CELINE LOPES DA SILVA SANTOS

REVISÃO TAXONÔMICA DO GÊNERO *CERIANTHEOMORPHE* (CNIDARIA; ANTHOZOA; CERIANTHARIA) NO OCEANO ATLÂNTICO OCIDENTAL

ASSIS - SP
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Dissertação apresentada à Universidade Estadual Paulista (UNESP), Faculdade de Ciências e Letras, Assis, para a obtenção do título de Mestre em Biociências (Caracterização e Aplicação da Diversidade Biológica)

Orientador (a): Sérgio Nascimento Stampar

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Dedico essa obra à voinha Adina (*in memorium*) e Tio Dito (*in memorium*), que apesar de ausentes nesse plano, se fazem fortemente presentes em minha vida e em meu coração. Sinto-os como uma luz muito forte e inapagável em mim.

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"O sol, manhã de flor e sal e areia no batom. Farol, saudades no varal... Eu sou cordão umbilical, pra mim nunca tá bom e o sol queimando meu jornal, minha voz minha luz, meu som. TODO HOMEM PRECISA DE UMA MÃE". Realmente, todo homem precisa de uma mãe. Obrigada às minhas mães, Lucilene, Jacira e Maria Eunice, luzes da minha vida, inspirações para mim, meu porto seguro. Agradeço pelo apoio incondicional, pela formação do meu caráter, por terem lutado sempre por mim. Não esqueço e nunca esquecerei o que vocês fizeram para eu estar aonde cheguei. Obrigada por manterem vivo o legado de minha avó. Minha vinda para tão longe de vocês me fez perceber mais ainda que eu preciso de minhas mães.

"Quando não tinha nada, eu quis. Quando tudo era ausência, esperei... Quando o olho brilhou, entendi. Quando criei asas, voei. Quando me chamou, eu vim. Quando dei por mim, estava aqui... Quando vi você...," EU AMEI. Obrigada aos meus irmãos André, Rhuan, Vitor e Washington. Certamente, quando vi vocês, eu os amei. Agradeço, pois vocês são inspirações imensas para mim, força motriz que me move para frente, nunca para trás, vocês são iluminação, raio solar de todas as manhãs da minha vida, vocês são o MAR para o qual eu sempre anseio voltar para os braços, vocês são o calor do meu coração em dias frios e o amor que acalenta meu viver, são esperanças de um mundo melhor, vocês são planos de Deus para todas as minhas vidas.

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SANTOS, Celine Lopes da Silva. **Revisão taxonômica do gênero *Ceriantheomorphe* (Cnidaria; Anthozoa; Ceriantharia) no Oceano Atlântico Ocidental.** 2018. 58 p. Dissertação (Mestrado Profissional em Biociências). – Universidade Estadual Paulista (UNESP), Faculdade de Ciências e Letras, Assis, 2018.

RESUMO

O filo Cnidaria é dividido em dois subfilos Medusozoa e Anthozoa. O último engloba a subclasse Ceriantharia, na qual a família Cerianthidae é a mais representativa em número de espécies. Nesta família é encontrado o gênero *Ceriantheomorphe* Carlgren, 1931. Nesse grupo, a espécie *Ceriantheomorphe brasiliensis* Carlgren, 1931 esteve presente na Lista Brasileira de Espécies em Risco de Extinção entre 2004 e 2014. Além disso, não existe qualquer estudo populacional sobre a espécie e sua descrição é pouco confiável. Nesse sentido, há registros de outra espécie no Brasil, *Cerianthus brasiliensis* Mello-Leitão, 1919 e estudos apontam a provável relação com o gênero *Ceriantheomorphe*. Nosso objetivo foi revisar a descrição taxonômica do gênero *Ceriantheomorphe* no Oceano Atlântico Ocidental e verificar a plasticidade fenotípica entre *Ceriantheomorphe brasiliensis* da costa do Atlântico Sul, discutindo a incongruência dos caracteres morfológicos. Indivíduos identificados como *Ceriantheomorphe brasiliensis* do Uruguai, Golfo do México e Brasil foram observados. Análises anatômicas e do cnidoma dos pólipos foram realizadas e os espécimes foram comparados. Nossos resultados mostraram que os indivíduos de *C. brasiliensis* da costa do Atlântico Sul apresentam alta variação morfológica mesmo ocorrendo troca de material genético entre os espécimes. O indivíduo descrito como *Cerianthus brasiliensis* é sinônimo de *Ceriantheomorphe brasiliensis* e os indivíduos registrados para o Golfo do México pertencem a uma nova espécie do gênero *Ceriantheomorphe*.

Palavras - chave: Taxonomia. Biologia Marinha. Biodiversidade. Plasticidade fenótipica.

SANTOS, Celine Lopes da Silva. **Taxonomic review of the genus *Ceriantheomorphe* (Cnidaria; Anthozoa; Ceriantharia) from Western Atlantic Ocean**. 2018. 58 p. Dissertation (Masters in Bioscience). – São Paulo State University (UNESP), School of Science, Humanities and Languages, Assis, 2018.

ABSTRACT

The phylum Cnidaria is separated in two subphylla Medusozoa and Anthozoa. The last one includes the subclass Ceriantharia, which the family Cerianthidae is the most speciose. In this family is found the genus *Ceriantheomorphe*, Carlgren 1931. In this group the species *Ceriantheomorphe brasiliensis* Carlgren, 1931 was present in the Brazilian List of the Species in Risk of Extintion between 2004 and 2014. Besides that, there is no population any study about the species and the description is few trustworthy. Thus, there is record of other species in Brazil, *Cerianthus brasiliensis* Mello-Leitão, 1919 and studies pointed the probable relation with the genus *Ceriantheomorphe*. Our aim was to review the taxonomic description of the genus *Ceriantheomorphe* from the Western Atlantic Ocean and to verify the phenotypic plasticity between individuals belonging to *Ceriantheomorphe brasiliensis* from the coast of the South Atlantic, discussing the incongruence of the morphological characters. Individuals identified as *Ceriantheomorphe brasiliensis* from Uruguay, Gulf of Mexico and Brazil were observed. Anatomical and cnidome analysis of the polyps were performed and the specimens were compared. Our results showed that the individuals of the *Ceriantheomorphe brasiliensis* from the coast of South Atlantic presented the high morphological variation even occurring exchange of genetic material between specimens. The individual described as *Cerianthus brasiliensis* is synonymous of *Ceriantheomorphe brasiliensis* and the individuals recorded from Gulf of Mexico belong to a new species of the genus *Ceriantheomorphe*.

KEYWORDS: Taxonomy. Marine Biology. Biodiversity. Phenotypic plasticity.

Sumário

INTRODUÇÃO GERAL

Cnidaria é um filo monofilético dividido em dois clados Anthozoa e Medusozoa que são bem fundamentados pela estrutura genômica e anatômica, por sequenciamento do material genético e pela história de vida. Todos os indivíduos desse grupo têm como singularidade a capacidade de produzir uma célula denominada cnidoblasto, a qual sintetiza os nematocistos (Daly et al., 2007). Os nematocistos possuem a função de captura de presa, proteção (Fautin, 2009) e atuam como um dos componentes dos tubos que são construídos por organismos do grupo Ceriantharia (Stampar et al., 2015).

Ceriantharia é um dos três clados da classe Anthozoa, além deste, estão inclusos Hexacorallia e Octocorallia (Stampar et al., 2014). Ceriantharia compreende aproximadamente 100 espécies, mas o grupo ainda permanece pouco estudado e diversos aspectos ainda não são bem entendidos. Por exemplo, muitas espécies são conhecidas somente pela descrição de seus estágios de vida larval, muitas inconsistências taxonômicas permeiam essa subclasse (Daly et al., 2007) e seus padrões de distribuição são ainda pouco compreendidos (Stampar et al., 2015).

Os indivíduos de Ceriantharia são popularmente conhecidos como anêmonas de tubo, são indivíduos conspícuos (Molodtsova et al., 2011) e semi-sésseis. Além de possuírem dois estágios de vida, a forma larval e de pólipo. O desenvolvimento larval é pouco conhecido em Ceriantharia, mas, acredita-se que podem ser dividido em duas formas, um estágio larval curto ou um ciclo de vida larval longo (Stampar et al., 2016).

Os ceriantários comumente habitam recifes e comunidades bênticas. Esses animais são conhecidos por construírem tubos logo após o assentamento larval a partir de sedimentos e de um tipo específico de cnida, o pticocisto. Os tubos são construídos em volta da coluna e cada espécie tem um comprimento de tubo peculiar. Por exemplo, em algumas, o tubo pode ser aproximadamente do mesmo tamanho do corpo do animal adulto, como observado em *Ceriantheomorphe brasiliensis* e em outros casos, muito mais longos do que o corpo, como acontece em *Isarachnanthus nocturnus* (Stampar et al., 2015).

As características anatômicas compartilhadas por indivíduos em Ceriantharia são corpos alongados, a presença de dois tipos de tentáculos, os marginais que estão dispostos à margem do disco oral e os labiais que estão circundando a boca, presença de mesentérios agrupados e uma sifonóglife (Arai, 1965; Stampar et al., 2016).

Taxonomia em Ceriantharia

Estudos envolvendo Ceriantharia, quando comparados a outros grupos em Anthozoa, são escassos e muitas espécies permanecem sem descrição (Spier, et al., 2012) ou com aspectos biológicos consideravelmente desconhecidos. Isso se deve, majoritariamente, à dificuldade em coletar os espécimes, o que consequentemente tem impedido a realização de estudos, por exemplo, taxonômicos (Stampar et al., 2016).

Estudos taxonômicos comparativos em Ceriantharia só foram feitos por Carlgren (1912) que realizou uma descrição minuciosa de cinco espécies pertencentes a três diferentes famílias e organizou um compilado, no qual o autor comparou e discutiu as peculiaridades dos caracteres morfológicos do grupo, apontando a existência ou não de valor taxonômico em alguns desses casos.

Cem anos depois, Stampar (2012) realizou um estudo no qual comparou morfologicamente vinte e quatro espécies pertencentes a três famílias distintas, contrapondo os seus resultados com dados de outros estudos anteriores. Nesse mesmo estudo o autor discutiu a posição sistemática de Ceriantharia em relação às outras classes dentro de Anthozoa com base em análises moleculares e morfológicas, abordou questões sobre o ciclo de vida de uma espécie e sobre o processo de regeneração dos ceriantários. Porém, para as duas últimas, não houve uma discussão ampla, somente a descrição dos processos.

Diante desse cenário, inconsistências nas descrições de espécies de Ceriantharia ainda são bastante comuns (Stampar & Morandini, 2014). Por exemplo, gêneros descritos com base somente nos registros larvais, onde os pólipos e o próprio ciclo de vida permanecem desconhecidos, bem como a falta de consenso entre os pesquisadores, alguns classificam larvas como indivíduos adultos, enquanto outros têm dúvidas se estão lidando com estágios larvais ou jovens (Molodtsova, 2004; Stampar et al., 2016).

Além disso, a maioria dos estudos taxonômicos realizados com Ceriantharia tem considerado somente caracteres morfológicos para identificar e distinguir espécies (Carlgren, 1912; Carlgren, 1931; Den Hartog, 1977), bem como têm sido desenvolvidos com poucos exemplares ou com espécimes danificados (Arai, 1965).

Nesse sentido, incongruências nos estudos taxonômicos de Ceriantharia podem ocorrer tanto por conta do uso de terminologias confusas para definir os caracteres, mais de uma palavra e conceitos são usados para nomear e descrever um único caractere

(Arai, 1965; Den Hartog, 1977), como devido à alta taxa de variação nos caracteres morfológicos dos indivíduos de Ceriantharia (Stampar & Morandini, 2014).

Carlgren (1912) discutiu a utilização de alguns caracteres morfológicos na identificação e diferenciação de espécies e já apontava para variações que aconteciam em alguns caracteres em Ceriantharia. O autor indicou que a organização de ambos os tentáculos, marginais e labiais em ciclos sofre modificações de acordo com a idade e tamanho do indivíduo. Consequentemente, a disposição dos mesentérios também pode sofrer alterações, pois o desenvolvimento está ligado aos tentáculos. Por exemplo, em espécimes de *Pachycerianthus solitarius* Rapp, 1829 a variação na organização tentacular e mesenterial foi bastante observada, o que foi atribuído a possíveis distúrbios no desenvolvimento dos indivíduos (Carlgren, 1912).

Portanto, discussões no intuito de minimizar os problemas taxonômicos em Ceriantharia são necessárias ainda nos dias atuais, uma vez que a precisão na identificação de espécies é essencial para entender diversos aspectos biológicos desse grupo que permanecem incompreendidos.

O caso *Ceriantheomorphe brasiliensis* Carlgren, 1931

O gênero *Ceriatheomorphe*, caracterizado por ter todos os mesentérios férteis, com exceção dos diretivos (Carlgren, 1931), compreende duas espécies *Ceriantheomorphe ambonensis* Kwietniewski, 1892 e *Ceriantheomorphe brasiliensis* (Fig. 1). Essa última apresenta uma distribuição convencionada como disjunta que até os dias atuais ainda não foi apontada para nenhuma outra espécie em Ceriantharia. *Ceriantheomorphe brasiliensis* foi descrita em 1931 por Carlgren para o Sudeste brasileiro e em 1952 Carlgren & Hedgpeth registraram a espécie para o Golfo do México. Dados prévios ainda apontam para a existência dessa espécie no Uruguai e em 2012, Spier e colaboradores descreveram espécimes de *Ceriantheomorphe brasiliensis* para o Sul do Brasil (Paraná).

Recentemente, estudos chamaram atenção para a distribuição incongruente dessa espécie que como descrito acima, ocorre em duas regiões sem conexão, entre as quais, aparentemente, não há manutenção de fluxo gênico e também indicaram a ocorrência de variação morfológica entre os espécimes do Hemisfério Sul e Norte. (Stampar, 2012;

Spier et al., 2012). Entretanto, nenhum estudo comparativo foi realizado entre os indivíduos no intuito de discutir esse cenário dúbio.

No entanto, essa discussão é crucial, uma vez que *Ceriantheomorphe brasiliensis* esteve na lista de invertebrados aquáticos ameaçados de extinção entre 2004 e 2015 (MMA, 2004). Porém, a inexistência de estudo populacional ou sobre ciclo de vida e a inconsistência taxonômica dessa espécie são aspectos que agravam a situação de *Ceriantheomorphe brasiliesis* e impedem o estabelecimento de medidas para conservação da espécie (Stampar & Silveira, 2006).

Esse cenário é ainda mais preocupante, porque *Ceriantheomorphe brasiliensis* estabelece uma relação simbiótica com *Phoronis australis* Heswell, 1883 (Stampar et al., 2010) e provavelmente, com outros invertebrados marinhos.

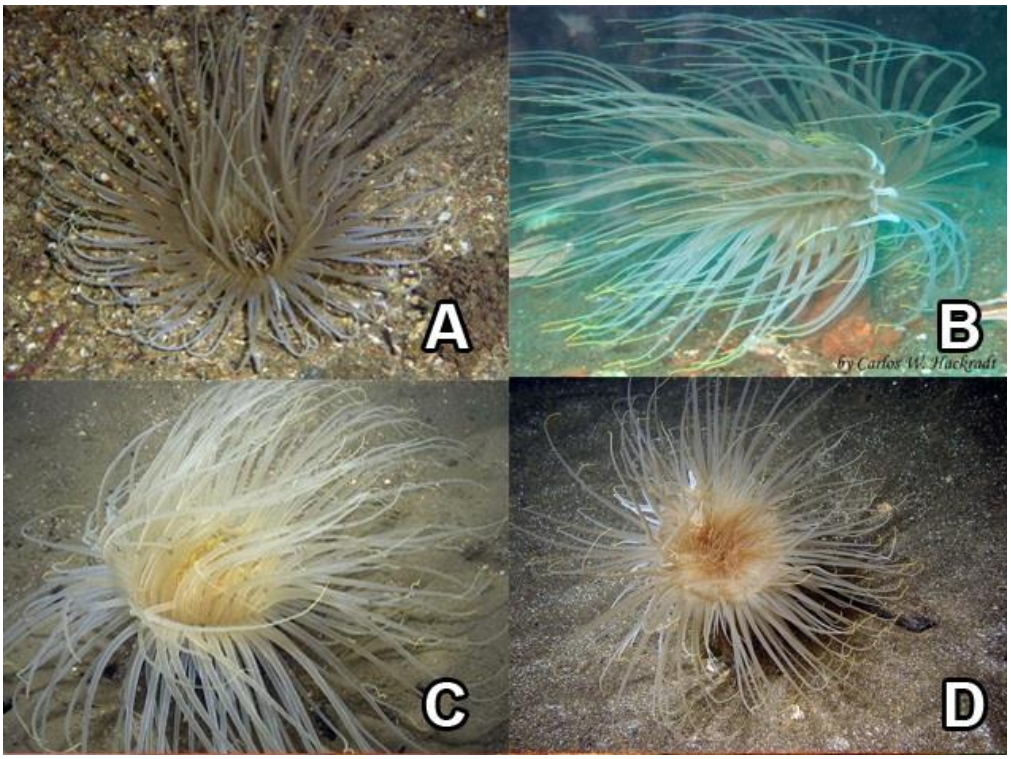

Figura 1. *Ceriantheomorphe brasiliensis* em habitat natural na costa brasileira. A. espécime de Ilha do Arvoredo – Santa Catarina. B. indivíduo fotografado no Paraná, créditos fotográficos: Carlos Hackradt. C. espécime de Ilha da Queimada Grande – São Paulo, créditos fotográficos: Leo Francini. D. indivíduo do Arraial do Cabo – RJ, créditos fotográficos: Arley Eishia.

OBJETIVO GERAL

O presente estudo comparou os indivíduos da espécie *Ceriantheomorphe brasiliensis* do Hemisfério Norte (Golfo do México e Estados Unidos) com os espécimes do Hemisfério Sul (Sudeste/Sul do Brasil e Uruguai). A partir desta análise, desenvolveu-se uma discussão sobre a inconsistência taxonômica, considerando a distribuição disjunta apresentada por essa espécie.

Objetivos específicos

- Comparar os espécimes de *Ceriantheomorphe brasiliensis* dos EUA e México com os indivíduos do Atlântico Sul (Sul/Sudeste do Brasil e Uruguai), verificar e discutir a congruência dos caracteres;
- Analisar o holótipo de *Cerianthus brasiliensis* e verificar a sua correta posição taxonômica;
- Verificar a existência de variação morfológica entre os espécimes de *Ceriantheomorphe brasiliensis* da Costa do Atlântico Sul.

Capítulo 1.

Redescrição e designação do holótipo de *Ceriantheomorphe brasiliensis* (Cnidaria, Anthozoa, Ceriantharia) com descrição de uma nova espécie para Golfo do México

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Resumo

Em Ceriantharia muitas inconsistências nas descrições taxonômicas acontecem e a escassez de estudos sobre padrões de distribuição torna difícil o processo de identificação de espécies. *Ceriantheomorphe brasiliensis* Carlgren, 1912 é uma espécie que apresenta distribuição desconexa. Além disso, a espécie descrita como *Cerianthus brasiliensis* Mello-Leitão, 1919 para a Baía de Guanabara, já foi apontada por alguns autores como sinônimo de *Ceriantheomorphe brasiliensis*. Diante do cenário acima, este estudo redescreveu a espécie *Ceriantheomorphe brasiliensis*, designando um novo holótipo e descreveu uma nova espécie de *Ceriantheomorphe* para o Golfo do México. Assim, foram analisados dezenove indivíduos identificados como *Ceriantheomorphe brasiliensis*, um espécime descrito como *Cerianthus brasiliensis* e um indivíduo pertencente à *Ceriantheomorphe ambonensis* Kwietniewski, 1892. As análises anatômicas e do cnidoma do pólipo foram realizadas e os espécimes foram comparados. A partir de nossas análises, uma nova espécie foi descrita *Ceriantheomorphe n. sp.* Lopes and Stampar para o Golfo do México que possui três pares de mesentérios conectados à sifonóglife, os protomesentérios (P2) são menores do que os metamesentérios (M) dos quatro primeiros quartetos e a proporção entre os metamesentérios M x m tem em média 0.19 cm à 0.3 cm. Além disso, nossos resultados mostraram que o espécime descrito como *Cerianthus brasiliensis* é sinônimo de *Ceriantheomorphe brasiliensis* e a nova distribuição da espécie se restringe à costa do Sul e Sudeste do Brasil e Uruguai.

Palavras-chave: Taxonomia. Invertebrados marinhos. Biogeografia. Biodiversidade.

Redescription and holotype designation of *Ceriantheomorphe brasiliensis* (Cnidaria, Anthozoa, Ceriantharia) with description of a new species from Gulf of Mexico

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Abstract

In Ceriantharia occur many inconsistencies in the taxonomic descriptions and the scarcity of studies about the distribution pattern become difficult the process of identification of species. *Ceriantheomorphe brasiliensis* Carlgren 1931 is a species that present a disconnected distribution. Besides that, the species described as *Cerianthus brasiliensis* Mello-Leitão, 1919 from Baía de Guanabara already was pointed by some authors as synonym of *Ceriantheomorphe brasiliensis*. Based in the scenario above, this study redescribed *Ceriantheomorphe brasiliensis*, designing a new holotype and described a new species of *Ceriantheomorphe* from Gulf of Mexico. Thus, nineteen individuals identified as *Ceriantheomorphe brasiliensis* were analyzed, one specimen described as *Cerianthus brasiliensis* and one individual belongs to *Ceriantheomorphe ambonensis* Kwietniewski, 1892. The anatomical and cnidome analysis of the polyps were performed and the specimens were compared. With our analysis a new species was described, *Ceriantheomorphe n. sp.* Lopes and Stampar. from Gulf of Mexico which has three pairs of mesenteries connected to syphonoglyph, the protomesenteries (P2) are shorter than first four quartets of the metamesenteries (M) and the proportion between the metamesenteries M and m has an average of the 0.19 cm to 0.3 cm. Furthermore, our results showed that the specimen described as *Cerianthus brasiliensis* is synonym of the *Ceriantheomorphe brasiliensis* and the new distribution of the species is restricted to the South and Southeast from Brazil and Uruguay.

Keywords: Taxonomy. Marine invertebrates. Biogeography. Biodiversity.

INTRODUCTION

Inconsistent descriptions are observed and discussed in several groups of marine invertebrates. In most of these studies the discussions are linked to the distribution pattern (Trussell, 1996; Hill and Hill, 2002; López-Lengentil et al., 2010; Daly et al., 2015). There are regularly consequences of environmental events that have caused modifications in the distribution of the species and contributed to the evolutionary process (Beaugrand et al., 2002). Thus, to understand the evolutionary trajectories is crucial to delimit and identify species (Padial et al., 2010).

However, the vast majority of species are described only on the basis of morphological data, without the use of distribution data or other ecological aspects, thus many taxonomic issues have been discovered (Castilla and Guinéz, 2000; Sotka et al., 2004; Haussermann and Forsterra, 2005). This scenario is especially problematic in groups with few studies (e.g. Stampar et al., 2016).

Ceriantharia, for example is a group with few studies, in part because of the burrowing habit (den Hartog, 1977). Several taxonomic inconsistencies have been found in ceriantharians since the earlier studies (Stampar et al., 2016). Besides that, the natural history, behavior and life cycle are poorly known and discussed, which contribute to taxonomic uncertainty (Spier et al., 2012, Stampar et al., 2015).

In addition, most of the taxonomic studies in this group are solely based on morphological characters (Carlgren, 1912; Arai, 1965, den Hartorg, 1977), many descriptions are made only with pelagic larvae and accepted as species (Stampar et al., 2016) and there are some confusions in the terminology of the morphological characters (Arai, 1965).

A combination of these problems occurs in the species *Ceriantheomorphe brasiliensis*, Calrgren, 1931. This was firstly described for southeastern Brazil, latter Carlgren and Hedgpeth (1952) recorded specimens from North America. However, the same authors considered that the individuals from North Atlantic could belong to another species, due to the absence of connectivity between the area of occurrence of the two populations. (Calgren and Hedgpeth, 1952; den Hartog, 1977).

In addition, another species was described for the southeast region of Brazil, *Cerianthus brasiliensis* Mello-Leitão, 1919, which brings together a large number of characters that coincide with *Ceriantheomorphe brasiliensis* Carlgren, 1931. Some

authors suggested that the two species are synonymous, but the absence, at that time, of some type material of *Cerianthus brasiliensis* had prevented any further discussion (Carlgren, 1931; Spier et al., 2012).

Despite the taxonomic confusion, the two species mentioned above from Brazil have been listed as endangered for more than 10 years (MMA, 2004). Furthermore, *Ceriantheomorphe brasiliensis* have an important ecological function, the tube of these specimens host an exclusive phoronid (Stampar et al., 2010). Based on the above scenario, this study presents a redescription of *Ceriantheomorphe brasiliensis* with the designation of the holotype and a description of a new species of the genus *Ceriantheomorphe* from Gulf of Mexico.

MATERIAL AND METHODS

Specimens

Nineteen specimens identified as *Ceriantheomorphe brasiliensis* were observed, include three specimens from Gulf of Mexico (Table 1). Furthermore, a specimen stored at National Museum of Rio de Janeiro (MNRJ) described as *Cerianthus brasiliensis* was studied. Besides that, a specimen of *Ceriantheomorphe ambonensis* Kwietniewski, 1892 (Jakarta, Indonesia) was utilized as outgroup.

Table 1. Specimens of *Ceriantheomorphe brasiliensis* analyzed.

Species ***Ceriantheomorphe brasiliensis***	**Country**	**Locality**	**Amount of specimens**
	Uruguay	Punta del Este	2
		Montevideu	1
	Brazil	Florianópolis (SC)	2
		São Sebastião (SP)	3
		Angra dos Reis (RJ)	1
		Rio de Janeiro (RJ)	2
		Arraial do Cabo (RJ)	2
		Guarapari (ES)	2
	Mexico	Tamaulipas	1
	United States of America	Corpus Christi	2

Morphological studies

The morphological studies were performed in two steps, anatomical and cnidome analysis of the polyps; 1) using the structures and criteria established by Carlgren (1931), Arai (1965), den Hartog (1977) and Stampar et al. (2015).

The specimens were dissected and fixed in dissection plates, observed and was performed a general description of each body parts, besides that, the individuals were photographed. The morphological aspects were compared between the specimens and the literature (Carlgren, 1912; Arai, 1965).

The marginal and labial tentacles were counted and their distributions and insertions were drawn. Also, the number of tentacle pores was also verified. The mesenteries were counted, measured, drawed and their structures were described. In addition, the proportion of the gastrovascular cavity and pharynx in relation of the entire body was measured and the number of mesenteries connected to siphonoglyph was also verified.

The five couples of mesenteries were measured, the average was calculated and the ratio between metamesenteries (M x m) and betamesenteries (B x b) was established.

The cnidome of each body part was analyzed, marginal and labial tentacles, pharyngeal region, column, meta-mesenteries and beta-mesenteries. Thirty cnidae of each type were photographed and analyzed. Small tissues were removed of each body part, macerated with water over the slide and analyzed in microscope using the magnification of 40x, both the length and the width of the cnidae were measured in the Motic Images Plus 2.0 software. The cnidae were grouped according to morphological varieties (Mariscal, 1974; den Hartog, 1977).

RESULTS

SYSTEMATICS
Phylum: Cnidaria Verrill, 1865
Subphylla: Anthozoa Ehrenberg, 1834
Order: Ceriantharia Perrier, 1893
Suborder: Spirularia den Hartog, 1977
Family: Cerianthidae Milne-Edwards and Haime, 1852

Genus: *Ceriantheomorphe* Carlgren, 1931

Diagnosis. Cerianthidae with all mesenteries fertile, except the directives. Two pairs of mesenteries connected to syphonoglyph. Mesenteries grouped in quartet with B,m,b,M. order.

Type species: *Ceriantheomorphe brasiliensis* Carlgren, 1931.

Valid species

Ceriantheomorphe brasiliensis Carlgren, 1931

Ceriantheomorphe (ambnonesis) Kwietniewski, 1898

Distribution. West Atlantic (Brazil, Uruguay, Gulf of Mexico, United States of America), Central West Pacific (Java Sea).

***Ceriantheomorphe brasiliensis* (Mello-Leitão, 1919)** new comb.

(?) *Cerianthus americanus* Hertwig, 1882: 110, 116
Cerianthus brasiliensis Mello-Leitão, 1919: 38-39
Ceriantheomorphe brasiliensis Carlgren, 1931: 2-6 - Carlgren, 1940: 6,11-12 - (?) Carlgren & Hedgpeth, 1952: 148, 169-170 - (?) Hedgpeth, 1954: 290; Frey, 1970: 309; Molodtsova, 2009: 365-367 - Stampar et al., 2010: 205-209 - Silveira & Morandini, 2011: 3; Rodriguez et al., 2011: 52, 54-55 - Spier et al., 2012: 1-3 - Stampar et al., 2012: 5-6, 9; Stampar et al., 2014a: 2,5,8 - Stampar et al., 2014b: 344, 347, 351, 353 - Stampar & Morandini, 2014: 2; Vieira & Stampar, 2014: - Stampar et al., 2015a: 3; González-Muñoz et al., 2016:5, 9 - Stampar et al., 2016b: 64, 67, 68.
Non - *Ceriantheomorphe brasiliensis* Hedgpeth, 1954: 286

Distribution: Brazil [Espirito Santo (20.5° S) to Rio Grande do Sul (33.7°S) states]; Uruguay (35°S); depth: shallow waters (1-40 meters).

Material examined (seventeen specimens). **Holotype: MNRJ 200**, adult individual, 16.5 cm length, between 7.7 and 10.4 cm width, Baía de Guanabara – Rio de Janeiro, Brazil (22°49'6''S, 43°8'45''N), collector Mello-Leitão, no date. Paratypes: **LD Ceriantharia 0337**, adult specimen, 16.5 cm long, 3.8 to 4.7 cm width, from Camburi – Espírito Santo, Brazil, collector not identified, no date. **LD Ceriantharia 0338**, adult individual, 9.3 cm length and 4.3 to 5.3 cm width from Arraial do Cabo – Rio de Janeiro, Brazil, collector not identified, no date. **LD Ceriantharia 0339**, adult individual, 24 cm length, between 3.7 and 6.0 cm width from Praia do Araçá – Santa Catarina, Brazil, collector not identified, no date. **LD Ceriantharia 0340**, adult individual, 14.5 cm long, 2.1 to 3.1 cm width from Ilha de Sabacú – Rio de Janeiro,

Brazil, collector not identified, no date. **LD Ceriantharia 0341** adult individual, 16.5 cm, between 3.8 and 4.7 cm width from São Sebastião – São Paulo, Brazil, collector not identified, no date. **LD Ceriantharia 0344** juvenile specimen, 8.5 cm long, 2.1 to 2.5 cm width from Ilhas Gagarras – Rio de Janeiro, Brazil (lat. 23°01'55'', long. 43°11'58''), collector S. Stampar, (COLOCAR A DATA). **LD Ceriantharia 0345 (9701)** adult specimen, 11 cm length, between 2.4 and 6.5 width, from Largo de Punta del Este – Uruguay, collector not identify, no date. **LD Ceriantharia 0348** adult individual, 22 cm long, between 3.4 and 5.7 cm width from Bahia de Guanabara – Rio de Janeiro, Brazil, collector A. Saldanha, no date. **LD Ceriantharia 0349** adult specimen, 22.2 cm length, 3.2 to 5.9 cm width from Largo de Punta del Este – Uruguay, collector not identified, no date. **LD Ceriantharia 0350** adult specimen, individual damaged, from Urca – Rio de Janeiro, Brazil, collector not identified, no date. **LD Ceriantharia 0351** adult specimen, 13 cm long, between 1.5 and 5.4 cm width, locality and collector not identified, no date. **LD Ceriantharia 0352** adult individual, 10.9 cm long, 2.3 to 3.1 cm width from Praia de Zimbros – Santa Catarina, Brazil, collector not identified, no date. **LD Ceriantharia 0353** adult specimen, 14.4 cm length, between 12.8 and 13.8 cm width from Santa Catarina, Brazil, collector not identified, no date. **LD Ceriantharia 0354** specimen damaged, Espírito Santo, Brazil, collected by ConvertII, no date. **LD Ceriantharia 0355** specimen damaged, Espírito Santo, Brazil, collected by ConvertII, no date. **LD Ceriantharia 0356** adult specimen, 17 cm long, 5.0 to 9.4 cm width from Guriri – Espírito Santo, Brazil, collector not identified, no date.

Diagnosis. Large cerianthid, 8.5 to 24 cm long and 1.5 to 13.8 cm width. Marginal tentacles from 66 to 196, labial tentacles 54 to 192, both in 4 cycles. Marginal tentacles arrangement: (1) 1.1.2.3…, labial tentacles arrangement: (1) 1.1.2.2…, or (1) 1.1.2.3… Pores present. The pharynx occupies about 8 to 27% of total size body. Siphonoglyph well-marked. Two pairs of mesenteries are connected to siphonoglyph, one pair of directive mesenteries and one pair of protomesenteries (P1). Presence of hyposulcus and hemisulci not consistent, however when both occurs, are distinct. The gastrovascular cavity occupies between 33 and 72% of the entire size body. The mesenteries, about 85 to 321 in number, are generally short with filaments and craspedonemes. The arrangement of mesenteries B,m,b,M. All mesenteries fertile, except the directives. The directives mesenteries longer than betamesenteries (b), the protomesenteries (P1) are longer than all metamesenteries, extending until the aboral

pore. The ratio between the betamesenteries (B x b) is 0.52 to 3.9 and of the metamesenteries (M x m) is 0.33 to 0.79. Cnidome (observed): microbasic b-mastigophore (five types), atrichous (two types), pytchocist and holotrich.

Description of holotype: (MNRJ 200)**.** Medium Ceriantharia, with 16.5 cm length and 7.7-10.4 cm width. 194 marginal tentacles with 4.9 cm long, 156 labial tentacles with 1.7 cm long, both type of tentacles arranged in 4 cycles, marginal tentacles arrangement: (1)1.1.2.3…, labial tentacles arrangement: (1)1.1.2.2…. Pharynx small, 15% of total body size, siphonoglyph well-marked, two pairs of mesenteries are connected to siphonoglyph. Hyposulcus and hemisulci indistinct. All mesenteries fertile, except the short directives. Protomesenteries P1 long, extending to aboral pore and longer than metamesenteries (M), betamesenteries (b and B) short. The mesenteries are arrangement B,m,b,M order (Fig. 1). Mesenteric filaments of almost the same length as mesenteries. Craspedonems only on initial part of gastrovascular cavity. Cnidome: microbasic b-mastigophores (two types), atrichs and ptychocysts (Fig. 2 and Table 1).

Comparison with other members of the genus: The labial and marginal tentacles are organized in four cycles in *Ceriantheomorphe brasiliensis*. The number of marginal and labial tentacles is from 66 to 196 and from 54 to 192, respectively. In *Ceriantheomorphe ambonensis* Kwietniewski, 1892 both kind of tentacles are arranged in 3 cycles and the number of marginal tentacles is from 24 to 150 and labial tentacles from 36 to 150. *Ceriantheomorphe n. sp.* presents 96-176 and 72-168 marginal and labial tentacles, respectively. *Ceriantheomorphe brasiliensis* is large species, in our analysis the individuals measured from 8.5 to 24 cm length unlike *C. ambonensis* that is a small cerianthid, measuring from 3.8 to 8.5 cm long. In *C. ambonensis* the arrangement of tentacles is (0)1,1,2,3; 1,1,2,3… and in *Ceriantheomorphe brasiliensis* the arrangement of marginal tentacles is (1)1.1.2.3 and the arrangement of labial tentacles is (1)1,1,2,2… In *Ceriantheomorphe n. sp.* the arrangement of both tentacles is (0)1.1.2.2… The labial and marginal directives tentacles are present in *Ceriantheomorphe brasiliensis* while are absent in *C. ambonensis*. Two pairs of mesenteries are connected to siphonoglyph of *Ceriantheomorphe brasiliensis*, unlike in *Ceriantheomorphe n. sp.* that has three pairs of mesenteries attached to siphonoglyph. The directives mesenteries were very small in *C. ambonensis*, shorter than betamesenteries (B and b). The directives mesenteries in *Ceriantheomorphe brasiliensis* are longer than betamesenteries (B and b). The protomesenteries (P1) are longer than all

meta-mesenteries (M) in *Ceriantheomorphe brasiliensis* and are shorter than metamesenteries (M) in *Ceriantheomorphe n sp.*

Table 1: Measurements of cnidae found in *Ceriantheomorphe brasiliensis*. In the left column is shown the body parts and types of cnidae found. In the right column show the measurement of each cnidae. Between the parentheses is presented the maximum and minimum length and width of cnidae and outside of parentheses the average. *Probably because of the preservation time.

	***Ceriantheomorphe brasiliensis* N = 30**
Marginal tentacles	
Cnida was not found*	
Labial tentacles	
Microbasic b-mastigophore type II	35.58 (26.50 - 44.66) X 4.69 (3.38 – 6.00)
Pharynx	
Atrichous type I	40.72 (35.88 – 45.57) X 4.97 (3.53 – 6.41)
Column	
Pytchocyst	80.19 (72.62 – 87.77) X 22.98 (18.86 – 27.10)
Atrichous type I	52.16 (48.17 – 56.16) X 10.31 (8.21 – 12.42)
Mesenteries M	
Microbasic b-mastigophore I	48.05 (35.00 – 61.11) X 9.45 (6.93 – 11.98)
Mesenteries b	
Cnida was not found*	

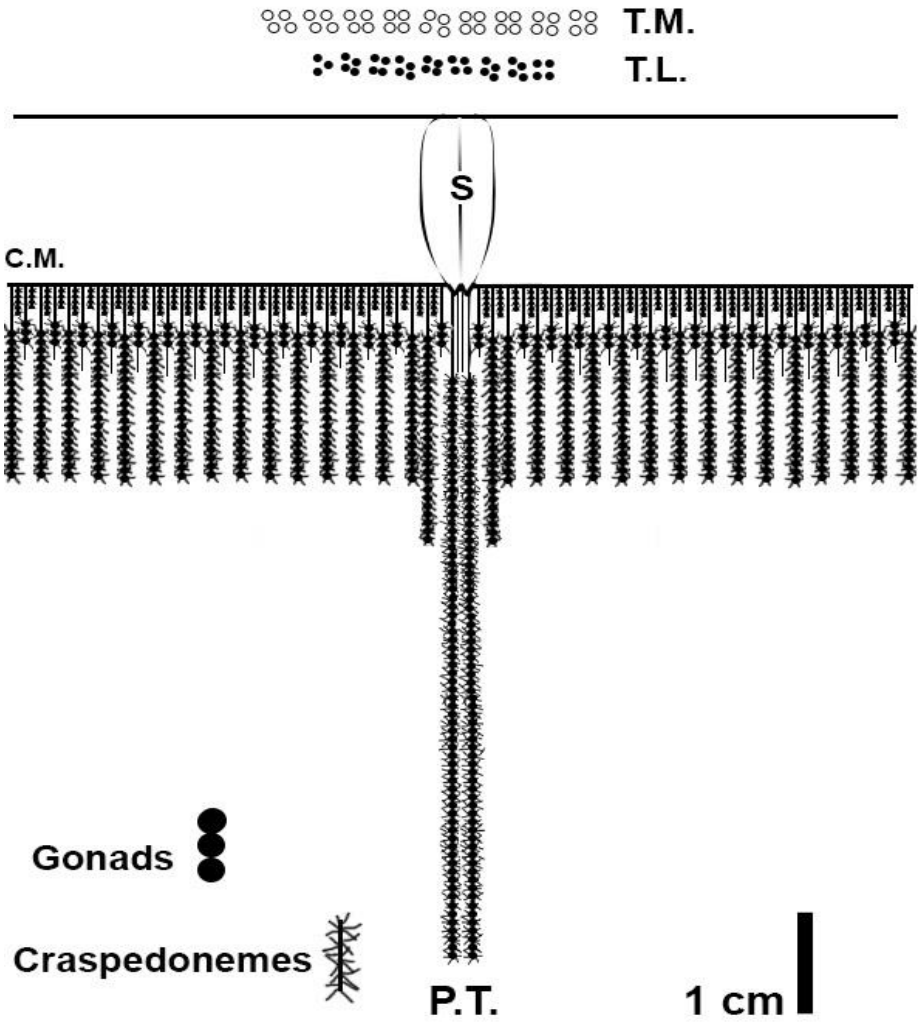

Figure 1. Mesenteries arrangement of the *Ceriantheomorphe brasiliensis* holotype. It is possible to observe two pairs of mesenteries connected to siphonoglyph and the proto-mesenteries P1 extend until the final part of body, as well as gonads present in all mesenteries, except to directives. T.M. marginal tentacles, T.L. labial tentacles, C.M. multiplication chamber, P.T. protomesenteries.

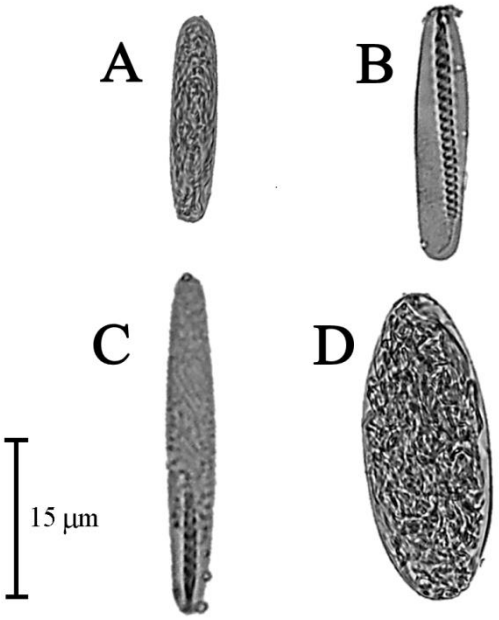

Figure 2. The cnidome composition of holotype of *Ceriantheomorphe brasiliensis*. A. atrichous, B. microbasic b- mastigophore type I, C. microbasic b-mastigophore type II and D. pytchocyst.

Ceriantheomorphe n. sp.

In part *Ceriantheomorphe brasiliensis* Carlgren & Hedgpeth, 1952: 148, 169-170 - Hedgpeth, 1954: 286-290; Molodtsova, 2009: 365-367 - Stampar et al., 2010: 205-209 - Spier et al., 2012: 1-3

Material examined (three specimens). **Holotype**: **LD Ceriantharia 0347 (USNM 50015)** adult specimen 19 cm long, 5,4 to 7,3 cm width from Corpus Christi – Texas, United States of America, collector W. Close, no date. **Paratypes: LD Ceriantharia 0342 (USNM 50016)** individual damaged and not possible to measure from Tamaulipas, Punta de Almagre to North of Hut's Bayo, collector not identified, no date. **LD Ceriantharia 0343 (USNM 51253)** juvenile individual, not possible indentify to measure, 5.0 to 5.9 width from Lousiana, Pass A'Loutre, collector not identified, no date.

Diagnosis. Large cerianthid, at least 19 cm length and 5.0 to 7.3 cm width. 91 – 176 marginal tentacles with 2.4 to 3 cm long, 72-168 labial tentacles with 0.5 to 2.0 cm long, both tentacles in 4 cycles, marginal and labial tentacles arrangement: (0)1.1.2.2…. Medium pharynx, occupies 21% of the entire body size. Siphonoglyph well-marked by

two protuberant tissues composed the pharynx. Three pairs of mesenteries were connected to siphonoglyph, one pair of directives mesenteries and two pairs of protomesenteries (P1 and P2). Hyposulcus well distinct and hemisulci absent. Gastrovascular cavity around 56% of the total body size. All mesenteries fertile, except the directive ones. The mesenteries in quartets (B,m,b,M). The directive mesenteries longer than betamesenteries. Protomesenteries (P1) shorter than all metamesenteries (M) and the P2 shorter than metamesenteries (M) of the quartets 1 to 4. Cnidome: microbasic b-mastigophore (five types) atrichous (two types) and pytchocyst.

Distribution: Gulf of Mexico to North Carolina, United States of America.

Description of holotype: (LD Ceriantharia 0347 - USNM 50015). Medium adult specimen with 19 cm long, between 5.4 and 7.3 cm width. 176 marginal tentacles in four cycles, 2.7 cm of length and tentacle arrangement (0) 1.1.2.2… directive tentacle absent. 168 labial tentacles in four cycles, 2.0 cm long and tentacle arrangement (0) 1.1.2.2… The pharynx occupies about 21% of the entire body size, siphonoglyph well-marked by two lateral protuberances. Three pairs of mesenteries connected to siphonoglyph. Grastrovascular cavity presents a proportion of about 56% in relation to all body size. Mesenteric filaments of almost the same length as mesenteries and craspedonemes only in initial part. Hyposulcus present and distinct and hemisulci absent. All mesenteries fertile, except directives. The mesenteries arrangement B,m,b,M (Fig. 3). Directive mesenteries shorter than betamesenteries (b and B). Protomesenteries (P1) shorter than P2 and the metamesenteries (M). The protomesenteries P2 shorter than metamesenteries (M) of the quartets 1 to 4. Cnidome: microbasic b-mastigophore (five types) atrichous (two types) and pytchocyst (Fig. 4 and Table 2).

Comparison with other species of the genus: The marginal and labial tentacles of *Ceriantheomorphe n. sp.* are arranged in 4 cycles. The arrangement of both tentacles is (0)1,1,2,2… unlike *C. ambonensis* that has 3 cycles and the arrangement of both type of tentacles is 1,1,2; 1,1,2… The number of marginal and labial tentacles of *Ceriantheomorphe n. sp.* are between 96-176 and 72-168, respectively while *C. ambonensis* presents 24 to 150 marginal tentacles and 36 to 150 labial tentacles.

Besides that, *Ceriantheomorphe n. sp.* has three pairs of mesenteries attached to siphonoglyph, directive mesenteries, protomesenteries P1 and P2, while *Ceriantheomorphe brasiliensis* and *C. ambonensis* present only two pairs.

The protomesenteries P1 are shorter than all metamesenteries (M), P2 are shorter than metamesenteries of the quartets (1 to 4) in *Ceriantheomorphe n. sp.*, opposed to this, *Ceriantheomorphe brasiliensis* and *C. ambonensis* present the P1 longer than all metamesenteries (M) and P2 are not attached to siphonoglyph. Nevertheless, while *Ceriantheomorphe n. sp.* has directives mesenteries longer than betamesenteries, *C. ambonensis* present directive mesenteries shorter than betamesenteries.

Furthermore, the ratio of mesenteries m and M when compared between the quartets has the average of the 0.33 to 0.66 in *Ceriantheomorphe brasiliensis*, and *Ceriantheomorphe n. sp.* present the mean among 0.19 to 0.3.

Table 2. Measurements of cnidae found in holotype of the *Ceriantheomorphe n. sp.* In the left column is shown the body parts and types of cnidae found. In the right column the measurement of each cnidae. Between the parentheses is presented the maximum and minimum length and width of cnidae and outside of parentheses the average.

	Ceriantheomorphe n. sp. **(N= 30)**
Marginal tentacles	
B-mastigophores II	39.19 (34.20 – 44.18) X 5.04 (4.07 – 6.01)
B-mastigophoresV	25.12 (20.16 – 30.09) X 3.04 (2.09 – 3.99)
Labial tentacles	
B-mastigophores I	48.72 (39.22 – 58.22) X 6.71 (5.24 – 8.19)
B-mastigophoresII	36.32 (28.18 – 44.46) X 4.77 (3.55 – 6.00)
Pharynx	
Atrichous I	41.66 (32.23 – 51.09) X 5.74 (4.13 – 7.35)
B-mastigophores I	51.43 (40.10 – 62.77) X 7.7 (6.25 – 9.15)
B-mastigophoresII	44.2 (35.29 – 53.11) X 5.13 (3.97 – 6.29)
B-mastigophores III	36.75 (27.57 – 45.93) X 3.36 (2.53 – 4.20)
Column	
Atrichous I	48.12 (38.88 – 57.37) X 9.28 (7.38 – 11.19)
Atrichous II	55.42 (50.08 – 60.77) X 13.92 (9.49 – 18.35)
B-mastigophores I	41.74 (47.80 – 35.68) X 6,0 (4.16 – 7.84)
Pytchocysts	64.3 (58.8 – 69.8) X 17.1 (15.0 – 19.2)
Mesenteries M	
B-mastigophores IV	18.77 (23.27 – 14.27) X 4.24 (2.5 – 5.99)
Mesenteries b	
B-mastigophores II	38.76 (34.01 – 43.51) X 4.36 (3.53 – 5.20)
B-mastigophores III	19.94 (15.46 – 24.42) X 4.79 (3.98 – 5.60)
B-mastigophores IV	23.37 (19.45 – 27.29) X 3.12 (2.15 – 4.10)

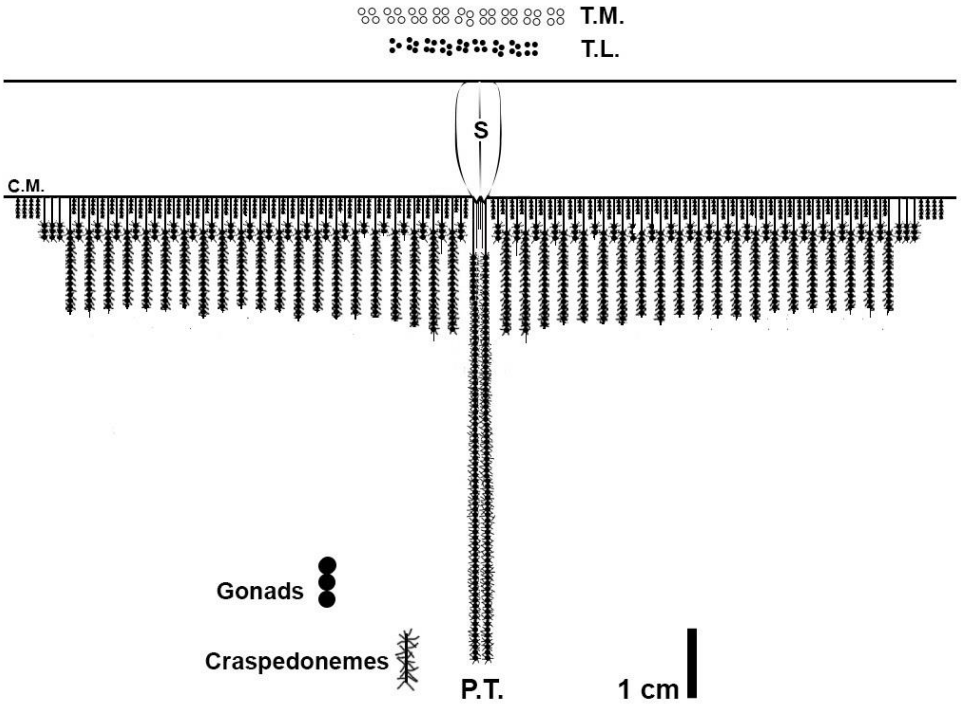

Figure 3. Mesenteries arrangement of *Ceriantheomorphe n. sp*. T.M. marginal tentacles, T.L. labial tentacles, C.M. multiplication chamber, b and B. betamesenteries, D. directives mesenteries, M and m. metamesenteries, P.T. protomesenteries.

DISCUSSION

Taxonomic studies

Although some authors pointed the morphological variation in Ceriantharia, few know about the plasticity of characters in this group (Stampar et al., 2012; Stampar et al., 2016). Morphological variations were observed in the genus *Isarachnanthus* (Stampar et al., 2015) and *Pachycerianthus* (personal observations), however some features present taxonomic value and can be used to identify species (Carlgren, 1912; Arai, 1965). Nevertheless, there are no data about phenotypic plasticity in *C. brasiliensis*. However, our data showed some different characteristics between the *Ceriantheomorphe n. sp.* from North America and *Ceriantheomorphe brasiliensis* from South America, which are distinct of the results of Carlgren and Hedgpeth (1952).

In the individuals of *Ceriantheomorphe n. sp.* present the protomesenteries (P1) are shorter than all meta-mesenteries (M), while the individuals of *Ceriantheomorphe brasiliensis* have the P1 longer than meta-mesenteries (M). Furthermore, the proto-mesenteries P2 are not connected to siphonoglyph in *Ceriantheomorphe brasiliensis* and unlike to *Ceriantheomorphe n. sp*. The taxonomic value of the mesenteries already has been pointed by some authors to identify and distinguish species at interspecific level (Carlgren, 1912; Arai, 1965). However, in the genus *Ceriantheomorphe*, the proportion between protomesenteries and meta-mesenteries have never been studied.

Besides that, the number of mesenteries connected to siphonoglyph also is different between *Ceriantheomorphe n. sp.* and *Ceriantheomorphe brasiliensis*. Despite Carlgren and Hedgpeth (1952) did not have observed differences between specimens, Spier et al. (2012) when recorded *Ceriantheomorphe brasiliensis* from South of Brazil discussed that this species presented two pairs of mesenteries connected to siphonoglyph and *Ceriantheomorphe n. sp.* from Gulf of Mexico had three pairs of mesenteries attached to siphonoglyph.

The ratio of metamesenteries m and M between quartets present a consistent variation. In specimens of *Ceriantheomorphe brasiliensis* the average (ratio) is between 0.33 to 0.66 cm and in the individuals of the *Ceriantheomorphe n. sp.* is 0.19 to 0.3 cm. This characteristic has never been analyzed and discussed before in Ceriantharia.

Despite of some characters not be consistent in Ceriantharia, like number and arrangement of marginal and labial tentacles, which can vary according with age and size of individuals (Carlgren, 1912), many features in relation to mesenteries can be used to distinguish species.

Therefore, some characters described in our results have been showed consistent to identify other species than the genus *Ceriantheomorphe*. For example, number of mesenteries attached to siphonoglyph, the length of proto-mesenteries and directive mesenteries when compared to meta-mesenteries and betamesenteries. The consistence of these characters was also observed in the *Pachycerianthus* and *Ceriantheopsis*.

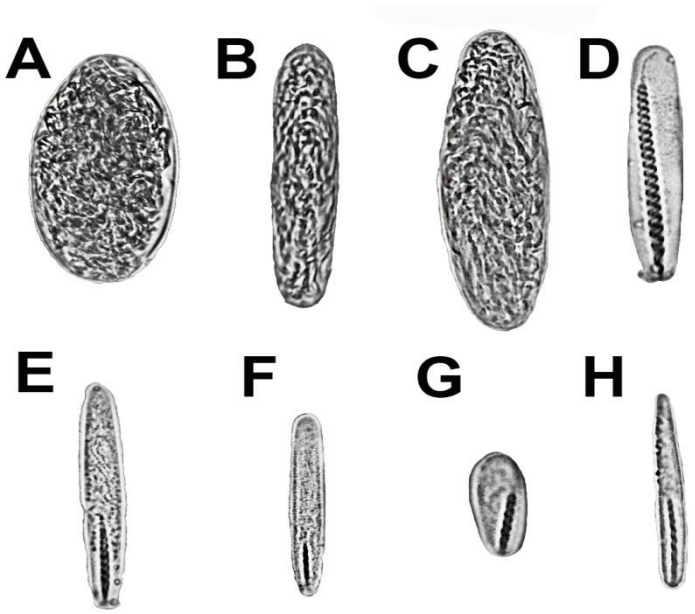

Figure 4. The cnidome of *Ceriantheomorphe n. sp.* holotype. A. Pytchocyst, B. atrichous type I, C. atrichous type II, D. microbasic b-mastigophore I, E. microbasic b-mastigophore type II, F. microbasic b-mastigophore type III, G. microbasic b-mastigophore type IV, I. microbasic b-mastigophore type V.

Distribution pattern

The species *Ceriantheomorphe brasiliensis* have been recorded from Southeastern Brazil to Uruguay (Carlgren, 1931; Spier et al., 2012) while *Ceriantheomorphe n. sp.* was described from Gulf of Mexico to North Carolina, United States of America (Carlgren and Hedgpeth, 1952). The distributional gap between *Ceriantheomorphe n. sp.* and *Ceriantheomorphe brasiliensis* has been discussed by some authors (Carlgren and Hedgpeth, 1952; den Hartog, 1977, Spier et al., 2012). However, no further study was conducted.

Indeed, *Ceriantheomorphe brasiliensis* and *Ceriantheomorphe n. sp.* share many morphological characteristics as observed by Carlgren and Hedgpeth (1952).

Probably the two species have a common ancestor and speciation may have occurred during the Early Miocene, with the beginning of the influence of the Amazon River in shallow areas of present-day northern Brazil. Around 23 Myr ago the western Amazonian was affected by tectonic mechanisms near the Andes and as consequence some modifications happened as subsidence process, movement of sediments towards west and foreland basins. In addition, the stage important to this discussion is the Pebas

system, which was formed approximately 9 Ma where the aquatic configuration at sea during the Miocene and that play a crucial role to migration of species (Wesselingh et al., 2006).

Furthermore, some paleogeographic, paleoclimatologic and paleoecologic evidences pointed the Pebas system has been connected with the Amazonian rivers and both received marine influence (Hoorn, 1994; Webb, 1995, Wesselingh and Salo, 2006), indicating that there was the interchange between the species from Venezuela/Pebas system and Amazonia (Hoorn, 1994; Marshall and Lundberg, 1996).

Indeed, seems that the Pebas system was important to migration of marine vertebrates (Marshall and Lundberg, 1996; Wesselingh and Salo, 2006), however the crossing to sessile and semi-sessile marine invertebrates not was well successful. Hoorn (1994) defended that characteristic freshwater Amazonian and Pebas developed a complex environment that played a barrier to mollusk, ostracods and Foraminifera, such as low salinity, chemistry factors, different rates of oxygen, heterogeneity of substrates and high predation (Wesselingh et al., 2006).

Probably the same scenario occurred with ancestral species of the *Ceriantheomorphe* in Central Atlantic, and *Ceriantheomorphe brasiliensis* and *Ceriantheomorphe n. sp.* were originated. The environmental conditions of the Pebas and freshwater Amazonian played as a geographic and ecological barrier to migration of these populations.

Besides that Wesselingh and Salo (2006) pointed that probably no exchange of fauna from Pebas system and eastern Brazilian occurred as well as there was no connection between the Paraná River. Thereby, probably the migration of individuals belonging to genus *Ceriantheomorphe* from North Atlantic population to eastern coast of Brazil and the maintenance of gene flow between both populations was prevented. Thus, it is possible that the populations from North and South Atlantic experimented an allopatric speciation because of geographic barrier (Krug, 2011) promoted by Pebas and Amazonian.

Table 3. Distinction features between *Ceriantheomorphe* species.

Characters	***Ceriantheomorphe brasiliensis***	***Ceriantheomorphe n. sp.***	***Ceriantheomorphe ambonensis***
Number of marginal tentacles	66 – 196	96 – 176	150* - 24**

Number of labial tentacles	54 – 192	72 – 168	150* – 36**
Tentacle cycles	4	4	3*
Arrangement of marginal tentacles	(1)1.1.2.3...	1.1.2.2...	(0)1.1.2...**
Arrangement of labial tentacles	(1)1.1.2.2…	1.1.2.2…	(0)1.1.2…**
Proportion between pharynx in relation to body size	8% - 27%	21%	18%**
Siphonoglyph	Two pairs of mesenteries connected	Three pairs of mesenteries connected	Two pairs of mesenteries connected**
Proportion of gastrovascular cavity in relation to body size	33% - 72%	56%	55%**
Number of mesenteries	85 – 321	118	38**
Proportion of mesenteries	0.52 – 3.9 cm (B x b); 0.33 – 0.79 cm (m x M)	1.5 – 3.0 cm (B x b); 0.19 – 0.36 cm (m x M)	0.3-0.5 cm (b x B); 2.2 – 3.0 cm (M x m)**
P1	Longer than all meta-mesenteries M	Shorter than all meta-mesenteries M	Longer than all meta-mesenteries M**
P2	Not connected to siphonoglyph	Attached to siphonoglyph. Shorter than meta-mesenteries M1, M2, M3 and M4	Not connected to siphonoglyph**
Directive mesenteries	Longer than beta-mesenteries B and b	Longer than beta-mesenteries B and b	Shorter than beta-mesenteries B and b**

* Data from Kwietniewski, 1892. ** Data from personal observation.

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Capítulo 2.

O CASO DE *Ceriantheomorphe brasiliensis* (CNIDARIA: ANTHOZOA: CERIANTHARIA): UMA COMPARAÇÃO NO ATLÂNTICO SUL

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Resumo

Variação morfológica é observada em muitos grupos de invertebrados marinhos, isso não é diferente em Ceriantharia, mas nesse grupo essa discussão é recente. Não obstante, a maioria dos estudos taxonômicos é realizado usando apenas caracteres morfológicos e muitas inconsistências taxonômicas tem ocorrido. A variação morfológica nunca foi estudada em muitos grupos de Ceriantharia, por exemplo, em *Ceriantheomorphe brasiliensis*, Carlgren, 1931. Assim, o objetivo do nosso estudo foi comparar os caracteres morfológicos dos espécimes de *Ceriantheomorphe brasiliensis* da costa do Atlântico Sul, verificar a variação morfológica entre os indivíduos e discutir a incongruência dos caracteres. Foram feitas análises anatômicas dos pólipos e o cnidoma foi verificado. Nossos resultados mostraram alta variação morfológica entre os espécimes da América do Sul que não apresentaram nenhuma diferença molecular. A quantidade de tentáculos marginais e labiais, mesentérios, tamanho corpóreo e presença do hemisulco e hiposulco foram inconsistentes entre os indivíduos. Em contraste alguns caracteres foram constantes como o número de mesentérios conectados à sifonóglife. Assim, nossos resultados mostraram que os indivíduos de *Ceriantheomorphe brasiliensis* apresentam caracteres morfológicos plásticos mesmo entre indivíduos que mantém troca de fluxo gênico.

Palavras-chave: Plasticidade fenotípica. Invertebrados marinhos. Condições ambientais.

THE CASE OF *Ceriantheomorphe brasiliensis* (CNIDARIA: ANTHOZOA: CERIANTHARIA): A COMPARISON IN THE SOUTH ATLANTIC

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Abstract

Morphological variation is observed in many marine invertebrate groups, this is not different in Ceriantharia, but in this group this discussion is recent. Nevertheless, most taxonomic studies are performed using only morphological characters and many taxonomic inconsistencies have occurred. The morphological variation was never studied in many groups of Ceriantharia, for example in *Ceriantheomorphe brasiliensis* Carlgren, 1931. Thus, the aim of our study was to compare the morphological characters of the specimens of *Ceriantheomorphe brasiliensis* from South Atlantic coast to verify variation between the individuals and discuss the incongruence of characters. We performed anatomical analysis of the polyp and the cnidome was verified. Our results showed high morphological variation between the specimens from South America without any molecular difference. The number of marginal and labial tentacles, number of mesenteries, body size, presence of hemisulci and hyposulcus was inconsistent between the individuals. In contrast, some characters were constant as the number of mesenteries attached to siphonoglyph. Thus, our analysis showed that individuals of *Ceriantheomorphe brasiliensis* present plastic morphological characters even in specimens with gene flow.

Keywords: Phenotypic plasticity. Marine invertebrates. Environmental conditions.

INTRODUCTION

Phenotypic plasticity is observed in several marine sessile animals, in most cases as a response to environmental conditions, such as depth, light, exposure to wave, sedimentation level and nutrients (Meroz-Fine et al., 2003). Because of it, many taxonomic problems are observed in marine invertebrates and the morphological variation has been discussed in some groups as corals (Foster, 1979; Stefani et al., 2011), Actiniaria (Stoletzki and Schierwater, 2005; Mallien, et al., 2017) and Porifera (Lopez-Legentil, 2011).

In Ceriantharia (Cnidaria: Anthozoa), few studies addressed morphological variation in same species. Carlgren (1912) just recorded that some morphological characters could vary in individuals of the same species, however the author did not discussed theses differences.

However, some taxonomic inaccuracies in studies with ceriantharians are now observed, for example *Ceriantheomorphe brasiliensis* Carlgren, 1931 and *Ceriantheomorphe n. sp.* that were described as the same species and just sixty-four years after this inconsistency was enlightened (Chapter 1) and specimens of genus *Isarachnanthus* from Madeira Island, Caribean sea and Canary Island. Nevertheless, Stampar et al. (2012) showed that the individuals belong to distinct species.

Besides that, the use of complex and confusing terminology (Arai, 1965; den Hartog, 1977), descriptions based only in larval stage that are not well known are some problems that has been resulted in inaccuracies in the Ceriantharia (Stampar et al, 2016).

Whereas taxonomic studies with ceriantharians exclusively adopt morphological characters to indentify and to describe species (Carlgren, 1912; Arai, 1965; den Hartog, 1977) and many taxonomic inconsistencies occur, leading to mistakes in descriptions (see discussion in Stampar et al., 2015 and Stampar et al., 2016), discussions about phenotypic plasticity in this group are crucial, but absent.

Given the taxonomic uncertainties in Ceriantharia, studies that discuss taxonomic incongruence assuming the higher rate of morphological variations and distribution factors are necessary. Thus, the aim of this study is to compare specimens of *Ceriantheomorphe brasiliensis* from Brazil and Uruguay, to verify morphological variation between the specimens and discuss the morphological inconsistencies.

MATERIAL AND METHODS

Specimens

Seventeen specimens of *Ceriantheomorphe brasiliensis* preserved in 4% formaldehyde solution and ethanol were analyzed and compared (Table 1). Specimens were obtained by SCUBA diving and collected by hand.

Table 1 – Studied specimens of *Ceriantheomorphe brasiliensis*.

Species	Country	Locality	Specimens
Ceriantheomorphe brasiliensis	Uruguay	Punta del Este	2
		Montevideo	1
	Brazil	Florianopólis (SC)	2
		São Sebastião (SP)	3
		Angra dos Reis (RJ)	1
		Rio de Janeiro (RJ)	2
		Arraial do Cabo (RJ)	2
		Guarapari (ES)	3
		Baía de Guanabara (RJ)	1

Morphological analysis

The morphological observation was performed in two steps, anatomical analysis of the polyps and morphometric analysis (cnidome) using the structures and criteria established by Carlgren (1931), Arai (1965), den Hartog (1977) and Stampar et al. (2014).

The specimens were individually dissected and fixed in dissection plates and photographed. The animals were measured, and each part of their bodies was observed and described. The marginal and labial tentacles were counted, and their distribution and insertion were drawn. Furthermore, the presence or absence of tentacle pores was also verified. The mesenteries were counted, measured, drawed and their structures were described.

Thirty capsules of the cnida of each type were analyzed for each body part, marginal and labial tentacles, pharyngeal region, column, meta-mesenteries and betamesenteries. Small piece of tissues were removed from each body part, macerated with water in the blade and analyzed in microscope using the magnification of 40x, both the length and the width of the cnidae were measured in the Motic Images Plus 2.0

software. The cnidae were grouped according to morphological varieties (Mariscal, 1974; den Hartog, 1977).

RESULTS

Morphological compilation

Our results showed that the specimens of *Ceriantheomorphe brasiliensis* analyzed presented high morphological variation in mostly characters. The ceriantharians have between 66 to 196 marginal tentacles and 54 to 192 labial tentacles. In relation to the cycles of both tentacles, it was not observed variation, all individuals present four cycles (Figure 1). Only one specimen from Uruguay exhibited difference in labial tentacles arrangement, (1)1.1.2.3; 1.1.2.3. Despite the variation in arrangement of both tentacles proximate to siphonoglyph, in stable areas the organization of the marginal and labial tentacles was (1) 1.1.2.3…, (1) 1.1.2.2…, respectively. The number of pores in tentacles varied (Figure 2).

Regarding body length, the individuals analyzed presented high variation, between 8.5 and 24 cm. The proportion of pharynx in relation to body length was not constant, occupying about 8 to 27%, while the gastrovascular cavity in some individuals covered more than half of the entire body, were the case of the specimens from Uruguay, São Paulo, four individuals from Rio de Janeiro, one from Espírito Santo and Santa Catarina. The proportion of other specimens varied, between 33% and 46%, however, the gastrovascular cavity was always longer than pharynx.

Ceriantheomorphe brasiliensis exhibit two pairs of mesenteries connected to siphonoglyph, the protomesenteries P1 and one pair of directive mesenteries. This characteristic did not present variation between specimens. Only one specimen from Uruguay did not present hiposulci. In other specimens, the structure was well distinct. Four individuals exhibited hemisulci evident.

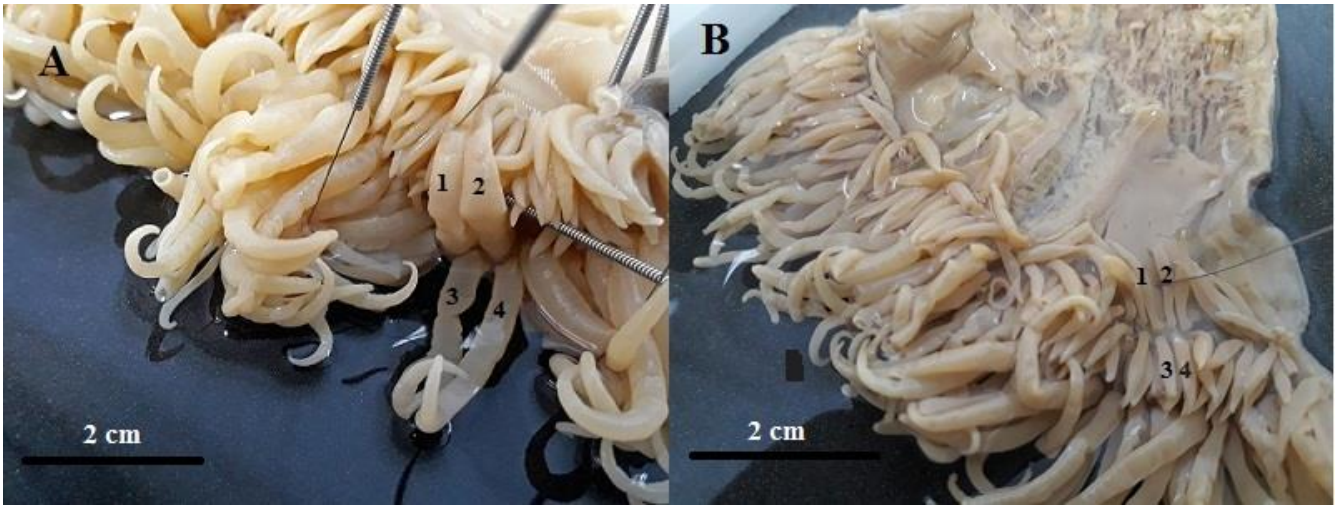

Figure 1. Cycles of marginal and labial tentacles of two distinct specimens of *Ceriantheomorphe brasiliensis*. **A.** Individual from Santa Catarina that present the marginal tentacle is arranged in four cycles. **B.** Labial tentacles of specimen from Espiríto Santo arranged in four cycles. In both images 1 = first cycle, 2 = second cycle, 3 = third cycle and 4 = fourth cycle.

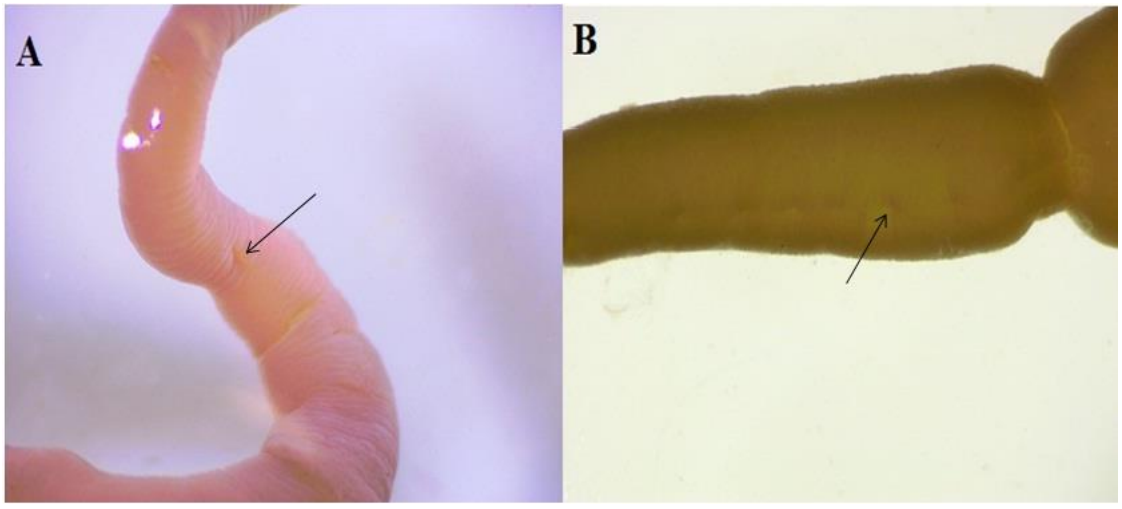

Figure 2. Pores present in tentacles of *Ceriantheomorphe brasiliensis*. **A.** The pores in marginal tentacles of individual from Santa Catarina. **B.** The labial tentacle from another specimen from Santa Catarina with many pores

The siphonoglyph length in relation to the pharynx varied between the specimens, however always occupied more than 84% of pharynx. The siphonoglyph of all individuals from Santa Catarina extended for all length of the pharynx.

Nevertheless, the number of mesenteries presents a noteworthy variation, between 70 and 321. The individuals from Santa Catarina present the larger number of mesenteries.

In all specimens, the P1 occupied almost the entire length of gastrovascular cavity. However, the proportion varied between 78 and 100%. The directive mesenteries were always longer than betamesenteries B and b and shorter than metamesenteries m and M, except in one specimen from Rio de Janeiro, in which the directive mesenteries were longer than metamesenteries m. Besides that, the directive mesenteries occupied between 9 and 26% of the length of gastrovascular cavity.

The ratio between meta-mesenteries M x m and B x b had few variation, 0.47 to 0.60 and 1.4 to 2.5, respectively. Furthermore, the arrangement of mesenteries was constant, B,m,b,M.

DISCUSSION

Our analysis showed significant morphological variation between individuals of *Ceriantheomorphe brasiliensis* that do not presented molecular differences to the regular markers (COI, ITS and 16S) (unpublished data). In the description of the species Calrgren (1931) did not mentioned the differences between the specimens, besides that, Calrgren and Hedgpeth (1952) described *Ceriantheomorphe brasiliensis* from North Atlantic arguing that there were no morphological differences.

The specimens distinguished by the number of mesenteries, marginal and labial tentacles and body size, are related to the age of each specimen (table 2). However, Stampar et al. (2015) defended that the taxonomic inconsistency in Ceriantharia can be due to the use of incongruent morphological characters as the cited above. However, no study discussed about the inconsistence of these characters in *Ceriantheomorphe brasiliensis*.

Carlgren (1912) pointed that the arrangement of labial and marginal tentacles is related with the size and stage of development (age) of the specimen. The author showed the example of *Botrucnidifer novergicus* Carlgren, 1912 that presented between

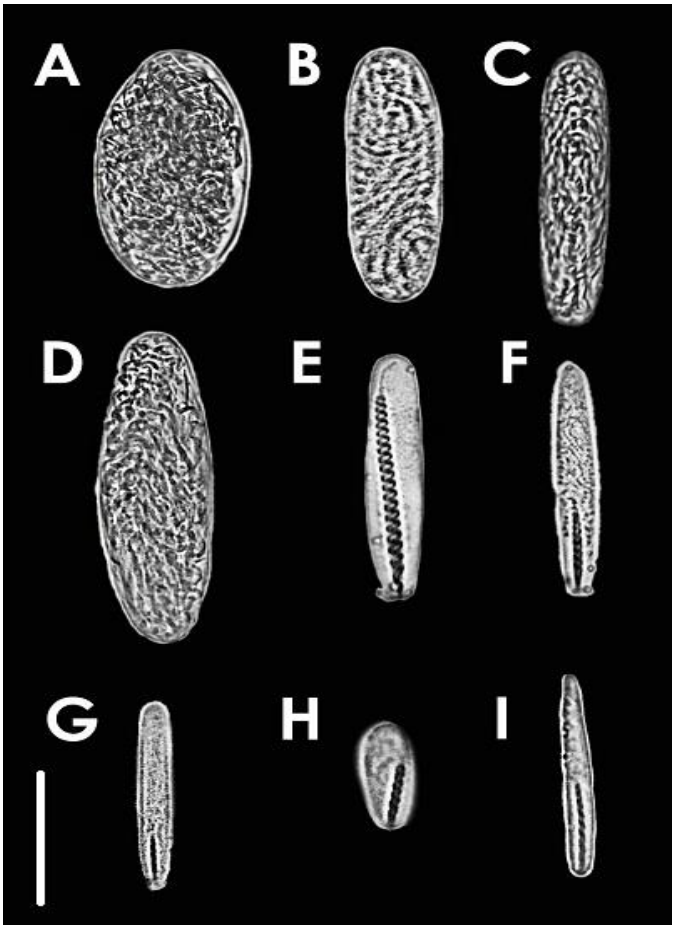

Figure 3. Cnidae that composed the cnidome of *Ceriantheomorphe brasiliensis* from coast of South Atlantic. **A.** Pytchocyst. **B.** Holotrich. **C.** Atrich type I. **D.** Atrich type II. **E.** microbasic b-mastigophore type I. **F.** microbasic b-mastigophore type II. **G.** microbasic b-mastigophore type III. **H.** microbasic b-mastigophore type IV. **I.** microbasic b-mastigophore type V.

3,2 and 3,6 cm long and exhibited the labial tentacles arranged in just 1 cycle, while *Pachycerianthus multiplicatus* Carlgren, 1912, a species with individuals measuring about 15,5 cm long, presented both tentacles arranged in 3 or 4 cycles. *Cerianthus lloydii* Gosse, 1859 in the juvenile stage has tentacles arranged in one cycle and as adult specimens can be found from 3 to 4 cycles

We analyzed large specimens with 8.5 to 24 cm long and did not observed variation in the number of cycles of both tentacles even in juvenile specimens. Therefore, in *Ceriantheomorphe brasiliensis* the number of tentacle cycle did not distinguish size or age of individuals. Nevertheless, this character is shared by some other genera, thus the use for taxonomic studies is not interesting. Furthermore, the presence of hemisulci and hyposulcus was not constant between the specimens (table 3). However, in individuals analyzed the hyposulcus when present were quite distinct.

Table 2. Comparison table of morphological features of *Ceriantheomorphe brasiliensis* specimens. The symbols X means that was not possible to observe the character because of damages and * means that the characteristic is uncertain.

Individuals	Number of marginal tentacles	Number of labial tentacles	Arrangement of marginal tentacles	Arrangement of labial tentacles	Number of pores of marginal tentacles	Number of pores labial tentacles	Body size (cm)
LD 0337	124	128	(1)1.2.3.3; 1.1.2.3...	(1) 1.1.2; 1.1.2.2	11	X	10.7
LD 0354	108	106	X	X	X	X	X
LD 0355	128	*118	X	X	X	X	X
LD 0357	176	170	(1) 1.1.2.2; 2.1.4.3; 2.1.4.3; 1.1.2.3…	(1) 1.1.2.2; 1.1.2.2…	8	X	17
LD 0356	194	156	(1)1.1.2.3…	(1)1.1.2.2…	1	X	16.5
LD 0338	104	98	(1) 1.2.3.3; 1.1.2.3…	(1) 1.1.2.2; 1.1.2.2	14	1	9.3
LD 0339	174	184	(1) 1.2.3.4; 1.1.2.3…	(1) 1.2.3.4; 1.1.2.3; 1.1.2.2	13	6	24
LD 0340	X	X	X	X	X	X	14.5
LD 0344	84	82	(1) 1.2.3.3; 1.1.2.3…	X	7	2	8.5
LD 0348	100	94	(1) 1.2.3.3; 1.1.2.3…	(1) 1.1.2.2; 1.1.2.2…	6	2-3	22
LD 0350	80	X	X	X	0-3	X	X
LD 0341	196	192	(1) 1.2.4.3; 1.1.2.3…	(1) 1.2.3.3; 1.1.2.2	7	1	16.5
LD 0352	112	115	(1) 1.2.3.4; 1.1.2.3...	(1) 1.2; 1.1.2.2...	X	2	10.9
LD 0353	172	176	(1) 1.2.3.4; 1.1.2.3...	(1) 1.2.3; 1.1.2.2...	5 – 12	3-4	14.4
LD 0345	150	148	(1) 1.2.3.3; 1.1.2.3…	(1) 1.1.2.3; 1.1.2.3	X	1	11
LD 0349	94	114	(1) 1.2.4.3; 1.1.2.2; 1.1.2.3…	(1) 1.1.2.3; 1.1.2.2…	2-3	2	*22.2
LD0351	66	*54	(1) 1.2.3.4; 1.1.2.3...	*(0) 1.2.2.2...	1-3	2	13

Table 3. Comparison of some features between the *Ceriantheomorphe brasiliensis* specimens. X means that was not possible observe the character because of damages. The number 1 and 0 shown in fifth and last column are referent the presence and absence, respectively of hemisulci and hyposulcus.

Individuals	Proportion of pharynx and body size (%)	Proportion of gastrovascular cavity and body size (%)	Number of pairs of mesenteries attached to siphonoglyph	Hyposulcus	Hemisulci
LD 0337	25	33	2	1	1
LD 0354	X	X	X	X	X
LD 0355	X	X	X	X	X
LD 0357	14	62	2	X	X
LD 0356	15	68	2	X	X
LD 0338	9	39	X	1	0
LD 0339	13	66	2	1	0
LD 0340	18	66	X	X	X
LD 0344	8	46	2	1	0
LD 0348	10	65	2	1	1
LD 0350	X	X	X	1	1
LD 0341	X	X	X	1	0
LD 0352	27	41	2	1	1
LD 0353	21	62	2	1	0
LD 0345	16	52	2	1	0
LD 0349	14	72	2	0	0
LD0351	9	62	2	1	X

Table 4. Comparison of some features between the *Ceriantheomorphe brasiliensis* specimens. X means that not was possible observe the character because of damages. B and b are referent to betamesenteries. M and m denotes the metamesenteries. P1 means the first pair of protomesenteries.

Individuals	Proportion between siphonoglyph and pharynx (%)	Numebr of mesenteries	Proportion between P1 and gastrovascular cavity (%)	Proportion between directive mesenteries X gastrovascular cavity (%)	M X m (cm)	B X b (cm)	Arrangenment of mesenteries
LD 0337	89	168	100	22	0.48	2.4	B,m,b,M
LD 0354	X	X	X	X	X	X	X
LD 0355	Longer than pharinx	X	X	X	X	X	X
LD 0357	95	70	78	9	X	X	B,m,b,M
LD 0356	X	X	X	X	X	X	X
LD 0338	100	X	X	X	X	X	X
LD 0339	Longer than pharinx	126	83	26	0.46	2.5	B,m,b,M
LD 0340	X	X	X	X	X	X	X
LD 0344	85	86	91	17	0.56	1.6	B,m,b,M
LD 0348	Longer than pharinx	X	X	X	X	X	X
LD 0350	Longer than pharinx	X	X	X	X	X	X
LD 0341	100	X	X	X	X	X	X
LD 0352	Longer than pharinx	198	X	X	0.56	1.7	B,m,b,M
LD 0353	Longer than pharinx	321	X	X	0.48	2.4	B,m,b,M
LD 0345	100	166	100	17	0.51	1.9	B,m,b,M
LD 0349	90	182	X	X	0.47	1.7	B,m,b,M
LD0351	X	108	X	X	0.60	1.4	B,m,b,M

Our approach is different from Carlgren (1912), which argued that hyposulci is short and show some differences in possible development of the structure between *Pachycerianthus* and *Arachnanthus*. Usually the hemisulci present an uneven development. In *Arachnanthus* it is absent, while in *Pachycerianthus solitarius* Rapp, 1829 and *P. multiplicathus* the hemisulci is similar to *C. lloydii* (Carlgren, 1912).

The scenario above showed that hemisulci and hyposulcus do not have an intraspecific and interspecific taxonomic information in Ceriantharia, since our results these structures varied between individuals of the same species and there are records that the hemisulci do not present differences between genera distinct.

Arai (1971) described species belong *Pachycerianthus* from British Columbia and Washington and related that the specimens presented morphological variation, mainly in characteristics of mesenteries as length of protomesenteries P1 and P2, as well as the metamesenteries M1, M2, M3.

In individuals of *Ceriantheomorphe brasiliensis* the length of P1 in relation to gastrovascular cavity, the ratio between metamesenteries M x m and betamesenteries B x b and the arrangement of mesenteries were consistent (table 4).

Carlgren (1912) argued that the arrangement of mesenteries has taxonomic value to distinguish species. However, in some cases this feature can be irregular between the individuals as in *P. solitarius*, *P. multiplicatus* and *B. novergicus*.

The number of mesenteries connected to siphonoglyph was stable between the specimens of *Ceriantheomorphe brasiliensis*. At description of species this information is already registered (Calrgren, 1912). However, this character is constant and can be used in taxonomic studies.

The morphological inconsistencies usually present in Ceriantharia mentioned by Stampar and Morandini (2014) were observed in our results. The variations described above are not particularly unique to *Ceriantheomorphe brasiliensis*, in new analyzes performed in the specimens of *Pachycerianthus* cf. *maua* from Singapore, such distinctions have been observed (unpublished data).

In a review of the genus *Isarachnanthus* Carlgren, 1924 from Atlantic Ocean, no morphological difference was found between the specimens from the Caribbean, Brazilian Coast and Madeira Island (except the cnidome). Despite the molecular analysis showed two consistent and different clades (Stampar et al., 2012).

On the other hand, in analysis performed in individuals belonging to *Pachycerianthus* cf. *maua* from the Singapore shoreline it was possible to observe significant morphological variation between the specimens (unpublished data) suggesting that a high phenotypic plasticity occurs in Ceriantharia.

The same variations can be comparable to other marine animals (Padilla and Savedo, 2013) such as Scleractinia (Todd et al., 2004; Stefani et al., 2011), Porifera (Klautau et al., 1999; López-Legentil et al., 2010) and Decapoda (Haye et al., 2010). For example, a study performed in two species of Porifera from South America, *Cliona celata* and *Cliona chilensis* the morphological and molecular analysis showed different results. According to the molecular data, four clades were indentified for two species of *Cliona*, while the morphological analysis based in morphometry of tylostyle did not demonstrate distinction between clades. However, that is a characteristic that is quite used in identification studies of Porifera, which can be a problem for accuracy in taxonomic studies. Besides, the results revealed the large geographic range with discontinuous distributions (De Paula et al., 2012).

The phenotypic plasticity has been an important subject to understand the function, metabolism and behavior of marine organisms and how these are maintained amid environmental conditions changes as well as the role that the plasticity has in evolutionary processes (Padilla and Savedo, 2013). Some studies report that the phenotypic plasticity occurs as a response from the individuals to environmental conditions variations or/and as a result of genetic modifications that the species accumulate across the time due to the decrease of gene exchange (Prada et al., 2008). The phenotypic plasticity involves changes in the development as much as the changes in phenotype and metabolism (Fusco and Minelli, 2010).

However, our analysis demonstrated that the morphological variation that occurs between the specimens of *Ceriantheomorphe brasiliesis* have no relation with the geographic distribution. The individuals probably maintained gene flow, to molecular level not was distinguish and the morphological differences happen between specimens of the same locality. The studies of Arai (1971) for *Pachycerianthus* also reported that the morphological variation found between the specimens and the environmental conditions that the individuals were submitted was not correlated.

Other case of phenotypic differentiation is for heterochromia that result in different adult form. A study performed with squat lobster *Pleuroncodes monodon* from

Southeast coast revealed through molecular data that the morphological and behavioral distinction of the adult forms is due to differences in development stage (Haye et al., 2010).

The same scenario was observed in *Isarachnanthus* that adult individuals develop different morphology (characteristics of genus *Arachnanthus*) due to time of the larval settlement, which is influenced by seasons, winter and summer (unpublished data).

About the cnidome, our analysis showed that statistical approach of these capsules is not profitable to distinguish individuals to specific level. The taxonomic value of the cnidae is already well discussed in other groups of Cnidaria, due to the high variation that these structure present, according with body tissues, body size, depth and latitude that specimen inhabit (Acuña et al., 2007; Fautin, 2009; Acuña et al., 2011).

Through our results it was possible to observe that a wide morphological variation occurs in *Ceriantheomorphe brasiliensis* from South Atlantic Coast that do not present molecular differences. Despite that ceriantharians usually showed morphological characters quite inconsistent, the most analysis are based solely on morphological aspects (Carlgren, 1912; Arai, 1965; den Hartog, 1977), the use of only morphological characters is not adequate to identify and distinguish species in Ceriantharia (Stampar et al., 2015).

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CONCLUSÃO GERAL

A espécie *Ceriantheomorphe brasiliensis*, assim como outras espécies de Ceriantharia, é pouco estudada. Apesar da inconsistência taxonômica apresentada por essa espécie e alguns autores terem apontado o problema, nenhum estudo tinha sido realizado a fim de discutir as incongruências na descrição dessa espécie.

Através de análises morfológicas foi possível determinar que o espécime descrito como *Cerianthus brasiliensis* para Baía de Guanabara (Rio de Janeiro) é sinônimo de *Ceriantheomorphe brasiliensis* e baseado na data da descrição do indivíduo do Rio de Janeiro, houve a redesignação do holótipo da última espécie. Este espécime esteve em exposição no Museu Nacional do RJ e depois guardado separadamente da coleção de Cnidaria. Talvez isso tenha inviabilizado o encontro do espécime no passado.

Além disso, *Ceriantheomorphe brasiliensis* possuía uma distribuição convencionada como disjunta. Havia indivíduos descritos para o Sul/Sudeste do Brasil, Uruguai e Golfo do México. Essa inconsistência perdurava desde 1952 quando Carlgren descreveu os espécimes do Atlântico Norte.

Nossas análises mostraram algumas diferenças morfológicas entre os indivíduos do Atlântico Sul e Norte como a quantidade de mesentérios conectados à sifonóglife, que nos deram base para distinguir que os espécimes do Golfo do México eram uma espécie nova do gênero *Ceriantheomorphe*. Portanto, uma nova espécie foi descrita nesse estudo, a saber, *Ceriantheomorphe n. sp*.

Alguns autores já vêem apontando e discutindo espécies crípticas e incongruências taxonômicas em Ceriantharia. Porém, poucos estudos abordaram plasticidade fenotípica nesse grupo e não há nenhuma discussão efetiva sobre a implicação dessas variações em estudos taxonômicos dos ceriantídeos.

A partir de nossas análises foi possível verificar que os indivíduos de *Ceriantheomorphe brasiliensis* da costa do Atlântico Sul apresentam alta plasticidade fenotípica entre si e que alguns caracteres morfológicos não são adequados para serem usados em estudos taxonômicos em Ceriantharia. Além disso, como alguns estudos recentes apontam o ideal para distinguir e identificar espécies seria a utilização e análise de um conjunto de informações morfológicas, moleculares e até mesmo comportamentais.

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APÊNDICE

Glossário

Actinofaringe ou faringe (actinopharynx or pharynx): se refere ao estomodeu (Mc Murrich, 1890). Tubo que faz a ligação entre a boca e a cavidade gástrica (Arai, 1965). A estrutura se inicia logo abaixo dos tentáculos labiais.

Câmara diretiva (directive chamber): câmara que se encontra entre os dois mesentérios diretivos (Arai, 1965).

Cavidade gastrovascular (gastrovascular cavity): também referido como colentero, principal cavidade do animal (Arai, 1965). Onde se encontram os mesentérios.

Cnida (cnidae): nematocisto (Arai, 1965).

Craspedonemas (craspedonem): processo da mesogleia e hipoblasto de mesentérios sobre os quais passam filamentos mesentéricos (Arai, 1965).

Hemisulco (hemisulci): continuação da metade do hiposulco e está ligado ao limite dos mesentérios diretivos (Carlgren, 1912; Arai, 1965).

Hiposulco (hyposulci): prolongação da sifonóglife abaixo da actinofaringe. Essa estrutura também está ligada aos mesentérios diretivos (Arai, 1965). Em *P. aestuarii* a estrutura é bastante desenvolvida.

Mesentérios (mesenteries): estrutura que se estende em direção longitudinal na cavidade gastrovascular. Estão conectados à actinofaringe e possui filamentos que se dispõem em cima dos mesentérios (Arai, 1965). Os mesentérios são organizados em pares (den Hartog, 1977).

Mesentério diretivo (directive mesenteries): Um par de mesentérios que está conectado à sifonóglife e está próximo ao plano diretivo (Arai, 1965).

Metamesentérios (metamesenteries): mesentério organizado em 4 ciclos (Carlgren, 1912)

Nematocisto (nematocyst): cápsulas produzidas pelo complexo de Golgi. Estrutura característica dos Cnidarios. São usadas para defesa e captura de presas (Fautin, 2009).

Protomesentérios (protomesenteries): mesentérios que surgem no primeiro estágio embriológico. Os três primeiros mesentérios que se dispõem ao lado do plano diretivo (Arai, 1965).

Tentáculos (tentacles): estruturas que são divididas em dois tipos, tentáculos marginais e labiais que se dispõem em linhas (Carlgren, 1912; Arai, 1965). Os tentáculos marginais estão próximos ao disco oral, enquanto os labiais estão circuncidando o disco oral (Arai, 1965).

Tentáculo diretivo (directive tentacles): tentáculo que se dispõe na abertura da câmara diretiva (Arai, 1965).

Sifonóglife (siphonoglyph): estrutura que se dispõe na faringe, porém em alguns espécimes podem se estender até o inicio da cavidade gastrovascular. Geralmente, mesentérios estão conectados a ela. Por exemplo, em *Pachycerianthus aestuarii* Torrey and Kleeburger, 1909 16 mesentérios podem estar conectados à sifonóglife, enquanto em *Ceriantheomorphe brasiliensis* 4 mesentérios estão conectados (Carlgren, 1912).