MARINE FICOLOGICAL FLORA OF URUBUQUEÇABA ISLAND AND WIZARD STONE.

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Abstract: *This paper aims to survey the ficologica flora of marine benthic algae Urubuqueçaba Island and the Stone Sorceress, the first, located on the border between Santos and São Vicente and the second located on the beach of Itarare in Sao Vicente. The Urubuqueçaba Island is located east of the island of São Vicente, in José Menino beach, near the border with the municipality of São Vicente. Near the island, in the south, it is the border between the municipalities of Santos and São Vicente. The island marks the beginning of Itararé beach, which is also the Stone Sorceress, close to it, when the low tide, can be reached on foot. The island is part of the Atlantic, coconut palms are found, fig trees, jerivás, pitangueiras and algae. The fauna found clams, anemones, urchins, turtles, crustaceans, fish such as sea bass, grouper and dory. Besides vultures, cormorants, boobies, herons and gulls. The island, which has 2000 m^2 of plateau and is 260 m away from the coast, has a sandy and rocky slope. The Urubuqueçaba Island has triangular shape and not rounded like most islands. The Stone Witch is a boulder located on the beach of Itarare in Sao Vicente, visible Urubuqueçaba Island. The following taxa were identified: Amphiroa rigida, Bryocladia thyrsigera, Centroceras clavulatum, Ceramium brevizonatum, Chaetomorpha antenina, C. spiralis, Gayralia brasiliensis, Grateloupia filicina, Gymnogongrus griffithsiae, Plocamium cartilagineum, Polysiphonia atlantica, Pterocladiella bartlettii, Rhizoclonium africanum, R. riparium, Ulva clathrata, U. fasciata, U. flexuosa, U. intestinalis, U. lactuca e U. rigida.*

Keywords: *seaweed, Urubuqueçaba Island, Stone Sorceress.*

INTRODUCTION

This paper aims to present the biodiversity of the marine phytological flora of Urubuqueçaba Island, located in Santos and Pedra da Feiticeira, located in São Vicente, São Paulo State. With about 2000 m^2 and about 260 m from the coast, frequented by fishermen and shellfish. On the island can be found algae, coconut palms, palm trees, pitangueiras and jerivás. As for the fauna, there are specimens of mollusks, anemones, hedgehogs, turtles, crustaceans, gulls, atobás and biguás. It can be easily accessed when the tide is low, despite its easy access and human presence, Urubuqueçaba Island remains very well preserved and practically intact. The Tupi-Guarani origin name means “Vulture's Landing”, formerly, in the late afternoon, the older ones witnessed the daily flock of animals to the place. To this day, it is a favorite place for birds. Located at the geographic coordinates $23^0$58'25.67”S and $46^0$21'10.02”W, privately owned by the Doneux family, bought in 1963 by Cláudio Pires Castanho Doneux, a man of the city's major real estate developments, who incorporated and built the Parque Balneário (mall, hotel and three residential buildings). The Sorceress Stone is a rounded stone

located on Itararé beach, in São Vicente, visible from Urubuqueçaba Island. Mystic stone, where in the years 1750 to 1800, beliefs shared by the people. They say that a mysterious woman spent the night there in the so-called “Cama da Velha”. This lady looked very poorly dressed, with a long dress, looking like the legendary image of a witch. They said she would light bonfires waving at the passing boats. It didn't bother anyone. She said that she loved a sailor she had met there when she was younger, who left her promising to return. She was pregnant, but he never showed up again. Due to disappointment and mental crisis, she lost her pregnancy and in that place, on the stone where their love affairs took place, remained for long periods waiting for the return of the beloved sailor. One day, thinking that someone from a distant boat was beckoning to him, he went into the sea at high tide, near the rocks, and drowned there under a strong current. They say that even today in the place, in some moonlit nights, they hear voices of that "witch". It aims at a taxonomic survey of the algae of the island, in order to inventory the ficological flora of the Baixada Santista Metropolitan Region. Studies on the island's bryophytes have been carried out, however, from algae, nothing has been inventoried so far, what is known about the algal biota of the island, sporadic collections have been conducted over time, however, nothing inventoried.

METHOD

Study area

The areas covered by this study are Urubuqueçaba Island and Pedra da Feiticeira, the first located on the border between the municipalities of Santos and São Vicente and the second located on Itararé beach in São Vicente, SP. With about 2000 m^2 and about 260 m from the coast, located in the metropolitan region of Baixada Santista, State of São Paulo and composed of 9 (nine) municipalities. According to Ross (2003), the region has a tropical climate. We sought to cover the geographical area to its fullest extent and as uniformly as possible, covering benthic materials.

Studied material

During collections, benthic material was sampled in as uniform a coverage as possible of chlorophyte and rhodophyte algae, no phaeophytes were found during the study.

Material collection

Eight (8) random sampling were performed in Urubuqueçaba Island and Pedra da Feiticeira, on the following dates: 08/29/2015, 08/30/2015, 09/26/2015, 09/27/2015, 12/12/2015, 01/24/2016, 03/26/2016 and 03/27/2016, scraping the substrate with a spatula to remove the benthic seaweed in the supra, meso and infralittoral regions, this collection occurred at low

tide, verified on the tides table provided by the Brazilian Navy. The collections were preferably made near the margin, in the coastal zone of the systems, where the studied algae usually occur totally or partially submerged. These environments are considered algae concentrators. Whole specimens were collected by scraping the submerged parts of emerging specimens. Information on the geographical origin of the material (as complete as possible), including the date of collection and the name of the collector, was recorded.

Fixation, preservation and preparation of observation material

Fixation and preservation of the materials were provided immediately after collection, while still in the field, with 3-5% aqueous formalin solution (40% commercial formaldehyde) in glass or plastic bottles. Immediate fixation prevents the sample from decomposing due to adverse conditions (sample concentration). After the fixation and analysis of the material, will be provided the assembly of exsiccates with the sampled specimens. The preparation of slides for observation under the optical microscope followed the following routine: (1) one or two drops of the homogenized sample material were placed on a standard microscopy slide; (2) a drop of alcoholic lugol solution was added to that of the material to evidence the starch (pyrene); and (3) a cover slip was placed over the droplet assembly, being careful not to bubble.

Observation of material under microscope and magnifying glass

For qualitative analysis, at least 10 specimens from each sample unit were examined, when possible. The aim was to observe the largest possible number of specimens of each type and taxonomically exhaust each sample unit. The observation of the specimens was performed using an Olympus CX31 binocular optical microscope, with 10 magnification eyepieces and 4, 10, 40 and 100 magnification lenses and Zeiss Stemi DV4 stereoscopic magnifying glass. For each trait, as many measures as necessary (and / or possible) were taken for 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 was accepted as taxonomic exhaustion without any representative of any species, variety or taxonomic form not yet identified in that sample unit. In the present study, however, for the greater certainty of taxonomic depletion, 10 preparations of the same sample unit were examined without new algal species, varieties or taxonomic forms appearing. Individuals found only once during the study were only identified when they presented their unambiguous diagnostic characters or when they showed no morphological variation or it was too small and considered negligible.

Material description

The description of each species, variety or taxonomic form identified included all the diacritical or meristic morphological characteristics of the vegetative and reproductive phases of their life history that could be observed in the examined materials. When varieties and / or taxonomic forms other than typical species have been identified, their descriptions address only distinctive characters in relation to their typical ones. When existing, it was related to homotypic (nomenclatural) synonymy and, in particular, the basionym component. Heterotypic (taxonomic) synonyms were also considered, but only those that could be evaluated. The identifications in the literature, whose lack of information (description, measurements, illustration and / or material deposited in herbarium) did not allow its reidentification, were not presently considered.

Taxonomic Identification

The taxonomic identifications were based on the analysis of the largest possible number of individuals from the population analysis. Isolated individuals were only identified when they presented their unambiguous diagnostic characteristics. Photographs were taken and with the help of bibliographic reviews, some taxa can be identified. All reference material in the specialized literature was evaluated. Taxonomic identifications of materials presenting description and / or illustrations were reviewed, as well as materials deposited in herbariums and document collections. The basic literature for classification was used for the identification of genera, species, varieties and taxonomic forms classic and recent works of specialized literature. We sought to observe as many individuals as possible and, whenever possible, through population analysis thus increasing the validity of interpretations. For each inventoried taxon the following data will be presented: (1) species name, variety or taxonomic form; (2) name (s) of the author (s) responsible for the specific binomial, varietal trinomial or formic quadrinomial; (3) complete bibliographic reference of the work “princeps”, ie the work containing the original description of the species, variety or taxonomic form; (4) basionym when existing; (5) synonyms (especially homotypic ones) from Brazilian material; (6) a detailed description of all diacritical morphological characteristics, including meristic and metric, with emphasis on the spectrum of their variation in population. The descriptions were accompanied by illustration for their taxonomic identification, relationship of the material (s) studied and taxonomic and nomenclatural comments.

RESULTS

We identified 13 genera and 20 species distributed as follows: 11 species of Chlorophyta and 9 species of Rhodophyta, listed below:

FILO CHLOROPHYTA

***Chaetomorpha aerea* (Dillwyn) Kützing**

Dark green stalk; rough to the touch; erect, 1.5-12.0 cm high; 0.5-2 mm width; growing isolated or in tufts. Filament attached to substrate through large basal cell with rhizoidal extensions at the base forming lobed disc measuring 200-1200 µm in length; 37.5-142 µm diameter at the base and 25-180 µm dia. at the apex. Cylindrical suprabasal cells, 50-340 µm length × 55-220 µm diameter; quadratic to elongated medianapical cells, 70-270 µm compr. × 87.5-350 µm diameter; filaments with some swollen cells; lamellated cell wall, with thickness measuring 3-6 µm; sharp constrictions between the septa. Found next to *Ulva fasciata*.

***Chaetomorpha anteninna* (Bory) Kützing**

Light green stalk, growing into small, rigid brush-shaped tufts, 1.0-2.9 cm height; 1 mm wide. Stem firmly fixed to the substrate by basal cell with long, branched, non-septate rhizoidal extensions which may form new filaments. Discoid basal cell, with clear annular constrictions at the base, increasing in diameter toward the apex, measuring 3-8 mm in length. × 100-140 µm in diameter. at the base and 220-350 µm diameter at the apex; thick wall, 40-87.5 µm. Filament with cylindrical suprasalum cells, 400-1420 µm long. × 300-340 µm diameter; longer than broad, cylindrical, sometimes barrel-shaped median-apical cells, 237-1260 µm long. × 250-390 µm diameter; lamellated cell wall, measuring 17.5-55 µm thick in the mid region and 15-25 µm thick in the apical stalk region. Birefringent crystalline inclusions of two types: silica crystals in the form of fine grouped needles and calcium oxalate in the shape of octahedra visible in the cell protoplast. Fertile cells at the apex of the stalk, becoming whitish after the release of reproductive cells.

***Gayralia brasiliensis* Pellizzari, M.C. Oliveira & Yokoya**

Single foliate monostromatic stalk, bright green; 1.0-7.3 cm in height; 0.9-2.5 cm wide; discoid appressories; cells with thickness of 8-3 µm and 18-25 µm length. The cells are uninucleated, with a large central vacuole, parietal chloroplast; 1-2 pyrenoids.

***Rhizoclonium africanum* Kützing**

Dark green, rough filamentous stalk forming dense matted, flexible, attached to the substrate by basal cell and unicellular and multicellular lateral rhizoids along the filament; 90° angle joint, frequent in the filament; occasional secondary branches; 2.5 cm high; 10 mm wide; cell

wall 2.5-5 µm thick. Straight to bent basal cells 2.5-5.0 cm long × 90-200 µm diameter. Longer than broad median-apical cells with more or less uniform diameter along the filament, measuring 150-300 µm in length. × 50-170 µm in diameter; tapered apical cells; lamellated cell wall measuring 7.5-30 µm thick. Apical cells with rounded apex measuring 200-380 µm in length. and 80-160 µm in diameter; unobserved reproductive structures.

***Rhizoclonium riparium* (Roth) Harvey**

Light green, delicate stalk, forming dense matted tuft, filamentous, some curved; filament simple or little branched; attached to the substrate by basal cell and occasional to frequent unicellular lateral rhizoids; may form free floating masses; 1.5-3.0 cm height; 0.5-1.5 mm wide Straight to curved basal cell length 3.5-8.5 cm × 17.5-65 µm diameter. Subquadratic median-apical cells, longer than large, measuring 10-130 µm in length × 10-50 µm in diameter; tapered apical cells, sometimes with rounded apexes; lamellated cell wall, 5-7.5 µm thick. Found in tidal pools and crevices of rocky shores.

***Ulva clathrata* (Roth) C. Agardh**

Hollow tubular filamentous stalk; forming light green tufts; quite branched; 1.5-5.3 cm tall; 0.5-1.5 cm wide; discoid appressory; in upper view, subquadrate cells, arranged neatly in longitudinal rows 7-19 µm in diameter and 7-24 µm length; formed by a single layer of cells; with 1 plastid and 2-4 pyrenoids. Found in tidal pools, commonly in spring and summer associated with *Rhizoclonium riparium*.

***Ulva fasciata* Delile**

Light green foliate tall, irregularly lobed narrow ribbon shaped, longer than broad; smooth margin; rigid membrane consistency; 2-35 cm height; 0.5-5.0 mm wide; 78.9-122.2 µm thickness. Fixed to the substrate by small discoid appressorium. Consisting of two layers of cells; in superficial view, cells with rounded polygonal outline; 3-6 µm dia. In cross section, the cells have a rectangular shape with 19-45 µm length; 12.0-22.0 µm dia. Parietal chloroplast with 1-3 pyrenoids. Fertile cells on the edge of the terminal portions of the stem showing darker color from August to October.

***Ulva flexuosa* Wulfen**

Light green, erect, tubular, flaccid stalk 2.0 to 4.0 cm high; 10-20 mm wide; fixed to the substrate by a small discoid appressor with rhizoidal filaments originating from the basal portion of the stalk. Narrow stalk at base with ca. 0.1-0.2 mm in diameter, extending towards the median-apical region; with 0.1-0.7 mm diameter. Basal region with branches or proliferations, forming several growth axes. In superficial view, quadratic cells, 12.5-30 µm in length and 12.5-22.5 µm in diameter to rectangular, 10-25 µm in length and 10-26 µm in

diameter, arranged transversely and longitudinally in the basal region, with or without organization pattern in the median-apical region of the stalk. Parietal chloroplast, with 1-4 pyrenoids. Reproductive structures not observed.

***Ulva intestinalis* Linnaeus**

The hollow, wrinkled tubular stem; bowel shaped; 1.5-11.0 cm long; 1-2 mm width; branching from the base; thick cell wall; yellow to dark green coloration. The young plant is attached to the substrate by a basal rhizoidal cell; Adult plants have no basal proliferation. Cells are rectangular to front-view, regular and irregularly arranged polygons and 10-16 µm diameter. Present on the meso-coast, in tidal pools; Supports low salinity.

***Ulva lactuca* Linnaeus**

Upright expanded lamellar stalk with rounded outline; 2 cell layers; 3-6 cm height; 3.5-5.0 cm wide; 66.7-91.7 µm thickness; light green; smooth margins; fixed to the substrate by a single discoid appressorium consisting of compacted basal filaments. In cross-section, quadratic cells along the entire length of the stalk with 22.4-28.7 µm; 15.5-17.5 µm diameter. In surface view, rounded polygonal cells, 17.9-22.0 length; 12.2-15.5 µm diameter. Parietal chloroplast with 1-5 pyrenoids.

***Ulva rigida* C. Agardh**

Dark green lobulated foliate laminar stem; presenting jagged margin; flabby consistency in the upper portion and rigid in the narrower lower portion; 2 cell layers; fixed to the substrate by rhizoids that grow as expansions of the basal stem cells; 1.5-2.5 cm high; 5-10 mm wide In superificial view, rounded polygonal cells with 14.1-17.3 µm length; 8.7-11.7 µm diameter; quadratic apex and rectangular cells towards the base, in cross section, with 23.6-26.2 µm length; 18.1-20.1 µm diameter at the apex and 31.3-35.0 µm length; 15.4-19.2 µm diameter. Parietal chloroplast with 1-4 pyrenoids. Darker colored fertile cells in the terminal portion of the stalk from August to October.

FILO RHODOPHYTA

***Amphiroa rigida* Lamouroux**

Intensely calcified, rigid stalk; 0.5 cm high; 20 mm wide; firm and unflinching genicles; dichotomous branching between 80-90º; can be obtuse near the base and apexes. What characterizes this species is the presence of loose tube branches, couplet organization; dichotomy originated from an intergenicle bifurcation; subcylindrical contour branches; 0.8-1.2 mm thickness; genus with two rows of long medullary cells measuring 165-194 µm, with typical interwoven contour.

***Bryocladia thyrsigera* (J. Agardh) Schmitz**

Growing in branched tufts; last-order branches arranged in a spiral; vinous color, 0.5-5 cm height; 0.3 mm width; apical cell growth; polysiphonic structure throughout the frond; 8-10 pericentral cells.

***Centroceras clavulatum* (C. Agardh) Montagne**

Upright filamentous stalk forming tufts on rocks; dense dichotomous to pseudodichotomous branching; prostrate portion with long pluricellular rhizoidal branches 7-12 µm in diameter and 130-149 µm length; forcipated apexes; dark red to brownish coloration; 1-4 cm height; 0.25-0.60 mm width; presence of thorns in nodal cells, arranged in whorls; cut branches; rectangular cortical cells arranged in longitudinal rows. Tetrasporangia measuring 43.2-49.8 µm in diameter; inserted into the cortical region of the apex of last order branches. Found in the intertidal zone.

***Ceramium brevizonatum* Petersen**

Upright talus, 0.5-4.0 cm height; 10-50 µm diameter; pseudodichotomous; branched every 7-9 segments; forcipated apex; attached to the substrate by multicellular rhizoids, starting from periaxial cells; node with 103-209 µm diameter; 35-39 µm height; axial cell with 68-124 µm diameter and 84-159 µm length; axial cell forming 8-10 rounded periaxial cells, each of these cells forming 2 acropetal cells and 1 pseudoperiaxial cell. Early cortical cells dividing acropetically into acropete daughter cells. The node is formed by 3-4 layers of cells.

***Grateloupia filicina* Lamouroux**

Stem formed by 5 mm diameter isodiametric cells; 2.5 cm height; 0.5 mm wide; straight dense filaments; erect axis; wine coloration.

***Gymnogongrus griffithsiae* (Turner) Martius**

Black wine vinegar; 0.5-3 cm height; 1.5 mm wide; rigid and rough consistency; Upright, flattened, abundantly branched main axes with cylindrical last-order branches gradually tapering. Tri or polytomic branching; present in moderately impacted environment, tolerant to environmental adversities such as pollution and salinity variations; considered indicators of moderately impacted environments.

***Plocamium cartilagineum* (Linnaeus) Dixon**

Unbranched stalk at base; 15-30 cm length; cartilaginous texture; alternate to irregular branching, containing 2-5 smaller curved branches of pointed apex at these branches toward the top of the shaft, comb-shaped; basal branches 2 mm wide; cystocarp 1 mm in diameter. scattered around the frond; pinkish red to reddish brown coloration.

***Polysiphonia atlantica* Kapraun & Norris**

Prostrate filamentous talus with apex without tricoblasts giving rise to short erect branches at 3-4 segment intervals and rhizoids with open connection to the pericentral cell; 1.5 cm height; 0.5 mm wide; present little branched tricoblasts. Upright axes of exogenous origin. Big apical cells. Unilateral development of the branches producing a dorsiventral habit.

***Pterocladiella bartlettii* (Taylor) Santelices**

Tuft forming tufts, cartilaginous, wine red; 5.0 cm height; attached to the substrate by appressories formed by rhizoidal filaments with discoid terminal portion adhered to the substrate; cylindrical stolons to compresses; 95-110 μm thickness; 210-2250 width. In cross section, stolon formed by a marrow of 5-6 layers of cells surrounded by 2 layers of cortical cells. Circular outermost cortical layer cells, 7-13 μm diameter; circular medullary cells, 14-23 μm diameter. Very rare rhizines. Upright branches with pinched to irregular branching in the median and apical portions of the stalk may present bilateral series of small branches along the entire branch. Upright branches compressed proximally, 88-105 μm thickness; 170-300 μm width, becoming flattened towards the apex, 88-125 μm thickness; 520-630 μm width. Base of lateral branches not constricted. Acute branch apex with prominent apical cell may be abundant by hyaline. In cross section, in the middle region, a medulla with 5-7 cell layers, surrounded by 1-2 layers of cortical cells; cells of the outermost cortical layer circular; 7-13,5 μm diameter. Longitudinally elongated and circular to slightly elliptical medullary cells transversely, 11-32 μm diameter. Very rare rhizines in the basal portion of the erect branch, few in the middle region when present in the central medulla.

DISCUSSION

First specific work for the study sites on the algae taxonomy of Urubuqueçaba Island and Pedra da Feiticeira, it can be observed that the sites do not have great algal richness and the presence of pollution-indicating algae such as *Gymnogongrus* and *Ulva*, serve as a warning to the authorities to control access to Urubuqueçaba Island, as Pedra da Feiticeira is close to the sand strip, making such control unfeasible. The observed material was collected in the above, meso and infra-coastal regions, because we do not have a boat and diving equipment, the pelagic region of the coast was not contemplated, only the regions closest to the tidal range. The number of organisms present gives us a sample of how the studied environments are impacted, even though an ecological study of the site has not been done, but by observations made throughout the samples. However, despite some difficulties and the great local anthropic impact, it is verified that the number of identified species is considerable until the end of this study. We still consider it incomplete due to deadlines to be met and the good

number of species to be identified. tends to increase in future projects, giving us data so that we can prevent the destruction of the place by the population and/or tourists.

CONCLUSIONS

Despite numerous works on the coast of São Paulo, nothing specific related to algae was done in the studied environments. There was the absence of brown algae in the region, corroborating the suspicion that the environment impacted by irresponsible tourism, predatory and irregular fishing, may contribute to the low number of taxa demonstrating the poor richness of the site in terms of aquatic biodiversity. From the list of identified species, we found bioindicator species of pollution, although ecological studies were not performed in this study. The work opens doors for ecological studies to be carried out on the premises, in order to promote an improvement of the sites and increase their biological richness and who knows, in the future, the implantation of a sustainable collection of local organisms for the subsistence of many people. , generating jobs and income.

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ANNEXES

Fig. 1-5. 1. *Amphiroa rigida*. 2. *Centroceras clavulatum*. 3. *Ceramium brevizonatum*. 4. *Rhizoclonium riparium*. 5. *Ulva fasciata*.

Fig. 6-9. 6. *Chaetomorpha aerea*. 7. *Gayralia brasiliensis*. 8. *Gymnogongrus griffithsiae*. 9. *Bryocladia thyrsigera*.

Fig. 10-13. 10. *Ulva clathrata*. 11. *Ulva lactuca*. 12. *Plocamium cartilagineum*. 13. *Chaetomorpha anteninna*.

Fig. 14-17. 14. *Ulva intestinalis*. 15. *Ulva rigida*. 16. *Ulva flexuosa*. 17. *Rhizoclonium africanum*.