Vascular flora of semi-arid region, São José do Piauí, state of Piauí, Brazil

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ABSTRACT: The Caatinga biome is located in the semi-arid region of northeastern Brazil and covers about 37 % of Piauí state. The main objective of the present study was a characterization of the Caatinga flora of the farm of Morro do Baixio, in state of Piauí, Brazil (06°51’13” S; 41°28’15” W, at 400 to 540 m above sea level) in view of the fact that very few such surveys were conducted in the state. The flora of the farm was surveyed monthly, during a year, to gather herbs, epiphytes, parasites, shrubs, shrubs and trees. We encountered 136 species belonging to 46 families, including a new species of Bauhinia. The richest families were Caesalpiniaceae (15 spp.), Fabaceae (11 spp.), Bignoniaceae and Mimosaceae (both with nine spp.). We observed a higher frequency of typical species from sedimentary Caatinga. However, local conditions favor the appearance of species that occur in Carrasco and Cerrado.

INTRODUCTION
The semi-arid of Brazil extends over 800,000 km², approximately 10 % of the national territory within the states of Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia and Northern Minas Gerais, delimited by the medium isoleta of 800 mm (Ab’Sáber 1974; Hueck 1972). This region presents heavy rains in some years, prolonged drought periods in others, with irregular and concentrated in a few months, higher evapotranspiration rates and low infiltration capacity of soils (Ab’Sáber 1974; Reis 1976; Kampen 1979).

The Caatinga is the dominant vegetation of the semi-arid region (Luetzelburg 1923; Engler 1951) which has been suffering severe environmental degradation in recent decades, mainly as a consequence of rural growth and expansion of agriculture and cattle grazing. Among different types of Caatingas, those located in sedimentary areas have been the focus of very few studies until recently.

The state of Piauí accounts for 37 % of the area of Caatinga biome and according to Sampaio (2002) 118 municipalities within the state are included in the semi-arid domain. The lack of such information has motivated the inclusion of sites such as the microrregion of Picos in Piauí as priority area for the conservation of the Caatinga biome (Silva et al. 2004).

In the present study, we aimed provide a check list the vascular flora of the municipality of São José do Piauí, a priority area for conservation, identifying the species which occur in the region in crystalline and sedimentary formations and determining whether the life-forms differ from the normal spectrum of Raunkiaer’s system.

MATERIALS AND METHODS
The present study was carried out in the municipality of São José do Piauí, within the Picos microrregion in Piauí state, in a privately owned property called Morro do Baixio (06°51’13” S; 41°28’15” W, at 400 to 540 m above sea level) (Figure 1). According IBGE classification (Veloso et al. 1991), the vegetation is characterized by steppe-savana. Based on temperature data, estimated through linear regression equations, and precipitation of 14 years (1984-1998) obtained from the São José Meteorology Station (Secretaria de Agricultura, Abastecimento e Recursos Hídricos – Departamento de Hidrometeorologia), the mean annual rainfall was 816.4 mm, with nine months of water deficit. The climate is Dd2A’3a’ (Thornthwaite and Mather 1955), characterized as semi-arid with little hydric excess and small thermal annual amplitude. This area is dated to Paleozoic and belongs to the sedimentary firth of Piauí-Maranhão. The lithology is characterized predominantly by sandstones, shales and silts of the Serra Grande, Pimenteira and Cabeça formations. Geomorphologically, it is located in the Eastern Plateau of Piauí, with the surface exhibiting varied dissection features (Jacomine et al. 1986; Ramos and Sales 2001).

The vascular flora was surveyed monthly, during a year in a 2 ha area, to collect herbs, epiphytes, parasites, lianas, shrubs, shrubs and trees, throughout the study area. All specimens collected were identified and
subsequently incorporated into the TEPB Herbarium collection. Data was organized listing the species and their families, according Cronquist (1988) for convenience of comparison to some floristic lists of Caatinga (Rodal et al. 2008; Araújo et al. 1995; Ferraz et al. 1998; Rodal et al. 1999; Figueiredo et al. 2000; Alcoforado-Filho et al. 2003; Lemos 2004; Araújo et al. 2005; Rodal et al. 2005; Costa et al. 2007), carrasco (Araújo et al. 1998; Araújo and Martins 1999), Caatinga-Carrasco transition (Oliveira et al. 1997), evergreen shrub vegetation (Rodal et al. 1998), transition from Campo Maior Complex (Farias and Castro 2004) and Cerrado (Castro et al. 1998; Ribeiro and Tabarelli 2002).

Species were classified as phanerophytes, camaxephytes, hemicryptophytes, geophytes, therophytes, lianas, epiphytes and parasites, according Raunkiaer (1934), adapted by Mueller-Dombois and Ellenberg (1974), to compare the Caatinga life-form spectrum with Raunkiaer’s normal spectrum. This classification is based on the meristematic tissue, which remains inactive to growth during unfavorable season (as dry summer or winter), and therefore the location of this tissue is an essential feature of plant’s adaptation to climate (Whittaker 1975). To verify if the life-form spectrum shows significant differences to Raunkiaer’s normal spectrum, we used a $\chi^2$ test (Zar 1999). For this comparison, lianas were included like phanerophytes, and epiphytes and woody parasites excluded from the statistical analysis.

**Results and Discussion**

We recorded 136 species distributed among 104 genera and 47 families (Table 1), including one new species of *Bauhinia*. The families with the greatest number of species were Caesalpiniaeae (15), Fabaceae (11), Bignoniaceae and Mimosaceae (9), Cactaceae and Malpighiaceae (6), and Euphorbiaceae (5), represented by 44.85 %. Twenty one families (44.68 %) were represented by only a single species. In terms of genera, Fabaceae (11), Caesalpiniaeae (7), Bignoniaceae (6), Euphorbiaceae, Malpighiaceae and Mimosaceae (5) were the most representative, being *Bauhinia* (6), *Aspidosperma*, *Eugenia* and *Senna* (3) with the largest number of species.

A comparison of the flora encountered in the presented study with reports from the literature for crystalline and sedimentary formations revealed 33 species (27.96 %) occurring only in the study area, while 85 species (72.03 %) were cited in at least one of the earlier reports. Generally, the more frequent families encountered in this study were representative of the crystalline and sedimentary formations in the semi-arid domain, except for Malpighiaceae. Euphorbiaceae, Mimosaceae, Caesalpiniaeae and Cactaceae could be found in crystalline areas (Rodal et al. 2008; Araújo et al. 1995; Ferraz et al. 1998; Alcoforado-Filho et al. 2003). In addition to these species, Bignoniaceae, Fabaceae and Myrtaceae could be found in the sedimentary areas, but not Cactaceae (Araújo et al. 1998; Araújo and Martins 1999; Lemos 2004).

Rodal et al. (2008) reported that Euphorbiaceae, Cactaceae and Caesalpiniaeae were the families with the largest number of species in Caatinga. Lemos and Rodal (2002), studying a deciduous thorny vegetation in the state of Piauí, found that, except for Bignoniaceae and Myrtaceae, there was no distinction between families with the largest number of species in crystalline and sedimentary formations. However, analyzing the species distribution of these families, we found that there were differences among crystalline and sedimentary formations. The higher proportion of species in common (32.2 % with 38 species) occurred in Caatinga sedimentary formations (Rodal et al. 2008; Rodal et al. 1999; Figueiredo et al. 2000; Lemos 2004), followed by Cerrado (31.35 % with 37 species) (Araújo et al. 1998; Araújo and Martins 1999), and crystalline formations (29.81 % with 34 species) (Rodal et al. 2008; Araújo et al. 1995; Ferraz et al. 1998; Alcoforado-Filho et al. 2003; Lemos 2004, Araújo et al. 2005; Rodal et al. 2005; Costa et al. 2007).

*Spondias tuberosa* Arruda (Anacardiaceae), *Cuspardaria argentea* (Wawra) Sandw., *Manosoa hirsuta* DC. (Bignoniaceae), *Tournefortia rubicunda* Salzm. ex DC. (Boraginaceae), *Pilosocereus piauhensis* (Werdm.) Byles & Rowley (Cactaceae), *Chamaecrista eiteronum* (Irwin & Barneby) Irwin & Barneby *Poepigia procera* Presl. (Caesalpiniaeae), *Crotalaria holossericea* Nees & Mart. (Fabaceae), *Anadenanthera colubrina* var. *cebil* (Griseb.) Altschul (Mimosaceae), *Ximenia americana* L. (Oleaceae) and *Cardiospermum corindum* L. (Sapindaceae) occurred both in crystalline and sedimentary areas. *Spondias tuberosa* and *Pilosocereus piauhensis* were the only endemic species (Giulietti et al. 2002). The geographical distribution of *Poepigia procera* needs further investigation and *Crotalaria holossericea* is typical of degraded areas of Caatinga (Queiroz 2002).

We found 24 species (20.34 %) with lists for Cerrado from the state of Piauí (Castro et al. 1998; Ribeiro and Tabarelli 2002) and 22 species (18.64 %) with transition from Campo Maior Complex (Farias and Castro 2004). The most common species in 17 flora lists, including this study, were *Cereus jamacaru* DC. (12 lists), *Rollinia leptopetala* (R.E.Fries) Safford (9), *Commiphora leptoleploes* (Mart.) Gillet, *Bauhinia cheilanthe* (Bong.) Steud. (8) and *Aspidosperma pyrifolium* Mart. (8). These, except *Bauhinia cheilanthe*, were cited by Giulietti et al. (2002) as endemic of Caatinga. However, Taylor and Zappi (2002) affirm that these species, despite being predominant, also occur in other vegetation types. *Aspidosperma pyrifolium* also occurred in Cerrado and *Commiphora leptoleploes* in Carrasco and Cerrado. *Bauhinia cheilanthe* is cited by many authors (Ferraz et al. 1998; Lemos and Rodal 2002) as occurring in crystalline and sedimentary formations.

The flora life-form spectrum in this study showed a high proportion of phanerophytes (64.70 %) followed by lianas (12.50 %), hemicryptophytes (8.09 %), camaxephytes (5.88 %), geophytes (3.68 %), therophytes (2.94 %), epiphytes (1.47 %) and parasites (0.73 %). Excluding the epiphytes and the parasites, and including the lianas as phanerophytes in the statistical analysis, the life-form spectrum increases the proportion of the phanerophytes (78.95 %), the same dominant pattern observed for Raunkiaer’s normal spectrum (Table 2). The $\chi^2$ test demonstrated significant differences between the study area flora and Raunkiaer’s normal spectrum ($\chi^2 = 45.20, p < 0.001$). Phanerophytes had the highest individual value obtained from $\chi^2$test (52.21 %).

It is important to note that Raunkiaer’s normal spectrum was created for world flora and take into account...
homogeneous climatic conditions (Cain 1950). The χ² test showed significant differences of São José flora from the normal spectrum. Phanerophytes and hemicryptophytes were already cited as the main life-forms of Cerrado (Batalha and Martins 2004).

Studies in semi-arid regions of northeastern Brazil are scarce except for recent studies carried out in Ceará and Pernambuco states (Araújo et al. 2005; Rodal et al. 2005; Costa et al. 2007). Therophytes are expected to register higher proportions in high temperature and low precipitation areas, characterizing the life-form spectrum of arid and semi-arid regions (Raunkiaer 1934; Araújo et al. 2005). However, our results show phanerophytes to be dominant, similar to the pattern found in dry forests and Carrasco areas of the state of Ceará (Araújo et al. 2005). This probably must be associated with the precipitation and altitudinal conditions of the study area, as well as the smaller number of species in the herbaceous/sub shrub layer when compared to shrub/woodland layer (99 species, including the woody lianas), a common pattern of sedimentary formations (Rodal et al. 1999; Figueiredo et al. 2000; Araújo et al. 2005).

The flora of Morro do Baixo was composed by a high frequency of typical species of sedimentary Caatinga. However, the geoenvironment of the São José municipality within the “cuesta” of Serra Grande (Rivas 1996) is characterized as a region of Cerrado/Caatinga/Carrasco transition, determining the appearance of species that occur in these formations.

**Table 1.** List of species, common names, families, and their life-forms in Morro do Baixo, municipality of São José do Piauí, state of Piauí, Brazil.

| FAMILY/SPECIES   | COMMON NAME       | LIFE-FORM   |
|------------------|-------------------|-------------|
| Acanthaceae      |                   |             |
| Ruellia sp.      |                   | Hemicryptophyte |
| Amaranthaceae    |                   |             |
| Gomphrena aff. leucocarpa Mart. |       | Hemicryptophyte |
| Pfaffia sp.      |                   | Hemicryptophyte |
| Anacardiaceae    |                   |             |
| Apterokarpus gardneri (Engler) Rizzini | aroeira-brava | Phanerophyte |
| Myrroodron urundevo Allemão | aroeira | Phanerophyte |
| Spondias tuberosa Arruda | umbu | Phanerophyte |
| Annonaceae       |                   |             |
| Rollinia leptopetala (R.E.Fries) Safford | bananinha/açoita | Phanerophyte |
| Apocynaceae      |                   |             |
| Aspidosperma sp. | pequió            | Phanerophyte |
| Aspidosperma multiflorum A.DC. | pereiro-branco | Phanerophyte |
| Aspidosperma pyrifolium Mart. | pereiro-preto | Phanerophyte |
| Araceae          |                   |             |
| Tacarum peregrinum L. | milho-de-cobra | Geophyte    |
| Aristolochiaceae |                   |             |
| Aristolochia sp. | flor-de-cera     | Liana       |
| Asclepiadaceae   |                   |             |
| Schubertia cf. multiflora Mart. | cipó-de-tamanduá | Liana      |
| Asteroideae      |                   |             |
| Pithecoseris pacourinoides Mart. | bananinha/açoita | Phanerophyte |
| Bignonaceae      |                   |             |
| Bignonia sp.     | cipó-de-arco     | Liana       |
| Caspidaria argentea (Wawra) Sandw. | chifre-de-carneiro | Phanerophyte |
| Godmania dardanoi (J.C.Gomes) A.H.Gentry | jarcara/carobinha | Phanerophyte |
| Jacaranda Jasminoides (Thunb.) Sandw. | caroba | Phanerophyte |
| Mansoa bisnata DC. | cipó-de-alho    | Liana       |
| Mansoa difficilis (Cham.) Bur. and K.Schum. | cipó-de-tamanduá | Liana |
| Tabebuia impetinosa (Mart. ex D.C.) Standl. | pau-d’arco-oxo | Phanerophyte |
| Tabebuia serratifolia (Vahl.) Nich. | pau-d’arco-amarelo | Phanerophyte |
| Bixaceae         |                   |             |
| Cochlospermum vitifolium (Will.) Spreng. | algodão-bravo | Phanerophyte |
| Bombaceae        |                   |             |
| Eriotheca sp.    | barriguda         | Phanerophyte |
| Pseudobomkis marginatum (A.St.-Hil.) A.Robyns | imbratanha | Phanerophyte |
| Boraginaceae     |                   |             |
| Cordia raefescens A.DC. | grão-de-galo  | Phanerophyte |
| Cordia trichotoma Vell. | freijorge/freijó | Phanerophyte |
| Tournefortia rubicunda Salzm. ex DC. | cipó-de-anjo | Liana |
| Bromeliaceae     |                   |             |
| Bromelia plumieri (E. Morren) L.B.Sm. | macambira | Hemicryptophyte |
| Tillandsia loliacea Mart. ex Schult.F. |              | Epiphyte    |
| Tillandsia streptocarpa Baker |            | Epiphyte    |
| Bursceraeae      |                   |             |
| Commiphora leptophloeos (Mart.) Gillet | imburana-de-cambão | Phanerophyte |

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(Continued)

| FAMILY / SPECIES       | COMMON NAME | LIFE-FORM |
|------------------------|-------------|-----------|
| **Cactaceae**          |             |           |
| Cereus albicaulis      | rabo-de-raposa | Phanerophyte |
| (Britton & Rose)       |             |           |
| Luetzelb.              |             |           |
| Cereus jamacaru DC.    | manadacaru  | Phanerophyte |
| Melocactus zehtnieri   | croa-de-frade | Camephyte |
| (Britton and Rose)     |             |           |
| Luetzelb.              |             |           |
| Pilosocereus gounellei | xique-xique | Phanerophyte |
| (F.A.C. Weber) Byles  |             |           |
| and Rowley             |             |           |
| Pilosocereus piauhensis| facheiro    | Phanerophyte |
| (Werdm.) Byles and Rowley |         |           |
| Tacinga inamoena       | palmatoria  | Camephyte |
| (K.Schum) N.P.Taylor and Stuppy |       |           |
| **Caesalpinioideae**   |             |           |
| Bauhinia cheilantha    | mororó      | Phanerophyte |
| (Bong.) Steud.         |             |           |
| Bauhinia pentandra     | mororó      | Phanerophyte |
| (Bong.) Steud.         |             |           |
| Bauhinia pulchella     | mororó      | Phanerophyte |
| Bauhinia subclava      | mororó      | Phanerophyte |
| Bauhinia sp. nov.      | mororó      | Phanerophyte |
| Bauhinia ungulata L.   |             |           |
| Caesalpinia bacteosa   | catinga-de-porco | Phanerophyte |
| Tul.                   |             |           |
| Caesalpinia ferrea     | jucá-pau-ferro | Phanerophyte |
| Mart. ex Tul.          |             |           |
| Chamaeclista etenorum  | birro-preto | Phanerophyte |
| (Irwin & Barneby) Irwin & Barneby |       |           |
| Hymenaea stigonocarpa  | jatobá-de-vaqueiro | Phanerophyte |
| Mart. ex Hayne         |             |           |
| Pelogyne confertiflora | jatobazinho | Phanerophyte |
| (Hayne) Benth.         |             |           |
| Poeppigia procer a     | _           |           |
| Presl.                 |             |           |
| Senna acureen sis      | canafistinha | Phanerophyte |
| (Benth.) Irwin & Barneby |         |           |
| Senna cearen sis A.Fern. | oca        | Phanerophyte |
| Senna spectabilis      | _           | Phanerophyte |
| var. excelsa (Schrad) Irwin & Barneby |       |           |
| **Capparaceae**        |             |           |
| Capparis hastata L.    | feijão-bravo | Phanerophyte |
| Cleome guianensis      |             |           |
| Aulect.                 |             |           |
| Crateva tapia L.        | trapiá      | Phanerophyte |
| **Combretaceae**       |             |           |
| Combretum leprosum     | mofumbo     | Phanerophyte |
| Mart.                   |             |           |
| Combretum melilium     | sipaubinha  | Phanerophyte |
| Eichler                |             |           |
| Terminalia actinophylla| chapada     | Phanerophyte |
| Mart.                   |             |           |
| Thiloo glaucocarpa     | sipauba-branca | Phanerophyte |
| (Mart.) Eichler         |             |           |
| **Convolvulaceae**     |             |           |
| Ipomeea brasiliana     | cabacinha-braba | Liana |
| (Choisy) Meisn          |             |           |
| Evolulus sp.            | _           | Hemicriptófito |
| **Dioscoreaceae**      |             |           |
| Dioscorea glandulosa    | _           | Camephyte |
| Klotsch ex Knuth       |             |           |
| **Erythroxylaceae**    |             |           |
| Erythroxylum laetevirens| carocinho   | Phanerophyte |
| O.E.Schulz             |             |           |
| Erythroxylum subracemum| carocinho   | Phanerophyte |
| Turcz.                 |             |           |
| **Euphorbiaceae**      |             |           |
| Croton celtifolius     | marmeleiro-preto | Phanerophyte |
| Baill.                 |             |           |
| Dalechampia affinis    | _           | Liana |
| MüLArg.                |             |           |
| Euphorbia comosa       | _           | Camephyte |
| Vell.                  |             |           |
| Maniho heterom (Pohl)   | _           | Phanerophyte |
| Sapium cf. obovatus Kt| mangaba     | Phanerophyte |
| **Fabaceae**           |             |           |
| Amburana cearensis     | imburana-de-cheiro | Phanerophyte |
| (Allemão) A.C.Sm.      |             |           |
| Crotalaria holosericea  | modubim-brabo | Camephyte |
| Nees & Mart.           |             |           |
| Dioclea grandiflora    | mucunã      | Liana |
| Mart. ex Benth.        |             |           |
| Galactia texana A.Gray |             | Hemicriptófito |
| Lonchocarpus arapiensis| amargoso    | Phanerophyte |
| Bentham.               |             |           |
| Luetzelburgia auriculata| pau-mocó   | Phanerophyte |
| Duerre.                |             |           |
| Macqueria acutifolius  | coração-de-negro | Phanerophyte |
| Vogel.                 |             |           |
| Macroptilium martii    | _           | Liana |
| (Benth.) Maréchal & Baudet |         |           |
| Pterocarpus villosus   | _           | Phanerophyte |
| Mart. ex Benth.        |             |           |
| Swartzia fleemmingii   | jacarandá   | Phanerophyte |
| Raddi.                 |             |           |
| Vigna cf. penduncularis| feijão-bravo | Liana |
| Fawc. & Rendle         |             |           |
| **Lamiaceae**          |             |           |
| Indetermined           | _           | Therophyte |
| **Lilaceae**           |             |           |
| Alstroemeria piauhynsis| senhora-me-deixe | Geophyte |
| Gardner ex Baker       |             |           |
| Hippeastrum aff. solandriflorum | _ | Geophyte |
| Herb.                  |             |           |
| Zephyranthes sylvatica | cebolinha   | Geophyte |
| Baker.                 |             |           |
| **Loranthaceae**       |             |           |
| Strutantus sp.         | erva-de-passarinho | Parasite |
| **Lythraceae**         |             |           |
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| FAMILY/SPECIES | COMMON NAME | LIFE-FORM |
|----------------|-------------|-----------|
| **Cuphea ericoides Cham. & Schlech.** | - | Therophyte |
| **MALPighiaceae** | **Byrsonima correifolia** A.Juss. | murici | Phanerophyte |
| | **Byrsonima lutea** (Griseb.) Cuatrec. | - | Liana |
| | **Banisteriopsis stellaris** (Griseb.) B.Gates | enfeito-de-grinalda | Liana |
| | **Barnebya harleyi** W.R.Anderson & B.Gates | murici-do-agreste | Phanerophyte |
| | **Peixotoa jussieuana A.Juss.** | flor-de-anjo | Phanerophyte |
| | **Stigmatophyllum paralias** A.Juss. | - | Hemicryptophyte |
| **MALVACEAE** | **Sida ulei** Ulbr. | malva-branca | Camephyte |
| **MIMOSACEAE** | **Acacia piauiensis** Benth. | jurema | Phanerophyte |
| | **Acacia sp.** | - | Phanerophyte |
| | **Albizia polypephala** (Benth.) Killip | - | Phanerophyte |
| | **Anadenanthera colubrina var. cebil** (Griseb.) Altschul | angico-preto | Phanerophyte |
| | **Indetermined** | maracaipe | Phanerophyte |
| | **Mimosa sensitiva** L. | - | Hemicryptophyte |
| | **Mimosa tenuiflora** (Willd.) Poir. | jurema-preta | Phanerophyte |
| | **Piptadenia moniliformis** Benth. | mama-de-bezerra | Phanerophyte |
| | **Piptadenia stipulacea** (Benth.) Duke | jurema-branca | Phanerophyte |
| **NYCTAGINACEAE** | **Guapira** sp. | farinha-velha | Phanerophyte |
| **OLACACEAE** | **Ximenia americana** L. | ameixa | Phanerophyte |
| **OPILIACEAE** | **Agonandra brasiliensis** Miers | marfim | Phanerophyte |
| **PASSIFLORACEAE** | **Passiflora cincinnata** Mast. | maracujá-do-mato | Liana |
| | **Passiflora edmundoi** Sacco | - | Liana |
| **RHAMNACEAE** | **Ziziphus cotinifolia** Reissek | juazeiro | Phanerophyte |
| **Rubiaceae** | **Alibertia edulis** (L.C.Rich.) A.Rich. ex D.C. | marmelada | Phanerophyte |
| | **Coutarea hexandra** (Jacq.) K.Schum. | quina-quina | Phanerophyte |
| | **Richardia scabra** L. | ervancinha | Hemicryptophyte |
| **RUTACEAE** | **Zanthoxylum rhoifolium** Lam. | laranjinha | Phanerophyte |
| | **Zanthoxylum stelligerum** Turcz. | laranjinha | Phanerophyte |
| **SAPIANACEAE** | **Cardiospermum corindum** L. | pustemeira | Liana |
| | **Magnonia pubescens** A.St.-Hil. | tingui | Phanerophyte |
| | **Serjania caracasana** (Jacq.) Willd. | moita-de-cururu | Liana |
| **SCROPHULARIACEAE** | **Angelonia sp.** | - | Phanerophyte |
| **SOLANACEAE** | **Capsicum parvifolium** Seuddtn | alecrim-quebrabo | Phanerophyte |
| | **Solanum crinitum** Lam. | jurubeba | Phanerophyte |
| | **Solanum cf. chytidoaudrum** Lam. | jurubeba-braba | Phanerophyte |
| **STERculiaceae** | **Helicteres barausensis** Jaq. | guaxum | Phanerophyte |
| | **Helicteres muscosa** Mart. | pimenta-de-mocó | Phanerophyte |
| | **Waltheria sp.** | malva | Hemicryptophyte |
| **Turneraceae** | **Turnera blanchetiana** Urb. | - | Phanerophyte |
| **VerbenaCaeae** | **Amasonia campestris** L. | - | Phanerophyte |
| | **Lantana canescens** Kunth | alecrim-quebrado | Phanerophyte |
| | **Vitex sp.** | pinho-brabo | Phanerophyte |
| | **Indetermined** | - | Phanerophyte |
| **VITACEAE** | **Cissus sp.** | - | Phanerophyte |
| **VOCHYSIACEAE** | **Callisthene microphylla** Warm. | carocinho | Phanerophyte |
TABLE 2. Results of χ² tests of Morro do Baixio, municipality of São José do Piauí, Brazil, and Raunkiaer’s normal spectrum.

| LIFE-FORM CLASS | EXPECTED | OBSERVED | χ² |
|-----------------|----------|----------|-----|
| Phanerophytes   | 46.00    | 78.95    | 23.60 |
| Camphytes       | 9.00     | 6.01     | 0.99 |
| Hemicymophytes  | 26.00    | 8.27     | 12.09 |
| Geophytes       | 6.00     | 3.76     | 0.84 |
| Therophytes     | 13.00    | 3.01     | 7.68 |
| **Total**       | 100.00   | 100.00   | 45.20 |

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