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OCCURRENCE AND DISTRIBUTION OF *BOSTRYCHIA* AND *CALOGLOSSA* (RHODOPHYTA, CERAMIALES) IN THE RATONES RIVER MANGROVE, FLORIANÓPOLIS – SC- BRAZIL[1]

OCORRÊNCIA E DISTRIBUIÇÃO DE *BOSTRYCHIA* E *CALOGLOSSA* (RHODOPHYTA, CERAMIALES) FLORIANÓPOLIS –SC – BRASIL[1]

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ABSTRACT

Four species of *Bostrychia* and two of *Caloglossa* were identified and their horizontal and vertical distribution are described for Santa Catarina State of Brazil. The reproductive state of each taxa along the year is also given. Horizontal and vertical distributions, and seasonal occurrence of fertile plants of *Bostrychia* and *Caloglossa* spp. are given for the seven identified taxa. *Bostrychia radicans* was more abundant at the river mouth (site one), where salinity ranged from 20 to 36 ‰. Site two, located 1.7 km from the river mouth, with salinity varying from 12 to 30 ‰ exhibited the largest specific diversity. *Caloglossa leprieurii* was more abundant upstream in areas with lower salinity.

KEY WORDS: *Bostrychia, Caloglossa,* Mangroves

RESUMO

Foram analisadas a distribuição horizontal e vertical de quatro espécies do gênero *Bostrychia* e duas do gênero *Caloglossa.* O estado reprodutivo de cada taxa, observado ao longo do ano, mostrou que ocorreu um predominio de plantas

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tetraspóricas. *Bostrichya radicans* foi mais abundante na estação um, localizada na desembocadura do rio, a salinidade variou de 20 a 36‰. Na estação dois, a 1.7 km da desembocadura, a salinidade variou de 12 a 30‰ e mostrou uma maior diversidade de espécies. *Caloglossa leprieurii* foi mais abundante nas estações 3 e 4 onde a salinidade foi mais baixa.

PALAVRAS CHAVE: Bostrychia, Caloglossa, Manguezal

INTRODUCTION

Mangroves constitute a community with low specific biodiversity. This small diversity is possibly related to a low oxygen content, the instability of muddy soil and the existence of a rhythmic variation in salinity (OLIVEIRA FILHO, 1984). According to YARISH & EDWARDS (1982) and DEN HARTOG (1967), salinity variation is the main characteristic of estuaries, resulting in a relatively poor flora diversity in comparison with typical sea and freshwater environments.

Mangroves seed plants and their pneumatophores represent an important substratum for macroalgae attachment and growth. The most characteristic benthic algae found in mangals constitute the so called "Bostrychietum" or the *Bostrychia-Caloglossa* association (POST, 1936). There are at least seven species of *Caloglossa* distributed around tropical and temperate regions, in marine and brackish water environments (KING, 1990). *Bostrychia*, with 11 species, is the most a conspicuous component of the mangal algal flora in the tropical and temperate regions associated with mangrove vegetation (KING & PUTTOCK, 1989, 1994a e b).

There is not much phycological information about the Santa Catarina mangroves.Fifteen species of macroalgae have been identified by HADLICH (1984) and by HADLICH & BOUZON (1985) on the Itacorubi Mangrove, Santa Catarina Island.

The Ratones River Mangrove is situated at the Santa Catarina Island (48°32'45" to 48°30'00" W, 27°21'43" to 27°29'10" S), with a total area of 6.25km² (Fig. 1). According to CARUSO (1983), this mangrove system has gone through some alterations due to drainage work, which changed the natural river bed, and the building of a highway, crossing the mangrove. The area is influenced by the tide and the retort the algae must be tolerant to salinity changes, and desiccation during low tide, what interacts with the salinity regime due to evaporation.

This work aims to study vertical, horizontal and seasonal distribution of the species of *Bostrychia* and *Caloglossa* in the Ratones River mangrove in relation to enviromental parametry.

MATERIAL AND METHODS

Study sites

The mangal of the Ratones River is approximately 10 km long in addition to a system of smaller creeks and channels. Four sites were selected for sampling: three along the river bank and one 0.5 km to SE of the river bank (Fig. 1). All the study sites are reached by the flooding tide establishing a salinity gradient during high tides.

Site one is located at the mouth of the river. The estuary bank is protected by a 20 m wide vegetation belt formed by *Spartina alterniflora* Loiseleur-Deslongchamps which grows on a sandy substratc, followed by a small area of muddy substrate where *Avicennia schaueriana* Stapf et Leechman ex Moldenke predominates with its extensive system of pneumatophores.

Site two is located 2.9 km away from the river mouth. This site is relatively well flooded by high tides, *Laguncularia racemosa* (Linnaeus) Gaert is the dominant vegetation with a few *A. schaueriana* and more rarely, *Rhizophora mangle* Linnaeus.

Site three is located 1.1 km away from the river bank, towards the inner part of the mangrove in an area with a less dense tree vegetation population. This area is only flooded at spring tides. The dominant vegetation is formed by small groups of exuberant trees of *A. schaueriana.*

Site four is located 6.5 km away from the mouth of the river at the border of the mangrove. A narrow belt of *L. racemosa* constitutes the vegetation in this site.

Sampling

Samples were collected bimonthly at the four study sites, between July 1988 and March 1990, during low tide.

In order to look for seasonal distribution, the occurrence and the reproduction of the different taxa of *Caloglossa* and *Bostrychia,* at least five pneumatophores and five seedlings were collected randomly in each study site, along transects parallel and perpendicular to the river channel, except in the site 4 because the access in this area only was possible in tide high. It was going done a transect in each collection area and drawn at random 5 squares of 20cm along each transect.

The material collected was preserved in 4% formaldehyde in estuarine water. In the laboratory, the algae were removed from their substrata, cleaned from mud, and separated into species. Vertical and horizontal distribution, and reproductive stage were registred for each specie.

Salinities at each sampling point were measured using the method of ESTON *et al.* (1991).

RESULTS

Caloglossa leprieurii (Montagne) J. Agardh

This species was associated with different species of *Bostrychia* during the whole year mainly at sites two and four. Tetrasporic and cystocarpic plants were found at all sampling sites (Table). This species grows especially on pneumatophores and could reach 1.8 cm long. Distinct morphological forms were collected at site four growing on *L. racemosa* stem which remain under water even during low tide.

Caloglossa ogasawaraensis Okamura

Just a few specimens of this species were collected during the whole sampling period at the collecting sites (Table). This species with 1.0 cm maximum lenght, occurred only on pneumatophores. It occurred mainly in site two growing on the basal portion of pneumatophores associated with *B. radicans* f. *radicans* (Montagne) Montagne and *B. radicans* f. *moniliforme* Post.

Bostrychia calliptera (Montagne) Montagne

Plants collected specially on pneumatophores at all study sites throughout the year (Table) were associated with other *Bostrychia* species. Only vegetative specimens reaching a length of 1.8 cm, were found. It was commonly associated with *B. radicans* f. *radicans*.

Bostrychia montagnei Harvey

Collected exclusively on *A. schaueriana* pneumatophores and stems, at site three, away from the river bank, which is rarely flooded. This was the most abundant species of *Bostrychia* at the site three. Tetrasporic and cystocarpic plants occurred only in spring, reaching up to 5 cm long (Table).

Bostrychia moritziana (Sonder) J. Agardh

This species was more frequent on submerged, or partially submerged, even at low tide, in *L. racemosa* pneumatophores and found only at site two (Table). This species have never been collected abundantly, and when found were intermixed with *B. radicans* f. *moniliforme*. Most plants were less than 1.0 cm high.

Bostrychia radicans (Montagne) Montagne f. *radicans*

This form was collected on pneumatophores of *A. schaueriana* and *L. racemosa* throughout the year at sites one and two, and during spring, autumn and winter at sites three and four. It occurred commonly on *A. schaueriana* and *L. racemosa* stems during autumn at site two. Male, female, cystocarpic and tetrasporic plants were found throughout the year, particulary at site two (Table).

Bostrychia radicans f. *moniliforme* Post

This form was found closely associated with *B. radicans* f. *radicans* at almost all sites and was identified on a variety of substrata, not abundant but widely distributed throughout the mangrove.The complete reproductive cycle was observed (Table).

Distribution of species

According to the distribution of the species of *Bostrychia* and *Caloglossa* found seemed to tolerate wide salinity variations. At site one, salinity variations between 20 and 36 ‰ were observed (Fig. 2), and the species *B. radicans* f. *radicans* predominated in the samples. Site two, with salinity ranging between 12 and 30 ‰ (Fig. 2), exihibited the largest specific diversity (Table). At site four, a decrease in the abundance and diversity of species were observed. This area present reduced salinity, between 0 and 18‰, where *Caloglossa leprieurii* was more abundant (Fig. 2).

Vretical distribution of species

The range of algal covering on the seedlings of *A. schaueriana* reached a maximum lenght of 30 cm at site one. The species of *Bostrychia* were distributed specially on the upper and median positions of the stems. *Bostrichya radicans* f. *radicans* predominated over the other species. *Caloglossa* species occurred predominantly on the basal region. At sites one and four *A. schaueriana* pneumatophores reached 19 cm high and macroalgae were distributed along the entire root, but predominantly at the basal region. The highest pneumatophores of *A. schaueriana* and *L. racemosa* had a maximum height of 26 cm at site two. The *Caloglossa* spp and *B. moritziana* were found along the substratum being more abundant on the basal portion. Site three the pneumatophores of *A. schaueriana* reached 16 cm high with *B. montagnei* in the samples growing on the apical and intermediary regions.

DISCUSSION

HADLICH & BOUZON (1985) identified three species of *Bostrychia* for the Itacorubi mangrove (27°34'05"S and 48°30'45"W) . In the Ratones river mangrove, four different species were identified therefore increasing the number of species to the Island of Santa Catarina. Among all the species studied, *B. radicans* was the most frequent one at the different collecting sites and throughout the year, especially on pneumatophores. The predominance of this species was also observed by Eston *et al.* (1991) in a mangrove at Cananéia (25°03'S and 47°55'W). This species is widely spread in tropical and temperate waters and common as an epiphyte on mangrove trees (LAMBERT *et al.*, 1987). All reproductive phases of the two forms of *B. radicans*

occur during the whole year, suggesting an adaptation of this species to the fluctuation on the environmental conditions observed in this ecosystem.

The dominant substrata in the sampled material were the pneumatophores. At site two, the pneumatophores were bigger than at other sites and macroalgae cover their whole surface. Besides, salinity variations seem to be the determining factor for the largest specific diversity at this site. There is a decrease in the size of pneumatophores and in algal diversity towards the maximum and minimum salinities.

The horizontal distribution of *Bostrychia* and *Caloglossa* in the Ratones River mangrove is shown in (Table). Almost all species were found in the surveyed region with salinities between 0 and 36 ‰. However, *Bostrychia* was most abundant in the intermediary region and at the river mouth, where salinities varied between 12 and 32 ‰, while the *Caloglossa* was most abundant in areas where salinity was lower.

The seasonal distribution of these genera is showed in (Table). It may be noticed that the majority of the species had their maximum growth, during spring and autumn. The complete reproductive cycles of *Caloglossa* and *Bostrychia* were observed and the tetrasporic phase predominated in the samples, as found by (LAMBERT *et al.* 1987) for the estuaries of South East Africa.

According to the results obtained, the genera *Bostrychia* and *Caloglossa* seemed to tolerate wide salinity variations, such as observed in differents mangroves.
We found two species of *Caloglossa* in the Ratones River mangrove: *C. leprieurii* and *C. ogasawaraensis*. *C. leprieurii* were almost always with tetrasporangio. The predominance of this reproductive stage was also observed by HADLICH and BOUZON (1985) for the Itacorubi mangrove. At site four, where the smallest salinity variations were observed, two morphologically distinct forms were found besides *C. leprieurii,* which could not be characterized as taxonomic forms. Morphologic variations have been previously observed in *Caloglossa* (OLIVEIRA FILHO, 1969; HADLICH & BOUZON, 1985; KING, 1990; KING & PUTTOCK, 1994). This species seems to be adapted to wider salinity fluctuations (YARISH *et al.*, 1979; YARISH & EDWARDS, 1982)

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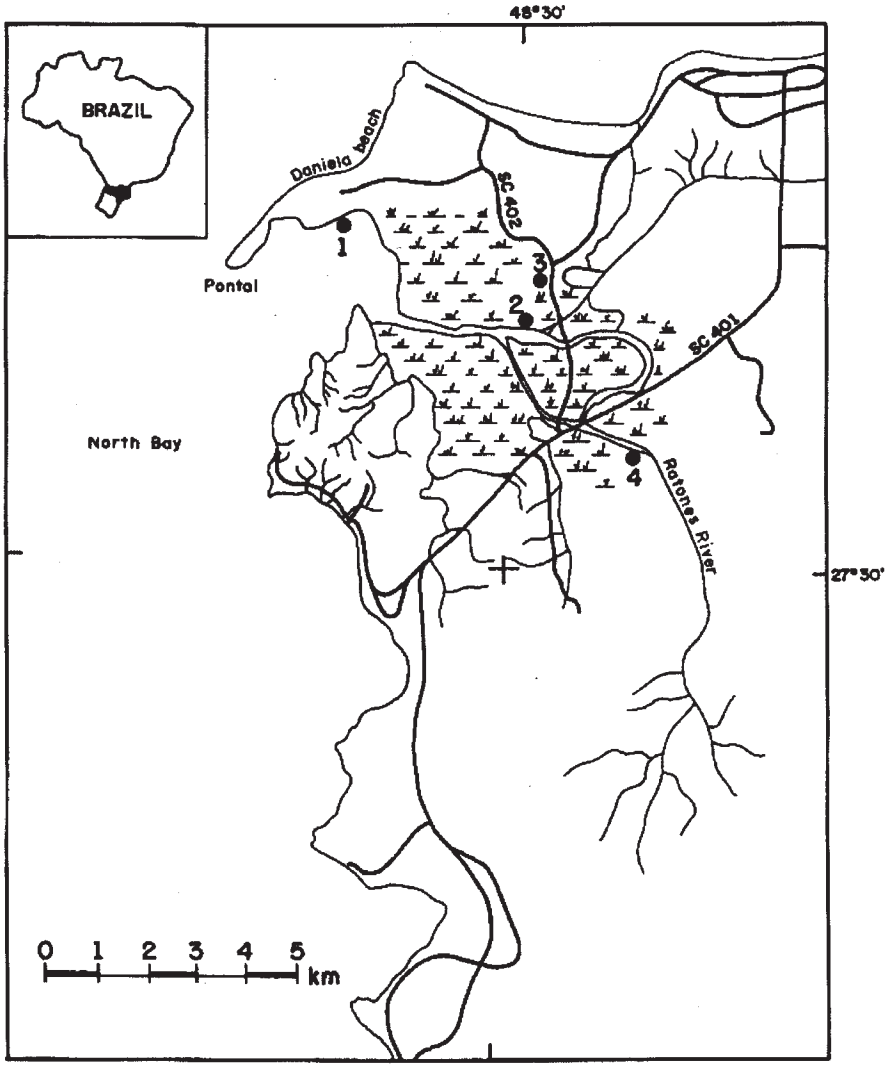

Fig. 1. Map of Ratones Mangrove showing location of collecting sites.

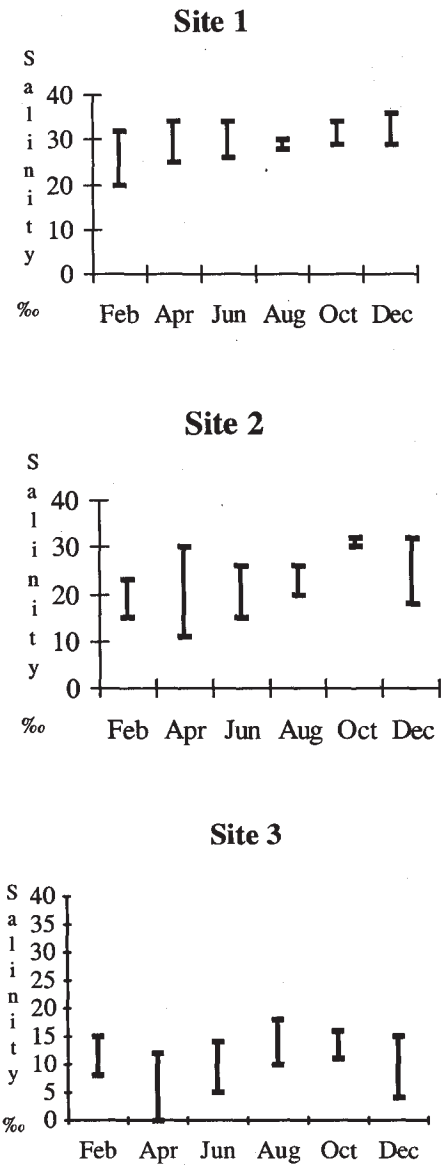

Fig. 2 . Salinity variations in site 1 - 3 during experimental period.

Tabela: The seasonal distribution and phenology of species at the four study areas in the Ratones River Mangrove

Sites	1						2						3						4					
	Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec	Feb	Apr	Jun	Aug	Oct	Dec
Species list																								
Caloglossa leprieuri	T	TC	V	V	T	T	TC	T	V	V	T	TC							V	T	V	V	T	T
C. ogasawarensis					V		V	V	V	V	V	V								T	V		V	V
Bostrychia calliptera					V			V	V	V	V								V	V			V	V
B. montagne												V	V	T	V	V	TC	V						
B. moritziana			V	V	V		V	V	V	V	V	V								T	T		V	
B. radicans f. radicans	V	TF	T	T	TMF	V	TF	TF	TC	TC	TMF	TF	T	T	V	V	T	V	V	TF	V	V	TMF	V
B. radicans f. moniliforme	V	TF	T	T	TMF	V	V	TF	T	T	TMF	V	V	V			V	V	V	TF	V	V	TMF	V

T. tetrasporangium; M. male; F. Female and/or carposporophyte; V. vegetative