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Plant species as a therapeutic resource in areas of the savanna in the state of Pernambuco, Northeast Brazil

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ABSTRACT

Ethnopharmacological relevance: Ethnobotanical studies have contributed significantly in research of plants with therapeutic potential. The aim of the present study was to learn about the use of native medicinal plants cited by the traditional population in "cerradão" (savanna woodland) areas in Northeast Brazil, providing data on therapeutic indications of the species used and their versatility.
Materials and methods: Semi-structured interviews were conducted on the basis of a standardized questionnaire designed for key informants selected using the "snowball" technique. The selection of plants species with therapeutic potential was performed on the basis of the relative importance (RI) and informant consensus fator (ICF).
Results: A total of 78 species were indicated for 87 therapeutic purposes. Of these, 11 species presented great versatility of use (RI > 1), as e.g.including *Copaifera langsdorffii* Desf., *Hybanthus calceolaria* (Mart.) Plumel., *Heliotropium* cf. *indicum* L., *Croton zehntneri*, *Croton heliotropiifolius*, *Myracrodruon urundeuva*, *Stryphnodendro rotundifolium*. Medicinal uses could be generalized Pax & K. Hoffm and *Hymenaea courbaril* L. The therapeutic indications were grouped into 14 use15 categories with 594 species–category combinations. The largest number of medicinal species was indicated for illnesses or undefined pain, followed by diseases associated with respiratory, digestive and genitourinaryof body systems. The factor informant consensus highlighted the agreement in the use of plants and showed that the, of which Diseases of the Nervous System and, Diseases of the Circulatory System had the greatest agreement 1.0 and 0.87 repectively, Disorders of the Visual Sensory System – Eyes and Respiratory System Disorder showed the highest agreement of use.
Conclusions: Most of the species cited by the key informants are well known scientifically, but it is interesting that some have been studied little or not all with regard to confirming their purported medicinal properties and can contribute substantially to pharmacological and phytochemical investigations in the search for new drugs.

1. Introduction

Traditional knowledge about medicinal plants is of utmost importance for various scientific and technological fields, since it indicates target species with great potential in traditional medicine. These plants was used as raw material in pharmacological and phytochemical studies for obtaining active substances used in the development of new drugs, adjuvants and/or herbal products, stirring strong interest from pharmaceutical companies (Schenkel et al., 2004). According to Machado and Oliveira (2014), the integration of several research areas of medicinal plants can lead to a promising and effective way for new drug discovery.

The World Health Organization (WHO) estimates that about 65–80% of the world's population, especially in developing countries, depends on medicinal plants as the sole therapeutic approach to primary health care (Calixto, 2005). However, only 17% of the plants have been studied in any way as to their medical use (Foglio et al.,

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2006). Therefore, the collection and organization of information on the use of medicinal plants of therapeutic value is essential for Brazilian herbal medicine.

Traditional communities feature a variety of popular habits and unique customs acquired by experiences from different generations. Among these customs, there is the popular use of plants in healing various diseases that affect the population. Such use is, in most cases, closely linked to rural communities due to several factors, mainly difficult access to health services and modern medicines, so native plant species are the only therapeutic option for treating different diseases (Tresvenzol, 2007; Guerra et al., 2010; Roque et al., 2010). Furthermore, reports of healing and success in treatment, as well as the belief that natural is harmless, has led to continued use and indications for later generations, even without scientific proof (Maciel et al., 2002; Oliveira and Figueiredo, 2007).

Brazil has the greatest biological diversity in the world, with flora estimated at about 50,000–60,000 species, which contributes to the widespread use of plants for medicinal purposes (Trzeciak et al., 2008). Among its biomes, the savanna woodland deserves special attention because of its high floristic diversity, including little-known medicinal species (Rodrigues and Carvalho, 2001), mainly in the northeastern fragmented savannas. In the state of Pernambuco, there have been important ethnobotanical studies for Caatinga areas, but there is a lack of studies that include savanna woodland species, where there are no known ethnobotanical studies for about the ethnobotany of areas the cerradão (savanna woodland).

Thus, this study aimed to contribute to knowledge of the use of native medicinal plants cited by the traditional population in savanna woodland areas, providing data on indications of species used and their versatility.

2. Materials and methods

2.1. Study area

The survey was conducted in the communities of Matozinho (7° 23′ 29″ S and 39° 37′ 09″ W), Estância (7° 24′ 52″ O and 39° 38′ 11″ W), Serra do Zé Gomes (7° 28′ 24″ S and 39° 35′ 45″ W) and Mangueiras (7° 28′ 33″ S and 39° 39′ 41″ W) located in Chapada do Araripe, of the municipality of Exu, Pernambuco State (Fig. 1). These communities are present in areas with high altitudes and have an annual average rainfall ranges 901–1000 mm, with the rainy season concentrated between the months from January to March, and the average annual temperature is 23 °C. The soil type is yellow latosol of low fertility due to its acidity (Araújo Filho et al., 2000; FUPEF, 2007; Sá et al., 2009).

The predominant vegetation in Exu is Caatinga at 38.1%, followed by "Cerradão/carrasco" transition (33.9%), carrasco (16%), regeneration forests (7%) and rainforests (5%) (MMA, 2007). The vegetation of the "Cerradão/carrasco" transition also called areas of ecological tension was observed only in Chapada do Araripe (MMA, 2007) and represents the main source of medicinal plants for the communities interviewed.

All Exu communities present on the plateau depend on a single health center, located in the village Posto Velho near the border of Pernambuco and Ceará on BR-122, and the population also has a health agent who does monthly monitoring at homes. However, many individuals report that they rely on natural resources because of greater availability, and depending on the severity or progression of the disease, they may go to the municipal hospital or to neighboring towns.

The main illnesses that affect the members of these communities, according to health professionals who see them at the Health Center, are mainly diarrhea, fever and sore throat during periods of seasonal changes, because of lower temperatures and increased humidity, general pain, particularly musculoskeletal resulting from field work, and chronic diseases, such as hypertension and diabetes, usually affecting patients over 40 years old.

2.2. Ethnobotanical survey

The survey was conducted with key informants found through the "snowball" technique (Albuquerque et al., 2010). The communities studied had 49 families, where 15 informants were found. Of these, 11 agreed to an interview, including 6 men and 5 women aged between 50 and 100 years, all of them had some traditional experience with medicinal plants as healers, and that is why they were sought out by other members of the community and of neighboring places. The interview technique used was semi-structured based on a standardized form (Martin, 2004), where respondents were asked about the medicinal plants used, the different uses and therapeutic indications. The interviews were granted after they read, gave permission and signed the consent form (CNS, 2013). The therapeutic indication of each species were grouped in 15 categories of body systems based on the internacional classification of diseases and related health problems (ICD-10) proposed by the World Health Organization (WHO, 2010): Non-Defined Disordersor Pain (NDDP), Disease of the Endocrine Glands, Nutrition and Metabolism (DEGNM), Infectious and Parasitic Diseases (IPD), Mental and Behavioral Disorders (MBD), Diseases of Blood and Hematopoietic Organs (DBHO), Diseases of the Musculoskeletal System and Connective Tissue (DMSCT), Injuries, Poisonings and Other Consequences of External Causes (IPOCEC), Neoplasms (N), Disorder of the Digestive System (DDS), Disorder of the Genitourinary System (DGS), Respiratory System Disorder (RSD), Disorders of the Visual Sensory System – eyes (DVSS-E), Diseases of the Circulatory System (DCS), Diseases of the Skinand Subcutaneous Cellular Tissue (DSSCT), Diseases of the Nervous System (DNS). The study was submitted to the Ethics and Research Committee of the Cariri Regional University and approved under No. 873,654.

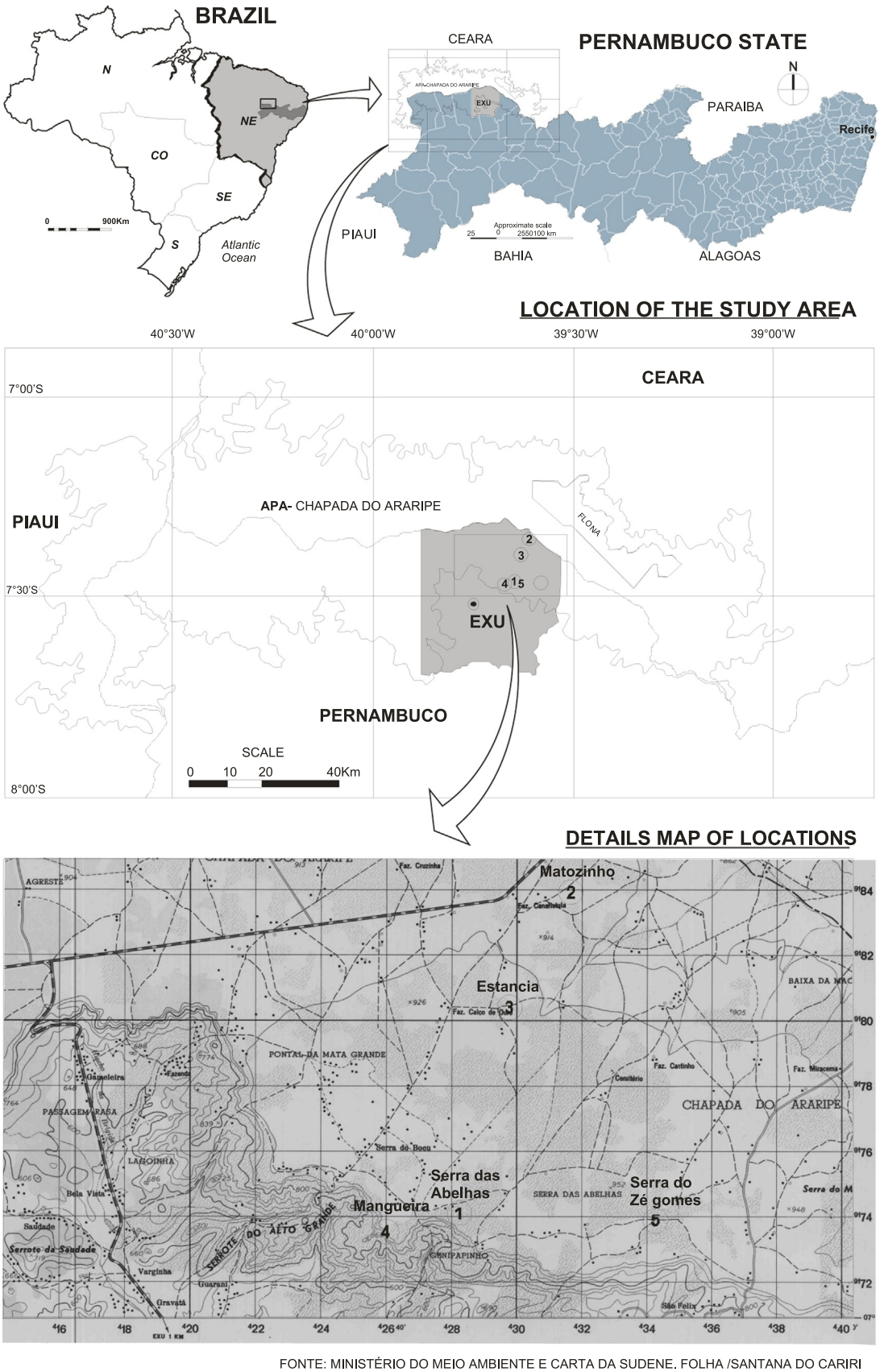
2.3. Collection and species identification

Medicinal species were collected from excursions with the help of informants and/or a person familiar with area, who identified the plants by their common names. Only native species of Brazilian origin that occur in Chapada do Araripe were considered. Some listed species cited were not found in the "Cerradão" area, where they were observed only in the surrounding phytogeographic domains, such as Caatinga, Carrasco and dry forest. The botanical material collected was dried and identified with the aid of specialized literature and comparison with the ones already identified. Voucher specimens were deposited in the collection of HCDAL herbarium (Herbarium Caririense Dárdano de Andrade Lima) of the Cariri Regional University and HST (Herbarium Sergio Tavares) of the Federal Rural University of Pernambuco for confirmation of identifications by specialists.

The classification system of species adopted was Angiosperm Phylogeny Group III (APG, 2009, and the scientific names were confirmed in the database of the Missouri Botanical Garden (Mobot), available at http://www.tropicos.org (Garden, 2014) and List Species of the Flora of Brazil, available at http://www.floradobrasil.jbrj.gov.br (Forzza et al., 2014). Authorization to collect botanical material was provided by the Authorization and Biodiversity Information System (SISBIO) of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), registered under No. 43960-1.

2.4. Data analysis

We calculated the relative importance (RI) index of the medicinal plants according to Bennett and Prance (2000), where the maximum value that a species can get is 2. To obtain the data we



FONTE: MINISTÉRIO DO MEIO AMBIENTE E CARTA DA SUDENE. FOLHA /SANTANA DO CARIRI

Fig. 1. Geographical location of the area of study in Matozinho, Estância, Serra do Zé Gomes and Mangueiras communities, Exu, Pernambuco, Brazil.

used the following formula: RI=NBS+NP, where: NBS=NBSS/NBSSV and NP=NPS/NPSV.

RI is the relative importance, NBS is the number of body systems, obtained by dividing the number of body systems treated for a particular species (NBSS) and the total number of body systems treated by the most versatile species (NBSSV). NP is the ratio of the number of properties assigned to a particular species (NPS) and the total number of properties assigned to the most versatile species (NPSV) (Almeida and Albuquerque, 2002; Silva et al., 2010).

The agreement about use of medicinal species was analyzed by the informant consensus factor (ICF). This measureisaimed at identifying the body systems that have more know ledge consensus and/oruse (Trotter and Logan, 1986). ICF ranges from 0 to 1 and is determined by the following formula: ICF=nur−nt/nur−1, where: nur is the number of citations of usage in each category, and (nt) is the number of species indicated in each category.

The frequency of citation in the survey (FS) of the species refers to the total number of instances the plant was cited for one of the symptoms.

3. Results and discussion

3.1. Species richness of medicinal plants

A total of 77 species belonging to 35 families and 63 genera (Table 1) were listed. The most representative families were Fabaceae with 19 species followed by Euphorbiaceae (8 spp.), Anacardiaceae (5 spp.) and Apocynaceae (6 spp.). Fabaceae is the family with the largest number of species in all the phytophysiognomy of the savanna woodland so the larger the number of species in a family, the greater the likelihood of their use by communities that make use of the resources of the native flora (Mendonça et al., 1998). This family also showed greater prominence in several surveys of medicinal plants from different biomes observed in Northeast Brazil (Alves and Nascimento, 2010; Paulino et al., 2011; Gomes and Bandeira, 2012) as well as in other regions of the country (Botrel et al., 2006; Souza, 2007; Moreira and Guarim-Neto, 2009; Cunha and Bortolotto, 2011). Species of this family, in turn, have numerous particular herbal activities for their extensive use (Bruneton, 2001). Despite the high richness of species of Fabaceae, the most representative genera were Solanum (Solanaceae) and Croton (Euphorbiaceae), with five and three species, respectively. In semiarid regions, these genera were also cited as the most representative (Albuquerque et al., 2007; Oliveira et al., 2010a). The plants of the genus *Croton* are rich in essential oils with extensive biological activity (Castro et al., 2005). *Solanum* is also known to possess a variety of biological activities, including antifungal, molluscicidal, teratogenic and embryotoxic activity (Esteves-Souza et al., 2002).

Regarding the habit of medicinal plants, 54% were trees, 23% shrubs and subshrubs, 14% herbaceous and 9% vines. Thus, there was a large dominance of woody species (trees, shrubs and subshrubs), making up a total of 77%. Trees and shrubs are commonly used for medicinal purposes in areas of Northeast Brazil (Agra et al., 2008; Cartaxo et al., 2010), which can be explained by the greater availability of forest resources throughout the year both in the Savanna woodland and Caatinga because of considerable resistance to sudden changes in the environment, such as prolonged drought that commonly occurs in the Northeast (Silva and Proença, 2008).

Of the medicinal species, the bark and inner bark of the stem were indicated as the most commonly used parts, corresponding to 33.7%, followed by roots (30.7%) and leaves (17.8%); the other parts had a lower incidence: fruits, seeds and flowers with 12.9% and latex/resin with 4.9%. According to Amoroso (2002), the use of bark and roots of medicinal plants is more common in savanna woodland areas of Savanna woodland. In the Northeast region, principally for works reported in caatinga areas, the use of extracted parts of the stem predominates, probablydue to greater availability, regardless of changes in seasonality (Roque et al., 2010; Marinho et al., 2011). Moreover, according to some informants, these plant parts allow them to be stored for a long period without loss of therapeutic effect.

In the population studied, different parts of the plant were used to cure the same disorder. For example, the leaves and inner bark of *Ocimum campechianum* (basil) were used to treat inflammation in general, and the roots and leaves of *Phyllanthus urinaria* (quebra-pedra) were indicated for renal inflammation, indicating that the same active chemicals may be present in different parts of the plant. However, phytochemical and pharmacological studies are needed to confirm this hypothesis.

With respect to the usual preparations of medicinal plants, 10 ways were recorded: immersed in water for bathing and washing (30.9%), infusion (19.4%), decoction (19.4%), maceration (7.2%), sirup (5%), potions (5%), juice (5%), diluted with water or milk (4.5%), poultice (2.9%) and flour (0.7%). Some authors grouped infusion and decoction as tea resulting in a higher proportion for tea (Alves and Nascimento, 2010; Freitas et al., 2012; Gomes and Bandeira, 2012). The forms used by people for homemade extractions of active principles are important and should be taken into consideration, since there may be an increase or decrease in the concentration of active substances, depending on the mode of obtaining it.

3.2. Indications and relative importance of medicinal species

Of the 78 species, 73.1% had two or more uses and 26.9% had only one therapeutic indication (Table 1). The largest number of medicinal species was indicated for disorders or undefined pain (20.3%) such as fever and general inflammation (Table 2), followed by 14.7% for treating respiratory ailments, 11.2% for combatting diseases related to the digestive system and 11.2% for the treatment of genitourinary disorders. These data are in line with the review by Albuquerque et al. (2007), who examined twenty-one studies carrid out in five states in Northeast Brazil (Alagoas, Sergipe, Pernambuco, Bahia and Paraíba) and showed the same category of body systems as indicated by most informants. Disorders and undefined pain and problems related to the digestive and respiratory systems appear to be the most often treated with herbs in Northeast Brazil.

In general, respiratory, digestive and genitourinary systems are noted in several ethnobotanical studies conducted in areas of the savanna woodland (Cunha and Bortolotto, 2011), caatinga (Freitas et al., 2012; Gomes and Bandeira, 2012), atlantic forest (Gazzaneo et al., 2005; Silva and Andrade, 2005) and amazon (Monteles and Pinheiro, 2007). These categories include the primary health problems that can be easily treated with the aid of medicinal plants (Almeida et al., 2006).

Among the medicinal plants specified, eleven showed relative importance (RI > 1), and therefore showed great versatility, where they were indicated for the treatment of diseases associated with 42 different categories of thirteen body systems (Table 2). The most versatile of woody species were arboreal, namely *Copaifera langsdorffii*, *Hybanthus calceolaria*, *Heliotropium* cf. *indicum*, *Croton zehntneri*, *Hymenaea courbaril*, *Myracrodruon urundeuva*, *Stryphnodrendron rotundifolium*, *Amburana cearensis*, *Spondias tuberosa*, *Scoparia dulcis* and *Croton heliotropiifolius*. Some of these plants also proved versatile in work with the same ethnobotanical approach in communities present in savanna woodland areas, as

Table 1
Medicinal species mentioned by key informants from the communities of Matozinho, Estância, Serra do Zé Gomes and Mangueiras in Exu, Pernambuco, Brazil.

Family/species	Herbarium no.	Common name	H	Part used	Method of preparation	Method of use	Therapeutic indication	FS	RI
Amaranthaceae									
Dysphania ambrosoides L. Mosyakin & Clemants	4585	Mastruz	He	Le	Maceration, juice	Poultice, oral intake	Inflammation, edema	5	0.6
Anacardiaceae									
Anacardium occidentale L.	10,072	Caju vermelho	Tr	Ib	Immersed in water	Bath, wash, oral in take	General scarring	1	0.3
Anacardium occidentale L.	20,137	Cajuí/caju do mato	Tr	Ib	Infusion, immersed in water	Bath, washing	General scarring, gingivitis, topical inflammation	6	0.7
Astronium fraxinifolium Schott ex Spreng	9424	Gonçalo alves	Tr	Ib	Sirup	Oral intake	Influenza	8	0.3
Myracrodruon urundeuva Allemão	8713	Aroeira	Tr	Ib, Ba	Immersed in water, infusion	Oral in take, bath, washing	Inflammation, expectorant, discharge, gonorrhea, mouth sores, gum disease, influenza	9	1.4
Spondias tuberosa Arruda	3146	Umbuzeiro	Tr	Ro	Juice	Oral intake	Dehydration, diarrhea, throat infection, worms	4	1.2
Annonaceae									
Annona coriacea Mart.	20,128	Araticum	Tr	Ro	Immersed in water, infusion, maceration	Oral intake, poultice	Snake bite	8	0.3
Apocynaceae									
Himatanthus drasticus (Mart.) Plumel	10,079	Janaguba	Tr	Lx	Diluted	Oral intake	Prostate cancer, inflammation of the colon	6	0.6
Rauvolfia sp.1	9281	Chacuaçá	Sl	Ba, Ro	Juice	Chewing	stomachache	1	0.3
Rauvolfia sp.2	9289	Quina-quina	Tr	Ib	Immersed in water, sirup	Bath, oral intake	Fever, influenza, sore mouth, infection, sinusitis, rhinitis	8	0.8
Secondatia floribunda A. DC.	9773	Catuaba de cipó	Vi	Ro	Immersed in water, potion	Oral intake	Rheumatism, lung inflammation, depression	7	0.6
Securidaca diversifolia (L.) S. F. Blake	9765	Caninana	Vi	Ro	Immersed in water, rum, decoction, infusion	Oral intake	Rheumatic pain, spinal pain, bone pain, muscle aches, depression	11	0.6
Tabernaemontana catharinensis A. DC.	Nc	Grão de galo	Sh	Ro	Infusion	Oral intake	Indigestion	2	0.3
Arecaceae									
Acrocomia aculeata (Jacq.) Lodd. ex Mart.	10,708	Macaúba	Tr	Fr, Se	Juice, decoction, oil extraction	Oral intake	Bone problems, arthritis, nerve	11	0.4
Syagrus oleracea (Mart.) Becc.	Nc	Catolé	Tr	Ro	Decoction, soak	Oral intake	Inflammation of theurethra andbladder	5	0.4
Asteraceae									
Acanthospermum hispidum Dc.	10,054	Espinho-de-cigano	He	Rz	Infusion, licking	Oral intake	Influenza, cough	5	0.4
Lepidaploa remotiflora (Rich.) H.Rob.	9760	Balaio de velho	Sh	Le, Ba, Ib, Ro	Decoction, juice, maceration	Oral intake	Constipation	6	0.3
Solidago chilensis Meyen	Nc	Arnica	Tr	Ba, Ib	Maceration, immersed in water	Oral intake	Inflammation, rheumatism, arthritis, osteoarthritis, general pain	1	0.7
Bignoniaceae									
Tabebuia impetigiosa Mart. et DC.	Nc	Pau d'arco	Tr	Ba	Immersed in water	Oral intake	General pain, inflammation, cancer	4	0.7
Boraginaceae									
Heliotropium cf. *indicum* L.	4597	Crista de galo	He	Le, Fl, Ro, Ib	Infusion, decoction	Oral intake	Influenza, headache, tiredness vision, inflammation, edema	8	1.4
Varronia leucomalloides (Taroda) J.S. Mill.	19,998	Moleque-duro	Sh	Fo	Decoction	Wash	Eye diseases	4	0.3
Cactaceae									
Cereus jamacaru DC.	8286	Mandacaru	He	Ro	Infusion, decoction	Oral intake	Kidney stones, ovarian cysts, menstrual regulation	1	0.5
Opuntia ficus-indica (L.) Mill.	Nc	Palma	He	Le	Juice, immersed in water	Bath, washing	Cleanse blood, inflammation of the rectum	3	0.6
Caryocaraceae									
Caryocar coreaceum Wintt.	9764	Pequi	Tr	Fr	Diluted oil with milk	Oral intake	Influenza, pneumonia, massage	9	0.5
Celastraceae									
Indeterminate I	10,037	Inharé	Tr	Lx	Diluted in water	Oral intake	Worms	5	0.3
Convolvulaceae									
Operculina macrocarpa (L.) Urb.	Nc	Batata de burga	Vi	Ro	Juice, maceration, candy	Oral intake	Worms	8	0.3
Erythroxylaceae									

Table 1 (*continued*)

Family/species	Herbarium no.	Common name	H	Part used	Method of preparation	Method of use	Therapeutic indication	FS	RI
Erythroxylum vacciniifolium Mart.	9805	Catuaba	Tr	Ba	Rum, immersed in water, sirup	Oral intake	Sexual stimulant, depression	5	0.6
Euphorbiaceae									
Croton argyrophylloides Müll Arg.	Nc	Caçatinga	Sh	Ib, Ro	Immersed in water, decoction	Oral intake	Stomach pain, upset stomach, liver, diarrhea and indigestion.	2	0.7
Croton conduplicatus Kunth	Nc	Quebra-faca	Tr	Le, Ba	Immersed in water, infusion	Bath, washing	influenza, inflamed tooth	7	0.6
Croton sp.	10,268	Marmeleiro manso	Sh	Ib	Decoction	Oral intake	Indigestion	5	0.3
Croton heliotropiifolius Kunth.	20,152	Velame-preto	Sh	Ro	Infusion, immersed in water	Oral intake	Influenza, general pain, inflammation, dermatitis	9	1.1
Croton zehntneri Pax & K. Hoffm.	10,084	Velame-branco	Sh	Le, Ro	Decoction, infusion, Immersed in water	Bath, oral intake	General infection, general inflammation, flu, blood thinner, cancer, furuncle	10	1.4
Jatropha sp.	4573	Pinhão-brabo	Sh	Lx	Diluted in water	Oral intake	Dog bite, centipede and scorpionstings	3	0.4
Jatropha mollissima (Pohl) Baill.	4592	Pinhão manso	Sh	Se	Maceration, decoction, oil extraction	Oral intake	Depression	4	0.3
Manihot sp.	10,036	Pinhão-roxo	Sh	Le, Lx	Infusion	Oral intake, drippingin tea	Headache, tired eyes	1	0.6
Fabaceae									
Amburana cearensis (Allemão) A.C. Smith	8702	Imburana de cheiro	Tr	Ba, Ib	Immersed in water, infusion, sirup	Oral intake	Measles, fever, influenza, menstrual regulation	9	1.2
Amburana sp.	Nc	Imburana vermelha	Tr	Ba, Ib	Immersed in water, decoction	Wash	Inflammation	5	0.3
Bowdichia sp.	Nc	Sucupira preta	Tr	Ib	Immersed in water, rum	Oral intake	Rheumatism	3	0.3
Bowdichia virgilioides Kunth	10,256	Sucupira	Tr	Ib, Ba	Immersed in water	Oral intake	Inflammation, fever, spinal pain	5	0.7
Cajanus cajan (L.) Mill.	Nc	Andú	Sh	Fr	Sun-dried, fried and maceration	Flour	Weakness and dizziness	4	0.4
Copaifera langsdorffii Desf.	10,642	Pau d'oleo	Tr	Le, Ba, Ib, Re	Decoction, immersed in water, diluted in water	Oral intake, bath, wash	Cancer, general pain, inflammation, constipation, depression, nerves, stomach pain, gastritis, influenza, lung inflammation	11	2.0
Dimorphandra gardneriana Tul.	9769	Faveira	Tr	Fr, Ba	Decoction	Oral intake	Injury, phlegm	7	0.6
Enterolobium contortisiliquum (Vell.) Morong.	10,516	Tamburil/ Timbauba	Tr	Ro	Immersed in water	Wash	Inflammation of the vagina and urinary bladder	5	0.4
Erythrina velutina Willd.	Nc	Mulungu	Tr	Ib	Immersed in water	Oral intake	Menopause, improving circulation	4	0.6
Hymenaea courbaril L.	9756	Jatobá	Tr	Ib, Ba, Fr	Immersed in water, decoction, sirup	Oral intake	Cough, constipation, chest and nasal congestion, influenza, poisoning, blood problems	9	1.4
Hymenaea sp.	9997	Jatobá roxo	Tr	Ba	Immersed in water, sirup	Oral intake	Severe influenza, tuberculosis, pneumonia	1	0.5
Libidibia ferrea (Mart. Ex Tul.) L. P. Queiroz	9450	Pau ferro	Tr	Ib	Immersed in water	Oral intake	Hemorrhage, general inflammation, general infection, general pain	6	0.8
Mimosa pudica L.	8675	Malissa	He	Le	Decoction, infusion	Oral intake	Fever	6	0.3
Mimosa tenuiflora (Willd.) Poir.	10,076	Jurema-preta	Sh	Le, Ro	Immersed in water, infusion	Oral intake	Liver diseases, anemia, appendicitis	8	0.7
Periandra mediterranea (Vell.) Taub.	20,003	Alcançuz	Vi	Ro	Immersed in water	Bath, oral intake	Lung infection, flu, tuberculosis, cough and nasal congestion	10	0.7
Poincianella pyramidalis (Tull.) L. P. Queiroz	8667	Catingueira	Tr	Fl	Infusion	Oral intake	Cough	3	0.3
Senegalia sp.	10,053	Angico	Tr	Ib	Immersed in water	Bath, wash, oral intake	Expectorant, influenza, leukemia	11	0.7
Senna occidentalis (L.) Link.	8670	Mangirioba	Tr	Fr	Fried, decoction	Oral intake	Stroke	4	0.3
Stryphnodendron rotundifolium Mart.	10,536	Barbatenã	Tr	Ib	Immersed in water	Bathwash, oral intake	Inflammation, vaginal infection, scarring, pain in general, tuberculosis	7	1.3
Lamiaceae									
Ocimum campechianum Mill	8362	Alfavaca	He	Le, Ib	Immersed in water, decoction	Bathing, washing, oral intake	Inflammation	8	0.3
Lauraceae									
Nectandra hihua (Ruiz & Pav.) Rohwer	Nc	Sassafrás	Tr	Ro	Immersed in water	Oral intake	Rheumatism and muscle aches	3	0.4
Lecythidaceae									
Eschweilera ovata (Cambess.) Mart. ex Miers.	Nc	Imbiriba	Tr	Fr	Infusion, maceration	Oral intake	Flatulence	1	0.3

Malpighiaceae									
Byrsonima sericea DC.	9761/ 20,122	Murici verdadeiro	Tr	Ib	Immersed in water, macerated and heated	Poultice	Wounds and dermatoses	9	1.0
Malvaceae									
Ceiba glaziovii (Kuntze) K. Schum.	Nc	Barriguda	Tr	Ib	Immersed in water	Oral intake	Prostate inflammation	11	0.3
Sida galheirensis Ulbr.	10,085	Malva branca	He	Ro	Incinerates and diluted in water	Eye wash	Glaucoma, cataracts, pterígio	6	0.5
Moraceae									
Dorstenia brasiliensis Lam.	Nc	Contra-erva	He	Ro	Infusion, decoction	Oral intake	Teething, general inflammation	6	0.6
Myrtaceae									
Psidium sp.	10,275	Araçá	Sh	Le	Infusion	Oral intake	High blood pressure, nerves	9	0.3
Nyctaginaceae									
Guapira opposita (Vell.) Reitz	20,141	Pau piranha	Tr	Ba	Potion	Oral intake	Clears the post partum uterus	7	0.3
Olacaceae									
Ximenia americana L.	10,512	Ameixa	Tr	Ib	Immersed in water, decoction	Bath, wash	General infection, general inflammation, scarring, general pain	10	0.7
Passifloraceae									
Passiflora sp.	10,075	Maracujá-do-mato	Vi	Le, Fr, Ro	Infusion, juice, immersed in water	Oral intake	Soothing, general inflammation, nerves	10	0.7
Phyllanthaceae									
Phyllanthus niruri L.	10,530	Quebra-pedra	Sl	Ro, Le	Infusion, decoction	Oral intake	Kidney inflammation	9	0.3
Phytollacaceae									
Petiveria alliacea L.	Nc	Tipí, pau pra-tudo	Tr	Ro	Immersed in water, rum	Oral intake	Spinal pain	7	0.3
Plantaginaceae									
Scoparia dulcis L.	9288	Vassourinha	Sl	Ro	Decoction, immersed in water, infusion	Oral intake	Measles, fever, menopause, chickenpox	9	1.1
Proteacae									
Roupala montana Aubl.	10,517	Congonha	Tr	Le	Infusion, decoction, soak	Oral intake	Protects against cancer, gastritis	8	0.6
Rhamnaceae									
Ziziphus joazeiro Mart.	4580	Juazeiro/ juá	Tr	Le, Ba	Maceration, immersed in water, decoction,	Wash, oral intake	Digestion aid, lung infection, general, inflammation, influenza	7	1.0
Sapindaceae									
Serjania sp.	9774	Croapé	Vi	Ba, Ro	Infusion, immersed in water	Poultice, wash	Softens the teeth, inflammation	7	0.6
Solanaceae									
Solanum aculeatissimum Jacq.	Nc	Melancia da praia / gogoia	Sh	Le, Ro, Ib, Ba	Decoction	Oral intake	Kidney inflammation, pain urinating	1	0.4
Solanum sp.	9751	Jurubeba-branca	Sh	Le, Fr, Ro	Infusion, immersed in water	Oral intake	Cancer, inflammation of kidney and liver	4	0.9
Smilacaceae									
Smilax japicanga Grised.	10,091	Japecanga	Vi	Ro	Immersed in water, potion, maceration, infusion	Drink	Rheumatism, edema, inflammation, kidney problem	11	0.9
Urticaria									
Cecropia pachystachya Trécul	Nc	Torém	Tr	Le	Decoction	Oral intake	Infection of the kidneys	5	0.3
Violaceae									
Hybanthus calceolaria (L.) Oken	8412	Papaconha	He	Ro	Infusion, decoction, Immersed in water	Oral intake	Worms, genital infections (STIs), skin disorders, laxative, teething, mouth sores, diarrhea	11	1.6
Indeterminate									
Indeterminate II	Nc	Erva-de-peba	He	Ro	Infusion, immersed in water	Oral intake	Fever, rheumatism, spinal pain, muscle pain	2	0.5
Indeterminate III	Nc	Nogueira	Tr	Se	Oil extraction	Massage	Rheumatism, inflammation	1	0.6

Legend: H – habit; He – herbaceous; Sh – shrub; Tr: Tree; Sl-shrublet; Vi – vine; Le – leaf; Ba – bark; Ib – innner bark; Fr – fruit; Se – seed; Ro – root; Lx – latex; Re – resin; RI – relative importance; FS – Frequency of Citation in the survey; Nc: number of collection in progress by Herbarium.

Table 2
List of medicinal species mentioned by key informants from the communities of Matozinho Estância, Serra do Zé Gomes and Mangueiras, Chapada do Araripe, in Exu, Pernambuco, Brazil.

Species with RI > 1	RI	Body systems (number of informants)	Therapeutic indication
Copaifera langsdorffii (pau d'óleo)	2.0	N (7); NDDP (2); DDS (6); MBD (4); RSD (3).	Cancer, general pain, general inflammation, constipation, depression, nerves, stomach pain, gastritis, influenza, lung inflammation.
Hybanthus calceolaria (papaconha)	1.6	IPD (3); DGS (3); DSSCT (1); DDS (5); NDDP (2).	Worms, genital infections (STIs), skin disorders, laxative, teething, mouth sores.
Heliotropium cf. *indicum* (crista de galo)	1.5	RSD (3); DNS (6); DVSS-E (4); NDDP (2); IPOCEC (1).	Influenza, headaches, vision problems, general inflammation, edema.
Croton zehntneri (velame branco)	1.4	NDDP (3); RSD (4); DBHO (5); N (2); DSSCT (3).	General infection, general inflammation, influenza, blood thinner, cancer, skin disorders.
Hymenaea courbaril (jatobá)	1.4	RSD (8); DDS (2); DBHO (2); IPOCEC (4).	Cough, constipation, chest and nasal congestion, influenza, poisoning, blood problems.
Myracrodruon urundeuva (aroeira)	1.4	NDDP (6); RSD (4); DGS (4).	General inflammation, expectorant, discharge, gonorrhea, mouth sores, gum disease, influenza.
Stryphnodrendron rotundifolium (barbatenã)	1.3	NDDP (3); DGS (5); RSD (2); IPOCEC (2).	General inflammation, vaginal infection, general scarring, general pain, tuberculosis.
Amburana cearensis (imburana de cheiro)	1.3	IPD (1); NDDP (3); RSD (4); DGS (4).	Measles, fever, cold, general inflammation, regulating menses.
Spondias tuberosa (umbuzeiro)	1.2	DEGNM (4); DDS (2); RSD (1); IPD (1).	Dehydration, diarrhea, throat infection, worms.
Scoparia dulcis (vassourinha)	1.1	IPD (8); NDDP (5); DEGNM (3).	Measles, fever, menopause, chickenpox, General pain.
Croton heliotropiifolius (velame preto)	1.1	RSD (4); NDDP (5); DSSCT (5).	Influenza, general pain, general inflammation, dermatitis, skin disorders.

Legend: RI – relative importance; NDDP: Non-Defined Disordersor Pain; DEGNM: Disease of the Endocrine Glands, Nutrition and Metabolism; IPD: Infectious and Parasitic Diseases; MBD: Mental and Behavioral Disorders; DBHO: Diseases of Blood and Hematopoietic Organs; IPOCEC: Injuries, Poisonings and Other Consequences of External Causes; N:Neoplasms; DDS: Disorder of the Digestive System; DGS: Disorder of the Genitourinary System; RSD: Respiratory System Disorder; DNS: Diseases of the Nervous System; DVSS-E: Disorders of the Visual Sensory System (Eyes); DCS: Diseases of the Circulatory System; DSSCT: Diseases of the Skinand Subcutaneous Cellular Tissue.

well as in the caatinga (Albuquerque et al., 2007; Cartaxo et al., 2010; de Oliveira et al., 2014, Oliveira et al., 2010b, 2010a; Freitas et al., 2012; Ribeiro et al., 2014).

The species with the greatest versatility was *C. langsdorffii* (pau d'óleo) which covered five body systems (disorders or general pain, digestive system, respiratory system, mental and behavioral disorders and neoplasms) with CFI 0.85 for Respiratory System Disorder, 0.77 for cancer and 0.62 for Non-Defined Disordersor Pain (Table 3) and had the largest number of therapeutic properties (10). This species is quite common in Savanna woodland areas and has recently been ranked among the most versatile in ethnobotanical studies conducted in the Savanna woodland of Northeast Brazil (Ribeiro et al., 2014), which also highlights the use of bark and inner bark of the stem for inflammation and wound healing.

In Brazil, the genus *Copaifera* is widely distributed, and the most common species in the Northeast is *C. langsdorffii*, a plant widely studied because of its pharmacological properties (Leite and Lleras, 1993). The anti-inflammatory and gastroprotective oil-resin activities were the most reported by respondents, thereby confirming analyses performed by Paiva et al. (2004), who attributed such effects to the diterpene kaurenoic acid. Bioassays conducted on mice showed that the colavenol diterpenes and hardwíckiic acid present in the oil had potent antitumor activity (Ohsaki et al., 1994), while kaurenoic acid alone showed smooth muscle relaxant activity on induced uterine contractions (De Alencar Cunha et al., 2003). In the first two studies, it was also found that this oil did not pose risks to other cells, i.e., it showed zero or very near zero cytotoxicity. The gastroprotective activity was the main indication reported by respondents, where this activity was proven in the study by Paiva et al. (2004), suggesting that the oil stimulates the secretion of gastric mucus, reducing acidity and gastric lesions. Besides its medicinal potential, the oil from “copaiba” or “pau d'óleo” has been extensively used in various industrial applications (Veiga Junior and Pinto, 2002).

The species *H. calceolaria* showed six therapeutic properties grouped in five body systems. Of these, the use of the decoction of the root to treat worms was also reported by other investigators (Oliveira et al., 2010a), as well as to combat influenza, an indication not shown in this study (Gomes and Bandeira, 2012). The other indication (genital infections by STDs, skin disorders, laxative, teething and mouth sores) were not normally observed in othe works, appearing to be peculiar to the region studied. Despite being indicated in several ethnobotanical studies, *H. calceolaria* has not been shown to have relative importance or used in pharmacological analyses, making it a species with still unknown potential.

Heliotropium cf. *indicum* was used to treat influenza, headache, edema, inflammation and vision problems, grouped into five body systems. This species is very suitable for ethnobotanical studies, but this study only showed it as being very versatile, which encourages further research into its medical potential. The antiinflammatory activity mentioned by the interviewees has been supported by scientific evidence from studies conducted in India (Srinivas et al., 2000), as well as healing activity which was not indicated in this study (Reddy et al., 2002). In other countries, *H. indicum* is used for other therapeutic purposes, where the root is used for contraception in Bangladeshi (Asia) (Mannan and Ahmad, 1978), and treatment of malaria in Nigeria (Africa) (Odugbemi et al., 2007). The communities studied here did not make use of the fruits and seeds of the plant, probably because they believed that they were toxic or because they did not know of any therapeutic property for these parts. But Pandey et al. (1983) showed that the major component of the seeds, the alkaloid heliotrine, has a ganglion blocking effect in the central nervous system and can act as an analgesic and/or anesthetic. The absence of pharmacological analyses of this species in Brazil is probably due to the fact that it has not been identified with relative importance in other studies to date.

Stryphnodendron rotundifolium and *Hymenaea courbaril* are commonly seen in both physiognomies of savanna as in the caatinga. They were among the six most versatile species in study in a caatinga area in Pernambuco (Almeida and Albuquerque, 2002) and showed considerable use value in the central Savanna (Moreira and Guarim-Neto, 2009). *S. rotundifolium* was mentioned for five therapeutic properties, as the gruped in Injuries, Poisonings and Other

Table 3
Informant consensus factor based on of use of medicinal species by key informants in Matozinho, Estância, Serra do Zé Gomes and Mangueiras in Exu, Pernambuco, Brazil.

Body systems	Number of species/ citations	Therapeutic indication (number of use citations)	Used species	ICF
DNS: Diseases of the Nervous System	1/7	Headache (7)	*Heliotropium* cf. *indicum*.	1.00
DCS: Diseases of the Circulatory System.	2/9	Stroke (4), high blood pressure (5).	*Senna occidentalis*; *Psidium* sp.	0.87
DVSS-E: Disorders of the Visual Sensory System (Eyes).	4/22	Eye disease (5), tired eyes (5), glaucoma (5), cataract (5), pterygium (2).	*Varronia leucomalloides*; *Heliotropium* cf. *indicum*; *Manihot* sp.; *Sida galheirensis.*	0.86
RSD: Respiratory System Disorder	21/132	Influenza (72), cough (15), expectorant (14), sinusitis (1), rhinitis (1), pulmonary inflammation (6), pneumonia (7), tuberculosis (7), pulmonary infection (9).	*Astronium fraxinifolium*; *Myracrodruon urundeuva*; *Spondias tuberosa*; *Rauvolfia* sp.2; *Secondatia floribunda*; *Acanthospermum hispidum*; *Heliotropium* cf. *indicum*; *Caryocar coreaceum*; *Croton conduplicatus*; *Croton heliotropiifolius*; *Croton zehntneri*; *Amburana cearensis*; *Copaifera langsdorffii*; *Dimorphandra gardneriana*; *Hymenaea courbaril*; *Hymenaea* sp.; *Periandra mediterranea*; *Poincianella pyramidalis*; *Senegalia* sp.; *Stryphnodendron rotundifolium*; *Ziziphus joazeiro.*	0.85
DBHO: Diseases of Blood and Hematopoietic Organs	8/40	liver problems (10), Blood purifier (7), bleeding (7), poor circulation (4), blood problems (1), leukemia (4), anemia (7).	*Mimosa tenuiflora*; *Opuntia ficus-indica*; *Croton zehntneri; Libidibia ferrea*; *Erythrina velutina*; *Hymenaea courbaril*; *Senegalia* sp.; *Solanum* sp.2.	0.82
DGS: Disorder of the Genitourinary System.	15/74	Leucorrhea (3), gonorrhea (2), inflammation of urethra (5), bladder inflammation (6), ovarian cysts (2), menstrual regulation (6), sexual stimulant (3), inflammation of prostate (13), vaginal inflammation (11), vaginal infection (4), to clear the post partum uterus (7), kidney inflammation (6).	*Myracrodruon urundeuva*; *Syagrus oleracea*; *Cereus jamacaru*; *Erythroxylum vacciniifolium*; *Amburana cearensis*; *Enterolobium contortisiliquum*; *Stryphnodendron rotundifolium*; *Ceiba glaziovii*; *Guapira opposita*; *Phyllanthus niruri*; *Solanum* sp.1; *Solanum aculeatissimum*; *Smilax japicanga*; *Cecropia pachystachya*; *Hybanthus calceolaria.*	0.81
IPD: Infectious and Parasitic Diseases	6/27	Worms (16), measles (7), chickenpox (4).	*Spondias tuberosa*; Indeterminate I (Inharé); *Operculina macrocarpa*; *Amburana cearensis*; *Scoparia dulcis*; *Hybanthus calceolaria.*	0.81
DSSCT: Diseases of the Skinand Subcutaneous Cellular Tissue	4/16	Dermatitis (2), furuncle (5), acne (1), skin disorders (8).	*Croton heliotropiifolius*; *Croton zehntneri*; *Byrsonima sericea*; *Hybanthus calceolaria.*	0.80
DDS: Disorder of the Digestive System	17/69	Diarrhea (4), throat infection (1), poor digestion (12), gastritis (8), constipation (12), inflammation of the rectum (3), stomach ache (1), belly pain (5), inflamed tooth (5), teething (9), softens the teeth (4), appendicitis (4), laxative (2).	*Spondias tuberosa*; *Tabernaemontana catharinensis*; *Ilex* sp.; *Opuntia ficus-indica*; *Croton argyrophylloides*; *Croton conduplicatus*; *Croton* sp.; *Copaifera langsdorffii*; *Hymenaea courbaril*; *Eschweilera ovata*; *Dorstenia brasiliensis*; *Ziziphus joazeiro*; *Serjania* sp.; *Solanum* sp.1; *Solanum* sp.2; *Rauvolfia* sp.1.	0,79
DMSCT: Diseases of the Musculoskeletal System and Connective Tissue;	12/53	Rheumatism (19), bone pain (2), muscle pain (3), spinal pain (13), inflammation of the spinal column (5), osteoarthritis (10), arthritis (1).	*Himatanthus drasticus*; *Secondatia floribunda*; *Securidaca diversifolia*; *Acrocomia aculeata*; *Solidago chilensis*; *Bowdichia* sp.; *Bowdichia virgilioides*; *Nectandra hihua*; *Petiveria alliaceae*; *Smilax japicanga*; Indeterminate II, Indeterminate III.	0.79
N: Neoplasms.	6/23	Cancer (18), prostate cancer (5).	*Himatanthus drasticus*; *Ilex* sp.; *Handroanthus* sp.; *Croton zehntneri*; *Copaifera langsdorffii*; *Solanum* sp.1.	0.77
IPOCEC: Injuries, Poisonings and Other Consequences of External Causes.	11/39	edema (9), general scarring (4), snake bite (9), dog bite (3), centipede and scorpion sting (2), intoxication (3), wounds (9).	*Dysphania ambrosoides*; *Anacardium ocidentale*; *Anacardium occidentale* (cajuí); *Annona coriacea*; *Heliotropium* cf. *indicum*; *Jatropha curcas*; *Hymenaea courbaril*; *Stryphnodendron rotundifolium*; *Byrsonima sericea*; *Ximenia americana*; *Smilax japicanga*	0.74
MBD: Mental and Behavioral Disorders	8/28	Soothing (14), nerves (13), depression (1)	*Passiflora* sp.; *Copaifera langsdorffii*; *Psidium* sp.; *Acrocomia aculeata*; *Jatropha mollissima*; *Securidaca diversifolia*; *Erythroxylum vacciniifolium*; *Secondatia floribunda.*	0.74
DEGNM: Disease of the Endocrine Glands, Nutrition and Metabolism.	4/11	Dehydration (2), weakness and dizziness (4), menopause (5).	*Spondias tuberosa*; *Cajanus cajan*; *Erythrina velutina*; *Scoparia dulcis.*	0.70
NDDP: Non-Defined Disordersor Pain.	28/72	General pain (10), general inflammation (18), gingivitis (3) mouth sores (4), fever (20), inflammation of the mouth (3), general infection (14).	*Dysphania ambrosoides*; *Anacardium occidentale* (cajuí); *Myracrodruon urundeuva*; *Rauvolfia* sp. 2; *Solidago chilensis*; *Handroanthus* sp.; *Heliotropium* cf. *indicum*; *Croton heliotropiifolius*; *Croton zehntneri*; *Amburana cearensis*; *Amburana* sp.; *Bowdichia virgilioides*; *Copaifera langsdorffii*; *Libidibia ferrea*; *Dimorphandra gardneriana*; *Mimosa pudica*; *Stryphnodendron rotundifolium*; *Ocimum campechianum*; *Byrsonima sericea*; *Dorstenia brasiliensis*; *Ximenia americana*; *Passiflora* sp.; *Scoparia dulcis*; *Ziziphus joazeiro; Serjania* sp.; *Hybanthus calceolaria*;Indetermina II; Indeterminate III.	0.62

Legend**:** ICF – Informant consensus factor.

Consequences of External Causes group with CFI = 0.74, where anti-inflammatory and healing properties are reported in the most ethnopharmacological studies. This result was corroborated with the CFI present in this work. For the genus *Stryphnodrendron*, there are the following proven medicinal properties: healing, antioxidant and antibacterial (Lopes et al., 2005), analgesic (Melo et al., 2007),

antibacterial (Oliveira et al., 2011) and antifungal (Ishida et al., 2006), and according to these authors, these activities are directly related to the high tannin content of these species.

Among the body systems treated with *H. courbaril*, respiratory system was the main one, showing three indications (cough, influenza and nasal and chest congestion) (Table 3). This species is often quoted in different ethnobotanical studies, having as main indication problems related to the respiratory system as the main indication. However, only antimicrobial activity has been proven (Martins et al., 2010; Gonçalo et al., 2011), and it is known that respiratory problems are very much associated with microorganisms and the seasonal change in the environment. Fernandes and Santos (2005) attributed this feature to antimicrobial terpenes and phenolic compounds present in the plant.

The root of *Scoparia dulcis* was cited by the key informants to treat measles, fever, menopause and chickenpox in studies conducted in the state of Pernambuco, proving to be quite versatile (Albuquerque et al., 2007; Oliveira et al., 2010b), where it was also used to treat other ailments, such as hemorrhoids, gynecological and respiratory problems, general inflammation, and diabetes. *S. dulce* has extensive proven pharmacological action, which is mainly due to the presence of diterpenes. The diterpene scopadulin has shown antiviral activity against herpes simplex type 1 (Hayashi et al., 1988), scopadulcic acid B (SDB) has antitumor activity (Nishino et al., 1993) and scoparinol has demonstrated its effectiveness as an analgesic, anti-inflammatory and diuretic (Ahmed et al., 2001). The extract, in turn, has shown antidiabetic and antioxidant potential (Pari and Latha, 2004) and antibacterial and antifungal activities (Latha et al., 2006). Although studied substantially, none of the properties shown in this study have been proven pharmacologically comprovated, indicating the need for such investigation.

The genus *Croton* had the greatest number of species reported by respondents and two species, *C. zehntneri* and *C. heliotropiifolius*, stood out as being very versatile. *C. zehntneri* included five body systems and eight therapeutic properties, and despite being well studied, there is no confirmation of the properties indicated this work. However, it is known that this species possesses cardiovascular (Siqueira et al., 2006), antidepressant (Lazarini et al., 2000), gastrointestinal antispasmodic (Coelho-de-Souza et al., 1998), analgesic (Oliveira et al., 2001) and wound healing (Cavalcanti et al., 2012) effects. *C. heliotropiifolius* was cited only to treat primary health problems such as pain in general, influenza, inflammation, dermatitis and skin disorders. However, in ethnobotanical research conducted in Chapada do Araripe in Savanna woodland areas in Pernambuco, this species was distinguished because of its great versatility (RI = 1.65), where its leaves were indicated for treating nematode infections, external inflammation, fever and tumors (Macêdo et al., In press). There is a lack of studies proving the healing properties indicated, but recent preliminary studies have shown antibacterial activity (Angélico et al., 2014). Thus, this species is should be subjected to pharmacological study, noting that several species of this genus have some kind of proven medicinal property.

Among the species with RI > 1, three (*M. urundeuva*, *A. cearensis*, *S. tuberosa*) were mentioned by the communities interviewed, but they commonly occur in Caatinga physiognomies, where they are found only in areas of lower elevations surrounding Chapada do Araripe. *M. urundeuva* and *A. cearenses* are widely used in Northeast Brazil, where their bark and inner bark are used primarily to treat inflammation in general; they are observed in most studies in Caatinga areas and stand out among the other species with high relative importance (Silva and Albuquerque, 2005; Alves and Nascimento, 2010; Roque et al., 2010; Gomes and Bandeira, 2012). Pharmacological studies of *M. urundeuva* have demonstrated anti-inflammatory activity, as well as analgesic and healing (Viana et al., 1997; Viana et al., 2003; Souza, 2007).

For *A. cearensis*, experiments in vivo and in vitro of the extract have shown significant anti-inflammatory, bronchodilator, analgesic, antispasmodic, antimalarial, antiprotozoal, antifungal and antibacterial activity (Bravo et al., 1999; Leal et al., 2003; Morais et al., 2005; Canuto and Silveira, 2006; Marinho et al., 2011). Therapeutic activities reported here for *S. tuberosa* were also shown in other studies (Mendes, 1990; Neves et al., 2004; Rocha et al., 2013.). In immunohistochemical studies, this species showed that tannins and alkaloids were major components, highly functional substances responsible for different therapeutic activities (Nascimento-Silva et al., 2008).

Certain fairly common medicinal plants indicated in the savanna, showed no relative importance in this work, where RI ranged from 0.5 to 0.8, however proved to be very versatile in another study in savanna woodland areas in the Northeast, namely *Caryocar coreaceum*, *Dimorphandra gardneriana*, *Ximenia americana, Roupala montana* and *Libidibia ferrea* (Ribeiro et al., 2014). Thus, noticing that all the species identified in this study have therapeutic potential, their importance may vary depending on the community analyzed, because they provide a unique body of knowledge and practices on availability and use of medicinal plants. Several studies with Caryocar coreaceum may sugest the therapeutical potential, as anti-inflammatory (Araruna et al., 2014, Saraiva et al., 2011a) or modulator of bacterial resistance (Saraiva et al., 2011b).

Most species in this study showed high versatility, and there is much known about their biological activities, but some are noteworthy because there has little or no studies proving their medicinal properties, such as *H. courbaril*, *H. calceolaria*, *S. dulcis* and *C. heliotropiifolius*. These species were cited by most key informants, demonstrating the importance of savanna woodland vegetation to the communities interviewed and can turn out to be promising species for the treatment and cure of diseases as well as in new drug discovery.

3.3. Consensus use of plants for therapeutic purposes

The medicinal plants cited were indicated for 87 therapeutic purposes and grouped into 15 categories of body systems (Table 3). In general, the categories showed great agreement between key informants with ICF values ranging from 0.62 to 1.0. The highest ICF value was for: Diseases of the Nervous System (DNS), followed by Diseases of the Circulatory System (DCS), Disorders of the Visual Sensory System – Eyes (DVSS-E) and Respiratory System Disorder (RSD) (Table 3), which provides evidence of the greater cultural importance of these categories for the community studied.

DNS had seven citations for *Heliotropium* cf. *indicum*, where the fresh leaves are used in tea preparation for the treatment of headaches. It is worth mentioning that the species has high versatility, representing a relevant species in this study, were its therapeutic potential is still little explored in Brazil. This category usually shows considerable consensus between informats in the northeastern communities regardless of the type of prevalent vegetation (Cartaxo et al., 2010; Ribeiro et al., 2014; Souza et al., 2014).

The disorders of the circulatory system (DCS) had the second highest ICF, where two species were listed, *Senna occidentalis* (four citations), used to treat stroke, and *Psidium* sp. (five citations), indicated for the treatment of high blood pressure, both used as teas. This category is also among those with highest consensus in the work of Ribeiro et al. (2014) in a savanna woodland area in Chapada do Araripe and in central area savanna (Botrel et al., 2006; Silva and Proença, 2008). *S. occidentalis* is widely used in the semi-arid northeast to treat different illnesses, such as influenza, fever, dysphonia, cancer, gastritis and hemostatic (Albuquerque et al., 2007). Of these, there is scientific proof of antimicrobial, antiviral, antitumor and other activities (Lombardo et al., 2009). However, it was not observed any research that relate the species with this category, and the present study is the first report of using this species for diseases linked to the nervous system. Due to

identification only in terms of genus, it was not possible to examine studies covering biological activities of *Psidium* sp., however, species in this genus, show antimicrobial (Santos et al.,1998), antifungal (Menezes et al., 2009), antioxidant and cytoprotective activities (Sobral-Souza et al., 2014).

Sensory System Disorders (eyes) was linked to the use of four species, where *Sida galheirensis* showed most therapeutic purposes, including the treatment of glaucoma, cataracts, and pterygium (totaling 12 citations). A few studies have reported some activity for this species, for example the antioxidant activity observed by Silva et al. (2006), but have been no reports of medicinal indications cited by the communities in the presente study. Most studies in the semi-arid region of the Northeast Brazil have noted that DVSS-E shows low ICF values (e.g., Almeida and Albuquerque, 2002; Almeida et al., 2006; Souza et al., 2014; Macêdo et al., In press.)

The category RSD had the largest number of use citations of use (132), which represented 21.2% of citations (622), and the second highest number of listed species (21), corresponding to 26.9% of the total species (78), with ICF of 0.85. In this category, the influenza, was responsible for the high number of use citations (72), with 17 medicinal species suitable for your treatment. The high consensus for this category is observed in areas of the savanna woodland (Silva and Proença, 2008; Cunha and Bortolotto, 2011; Ribeiro et al., 2014; Macêdo et al., In press) and caatinga (Almeida and Albuquerque, 2002; Cartaxo et al., 2010; Souza et al., 2014). The most suitable species for the treatment of the respiratory system related issues were *Periandra mediterranea* and *H. courbaril*, cited by all informants, which demonstrated the high degree of agreement on medicinal plants used for treating respiratory problems. Saponins extracted from the root of *P. mediterranea* increase the immune response, thus justifying is use (Santos et al., 1997), and polysaccharides isolated from glucans in its dried roots have been found to show anti-inflammatory activity (Pereira et al., 2000).

Among the other categories of body systems, NDDP showed the lowest consensus facto (0.62) but had the highest number of species (28). This category is noted in other studies (Ribeiro et al., 2014; Macêdo et al., In press) in the northeastern savanna woodland with an ICF of 0.70 and 0.75, considered high by the authors. However, in caatinga áreas, that category showed no or very low consensus among informants, ranging from 0.0 to 0.4 (Almeida and Albuquerque, 2002; Almeida et al., 2006; Souza et al., 2014.).

The categories, DGS, DSSCT, DMSCT, DDS, DMSO, MBD, N and IPOCEC were indicated by more than 70% of the informants interviewed in other northeastern communities, indicating high agreement between them (Cartaxo et al., 2010; Ribeiro et al., 2014; Macêdo et al., In press), whereas, IPD, DBHO and DEGNM showed low ICF values in most studies examined.

The most frequently reported species for the above categories were *Ximenia americana* (NDDP), *Ceiba glaziovii* (DGS), *Operculina macrocarpa* (IPD), *Byrsonima sericea* (DSSCT), *Dorstenia brasiliensis* (DDS), *Petiveria alliacea* (DMSCT), *Mimosa tenuiflora* (DBHO), *C. langsdorffii* (N), *Annona coriacea* (IPOCEC), *Passiflora* sp. (DMC) and *S. dulcis* (DEGNM).

Of these, *Ximenia americana*, *B. sericea* and *M. tenuiflora*, featured several studies on their biological activities (e.g., Brasileiro et al., 2008; Guilhon-Simplicio and Pereira, 2011; Bezerra et al., 2011). Though the properties cited by informants were not proven in this work, studies of the biological activities of *C. glaziovii* and *S. dulcis* are still lacking, meaning that these species may be promising candidates for chemical and pharmacological analyses.

4. Conclusion

The communities studied showed a vast knowledge of medicinal plants and a strong dependence on natural resources, where the plants were obtained mostly from local vegetation and mainly used for therapeutic purposes. The most versatile species in the communities studied, *C. langsdorffii*, has also been often indicated in various studies, mainly in areas with the savanna physiognomies, always showing a high relative importance; moreover, studies have proven many of the therapeutic properties ensuring its use. However, the species *H. courbaril*, *H. calceolaria*, *S. dulcis*, *C. heliotropiifolius and C. glaziovii* deserves attention because their medicinal properties have been studied litle or not at all, so they can be targeted for chemical and biological studies in an attempt to prove their therapeutic properties and to isolate biologically active substances, with the expectation of the emergence of new drugs. Thus, this work contributes substantially to the medicinal knowledge of potentially important species, and the findings can be used to help guide their research in other areas of science.

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References

Agra, M.F., Silva, K.N., Basílio, I.J.L.D., Freitas, P.F., Barbosa-Filho, J.M., 2008. Survey of medicinal plants used in the region Northeast of Brazil. Braz. J. Pharmacogn. 18, 472–508.

Ahmed, M., Shikha, H.A., Sadhu, S.K., Rahman, M.T., Datta, B.K., 2001. Analgesic, diuretic, and anti-inflammatory principle from *Scoparia dulcis*. Pharmazie 56, 657–660.

Albuquerque, U.P., Lucena, R.F.P., Lins-Neto, E.M.F., 2010. Seleção dos participantes da pesquisa. In: Albuquerque, U.P., Lucena, R.F.P., Cunha, L.V.F.C. (Eds.), Métodos e Técnicas na Pesquisa Etnobiológica e Etnoecológica. NUPEEA, Recife, pp. 23–37.

Albuquerque, U.P., Medeiros, P.M., Almeida, A.L.S., Monteiro, J.M., Lins Neto, E.M.F., Melo, J.G., Santos, J.P., 2007. Medicinal plants of the caatinga (semi-arid) vegetation of NE Brazil: a quantitative approach. J. Ethnopharmacol. 114, 325–354.

Almeida, C.F.C.B.R., Albuquerque, U.P., 2002. Uso e conservação de plantas e animais medicinais no estado de Pernambuco (Nordeste do Brasil): um estudo de caso. Interciência 27, 276–285.

Almeida, C.F.C.B.R., Amorim, E.L.C., Albuquerque, U.P., Maia, M.B.S., 2006. Medicinal plants popularly used in the Xingó region – a semi-arid location in North-eastern Brazil. J. Ethnobiol. Ethnomed. 2, 15.

Alves, J.J.A., Nascimento, S.S., 2010. Levantamento fitogeográfico das plantas medicinais nativas do Cariri Paraibano. Rev. Geogr. Acad. 4, 73–85.

Amoroso, M.C.M., 2002. Uso e diversidade de plantas medicinais em Santo Antonio do Leverger, MT, Brasil. Acta Bot. Bras. 16, 189–203.

Angélico, E.C., Rodrigues, O.G., Costa, J.G.M., Lucena, M.F.A., Queiroga Neto, V., Medeiros, R.S., 2014. Chemical characterization and antimicrobial activity of eessentiaql oils and Croton's varieties modulator in the Brazilian's Northeast semiarid. Afr. J. Plant Sci. 8, 392–397.

APG (Angiosperm Phylogeny Group, 2009. Na update of the Angiosperm Phylogeny Group classification for the ordens and families of flowering plants: APG III. Bot. J. Linn. Soc. 161, 105–121.

Araruna, M.K., Saraiva, R.A., Nogara, P.A., Rocha, J.B., Boligon, A.A., Athayde, M.L., Rodrigues, L.B., da Costa, R.H.S., Santana, F.R.A., Costa, J.G., 2014. Effect of pequi tree Caryocar coriaceum Wittm. leaf extracts on different mouse skin inflammation models: inference with their phenolic compound content. Afr. J. Pharm. Pharmacol. 8, 629–637.

Araújo Filho, J.C., Burgos, N., Lopes, O.F., Silva, F.H.B.B., Medeiros, L.A.R., Melo Filho, H.F.R., Parahyba, R.B.V., Cavalcanti, A.C., Oliveira Neto, M.B., Silva, F.B.R., Leite, A. B., Santos, J.C.P., Sousa Neto, N.C., Silva, A.B., Luz, L.R.Q.P., Lima, P.C., Reis, R.M.G., Barros, A.H.C., 2000. Levantamento de reconhecimento de baixa e média intensidade dos solos do Estado de Pernambuco. Embrapa Solos, Rio de Janeiro.

Bennett, B.C., Prance, G.T., 2000. Introduced plants in the indigenous pharmacopoeia of Northern South America. Econ. Bot. 54, 90–102.

Bezerra, D.A.C., Rodrigues, F.F.G., da Costa, J.G.M., Pereira, A.V., de Sousa, E.O., Rodrigues, O.G., 2011. Abordagem fitoquímica, composição bromatológica e atividade antibacteriana de *Mimosa tenuiflora* (Wild) Poiret e *Piptadenia stipulacea* (Benth) Ducke. Acta Sci. Biol. Sci. 33, 99–106.

Botrel, R.T., Rodrigues, L.A., Gomes, L.J., Carvalho, D.A., Fontes, M.A.L., 2006. Uso da vegetação nativa pela população local no município de Ingaí, MG, Brasil. Acta Bot. Bras. 20, 143–156.

Bravo, J.A., Sauvain, M., Gimenez, A., Munoz, V.O., Callapa, J., 1999. Bioactive phenolic glycosides from *Amburana cearensis*. Phytochemistry 50, 71–74.
Bruneton, J., 2001. Farmacognosia: Fitoquímica, Plantas Medicinales, segunda ed. Acribia, Zaragosa.
Calixto, J.B., 2005. Twenty-five years of research on medicinal plants in Latin America: a personal view. J. Ethnopharmacol. 100, 131–134.
Canuto, K.M., Silveira, E.R., 2006. Constituintes químicos da casca do caule de *Amburana cearensis* A.C. Smith. Quím. Nova 29, 1241–1243.
Cartaxo, S.L., Souza, M.M.A., Albuquerque, U.P., 2010. Medicinal plants with bioprospecting potential used in semi-arid northeastern Brazil. J. Ethnopharmacol. 131, 326–342.
Castro, C.R., Prado, F.M.V., Brito, E.S., Araújo, F.S., Rocha, J.G.M., Assuncão, M.V., Figueiredo, M.A., Silva, M.G.V., Gallão, M.I., Ferme, M.C., Pessoa, M.A.M., Rocha, S.J., Silva, S.I., 2005. Óleos, ceras, taninos, látex e gomas. In: Sampaio, E.V.S.B. (Ed.), Espécies da Flora Nordestina de Importância Econômica Potencial. Associação de Plantas do Nordeste, Recife, pp. 199–226.
Cavalcanti, J.M., Leal-Cardoso, J.H., Diniz, L.R.L., Portella, V.G., Costa, C.O., Linard, C.F. B.M., Alves, K., Rocha, M.V.A.P., Lima, C.C., Cecatto, V.M., Coelho-de-Souza, A.M., 2012. The essential oil of *Croton zehntneri* and *trans*-anethole improves cutaneous wound healing. J. Ethnopharmacol. 144, 240–247.
Coelho-de-Souza, A.N., Criddle, D.N., Leal-Cardoso, J.H., 1998. Selective modulatory effects of the essential oil of *Croton zehntneri* on isolated smooth muscle preparations of the guinea-pig. Phytother. Res. 12, 189–194.
CNS – Conselho Nacional de Saúde (Brasil), 2013. Resolução no 466, de 12 de Dezembro de 2012. Diretrizes e Normas para a Pesquisa Envolvendo Seres Humanos, Brasília, 13 Jun. 2013. Seção 1, 59. ⟨http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf⟩.
Cunha, S.A., Bortolotto, I.M., 2011. Etnobotânica de plantas medicinais no assentamento monjolinho, município de Anastácio, Mato Grosso do Sul, Brasil. Acta Bot. Bras. 25, 713–726.
de Oliveira, D.R., Júnior, W.S.F., Bitu, V.d.C.N., Pinheiro, P.G., Menezes, C.D.A., de Brito Junior, F.E., de Albuquerque, U.P., Kerntopf, M.R., Coutinho, H.D.M., Fachinetto, R., 2014. Ethnopharmacological study of *Stryphnodendron rotundifolium* in two communities in the semi-arid region of northeastern Brazil. Rev. Bras. Farmacogn. 24, 124–132.
De Alencar Cunha, K.M., Paiva, L.A.F., Santos, F.A., Gramosa, N.V., Silveira, E.R., Rao, V.S.N., 2003. Smooth muscle relaxant effect of kaurenoic acid, a diterpene from *Copaifera langsdorffii* on rat uterus in vitro. Phytother. Res. 17, 320–324.
Esteves-Souza, A., Silva, T.M.S., Alves, C.C.F., Carvalho, M.G., Braz-Filho, R., Echevarria, A., 2002. Cytotoxic activities against ehrlich carcinoma and human K562 leukaemia of alkaloids and flavonoid from two Solanum species. J. Braz. Chem. Soc. 13, 838–842.
Fernandes, T.T., Santos, A.T.F., 2005. Atividade antimicrobiana das plantas *Plathymenia reticulata, Hymenaea courbaril* e *Guazuma ulmifolia*. Rev. Patol. Trop. 34, 113–122.
Foglio, M.A., Queiroga, C.L., Sousa, I.D.O., Rodrigues, R.A.F., 2006. Plantas medicinais como fonte de recursos terapêuticos: um modelo multidisciplinar. Construindo a história dos produtos naturais 7.
Forzza, R.C., Leitman, P.M., Costa, A.F., Carvalho Jr., A.A., Peixoto, A.L., Walter, B.M.T., Bicudo, C., Zappi, D., Costa, D.P., Lleras, E., Martinelli, G., Lima, H.C., Prado, J., Stehmann, J.R., Baumgratz, J.F.A., Pirani, J.R., Sylvestre, L., Maia, L.C., Lohmann, L. G., Queiroz, L.P., Silveira, M., Coelho, M.N., Mamede, M.C., Bastos, M.N.C., Morim, M.P., Barbosa, M., Menezes, M., Hopkins, M., Secco, R., Cavalcanti, T.B., Souza, V. C., 2014. Introdução. In: Lista de Espécies da Flora do Brasil. Jardim Botânico do Rio de Janeiro. ⟨http://floradobrasil.jbrj.gov.br/2014/⟩ (consulted on: Junho 20, 2014).
Freitas, A.V., Coelho, M.F.B., Maia, S.S.S., Azevedo, R.A.B., 2012. Plantas medicinais: um estudo etnobotânico nos quintais do Sítio Cruz, São Miguel, Rio Grande do Norte, Brasil. Rev. Bras. Biociênc. 10, 48–59.
FUPEF – Fundação de Pesquisas Florestais do Paraná, 2007. Apoio Técnico e Institucional para o desenvolvimento do Programa Florestal da Chapada do Araripe em Pernambuco. Produto 2 – Diagnóstico, Curitiba. 203p.
Garden, M.B., 2014. Tropicos. ⟨http://www.tropicos.org⟩ (consulted on: Junho 18, 2014).
Gazzaneo, L.R.S., Lucena, R.F.P., Albuquerque, U.P., 2005. Knowledge and use of medicinal plants by local specialists in an region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). J. Ethnobiol. Ethnomed. 1, 1–11.
Gomes, T.B., Bandeira, F.P.S.F., 2012. Uso e diversidade de plantas medicinais em uma comunidade quilombola no Raso da Catarina, Bahia. Acta Bot. Bras. 26, 796–809.
Gonçalo, A.L., Alves, A.A., Menezes, H., 2011. Antimicrobial effects of some brazilian medicinal plants against intestinal disorders. Rev. Saúde e Pesqui. 4, 153–160.
Guerra, A.M.N.M., Pessoa, M.D.F., Souza, C.S.M., Maracajá, P.B., 2010. Utilização de plantas medicinais pela comunidade rural Moacir Lucena, Apodi – RN. Biosci. J. 26, 442–450.
Guilhon-Simplicio, F., Pereira, M.M., 2011. Aspectos químicos e farmacológicos de *Byrsonima* (Malpighiaceae). Quím. Nova 34, 1032–1041.
Hayashi, K., Niwayama, S., Hayashi, T., Nago, R., Ochiai, H., Morita, N., 1988. In vitro and in vivo antiviral activity of scopadulcic acid B from *Scoparia dulcis*, Scrophulariaceae, against herpes simplex virus type 1. Antivir. Res. 9, 345–354.
Ishida, K. De Mello, Cortez, J.C.P., Dias-Filho, D.A.G., Ueda-Nakamura, B.P., Nakamura, C.V., T., 2006. Influence of tannins from *Stryphnodendron adstringens* on growth and virulence factors of *Candida albicans*. J. Antimicrob. Chemother. 58, 942–949.
Latha, M., Ramkumar, K.M., Pari, L., Damodaran, P.N., Rajeshkannan, V., Latha, M., Ramkumar, K.M., Pari, L., Damodaran, P.N., Rajeshkannan, V., Suresh, T., 2006. Phytochemical and antimicrobial study of an antidiabetic plant: *Scoparia dulcis* L. J. Med. Food 9, 391–394.
Lazarini, C.A., Uema, A.H., Brandão, G.M.S., Guimarães, A.P.C., Bernardi, M.M., 2000. *Croton zehntneri* essential oil: effects on behavioral models related to depression and anxiety. Phytomedicine 7, 477–481.
Leal, L.K.A.M., Nechio, M., Silveira, E.R., Canuto, K.M., Fontenele, J.B., Ribeiro, R.A., Viana, G.S.B., 2003. Anti-inflammatory and smooth muscle relaxant activities of the hydroalcoholic extract and chemical constituents from *Amburana cearensis* A. C. Smith. Phytother. Res. 17, 335–340.
Leite, A.M.C., Lleras, E., 1993. Áreas prioritárias na Amazônia para conservação dos recursos genéticos de especies florestais nativas: fase preliminar. Acta Bot. Bras. 7, 61–94.
Lombardo, M., Kiyota, S., Kaneko, T.M., 2009. Aspectos étnicos, biológicos e químicos de *Senna occidentalis* (Fabaceae). Rev. Ciênc. Farm. Básica Apl. 30, 9–17.
Lopes, G.C., Sanches, A.C.C., Nakamura, C.V., Dias-Filho, B.P., Hernandes, L., De Mello, J.C.P., 2005. Influence of extracts of *Stryphnodendron polyphyllum* Mart. And *Stryphnodendron obovatum* Benth. on the cicatrisation of cutaneous wounds in rats. J. Ethnopharmacol. 99, 265–272.
Macêdo, D.G., Ribeiro, D.A., Menezes, I.R.A., Souza, M.M.A., 2015. Práticas terapêuticas tradicionais: uso e conhecimento de plantas do no estado de Pernambuco (Nordeste do Brasil). Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas. In press.
Machado, A.C., Oliveira, R.C., 2014. Medicamentos Fitoterápicos na odontologia: evidências e perspectivas sobre o uso da aroeira-do-sertão (*Myracrodruon urundeuva* Allemão). Rev. Bras. Plantas Med. 16, 283–289.
Maciel, M.A.M., Pinto, A.C., Veiga Jr., V.F., 2002. Plantas medicinais: a necessidade de estudos multidisciplinares. Quím. Nova 25, 429–438.
Mannan, A., Ahmad, K., 1978. Preliminary study of sex hormones of medical importance in Bangladeshi plants. Bangladesh Med. Res. Counc. Bull. 4, 78–85.
Marinho, M.G.V., Silva, C.C., Andrade, L.H.C., 2011. Levantamento etnobotânico de plantas medicinais em área de caatinga no município de São José de Espinharas, Paraíba. Bras. Rev. Bras. Plantas Med. 13, 170–182.
Martin, G.J., 2004. Ethnobotany: a methods manual.People and plants, Conserv. Ser. Earthscan, London.
Martins, C.H.G., Souza, F.R., Fonseca, C., Casemiro, L.A., Furtado, N.A.J.C., Ambrosio, S. R., Cunha, W.R., 2010. Determinação in vitro da atividade antibacteriana dos extratos brutos da casca e polpa farinácea de *Hymenaea courbaril* L. Rev. Investig. 10, 37–43.
Melo, J.O., Endo, T.H., Bersani-Amado, L.E., Svidzinski, A.E., Baroni, S., De Mello, J.C.P., Bersani-Amado, C.A., 2007. Effect of *Stryphnodendron adstringens* (barbatimão) bark on animal models of nociception. Rev. Bras. Ciênc. Farm. 43, 465–469.
Mendes, B.V., 1990. Umbuzeiro (*Spondias tuberosa* Arr. Cam.): importante fruteira do semi-árido. (Coleção Mosoroense, v. DLXIV). Secretaria de Indústria e Comercio, Mossoró.
Mendonça, R.C., Felfili, J.M., Walter, B.M.T., Silva Júnior, M.C., Rezende, A.V., Filgueiras, T.S., Nogueira, P.E., 1998. A flora vascular do savanna woodland. In: Sano, S.M., Almeida, S.P. (Eds.), Savanna Woodland – Ambiente e Flora. EMBRAPA, Planaltina, pp. 289–557.
Menezes, T.O.A., Alves, A.C.B.A., Vieira, J.M.S., Menezes, S.A.F., Alves, B.P., Mendonça, L.C.V., 2009. Avaliação in vitro da atividade antifúngica de óleos essenciais e extratos de plantas da região amazônica sobre cepa de *Candida albicans*. Rev. Odontol. UNESP 38, 184–191.
MMA – Ministério do Meio Ambiente, 2007. Região do Araripe – Pernambuco: Diagnóstico florestal/Secretaria de Ciência, Tecnologia e Meio Ambiente. Ministério de Meio Ambiente, Brasília.
Monteles, R., Pinheiro, C.U.B., 2007. Plantas medicinais em um Quilombo maranhense: uma perspectiva etnobotânica. Rev. Biol. Ciênc. 7, 38–48.
Morais, S.M., Dantas, J.D.P., Silva, A.R.A., Magalhães, E.F., 2005. Plantas medicinais usadas pelos índios Tapebas do Ceará. Rev. Bras. Farmacogn. 15, 169–177.
Moreira, D.L., Guarim-Neto, G., 2009. Usos múltiplos de plantas do Savanna woodland: um estudo etnobotânico na comunidade sítio Pintura, Rosário Oeste, Mato Grosso. Bras. Polibot. 27, 159–190.
Nascimento-Silva, O., Chinalia, L.A., Paiva, J.G.A., 2008. Caracterização histoquímica dos folíolos de *Spondias tuberosa* Arruda (Anacardiaceae Lindl.). Rev. Caatinga 21, 62–68.
Neves, O.S.C., Carvalho, J.G., Rodrigues, C.R., 2004. Crescimento e nutrição mineral de mudas de umbuzeiro (*Spondias tuberosa* Arr. Cam.) submetidas a níveis de salinidade em solução nutritiva. Ciênc. Agrotéc. 28, 997–1006.
Nishino, H., Hayashi, T., Arisawa, M., Satomi, Y., Iwashima, A., 1993. Antitumor-promoting activity of scopadulcic acid B, isolated from the medicinal plant *Scoparia dulcis* L. Oncology 50, 100–103.
Odugbemi, T.O., Akinsulire, O.R., Aibinu, I.E., Fabeku, P.O., 2007. Medicinal plants useful for malaria therapy in Okeigbo, Ondo state, southwest Nigeria. Afr. J. Tradit. Complement. Altern. Med. 4, 191–198.
Ohsaki, A., Yan, L.T., Ito, S., Edatsugi, H., Iwata, D., Komoda, Y., 1994. The isolation and in vivo potent antitumour activity of clerodane diterpenoid from the oleoresin of the Brazilian medicinal plant, *Copaifera langsdorffii* Desf. Bioorg. Med. Chem. 4, 2889–2892.
Oliveira, A.C., Leal-Cardoso, J.H., Santos, C.F., Morais, S.M., Coelho-De-Souza, A.N., 2001. Antinociceptive effects of the essential oil of *Croton zehntneri* in mice. Braz. J. Med. Biol. Res. 34, 1471–1474.
Oliveira, A.L.S., Figueiredo, A.D.L., 2007. Prospecção fitoquímica das folhas de *Stryphnodendron adstringens* (Mart.) Coville (*Leguminosae-Mimosae*). Rev. Bras. Biociênc. 5, 384–386.

Oliveira, D.R., Brito, F.E., Bento, E.B., Matias, E.F.F., Sousa, A.C.A., Costa, J.G.M., Coutinho, H.D.M., Kerntopf, M.R., Menezes, I.R.A., 2011. Antibacterial and modulatory effect of *Stryphnodendron rotundifolium*. Pharm. Biol. 49, 1265–1270.

Oliveira, F.C.S., Barros, R.F.M., Moita Neto, J.M., 2010a. Plantas medicinais utilizadas em comunidades rurais de Oeiras, semiárido piauiense. Rev. Bras. Plantas Med. 12, 282–301.

Oliveira, G.L., Oliveira, A.F.M., Andrade, L.H.C., 2010b. Plantas medicinais utilizadas na comunidade urbana de Muribeca, Nordeste do Brasil. Acta Bot. Bras. 24, 571–577.

Paiva, L.A.F., Gurgel, L.A., De Souza, E.T., Silveira, E.R., Silva, R.M., Santos, F.A., Rao, V. S.N., 2004. Protective effect of *Copaifera langsdorffii* oleo-resin against acetic acid-induced colitis in rats. J. Ethnopharmacol. 93, 51–56.

Pandey, V.B., Singh, J.P., Mattocks, A.R., Bailey, E., 1983. A note on isolation and pharmacological action of heliotrine, the major alkaloid of *Heliotropium indicum* seeds. Planta Med., 49.

Pari, L., Latha, M., 2004. Protective role of *Scoparia dulcis* plant extract on brain antioxidante status and lipidperoxidation in STZ diabetic male Wistar rats. BMC Complement. Altern. Med. 4, 16.

Paulino, R.C. Henriques, Coelho, G.P.S.A., Araújo, P.V.N., M.F.M., 2011. Riqueza e importância das plantas medicinais do Rio Grande do Norte. Rev. Biol. Ciênc. Terra 11, 157–168.

Pereira, B.M., da Silva, B.P., Pereira, N.A., Parente, J.P., 2000. Anti-inflammatory and immunologically active polysaccharides of *Periandra mediterranea*. Phytochemistry 54, 409–413.

Reddy, J.S., Rao, P.R., Reddy, M.S., 2002. Wound healing effects of *Heliotropium indicum, Plumbago zeylanicum* and *Acalypha indica* in rats. J. Ethnopharmacol. 79, 249–251.

Ribeiro, D.A., Oliveira, L.G.S., Macêdo, D.G., Menezes, I.R.A., Costa, J.G.M., Silva, M.A. P., Lacerda, S.R., Souza, M.M.A., 2014. Promising medicinal plants for bioprospection in a Savanna woodland area of Chapada do Araripe, Northeastern Brazil. J. Ethnopharmacol. 155, 1522–1533.

Rocha, E.A.L.S.S, Carvalho, A.V.O.R., Andrade, S.R.A., Trovão, D.M.M.B., Medeiros, A.C. D., Costa, E.M.M.B., 2013. Atividade antimicrobiana de extratos hidroalcoólicos de plantas medicinais do Nordeste brasileiro. Pesqui. Bras. Odontopediatr. Clín. Integr. 13, 233–238.

Rodrigues, V.E.G., Carvalho, D.A., 2001. Levantamento Etnobotânico de plantas medicinais no domíniodo Savanna woodland na região do Alto Rio Grande-Minas Gerais. Rev. Ciênc. Agrotéc. 25, 102–123.

Roque, A.A., Rocha, R.M., Loiola, M.I.B., 2010. Uso e diversidade de plantas medicinais da Caatinga na comunidade rural de Laginhas, município de Caicó, Rio Grande do Norte (nordeste do Brasil). Rev. Bras. Plantas Med. 12, 31–42.

Sá, I.B., Taura, A.T., Drumond, A.M., Cunha, T.J.F., Oliveira, V.R., Sá, I.I.S., 2009. Zoneamento da região do Araripe para indicação de atividades florestais sustentáveis com base em dados orbitais. In: Anais, X.I.V. (Ed.), Simpósio Brasileiro de Sensoriamento Remoto. INPE, Natal, Brasil, pp. 6297–6304.

Saraiva, R.A., Araruna, M.K.A., Oliveira, R.C., Menezes, K.D.P., Leite, G.O., Kerntopf, M. R., Costa, J.G.M., Rocha, J.B.T., Tome, A.R., Campos, A.R., Menezes, I.R.A., 2011a. Topical anti-inflammatory effect of Caryocar coriaceum Wittm. (Caryocaraceae) fruit pulp fixed oil on mice ear edema induced by different irritant agents. J. Ethnopharmacol. 136, 504–510.

Saraiva, R.A., Matias, E.F.F., Coutinho, H.D.M., Costa, J.G.M., Souza, H.H.F., Fernandes, C.N., Rocha, J.B.T., Menezes, I.R.A., 2011b. Synergistic action between Caryocar coriaceum Wittm. fixed oil with aminoglycosides in vitro. Eur. J. Lipid Sci. Technol. 113, 967–972.

Santos, F.A., Cunha, G.M.A., Viana, G.S.B., 1998. Antibacterial activity of essencial oils from *Psidium* and *Pilocarpus* species of plants. Phytother. Res. 12, 24–27.

Santos, W.R., Bernardo, R.R., Peçanha, L.M.T., Palatnik, M., Parente, J., de Sousa, C.B. P., 1997. Haemolytic activities of plant saponins and adjuvants. Effect of *Periandra mediterranea* saponin on the humoral response to the FML antigen of Leishmania donovani. Vaccine 15, 1024–1029.

Schenkel, E.P., Gosmann, G., Petrovick, P.R., 2004. Produtos de origem vegetal e o desenvolvimento de medicamentos cap. 15. Simões, C.M.O., Schenkel, E.P., Gosmann, G., Mello, J.C.P., Mentz, L.A., Petrovick, P.R. (Eds.), Farmacognosia: Da Planta ao Medicamento (Org.), quinta ed. Editora da UFRGS/Editora da UFSC, Porto Alegre/Florianópolis, pp. 371–400.

Silva, A.C.O., Albuquerque, U.P., 2005. Woody medicinal plants of the caatinga in the state of Pernambuco (Northeast Brazil). Acta Bot. Bras. 19, 17–26.

Silva, A.J.R., Andrade, L.H.C., 2005. Etnobotânica nordestina: estudo comparativo da relação entre comunidades e vegetação na Zona do Litoral – Mata do Estado de Pernambuco. Bras. Acta Bot. Bras. 19, 45–60.

Silva, C.S.P., Proença, C.E.B., 2008. Uso e disponibilidade de recursos medicinais no município de Ouro Verde de Goiás, GO, Brasil. Acta Botân. Bras. 22, 481–492.

Silva, D.A., Silva, T.M.S., Lins, A.C.S., Costa, D.A., Cavalcante, J.M.S., Matias, W.N., Souza, M.F.V., Braz filho, R., 2006. Constituintes químicos e atividade antioxidante de *Sida galheirensis* Ulbr. (Malvaceae). Quím. Nova 29, 1250–1254.

Silva, V.A., Nascimento, V.T., Soldati, G.T., Medeiros, M.F.T., Albuqueruque, U.P., 2010. Técnicas para análise de dados etnobiológicos. In: Albuquerque, U.P., Lucena, R. F.P., Cunha, L.V.F.C. (Eds.), Métodos e Técnicas na Pesquisa Etnobiológica e Etnoecológica. NUPPEEA, Recife, pp. 189–206.

Siqueira, R.J.B., Magalhães, P.J.C., Leal-Cardoso, J.H., Duarte, G.P., Lahlou, S., 2006. Cardiovascular effects of the essential oil of *Croton zehntneri* leaves and its main constituents, anethole and estragole, in normotensive conscious rats. Life Sci. 78, 2365–2372.

Sobral-Souza, C.E., Leite, N.F., Cunha, F.A., Pinho, A.I., Costa, J.G., Coutinho, H.D., 2014. Evaluation of the Cytoprotective and Antioxidant Activity of the Extracts of *Eugenia uniflora* Lineau e *Psidium sobraleanum* Proença & Landrum Against Heavy Metals. Rev. Cienc. Salud 12, 401–409.

Souza, L.F., 2007. Recursos vegetais usados na medicina tradicional do Savanna woodland (comunidade de Baús, Acorizal, MT, Brasil). Rev. Bras. Plantas Med. 9, 44–54.

Souza, R.K.D., da Silva, M.A.P., de Menezes, I.R.A., Ribeiro, D.A., Bezerra, L.R., de Almeida Souza, M.M., 2014. Ethnopharmacology of medicinal plants of carrasco, northeastern. Braz. J. Ethnopharmacol. 157, 99–104.

Srinivas, K., Rao, M.E.B., Rao, S.S., 2000. Anti-inflammatory activity of *Heliotropium indicum* Linn. and *Leucas aspera* Spreng. in albino rats. Indian J. Pharmacol. 32, 37–38.

Tresvenzol, L.M., 2007. Estudo sobre o comércio informal de plantas medicinais em Goiânia e cidades vizinhas. Rev. Eletrôn. Farm. 3, 23–28.

Trotter, R., Logan, M., 1986. Informant consensus: a new approach for identifying potentially efffective medicinal plants. In: Etkin, N.L. (Ed.), Indigenous Medicine and Diet: Biobehavioural Approaches. Redgrave, Bedford Hills, New York, pp. 91–112.

Trzeciak, M.B., Das Neves, M.B., Vinholes, P.S., Villela, F.A., 2008. Utilização de sementes de espécies oleaginosas para produção de biodiesel. Inf. ABRATES 18, 30–38.

Veiga Junior, V.F., Pinto, A.C., 2002. O Gênero *Copaifera* L. Quím. Nova 25, 273–286.

Viana, G.S.B., Bandeira, M.A.M., Matos, F.J.A., 2003. Analgesic and antiinfl ammatory effects of chalcones isolated from *Myracrodruon urundeuva* Allemão. Phytomedicine 10, 189–195.

Viana, G.S.B., Bandeira, M.A.M., Moura, L.C., Souza-Filho, M.V.P., Matos, F.J.A., Ribeiro, R.A., 1997. Analgesic and antiinfl ammatory effects of the tannin fraction from *Myracrodruon urundeuva* Fr. All. Phytother. Res. 11, 118–122.

WHO – World Health Organization, 2010. ICD-10: International Classification of Diseases and Related Health Problems, Tenth Revision. WHO Library Cataloguing-in-Publication Data.