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Benthic Seaweeds of the Cibratel Beach, Itanhaém, SP.

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Abstract: This work aims to present the biodiversity of the ficologic flora of Cibratel Beach, located in the Cibratel neighborhood, in the city of Itanhaém, SP, with geographic coordinates 24º12'00 "S and 46º48'39" W, with subtropical humid climate (Cfa), with average annual temperature of 22ºC and rainfall of 2000-2500 mm / year. The interest in this place is due to its rich biodiversity. The samplings carried out, have followed a seasonality. We performed 07 samplings on the following dates 08/07/2017, 09/09/2017, 04/11/2017, 04/12/2017, 01/13/2018, 04/29/2018 and 06/17/2018, in these one can observe a great variety of species, one persisting throughout the period, others only observed in only one opportunity. As for the fauna, we find bryozoans, enteroprocts, sponges, mollusks, birds, anemones, sea urchins, turtles, crustaceans, loons, buzzards, biguas, atobas, sea cucumbers, aplysia, herons and seagulls. The sampling process was done by scraping the substrate with the aid of a spatula, in order to collect the alga as a whole, without damaging any part of the material, the storage was carried out in plastic bags and conditioned in a freezer until identification, after which, with the aid of specialized bibliography, the samples were placed in 4-5% formalin polypropylene flasks. To date, 41 genre and 61 species have been identified.

Keywords: seaweed, Cibratel Beach, taxonomy.

Introduction

The term alga characterizes organisms that have their stem not differentiated in leaves and stem, it also gathers characteristics of other organisms, such as, for example, plants that contain chlorophyll and bacteria that contain cell wall. Its size ranges from macro to microscopic (Blackmann, F.F.; Tansley, A.G. 1902). Much is said about the presence of certain algae and the environment in which they are found, together with their interaction and adaptation, data that provide subsidies to suppose the general situation of that aquatic environment, strengthening the idea that Cibratel Beach it can present a good environmental quality with low pollution levels. Located at geographic coordinates 24º12'00"S and 46º48'39"W, with humid subtropical climate (Cfa), with average annual temperature of 22ºC and rainfall of 2000-2500 mm / year. In relation to the fauna, it is possible to observe the presence of aplisia, bryozoans, enteroprocts, sponges, mollusks, sea cucumbers, sea anemones, sea urchins, turtles, crustaceans, grebes, cormorants, boobies, herons and seagulls. The first records about seaweed collections in the State of São Paulo date back to 1919, by Lüderwaldt, being made incidentally. From the 1950's onwards, a more effective study began, with the work carried out in the Bay of Santos and surroundings (Joly, A.B. 1957). Comparative studies on the change in flora over a period of about 20 years (Oliveira Fº, E.C.; Berchez, F.A.S. 1978) concluded that out of 105 species, 48 were not found, due to pollution. The present work had as objective the taxonomic survey of the benthic marine algae of Praia do Cibratel, in order to inventory the species of the Baixada Santista Metropolitan Region. Comprehensive studies on algae in the region have already been carried out, however, nothing punctual, the studies aimed at the phycological flora of the São Paulo coast (Avanzo Neto, J.; Fujii, M.T. 2016), with surveys not specific to Cibratel beach, it was unknown then, the species present in the local algal flora. The work is justified to the extent that little is known about the phytological flora of Praia do Cibratel, the current moment in relation to the marine phycological community in the Baixada Santista Metropolitan Region, to what extent the anthropic action has influenced the distribution of these algae, in the loss biodiversity and ecological importance are some of the objects of investigation in this work. This study then aims to inventory the region's phytoflora.

Methods

Praia do Cibratel, chosen as a study area, is named for its location, the neighborhood of Cibratel, Itanhaém, SP is a section divided between Cibratel I and Cibratel II. The rocky shore formed at the foot of the hill is home to a large number of species, the fauna

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varies from small invertebrates such as porifers, cnidarians, arthropods and mollusks to small fish. The presence of brown algae shows us the good quality of the environment, since they are bioindicators of environmental pollution. Comprising an extension of 9.9 km^2, located in the metropolitan region of Baixada Santista, an attempt was made to cover the geographical area in a uniform manner, with attention to the rocky shore located on the left side of the beach due to the greater concentration of algae. The study aimed to carry out the most comprehensive sampling of the environments in coverage as uniform as possible, with materials that present an equivalent representation to populations. Studies were carried out whenever the tide was low in order to facilitate the sampling work, for this purpose, spatulas used for scraping materials adhered to rocks and flasks and polypropylene bags were used to store the material. The collections were made, preferably, close to the margin, in the coastal zone of the systems, where floating and other fixed aquatic organisms commonly occur, totally or partially submerged. These environments are considered benthic algae concentrators. Whole specimens were sampled from the species' appressorium, otherwise, representative parts of the algae were sampled. Information on the geographic provision of the material (as complete as possible), including the date of collection, the name of the collector and also registered geographical references. Seven samplings were carried out on the following dates: 07/08/2017, 09/09/2017, 11/04/2017, 12/04/2017, 3/01/2018, 04/29/2018 and 17 / 06/2018. These samplings occurred in the infra, meso and supralittoral regions on low tide days, preferably on tides ranging from 0.0 to 0.3 m, facilitating sampling. In the sampling process. Information on geographic location, water pH, density, salinity, date of collection were recorded. After sampling, the algae were packed in plastic bags, taken to the freezer in order to preserve the material until its identification. The fixation and preservation of the materials were provided after identification, with 4-5% aqueous formalin solution (37% commercial formalin), in polypropylene bottles. The fixation prevents the decomposition rate from being accelerated due to adverse conditions (sample concentration), which can promote the appearance of anomalous phenotypes. The making of dried sausages was also part of the activities of this project, in order to supply the herbarium, under construction, of UNIP - Santos / Rangel.

The preparation of the slides for observation under the optical microscope followed the following routine: (1) cutting of reproductive structures or transversal cuts of the stem in order to assist in the identification of the species were placed on a common microscope slide; (2) a drop of alcoholic lugol solution can be added to the material to highlight the starch; and (3) a coverslip was placed over the set of drops, taking care not to form a bubble. In some cases, a drop of methylene blue was also added to evidence mucilage and another, of pure glycerin, to density the medium and, consequently, facilitate the rotation of the structures on themselves and observe them from other angles. For qualitative analysis, reproductive structures, cellular organization in slides prepared from the material of each sample unit were examined. The aim was to observe the largest possible number of specimens of each type and exhaust each sample unit taxonomically. The observation of the specimens was carried out using an Olympus CX31 binocular optical microscope, with 10 magnifying eyepieces and 4, 10, 40 and 100 magnifying lenses. Carl-Zeiss binocular loupes were also used in order to assist in the identification of taxa. For each characteristic, as many measures were taken as necessary (and/or possible) with the sole purpose of accurately describing each species, variety or taxonomic form identified. Obviously, the minimum number of specimens observed depended on the size of the populations available in the preparations. The analysis of three preparations without any representative of any species, variety or taxonomic form not yet identified in that sample unit was accepted as taxonomic depletion. In the present study, however, for the greatest certainty of taxonomic depletion, we examined 10 preparations from the same sample unit without new species, varieties or taxonomic forms of algae appearing. The individuals found only once during the study were only identified when they presented their unmistakable diagnostic characters, when they did not present morphological variation or it was too small and considered negligible. The description of each species, variety or taxonomic form identified included all the diacritic or meristic morphological characteristics of the vegetative and reproductive phases of its life-history that could be observed in the materials examined. When varieties and / or taxonomic forms other than the typical species were identified, their descriptions addressed only the distinctive characters in relation to the respective typical. If it exists, we would relate it to the homotypic (nomenclatural) synonym and, in particular, the basionym component. The heterotypic (taxonomic) synonyms were also considered, however, only those that could be evaluated. The identifications in the literature, whose lack of information (description, measurements, illustration and / or material deposited in a herbarium) did not allow their reidentification, were not currently considered. All material in the specialized literature of the State of São Paulo was evaluated. Taxonomic identifications of materials that presented description and / or illustrations were also revised, as well as the materials deposited in herbariums and document collections. The identifications of the genera, species, varieties and taxonomic forms were based on classic and recent works in the specialized literature. We sought to observe the largest possible number of

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individuals and, whenever possible, through the analysis of populations, thus increasing the validity of interpretations. For each taxon inventoried, the following data were presented: (1) species name, variety or taxonomic form; (2) name (s) of the author (s) responsible for the specific binomial, varietal trinomial or formatic quadrinomial; (3) complete bibliographic reference of the work "princeps", that is, the work that contains the original description of the species, variety or taxonomic form; (4) basionym when existing; (5) synonyms (especially homotypes) from Brazilian material; (6) detailed description of all diacritical morphological characteristics, including meristic and metric ones, with an emphasis on the spectrum of their variation in the population scope. The descriptions were accompanied by an illustration for their taxonomic identification, a list of the material (s) studied.

Results

We were able to observe insignificant variations regarding the pH of the water, which remained at an average of 7.0 to 7.6, the salinity remained at an average of 32 ppm and the average water temperature ranged from 20°C to 24°C. The identified taxa are distributed as follows: 41 genera and 61 species, described below.

Table 1. Results.

SPECIES	08/07/17	09/09/17	04/11/17	04/12/17	13/01/18	29/04/18	17/06/18
Amphiroa beauvoisii	1	1	1	1	1	0	0
Amphiroa rigida	0	0	1	1	0	1	0
Asparagopsis taxiformis	0	0	0	0	1	1	1
Bostrychia calliptera	1	0	0	0	0	0	0
Bostrychia tenella	1	1	0	0	0	1	0
Bryocladia thyrsigera	1	0	0	0	0	0	0
Bryopsis pennata	0	0	0	0	0	1	0
Bryothamnion seaforthii	1	1	1	0	0	1	1
Canistrocarpus cervicornis	0	0	0	1	0	0	0
Caulerpa fastigiata	0	0	0	1	0	0	1
Caulerpa lanuginosa	0	0	1	0	0	0	0
Centroceras clavulatum	1	1	1	1	1	1	1
Ceramium brevizonatum	1	1	0	1	0	0	1
Ceratodictyon variabile	1	0	1	0	0	0	0
Chaetomorpha antennina	1	0	1	1	0	1	1
Chondracanthus teedei	1	0	0	1	0	0	1
Cladophora ordinata	0	0	0	0	1	0	0
Cladophora prolifera	1	1	1	1	1	0	0
Cladophora rupestris	0	0	0	0	1	0	0
Cladophora vagabunda	0	0	1	0	0	0	0
Colpomenia sinuosa	0	0	1	0	0	0	0
Corallina officinalis	1	0	0	0	0	0	0
Dictyopteris delicatula	0	0	1	0	0	0	0
Dictyota crenulata	0	0	0	0	0	1	0
Entocladia viridis	0	0	1	0	0	0	0

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Gelidium americanum	1	0	0	0	0	0	0
Gelidium coarctatum	0	0	1	0	0	0	0
Gelidium floridanum	1	1	1	1	0	0	0
Gelidium pusillum	1	0	1	0	0	1	1
Gigartina acicularis	0	0	1	0	0	0	0
Gymnogongrus griffithsiae	1	0	0	0	0	0	0
Halymenia dilatata	0	0	0	0	0	1	0
Heterosiphonia gibbesii	1	0	1	1	0	1	1
Hypnea musciformis	0	0	0	0	1	0	0
Hypnea spinella	1	1	1	1	1	1	0
Jania adhaerens	0	0	0	0	1	0	0
Jania crassa	1	1	1	1	0	1	0
Laurencia dendroidea	0	0	1	0	0	0	0
Laurencia obtusa	0	0	1	0	0	0	0
Liagora farinosa	0	0	1	0	0	0	0
Lyngbya martensiana	0	0	0	0	0	0	1
Padina boergesenii	1	0	0	0	1	0	0
Padina gymnospora	1	0	1	1	1	0	1
Phaeophila viridis	0	1	0	0	0	0	0
Polysiphonia denudata	0	0	0	0	1	0	0
Porolithon pachydermum	1	0	1	0	0	0	1
Pyropia acanthophora	1	0	1	0	0	0	1
Rhizoclonium riparum	1	1	0	0	0	1	0
Rhodymenia pseudopalmata	0	0	0	0	0	1	0
Sargassum cymosum	1	0	1	1	1	0	0
Sargassum filipendula	1	0	1	0	1	1	0
Sargassum stenophyllum	0	1	1	1	0	0	0
Stypopodium zonale	0	0	1	0	0	0	0
Tricleocarpa fragilis	0	0	1	0	0	0	0
Ulva chaetomorphoides	0	0	1	0	0	0	0
Ulva fasciata	1	0	1	0	1	1	1
Ulva flexuosa	0	1	0	0	1	0	1
Ulva lactuca	0	0	1	1	0	0	1
Ulva linza	0	0	0	0	0	1	1
Ulva rigida	1	0	0	1	0	0	0
Wrangelia argus	0	0	1	0	0	0	0

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Discussion

Similarities are observed in the observed taxa, but a significant loss of biodiversity since Joly (1957), who observed 105 species of marine flora in the Santos region, although we found the same proportions for the algal phylum of the present study (33 Rodophyta, 16 Clorophyta, 10 Ochrophyta and 1 Cyanobacteria) compared to his studies (63 Rodophyta, 22 Clorophyta, 16 Ochrophyta and 4 Cyanobacteria) we observed that the morphological variations of the algae presented do not escape the characteristics already presented, as well as the survey carried out among the 1976-1978 by Oliveira Fº & Berchez (1978) at the same points as Joly (1957) presented 68 different species found, indicating a loss of biodiversity of almost half that found about 20 years ago, which leads us to believe that the anthropic action has influenced the distribution of algae in the studied environments. Among the observations made, on the different dates and seasonality, we could verify that the sampling effort did not reach the asymptote, which may be due to the areas of the coast that were not so accessible, such as the areas of beaten coast. Although the curve shown in the graph did not express this stability, we can encourage you to open the way for further studies to be carried out, aiming at reaching the sampling effort, and as a result of this we present the frequency of algae in Table 1, but we cannot say accurately the data compared to previous studies as well as Avanzo *et al.* (2016) in relation to biodiversity, since Yaobin (1999) in his study also carried out in the same points as Joly (1957) suggested an increase in algal biodiversity, as well as in collaboration with the survey by Crispino & Sant'anna (2006) there has been the exclusion of the group of cyanobacteria in surveys along the Brazilian coast, the same occurring only in studies conducted in the state of São Paulo.

Conclusion

What can be noticed in wide observation were the differences in the seasonally observed taxa, which leads us to say that there is a taxon present in all seasons of the year while others appear only in some or only one of the dates, besides that bioindicator algae could be observed in all visits to the coast such as brown algae that indicate environments with considerable pollution levels and green algae that indicate eutrophic environments. We were able to notice the good quality of the beaches and then conclude that Praia do Cibratel contributed positively by presenting an abundant ficological biodiversity that adds great knowledge and becomes an excellent brazilian representation of algae in relation to those found throughout the country.

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