulated perisarc, two types of euryteles, the larger with everted shaft much longer than capsule, female gonophore with bifurcated spadix.

Eudendrium terranovae: large, fascicled colonies, only one size of eurytele.

Eudendrium maorianus: small colonies, only sporadically annulated, two sizes of eurytele, the larger capsules smaller than twice the size of the smaller capsules, shaft of larger capsules not longer than capsule, spadix of female gonophore 0–2 times branched.

Eudendrium novaezelandiae Marktanner-Turneretscher, 1890 (Fig. 47a-f)

Eudendrium novaezelandiae Marktanner-Turneretscher 1890: 201, pl. 3, fig. 21; Watson 1987: 326, figs 14.

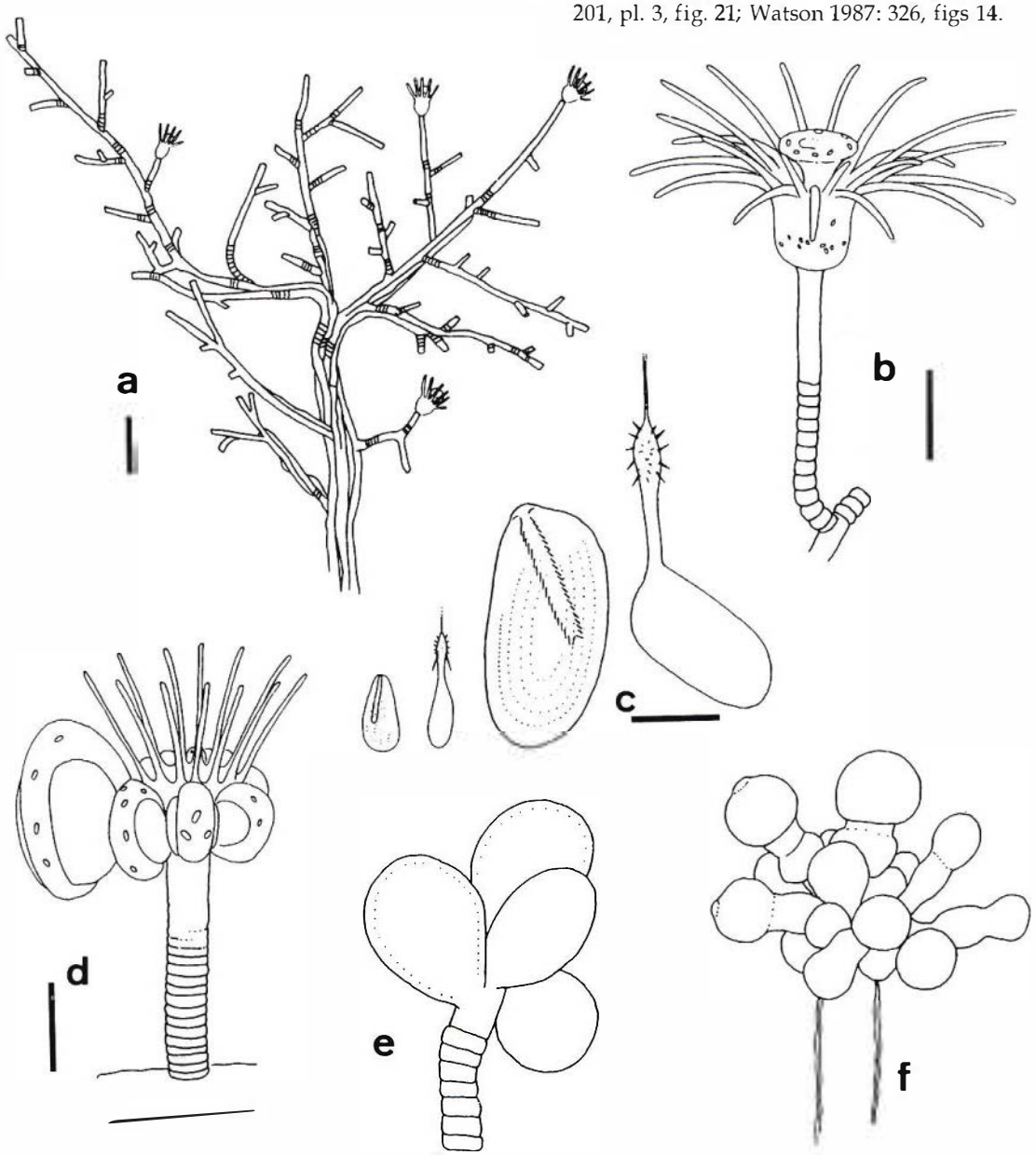


Fig 47. ***Eudendrium novaezelandiae***, from life except e) and f). **a)** distal part of colony from Kaikoura; scale bar 2 mm. **b)** hydranth from Mahanga Bay, Wellington Harbour; scale bar 0.5 mm. **c)** nematocysts: small microbasic eurytele from tentacles, same discharged, large microbasic eurytele from body and hypostome, same discharged; scale bar 10 μm. **d)** young female gonophore from Te Raekaihau; scale bar 0.2 mm **e)** mature female gonophores from Stn C380, same scale as d). **f)** male gonophores from Stn A439, same scale as d).

MATERIAL EXAMINED:

1 colony from NZOI Stn A439, 40°59.6'S, 174°27.2'E, Cook Strait, 4.10.1958, 140–160 m, small colony on polychaete tube, with male gonophores.

2 colonies from NZOI Stn C380, 38°50'S, 174°21.5'E, north of New Plymouth, 37 m, 28.10.1959, 25 and 40 mm high, hydranths mostly lost, strongly fascicled, both fertile females.

1 microslide prepared by P. Ralph with terminal portion of colony, labelled: *Eudendrium* spec. from *Ikatere*, drift, 26.5.1950. Locality unknown; colony bears female gonophores with various degrees of hydranth reduction.

1 live colony from Kaikoura, dredged from 90 m, March 1994, few hydranths and no gonophores left, 60 mm high, cultivated in running sea water for 1 month then preserved, deposited.

2 very small, live colonies with few hydranths, collected 13.3.1994 east of Te Raekaihau, 2 m, on sponges, one with developing female gonophores.

1 very small live colony with only 2 hydranths, infertile, from Mahanga Bay, Wellington Harbour, 27.1.1994, 1 m.

DESCRIPTION: Hydroid colonies with erect branching stems arising from attached ramifying stolons. Colony may reach 60 mm in height. Larger colonies fascicled almost to the tips, branching irregularly in various planes. Perisarc of erect parts with dispersed intervals of annulation, otherwise smooth. Hydranths with 20–24 tentacles, top of hypostome often rather flat in life, without cnidophores but with conspicuous nematocysts on hypostome and as a ring on basal part of hydranth body. Male and females on separate colonies. Male gonophores develop on blastostyle without tentacles, in groups of up to 12, each with 1–2 chambers, some with a distal knob containing nematocysts. Female gonophores develop initially from a smaller hydranth with reduced tentacle number. Spadix of female gonophores initially present, simple, not branching. Tentacles and spadices are lost during later development. Nematocysts:

a) large microbasic euryteles, on body, hypostome and gonophores, discharging at 45° angle to main axis, with spines, (18–31) x (8–15) mm, s = 0.8–0.9.
b) intermediate microbasic euryteles, rare, present in female gonophores only, (11–17) x (4.5–8.5) mm, s = ~ 0.9.
c) small microbasic euryteles, on tentacles, discharging almost directly foreward, (6.5–9.5) x (2.5–4) mm, s = 0.8–0.9.

Colours: live hydranths have a characteristic creamy to yellow colour; stems brown, becoming lighter distally.

TYPE LOCALITY: New Zealand.

REMARKS: The identification of small infertile *E. novaezelandiae* colonies is based mainly on the presence of the conspicuous large microbasic euryteles in addition to the smaller ones in the tentacles. The size ratio between these capsules is always larger than 2.5, although the large capsule especially has a very variable size in different colonies. The capsule types and sizes observed in this study are as described by Watson (1987), but their size range was wider.

The colony size of fertile animals varied considerably, from only a few hydranths to several dozen. The small colonies, mostly infertile, were obtained from shallow depths, while all larger ones were from deeper water (37–140 m).

The colour of the live hydranth was found to be very characteristic and allowed a quick preliminary identification. This specific colour was even observed to some extent in alcohol-preserved animals and in cultivated animals fed on *Artemia*.

RECORDS FROM NEW ZEALAND: Coromandel (Watson 1987), Taranaki Bight, Cook Strait, Wellington, Kaikoura (this study).

OTHER RECORDS: Not known outside New Zealand.

Eudendrium ritchiei Millard, 1975 (Fig. 48a-f)

Eudendrium insigne: Ralph 1953: 63, fig. 2A–B.
[Not *Eudendrium insigne* Hincks, 1861]
Eudendrium ritchiei Millard 1975: 87, fig. 30; Watson 1987: 327, figs 5–8.

MATERIAL EXAMINED:

Live colonies from Cheltenham Beach, Auckland, on drift seaweed, 27.7.1991, infertile.

Live colonies from Narrow Neck Beach, Auckland, on *Carpophyllum maschalocarpum*, 1 m, 7.1.1994, male and female colonies.

DESCRIPTION: Hydroid colonies with erect branching stems arising from loosely adhering, ramified, thick stolons. Stolons not annulated. Stems reaching 15 mm in height, not fascicled in New Zealand specimens, branching irregularly in all planes but with a tendency to unilateral growth. Perisarc of erect parts strongly annulated throughout. Hydranths with 17–25 tentacles and no cnidophores, but a ring of large euryteles towards base of hydranth above basal furrow. Males and females on separate colonies. Male blastostyles with no tentacles, bearing a cluster of one-chambered gonophores with an occasional terminal tubercle containing large euryteles. Hydranths developing female gonophores with reduced tentacles which may be lost in later development, 3–6 gonophores in a whorl. Young female gonophores with bifurcating spadix clasping the single egg, older gonophores oval

with a smooth transparent capsule and without spadix. Nematocysts and other measurements:

a) larger macrobasic euryteles, present as ring on body of hydranth and on male and female gonophores, shaft with spiral bands of spines, (17.5–21.5) x (6.5–9) µm, s = 2.8.
b) smaller microbasic euryteles, present in tentacles, (6.5–7.5) x (3.5–3.5) µm, s = 0.8.

Caulus diameter 110–140 µm, stolon diameter 155–190 µm. Colour of hydranths white to grey, sometimes slightly green, gonophores yellow.

TYPE LOCALITY: Saunders Rocks, Sea Point, South Africa.

REMARKS: The material of *E. ritchiei* from New Zealand available for the present study agrees in most respects with the diagnostic features given by Millard (1975). The main difference, as in the material examined by Watson (1987), is that the New Zealand colonies are not fascicled like the South African ones. This may depend on the environment and age however.

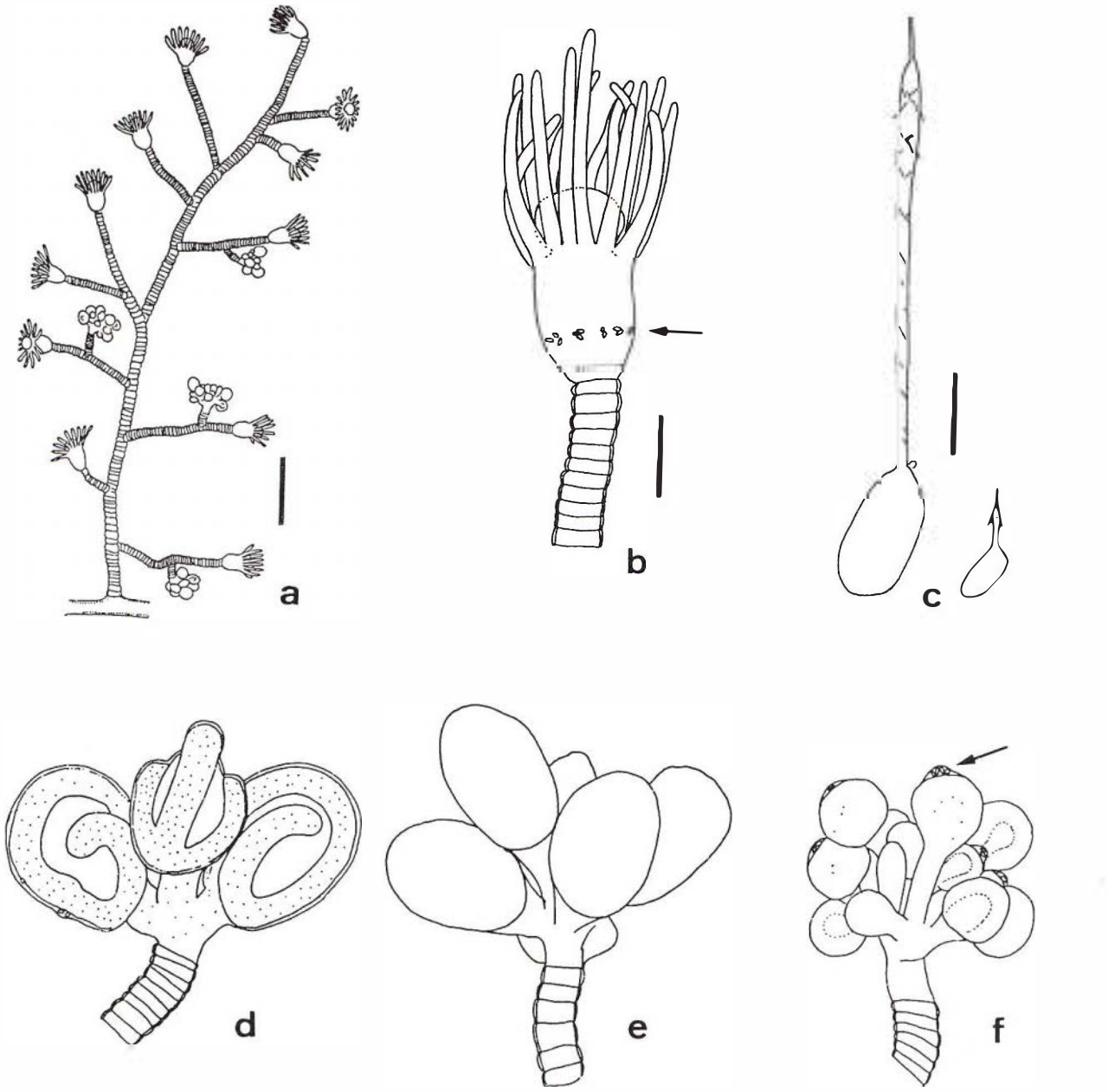


Fig. 48. *Eudendrium ritchiei* from preserved material. **a)** colony form, note strong annulation of perisarc, CL; scale bar 1 mm. **b)** hydranth showing belt of large euryteles (arrow) and below the basal furrow, CL; scale bar 0.2 mm. **c)** nematocysts: macro- and microbasic euryteles; scale bar 10 µm. **d)** young female gonophore showing characteristic bifid spadices (shaded), CL, same scale as b). **e)** older female gonophores with lost spadices, same scale as b). **f)** male gonophores, the arrow points towards distal knob with euryteles, same scale as b).

RECORDS FROM NEW ZEALAND: East coast beaches from Auckland to Gisborne (Ralph 1953, as *E. insigne*), Coromandel (Watson 1987), Hauraki Gulf (this study).

OTHER RECORDS: South Africa (Millard 1975).

Eudendrium terranovae Watson, 1985 (Fig. 49a-d)

Eudendrium sp.: Totton 1930: 141.
Eudendrium terranovae Watson 1985: 189, figs 20–23.

MATERIAL EXAMINED:
2 colonies from NZOI Stn E413, 45°12'S, 171°44'E, near Oamaru, 11.10.1965, 594 m (error ?), Agassiz trawl; 4 and 10 cm high colonies, one colony a fertile male, det. by J. Watson.
1 male colony from Cliffy Island, Australia, MV no. F50503, cited in Watson (1985).
1 female colony from Cliffy Island, Australia, MV no. F50504, cited in Watson (1985).

DESCRIPTION: Hydroid colonies with erect branching stems to 10 cm height, arising from attached, ramified stolons. Main stems fascicled. Branching rather regular, mostly in one plane. Perisarc at origin of new branches may have 0–9 annulations, otherwise smooth. Hydranth with 22–28 tentacles. Male and female gonophores on separate colonies. Mature male gonophores small, on a blastostyle devoid of tentacles at all stages, up to 30 in tightly-packed clusters at the end of a caulus, with up to 3 chambers, immature gonophores with terminal knob. Female gonophores borne on a blastostyle showing atrophy of the tentacles from early growth stages, tentacles completely absent at maturity. Spadices in younger female gonophores present, not branching. Nematocysts:
a) microbasic eurytheles, discharging directly forward, with indistinct terminal swelling of shaft, (6–9) x (2.5–4) µm, s ~ 0.8.
Measurements: stolon diameter 160–240 µm; diameter stems at base of colony 220–250 µm; diameter of cauli 140–200 µm.

TYPE LOCALITY: North Cape, New Zealand.

REMARKS: The preferred branching in one plane is very characteristic of *E. terranovae*.

RECORDS FROM NEW ZEALAND: North Cape (Totton 1930), Oamaru (this study).

OTHER RECORDS: Cliffy Island (Australia).

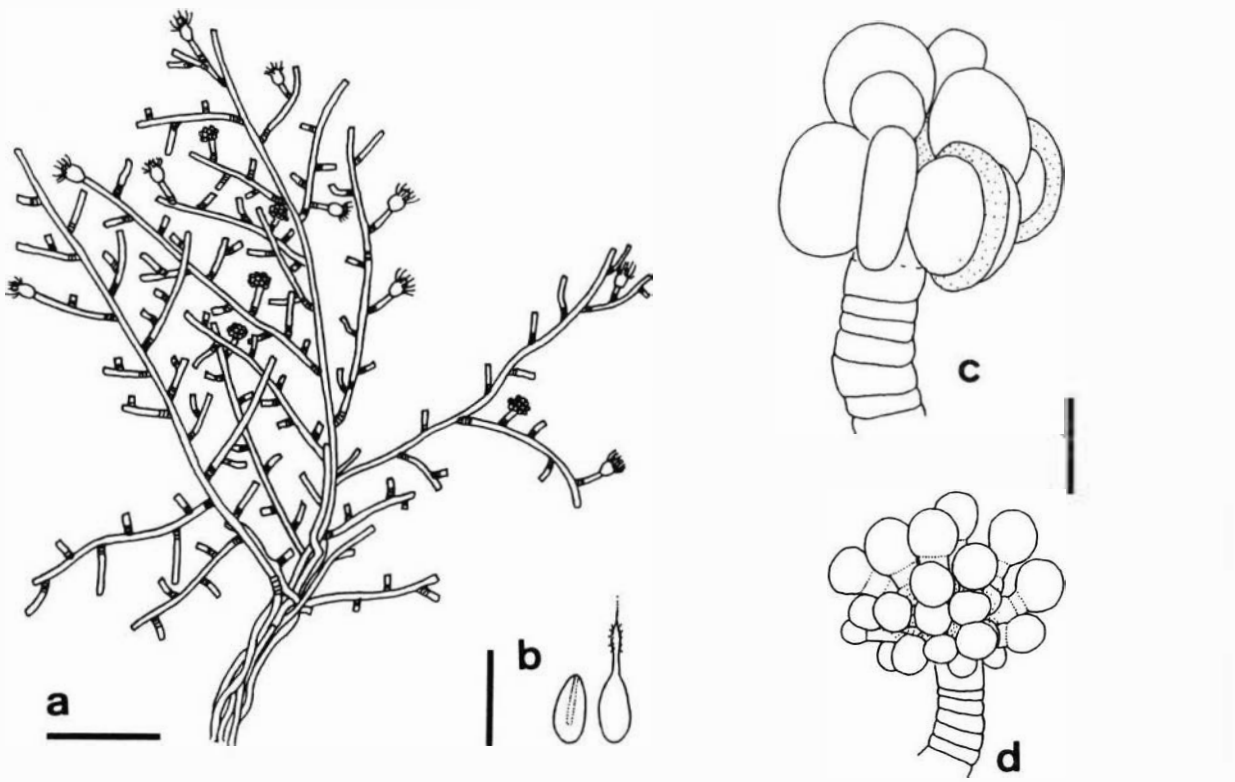


Fig. 49. ***Eudendrium terranovae,*** from material from Cliffy Island (Australia) except b). **a)** whole colony, sample F50503, scale bar 5 mm. **b)** nematocysts: microbasic eurytele, same discharged; scale bar 10 µm. **c)** female gonophores from sample F50504; scale bar 0.2 mm. **d)** male gonophores from sample F50503, same scale as c).

Eudendrium maorianus n.sp. (Fig. 50a-f)

MATERIAL EXAMINED:

Small colony from western side of Te Raekaihau (Wellington), 1 m, 13.1.1994, erect parts once or twice branched, male gonophores developed in culture.

1 colony from western side of Te Raekaihau, 1 m, 30.1.1994, on sponge, 3 times branched, infertile.

Several colonies from western side of Te Raekaihau, 2 m, 26.2.1994, mature female colony on stone, 10 mm high, deposited as holotype H-642. One male colony, stem ~ 10 mm, 3–4 times branched, deposited as paratype P-1083.

Several colonies from South Bay, Kaikoura, South Island, 1 m, 1.3.1994, one female colony, 10 mm high; one male colony, 10 mm high, 2–4 terminal hydranths, material deposited as paratype P-1069.

1 colony from western side of Te Raekaihau, intertidal, 13.3.1994, 18 mm high, infertile.

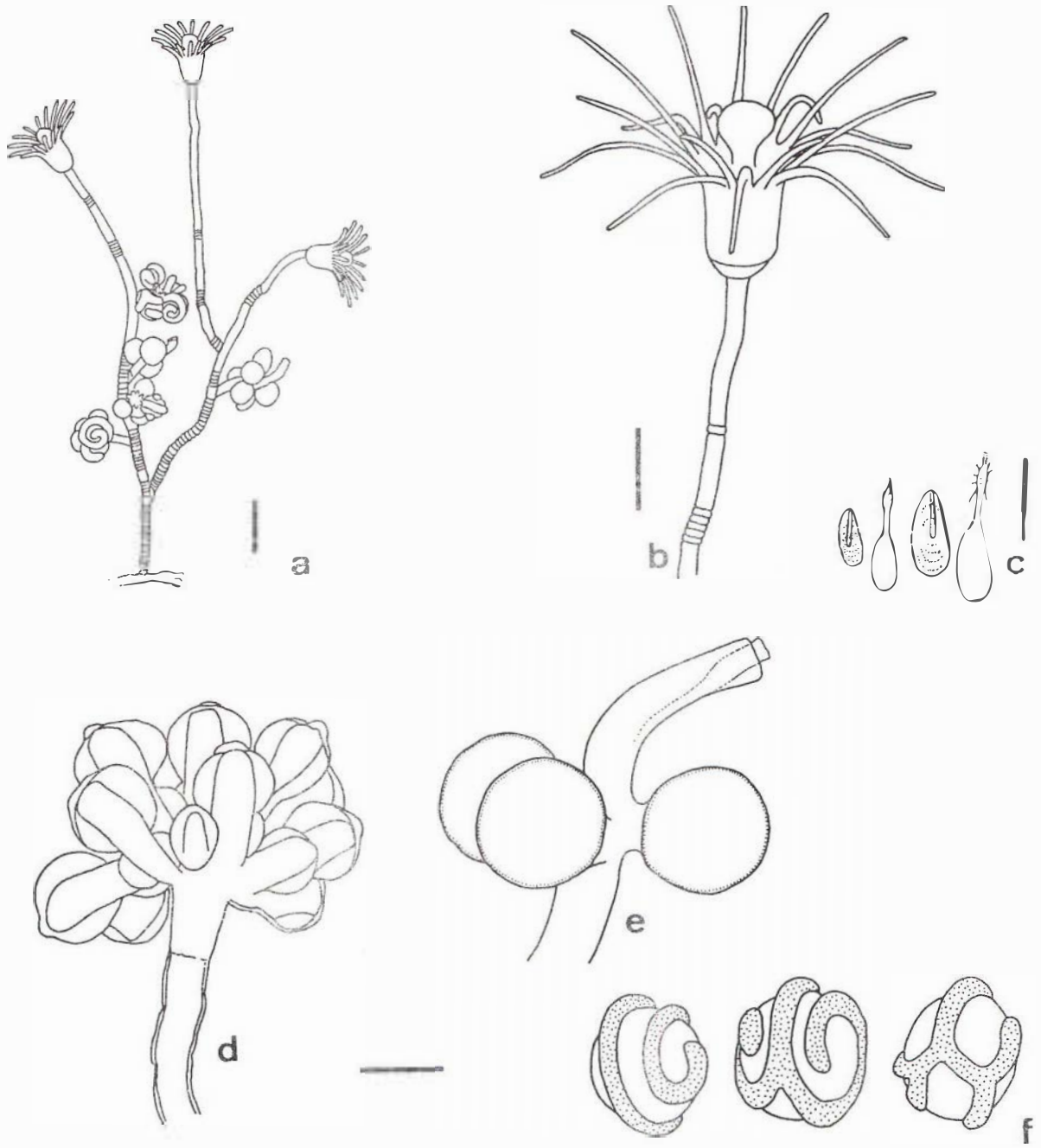


Fig. 50. *Eudendrium maorianus* n.sp, from life. **a)** type specimen, female colony; scale bar 1 mm. **b)** hydranth; scale bar 0.5 mm. **c)** nematocysts: microbasic euryteles; scale bar 10 µm. **d)** male gonophores; scale bar 0.2 mm. **e)** mature female gonophores, the hydranth and spadices are completely lost and the caulus has resumed growth distally, same scale as in d). **f)** younger female gonophores that show the variation of the spadix form (shaded), same scale as d).

1 colony from western side of Te Raekaihau, 2 m, female colony on sponge, together with *Hybocodon prolifer*.
Numerous colonies from underneath Queens Wharf, Wellington Harbour, subtidal, 16.6.1994, very abundant on oysters, some fertile.

DESCRIPTION: Hydroid colonies with erect branching stems arising from attached, ramified stolons. Stems reaching 18 mm in height, branching sparingly, with up to 10 terminal hydranths per erect stem, mostly only 3. Perisarc of erect parts annulated at intervals. Hydranths with up to 16 tentacles. Male and female gonophores on separate colonies. Male blastostyles with no tentacles at any stage of development, bearing a cluster of gonophores with 1–3 chambers and an occasional terminal tubercle containing euryteles. Female gonophores initially on small hydranth with tentacles which is later completely reduced, up to 6 gonophores per hydranth, spadix long and coiled, often bifid, but in the same colony they may also be unbranched or twice branched. Spadices are lost in later stages and the egg is covered by a thin perisarc hull. In mature blastostyles the caulus may resume growth distally. As nematocysts there are two distinct types of euryteles with an observed size ratio of 1.28–1.46 (mean = 1.35, s.d. = 0.075, n = 7 colonies):

a) larger microbasic euryteles on body and male gonophores, shaft with distinct spines, (9–12) x (3–5) µm, s = 0.8.
b) smaller microbasic euryteles on tentacles, shaft with delicate spines, (6.5–9) x (2.5–4) µm, s = 0.8–0.9.

Colour of living hydranths: orange to pink.

TYPE LOCALITY: West side of Te Raekaihau, Wellington.

ETYMOLOGY: The species name refers to the first inhabitants of New Zealand, the bifid and coiled spadix being somewhat reminiscent of Maori symbolic motifs (Fig. 50f).

REMARKS: *Eudendrium maorianus* seems to be quite abundant and widespread. It would be interesting to determine whether it occurs only in the more southern parts of New Zealand, replacing *E. ritchiei* which seems to be confined to more northerly regions.

The low stems with few hydranths, the two different euryteles, and the long and occasionally branched spadix are the main distinctive characters that separate *E. maorianus* from the previously known New Zealand species. Although the total size range of the two capsules observed in several populations overlaps slightly, the size ratio between the two capsule types within one colony was always larger than 1.28 and both types are easily distinguishable, even without measurements.

RECORDS FOR NEW ZEALAND: Wellington, Kaikoura.

Family PROBOSCIDACTYLIDAE
Hand & Hendrickson, 1950

Colonial hydroids connected by stolons which are not covered by perisarc. Hydranths sessile and polymorphic: with gastrozooids and gonozooids, sometimes dactylozooids. Gastrozooids with only two filiform tentacles originating below a large hypostome which is densely covered by nematocysts. Gonozooids and dactylozooids without mouth and tentacles. Gonozooids produce free medusae. Medusae with a manubrium that has four, six, or more gastric lobes that extend along the proximal parts of the radial canals. Radial canals may be branching and an obliterated radial canal may be present or completely absent. The gonads encircle the manubrium and can extend onto the gastric lobes. Alternating with the tentacles may be clusters of nematocysts on the exumbrella. Ocelli and statocysts absent.

REMARKS: This diagnosis was amended after Bouillon (1985a) to allow the inclusion of the new genus *Fabienna*. The emendation concerns the possible absence of exumbrellar nematocyst clusters. The Proboscidactylidae have been included in the Limnomedusae by some authors (e.g., Kramp 1961; Bouillon 1985a). The absence of statocysts, the polyps with stolons, and the presence of desmonemes indicate that this family is better placed in the Filifera of the Anthoathecata. Other authors have already proposed this classification (Werner 1984; Petersen 1990). The inclusion of *Fabienna* is somewhat of a compromise and the arguments for it are discussed below.

Diagnostic characters for genera known from New Zealand:

Fabienna: medusa without medusa buds on manubrium, without exumbrellar nematocyst pads, nematocysts of tentacles confined to tip.
Proboscidactyla: medusa with medusa buds on manubrium, with patches of nematocysts on exumbrella, tentacles covered with nematocysts along entire length.

Fabienna n.gen.

Medusae with slightly lobed umbrella margin. With four perradial tentacles that have their origin somewhat displaced towards the exumbrella. Larger nematocysts confined to tentacle tips in one terminal cluster immediately followed proximally by an adaxial cluster; the two clusters may fuse in older individuals. Cnidome includes macrobasic euryteles. Gonads develop on manubrium only, in an interradial position. Circular canal present as solid cord.

TYPE SPECIES: *Fabienna sphaerica* n.sp.

REMARKS: The new genus is provisionally included in the Proboscidactylidae. Possible synapomorphies are the solid radial canal and the macrobasic euryteles. Influencing this decision was the inclusion of *Pochella oligonema* Kramp, 1955 in this family. *Pochella oligonema* is congeneric with *Fabienna*.

ETYMOLOGY: The genus name *Fabienna* is dedicated to my little daughter Fabienne, in order to acknowledge this source of much joy and inspiration.

Fabienna sphaerica n.sp. (Fig. 51a-g)

MATERIAL EXAMINED:
2 juvenile specimens from Evans Bay, 14.7.1994, cultivated until gonad tissue became visible (2.7.94).
1 juvenile specimen from Seatoun.
1 advanced but not mature specimen from Evans Bay, 30.8.1994, 1 ciliary field damaged and missing, preserved after one day, deposited as holotype H-644.
1 juvenile specimen from Evans Bay, 1.9.1994, cultivated until female gonads became visible (20.9.94).
1 juvenile and one fully mature animal, both damaged, collected by T. Barnett near Goat Island, Leigh Marine Reserve, date not known (1984?), not mentioned in her thesis (1985), both medusae deposited as paratype P-1070.
For comparison, holotype and 2 paratypes of *Pochella oligonema* Kramp, 1955, held by ZMC, collected 26.1.1946, *Atlantide* Stn 77, Accra, Shana.
Also ~15 medusae of *Kantiella enigmatica* Bouillon, 1978a originating from Laing Island, Papua New Guinea, collected and identified by Prof. J. Bouillon.

DESCRIPTION:
Mature medusa: Up to 1.8 mm high, bell rather spherical. Jelly thick, apex about 1.5 times thicker than lateral walls. Bell-margin lobed through 4 perradial furrows where tentacles originate. Velum when dilated spanning half of radius. On umbrella margin in each interradial position a small triangular field with long cilia. These fields are slightly more opaque than the epidermis of the exumbrella. The base of these fields lies along the circular strand. A few scattered nematocysts are situated along the bell margin, occasionally more near the base of the ciliated fields. Manubrium about two-thirds as long as the bell cavity, with large cruciform base, without a peduncle. Distal part of manubrium simple, conical, mouth opening circular to quadrangular, margin provided with nematocysts. Gonads in the form of 4 large, interradial, triangular pads leaving manubrium free only at small perradial zone and near mouth. With 4 narrow, hollow radial canals. Very fine, blindly ending lateral branches rarely observed. Circular gastrodermal strand running closely along bell-margin, thin and no lumen visible. Four perradial marginal bulbs, egg-shaped, gastrodermis very opaque and probably without lumen, below gastrodermis a pad of epidermis with nematocysts. The circular strand is in direct connection with the gastrodermis of the bulb. Four tentacles arise somewhat towards the exumbrella and may be adnate to it for a short distance. Tentacles without terminal swelling, but terminal region often bent like a hook. Tentacle gastrodermis proximally parenchymatous for a short distance, without lumen, then chordoid. Tentacles mostly without nematocysts, these concentrated at tips of tentacles in one terminal cluster followed by another cluster confined to the adaxial side. No ocelli or statocysts present. Nematocysts (some also present in subumbrella along radial canals and along circular strand):
a) macrobasic euryteles, from tentacles, with spines only terminally or all along the shaft (14.5–17) x (9–10) µm, s = 6-9.
b) macrobasic euryteles from mouth, (12–17) x (6–8) µm, s = 4.7.
c) small capsules in tentacle bulbs, rare, ev. isorhiza, (5–6) x (3–3.5) µm.
d) microbasic euryteles, (8–11) x (3.5–5) µm, s = 2.2.

Young medusa: ~ 0.9 mm high, spherical, with thick jelly, jelly at apex almost twice as thick, indented as funnel at apex, margin slightly lobed. Manubrium a simple inverted cone, basal perradial extension not present. Tentacles short and stiff, bent upwards, without terminal swelling. Few nematocysts in only one cluster at tentacle tip. Interradial ciliary field only in some animals visible.

TYPE LOCALITY: Greta Point, Evans Bay, Wellington.

ETYMOLOGY: The species name refers to the almost spherical shape of this medusa.

REMARKS ON TAXONOMY: *Fabienna sphaerica* can be placed only with difficulty into the present taxonomic system. The main reasons for its inclusion in the Proboscidactylidae are given above. The absence of exumbrellar pads of nematocysts and the absence of desmonemes may argue against this, but in other families such variation can also be seen. The closest resemblance of *Fabienna sphaerica* to any known medusa is to *Pochella oligonema* Kramp, 1955. Two species of *Pochella* have been described: *P. polynema* Hartlaub, 1917 and *P. oligonema* Kramp, 1955. Edwards (1973a) was able to determine the life cycle of *P. polynema* and showed that this medusa belongs to a hydroid known as *Trichydra pudica* (see also Rees 1941), a senior synonym. Based only on its superficial similarity and pending

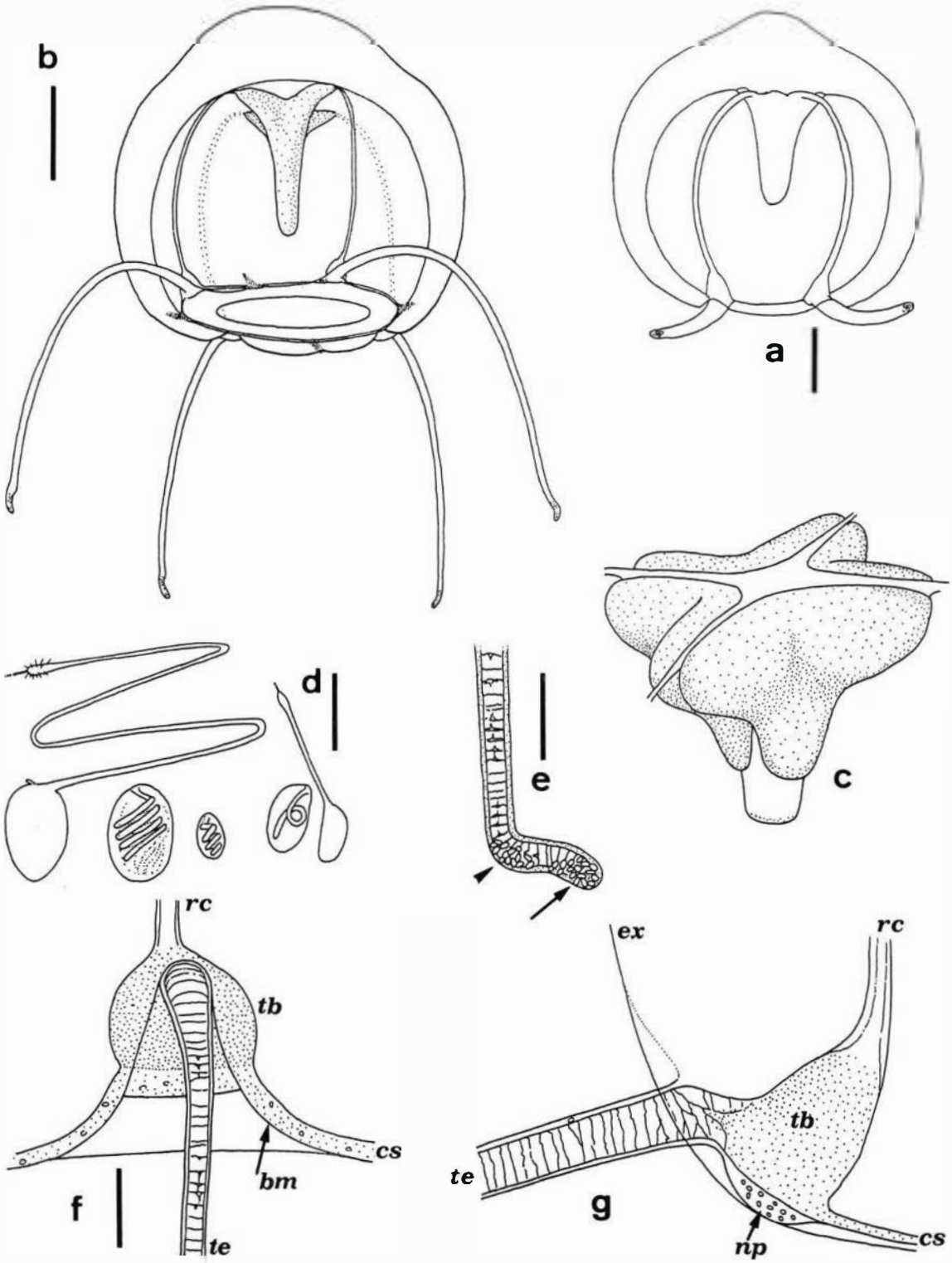


Fig. 51. *Fabienna sphaerica* n.gen., n.sp., from life except c), e) and f). a) very young medusa; scale bar 0.2 mm **b)** medusa, just before maturation of gonads; scale bar 0.5 mm. c) manubrium with mature gonads from a preserved medusa from Leigh, same scale as a). d) nematocysts: discharged macrobasic eurytele, same not discharged, small capsule, microbasic eurytele, same discharged; scale bar 10 µm. **e)** tentacle tip of preserved holotype showing the characteristic bending, note the terminal nematocyst cluster (arrow) and the adjacent adaxial cluster (arrowhead); scale bar 0.1 mm. f) frontal view of tentacle bulb from preserved holotype, CL, fixation tends to accentuate the lobes of the bell margin; scale bar 0.1 mm. g) lateral view of tentacle bulb of living medusa, CL, same scale as f). Abbreviations: *bm* bell margin, *cs* circular strand, *ex* exumbrella, *np* nematocyst pad, *rc* radial canal, *tb* tentacle bulb, *te* tentacle.

more information on its life cycle, *P. oligonema* was provisionally also transferred to *Trichydra* by Edwards (1973a). The type specimens of *P. oligonema* Kramp, 1955 were re-examined for the present study. This medusa is different from that of *Trichydra* and must be placed in a separate genus. It has 4 tentacles with nematocysts present only in a terminal cluster and an adjacent adaxial cluster, exactly as described for *Fabienna sphaerica* (Fig. 51e). In older medusae they may fuse. This arrangement was indicated by Kramp (1955) in his figure 7. The medusa of *T. pudica* has many tentacles covered throughout with nematocysts (Edwards 1973a; unfortunately, the kinds of nematocysts of *Trichydra* are unknown). In one of the paratypes of *P. oligonema*, is an interradial triangular field like the ciliary fields of *F. sphaerica*. Kramp's *P. oligonema* resembles *Fabienna sphaerica* so closely that they are certainly congeneric. Some small differences between these two samples can be found. Kramp's medusa has a peduncle (only half the size as given in his figure of 1955). The tentacle bulbs are slightly different; as in Kramp's medusae they become narrower towards the circular strand. The bulbs are therefore almost as in *Kantiella* (cf. Bouillon 1978a, c). The gonads in Kramp's medusae are also oval in shape compared to triangular in *F. sphaerica*. The prismatic shape of the stomach in the holotype of *P. oligonema* may be a fixation artefact only, as the mouth is widely gaping. In the paratypes the stomach is obviously cruciform in section and the mouth has 4 very inconspicuous lips provided with nematocyst concentrations.

Because the type species of *Pochella* has been transferred to *Trichydra*, the former name cannot be used anymore and Kramp's medusa is here included in the new genus *Fabienna* as *F. oligonema* n. comb. More data, especially life-cycle information, of both *Fabienna* species are urgently needed to confirm their systematic position. The relationship to the Laingiomedusae Bouillon, 1978c should also be elucidated. An examination of *Kantiella enigmatica* Bouillon, 1978a revealed that younger individuals of this species have tentacle tips that are astonishingly like the special tentacle tips of *Fabienna*: one terminal cluster followed by an adaxial one, with a bend after after the proximal cluster. The two clusters are more widely separated than in *Fabienna* and in older individuals the nematocyst clusters are mostly grown together, otherwise *Kantiella* and *Fabienna* are distinct. Some of the major distinctions in *Kantiella* are: the exumbrellar nematocyst bands, the pronounced separation of the tentacular bulbs from the circular strand, and the origin of the tentacles.

GENERAL REMARKS: Few specimens of *Fabienna sphaerica* were found in Evans Bay during the winter months. The occurrence of very young stages in Wellington Harbour may indicate that the polyp must be present in the proximity of Wellington. Medusae are easy to keep at room temperature and they feed vigorously on *Artemia*. Gonad tissues become recognisable quite soon and the morphology does not change much. Developing gonads in the cultivated medusae were as in the mature medusa obtained from Leigh.

The interradial triangular fields on the umbrella margin are known only from this species and are clearly visible only in live specimens. These fields are composed of epidermal cells with long cilia. Their function remains unknown. Normally these fields do not contain nematocysts, but some few may occur at their base along the bell margin. The bell margin itself normally has some scattered nematocysts. In the preserved samples from Leigh with a rather damaged and crumpled umbrella, the ciliated fields could not be seen.

Because *F. sphaerica* contains comparatively few nematocysts and only few specimens were available, not enough nematocysts could be analysed. It seems that all capsules are very variable, even within one animal, and the various euryteles distinguished above may actually be only extremes of a continuous row.

RECORDS FROM NEW ZEALAND: Wellington Harbour; Leigh Marine Reserve (this study).

Proboscidactyla Brandt, 1835

Colonial hydroids conforming to the family diagnosis, living as obligatory commensals with polychaetes. Medusae with a manubrium that has four, six, or more gastric lobes extending along the proximal parts of the radial canals. Radial canals often branching and a solid circular strand may be present or completely reduced. Gonads encircle the manubrium and extend onto the gastric lobes. Alternating with the tentacles the exumbrella bears clusters of nematocysts that are connected with the umbrella margin by a line. Ocelli and statocysts absent. Tentacles absent in *P. abyssicola*.

TYPE SPECIES: *Proboscidactyla flavicirrata* Brandt, 1835.

REMARKS: The life cycles within this genus are now rather well known (e.g., Hand 1954; Brinckmann-Voss & Vannucci 1965). Only one species is known from New Zealand, based on juveniles.

Proboscidactyla sp. (Fig. 52a-b)

MATERIAL EXAMINED:
About 30 medusae collected by T. Barnett, June to August 1983 and February to July 1984, Leigh Marine Reserve, some deposited.

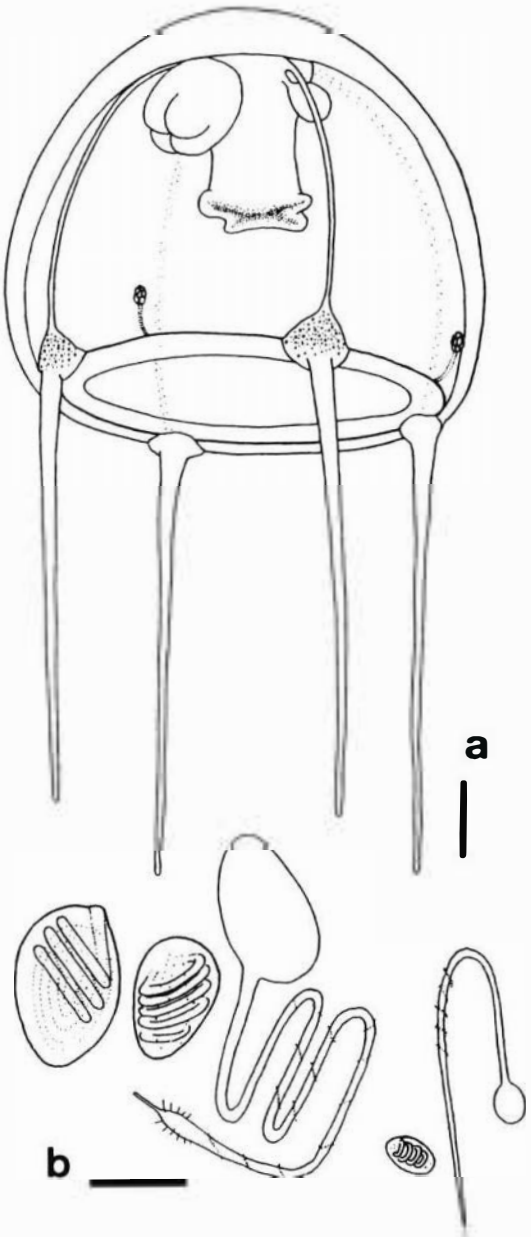


Fig. 52. ***Proboscidactyla*** sp., from preserved samples. **a)** medusa with medusae buds; scale bar 0.2 mm. **b)** nematocysts: macrobasic eurytele from exumbrella, from tentacles, discharged eurytele, anisorhiza, discharged anisorhiza; scale bar 10 µm.

DESCRIPTION: Medusa up to 1 mm high, wider than high, bell almost hemispherical, jelly moderately thick, slightly thicker at apex. Velum spans approximately one-fifth of radius. Exumbrella bears 4 interradial clusters of nematocysts from where a fine line leads to the umbrella margin. About 12 nematocyst capsules per cluster. Manubrium about half of the height of bell cavity, mouth either simple or with 4 irregular perradial lips, mouth rim with nematocysts. Medusae buds arise from manubrium base at origin of radial canals, with short stem but not on blastostyles. Four radial canals and a very thin, solid circular strand present. With 4 large perradial marginal bulbs with black pigment granules. Four perradial tentacles, longer than bell height, tapering, with evenly distributed nematocysts. No ocelli present. No gonads present. Nematocysts:

a) macrobasic euryteles from exumbrella, (15–18) x (10–11) µm, s = 6.9.
b) macrobasic euryteles in tentacles, (9–11) x (6–7) µm, s = 7.6.
c) merotrichous anisorhizas, in tentacles, spines very fine, (4–5) x (3.5–4) µm.

REMARKS: This *Proboscidactyla* species was found in very large numbers by T. Barnett (1985, as unknown Tubulariidae sp. A.) during autumn and winter months. The medusa resembles some juvenile forms of *Proboscidactyla ornata*, especially the figure of *P. ornata* var. *stolonifera* given in Hartlaub (1918, fig. 322). *Proboscidactyla ornata* as understood at present is an extremely variable species and it may well be that several species have been lumped together (cf. Mayer 1910; Hartlaub 1918; Kramp 1961). The medusae from Leigh differed from young *P. ornata* in lacking desmonemes and in developing their medusae buds not on blastostyles but directly on the base of the manubrium. Brinckmann-Voss and Vannucci (1965) were able to reveal the life cycle of *P. ornata* and found that juvenile medusae also had desmonemes. Although not all nematocysts may have been found in the preserved samples available, the medusae from New Zealand probably are referrable to a new species. As only immature animals were found and the adult morphology in *Proboscidactyla* is considerably different, it seems advisable to defer creation of a new species name until the life cycle is known.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985).

Family EUCODONIIDAE n. fam.

Anthomedusae without pointed apical projection. Exumbrella without nematocyst tracks. Manubrium on peduncle, quadrangular, with medusae budding from stomach. Gonads completely surrounding stomach. Four radial canals and circular canal, no mesenteries. Four perradial marginal bulbs and four tentacles; tentacles with terminal swelling. No ocelli. Nematocysts are microbasic euryteles and desmonemes.

REMARKS: The family comprises only the genus *Eucodonium*. The systematic position of this monotypic family and genus is discussed below.

Eucodonium Hartlaub, 1907

As in the family diagnosis.

TYPE SPECIES: *Eucodonium brownei* Hartlaub, 1907.

REMARKS: *Eucodonium* includes only *E. brownei*. The only other described species, *E. arctica* Hand & Kan, 1961, was synonymised with *Plotocnide borealis* Wagner, 1885 by Arai and Brinckmann-Voss (1980).

Eucodonium brownei Hartlaub, 1907 (Fig. 53a-b)

Dipurena sp.: Browne 1896: 473, pl. 16, fig. 2.
Eucodonium brownei Hartlaub 1907: 71, fig. 67; Russell 1953: 93, fig. 40; Vannucci 1957: 43, figs 2–3; Kramp 1959: 91, fig. 44; Kramp 1961: 36; Brinckmann-Voss 1970: 19, pl. 2, fig. 4, text-figs 16–19; Petersen 1990: 217.

MATERIAL EXAMINED:
14 medusae collected by T. Barnett from Leigh Marine Reserve and Whangateau Harbour, 1980 and 1984, February to March, all infertile, three cleared with lactic acid for closer anatomical and nematocyst examinations, some material deposited.

DESCRIPTION: Medusa bell-shaped, up to 1 mm high and as broad or slightly less broad, lateral walls thin, apex with thickened jelly. Manubrium on a broad, well-developed peduncle. Manubrium cylindrical, half as long as bell cavity, mouth quadrangular with 4 inconspicuous perradial lips, each containing a group of about 100 nematocysts. Medusae buds arise from middle region of stomach. Four very narrow radial canals and circular canal present. Four small marginal bulbs containing blackish pigment granules. With four equally developed tentacles with a conspicuous terminal swelling. Tentacle gastrodermis chordoid. Terminal swellings with swollen gastrodermis and epidermis cells with fibrous structure. Nematocysts not only present in terminal swelling but also along the tentacles. No ocelli present. Nematocysts:
a) microbasic euryteles from tentacles, (7–8.5) x(3.5–4.5) µm, s = 0.9.
b) heteronemes (microbasic euryteles?) from lips, (5–6) x (2–3) µm.
c) desmonemes from tentacles, (4–5) x (2–3.5) µm.

TYPE LOCALITY: Plymouth, England.

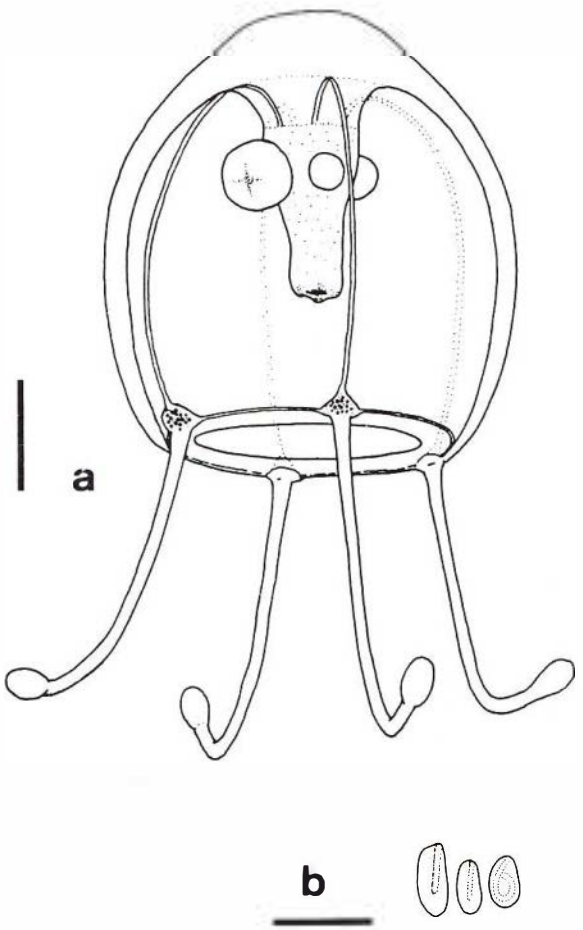


Fig. 53. *Eucodonium brownei* from preserved samples from Leigh. **a)** medusa with buds on manubrium; scale bar 0.2 mm. **b)** nematocysts: microbasic eurytele from tentacle, heteroneme from manubrium, desmoneme; scale bar 10 µm.

REMARKS: The medusae from Leigh agreed well with other descriptions of *Eucodonium brownei*, although the terminal swelling of the tentacles was not as large as depicted by some authors. According to Brinckmann-Voss (1970), the gonads encircle the manubrium completely in mature animals and there is no further medusa budding. The mouth has been described by early authors as simple and tubular, but Brinckmann-Voss (1970) corrected this, observing four inconspicuous lips, also seen in the present samples. Closer microscopic examination revealed that the tips of these lips contain nematocysts. There are thus four perradial groups of nematocysts, separated in the interradii. The nematocysts are rather deeply embedded in the lips and do not protrude as in *Podocoryna* medusae, thus are not easily seen at low magnifications. Contrary to Brinckmann-Voss (1970), no stenoteles could be found in three thoroughly examined animals. Picard (1955) also found only euryteles and desmonemes, and the

report of stenoteles for *E. brownei* may be considered erroneous. At present, *E. brownei* cannot be placed in any known family. Previously this species has been associated either with the Tubulariidae, Corymorphidae, or placed as Capitata *incertae sedis* (Kramp 1961; Brinckmann-Voss 1970; Petersen 1990). All these groups must be ruled out as *E. brownei* does not have stenoteles and thus should not be placed among the Capitata (cf. Picard 1955). The four perradial nematocyst clusters embedded in the mouth margin ally *E. brownei* closer to genera like *Podocoryna* and *Cytaeis*, but still without corresponding to them. For these reasons the new family Eucodoniidae is established here to accommodate *E. brownei*.

Barnett (1985) found *E. brownei* in comparatively high numbers during summer months. The species has not so far been found in the wider Pacific, and may have been introduced recently through human activities. Brinckmann-Voss (1970) also indicated that *E. brownei* occurs only during summer months in the northern hemisphere. In the laboratory, lowering of temperature causes a cessation of medusae budding, regardless of season, which can be seen as a precondition for gonad maturation.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve, Whangateau Harbour (Barnett 1985).

OTHER RECORDS: Northeastern Atlantic; Mediterranean; Brazil (Kramp 1961).

Order CAPITATA

Athecate hydroids typically having capitate tentacles. In some species these present only during development, in some only moniliform or even only filiform tentacles present. Medusae typical single anthomedusae, not colonial. Cnidome always includes stenoteles in at least one stage.

REMARKS: According to Petersen (1990), the synapomorphy uniting the Capitata is moniliform tentacles. These have, however, been modified very early to either capitate tentacles or reverted to filiform tentacles again. Despite this difficulty, at present it is rather easy to recognise members of the Capitata. Hydroids or solitary Anthomedusae possessing stenoteles are always included in the Capitata. The presence of stenoteles is a good diagnostic tool, but most probably a plesiomorphic character because other groups (Trachymedusae, Cubozoa) also have them.

Family POLYORCHIDAE Agassiz, 1862

Medusae with gastric peduncle. Stomach prismatic, the four oral lips crowded with nematocysts. With four sac-shaped or spiral, or several sausage-shaped stomach pouches on peduncle only. Gonads surrounding stomach pouches. Four radial canals, with or without blind side branches. Four to 260 tentacles with stout, elongate bulbs with abaxial ocelli. Hydroids unknown (after Petersen 1990).

REMARKS: The polyps of this family are still unknown. The putative hydroid of *Polyorchis penicillatus* was described by Brinckmann-Voss (1977), but her work was based on an uncertain linkage of life stages (Brinckmann-Voss, pers. comm.).

Only *Tiaricodon* is known from New Zealand.

Tiaricodon Browne, 1902

Medusa with four perradial, imperfectly moniliform tentacles with stout, elongated bulbs surrounded by thickened, nematocyst-studded epidermis. With abaxial ocelli. Stomach with short, sac-like perradial lobes; mouth with four distinct, frilled lips with band of nematocysts. Gonads on surface of stomach and on stomach lobes. Four radial canals without diverticulae.

TYPE SPECIES: *Tiaricodon coeruleus* Browne, 1902.

REMARKS: *Tiaricodon* was previously allied with the family Moerisiidae. Petersen (1990) referred it to the family Polyorchidae and his arguments are followed here. Only *T. coeruleus* is known in this genus. The polyp stage is unknown.

Tiaricodon sp. (Fig. 54a-d)

MATERIAL EXAMINED:

1 young medusa collected 15.6.1994 in plankton Evans Bay, height 2.6 mm, infertile, cultivated until 19.8.1994, fed daily with several *Artemia* nauplii, maximal height attained 7 mm, preserved after microbial infection caused deterioration, deposited.

4 *T. coeruleus* from Stanley Harbour, Falkland Islands, South Atlantic, collected by Vallentin 17.3.1902, held by ZMC, identified by P. Kramp, size up to 18 mm, some mature (figured in 54e).

1 *T. coeruleus* from Valparaiso Bay, South America, collected 15.9.1958 by E. Fagetti, identified by P. Kramp, 5 mm high but shrunken, stomach sacs present, immature.

DESCRIPTION

Young medusa: Youngest observed stage 2.6 mm high,

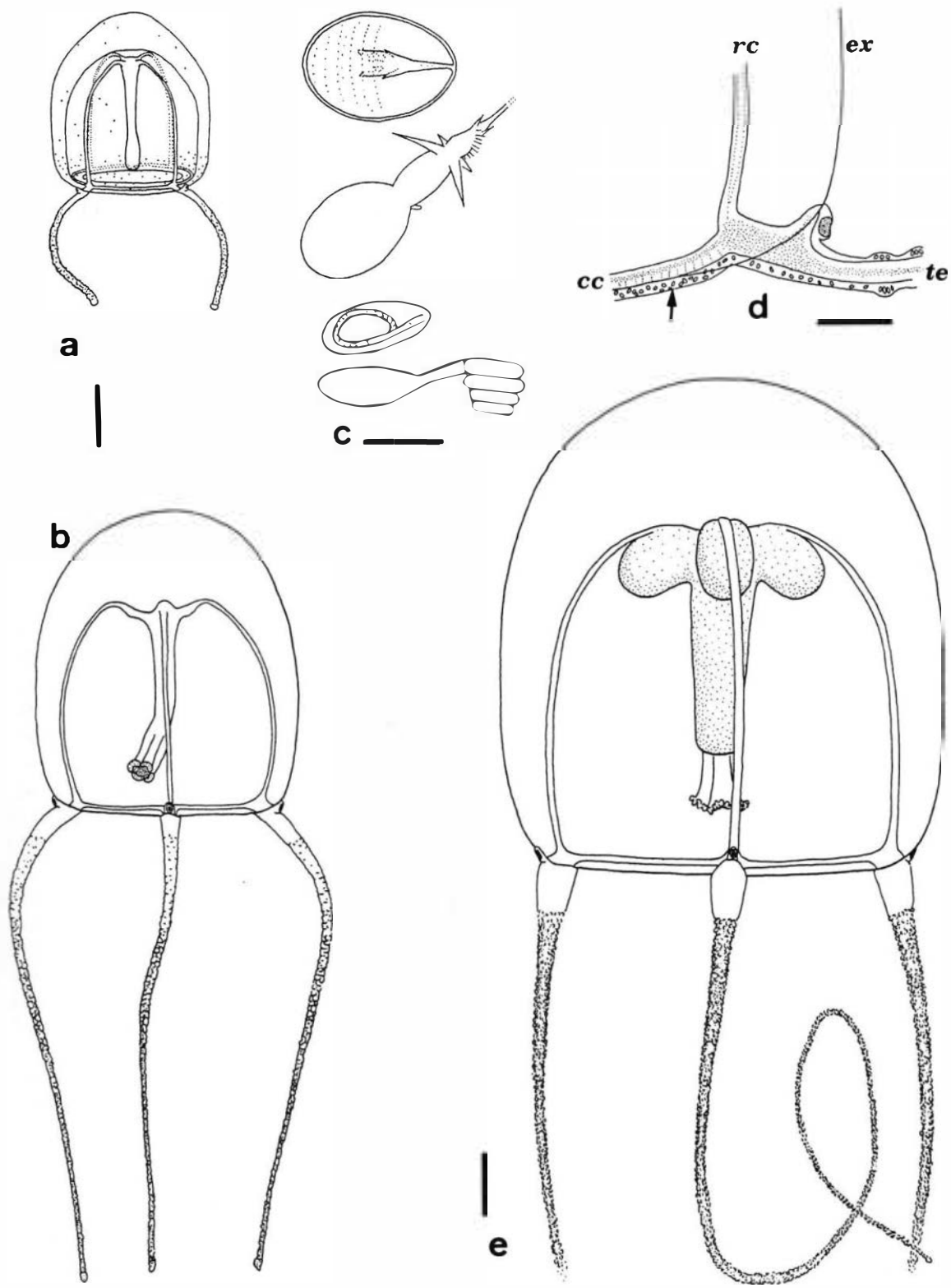


Fig. 54. a) to d) *Tiaricodon* sp., all from life. **a)** medusa found in the plankton of Evans Bay; scale bar 1 mm. **b)** same medusa after 1 month, same scale as a). **c)** Nematocysts, from top: stenotele, same discharged, desmoneme, same discharged; scale bar 10 µm. **d)** lateral view of tentacle bulbs showing nematocyst ring (arrow). Note the ocellus on the abaxial spur of the tentacle base; *cc* circular canal, *ex* exumbrella, *rc* radial canal, *te* tentacles; scale bar 0.2 mm. **e)** ***Tiaricodon coeruleus*** from the Falkland Islands, South Atlantic; scale bar 2 mm.

bell-shaped with parallel lateral walls and conical top, with very slight gastric peduncle. Exumbrella with scattered stenoteles, denser towards margin. With ring of thickened epidermis containing nematocysts beneath circular canal. Manubrium tubular, reaching almost the level of the velum, cylindrical with quadrangular base, lacking stomach pouches. Four radial canals and a circular canal, all thin and smooth. Radial canals without dilatation on entering circular canal. Four tentacles, contracted ~1.5 times bell length, length when expanded more than three times bell size. Tentacles with base free of nematocyst clusters and an abaxial process adhering on exumbrella. This spur bears a large ocellus. Tentacles hollow, with many nematocyst clasps in indistinct spirals and a larger terminal cluster. Radial and ring canal with golden colour through zooxanthellae. Nematocysts:

a) stenoteles, (18–20.5) x (13.5–15.5) µm.
b) desmonemes, discharged with four coils, (10.5–15.5) x (4.5–6.5) µm.
c) heteronemes.

Premature medusa: Medusa 7 mm high and 4 mm wide. Umbrella bell-shaped with rounded apex, jelly thick, at apex three times as thick as lateral walls. With shallow gastric peduncle. Epidermal ring beneath circular canal not observable. Manubrium almost as long as bell cavity, with prismatic stomach, mouth with 4 perradial lips. Mouth margin thickened with nematocysts. Base of stomach cruciform, with small pouches that also differ in colour from radial canals. Incipient gonad tissue (oocytes) visible on stomach pouches. Tentacles thick, tapering, with bullet-shaped terminal cluster. Ocelli on abaxial process of tentacle bulb.

REMARKS: Only one young medusa of *Tiaricodon* sp. was found in Wellington Harbour during winter. After several weeks of cultivation (Fig. 54b) the basal sacs started to grow and some small oocytes began to develop. Comparison with *Tiaricodon coeruleus* from the type locality showed that the medusa from Wellington most probably belongs to this species (cf. Fig. 54e), but because the observed animal from Wellington was immature, it was not definitely assigned to *T. coeruleus*. Only if mature animals are discovered in New Zealand can the present observation be used as a record for this species.

The basal sacs and especially the abaxial process of the tentacle base bearing the ocellus (Figs 54b, d, e) are very characteristic of *Tiaricodon coeruleus*. Contrary to earlier descriptions, *T. coeruleus* from the type locality does not always have a peduncle or has only a very indistinct one.

In the youngest stage obtained from Wellington (Fig. 54a, d) there was a ring of thickened epidermis containing nematocysts beneath the radial canal. This ring is most probably reduced during later development. Adult *T. coeruleus* from South America do not have it.

Tiaricodon sp. is a very active swimmer, consuming large numbers of *Artemia* nauplii (5–10 per day). Despite this, it grew only very slowly to a size of 7 mm, after which it was preserved because it started to deteriorate.

RECORDS FROM NEW ZEALAND: Wellington Harbour (this study).

Family ZANCLEIDAE Russell, 1953

Colonial hydroids with claviform or cylindrical hydranths. Hydranths monomorphic or polymorphic. With one oral whorl of four to six capitate tentacles and below them numerous scattered capitate or moniliform tentacles; rarely tentacles reduced. Hydrocaulus short, unbranched, not clearly demarcated from hydranth, arising from creeping stolons. Perisarc covering stolons and it may form a low cup around base of hydrocaulus, or covering hydrocaulus entirely. Gonophores arise on short pedicels or in clusters on short-branched blastostyles either among tentacles, below tentacles, or from stolons. Gonophores are liberated as free medusae with evenly rounded umbrella. With exumbrellar nematocysts confined to perradial patches of specialised tissue. With either two or four solid marginal tentacles with abaxial stalked cnidophores or tentacles lacking. Ocelli absent. Gonads usually differentiated in interradial position, rarely in a single mass around manubrium of eumedusoids. Cnidome with stenoteles and normally with macrobasic heteronemes, desmonemes absent.

REMARKS: The above diagnosis was taken from Petersen (1990) and modified according to Boero and Hewitt (1992) to accommodate polymorphic polyps and *Halocoryne epizoica* Hadzi, 1917. According to Petersen (1990), the family comprises *Asyncoryne* and *Zanclea sensu lato*. The monotypic genera *Ctenaria* and *Oonautes* are not included. *Ctenaria ctenophora* Haeckel, 1879 is here considered a doubtful species, and *Oonautes hanseni* Damas, 1936 is of uncertain affinity. Both species are normally included in the Zancleidae (e.g., Kramp 1961; Bouilon 1985b), but they are better excluded as *incertae sedis*. Only *Zanclea* is known from New Zealand.

Zanclea Gegenbaur, 1857 emend.

Halocoryne Hadzi, 1917 **new synonym.**
Zanclella Boero & Hewitt, 1992 **new synonym,**
for more see Calder (1988)

Colonial hydroids arising from ramified stolons. Often associated with bryozoans. Hydranths monomorphic or polymorphic, with elongated cylindrical or fusiform body, with an oral whorl of 1 to 6 capitate tentacles and normally additional capitate tentacles scattered over the hydranth body. Tentacles rarely reduced to mere nematocyst patches. Stolons covered by perisarc which can extend up to the hydrocaulus. Medusae-buds arise either scattered among or under tentacles or from stolons. Gonophores develop singly on short pedicels or on short, branching blastostyles. Medusae with two or four perradial tentacles with abaxial stalked cnidophores or tentacles absent. Ocelli lacking. With nematocyst clusters on exumbrella above tentacle bulbs that contain stenoteles. Nematocysts of medusa includes stenoteles and macrobasic heteronemes.

TYPE SPECIES: *Zanclea costata* Gegenbaur, 1857.

REMARKS: The diagnosis of the genus *Zanclea* is emended here to include *Z. polymorpha* n.sp. This species has polymorphic hydranths and an obligatory association with bryozoans as in *Zanclella* Boero & Hewitt, 1992. It does not conform to *Zanclella*, however, because its polyps have normally developed tentacles and the medusa agrees with the previously accepted diagnosis of *Zanclea*. Polymorphic polyps and association with bryozoans are apparent synapomorphies of a clade that includes the present new species and *Zanclella bryozoophila*. It is therefore not possible to widen the genus definition of *Zanclea* to include only the new species as this would render *Zanclea* obviously paraphyletic. Because no apparent synapomorphies are available for the remaining species with monomorphic polyps, they are thus probably paraphyletic. The generic diagnosis of *Zanclea* is therefore widened to accommodate not only the new species but also *Zanclella*.

The monotypic genus *Halocoryne* Hadzi, 1917 was shown by Piraino *et al.* (1992) and Boero and Hewitt (1992) to be closely related to *Zanclella*. It shares with the latter polymorphic polyps, an obligatory association with bryozoans, a reduction of tentacles in the medusa, and gonads encircling the manubrium. All these characters are synapomorphies within the genus as defined here. *Halocoryne* is therefore also incorporated into the new diagnosis of *Zanclea* to avoid paraphyletic taxa. *Zanclella* and *Halocoryne* thus become synonyms of *Zanclea*.

Only one species of *Zanclea* is known in New Zealand.

Zanclea polymorpha n.sp. (Figs 55a-g, 56a-b)

MATERIAL EXAMINED:

1 colony collected east of NIWA buildings, Greta Point, Wellington, under rocks, intertidal, 17.11.1993, infertile.

Ca. 12 colonies from type locality, collected 17.10.1994 and 2.11.1994, 0.5 m, infertile at date of collection, all on the bryozoan *Rhynchozoon larreyi* (kindly identified by Dr D. Gordon, see also Gordon & Mawatari 1992), several colonies cultivated in running seawater and fed every second day with *Artemia* nauplii. Many new stolons grew between zooids but never extended beyond the bryozoan host. After 2–4 weeks medusae buds appeared and about 30 free medusae from 3 colonies were obtained. Medusae were cultivated at room temperature and fed daily with *Artemia* parts. After 7 days gonads (only males seen) became mature (as judged by their turning opaque). Many medusae were lost during cultivation as they are prone to microbial infections. After 8 days the medusae looked very closely like medusae from the plankton, only being smaller in size (1 mm) and the apical thickening was not as thick as seen in medusae from the plankton. One hydroid colony deposited as holotype H-653, young medusae deposited as paratype P-1084.

8 medusae, collected 14.4.1994 in the surface plankton near Seatoun, several mature which spawned later on, some deposited as paratype P-1084.

7 preserved medusae collected by T. Barnett, Leigh Marine Reserve, 1983–1984, labelled *Zanclea costata*.

DESCRIPTION

Polyp stage: Hydroid colonies growing within and on colonies of *Rhynchozoon larreyi* (Audouin, 1826) (Bryozoa, Cheilostomatida). Polyps polymorphic, sessile, without marked caulus, arising from stolons which are mostly embedded in the bryozoan colony or covered by calcified material secreted by the bryozoans. The hydranths cannot completely withdraw into the bryozoan colony and are always visible. Stolons may be visible in wild colonies only near the edge of the bryozoan colony where they run along the margins of the zooids. Stolons are covered by a thin, single-layered perisarc, there is no perisarc cup present at the base of the polyps.

Polyps differentiate into gastrozooids, dactylozooids, and rarely into gonozooids. Gastrozooids are normally 1 mm high but can reach 2 mm, claviform with a thicker distal end and a white oral region and orange body. With 4–6 capitate oral tentacles and 8–14 scattered capitate tentacles below them. Tentacles become progressively shorter towards hydranth base. Dactylozooids are very long and thin, extensible for

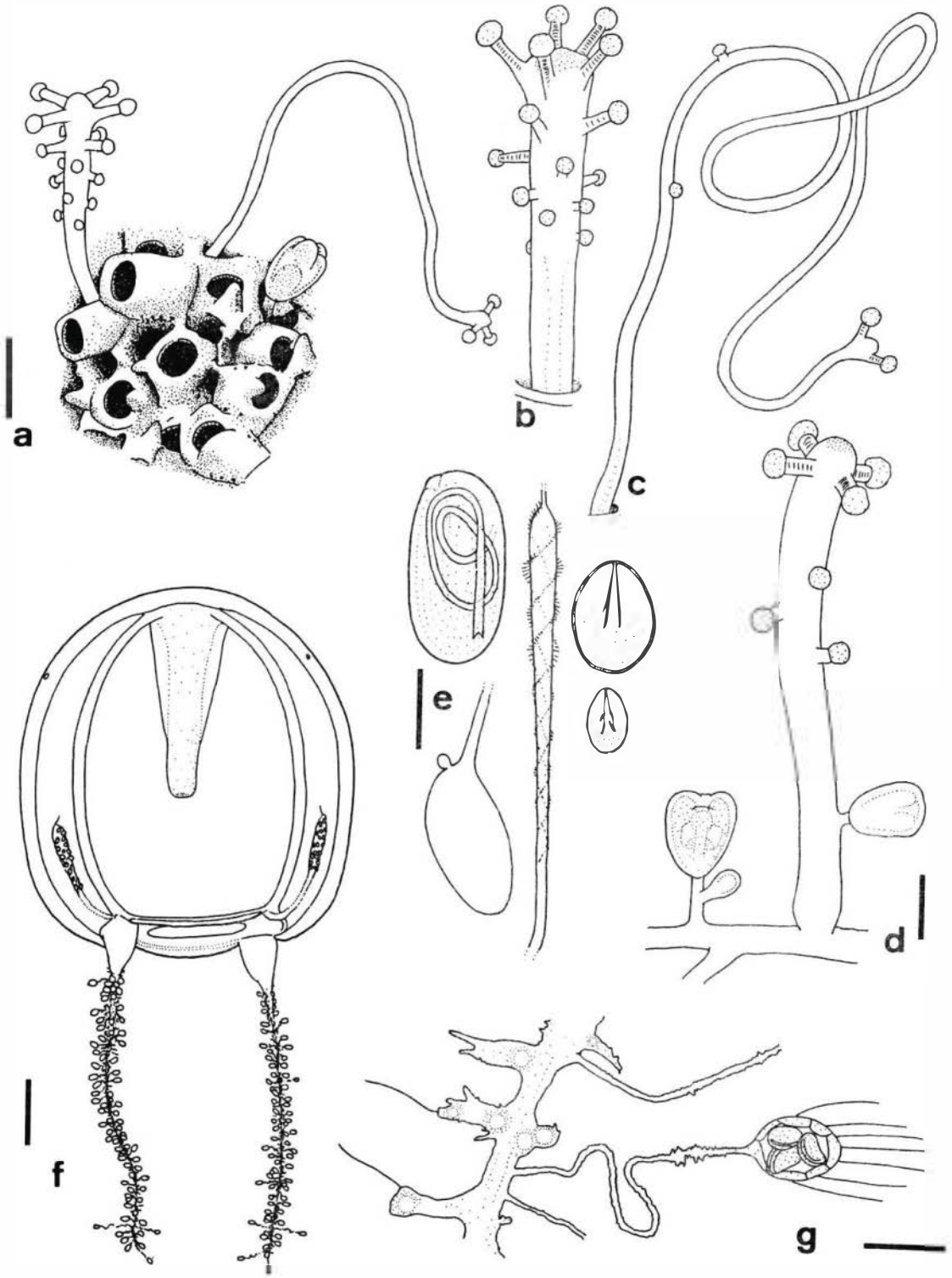


Fig. 55. *Zanclea polymorpha* n.sp., all from life. **a)** fertile colony on its bryozoan host *Rhynchozoon larreyi*; scale bar 0.5 mm. **b)** gastrozooid, same scale as d). **c)** dactylozooid, same scale as d). **d)** Medusae buds arising from stolons (left) or gonozooid like polyps (right); scale bar 0.2 mm. **e)** nematocysts of polyp stage, anticlockwise: macrobasic eurytele, same discharged, shaft of the latter, small stenotele, larger stenotele; scale bar 10 µm. **f)** newly released medusa; scale bar 0.1 mm. **g)** morphology of tentacle with cnidophore; scale bar 20 µm.

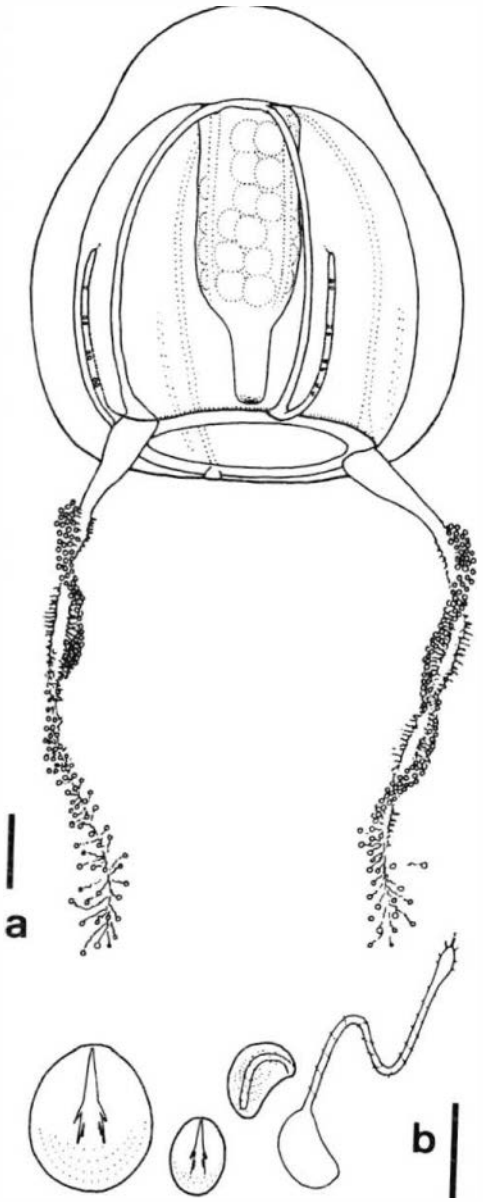


Fig. 56. *Zanclea polymorpha* n.sp. from life. **a)** adult medusa from plankton; scale bar 0.25 mm. **b)** nematocysts of medusa stage: larger stenotele, smaller stenotele, macrobasic euryteles same discharged; scale bar 10 µm.

up to 5 mm, more frequently present near margin of bryozoan colony, with oral region swollen and hypostome white, with 1–4 capitate oral tentacles and 0–4 short capitate tentacles widely scattered on body. At least some of the dactylozooids still have a mouth and are able to consume small prey, but mostly prey caught by dactylozooids is eaten by neighbouring gastrozooids.

Gonophores normally arise from stolons, either singly on stems or from short blastostyles that branch once or twice. Occasionally gonophores are produced below the tentacle zone of gastrozooid-like polyps that have a reduced number of tentacles. Gonophores develop into free medusae. The buds soon become bilaterally symmetrical by the pronounced growth of two opposite marginal bulbs. Nematocysts:

a) macrobasic euryteles, concentrated near mouth, with three bands of spines spiralling around distal quarter of shaft, (22–25) x (10.5–12) µm, s = 8–10.
b) smaller stenoteles, (7.5–8.5) x (5–6) µm.
c) larger stenoteles, (12.5–14.5) x (10–11) µm.

Young medusa: Newly released medusa bell-shaped, not bilaterally flattened, as broad as high or slightly higher, approximately 0.6 mm high, jelly evenly thin. With 4 perradial exumbrellar ridges extending from bell margin upwards one-third of bell, each bearing an oval to fusiform patch of nematocytes with stenoteles. Occasionally some single nematocysts on exumbrella. Velum spanning approximately half of radius. Manubrium length half of bell height, simple, tubular with circular mouth. Four incipient interradial gonads visible. With 4 radial canals without median swelling, ending in 2 opposite marginal bulbs with tentacles and 2 small bulbs without tentacles. Circular canal thinner than radial canals. One pair of opposite tentacles, extended somewhat longer than bell height, rapidly tapering from proximal to distal, with around 70 abaxial cnidophores on long contractile stalks. Cnidophores and stalks are purely epidermal and contain 3–4 euryteles. Tentacle main axis additionally with many protruding cell processes. No ocelli present. Nematocysts:

a) macrobasic euryteles, undischarged capsule often with a concave side, shaft not coiled, few spines on everted shaft, (7.5–9) x (5–6) µm, s = 3.5–5.4.
b) smaller stenoteles, (6–9) x (4–6.5) µm.
c) larger stenoteles, (13–15) x (10–12) µm.

Mature medusa: Similar to young medusa, only larger (1–1.6 mm), jelly thicker. Apex mostly with a thickened jelly of variable height, up to approximately 2.5 times the thickness of lateral walls. The exumbrellar nematocyst patches are reduced to narrow bands. The tentacles are longer and with many more cnidophores. The gonads are 4 bulging pads in interradial positions on the manubrium. Nematocysts:

a) macrobasic euryteles, (8.5–11) x (5–6.5) µm, s = 3.3–4.3.
b) smaller stenoteles, (8–10.5) x (6–8.5) µm.
c) larger stenoteles, (12–16) x (9.5–13) µm.

Egg size: 99 mm (s.d. 5 mm, n = 8).

TYPE LOCALITY: South of NIWA buildings, Greta Point, Wellington Harbour, depth 0.5 m, on colonies of *Rhynchozoon larreyi* (Bryozoa) on the underside of loose bricks.

ETYMOLOGY: The species name refers to the polymorphic polyps.

REMARKS: With its polymorphic polyps *Zanclea polymorpha* somewhat resembles *Zanclella* Boero & Hewitt, 1992, although the latter has more-reduced polyps. The medusa of Z. *polymorpha* is also different in having two fully developed tentacles. The medusa alone is indistinguishable from medusae commonly referred to *Zanclea costata* (cf. Russell & Rees 1936; Russell 1953; Kramp 1968; Brinckmann-Voss 1970). The systematics of this species is very complicated and unsettled. Some authors have already indicated that more than one species may be lumped together under the name Z. *costata* (cf. Bérhaut 1969; Millard & Bouillon 1973; Tregouboff & Rose 1978). With Z. *polymorpha* the uncertainty becomes even larger. It seems that the various Z. *costata*-like medusae are not properly identifiable if only this stage is known, and complete life-cycle information will be necessary for all future identification. As shown by Bouillon (1978b) there are also several valid *Zanclea* species known from their medusa stage only. This indicates that there are a large number of *Zanclea* species to be properly investigated and described.

Zanclea polymorpha polyps fed well on *Artemia* nauplii, but all colonies degenerated after few weeks, perhaps because the bryozoan was not surviving. Albeit with difficulty, several released medusae could be cultivated until their gonads appeared mature. They reached a size of about 1 mm and differed from the medusae found in the plankton only in having a less thickened apical jelly. This can most probably be attributed to the cultivation conditions and younger age, however, as similar effects were observed with other medusae (pers. obs.). The apical thickening is also rather variable in medusae from the plankton. There were no differences in variety or size of nematocysts between the cultivated and wild medusae, therefore the *Zanclea* medusae from the plankton of Wellington Harbour can quite reliably be attributed to Z. *polymorpha*. No other zancleid was found and Z. *polymorpha* polyps were quite abundant at the type locality. The medusae originating from Leigh are not distinguishable from the ones found in Wellington and were tentatively assigned to the same species.

The bryozoan host *Rhynchozoon larreyi* is abundant throughout New Zealand (Gordon & Mawatari 1992). Not all colonies host Z. *polymorpha*, however, and the hydroid was never found on other bryozoans despite a large number of examined species. At the type locality only about one-third of the *R. larreyi* colonies encrusting the underside of stones had visible polyps. Colonies of *R. larreyi* on gastropod or bivalve shells, or on seaweeds did not host the hydroid. Gordon and Mawatari (1992, fig. 3b) depicted a *R. larreyi* colony originating from South Island (D.P. Gordon pers. comm.) which clearly shows a similar hydroid like Z. *polymorpha* and most presumably also belongs to this species.

Rhynchozoon larreyi is also widespread outside New Zealand (Turkey, Red Sea, Indonesia, Lord Howe Island, Victoria, see Gordon & Mawatari 1992). In colonies from the Red Sea it is known to host a hydroid of the genus *Zanclea* in almost all examined colonies and this association may contribute to the competitiveness of the bryozoan (Ristedt & Schuhmacher 1985). Whether it hosts the same species of *Zanclea* as in New Zealand cannot be decided from the information available. *Rhynchozoon larreyi* has a frontal budding pattern resulting in thick colonies with a complicated and highly structured surface. The microrelief may offer the hydroids protection from abrasion and grazing as they can withdraw into the cavities and depressions.

RECORDS FROM NEW ZEALAND: Wellington Harbour; ?South Island (Gordon and Mawatari 1992), Leigh Marine Reserve (Barnett 1985, as *Zanclea costata*).

Family CLADOCORYNIDAE Allman, 1872

Hydroids with club-shaped hydranths, moniliform or capitate tentacles in one oral whorl and moniliform or modified moniliform aboral tentacles scattered or in whorls. With rounded nematocyst patches on body wall below oral tentacles. Stems simple or sparingly branched, arising from attached stolons. Gonophores develop singly or on short, branched blastostyles on lower part of hydranth. Gonophores either liberated as free medusae or remaining fixed as sporosacs. Newly liberated medusa with two perradial tentacles with stalked cnidophores and two non-tentacular bulbs; exumbrellar nematocyst pouches absent. Cnidome of both hydroid and medusa comprising macrobasic euryteles and stenoteles (Petersen 1990).

REMARKS: This family comprises the genera *Pteroclava* and *Cladocoryne*. Only the latter genus is known from New Zealand.

Cladocoryne Rotch, 1871

SYNONYMS: see Petersen (1990).

Hydroid colonies with club-shaped hydranths with an oral whorl of four to six short, capitate tentacles and one to four whorls of branched-capitate aboral

tentacles. One or two series of oval patches of macrobasic euryteles on hydranth body. Hydrocaulus long, unbranched or sparingly branched, covered by perisarc. Cauli arising from attached stolons. Gonophores carried singly on short pedicels between or over aboral tentacles. Gonophores remain fixed as sporosacs in the presently known species (after Petersen 1990).

TYPE SPECIES: *Cladocoryne floccosa* Rotch, 1871.

REMARKS: Only the type species is known from New Zealand.

Cladocoryne floccosa Rotch, 1871 (Fig. 57a-c)

Cladocoryne floccosa Rotch, 1871: 228; Brinckmann-Voss 1970: 69, figs 80–82; Millard 1975: 65, figs 21A–B; Bouillon *et al.* 1987: 297, figs 1 & 5–6; Hirohito 1988: 52, figs 16b-f.

MATERIAL EXAMINED:
1 live, infertile colony with 6 hydranths, on holdfasts of the alga *Macrocystis pyrifera*, 10.3.1994, drift, Greta Point, Wellington.

DESCRIPTION: Colonial hydroids reaching several millimetres in height, arising from ramified stolons. Stems not branched. Stems covered by perisarc, smooth or with annulated stretches and becoming thinner distally to terminate below hydranth. Hydranth cylindrical, up to 1 mm high, with dome-shaped hypostome, with a single whorl of 4 capitate oral tentacles and 3 alternating whorls of aboral tentacles. Aboral tentacles branched, side-branches short, in 2 lateral rows and 1 median row on upper side. Lateral rows with up to 7 tentacles, median rows with 0–2 tentacles. All side branches and end of main branch with a terminal, spherical nematocyst cluster. Colour white.
Nematocysts:
a) telotrichous macrobasic euryteles, on body wall between oral tentacles and most proximal aboral tentacles, (33–41) x (16–17) µm, s > 10.
b) smaller stenoteles, (6–7) x (4–5) µm.
c) medium sized stenoteles, (9) x (6–7) µm.
d) larger stenoteles, (15–16.5) x (12–13.5) µm.

TYPE LOCALITY: Herm, Channel Islands, United Kingdom.

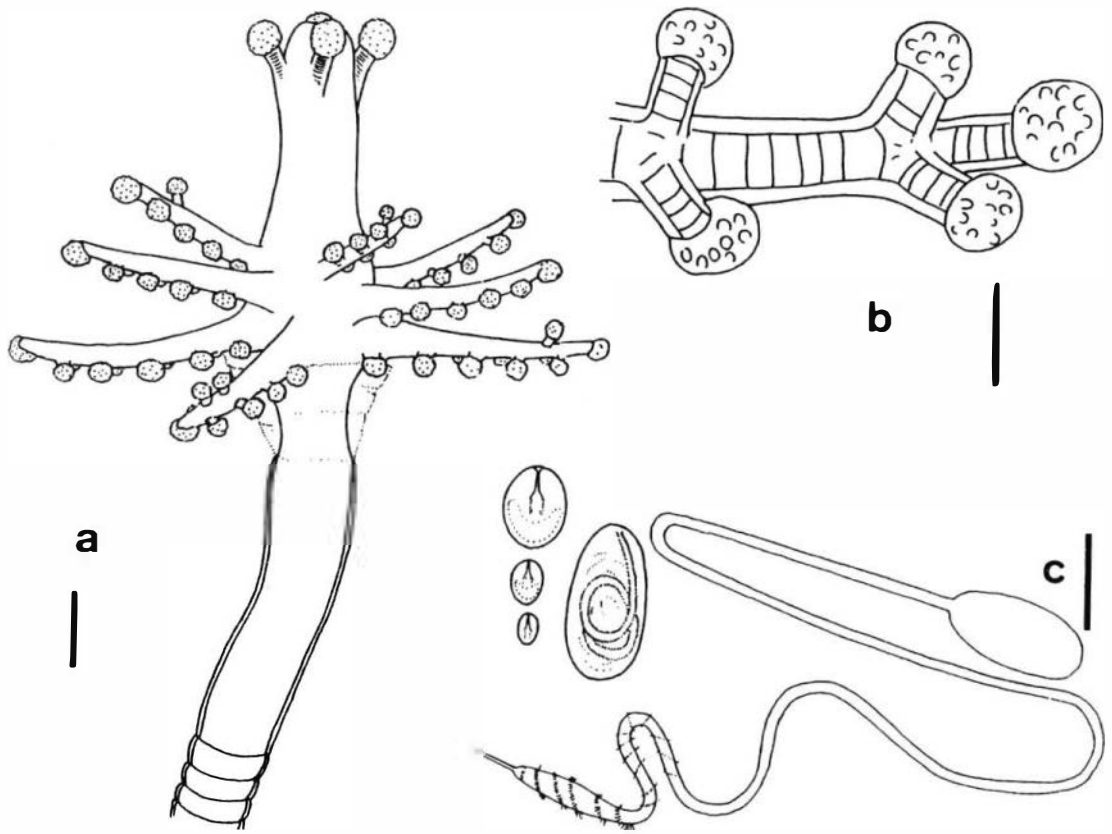


Fig. 57. ***Cladocoryne floccosa***, from life. **a)** distal part of caulus and hydranth; scale bar 0.2 mm. **b)** terminal part of an aboral tentacle showing branching, CL; scale bar 50 µm. **c)** nematocysts: column of stenoteles, macrobasic eurytele, same discharged; scale bar 10 µm.

REMARKS: According to Millard (1975), the gonophores are borne on the hydranth among the aboral tentacles on short pedicels; they are spherical, reaching 0.34 mm in diameter, remaining fixed as sporosacs of the cryptomedusoid type.

Although the examined colonies were not fertile, the identification of *C. floccosa* is rather unambiguous as it had three aboral tentacle whorls (cf. Bouillon *et al.* 1987). The macrobasic euryteles are clustered in groups on the body wall, but are not easy to see under a dissecting microscope.

RECORDS FROM NEW ZEALAND: Wellington (new record).

DISTRIBUTION: Circumglobal in tropical and subtropical waters, occasionally extending into temperate areas (Millard 1975).

Family PORPITIDAE Goldfuss, 1818

Hydroids developed as floating colony. Underside with a large central gastrozooid surrounded by gonozooids and peripheral dactylozooids. Float contains a perisarc disc with concentric air chambers and a complex system of gastrodermal canals. Gonophores develop on basal parts of gonozooids and are liberated as medusae. Umbrella of medusa with four or eight tracks of nematocysts originating from marginal bulbs. With four or eight radial canals and a ring canal. Manubrium short, with circular mouth. Gonads perradial or interradial; may be irregularly developed so that number may vary. With two opposite marginal tentacles terminating in large spherical nematocyst knob. With or without an additional adaxially oriented short tentacle developed from bulbs with tentacles. Two or six marginal bulbs without tentacles. No ocelli present. Zooxanthellae often present.

REMARKS: Only *Porpita* and *Velella* are known from New Zealand. Diagnostic characters:

Porpita: float without sail, smooth surface, dactylozooids with capitate tentacles.

Velella: float with upright sail, dactylozooids without tentacles.

Porpita Lamarck, 1801

Porpitid hydroids with disc-shaped float and mantle. Float flat or with central bulge, without sail. Dactylozooids with three vertical rows of short, capitate tentacles. Medusa with small manubrium. Juvenile specimens without marginal tentacles; adults with one to two slender, decidedly capitate tentacles. With eight radial canals, their gastrodermal cells bearing algal symbionts.

TYPE SPECIES: *Porpita porpita* (Linnaeus, 1758).

REMARKS: Only the type species is known from New Zealand.

Porpita porpita (Linnaeus, 1758) (Fig. 58a-b)

Medusa porpita Linnaeus, 1758: 659.
Porpita pacifica Lesson, 1826: pl. 7, figs 3, 3'.
Porpita umbella: Vanhoeffen 1906: 39, figs 64–65.
Porpita pacifica: Powell 1947: 5, figure.
Porpita porpita: Brinckmann-Voss 1970: 38, figs 40–42; Daniel 1976: 111, fig. 1a-d; Calder 1988: 77, figs 65–67 (*cum syn.*); Pagès *et al.* 1992: 23, fig. 22.

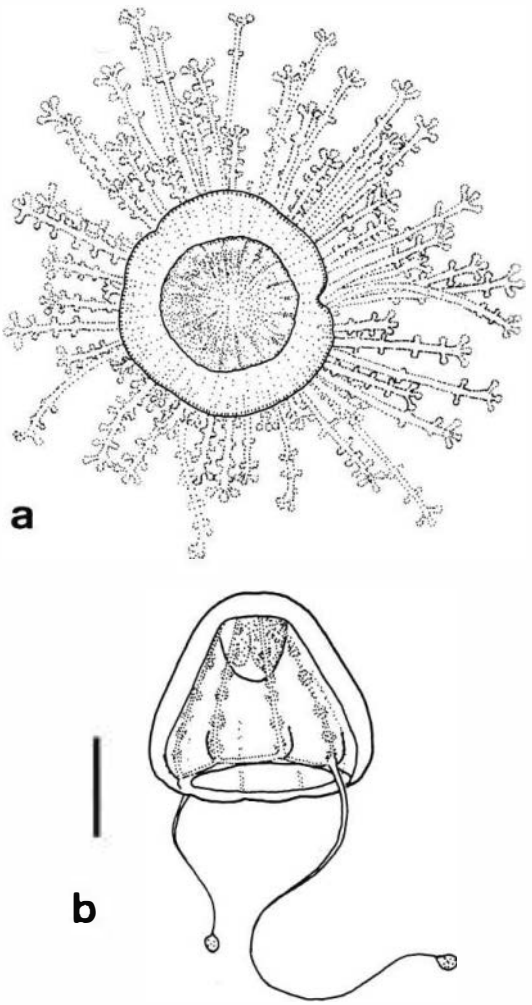


Fig. 58. ***Porpita porpita***. **a)** polyp stage, drawn from photograph, no scale available. **b)** mature medusa from plankton, redrawn from Bouillon (1984) with permission of the publisher. Note: the medusa is not yet known from New Zealand; scale bar 1 mm.

MATERIAL EXAMINED:
No material from New Zealand seen.

DESCRIPTION:
Polyp stage (after Vanhoeffen 1906; Calder 1988): Hydroid colony floating on water surface, diameter up to 30 mm, mostly smaller, with disc-shaped mantle and internal float; upper surface slightly convex, with a central pore and numerous stigmata. Mantle with radiating gastrodermal canals; margin soft, flexible; central region firm, with an internal chitinous float consisting of a series of concentric chambers; a disc-shaped reservoir of nematocysts lying between float and central gastrozooid. Undersurface with one large central gastrozooid, a median circle of gonozooids, and a peripheral circle of dactylozooids. Central gastrozooid short and broad with a terminal mouth, without tentacles or prominent nematocyst clusters. Gonozooids clavate, lacking tentacles but with prominent nematocyst clusters scattered over body, medusae develop near base in clusters. Dactylozooids with tentacles, with a distal whorl of 4 capitate tentacles, body with varying number of short, small capitate tentacles in 3 vertical rows.
Nematocysts: atrichous isorhizas, haplonemes, three types of stenoteles.

Young medusa (after Brinckmann-Voss 1970 and Bouillon 1984): Bell-shaped, slightly higher than wide, height 0.3 mm. With 4 exumbrellar rows of nematocysts. Manubrium very short. Four broad radial canals, circular canal missing. Tentacles lacking. Gastrodermal system without lumen, composed of large, vacuolated cells. Gastrodermis of radial canals with zooxanthellae.

Adult medusa (after Bouillon 1984, not known from New Zealand): Up to 2.5 mm high and 2 mm diameter, bell rather conical, with jelly of even thickness. Exumbrella with 8 perradial tracks of nematocysts, only one capsule wide. Manubrium length one-third of bell cavity, conical, with circular, hardly visible mouth. Gonads normally in four perradial masses on manubrium, but 3–8 gonads may be present. With 8 large radial canals with zooxanthellae. Circular canal present. With 8 little developed marginal bulbs. Only 2 opposite tentacles present. Tentacles long and ending in a voluminous terminal swelling. Tentacles develop unequally and are often of different length. Often only one tentacle present. Ocelli absent. Nematocysts:
a) stenoteles, (24) x (23) µm.
b) telotrichous macrobasic euryteles, (23) x (17) µm, s ~ 7.

TYPE LOCALITY: India.

REMARKS: *Porpita porpita* is often found stranded together with *Velella velella*, though *Porpita* is normally only present in few numbers.

RECORDS FROM NEW ZEALAND (POLYP): Muriwai Beach (Powell 1947); Tawharanui Peninsula (D. P. Gordon, pers. comm.).

DISTRIBUTION: Circumglobal in warmer waters (polyp stage, Daniel 1976). Adult medusa known from Papua New Guinea (Bouillon 1984).

Velella Lamarck, 1801

Floating hydroid colonies with an upright sail; with a central gastrozooid, numerous feeding gonozooids, and dactylozooids. Free medusa with exumbrellar nematocyst rows, with two pairs of opposite, perradial tentacles, each tentacle with a large terminal nematocyst cluster, two perradial marginal bulbs without tentacles. Stomach with tubular mouth. Gonads in male divided. Female with one egg. (Brinckmann-Voss 1970).

TYPE SPECIES: *Velella velella* (Linnaeus, 1758).

Velella velella (Linnaeus, 1758) (Fig. 59a-f)

Medusa velella Linnaeus, 1758: 660.
Velella spirans: Vanhoeffen 1906: 37, figs 58–60.
Velella velella: Brinckmann-Voss 1964: 327, figs 1–3; Edward 1966a: 283; Brinckmann-Voss 1970: 34, figs 36–39; Daniel 1976: 118, fig. 1m-n; Larson 1980: 183, fig. 1; Calder 1988: 81, figs 58–59 (*cum syn.*); Pagès *et al.* 1992: 21, fig. 21.

MATERIAL EXAMINED:
2 colonies held by Portobello Marine Laboratory, collected 17.1.1961 near Tokomairo mouth (Otago); 3 and 5 cm long, both right sailing (sail running from northeast to southwest, see Edwards 1966).
8 colonies held by Portobello Marine Laboratory, collected 27.3.1971 near East Cape, 1–3.5 cm, all right sailing.
37 colonies held by MoNZ, collected 5.5.1975 in Island Bay, Wellington, 1.5–4 cm, all right sailing.
8 colonies from NZOI Stn U799, 42°33.8'S, 170°34,E, 2.8.1990, 2–20 mm, all right sailing.
9 colonies from NZOI Stn U796, 42°34'S, 170°34.4'E, 6.8.1990, 3 –20 mm, all right sailing .
3 floats collected in December 1993 by C. Battershill on Piha Beach, 1.8–2.3 cm, all right sailing.
Several live colonies collected 19.3.1994 on east coast of Kapiti Island, all examined right sailing, medusae released and cultivated.
2 preserved colonies collected by M. McLean 16.4.1994 near Poor Knights Islands, 4–5 cm, one right and one left sailing form.

DESCRIPTION:

Polyp stage: Hydroid colonies floating on water surface, with flattened oval float and a triangular sail. There are two mirror images of the animal (left and right sailing). Float and sail are kept rigid by a chitinous support covered by mantle tissue. Margin of float soft and flexible. Chitinous float oval to slightly S-shaped with concentric air chambers. Mantle tissue with network of gastrodermal canals. In centre of underside a single large gastrozooid encircled by a band of medusae producing gonozooids and a peripheral band of dactylozooids. Central feeding zooid broadly oval with an elongated hypostome, without tentacles or medusae buds. Gonozooids spindle-shaped with a swollen mouth region, lacking tentacles but with warts of nematocyst clusters concentrated in distal half. On proximal half of hydranth numerous medusae buds growing in groups from short blastostyles. Dactylozooids long and tapering, oval in cross section with nematocysts concentrated on the narrow sides, mouth lacking. Nematocysts:

a) larger stenoteles, (17.5–19.5) x (15.5–17) µm.
b) medium sized stenoteles, (14–16) x (11–12) µm.
c) smaller stenoteles, (10.5–12.5) x (8–9.5) µm.
d) isorhizas with very fine spiral pattern on thread almost like atrich, (7.5–8.5) x (3–4) µm.

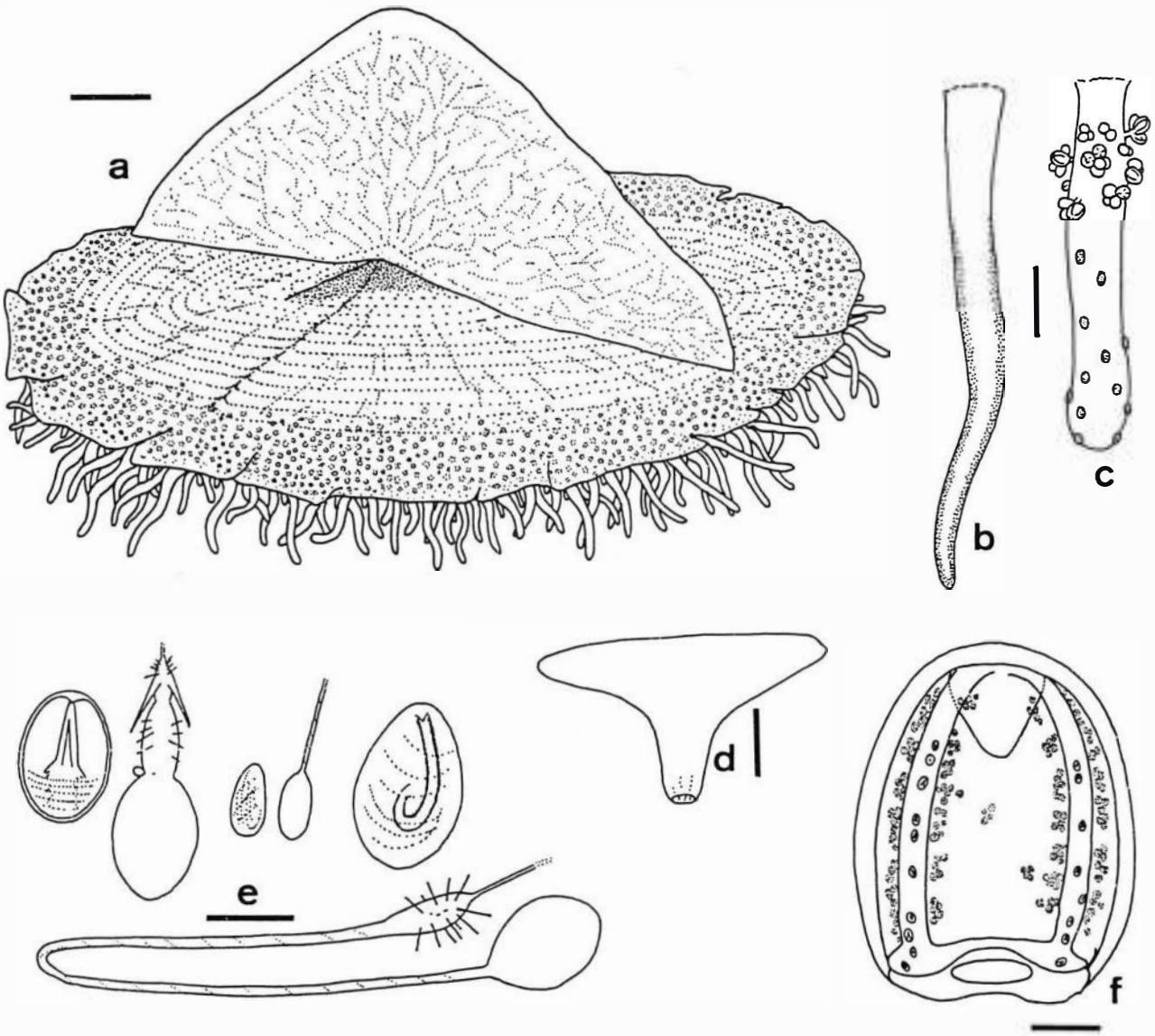


Fig. 59. ***Velella velella***, from preserved material except e) and f). **a)** view of a colony (right sailing); scale bar 3 mm. **b)** dactylozooid; scale bar 1 mm. **c)** gonozooid with medusae buds, same scale as b). **d)** central gastrozooid; scale bar 2 mm. **e)** nematocysts in pairs of native and discharged capsule: stenotele, isorhiza, macrobasic eurytele of medusa; scale bar 10 µm **f)** newly released medusa, zooxanthellae shaded; scale bar 0.2 mm.

Colours: float deeply blue when alive, medusae buds yellow-olive from symbiotic algae.

Young medusa (from live samples): Newly released medusa bell-shaped, up to 1 mm high and 0.8 mm in diameter. Manubrium short, conical, red colour often broad radial canals ending in 4 broad marginal bulbs connected by radial canal. No tentacles present in examined material. Many zooxanthellae are found in groups along the radial canals. During development present. With 4 perradial rows of stenoteles on exumbrella originating from the marginal bulbs. Four the zooxanthellae were reduced and an opposite tentacle pair grew, many macrobasic euryteles were produced. Nematocysts:

a) stenoteles, ca. 20 x 15 µm.
b) telotrichous macrobasic euryteles, (14–19.5) x (10–14) µm, s = 7.

Adult medusa (not known from NZ): Up to 2.8 mm high and 2 mm wide, bell cylindrical, with flat top, jelly evenly thin. Exumbrella with numerous papillae. Manubrium conical, length half to two-thirds of bell cavity. Gonads on manubrium as 4 longitudinal swellings in perradial position. With 4 marginal bulbs. Two opposite bulbs lack tentacles, and the other bulbs have 2 tentacles each, a short stout adaxial capitate tentacle, and a longer axially-directed capitate tentacle. Tentacles with parenchymatic gastrodermis. On the abaxial side of each tentaculate marginal bulb is a triangular patch of about 50 stenoteles which extends in an irregular line to the bell apex. On the abaxial side of each atentaculate bulb 15–20 stenoteles forming a vertical, irregular double row extending a short distance from the bell margin, and continuing as an irregular line to the bell apex. Marginal sense organs absent (after Brinckmann-Voss 1964; Larson 1980).
Nematocysts: stenoteles, macrobasic euryteles.
Colour: umbrella dark brown due to zooxanthellae.

Remarks: The newly-released medusae observed in this study did not have rudiments of tentacles and also lacked macrobasic euryteles. This does not agree with descriptions of Brinckmann-Voss (1970). However, the euryteles were formed shortly afterwards and in some medusae rudiments of tentacles also became visible. Unfortunately the medusae could not be cultivated for longer than seven days.

Although *Velella velella* can occur in enormous swarms spreading over hundreds of kilometres, and each individual colony can release thousands of medusae, the adult medusa has only rarely been reported from nature (by Metschnikoff after Brinckmann-Voss 1970; Larson 1980). Metschnikoff's medusa was a female that had one large, red egg. Brinckmann-Voss (1964) managed to cultivate male medusae to maturity. More information on the development of the colony can also be found in Brinckmann-Voss (1970). Larson (1980) described the only fully mature animal known from nature. The animal was intensely pigmented by zooxanthellae which suggests that the medusae normally occur near the water surface.

Almost all polyp colonies observed in this study had their sail in "right sailing" position (see Edwards 1966a). The prevalence of one form in one region may be due to sorting by prevailing winds (cf. Edwards 1966a).

Records from New Zealand: North Island (Powell 1947), South Island (see under Material examined).

Distribution: Widely distributed in Atlantic, Mediterranean, Indian Ocean, Pacific Ocean.

Family **CORYMORPHIDAE** Allman, 1872

Solitary hydroids with one whorl of moniliform or capitate oral tentacles or several close-set whorls of filiform oral tentacles. With one to three whorls of moniliform or filiform aboral tentacles. Hydrocaulus long, lower end pointed or rounded, hollow or more or less filled with parenchymatic gastrodermis. With short papillae or longer filaments composed of epidermis with a core of chordoid gastrodermis terminating in non-ciliated statocysts. Gonophores carried singly or on blastostyles just above the aboral tentacle whorl. Gonophores remain fixed as sporosacs or are liberated as free medusae. Medusa with umbrella that may or may not have an apical projection. Manubrium mostly not extending beyond umbrella margin; mouth simple, circular. With one to four hollow, usually moniliform tentacles. Ocelli lacking. Development from egg to polyp via encysted gastrula which develops directly into young polyp without planula stage. Cnidome includes both stenoteles and desmonemes (after Petersen 1990).

Remarks: The family Corymorphidae as recently redefined by Petersen (1990) comprises the genera *Euphysa*, *Siphonohydra*, *Gymnogonos*, *Corymorpha*, *Branchioceriantlius* and *Fukaurahydra*. It is here modified slightly to allow the inclusion of medusae with manubria longer than the bell cavity. This becomes necessary with the inclusion of *Euphysa problematica* (see p. 106). The more classical concept of this family (e.g., Bouillon 1985a) also contained genera that are either problematic (e.g., *Plotocnide*) or may be referred to other taxa (e.g., *Eucodonium*, *Ralpharia*). In New Zealand only *Corymorpha* and *Euphysa* are known.

Characteristics:
Corymorpha: medusa with pointed apical projection, one tentacle only.
Euphysa: medusa with evenly rounded umbrella, tentacles all of the same structure.

Corymorpha M. Sars, 1835

SYNONYMS: (after Petersen 1990)
Steenstrupia Forbes, 1846
Euphysora Maas, 1905
Vannuccia Brinckmann-Voss, 1967
Gotoea Uchida, 1927
Eugotoea Margulis, 1989

Solitary hydroids with more or less vasiform hydranth, one or several closely set oral whorls of sixteen or more moniliform or filiform tentacles and one aboral whorl of sixteen or more long non-contractile filiform tentacles. Gastrodermal diaphragm parenchymatic. Hydrocaulus stout, covered by thin perisarc, filled with parenchymatic gastrodermis with long peripheral canals; aboral third of caulus with papillae and, more aborally, rooting filaments. These have gastrodermal, non-ciliated statocysts in the species investigated. With or without asexual reproduction through constriction of tissue from aboral end of hydrocaulus.

Gonophores develop on blastostyles arranged in a whorl over aboral tentacles. Gonophores remain either fixed as sporosacs or are released as free medusae. Medusa apex dome-shaped or pointed. With three short or rudimentary tentacles and one long tentacle that differs not merely in size, but also in structure. Manubrium thin-walled, sausage-shaped with flared mouth rim, reaching to umbrella margin (after Petersen 1990).

TYPE SPECIES: *Corymorpha nutans* M. Sars, 1835.

REMARKS: The revised generic concept of *Corymorpha* includes genera like *Euphysora* and *Vannuccia* (Petersen 1990). The genus is now mainly defined through its polyp phase which offers better characters. Some of the characters of the medusa given in Petersen's diagnosis may be problematic. The flared mouth rim, for example, could not be seen in the available preserved material and could not be verified from other sources. More observations concerning this point are needed. Despite this, the system of Petersen (1990) is an improvement leading towards a more natural classi-

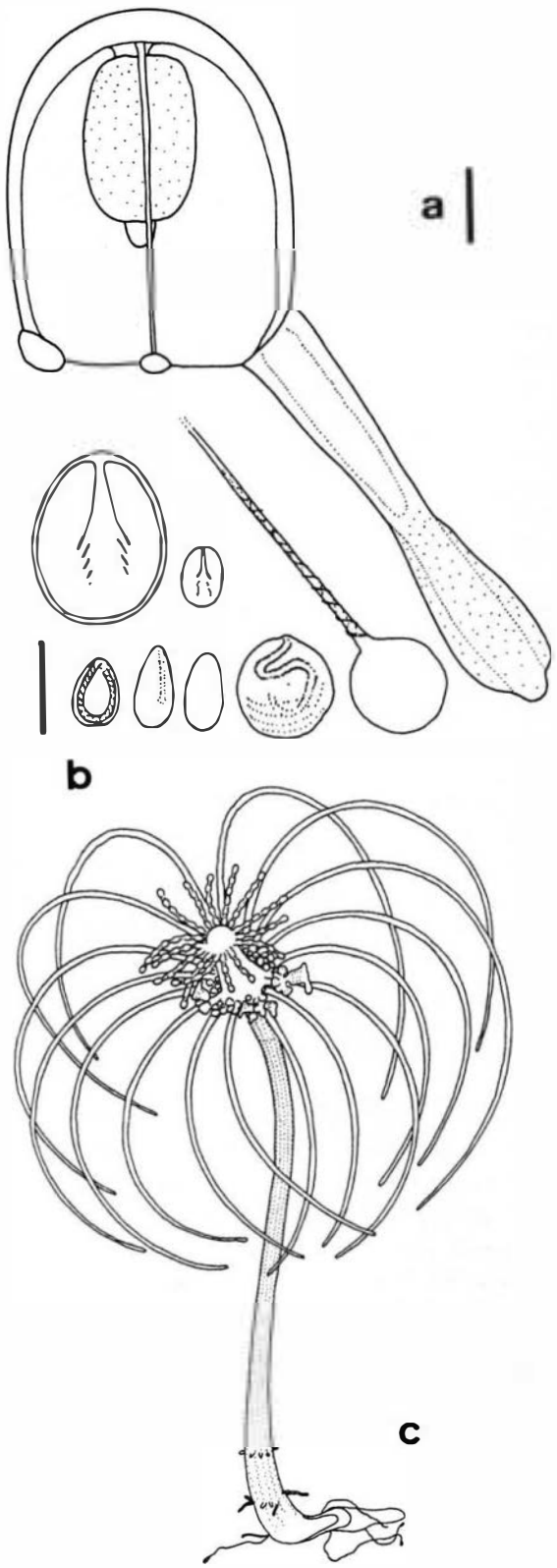


Fig. 60. ***Corymorpha forbesii***. a) medusa from Leigh; scale bar 0.2 mm. b) nematocysts of medusa: large stenotele, small stenotele, desmoneme, heteroneme, haploneme, heterotrichous anisorhiza, same discharged; scale bar 10 µm. c) polyp stage, redrawn from Brinckmann-Voss (1970) with permission of the publisher; size of polyp 10 mm. Note: the hydroid has not yet been found in New Zealand.

fication. Characteristics of species known from New Zealand:

C. forbesii: medusa with one thick tentacle with a terminal swelling, no apical process present.

C. furcata: medusa with apical process, with three smaller and one large tentacle with branching ends.

C. intermedia: medusa with pointed apical process, one slender, moniliform tentacle.

Corymorpha forbesii (Mayer, 1894) (Fig. 60a-c)

Hybocodon forbesii Mayer, 1894: 236, pl. 1, fig. 1; Mayer 1910: 42, pl. 1, fig. 8, pl. 2, fig. 3; Uchida 1927: 193, fig. 30; Kramp 1959: 87, fig. 36; Kramp 1961: 42; Kramp 1968: 13, fig. 22.

Hybocodon forbessi: Nair 1951: 50, pl. 1, fig. 1 [incorrect spelling].

Vannuccia forbesii: Brinckmann-Voss 1967: 1, figs 1-6; Brinckmann-Voss 1970: 14, pl. 1, figs 1-2, text-figs 9-11; Bouillon 1978a: 268, fig 8.3-4; Bouillon 1978b: 20.

Corymorpha forbesii: Petersen 1990: 149, fig. 16B.

MATERIAL EXAMINED:

3 medusae from Leigh Marine Reserve, 1 medusa from Whangateau Harbour (Leigh) obtained from T. Barnett.

DESCRIPTION:

Medusa stage: Adult medusa with bell-shaped umbrella up to 1.8 mm high, higher than wide, without apical process. Jelly evenly thin. Bell margin slightly oblique. Without exumbrellar tracks of nematocysts. Manubrium cylindrical, length half to two-thirds of bell height. Gonads encircle manubrium for almost all its length. Four narrow radial canals and circular canal present. One voluminous tentacle only. Tentacle hollow for half its length, terminal region except very distal end with a swollen epidermis containing many nematocysts. On perradial sites other than occupied by tentacle only marginal bulbs present. Bulb opposite tentacle slightly larger than the other ones. Nematocysts:

a) larger stenoteles, rare, (18) x (15.5) µm.
b) smaller stenoteles, (6.5-8.5) x (4.5-5.5) µm.
c) desmonemes, (6-7.5) x (4.5-5.5) µm.
d) heterotrichous anisorhizas, thread tapering only slowly, diameter (10-11.5) µm.
e) heteronemes (microbasic euryteles?, not seen discharged), (8) x (4) µm.
f) haplonemes (isorhizas?, not seen discharged), (7.5-9) x (3.5-4) µm.

Polyp stage (after Brinckmann-Voss 1967, 1970, not known from New Zealand): Solitary hydroids, up to 3 cm high, but length of caulus very variable. Polyp composed of caulus and hydranth. Caulus covered by flexible perisarc that extends slightly onto the hydranth body. Caulus with gastrodermal canals and at aboral end with many rooting filaments. Hydranth vasiform, with one oral and one aboral whorl of tentacles. Oral tentacles 12-14, moniliform with 4-6 nematocyst clusters. Aboral whorl with 16-20 filiform tentacles. Medusae buds develop in clusters on short blastostyles originating above the aboral tentacles. Medusae buds naked. Young medusae resemble adult ones, only without gonads which start to develop soon after liberation.

TYPE LOCALITY: Bahamas.

REMARKS: Only a limited number of *C. forbesii* medusae became available and not all nematocysts could be examined appropriately. The observed nematocysts mostly agreed with observations of Bouillon (1978b), except that the large spherical haplonemes were seen here as heterotrichous anisorhizas and not as isorhizas. The distinction between an isorhiza and anisorhiza is quite often subject to judgment because in large capsules the thread may taper only gently.

The hydroid stage has not yet been found outside the Mediterranean. As the medusa is present in coastal waters of New Zealand, the polyp almost certainly occurs here. It can be expected on muddy or sandy bottoms (cf. Brinckmann-Voss 1970).

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve; Whangateau Harbour (Barnett 1985).

OTHER RECORDS (MEDUSA): India; Vietnam; southern Japan; Tortugas; Florida (Kramp 1968); Mediterranean (Brinckmann-Voss 1970); Seychelles (Bouillon 1978a); Papua New Guinea (Bouillon 1978b). Polyp known only from the Mediterranean.

Corymorpha furcata (Kramp, 1948) (Fig. 61a-b)

Euphysora furcata Kramp 1948: 19, pl. 1, figs 7-8; Kramp 1957: 5, pl. 1, fig. 2; Kramp 1959: 89, fig. 40b; Kramp 1961: 40; Kramp 1968: 15, fig. 30; O'Sullivan 1982: 20, fig. 7, map 4; ?Pagès *et al.* 1992: 19, fig. 17.

MATERIAL EXAMINED:

4 medusae from *Dana* Stn 3624IX, 28°19.5'S, 176°56'E, 100 m of wire, 10.12.1928, damaged.

1 medusa from *Dana* Stn 3627II, 30°08'S, 176°50'W, 4000 m of wire, 14.12.1928, 6.5 mm high, well-preserved.

DESCRIPTION: Medusa up to 8 mm high, bell-shaped, higher than wide, with pointed apex. Stomach cylindrical, two-thirds the length of the bell cavity, with a broad apical chamber. Gonads encircle manubrium for almost all its length, with longitudinal depressions

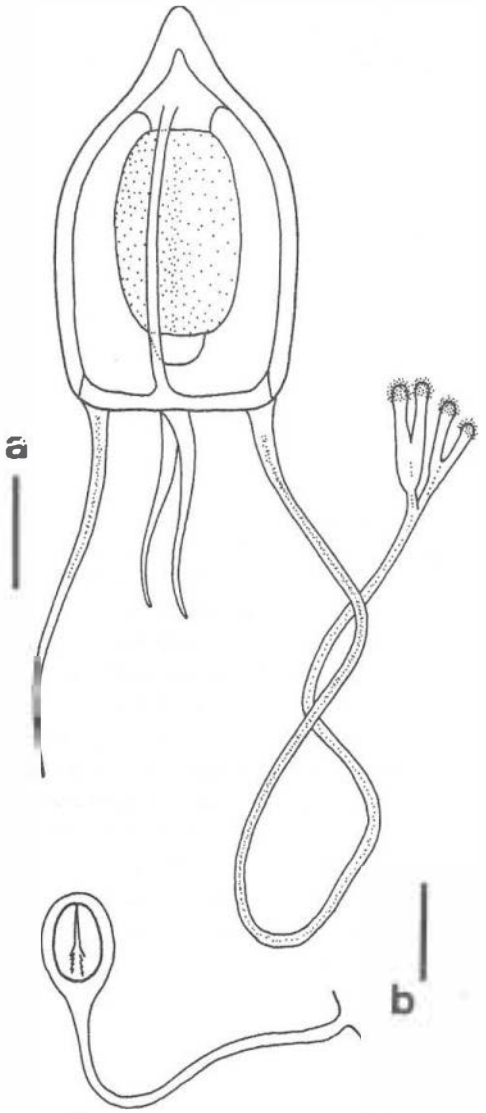


Fig. 61. *Corymorpha furcata*, from *Dana* Stn 3627. **a)** whole medusa; scale bar 2 mm. **b)** cnidophore from end of main tentacle; scale bar 20 µm.

perradially. Four radial canals and circular canal, all rather broad. Tentacles hollow. One main tentacle, longer than three times the bell height, bifurcating twice at the end. Nematocysts confined to ends, carried on cnidophores with long stalks. One stenotele per cnidophore. Remaining tentacles shorter, conical. Tentacle opposite main tentacle longer than other pair. Polyp stage unknown.

TYPE LOCALITY: South of Newfoundland Bank.

REMARKS: The twice-bifurcating end of the main tentacle makes *Corymorpha furcata* easy to recognise. Close microscopic examination shows the terminal swellings to be a mass of stenoteles, each carried singly on a cnidophore (Fig. 61b). Gonads were seen in only a few specimens. In the animal figured (Fig. 61a), the gonads were very advanced and encircled the manubrium. Perradial, longitudinal depressions indicated a division of the gonads. Pagès *et al.* (1992) described and figured the gonads as perradial with interradial interruptions. This is not in accordance with Kramp's description (1957) and figures (1959, 1968).

RECORDS FROM NEW ZEALAND: Kermadec Islands (Kramp 1965).

DISTRIBUTION: Widely distributed in the Indian Ocean and the western Pacific; Chile; Atlantic Ocean between 40°N and 40°S (Kramp 1968).

Corymorpha intermedia n.sp. (Fig. 62a-b)

MATERIAL EXAMINED:

4 live medusae collected near Ti Point, Leigh, 8.8.1991.

Ca. 110 specimens collected at Greta Point, Wellington, surface plankton, dates: 15.12.1993, 20.6.1994, 27.6.1994, 11.10.1994 (last date yielded more than 100 animals, many mature), some young medusae cultivated until mature, gametes were obtained and the development followed, embryos apparently went through resting stage which, however, did not develop further in vitro.

10 preserved medusae collected by T. Barnett near Goat Island, 1983–1984, one selected as holotype H-640, remaining medusae deposited as paratype P-1067.

DESCRIPTION: Adult medusa up to 2.5 mm high, with apical process of variable shape and height, may reach one-third of the total height. Bell shape varies from almost spherical to higher than wide, jelly thin. Peduncle absent. Umbrella margin at right angle to main axis. Apical canal absent. No nematocyst tracks on exumbrella. Relaxed velum spanning one-third to half of radius. Manubrium tubular, measuring half to three-quarters of the subumbrellar height, mouth margin with nematocysts, sometimes flaring in preserved specimens. With large oil droplet at base of manubrium. Gonads encircle manubrium for almost its entire length, leaving only a small part near mouth free. Four narrow radial canals ending in 1 large and 3 smaller marginal bulbs, all connected by narrow circular canal. Only largest bulb bears a single tentacle with around ten annular and one terminal nematocyst clusters (moniliform tentacle). Ocelli lacking.

Young medusa spherical, 0.4 mm diameter, without apical process, no apical canal, no oil droplet or oil sequestered into many small droplets, 1 tentacle with 3 annular nematocyst clusters and a single terminal one. Exumbrella with scattered nematocysts that are lost later. Nematocysts:

a) larger stenoteles, (6.5–8.5) x(5–6.5) µm.
b) smaller stenoteles, predominantly around mouth, (9.5–10.5) x (8.5–9.5) µm.

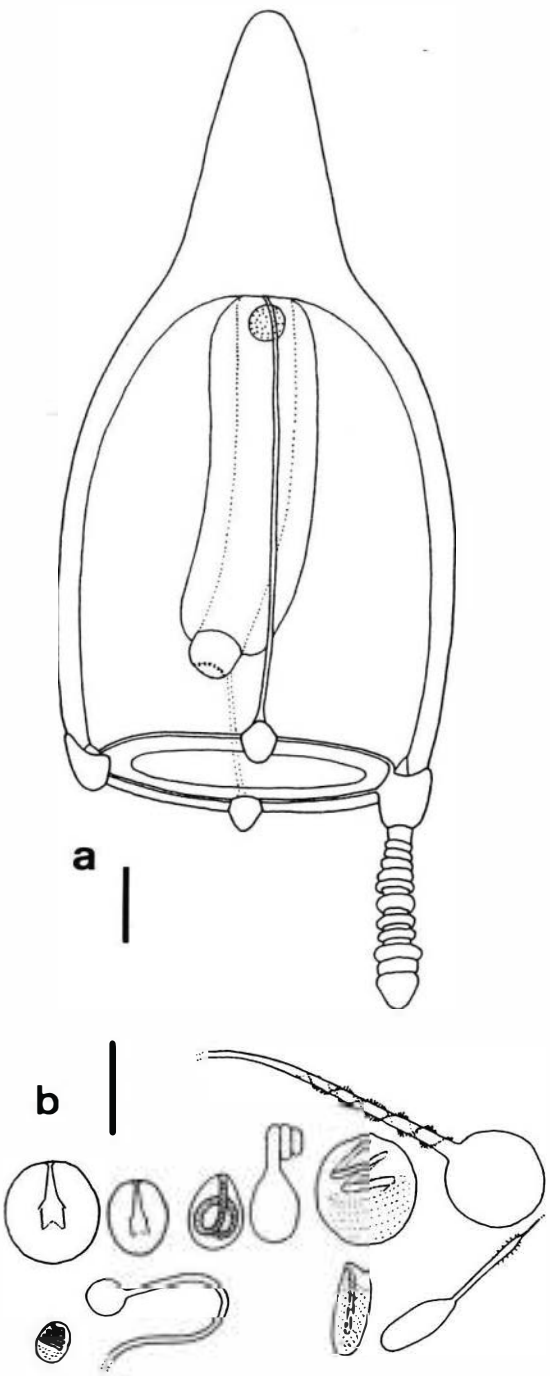


Fig. 62. *Corymorpha intermedia* n. sp. a) mature medusa from preserved material; scale bar 0.2 mm. b) nematocysts, top row: stenotele 1, stenotele 2, desmoneme, same discharged, anisorhiza, same discharged; bottom row: atrichous isorhiza, same discharged, microbasic eurytele, same discharged; scale bar 10 µm.

c) desmonemes, discharged with three coils, (6.5–8) x (4.5–5.5) µm.
d) basitrichous anisorhizas with slowly tapering thread, (10.5–11.5) x (10–10.5) µm.
e) atrichous isorhizas, (3.5–4.5) x (3.5–4) µm.
f) microbasic euryteles, mostly in juvenile only, swelling of shaft indistinct, (3.5–4.5) x(3.5–4)mm, s = 1.1.

Colour: transparent.
Polyp stage unknown.

TYPE LOCALITY: Surface plankton of Goat Island, Leigh Marine Reserve.

ETYMOLOGY: The species name refers to the intermediate morphology of the medusa which places it between *Corymorpha* and *Euphysa*.

REMARKS: *Corymorpha intermedia* n.sp. resembles medusae of *C. nutans* M. Sars, 1835, but clearly differs by lacking an apical (= umbilical) canal and a peduncle in all stages. The nematocyst types are mostly the same for both species, except for the isorhiza which is not present in *C. nutans* (Russell 1938a).

Corymorpha intermedia had no apical canal in all examined medusae. The presence of an apical canal has previously been used in the generic diagnosis to distinguish it more clearly from medusae of *Euphysa*. The only other difference is the lack of an apical process in *Euphysa* medusae. The *Corymorpha intermedia* medusa is therefore intermediate between the two genera as defined by earlier authors; its inclusion in *Corymorpha* is somewhat arbitrary and is made with reference to the presence of the prominent apical process. *Corymorpha* and *Euphysa*, however, differ considerably in the anatomy of their polyp stages (see Bouillon 1985a; Petersen 1990). When more information on the life cycle of *C. intermedia* becomes available, it might become necessary to transfer it to another genus. Although gametes could be obtained during this study, few eggs developed and then went into an apparent resting stage which did not develop further for a period of two months. The absence of a planula stage and resting gastrula stages are typical for the Corymorphidae (cf. Rees 1937; Brinckmann-Voss 1970).

The polyp of *C. intermedia* will most probably be found in sandy or muddy bottoms as in many other species of this genus.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985, as *Steenstrupia* sp.; this study); Wellington Harbour (this study).

Euphysa Forbes, 1848

SYNONYMS: (all after Petersen (1990)
Hypolytus Murbach, 1899
Heteractis Allman, 1864
Meiorhopalon Salvini-Plawen, 1987
Euphysonima Kramp, 1962

Solitary hydroids with elongated hydranth. With one oral whorl of usually four to six short, moniliform or capitate tentacles, and one to three close-set aboral whorls of four to sixteen moniliform tentacles, all with chordal gastrodermis. Hydrocaulus with an irregular whorl of four to sixteen short papillae, each with a gastrodermal statocyst and situated just under the hydranth. Hydrocaulus hollow, without gastrodermal canals. Perisarcal tube long. With asexual reproduction through budding of polarity-reversed polyps from the hydranth and through asexual bodies constricted off from pointed end of hydrocaulus. Gonophores develop singly or in clusters just above aboral tentacles. Gonophores either released as free medusae or remaining fixed as sporosacs. Medusa with evenly rounded umbrella, without apical canal. One to four tentacles, unequally developed but all of the same structure, moniliform or modified moniliform. Manubrium stout, cylindrical with small round mouth. Gonads encircle manubrium.

TYPE SPECIES: *Euphysa aurata* Forbes, 1848.

REMARKS: This diagnosis was derived from Petersen (1990). The slight modification made concerns the length of the manubrium, which in the new diagnosis may be longer than the bell cavity. This emendation is necessary to accommodate *E. problematica*, the only species of this genus known from New Zealand.

Euphysa problematica n.sp. (Fig. 63)

MATERIAL EXAMINED:
1 medusa obtained from T. Barnett, collected February 1980 or 1981, Whangateau Harbour. Material deposited as holotype H-643.

DESCRIPTION: Medusa up to 1 mm high, umbrella almost spherical. Jelly thin, slightly thicker at apex. Manubrium cylindrical, as long as or longer than bell cavity, with a small apical chamber. Mouth simple, circular. Gonad encircles manubrium completely and is restricted to the distal part of the manubrium, leaving proximal two-thirds of the manubrium free. Four moderately broad radial canals and ring canal present. Four broad perradial marginal bulbs with 4 identical tentacles, these rather short. Tentacles with about 10 nematocyst clusters and a larger terminal cluster. Ocelli absent. Nematocysts: stenoteles, desmonemes and one additional type of uncertain identity.

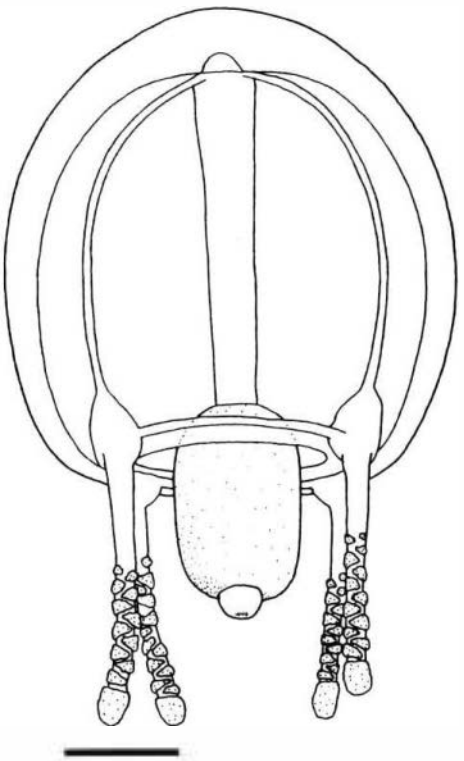


Fig. 63. ***Euphysa problematica*** n.sp., type specimen; scale bar 0.2 mm.

TYPE LOCALITY: Whangateau Harbour near Leigh, surface plankton.

ETYMOLOGY: The species name refers to the difficulties of placing it within the existing system of corymorphid classification.

REMARKS: This medusa can be assigned to the genus only with difficulty. It bears some slight resemblance to *Euphysora flammea* (Linko, 1905) and *E. japonica* (Maas, 1909) in having four identical tentacles. But by having gonads confined to the distal end of the manubrium it is rather different from all other members of the genus. In the examined specimen, the manubrium protrudes from the umbrella; this may, however, be a fixation artefact. Barnett (1985, as *Plotocnide* sp.) also gave a photograph of the only other specimen found so far. In this specimen the manubrium seems not to reach beyond the velum.

Although only two specimens are known, and these in a rather poor condition, the morphology of the gonads make this medusa easily recognisable. Further information on the life cycle is needed to confirm its generic identity.

RECORDS FROM NEW ZEALAND: Whangateau Harbour, near Leigh (Barnett 1985).

Family TUBULARIIDAE Allman, 1864

Solitary or colonial hydroids, hydranth vasiform with one to several close-set whorls of indistinctly moniliform of pseudofiliform oral tentacles with chordal or parenchymatic gastroderm, and with one whorl of long, pseudofiliform aboral tentacles with chordal or parenchymatic gastrodermis; more or less well-developed parenchymatic cushion under aboral whorl. Hydrocaulus divided into a distal neck region covered by thin periderm, and a proximal stem which may be short and thick with tuber-like aboral processes, or long, cylindrical, or cone shaped-shaped with basal disc or stolons, covered by thicker perisarc.

Gonophores develop on blastostyles arranged in a whorl just over aboral tentacles. Gonophores may be released as free medusae or remain fixed as sporosacs. Free medusae with or without five or eight longitudinal nematocyst tracks on exumbrella. Umbrella margin straight or oblique, with one perradial, two opposite, or four perradial equally developed tentacles. With or without asexual budding from tentacle bulb.

REMARKS: This diagnosis from Petersen (1990) encompasses the genera *Bouillonia, Ectopleura, Hybocodon, Ralpharia, Tubularia* and *Zyzzyzus*. Only *Ectopleura* and *Hybocodon* are at present known from New Zealand, but more can be expected. Characteristics of New Zealand species:

Ectopleura: Hydroids with high stems, oral tentacles in one whorl, perisarc originates from collar on neck region and does not cover whole neck.

Hybocodon: Hydroids with high stems, oral tentacles in two whorls, perisarc originates just below hydranth and covers the whole neck region, medusa bilaterally symmetrical with one marginal bulb much larger than the others.

Ectopleura L. Agassiz, 1862

Solitary or colonial hydroids, hydranths vasiform with oral and aboral tentacles. Oral tentacles arranged in one whorl. Periderm thin, covering pyriform neck region and secreted from groove around broadest part of neck. Hydrocaulus with two, rarely up to five, internal longitudinal gastrodermal ridges. Stolons filiform, creeping or forming dense net. Gonophores arise on blastostyles which are dichotomously branched or not.

Medusa where present with evenly rounded umbrella with eight meridional nematocyst tracks issuing in pairs from tentacle bulbs. Two opposite or four perradial tentacles, moniliform or with abaxial nematocyst clusters. Manubrium short, at most reaching bell margin. Medusa in some species reduced to radially symmetrical eumedusoids or cryptomedusoid sporosacs with or without symmetrically arranged distal protuberances.

TYPE SPECIES: *Ectopleura dumortieri* (van Beneden, 1844).

REMARKS: The above diagnosis was only slightly modified after Petersen (1990). Contrary to older definitions it does not rely on the presence of a free medusa. The major diagnostic characters distinguishing *Ectopleura* from other members of the family are the symmetrical gonophore (medusae or sessile sporosacs) and the origin of the perisarc in the middle of the neck region.

There are several very similar *Ectopleura* polyps known from the Pacific: *E. crocea, E. larynx, E. japonica, E. radiata, E. venusta*, and *E. marina*. All of these species have been reviewed by Petersen (1990). For correct identification it is always necessary to examine mature female gonophores. Another *Ectopleura* species that may be found in New Zealand is *E. exxonia* (Watson, 1978). This species occurs in Bass Strait, Australia and is characterised by its small size.

Characteristics of species known from New Zealand:

Ectopleura crocea: polyps with sessile gonophores, in female with eight laterally compressed distal processes.

Ectopleura larynx: polyps with sessile gonophores, in female with four rounded distal processes.

Ectopleura multicirrata: polyps with sessile gonophores, at least in females with a tuft of tentacle-like distal processes.

Ectopleura sp.: medusa with eight meridional nematocyst tracks, two opposite tentacles with abaxial nematocyst clusters, broad marginal bulbs, polyp unknown.

Ectopleura crocea (L. Agassiz, 1862) (Fig. 64a-g)

Tubularia crocea L. Agassiz, 1862: pls 23–23a; Torrey 1902: 42, pl. 3, figs 22–23; Brinckmann-Voss 1970: 28, figs 390–34 (*cum syn.*).

Tubularia mesembryanthemum Allman, 1871: 418, figs 83–84; Hirohito 1988: 18, fig. 4, pl. 1, fig. B.

Ectopleura crocea: Petersen 1990: 174, fig. 27.

MATERIAL EXAMINED:

Live colonies collected on underside of raft near Devonport Wharf, Auckland, 4.1.1994 (infertile), 13.2.1994 (fertile), 8

actinulae examined in preserved material, material deposited.

Preserved material from MoNZ, date and locality of collection unknown, but from New Zealand.

NZOI collection, Stn Z1060, 17.8.1954, from New Zealand probably from ship hull.

Ectopleura crocea from Cumming's Point, entrance to Charleston Harbour , South Carolina, USA, preserved, collected, and identified by Dr Dale Calder, ROM, 2.1.1975, up to 2 cm high.

For comparison, neotype of *Ectopleura ralphi* (Bale, 1884), Catalogue no. 43227, Museum of Victoria, Melbourne, Australia, up to 10 cm high.

DESCRIPTION: Colonial, tubulariid hydroids arising from attached ramifying stolons. Height up to 50 mm. Cauli not branching, thinner basally (up to one-third of distal end diameter), with occasional annulated stretches gastrodermis of cauli with 2 longitudinal ridges. Hydranth broadly vasiform with one oral whorl of up to 20 filiform tentacles and one aboral whorl of up to 22 tentacles with nematocysts concentrated on lower side. Between hydranth and caulus a distinct spherical neck region. On thickest part of neck a filmy perisarc originates; basal half of the neck, which is covered by the filmy perisarc, shows a striation pattern. Perisarc of the caulus firm.

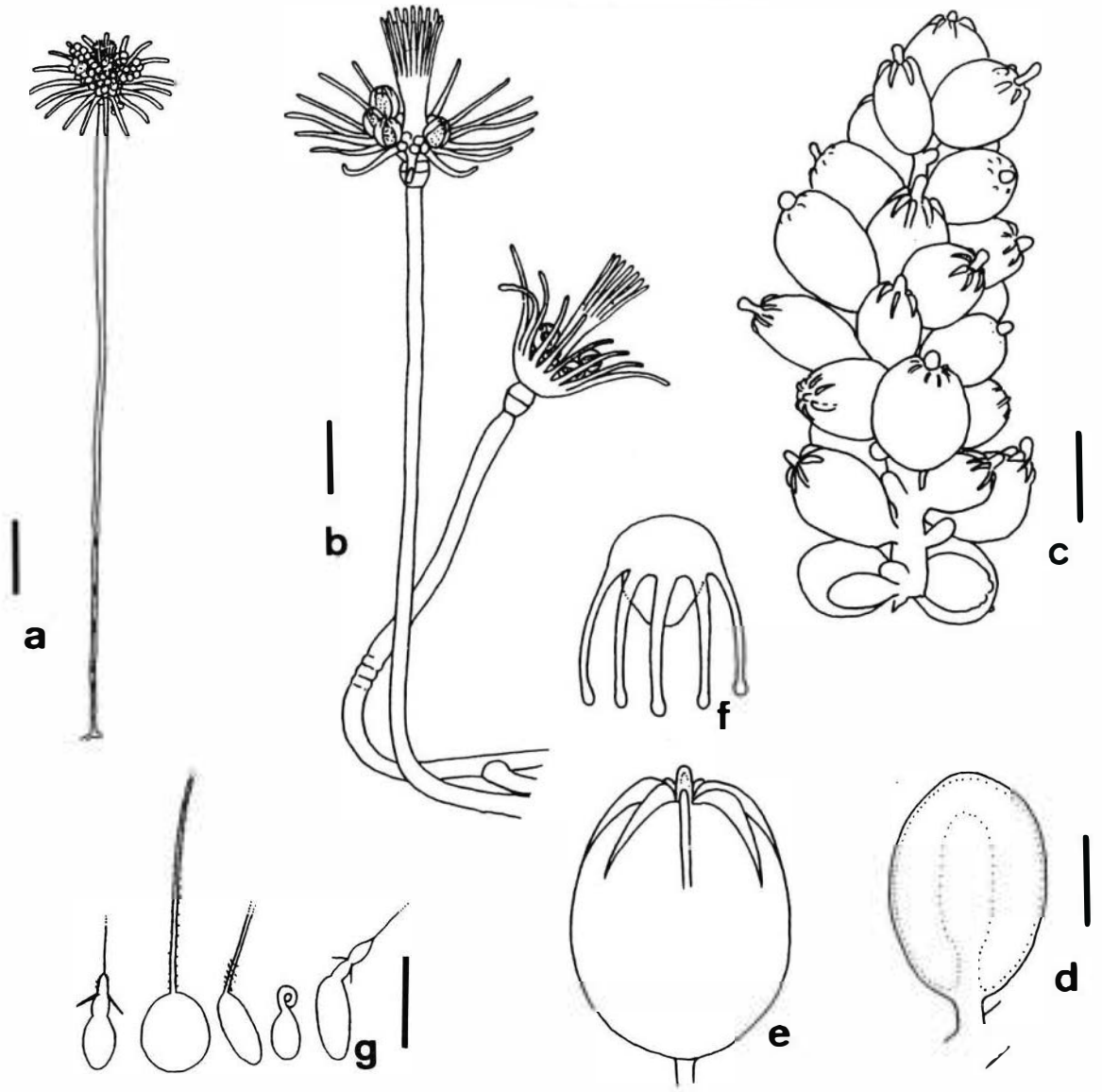


Fig. 64. ***Ectopleura crocea***, only b) from life. **a)** fully mature female polyp; scale bar 5 mm. **b)** younger polyps with maturing gonophores; scale bar 2 mm. **c)** blastostyle with female gonophores showing variation of the distal crests; scale bar 0.5 mm. **d)** male gonophore, CL; scale bar 0.2 mm. **e)** female gonophore, same scale as d). **f)** actinula from female gonophore, same scale as d). **g)** discharged nematocysts: stenotele, anisorhiza, basitrichous isorhiza, desmoneme, microbasic eurytele (foreign?); scale bar 10 µm.

Gonophores spherical to oblong, with short stems, born on blastostyles just above aboral tentacles. Blastostyles of different length, the largest may bear up to 35 gonophores and may branch once. Gonophores remain sessile as sporosacs with no radial canals or circular canals but with spadix. Female gonophores slightly larger than male ones, with 6–8 laterally compressed processes around distal opening, size of these crests very variable. Female gonophores contain 2–6 eggs and up to 2 developing actinulae. Spadix or tentacles of actinula may protrude from distal opening of gonophore. Actinula with 8 slightly capitate aboral tentacles an no rudiments of oral tentacles. Male gonophores without apical crests. Nematocysts:

a) larger stenoteles, (6.5–7) x (5–5.5) µm.
b) smaller stenoteles, (5–6) x (3.5–4.5) µm.
c) heterotrichous anisorhizas, (8–9.5) x (7–9.5) µm.
d) basitrichous isorhizas,(9–9.5) x (3–4) µm.
e) desmonemes, (5–5.5) x (3–3.5) µm.
f) microbasic eurytеles, rare, ca. 9 x 4 µm, s = 0.7.

Measurements: stem diameter basally 0.2 mm, distally 0.6 mm; female gonophore 0.5 x 0.6 mm; male gonophore 0.4 x 0.5 mm.

TYPE LOCALITY: Boston Harbour, Massachusetts, USA.

REMARKS: The morphology of the material referred here to *E. crocea* accords well with other descriptions of this species. The only major difference is the presence of microbasic eurytеles in the New Zealand material. Although the nematocysts had to be examined in preserved material, eurytеles were found in both samples from Devonport taken at different dates. Only a few discharged nematocysts were found each time. The undischarged isorhiza and eurytele are very difficult to distinguish. Eurytеles have not so far been reported for *E. crocea* (Weill 1934; Bouillon 1985a; Zamponi & Arca-Tellecha 1988; Petersen 1990), but these sources do not agree on what types are present. Inasmuch as the presence of some nematocyst types is easily overlooked, especially when there are many as in tubulariids, and also considering that the eurytеles of the New Zealand material may have been contaminated, the examined material is referred to *E. crocea*. If future comparison of nematocysts will confirm any distinctions, the species from New Zealand may be new. The presence of microbasic eurytеles, however, can be expected from the cladogram given by Petersen (1990).

The only minor difference from the other descriptions was the occasional occurrence of branching blastostyles, but in material from the USA some are also present. Regularly branching blastostyles have been described for *E. ralphi* (Bale 1884), a very similar species from Australia and South Africa (cf. Millard 1975, as *Tubularia warreni*; Watson 1980; Petersen 1990). The neotype of *Ectopleura ralphi* was examined for this study and it was found that the blastostyles are also only occasionally branched. The actinulae of *E. ralphi*, however, are reported to have rudiments of oral tentacles which are absent from *E. crocea*. *Ectopleura ralphi* also seems to form much taller polyps. Until further, preferably also molecular, analysis has been made it seems advisable to keep both species separate.

As can be seen from Figure 64c, the distal crests of the female gonophore of *E. crocea* may vary greatly in size and shape. This was also observed by Torrey (1902) and can make identifications difficult.

Ectopleura crocea is distributed by ships, so a wide distribution can be expected.

RECORDS FROM NEW ZEALAND: Devonport, Auckland.

OTHER RECORDS: Pacific and Atlantic coast of USA; Europe; Mediterranean; Japan (Petersen 1990).

Ectopleura larynx (Ellis & Solander, 1786)
(Fig. 65a-b)

Tubularia larynx Ellis & Solander, 1786: 31; Broch 1916: 27; Ralph 1953: 68, fig. 12; Brinckmann-Voss 1970: 31 (*cum syn.*); Miller 1973: figs A & E, not B; Millard 1975: 35, fig. 15H–J; Werner 1984: fig. 106; Cornelius *et al.* 1990: 116, fig. 4.5

[Not *Acharadria larynx* Wright, 1863 = *Ectopleura wrighti* Petersen, 1979]

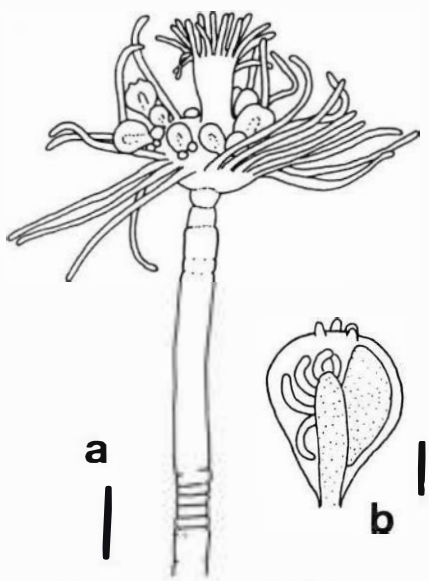


Fig. 65. *Ectopleura larynx*, redrawn from Ralph (1953) with kind permission of the publisher. **a)** distal part of polyp; scale bar 1 mm. **b)** female gonophore containing a planula and an actinula larva; scale bar 0.2 mm

Tubularia attenoides Coughtrey, 1876: 302.
Ectopleura larynx: Petersen 1990: 170.

MATERIAL EXAMINED:
No material from New Zealand seen; for the description below one sample was examined originating from Nova Scotia, Canada, ROM B512, det. D. Calder.

DESCRIPTION: Colonial tubulariid hydroids, up to 50 mm high, arising from a dense hydrorhiza formed from ramifying stolons. Cauli normally not branching, but with apparent branching caused by settling of larvae on stems of older polyps. Perisarc of stem firm, with some irregular annulations which may be more or less pronounced. Gastrodermis of hydrocaulus with 2–4 longitudinal ridges. Hydranth vasiform with long hypostome; with one oral whorl of up to 20 filiform tentacles adnate to hypostome and forming longitudinal ridges over distal half of hypostome, and with one aboral whorl of 20–25 long filiform tentacles. Neck region of hydranth with fine longitudinal striations. Neck region only covered in lower half by filmy perisarc secreted from a groove.

Gonophores born on blastostyles that may be branched or not. Blastostyles arising distal to aboral whorl of tentacles, as long as tentacles, up to 12 per hydranth with up to 12 gonophores per blastostyle. Gonophores remain fixed as sporosacs, up to 0.6 mm long, oval, without radial canals. Older female gonophores with 4 closely set distal processes varying in shape from rounded tubercles to short finger-like appendages. Male gonophores mostly lack distal processes.

ADDITIONAL INFORMATION FROM LITERATURE: The actinula has an aboral whorl of 6–3 tentacles with swollen tips, oral tentacles may be absent or present as three to five rudiments (Petersen 1990). Nematocysts (after Bouillon 1985a): stenoteles, anisorhizas, basitrichous isorhizas, desmonemes.

TYPE LOCALITY: British Isles.

REMARKS: No New Zealand material could be examined for this study, but the drawings of Ralph (1953) rather unambiguously show the specific characters of *E. larynx*, a very widespread species distributed by shipping. Many authors have confused *Ectopleura larynx* and *E. crocea* (Petersen 1990). The identifications are reliable only where information on the female gonophore is provided.

RECORDS FROM NEW ZEALAND: Otago Harbour; Wellington Harbour (Ralph 1953).

OTHER RECORDS: Atlantic coast of Europe from White Sea to Portugal; Iceland; east coast of North America from Newfoundland to southern New England; Sea of Okhotsk near southern Sakhalin and the Kuriles; Pacific coast of Washington and British Columbia (Petersen 1990).

Ectopleura multicirrata n.sp. (Fig. 66a-d)

MATERIAL EXAMINED:
Few fertile colonies growing on live *Perna canaliculus* (Bivalvia), collected 30.3.1994, 10 m, Steeple Rock beacon, Wellington Harbour. One colony cultivated for 4 weeks, colonies thriving on *Artemia*, many new polyps and gonophores formed, material fixed 30.3.94 and deposited as holotype H-763.

DESCRIPTION: Colonial tubulariid hydroids, up to 15 mm high, arising from thick, attached, ramifying stolons that penetrate shell substratum (into holes made by boring organisms). Erect part of polyps composed of caulus, neck region, and hydranth. Cauli unbranched, occasionally annulated or corrugated. Gastrodermis of cauli with 2 opposite longitudinal ridges. Neck region forming a spherical or blunt cone. Perisarc originates from widest part of neck region. Hydranth vasiform with one oral and one aboral whorl of filiform tentacles. Oral tentacles 10–14 in number, short and stubby, not tapering, often 2–3 fused together basally, basal portions adnate to hydranth body. Aboral tentacles 16–20 in number, up to 2 mm long, tapering, oval in cross section, nematocysts concentrated in narrower sides (abaxial and adaxial). Bases of aboral tentacles not continued as ridges over hydrant body.

Gonophores arise in clusters on unbranched, short blastostyles arising just above aboral tentacles, 6 or more blastostyles. Gonophores remain fixed as sporosacs. Sporosacs elongate, without radial canals or circular canal but with conspicuous spadix placed asymmetrically, with one large egg only. Gonophores with a distal tuft of up to 30 tentacle-like processes. These processes bear no nematocysts, they are provided with a row of chordoid gastrodermis cells. In young gonophores the processes are short and stubby and separated into 4 clusters that fuse later. Some tufts are not exactly positioned at distal end thus rendering the gonophore bilaterally symmetrical. Male gonophores not observed. Nematocysts:
a) stenoteles size class 1, rare, (12–13) x (10.5–11) µm.
b) stenoteles size class 2, (8–9) x (7–8.5) µm.
c) stenoteles size class 3, (7–8) x (5.6–6) µm.
d) stenoteles size class 4, (5–6.5) x (3.5–4.5) µm.
e) desmonemes, (5–5.5) x (3–4) µm.
f) basitrichous anisorhizas, very slowly tapering, almost like isorhiza, (9.5–11) x (3.5–4) µm.

g) anisorhizas with very fine and short spines in spirals, rare, (12–13.5) x (9–9.5) µm.

Colour: greenish in samples from nature, turns orange on *Artemia* diet.

TYPE LOCALITY: Steeple Rock Beacon, Wellington Harbour, depth 10 m.

ETYMOLOGY: The species name refers to the distal tuft of tentacle-like processes of the gonophores.

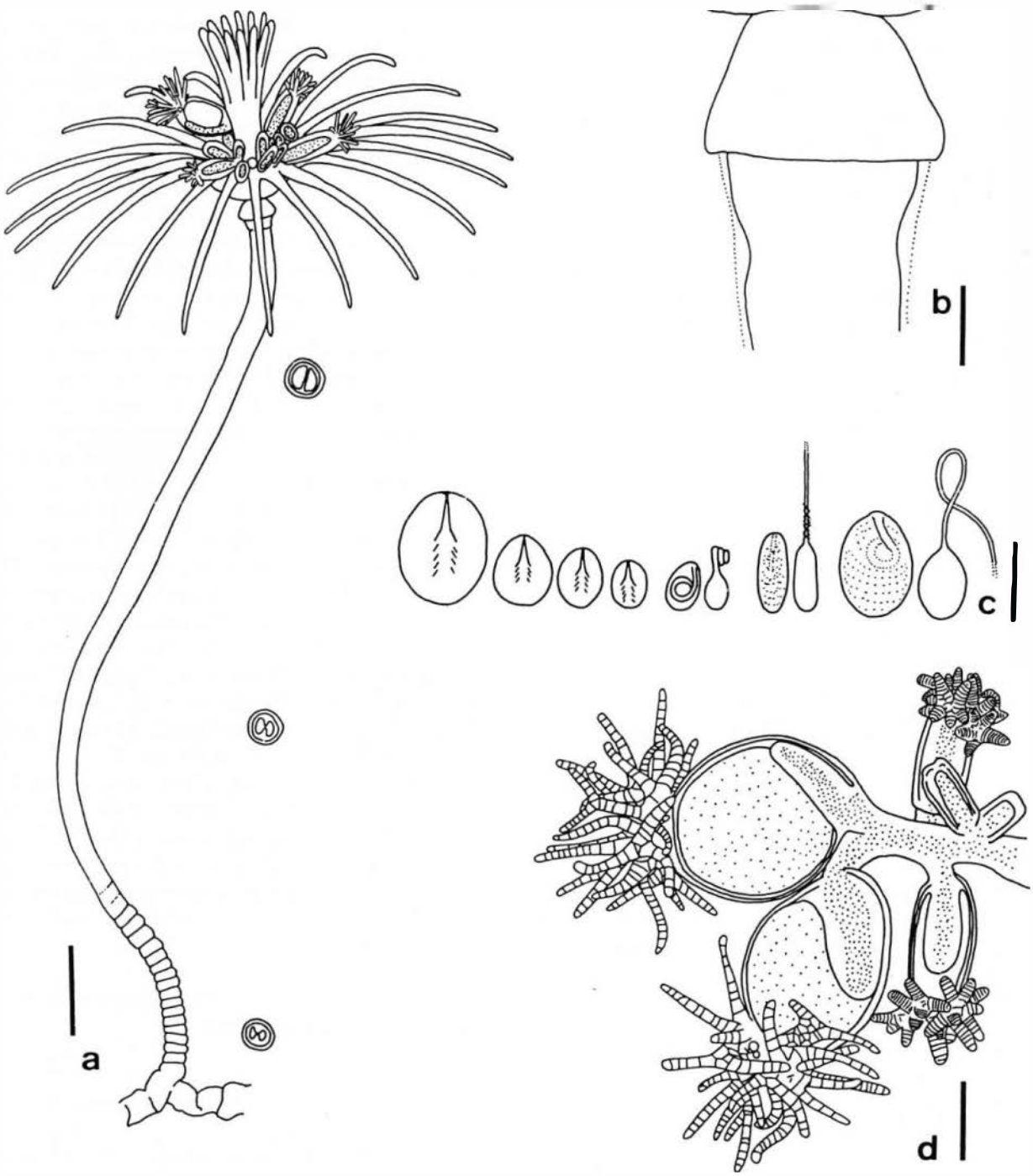


Fig. 66. *Ectopleura multicirrata* n. sp., from life. **a)** total view of animal with gonophores, at right cross sections of caulus at corresponding heights; scale bar 1mm. **b)** neck region with origin of perisarc (dotted), CL; scale bar 0.1 mm. **c)** nematocysts, from left: four stenoteles, desmoneme, discharged desmoneme, basitrichous anisorhiza, same discharged, holotrichous anisorhiza, same discharged; scale bar 10 µm. **d)** blastostyle with female gonophores of various stages of development; note the characteristic tentacle-like structures at the distal end of the gonophores, CL; scale bar 0.2 mm.

REMARKS: The tuft of up to 30 tentacle-like processes of the gonophore is unique and not known for any otherspecies (cf. Petersen 1990). The animals are rather easy to cultivate in running sea water and feed well on *Artemia* nauplii.

RECORDS FROM NEW ZEALAND: Known only from the type locality, Wellington Harbour.

Ectopleura sp. (Fig. 67)

MATERIAL EXAMINED:
Several medusae collected by T. Barnett, Leigh Marine Reserve, date unknown (1983–1984).

DESCRIPTION: Medusa up to 1.6 mm high and 1.4 mm wide. Umbrella bell-shaped, narrowing at base. Jelly moderately thick, about twice as thick apically as laterally, without clear apical process. Exumbrella with 4 pairs of longitudinal nematocyst bands originating from the sides of the marginal bulb epidermis. Manubrium tubular, about two-thirds as long as bell cavity, with large apical chamber in the form of a pointed cone. Gonads encircle the manubrium, leaving only proximal and mouth parts free. With 4 radial canals and a circular canal, all rather narrow; 4 broad marginal bulbs, all the same size, oval in shape, nearly as broad as space between bulbs. Two opposite perradial tentacles only. Tentacles with one larger terminal nematocyst cluster and about 6 abaxial nematocyst clusters distributed along the whole tentacle. Polyp stage unknown.

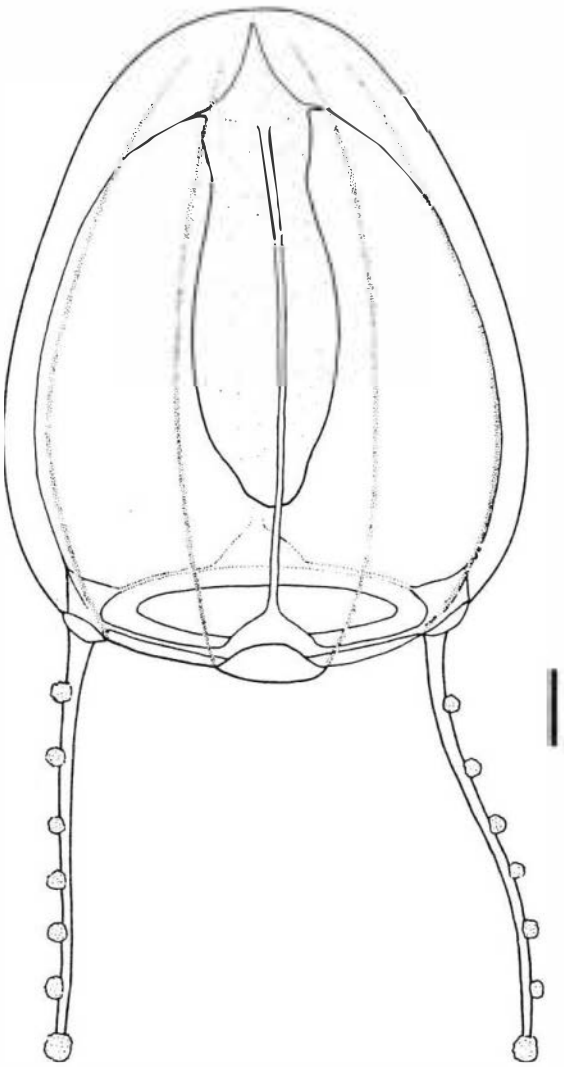


Fig. 67. *Ectopleura* medusa from Leigh; scale bar 0.2 mm.

REMARKS: This medusa resembles *Ectopleura minerva* Mayer, 1900b, described originally from Florida. Other *Ectopleura* polyps are known that also produce medusae with two tentacles: *E. pacifica*, *E. larynx* (Wright, 1863) and *E. mayeri* (cf. Brinckmann-Voss 1970; Petersen 1990). *Ectopleura* medusae from Leigh differed from other descriptions of *E. minerva* in the absence of a an apical process and the presence of rather broad marginal bulbs instead of small ones. All *Ectopleura* medusae are quite simple and species distinctions should rather rely on the more complex polyp stage. Some authors (e.g., Mayer 1910; Hirohito 1988) allocated the medusae *E. minerva* (type locality Florida) to the hydroid *E. pacifica* Thornely, 1900, a species known from New Britain (Papua New Guinea). This was based on the unreleased medusa. As stated by Petersen (1990) this allocation cannot be maintained because there are more *Ectopleura* medusae known with two tentacles only. It may well be that the *Ectopleura* medusa from Leigh belongs in fact to *E. pacifica*, while *E. minerva* more probably belongs to the hydroid *E. mayeri* Petersen, 1990 from Bermuda. For all species, rearing experiments to elucidate the life cycle must be made before any 2-tentacled *Ectopleura* medusa can be allocated to a certain species. The present material is therefore not assigned a specific name. Also other records of *E. minerva* from the Pacific should be seen in this light.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve (Barnett 1985, as *E. minerva*).

Hybocodon L. Agassiz, 1862

Solitary tubulariid hydroids with long, perisarc-covered caulus and a neck region below hydranth. Hydrorhiza irregularly branched, slightly swollen and often embedded in sponges. Perisarc thin, much inflated around neck region, secreted from groove between hydranth and neck. Hydrocaulus tubular with open centre, with eight or more longitudinal

gastrodermal ridges. Hydranth vasiform, with two closely set whorls of oral tentacles and one whorl of aboral tentacles. Gonophores arise from branching blastostyles distal to aboral whorl of tentacles and are released as free medusae. Medusa with bilaterally symmetrical umbrella with oblique margin. Exumbrella with or without five longitudinal nematocyst tracks. Manubrium cylindrical, on short peduncle, not extending beyond umbrella margin. With one shorter, two medium-sized and one longer radial canals. One broad, bean-shaped marginal bulb with long moniliform tentacle at end of longest radial canal, and three equally developed rudimentary bulbs (modified after Petersen 1990).

TYPE SPECIES: *Hybocodon prolifer* L. Agassiz, 1962.

REMARKS: Only *H. prolifer* is known from New Zealand. Other species from similar southern latitudes are *H. unicus* and *H. cryptus* (cf. Millard 1975; Watson 1984).

Hybocodon prolifer L. Agassiz, 1862 (Fig. 68a-e)

Hybocodon prolifer L. Agassiz, 1862: 243, pl. 23a, figs 10-11, pl. 25, fig. 19; Mayer 1910: 38, pl. 2, fig. 1, pl. 3, fig. 3, text-fig. 10; Uchida 1927: 192, fig. 29; Fraser 1937: 54,pl. 2, fig. 46; Fraser 1944: 106, pl. 18, fig. 78; Ralph 1953: 70, figs 11 & 22; Russell 1953: 79, pl. 3, figs 3-4, text-fig. 34; Kramp 1959: 86, fig. 33; Kramp 1961: 43 (*cum syn.*); Kramp 1968: 12, fig. 19; Arai & Brinckmann-Voss 1980; 10, fig. 4; Roper *et al.* 1983: table 2; Petersen 1990: 192, fig. 37; Bouillon 1995: 224.

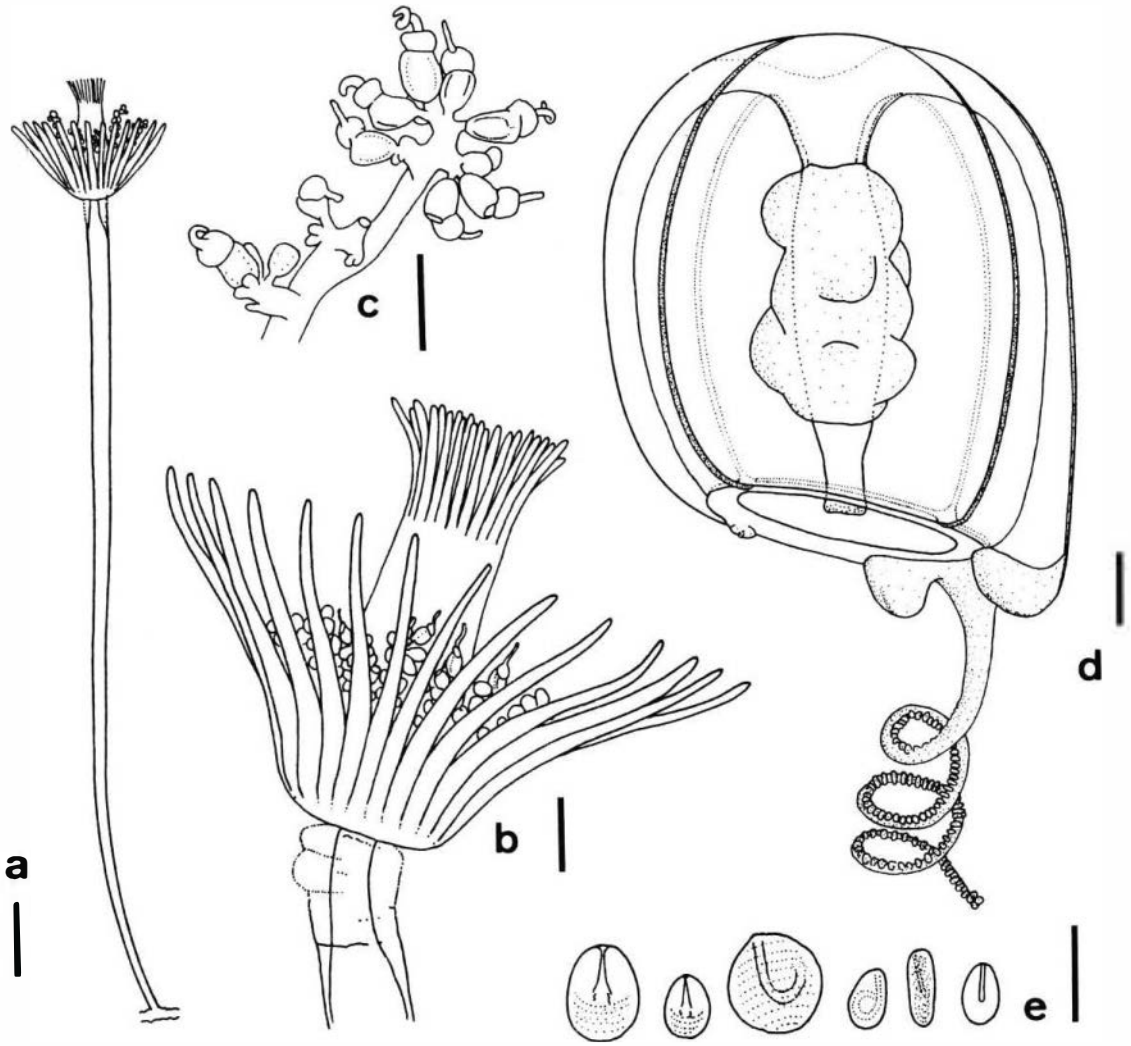


Fig. 68. ***Hybocodon prolifer.*** **a)** whole polyp; scale bar 5 mm. **b)** neck region and hydranth with blastostyles; scale bar 1 mm. c) blastostyle with medusae buds, CL; scale bar 0.5 mm. **d)** Adult medusa from life; scale bar 0.5 mm. **e)** nematocysts, from left: two sizes of stenoteles, basitrichous haploneme, desmoneme, microbasic eurytele, microbasic mastigophore occurring in polyp only; scale bar 10 µm.

MATERIAL EXAMINED:

3 polyps collected by P. Ralph, tube No. 235, held at MoNZ, date and origin not given, but from New Zealand, with remains of sponge on hydrorhiza, with medusae buds.

Numerous polyps collected live 30.3.1994, Steeple Rock beacon (Wellington Harbour, near Seatoun), 2 m, on orange sponge, infertile, cultivated for more than 1 month, formed blastostyles but no medusae buds.

A few polyps collected live west of Te Raekaihau, April 1994, 2 m, infertile, cultivated for several months.

~10 preserved medusae from Leigh Marine Reserve, collected by T. Barnett 1983–1984.

~30 live medusae collected near Seatoun 14.5.94, 6.6.94, 28.9.94, 4 of them fully mature, material deposited.

DESCRIPTION:

Polyp stage: Solitary tubulariid hydroids, height up to 60 mm, divided into hydranth, neck region, caulus, and hydrorhiza. Hydrorhiza formed by branching stolons embedded in sponges. Caulus tapering proximally to one-third of distal diameter, with firm perisarc. Gastrodermis with central lumen and several longitudinal ridges. Neck region simple, not swollen, surrounded by loose filmy perisarc with wrinkles. Perisarc originates in groove between neck and hydranth, turning firm after reaching caulus. Hydranth pear-shaped, diameter with tentacles 10 mm, with up to 31 longer aboral filiform tentacles in one whorl, oval in cross section, bases of tentacles continue as ridges over basal part of hydranth body. With up to 30 shorter oral filiform tentacles in 2 closely-set whorls. Oral tentacles continue basally as ridges on hydranth body. Hypostome rounded. Between oral and aboral tentacles 8 longer and additional shorter blastostyles. Blastostyles branching and bearing naked gonophores that are liberated as free medusae. Nematocysts:

a) stenoteles, (7–11.5) x (5.5–10) µm.
b) heterotrichous anisorhizas, spines visible for more than 5 capsule lengths, (11–17) x (10–18) µm.
c) desmonemes, discharged with 3 coils, (5–6) x (3.5–4) µm.
d) microbasic euryteles with very faint distal swelling of shaft, some like mastigophores, (9.5–10.5) x (3.5–4.5) µm, s = 0.8.
e) microbasic mastigophores, rare, (5.5–6.5)x (3.5–4) µm.

Colour: pink.

Mature medusa: Umbrella bell-shaped, 2–4 mm in height. Base of bell oblique. Jelly moderately thick, sometimes with apical depression. Jelly on side of tentacle thicker. Gastric peduncle present. Dilated velum spanning one-third of radius. Exumbrella with 5 longitudinal bands of nematocysts (stenoteles) issuing from marginal bulbs, tentacular bulb issuing 2 bands. Nematocyst bands extend almost to apex. Manubrium simple, cylindrical, reaching velum but not beyond. Mouth surrounded by narrow ring of nematocysts. Gonads surrounding stomach, leaving peduncle, upper portion and distal portion, of manubrium free. With one short, 2 opposite medium-length and one long radial canal ending in circular canal, all canals thin. Longest radial canal ends in a broad, bipartite bulb with one tentacle. Other marginal bulbs very rudimentary. Tentacle tapering, with one row of adaxial nematocyst clasps. Ocelli absent. Nematocysts:

a) larger stenoteles, (8.5–10.5) x (7–8.5) µm.
b) smaller stenoteles, (5.5–7) x (4.5–5) µm.
c) heterotrichous anisorhizas, (8–11.5) x (8–11) µm.
d) microbasic euryteles with indistinct swelling of shaft, (7–8.5) x (2.5–3) µm.

Colour: bulb and upper end of stomach intensively red.

TYPE LOCALITY: Rock ledge off Nahant, north of Boston, Massachusetts, USA.

REMARKS: According to Russell (1953), the peduncle may be absent, there are not always five nematocyst bands on the exumbrella, and there may be more than one tentacle on the large bulb. In younger stages there may be medusae buds on the tentacular bulb.

Hybocodon prolifer is mostly described as a solitary species. During the present study, however, some rare branching of cauli was observed under cultivation. Despite being solitary, quite a number of polyps can be found together. The living material examined for this study did not form medusa buds, only incipient blastostyles, but the polyp is distinct enough to allow generic identification even in the absence of medusae buds. Identification is further aided by the presence of mature medusae at the same site. The preserved sample available had medusae buds with meridional nematocyst tracks and are thus certainly like *H. prolifer*. Medusae buds on medusae were never seen at any stage. This may indicate a difference from the Atlantic population. Identification of the anisorhiza is somewhat uncertain as the thread tapered only very gently, thus resembling isorhizas. This ambiguity seems to be a general problem with large haplonemes found in the Tubulariidae. Haplonemes have not so far been reproted for *H. prolifer*, but are known for *H. unicus* (Millard 1975; Bouillon 1985a). At present, the observed differences (medusa-budding absent, presence of haploneme) are insufficient to warrant the creation of a new species.

RECORDS FROM NEW ZEALAND: Polyp stage: Antipdoes Islands (Ralph 1953); Wellington Harbour and south coast (this study). Medusa: Avon-Heathcote estuary, Christchurch (Roper *et al.* 1983); Leigh Marine Reserve

(Barnett 1985); Cape Egmont (Bouillon 1995); Wellington Harbour (this study).

OTHER RECORDS: Newfoundland to Chesapeake Bay; West Greenland; Iceland; NW Europe from English Channel to Beren Island; Bering Sea; Puget Sound: Sea of Okhotsk; Alaska; Hokkaido to Kamchatka (Arai & Brinckmann-Voss 1980; Petersen 1990; and Dale Calder pers. comm.).

Family BOEROMEDUSIDAE Bouillon, 1995

Medusae of the order Capitata, with apical projection, cylindrical manubrium bearing gonads as four large perradial pouches hanging freely in the bell cavity. Four radial canals and circular canal. Four marginal bulbs, and four simple tentacles with many nematocyst clusters including a terminal cluster.

REMARKS: This family was proposed by Bouillon (1995) to accommodate the rather unusual *Boeromedusa auricogonia*.

Boeromedusa Bouillon, 1995

Diagnosis as for the family.

TYPE SPECIES: *Boeromedusa auricogonia* Bouillon, 1995.

REMARKS: Only one species is known in this genus.

Boeromedusa auricogonia Bouillon, 1995 (Fig. 69)

Boeromedusa auricogonia Bouillon 1995: 231, figs 3b, 7.

MATERIAL EXAMINED:
Holotype H-620, NZOI Stn N433, 41°46.1'S, 171°25.9'E (Cape Foulwind), 0–25 m, 30.1.1975.

DESCRIPTION: Medusa 7 mm high and 4 mm wide, umbrella bell-shaped with widest diameter in the upper half, with shallow rounded apical process. Jelly thick, increasing in thickness from margin towards top. Roof of subumbrella with 4 interradial, solid, pyramidal projections into the mesogloea. Manubrium barrel-shaped, length about half of of bell cavity, circular in cross-section; mouth open, circular with an inconspicuous ring of nematocysts. Four gonads in perradial position, originating from base of manubrium; gonads in the form of flattened sac-like processes hanging freely into the subumbrellar cavity. Each gonad is bent slightly adaxially, longer than wide, with distal ends lobed, middle lobe of the 3 lobes longer than lateral ones. Four radial canals and circular canal present, all narrow and smooth. Radial canals widening slightly on entering circular canal. With 4 conical perradial tentacle bulbs that turn without transition into short tentacles. Tentacles covered by numerous nematocyst clusters and ending in a large ovoid terminal cluster. No ocelli observed. Polyp stage unknown.

Nematocysts (after Bouillon 1995): stenoteles, desmonemes, microbasic euryteles.

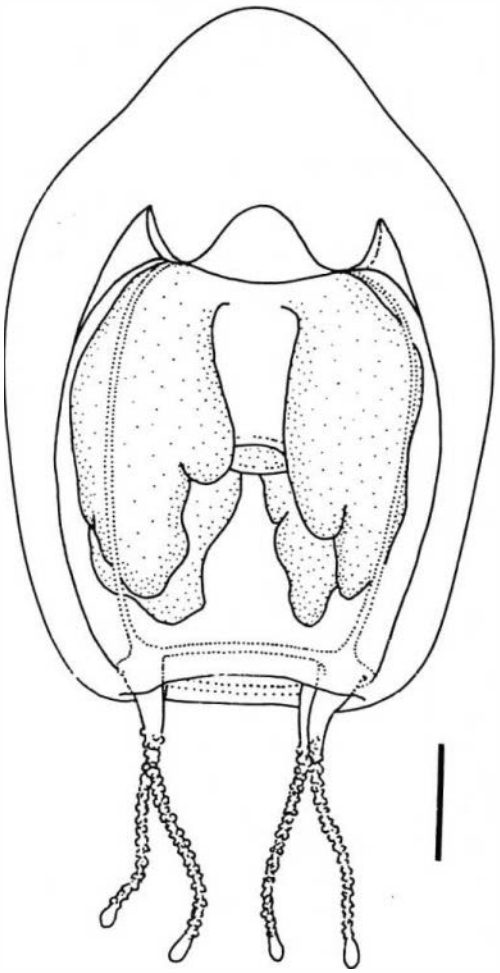


Fig. 69. *Boeromedusa auricogonia*, holotype; scale bar 1mm.

TYPE LOCALITY: Cape Foulwind, South Island, New Zealand.

REMARKS: *Boeromedusa auricogonia* is rather unique and at present difficult to accommodate within the system. Bouillon's (1995) use of a separate family is thus followed here. Knowledge of the polyp stage will, it is hoped, clarify its uncertain systematic position. Re-examination of the type species showed only a few

differences from Bouillon's (1995) description. The subumbrellar projections into the apical mesogloea were found to be solid. This was verified by probing them with a blunt needle. Bouillon (1995) described them as pockets of the subumbrella. Almost all medusae in the collection containing *B. auricogonia* had lost their ocelli owing to the fixative used. The absence of ocelli in *B. auricogonia* is therefore not certain. The mouth in the only specimen is widely dilated, forming a circular opening. It may be that the shape of the mouth differs in live animals.

RECORDS FROM NEW ZEALAND: Known only from a single medusa taken off Cape Foulwind near Westport (Bouillon 1995).

OTHER RECORDS: Not known outside of New Zealand.

Family MARGELOPSIDAE Uchida, 1927

Solitary, pelagic hydroids, adult with filiform tentacles only. One or more oral whorls of tentacles and aboral tentacles which are either in several whorls or dispersed. Occasionally aboral region of hydranth modified for floating. Gonophores develop between oral and aboral, or between aboral tentacles and are liberated as free medusae.

Medusae with no apical projection, no exumbrellar tracts of nematocysts. Mouth simple, circular, no lips, no oral tentacles. Gonads encircle manubrium completely. Four radial canals. Tentacles solid, generally moniliform, distributed either in perradial groups on equal height, or in pairs at different levels of exumbrella. No ocelli present. Eggs may develop into actinula on manubrium (*Climacocodon*, *Margelopsis*).

REMARKS: The above diagnosis was slightly modified after Bouillon (1985a) by allowing more than one whorl of oral tentacles in the polyp, a condition seen in *Pelagohydra*. Only the genus *Pelagohydra* is known from New Zealand.

Pelagohydra Dendy, 1902

Margelopsid hydroid with aboral half of hydranth transformed into floating body, without caulus. Adult medusa unknown, young ones with four groups of five to seven marginal tentacles. Each group composed at least of two long abaxial and three short adaxial tentacles. Monotypic genus (Bouillon 1985a).

TYPE SPECIES: *Pelagohydra mirabilis* Dendy, 1902.

Pelagohydra mirabilis Dendy, 1902 (Fig. 70a-d)

Pelagohydra mirabilis Dendy 1902: 1, pls 1–2; Mayer 1910: 83, fig. 40a-b; Percival 1938: 439; Ralph 1953: 66, figs 7, 23; Kramp 1961: 50; Pilgrim 1967a: 439, figs 1–6; Pilgrim 1967b: 491; Kramp 1968: 18, fig. 40; Rees & Ralph 1970: 11, pls 1–2, fig. 4; Bouillon 1974: 143; Roper *et al.* 1983 table 2; Werner 1984: 178, fig. 98.

MATERIAL EXAMINED:
Polyp and liberated medusae collected and described by R. Pilgrim (1967), 22.4.1966, from Sumner Beach, held at MCC.

DESCRIPTION:
Polyp stage: Solitary hydroids freely floating in the sea, up to 35 mm long. The body of the hydranth is divided into a larger oval part (float) and a smaller tubular oral part (proboscis). The float bears up to 150 scattered, tapering tentacles, length up to 7 mm. The oral part of the hydranth is provided with up to 80 tentacles scattered over the distal three-quarters of its length. These oral tentacles are shorter than the aboral ones and slightly capitate; towards the mouth they originate very obliquely so that their basal part becomes adnate to the proboscis wall. Along the mouth rim are some very short, differently coloured tentacles. The float has a complicated internal anatomy consisting in an intricate structure of mesogloeal lamellae and gastrodermal chambers (for details see Dendy 1902; Rees & Ralph 1970).

Gonophores develop on branched blastostyles which are dispersed between the aboral tentacles, up to 300 per animal. The blastostyles may bear up to 5 gonophores which develop into free medusae.
Nematocysts:
a) stenoteles, (11–13) x (9–10) µm.
b) desmonemes, (6–7) x (4–4.5) µm.

Young medusa:With a bell-shaped umbrella (1.4 mm, preserved), jelly rather thick (0.2 mm), apex only slightly thicker. Exumbrella with many scattered stenoteles and haplonemes. Manubrium cylindrical, reaching velum or projecting beyond it, manubrium base quadratic with apical canal, mouth simple. No gonads visible. With 4 radial canals and a circular canal. Four large perradial marginal bulbs; these extend from velum around umbrella margin onto exumbrella. Each tentacle bulb has 6–7 slightly capitate, solid tentacles in a special arrangement: the most abaxial pair points sideways, the next pair projects downwards and is followed adaxially by a single median tentacle which also projects downwards and then 1–2 small tentacles projecting adaxially. Nematocysts:
a) stenoteles, (10–15) x (8–12) µm.

b) desmonemes, 6 x 4 µm.
c) heteronemes, (7–8.5) x (2.5–3) µm.
d) haplonemes (basitrichous isorhizas?), (6–7) x (4–5.5) µm.
Adult medusa: unknown.

TYPE LOCALITY: Sumner Beach, Christchurch, New Zealand.

REMARKS: *Pelagohydra mirabilis* is a rarely reported and unique species. The rarity may, however, be due to the paucity of plankton studies in New Zealand. Roper *et al.* (1983) found several polyps and medusae in the Avon-Heathcote estuary in Christchurch. It may well be that the species is more frequent than previously thought. The distribution of *P. mirabilis* is restricted to New Zealand and all animals found so far have been found near Christchurch. This very localised distribution is rather astonishing considering that the polyp is freely floating. It would be very interesting to know the complete life cycle and to have more ecological data.

The peculiar structure of *Pelagohydra* has attracted much interpretation and speculation (e.g., Garstang 1946). Rees and Ralph (1970) re-examined the anatomy and convincingly homologised the float region to the aboral end of a tubulariid hydranth and the proboscis to the oral region. They also made clear that *Pelagohydra* has no caulus like sessile forms, and offered a model on how the float evolved.

RECORDS FROM NEW ZEALAND: Christchurch area; Portobello (W. Vervoort, pers. comm.).

OTHER RECORDS: Not known outside of New Zealand.

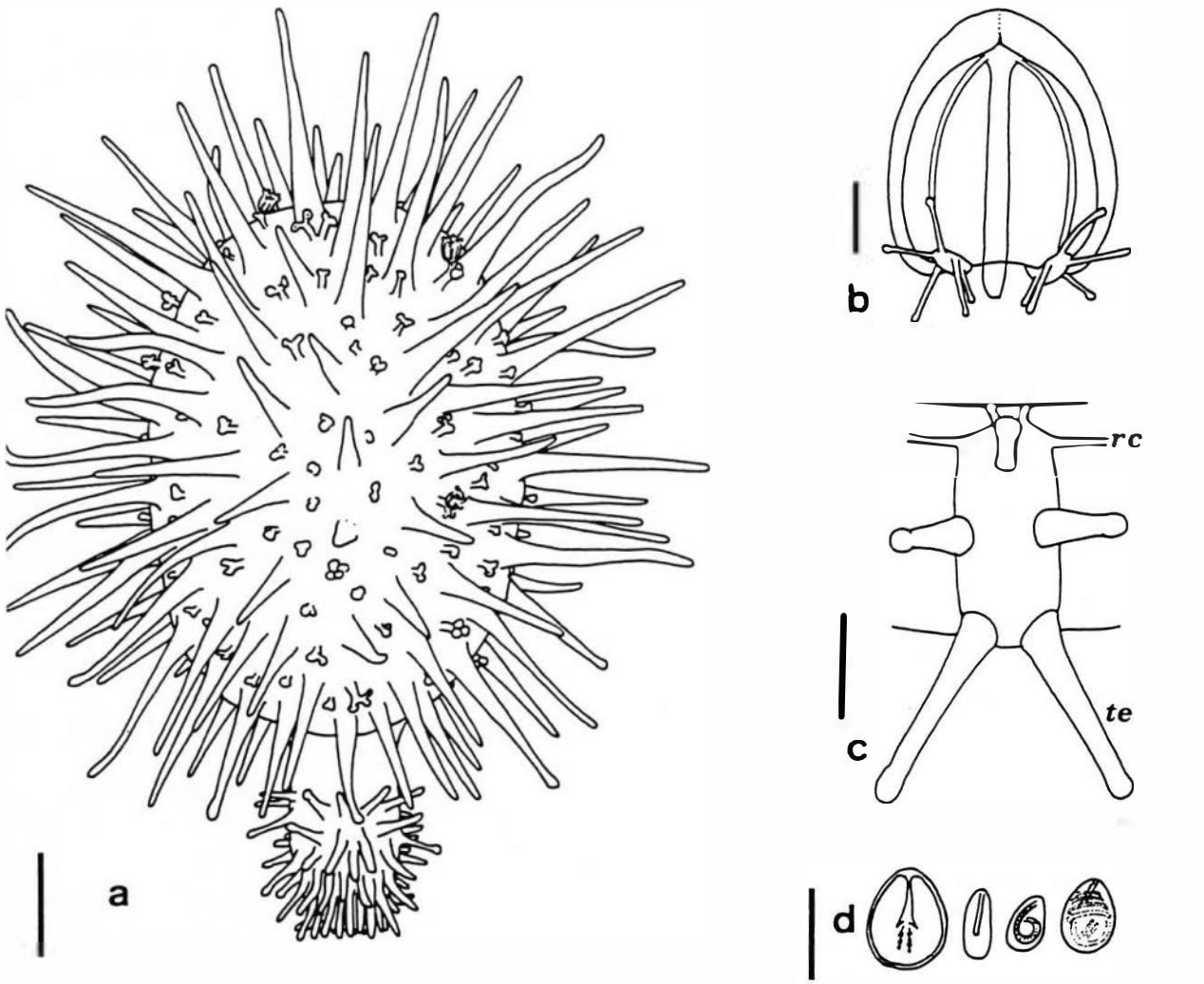


Fig. 70. ***Pelagohydra mirabilis***, from preserved material **a)** floating polyp stage (mouth downwards) with some medusae buds; scale bar 2 mm. **b)** young medusa; scale bar 0.5 mm. **c)** oral view of tentacle bulb of young medusa, the adaxial side faces upwards; *rc* radial canal, *te* tentacle; scale bar 0.1 mm. **d)** nematocysts of medusa: stenotele, heteroneme (eurytele?), desmoneme, basitrichous isorhiza (?); the polyp stage has only stenoteles and desmonemes; scale bar 10 µm.

Family **CANDELABRIDAE** de Blainville, 1830

Solitary hydroids; hydranth elongated, cylindrical with thickened mesolamella and gastrodermal villi; numerous scattered, hollow capitate tentacles, simple or compound. Hydrocaulus short, stout, with tubular or root-like adhesive processes, with or without perisarc; gonophores develop directly on hydranth or on coryniform blastostyles in budding zone under body tentacles.

REMARKS: All known species of the family reproduce by fixed sporosacs. Only the genus *Candelabrum* is known from New Zealand. (For a systematic review of the genus see Segonzac & Vervoort 1995.)

Candelabrum de Blainville, 1830

Hydroids with long, cylindrical hydranth with numerous densely packed, separate tentacles; hydrocaulus plate- or tuber-like, with adhesive processes that end in discs covered by firm, lamellar perisarc. Gonophores borne on coryniform blastostyles developed from aboral part of hydranth.

TYPE SPECIES: *Candelabrum cocksii* (Vigurs, 1849).

REMARKS: Only one species of *Candelabrum* is known from New Zealand.

Candelabrum sp. (Fig. 71a-b)

MATERIAL EXAMINED:
1 specimen collected from west side of Te Raekaihau, 11.4.1994, 1 m, growing on stone underneath layer of encrusting coralline algae, cultivated on glass slide for 8 months in running sea water, fed on *Artemia* nauplii. Animal grew from 7 to 25 mm. No gonophores formed. Preserved animal deposited.

DESCRIPTION: Solitary hydroid, when fully extended reaching more than 25 mm in height. Shape very variable, mostly club-shaped with broad end as base. Body of hydranth except most basal part covered by a large number of capitate hollow tentacles. Tentacles especially dense around oral region, becoming gradually shorter proximally. Basis of hydranth with up to 3 short, stout processes that anchor polyp to substratum. Near base often up to 4 long, tentacle-like processes that end in a sucker-like terminal swelling. These tentacles can attach to the substratum and then transform into the stout anchoring processes or are again reduced. No perisarc discs were observed at the end of anchoring processes. No gonophores formed.

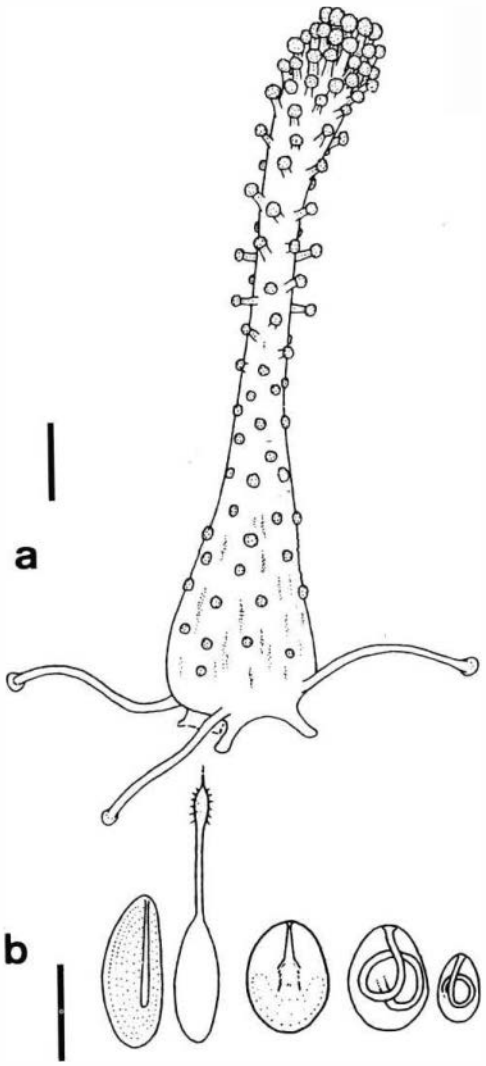


Fig. 71. ***Candelabrum*** sp. from life. **a)** young polyp; scale bar 0.5 mm. **b)** nematocysts: microbasic eurytele, same discharged, stenotele, large desmoneme, small desmoneme; scale bar 10 µm.

Polyp has limited mobility. Nematocysts:
a) stenoteles, (10–12) x (8–10) µm.
b) smaller desmonemes, discharged with 4 coils, (7–8.5) x (4.5–5.5) µm.
c) larger desmonemes, (10–11.5) x (8–9) µm.
d) microbasic euryteles, (14–17) x (5.5–6.5) µm, s = 1.1.

REMARKS: This *Candelabrum* cannot be identified to species level, owing to absence of information on gonophores. There are a number of *Candelabrum* species known from the southern hemisphere (cf. Briggs 1939; Manton 1940; Millard 1971, Millard 1975; Segonzac & Vervoort 1995) and the gonophores are crucial in separating the species. The only specimen found in

this study may not have been fully grown. It also lacked perisarcal discs at the attachment sites, which may be a culture artifact. It was able to change position and in one month moved about 1 cm.

RECORDS FROM NEW ZEALAND: East side of Te Raekaihau (this study).

Family CORYNIDAE Johnston, 1836

Capitate hydroids forming stolonal or erect, branching colonies, arising from attached, ramified stolons. Perisac firm. Hydranths on cauli, with one whorl of capitate oral tentacles and often below them more capitate tentacles in whorls or scattered. There may be filiform tentacles below the capitate ones. Gonophores develop on the polyps, proximal to or among the tentacles, either sessile sporosacs or are liberated as free medusae.

Medusae are bell-shaped, with a simple circular mouth, four radial canals, circular canal, and 2 to 4 hollow marginal tentacles. The gonads encircle the manubrium completely. Mostly with abaxial ocelli on the tentacle bulbs.

REMARKS: In this memoir the traditional system of classification (Bouillon 1985a) is used in preference to that based on phylogenetic analysis by Petersen (1990). Although the present system is certainly artificial, Petersen's classification of the Corynidae is difficult to use and some characters need revisions (see also discussion in Kubota & Takashima 1992; Pagès *et al.* 1992). The material in the present study shows especially the site of medusae budding and the shape of marginal bulbs are not as simple to use as proposed by Petersen (1990). Although it is highly desirable to create a classification basing on phylogeny, in the case of the Corynidae it seems advisable to wait until, for example, a RNA sequence comparison confirms Petersen's cladogram.

Characteristics of New Zealand genera:

Coryne: polyps with many capitate tentacles and sessile sporosacs.

Dipurena: free medusae with manubrium projecting beyond umbrella, gonad split into several rings.

Sarsia: polyps with many capitate tentacles and producing free medusae with gonads not interrupted.

Coryne Gaertner, 1774

Colonial polyps with capitate tentacles all over their body, either scattered or in more or less distinct whorls; sometimes with a whorl of filiform tentacles beneath the capitate ones. Gonophores arise from the hydranths and remain fixed as sporosacs (after Bouillon 1985a).

TYPE SPECIES: *Coryne pusilla* Gaertner, 1774.

REMARKS: Diagnostic characters of New Zealand species:

C. pusilla: branching colonies, tentacles not in distinct whorls, without perisarc funnel beneath hydranth, without mastigophores and desmonemes.

C. tricycla: branching colonies, tentacles in three distinct whorls, with perisarc funnel beneath hydranths, without mastigophores and desmonemes.

?*Coryne* sp. 1: stolonal, not branching colonies, tentacles not in distinct whorls, without perisarc funnels, with mastigophores and desmonemes.

?*Coryne* sp. 2: stolonal, not branching colonies, tentacles in two sometimes three distinct whorls each containing four tentacles, with basitrichous isorhiza.

Coryne pusilla Gaertner, 1774 (Fig. 72a-d)

Coryne pusilla Gaertner, 1774: 40, pl. 4, fig. 8; Broch 1916: 16; Stechow 1919: 5, fig. A; Brinckmann-Voss 1970: 51, fig. 57; Morton & Miller 1973: 155, fig. 55; Millard 1975: 51, figs 19F-G; Boero 1981: 187, fig. 1C-D; Hirohito 1988: 33, fig. 10a-e.

MATERIAL EXAMINED:

Several colonies on underside of raft near Devonport Wharf, Auckland, collected 13.2.1994, female gonophores present.

DESCRIPTION: Hydroid colonies with branching stems, arising from attached, ramified stolons. Stems up to 20 mm high and with up to 20 hydranths, irregularly branching in all planes, branching mostly at acute angle. Perisarc green (preserved material), occasionally annulated, especially so at origin of side branches. Perisarc ends below hydranth; no basal calyx. Hydranths are spindle-shaped, up to 1.2 mm, with dome-shaped hypostome encircled by 4 capitate tentacles, tapering only slightly when fully expanded; below oral tentacles up to 16 capiate tentacles in 3-4 indistinct whorls. No filiform tentacles. Gonophores spherical, arising on short stems in the upper axils of the proximal tentacles, occasionally 2 gonophores of different age per tentacle; mature gonophores slightly oval (only female seen) remaining fixed as sporosacs, lacking radial and circular canals. A hollow spadix is present, surrounded by approximately 25 polygonal eggs. The mature female gonophore has a terminal knob without nematocysts. Nematocysts:

a) larger stenoteles, (21–23) x (13–15) mm.
b) smaller stenoteles, (10–12) x (5.5–6.5) mm.

REMARKS: The present material agrees rather well with other descriptions from the more recent literature, except that the annulation was not as pronounced as indicated by Brinckmann-Voss (1970) or Hirohito (1988). Most probably the extent of annulation is dependent on the environment.

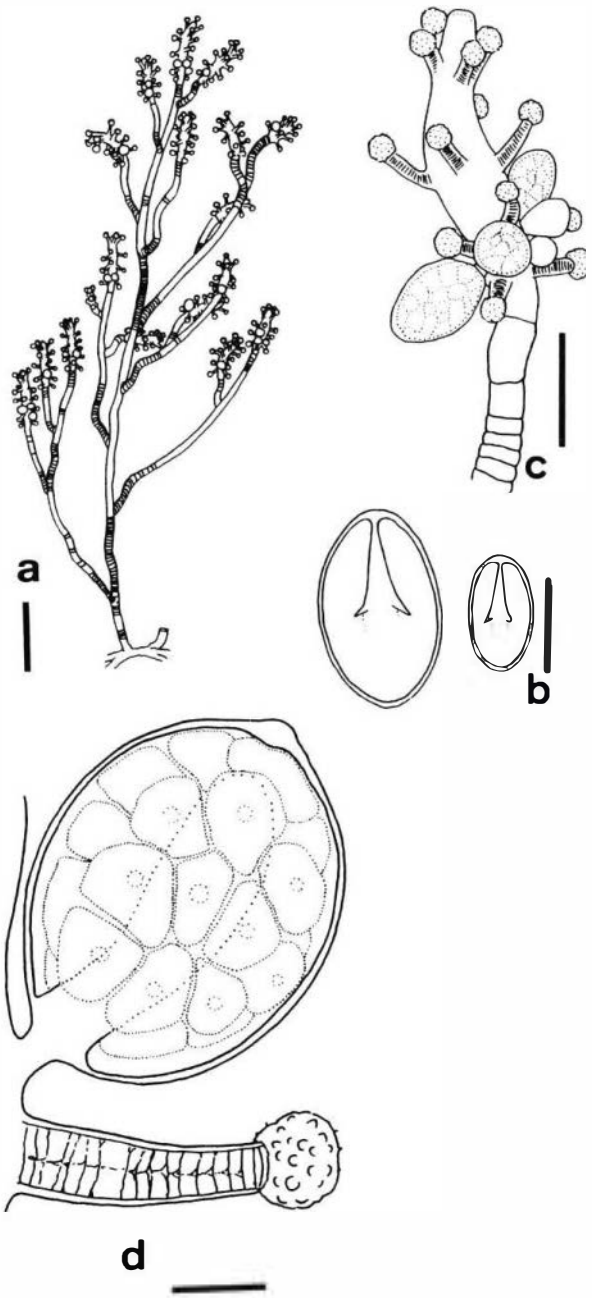


Fig. 72. ***Coryne pusilla***, from preserved sample. **a)** colony form; scale bar 2 mm. **b)** nematocysts: two sizes of stenoteles; scale bar 10 µm. **c)** hydranth with gonophores, CL; scale bar 0.5 mm. **d)** female gonophore arising from the upper axil of tentacle, CL; scale bar 100 µm.

The presence of *C. pusilla* in New Zealand was indicated by Morton and Miller (1973), who gave no locality. The only sample found in the present study came from the underside of a raft at Devonport wharf where it occurred with *Pennaria disticha* and *Ectopleura crocea*. All of these species are distributed by ships.

RECORDS FROM NEW ZEALAND: Devonport, Auckland (this study).

OTHER RECORDS: All European coasts; Mediterranean; South Africa; Indian Ocean; Korea; Japan (Brinckmann-Voss 1970; Hirohito 1988).

Coryne tricycla n.sp. (Fig. 73a-d)

Coryne vaginata: Ralph 1953: 66, fig. 13.

MATERIAL EXAMINED:
Holotype colony H-641, collected 5.10.1994 east of Te Raekaihau, Wellington, growing on intertidal rock, fertile female, 45 mm high.

DESCRIPTION: Hydroid colonies arising from attached, ramified stolons. Stems up to 45 mm high with up to 30 hydranths. With monopodial growth and branching in all planes. Perisarc soft and elastic, annulated throughout. At the base of the hydranths the perisarc dilates to a thick, gelatinous funnel into which hydranths unable to retract. Hydranths up to 2 mm long (free part), cylindrical to slightly pear-shaped; with an oral whorl of 4 short, adnate capitate tentacles, one median whorl of 4 capitate tentacles in alternate positions to oral tentacles, and one aboral (proximal) whorl of 8 capitate tentacles that originate all at the same level from a slightly thickened region of the hydranth body; they are disposed in the same plane. The median whorl is either exactly in the middle of the body or closer to the oral whorl of tentacles. Gonophores arise just above the aboral whorl of tentacles and alternate in position with these; there are up to 3 gonophores per position, all in various stages of development. Mature female gonophores are oblong and remain fixed as sporosacs with up to 100 eggs; a spadix is present but radial or circular canals are absent. Male gonophores unknown.
Nematocysts:
Only stenoteles of very variable size, (19–36) x (9–22) µm.
Colour: brown, especially gonophores. Stem diameter 0.20–0.23 mm, gonophores up to 1 mm long, size of spawned eggs 114 µm (s.d. = 6 µm, n = 6).

TYPE LOCALITY: Northeast of Te Raekaihau (Lyall Bay, Wellington), intertidal.

ETYMOLOGY: The species name refers to the regular arrangement of the tentacles in three whorls.

REMARKS: At first glance, *Coryne tricycla* can be mistaken for *Coryne muscoides* (Linnaeus, 1761) (of which *C. vaginata* is a synonym). Both species have a similar colony form and the characteristic funnel-shaped dilatation of the perisarc proximal to the hydranths. A closer look reveals, however, that they must be different species, if not different genera. In contrast to *C. muscoides*, *C. tricycla* has a different and unique arrangement of the tentacles in three well-defined

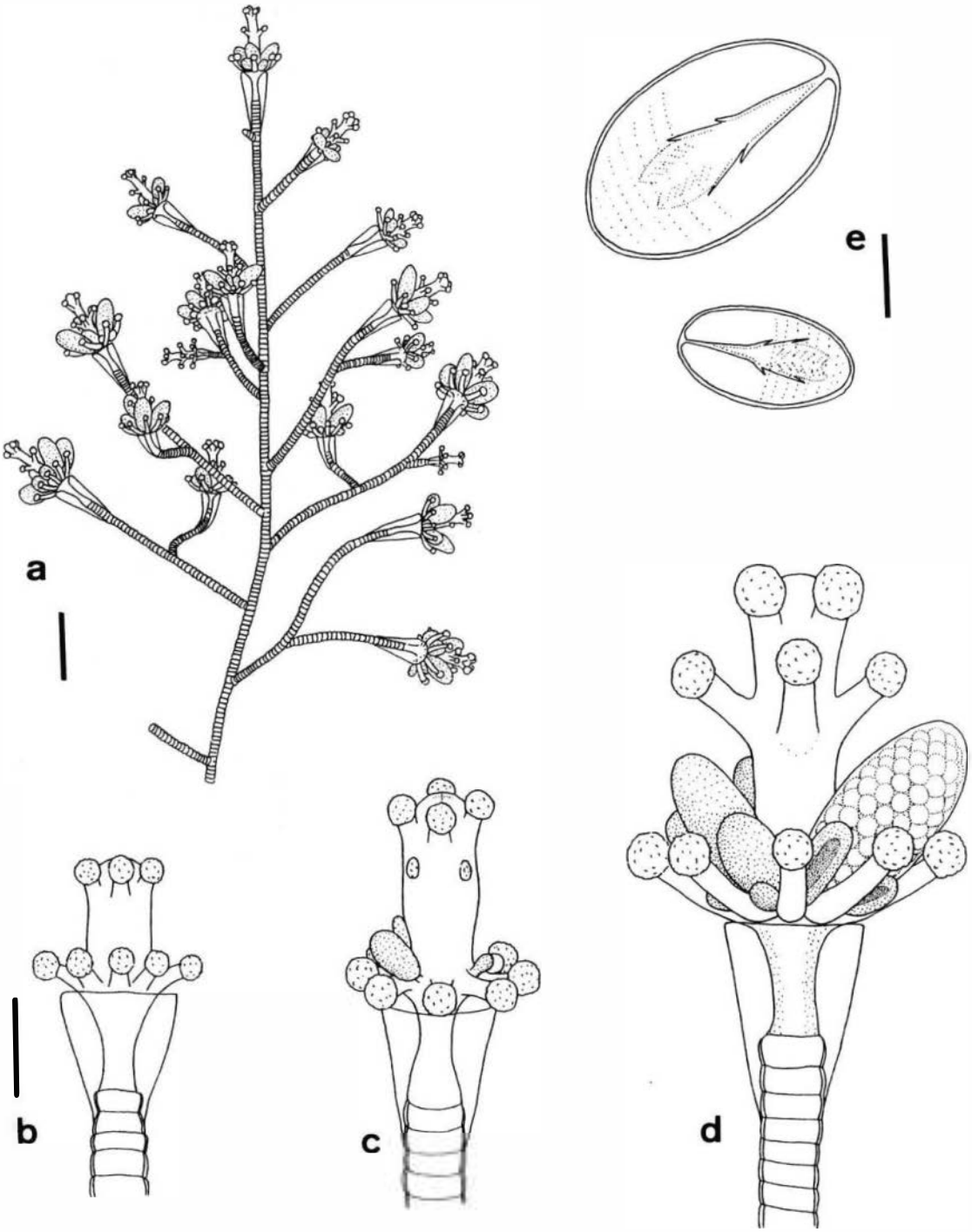


Fig. 73. *Coryne tricyla* n.sp., from live holotype. **a)** distal half of colony; scale bar 2 mm. **b)** young hydranth with median tentacle whorl not yet formed; scale bar 0.5 mm. **c)** intermediate stage with growing gonophores and incipient median tentacle whorl, same scale as b). **d)** hydranth with mature gonophores and median tentacles fully developed, same scale as b. **e)** nematocysts: stenoteles of various sizes; scale bar 10 µm.

whorls with a constant number of tentacles. The most proximal whorl with its eight tentacles is especially unique. Further differences are found in the inability of the hydranths to retract into the perisarc funnel, the more oblong gonophores in *C. tricycla* (cf. Cornelius *et al.* 1990) and their position (in *C. muscoides* in the axils of the two proximal whorls of tentacles), the possible occurrence of desmonemes in *C. muscoides* (Brinckmann-Voss 1970, but cf. Boero 1981), and the sequence of development of the tentacles. In the examined mature colony of *C. tricycla*, the median whorl of tentacles was formed last, after the gonophores started their development (Fig. 73b-d). In *C. muscoides*, the sequence of tentacular development is from distal to proximal (Brinckmann-Voss 1970).

The slightly swollen region of the hydranth body at the level of the aboral whorl of tentacles is somewhat reminiscent of hydranths of *Pennaria*, but the structure of the tentacles, and the cnidome, preclude any association. The unique morphology of the aboral tentacle whorl could be used as reason to create a new genus for this species.

Ralph (1953) reported *C. muscoides* (as *C. vaginata*) from near Wellington. Her figures are compatible with *C. muscoides* but not with *C. tricycla*. However, the drawings may not be accurate and it seems much more probable that she had *C. tricycla* before her because *C. muscoides* is known only from Europe. Her record of *C. muscoides* in New Zealand should therefore be treated as a misidentification until confirmation.

Although forming large colonies, *C. tricycla* is not so easy to detect as its brown colour perfectly blends into the surrounding colours of macroalgae.

?Coryne sp. 1 (Fig. 74a-b)

MATERIAL EXAMINED:

1 colony growing on stone collected 11.4.1994 west of Te Raekaihau, 1 m, cultivated for 4 months, after 9 days gonophores started to grow in axils of tentacles, but aborted later at very early stage. Some material deposited.

1 colony growing on sponge underneath encrusting bryozoan, collected 15.12.1994, Barretts Reef, Wellington, 10 m.

DESCRIPTION: Hydroid colonies arising from attached, ramified stolons. Hydranths on unbranched stems. Stolons and stems covered by firm perisarc without regular annulations. Hydranths spindle-shaped with one oral whorl of capitate tentacles and up to 18 capitate tentacles in up to 5 indistinct whorls below. Oral tentacles somewhat adnate. All tentacles rather short and stubby in colonies from nature, becoming gradually shorter and smaller proximally, the most proximal tentacles with almost no terminal swelling, but nematocysts confined to tips. No filiform tentacles. Gonophores most probably arise in the upper axils of the lowest 2-3 whorls of tentacles, but only initial stages observed. Nematocysts:

a) larger stenoteles, (39-40) x (21-24) µm.
b) medium size stenoteles, (24.5-28)x (15.5-18) µm.
c) smaller stenoteles, (12.5-15) x (7.5-9.5) µm.
d) mastigophores, shaft only slightly thicker than thread, (14-16) x (5-6) µm, s ~ 0.8.
e) desmonemes, thread in undischarged capsules with ropy texture, with 4 coils when discharged, (10-12) x (5-6.5) µm.

Measurements: hydranths up to 2.4 mm high and 0.4 mm diameter; stems 1-3 µm high.

REMARKS: This species is easily distinguished from all other known corynids known from New Zealand by its size, the stubby tentacles, and its nematocysts. Because the nature of the gonophores remains unknown, the species was not given a specific name. With the presumable gonophores in the upper axils it

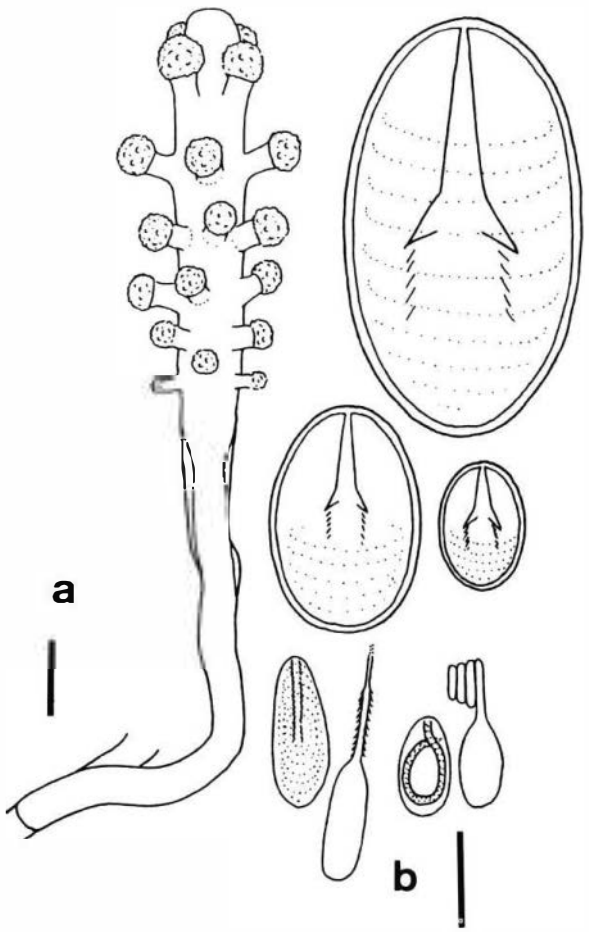


Fig. 74. ***?Coryne*** sp. 1, from life. **a)** polyps shortly after collection from nature; scale bar 0.5 mm. **b)** nematocysts, from top: large, medium-sized and smaller stenotele, mastigophore, same discharged, desmoneme, same discharged; scale bar 10 µm.

resembles *Coryne* sensu Petersen (1990). It is therefore provisionally assigned to *Coryne*, pending more knowledge of the life cycle. This species is rather distinct from the majority of corynids as it contains desmonemes (cf. Petersen 1990). It may therefore also belong to a completely different capitate group (e.g., *?Tiaricodon)*.

Colonies were kept in running sea water on their original substratum and were rather easy to cultivate. They did not feed on *Artemia*, but voraciously consumed large planktonic copepods. The colonies needed only occasional feeding, yet with even more food failed to develop gonophores beyond initial stages. These initial stages were only bulges of the size of the tentacular capitae. In culture, the tentacles grew about twice as long as those seen in nature.

RECORDS FROM NEW ZEALAND: Te Raekaihau, Barretts Reef (this study).

?Coryne sp. 2 (Fig. 75a-b)

MATERIAL EXAMINED

1 colony growing on unidentified chitinous tube, one colony growing attached on sand grain, both found 11.11.1994 on surface of sand in 1 m of water at Greta Point, Evans Bay, Wellington collected 2.11.1994; one colony cultivated in 5 ml plastic petri dish at ambient sea temperature until 3.1.1995, no gonophores formed.

DESCRIPTION: Hydroid colonies arising from ramifying stolons. Cauli not branched, up to 1 mm. Stolons and cauli covered by perisarc. Perisarc of caulus thin, slightly funnel-shaped, with adhering silt and detritus. Hydranth club-shaped, reaching 0.5 mm high, with nipple-shaped hypostome. With 2, sometimes 3 precise and closely set whorls of capitate tentacles. Four tentacles per whorl, alternating in position with the other whorls. Tentacles long, with few chordoid gastrodermis cells. Nematocysts:

a) larger stenoteles, (17–19) x (12.5–13) µm.
b) smaller stenoteles, (13.5–15) x (9–10) µm.
c) basitrichous isorhizas, (12–15) x (3–4) µm.

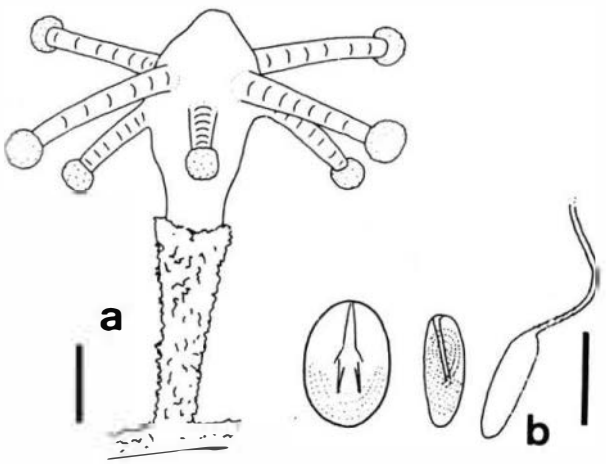


Fig. 75. *?Coryne* sp. 2, from life. **a)** hydranth as found on sand; scale bar 0.2 mm. **b)** nematocysts: stenotele, basitrichous isorhiza, same discharged; scale bar 10 µm.

REMARKS: In the absence of gonophores, no definite generic name can be given. It is therefore also not named specifically. The absence of desmonemes and the tentacles in more than one whorl are in accord with the Corynidae, and the species was therefore provisionally referred to *Coryne*. Although the genus remains uncertain, the species is most probably new. The tentacles are in rather exact whorls (2–3), each containing four tentacles. The arrangement of tentacles is very regular in all hydranths. Such a configuration, together with the basitrichous isorhizas make this species rather distinct. The colonies were found on the surface of a sand sample that had been standing submerged for nine days. Most probably the colonies developed during that time because initially no hydroids could be detected. Whether sand is the natural habitat of this species is not certain. The polyps feed well on *Artemia* nauplii and the colony grew very rapidly. Unfortunately no gonophore formation was observed, even after transfer to running sea water.

RECORDS FROM NEW ZEALAND: Evans Bay, Wellington (this study).

Dipurena McCrady, 1859

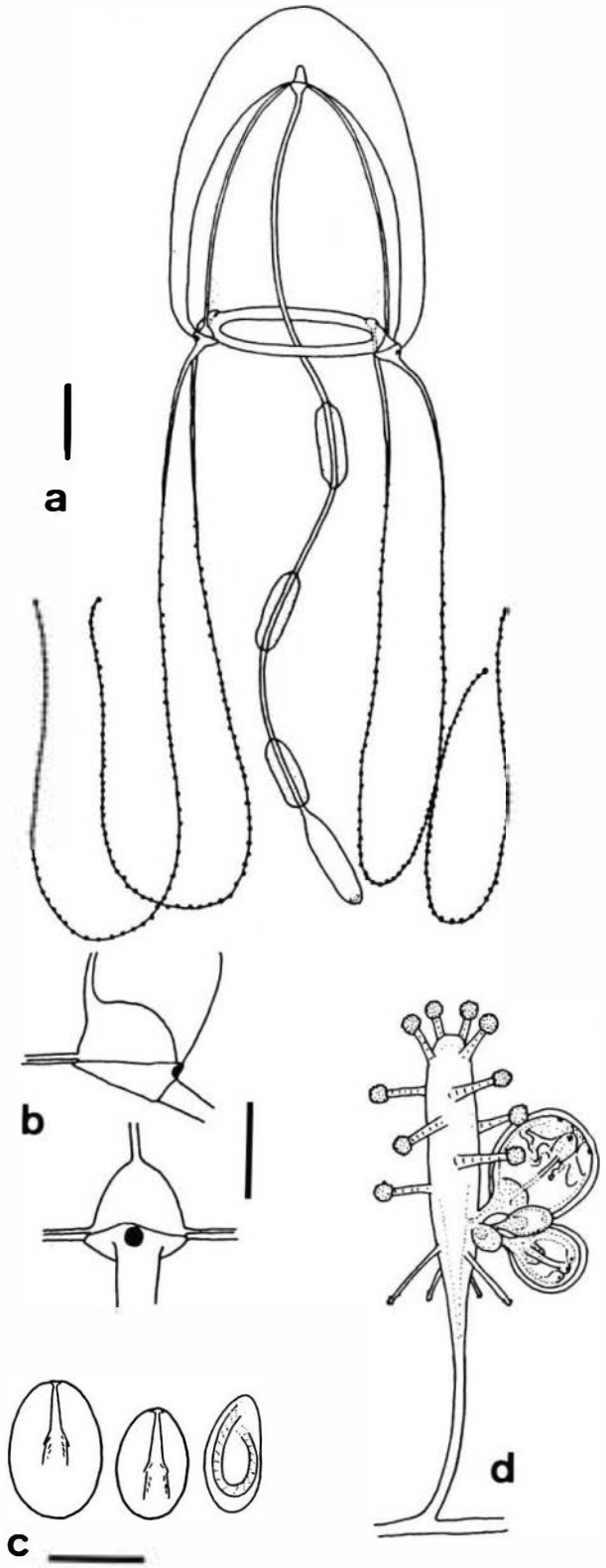
Colonial hydroids with one or several whorls of capitate tentacles, with or without one whorl of aboral filiform tentacles. With a button of high gland cells around mouth. Polyps often associated with sponges. Gonophores released as free medusae. Gonads of medusae in two or more rings around manubrium (after Bouillon 1985a).

TYPE SPECIES: *Dipurena strangulata* McCrady 1859.

REMARKS: Bouillon (1971) and Pagès *et al.* (1992) gave a summary of the characteristics of *Dipurena* medusae and polyps. Only *D. ophiogaster* is known from New Zealand.

Dipurena ophiogaster Haeckel, 1879 (Fig. 76a-d)

Dipurena ophiogaster Haeckel, 1879: 25; Uchida 1927: 187, fig. 27; Rees 1941: 131, fig. 2; Russell 1953: 71, pl. 1, fig.



5, pl. 2, fig. 4, text figs 25e, 30a-b, 31; Kramp 1959: 52, fig. 22; Kramp 1961: 23 (*cum syn.*); Kramp 1968: 8, fig. 11; Petersen 1990: 212, fig. 44E; Pagès *et al.* 1992: 16.

Slabberia ophiogaster: Mayer 1910: 79, figs 36–37.

Sarsia ophiogaster: Brinckmann-Voss 1970: 59, pl. 3 fig. 4, text-figs 66–71.

MATERIAL EXAMINED:

4 (24.11.1993), 10 (9.12.1993), 5 (12.1.1994), 3 (31.1.1994), 1 (7.3.1994), medusae from Evans bay plankton, most of them mature; gametes were spawned and about 30 planulae obtained. Resulting planulae settled on bottom of plastic petri dish and metamorphosed into primary polyps with long cauli. The oldest primary polyps had one whorl of four capitate tentacles and rudiments of tentacles in another whorl. They fed only reluctantly and the colonies deteriorated afterwards.

DESCRIPTION:

Medusa stage: Mature medusa 4–5.5 mm high, bell-shaped, 1.5 times higher than wide. Jelly unevenly thick, becoming gradually thicker from margin towards top; at apex 3 times as thick as lateral walls. Relaxed velum spanning half to two-fifths of radius. With a distinct, rounded apical chamber. Manubrium very long, up to 3 times the bell height, with long and thin proximal part and a broader distal stomach. Gonads distributed in 2–4 broad rings encircling manubrium. With 4 narrow radial canals and ring canal. Four marginal bulbs, epidermal part with nematocysts, rather flat, bearing an abaxial, dark-brown ocellus; gastrodermal chamber egg-shaped, circular canal entering adaxially. With 4 very long and thin tentacles, length up to 5 times bell height, with up to 70 nematocyst clusters and a slightly larger terminal cluster. Nematocysts:

a) larger stenoteles, (14–15) x (9.5–10.5) µm.
b) smaller stenoteles, (11–12.5) x (8–9) µm.
c) desmonemes, with ropy thread in undischarged capsules, (11–13) x (5.5–6.5) µm.

Egg size (spawned): 122 µm (n = 5, s.d. = 5.7 µm).

Polyp stage and young medusa (after Rees 1941; Brinckmann-Voss 1970): Colonial hydroids with rarely branching stems arising from attached, ramifying stolons. Perisarc covers stolons and stems, without annulation. Stems (cauli) may reach 2 mm in height, with wide perisarc into which basal part of polyp can retract (colonies from nature, not cultivated ones). Hydranths 1–2 mm long, with 10–18 capitate tentacles, scattered or in indistinct whorls. With 4 aboral filiform tentacles that may also bear occasional nematocysts.

Fig. 76. *Dipurena ophiogaster* from life, except d). **a)** mature medusa from Wellington Harbour; scale bar 1 mm. **b)** side view (top) and frontal view (below) of marginal bulbs; scale bar 0.3 mm. **c)** nematocysts of medusa: two stenoteles, desmoneme; scale bar 10 µm. **d)** polyp stage with medusae buds, redrawn from Rees (1941) with permission of Cambridge University Press, no scale given. Note: the polyp stage has not yet been identified from New Zealand waters.

Filiform tentacles often absent or contracted in colonies from nature, always present in cultures. Medusae buds develop in groups of up to 4 on short blastostyles distally to filiform tentacles.

Newly released medusa spherical, approximately 1 mm in size, with evenly thin jelly, with apical canal, with 8 adradial rows of exumbrellar nematocysts. Manubrium length one-third of bell cavity, simple cylindrical.

Nematocysts of polyp (Bouillon 1985a): stenoteles only.

TYPE LOCALITY: First described from British Isles and Ireland.

REMARKS: With its very long manubrium, *Dipurena ophiogaster* is rather distinct from all other New Zealand medusae. Adult *D. ophiogaster* are, however, very difficult to distinguish from *D. reesi*, a medusa known from the Mediterranean and Brazil. Brinckmann-Voss (1970) gave some help in discriminating them. Both species are easy to distinguish in their polyp phase, as *D. reesi* polyps have only one whorl of capitate tentacles, making them similar to polyps of *Cladonema radiatum* (Fig. 80c). Polyps of *D. ophiogaster*, on the other hand, resemble certain other *Dipurena* polyps and also *Sarsia japonica*, especially when without medusae buds (Fig. 79a).

Polyps of *D. ophiogaster* have not yet been found in New Zealand. According to Brinckmann-Voss (1970) they occur in shaded parts of the rocky littoral 1–3 m deep on rocks or on barnacles.

RECORDS FROM NEW ZEALAND: Leigh Marine Reserve, Whangateau Harbour (Barnett 1985), Wellington Harbour (this study).

OTHER RECORDS: Northwestern Europe; Mediterranean; Sri Lanka; Japan; Palau Islands; Papua New Guinea; Pacific Coast of Mexico and Chile (Kramp 1968).

Sarsia Lesson, 1843

Hydranths similar to *Coryne*, but with free medusae. Medusae with undivided gonads (Bouillon 1985a).

TYPE SPECIES: *Sarsia tubulosa* (M. Sars, 1835).

REMARKS: Characteristics of New Zealand species:

S. eximia: polyp colonies always branching, without filiform tentacles.

S. japonica: polyp colonies mostly stolonal, with filiform tentacles.

Sarsia eximia (Allman, 1859) (Figs 77a-h, 78)

Coryne eximia Allman, 1859: 141; Petersen 1990: 211, fig. 43A-C.

Coryne tenella Farquhar, 1895: 208, pl. 13, fig. 5 **(new synonym).**

Sarsia eximia: Mayer 1910: 57, fig. 20; Hartlaub 1914: 8, figs 1–2; Russell 1938b: 150, figs 8–12; Ralph 1953: 74, fig. 24; Russell 1953: 50, text fig. 17A, 18A-B, plate 2 fig. 3; Kramp 1959: 79, fig. 15; Kramp 1961: 27; Kramp 1968: 7, fig. 6; Millard 1975: 52, fig. 20A–D; Brinckmann-Voss 1989: 688, figs 5–6.

Syncoryne tenella: Bale 1924: 228; Ralph 1953: fig. 15.

Syncoryne eximia: Bale 1924: 229; Ralph 1953: 68.

MATERIAL EXAMINED:

Type material of *Coryne tenella* Farquhar, 1895, MCC type AQ3276, type locality Wellington Harbour. Short description: erect colonies arising from ramifying hydrorhiza, fragments up to 12 mm high, branching more distally, up to 10 terminal branches ending in hydranths. Perisarc strongly annulated for short, dispersed stretches, especially at origin of branches; hydranths up to 1.5 mm, tubular to spindle-shaped body with 4 oral and 15–22 scattered capitate tentacle below them, no basal cup of perisarc present; only a few young gonophores present, these in the upper axil of the proximal tentacles, with short stems. Additional data: gastrodermal cells in oral tentacles 13–15; hydrorhiza diameter 176–216 µm, stem proximally 110–208 µm, caulus at hydranth base 104–143 µm, hydranth length 900–1480 µm.

Numerous living colonies from different localities in Wellington Harbour, present year-round, very often with medusa buds, medusae released from several colonies and cultivated to maturity (spawning); some of the polyp material deposited.

Many hundreds of adult medusae from Wellington Harbour (Evans Bay, Seatoun), present year-round; some deposited.

Ca. 10 medusae collected by T. Barnett at Leigh Marine Reserve in 1983–1984, identified as *S. eximia*, *S. gracilis* and *Sarsia* sp.

DESCRIPTION:

Polyp stage: Capitate hydroids forming initially stolonal, later erect, branching colonies arising from attached, ramifying stolons. Colonies reaching 40 mm in height, but mostly 10–20 mm. Stems not fascicled, branching irregularly with an occasional tendency to unilateral arrangement. Perisarc mainly smooth but annulated at base of stem, at origin of branches and sometimes for the entire length of small branches. The perisarc terminates as a very delicate layer below the most proximal tentacles.

Hydranths are tubular to spindle-shaped and reach 2 mm in length, normally 1.5 mm; with one whorl of 4–5 oral tentacles; beneath are 15–35 additional tentacles, scattered or in indistinct whorls; tentacles capitate and proximal part tapering only slightly. Oral tentacles at their point of insertion shorter than twice the diameter of the hydranth. Filiform tentacles absent.

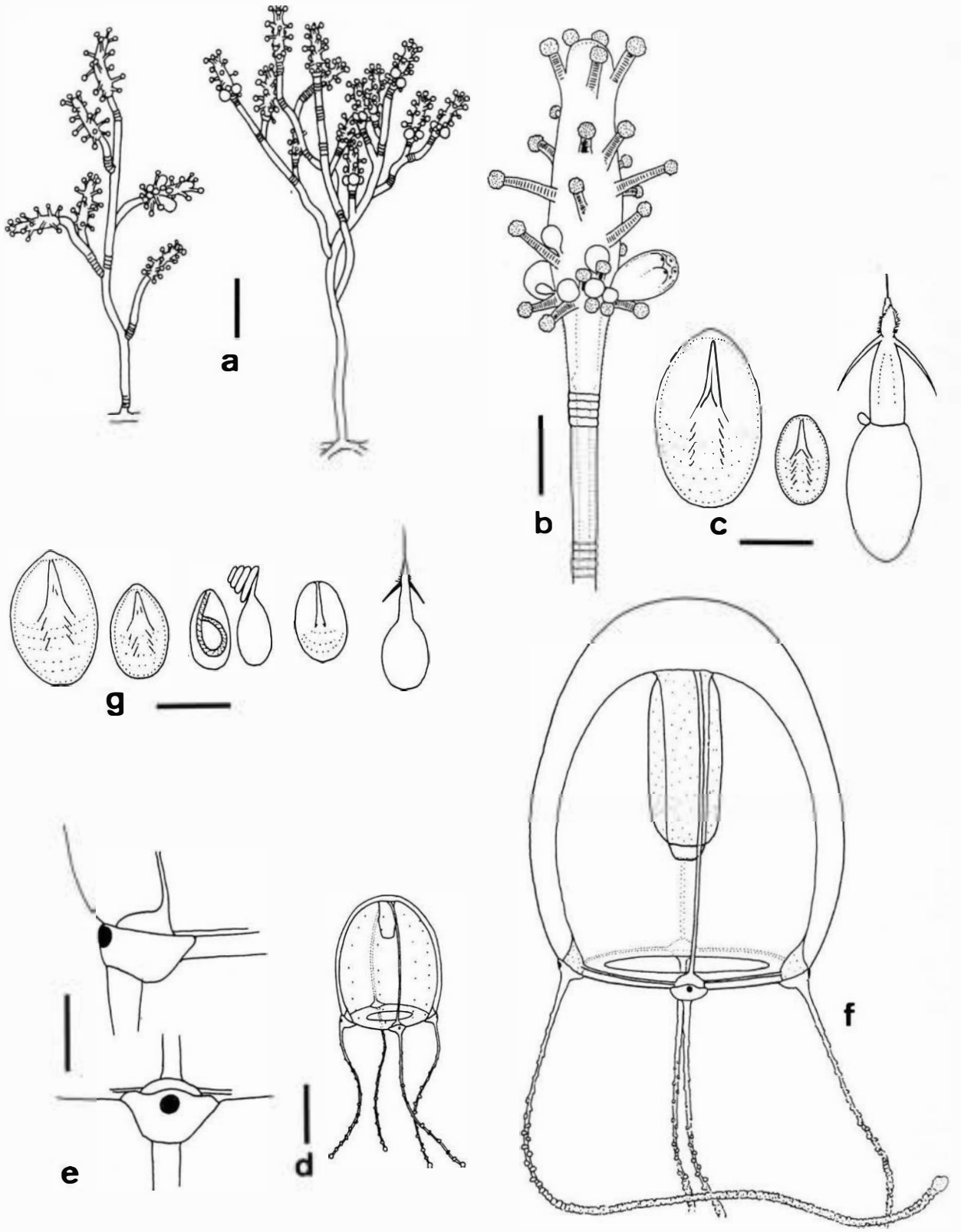


Fig. 77. ***Sarsia eximia*** from life. **a)** colony forms; scale bar 2 mm. **b)** hydranth with medusae buds; scale bar 0.5 mm. **c)** stenoteles of polyp; scale bar 10 µm. **d)** newly released medusa; scale bar 0.5 mm. **e)** lateral (top) and side view (below) of tentacle bulbs; scale bar 0.2 mm. **f)** nmature male medusa, form with rounded bell, same scale as d). **g)** nematocysts of medusa; two stenoteles, desmoneme, same discharged, stenotele of exumbrella, same discharged; scale bar 10 µm.

Medusa buds arise from short stems in upper axil of the tentacles. Medusa budding zone may cover proximal two-thirds of hydrant there are occasionally 2 buds per tentacle, each with its own stem. Not only hydranths of erect part of one colony bear medusa buds, but also stolonal polyps from the same colony. Nematocysts and additional observations:

a) larger stenoteles, (20–24) x (13.5–15) µm.
b) smaller stenoteles, (11–13) x (6.5–7) µm.

Caulus diameter 160–260 µm.
Colours: epidermis and tentacles transparent; gastrodermis variable, orange to light green, perisarc amber.

Young medusa: Medusa after liberation bell-shaped, reaching 1 mm height and 0.8 mm diameter, jelly thin, velum approximately half of the radius; with 8 adradial nematocyst tracks, lacking exumbrellar furrows. Manubrium not longer than half the subumbrellar cavity and lacks nematocysts. Without apical canal. Four radial canals ending in tentacle bulbs with abaxial red-brown ocelli; 4 tentacles bear clasping nematocyst clusters and a terminal spherical cluster. Gonads not visible. Nematocysts:

a) smaller stenoteles in tentacles, (9.5–11) x (6.5–8) µm.
b) larger stenoteles in tentacles, (12–14.5) x (9–9.5) µm.

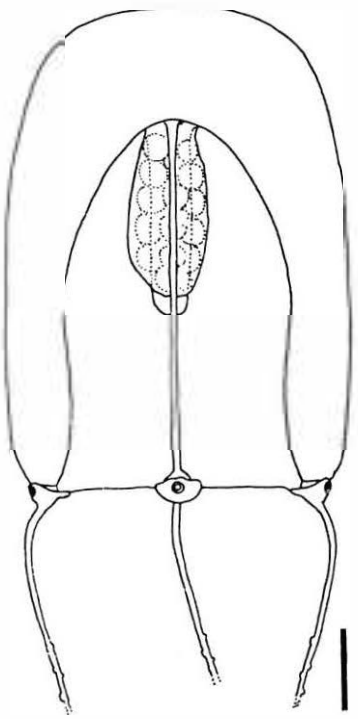


Fig. 78. *Sarsia eximia* medusa; large cylindrical form; scale bar 1 mm.

c) stenoteles on exumbrella, shaft with little or no constriction near large spines, (11.5–13) x (8.5–10) µm, s = 1.
d) desmonemes, discharged with 3 coils, (9–11) x (5–5.5) µm.

Adult medusa: Bell-shaped to cylindrical, normally 3–4 mm high (2.2–7 mm range), jelly thicker at apex, without nematocysts on exumbrella. Manubrium cylindrical and spanning half to all of subumbrellar height. Gonads encircle the manubrium, extending from near its base almost to the mouth. Four marginal bulbs with red-brown ocelli and 4 very extendible tentacles. The abaxial side of the tentacle bulb gastrodermis is convex, the radial canals enter adaxially. Tentacles bear 50–100 nematocyst clasps in indistinct spirals and one terminal cluster. Nematocysts and additional observations:

a) larger stenoteles, (14.5–17.5) x (10.5–12) µm.
b) smaller stenoteles, (10.5–13) x (7–9) µm.
c) desmonemes, (11.5–12) x (5–6.5) µm.

Egg diameter (spawned) 192 µm (n = 24, 5 animals from 3 different dates); diameter of terminal capitae 80 µm.
Colours: manubrium light green, tentacles light orange.

TYPE LOCALITY: British Isles.

LIFE-CYCLE OBSERVATIONS: The hydroid is quite easy to cultivate. In culture its tentacles may become much longer. Medusae released from three different colonies were raised to sexual maturity (spawning) at about 2.6 mm bell height within 18–22 days (room temperature). Medusae thus obtained were not distinguishable from those taken from the plankton.

REMARKS ON VARIATION: The perisarc at the base of hydranths is normally only visible under a compound microscope. In some colonies, however, it forms an obvious basal cup reaching up to the most proximal tentacles. Although these colonies also have normal hydranths they can be mistaken for another species. In culture, such colonies loose their cups and the medusae grow into normal *S. eximia*. The occasional cups may be a general feature of *S. eximia*, as Brinckmann-Voss (1989: fig. 5) also depicted polyps with an indication of basal perisarc cups.

The medusa shows an even greater degree of variation. Frequently, medusae showed a highly cylindrical bell with a thickened apical jelly and flat top (Fig. 78). The subumbrella, however, always had curved walls. This form was first taken for another species, namely *Sarsia gracilis* Browne, 1902, but the typical juvenile forms of *S. gracilis* described by

Browne and Kramp (1939) were never found, despite the majority of all collected *Sarsia* medusae being juvenile. Several other observations showed that the cylindrical medusa is a form of *S. eximia*: there is a continuum of morphological forms in between the shapes given in figures 77f and 78; there were no significant differences in nematocyst or egg size; both forms interbreed easily (see Appendix). Although it was not possible to quantify fertilisation success, most spawned eggs developed. Crosses between sibling species of *Sarsia* are possible, but viable larvae are few (Miller 1982). Hartlaub (1907, fig. 2a) and Brinckmann-Voss (1989) also depicted *S. eximia* with thickened apical jelly. The size of the bell was normally in the range of 3–4 mm, but exceptionally there were some specimens reaching 6 mm, and one even 7 mm. According to Russell (1953), *S. eximia* can rarely reach 10 mm in height and the length of the manubrium, which can be as long as the subumbrella, is variable in this species (cf. Appendix).

Barnett (1985) recorded *S. eximia* and *S. gracilis* from Leigh. She mentioned that the two species were difficult to identify because there were also intermediate forms. Having examined part of her material, her *S. gracilis* is here referred to *S. eximia*, being within the range of the animals observed in Wellington.

GENERAL REMARKS: Brinckmann-Voss (1989) recently reviewed the data for species of the *S. eximia* group, and further information can be found in Watson (1978) and Kubota and Takashima (1992).

Coryne tenella was described as a polyp occurring in Wellington Harbour on holdfasts of *Macrocystis* (Farquhar 1895). His description and figures also fit *S. eximia*. A problem arises from his remark that the gonophores are sessile, but he may not have used the term in the modern sense, meaning that no medusa is liberated, as he did for *Tubiclava rubra* (see *Turritopsis nutricula*). Later, Bale (1924) kept *C. tenella* separate from *S. eximia* as *Syncoryne tenella* but did not clearly state why. He thought that the medusa may not become free, which is quite improbable as he observed ocelli. Ralph kept *S. tenella* distinct from *S. eximia* by stating that the former has gonophores without stems. This contradicts Bale's description (1924) and also her figure to some extent.

Examination of the holotype of *Coryne tenella* showed that it cannot be separated from the *S. eximia* material collected for this study. For correct identification of most corynid polyps, the released medusae must be raised to maturity because many *Sarsia* and *Coryne* species cannot be distinguished in the polyp phase alone. Farquhar's species may, therefore, never be identified with certainty; however, its accordance with *S. eximia* polyps, which are abundant in Wellington Harbour (including on *Macrocystis*) make it very probable that Farquhar's sample was *S. eximia*. *Sarsia eximia* hydroids often form very dense populations in Wellington Harbour, particularly on floating objects like *Macrocystis*, buoys or rafts. On a raft used for mussel culture they formed colonies occupying square metres. *Sarsia eximia* can also grow on ship hulls (Millard 1975) which may explain its wide distribution.

The present samples agreed in most respects with published descriptions of *S. eximia*. Only a few characters did not fit the data of other authors. The tentacle bulbs of the medusa were not found to be laterally compressed as assumed by Petersen (1990), and other studies do not show such a morphology (e.g., Brinckmann-Voss 1989). Additionally, it was noted that the shape of the gastrodermal chambers depends on how recently food has been consumed. Contrary to Petersen (1990), the tentacles of the polyp are mostly not arranged in whorls. An irregular arrangement of the tentacles is also given by Brinckmann-Voss (1989) and Russell (1953). The most significant difference was the egg size of 192 µm. This is in contrast to data of Bodo and Bouillon (1968, 130 µm) and Brinckmann-Voss (1989, 113 µm). This difference is larger than the variation observed within populations (cf. Rees 1957, table 2; Miller 1982, fig. 2), but unfortunately nothing is known about variations between populations.

A similar species which could also be present in New Zealand is the Australian *Sarsia radiata* von Lendenfeld, 1884, but polyps are distinguishable from *S. eximia* by their microbasic euryteles (Watson 1978).

RECORDS FROM NEW ZEALAND: The hydroid is known from Wellington Harbour (Farquhar 1895, as *Coryne tenella*, this study); and Oamaru (Bale 1924). The medusa is known from Cook Strait (Kaberry 1937); Oamaru Harbour (Ralph 1953); marine reserve Leigh (Barnett 1985, as *S. eximia* and *S. gracilis*); Wellington Harbour (this study).

OTHER RECORDS: North Atlantic from America to Europe and from Iceland to France; Mediterranean; west coast of North America. Medusa also known from Brazil, Valparaiso, and the N W Pacific (Millard 1975).

Sarsia japonica (Nagao, 1962) (Fig. 79a-g)

Stauridiosarsia japonica Nagao, 1962: 176, figs 1-5.
[not *Sarsia japonica* Maas, 1909 = *Euphysa japonica*]
Sarsia japonica: Arai & Brinckmann-Voss 1980: 21, fig. 10; Brinckmann-Voss 1989: tables 2 & 3; Kubota & Takashima 1992: 371, figs 1–14.
Coryne japonica: Petersen 1990: 211.

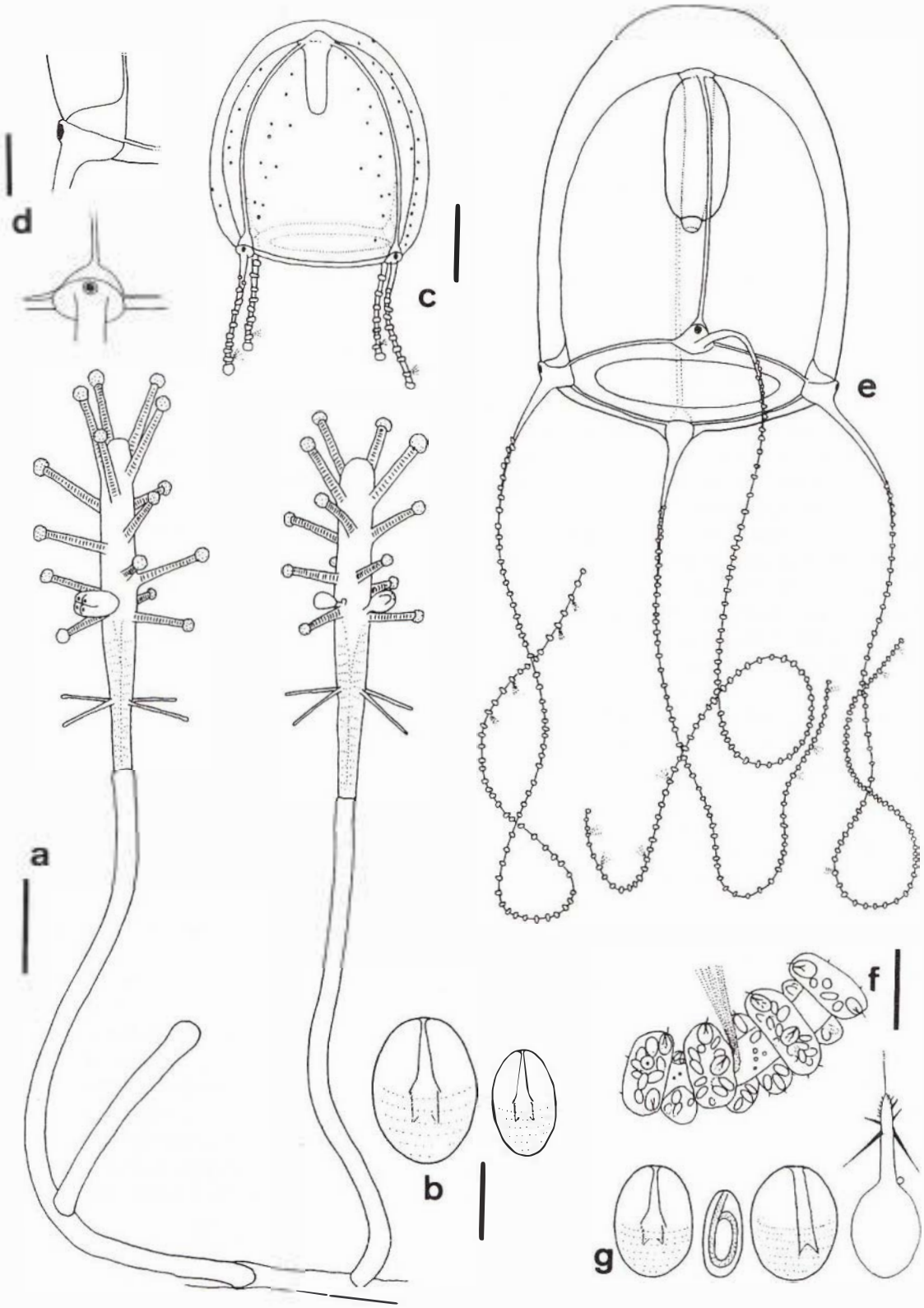


Fig. 79. *Sarsia japonica*, all afrom life. **a)** cultivated polyp stage with medusa buds; scale bar 0.5 mm. **b)** nematocysts of polyp stage: stenoteles; scale bar 10 mm. **c)** newly released medusa; scale bar. **d)** side and frontal view of tentacle bulbs, scale bar 0.2 mm. e) adult medusa from culture, same scale as c). **f)** part of tentacle with tuft of long, stiff cilia, CL; scale bar 50 µm. **g)** nematocysts of young medusa: stenotele, desmoneme, exumbrellar mastigophore, same discharged; scale bar 10 µm.

MATERIAL EXAMINED:

1 polyp colony on holdfast of drift *Macrocystis*, collected 4.7.1994 at Lyall Bay Beach, Wellington.

1 polyp colony growing on oyster, collected 28.6.1994 underneath the pier restaurant, Greta Point, Evans Bay, Wellington, 0.5 m.

1 colony growing on red sponge, collected 5.9.1994 near NIWA, Greta Point, 0.5 m.

All above colonies were infertile but were cultivable in plastic dishes until medusae were produced. Approximately 30 medusae were released and most of them reared to maturity. It takes two weeks to reach full maturity, but gonads are easily visible after one week. Some material deposited.

DESCRIPTION:

Polyp stage: Capitate hydroid colonies, mostly stolonal, only occasionally branched, arising from attached, ramifying stolons. Cauli longer than hydranths (in culture). Perisarc covers stolons and cauli, not annulated. Hydranths claviform, up to 1.5 mm. With a distal whorl of 4– 5 capitate tentacles; below them 3–4 whorls, each with 4 capitate tentacles, all of similar length, only slightly tapering, up to 20 gastrodermis cells in the most distal tentacles. Below capitate tentacles a whorl of 4–5 filiform tentacles. Medusae buds arise either singly or in groups of up to 3 among the lowest tentacles, some of them may also arise in the upper axil of these tentacles. Medusae buds on relatively long, unbranched stalks. Ocelli of medusae buds point in axial direction. Nematocysts:

a) smaller stenoteles, (12–14.5) x (7–8.5) µm.
b) larger stenoteles, (19–19.5) x (12–15) µm.

Newly released medusa: 1.4 mm high, bell-shaped, with 8 adradial rows of nematocysts; the rows may be rather indistinct in some specimens but the perradial and interradial positions are always free of nematocysts. Manubrium length one-third of bell cavity, a slight rounded apical chamber present or absent, gonads not developed. Four tentacles with 10–15 nematocysts clusters and a terminal cluster of similar size, most nematocyst clusters encircling tentacle (moniliform condition). On the first cluster beyond the terminal one, and additionally on 1–2 more proximal ones, are adaxial tufts of stiff, long cilia (visible at higher magnifications only). These tufts move actively. Ocelli dark red. Nematocysts:

a) stenoteles in tentacles, (13.5–16) x (8.5–11) µm.
b) stenoteles from exumbrella, shaft tapering, constriction at level of large spines almost absent, ca. 15 x 11 µm, s = 1.1.
c) desmonemes, (10–11.5) x (4–5.5) µm.

Adult medusa (after two weeks in culture): Up to 2.7 mm high, higher than wide, bell-shaped with apex slightly flattened, jelly slightly thicker at apex. Dilated velum spanning half of radius. Manubrium half to two-thirds the subumbrellar depth, manubrium apex slightly rounded, gonads surrounding manubrium completely leaving only parts near mouth and apex free. Large tentacle bulbs with abaxial ocelli and long tentacles. Ocelli dark red. Tentacles expanded 2–3 times bell length, with 60–70 nematocyst clusters, these, except most proximal ones, apparently encircle relaxed tentacle (moniliform tentacle). One terminal cluster of similar size as other the clusters. Tentacles are mostly fully expanded and actively moving. Several of the nematocyst clusters have an adaxial tuft of 10–20 long stiff cilia that move actively. No exumbrellar nematocysts present.

TYPE LOCALITY: Akkeshi, Hokkaido, Japan.

REMARKS: The present sample of *S. japonica* agrees in most respects with the descriptions given by Nagao (1962) and Kubota and Takashima (1992). The most obvious difference is the presence of tufts of stiff cilia on the tentacles. These tufts are not easily seen and require observation at high magnifications with suitable illumination. It may well be that they have been overlooked by previous workers. Other differences are the smaller size of the larger stenoteles of the polyp and the presence of some medusae buds in the upper axil of the tentacles. As amended by Kubota and Takashima (1992) the stems of the medusae buds are not branched blastostyles as given in the original description of Nagao (1962). The length of the manubrium in the present sample conforms more with the description of Nagao (1962) than with that of Kubota and Takashima (1992).

The nematocysts on the exumbrella of the newly released medusae have been described as microbasic mastigophores (Kubota & Takashima 1992), but their figures 11–12 do not correspond to this type. The exumbrellar nematocysts found in the present sample were interpreted as somewhat aberrant stenoteles, an interpretation that can also be applied to the figures of Kubota and Takashima (1992). The shafts of these stenoteles taper only slightly and mostly have no constriction at the level of the large spines (Fig. 79g). A stenotele with a similar shaft, although less deviant from the normal type is also found on the exumbrella of *S. eximia* (Fig. 77g).

Petersen (1990) used the position of the medusae buds as one character to redefine the genera within the Corynidae. But in *S. japonica* the occurrence of medusae buds in the axils of the lowest tentacles as well as independent of them makes the revised classification of Petersen (1990) less applicable. The same has been noted for the morphology of the tentacular bulbs (Kubota & Takashima 1992). The

shape of the gastrodermal chamber, however, seems not to be a constant feature and varies with the amount of food present in the gastric system (unpubl. observ. for several corynid medusae).

The adult medusa of *S. japonica* is very similar to *S. eximia* (cf. Figs 77f, 79e). In preserved material they may be not distinguishable, as not all specimens of *S. japonica* have an apical chamber. The presence of tufts of cilia on the tentacle is, however, a character that might allow a clear distinction between these species. Additionally, the tentacles of *S. japonica* show a different behaviour as they are more often kept expanded and move more actively. Unfortunately, medusae of *S. japonica* are not yet known from New Zealand waters, and it is not known whether natural populations always have these cilia and tentacular behaviour.

The adult medusa may reach 5–6 mm in height (Arai & Brinckmann-Voss 1980; Kubota & Takashima 1992).

Infertile polyps of *S. japonica* are very similar to *Dipurena ophiogaster* (cf. Figs 79a and 76d). Only the site of medusae budding is different. In *D. ophiogaster* the buds are mostly located below the capitate tentacles.

RECORDS FROM NEW ZEALAND: Lyall Bay and Evans Bay, Wellington (this study).

OTHER RECORDS: British Columbia, Canada; California (?); Japan (Kubota & Takashima 1992).

Family **CLADONEMATIDAE** Gegenbaur, 1857

Capitate hydroids forming stolonal or sparingly branched colonies. Stolons ramifying, these and stems covered by perisarc reaching to base of hydranths. Hydranth spindle-shaped, with an oral whorl of four to five capitate tentacles with chordoid gastrodermis, with or without an aboral whorl of four to six slender, solid filiform tentacles with few or no nematocysts but with sensory hairs. Mouth with oral mucus glands enclosed by ectodermal lips forming preoral chamber. Medusa buds not enclosed in perisarcal film, carried singly or in clusters distal to aboral whorl or at base of hydranth.

Medusae with variable number of bifurcating or simple radial canals. Stomach cylindrical, with or without stomach pouches, mouth circular with or without short protuberances armed with nematocysts. Gonads on stomach wall, on subumbrellar surface or in special brood pouch. Branching marginal tentacles with adhesive organs, corresponding in number to, or exceeding number of radial canals that reach ring canal. Gastrodermis of tentacles parenchymatic. Abaxial ocelli present (modified after Petersen 1990).

REMARKS: Characteristics of genera known from New Zealand:

Cladonema: medusa with bell high, tentacles branching more than once.

Staurocladia: flat medusae, tentacles branching once only.

Cladonema Dujardin, 1843

Hydroid colonial, mostly stolonal and only occasionally branching. Hydranth with a whorl of four to five oral capitate tentacles; with or without four to five filiform aboral tentacles. Medusa bud borne singly on body of hydranth immediately above aboral tentacles or in similar position when aboral tentacles are absent.

Medusa adapted for swimming and creeping. With bifurcating and simple radial canals. Cylindrical stomach with perradial stomach pouches and four to six oral nematocyst clusters. Gonads surround stomach. Branching marginal tentacles correspond in number to radial canals that reach ring canal, each with one to six branches ending in adhesive organ and one to ten branches with clusters of nematocysts (after Petersen 1990).

TYPE SPECIES: *Cladonema radiatum* Dujardin, 1843.

REMARKS: The taxonomy of the genus *Cladonema* is, at present, tentative. The species limits are far from clear and much more information is needed to delimit them. A good review is given by Rees (1979a) – there seem to be at least three species, namely *C. radiatum* Dujardin, 1843, *C. californicum* Hyman, 1947 and *C. pacificum* Naumov, 1955.

In New Zealand there is only one known finding of a *Cladonema*.

Cladonema radiatum Dujardin, 1843 (Fig. 80a-d)

Cladonema radiatum Dujardin, 1843: 1134; Mayer 1910: 90, figs 53–55; Weill 1937: 443, fig. 1 (*cum. syn.*); Russell 1953: 105, figs 49-51; Brinckmann & Petersen 1960: 388, fig. 2; Kramp 1959: 96, fig. 55; Kramp 1961: 57 (*cum. syn.*); Kramp 1968: 22, fig. 52; Brinckmann-Voss 1970: 76, figs 88-89, pl. 5 figs 1-2; Rees 1979a: 300; Calder 1988: 67, fig. 50 (*cum syn.*), Hirohito 1988: fig. 12a-b.

Cladonema perkinsi Mayer, 1904: Mayer 1910: 101, pl. 9 fig. 1.

Cladonema mayeri Perkins, 1906: 118; Mayer 1910: 101, pl. 9 figs 2–3.

Cladonema novae-zelandiae Ralph, 1953: 72, fig. 20 **(new synonym).**

MATERIAL EXAMINED:

Microslide with holotype of *Cladonema novaezelandiae* Ralph, 1953, MoNZ Co208, collected 1949 in rockpool in Island Bay near Fisherman's Creek, Wellington.

Microslide with paratype of *Cladonema novaezelandiae*, collected 1949 by P. Ralph, MoNZ Co209.

Microslide made by P. Ralph in 1949, held by MoNZ, labelled: M2 *Cladonema radiatum californica* (*radiatum* later crossed out).

Cladonema radiatum polyps and medusae from the Mediterranean (Banyuls-sur-Mer), life cycle observed from polyp to medusa.

DESCRIPTION:

Medusa stage (Mediterranean material): Medusa up to 3 mm high with bell-shaped umbrella, slightly higher than wide, jelly moderately thin, velum rather broad. Medusa able to swim freely but mostly remaining attached. Manubrium spindle-shaped with 4–5 perradial pouch-like protuberances in its middle region. Mouth with 4–5 nematocyst clusters. Manubrium does not extend beyond umbrella margin. The gonads completely surround the manubrium in the region of the pouches. Radial canals may bifurcate and up to 10 canals may reach the circular canal; the branching pattern varies between individuals. Number of marginal tentacles corresponds to number of radial canals. Marginal tentacles branched with elongated thickened bases, from the distal underside of which grow 1- 4 (up to 6 according to Weill 1937) short tentacles with adhesive organs. The branched upper portion of the tentacles may have up to 5 ends with numerous nematocyst clusters alternating in position (aboral and oral) and one larger terminal cluster. Each tentacle base has an abaxial ocellus.

Nematocysts:

a) larger stenoteles, (13–16) x (9–10) µm.
b) smaller stenoteles, (9.5–11) x (5–8.5) µm.
c) desmonemes, (9–12) x (3.5–5) µm.

Polyp stage (Mediterranean material): Hydroid colonies arising from attached, ramifying stolons, occasionally with branching stems, reaching a height of up to 2.5 mm. Perisarc smooth, terminating shortly below filiform tentacles. Hydranths ca. 1 mm high, with a whorl of 4–5 capitate tentacles with 7–9 chordoid gastrodermal cells. Below capitate tentacles a whorl of 4–5 slender, filiform tentacles with a slight terminal swelling. Hypostome with an ectodermal preoral chamber. Medusae buds naked, distal to filiform tentacles. Nematocysts:

a) stenoteles, (11–17) x (8–10) µm.
b) mastigophores, rare or absent, in stolons only, (10–12) x (3.5–4) µm.

TYPE LOCALITY: First described from the Mediterranean Sea.

REMARKS: The nominal species *Cladonema novae-*

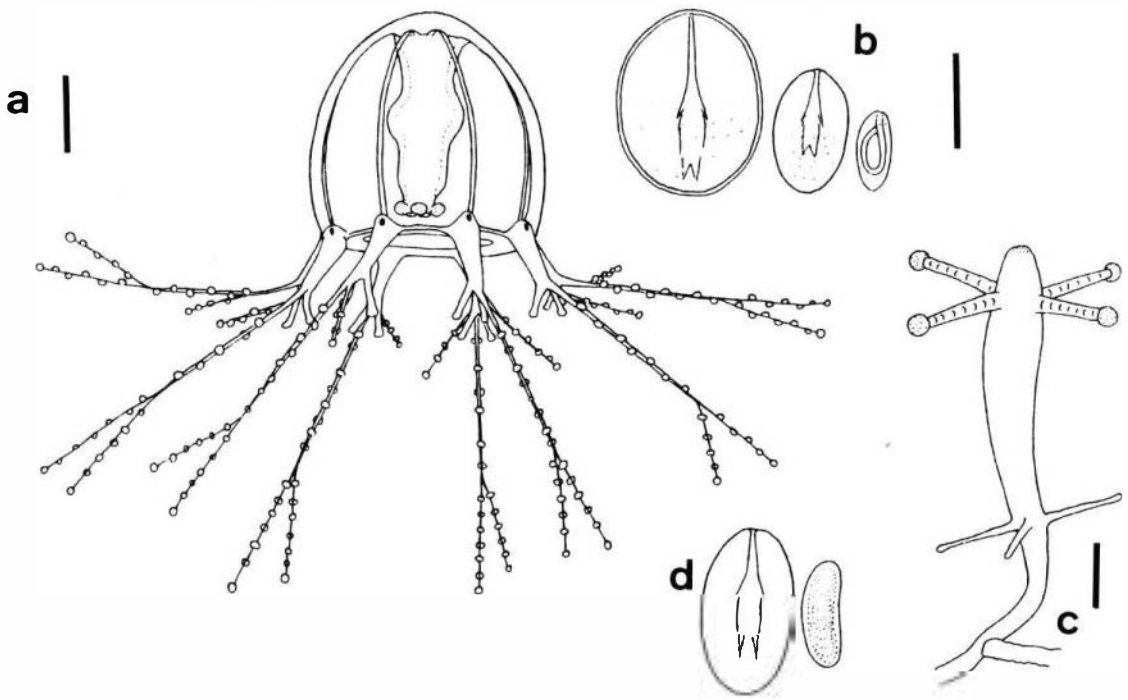


Fig. 80. ***Cladonema radiatum,*** from live Mediterranean material. **a)** young medusa; scale bar 0.5 mm. **b)** nematocysts of medusa: two types of stenoteles, desmoneme; scale bar 10 µm. **c)** polyp stage; scale bar 0.2 mm. **d)** nematocysts of polyp: stenotele, rare mastigophore; same scale as b).

zelandiae was erected by Ralph (1953) based on medusae found near Wellington. Her descriptions are limited and the reasons for creating a new species are not apparent. The original type material of *C. novaezelandiae* was examined for this study. The samples comprise a holotype and a paratype specimen mounted onto microslides. The morphology of both animals is only very poorly preserved, but permits observation of some characters valuable for a more precise taxonomic evaluation. The most important are as follows: manubrium shorter than bell height, gonads cover middle part of manubrium, 9 tentacle bulbs with much-branched tentacles with up to 6 adhesive branches and up to 5 branches with nematocyst clusters. Ralph (1953) related her species to *C. californicum*, which, however, is not the case. *Cladonema californicum* has a manubrium that protrudes through the velar opening, has no branching radial canals, and far fewer tentacle branches (Rees 1979a). As the gonads in Ralph's medusa do not cover the whole manubrium, *C. pacificum* (syn. *C. uchidai*) can also be ruled out (cf. Hirohito 1988). Ralph's description of *C. novaezelandiae* (1953), her figures, and the results of the re-examination of the types match rather well the description of *C. mayeri* given by Mayer (1910, p. 101), especially the 9 tentacles, each with up to 6 adhesive branches per tentacle. Weill (1937) examined the variability of *Cladonema* at Bermuda and concluded that *C. mayeri* is a variant (and junior synonym) of *C. radiatum* only. Mayer (1910) also considered this as a possibility. For these reasons, *C. novaezelandiae* is here synonymised with *C. radiatum*. However, further information on the New Zealand population, especially its polyp stage, is needed to confirm this. In order to facilitate future recognition of differences or similarities of the local population to the population of *C. radiatum* from the type locality, the descriptions and figures give above were made from Mediterranean material.

RECORDS FROM NEW ZEALAND: Known only from Wellington (Ralph 1953).

OTHER RECORDS: Western Atlantic; Europe; Mediterranean; Japan (Calder 1988; Hirohito 1988).

Staurocladia Hartlaub, 1917

Hydroids, where known, stolonal or on erect, nonbranching cauli. Hydranth with an oral whorl of capitate tentacles, with or without four to five aboral filiform tentacles. Medusa buds borne singly on body of hydranth immediately above aboral tentacles or in similar position when aboral tentacles are absent. Medusa adapted for walking. Umbrella with continuous, broken, or no nematocyst ring along margin. With six to eleven radial canals, some shortly bifurcating distal to manubrium. Manubrium with circular mouth with or without five to six knobs armed with nematocysts. Gonads surrounding stomach or developed on protrusions from stomach. With up to 60 bifurcating marginal tentacles, one upper branch with several nematocyst clusters, one lower branch with adhesive organ. Asexual reproduction through fission, or budding of medusae from umbrella margin.

TYPE SPECIES: *Staurocladia vallentini* (Browne, 1902).

REMARKS: The above diagnosis was modified after Petersen (1990) to accommodate *Staurocladia wellingtoni* n.sp., which has sessile, stolonal polyps without cauli and also no nematocyst ring in the medusa. The latter character reduces the distinguishing characters of *Staurocladia* and *Cladonema*. The assignment of these two genera to two separate families Cladonematidae and Eleutheridae thus becomes even less reasonable than before (see Petersen 1990). Another character is the structure of the gonads which seem not to be located on manubrial protuberances in all species. In the original description of *Staurocladia hodgsoni* (Browne, 1910), the gonads were described as completely surrounding the manubrium in a continuous ring, with seven or eight swellings each containing a single large egg. All species of *Staurocladia* have been reviewed in tabular form by Bouillon (1978a).
Characteristics of the New Zealand species:

S. vallentini: tentacular nematocyst clusters of medusa on oral and aboral sides, polyp with filiform tentacles.

S. wellingtoni: tentacular nematocyst clusters of medusa lateral, polyp without filiform tentacles and with desmonemes.

Staurocladia vallentini (Browne, 1902) (Fig. 81a-e)

Eleutheria vallentini Browne, 1902: 279.
Cnidonema capensis Gilchrist, 1918: 509, pl. 30.
Staurocladia vallentini: Browne & Kramp 1939: 274, pl. 14, figs 3–4, pl. 15 fig. 4, pl. 19, fig. 2; Kramp 1959: 98, figs 58–59; Kramp 1961: 62; Millard 1975: 57, fig. 23D–G; O'Sullivan 1982: 29, fig. 11, map 10; Hirohito 1988: 42, figs 12c-e.
Cnidonema vallentini: in part Ralph 1947: 414, pl. 35, figs 1, 2,3, 4A, not others.
Cnidonema hodgsoni: in part Ralph 1953: fig. 16, polyp.
[not *Staurocladia hodgsoni* (Browne, 1910)].

MATERIAL EXAMINED:
Ca. 30 medusae collected from *Cystophora*, other macroalgae, and bryozoans, from January to October 1994 at Te Rae-Raekaihau Point, Houghton Bay, and Island Bay, Welling-

ton, all sizes from 6–24 tentacles, none fully mature, intertidal to 13 m. Many were also cultivated but they are rather difficult to feed.

Microslide prepared by P. Ralph, held at MoNZ. Label 1 (older): *Cnidonema vallentini*, 1946, M1. Label 2: *Staurocladia hodgsoni* Browne, M1. The slide contains two medusae in poor condition. The larger one is 1.4 mm in diameter with 31 tentacles with 1–2 accessory nematocyst clasps in aboral position, none in oral position, an aboral ring of nematocytes tissue, and 4 or more gastric pockets (gonads?) fill the subumbrella. The smaller one is 0.5 mm in diameter, with 7 tentacles but originally more, only a terminal nematocyst cluster on the tentacles and there may be an aboral nematocyst ring may be present.

DESCRIPTION:

Medusa stage: Crawling medusa unable to swim freely, bell much reduced, diameter up to 1.5 mm and only half as high. Manubrium pear-shaped, almost filling subumbrella; oral part of manubrium tubular

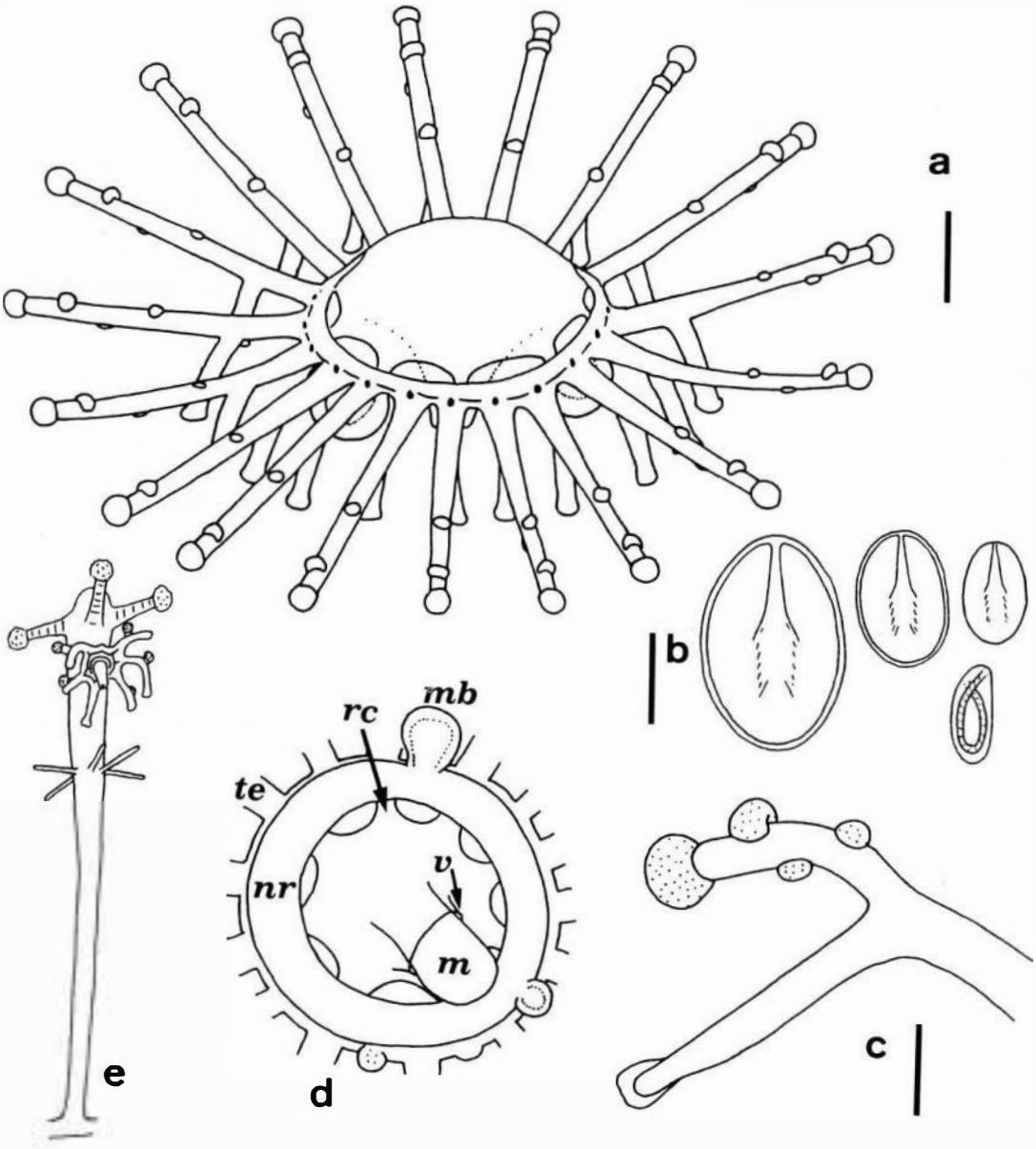


Fig. 81. ***Staurocladia vallentini,*** from life except e). **a)** medusa, not fully mature; scale bar 0.5 mm. **b)** cnidome of medusa: three sizes of stenoteles, desmoneme; scale bar 10 µm. **c)** lateral view of tentacle showing the aboral and oral position of the nematocyst clusters (shaded), CL; scale bar 0.2 mm. **d)** oral view of medusa, *m* manubrium, *mb* medusa bud, *nr* nematocyst ring, *rc* radial canal, *te* tentacle, *v* velum; CL, same scale as c). **e)** polyp stage with medusa bud, redrawn from Ralph (1953) with permission of Victoria University Press, same scale as a).

and very extensible, without nematocyst clusters around mouth. Gonads bulge from manubrium walls. Velum very broad, reaching manubrium. Between velum and bell margin a continuous ring of thickened epidermis containing many nematocysts. This region buds off new medusae in immature animals. Mostly 8 (6–11) short, unbranched radial canals issue from manubrium. Circular canal very broad. Up to 30 branched tentacles, each with an abaxial ocellus at its origin. Lower branch of tentacles with a suckerpad used to adhere to substratum, the upper and longer branch with a terminal knob of nematocysts and 2–3 aboral and 0–1 aboral nematocyst cluster.

Nematocysts:

a) larger stenoteles, (19–25) x (12–16) µm.
b) medium sized stenoteles, (14–15.5) x (8.5–10.5) µm.
c) smaller stenoteles, (11–13) x (7–9) µm.
e) desmonemes, (10–11) x (4.5–5.5) µm.

Colour: pink to orange, very opaque.

Polyp stage (after Gilchrist 1918 and Millard 1975): Hydroids colonial, hydranths born on slender hydrocauli arising directly from a tubular hydrorhiza, hydranth length up to 1.5 mm, slender at base and increasing in diameter distally, with 3–4 capitate oral tentacles and 4–6 filiform aboral tentacles. Hydrocaulus reaching 2 mm in length, covered with thin perisarc. Medusae buds develop slightly above level of filiform tentacles, with about 6 bifurcating tentacles at liberation, the aboral branch with a terminal nematocyst cluster.

TYPE LOCALITY: Falkland Islands.

REMARKS: *Staurocladia vallentini* has been known from New Zealand since Ralph's 1947 paper, in which she described various stages of medusae and polyps found in her aquarium and the sea. It is not apparent that Ralph followed the development of single medusae – which is rather difficult – but most probably she assembled various sizes of medusae into a developmental pattern. She described some unusual developments such as the shifting of the position of the tentacular nematocyst clusters and also variations in the gonads. Such features are atypical and were not observed in the present study. From re-examination of part of her material and much new living material it became evident that she had two different species before her, *S. vallentini* and *S. wellingtoni*, a new species described below. A polyp depicted in Ralph's work of 1953 as *Staurocladia hodgsoni* (plate III, fig. 16A) is most probably the polyp of *S. vallentini*. Its medusa bud has six tentacles and only terminal nematocyst clusters. The figure and her description of the polyp (Ralph 1947) differ from other descriptions of *S. vallentini* only in the more distal position of the medusa bud (cf. Gilchrist 1918, Hirohito 1988). Unfortunately no polyps could be found in this study. The medusae of the available material agreed well with other descriptions. The only observed difference was the higher number of radial canals, which is rather variable in other populations too. The youngest observed medusae had six radial canals.

Staurocladia wellingtoni differs radically from *S. vallentini* at all stages. The main differences are: size, colour (orange versus yellow-brown), position of tentacular nematocyst clasps, presence of a nematocyst ring, absence of oral nematocyst clusters, and presence of filiform tentacles in polyp. It was interesting to note, however, that both were often found together on the same algal frond.

RECORDS FROM NEW ZEALAND: Wellington area (this study), Leigh (Barnett 1985).

OTHER RECORDS: Falkland Islands; Australia; South Africa; Japan (Hirohito 1988); Bermuda (Kramp 1959).

Staurocladia wellingtoni n. sp.

(Figs. 82a-g, 83a-d, cover)

Staurocladia vallentini: in part Ralph 1947: 417, fig. 4B.
Staurocladia hodgsoni: in part Ralph 1953: 70.

MATERIAL EXAMINED:

Four slides prepared by P. Ralph, held at MoNZ Wellington, labelled "*Staurocladia hodgsoni* July 1952 from Aq. Tank"; 8 medusae total.

Ca. 60 living adult and many juvenile stages from 16-tentacle stage on, collected 30.1.94, 11.3.94, 26.4.94, and 25.8.94, on macroalgae *Cystophora torulosa* and *C. retroflexa* at 0.5–2 m, western side of Te Raekaihau, Wellington. One male medusa from first batch was selected as holotype H-650. Part of the remaining material is deposited as paratype P-1080.

A colony with 5 polyps (2 with medusae buds) growing on stone from western side of Te Raekaihau Point, collected 11.4.94, at 1–2 m, cultivated in aquarium until 23.5.94 when polyps were discovered. One of the two medusae buds was released and the medusa cultivated to the 24-tentacle stage. Polyps and especially medusae were easy to cultivate. The medusa was kept in a small petri dish in 5 ml sea water and fed daily with several *Artemia* nauplii. Medusa deposited.

DESCRIPTION:

Adult medusa: Crawls on macroalgae and unable to swim freely. Umbrella a shallow bell, much wider than high, diameter up to 4 mm without tentacles, the jelly thin but noticeable. Velum broad, fitting closely around the manubrium which may protrude from the

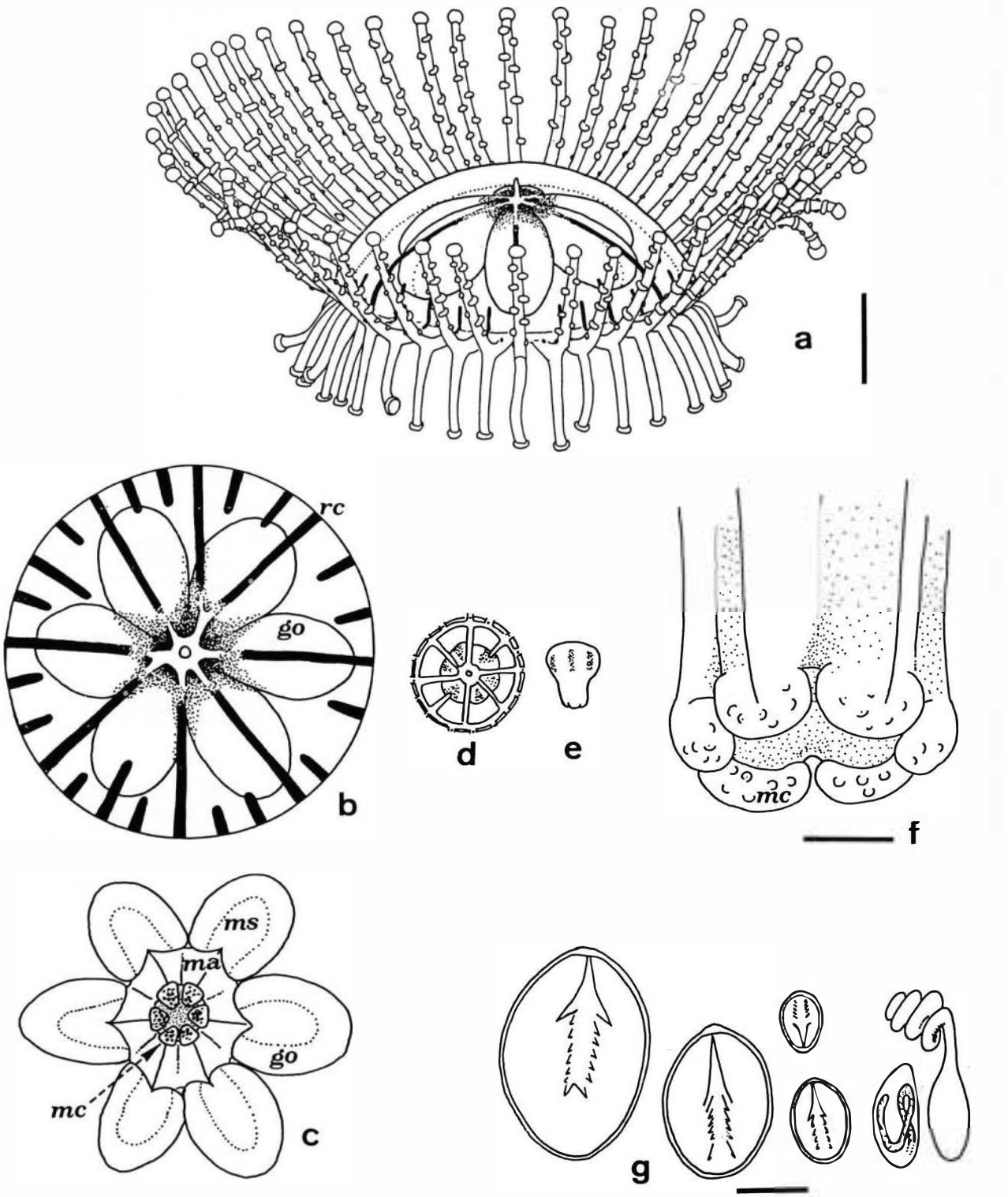


Fig. 82. *Staurocladia wellingtoni* n.sp., all fromlife. **a)** adult medusa from western side of Te Raekaihau, Wellington; scale bar 1 mm. **b)** aboral view of bell of female medusa, no tentacles shown, same scale as a). **c)** oral view of manubrium and gonad sacs of a male medusa, note the six nematocyst knobs (*mc*) on lip, same scale as a). **d)** aboral view of bell of a young medusa from nature, 16-tentacle stage, same scale as a). **e)** side view of manubrium of medusa depicted in d), shaded area is pigmented black, note presence of nematocyst knob on lip margin, same scale as a). **f)** side view of manubrium of an adult medusa, the mouth knobs (*mc*) continue as ridges along the manubrium; scale bar 0.2 mm. **g)** nematocyst of adult medusa, from right: four sizes of stenoteles, desmoneme and discharged desmoneme; scale bar 10 µm. Abbreviations: *go* gonads, *ma* manubrium, *mc* mouth knobs, *ms* manubrial sacs, *rc* radial canals.

subumbrella. The upper part of the tubular manubrium with 6, rarely 5, large mobile protrusions (sacs) covered by the gonads. Female gonads contain a large number of small eggs (diameter 74 µm, spawned). Mouth rim is lined by 6 conspicuous knobs of nematocyst clusters that continue over the outside of the manubrium as gentle ridges without nematocysts.

Long radial canals originate at apex of manubrium; normally 8 complete radial canals, 2 pairs of which may fuse near the manubrium. This branching pattern variable. Between the complete radial canals, there are 2-4 centripetal, incomplete radial canals originating from the circular canal. Radial canals are darkly pigmented. The pigmentation of the complete canals

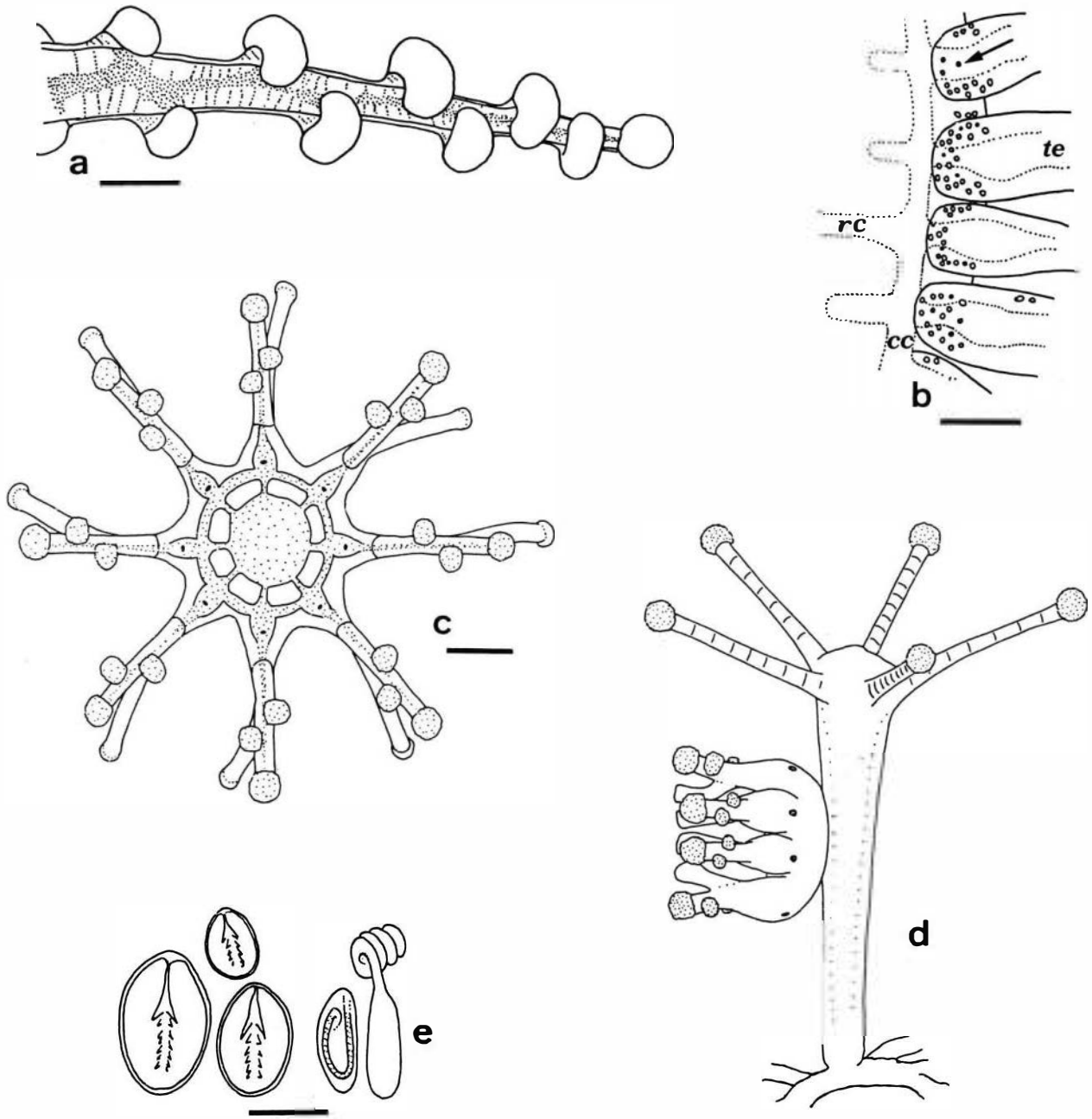


Fig. 83. ***Staurocladia wellingtoni*** n.sp., all from life. a) CL drawing of tentacle of adult medusa viewed from aboral, pigmented region in gastrodermis is shaded; scale bar 0.2 mm. b) CL drawing of tentacle bulb region of an adult medusa from oral, the arrow indicates a nematocyst, no continuous ring of nematocysts is present; scale bar 0.2 mm. **c)** aboral view of a one day old medusa released form polyp shown in d); scale bar 0.2 mm. **d)** polyp stage with medusa one-day before liberation, same scale as c). **e)** nematocysts of polyp stage, from right: three sizes of stenoteles, desmoneme and discharged desmoneme; scale bar 10 µm. Abbreviations: *cc* circular canal, *rc* radial canal, *te* tentacle.

fades towards the centre and then becomes a white star or hexagonal-shaped disk on top of stomach base. The complete radial canals are not in phase with the gonads. Up to 55 marginal tentacles, each up to 3 mm long with a red abaxial ocellus. The tentacles are bifurcated into a lower branch ending in an adhesive organ used for walking and adhering, and an upper branch with nematocyst clusters. The upper branch longer than the lower one, bearing a terminal spherical cluster and up to 6 lateral clasps of nematocyst alternating on each side. Tentacles hollow, the lumen lined by dark pigment. No nematocyst ring along the bell margin. Nematocysts:

a) stenoteles size class 1, (28–30.5) x (20–21) µm.
b) stenoteles size class 2, (17.5–24) x (13–15) µm.
c) stenoteles size class 3, (9.5–14.5) x (7–9.5) µm.
d) stenoteles size class 4, (7–9) x (5.5–6.5) µm.
e) desmonemes, discharged with 3–4 coils with bristles, (10.5–14.5) x (4–6) µm.

Colours in life: gonads of female brown-yellow opaque, in male olive-green transparent, both gonads covered with black pigment towards the centre; lumen of tentacles and radial canals dark brown to black, apex of manubrium white; sucker pads of lower tentacle branch light yellow.

Newly released medusa: Bell diameter 0.5 mm, umbrella flat, with 8 branching tentacles, lower branch with adhesive organs, upper branch with a terminal spherical nematocyst cluster and a pair of lateral clasps. Eight ocelli. No nematocyst ring, no manubrial sacs, with 6 small nematocyst clusters on mouth margin. Eight short radial canals, medusae buds lacking (also during later development).
Colour: pink.

Growth table (time in days):

1: Newly released medusa (see description and Fig. 83c).
3: New tentacle buds grow.
5: Bell grows, radial canals lengthen.
6: Stomach turns white, four pairs of lateral clasps.
8: 16 tentacles, now the same morphology as the youngest stages observed from nature (cf. Fig. 82d).
14: Bell diameter 1 mm, 2–3 pairs of lateral clasps.
17: Four pairs of lateral clusters, 16 tentacles, stomach sacs grow.
24: 24 tentacles, gonad tissue starts development, bell 1.8 mm diameter, centripetal canals start to grow.
53: 24 tentacles, bell 3 mm diameter, gonads well formed.

Polyp stage: Hydroid colonies arising from attached, ramifying stolons. Hydranths arise directly from stolons and have no caulus. Hydranths spindle-shaped, up to 1.2 mm high, with conical hypostome. With 4–5 oral capitate tentacles containing 8–10 chordoid gastrodermis cells. Filiform aboral tentacles absent. Medusa bud in middle of hydranth body, not covered by perisarc. Eight incipi-ent tentacles of medusa visible from an early stage of development. Hydranths are very contractile and rather sensitive to stimuli.
Colour pink-orange.
Nematocysts:

a) stenoteles, very variable in size, (4.5–17.5) x (4–13) µm.
b) desmonemes, also in tentacles, with ropy thread in nondischarged capsules, with bristles on inside of coils, discharged with 4 coils, (11.5–14.5) x (4–5.5) µm.

TYPE LOCALITY: Subtidal, western side of Te Raekaihau, Wellington, New Zealand.

ETYMOLOGY: The species name refers to the type locality near Wellington. With this naming the author also wishes to express his deep appreciation for the city of Wellington which made him feel really at home.

REMARKS: *Staurocladia wellingtoni* is quite a conspicuous medusa which can be collected only by screening through *Cystophora* algae. In January 1994 it was abundant, and there were often more than four animals per plant. It was interesting to note that the species occurred together with the other crawling medusa *Staurocladia vallentini*, which, in contrast to *S. wellingtoni* was not mature at this time. The co-occurrence may be incidental, as *Cystophora* seems to be the preferred substratum for epibiontic cnidarians compared to other macroalgae in the intertidal. At that time also the densities of the brooding anemone *Cricophorus nutrix* and of thecate hydroids appeared much higher on *Cystophora* than on other algae.

According to Bouillon (1978a) there are only three species of *Staurocladia* with several lateral nematocyst clusters on their tentacles. Of these, *S. hodgsoni* (Browne, 1910) is the only one that has no complete nematocyst ring and is the one most closely related to *S. wellingtoni*. Due to its occurrence in Antarctica, *S. hodgsoni* has not often been examined and reinvestigation with detailed comparisons to *S. wellingtoni* would be valuable. *Staurocladia wellingtoni* differs from *S. hodgsoni* (Browne, 1910) in the following details: it is at least twice as large; has up to twice as many tentacles; completely lacks a nematocyst ring; has six nematocyst clusters on mouth margin; long radial canals compared to very short ones; the gonads are on six regular, large protrusions of the manubrium; and the eggs are considerably smaller. In *S. hodgsoni*,

the gonad also forms swellings, but they are irregular, immovable and mainly result from the large eggs. The structure of the mouth rim in *S. hodgsoni* is not very clear. Browne (1910: 28) described the mouth as small and circular, but in his figure 3 of plate 3, six knobs appear to be present. The extent of the incomplete nematocyst ring in *S. hodgsoni* is also not clear. It may be very similar to that in *S. wellingtoni*. In *S. wellingtoni* there are only some nematocysts in the adaxial sides of the tentacular bulbs, a condition also seen in many other Anthomedusae (Fig. 83b).

Ralph (1947) noted the presence of *S. wellingtoni* (as *S. vallentini*); most of her material (from Island Bay, Wellington) was actually the latter species, in which she observed the polyp and medusa stages. Ralph's (1947) description and figures make it obvious, however, that she also had *S. wellingtoni* in her material. The only material left predating the publication date 1947 is a slide from 1946 with two *S. vallentini* (see under this species). The occurrence of two species would explain her difficulty in reconciling the different morphologies. In her 1953 key she referred all of her material to *S. hodgsoni*, but gave no figure of the medusa. The illustrated and described polyp, however, is *S. vallentini*.

The polyp of *S. wellingtoni* is unique in having desmonemes (Fig. 83e). They are also present in the capitae of the tentacles. Polyps of the Cladonematidae and many other Capitata like the Corynidae do not have desmonemes in the polyp stage. This lack has been interpreted as a good synapomorphy for several families by Petersen (1990). But other species within these groups may also prove to have desmonemes see (e.g., *Coryne* sp. 1).

The presence or absence of filiform aboral tentacles is a somewhat problematic character. In many species of Corynidae with filiform tentacles these are present only in cultures and rarely in material from nature (Brinckmann-Voss 1970). Only one colony of polyps of *S. wellingtoni* could be examined, but they were from a laboratory culture and lacked filiform tentacles, *S. wellingtoni* polyps almost certainly always lack filiform tentacles. The newly released medusa is easily identifiable because it already has several lateral nematocyst clusters, lacks a nematocyst ring, and has six incipient nematocyst clusters on its mouth margin. Other distinguishing characters of newly hatched medusae of *S. vallentini* are eight tentacles as opposed to six, and the absence of medusa buds in later development (Figs 82d, 83c-d).

The stenotele 3 and 4 of the medusa belong to the same, variable class. The stenoteles of the polyp are very variable in size and are not classifiable in subclasses.

RECORDS FROM NEW ZEALAND: Known only from the Wellington south coast.

Family SOLANDERIIDAE Marshall, 1873

Hydroids forming large branching colonies. With chitinous internal anastomosing skeleton formed by coalescence and modification of adjacent hydrocauline tubes. Coenosarc covering entire colony and penetrating skeletal interstices. Hydranths borne over whole surface of colony, uniform in structure, cylindrical; with single circlet of capitate tentacles around mouth and numerous similar tentacles dispersed over body. Gonophores where known cryptomedusoid or eumedusoid sporosacs arising directly from the coenosarc.

TYPE SPECIES: *Solanderia gracilis* Duchassaing & Michelin, 1846.

REMARKS: The above diagnosis is taken from Bouillon and Cornelius (1988) and only slightly modified to include the cryptomedusoid gonophores of *Solanderia gracilis* Duchassaing & Michelin, 1846 (see Wedler & Larson 1986).

Bouillon *et al.* (1992b) recently revised the family and included two genera: *Solanderia* and *Chitina*. *Chitina* was re-established by Bouillon and Cornelius (1988) and supposedly differed from *Solanderia* in having bushy colonies and hydranths confined to the hydrocladia. As outlined below, however, this generic separation cannot be maintained because the bushy appearance is not a constant and characteristic feature of *S. ericopsis*.

Solanderia Duchassaing & Michelin, 1846

SYNONYM: *Chitina* Carter, 1873

Diagnosis as for the family.

TYPE SPECIES: *Solanderia gracilis* Duchassaing & Michelin, 1846.

REMARKS: Only *Solanderia ericopsis* (Carter, 1873) is known from New Zealand.

Solanderia ericopsis (Carter, 1873)

(Fig. 84a-g, frontispiece)

Chitina ericopsis Carter, 1873: 13; Bouillon & Cornelius 1988: 1551, figs 1-5, 7.

Solanderia misakinensis: Wineera 1968: 2, figs 1–2, pls 1–3.

[Not *Solanderia misakinensis* (Inaba, 1892)]

MATERIAL EXAMINED:

1 colony from Goat Island, Leigh, 1 m, collected 9.8.1991, examined alive, fertile, ca. 150 mm high, fan-shaped.

3 colonies from Barretts Reef, Wellington Harbour entrance, 11 m, collected 5.2.1994 and 13.12.1994, examined alive, fertile, both fan-shaped but one with slightly bushy ends, 170–200 mm high.

2 small fragments from NZOI Stn C814, 37°40' S, 178°56.4' E, 194 m, 25.2.1962, polyps badly preserved.

1 colony from NZOI Stn I69, 36°11.2' S, 175°17.7' E, 23 m, 14.5.1975, collected by SCUBA, size 120 x 80 mm, slightly bushy although bent by preservation.

1 colony from NZOI Stn I357, 35°27.8' S, 174°44.1' E, 0–10 m, 20.11.1977, 100 x 100 mm, hydranths well-preserved, slightly bushy due to bending in jar, even main stem bears hydranths, fertile male.

1 colony from NZOI Stn I378, 34°09.5' S, 172°08.7' E, 0–24 m, collected 23.11.1977, by SCUBA, 140 mm high, no hydranths left, fan-shaped.

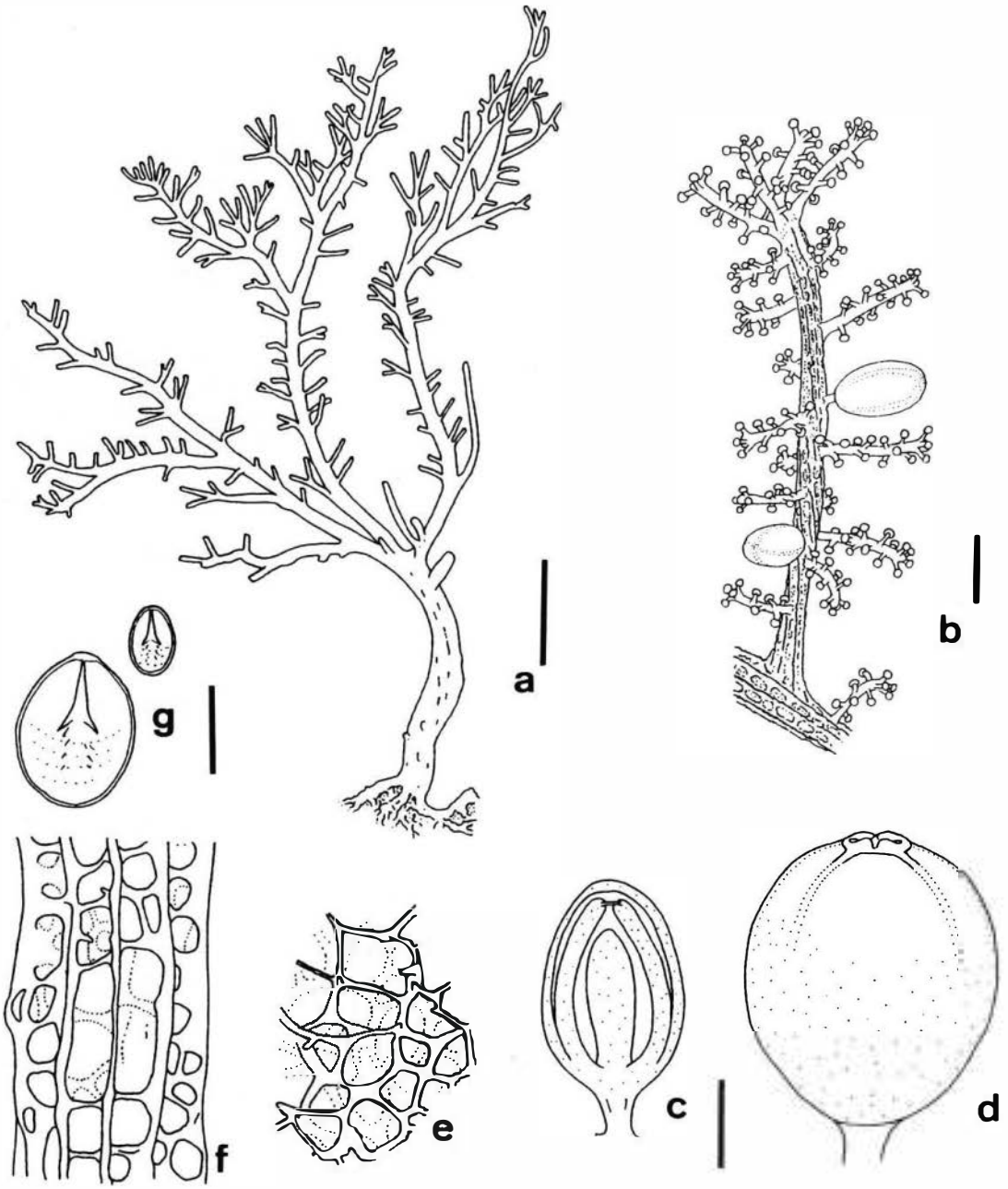


Fig. 84. ***Solanderia ericopsis.*** **a)** colony from Barretts Reef, Wellington; scale bar 2 cm. **b)** terminal branch with hydranths and gonophores, colony from Leigh; scale bar 1 mm. **c)** young gonophore from live material; scale bar 0.2 mm. **d)** mature male gonophore with gametes partly spent, same scale as c). **e)** skeleton from main stem, CL, same scale as c). f) skeleton of distal branches, longitudinal elements dominate, CL, same scale as c). **g)** nematocysts: stenoteles of two sizes; scale bar 10 µm.

1 colony from NZOI Stn J673, 36°26.37' S, 175°45.60' E, 2 m, 7.9.1974, 130 x 60 mm, dried sample, strictly fan-shaped.

Several fused colonies from NZOI Stn J674, 36°41.85' S, 175°55.20' E, 20–30 m, collected by SCUBA 8.9.1974, up to 180 mm, main stem fascicled, slightly bushy, bent into jar, a few gonophores present even on main branches.

2 colonies from NZOI Stn J698, 37°49.8' S, 176°51.8' E, 6–10 m, collected by SCUBA 10.7.1974, size 77 x 60 and 50 x 30 mm, soft tissues deteriorated, larger colony fan shaped but bent, smaller one slightly bushy but also bent.

1 colony from NZOI Stn J705, 37°16' S, 176°51' E, 190 m, collected 11.9.1974, up to 200 mm, highly bushy and chaotic colony, attached to old stem of antipatharian or gorgonian, most hydranths lost, with gonophores.

1 colony held by MoNZ, collected 19.9.1970, White Rock, Wairarapa, 5 m, 120 mm high, infertile, bushy cylinder, but bushiness mostly confined to terminal branches.

DESCRIPTION: Very large hydroid colonies, 5–50 cm in height, mostly fan-shaped but part of colony or whole may have a bushy appearance. Colony composed of one or several fascicled stems with a diameter of up to 25 mm, from which hydrocladia arise at irregular intervals; yellow to light brown in colour. Branches bifurcating several times in succession, resulting in gradually finer and more delicate branches. When there are several stems these may fuse; branches only rarely anastomose. Main stems issuing from a well developed meshwork of root-like processes. Skeleton internal, penetrated by and covered with coenosarc. Skeleton of larger rootlets, main stems and principal branches a dense network of chitinous fibres, surface fibres thinner than deeper ones, openings round to oval (Fig. 84f). Skeletal network of finer branches less closely reticulate, more fenestrate, predominantly and distinctively with longitudinal elements visible even in living material. Longitudinal fibres joined by rather well-spaced transverse connections. Peripheral longitudinal fibres forming gentle protrusions from surface thus delimiting grooves of coenosarc of varied length separated by ridges of skeleton (Fig. 84b). Hydranths 1.2–2 mm high, tubular to club-shaped with rounded hypostome, with an oral whorl of 3–5 capitate tentacles and further below them 12–16 scattered capitate tentacles, hydranths more numerous towards terminal ramifications, rare on main stems. Hydranths arise in all planes from superficial coenosarc and are not accompanied by hydrophoral structures. If occasionally flanked by shallow triangular elevations of the longitudinal skeletal elements these do not occur on both sides of the hydranth. Gonophores remain fixed as sporosacs, with 4 radial canals ending in small bulbs, with circular canal and spadix (eumedusoids). Size of gonophores up to 1.1 mm, oblong to spherical, with a short stem. Nematocysts:

a) larger stenoteles, (15–18) x (12–15) μm.

b) smaller stenoteles, (6.5–9.5) x (4.5–7) μm.

TYPE LOCALITY: New Zealand (exact locality unknown).

REMARKS: With the exception of the generic characters, all the examined material agrees perfectly with the description of *Chitina ericopsis* given by Bouillon and Cornelius (1988). There can be little doubt that they belong to the same species, even more so as their samples were from Wellington Harbour. However, the present material shows that the generic distinction of *Chitina* as having a bushy growth cannot be maintained. The colony shape can be bushy, but more often it is strictly fan-shaped. Both branching patterns may even occur in the same colony. It could be that the type of growth is determined by the prevailing currents. In addition, it is apparent from Bouillon and Cornelius (1988, figs 1–2) that their material is bent and folded, probably caused by stuffing these large colonies into smaller jars for preservation. This can also produce a bushy appearance as was observed during this study with fresh material. The other character that supposedly separates *Chitina* from *Solanderia* is the absence of hydranths from the main branches. With more and living material examined this character too was seen to be invalid. Hydranths may even occur on the main trunks, although not frequently. The only way to distinguish the two genera therefore, would be the potential or bushy growth in *Chitina*. However, this seems to be insufficient to warrant generic distinction and *Chitina* is here synonymised with *Solanderia*.

From the figures given by Wineera (1968) it is quite obvious that he also had *S. ericopsis* and not *S. misakinesis*. Therefore, contrary to Bouillon *et al.* (1992b), the latter species is not known from New Zealand.

The gonophores of *S. ericopsis* are described here for the first time and they resemble the gonophores of many other species in the genus. *Solanderia* species are rather difficult to separate and the number of species has been drastically reduced by Bouillon *et al.* (1992b). *Solanderia ericopsis*, especially in its fan-shaped form, is rather similar to *S. secunda* (Inaba, 1892). Although the latter has hydrophores, they may often be reduced, but in at least some colonies they are generally present (Bouillon *et. al.* 1992b). In contrast to this, all examined specimens of *S. ericopsis* lacked any hydrophoral structures. The only other similar species of *Solanderia* that completely lacks hydrophores is *S. gracilis*. It is, however, distinct from *S. ericopsis* in having cryptomedusoids instead of eumedusoids (see Wedler & Larson 1986), being purple instead of yellow, and having hydranths in one plane only.

Solanderia ericopsis forms very large, conspicuous colonies which are often noted by divers. The colonies

may even occur in rather shallow water. During long-term monitoring of defined rock areas around the Poor Knights Islands, Dr C. Battershill was able to observe one colony of *S. ericopsis* for more than 15 years (pers. comm.). During this time the colony reached more than 50 cm in height (frontispiece). Apparently, *S. ericopsis* forms unusually long-lived colonies.

RECORDS FROM NEW ZEALAND: Rather frequently found around the North Island; see under material examined.

OTHER RECORDS: Not known outside of New Zealand.

Family PENNARIIDAE McCrady, 1859

Colonial hydroids with tubular, ramified hydrorhiza and upright, pinnately branched hydrocauli bearing polyp cauli on upper side only. Perisarc tubular, thick, and firm. Hydranths terminal, clavate to pear-shaped, each with an aboral whorl of filiform or slightly capitate tentacles, an oral whorl of short capitate tentacles, and one or more distinct or indistict whorls of short capitate tentacles between.

Gonophores borne just above aboral tentacles, either liberated as short-lived medusae or remaining attached to hydranth as eumedusoids. Gonophore elongated with thin mesogloea, manubrium short, mouth lacking. Radial canals four. Tentacle bulbs four. Tentacles absent or rudimentary. Ocelli present or absent. Gonads surrounding manubrium. Only one genus: *Pennaria*.

Pennaria Goldfuss, 1820

With the characters of the family.

TYPE SPECIES: *Pennaria disticha* Goldfuss, 1820.

REMARKS: At present, it is not clear whether *Halocordyle* or *Pennaria* should be used to name this genus (Garcia-Corrales & Aguirre 1985; Calder 1988; Gibbons & Ryland 1989). Following the arguments of Gibbons and Ryland (1989) and for the sake of stability of nomenclature the name *Pennaria* is used in the present study. Only one species is nown from New Zealand.

Pennaria disticha Goldfuss, 1820 (Fig. 85a-c)

Pennaria disticha Goldfuss, 1820: 89; Brinckmann-Voss 1970: 40, text-figs 43, 45–50; Gibbons & Ryland 1989: 387, fig. 5.

Halocordyle disticha: Millard 1975: 41, fig. 16C–G; Garccia-Corrales & Aguirre 1985: 85, figs 1–3 (*cum syn.*), Calder 1988: 57, figs 43–45 (*cum syn.*), Oestman *et al.* 1991: 607, figs 1–18; Hirohito 1988: 28, figs 9a-d, pl. 1, fig. C (*cum syn.*)

Pennaria australis Bale, 1884: 45; Trebilcock 1928: 1; Ralph 1953: 70, figs 14, 21.

MATERIAL EXAMINED:

Several colonies from on underside of raft near Devonport wharf, Auckland, collected and preserved 13.2.1994, size 2–5 cm, one colony with medusae buds. Material deposited.

NZOI collection Z1060, from unknown port in NZ, labelled *Pennaria australis*, polyps lost.

DESCRIPTION: Hydroid colonies forming branching feather-like stems up to 50 mm high, arising from attached ramifying stolons. Growth monopodial with terminal hydranths. Main axis often curved, not fascicled, 0.15–0.25 mm thick, thicker in middle part, annulated in more or less regular intervals distal to insertion of hydrocladia (side branches). Main axis and hydrocladia deeply black, then colour fading to clear more distally. Hydrocladia up to 16 mm long, longest cladia in middle of axis, originating approximately 1.5 mm apart from each other on alternate sides of main axis. The hydrocladia of one side form an angle of about 140° with those from the other side and are slightly curved. They bear either hydranths on pedicels (ramuli) or secondary hydrocladia with hydranths again on pedicels, spacing 1.5 mm. The main axis and the hydrocladia bear a terminal hydranth. Pedicels (ramuli) of hydranths originate on upper side of hydrocladia, with annulation at their base, younger ones without annulation. Hydranths are spindle- to pear-shaped, up to 1 mm long, with an aboral whorl of about 12 long, filiform to slightly capitate tentacles and up to 16 short capitate oral tentacles scattered on distal half of hydranth. Nematocysts of aboral tentacles mainly on aboral side and terminally (= semifiliform according to Petersen 1990). Hypostome dome-shaped. Gonophores are degenerate oblong medusae arising on short stems just above aboral tentacles, with gonads encircling manubrium, 4 radial canals and circular canal, 4 marginal bulbs, without ocelli or tentacles. Nematocysts:

a) stenoteles size class 1, in capitate tentacles, (31–36) x (17–21) µm.
b) stenoteles size class 2, (15.2–16) x (10.5–12) µm.
c) stenoteles size class 3, (8–10) x (6–7.5) µm.
d) stenoteles size class 4, (6.5–8) x (4.5–6.5) µm.
e) microbasic heteronemes with inclusion body (mastigophore?), in aboral tentacles, not seen discharged, (11–14) x (5–7) µm.
f) microbasic heteronemes without inclusion body (mastigophore?), rare, only one undischarged seen, 11 x 5 µm.

g) basitrichous isorhizas, (7–9) x (2.5–3) µm.
h) desmonemes, (5–5.5) x (3–4) µm.

TYPE LOCALITY: Gulf of Naples, Mediterranean.

REMARKS: *Pennaria disticha* is a large, conspicuous hydroid which is easy to detect. The species name *australis* was erected for animals with a paucity of annulation of the ramuli. This is, however, a variable character and all modern authors treat *P. australis* as a synonym of *P. disticha.*

In the examined samples, no release of medusae was observed as the colonies were kept alive for few hours only. The sizes of the nematocysts of the present sample agree quite well with the data of Calder (1988). There are some differences from the data of Oestman *et al.* (1991). They did not include the basitrichous isorhiza (haploneme) seen by Calder (1988) and also in the present samples. There is also some discrepancy concerning the types of the heteronemes (euryteles versus mastigophores). Unfortunately, the present data do not allow a conclusion on that matter.

RECORDS FROM NEW ZEALAND: Auckland Harbour (Trebilcock 1928; Ralph 1953; this study).

DISTRIBUTION: Circumglobal in tropical to warm-temperate waters (Gibbons & Ryland 1989).

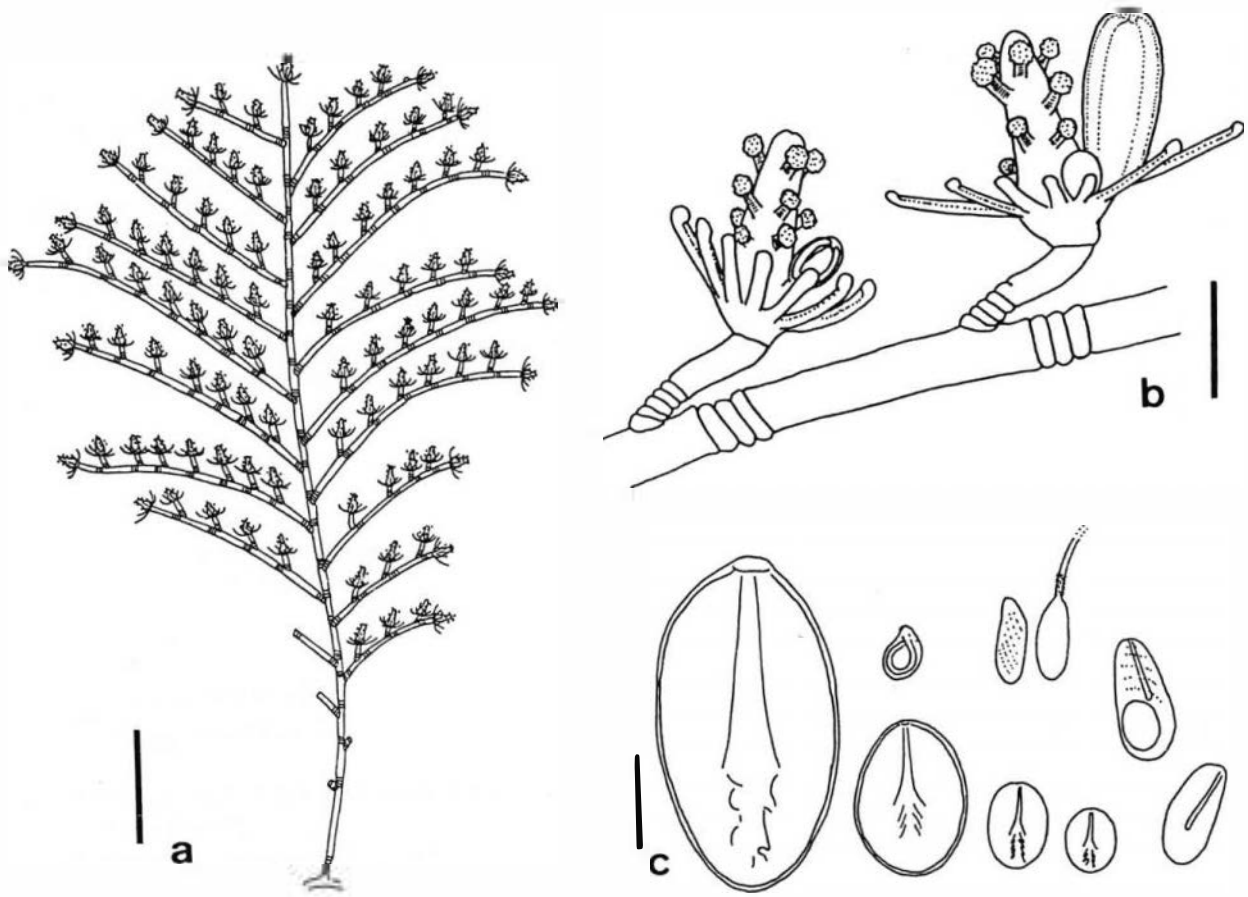


Fig. 85. ***Pennaria disticha*** from preserved material. **a)** Colony form; scale bar 5 mm. **b)** Part of hydrocladium with two hydranths bearing medusae buds of different stages, at right almost mature; scale bar 0.5 mm. **c)** Nematocysts, clockwise from right: four size classes of stenoteles, rare heteroneme without inclusion (mastigophore?), heteroneme with inclusion body (mastigophore?), basitrichous isorhiza and same discharged, desmoneme; scale bar 10 µm.

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APPENDIX

Growth stages of *Bougainvillia vervoorti*

Medusae were released from polyps collected from nature. Several medusae were examined but data are for one representative medusa.

Day	Size (mm)	Branching of oral tentacles	Marginal tentacles/bulb	Remarks
1	0.8	0	2	tentacles short
2	1	0	2	tentacles grow
5	1.7	1	3	stomach base cruciform
6	1.8	1	3	-
7	2	1	4	-
8	2.2	1	4	manubrium turns green
9	2.6	2	5	perradial manubrium extensions grow
11	3	3	6-7	-
12	3.2	3	7	-
13	3.2	3	7-8	-
14	3.4	3	8	-
15	3.6	3-4	8-9	-
17	3.6	4	10	female gonad tissue well visible

Results of crosses between different morphs of *Sarsia eximia*

Pairs of medusae of *Sarsia eximia* belonging to both observed extrema of morphologies (normal bell-shape to cylindrical form) were kept in small petri dishes in millipore-filtered sea water. The animals were kept for 16 hours in the dark and then transferred to bright light which induced spawning.

The results are given below. The normal form is always left, the cylindrical form right. Not all sizes could be measured because some bells shrunk overnight. In the columns labelled "manubrium", the length of the manubrium in proportion to the bell cavity height is given. Only cross no. 4 did not yield larvae. The male used for this cross was somewhat small and may have been immature. Otherwise, more than half of the spawned eggs developed into embryos.

Legend: sex = sex used; size = umbrella height; manubrium = fraction of manubrium length to subumbrella height; result = observed result, embryos were followed up to gastrula stage.

Rounded bell				Cylindrical bell			Results
cross	sex	size	manubrium	sex	size	manubrium	
1	male		1/2	female	-	1/1	10 embryos
2	female	3 mm	2/3	male	3.6 mm	1/1	30 embryos
3	female	-	1/1	male	-	1/1	11 embryos
4	male	2.2 mm	2/3	female	3.6 mm	2/3	few eggs, no development
5	male	3 mm	1/1	male	3.6 mm	1/1	17 embryos

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