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Epiphytic macroalgae from Boa Viagem Beach, Recife, Pernambuco state, Brazil

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Abstract: The aim of this study was to carry out a taxonomic survey of epiphytic seaweeds that occur on reefs of Boa Viagem Beach, located in the metropolitan region of Recife – Pernambuco state, Brazil. The samplings were performed in the dry season (December 2009) and rainy season (April 2010) at intertidal reefs using 625 cm2 squares. Voucher specimens are deposited at the Herbarium of the Instituto de Botânica, São Paulo, Brazil (SP). A total of 48 taxa were recorded of which 20 were Chlorophyta, 27 Rhodophyta and one Heterokontophyta. The most representative orders were Ceramiales and Cladophorales, with 17 and 10 taxa respectively. Nine species are new additions to the flora of Pernambucan coast. *Gelidium pusillum* (Stackh.) Le Jol. 1863 and *Chondracanthus saundersii* C. W. Schneid. and C. E. Lane 2005 had the highest number of epiphytic macroalgae. The majority of species was collected in the rainy season and on wave-exposed sites.

Introduction

Epiphytic seaweeds play an important role in the ecology of marine communities but are poorly studied in the majority of phytobenthic surveys (Levin and Mathieson 1991). These organisms are a source of food for grazers, and contribute to the increase in species richness and primary production (Elven *et al*. 2004). Epiphytism is a very common association in benthic marine communities (Kraberg and Norton 2007) and epiphytic macroalgae are often present on the thallus of perennial macroalgae (Kersen *et al*. 2011). In Brazil few studies have analyzed the macroalgae that grow as epiphytes: Ferreira-Correia (1969) recorded 36 species of epiphytic algae on *Digenea simplex* (Wulfen) C. Agardh 1822 in Ceará state; Guimarães *et al*. (1981) found 36 species on macroscopic Phaeophyceae on the continental shelf of northeastern and southeastern Brazil; Széchy and Paula (1997) listed 81 infrageneric taxa of epiphytic macroalgae in *Sargassum* C. Agardh 1820 communities of Rio de Janeiro and São Paulo; Nunes (1998) identified 23 taxa of epiphytic macroalgae in Rhodophyta from Salvador, Bahia state; Széchy and Paula (2000) recorded 152 species of macroalgae associated to beds of *Sargassum* in Rio de Janeiro and São Paulo; Lucio and Nunes (2002) found 37 taxa of epiphytic macroalgae in Rhodophyta from Guarajuba Beach, Bahia state; Széchy and Sá (2008) identified 46 species of macroalgae in a population of *Sargassum vulgare* C. Agardh 1820 in Rio de Janeiro state and, recently, Santos and Moura (2011) reported the occurrence of five new records of epiphytic macroalgae for Bahia state.

The aim of the present study was to perform a taxonomic survey of epiphytic seaweeds at Boa Viagem Beach, Pernambuco state.

Materials and Methods

The study was carried out at the intertidal reefs of the Boa Viagem Beach, located in the metropolitan region of Recife, Pernambuco state, northeastern Brazil (08°05'26" S, 34°52'55" W and 08°08'52" S, 34°54'23" W). This region shows a landscape characterized by several buildings, hotels, business centers and contributes significantly to tourism in the state due to the occurrence of beach rocks parallel to the coastline.

Sampling was performed during the dry season (December 2009) and rainy season (April 2010) using squares with an area of 625 cm^2. Twenty squares were randomly disposed along the reefs at each sampling site. The whole area of the square was scraped and the algae were placed in labeled plastic bags, and kept frozen until the analysis procedure. In the laboratory the algae were fixed and preserved in 4% formalin-seawater solution and separated for later taxonomic identification with the aid of a stereomicroscope and an optical microscope. From total of number of species identified, was obtained the percent of distribution of each order of epiphytic macroalgae. The taxonomic classification follows Wynne (2011) and the voucher specimens are deposited in the Herbarium SP of the Instituto de Botânica, São Paulo, Brazil.

Results and Discussion

A total of 48 taxa were identified: 20 Chlorophyta, 27 Rhodophyta and one Heterokontophyta, distributed in 11 orders and 16 families (Table 1). The high representativity of the phylum Rhodophyta was observed in the two sampling sites and during the two seasons. Ceramiales was the most representative order with 17 taxa, followed by Cladophorales with 10 and Ulvales, with six taxa (Figure 1). The genera with the highest number of species were *Cladophora* Kütz. (6), *Ulva* L. (6), *Ceramium* Roth (5) and *Chaetomorpha* Kütz. (4). Santos *et al*. (2006) and Ribeiro *et al*. (2008) also cite that the greatest contribution comes from the phylum Rhodophyta, followed by Chlorophyta and Heterokontophyta at Boa Viagem Beach. Sousa and Cocentino (2004) at Piedade Beach, south of Boa Viagem, also obtained similar results. According to Pereira *et al*. (2002) the high number of taxa of the phylum

Rhodophyta, specifically of the order Ceramiales is already a well-documented fact for the studied region and for the Brazilian coast. Széchy and Paula (1997; 2000) and Széchy and Sá (2008), found a high number of seaweeds of the phylum Rhodophyta growing on *Sargassum* beds. From Bahia state, Nunes (1998) and Lucio and Nunes (2002) also recorded more Rhodophyta growing as epiphytes. The greatest number of taxa of epiphytic macroalgae was recorded in the rainy season and in sites exposed to waves, a trend also found by Silva *et al*. (1987) and Quan-Young *et al*. (2006).

The phylum Heterokontophyta was represented by a single species, *Dictyopteris delicatula* J. V. Lamour. 1809. The small representativity of this phylum at Boa Viagem Beach and surrounding areas was also reported by other authors such as Sousa and Cocentino (2004), Santos *et al*. (2006) and Ribeiro *et al*. (2008). Berchez and Oliveira (1992) comment that the brown algae are more sensitive to pollution while the green algae are more resistant. Borowitzka (1972) and Teixeira *et al*. (1987) associate the low number or even the absence of brown algae species to toxicity of domestic and industrial effluents that are probably being released into the studied area. The presence of organic compounds of anthropogenic origin that interfere in the life cycle of such species may also cause this fact.

Boodlea composita (Harv.) F. Brand 1904, *Ceramium corniculatum* Mont. 1861, *Chaetomorpha clavata* Kütz. 1847, *Chaetomorpha nodosa* Kütz. 1849, *Chondracanthus saundersii* C. W. Schneid. and C. E. Lane 2005, *Cladophora laetevirens* (Dillwyn) Kütz. 1843, *Neosiphonia sphaerocarpa* (Borgesen) M. –S. Kim and I. K. Lee 1999, *Ulva linza* L. 1753 and *Ulva prolifera* O. F. Müll. 1778 are new occurrences for the coast of Pernambuco.

Erythrotrichia carnea (Dillwyn) J. Agardh 1883 was the epiphyte of most taxa (13), followed by *Herposiphonia tenella* C. Agardh 1880, *Hypnea musciformis* (Wulfen in Jacq.) J. V. Lamour. 1813, which were epiphyte of 11 taxa each, while *Ulva rigida* C. Agardh 1823 and *Centroceras* sp. Kütz. 1842 were epiphyte of ten and nine taxa, respectively. A total of 30 taxa were used as substrates by the epiphytic macroalgae. Of these, *Gelidium pusillum* (Stackh.) Le Jol. (65%), *Chondracanthus saundersii* (61%) and *Palisada perforata* (Bory) K. W. Nam 2007 (44%) showed the highest number of epiphytic macroalgae. Large algae with very branched thalli were used as hosts by the majority of epiphytes, while filamentous algae with simple thalli served as hosts for only one or two taxa of epiphytic macroalgae, as was also observed by Quan-Young *et al*. (2006) for the region of Isla Mujeres, in Mexico. Schmidt and Scheibling (2006) comment that the different forms of macroalgae affect the physical and biological factors that influence the epiphytic assemblages. Small algae do not offer enough protection against grazing and abrasion caused by waves and are not able to accumulate enough particulate food to permit the settlement of the persistent epiflora. Thereby, algae with more complex thalli have a higher surface area for colonization by both animals and epiphytes.

The results obtained contribute to the knowledge of benthic biodiversity in Pernambuco state and Brazil, besides emphasizing the importance of these small epiphytic algae in floristic studies.

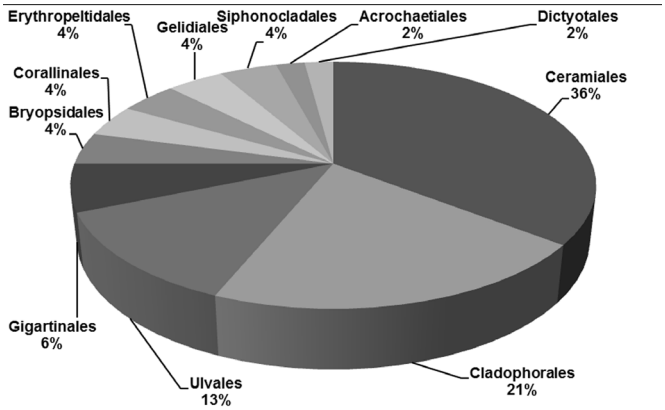

Figure 1. Distribution of the orders of epiphytic macroalgae found at Boa Viagem Beach, Pernambuco state, Brazil.

Table 1. Epiphytic macroalgae recorded at Boa Viagem Beach, Pernambuco State, Brazil.

* Voucher specimens were not possible to be obtained due to the fragility and small size of host macroalgae.

PHYLUM/Order/Family	Species	Season		Number in the Herbarium SP
		Dry	Rainy	
RHODOPHYTA				
Erythropeltidales				
Erythrotrichiaceae	*Erythrotrichia carnea* (Dillwyn) J. Agardh 1883	+	+	401.198
	Sahlingia subintegra (Rosenv.) Kornmann 1989	+	+	*
Corallinales				
Corallinaceae	*Corallina officinalis* L. 1758	+	+	401.199
	Jania adhaerens J. V. Lamour. 1816	+	+	401.200, 401.201
Acrochaetiales				
Acrochaetiaceae	*Acrochaetium* sp. Nägeli in Nägeli in Cramer 1858	+	+	401.413
Ceramiales				
Callithamniaceae	*Aglaothamnion* sp. Feldm.-Maz. 1941	+	-	401.414
	Crouania attenuata (C. Agardh) J. Agardh 1842	-	+	401.415

Table 1. *Continued.*

PHYLUM/Order/Family	Species	Season		Number in the Herbarium SP
		Dry	Rainy	
Ceramiaceae	*Acrothamnion butleriae* (Collins) Kylin 1956	-	+	401.394, 401.395
	Centroceras sp. Kütz. 1842	+	+	401.396, 401.397
	Ceramium brasiliense A. B. Joly, 1957	+	-	401.416
	Ceramium brevizonatum var. *caraibicum* H. E. Petersen and Børgesen 1924	+	-	427.659
	Ceramium codii (H. Richards) Maz. 1938	-	+	401.398
	Ceramium corniculatum Mont. 1861	+	-	401.399
	Ceramium tenerrimum (G. Martens) Okamura 1921	+	-	427.660
	Gayliella sp. T. O. Cho, L. McIvor and S. M. Boo 2008	+	+	401.400, 401.401, 401.402
Rhodomelaceae	*Bryocladia cuspidata* (J. Agardh) De Toni 1903	+	+	401.406, 401.407
	Herposiphonia secunda (C. Agardh) Ambronn 1880	+	+	401.408, 401.409
	Herposiphonia tenella (C. Agardh) Ambronn 1880	+	+	401.410
	Neosiphonia ferulacea (Suhr ex J. Agardh) S. M. Guim. and M. T. Fujii 2004	+	+	401.411
	Neosiphonia sphaerocarpa (Børgesen) M.-S. Kim and I. K. Lee 1999	-	+	401.412
Wrangeliaceae	*Gymnothamnion elegans* (Schousb. ex C. Agardh) J. Agardh 1892	+	-	401.403
	Ptilothamnion speluncarum (Collins and Herv.) D. L. Ballant. and M. J. Wynne 1998	+	+	401.404, 401.405
Gelidiales				
Gelidiaceae	*Gelidium pusillum* (Stackh.) Le Jol. 1863	-	+	401.392
Gelidiellaceae	*Gelidiella acerosa* (Forssk.) Feldmann and Hamel 1934	-	+	401.393
Gigartinales				
Cystocloniaceae	*Hypnea musciformis* (Wulfen in Jacq.) J. V. Lamour. 1813	+	+	401.202, 401.203
	Hypnea spinella (C. Agardh) Kütz. 1847	-	+	401.204
Gigartinaceae	*Chondracanthus saundersii* C. W. Schneid. & C. E. Lane 2005	+	+	401.390, 401.391
HETEROKONTOPHYTA				
Dictyotales				
Dictyotaceae	*Dictyopteris delicatula* J. V. Lamour. 1809	+	+	401.196, 401.197
CHLOROPHYTA				
Ulvales				
Ulvaceae	*Ulva compressa* L. 1753	+	+	401.189, 401.190
	Ulva flexuosa subsp. *flexuosa* Wulfen 1803	+	+	401.191
	Ulva flexuosa subsp. *paradoxa* (C. Agardh) M. J. Wynne 2005	-	+	401.193
	Ulva linza L. 1753	+	+	401.192
	Ulva prolifera O. F. Müll. 1778	+	+	401.194
	Ulva rigida C. Agardh 1823	+	+	401.195
Cladophorales				
Cladophoraceae	*Chaetomorpha aerea* (Dillwyn) Kütz. 1849	+	+	401.168, 401.169
	Chaetomorpha brachygona Harv. 1858	+	+	401.170, 401.171
	Chaetomorpha clavata Kütz. 1847	-	+	401.172, 401.173
	Chaetomorpha nodosa Kütz. 1849	-	+	401.174
	Cladophora coelothrix Kütz. 1843	-	+	401.175, 401.176
	Cladophora dalmatica Kütz. 1843	+	+	401.177, 401.178
	Cladophora laetevirens (Dillwyn) Kütz. 1843	-	+	401.179, 401.180
	Cladophora montagneana Kütz. 1849	+	+	401.181, 401.182
	Cladophora prolifera (Roth) Kütz. 1843	+	+	401.183, 401.184
	Cladophora vagabunda (L.) C. Hoek 1963	+	+	401.185, 401.186
Siphonocladales				
Boodleaceae	*Boodlea composita* (Harv.) F. Brand 1904	+	+	401.187
	Phyllodictyon anastomosans (Harv.) Kraft and M. J. Wynne 1996	+	+	401.188
Bryopsidales				
Bryopsidaceae	*Bryopsis pennata* J. V. Lamour. 1809	+	+	401.166
	Bryopsis plumosa (Huds.) C. Agardh 1823	+	-	401.167

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