Ethinopharmacology of the angiosperms of Chapada of Araripe located in Northeast of Brazil

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Abstract

The Chapada of Araripe, located in the Northeast of Brazil, presents a great vegetal wealth. The region presents a great cultural plurality, which is reflected in several popular knowledge, such as medicinal plants in the region. The study aimed to carry out an ethinopharmacological bibliographic survey of angiosperms present in the region. The scientific name of species was associated with the keywords "traditional use", "traditional medicine" "traditional knowledge", and "Brazil" to collect information published and available on Pubmed, Science Direct, Scielo, and Scopus Platform. Subsequently, the species with the greatest versatility of use were selected, and its relative importance (RI) indexes were calculated. As a result, 92 species with medicinal potential were identified in the Chapada of Araripe, corresponding to 81 genera and 44 botanical families, with Fabaceae, Asteraceae, Malvaceae, and Rubiaceae being the taxa that presented the highest number of species with 16, 6, 5 and 5, respectively. The 10 most versatile species were Anacardium occidentale (RI: 1.38), Astronium urundeuva (1.86), Copaifera langsdorffii (2.00), Hancornia spectabilis (1.81), Himanthus drasicus (1.62), Hymenaea stigonocarpa (1.89), Lapaenasia pacari (1.83), Libidibia ferrea (1.43), Scoparia dulcis (1.71) and Ximenia americana L. (1.46). Finally, we emphasize that Chapada of Araripe is a region of great biological and cultural value, important for preserving local flora and traditional knowledge.

Keywords: Ethnobotany, traditional knowledge, herbal medicine.

Introduction

The Brazilian flora is recognized for hosting several native species of great biological importance, responsible for approximately 20% of the planet’s plant biodiversity. We can identify all this natural wealth distributed among the various phytogeographic domains in the national territory, with its characteristic and diversified vegetation (Amaral et al., 2015; Garcez et al., 2016; Macedo et al., 2018). One of these exclusively Brazilian domains is the Caatinga, a seasonally dry tropical forest located in the country’s Northeast (Santos et al., 2011). There are enclaves with characteristic physigomnomic in this ecosystem due to their geological formations, such as Chapada of Ibiapaba, Serra Maciço of Baturité, Serra of Pirapora, and Chapada of Araripe (Batista et al., 2018). The latter, located in the Brazilian semi-arid region (between the states of Pernambuco, Piauí, and Ceará), is an area considered important for the protection of the Caatinga's biodiversity, being formed by two conservation units: the Araripe-Apodi National Forest (Flona Araripe-Apodi ) and the Chapada of Araripe Preservation Area (APA-Araripe), the units are managed by environmental agencies of the public power and also by private initiative (Bastos et al., 2016; Sousa-Júnior et al., 2018; Alcântara et al., 2020). The vegetation of this region is composed of Mata Humid, Mata Seca, Caatinga, Cerrado and Cerradão (Moro et al., 2015).
The Chapada of Araripe is among the 27 areas of Brazil of high biological value, where approximately 173 species of native plants are traditionally used by the communities that inhabit this region (IBAMA, 2004; Sousa-Júnior et al., 2018; Ribeiro et al., 2017a). However, the therapeutic potential of most of these species is still unknown. There is a need for ethnopharmacological studies to support the discovery of new herbal medicines and contribute to sustainable use practices, as the irrational exploitation of local flora can lead to the loss of native species of great biological importance (Ribeiro et al., 2014; Albuquerque et al., 2007a; Albuquerque et al., 2011).

Despite the advancement of modern medicine in recent years, the World Health Organization (WHO) recognizes that many developing countries still depend on medicinal plants for therapeutic use (WHO, 2018). Such use is mainly due to difficulties accessing health systems and services, isolation and distance from urban centers, the low economic cost concerning commercial drugs, and a culturally accepted practice (Bitu et al., 2015; Macedo et al., 2015).

In this sense, some ethnomedical studies provide information on the use and therapeutic potential of many plants used by traditional communities in the semi-arid Caririense (Ribeiro et al., 2014; Souza et al., 2014; Bitu et al., 2015; Macedo et al., 2015; Lemos et al., 2016), such as Astronium urundeuva (M. Allemão) Engl. (aroêira), Hancornia speciosa Gomes (mangaba), Himatanthus drasticus (Mart.) Plumel (janaguba), Caryocar coriaceum Wittm. (pequi), Dimorphandra gardneriana Tul. (faveira), Stryphnodendron rotundifolium Mart. (barbatimão) e Ximenia americana L. (ameixa). These species have great medicinal, cultural, food, and commercial value in the region, including some of which are known to have scientifically proven pharmacological and biological activities, being explored in the bioprospecting of molecules and the search for new drugs (Pereira et al., 2015; Bezerra et al., 2018; Galvão et al., 2018; Silva et al., 2018 Almeida et al., 2019).

Given the above, the objective of this study is to carry out a bibliographic survey on specialized bases of the ethnopharmacological uses of medicinal plants found in Chapada of Araripe. In addition, it was selected the most versatile species and investigating their respective pharmacological and biological activities in the literature and their main chemical classes.

Material and Methods
The study area of this research is the Chapada of Araripe (Figure 1), a region inserted in the Caatinga domain with a tabular feature of sedimentary origin, is located between the states of Pernambuco, Piauí and the extreme south of Ceará (where most of its territory is found) (Novaes & Laurindo, 2014; Moro et al., 2015). The species documented in the Chapada of Araripe floristic inventory were consulted. This survey gathers information about the local flora collected in Herbariums and field research; in general, 474 plant species belonging to 79 families and 275 genera are listed, occurring in Chapada (Loiola et al., 2015).

The scientific name of these species was associated with the keywords "traditional use", "traditional medicine" “traditional knowledge” and “Brazil” to collect information published and available on Pubmed, Science Direct, Scielo, and Scopus platform. There was no time limit for the inclusion of publications. Scientific papers that had a research objective in the format of abstracts, monographs, dissertations, theses, book chapters, and articles with incomplete information were not considered. Before the bibliographic survey, the scientific names of the species were checked and confirmed in Flora do Brasil 2020 (http://floradobrasil.ibri.gov.br) and The Plant List (http://www.theplantlist.org), when appropriate, species names, synonyms, and authors were corrected according to information collected on the websites. The results obtained were analyzed and summarized in a table. The species' scientific name, vernacular name, therapeutic indication, part of the plant used, forms of use, and respective citations were listed.

The relative importance index (RI) was calculated according to the methodology of Bennett & Prance (2000) for plants that have a higher number of therapeutic indications. Relative importance is a method that quantifies the importance of a species based on its versatility, with “2” being the maximum value obtained by a species.

The calculation is made using the formula: $RI = NBS + PN$, where $RI$ corresponds to Relative Importance, $NBS$ is the number of body systems of a given species (NBSS), divided by the total number of body systems assigned to the most versatile species (NBSVS); that is, $NBS = NBSS/NBSVS$, while $PN$ corresponds to the number of properties attributed to a given species (NPS), divided by the total number of properties attributed to the most versatile species (NPVS), equivalent to $PN = NPS/NPVS$ (Silva et al., 2010). The calculation of this index was based on the
distribution of the therapeutic indications of the most versatile species in body systems, according to the International Statistical Classification of Diseases and Related Health Problems (ICD-10) (WHO, 2019).

Results and Discussion
Diversity of medicinal species
In this study, a total of 92 species found in Chapada of Araripe were found, which are used in traditional medicine, corresponding to 81 genera and 44 families (Table 1), with Fabaceae, Asteraceae, Malvaceae, and Rubiaceae being the taxa that presented the highest number of species with 16, 6, 5 and 5, respectively. The versatility of Fabaceae is also cited in other ethnopharmacological studies in cerrado areas of the Chapada of Araripe, considered the family with a greater abundance of species used in traditional medicine in this region (Ribeiro et al., 2014; Macedo et al., 2015; Macedo et al., 2016). Most of the listed species are trees (41%), followed by shrubs (28%) and terrestrial herbs (16%), as shown in Figure 2. Some research indicates a relationship between the form of growth and the presence of chemical compounds, being that trees generally have higher amounts of phenols, tannins, alkaloids, triterpenes, and quinones when compared to shrubs and herbaceous species; these classes have pharmacological and biological actions (Almeida et al., 2005; Alencar et al., 2010).

Figure 1. Geographic location of the study area in Chapada of Araripe, Northeast, Brazil Font: Cruz, R. P. (2021).

Figure 2. Percentage distribution of the form of growth of medicinal plants found in Chapada of Araripe, Northeast Brazil. Font: Cruz, R. P. (2021).
The most used vegetable parts were barks (26%), leaves (25%), and roots (15%) (Figure 3). Also less frequently used were fruits, flowers, stems, seeds, and plant products, such as sap, latex, and resin. Ribeiro et al. (2017a) stated that the disordered collection of bark, stem, roots, resin, and latex can cause irreversible damage to the plant, decreasing the density and richness of species in ecosystems. It is especially aggravated when the species has several therapeutic indications or when using the entire plant (5%), as in the case of Scoparia dulcis and Ageratum conyzoides, being necessary to reinforce the importance of sustainable use for the conservation of priority native species.

![Figure 3. Percentage of the main parts used in the ethnopharmacological preparation of angiosperms from Chapada of Araripe, Northeastern Brazil. Font: Cruz, R. P. (2021).](image)

It was identified 11 forms of preparation, the most prevalent being decoction (26%), followed by maceration (24%) and infusion (23%), as shown in Figure 4. Some specificities in the preparation method were identified, as in the case of the species H. drasticus, where latex with water is indicated to treat various diseases. This mixture is popularly known in the region of Cariri Cearense as “leite-da-janaguba”. Due to the extraction of this medicinal plant for the sale of latex, the species suffered high anthropogenic pressure, and there is currently specific legislation for its management (Badaulf & Santos, 2013).

![Figure 4. Percentage of the preparation methods of medicinal plants found in the Chapada of Araripe, Northeast Brazil. Font: Cruz, R. P. (2021).](image)

### Medicinal species with great versatility of use

Regarding the number of therapeutic indications, Copaifera langsdorffii was the species that showed greater versatility, being cited for the treatment of 38 diseases, followed by L. pacari (35 therapeutic indications), Hymenaea stigonocarpa (36), A. urundeuva (33), H. speciosa (31), S. dulcis (28), H. drasticus, X. americana (both with 27 indications), Libidibia ferrea (21) and Anacardium occidentale (21) (Table 1) (Figure 5).

Cruz, R.P.; Almeida-Bezerra, J.W.; Menezes, S.A.; Silva, V.B.; Santos, L.T.; Morais-Braga, M.F.B.; Moraes, J.L. 329
Table 1. List of species of medicinal use of Chapada of Araripe, Northeastern Brazil. Habit: Tree (Tr), Shrubby (Sh), Shrublet (Sl), Climbing plants (Cp), Herbaceous (He), Epiphyte (Ep); Part used: Stem (St), Stem bark (Sb), Leaf (Le), Flower (Fl), Fruit (Fr), Latex (La), Sap (Sa), Seed (Se), Root (Ro), Resin (Re), Rhizomet (Rh), Areas parts (Ap), Whole plant (Wp). * Brazilian distilled alcoholic beverage. Font: Cruz, R. P. (2021).

| Familia/Espécie            | Vernacular name                      | Habit | Therapeutic indication                                                                 | Part used | Preparation       | References                                                                 |
|---------------------------|--------------------------------------|-------|----------------------------------------------------------------------------------------|-----------|-------------------|---------------------------------------------------------------------------|
| **AMARANTHACEAE**         |                                       |       |                                                                                       |           |                   |                                                                           |
| Alternanthera brasiliana  | quebra-panela, acônito, ervanço, terramicina, benzetacil | He    | Influenza, common cold, healing, cancer, diarrhea, headache, uterine inflammation, vaginal discharge, postoperative infection, throat inflammation, inflammations in general, localized pain, fever, worms, digestive problems, diuretic, expectorant | Fl, Ro    | Infusion, decoction | Agra et al. (2007); Albuquerque et al. (2007); Bieski et al. (2015); Lemos et al. (2016); Miguéis et al. (2019); Yazbek et al. (2019) |
| (L.) Kuntz               |                                       |       |                                                                                       |           |                   |                                                                           |
| Alternanthera tenella     | carrapichinho, corrente, quebra-panela, anador | He    | Influenza, fever, headache, antiseptic urinary tract, diuretic                         | Le        | Infusion, decoction | Dorigoni et al. (2001); Agra et al. (2007); Albuquerque et al. (2007a)   |
| Colla                     |                                       |       |                                                                                       |           |                   |                                                                           |
| **ANACARDIACEAE**         |                                       |       |                                                                                       |           |                   |                                                                           |
| Anacardium occidentale L. | cajuí, cajueiro, caju                | Tr    | Urinary retention, edema, inflammations in general, healing, constipation, rheumatism, diabetes, bleeding, mycoses, diarrhea, gastritis, infections in general, tooth inflammation, toothache, dermatitis, pneumonia, tuberculosis, blows, antiseptic, uterine inflammation, hepatitis, gingivitis, kidney infection, vaginal discharge, magical-religious use | Sb, Le, Ro, Fr | Decoction, infusion, maceration | Albuquerque et al. (2007a); Albuquerque et al. (2007b); Santos et al. (2009); Ribeiro et al. (2014); Bitu et al. (2015); Saraiva et al. (2015); Vieira et al. (2015); Ribeiro et al. (2017b); Mesquita & Tavares-Martins (2018) |
| **ANNONACEAE**            |                                       |       |                                                                                       |           |                   |                                                                           |
| Astronium fraxinifolium   | goiâncave, goiâcalves, aroeirinha     | Tr    | Cough, influenza, back pain, fever, expectorant, AIDS                                   | Sb, Ro    | Decoction, Infusion, maceration | Ribeiro et al. (2014); Macedo et al. (2015); Ribeiro et al. (2017b)       |
| Schott.                   |                                       |       |                                                                                       |           |                   |                                                                           |
| Astronium urundeuva       | aroeira, aroeira-do-sertão            | Tr    | Inflammations in general, cough, pains in general, allergy, healing, bronchitis, menstrual colic, cystitis, urethritis, diarrhea, acne, ulcer, bone fracture, muscle cramp, cancer, rheumatism, vaginal discharge, asthma, influenza, itching, tuberculosis, gastritis, gonorrhea, gingivitis, anemia, diphtheria, arthritis, insect bites, bacterial infection, mycoses, irregular menstruation, bleeding, rheumatic fever, magical-religious use | Sb, St, Le, Ro, Re | Decoction, infusion, maceration, poultice, sirup | Agra et al. (2007); Albuquerque et al. (2007a); Albuquerque et al. (2007b); Albuquerque & Oliveira (2007); Ribeiro et al. (2014); Pereira-Júnior et al. (2014); Bitu et al. (2015); Saraiva et al. (2015); Penido et al. (2016); Ribeiro et al. (2017b) |
| Plant Name                  | Common Names                          | Genus | Habitat | Medicinal Uses                                                                 | Reference                        |
|----------------------------|---------------------------------------|-------|---------|--------------------------------------------------------------------------------|----------------------------------|
| Annona coriacea Mart.      | ariticu, araticum, pinha, fruto-da-quaressesma | Sh    |         | Snakebite, thrombosis, dermatitis, depurative, hypertension                      | Le, Sb, Fr                       |
| Duguetia furfuracea (A.St.-Hil.) Saff. | pinha-braba, atabava, pariri, araticum-seco | Sh    |         | Vaginal discharge, cancer, anemia, hypertension, diuretic, kidney infection, bone fracture, rheumatism | Le, Ap, Ro                       |

**APOCYNACEAE**

| Plant Name                  | Common Names                          | Genus | Habitat | Medicinal Uses                                                                 | Reference                        |
|----------------------------|---------------------------------------|-------|---------|--------------------------------------------------------------------------------|----------------------------------|
| Hancornia speciosa Gomes    | mangaba, mangavamansa, mangabeira     | Tr    |         | Blows, uterine inflammation, stomach pain, gastritis, varicose veins, hernia (abdominal), ulcer, inflammations in general, cancer, uterine myoma, dermatitis, infections in general, diarrhea, dysentery, furuncle, urinary infection, diabetes, hypertension, labyrinthitis, eye irritation, indigestion, back pain, anomaly of the female reproductive system, menopause disorders, thyroid, healing, bone fracture, hemotoma, worms, rehydration | La, Le, Fr, Sb, Ro               |
| Himatanthus drasticus (Mart.) Plumer | janaguba                               | Tr    |         | Ulcer, cancer, healing, worms, inflammations in general, rheumatism, hemorrhoids, erectile dysfunction, uterine myoma, mycoses, gallbladder problems, arthritis, laxative, cough, gastritis, diabetes, inflammation of the liver, hernia (abdominal), uterine inflammation, throat inflammation, diarrhea, indigestion, influenza, stomach pain, anemia, varicose veins, thyroid | Fl, Sb, Le, La, Ro               |
| Secondatia floribunda A.DC. | catuaba-preta, catuaba-de-cipó, catuaba-de-rama | Sh    |         | Aphrodisiac, sexual impotence, internal inflammation                           | Le, Sb, St                       |

**ARALIACEAE**

| Plant Name                  | Common Names                          | Genus | Habitat | Medicinal Uses                                                                 | Reference                        |
|----------------------------|---------------------------------------|-------|---------|--------------------------------------------------------------------------------|----------------------------------|
| Schefflera morototoni (Aubl.) Maguire, Steyerm. & Frodin. var. morototoni | tacapemba, cinco-dedos                | Tr    |         | Infections in general, bleeding, post-infarction, inflammations in general, rheumatism, pains in general | Ro                               |

**ASTERACEAE**

| Plant Name                  | Common Names                          | Genus | Habitat | Medicinal Uses                                                                 | Reference                        |
|----------------------------|---------------------------------------|-------|---------|--------------------------------------------------------------------------------|----------------------------------|
| Acanthospermum australe (Loefl.) Kuntze | carrapicho, carrapicho-de-ovelha, carrapicho-de-carneiro | He    |         | Bronchitis, influenza, diuretic, intestinal infections, antiseptic, diarrhea, fever, tonic, worms, inflammations in general | Se, Ro, Wp                       |

*Cachaca* is a traditional Brazilian spirit made from sugarcane.
| Family         | Species                                      | Common Names                                      | Uses                                                                 | Extraction Method | Other Uses                                                                 | Refs                                                                 |
|---------------|----------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------|
| **Achyrocline** | *A. satureioides* (Lam.) DC.                 | macela-do-campo, carrapicho-de-agulha, vareda     | Throat inflammation, fever, indigestion, stomach pain, malaria, asthma, bronchitis, influenza, sinusitis, pains in the liver, pain intestine, headache | He                | Diarrhea with colic, infections in general, common cold, postpartum recovery, asthma, spasms, bronchitis, hemotoma, skin allergy, pneumonia, stomach pain, inflammations in general, inflammation injury, menstrual colic, expectorant, irregular menstruation | Negrelle and Fornazzari (2007); Oliveira et al. (2012); Lemos et al. (2016); Ribeiro et al. (2017b) |
| **Ageratum**   | *A. conyzoides* L.                           | mentrasto, erva-de-são-joão                       | Worms                                                                | Ro, Le, Wp, Sb   | Decoction, infusion, juice, sirup, maceration                               | Rodrigues & Carvalho (2001); Silva et al. (2005); Ribeiro et al. (2017b); Yazbek et al. (2019) |
| **Bidens**     | *B. bipinnata* L.                            | Espinho-de-agulha, carrapicho                     | Inflammation, common colds                                           | Ap               | Infusion, sirup                                                             | Agra et al. (2007)                                                     |
| **Conocliniopsis** | *C. prasiifolia* (DC.) R.M.King & H.Rob.   | aleluia                                           | Gastritis                                                            | Le, Rh           | Maceration                                                                  | Yazbek et al. (2019)                                                   |
| **Emilia**     | *E. sonchifolia* (L.) DC. ex Wight           | serralha                                          | Gastritis, vitiligo, kidney pain                                     | Le, Rh           | Maceration                                                                  | Ribeiro et al. (2017b)                                                 |
| **Bignoniaceae**| *Fridericia chico* (Bonpl.) L.G.Lohmann     | crajiru                                           | Malaria                                                              | Le               | Infusion                                                                    | Frausin et al. (2015)                                                  |
| **Boraginaeae**| *Pyrostegia venusta* (Ker Gawl.) Miers       | cipó-de-São-João, unha-de-lagetartixa             | Gastritis, vitiligo, kidney pain                                     | Le, Rh           | Maceration                                                                  | Ribeiro et al. (2017b)                                                 |
| **Caryocaraceae**| *Caryocar coriaceum* Wittm.                 | porcunda, amescla, almescla, alméceha, breu-amarelo, breu-preto | Throat inflammation, bronchitis, cough, asthma, influenza, rheumatism, furuncle, swelling, throat inflammation, blows, fever, burns, pains in general, indigestion, expectorant | Tr                | American trypanosomiasis, bleeding, anxiety, bronchitis, sinusitis, indigestion, stroke, respiratory disorders, healing, headache | Ribeiro et al. (2017b); Pagini et al. (2017) |
| **Caryocaraceae**| *Caryocar coriaceum* Wittm.                 | pequi, piqui, pequizeiro                          |                                                                                                                                | Fr, Fl            | Sirup, decocion                                                             | Ribeiro et al. (2014); Macedo et al. (2015); Lemos et al. (2016)     |
| **Celastraceae**|                                               |                                                   |                                                                     |                  |                                                                             |                                                                     |
| Monteverdia distichophylla  
(Mart. ex Reissek) Biral | bom-nome, bonone | Tr | Uterine inflammation, inflammations in general, healing | Sb | Uninformed | Souza et al. (2014) |
|-----------------------------|-----------------|----|----------------------------------------------------|----|------------|-------------------|
| **CLUSIAEAE**               |                 |    |                                                    |    |            |                   |
| Garcinia gardneriana  
(Planch. & Triana) Zappi | bacupari       | Tr | Gastritis                                          | Sb | Decoction  | Yazbek et al. (2019) |
| **DILLENIACEAE**            |                 |    |                                                    |    |            |                   |
| Curatella americana L.      | sambaiba, lixeira | Tr | Diarrhea, vaginal discharge, infections in general, anaemia, depurative, tonic, bronchitis, indigestion, inflammation of the liver, muscle cramp, intestinal colic, menstrual irregular, kidney pain, rehydration | Sb, St, Fl, Le, Ro | Decoction, infusion, maceration, *in natura* | Ribeiro et al. (2017b) |
| **ERYTHROXYLACEAE**         |                 |    |                                                    |    |            |                   |
| Erythroxylum vacciniifolium Mart. | catuaba, catuaba pau | Sh | Aphrodisiac, sexual impotence | Le, Sb | Infusion, maceration | Ribeiro et al. (2014) |
| **EUPHORBIACEAE**           |                 |    |                                                    |    |            |                   |
| Croton blanchetianus Baill. | marmeleiro, marmeleiro-branco | Sh | Ectoparasites, dysentery, stomach pain, naúsea | Sb | Poultice | Silva et al. (2014a); Souza et al. (2014) |
| Croton heliotropifolius Kunth. | velame, velame-branco | Sh | Nausea, indigestion, depurative, furuncle, back pain, inflammations in general, itching, influenza, cancer, fever, diarrhea, healing | Le, Ro, Sb | Infusion, decoction | Souza et al. (2014); Macedo et al. (2015) |
| Jatropha mollissima (Pohl) Baill. | pião-brabo | Sh | Worms | Sb | Maceration | Silva et al. (2014a) |
| **FABACEAE**                |                 |    |                                                    |    |            |                   |
| Anadenanthera colubrina var. cebil (Griseb.) Altschul | angico-preto, angico, angico-de-caroço, angico-branco | Tr | Cough, bronchitis, anemias, inflammations in general, asthma, influenza, magical-religious use, whooping cough, lung inflammation, constipation, cancer, intestinal infections, depurative, blows, injury, scrofula, diphtheria, foot cracks, gastritis, expectorant, stomach pain, swelling | Sb, St, Fl, Le, Fr | Maceration, in ‘cachaça’*, sirup | Agra et al. (2007); Albuquerque et al. (2007a), Albuquerque et al. (2007b); Pereira-Junior et al. (2014); Ribeiro et al. (2014) |
| Bauhinia forficata Link. | pata-de-vaca, mororó | Sh | Diabetes, depurative, rheumatism, pains in general, uterine inflammation, back pain, rheumatism, diuretic, kidney pain | Fl, Le, Sb | Decoction, infusion, in ‘cachaça’* | Silva et al. (2005); Bieski et al. (2015); Bolson et al. (2015); Yazbek et al. (2019) |
| Bauhinia ungulata L. var. ungulata | miroró, pata-de-vaca, pata-de-boi | Sh | Diarrhea, cancer, hypercholesterolemia, diabetes, obesity, constipation | Le, Fl | Decoction, infusion, maceration | Ribeiro et al. (2017b) |
| Bowdichia virgilioides Kunth | sicupira, sucupira, sucupira-preta | Tr | Arthritis, osteoporosis, back pain, diabetes, rheumatism, indigestion, inflammations in general, uterine inflammation, healing, pains | Sb, Se | Maceration | Albuquerque et al. (2007b); Souza et al. (2014); Ribeiro et al. (2017b) |

Cruz, R.P.; Almeida-Bezerra, J.W.; Menezes, S.A.; Silva, V.B.; Santos, L.T.; Morais-Braga, M.F.B.; Moraes, J.L. 333
| Species                     | Synonyms                  | Common Name   | Active Principles                                                                 | Uses                                                                 | Preparations                                  | References                                                                 |
|----------------------------|---------------------------|---------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------|
| Copaifera langsdorffii Desf. | paudoia, podoa, pau-dóleo, copaiba | Tr            | in general, back pain, depurative, vaginal inflammation, throat infection          | Bronchitis, rheumatism, arthrosis, arthritis, leg pain, cough, healing, diarrhea, fever, allergy, swelling, influenza, headache, uterine inflammation, bone fracture, gastritis, angina, blows, prostate inflammation, intestinal inflammation, diuretic, uterine inflammation, ovary infection, urinary infection, kidney stones, kidney infection, snakebite, burns, infections in general, throat inflammation, repellent, constipation, cancer, depression, stomach pain, gastritis, lung inflammation, anxiety | St, Sb, Le, Re, Se | Infusion, decoction, maceration, in natura, sirup | Ribeiro et al. (2014); Souza et al. (2014); Macedo et al. (2015); Saraiva et al. (2015); Guimarães et al. (2019) |
| Dimorphandra gardneriana Tul. | faveira, fava-d’anta       | Tr            | Inflammations in general, eye irritation, cancer, pains in general, conjunctivitis, cough, influenza, healing, hernia, marginal osteophytes |                                                                     | Se, Fr, Sb                                 | Maceration, decoction                                      | Ribeiro et al. (2014); Souza et al. (2014); Macedo et al. (2015)   |
| Dioclea grandiflora Mart. ex Benth. | mucunã                     | Cp            | Prostate inflammation, healing, dermatitis                                        |                                                                     | Ro, Se, Sb                                 | Decoction, infusion, maceration                              | Agra et al. (2007); Ribeiro et al. (2014) |
| Hymenaea courbaril L.       | jatobá-de-veado, jatobá, jatobá-de-boi, jatobá-do-mato | Tr            | Gastritis, ulcer, cough, influenza, urethral problems, blows, anemia, asthma, expectorant, inflammations in general, prostate inflammation, healing, constipation, nasal congestion, poisoning, blood problems, fever, headache, bronchitis, pains in general | Diarrhea, infections in general, prostate cancer, anemia, depurative, leukemia, anxiety, sedative, cataract, eye irritation, asthma, bronchitis, expectorant, pulmonary tonic, influenza, pneumonia, gastritis, indigestion, ulcer, tonic, inflammations in general, rheumatism, uterine inflammation and ovary, vaginal cleaning, prostate inflammation, kidney pain, healing, bone fracture, pains in general, throat infection, throat inflammation, vomit, tonic | Sb, Le, Re, Fr | Decoction, infusion, sirup, maceration, poultice, juice, sirup | Pereira-Junior et al. (2014); Ribeiro et al. (2014); Souza et al. (2014); Macedo et al. (2015); Saraiva et al. (2015); Ribeiro et al. (2017b) |
| Hymenaea stigonocarpa Mart. ex Hayne | jatobá-de-veado, jatobá-do-cerrado | Tr            |                                                                      |                                                                     | Sb, Fr, Ro, Re, Sa | Decoction, maceration, infusion, poultice, juice, sirup | Souza & Felfili (2006); Ribeiro et al. (2017b); Migués et al. (2019) |
### Libidibia ferrea (Mart. ex Tul.) L.P. Queiroz
- *pau-ferro, jucá*  
  - **Tr**  
  - **Fr, Sb, Se**  
  - Anemia, asthma, vaginal cleaning, blows, stroke, diarrhea, stomach pain, injury, internal wounds, insect bites, throat inflammation, gastritis, influenza, uterine inflammation, foot cracks, cough, ulcer, back pain, worms, inflammation of internal and external organs, bone pain, bone fracture
  - In ‘cachaça’*, maceration, banho, infusion, decoction, sirup, in natura
  - Ribeiro et al. (2014); Silva et al. (2014a); Magno-Silva et al. (2020)

### Machaerium acutifolium Vogel var. acutifolium
- *coração-de-nego*  
  - **Tr**  
  - **Sb, Ro**  
  - Pains in general, inflammation of internal and external organs
  - Bronchitis, cough, aphrodisiac, uterine inflammation, wounds, pains in general, inflammation of external organs
  - Decoction, in ‘cachaça’*, seco  
  - Ribeiro et al. (2014)

### Mimosa tenuiflora (Willd.) Poir.
- *jurema, jurema-preta*  
  - **Sh**  
  - **Sb**  
  - Bronchitis, cough, aphrodisiac, uterine inflammation, wounds, pains in general, inflammation of external organs
  - Decoction, sirup, infusion  
  - Albuquerque (2001); Agra et al. (2007); Ribeiro et al. (2014); Macedo et al. (2015)

### Mimosa verrucosa Benth.
- *jurema-preta amargoso, amarelo, candeia, vinhático*  
  - **Sh**  
  - **Sb**  
  - Bleeding, swelling, pains in the liver, kidney pain, healing
  - Diabetes, ulcer, healing, inflammations in general, genital disease, bleeding, worms, hypertension, anemia, cancer, hepatic problems, gastritis, uterine inflammation and ovary, respiratory distress, furuncle, urinary infection, dermatitis, throat infection
  - Decoction, sirup, maceration  
  - Ribeiro et al. (2014); Souza et al. (2014); Bitu et al. (2015); Macedo et al. (2015)

### Plathymenia reticulata Benth.
- *amargoso, amarelo, candeia, vinhático*  
  - **Tr**  
  - **Sb**  
  - Bleeding, swelling, pains in general, inflammation of external organs
  - As sneeze, wound healing
  - Decoction  
  - Albuquerque et al.  

### Stryphnodendron rotundifolium Mart.
- *barbatimão, barbatená*  
  - **Tr**  
  - **Sb**  
  - Pains in general, inflammation of internal and external organs
  - Decoction, in ‘cachaça’*, seco
  - Ribeiro et al. (2014)

### Vachellia farnesiana (L.) Wight & Arn.
- *acácia, coronha*  
  - **Sh**  
  - **Fl, Ro**  
  - Anemia, hypercholesterolemia, diabetes, chest pain, premature ejaculation
  - Maceration, infusion
  - Ribeiro et al. (2017b)

### HYPERICACEAE

### Vismia guianensis (Aubl.) Choisy
- *lacre, lacre-vermelho*  
  - **Tr**  
  - **Le**  
  - Back pain, pains in general, kidney pain, magical-religious use
  - Uninformed
  - Albuquerque et al. (2017b)

### LAMIACEAE

### Rhaphiodon echinus Schauer
- *betônica*  
  - **He**  
  - **Le**  
  - Influenza, intestinal colic
  - Infusion, banho
  - Pio et al. (2019)

### LYTHRACEAE

### Lafoensia pacari A.St.-Hil.
- *româ-braba, lagartixeiro, pacari, didal*  
  - **Sh**  
  - **Sb, Le, Sa, Ro**  
  - Skin diseases, infections in general, dysentery, genital disease, mycoses, furuncle, vaginal discharge, syphilis, worms, cancer, deputative, diabetes, obesity, abscess, hemorrhoids, edema, labyrinthitis, pneumonia, tuberculosis, heartburn, pains in the liver, gastritis, indigestion, gallbladder stones, ulcer, back pain, uterine inflammation, diuretic, uterine and ovarian infection, kidney infection, menopause disorders, healing, burns, headache
  - Decoction, maceration, poultice, in natura, infusion, juice
  - Ribeiro et al. (2017b); Miguéis et al. (2019)

### MALPIGHIACEAE

Cruz, R.P.; Almeida-Bezerra, J.W.; Menezes, S.A.; Silva, V.B.; Santos, L.T.; Morais-Braga, M.F.B.; Moraes, J.L
|                | Latin Name                                      | English Name                  | Family       | Mode of Use                  | Components                          | Pharmacological Actions                        | Authors                                      |
|----------------|-----------------------------------------------|------------------------------|--------------|-----------------------------|-------------------------------------|-----------------------------------------------|----------------------------------------------|
| **MALVACEAE**  |                                               |                              |              |                             |                                     |                                               |                               |
| Byrsonima sericea DC. | murici-vermelho, murici-branco | Tr                           |              | Hypercholesterolemia, healing | Sb                                  | Maceration                                    | Ribeiro et al. (2014)                     |
| Guazuma ulmifolia Lam. | cabeça-de-negro, chico-magro, mutamba | Tr                           |              | Snakebite, diabetes, gastritis, hair tonic, wounds | Sb                                  | In ‘cachaça’*, decoction, maceration          | Ribeiro et al. (2014); Ribeiro et al. (2017b) |
| Pavonia malacophylla (Link & Otto) Garcke | malva-branca | SI                           |              | Cough, influenza             | Le, Ro                             | sirup                                         | Ribeiro et al. (2014)                     |
| Sida cordifolia L. | malva-branca, malva-veludo, malvão | SI                           |              | Acne, vaginal discharge, cough, toothache, inflammations in general, itching, wounds, indigestion, magical-religious use, influenza, mycoses, irregular menstruation | Le                                  | Infusion, sirup                              | Ribeiro et al. (2014)                     |
| Sida spinosa L. | malva-lanceta, malva-relógio | He                           |              | Asthma, influenza, respiratory problems in general, ulcers, insect bites, emollient | Le                                  | Infusion                                     | Agra et al. (2007)                       |
| Sidastrum micranthum (A.St.-Hil.) Fryxell guaxima, malva-preta | Sh                           | Sh                           |              | Bronchitis, cough, asthma, emollient | Le, Wp                              | Infusion, poultice                           | Agra et al. (2007)                       |
| **MELASTOMATACEAE** |                                               |                              |              |                             |                                     |                                               |                               |
| Miconia albicans (Sw.) Triana | candieiro, carrasco, canela-de-veio | Sh                           |              | Fever, vitiligo, magical-religious use, arthritis, back pain | St, Le                              | Infusion, decoction, maceration              | Albuquerque et al. (2007b); Ribeiro et al. (2017b) |
| **MYRTACEAE**  |                                               |                              |              |                             |                                     |                                               |                               |
| Myrcia splendens (Sw.) DC. | mutra, sangue-de-tatu, cumatí araçá-vermelho, goiabinha | Tr                           |              | Cancer                      | Sb, Sa, Le, Sh, Fr                  | In natura, maceration Infusion, Maceration | Ribeiro et al. (2017b)                     |
| Psidium myrsinites DC. |                                             |                              |              | Stomach pain, diarrhea     |                                    |                                               |                               |
| **NYCTAGINACEAE** |                                               |                              |              |                             |                                     |                                               |                               |
| Guapira graciliflora (Mart. ex Schmidt) Lundell pau-piranha |                         | Tr                           |              | Placental delivery, mastite, wounds, infections in general | Sb, Le                              | Infusion, decoction                          | Silva et al. (2020)                      |
| **OLACACEAE**  |                                               |                              |              |                             |                                     |                                               |                               |
| Ximenia americana L. | ameixa | Sh                           |              | Obesity, healing, diabetes, cough, hoarseness, constipation, genital disease, osteoporosis, gastritis, uterine inflammation, burning, itching, furuncle, throat inflammation, pains in the liver, dermatitis, back pain, genital inflammation, inflammation of internal organs, kidney pain, contusion, gallbladder problems, prostate inflammation, blows, influenza, headache, fever | Sb, Ro, Fr, St                       | Infusion, maceration, decoction, in ‘cachaça’* | Ribeiro et al. (2014), Souza et al. (2014); Bitu et al. (2015); Macedo et al. (2015) |
| **PASSIFLORACEAE** |                                               |                              |              |                             |                                     |                                               |                               |

*Cachaça* refers to a traditional Brazilian alcoholic drink made from fermented sugarcane molasses.
| Plant Family          | Scientific Name | Common Names                      | Uses                                                                 | Solvent | Extraction Method | References |
|----------------------|-----------------|-----------------------------------|----------------------------------------------------------------------|---------|-------------------|------------|
| Passiflora cincinnata Mast. | maracujá-do-mato, maracujá-de-boi | Cp | Hypertension, anxiety, sedative, insomnia, renal insufficiency | Le, Fr, Ro | Decoction, infusion | Ribeiro et al. (2014); Souza et al. (2014); Macedo et al. (2015) |
| Passiflora foetida L. | maracujá-do-estalo | Cp | Gonorrhea | Wp | Decoction | Agra et al. (2007) |
| PLANTAGINACEAE       |                 |                     |                                                                      |         |                   |            |
| Passiflora foetida L. | vassourinha, vassourinha-de-benzer | He | Irregular menstruation, worms, magical-religious use, bladder wound, healing, diabetes, pains in general, bone fracture, swelling in pregnant woman, kidney pain, syphilis, fever, bronchitis, throat inflammation, cough, influenza, toothache, renal inflammation, infections in general, depreative, tonic for the heart, conjunctivitis, pneumonia, gastritis, inflammations in general, muscle cramp, uterine inflammation, vaginal discharge | Wp, Ro, Le | Decoction, infusion, decoction, sirup, juice | Agra et al. (2007); Albuquerque et al. (2007b); Bieski et al. (2012); Ribeiro et al. (2014); Silva et al. (2014a); Souza et al. (2014); Lemos et al. (2016); Ribeiro et al. (2017b) |
| Scoparia dulcis L.   | vassourinha, vassourinha-de-benzer | He |                                                                      |         |                   |            |
| PLUMBAGINACEAE       |                 |                     |                                                                      |         |                   |            |
| Plumbago scandens L.  | louco           | He | Pains in general, arthritis, sedative, warts | Wp | Decoction, infusion, poultice | Agra et al. (2007) |
| POLYGALACEAE         |                 |                     |                                                                      |         |                   |            |
| Bredemeyera brevifolia (Benth.) Klotzsch ex A.W.Benn. | manacá-cipó, mau-vizinho | Cp | Kidney pain, back pain | Sb | Maceration | Ribeiro et al. (2014) |
| Bredemeyera floribunda Willd. | pau-gemada | Tr | Tonic, stomach problems | Sb, Ro | Maceration | Ribeiro et al. (2014) |
| PROTEACEAE           |                 |                     |                                                                      |         |                   |            |
| Roupala montana Aubl. | congonha       | Tr | Anxiety, sedative, menstrual colic, hypertension, migraine, muscular pain, heart disease, kidney pain, nausea, leg pain, back pain | Le | Infusion | Ribeiro et al. (2014); Souza et al. (2014) |
| RHAMNACEAE           |                 |                     |                                                                      |         |                   |            |
| Colubrina cordifolia Reissek | saboeiro, joão-vermelho | Sh | Healing | Wp, Le, Ro | Decoction | Ribeiro et al. (2014) |
| RUBIACEAE            |                 |                     |                                                                      |         |                   |            |
| Borreria verticillata (L.) G.Mey | vassourinha-de-botão | He | Hemorrhoids, vaginal discharge, worms, sexual impotence, magical-religious use | Wp, Le, Ro | Decoction | Agra et al. (2007); Albuquerque et al. (2007b) |
| Chiococca alba (L.) Hitchc. | caninana, cainca | Sh | Headache, snakebite, infections in general, leprosy, intestinal infections, syphilis, influenza, gastritis, constipation, buck pain, inflammations in general, rheumatism, | Le, Ro | Infusion, decoction, maceration | Ribeiro et al. (2017b); Miguéis et al. (2019) |

Cruz, R.P.; Almeida-Bezerra, J.W.; Menezes, S.A.; Silva, V.B.; Santos, L.T.; Morais-Braga, M.F.B.; Moraes, J.L. 337
| Family          | Species                                      | Common Names                        | Uses                                                                 | Reference                                      |
|-----------------|----------------------------------------------|-------------------------------------|----------------------------------------------------------------------|-----------------------------------------------|
| **RUTACEAE**    | **Cordiera sessilis** (Vell.) Kuntze        | marmelinho                         | vaginal discharge, sexual impotence, prostate inflammation, healing, pains in general, fever | Ribeiro et al. (2017b)                        |
|                 | **Guettarda viburnoides** Cham. & Schldtl.  | angélica                            | Diarrhea                                                             | Infusion, maceration                          |
|                 | **Tocoyena formosa** (Cham. & Schldtl.) K.Schum. | genipapinho, geninapo-bravo        | Pains in general, throat inflammation                                | Ribeiro et al. (2014)                        |
|                 |                                               |                                     | Rheumatism, bone fracture, contusion, blows, swelling, healing       | Poultec, maceration                           |
| **SALICACEAE**  | **Casearia sylvestris** Sw.                  | pereirinha, chá-de-frade            | Diabetes                                                              | Infusion, maceration, sirup, in natura         |
| **SAPINDACEAE** | **Magonia pubescens** A.St.-Hil.             | tinguí                              | Stingray sting, dermatitis, seborreia                                 | Poultec                                      |
|                 | **Matayba guianensis** Aubl.                 | pitomba-braba, chiador, cipó-de-vaqueiro, cruapé | Leg pain, back pain                                                  | Uninformed                                   |
|                 | **Serjania lethalis** A.St.-Hil.             |                                     | Toothache                                                            | Uninformed                                   |
|                 | **Talisia esculenta** (Cambess.) Radlk.      | pitomba                            | Kidney stones                                                        | Maceration                                   |
| **SIMAROUBACEAE** | **Simarouba versicolor** A.St.-Hil.         | mata-menino                         | Itching, healing                                                     | Decoction, maceration                         |
| **SIPARUNACEAE** | **Siparuna guianensis** Aubl.                | pau-fedido, capitú, negramina      | Influenza, sinusitis, respiratory problems in general, stroke, ulcer, itching, arthritis, rheumatism, pains in general, fever, repellent, magical-religious use | Pagani et al. (2017); Ribeiro et al. (2017b) |
| **SMILACACEAE** | **Smilax campestris** Griseb.                | japecanga                           | Dermatitis, syphilis, rheumatism, depurative, diuretic, arthritis, diaphoretic | Decoction, infusión                            |
| **SOLANACEAE**  | **Solanum rhytidoandrum** Sendtn.            | jurebeba-branca                     | Hepatic problems                                                     | Decoction                                     |

**Cruz, R.P.; Almeida-Bezerra, J.W.; Menezes, S.A.; Silva, V.B.; Santos, L.T.; Morais-Braga, M.F.B.; Moraes, J.L.** 338
| TURNERACEAE            | Turnera subulata Sw. | perpétua, chanana | He | Irregular menstruation, expectorant, bronchitis, cough | Ro, Le, Wp | Decoction, infusion, sirup | Agra et al. (2007); Lemos et al. (2016) |
|------------------------|----------------------|-------------------|----|------------------------------------------------------|------------|----------------------------|------------------------------------------|
| VERBENACEAE            | Lantana camara L.    | camará, chumbinho | Sh | Diuretic, expectorant, cough, irregular menstruation, pains in general, rheumatism | Le, Fl     | Decoction, infusion         | Agra et al. (2007); Ribeiro et al. (2014); Souza et al. (2014) |
|                        | Lippia microphylla Cham. | alecrim-pimenta, alecrim-de-flepa, salva-de-marajó | Sh | Antiseptic, respiratory problems in general, myiasis, stomach pain, gastritis, malaria | Le         | Decoction, infusion, maceration | Agra et al. (2007); Silva et al. (2014a); Vásquez et al. (2014) |
| VITACEAE               | Cissus simsiana Schult. & Schult.f. | parreira | Cp | myiasis | Sb | In natura | Silva et al. (2014a) |
| VOCHYSIACEAE           | Qualea parviflora Mart. | pau-terra | Tr | Diarrhea, anemia, diabetes, conjunctivitis, ulcer, inflammations in general, kidney infection, internal wounds, throat infection | Sb, Le, Ro | Decoction, infusion, maceration | Ribeiro et al. (2017b) |
When distributing the therapeutic indications attributed to the most versatile species according to the ICD-10 body systems of the World Health Organization (WHO), we observed that diseases of the digestive system (DDS), musculoskeletal system, and connective tissue (DMC), genitourinary system (DGS) and skin diseases (DS) are the disorders most cited and with the largest number of species used for treatment (10 species), as shown in Table 2. Similar data were found in the study of Ferreira-Júnior et al. (2015), where diseases of the digestive system and genitourinary system were also prevalent in research conducted in communities in Chapada of Araripe, reinforcing the importance of many native species in the treatment of diseases grouped in these body systems.

Figure 5. Species of medicinal use of Chapada of Araripe (Brazil), with greater numbers of therapeutic indications. A = *Copaifera langsdorffii* (pau-d’óleo); B = *Lafoensia pacari* (romã braba); C = *Hymenaea stigonocarpa* (jatobá-do-cerrado); D = *Astronium urundeuva* (aroíra); E = *Hancornia speciosa* (mangaba); F = *Scoparia dulcis* (vassourinha); G = *Himatanthus drasticus* (janaguba); H = *Ximenia americana* (ameixa); I = *Libidibia ferrea* (pau-ferro); J = *Anacardium occidentale* (caju). Font: Cruz, R. P. (2021).
Table 2. List of versatile species found in Chapada of Araripe (Brazil) with their respective chemical groups and pharmacological and biological activities. Body systems: Diseases of the digestive system (DDS); Diseases of the respiratory system (DRS); Diseases of the genitourinary system (DGS); Injury, poisoning, and certain other infirmities with external causes (IPO); Diseases of the musculoskeletal system and connective tissues (DMC); Endocrine, nutritional and metabolic diseases (ENM); Diseases of the skin and subcutaneous tissues (DSS); Diseases of the circulatory system (DCS); Diseases of the nervous system (DNS); Infectious and parasitic diseases (IPD); Diseases of the ears and mastoid processes (DEM); Neoplasms (NEO); Diseases of the eyes and adnexa (DEA); Mental and behavioral disorders (MBD); Afflictions and pains not defined (AND). RI = Relative Importance. Font: Cruz et al. (2021).

| Species                     | Body systems | RI  | Chemical groups                                                                 | Pharmacological and biological activities                                                                 | References                                                                 |
|-----------------------------|--------------|-----|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Anacardium occidentale L.   | DGS, DCS, NC, DSS, SD, DMC, ENM, IPO | 1.38 | Alkaloids, flavonoids, saponins, tannins, anthraquinones, terpenoids, cardiac glycosides, phenolic compounds, steroids, carotenoids, coumarins, anthocyanidins, monoterpenes, sesquiterpenes | Antioxidant, lipid-lowering, antibacterial, anti-inflammatory, healing, antiparasitic, anti-tumor              | Aguilar et al. (2012); Mustapha et al. (2015); Vasconcelos et al. (2015); Anyaegbu et al. (2017); Davuluri et al. (2019); Aponjolosun & Fasola (2020); Costa et al. (2020) |
| Astronium urundeuva (M. Allemão) Engl. | AND, DRS, DSS, DGS, NEO, DR, IPD, ENM, IPO, DCS IPO, DSS, DGS, DCS, IPD, NEO, MBD, DRS, DMC, DDS, AND IPO, DGS, DDS, DC, DDS, NEO, DSS, IPD, ENM, DEM, DEA, DM, DDS, NEO, DSS, IPD, AND, DMC, DNS, DGS, DRS, ENM, DCS | 1.86 | Polyphenols, flavonoids, chalcones, fatty acids, monoterpenes, sesquiterpenes, tannins, anthocyanins, anthocyanidins, flavones, flavonoids, xanthenes, auronas, flavononols, leucoanthocyanidins, catechins, flavonones | Anti-inflammatory, gastroprotective, antibacterial, anti-tumor, anti-parasitic | Figueredo et al. (2014); Araújo et al. (2017); Carvalho et al. (2017); Galvão et al. (2018); Castro et al. (2020) |
| Copaifera langsdorffii Desf. | IPO, DSS, DGS, DMC, DSS, AND IPO, DGS, DDS, NEO, MBD, DRS, DMC, DDS, AND IPO, DGS, DDS, DC, DDS, NEO, DSS, IPD, ENM, DEM, DEA, DM, DDS, NEO, DSS, IPD, AND, DMC, DNS, DGS, DRS, ENM, DCS | 2.00 | Flavonoids, sesquiterpenes, diterpenes | Gastroprotective, anti-inflammatory, antioxidant, antipsoriatic, healing | Pereira et al. (2008); Gelmini et al. (2013); Lemos et al. (2015); Gushiken et al. (2017) |
| Hancornia speciosa Gomes     | IPO, DSS, DGS, DMC, DSS, AND IPO, DGS, DDS, NEO, MBD, DRS, DMC, DDS, AND IPO, DGS, DDS, DC, DDS, NEO, DSS, IPD, ENM, DEM, DEA, DM, DDS, NEO, DSS, IPD, AND, DMC, DNS, DGS, DRS, ENM, DCS | 1.81 | Phenols, tannins, flavones, flavonoids, xanthenes, leucoanthocyanidins, catechins, flavonones, alkaloids | Antioxidant, antimutagen, osteogenic, anti-diabetic, antimicrobial, cytotoxic | Assumpção et al. (2014); Lima et al. (2015); Pereira et al. (2015); Floriano et al. (2016); Santos et al. (2016) |
| Himatanthus drasticus (Mart.) Plumel | IPO, DSS, DGS, DMC, DSS, NEO, MBD, DRS, DMC, DDS, AND IPO, DGS, DDS, NEO, MBD, DRS, DMC, DDS, DSS, NEO, IPD, ENM, DEM, DEA, DM, DDS, NEO, DSS, IPD, AND, DMC, DNS, DGS, DRS, ENM, DCS | 1.62 | Triterpenes, steroids, saponins, monoterpenes, sesquiterpenes, flavonoids, iridoides | Cytotoxic, antinociceptive, antitumor, anti-inflammatory, genotoxic, antibacterial, anti-diabetic | Colares et al. (2008); Sousa et al. (2010); Silva et al. (2017); Almeida et al. (2019); Moura et al. (2020); Morais et al. (2020) |
| Plant Species                        | Gastroprotective, healing, antioxidant, intestinal anti-inflammatory, anti-thermal, antibacterial | Gastroprotective, antitumor, antidepressant, antimutagenic, antigenotoxic, cytotoxic, anti-inflammatory, antioxidant, anti-thermal, antibacterial | Antibacterial, anti-inflammatory, antioxidant, antinociceptive, antiparasitic, healing activity | Anti-inflammatory, antitumor, antioxidant, antidiabetic, antimicrobial | Gastroprotective, antiparasitic, antioxidant, anti-inflammatory, antinoceptive, antidiabetic activity |
|-------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| *Hymenaea stigonocarpa* Mart. ex Hayne | Flavonoids, tannins, terpenes, coumarins, fatty acids, flavones | | | | |
| *Lafoensia pacari* A.St.-Hil.       | Saponins, tannins, steroids, triterpenes, flavonoids | | | | |
| *Libidibia férrea* (Mart. ex Tul.) L.P.Queiroz | Tannins, flavonoids, alkaloids, cinnamic derivatives, triterpenes, saponins, organic acids, phenols, lactone sesquiterpenes, anthraquinones | | | | |
| *Scoparia dulcis* L.                | Diterpenes, glycosides, phenolic compounds, steroids, triterpenes, flavonoids | | | | |
| *Ximenia americana* L.              | Alkaloids, flavonoids, lignans, monoterpenes, sesquiterpenes, diterpenes, naphthoquinones, saponins, hydrolyzable tannins, triterpenes, steroids, polyphenols, anthocyanins, aurones, leucoanthocyanidin, catechins, anthocyanidins flavones, chalcones | | | | |

Cruz, R.P.; Almeida-Bezerra, J.W.; Menezes, S.A.; Silva, V.B.; Santos, L.T.; Morais-Braga, M.F.B.; Moraes, J.L. 342
When relating the therapeutic indications of the species with their biological and pharmacological activities available in the literature, we verify the therapeutic potential of all versatile medicinal species found in this study. Species indicated for disorders of the digestive system, such as stomach pain, ulcer, diarrhea, and gastritis, have reports of gastroprotective activity: *C. langsdorffii* (Lemos et al., 2015), *L. pacari* (Tamashiro-Filho et al., 2012; Chaibub et al., 2020), *H. stigonocarpa* (Orsi et al., 2012), *A. urundeuva* (Galvão et al., 2018) and *X. americana* (Aragão et al., 2018). All these species, when submitted to preclinical tests (*in vivo*), were able to reduce the formation of gastric ulcers in animal models (Orsi et al., 2012; Tamashiro-Filho et al., 2012; Lemos et al., 2015; Aragão et al., 2018; Galvão et al., 2018; Chaibub et al., 2020), reinforcing the evidence of pharmacological properties of these species used in traditional medicine.

The inflammatory process was another condition with many citations in the group of unclassified systems or pain; we verified investigations of anti-inflammatory actions in the species *A. occidentale* (Vasconcelos et al., 2015) and *A. urundeuva* (Galvão et al., 2018) by significantly inhibiting ear edema in mice and rats respectively. *C. langsdorffii* (Pereira et al., 2008) and *H. drasticus* (Almeida et al., 2019) also due to inhibition of leg edema in animal models, and *L. ferrea*, which in additional to anti-inflammatory properties, also had an anti-receptive effect *in vivo* test (Falcão et al., 2019).

Anti-tumor activities have also been observed in plants associated with the popular treatment of neoplasms. *A. urundeuva*, in an *in vitro* test against HeLa, HEK-293, and Vero E6 cells, demonstrated mild anti-tumor activity in cancer cells and did not present toxicity in human cells (Araújo et al., 2007). *H. drasticus* also had an anticancer effect compared to the experimental model Sarcoma 180 (Souza et al., 2010). However, in the study of Moura et al. (2020), the latex of *H. drasticus* was genotoxic to S-180 cells in low concentrations (≥50 µg mL⁻¹). However, no sign of toxicity or mutagenicity was found in mice. Finally, the antineoplastic effect of *L. pacari* was seen in human and murine lung cancer cells (Cordeiro et al., 2019). Lima et al. (2013), through the Ames test and the bone marrow micronucleus test in mice, discovered genotoxic and anti-cytotoxic properties of this plant. Although promising, further studies are needed to elucidate these species’ anti-tumor activity; it is also necessary to investigate toxic adverse effects on human organisms to ensure safe use without risk to human health.

All versatile species cited for endocrine, nutritional, and metabolic diseases have reports of anti-diabetic activity in the literature. Pereira et al. (2015) report the anti-diabetic effect of *H. speciosa* by inhibiting α-glucosidase and increased glucose uptake. Mishra et al. (2013) observed the hypoglycemic activity of *S. dulcis* by significantly inhibiting the blood glucose level *in vivo* tests. Morais et al. (2020) also found inhibition of enzymes related to type II diabetes (α-amylase and α-glucosidase) by *H. drasticus*. These results favor support for the traditional use of these species against diabetes mellitus. However, few studies still prove medicinal properties to guarantee the effective use of these plants against the disease.

Regarding infectious and parasitic diseases, there are scientific studies related to the antimicrobial activity of several species used in the popular treatment of infections, for example, the antibacterial activity of *A. urundeuva* against *Staphylococcus aureus* (ATCC 25923), *Staphylococcus epidermidis* (ATCC 12228), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853) and *Salmonella enteritidis* (INCOQ 500258) (Araújo et al., 2017); moderate antifungal activity of *Scoparia dulcis* against *Aspergillus niger* (NCIM Nº. 1055) and *Candida albicans* (NCIM Nº. 3471) (Parvataneni, 2019); and antiparasitic activity of *L. ferrea* in the inhibition of promastigote forms of *Leishmania amazonensis* and amastigotes of *Leishmania guyanensis* (Comandolli-Wyprekowski et al., 2017).

The antimicrobial activities of these species and other important activities should be attributed mainly to their groups of chemical constituents. As shown in Table 2, several groups of secondary metabolites found in these medicinal plants were found, such as flavonoids and terpenoids, known for their important antioxidant, anti-inflammatory, antimutagenic, anticancer, antifungal, anti-viral, antibacterial, and anti-parasitic properties (Cushnie & Lamb, 2005; Duru & Çayan, 2015; Panche et al., 2016).

**Conclusion**

The flora of Chapada of Araripe has a great wealth of medicinal species, but there is still a need for scientific study to prove the pharmacological effects of these species. This study provides a checklist on the ethnomedicinal uses of various plants with high therapeutic versatility, such as *C. langsdorffii*, *L. pacari*, *H. stigonocarpa*, *A. urundeuva*, and *H. speciosa*. It can support research to investigate new drugs and bioactive molecules.
Finally, we emphasize that Chapada of Araripe is a region of great biological and cultural value, important for preserving local flora and traditional knowledge.

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