



Original Paper

Floristic composition of an urban coastal forest fragment at the State University of Ceará, Fortaleza, Brazil

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Abstract

The urban areas have suffered with the loss in their biodiversity along the years due to the decrease of green areas by civil construction or by the urban population growth. Therefore, this work aimed at registering the angiosperms diversity in an urban forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza, Brazil. The sampling was carried out from May/2018 to April /2019 through walks during the rainy and dry seasons. 160 species distributed in 128 genera and 49 families were registered. Fabaceae (27 spp.), Asteraceae (13 spp.), Convolvulaceae and Malvaceae (11 spp. each), Rubiaceae e Poaceae (9 spp. each), and Euphorbiaceae (8 spp.) were the richest families, accounting for 55% of the sampled flora. The herbaceous plants (36.65%) were the most represented habit after which the sub-shrubs and shrubs (17,50% each), arboreal (16,25%) and climbing plants (13.12%) were classified. Among the total species 94.37% are natives, 15,62% are endemic to Brazil and 5,62% are exotic. Of the identified species, 10 spp. are in the Red List of the Flora Conservation National Center and 30 spp. are in the Red List of the International Union for the Conservation of Nature. It can be concluded that the studied fragment has an important richness of plant species in an urban area, therefore it is necessary to create a Conservation Unity and a management plan in order to guarantee the conservation of the area.

Key words: coastal zone, flora, Northeastern Brazil, urban vegetation.

Resumo

As áreas urbanas sofrem no decorrer dos anos com a perda da sua biodiversidade, devido à redução das áreas verdes pela construção civil ou pelo crescimento populacional urbano. Desse modo, o presente trabalho objetivou registrar a diversidade de angiospermas de um fragmento florestal urbano ocorrente no Campus Itaperi da Universidade Estadual do Ceará, em Fortaleza, Ceará. As coletas foram realizadas de maio/2018 a abril/2019, por meio de caminhadas realizadas nas estações seca e chuvosa. Foram registradas 160 espécies distribuídas em 128 gêneros e 49 famílias. Fabaceae (27 spp.), Asteraceae (13 spp.), Convolvulaceae e Malvaceae (11 spp. cada), Rubiaceae e Poaceae (9 spp. cada), e Euphorbiaceae (8 spp.) foram as famílias mais ricas, respondendo por 55% da flora amostrada. As plantas herbáceas (36,65%) foram o hábito mais representado, após o qual foram classificados os subarbustos e arbustos (17,50% cada), arbóreos (16,25%) e trepadeiras (13,12%). Dentre o total de espécies 94,37% são nativas, 15,62% são endêmicas do Brasil e 5,62% são exóticas. Das espécies identificadas, 10 spp. estão na Lista Vermelha do Centro Nacional de Conservação da Flora e 30 spp. na Lista Vermelha da União Internacional para a Conservação da Natureza. Podemos concluir que o fragmento estudado possui uma importante riqueza de espécies de plantas em área urbana, sendo necessário a criação de uma Unidade de Conservação e de um plano de manejo de modo a garantir a conservação da área.

Palavras-chave: zona costeira, flora, Nordeste do Brasil, vegetação urbana.

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Introduction

Great areas of the Earth surface are being altered by human activities (Pardini *et al.* 2017). The lost and fragmentation of the habitats are the main causes of species extinction besides increasing the fragment vulnerability to the invasion of exotic and native ruderal species (Primack & Rodrigues 2001; Mullu 2016).

Currently, all the vegetal formations are altered by anthropic actions in a bigger or smaller degree especially due to agricultural and cattle raising activities and the industrialization and urbanization impacts, leaving only a few patches where the original vegetation is present (Silva 2019). The urban areas, especially in big metropolises, have suffered along the years with their biodiversity loss due to the decrease in the green areas by civil construction or by the urban population growth (Alencar *et al.* 2017).

Big Brazilian metropolises as the city of Fortaleza, capital of Ceará state, Brazilian Northeast, the 5th biggest metropolis in the country, has 312,353 km² of urbanized area and an estimated population of 2,669,342 inhabitants (IBGE 2019). Located in the Atlantic coast, Fortaleza has its native forest vegetation reduced and considerably degraded due to urban expansion causing an irrecoverable damage to the fauna and flora biodiversity of the region. Likewise, the hydric resources suffer with the deforestation of the riparian vegetation which has a crucial role in feeding and sheltering the local fauna (Fortaleza 2003).

In extremely altered and degraded landscapes, the remaining vegetational becomes even more important. The coastal vegetation in Ceará presents a richness of species and aspects considered a diversified vegetational collection subjected to very differentiated ecological conditions, from dunes vegetation, semideciduous forest, through coastal *cerrados* to mangroves (Moro *et al.* 2015).

The coastal ecosystems suffer a strong anthropic pressure in Fortaleza, for example, more than 90% of the original vegetation has already been lost (Fortaleza 2003; Moro 2020). There are only few patches of native vegetation left and they are in urgent need of public politics to establish the areas protected by Conservation Units (Moro *et al.* 2011).

Allied to the vegetal biodiversity conservation, the floristic surveys are fundamental and provide subsidies to the conservation of the remaining ones that host a high richness of native and endemic

species, mainly for the *Caatinga* phytogeographical domain that has less than 2% of its territory protected by conservation units (Fernandes *et al.* 2020). Thus, the knowledge about the biodiversity present in the remaining vegetation of the region is increasingly necessary besides the importance of the beneficial effects that the contact with nature generates to human health, especially in the big metropolises where the vegetation alleviates the impacts caused by the anthropic action (Melo *et al.* 2011; Amato-Lourenço *et al.* 2016; Pereira *et al.* 2018).

Therefore, the present work aimed at registering the angiosperms diversity in an urban forest fragment at the Itaperi Campus of the State University of Ceará (UECE), in Fortaleza, Ceará, as well as verifying which taxon are native to Brazil and which are exotics, with habit information, endemism, new registers and conservation status information in order to broaden the knowledge about the local flora and evaluate its potential for the conservation of the local biodiversity.

Material and Methods

Study area

The floristic survey was made in an urban fragment of coastal forest located inside the Itaperi Campus of the State University of Ceará (UECE). The fragment is located in the municipality of Fortaleza, state of Ceará, Northeastern Brazil. The study area extends across 25.83 ha, a varying altitude from 15 to 31 m, located between the geographic coordinates 03°47'49"S, 38°33'21"W and 03°48'10"S, 38°33'35"W (Fig. 1).

The climate in the region is characterized as Tropical Warm and Sub-humid presenting an average rainfall of 1,338 mm with an average annual temperature from 26 to 28 °C, with rainy season from January to May. Its relief is classified as Coastal Plain and Pre-coastal Semideciduous Forest, with the presence of Marine Quartzite Sands, Solodic Planosoil, Red-Yellow Podzolic and Solonchak soils types (IPECE 2018). According to Moro *et al.* (2015), the coastal region of Ceará has a recent geological origin (Tertiary-Quaternary), with a diversity of vegetation types, such as Semi-fixed and Mobile Dunes Vegetation, Fixed Dunes Vegetation, Coastal Semideciduous Forest (*Mata de Tabuleiro*), *Cerrado* and Coastal Forested Savanna, *Cerradão*.

The typical vegetation of the study area is Coastal Semideciduous Forest, under the influence of Barrier Formations which comprises a Seasonal

Semi-deciduous Forest of medium size that gathers species from the *Caatinga* and *Cerrado* phytogeographical domains, although they are very anthropized (Castro *et al.* 2012; Moro *et al.* 2015).

In order to elaborate a map of the study area a QGIS version 3.4.8 software was used and the vegetation classification followed the phytoecological units available at the IPECE website (<<http://www.ipece.ce.gov.br/>>) and described by Figueiredo (1997).

Floristic survey

The floristic samplings were carried out from May/2018 to April/2019 during the dry and rainy seasons. The walking method was the one used (Filgueiras *et al.* 1994) in all the study area (Fig. 2). All the fertile plant species (*i.e.*: those with flowers and/or fruit) were photographed in the field and collected for taxonomic identification. The samples were herborized according to the usual botanic techniques (Mori *et al.* 1985) and deposited in the Prisco Bezerra Herbarium (EAC) of the Federal University of Ceará (UFC).

The identifications were carried out from specialized bibliography (Barroso *et al.* 2004; Souza & Lorenzi 2019), key identifications, experts' consultation, comparison with exsiccates of the specimens deposited in the EAC herbarium and BFG (2018) and SpeciesLink (CRIA 2020) websites. The origin, endemism and new registers information are in agreement with the data from the BFG website (2018). The registered species were classified in families according to APG IV (Angiosperm Phylogeny Group 2016), except for the Turneraceae family, which was considered a separate family of Passifloraceae, according to Souza & Lorenzi (2019). To determine the Fabaceae subfamily the Leguminosae Phylogeny Working Group (LPWG 2017) identification key was used. The taxon names and authors are in agreement with The International Plant Names Index (IPNI 2020).

Results and Discussion

A total of 160 angiosperms species were registered distributed in 128 genera and 49 families

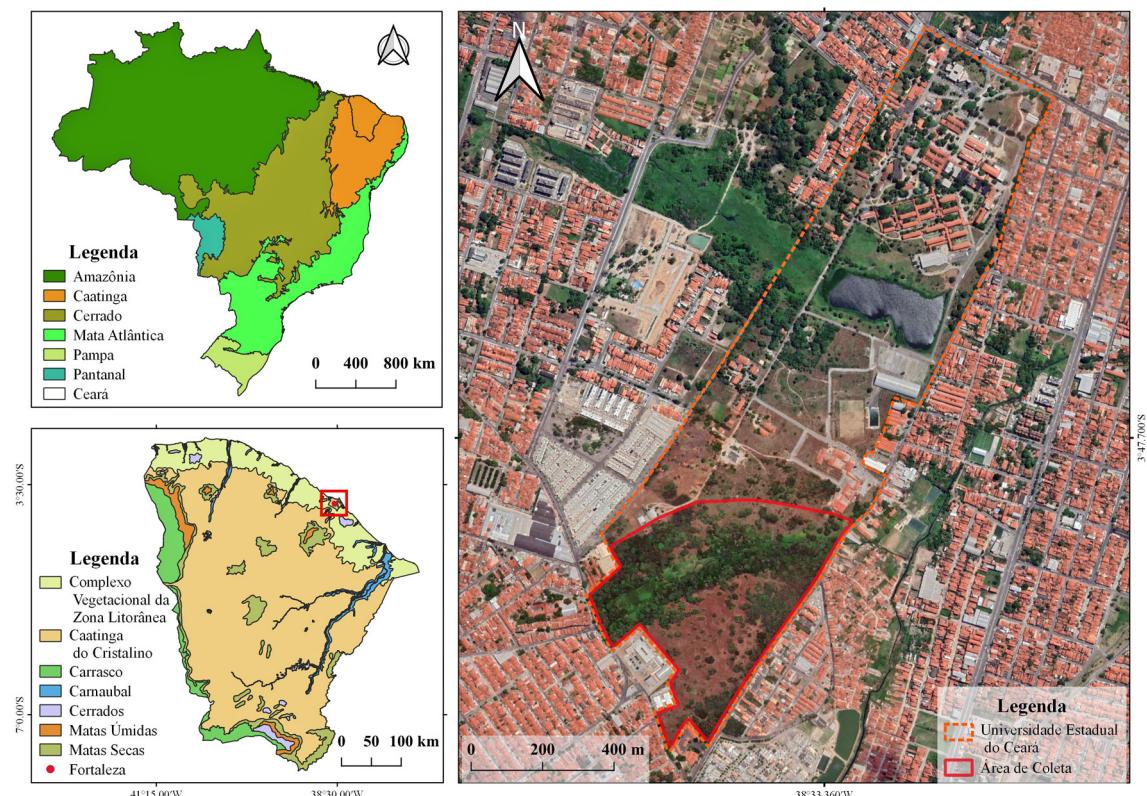


Figure 1 – Location of the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza-CE.



Figure 2 – a-f. Physiognomies of the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza-CE – a. aquatic vegetation of the ponds and swamps; b-c. vegetation of Coastal Semideciduous Forest; d-f. Vegetation of Coastal *Cerrado*.

in the UECE coastal vegetation fragment (Tab. 1). The floristic list produced in this study had, practically, all species identified up to a specific level, with the exception of two species that were identified up to their generic name. The richness of species found in this study is bigger than the one surveyed in the UECE urbanized area by Oliveira *et al.* (2020), who registered 135 species; Diogo *et al.* (2014), in turn, registered

116 species registered in the Semideciduous Forest in the Pici Campus of the Federal University of Ceará (UFC); Castro *et al.* (2011) registered 93 species present on the free areas of the rectorate of the Fortaleza University (Unifor); and Moro *et al.* (2011) registered 151 species in the savanna vegetation fragment belonging to the Brazilian Telegraph Post Company and the Brazilian Army; all in Fortaleza urban zone.

Table 1 – List of angiosperm species registered of the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza-CE, including family/species, habit (H = herbaceous; SU = sub-shrub; S = shrub; T = tree; C = climber), species endemic to Brazil (END), Prisco Bezerra Herbarium voucher number (EAC), collector and collector number (COLLECTOR, CN). * = exotic species; ¹ = species of the Red List of the National Center for Flora Conservation (CNCFLORA 2016) classified as Least Concern; ² = species of the International Union for Conservation of Nature Red List (IUCN 2020) classified as Least Concern; ³ = species of the International Union for Conservation of Nature Red List (IUCN 2020) classified as vulnerable.

Family / Species	Habit	END	EAC	Collector, CN
Acanthaceae				
<i>Ruellia bahiensis</i> (Nees) Morong	SU	Yes	62933	V.S. Sampaio 309
<i>Ruellia paniculata</i> L.	S	No	62922	V.S. Sampaio 312
Amaranthaceae				
<i>Alternanthera brasiliiana</i> (L.) Kuntze	SU	No	63299	E.M.P. Lucena 113
<i>Celosia argentea</i> L.*	SU	No	63837	V.S. Sampaio 399
Anacardiaceae				
<i>Anacardium occidentale</i> L.	T	No	63838	E.M.P. Lucena 218
<i>Astronium fraxinifolium</i> Schott ¹	T	No	64126	E.M.P. Lucena 320
<i>Tapirira guianensis</i> Aubl. ²	T	No	64127	E.M.P. Lucena 330
Annonaceae				
<i>Annona coriacea</i> Mart. ¹	S	No	64128	E.M.P. Lucena 349
<i>Annona glabra</i> L. ¹	T	No	63839	E.M.P. Lucena 221
Apocynaceae				
<i>Allamanda blanchetii</i> A.DC.	S	Yes	63840	E.M.P. Lucena 197
<i>Asclepias curassavica</i> L.	H	No	64129	V.S. Sampaio 525
Araceae				
<i>Taccarum ulei</i> Engl. & K.Krause	H	Yes	64347	V.S. Sampaio 336
Araliaceae				
<i>Hydrocotyle bonariensis</i> Lam.	H	No	64130	V.S. Sampaio 514
Asteraceae				
<i>Blainvillea acmella</i> (L.) Philipson ²	H	No	63300	E.M.P. Lucena 98
<i>Centratherum punctatum</i> Cass.	SU	No	63302	E.M.P. Lucena 97
<i>Cosmos sulphureus</i> Cav.*	H	No	63841	V.S. Sampaio 328
<i>Cyanthillium cinereum</i> (L.) H.Rob.	H	No	64212	E.M.P. Lucena 227
<i>Elephantopus mollis</i> Kunth	H	No	63301	E.M.P. Lucena 95
<i>Lepidaploa arripensis</i> (Gardner) H.Rob.	SU	Yes	63842	V.S. Sampaio 314
<i>Melanthera latifolia</i> (Gardner) Cabrera	H	No	64210	E.M.P. Lucena 202

Family / Species	Habit	END	EAC	Collector, CN
<i>Mikania cordifolia</i> (L.f.) Willd.	C	No	64131	<i>E.M.P. Lucena</i> 498
<i>Porophyllum ruderale</i> (Jacq.) Cass.	H	No	62937	<i>E.M.P. Lucena</i> 172
<i>Praxelis clematidea</i> (Griseb.) R.M.King & H.Rob.	H	No	64132	<i>E.M.P. Lucena</i> 165
<i>Synedrella nodiflora</i> (L.) Gaertn.	H	No	64133	<i>V.S. Sampaio</i> 307
<i>Tilesia baccata</i> (L.f.) Pruski*	S	No	63303	<i>E.M.P. Lucena</i> 103
<i>Tridax procumbens</i> L.	H	No	63077	<i>E.M.P. Lucena</i> 102
Bignoniaceae				
<i>Adenocalymma apparicianum</i> J.C.Gomes	C	Yes	64135	<i>E.M.P. Lucena</i> 251
<i>Fridericia dispar</i> (L.G.Lohmann	S	Yes	64136	<i>E.M.P. Lucena</i> 348
Bixaceae				
<i>Cochlospermum vitifolium</i> (Willd.) Spreng. ²	S	No	63321	<i>E.M.P. Lucena</i> 195
Boraginaceae				
<i>Varronia leucomalloides</i> (Taroda) J.S.Mill.	SU	Yes	64137	<i>E.M.P. Lucena</i> 337
<i>Varronia polyccephala</i> Lam. ²	SU	No	64169	<i>V.S. Sampaio</i> 338
Cannabaceae				
<i>Trema micrantha</i> (L.) Blume ²	T	No	63304	<i>E.M.P. Lucena</i> 83
Capparaceae				
<i>Cynophalla flexuosa</i> (L.) J.Presl ²	S	No	64181	<i>E.M.P. Lucena</i> 344
Chrysobalanaceae				
<i>Hirtella racemosa</i> Lam. ^{1,2}	T	No	63325	<i>V.S. Sampaio</i> 295
Commelinaceae				
<i>Commelina erecta</i> L. ²	H	No	64120	<i>E.M.P. Lucena</i> 323
Convolvulaceae				
<i>Aniseia martinicensis</i> (Jacq.) Choisy ²	C	No	64138	<i>E.M.P. Lucena</i> 161
<i>Camonea umbellata</i> (L.) A.R. Yesões & Staples	C	No	64139	<i>E.M.P. Lucena</i> 188
<i>Distimake aegyptius</i> (L.) A.R. Yesões & Staples	C	No	63844	<i>V.S. Sampaio</i> 337
<i>Evolvulus cardiophyllus</i> Schltdl.	H	No	64140	<i>V.S. Sampaio</i> 310
<i>Evolvulus ovatus</i> Fernald	H	No	63843	<i>V.S. Sampaio</i> 396
<i>Ipomoea alba</i> L.	C	No	63322	<i>V.S. Sampaio</i> 297
<i>Ipomoea asarifolia</i> (Desr.) Roem. & Schult.	C	No	63323	<i>E.M.P. Lucena</i> 187
<i>Ipomoea bahiensis</i> Willd. ex Roem. & Schult.	C	Yes	64141	<i>V.S. Sampaio</i> 379
<i>Jacquemontia gracillima</i> (Choisy) Hallier f.	H	Yes	64142	<i>V.S. Sampaio</i> 324
<i>Jacquemontia tamnifolia</i> (L.) Griseb.	C	No	64143	<i>V.S. Sampaio</i> 387
<i>Operculina hamiltonii</i> (G.Don) D.F.Austin & Staples	C	No	63324	<i>V.S. Sampaio</i> 304
Curcurbitaceae				
<i>Cayaponia racemosa</i> (Mill.) Cogn.	C	No	64144	<i>V.S. Sampaio</i> 505
<i>Melothria pendula</i> L.	C	No	64145	<i>V.S. Sampaio</i> 518
Cyperaceae				
<i>Cyperus chalananthus</i> J.Presl & C.Presl	H	No	64172	<i>E.M.P. Lucena</i> 346
<i>Rhynchospora nervosa</i> (Vahl) Boeckeler	H	Yes	64121	<i>E.M.P. Lucena</i> 332
<i>Scleria gaertneri</i> Raddi ²	H	No	64174	<i>V.S. Sampaio</i> 528
Euphorbiaceae				
<i>Croton blanchetianus</i> Baill. ²	S	Yes	64146	<i>E.M.P. Lucena</i> 351

Family / Species	Habit	END	EAC	Collector, CN
<i>Croton jacobinensis</i> Baill.	SU	Yes	64147	<i>E.M.P. Lucena</i> 322
<i>Dalechampia pernambucensis</i> Baill.	C	Yes	63326	<i>E.M.P. Lucena</i> 169
<i>Euphorbia hyssopifolia</i> L.	H	No	63845	<i>V.S. Sampaio</i> 382
<i>Euphorbia insulana</i> Vell.	H	No	63305	<i>E.M.P. Lucena</i> 87
<i>Manihot carthagenensis</i> (Jacq.) Müll.Arg. ¹	S	No	64148	<i>E.M.P. Lucena</i> 350
<i>Microstachys corniculata</i> (Vahl) Griseb.	SU	No	63846	<i>V.S. Sampaio</i> 383
<i>Sapium glandulosum</i> (L.) Morong ²	S	No	64149	<i>E.M.P. Lucena</i> 325
Fabaceae - Cercidoideae				
<i>Bauhinia pentandra</i> (Bong.) D.Dietr. ²	S	No	63847	<i>V.S. Sampaio</i> 405
<i>Bauhinia unguulata</i> L. ²	T	No	63327	<i>V.S. Sampaio</i> 302
Fabaceae - Caesalpinioideae				
<i>Chamaecrista absus</i> (L.) H.S.Irwin & Barneby ²	SU	No	63848	<i>V.S. Sampaio</i> 386
<i>Chamaecrista trichopoda</i> (Benth.) Britton & Rose ex Britton & Killip	SU	No	63849	<i>V.S. Sampaio</i> 407
<i>Enterolobium timbouva</i> Mart.	T	No	63851	<i>E.M.P. Lucena</i> 214
<i>Inga laurina</i> (Sw.) Willd. ^{1,2}	T	No	64208	<i>V.S. Sampaio</i> 526
<i>Libidibia ferrea</i> (Mart. ex Tul.) L.P.Queiroz ²	T	Yes	63328	<i>E.M.P. Lucena</i> 205
<i>Mimosa arenosa</i> (Willd.) Poir.	S	No	63306	<i>E.M.P. Lucena</i> 91
<i>Mimosa caesalpiniifolia</i> Benth. ¹	S	Yes	64150	<i>E.M.P. Lucena</i> 503
<i>Mimosa camporum</i> Benth.	H	No	63329	<i>E.M.P. Lucena</i> 175
<i>Mimosa candollei</i> R.Grether	H	No	63852	<i>V.S. Sampaio</i> 388
<i>Mimosa sensitiva</i> L.	SU	No	63330	<i>V.S. Sampaio</i> 319
<i>Senegalia polyphylla</i> (DC.) Britton & Rose ²	T	No	64206	<i>V.S. Sampaio</i> 540
<i>Senna alata</i> (L.) Roxb. ²	S	No	63850	<i>V.S. Sampaio</i> 296
Fabaceae - Papilionoideae				
<i>Aeschynomene histrix</i> Poir.	SU	No	63853	<i>V.S. Sampaio</i> 385
<i>Aeschynomene viscidula</i> Michx.	SU	No	64209	<i>V.S. Sampaio</i> 501
<i>Calopogonium mucunoides</i> Desv.	C	No	63871	<i>V.S. Sampaio</i> 323
<i>Centrosema brasiliannum</i> (L.) Benth.	C	No	63331	<i>V.S. Sampaio</i> 315
<i>Cratylia argentea</i> (Desv.) Kuntze	S	No	63854	<i>V.S. Sampaio</i> 301
<i>Crotalaria pallida</i> Aiton*	SU	No	63855	<i>V.S. Sampaio</i> 389
<i>Crotalaria stipularia</i> Desv.	SU	No	63332	<i>V.S. Sampaio</i> 370
<i>Desmodium distortum</i> (Aubl.) J.F.Macbr.	S	No	64168	<i>V.S. Sampaio</i> 541
<i>Indigofera hirsuta</i> L.*	SU	No	63856	<i>V.S. Sampaio</i> 374
<i>Macroptilium gracile</i> (Poepp. ex Benth.) Urb.	H	Yes	63857	<i>V.S. Sampaio</i> 316
<i>Macroptilium lathyroides</i> (L.) Urb.	C	No	63333	<i>E.M.P. Lucena</i> 177
<i>Rhynchosia minima</i> (L.) DC. ²	C	No	63334	<i>E.M.P. Lucena</i> 111
<i>Stylosanthes capitata</i> Vogel	SU	No	63335	<i>E.M.P. Lucena</i> 92
Iridaceae				
<i>Cipura paludosa</i> Aubl.	H	No	64122	<i>E.M.P. Lucena</i> 493
Lamiaceae				
<i>Amasonia campestris</i> (Aubl.) Moldenke	SU	No	63307	<i>E.M.P. Lucena</i> 85
<i>Hyptis atrorubens</i> Poit.	H	No	64151	<i>V.S. Sampaio</i> 516
<i>Marsypianthes chamaedrys</i> (Vahl) Kuntze	H	No	64173	<i>V.S. Sampaio</i> 510

Family / Species	Habit	END	EAC	Collector, CN
<i>Mesosphaerum suaveolens</i> (L.) Kuntze	H	No	63863	<i>V.S. Sampaio</i> 375
Loranthaceae				
<i>Struthanthus syringifolius</i> (Mart.) Mart.	H	No	64182	<i>E.M.P. Lucena</i> 182
Lythraceae				
<i>Cuphea campestris</i> Koehne	SU	No	63864	<i>E.M.P. Lucena</i> 210
<i>Cuphea</i> sp.	H		63865	<i>V.S. Sampaio</i> 378
Malpighiaceae				
<i>Byrsinima sericea</i> DC.	T	No	64153	<i>E.M.P. Lucena</i> 194
<i>Bunchosia apiculata</i> Huber	S	No	64152	<i>E.M.P. Lucena</i> 347
<i>Diplopterys lutea</i> (Griseb.) W.R.Anderson & C.C.Davis	C	No	64171	<i>E.M.P. Lucena</i> 280
Malvaceae				
<i>Guazuma ulmifolia</i> Lam. ²	T	No	63858	<i>V.S. Sampaio</i> 333
<i>Helicteres heptandra</i> L.B.Sm.	S	No	63308	<i>E.M.P. Lucena</i> 86
<i>Melochia betonicifolia</i> A.St.-Hil.	SU	Yes	64154	<i>V.S. Sampaio</i> 539
<i>Pavonia cancellata</i> (L.) Cav.	H	No	63859	<i>V.S. Sampaio</i> 384
<i>Sida brittoni</i> León	SU	No	63336	<i>E.M.P. Lucena</i> 193
<i>Sida cordifolia</i> L.	H	No	63860	<i>V.S. Sampaio</i> 331
<i>Sida glomerata</i> Cav.	SU	No	63309	<i>E.M.P. Lucena</i> 93
<i>Sida linifolia</i> Cav.	H	No	63310	<i>E.M.P. Lucena</i> 101
<i>Sida rhombifolia</i> L.	H	No	63311	<i>E.M.P. Lucena</i> 106
<i>Triumfetta semitriloba</i> Jacq. ²	SU	No	63861	<i>E.M.P. Lucena</i> 247
<i>Waltheria indica</i> L.	SU	No	63862	<i>V.S. Sampaio</i> 373
Melastomataceae				
<i>Clidemia hirta</i> (L.) D.Don	S	No	64155	<i>E.M.P. Lucena</i> 489
Menispermaceae				
<i>Cissampelos glaberrima</i> A.St.-Hil.	C	No	63312	<i>E.M.P. Lucena</i> 99
Myrtaceae				
<i>Campomanesia aromatica</i> (Aubl.) Griseb. ^{1,3}	T	No	64179	<i>E.M.P. Lucena</i> 333
<i>Eugenia punicifolia</i> (Kunth) DC. ²	S	Yes	63337	<i>E.M.P. Lucena</i> 110
<i>Myrcia splendens</i> (Sw.) DC. ²	T	Yes	63314	<i>E.M.P. Lucena</i> 100
Ochnaceae				
<i>Ouratea hexasperma</i> (A.St.-Hil.) Baill.	T	No	63338	<i>E.M.P. Lucena</i> 254
Olacaceae				
<i>Ximenia americana</i> L. ²	T	No	63339	<i>E.M.P. Lucena</i> 196
Onagraceae				
<i>Ludwigia erecta</i> (L.) H.Hara	S	No	64175	<i>V.S. Sampaio</i> 532
Orchidaceae				
<i>Oeceoclades maculata</i> (Lindl.) Lindl.* ²	H	No	63298	<i>E.M.P. Lucena</i> 94
Oxalidaceae				
<i>Oxalis divaricata</i> Mart. ex Zucc.	H	Yes	63315	<i>E.M.P. Lucena</i> 104
Phyllanthaceae				
<i>Phyllanthus orbiculatus</i> Rich.	H	No	63316	<i>E.M.P. Lucena</i> 105

Family / Species	Habit	END	EAC	Collector, CN
Piperaceae				
<i>Piper arboreum</i> Aubl.	S	No	63866	V.S. Sampaio 329
Plantaginaceae				
<i>Angelonia pubescens</i> Benth.	H	Yes	64156	E.M.P. Lucena 208
<i>Stemodia foliosa</i> Benth.	S	No	64157	E.M.P. Lucena 179
<i>Tetraulacium veroniciforme</i> Turcz.	H	Yes	64158	E.M.P. Lucena 183
Poaceae				
<i>Andropogon angustatus</i> (J. Presl) Steud.	H	No	64123	E.M.P. Lucena 190
<i>Andropogon bicornis</i> L.	H	No	64124	E.M.P. Lucena 224
<i>Aristida longifolia</i> Trin.	H	No	64170	E.M.P. Lucena 181
<i>Cenchrus echinatus</i> L.	H	No	64211	E.M.P. Lucena 192
<i>Dactyloctenium aegyptium</i> (L.) Willd*	H	No	64125	E.M.P. Lucena 483
<i>Panicum condensatum</i> Bertol. ¹	H	Yes	64178	E.M.P. Lucena 334
<i>Pappophorum mucronulatum</i> Nees	H	No	64263	E.M.P. Lucena 324
<i>Setaria adhaerens</i> (Forssk.) Chiov*	H	No	63835	V.S. Sampaio 317
<i>Setaria</i> sp.	H		64207	E.M.P. Lucena 491
Polygalaceae				
<i>Asemeia martiana</i> (A.W.Benn.) J.F.B.Pastore & J.R.Abbott	H	Yes	63867	E.M.P. Lucena 228
<i>Asemeia violacea</i> (Aubl.) J.F.B.Pastore & J.R.Abbott	H	No	63317	E.M.P. Lucena 89
<i>Polygala cf. paniculata</i> L.	H	No	64159	E.M.P. Lucena 490
Rubiaceae				
<i>Borreria latifolia</i> (Aubl.) K.Schum.	H	No	64176	V.S. Sampaio 500
<i>Borreria scabiosoides</i> Cham. & Schldtl.	H	No	63340	E.M.P. Lucena 107
<i>Borreria spinosa</i> Cham. et Schldtl.	H	No	64354	V.S. Sampaio 340
<i>Borreria verticillata</i> (L.) G.Mey.	SU	No	64177	V.S. Sampaio 517
<i>Genipa americana</i> L. ¹	T	No	63868	V.S. Sampaio 341
<i>Mitracarpus strigosus</i> (Thunb.) P.L.R. Moraes, De Smedt & Hjertson	H	No	64355	V.S. Sampaio 369
<i>Randia armata</i> (Sw.) DC. ²	T	No	63318	E.M.P. Lucena 84
<i>Richardia grandiflora</i> (Cham. & Schldtl.) Steud.	SU	No	64160	V.S. Sampaio 391
<i>Tocoyena sellowiana</i> (Cham. & Schldtl.) K.Schum.	T	Yes	64180	E.M.P. Lucena 279
Rutaceae				
<i>Zanthoxylum syncarpum</i> Tul.	T	No	63319	E.M.P. Lucena 112
Salicaceae				
<i>Casearia hirsuta</i> Sw.	T	No	64161	E.M.P. Lucena 216
Sapindaceae				
<i>Paullinia pinnata</i> L.	C	No	63341	V.S. Sampaio 303
<i>Serjania glabrata</i> Kunth	C	No	64162	E.M.P. Lucena 215
Simaroubaceae				
<i>Homalolepis trichilioides</i> (A.St.-Hil.) Devecchi & Pirani	T	No	64163	E.M.P. Lucena 253
<i>Simarouba amara</i> Aubl. ²	T	No	64165	V.S. Sampaio 508
Solanaceae				
<i>Solanum palinacanthum</i> Dunal	S	No	63869	V.S. Sampaio 394
<i>Solanum paniculatum</i> L. ²	S	No	63343	E.M.P. Lucena 174

Family / Species	Habit	END	EAC	Collector, CN
Turneraceae				
<i>Piriqueta guianensis</i> N.E.Br.	H	No	64167	V.S. Sampaio 498
<i>Turnera melochioides</i> var. <i>latifolia</i> Urb.	SU	No	63870	V.S. Sampaio 320
<i>Turnera subulata</i> Sm.	S	No	64166	E.M.P. Lucena 485
Urticaceae				
<i>Cecropia pachystachya</i> Trécul	T	No	64205	E.M.P. Lucena 222
Verbenaceae				
<i>Lantana camara</i> L.*	S	No	63342	E.M.P. Lucena 168
<i>Lantana fucata</i> Lindl.	S	No	63320	E.M.P. Lucena 90
<i>Stachytarpheta angustifolia</i> (Mill.) Vahl	S	No	63344	E.M.P. Lucena 184
Violaceae				
<i>Pombalia calceolaria</i> (L.) Paula-Souza	H	No	63345	V.S. Sampaio 325

In this study, the richest families were: Fabaceae (27 spp.), Asteraceae (13 spp.), Convolvulaceae and Malvaceae (11 spp. each), Poaceae and Rubiaceae (nine spp. each) and Euphorbiaceae (eight spp.), which comprise 55% of the sampled flora (Fig. 3). These families, except for Convolvulaceae, are among the ten main families in Brazil's angiosperms in which we can highlight the Fabaceae family as the richest in species in the *Caatinga* phytogeographic domain (BFG 2015), and registered with the greater richness in the Ceará Floristic Costal survey (Moro *et al.* 2011; Castro *et al.* 2012; Diogo *et al.* 2014; Oliveira *et al.* 2020). The species richness attributed to Fabaceae corroborates with BFG (2015), which states that the leguminous family presents the greatest richness of the angiosperms species in Brazil (BFG 2015).

Regarding the other families, Asteraceae is the third family in species richness in Brazil and is among the richest families in the *Cerrado* phytogeographical domain (BFG 2015; Pereira *et al.* 2019). Convolvulaceae, in turn, has registers in various Brazilian phytogeographic domains; however the majority of the species are found in *Cerrado*, *Caatinga* and Atlantic Forest (Alencar *et al.* 2019). Now the Malvaceae family is the tenth one in species richness in Brazil, being the seventh richest family in the *Caatinga* (BFG 2015).

Poaceae is considered the second family in richness in Brazil and in the *Caatinga*, and the fourth richest one in the *Cerrado* (BFG 2015). Rubiaceae is the fourth richest family in Brazil showing a great diversity of forms, sizes and colors in its flowers, the same for its fleshy fruits, being visited and dispersed by different animals (Taylor *et al.* 2007). While the Euphorbiaceae family is the ninth one in species richness in Brazil being the fourth richest in the *Caatinga* (BFG 2015), hosting highly diversified and complex groups (Lucena & Alves 2010) and placed among the most economically significant (Sátiro & Roque 2008).

The families with greatest genera richness were Fabaceae with 18 genera, Asteraceae with 13, Convolvulaceae, Malvaceae and Poaceae with seven each. The genera that presented the biggest number of species were: *Mimosa* L. (Fabaceae) and *Sida* L. (Malvaceae) with 5 spp. each, *Borreria* G.Mey. (Rubiaceae) with four spp. and *Ipomoea* L. (Convolvulaceae) with three spp., these four genera together have 10,62% of the total sampled species and 13,28% of genera, where all of them are part of the species richest families. Other floristic surveys

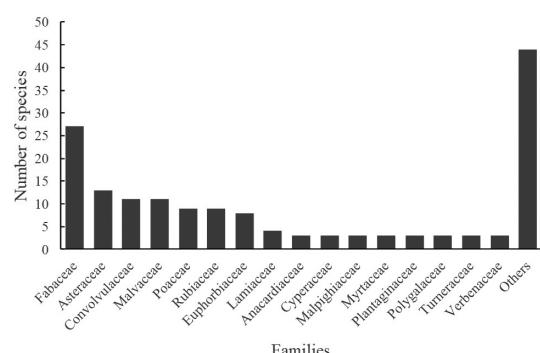


Figure 3 – Most representative botanical families identified during the survey of the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza-CE.

also registered the *Mimosa* and *Sida* genera among the most representative of the Ceará Coastal region (Santos-Filho *et al.* 2011; Castro *et al.* 2012).

In the study area it is possible to notice two very distinct main physiognomies, the *Mata de tabuleiro* vegetation, characterized as a middle sized semideciduous forest with the presence of species from the *Cerrado* and *Caatinga* (Castro *et al.* 2012; Moro *et al.* 2015), and the Coastal *Cerrado* vegetation. Species like *Anacardium occidentale* L., *Hirtella racemosa* Lam., *Myrcia splendens* (Sw.) DC., *Tapirira guianensis* Aubl. and *Zanthoxylum syncarpum* Tul., are considered typical of *Mata de Tabuleiro* (Moro *et al.* 2015). Whereas the *Annona coriacea* Mart., *Cyperus chalananthus* J.Presl & C.Presl e *Ouratea hexasperma* (A.St.-Hil.) Baill. are common in the *Cerrado* areas (BFG 2018).

Species that frequently occur in the *Caatinga* domain can also be observed, such as *Allamanda blanchetii* A.DC., *Cochlospermum vitifolium* (Willd.) Spreng., *Croton blanchetianus* Baill., *Croton jacobinensis* Baill., *Cuphea campestris* Mart. ex Koehne and *Ruellia paniculata* L. (BFG 2018). The woody species *Campomanesia aromatica* (Aubl.) Griseb., *Tocoyena sellowiana* (Cham. & Schltdl.) K.Schum. and the herbaceous climbing *Centrosema brasiliannum* (L.) Benth. are common in the Northeastern coastal region (Moro *et al.* 2011).

Regarding the habit, the herbs were represented by 57 spp. (36,65%), the sub-shrubs and shrubs with 28 spp. each (17,50%), trees with 26 spp. (16,25%) and the herbaceous climbing with 21 spp. (13,12%) (Fig. 4). The *Struthanthus syringifolius* (Mart.) Mart. specie, that is considered an hemiparasite plant (BFG 2018), was found in the area as a parasite of the exotic and cultivated *Mangifera indica* L. species.

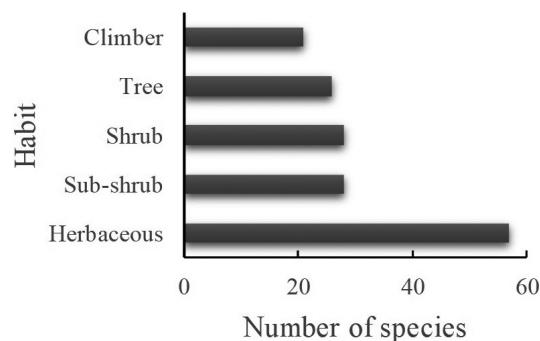


Figure 4 – Species distribution based on the habits in the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza-CE.

Among the total of the species 151 (94,37%) are natives, 25 (15,62%) are endemic to Brazil (Fig. 5) and nine (5,62%) are exotic (Tab. 1). From the endemic species, five occur in the *Caatinga* phytogeographical domain which are: *Adenocalymma apparicianum* J.C.Gomes, *Croton blanchetianus* Baill., *Croton jacobinensis* Baill., *Ruellia bahiensis* (Nees) Morong, and *Varronia leucomalloides* (Taroda) J.S.Mill., whereas *Lepidaploa araripensis* (Gardner) H.Rob is endemic to the *Cerrado* phytogeographical domain. However, some of the species found in this research present an ample distribution in Brazil, for example, *Alternanthera brasiliiana* (L.) Kuntze, *Celosia argentea* L., *Tapirira guianensis* Aubl., *Centratherum punctatum* Cass., among others (BFG 2018). As new registers for the Ceará State there are: *Cyanthillium cinereum* (L.) H.Rob., *Cyperus chalananthus* J.Presl & C.Presl, *Hydrocotyle bonariensis* Lam., *Panicum condensatum* Bertol and *Praxelis clematidea* (Griseb.) R.M.King & H.Rob. (Fig. 6) (BFG 2018).

The *Celosia argentea* L., *Cosmos sulphureus* Cav., *Crotalaria pallida* Aiton, *Dactyloctenium aegyptium* (L.) Willd., *Tilea baccata* (L.f.) Pruski and *Setaria adhaerens* (Forssk.) Chiov. are considered naturalized exotic species (BFG 2018). According to Moro *et al.* (2012) the naturalized exotic species are plants that can establish themselves where they were introduced, however they do not disperse becoming restricted to the nearby areas. *Cayaponia racemosa* (Mill.) Cogn., *Indigofera hirsuta* L. and *Oeceoclades maculata* (Lindl.) Lindl. are considered invasive exotic species. This last one is an orchid bioindicator of anthropic forest fragments by its ease to adapt and environmental colonization in disturbed areas (Quenzer & Pedroso-de-Moraes 2014). The invasive exotic plants are able to establish themselves in a consistent way besides dispersing to distant areas, but they can be considered an environmental problem (Moro *et al.* 2012).

The disturbed forest areas show to be more susceptible to biological invasions just as the small forest fragments show a greater vulnerability to the biological invasion which can be explained by the presence of invader species reproductive structures in the fragment coming from the neighboring areas (Cronk & Fuller 1995, Laurance & Bierregaard-Junior 1997; Dislich *et al.* 2002). The *Indigofera hirsuta* L. and *Oeceoclades maculata* species were also reported in Ceará coast as well as in an urban area (Castro *et al.* 2012; Moro *et al.* 2011).

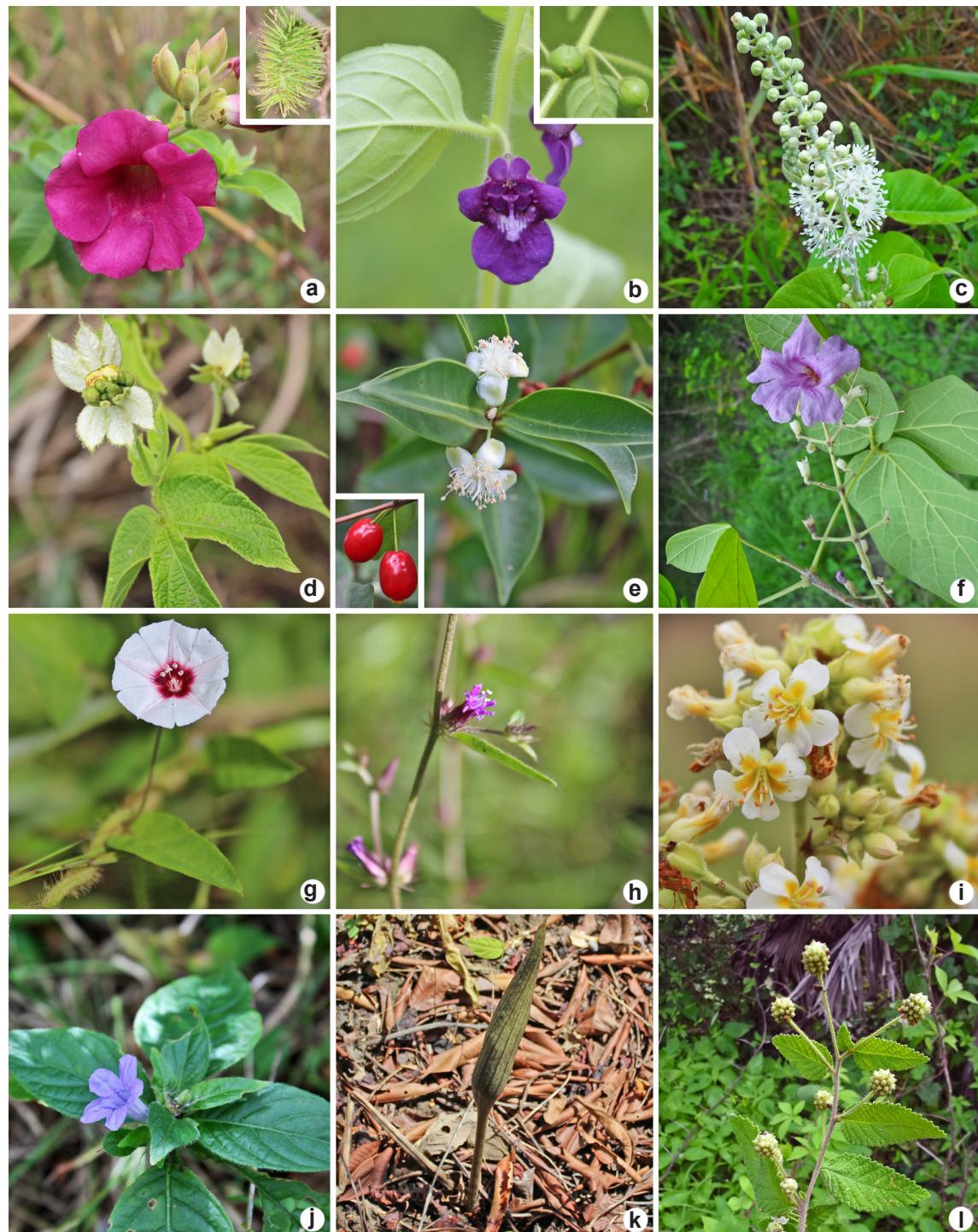


Figure 5 – a-l. Endemic species of Brazil in the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará, Fortaleza-CE – a. *Allamanda blanchetii* (Apocynaceae); b. *Angelonia pubescens* (Plantaginaceae); c. *Croton jacobinensis* (Euphorbiaceae); d. *Dalechampia pernambucensis* (Euphorbiaceae); e. *Eugenia punicifolia* (Myrtaceae); f. *Fridericia dispar* (Bignoniaceae); g. *Jacquemontia gracilima* (Convolvulaceae); h. *Lepidaploa araripensis* (Asteraceae); i. *Melochia betonicifolia* (Malvaceae); j. *Ruellia bahiensis* (Acanthaceae); k. *Taccarum ulei* (Araceae); l. *Varronia leucomalloides* (Boraginaceae).

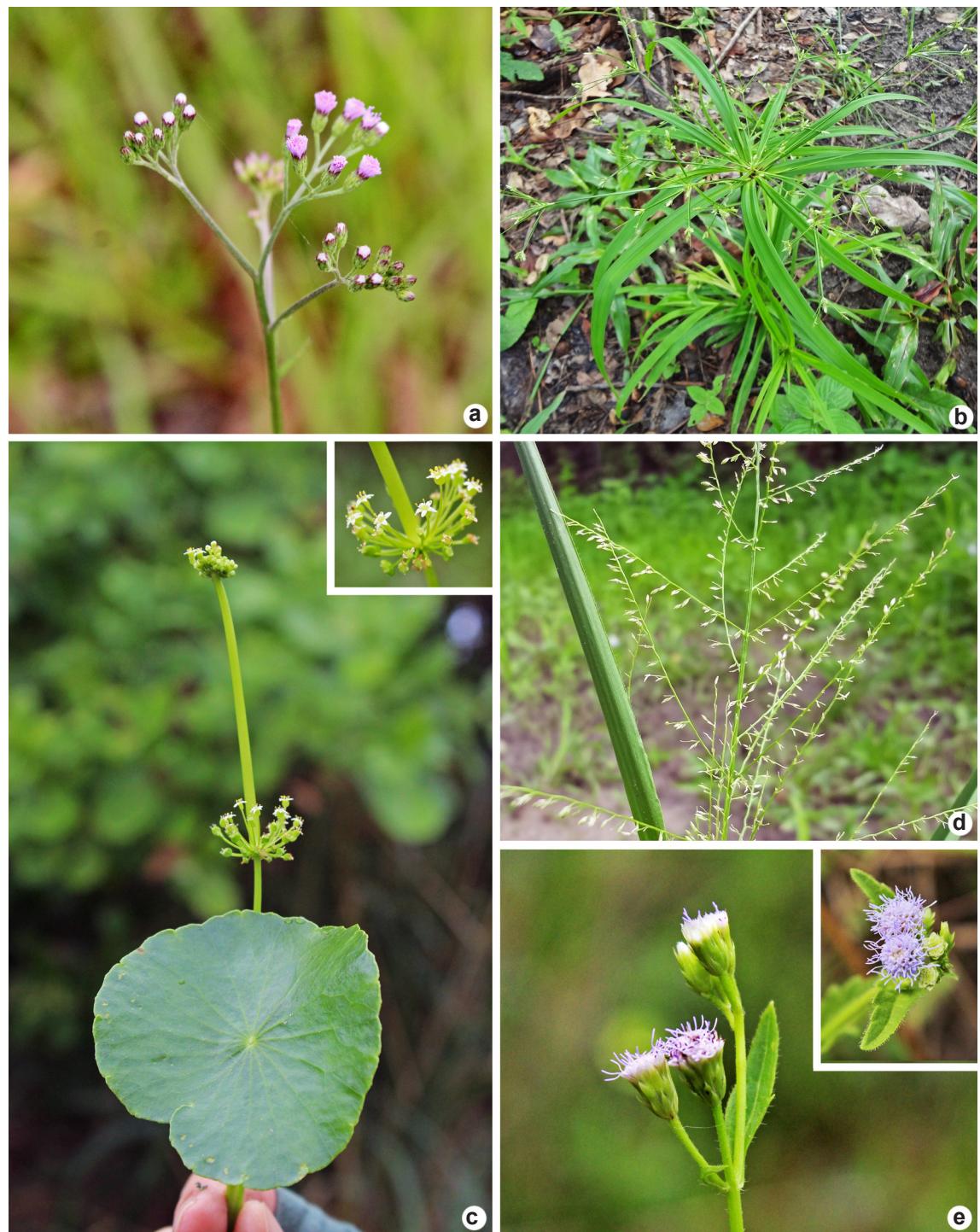


Figure 6 – a-e. New records for the state of Ceará identified in the urban coastal forest fragment at the Itaperi Campus of the State University of Ceará – a. *Cyanthillium cinereum* (Asteraceae); b. *Cyperus chalananthus* (Cyperaceae); c. *Hydrocotyle bonariensis* (Araliaceae); d. *Panicum condensatum* (Poaceae); e. *Praxelis clematidea* (Asteraceae).

It was verified that 39 species are classified by their conservation status as LC (Least Concern) but the *Campomanesia aromatica* (Aubl.) Griseb. specie is considered vulnerable (VU) (CNCflora 2016; IUCN 2020).

Among the sampled species, the presence of 37 spp. in the Red Lists (CNCflora 2016; IUCN 2020) were verified, classified regarding their conservation status as Least concern (LC) and the *Campomanesia aromatica* (Aubl.) Griseb. (Myrtaceae) specie was classified as vulnerable (VU) (IUCN 2020), probably due to its use as wood for fence building as cited by Chaves *et al.* (2014).

The coastal urban fragment of UECE, despite the presence of exotic species, is predominantly composed by a native vegetation besides presenting species endemic to Brazil and the *Caatinga* and *Cerrado* phytogeographical domains. It was also considered as a very anthropized area for its location being inside the UECE campus and by various anthropic activities carried out in the fragment surroundings. However, the area has an elevated ecologic and self-sustainability potential of the local species which is important for the vegetal biodiversity conservation in Fortaleza municipality. In addition to sheltering many vegetal species it also presents many animal species, and according to Carmo *et al.* (2018), the Itaperi campus presents itself as a haven for the wild fauna, as shelter, food resource and a favorable environment for reproduction, for example, the *Boa constrictor* (Linnaeus, 1758) snake, popularly known as *jiboia*. The creation of a Conservation Unit (CU) in the area will be of extreme importance to keep the native species and the ecological processes which are still present. Furthermore, this area is a source for academic researches, such as scientific initiation, masters degree studies and projects towards the environmental education.

Menezes *et al.* (2010) states that Ceará state has 81 protected areas with the potential to maintain the fauna and flora species, however, these areas comprise only 7,7% of the state territory. Twenty-two of these are managed by the State Environmental Superintendency (SEMACE), where there are twelve Environmental Protection Areas, three State parks, two Natural Monuments and one Area of Relevant Ecological Interest (SEMACE 2010).

Thus, it is recommended that the study area be protected and the creation of a municipal Area of Relevant Ecological Interest (ARIE), a Sustainable Use Conservation Unit, seems to be

the more indicated for areas with little extension or no human occupation according to the Article 16 Law 9.985/2000. Therefore, considering that the urban coastal forest fragment studied has a small extension of vegetation with the presence of diverse fauna and flora species, the ARIE creation is justified.

So, it can be concluded that the studied fragment has an important richness of native plants species being of extreme importance to be conserved in the Fortaleza municipality urban area. Its flora is composed by various native species common to the Ceará coast besides presenting many species of different vegetation types, showing the local heterogeneity and ecological potentiality. Regarding the exotic species, there is a need to control and manage the non-native species in the area. Despite being very anthropized and the target of many human activities, the study area is feasible for the creation of a Conservation Unit and a management plan to guarantee the area conservation. Therefore, this study can contribute with the future decisions related to its management, besides presenting the floristic diversity of the studied area.

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