

Floristic survey in an Atlantic Forest remnant in the Recôncavo da Bahia, Bahia State, Brazil

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RESUMO – (Levantamento florístico em remanescente de Mata Atlântica no Recôncavo da Bahia, Estado da Bahia, Brasil). O presente trabalho apresenta a lista de Angiospermas ocorrentes em um fragmento de Floresta Atlântica localizado no Recôncavo da Bahia. O estudo foi desenvolvido na Serra da Copioba, município de São Felipe, Estado da Bahia, Brasil. Expedições botânicas foram realizadas à área de estudo entre os anos de 2016 e 2017. As coletas foram realizadas a partir de trilhas por toda a região da Serra da Copioba. Todo o material coletado foi depositado no Herbário do Recôncavo da Bahia (HURB). Foram registradas 306 espécies, das quais 20,46% são endêmicas da Floresta Atlântica e 4,25% são endêmicas do Estado da Bahia. Os índices de endemismo somados a ocorrência exclusiva de plantas fazem com que a Serra da Copioba possa ser considerada um importante remanescente de Floresta Atlântica da região.

Palavras-chave: Angiospermas, checklist, florística

ABSTRACT – (Floristic survey in an Atlantic Forest remnant in the Recôncavo da Bahia, Bahia State, Brazil). This work presents a list of the Angiosperms that occurs in a fragment of the Atlantic Forest, Recôncavo da Bahia region. The present study was carried out in the Serra da Copioba in the municipality of São Felipe, Bahia State, Brazil. Botanical expeditions were carried out in the studied area between the years 2016 and 2017. The collections were performed in trails throughout the region of the Serra da Copioba. The specimens were housed in the Herbarium of the Recôncavo da Bahia (HURB). We found 306 species. The rates of endemism registered by this study are 20.46% for species occurring exclusively in the Atlantic Forest and 4.25% are endemic to Bahia State. The good indexes of endemism added to the exclusive occurrence of plants make the Copioba Mountain an important remnant of the Atlantic Forest of the region.

Keywords: Angiosperms, checklist, floristics

Introduction

The Atlantic Forest is a phytogeographical domain formed by a set different vegetations in the Brazilian coast that originally occupied about 1,315,460 km², however, currently only 12.5% of this area is preserved and distributed in small and threatened fragments (SOS Mata Atlântica 2018). The Atlantic Forest has been explored since the colonization of Brazil and its devastation has been intensified with the development of cities, road construction, exploitation of natural resources and agricultural expansion from the coast (Morellato & Haddad 2000, Joly *et al.* 2014).

The Atlantic Forest is considered one of the most threatened hotspots in the world, besides being a great center of diversity and endemism of plants (Mittermeier *et al.* 2011, Rezende *et al.* 2018). The Atlantic Forest covers about 15% of the Brazilian territory, is distributed throughout the coast of the Brazilian coast from the State of Rio Grande do Sul to the Piauí, with forest patches in non-coastal states such as Goiás, Mato Grosso and Minas Gerais (SOS Mata Atlântica 2018). The Atlantic Forest has suffered from the effects of its fragmentation, the result of recurrent and disorderly deforestation that degrades and changes the distribution patterns of the species, causing incalculable and irreparable

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losses to the Brazilian biodiversity (Calgaro *et al.* 2015, Melo *et al.* 2015). This has reduced the number and size of plant and animal populations, increasing the loss of biodiversity and alleles that are fundamental for the adaptation and evolution of species (Calgaro *et al.* 2015, Melo *et al.* 2015). This reduction of the environment makes the Atlantic Forest fragile and compromises local biodiversity (Newbold *et al.* 2015).

The floristic knowledge is useful to record the species of plants occurring in a given location, what can be used to understand biogeographical patterns and help to restore degraded areas with local native species (Moro & Martins 2011). This knowledge could be useful to characterize and compare it with other areas, as well as to provide useful data for biodiversity conservation of remnants of the Atlantic Forest is fundamental. Also, they contribute to understanding processes that involve the effects of the fragmentation, structure and diversity of species, which are essential to draw strategies of conservation of these environments (Mota *et al.* 2017). In addition, studies at local scales, whether surveying or taxonomic treatment, are fundamental to compose the knowledge of the flora and biogeography of the species, since most of the studies on a global scale have been treated as a compilation of studies at smaller scales (Thomas *et al.* 2012).

In the State of Bahia, most of the studies involving the Atlantic Forest have concentrated in the southern part of the State, a region that is comprised of several forest formations (ombrophilous and semideciduous forests, for example) and has much of the biome's floristic diversity (Mori *et al.* 1981, Sobrinho & Queiroz 2005, Thomas *et al.* 2009). However, Carnaval & Moritz (2008) have already addressed the need to extend studies to other tropical forest areas in northeastern Brazil that are relatively little known and highly impacted.

The Recôncavo da Bahia is a region where there is a shortage of floristic and ecological studies, except for a study carried out in Serra da Jiboia (Sobrinho & Queiroz 2005), where there is little or almost nothing about its native forest remnants. There were recorded 116 species of Angiosperms for Serra da Copioba, of which 36 were from historical collections made between the 1950s and 1970s and deposited in the Alexandre Leal Costa Herbarium (ALCB), 15 species deposited in the Universidade Estadual de Feira de Santana Herbarium (HUEFS) and 70 species were deposited in the Recôncavo da Bahia Herbarium (HURB) some collects from the Serra da Copioba (Specieslink, 2016) and Virtual Re flora databases Herbarium (JBRJ 2012). Thus, the objective of this work was to increase the floristic studies in the region by surveying the Angiosperms occurring in the the Atlantic Rain Forest fragment in the Serra da Copioba, which has

information on endemism, conservation and its ecological implications on local biodiversity.

Materials and methods

The study was carried out in Serra da Copioba, located in the city of São Felipe (Bahia State), Recôncavo da Bahia region (figure 1). The area has rugged relief and maximum elevation of 360 meters. Soil types belong to the interior and pre-littoral trays: yellow latosol, red-yellow alico latosol, dystrophic and podzolic. The climate varies from humid and dry submerged with an average annual temperature of 23.8 °C and an average annual rainfall of 800 to 1100 mm, with a higher rainfall incidence between November and January (SEI 2017).

The vegetation of Serra da Copioba can be characterized as a remnant of dense ombrophilous forest located on a coastal tableland with high rainfall and without the presence of a defined dry period. Due to anthropic actions the vegetation is in a secondary successional state, marked mainly by presence of light-demanding tree and the striking presence of exotic species

The survey was carried out through collections on the tracks to cover the largest possible territory, between October 2016 and October 2017, totaling ten excursions ranging from 1 to 4 days. The botanical material was processed following the technical standards recommended by Bridson & Forman (1992). All the collected materials were deposited in the Recôncavo da Bahia Herbarium (HURB). The identifications of the specimens were made from a comparison with exsiccates previously identified in HURB and consultation with specialists and assistance of specialized bibliography.

The records of plants collected in Serra da Copioba deposited at the Universidade Estadual de Feira de Santana Herbarium (HUEFS) and the historical collections made between the years of 1950 and 1970 that are inserted in the Alexandre Leal Costa Herbarium (ALCB) were added to the floristic list. Data was accessed through the Centro de Referência em Informação Ambiental database (CRIA 2016). The data was verified, evaluated and the materials without possibility for identification or doubtful location were excluded.

The classification system adopted was APG IV (2016). To define the habit of the individuals, field observations were used, as well as descriptions on voucher labels (for herbarium research), following information in the literature (Gonçalves & Lorenzi 2007). The species nomenclature and distribution were verified in the Flora do Brasil database (BFG 2015, Flora do Brasil 2020 under construction 2018).

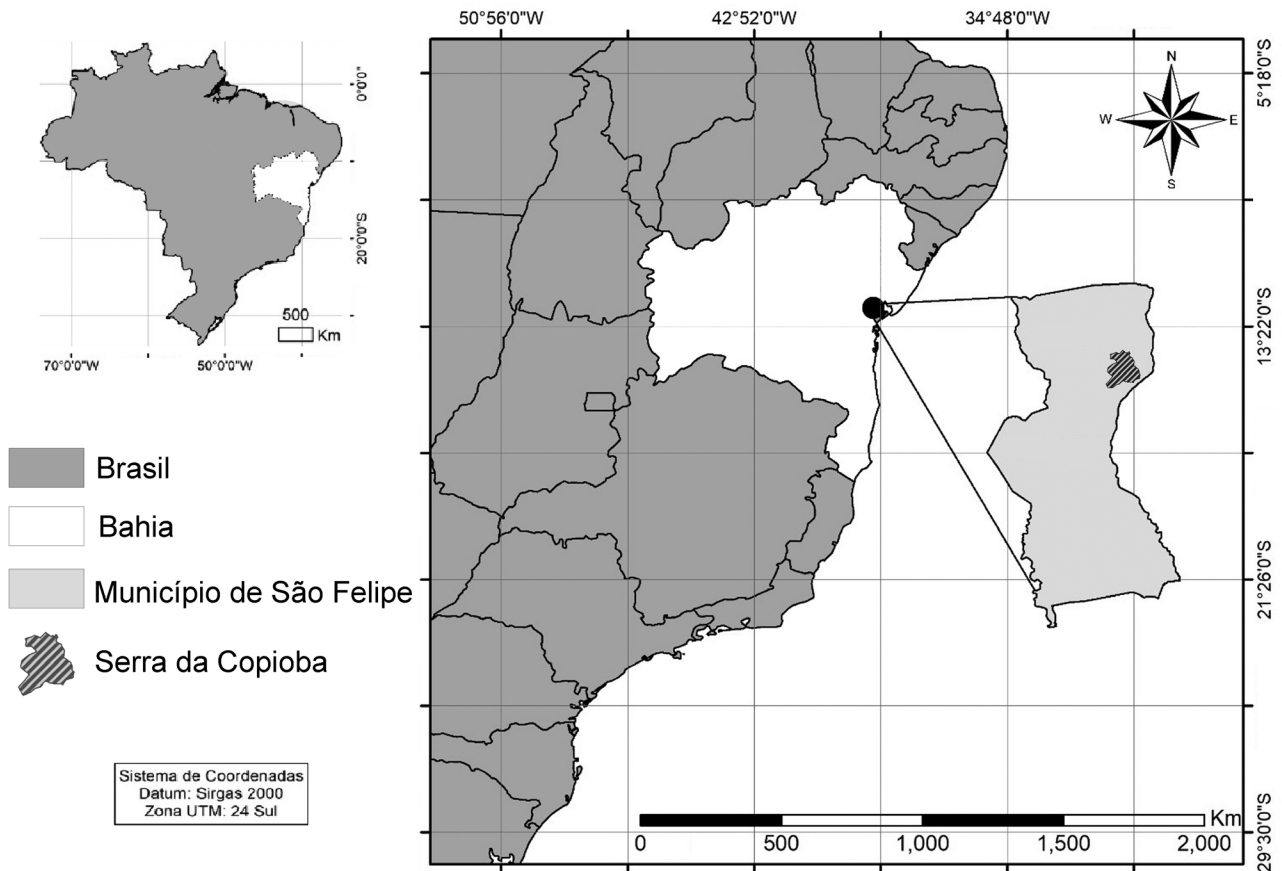


Figure 1: Location map of the study area, Serra da Copioba, São Felipe, Bahia State, Brazil.

Results

A total of 306 species of Angiosperms, distributed in 77 families and 200 genera were recorded for Serra da Copioba (table 1). In total, 273 species were identified up to the specific level (88.9%), 19 to genera (6.5%) and 14 at the family level (4.6%). The families with the highest number of species were: Rubiaceae (30 spp.); Fabaceae (19 spp.); Malvaceae (11 spp.), Asteraceae, Myrtaceae and Sapindaceae (10 spp.); Acanthaceae, Rutaceae (nine spp.); Araceae, Euphorbiaceae, Melastomataceae and Poaceae with (eight spp.); and Orchidaceae and Piperaceae (seven spp.). These 14 families comprise 50.3% of all species recorded in Serra da Copioba.

The endemism indexes recorded in this study are 23.2% for endemic species of the Atlantic Forest (*e.g.* *Aechmea depressa* L.B.Sm. and *Guatteria villosissima* A.St.-Hil.) and 4.05% for endemic species of Bahia (*e.g.* *Begonia delicata* Gregório & J.A.S. Costa, according to information of the List of Flora of Brazil (Flora do Brasil 2020, under construction). Three exotic species were recorded and

identified: *Artocarpus heterophyllus* Lam., *Cordyline australis* Hook.f. and *Citrus* sp.

The historical collections made in the Serra da Copioba in the 1950s totaled 25 species (*e.g.* *Asclepias curassavica* L., *Anthurium jilekii* Schott and *Abildgaardia ovata* (Burm.f.) Kral) and 11 species in the 1970s (*e.g.*, *Gonzalagunia dicocca* Cham. & Schldtl., *Erythroxylum nobile* O.E.Schulz and *Fareamea hyacinthina* Mart.). Although the sample effort of this study was much higher than those collected in the 50s and 70s, only seven species from the 25 collected in 1950 were collected.

The species *Begonia reniformis* Dryand (Begoniaceae), *Cyperus luzulae* (L.) (Cyperaceae), *Erythroxylum citrifolium* A.St.-Hil (Erythroxylaceae), *Heliconia pendula* Wawra (Heliconiaceae) and *Begonia delicata* Gregório & J.A.S. Costa (Begoniaceae), are endemic to the Atlantic Forest. Of the 11 species collected in the 1970s, only five were collected: *Gonzalagunia dicocca* Cham. & Schldtl. (Rubiaceae), *Erythroxylum nobile* O.E.Schulz (Erythroxylaceae), *Fareamea hyacinthina* Mart. (Rubiaceae) and *Margaritopsis chaenotricha* (DC.) C.M.Taylor (Rubiaceae).

Table 1. List of species occurring in Serra da Copioba, São Felipe, Bahia State, Brazil. shrub: shrub; tree: tree; epi: epiphyte; herb: herb; sub: subshrub; par: parasite; trep: vine. ●: Collection of the 1950s; ■: Collection of the 1970s; Δ: Retrieved in this work; ▲: not collected in this work. AM: Amazonas; CAA: Caatinga; CER: Cerrado; PAN: Pantanal; MA: Mata Atlântica; PAM: Pampas.

Family	Habit	Colector/Number	Phytogeographical Domain
Acanthaceae			
<i>Aphelandra bahiensis</i> (Nees) Wassh.	herb	Costa, G. 1051	MA
<i>Aphelandra nitida</i> Nees & Mart.	sub	Moreira, D.M. 55	MA
<i>Justicia antirrhina</i> Nees & Mart.	herb	Moreira, D.M. 52	MA
<i>Lepidagathis nemoralis</i> (Mart. ex Nees)	sub	Lordêlo, R.P. 56-572	MA
Kameyama●▲			
<i>Ruellia affinis</i> (Schrad.) Lindau	sub	Moreira, D.M. 79	MA
<i>Ruellia bahiensis</i> (Nees) Morong	sub	Conceição, S. F. 807	CAA
<i>Ruellia incompta</i> (Ness) Lindau	sub	Moreira, D.M. 81	AM, CAA, CER, PAN, MA
<i>Ruellia paniculata</i> L.	shrub	Moreira, D.M. 60	CAA, CER, MA
<i>Schaueria gonatistachya</i> Nees	sub	Moreira, D.M. 54	MA
Alstroemeriaceae			
<i>Bomarea edulis</i> (Tussac) Herb.●■Δ	vine	Moreira, D.M. 227	AM, CAA, CER, PAN, MA
Amaranthaceae			
<i>Alternanthera brasiliiana</i> var. <i>brasiliiana</i> (L.) Kuntz	shrub	Moreira, D.M. 163	AM, CAA, CER, MA
<i>Alternanthera brasiliiana</i> var. <i>vilosa</i> (Moq.) Kuntz	shrub	Conceição, S.F. 815	AM, CAA, CER, MA
Anacardiaceae			
<i>Astronium concinnum</i> Schott	tree	Souza, J.S. (HURB 20475)	CAA, CER, MA
<i>Schinus terebinthifolius</i> Raddi	tree	Moreira, D.M. 119	AM, CAA, CER, PAN, MA
<i>Spondias venulosa</i> (Engl.) Engl.	tree	Souza, J.S. (HURB 20492)	MA
Annonaceae			
<i>Annona cacans</i> Warm.	tree	Souza, J.S. (HURB 20482)	MA
<i>Guatteria villosissima</i> A.St.-Hil.	tree	Souza, J.S. (HURB 20438)	MA
<i>Guatteria</i> sp.	shrub	Moreira, D.M.50	*
<i>Unonopsis guatterioides</i> (A.DC.) R.E.Fr.	tree	Souza, J.S. (HURB 20461)	AM, CE, MA
<i>Xylopia sericia</i> A.St.-Hil.	tree	Moreira, D.M. 104	AM, CER, MA
Apiaceae			
<i>Spananthe paniculata</i> Jacq.	sub	Costa, G. 1536	CAA, CER, MA
Apocynaceae			
<i>Asclepias curassavica</i> L.●▲	sub	Lordêlo, R.P. 56-617	AM, CAA, CER, PAN, PAM, MA
<i>Himatanthus obovatus</i> (Müll. Arg.) Woodson	tree	Moreira, D.M. 36	AM, CAA, CER
<i>Mandevilla scabra</i> (Hoffmanns. ex Roem. & Schult.) K.Schum.	vine	Conceição, S.F. 808	AM, CAA, CER, MA

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
<i>Tabernaemontana hystrix</i> Steud.	tree	Souza, J.S. (HURB 20503)	CER, MA
Araceae			
<i>Anthurium affine</i> Schott	herb	Moreira, D.M. 260	CAA, CER, MA
<i>Anthurium bellum</i> Schott	herb	Moreira, D.M. 74	MA
<i>Anthurium jilekii</i> Schott ●▲	herb	Pinto, G.C.P. 1050	MA
<i>Anthurium pentaphyllum</i> (Aubl.) G.Don	herb	Andrade, I.M. 810	AM, MA, PAN
<i>Anthurium radicans</i> K.Koch & Haage	sub	Moreira, D.M. 202	MA
<i>Heteropsis oblongifolia</i> Kunth	herb	Andrade, I.M. 828	AM, CER, MA
<i>Monstera adansonii</i> Schott	herb	Andrade, I.M. 2771	AM, CAA, CER, MA
<i>Philodendron pedatum</i> (Hook.) Kunth	herb	Andrade, I.M. 2744	AM, CAA, CER, MA
Arecaceae			
<i>Attalea funifera</i> Mart.	palm	Costa, G. 1565	MA
Aristolochiaceae			
<i>Aristolochia labiata</i> Willd.	vine	Costa, G. 1055	CAA, CER, MA
Asteraceae			
<i>Achyrocline flaccida</i> (Weinm.) DC.	herb	Costa, G. 1553	CER, MA, PAM, PAN
<i>Achyrocline saturejoides</i> (Lam.) DC.	shrub	Moreira, D.M. 7	CER, MA, PAM
<i>Baccharis cinerea</i> DC.	shrub	Moreira, D.M. 127	CAA, CER, MA
<i>Blanchetia heterotricha</i> DC.	shrub	Costa, G. 1545	CAA, MA
<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	shrub	Costa, G. 1542	AM, CAA, CER, PAN, PAM, MA
<i>Cyrtocymura mattos-silvae</i> (H.Rob.) H.Rob.	shrub	Moreira, D.M. 11	MA
<i>Lepidoploa cotoneaster</i> (Willd. ex Spreng.) H.Rob.	shrub	Moreira, D.M. 6	CER
<i>Rolandra fruticosa</i> (L.) Kuntze	shrub	Costa, G. 1053	AM, CAA
<i>Verbesina macrophylla</i> (Cass.) S.F.Blake	shrub	Moreira, D.M. 232	CAA, MA
<i>Vernonanthura brasiliiana</i> (L.) H.Rob.	shrub	Moreira, D.M. 13	AM, CAA, CER
Begoniaceae			
<i>Begonia delicata</i> Gregório & J.A.S. Costa ●Δ	shrub	Moreira, D.M. 10	MA
<i>Begonia reniformis</i> Dryand. ●Δ	herb	Moreira, D.M. 192	CAA, CER, MA
Bignoniaceae			
<i>Adenocalymma marginatum</i> (Cham.) DC.	vine	Moreira, D.M. 77	MA, PAM
Bignoniaceae			
<i>Adenocalymma coriaceum</i> A.DC.	vine	Moreira, D.M. 149	MA
<i>Fridericia bahiensis</i> (Schauer ex. DC.) L.G.Lohmann	tree	Moreira, D.M. 234	CAA, CER, MA
<i>Handroanthus chrysotrichus</i> (Mart. ex DC.) Mattos	tree	Souza, J.S. (HURB 20445)	AM, CAA, CER, PAN, PAM, MA
<i>Handroanthus impetiginosus</i> (Mart. ex DC.) Mattos	tree	Souza, J.S. (HURB.20446)	AM, CAA, CER, PAN, PAM, MA

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
<i>Tabebuia roseoalba</i> (Ridl.) Sandwith	tree	Souza, J.S. (HURB 20435)	CAA, CER, MA
Boraginaceae			
<i>Cordia corymbosa</i> (Desv.) Don	*	Moreira, D.M. 72	AM, CAA, CER, PAN, PAM, MA
<i>Cordia lomitoloba</i> I.M.Johnst. ●▲	tree	Lordêlo, R.P. 56675	AM
<i>Cordia superba</i> Cham.	tree	Moreira, D.M. 120	CAA, CER, MA
<i>Cordia</i> sp.	shrub	Moreira, D.M. 247	*
<i>Myriopus villosus</i> (Salzm. ex DC.) J.I.M.Melo	*	Moreira, D.M. 19	CAA, MA
<i>Varronia curassavica</i> Jacq.	sub	Moreira, D.M. 125	AM, CAA, CER, MA
Bromeliaceae			
<i>Aechmea depressa</i> L.B.Sm.	terr	Moreira, D.M. 144	MA
<i>Aechmea fulgens</i> Brongn.	terr	Moreira, D.M. 170	MA
<i>Billbergia saundersii</i> Bull	terr	Moreira, D.M. 150	MA
<i>Canistrum</i> sp.	terr	Moreira, D.M. 169	*
<i>Hohenbergia stellata</i> Schult. & Schult.f.	terr	Moreira, D.M. 171	MA, CAA
sp. 1	terr	Moreira, D.M. 168	*
Bursaceae			
<i>Protium spruceanum</i> (Benth.) Engl.	tree	Souza, J.S. (HURB 20494)	AM, CER, MA
Cactaceae			
<i>Brasiliopuntia brasiliensis</i> (Willd.) A.Berger	tree	Moreira, D.M. 221	AM, CAA, CER, MA
<i>Hylocereus setaceus</i> (Salm-Dyck) R.Bauer	herb	Moreira, D.M. 261	AM, CAA, CER, MA
<i>Rhipsalis oblonga</i> Loefgr.	epi	Moreira, D.M. 108	AM, CAA, CER, MA
Cannabaceae			
<i>Celtis pubescens</i> (Kunth) Spreng.	shrub	Moreira, D.M. 30	AM, CAA, CER, PAN, PAM, MA
<i>Celtis spinosa</i> Spreng.	shrub	Moreira, D.M. 135	AM, CAA, CER, PAN, PAM, MA
Capparaceae			
<i>Cynophalla flexuosa</i> (L.) J.Presl	tree	Souza, J.S. (HURB 20479)	AM, CER, CAA, MA, PAN
<i>Crateva tapia</i> L.	tree	Moreira, D.M. 24	AM, CAA, CER, MA
<i>Monilcarpa brasiliana</i> (Banks ex DC.) Cornejo & Iltis.	tree	Souza, J.S. (HURB 20447)	MA, PAN
<i>Neocalyptrocalyx grandipetala</i> (Maguire & Steyerm.) Cornejo & Iltis	tree	Moreira, D.M. 267	MA, AM
Celastraceae			
<i>Monteverdia ilicifolia</i> (Mart. ex Reissek) Biral	tree	Souza, J.S. (HURB 20418)	CE, MA, PAM
<i>Monteverdia</i> sp.	*	Moreira, D.M. 148	*
Clusiaceae			

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
<i>Garcinia brasiliensis</i> Mart.	tree	Souza, J.S. (HURB 20434)	MA
Commelinaceae			
<i>Commelina erecta</i> L.	herb	Moreira, D.M. 87	AM, CAA, CER, PAN, MA
<i>Dichorisandra hexandra</i> (Aubl.) C.B.Clarke	shrub	Moreira, D.M. 181	AM, CAA, CER, MA
<i>Dichorisandra</i> sp.	herb	Moreira, D.M. 263	*
Connaraceae			
<i>Connarus regnellii</i> G. Schellenb.	tree	Souza, J.S. (HURB 20491)	MA
Convolvulaceae			
<i>Ipomoea</i> sp.	vine	Moreira, D.M. 18	*
Costaceae			
<i>Costus scaber</i> Ruiz & Pav.	sub	Moreira, D.M. 64	AM, CER, MA
Cucurbitaceae			
sp. 1	herb	Moreira, D.M. 266	*
Cyperaceae			
<i>Abildgaardia ovata</i> (Burm.f.) Kral ●▲	herb	Lordêlo, R.P. 56-396	AM, CAA, CER, MA
<i>Andropogon bicornis</i> L.	herb	Costa, G. 1562	AM, CAA, CER, PAN, MA, PAM
<i>Cyperus luzulae</i> (L.) Retz. ●Δ	herb	Moreira, D.M. 131	AM, CAA, CER, PAN, MA, PAM
<i>Fuirena umbellata</i> Rottb.	herb	Moreira, D.M. 235	AM, CAA, CER, PAN, MA, PAM
Dioscoreaceae			
<i>Dioscorea altissima</i> Lam.	vine	Moreira, D.M. 246	AM, CAA, CER, MA
Ebenaceae			
<i>Diospyros inconstans</i> Jacq.	shrub	Moreira, D.M. 213	AM, CAA, CER, PAN, MA
Erythroxylaceae			
<i>Erythroxylum citrifolium</i> A.St.-Hil. ●Δ	tree	Moreira, D.M. 107	AM, CER, MA
<i>Erythroxylum nobile</i> O.E.Schulz ■Δ	tree	Moreira, D.M. 101	MA
<i>Erythroxylum pelleterianum</i> A.St.-Hil.	tree	Souza, J.S. (HURB 20472)	AM, CER, MA
Euphorbiaceae			
<i>Acalypha brasiliensis</i> Müll.Arg.	sub	Moreira, D.M. 159	AM, CAA, CER, MA
<i>Acalypha multicaulis</i> Müll.Arg.	sub	Conceição, S.F. 815	CAA, CER, MA, PAM
<i>Actinostemon concolor</i> (Spreng.) Müll.Arg.	tree	Souza, J.S. (HURB 20518)	AM, CAA, MA
<i>Actinostemon klotzschii</i> (Didr.) Pax	tree	Souza, J.S. (HURB 20517)	AM, MA
<i>Actinostemon verticillatus</i> (Klotzsch) Baill.	tree	Souza, J.S. (HURB 20487)	MA
<i>Croton heliotropiifolius</i> Kunth	sub	Costa, G. 1561	AM, CAA, CER, MA

continue

Table 1 (continuation)

Family	Habit	Collector/Number	Phytogeographical Domain
<i>Mabea piriri</i> Aubl.	tree	Souza, J.S. (HURB 20450)	AM, CER, MA
<i>Senefeldera verticillata</i> (Vell.) Croizat	tree	Souza, J.S. (HURB 20509)	MA
Fabaceae			
<i>Albizia polycephala</i> (Benth.) Killip ex Record	tree	Souza, J.S. (HURB 20443)	CAA, CER, MA
<i>Andira fraxinifolia</i> Benth.	tree	Conceição, S.F. 799	CAA, CER, MA
<i>Diptotropis ferruginea</i> Benth.	tree	Souza, J.S. (HURB 20440)	MA
<i>Hymenaea courbaril</i> L.	tree	Souza, J.S. (HURB 20455)	AM, CAA, CER, PAN, MA
<i>Inga capitata</i> Desv.	tree	Souza, J.S. (HURB 20466)	AM, MA
<i>Inga edulis</i> Mart.	tree	Moreira, D.M. 136	AM, CAA, CER, MA
<i>Inga ciliata</i> C.Presl	shrub	Moreira, D.M. 242	AM, MA
<i>Inga striata</i> Benth.	tree	Souza, J.S. (HURB 20464)	AM, CER, CAA
<i>Macroptilium</i> sp.	vine	Moreira, D.M. 139	*
<i>Myroxylon peruiferum</i> L.f.	tree	Souza, J.S. (HURB 20439)	CE, MA
<i>Ormosia fastigiata</i> Tul.	tree	Souza, J.S. (HURB 20441)	CE, MA
<i>Pseudopiptadenia brenanii</i> G.P.Lewis & M.P.Lima	tree	Souza, J.S. (HURB 20444)	CAA, CER
<i>Senegalia polyphylla</i> (DC.) Britton & Rose	tree	Souza, J.S. (HURB 20442)	AM, CAA, CER, PAN, MA
<i>Senna affinis</i> (Benth.) H.S.Irwin & Barneby	*	Moreira, D.M. 132	CE, MA
<i>Senna macranthera</i> (DC. Ex Collad.) H.S.Irwin & Barneby	tree	Moreira, D.M. 231	CAA, CER, MA
<i>Swartzia simplex</i> (Sw.) Spreng.	tree	Souza, J.S. (HURB 20445)	MA
<i>Zollernia cowanii</i> Mansano	tree	Moreira, D.M. 51	MA
sp. 1	vine	Moreira, D.M. 100	*
sp. 2	vine	Moreira, D.M. 138	*
Gentianaceae			
<i>Coutoubea spicata</i> Aubl.	*	Costa, G. 1539	AM, CER, MA
<i>Schultesia gracilis</i> Mart.	herb	Conceição, S.F. 810	CE, MA
Gesneriaceae			
<i>Sinningia barbata</i> (Nees & Mart.) G.Nicholson	sub	Moreira, D.M. 59	MA
Heliconiaceae			
<i>Heliconia pendula</i> Wawra ●Δ	sub	Moreira, D.M. 73	MA
<i>Heliconia psittacorum</i> L.f.	herb	Conceição, S.F. 817	AM, CA, CER, PAN, MA

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
Hydroleaceae			
<i>Hydrolea spinosa</i> L.	sub	Conceição, S.F. 809	AM, CA, CER, PAN, MA, PAM
Hypericaceae			
<i>Vismia guianensis</i> (Aubl.) Pers.	tree	Moreira, D.M. 106	AM, CAA, CER, MA
Iridaceae			
<i>Cipura paludosa</i> Aubl.	herb	Moreira, D.M. 204	AM, CAA, CER, MA
Lamiaceae			
<i>Mesosphaerum irwinii</i> (Harley) Harley & J.F.B.Pastore	sub	Conceição, S.F. 800	CAA
sp. 1	herb	Conceição, S.F. 811	*
Lauraceae			
<i>Aniba firmula</i> (Nees & Mart.) Mez	tree	Souza, J.S. (HURB 20514)	AM, CER, MA
<i>Endlicheria paniculata</i> (Spreng.) J.F.Macbr.	tree	Souza, J.S. (HURB 20504)	AM, CAA, CER, MA, PAN
<i>Ocotea brachybotrya</i> (Meisn.) Mez	tree	Souza, J.S. (HURB 20456)	MA
<i>Ocotea indecora</i> (Schott) Mez	tree	Souza, J.S. (HURB 20457)	MA
<i>Ocotea laxa</i> (Nees) Mez	tree	Souza, J.S. (HURB 20507)	MA
<i>Ocotea velutina</i> (Nees) Rohwer ●▲	tree	Lordêlo, R.P. 5637	MA, CER
Laxmanniaceae			
<i>Cordyline australis</i> Hook.f.	tree	Moreira, D.M. 34	EXOTIC
Lecythidaceae			
<i>Eschweilera ovata</i> (Cambess.) Mart. ex Miers	tree	Souza, J.S. (HURB 20497)	AM, MA
Linderniaceae			
<i>Cubitanthus alatus</i> (Cham. & Schltld.) Barringer ●▲	herb	Lordêlo, R.P. 56-329	MA
Loasaceae			
<i>Aosa parviflora</i> (Schrud. ex DC.) Weigend	vine	Moreira, D.M. 203	MA
Loranthaceae			
<i>Phthirusa</i> sp.	tree	Moreira, D.M. 137	*
Lythraceae			
<i>Cuphea brachypoda</i> T.B.Cavalc.	sub	Conceição, S.F. 797	CER
<i>Cuphea racemosa</i> (L.f.) Spreng.	herb	Costa, G. 1532	AM, CA, CER, PAN, MA, PAM
Malpighiaceae			
<i>Byrsonima sericea</i> DC.	shrub	Moreira, D.M. 122	AM, CAA, CER, MA
<i>Heteropterys sanctorum</i> W.R.Anderson ●▲	vine	Lordêlo, R.P. 56	MA
<i>Tetrapteryx</i> sp.	sub	Moreira, D.M. 57	*

continue

Table 1 (continuation)

Family	Habit	Collector/Number	Phytogeographical Domain
Malvaceae			
<i>Ceiba speciosa</i> (A.St.-Hil.) Ravenna	tree	Souza, J.S. (HURB 20480)	AM, CAA, CER, MA
<i>Eriotheca pentaphylla</i> (Vell. & K.Schum.) A.Roby**	tree	Souza, J.S. (HURB 20463)	MA
<i>Helicteres corylifolia</i> Nees & Mart	*	Costa, G. 1057	AM, CAA, CER, MA
<i>Pavonia fruticosa</i> (Mill.) Fawc. & Rendle ●▲	shrub	Lordêlo, R.P. 56-331	AM, MA
<i>Pavonia malacophylla</i> (Link & Otto) Garcke	shrub	Moreira, D.M. 99	AM, CAA, CER, MA
<i>Pavonia martii</i> Colla	*	Moreira, D.M. 134	CAA, CER
<i>Sida cordifolia</i> L.	shrub	Moreira, D.M. 140	AM, CAA, CER, MA
<i>Sida glomerata</i> Cav.	**	Costa, G. 39	AM, CAA, CER, MA, PAN
<i>Sida indica</i> L.	sub	Moreira, D.M. 23	*
<i>Sidastrum paniculatum</i> (L.) Fryxell	*	Costa, G. 1544	AM, CAA, CER, MA
<i>Triumfetta semitriloba</i> Jacq.	*	Costa, G. 155	AM, CAA, CER, MA
Marantaceae			
<i>Goepertia oblonga</i> (Mart.) Borchs & S. Suárez ●Δ	herb	Moreira, D.M. 225	MA
<i>Goepertia cylindrica</i> (Roscoe) Borchs. & S.Suárez	herb	Moreira, D.M. 206	CER, MA
<i>Stromanthe porteana</i> Griseb.	herb	Moreira, D.M. 103	CER, MA
Melastomataceae			
<i>Clidemia hirta</i> (L.) D.Don	sub	Conceição, S.F. 796	AM, CAA, CER, MA
<i>Miconia francavillana</i> Cogn.	shrub	Moreira, D.M. 42	MA
<i>Miconia minutiflora</i> (Bonpl.) DC.	*	Costa, G. 1547	AM, CAA, CER, MA
<i>Miconia nervosa</i> (Sm.) Triana ●▲	shrub	Lordêlo, R.P. 5730	AM, CAA, CER, MA
<i>Miconia prasina</i> (Sw.) DC.	tree	Moreira, D.M. 123	AM, CAA, CER, MA
<i>Miconia</i> sp. 1	arb	Moreira, D.M. 63	*
<i>Pleroma clidemioides</i> Berg. ex Trianna	shrub	Moreira, D.M. 94	MA
sp. 1	tree	Moreira, D.M. 185	*
Meliaceae			
<i>Guarea guidonia</i> (L.) Sleumer	tree	Moreira, D.M. 141	AM, CAA, CER, MA
<i>Guarea macrophylla</i> Vahl	tree	Moreira, D.M. 254	AM, CAA, CER, MA
<i>Trichilia hirta</i> L.	shrub	Moreira, D.M. 29	AM, CAA, CER, MA
<i>Trichilia lepidota</i> Mart.	tree	Moreira, D.M. 248	MA
<i>Trichilia pallens</i> C.DC.	tree	Souza, J.S. (HURB 20465)	CE, MA
<i>Trichilia pallida</i> Sw.	tree	Souza, J.S. (HURB 20483)	AM, CER, MA
Menispermaceae			
<i>Chondrodendron microphyllum</i> (Eichler) Moldenke	tree	Moreira, D.M. 75	MA

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
<i>Chondrodendron platiphyllum</i> (A.St.-Hil.) Miers	vine	Moreira, D.M.265	MA
<i>Cissampelos andromorpha</i> DC.	vine	Moreira, D.M. 112	AM, CAA, CER, MAT, PAN, PAM
Monimiaceae			
<i>Mollinedia elegans</i> Tul.	*	Moreira, D.M. 20901	MA
<i>Mollinedia triflora</i> (Spreng.) Tul.	shrub	Moreira, D.M. 56	MA
Moraceae			
<i>Artocarpus heterophyllus</i> Lam.	tree	Moreira, D.M. 274	EXOTIC
<i>Ficus adhatodifolia</i> Schott in Spreng.	tree	Souza, J.S. (HURB 20454)	CAA, CER, MA, PAN
<i>Sorocea bonplandii</i> (Baill.) W.C.Burger et al.	tree	Souza, J.S. (HURB 20481)	CER, MA
<i>Sorocea hilarii</i> Gaudich.	shrub	Moreira, D.M. 155	CER, MA
Myrtaceae			
<i>Calyptranthes widgreniana</i> O.Berg	tree	Souza, J.S. (HURB 20513)	CER, MA
<i>Eugenia excoriata</i> O.Berg	tree	Souza, J.S. (HURB 20497)	MA
<i>Eugenia florida</i> DC.	tree	Souza, J.S. (HURB 20432)	AM, CAA, CER, MA
<i>Eugenia expansa</i> Spring ex Mart.	shrub	Moreira, D.M. 146	MA
<i>Myrcia splendens</i> (Sw.) DC. ●▲	tree	Lordêlo, R.P. 352	AM, CAA, CER, MA, PAN
<i>Myrcia venulosa</i> DC.	tree	Souza, J.S. (HURB 20477)	CER, MA
<i>Psidium cauliflorum</i> Landrum & Sobral	tree	Souza, J.S. (HURB 20471)	MA
<i>Psidium guineense</i> SW.	tree	Moreira, D.M. 113	AM, CAA, CER, MA
<i>Psidium</i> sp. 1	tree	Moreira, D.M. 130	*
sp. 1	shrub	Moreira, D.M. 216	*
Nyctaginaceae			
<i>Guapira opposita</i> (Vell.) Reitz	tree	Souza, J.S. (HURB 20490)	AM, CAA, CER, MA
<i>Guapira venosa</i> (Choisy) Lundell	tree	Souza, J.S. (HURB 20510)	AM, MA
<i>Pisonia zapallo</i> Griseb.	tree	Souza, J.S. (HURB 20516)	MA, PAN
Olacaceae			
<i>Heisteria perianthomega</i> (Vell.) Sleumer ●▲	tree	Lordêlo, R.P. 56	AM, CAA, CER, MA
<i>Ximenia coriacea</i> Engl.	tree	Souza, J.S. (HURB 20462)	CAA, CER
Oleaceae			
<i>Chionanthus crassifolia</i> (Mart.) P.S. Green	tree	Souza, J.S. (HURB 20488)	CAA, CER, MA

continue

Table 1 (continuation)

Family	Habit	Collector/Number	Phytogeographical Domain
Orchidaceae			
<i>Cattleya amethystoglossa</i> Linden & Rchb.f. ●▲	epi	Lordêlo, R.P. 5743	CAA, MA
<i>Cyclopogon elatus</i> (Sw.) Schltr.	herb	Moreira, D.M. 68	CER, MA
<i>Dimerandra emarginata</i> (G.Mey.) Hoehne	epi	Moreira, D.M. 270	AM, MA
<i>Habenaria hamata</i> Barb.Rodr.	herb	Moreira, D.M. 210	AM, CAA, CER
<i>Lockhartia lunifera</i> (Lindl.) Rchb.f.	epi	Moreira, D.M. 271	AM, CER, MAA
<i>Miltonia flavescens</i> (Lindl.) Lindl. ●▲	epi	Lordêlo, R.P. 57-714	CAA, CER, MA
sp. 1	epi	Costa, G. 1529	*
Oxalidaceae			
<i>Oxalis puberula</i> Nees & Mart.	herb	Moreira, D.M. 76	CER, MA
Passifloraceae			
<i>Passiflora amethystina</i> J.C.Mikan	vine	Moreira, D.M. 228	AM, CAA, CER, MA, PAN
<i>Passiflora foetida</i> L.	vine	Moreira, D.M. 22	AM, CAA, CER, MA, PAN, PAM
Piperaceae			
<i>Piper aduncum</i> L.	*	Moreira, D.M. 20	AM, CAA, CER, MA, PAN, PAM
<i>Piper amalago</i> L.	tree	Souza, J.S. (HURB 20506)	AM, CAA, CER, MA, PAN
<i>Piper corcovadensis</i> (Miq.) C.DC.	shrub	Moreira, D.M. 218	AM, MA
<i>Piper gaudichaudianum</i> Kunth	*	Costa, G. 1551	AM, CER, MA
<i>Piper hispidum</i> Sw.	shrub	Moreira, D.M. 16	AM, CER, MA
<i>Piper</i> sp. 1	*	Costa, G. 1546	*
<i>Piper umbellatum</i> L.	shrub	Moreira, D.M. 8	AM, CER, MA
Plantaginaceae			
<i>Angelonia salicariifolia</i> Bonpl.	**	Conceição, S.F. 801	CAA, CER, PAN
sp. 1	sub	Moreira, D.M. 133	*
Poaceae			
<i>Acroceras zizanioides</i> (Kunth) Dandy ●▲	herb	Lordêlo, R.P. 52-142	AM, CAA, CER, MA
<i>Ichnanthus hirtus</i> (Raddi) Chase ●▲	herb	Pinto, G.C.P. 530	MA
<i>Ichnanthus leiocarpus</i> (Spreng.) Kunth ●▲	herb	Lordêlo, R.P. 56-92	CAA, CER, MA
<i>Lasiacis divaricata</i> (L.) Hitchc.	sub	Moreira, D.M. 98	CAA, CER, MA
<i>Olyra ciliatifolia</i> Raddi ●Δ	herb	Oliveira, R.P. 913	AM, CAA, CER, MA, PAN
<i>Olyra latifolia</i> L.	herb	Moreira, D.M. 90	AM, CAA, CER, MA, PAN
<i>Pharus latifolius</i> L.	..	Oliveira, R.P. 912	AM, CAA, MA
<i>Raddia guianensis</i> (Brongn.) Hitchc.	herb	Oliveira, R.P. 911	AM, MA
Polygalaceae			
<i>Asemeia</i> sp.	shrub	Moreira, D.M. 244	*
<i>Caamembeca grandifolia</i> (A.St.-Hil. & Moq.) J.F.B.Pastore	shrub	Moreira, D.M. 264	MA
<i>Polygala paniculata</i> L.	herb	Moreira, D.M. 96	AM, CAA, CER, MA, PAM

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
Polygonaceae			
<i>Coccoloba alnifolia</i> Casar.	tree	Souza, J.S. (HURB 20458)	CAA, MA
<i>Coccoloba declinata</i> (Vell.) Mart	tree	Souza, J.S. (HURB 20459)	AM, CAA, CER, MA
<i>Coccoloba arborescens</i> (Vell.) R.A.Howard.	tree	Souza, J.S. (HURB 20498)	AM, CER, MA
<i>Coccoloba mollis</i> Casar.	tree	Moreira, D.M. 2	AM, CAA, CER, MA
Primulaceae			
<i>Clavija caloneura</i> Mart.	sub	Moreira, D.M. 37	MA
Rubiaceae			
<i>Borreria humifusa</i> Mart.	*	Costa, G. 1552	MA
<i>Borreria ocymifolia</i> (Roem. & Schult.) Bacigalupo & E.L.Cabral	sub	Moreira, D.M. 1052	AM, CAA, CER, MA
<i>Chomelia anisomeris</i> Müll.Arg.	shrub	Costa, G. 1534	AM, CAA, CER, MA
<i>Chomelia martiana</i> Müll.Arg.	tree	Moreira, D.M. 110	CAA, CER, MA
<i>Chomelia obtusa</i> Cham. & Schltl.	shrub	Moreira, D.M. 84	AM, CAA, CER, MA
<i>Chomelia sericea</i> Müll.Arg.	tree	Souza, J.S. (HURB 20449)	CAA, CER
<i>Chomelia</i> sp1.	shrub	Moreira, D.M. 9	*
<i>Coccocypselum cordifolium</i> Nees & Mart.	*	Costa, G. 1552	AM, CAA, CER, MA
<i>Coussarea leptopus</i> Müll.Arg. ■▲	shrub	Gusmão, E.F. 407	MA
<i>Faramea axilliflora</i> DC.	shrub	Moreira, D.M. 48	AM, CAA, CER, MA, PAN, PAM
<i>Faramea hyacinthina</i> Mart. ■Δ	shrub	Moreira, D.M. 145	MA
<i>Faramea oligantha</i> Müll.Arg.	shrub	Moreira, D.M. 190	MA
<i>Gonzalagunia dicocca</i> Cham. & Schltl. ■Δ	shrub	Costa, G. 1559	AM, CAA, CER, MA
<i>Hamelia patens</i> Jacq. ■▲	shrub	Gusmão, E.F. 410	AM, CAA, CER, MA, PAN, PAM
<i>Ixora muelleri</i> (Muell. Arg.) Bremekamp ■▲	shrub	Gusmão, E.F. 403	MA
<i>Machaonia acuminata</i> Bonpl.	tree	Souza, J.S. 20501	CAA, CER, MA
<i>Margaritopsis chaenotricha</i> (DC.) C.M.Taylor ■Δ	shrub	Moreira, D.M. 26	MA
<i>Mitracarpus hirtus</i> (L.) DC.	herb	Costa, G. 1537	AM, CAA, CER
<i>Palicourea racemosa</i> (Aubl.) Borhidi	shrub	Moreira, D.M. 129	AM, CER, MA
<i>Posoqueria latifolia</i> (Rudge) Schult.	shrub	Moreira, D.M. 70	AM, CAA, CER, MA
<i>Psychotria carthagenensis</i> Jacq. ■▲	shrub	Gusmão, E.F. 406	AM, CAA, CER, MA, PAN, PAM
<i>Psychotria colorata</i> (Willd. ex Schult.) Müll. Arg.	herb	Moreira, D.M. 208	AM, CER, MA
<i>Psychotria cupularis</i> (Müll.Arg.) Standl.	shrub	Moreira, D.M. 69	AM, MA
<i>Psychotria deflexa</i> DC. ●■Δ	shrub	Moreira, D.M. 14	AM, CAA, CER, MA

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
<i>Randia armata</i> (Sw.) DC	tree	Souza, J.S. (HURB 20486)	AM, CER, MA
<i>Randia calycina</i> Cham.	tree	Moreira, D.M. 165	AM, CAA, CER, MA
<i>Rudgea</i> aff. <i>erythrocarpa</i> Müll. Arg.	tree	Moreira, D.M. 166	MA
<i>Rudgea jacobinensis</i> Müll.Arg. ■▲	shrub	Gusmão, E.F. 405	MA, CAA
<i>Tocoyena bullata</i> (Vell.) Mart.	tree	Souza, J.S. (HURB 20505)	CAA, CER, MA
sp. 1	vine	Moreira, D.M. 44	*
Rutaceae			
<i>Angostura bracteata</i> (Nees & Mart.) Kallunki	shrub	Moreira, D.M. 158	MA
<i>Citrus</i> sp.	shrub	Moreira, D.M. 275	EXOTIC
<i>Conchocarpus macrophyllus</i> J.C.Mikan	shrub	Moreira, D.M. 147	MA
<i>Ertela trifolia</i> (L.) Kuntze	herb	Moreira, D.M. 172	AM, CAA, CER, MA
<i>Erythrochiton brasiliensis</i> Nees & Mart.	shrub	Moreira, D.M. 182	AM, MA
<i>Esenbekia</i> sp 1.	sub	Moreira, D.M. 71	*
<i>Pilocarpus spicatus</i> A.St.-Hil.	herb	Moreira, D.M. 45	CAA, CER, MA
<i>Metodrorea</i> sp.	shrub	Moreira, D.M. 198	*
sp. 2	*	Moreira, D.M. 40	*
Salicaceae			
<i>Banara serrata</i> (Vell.) Warb.	shrub	Moreira, D.M. 80	AM, MA
<i>Casearia javitensis</i> Kunth	tree	Souza, J.S. (HURB 20512)	AM, CAA, CER, MA
<i>Casearia sylvestris</i> Sw.	shrub	Moreira, D.M. 249	AM, CAA, CER, PAN, PAM
Sapindaceae			
<i>Allophylus edulis</i> (A.St.-Hil. <i>et al.</i>) Hieron. ex Niederl.	tree	Souza, J.S. (HURB 20511)	AM, CAA, CER, PAN
<i>Allophylus racemosus</i> Sw.	tree	Souza, J.S. (HURB 20467)	AM, CAA, CER, MA
<i>Cupania oblongifolia</i> Mart.	tree	Moreira, D.M. 12	AM, CAA, CER, MA
<i>Matayba guianensis</i> Aubl.	tree	Souza, J.S. (HURB 20508)	AM, CAA, CER, MA, PAN
<i>Paullinia elegans</i> Cambess.	vine	Moreira, D.M. 85	AM, CAA, CER, MA, PAN
<i>Paullinia revoluta</i> Radlk.	shrub	Moreira, D.M. 109	MA
<i>Paullinia rubiginosa</i> Cambess.	vine	Moreira, D.M. 245	AM, CER, MA
<i>Serjania pernambucensis</i> Radlk.	vine	Costa, G. 1533	CAA, MA
sp. 1	vine	Moreira, D.M. 142	*
sp. 2	vine	Moreira, D.M. 86	*
Sapotaceae			
<i>Manilkara salzmannii</i> (A.DC.) H.J.Lam	tree	Souza, J.S. (HURB 20493)	CAA, MA
<i>Pouteria gardneri</i> (Mart. & Miq.) Baehni	tree	Souza, J.S. (HURB 20453)	AM, CAA, CER, MA

continue

Table 1 (continuation)

Family	Habit	Colector/Number	Phytogeographical Domain
<i>Pouteria gardneriana</i> (A.DC.) Radlk.	tree	Souza, J.S. (HURB 20502)	CAA, CER, MA
Smilacaceae			
<i>Smilax cissooides</i> Mart. ex Griseb.	vine	Moreira, D.M. 67	AM, CAA, CER, MA
Solanaceae			
<i>Cestrum nocturnum</i> L.	shrub	Conceição, S.F. 795	*
<i>Solanum americanum</i> Mill.	herb	Moreira, D.M. 226	AM, CAA, CER, MA, PAM, PAN
<i>Solanum maranguapense</i> Bitter ●▲	shrub	Lordêlo, R.P. 5751	MA
<i>Solanum paniculatum</i> L.	sub	Moreira, D.M. 115	AM, CAA, CER, MA
<i>Solanum polytrichum</i> Moric.	arb	Costa, G. 1050	CAA, MA
<i>Solanum pseudoquina</i> A. St.-Hil.	tree	Souza, J.S. (HURB 20491)	MA
Urticaceae			
<i>Cecropia hololeuca</i> Miq.	tree	Moreira, D.M. 272	CER, MA
<i>Cecropia pachystachya</i> Trécul	tree	Moreira, D.M. 273	AM, CAA, CER, MA, PAN
sp. 1	shrub	Moreira, D.M. 194	*
Verbenaceae			
<i>Lantana canescens</i> Kunth	*	Costa, G. 1538	AM, CAA, CER, MA
<i>Lantana</i> sp.	sub	Moreira, D.M. 114	*
<i>Lippia</i> sp.	shrub	Conceição, S.F. 813	*
<i>Priva lappulacea</i> (L.) Pers.	herb	Moreira, D.M. 82	AM, CER, MA, PAN
<i>Tamonea spicata</i> Aubl.	*	Costa, G. 1550	CAA, CER, MA
Violaceae			
<i>Amphirrhox longifolia</i> (A.St.-Hil.) Spreng.	tree	Moreira, D.M. 184	AM, MA

Discussion

In general, the Atlantic Forest (AF) is marked by the predominance of some groups with a high number of species, such as Orchidaceae, Fabaceae, Myrtaceae, Rubiaceae, Melastomataceae and Bromeliaceae (Amorim *et al.* 2005, Amorim *et al.* 2009, Thomas *et al.* 2009, Oliveira *et al.* 2016) (figures 4-5). The Sapindaceae, Acanthaceae and Araceae are not usually the ones with the highest number of species in floristic surveys for AF (Amorim *et al.* 2005, Amorim *et al.* 2009, Thomas *et al.* 2009, Coelho & Amorim 2014). The differences between the main families found in this study and other floristic surveys in the Atlantic Forest of Bahia may be associated to the different degree of conservation of the studied areas and the different interactions among physical, biological, geological and altitude factors. Such factors can cause floristic variations in the family-level communities and lower taxonomic categories (Lingner *et al.* 2015).

The representative number of species of the Sapindaceae family in this study is mainly due to the occurrence of a significant number of vines species (table 1). Of the 10 species reported for this group, five are vines plants, which may indicate that Serra da Copioba has a secondary successional state, since this habit in ombrophilous forests is commonly associated with border areas and altered vegetation (Engel *et al.* 1998, Pereira *et al.* 2016). The Acanthaceae family is one of the most important families in the number of species (10 spp.), Because seven species of the species reported here are endemic to the AF, and three of them are endemic to Bahia (Flora do Brasil under construction 2018). Some reproductive and dispersal characteristics of this family such as showy and bisexual flowers and fruits with explosive dehiscence (Souza & Lorenzi 2012, Braz & Azevedo 2016), may have been fundamental for its success in Serra da Copioba, since forests altered species tend to have fewer dispersers, negatively affecting zoochoric species (Volpato *et al.* 2018).

The richness found for Araceae (eight spp.) may be associated with the previous survey of the family made by Andrade *et al.* (2007) for the study area. Of the eight species listed here, four (*Anthurium pentaphyllum* (Aubl.) G. Don, *Heteropsis oblongifolia* Kunth, *Monstera adansonii* Schott and *Philodendron pedatum* (Hook.) Kunth) were collected by Andrade *et al.* 2007. In addition, the species richness can be linked to a variety of biotic to abiotic factors and may also be associated with sampling effort (Gaston 2000, Felfili *et al.* 2011, Arceo-Gómez *et al.* 2018). *Anthurium radicans* K. Koch & Haage, a vulnerable species (Coelho *et al.* 2014), has increased its extent of occurrence, however, occurring in small and unique populations that are threatened by agricultural activities in Serra da Copioba (figure 4).

The richness of Rubiaceae, Fabaceae, Melastomataceae and Myrtaceae has been reported in studies on areas of AF of Bahia, regardless of location and phytophysionomy (Amorim *et al.* 2005, Amorim *et al.* 2009, Thomas *et al.* 2009).

Myrtaceae has been pointed out by several authors as indicator of forest quality, where there is a direct relation between fall in family richness and habitat reduction (Rodal *et al.* 2005, Amorim *et al.* 2009, Rigueira *et al.* 2013). The Serra da Copioba shelters areas at different levels of anthropization, less altered areas conserve relative diversity of Myrtaceae, which may be related to the fact that the species of this family does not produce valuable woods (Fontana *et al.* 2014), and thus not be targets of illegal extraction. Both this activity and livestock and agriculture devastated the native vegetation of the Recôncavo da Bahia region, and still threaten the few fragments of Atlantic Forest that remained in the region (Nardi 2013). Melastomataceae is a typical group found in forests in a recent secondary state, mainly because they are heliophiles and occupy clearings, forming a fundamental group in areas of recovery and forest regeneration in the AF (Melo Junior *et al.* 2017, Pessoa *et al.* 2012).

Most threatened groups, such as Orchidaceae, preferentially occupy primary forests with high conservation status and are sensitive to climate change, forest fragmentation and soil pollution (Fajardo *et al.* 2016). Therefore, the most conserved forest areas such as those found in southern Bahia tend to have a higher concentration of Orchidaceae species and areas that are more vulnerable to anthropic action, such as Serra da Copioba, tend to have a reduced number of species (seven species, figure 2).

The number of families found in this study (77 families) was similar to the one obtained in the Serra da Jiboia survey (between Santa Teresinha and Castro Alves, Sobrinho & Queiroz (2005), which presented 80 families. However, they were lower than the values found by Amorim *et al.* (2009) in the municipalities of Barro Preto (87), Arataca (110) and Camacan (103) (table 2). This fact is due to the high degree of conservation that these forests are in the South of the State. Values higher than those found by Thomas *et*

al. (2009) in Jussari (56 families) (table 2), all located in the South of Bahia that despite being an area with a high degree of conservation associated with other factors such as, the sampling that was done through plot methods and inclusion of plants with DAP of ≥ 5 cm, excludes most of the herbs, and the temporal effort of collection did not comprise a large time interval, which can result in lower values of wealth (Freitas & Magalhães 2012).

The proportion between arboreal and non-arboreal habits reveals a greater richness of this in Serra da Copioba vegetation (figure 3). The variation in the proportion of non-arboreal / arboreal habits in the several surveys for the Atlantic Forest in the State of Bahia has already been reported (Amorim *et al.* 2005, Amorim *et al.* 2009, Thomas *et al.* 2009). However, the proportion of non-arboreal species was only higher than the tree species in the Reserva Particular do Patrimônio Natural Serra Bonita (Amorim *et al.* 2009). This relationship needs to be better investigated, as it may reflect better conservation status or variations in slope, topography, latitude, altitude in the studied environments (Coelho & Amorim 2014).

The epiphytic component in Serra da Copioba was inferior when compared to the number of other species of Atlantic Forest in Bahia (Amorim *et al.* 2005, Amorim *et al.* 2009, Thomas *et al.* 2009, Coelho & Amorim 2014). This type of habit has been shown to be an important indicator of well-conserved forests and has a relevant ecological role, as epiphytes influence nutrient cycles and provide shelter and feed (Freitas *et al.* 2016, Leitman *et al.* 2015). Vine habit is commonly found in almost all forest communities. Despite this, it is more common in forests with higher levels of degradation and forest edges due to clearings and consequent high luminosity. The low number of vines species found in Serra da Copioba may be due to the high slope and altitude of the area, which are possible limiting factors for the volatiles / lianas / creepers, which prefer lower and flat lands (Engel *et al.* 1998).

Regarding the exotic species, we can infer that the presence of individuals of *Artocarpus heterophyllus* Lam. (jackfruit tree) in the interior of Serra da Copioba has caused concern, since it has already been observed that this species interferes in species richness, diversity and soil composition, being these strong threats to fragments of AF (Fabricante *et al.* 2012). Species of *Cordyline* sp. have been reported as invasive in the *Cerrado* (Horowitz *et al.* 2013), as well as species of *Citrus* sp. were already evidenced as invasive potentials in the AF (MMA 2006).

The advanced level of anthropization and the still recurrent threats such as the removal of wood, suppression of vegetation for pasture replacement and the presence of domestic animals (cattle and horses) within the Serra da Copioba area have rendered this fragment fragile, endangering species that occur there. This factor can be evaluated through analysis of historical collections.

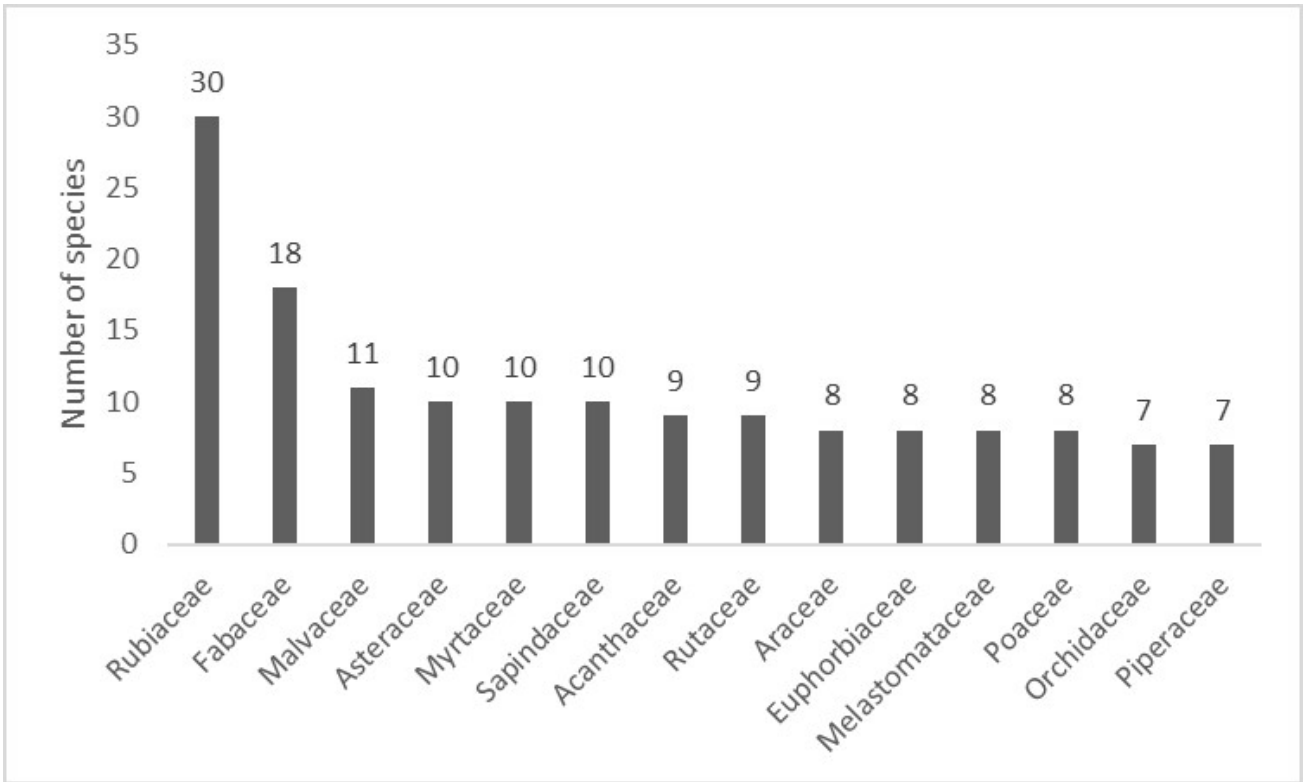


Figure 2: Families with the highest number of species in Serra da Copioba, São Felipe, Bahia State, Brazil.

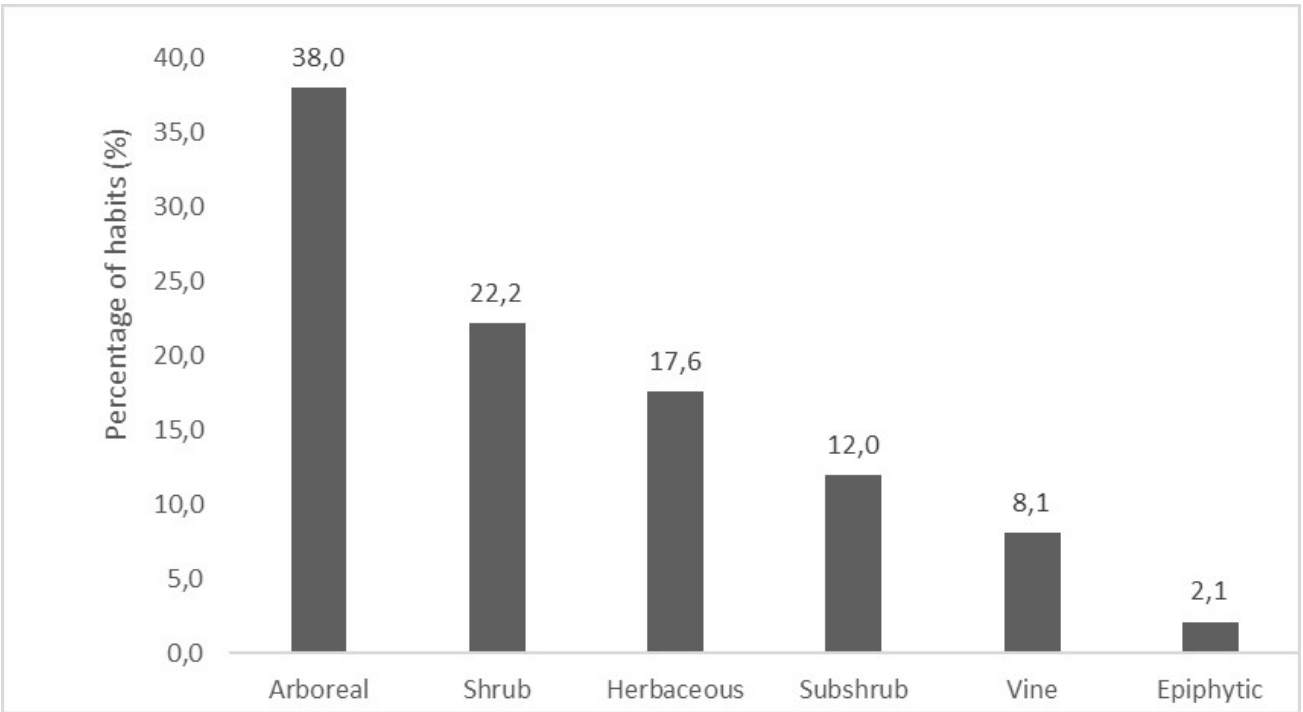


Figure 3: Percentage of habits found in the angiosperms occurring in Serra da Copioba, São Felipe, Bahia State, Brazil.



Figure 4. Species of angiosperms occurring in Serra da Copioba, São Felipe, Bahia State, Brazil. a. *Aechmea fulgens* Brongn. b. *Anthurium radicans* K.Koch & Haage. c-d. *Begonia delicata* Gregório & J.A.S. Costa. e. *Brasiliopuntia brasiliensis* (Willd.) A.Berger. f. *Clavija caloneura* Mart. g. *Conchocarpus macrophyllus* J.C.Mikan. h. *Costus scaber* Ruiz & Pav.



Figure 5. Species occurring in Serra da Copioba, São Felipe, Bahia State, Brazil. a. *Erythrochiton brasiliensis* Nees & Mart. b. *Hohenbergia stellata* Schult. & Schult.f. c. *Neocalyptocalyx grandipetala* (Maguire & Steyerf.) Cornejo & Iltis. d. *Randia calycina* Cham. e. *Sinningia barbata* (Nees & Mart.) G.Nicholson.

Of the 36 species from historical collections, 24 were not found again in Serra da Copioba, for example, *Cattleya amethystoglossa* Linden & Rehb.f. (Orchidaceae) that is threatened with extinction and *Heteropterys sanctorum* W.R.Anderson (Malpighiaceae) that is critically endangered (BFG 2015). In most cases, the risk of extinction or disappearance of species is related to human activities and unsustainable use of natural resources, which culminate in the degradation of habitats and the

disappearance of species (Penedo *et al.* 2015, Srbek-Araujo *et al.* 2017). The only species that were sampled at the three intervals (decades of 50, 70 and the present) are species of wide distribution, as for example, *Psychotria deflexa* DC. (Rubiaceae) which has distribution in several biomes such as *Caatinga*, *Cerrado*, Amazon and Atlantic Forest (BFG 2015), and *Bomarea edulis* (Tussac) Herb. (Alstromeriaceae), typical of forest edges (Lorenzini & Souza, 2012).

Table 2: Comparison of the main families and number of species in surveys in areas of Atlantic Forest in the State of Bahia, Brazil.

Municipality	Species Number	Family number	Main families	Method	Reference
São Felipe	306	77	Rubiaceae, Fabaceae, Acanthaceae, Asteraceae, Malvaceae, Myrtaceae and Sapindaceae	Floristic	Present study
Jussari	264	56	Fabaceae, Myrtaceae, Sapotaceae, Meliaceae, Moraceae, Lauraceae and Rubiaceae	Plot/Inclusion criteria ≥ 5 cm	Thomas <i>et al.</i> (2009)
Barro Preto	412	87	Orchidaceae, Rubiaceae, Bromeliaceae, Melastomataceae, Poaceae, Piperaceae and Araceae	Floristic	Amorim <i>et al.</i> (2009)
Arataca	709	110	Orchidaceae, Melastomataceae, Bromeliaceae, Asteraceae, Myrtaceae, Fabaceae and Piperaceae	Floristic	Amorim <i>et al.</i> (2009)
Camacan	628	103	Orchidaceae, Rubiaceae, Melastomataceae, Asteraceae, Poaceae, Solanaceae and Fabaceae	Floristic	Amorim <i>et al.</i> (2009)
Santa Terezinha/ Castro Alves	269	80	Fabaceae, Rubiaceae, Asteraceae, Melastomataceae, Orchidaceae, Myrtaceae and Solanaceae	Floristic	Coelho & Amorim (2005)

Despite the advanced degree of devastation in Serra da Copioba, the area is still an important representative of the local flora and has considerable species richness, as indicated by the results obtained here (table 1). This area comprises several important species such as *Eugenia expansa* Spring ex Mart. (Myrtaceae), species that was first recorded by this study for the State of Bahia and *Begonia delicata* Gregório & J.A.S. Costa (Begoniaceae), a recently described species (2015), micro-endemic to the study area, found only in the highest areas (above 250 m altitude) and well conserved in the Serra da Copioba (figure 4).

In this way, the surroundings of Serra da Copioba, as well as every local community, need to be made aware of the importance of conservation of this fragment. The threats of the Atlantic Forest evidenced by the literature, in addition to the fact that the species found in the 50s and 70s have not been recovered, show a high degree of atrocities in Serra da Copioba. This fact can also be verified by the observation of the increasing deforestation that continues towards the summit during the collection years of this study, where the endemic species (*Begonia delicata*) of Serra da Copioba occurs. There is no doubt about the necessity and urgency of using protective measures around the Serra da Copioba, as inspection to prevent deforestation as well as actions to raise awareness of the local population.

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