

## ***Eudendrium* (Cnidaria: Hydrozoa) from Bunaken Marine Park, Sulawesi Sea, Indonesia**

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**Stefania Puce, Carlo Cerrano, Cristina Di Camillo, Giorgio Bavestrello, and Antonio Carlos Marques (2006)** *Eudendrium* (Cnidaria: Hydrozoa) species from Bunaken Marine Park, Sulawesi Sea, Indonesia. *Zoological Studies* 45(4): 616-625. Three species of the genus *Eudendrium* were recorded from the Bunaken Marine Park (North Sulawesi, Indonesia). The new species *Eudendrium garis* sp. nov. is well characterized by the aggregation of microbasic euryteles in vertical stripes, in which the nematocysts are generally also vertically oriented, and by the eggs which are linked to the blastostyle by a small concave perisarcial support. The female gonophores of the Australian *E. aylingae*, unknown hitherto, are herein described. They are characterized by having a simple and curved spadix with the distal end free, turning away from the egg, forming a prominent nose. The 3rd recorded species is *E. racemosum*. Its presence in Indonesian water confirms the other Indo-Pacific records and indicates a Tethyan distribution for the species.  
<http://zoolstud.sinica.edu.tw/Journals/45.4/616.pdf>

**Key words:** *Eudendrium*, Hydrozoa, Indonesia, Biodiversity, Distribution.

Information about hydroids from the tropical Indo-West Pacific is generally included in expeditionary reports and scattered accounts in collections from specific regions or groups of islands, such as the voyages of the *Uranie* (Lamouroux 1824), *Challenger* (Allman 1883 1888), and *Siboga* (Billard 1913 1925). Information about hydroids of the Indian Ocean (Ritchie 1910, Mammen 1963 1965 1967), and results of expeditions to the Malay Archipelago, the seas of Indochina, and the Philippines are also available (Pictet 1893, Bedot 1909, Hargitt 1924, Nutting 1927, Leloup 1937). The most recent reports on hydroids are from Papua New Guinea (Bouillon et al. 1986), the Philippines, Indonesia (Makassar Strait), New Caledonia (Vervoort 1993), Indonesia (Schuchert 2003), and New Zealand (Vervoort and Watson 2003).

The Indo-Pacific species of the genus *Eudendrium* have received more attention during the last 50 yrs. The *Eudendrium* species from Sagami Bay (Japan) were first studied by Stechow (1913), and later by Yamada (1954) and Hirohito (1988). Complete surveys of species from Australia and New Zealand were carried out by Watson (1985 1987) and Schuchert (1996). Millard and Bouillon (1973 1974) and Millard (1975) studied the genera of southern Africa. Scattered records and descriptions of new species have also been made elsewhere, including material from India, Indochina, Korea, the Philippines, Papua New Guinea, Macquarie I., and the Maldives.

The goal of this study was to provide a survey of the *Eudendrium* fauna of the Bunaken Marine Park, North Sulawesi, Indonesia, an area com-

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monly considered to be a hotspot of marine biodiversity due to its position at the intersection of the Indian and Pacific Oceans), and its geological history (Sheppard and Wells 1988, Muller 1996, Tomascik et al. 1997, Edinger et al. 1998).

## MATERIALS AND METHODS

Samples were gathered by scuba diving at different sites (Lekuan I, Lekuan II, Sachiko's Point, Siladen, Bualo, Manado Tua, Bunaken Timur, Depang Kampung, Mandolin, and Alung Banua) of the reef surrounding Bunaken I. (Fig. 1), during the period of 2001-2005. The sites all have similar characteristics: vertical winding walls with many cracks and canyons and caves characterized by strong currents. Alung Banua was the only sheltered site sampled. The Bunaken zone is characterized by the presence of a diverse and abundant sponge fauna. The collected samples were fixed in 4% formaldehyde. Drawings and photographs of the fixed material were made using both low- and high-power microscopes. Some of the drawings were made from live material just after being sampled. The cnidome terminology follows Weill (1934) and Mariscal (1974), and measurements of each type of nematocyst were made on non- discharged and, if possible, discharged capsules of the preserved material. Specimens described in this study, including the new species, are deposited in the Museo di Storia Naturale, Genova, Italy (MSNG). Abbreviations: MCZ, Museum of Comparative Zoology, Harvard Univ., Cambridge, MA, USA, MVF, Museum of Victoria, Victoria, Australia.

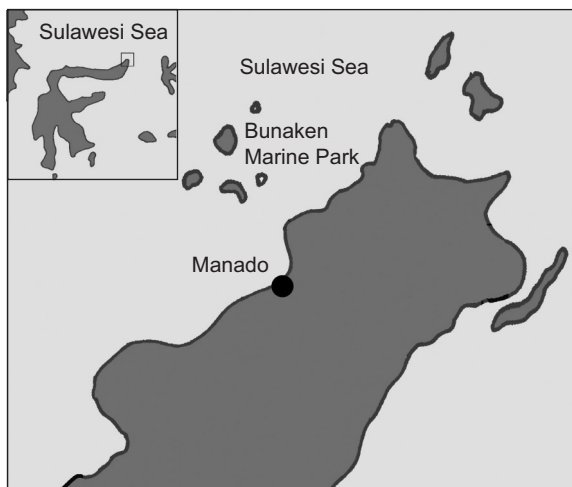


Fig. 1. Map of northern Sulawesi.

## RESULTS

### Family Eudendriidae

#### Genus *Eudendrium* Ehrenberg, (1834)

#### *Eudendrium garis* sp. nov. Puce, Cerrano,

#### Di Camillo, Bavestrello and Marques

(Fig. 2a-g)

*Type material*: Holotype MSNG 52718, formalin-preserved female colony. Siladen (Bunaken Marine Park, Indonesia), depth 40 m; coll. S. Puce and C. Di Camillo (scuba), Feb. 2005. Paratype MSNG 52719, formalin-preserved male colony on skeleton of dead black coral. Siladen (Bunaken Marine Park, Indonesia), depth 25 m; coll. S. Puce (scuba), Feb. 2001.

*Other material examined*: Sachiko's Point: 5 m, small colony, Jan. 2001; 20 m, colony on dead black coral, Jan. 2001; 35 m, small colony, Jan. 2001. Lekuan II: 6 m, colony on dead black coral, Jan. 2001. Manado Tua: 7 m, colony on red algae, Feb. 2001; 7 m, colony on orange-colored sponge, Feb. 2001; 20 m, arborescent colony, Feb. 2001. Bunaken Timur: 15 m, colony on ascidian, Feb. 2001. Siladen: 7 m, colony on sponge, Jan. 2001; 20 m, arborescent colony, Feb. 2001; 25 m, shrubby colony, Feb. 2001; 10 m, colony on algae, May 2004; 20 m, colony on dead black coral, Nov. 2004; 18 m, colony on sponge, Jan. 2005. Depan Kampung: 25 m, shrubby colony, Feb. 2001. Lekuan I: 5 m, colony on dead black coral, Jan. 2001. Bunaken National Park, Indonesia. Coll. S. Puce and C. Di Camillo (scuba).

*Description*: Colonies dioecious, shrubby, sometimes arborescent, up to 30 mm in height; main stem monosiphonic (Fig. 2a). Hydrocauli arising from creeping hydrorhiza; branches delicate, irregular, occurring over entire hydrocaulus, branches up to 1st-order in various planes; pedicels arising from main stem. Perisarc of caulus strong, ~0.02 mm thick, 0.10-0.17 mm in diameter, mostly smooth, rarely 1 or 2 annuli. Pedicels with 5 or 6 rings at origin, ~1 mm in length, 0.10-0.14 mm in diameter, perisarc 0.01 mm thick.

Hydranths delicate (Fig. 2b), 0.40-0.55 mm in height, 0.40-0.50 mm in diameter (measured in the body region just below tentacles), with a distinct groove in aboral region; smooth tentacles 20-24 in number, occurring in 1 whorl below hypostome. Hypostome relatively small.

Gonophores styloid, arising from body of hydranth. Immature styloid gonophores placed in

a circle around body of hydranth. Male blastostyles with 4-6 sporosacs, each sporosac 1-3 chambered (Fig. 2c); sporosac with a distinct spadix as its longitudinal axis, and a terminal tubercle on its apex; distal chamber 0.18-0.23 mm in diameter. Mature male blastostyles not reduced, with 20-24 tentacles. Male blastostyle pedicel vase-shaped, 1 mm in length, basal diameter 0.08 mm, distal diameter 0.10 mm, perisarc 0.01 mm thick. Female gonophores (Fig. 2d) arising on partially reduced blastostyles with ~16 degenerated tentacles, blastostyles mainly concentrated in basal 1/2 of colony. Immature eggs with a simple curved spadix. Blastostyle completely reduced during development, with spadices being shed. Mature eggs oval, linked to blastostyle or pedicel by short peduncles, which persist after planula release as a small concave perisarcal support (Fig. 2e). Four or 5 eggs per blastostyle, ~0.50 mm in diameter. Female blastostyle pedicel slightly vase-shaped, 0.45 mm in length, with 2 or 3 superficial rings at base.

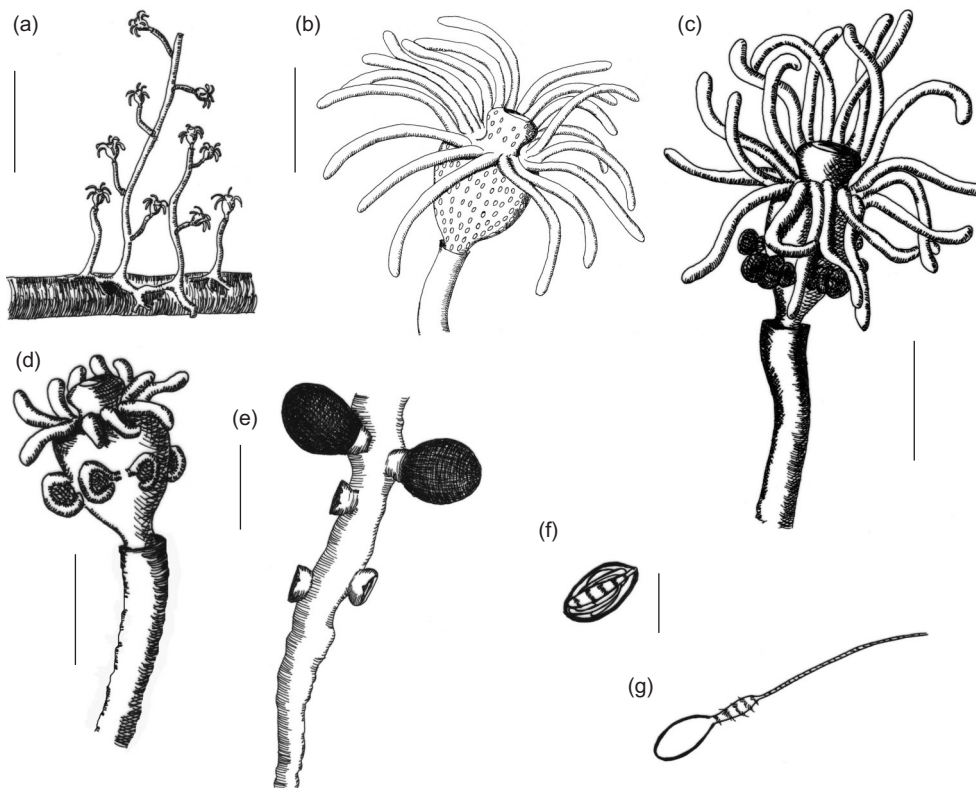
Nematocysts of 1 category, heterotrichous microbasic euryteles, in 2 size classes.

Small microbasic euryteles (not seen discharged),  $7.0 \times 2.5 \mu\text{m}$ , L: W = 2.8: 1, oval; abundantly and regularly distributed over hydranth body, coenosarc, hypostome, and tentacles.

Large microbasic euryteles (Fig. 2f, g) (seen discharged),  $22.0\text{-}27.0 \times 12.0\text{-}13.0 \mu\text{m}$ , L: W = 1.8-2.1: 1, bean-shaped; discharged capsule  $20\text{-}27 \times 7.0 \mu\text{m}$ , shaft  $20 \mu\text{m}$  long; abundant on hydranth body, forming vertical bands and generally their long axis oriented along the oral-aboral axis of hydranth, hypostome, and female spadix, and on marginal zone of chambers of male gonophores; rare in coenosarc.

*Etymology*: The specific name is derived from the Indonesian word "garis", meaning "stripe", and refers to the vertical nematocyst bands on the hydranth body.

*Remarks*: *Eudendrium garis* sp. nov. is well characterized by the aggregates of microbasic euryteles in vertical stripes, in which the nematocysts are generally also vertically oriented. This characteristic was not hitherto described for the genus *Eudendrium* and distinctly separates *E. garis* sp. nov. from the other species characterized



**Fig. 2.** *Eudendrium garis* sp. nov. Epibiontic colony (a), hydranth showing the typical nematocyst distribution (b), male blastostyle (c), female blastostyle (d), mature eggs with perisarcal supports (e), large microbasic euryteles undischarged (f) and discharged (g). Scale bars: a = 1 cm; b-e = 0.5 mm; f, g = 20  $\mu\text{m}$ .

by having large microbasic euryteles on both the body and the hypostome of the polyps.

The presence of aggregations of large nematocysts is a diagnostic characteristic also known from some other species of *Eudendrium*, viz. *E. arbuscula* Wright, (1859), *E. glomeratum* Picard, (1951) (see synonymy in Marques et al. 2000a), *E. magnificum* Yamada, (1954), *E. nambuccense* Watson, (1985), and *E. caraiuru* Marques and Oliveira (2003). Some of these species were previously dubbed the *E. glomeratum* species complex, but they exhibit significant ecological differences (Marques and Oliveira 2003, Oliveira and Marques 2005).

A closer comparison of *Eudendrium* species with large nematocyst aggregations revealed other features that are useful in distinguishing them. Despite the potential conspecificity of *E. glomeratum* and *E. magnificum* (Marques et al. 2000a: 205), several characteristics differentiate *E. garis* sp. nov. from the species listed above. Concerning the nematocyst types, for instance, *E. glomeratum* has macrobasic euryteles (cf. Picard, 1951), and *E. caraiuru* has euryteles (considered in the original description as macro- or mesobasic euryteles, see discussion in Marques and Oliveira 2003: 8) in which the proportion of the shaft: discharged capsule is higher compared with that of the microbasic euryteles observed in *E. garis* sp. nov. Although the nematocysts of *E. arbuscula* and *E. nambuccense* are microbasic euryteles, they differ in their arrangement on the hydranth, forming a continuous ring around the hydranth body. They are also smaller than those of *E. garis* sp. nov. (Watson 1985, Marques et al. 2000b, Marques 2001).

The nematocyst type of *E. magnificum* was not identified (Yamada 1954 1959, Hirohito 1988), but their arrangement in discontinuous warts at the apical 3rd of the hydranth clearly differs from that of *E. garis* sp. nov.

*Eudendrium garis* sp. nov. is also similar to several samples collected in Sagami Bay (Japan) and assigned to *E. tenellum* Allman (1877) by Hirohito (1988). Actually, the original description of *E. tenellum* by Allman (1877) is not suitable for species identification, because the type specimen has no polyps and no gonophores, making Allman (1877) himself consider the assignment of the specimen to the genus *Eudendrium* as dubious. Despite being unrecognizable because of the original description and the condition of the type specimen, the specific name *E. tenellum* has been adopted many times after its original description,

such as in Fraser (1914 1937, from Vancouver I. and the Pacific Ocean, respectively), Yamada (1954 1959) and Hirohito (1988) from Sagami Bay, Japan, and Calder (1972) from the northern Atlantic off Canada. The type material of *E. tenellum* (MCZ 50235, colony without gonophores, USA, off Florida, off Double-Head Shot Key, Gulf Stream Expedition, 23°57'30"N, 80°29'15"W, alcohol preserved, 10 Mar. 1869, 862 m, leg. L.F. de Pourtalés, det. G.J. Allman, holotype, with no hydranths) apparently has only small microbasic euryteles. This cnidome differs from that described by Hirohito (1988), consisting of nematocysts of 2 dimensions. This fact led us to conclude that *E. tenellum* auct. is frequently not comparable to *E. tenellum* Allman, 1877. In order to investigate the affinities of *E. tenellum* auct. with *E. garis*, we studied the female material nr. 1078 (Japan, Samejima, Hayama, 11 June 1934, no depth, alcohol-preserved, det. Hirohito) recorded by Hirohito (1988) as *E. tenellum* and, although the preservation in alcohol make it difficult to observe the nematocysts, we distinctly observed the presence of macrobasic euryteles.

Some species of *Eudendrium* present a cnidome as well as male and female blastostyles similar to those of *E. garis* sp. nov.: for instance *E. kirkpatricki* Watson (1985), *E. pocaruquarum* Marques (1995), and *E. moulouyensis* Marques, Peña Cantero and Vervoort (2000a). *Eudendrium angustum* Warren (1908), on the other hand, has a similar cnidome but unknown gonophores. None of these species has nematocysts aggregated in vertical stripes. Moreover the Australian *E. kirkpatricki* differs from *E. garis* sp. nov. by its hydranth pedicel, characteristically widening distally, the lack of peduncled eggs (i.e., sessile eggs), and the greater size of its large microbasic euryteles (Watson 1985, pers. obs.). *Eudendrium pocaruquarum* has extensively annulated hydrocauli, sessile eggs, and smaller microbasic euryteles of large dimensions (Marques 1995), while *E. moulouyensis* presents associated zooxanthellae and sessile eggs (Marques et al. 2000a). Finally, the South African *E. angustum* is characterized by the hypostome being blocked by a plug of elongated endoderm cells continuous with the digestive endoderm at the base of the hydranth (Millard 1975).

Another interesting character of *E. garis* sp. nov. is the concave perisarc-support of the egg, remaining attached to the pedicel after planula release. This character was first described for *E. cyathiferum* Jäderholm (1904), and was subse-

quently also found in other species of *Eudendrium*, such as *E. fruticosum* Allman (1877), *E. glomeratum* Picard (1951) (Marques et al. 2000b: 97, figs. 54, 55), and *E. caraiuru*. After the study of the type material of *E. fruticosum* (MCZ 35105, male and female colonies, Key West, FL, USA, "BIBB" Florida Straits, off Key West, Gulf Stream Expedition, 21 Jan. 1869, 24°18'00"N, 81°50'15"W, 247 m, col. L.F. Pourtalés, det. G.J. Allman, alcohol, holotype), we concluded that both species have similar nematocyst types (microbasic euryteles), although they are smaller in *E. fruticosum* (18-20 x 7.5-8  $\mu$ m), but they differ in the distribution of the nematocysts, in the presence of eggs that are completely enveloped by a gelatinous capsule, and in the fascicled condition of colonies of *E. fruticosum*.

***Eudendrium aylingae* Watson (1985)**  
(Fig. 3a-g)

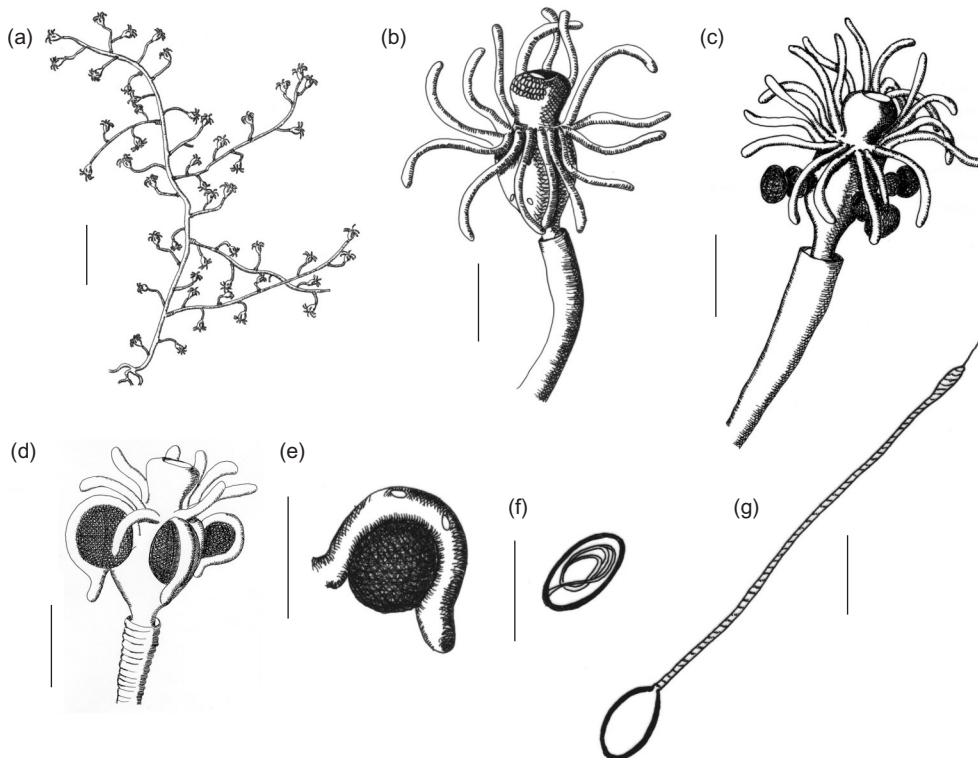
*Eudendrium aylingae* Watson (1985): 208-209, figs. 75-79; Stranks, 1993: 3.

*Material examined*: Siladen (15 m, female

colony, Jan. 2001), MSNG 52720.

*Other material examined*: Manado Tua (38 m, large arborescent colony, Feb. 2001), Siladen (7 m, large arborescent colony covered by algae and bryozoans, Jan. 2001; 15 m, small arborescent colony on coral, Feb. 2001; 10 m, small colony covered by algae, May 2004; 15 m, large colony, Sept. 2004; 30 m, colony covered by bryozoans, Nov. 2004; 24 m, large colony on coral, Jan. 2005), Alung Banua (15 m, small colony covered by bryozoans, Feb. 2001), Lekuan I (small colony, Jan. 2001). Bunaken National Park, Indonesia. Coll: S. Puce and C. Di Camillo (scuba).

*Description*: Colonies (Fig. 3a) dioecious, arborescent, up to 100 mm in height, sometimes planar; main stems unfascicled. Hydrocauli arising from creeping hydrorhiza; branches delicate, more or less regular, occurring over entire hydrocaulus, up to 2nd-order branches present; pedicels arising from main stem or 1st-order branches. Perisarc of main stem strong, 0.006-0.023 mm thick, single tubes 0.14-0.28 mm in diameter, with rare annulations, in sets of 3 or 4 rings. Branches with 2-6 rings at origin, sets of 3 or 4 rings elsewhere, 0.12-



**Fig. 3.** *Eudendrium aylingae* Watson, 1985. Colony (a), hydranth showing the typical nematocyst distribution (b), male blastostyle (c), female blastostyle (d), immature egg with the free distal end of the spadix (e), macrobasic euryteles undischarged (f) and discharged (g). Scale bars: a = 1 cm; b-e = 0.5 mm; f, g = 24  $\mu$ m.

0.16 mm in diameter. Pedicels with 1-6 rings at origin, distal sets of 3-5 rings, 0.12-0.14 mm in diameter, perisarc 0.004-0.006 mm thick.

Hydranths (Fig. 3b) delicate, 0.40-0.50 mm in height, 0.38-0.45 mm in diameter (measured in body region just below tentacles), with a distinct groove in aboral region; smooth tentacles 18-26 in number, occurring in a whorl below hypostome. Hypostome very prominent.

Gonophores styloid, arising from body of hydranth. Immature styloid gonophores placed in a circle around body of hydranth. Male blastostyle (Fig. 3c) with 1-4 sporosacs, each sporosac 1-3 chambered. Sporosac with a distinct spadix along its longitudinal axis; distal chamber 0.20-0.25 mm. Mature male blastostyles not reduced, with 19-26 tentacles. Male blastostyle pedicel vase-shaped, 1.5 mm in length, basal diameter 0.11 mm, distal diameter 0.15 mm, perisarc 0.01 mm thick. Female blastostyles (Fig. 3d) mainly concentrated in apical 1/2 of colony, each having eggs with a simple and curved spadix; often the distal end of spadix free, prominent, turning away from egg (Fig. 3e). Tentacles reduced in number, 8 or 9 tentacles remaining, sometimes only stumps instead of developed tentacles, hypostome not regressed. In other cases, hydranths continuing to grow, spadices then shed, and mature round eggs becoming encapsulated by a thin perisarc and directly attached to pedicel without peduncle. Immature eggs 4-6 per blastostyle, ~0.45 mm in diameter, mature scattered eggs up to 8 per pedicel. Female blastostyle pedicel short, slightly enlarged distally, deeply annulated throughout.

Nematocysts of 2 categories: heterotrichous microbasic euryteles and heterotrichous macrobasic euryteles.

Small microbasic euryteles (not seen discharged), 7.5 x 2.5  $\mu\text{m}$ , L: W = 3: 1, oval, abundant; distributed over hydranth body, hypostome, coenosarc, and regularly on tentacles. Large macrobasic euryteles (Fig. 3f, g) (seen discharged), variable in size, some colonies 22.5-30.0 x 11.0-12.5  $\mu\text{m}$ , L: W = 2.0-2.4: 1, shaft 125  $\mu\text{m}$  in length, other colonies 35.0-42.0 x 12.0-13.0  $\mu\text{m}$ , L: W = 2.9-3.2: 1 shaft 137  $\mu\text{m}$  in length; bean shaped, shaft arranged in ~3 coils inside capsule; distributed rarely on hydranth body (0-5 capsules) and female spadix (up to 6 capsules), abundant on hypostome where they form a continuous, multilayered, dense ring surrounding mouth, and in coenosarc.

*Distribution:* Australia and Indonesia.

*Remarks:* The species is characterized by its

large macrobasic euryteles which form a continuous multilayered band around the mouth. In Australia, Watson (1985) described 3 different size classes of large macrobasic euryteles: 28-30 x 11-14  $\mu\text{m}$  from Queensland (northeastern Australia; MVF 50529, holotype), 27-30 x 9-10  $\mu\text{m}$  from Bass Strait (southern Australia; MVF 50722), and 35-36 x 13-15  $\mu\text{m}$  from Perth (southwestern Australia; MVF 50723). The Bunaken material also shows wide variability of nematocyst sizes. Watson (1985) remarked that the capsules of this species are particularly elongate; from her data, the L: W ratio range is 2.1-3.0: 1, values that are quite similar to the ones we observed.

The nematocysts of *E. aylingae* were originally described as "(?)macrobasic" (Watson 1985: 208, although on p. 209 they are unmistakably referred to as "macrobasic"), and as "few fully-discharged specimens" with a "very long, distally swollen shaft" (p. 209); but Watson gave no information on the proportion of the shaft in relation to the discharged capsule (S/C). The nematocyst we have observed has S/C values ranging from 3.3 to 5.5. After Weill's (1934) classification (also adopted by Watson 1985, see p. 180), this proportion is intermediate between the definitions of microbasic (shaft up to 3 times the length of the capsule) and macrobasic (shaft more than 4 times the length of the capsule). Östman (2000) considered this proportion to be "mesobasic". A similar case occurred with *E. caraiuru* Marques and Oliveira (2003) (see original description).

The shaft "covered by overlapping leaf-shaped spines" (Watson 1985: 209) was not clearly visible in our material, but the general shape of the shaft, slightly enlarging distally, was similar. Watson described the shaft as a "loose coil along the walls of the capsule" (Watson 1985: 209) which was also the case in our material. Watson (1985) observed no thread in the intact nematocyst, which was likewise not apparent in our material.

Watson (1985) commented about similarities between *E. aylingae* and *E. infundibuliforme* Kirkpatrick (1890), stressing differences in the shape of the nematocyst capsules and the morphology of their shafts. Subsequently, Marques et al. (2000b) also pointed out the uniqueness of *E. infundibuliforme*, which has several traits that distinguish it from any other species of *Eudendrium*. The Indonesian material of *E. aylingae* allows us to provide the first description of the female gonophores of the species. The spadix encircles the eggs, but often its distal part has a free end

that may either continue the curvature of the spadix or clearly bend away from the egg, looking like a prominent nose. Generally, the female gonophores of *Eudendrium* have simple and unbranched spadices surrounding a single egg. Deviations from this basic gonophore shape are generally considered good taxonomic characters. Some species have a bifid spadix (e.g., *E. racemosum* (Cavolini 1785), *E. carneum* Clarke, (1882), *E. japonicum* Yamada (1954), *E. ritchiei* Millard (1975), and *E. maorianus* Schuchert (1996)), or branched (*E. deciduum* Millard (1957)), axe-shaped (*E. calceolatum* Motz-Kossowska (1905)), and even absent (*E. vervoorti* Marques and Migotto (1998) and *E. bathyalis* Marques and Calder (2000)). *Eudendrium simplex* Pieper (1884) is characterized by hermaphroditic gonophores in the female blastostyles (Marques et al. 2000a).

#### ***Eudendrium racemosum* (Cavolini 1785)**

(Fig. 4a-c)

*Sertolara racemosa* Cavolini 1785: 160, pl. 6 figs. 1-7, 14-15.

*Sertularia racemosa* Gmelin 1791: 3854.

*Eudendrium racemosum*: Ehrenberg 1834: 296; Millard and Bouillon 1973: 33; Watson 1985: 204-205, figs. 63-67; Marques et al. 2000a: 207-209; 2000b: 100-101, figs. 67-70.

**Material examined:** Sachiko's Point (5 m, large female colony, Feb. 2001), MSNG 52721.

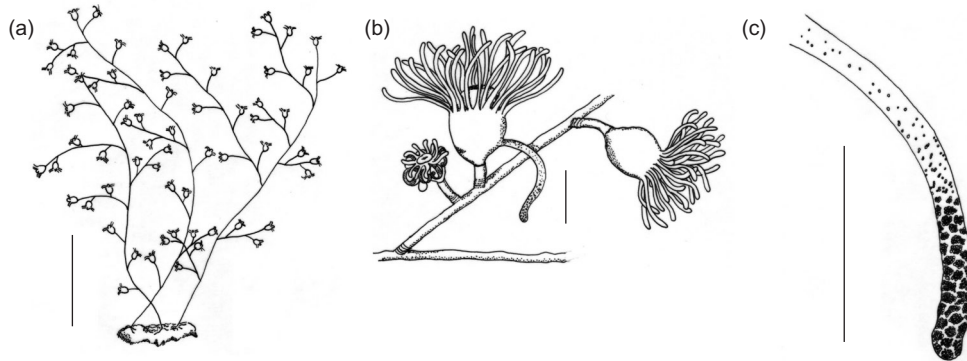
**Other material examined:** Manado Tua (7 m, large colony, Feb. 2001; 20 m, small colony, Feb. 2001), Alung Banua (30 m, colony on algae, Feb. 2001), Lekuan I (5 m, large colony, Jan. 2001), Mandolin (25 m, large colony, Feb. 2001), Siladen (25 m, large colony, Jan. 2001; 30 m, large colony on coral, May 2004; 8 m, small colony on sponge, Sept. 2004; 18 m, large colony on dead black

coral, Nov. 2004; 15 m, small colony on algae, Jan. 2005), Lekuan I (5 m, large colony, Jan. 2001), Depan Kampung (10 m, arborescent colony, Feb. 2001). Bunaken National Park, Indonesia. Coll. S. Puce and C. Di Camillo (scuba).

**Description:** Colonies dioecious, arborescent, up to 150 mm in height; main stems unfascicled (Fig. 4a); several stems arising from a common rootstock formed by creeping hydrorhiza; branches delicate, alternate, occurring over entire hydrocaulus, up to 2nd-order branches present, in 1 plane; hydranth pedicels arising from main stem or 1st-order branches. Perisarc of main stem quite strong, (0.009-0.03 mm), single tubes 0.28-0.32 mm in diameter, mostly smooth. Branches with 3-5 rings at origin, 0.19-0.21 mm in diameter. Pedicels with 2-4 rings at origin, 0.13-0.15 mm in diameter, perisarc 0.002-0.004 mm thick.

Hydranths delicate, ca. 0.65-0.85 mm in height, 0.42-0.65 mm in diameter (measured in body region just below tentacles), with a distinct groove in aboral region; spiny tentacles 24-28 in number, occurring in a single whorl below hypostome. Hypostome up to 0.65 mm in diameter, up to 0.37 mm in height. Around 5% of hydranths with cnidophores, often placed near blastostyles (Fig. 4b).

Gonophores styloid, arising from body of hydranth. Immature styloid gonophores in a circle around body of hydranth. Male blastostyle with up to 13 sporosacs, each sporosac up to 5 chambered. Sporosac with a distinct spadix forming its longitudinal axis, with a terminal tubercle on its end; distal chamber 0.28-0.32 mm in diameter, 0.21-0.23 mm in height. Mature male blastostyles completely reduced. Female gonophores arising on completely reduced blastostyles. Immature eggs with a bifid and curved spadix. Immature



**Fig. 4.** *Eudendrium racemosum* (Cavolini, 1785). Colony (a), normal hydranth and hydranth with cnidophore placed near a female blastostyle (b), cnidophore with nematocyst patches (c). Scale bars: a = 2 cm; b, c = 0.5 mm.

eggs up to 10 in number, 0.20-0.23 mm in diameter.

Nematocysts of 2 categories: heterotrichous microbasic euryteles and atrichous isorhizas. Small microbasic euryteles (not seen discharged), 7-7.5 x 3.5-4  $\mu\text{m}$ , L: W = 1.75-2, oval, common; distributed over hydranth body, hypostome, coenosarc, and tentacles. Large atrichous isorhizas (not seen discharged), 8-9 x 3.5-4  $\mu\text{m}$ , L: W = 2.25-2.28, bean-shaped, abundant and arranged in clusters of 10-12 on cnidophore (Fig. 4c), distributed at base of hydranth body and in coenosarc.

*Distribution:* Indo-Pacific and Mediterranean Sea.

*Remarks:* Similar to the colony from Seychelles (Millard and Bouillon 1973), all Indonesian colonies are unfascicled, while the Mediterranean ones may have complementary tubes, although this is rare. Indonesian colonies are slender, and the stem and branches are thinner than in the Australian colonies described by Watson (1985). Hydranths with cnidophore are rarer, and generally they are located near the blastostyles. The grouped distribution of the nematocysts in the cnidophores is very particular and has never been reported in previous descriptions.

### Ecology and distribution

Species of the genus *Eudendrium* are a frequent component of the reef fauna. The hydroid community of the area is composed of more than 100 species, mainly leptotheccates (unpubl. data). Anthoathecate hydroids are inconspicuous and scarcely present, and with the exception of large colonies of *Corydendrium* cf. *corrugatum* Nutting, the only conspicuous species are those belonging to the genus *Eudendrium*.

The described species occupy the entire reef, from the superficial slope to the base of the reef. The colonies herein recorded were collected at between 5 and 40 m depth, but colonies of *E. racemosum* were also observed on a bottom rich in detritus, 65 m deep, living epibiontically on gorgonians.

The epibiontic habit is typical of the species described herein. *Eudendrium aylingae* and *E. racemosum* may be collected on both the reef and other erect organisms, while the new species, *E. garis* sp. nov., was always found as an epibiont, mainly attached to dead portions of sea fans or black corals (Anthozoa).

*Eudendrium racemosum* has been extensive-

ly recorded from the Indo-Pacific region, viz. Australia, Japan, Indonesia, and the Seychelles (Millard and Bouillon 1973, Watson 1985, Hirohito 1988), as well as from the Mediterranean Sea (Marques et al. 2000a). On the other hand, the species is still unknown in some well-investigated regions, like southern Africa and New Zealand (Millard 1975, Watson 1987). This geographic distribution suggests that *E. racemosum* is a Tethyan relict, a distribution pattern known for many genera, like the popular examples of the precious coral (*Corallium rubrum* (L.) with specimens distributed from the Atlantic to Pacific passing through the Mediterranean basin (Bayer 1964)) and the sea grass *Posidonia*, (with the only Mediterranean species, *P. oceanica* (L.), and a group of 8 species around the Australian coast (Kuo and McComb 1989)). *Eudendrium racemosum* is a very common, well-described, and well-recognizable species, with a lot of records, both in the Mediterranean and in the Indo-Pacific. However, from a morphological point of view, it is impossible to distinguish between Mediterranean and Indo-Pacific populations of *E. racemosum*. On one hand, this is an intriguing fact because the 2 populations must have separated almost 15 million yrs ago, when the Mediterranean became separated from the Indian Ocean, indicating an astonishing stability of morphological characters of this hydroid. On the other hand, it is also quite plausible that both populations belong to cryptic species recognizable only by genetic methods.

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