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Eudendrium pocaruquarum n. sp. (Hydrozoa, Eudendriidae) from the southeastern coast of Brazil, with remarks on taxonomic approaches to the family Eudendriidae

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Abstract

Eudendrium pocaruquarum, a new species of athecate hydroid referable to the family Eudendriidae, is described from the state of São Paulo, Brazil. The species is very similar to the widespread *Eudendrium ramosum* (Linnaeus, 1758), differing from it in the smaller size of the large microbasic euryteles. Longstanding problems in the systematics of eudendriid hydroids are noted, and the inadequacies of many early descriptions of species are discussed. The nematocysts provide a supplementary character for discrimination of species of *Eudendrium*, although information on the cnidome appears to have been sometimes misinterpreted in literature.

Résumé

Eudendrium pocaruquarum, nouvelle espèce d'Hydroïdes athécates de la famille des Eudendriidae, est décrite de l'État de São Paulo, Brésil. Elle ressemble beaucoup à l'espèce largement répandue *Eudendrium ramosum* (Linnaeus, 1758) dont elle diffère par la moindre taille des grands euryteles microbasiques. On note l'existence de problèmes de longue date dans la systématique des Hydroïdes eudendriides, et le caractère insatisfaisant de nombreuses anciennes descriptions d'espèces est remarqué. Les nematocystes fournissent un caractère supplémentaire pour la distinction d'espèces d'*Eudendrium*; néanmoins, l'information sur le cnidome s'avère ayant été parfois interprétée de manière erronée dans la littérature.

Introduction

The systematics of the genus *Eudendrium* Ehrenberg, 1834 is among the most confusing taxa within the Anthomedusae (Millard, 1975; Marinopoulos, 1992, among others). This is in large part due to the work of early hydrozoan taxonomists, who often distinguished species on unreliable characters. To advance taxonomic knowledge of the genus, Picard (1951) proposed supplementing observations on morphological characters with information on the cnidome. While this has been a useful approach, no clear standard exists for measuring nematocysts or deriving their proportions. Most recent descriptions of species of *Eudendrium* (e.g., Millard, 1975; Watson, 1985) routinely provide information on nematocysts. In some cases, however, this information has apparently been misinterpreted. Related to this problem is the decision on the scope of species in Hydrozoa. I quote Calder (1988: 2) "most recent hydrozoan systematists have tended to be taxonomic lumpers", although "the hydrozoan literature is replete with extremes of lumping and splitting, and the confusion resulting from both".

The purpose of the present paper is to describe a new species of *Eudendrium* from southern Brazil. The use of nematocysts in the systematics of the family, and other approaches in the use of the cnidome in Eudendriidae, are discussed.

Material and methods

Specimens of *Eudendrium pocaruquarum* n. sp. were collected by hand between 1987–1992 at two localities on the northern coast of São Paulo state, Brazil: São Sebastião (23°56'S 45°25'W) and Ubatuba (23°25'S 45°05'W). In São Sebastião, collecting was undertaken monthly during 1988 by Dr. A.E. Migotto (Migotto, 1993).

After collecting, specimens were anesthetized in 7.5% magnesium chloride solution, and fixed in a 10% formalin solution

(= formaldehyde 4%). The cnidome was studied in all colonies (batches), although living specimens and discharged nematocysts were examined in only some colonies. The method of triggering nematocyst discharge followed procedures described in Migotto & Da Silveira (1987). Nematocyst terminology follows that of Weill (1934) and Mariscal (1974). Measurements were made on nematocysts from preserved specimens.

Abbreviations used are: MNRJ = cnidarian collection of the Museu Nacional do Rio de Janeiro; ROMIZ = Royal Ontario Museum, Invertebrate Zoology (Toronto, Canada); and SP = private collection of the author, from São Paulo state.

Taxonomic part

Eudendrium pocaruquarum sp. nov (Figs. 1–9)

Type series. – Holotype: female, MNRJ2046, Cigarras beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 30.vi.1988. Paratypes: male, MNRJ2047, São Francisco beach, São Sebastião, São Paulo, on rock, intertidal zone; coll. A.C. Marques, 25.x.1992. Sterile stems, MNRJ2048, São Francisco beach, São Sebastião, São Paulo, on rock, intertidal zone; coll. A.C. Marques, 25.x.1992. Sterile stems, ROMIZ B1224, São Francisco beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 30.vi.1988.

Other material. – Male, SP020, São Francisco beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 10.viii.1987. Sterile stems, SP022, Cigarras beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 6.x.1987. Female, SP023, Cigarras beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 3.xi.1987. Sterile stems, SP033, São Francisco beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 15.vii.1988. Female, SP053, Cigarras beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 15.vii.1988. Sterile stems, SP060, Cigarras beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 15.vii.1988. Sterile stems, SP037, São Francisco beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 27.viii.1988. Sterile stems, SP039, Cigarras beach, São Sebastião, São Paulo, intertidal zone; coll. A.E. Migotto, 24.ix.1988. Male, SP129, Perequê-Açu beach, Ubatuba, São Paulo, on rock, intertidal zone; coll. A.C. Marques, 1.viii.1992. Sterile stems, SP156, Estaleiro beach, Ubatuba, São Paulo, on rock, intertidal zone; coll. A.C. Marques, 27.ix.1992. Female, SP164, São Francisco beach, São Sebastião, São Paulo, on rock, intertidal zone; coll. A.C. Marques, 25.x.1992.

Description. – Colonies dioecious, shrubby, unfascicled, 29–56 mm in height. Hydrocaulus arising from creeping hydrorhiza; branched to the third order, in radiate planes. Pedicels arising from main stem or branches of second or third order. Perisarc of main stem well developed, 0.15–0.18 mm in diameter, pale to dark brown, either completely annulated or with smooth parts. Origins of branches extensively or completely annulated. Pedicels completely annulated, or wrinkled.

Hydranths whitish, 0.21–0.57 mm in height, 0.18–0.39 mm in diameter (measured in the body region just below the tentacles), with a distinct groove in the aboral region; tentacles 17–27 in number, occurring in a whorl below hypostome.

Gonophores styloid, arising from body of hydranth. Male blastostyles white, with 4–8 sporosacs; each sporosac 2-chambered. Each sporosac with a spadix over its longitudinal axis, and a terminal tubercle on its apex; distal chamber 0.12–0.18 mm in diameter. Mature blastostyles not reduced, tentacles 19–23 in number. Female blastostyles with orange styloids, each having a simple and curved spadix over a single egg. Immature styloids are placed in a circle around body of hydranth. Tentacles and hypostome regression and spadix shed, during ontogeny of female blastostyles. Mature eggs oval, encapsulated by a thin gelatinous layer, when still in a circle around hydranth body. Eggs 3–5 in number, 0.24–0.30 mm in diameter.

Nematocysts of one category, heterotrichous microbasic euryteles, but in two size classes.

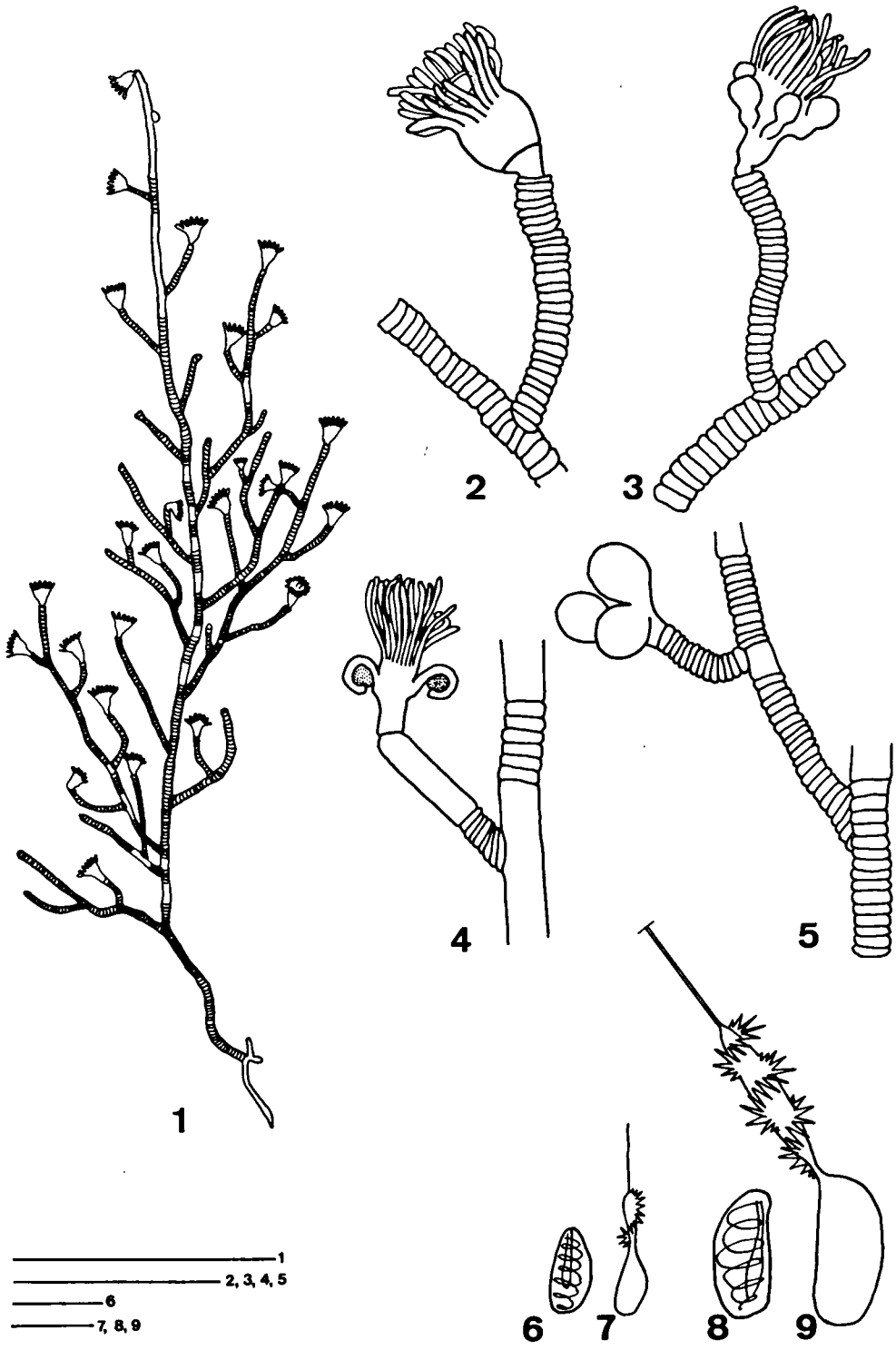
Large microbasic euryteles (discharged) 12.8–19.2 × 5.4–8.0 µm, bean-shaped; shaft 0.9–1.1 times length of capsule; nematocysts distributed over hydranth body, hypostome, and spadix of immature female gonophores.

Small microbasic euryteles (discharged) 5.9–8.0 × 2.6–3.9 µm, oval, distributed over hydranth body, hypostome, and tentacles.

Etymology. – The specific name is derived from the Tupi (language of some pre-Columbian natives of Brazil) "pocaruquara" (= delicate, fragile), and refers to the habit of the colonies.

Discussion

Most nominal species of hydroids currently assigned to the genus *Eudendrium* are inadequately



Figs. 1–9. Morphological representations of *Eudendrium pocaruquarum*: 1, colony; 2, hydranth; 3, male blastostyle; 4, immature female blastostyle; 5, mature female blastostyle; 6, 7, small microbasic euryteles; 8, 9, large microbasic euryteles. Scale bars: 14.0 mm for Fig. 1; 1.0 mm for Figs. 2, 3, 4, and 5; 10.0 μm for Fig. 6; 8.0 μm for Figs. 7, 8, and 9.

Table I. Eudendrium ramosum/E. pocaruquarum ratios for continuous characters, separated in the morphological set and the cnidome set. Legend: Rmv = ratio between the medium values of the species; Rmin = ratio between the minimum values; Rmax = ratio between the maximum values.

Morphology	Rmv	Rmin	Rmax	(Rmv + Rmin + Rmax)/3
Hydranth height	1.70	1.71	1.58	1.66
Hydranth diameter	1.43	1.50	1.54	1.49
Distal chamber diameter	2.07	2.00	2.17	2.08
Egg diameter	1.00	0.88	1.10	0.99
Mean	1.55	1.52	1.59	1.55
Cnidome				(Rmin + Rmax)/2
Large euryteles length		1.93	1.72	1.83
Large euryteles width		2.00	2.18	2.09
Small euryteles length		1.02	1.20	1.11
Small euryteles width		1.04	1.13	1.09

described, and information on nematocysts is usually lacking. Therefore, I compare *E. pocaruquarum* only to species with relatively complete descriptions.

For comparisons with *Eudendrium ramosum* (Linnaeus, 1758) I used specimens assigned to that species from Brazil; unfortunately, the type of *E. ramosum* is lost (Boero & Cornelius, 1987). Marques (1993)* provided information on the "*E. ramosum*" complex, which appears to be a poorly diagnosed and merophyletic group of species.

Distinction between E. pocaruquarum *and* E. ramosum

Eudendrium pocaruquarum is very similar to *E. ramosum* in its trophosome, its gonophore morphology, and in its nematocyst category. *Eudendrium ramosum* is commonly distinguished from other species of the genus by its concentration of large microbasic euryteles on the apex of the hypostome. Microbasic euryteles in this region are a common feature in many species of *Eudendrium* (personal observations). In *Myrionema*, the only other genus presently assigned to the Eudendriidae, the microbasic euryteles display the same distribution over the body (Calder, 1988, and personal observations). This, together with the hypotheses that the family Eudendriidae is monophyletic and that *Myrionema* and *Eudendrium* are sister-groups (Marques, 1993), led to the conclusion that the character state in which microbasic euryteles occur on the apex of the hypostome is plesiomorphic (using the outgroup comparison method, Watrous & Wheeler, 1981; Maddison et al., 1984). To regard *E. ramosum* different from other species of *Eudendrium* based on the distribution of the microbasic euryteles is a double error: the character is widespread in the genus, and it is plesiomorphic.

I here distinguish *E. pocaruquarum* from *E. ramosum* based on the smaller size of the large microbasic euryteles in the former (respectively 12.8–19.2 × 5.4–8.0 μm versus 24.7–33.0 × 10.8–17.4 μm), for the following reasons:

(A) *E. ramosum* and *E. pocaruquarum* are sympatric and synchronic in São Paulo state. However, I did not find clines or gradual variation in size of the microbasic euryteles. Instead, the size differences were discontinuous.

(B) There is evidence of differentiation in life cycle and bathymetric range of the species: *E. ramosum* seems to reproduce in summer (January to March) while *E. pocaruquarum* is fertile in winter (June to November); moreover, the former were recorded from deeper waters than

*Papers concerning *Eudendrium* phylogeny, ecology, and a general survey of Brazilian eudendriids are being prepared. They are also results of Marques (1993).

the latter (Marques, 1993). One could explain these differences in two ways: (1) as characterizing subgroups within the same species, or (2) as evidence for two evolutionary lineages (here referred to as species). I consider the second option more appropriate, because sympatry and synchrony would allow for genetic interchange. Thus, the different characters in biology of the two are interpreted as markers of different evolutionary lines.

(C) Arguably, *E. pocaruquarum* may be a smaller morphometric form of *E. ramosum*. This hypothesis agrees with the size class of the large nematocysts. To test this hypothesis, I verified the ratio between the morphometric characters of the two species (Table I). The table shows ratios varying from 0.99 (egg diameter) to 2.09 (width of large microbasic euryteles). No allometric correspondence exists between the "set" *E. ramosum* and the "set" *E. pocaruquarum*, which leads to the conclusion that these "sets" represent different species rather than different populations of the same species.

Other related species

Marques (1993) characterized the phylogenetic relationships between *E. ramosum*, *E. pocaruquarum*, *E. kirkpatricki* Watson, 1985, and the group *E. merulum* as a polytomy (the *E. merulum* group represents a polytomy itself).

The first three species are morphologically similar, with *E. pocaruquarum* being distinguished from the others based on the smaller size of the large nematocysts. None of the species has an autapomorphic character (Marques, 1993). The lack of autapomorphous features does not invalidate the species, but it is a sign of the poor resolution in *Eudendrium* systematics.

The different nematocyst size classes correspond to plesiomorphic and apomorphic states of the same character, but I prefer not to polarize continuous characters. It remains unclear whether the smaller nematocysts in *E. pocaruquarum* is an autapomorphy of the species, or whether the larger nematocysts represent the apomorphic state, being the synapomorphy of the species of the *E. ramosum* group mentioned above (*E. pocaruquarum* excluded).

Other species that could be phylogenetically close to *E. pocaruquarum* are *E. currumbense* Watson, 1985, *E. aylingae* Watson, 1985, *E. minutum* Watson, 1985, and *E. boreale* Yamada, 1954, but all of these are incompletely described, making it impossible to establish their relationships. *Eudendrium boreale* is the only species among these five with an autapomorphy, the cup-like shape of the perisarc around the hydranth (Marques, 1993).

Splitters vs. lumpers: systematists and the preservation of information

Eudendrium pocaruquarum is recognized as a new species, even in the absence of an apomorphic character, because there is a diagnostic character (the smaller size of the large microbasic euryteles) distinguishing the species from several others. This decision preserves significant phylogenetic information for differentiating the species from others in the "*E. ramosum*" complex (the status of which remains unsettled).

The size differences of the nematocyst capsules can be treated either as an interspecific or as an intraspecific variable. In morphological studies, where information of the genetical basis of such variation is lacking, the interpretation of variation is based on the judgement of the systematist. Watson (1985, 1987) considered population variations in nematocyst size as intraspecific, as is evident in her analysis of *E. generale* von Lendenfeld, 1885, *E. novaezelandiae* Marktanner-Turneretscher, 1890, *E. ritchiei* Millard, 1975, and *E. aylingae* Watson, 1985. These species are not equivalent to *E. pocaruquarum* and *E. ramosum*, because they are represented by allopatric populations and are difficult to compare.

The approach of taxonomic "lumpers" leads to the possibility that species may be paraphyletic. Small discontinuities of features are interpreted as variations only, and not as evolutionary marks of distinct lineages. This confounds interpretation of phylogenetic relationships because pertinent evolu-

tionary information is suppressed. I conclude that it is easier to merge nominal species later, if necessary, than to divide a complex of species, especially when this complex is justified by plesiomorphies and variations.

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References

Boero, F. & P.F.S. Cornelius, 1987. First records of Eudendrium glomeratum (Cnidaria: Hydroida) in British and Irish waters, and taxonomic comments. Ir. Nat. J., 22 (6): 244–246.

Calder, D.R., 1988. Shallow-water hydroids of Bermuda: the Athecatae. Life Sci. Contr., Royal Ontario Museum, 148: 1–107.

Maddison, W.P., M.J. Donoghue & D.R. Maddison, 1984. Outgroup analysis and parsimony. Syst. Zool., 33 (1): 83–103.

Marinopoulos, J., 1992. Contribution à l'étude du genre Eudendrium (Hydrozoa: Hydroida) de la Méditerranée: taxonomie et phylogénie. Bull. Inst. océanogr. Monaco, nº special 9: 53–66.

Mariscal, R.N., 1974. Nematocysts. In: L. Muscatine & H.M. Lenhoff (eds.), Coelenterate biology: 129–178 (Academic Press, New York).

Marques, A.C., 1993. Sistemática dos Eudendriidae L. Agassiz, 1862 (Cnidaria, Hydrozoa) do litoral paulista: 1–167 (MSci thesis, Universidade de São Paulo, São Paulo).

Migotto, A.E., 1993. Hidróides (Hydrozoa, Cnidaria) marinhos bentônicos da região costeira do Canal de São Sebastião, SP: 1–258 (Ph.D. thesis, Universidade de São Paulo, São Paulo).

Migotto, A.E. & F.L. da Silveira, 1987. Hidróides (Cnidaria, Hydrozoa) do litoral sudeste e sul do Brasil: Halocordylidae, Tubulariidae, Corymorphidae. Iheringia, Sér. Zool., 66: 95–115.

Millard, N.A.H., 1975. Monograph on the Hydroida of southern Africa. Ann. S. Afr. Mus., 68: 1–513.

Picard, J., 1951. Note sur les Hydraires littoraux de Banyuls-sur-Mer. Vie Milieu, 2: 338–349.

Watrous, L.E. & Q.D. Wheeler, 1981. The out-group comparison method of character analysis. Syst. Zool., 30 (1): 1–11.

Watson, J.E., 1985. The genus Eudendrium (Hydrozoa: Hydroida) from Australia. Proc. R. Soc. Vict., 97 (4): 179–221.

Watson, J.E., 1987. Records of Eudendrium (Hydrozoa: Hydroida) from New Zealand. Proc. Linn. Soc. NSW, 109 (4): 325–330.

Weill, R., 1934. Contribution à l'étude des Cnidaires et de leurs nématocystes. I. Recherches sur les nématocystes (morphologie, physiologie, développement). II. La valeur taxonomique du cnidome. Trav. Sta. zool. Wimereux, 11: 1–351.

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