Floristic Survey of a Portion of the Vegetation Complex of the Coastal Zone in Piauí State, Brazil

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Abstract: The coast of Piauí state, unexplored regarding its phytodiversity, instigates conducting research that contributes to the knowledge of its flora. This study aims to better understand the floristic diversity of a patch of vegetation in the village of Curral Velho (02° 52’ 45” S and 41° 40’ 01” W), in the municipality of Luís Correia, Piauí state. Random monthly samples were collected in the study area over eight months; 105 specimens were collected and 93 species belonging to 76 genera and 33 families were identified. Local flora includes floristic elements of Caatinga, Cerrado and Restinga, suggesting that the plant community in the coastal area of Piauí has a transitional nature. This study brings unpublished data on the floristic diversity of the studied area, contributing, ultimately, to the knowledge of the flora in the state as a whole. This is a pioneer and partial inventory in this portion of the state and does not portray its full phytodiversity, thus subsequent surveys are required to add data for a better knowledge on the flora in the studied stretch.

Keywords: Flora, Phytogeography, Piauí State

1. Introduction

The classification of the Brazilian territory in broad geographic areas [1] inevitably leads to a certain level of generality and vagueness. Maps and vegetation classifications of continental scale have trend to underestimate regional differences in physiognomy, structure and composition of plant communities. This is the case of Brazilian maps and systems of vegetation classification [2], that often ignore Restingas and coastal formations which, despite being relatively narrow bands of vegetation, can reach tens of kilometers into the continent [3].

Refs. [4,5] has individualized the stretch of the Brazilian Northeast coast that lies between Maranhão and the “curve of the South American continent”, in Rio Grande do Norte, as a unit called “Litoral Setentrional do Nordeste” (The Northern Coast of Brazilian Northeast) – LSN. Due to the geographical proximity of LSN with the area of Caatinga, Cerrado and Atlantic Forest, LSN allows the formation of a very peculiar ecotone: a floristic complex which includes species from Caatinga, Cerrado, Atlantic Forest and Amazon besides typical species from Restingas [6, 3, 7, 8, 9]. According to Ref. [10], studies in areas of transition between two or more distinct ecosystems are still not common in Brazil, though to Ref. [11], ecotones in general show great floristic richness that brings together species from different plant communities, and areas with abrupt changes of vegetation may, however, occur.

Ref. [12] emphasize that Piauí state has its coastline under two recent geological formations: areas composed by quartz sands, and areas settled on the Barreiras Formation. Besides mangrove, the vegetation that occurs in this coast is the one known as Tabuleiro and Restinga, which shows variations in its features and these vegetation formations are most likely related to a combination of abiotic factors occurring in the area. Ref. [13] point out that this area is well characterized for having a mosaic of diverse ecosystems.

Ref. [14] highlights that coastal ecosystems are geologically recent environments, and plant species that inhabit there are typical from adjacent ecosystems, such as the Atlantic Forest, the Tabuleiro Forest and Caatinga. Ref. [15] emphasize that they are fragile complex and are highly affected by deforestation, besides depending on the hydric dynamics in the areas where they occur.

Early studies in the Northeastern Region were presented
through the pioneer Dârdano de Andrade Lima still in the 1950s [16]. Although great floristic diversity is observed in plant communities of the Northeastern Region [17], there is a great scarcity of research papers published, with only isolated floristic surveys [18, 19, 8]. Anyway, it is noticed that the northeastern coastal vegetation is quite diverse in terms of floristic richness. Fabaceae, Myrtaceae, Cyperaceae, Poaceae, and Euphorbiaceae are the families with the highest number of species [14, 20, 21, 22, 16], and they are often reported as being of great economic importance.

The northern coast of Piauí state, still little explored as to its phytodiversity, instigates conducting research that contributes to the knowledge of its flora, bringing positive results for both the scientific and local communities. Given this context, it thus becomes necessary and useful to know, disseminate and subsequently apply biological data derived from this knowledge in the everyday life of residents in this area, and awaken them to the extreme importance of the existence of ecosystems that hold a large plant diversity, which will be better observed and understood by the local population.

2. Materials and Methods

2.1. Study Area

The study was conducted in Curral Velho (02° 52’ 45” S and 41° 40’ 01” W), a village that belongs to the rural area of the municipality of Luís Correia (northern Piauí), which has approximately 46 km of coastline. According to data obtained from the CPRM [23], the climatic conditions in the municipality of Luís Correia (whose center altitude is 10m above sea level) have minimum and maximum temperatures of 25°C to 32°C with warm tropical weather. The average annual rainfall (with a record of 1,200 mm.year⁻¹ in the center of the municipality) is defined in Equatorial Maritime Regime, with annual isohyets between 800-1600 mm.year⁻¹, about 5 to 6 months are the rainiest months and the remainder period is a dry season. The wettest quarter is formed by the months of February, March and April.

According to data contained in the works of Ref. [24] and Project RADAM [25], the soils in the county are represented by various types: Indiscriminate grouping of Eutrophic, Solodic and Non-Solodic Planosols, weak to moderate, with medium texture, and stony and non-stony phase.

According to data from IBGE [26], the sampled area is characterized by a sandy barrier, with partially anthropized vegetation, corresponding to a semideciduous non-floodable open shrubby plant community, organized both as thickets and as areas of dense vegetation. Due to anthropic pressure in the region, by the presence of several farms near the area collected, is likely to be the elimination of populations of some species in the study area mainly through the use of natural areas for plantations.

2.2. Data Sampling and Analysis

Specimens collection was made by random walks by four people in an area from about 5 km², following the methodology adopted by Ref. [27], giving priority to fertile branches. In this study, the presence of invasive and/or introduced species in the area is also taken into account. Each sample consisted of five to seven specimens that were processed following the methodology described by Ref. [28] and identified in the Botany Laboratory of the Federal University of Piauí/Campus Ministro Reis Velloso, in the city of Parnaíba, using specialized literature and also by comparisons made in the Herbarium GrazIELa Barroso (TEPB). The botanical families followed the Angiosperm Phylogeny Group III System [29]. The botanical synonyms were updated using the database available in the list of species of the Botanical Garden of Rio de Janeiro [30] as well as the name of authors of the species. The botanical collection is found deposited at the collection of the Herbarium HDelta and TEPB [31].

3. Results and Discussion

For the floristic survey in the area 105 specimens in reproductive stage were collected. Out of them, the botanical identification of 93 species belonging to 76 genera and 33 families was performed, and five were identified up to the genus level (Table 1). Families with higher species richness were Fabaceae (26 species) and Bignoniaceae and Euphorbiaceae (with six species each). Those data indicate that these families form a group of high floristic representation for the studied stretch.

| Families/Species | Vernacular Name | Habit | CN |
|------------------|----------------|-------|----|
| 1 ACANTHACEAE    |                |       |    |
| 1 Dicliptera     | Herb           | 29    |
| 2 AMARANTHACEAE  |                |       |    |
| 2 Alternanthera  | Herb           | 16    |
| 3 Alternanthera  | Herb           | 21    |
| 4 Amaranthus     | Herb           | 86    |
| 5 Eruca          | Herb           | 20    |
| 6 PAPYRACEAE     |                |       |    |
| 1 Acapina        | Tree           | 42    |
| 2 Allamanda      | Shrub          | 13    |
| 3 Apicarpiaux    | Tree           | 17    |

Table 1. List of families and species recorded in a patch of vegetation on the coast of the Piauí state with its vernacular names, habit and collector number (CN) of Mateus Cardoso do Amaral.
| Families/Species | Vernacular Name | Habit | CN |
|------------------|----------------|-------|----|
| 9 | Calotropis procera (Aiton) W.T. Aiton | Ciumeira | Shrub | 52 |
| 10 | Cryptostegia grandiflora R. Br. | Alamanda-roxa | Climber | 84 |
| 5 | ARISTOLOCHIACEAE | | | |
| 11 | Aristolochia laevis Wild. | Orelha-de-cavalo | Climber | 23 |
| 6 | ASTERACEAE | | | |
| 12 | Acanthophyllum hispidum DC. | Carrapicho | Herb | 83 |
| 13 | Bidens bipinnata L. | - | Herb | 27 |
| 7 | BIGNONIACEAE | | | |
| 14 | Anemopaegma chamberlaynii (Sims) Bureau & K. Schum. | - | Climber | 105 |
| 15 | Anemopaegma chrysoteleum (Kuntth.) Sandwith. | - | Climber | 65 |
| 16 | Cucuparia argentea (Wawra) Sandwith | - | Shrub | 12 |
| 17 | Freidericia platypetala (Cham.) L.G. Lohman | Cipó-uma | Shrub | 06 |
| 18 | Lantida helicocalyx A.H. Gentry | - | Shrub | 61 |
| 19 | Handroanthus impetiginosus (Mart. ex. DC.) Mattos | Ipê-roxo | Tree | 35 |
| 8 | BORAGINACEAE | | | |
| 20 | Cordia affinis Fresen. | - | Shrub | 18 |
| 21 | Cordia rufescens A.DC. | Grão-de-galo | Tree | 19 |
| 22 | Heliotropium indicum L. | Crista-de-galo | Climber | 47 |
| 9 | CHRYSOBALANACEAE | | | |
| 23 | Chrysobalanus icaco L. | Guajiru | Shrub | 70 |
| 24 | Cyperaceae | | | |
| 25 | Cyperus articulatus L. | Junco | Herb | 91 |
| 26 | Cordiopsis leprosum Mart. | Mufumbo | Shrub | 15 |
| 27 | Convulvulaceae | | | |
| 28 | Ipomoea sp. | Café-bravo | Shrub | 03 |
| 29 | EUPHORBIAEAE | | | |
| 32 | Croton urucurana Baill. | - | Shrub | 11 |
| 33 | Cratospora aurea (L.) Arthur | Cansanção | Herb | 75 |
| 34 | Dalechampia pernambucensis Baill. | - | Climber | 54 |
| 35 | Jatropha gossypifolia L. | Pão Roxo | Shrub | 82 |
| 36 | Jatropha mollissima (Pohl) Baill. | Pão manso | Shrub | 92 |
| 37 | Ricinus communis L. | Mamonha | Shrub | 71 |
| 14 | ERYTHROXYLACEAE | | | |
| 38 | Bauhinia brevipes Vogel | Pata-de-vaca | Shrub | 01 |
| 39 | Bauhinia angulata L. | Mororó | Shrub | 39 |
| 40 | Canavalia brasiliensis Mart. ex Benth. | - | Shrub | 10 |
| 41 | Cassia alata L. | Fedegoso | Shrub | 73 |
| 42 | Centrosema brasiliense (L.) Benth. | - | Climber | 04 |
| 43 | Chamaeacrispa | - | Shrub | 04 |
| 44 | Chamaeacrispa nictitans (L.) Moench. | - | Shrub | 26 |
| 45 | Chamaeacrispa rotundifolia (Pers.) Greene | - | Shrub | 104 |
| 46 | Copaifera langsdorfii Desf. | Podói | Tree | 58 |
| 47 | Crotalaria incana L. | - | Shrub | 93 |
| 48 | Dioecia grandiflora Mart. ex Benth. | Mucunã | Shrub | 46 |
| 49 | Hymenaea courbaril L. | Jatobá | Tree | 31 |
| 50 | Lysidia ferrea (Mart. Ex Tul.) L.P.Queiroz | Jucá | Tree | 37 |
| 51 | Luezetburghia sp. | - | Shrub | 41 |
| 52 | Macropodium atropurpureum (Sessé & Moc. ex DC.) Urb. | - | Shrub | 33 |
| 53 | Macropodium lathyroides (L.) Urb. | - | Shrub | 98 |
| 54 | Mimosas caesalpinifolia Bentham. | Sabiá | Tree | 30 |
| 55 | Mimosas pudica L. | Malicia | Herb | 77 |
| 56 | Poinciana gardneriana (Benth.) L.P. Queiroz | Catngrueira | Shrub | 02 |
| 57 | Pyrocarpa monticola (Benth.) Luckow & R.W. Jobson | Catanduva | Shrub | 40 |
| 58 | Senegalia langsdorfii (Benth.) Seigler & Eisinger | Acácia | Tree | 07 |
| 59 | Senna cearensis A.Fr. Fern. | - | Shrub | 60 |
| 60 | Senna obtusifolia (L.) Irwin & Barneby | - | Shrub | 78 |
| 61 | Senna occidentalis (L.) H.S. Irwin & R.C. Barneby | Manjerioba | Shrub | 79 |
| 62 | Vachellia farnesiana (L.) Wight & Arn. | Coronha | Shrub | 49 |
| 63 | Leucaena leucocephala (Lam.) de Wit. | - | Shrub | 87 |
The most representative families found in the study area were also mentioned earlier in the study by Ref. [16], which also found that the physiognomy of Restinga in Piauí is similar to the ones in the North, South and Southeast Regions of Brazil (fields, fruitful and forestry) and still showed through a dendrogram of floristic similarity that the vegetation of the municipalities of Luís Correia, Parnaíba and Ilha Grande has similarities to other municipalities of Luís Correia, Parnaíba and Ilha Grande has similarities to other municipalities of Brazil (fields, fruitful and forestry) and still showed through a dendrogram of floristic similarity that the vegetation of the North, South and Southeast Regions of Brazil is similar.

In the sampled area we observed the predominance of species of shrub habit (40.86%), with representatives in 17 out of the 36 families identified in the area. The herbaceous habit corresponded to 31.18% of species and climber (vines) and tree habits are represented by 15.05% and 12.90%, respectively (Table 1). These data reveal that the floristic composition of the area consists mainly of specimens of shrub layer interspersed with open areas consisting of herbaceous plants.

Analyzing the distribution of the species recorded in the study area and comparing them to main surveys in Piauí in Caatinga [32, 33, 34], Cerrado [35, 13, 36] and Carrasco areas [37, 38], it was possible to identify characteristic species of these plant formations composing the flora of the studied vegetation. It was found that 29.03% of the species identified in the area were found in surveys of Cerrado, 25.80% in areas Cerrado, 25.80% in areas Cerrado, 25.80% in areas Cerrado, 25.80% in areas of Caatinga and 16.12% in studies conducted in Carrasco.

According to data from CEPRO [39], plant formations in Piauí state are influenced by different other vegetation formations, such as the ones in the Amazon, the Central Plateau (Cerrado) and the xeric vegetation present in the Brazilian Northeast, and it is characterized by presenting great diversity of ecosystems, such as the semideciduous broadleaf forest, the mixed semideciduous forest, the non-thorny deciduous broadleaf forest, and the transition...
areas between Babaçu Forest/Cerrado, Mata Seca/Cerrado and Cerrado/Caatinga. According to Ref. [13], transition areas of the state correspond to 19% of its territory.

After the comparative results between the subject area of this study and other surveys in various vegetational formations of the semi-arid northeast [35, 32, 33, 13, 34, 36, 37, 38, 40, 41, 42], it becomes apparent that the study area has the highest floristic similarity to the surveys on Cerrado and Caatinga, which points to the fact that the study area is an area of Caatinga-Cerrado transition, coinciding with that described by Ref. [16] in his study area.

Species of widely occurrence in areas of Cerrado in Piauí [35, 13, 36, 40, 41] such as Byrsonima gardneriana, Hymenaea courbaril, Fredericia platyphylla, Bauhinia ungulata and Copaifera langsdorffii, for example, were recorded in the study area, as well as in the Caatinga in this state [32, 33, 34], for example Aspidosperma pyrifolium, Combretum leprosum, Pityrocarpa moniliformis and Acacia langsdorffii. Moreover, it is possible to cite the typical species of the Restinga along the coast of Piauí [16] such as Ipomoea asarifolia and Chrysobalanus icaco and also species occurring in Carrasco, such as Mimosa caesalpinifolia and Mitracarpus hirtus [37, 38]. On the other hand, some species recorded in the study area are reported as being widely distributed, such as Ximenia americana and Handroanthus impetiginosus [42].

According to Ref. [43], considering that some species of Cerrado and also Caatinga have certain success in installing coastal environments and when one realizes that the local flora tends to be a mixture of species of different phytogeographical areas, they used the intermediary local climatic conditions to settle. The same authors also claim that from this condition it is noticed that the northern coast of Northeastern Brazil appears to serve, in greater or lesser degree, as an ecological corridor between Cerrado in the west and the Atlantic Forest in the east, surrounded by Caatinga. This mosaic of environmental conditions, in this ground, allows the coexistence of species in Caatinga, Cerrado, Psamófilas species and even forest species.

4. Conclusion

It was found that the flora present in the studied area has typical species from Caatinga, Cerrado and Restinga, suggesting that the plant community located in the studied coastal area of Piauí state has a transitional nature, as already mentioned by some authors.

In a general context, this survey provides unpublished data of the floristic diversity of the study area, contributing, ultimately, to the knowledge of the phytodiversity in Piauí state as a whole, still lacking in studies of such nature.

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