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Ethnopharmacology 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 diversity. 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 ethnopharmacological 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 speciosa* (1.81), *Himatanthus drasticus* (1.62), *Hymenaea stigonocarpa* (1.89), *Lafoensia 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 physiognomies 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 ethnomedicinal 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. (aroeira), *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, Piaui 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.jbrj.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).

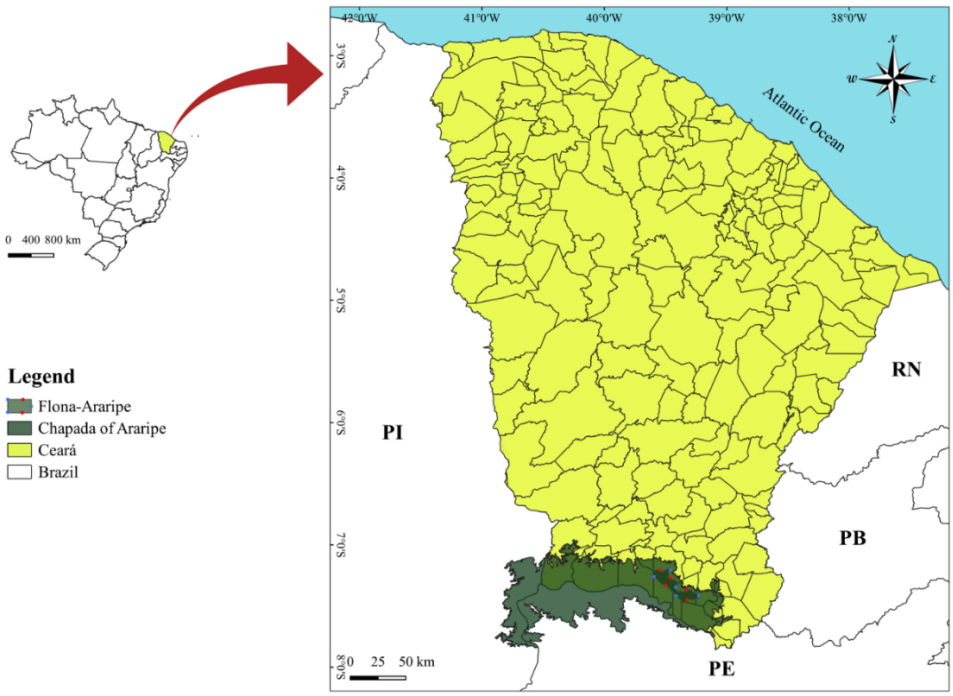

Figure 1. Geographic location of the study area in Chapada of Araripe, Northeast, Brazil Font: Cruz, R. P. (2021).

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).

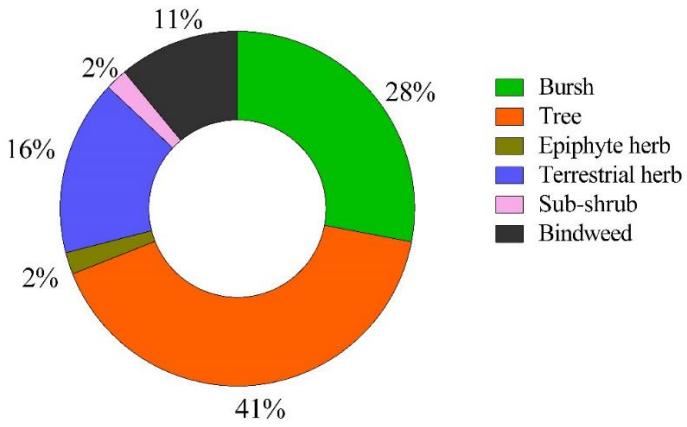

Figure 2. Percentage distribution of the form of growth of medicinal plants found in Chapada of Araripe, Northeast Brazil. Font: Cruz, R. P. (2021).

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.

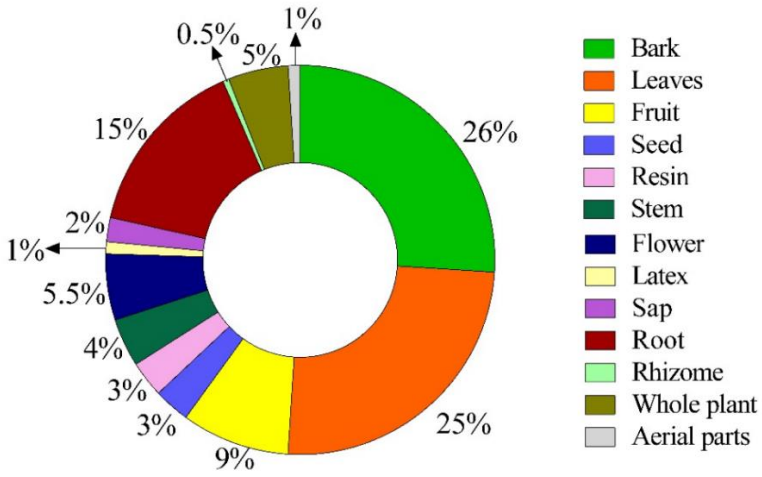

Figure 3. Percentage of the main parts used in the ethnopharmacological preparation of angiosperms from Chapada of Araripe, Northeastern Brazil. Font: Cruz, R. P. (2021).

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).

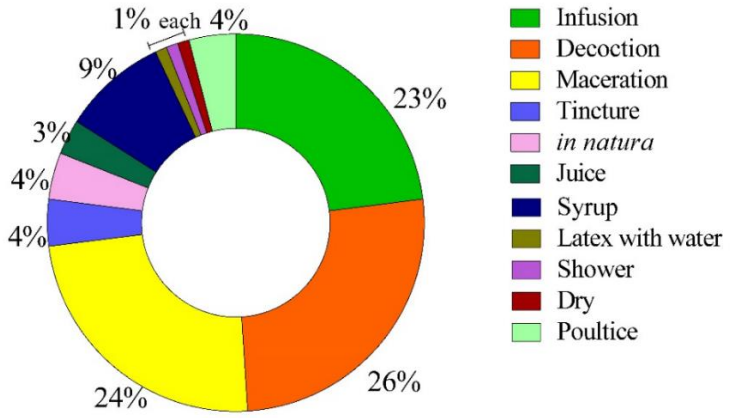

Figure 4. Percentage of the preparation methods of medicinal plants found in the Chapada of Araripe, Northeast Brazil. Font: Cruz, R. P. (2021).

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 *Lafoensia 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).

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).

Família/Espécie	Vernacular name	Habit	Therapeutic indication	Part used	Preparation	References
AMARANTHACEAE						
Alternanthera brasiliana (L.) Kuntz	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[a]); Bieski et al. (2015); Lemos et al. (2016); Miguéis et al. (2019); Yazbek et al. (2019)
Alternanthera tenella Colla	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)
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)
Astronium fraxinifolium Schott.	gonçalave, gonçalo-alves, 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)
Astronium urundeuva (M. Allemão) Engl.	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)
ANNONACEAE						

Annona coriacea Mart.	ariticu, araticum, pinha, fruto-da-quaresma	Sh	Snakebite, thrombosis, dermatitis, depurative, hypertension	Le, Sb, Fr	Maceration, decoction	Ribeiro et al. (2014); Souza et al. (2014); Macedo et al. (2015); Ribeiro et al. (2017b)
Duguetia furfuracea (A.St.-Hil.) Saff.	pinha-braba, ata-brava, pariri, araticum-seco	Sh	Vaginal discharge, cancer, anemia, hypertension, diuretic, kidney infection, bone fracture, rheumatism	Le, Ap, Ro	Decoction, infusion, maceration, sirup	Rodrigues e Carvalho (2001); Ribeiro et al. (2017b)
APOCYNACEAE						
Hancornia speciosa Gomes	mangaba, mangava-mansa, 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, hematoma, worms, rehydration	La, Le, Fr, Sb	Decoction, infusion, *in natura*, poultice, Maceration, juice, latex with water	Ribeiro et al. (2014); Macedo et al. (2015); Vieira et al. (2015); Ribeiro et al. (2017b)
Himatanthus drasticus (Mart.) Plumel	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	Decoction, infusion, maceration, latex with water	Ribeiro et al. (2014); Soares et al. (2014), Souza et al. (2014); Bitu et al. (2015); Macedo et al. (2015); Vieira et al. (2015)
Secondatia floribunda A.DC.	catuaba-preta, catuaba-de-cipó, catuaba-de-rama	Sh	Aphrodisiac, sexual impotence, internal inflammation	Le, Sb, St	Infusion, maceration, in 'cachaça'*	Ribeiro et al. (2014); Souza et al. (2014); Macedo et al., (2015)
ARALIACEAE						
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	Maceration	Ribeiro et al. (2017b)
ASTERACEAE						
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	Decoction, infusion, maceration	Rodrigues & Carvalho (2001); Souza & Felfili (2006); Ustulin et al. (2009); Ribeiro et al. (2017b)

Achyrocline satureioides (Lam.) DC.	macela-do-campo, carrapicho-de-agulha, vareda	He	Throat inflammation, fever, indigestion, stomach pain, malaria, asthma, bronchitis, influenza, sinusitis, pains in the liver, pain intestine, headache	Le	Infusion, decoction	Negrelle and Fornazzari (2007); Oliveira et al. (2012); Lemos et al. (2016); Ribeiro et al. (2017b)
Ageratum conyzoides L.	mentrasto, erva-de-são-joão	He	Diarrhea with colic, infections in general, common cold, postpartum recovery, asthma, spasms, bronchitis, hematoma, skin allergy, pneumonia, stomach pain, inflammations in general, inflammation injury, menstrual colic, expectorant, irregular menstruation	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 bipinnata L.	Espinho-de-agulha, carrapicho	He	Worms	Ro	Decoction	Silva et al. (2014a)
Conocliniopsis prasiifolia (DC.) R.M.King & H.Rob.	aleluia	He	Influenza, common colds	Ap	Infusion, sirup	Agra et al. (2007)
Emilia sonchifolia (L.) DC. ex Wight	serralha	He	Gastritis	Le	Decoction	Yazbek et al. (2019)
BIGNONIACEAE						
Fridericia chica (Bonpl.) L.G.Lohmann	crajiru	Cp	Malaria	Le	Infusion	Frausin et al. (2015)
Pyrostegia venusta (Ker Gawl.) Miers	cipó-de-São-João, unha-de-lagartixa	Cp	Gastritis, vitiligo, kidney pain	Le, Rh	Maceration	Ribeiro et al. (2017b)
BORAGINACEAE						
Cordia rufescens A.DC.	grão-de-galo, uva-brava	Sh	Earache	Fr	Maceration	Ribeiro et al. (2014)
Varronia curassavica Jacq.	erva-baleeira	Sh	Hematoma	Le	Maceration	Yazbek et al. (2019)
BROMELIACEAE						
Tillandsia recurvata (L.) L.	barba-de-velho	Ep	Rheumatism, ulcer, hemorrhoids	Wp	Decoction	Agra et al. (2007)
Tillandsia streptocarpa Baker	gravatá-do-ar	Ep	Laxative, vomit	Wp	Decoction	Agra et al. (2007)
BURSERACEAE						
Protium heptaphyllum (Aubl.) Marchand subsp. *heptaphyllum*	corcunda, amescla, almescla, alméceha, breu-amarelo, breu-preto	Tr	American trypanosomiasis, bleeding, anxiety, bronchitis, sinusitis, indigestion, stroke, respiratory disorders, healing, headache	Le, Fr, Sb, Re	Decoction, maceration, sirup	Ribeiro et al. (2017b); Pagini et al. (2017)
CARYOCARACEAE						
Caryocar coriaceum Wittm.	Pequi, piqui, pequizeiro	Tr	Throat inflammation, bronchitis, cough, asthma, influenza, rheumatism, furuncle, swelling, throat inflammation, blows, fever, burns, pains in general, indigestion, expectorante	Fr, Fl	Sirup, decoction	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)
CLUSIACEAE						
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, anemia, 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)
Doliocarpus dentatus (Aubl.) Standl.	cipó-de-cururu, cipó-d´agua	Cp	Diuretic	Sa	*in natura*	Ribeiro et al. (2017[b])
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, náusea	Sb	Poultice	Silva et al. (2014a); Souza et al. (2014)
Croton heliotropiifolius 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, anemia, 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 a.l. (2007a), Albuquerque et a.l. (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 a. (2007b); Souza et al. (2014); Ribeiro et al. (2017b)

			in general, back pain, depurative, vaginal inflammation, throat inflammation, throat infection			
Copaifera langsdorffii Desf.	paudoia, podoia, pau-d'óleo, copaiba	Tr	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, in 'cachaça'*, decoction, maceration, *in natura*, sirup	Ribeiro et al. (2014); Souza et al. (2014); Macedo et al. (2015); Saraiva et al. (2015); Ribeiro et al. (2017b); Guimarões 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	Sb, Le, Re, Fr	Decoction, infusion, sirup, maceration	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	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, 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	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	Fr, Sb, Se	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	Pains in general, inflammation of internal and external organs	Sb, Ro	Decoction, in 'cachaça'*, seco	Ribeiro et al. (2014)
Mimosa tenuiflora (Willd.) Poir.	jurema, jurema-preta	Sh	Bronchitis, cough, aphrodisiac, uterine inflammation, wounds, pains in general, inflammation of external organs	Sb	Decoction, sirup, infusion	Albuquerque (2001); Agra et al. (2007); Ribeiro et al. (2014); Macedo et al. (2015)
Mimosa verrucosa Benth.	jurema-preta	Sh	Uterine inflammation	Sb	Decoction	Aguiar & Barros (2012)
Plathymenia reticulata Benth.	amargoso, amarelo, candeia, vinhático	Tr	Bleeding, swelling, pains in the liver, kidney pain, healing	Sb	Decoction, maceration	Ribeiro et al. (2017b)
Stryphnodendron rotundifolium Mart.	barbatimão, barbatenã	Tr	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	Sb	Maceration, in 'cachaça'*, infusion, decoction, sirup	Ribeiro et al. (2014); Souza et al. (2014); Bitu et al. (2015); Macedo et al. (2015)
Vachellia farnesiana (L.) Wight & Arn.	acácia, coronha	Sh	Anemia, hypercholesterolemia, diabetes, chest pain, premature ejaculation	Fl, Ro	Maceration, infusion	Ribeiro et al. (2017b)
HYPERICACEAE						
Vismia guianensis (Aubl.) Choisy	lacre, lacre-vermelho	Tr	Back pain, pains in general, kidney pain, magical-religious use	Le	Uninformed	Albuquerque et al. (2017b)
LAMIACEAE						
Rhaphiodon echinus Schauer	betônica	He	Influenza, intestinal colic	Le	Infusion, banho	Pio et al. (2019)
LYTHRACEAE *Lafoensia pacari* A.St.-Hil.	romã-braba, lagartixeiro, pacari, didal	Sh	Skin diseases, infections in general, dysentery, genital disease, mycoses, furuncle, vaginal discharge, sífilis, worms, cancer, depurative, 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	Sb, Le, Sa, Ro	Decoction, maceration, poultice, *in natura*, infusion, juice	Ribeiro et al. (2017b); Miguéis et al. (2019)
MALPIGHIACEAE						

Byrsonima sericea DC.	murici-vermelho, murici-branco	Tr	Hypercholesterolemia, healing	Sb	Maceration	Ribeiro et al. (2014)
MALVACEAE						
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	Sl	Cough, influenza	Le, Ro	sirup	Ribeiro et al. (2014)
Sida cordifolia L.	malva-branca, malva-veludo, malvão	Sl	Acne, vaginal discharge, cough, toothache, inflammations in general, itching, wounds, indigestion, magical-religious use, influenza, mycoses, irregular menstruation	Le	Infusion, sirup	Agra et al. (2007); Albuquerque et al. (2007b); Santana et al. (2016)
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	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.	murta, sangue-de-tatu, cumatí	Tr	Cancer	Sb, Sa	*In natura*, maceration	Ribeiro et al. (2017b)
Psidum myrsinites DC.	araçá-vermelho, goiabinha	Tr	Stomach pain, diarrhea	Le, Sb, Fr	Infusion, Maceration	Ribeiro et al. (2014)
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						

Passiflora cincinnata Mast.	maracujá-do-mato, maracujá-de-boi	Cp	Hypertension, anxiety, sedative, insomnia, renal insufficiency	Le, Fr, Ro	Decoction, juice, 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						
Scoparia dulcis 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, depurative, tonic for the heart, conjunctivitis, pneumonia, gastritis, inflammations in general, muscle cramp, uterine inflammation, vaginal discharge	Wp, Ro, Le	Decoction, infusion, decoction, maceration, 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)
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	Le	Maceration	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, back pain, inflammations in general, rheumatism,	Le, Ro	Infusion, decoction, maceration	Ribeiro et al. (2017b); Miguéis et al. (2019)

			vaginal discharge, sexual impotence, prostate inflammation, healing, pains in general, fever			
Cordiera sessilis (Vell.) Kuntze	marmelinho	Sh	Diarrhea	Sb, Ro	Maceration	Ribeiro et al. (2017b)
Guettarda viburnoides Cham. & Schltdl.	angélica	Sh	Pains in general, throat inflammation	Sb, Le	Infusion, decoction	Ribeiro et al. (2014)
Tocoyena formosa (Cham. & Schltdl.) K.Schum.	genipapinho, geninapo-bravo	Sh	Rheumatism, bone fracture, contusion, blows, swelling, healing	Le, Sb, Re	Poultice, maceration	Agra et al. (2007); Ribeiro et al. (2014); Souza et al. (2014)
RUTACEAE						
Zanthoxylum gardneri Engl.	laranjinha, limãozinho, quebra-faca	Tr	Injury, influenza, diarrhea, headache	Sb	Infusion, maceration	Ribeiro et al. (2014)
Zanthoxylum rhoifolium Lam.	laranja-braba, mamica-de-porca	Tr	Depurative, ulcer, gastritis, healing, throat inflammation	Sb, Fr	Decoction, maceration	Ribeiro et al. (2017b); Yazbek et al. (2019)
SALICACEAE						
Casearia sylvestris Sw.	pereirinha, chá-de-frade	Tr	Diabetes	Sb	Decoction, infusion, maceration, sirup, *in natura*	Ribeiro et al. (2017b)
SAPINDACEAE						
Magonia pubescens A.St.- Hil.	tingui	Tr	Stingray sting, dermatitis, seborreia	Sb	Poultice	Souza & Felfiti (2006); Ribeiro et al. (2017b)
Matayba guianensis Aubl.	pitomba-braba	Tr	Leg pain, back pain	Sb	Uninformed	Souza et al. (2014)
Serjania lethalis A.St.-Hil.	chiador, cipó-de-vaqueiro, cruapé	Cp	Toothache	Sb	Uninformed	Souza et al. (2014)
Talisia esculenta (Cambess.) Radlk.	pitomba	Tr	Kidney stones	Fr	Maceration	Ribeiro et al. (2017b)
SIMAROUBACEAE						
Simarouba versicolor A.St.- Hil.	mata-menino	Tr	Itching, healing	Sb, Le	Decoction, maceration	Ribeiro et al. (2017b)
SIPARUNACEAE						
Siparuna guianensis Aubl.	pau-fedido, capitiú, negramina	Tr	Influenza, sinusitis, respiratory problems in general, stroke, ulcer, itching, arthritis, rheumatism, pains in general, fever, repellent, magical-religious use	Le	Decoction, infusion, maceration	Pagani et al. (2017); Ribeiro et al. (2017b)
SMILACACEAE						
Smilax campestris Griseb.	japecanga	Cp	Dermatitis, syphilis, rheumatism, depurative, diuretic, arthritis, diaphoretic	Ro	Decoction, infusion	Rodrigues & Carvalho (2001)
SOLANACEAE						
Solanum rhytidoandrum Sendtn.	jurebeba-branca	Sh	Hepatic problems	Ro	Decoction	Agra et al. (2007)

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	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.

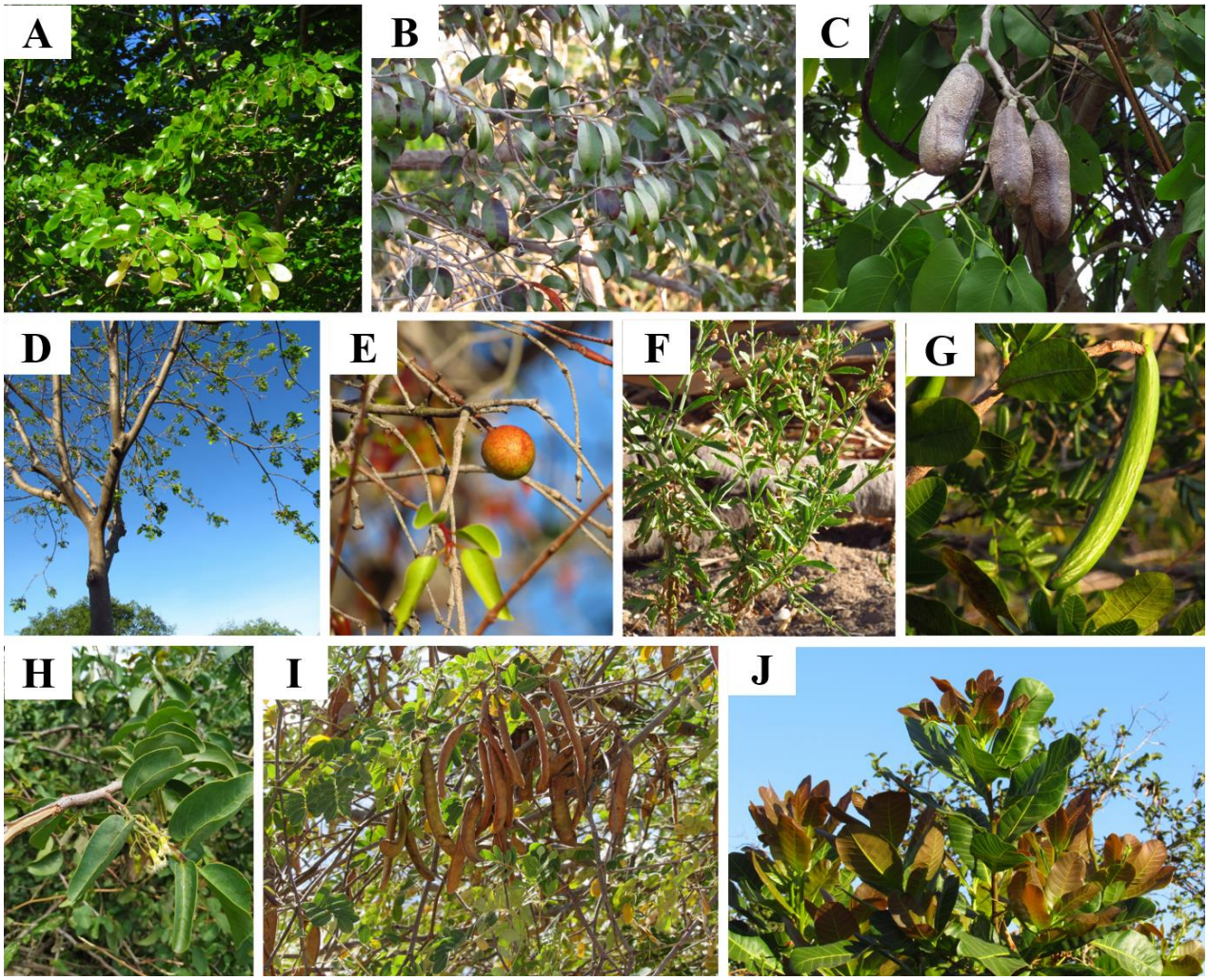

Figure 5. Species of medicinal use of Chapada of Araripe (Brazil), with greater numbers of therapeutic indications. A = *Copaifera langsdorffii* (pau-d'óleo); B = *Lafoensia pacari* (romã braba); C = *Hymenaea stigonocarpa* (jatobá-do-cerrado); D = *Astronium urundeuva* (aroeira); E = *Hancornia speciosa* (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, IPD, 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, DDS, DMC, NEO, DR, IPD, ENM, IPO, DCS	1.86	Polyphenols, flavonoids, chalcones, fatty acids, monoterpenes, sesquiterpenes, tannins, anthocyanins, anthocyanidins, flavones, flavonols, xanthones, 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, DNS, DGS, DCS, IPD, NEO, MBD, DRS, DMC, DSS, DDS, AND	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, DGS, DDS, DCS, AND, NEO, DSS, IPD, ENM, DEM, DEA, DMC	1.81	Phenols, tannins, flavones, flavonols, xanthones, 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	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)

Hymenaea stigonocarpa Mart. ex Hayne	DDS, IPD, NEO, ENM, IPO, DNS, DEM, DRS, AND, DMC, DGS, DSS	1.89	Flavonoids, tannins, terpenes, coumarins, fatty acids, flavones	Gastroprotective, healing, antioxidant, intestinal anti-inflammatory, anti-thermal, antibacterial	Orsi et al. (2012); Dimech et al. (2013); Maranhão et al. (2013); Orsi et al. (2014); Silva et al. (2014b)
Lafoensia pacari A.St.-Hil.	IPD, DSS, DDS, DGS, NEO, IPO, ENM, DCS, DEM, DMC, DNS	1.83	Saponins, tannins, steroids, triterpenes, flavonoids	Gastroprotective, antitumor, antidepressant, antimutagenic, antigenotoxic, cytotoxic, anti-inflammatory, antioxidant, healing	Tamashiro-Filho et al. (2012); Lima et al. (2013); Galdino et al. (2015); Pereira et al. (2018); Cordeiro et al. (2019); Chaibub et al. (2020)
Libidibia férrea (Mart. ex Tul.) L.P.Queiroz	ENM, DRS, DGS, IPO, DCS, DDS, DSS, DMC, IPD, AND	1.43	Tannins, flavonoids, alkaloids, cinnamic derivatives, triterpenes, saponins, organic acids, phenols, lactone sesquiterpenes, anthraquinones	Antibacterial, anti-inflammatory, antioxidant, antinociceptive, antiparasitic, healing activity	Kobayashi et al. (2015); Comandolli-Wyrepkowski et al. (2017); Falcão et al. (2019); Luna et al. (2020)
Scoparia dulcis L.	DGS, IPD, DSS, ENM, IPO, IPD, DNS, DRS, DDS, DCS, DEA, DMC	1.71	Diterpenes, glycosides, phenolic compounds, steroids, triterpenes, flavonoids	Anti-inflammatory, antitumor, antioxidant, antidiabetic, antimicrobial	Muthumani et al. (2010); Mishra et al. (2013); Parvataneni (2019); Nur-e-Alam et al. (2020)
Ximenia americana L.	ENM, DSS, DRS, DDS, DGS, DMC, AND, IPO, DNS	1.46	Alkaloids, flavonoids, lignans, monoterpenes, sesquiterpenes, diterpenes, naphthoquinones, saponins, hydrolyzable tannins, triterpenes, steroids, polyphenols, anthocyanins, aurones, leucoanthocyanidin, catechins, anthocyanidins flavones, chalcones	Gastroprotective, antiparasitic, antioxidant, anti-inflammatory, antinoceptive, antidiabetic activity	Almeida et al. (2016); Silva-Leite et al. (2017); Shettar & Vedamurthy (2017); Sobeh et al. (2017); Aragão et al. (2018); Silva et al. (2018); Menezes et al. (2019)

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 addition 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 ($\geq$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 antigenotoxic 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* (INCQS 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-Wyrepkowski 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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