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ECOSYSTEMS

Priority conservation of medicinal woody plants from protected forests based on ecological and ethnobotanical data

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Abstract: The combination of ethnobotanical and ecological knowledge is an important tool in indicating priority species for conservation. We sought to gather ethnobotanical knowledge on the diversity and use of woody medicinal plants in the Chapada Araripe region, assessing the real availability of woody medicinal resources in the Araripe Forests in the cerrado and carrasco areas, and indicate priority species for conservation. A total of 107 species were recorded in the ethnobotanical surveys, classified into 39 families and 83 genera, of which 92 species, 36 families and 70 genera for the cerrado areas, and 47 species, 25 families and 39 genera, for the carrasco areas. 59% were present in the phytosociological surveys for cerrado and 38% for carrascos. Species with high versatility of medicinal use did not necessarily have high local availability, and some were not recorded in the sampling. Thirteen species in cerrados and four in carrascos were indicated as conservation priorities. Use not aligned of species with the reality of the present time can indeed affect the vegetation landscape, and in a future scenario, not taking local measures to conserve protected forest resources, besides increasing the lists of local conservation priorities, can affect economic practices, increasing social and environmental conflicts.

Key words: Savanna, Carrasco, resource availability, conservation problems.

INTRODUCTION

The conservation of biological diversity is a global challenge (Forzza et al. 2012, Ulloa-Ulloa et al. 2017, Archibald et al. 2020), especially in large countries with high physical and climatic heterogeneity, which are reflected in their different ecosystem types and biological diversity (Van-Wyk & Prinsloo 2018, Schultz et al. 2020).

One of the strategies adopted for the conservation of biological diversity has been the establishment of protected areas or conservation units - Ucs (Dias & Hoft 2013). However, these areas of protection do not necessarily prevent local people from making use of their resources (Andrade et al. 2015, Mammides 2020), as is the case near the Chapada do Araripe in Brazil (Zank & Hanazaki 2017, Silva et al. 2019).

The relationship between people and resources provides them with knowledge about the location, size, and availability of the exploited resource. This knowledge has been made available in ethnobotanical studies, and if added to the actual biological data of the availability of the resource in the forests and the

socio-economic information of the populations, it enables actions for the development of management plans that consider the local conservation priorities (Albuquerque & Andrade 2002, Kristensen & Braslev 2003, Andrade et al. 2015). The conservationist approach that considers local ecological knowledge brings the idea of a biocultural conservation scenario, which favors management actions that minimize socio-environmental conflicts in the regions (Monteiro et al. 2006, Albuquerque et al. 2009, 2011, Lucena et al. 2013, Campos et al. 2018, Silva et al. 2019).

Among the uses of phytodiversity, the medicinal one has particular importance, especially for low-income populations, for the treatment of different diseases. The collection of bark, fruits and leaves of medicinal plants generates consequences for plant populations and may reduce the reproduction rate of some species (Baldauf & Santos 2013, 2014, Baldauf et al. 2014, Gaoue et al. 2016).

The medicinal use of plants in forests associated or not with the use of pharmaceutical drugs is old and frequent in several regions of the world (Monteiro et al. 2011, Petrovska 2012, Maldonado et al. 2013, Zank & Hanazaki 2017, Silva et al. 2019, Cámara-Leret & Dennehy 2019, Paredes et al. 2020). However, the collection of medicinal resources often generates local conservation problems, depending on the intensity of use, the size of the population and the part of the plant used. The solution to such a problem can be complex, especially in forests with great biological diversity and requires knowledge about the real availability of the flora species to define conservation priorities. Moreover, according to the availability hypothesis (Albuquerque et al. 2019), the local importance of a resource depends on its abundance, which can be influenced by different factors, and collectors adopt strategies that optimize the energy and time spent to obtain the resource.

Admitting that the definition of priority plants for conservation should be based on ecological, pharmacological, commercial aspects, and knowledge that people have about the resource used (Bisht et al. 2006, Silva et al. 2019), we aim in this study: 1. Gather ethnobotanical knowledge about the diversity of woody medicinal plants in the Chapada do Araripe region and their uses, 2. Evaluate the actual availability of woody medicinal resources in the Araripe FLONA, and 3. Indicate priority species for conservation.

Thus, we tried to answer the following questions: 1. Which species have the greatest versatilidade of therapeutic use? 2. Are species of high versatility of medicinal use species of high abundance in the forest patch? 3. which parts of the plants are most used? 4. Which species need priority actions for conservation?

MATERIALS AND METHODS

Field of study

The survey was conducted using secondary and primary data obtained in the region of the Chapada do Araripe. The studied communities are located in the states of Ceará and Pernambuco, within the Environmental Protection Area - APA Araripe (9400 km²), and the FLONA- Araripe (380 km²) (Figure 1). The Chapada do Araripe is inserted in the equatorial tropical climate zone - Equatorial hot type zone. Most of the Chapada region has a "semi-arid, tropical or subtropical" climate with an average temperature of 21-28°C and humidity of 60-70%. However, in the center of it, a small area is classified as "Sub-humid, tropical or subtropical" with average temperatures of 20-27°C and humidity 70-80% and another small area is classified as "Sub-humid dry, tropical or subtropical" with average

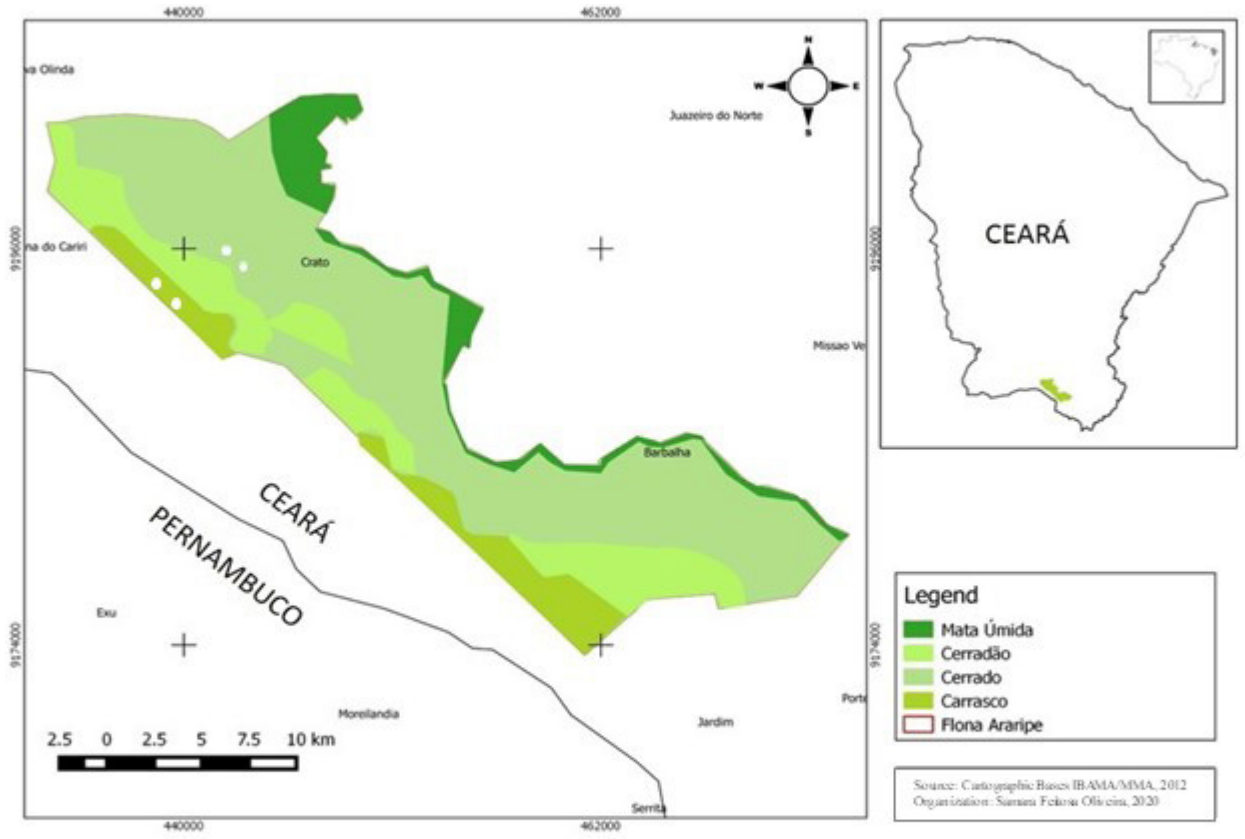

Figure 1. Geographic location of the vegetation sample areas, Chapada do Araripe, Brazil.

temperatures of 20-27°C and humidity 65-76% (Brazil 2010).

In general, the plateau presents an altitude ranging from 700 m to 1000 m; average annual precipitation ranging from 600 mm to 1300 mm (Brazil 2010); different soil patches classified as Litolic, Red-Yellow Latosol, Red-Yellow Podzolic, Similar Structured Thighs and Vertissols and a mosaic of vegetational types classified as Spiny Caducifolic Forest, Rainforest Subcaducifolia Tropical Pluvial, Rainforest Subperenifolia Tropical Pluvio-Nebular and Xeromorfa Subcaducifolia Tropical (IPECE 2015), being the predominant cerrado vegetation, with about 27.5% of the total area of the Araripe National Forest, and the carrasco with the corresponding 6.67% of the total area of the FLONA (Costa et al. 2004, Ribeiro-Silva et al. 2012).

Many rural communities (Serra do Zabelê, Barreiro Grande, Betânia, Matozinho, Estância, Serra do Zé Gomes, Mangueira, Minguiriba, Horizonte, Macaúba, Cacimbas and Baixa do Maracujá) are located inside the APA-Araripe and in the surroundings of the FLONA-Araripe, and collect timber and non-timber forest resources for different purposes (Souza et al. 2014, Ribeiro et al. 2014, Campos et al. 2015, Cavalcanti et al. 2015, Silva et al. 2019). The extraction pressure is higher in the cerrado vegetation, for being the predominant physiognomy for the Chapada do Araripe; while it is lower in the carrasco vegetation, for occupying a smaller territorial extension, and is located in a more central area and of difficult access, being part of the area where the forest management organs, do not allow collection of recuros by the communities of the Chapada do Araripe.

Besides, all communities present agriculture as the main economic activity, followed by other activities, including the trade of products in nature from the forests or manufactured by hand (Souza et al. 2014, Ribeiro et al. 2014, Feitosa et al. 2014, Campos et al. 2015, Cavalcanti et al. 2015, Silva et al. 2019).

Secondary data: ethnobotanical survey.

The ethnobotanical survey was based on secondary data, from the plant ecology laboratory of the Regional University of Cariri, which originated several dissertations from the postgraduate course in Molecular Bioprospecting - URCA, collected in eight communities surrounding Chapada do Araripe, in environments Cerrado and Carrasco, in the localities of Serra do Zabelê -Nova Olinda (Ribeiro et al. 2014), Barreiro Grande - Crato (Macedo et al. 2016), Betânia - Barbalha (Macedo et al. 2016) state of Ceará; Matozinho, Estância, Serra do Zé Gomes and Mangueira - Exu (Saraiva et al. 2015) state of Pernambuco and Minguiriba on the border of the two states (Souza et al. 2014).

The selection of these communities was based on similar criteria in the methodological procedure of conducting the research, where access to the ethnobotanical knowledge of all participants in the work was done through the semi-structured interview technique (Albuquerque et al. 2010), covering questions related to the medicinal uses of the species. The number for all areas was the total census, with one interview per household.

The study was approved by the Research Ethics Committee of the Regional University of Cariri, through Opinion No. nº 3.024.194, and registered with the National System for Management of Genetic Heritage and Associated Traditional Knowledge - SisGen.

Primary data: availability of species in the forests

To assess the local availability of species mentioned in ethnobotanical surveys (Ribeiro et al. 2014, Souza et al. 2014, Saraiva et al. 2015, Macedo et al. 2016), four vegetational sampling areas were selected (2 cerrado and 2 carrasco areas - Figure 1). The criterion for selection of the areas was based on the regulations of the management plan of the protected area, and an area was selected for each physiognomy where access is allowed for the local population for collection, which is about 3 km from the community and another area, also for each type of vegetation studied, where access is not allowed, which is about 7 km from the community and functioned as control areas for observation of the effects of collection on resource availability.

Following the systematic sampling method, for the implementation of the sampling units in the different vegetation types, 60 plots of 10 x 20 m were allocated, totaling 4.8 hectares of vegetation sampling, for the areas with cerrado and carrasco. The plots were located at a distance of 10 m from each other, and for all were sampled all living individuals that at 30 cm from ground level had a stem diameter greater than 3 cm and height greater than 1 m. The plot method and the 3 cm diameter criterion were adopted because it is commonly used to study woody vegetation (Felfili et al. 2005, Araújo & Ferraz 2010).

The availability of the species was assessed based on the number of individuals in the sample (N) and on the phytosociological parameters of relative density (DRi), relative frequency (FR), relative dominance (DoR) and importance value (VI), which are the structural parameters that may be being altered as a result of the use/ withdrawal of the parts of the vegetation, by the surrounding populations, and are also the

usual numerical data for the calculation of conservation priority.

The sufficiency of floristic sampling was evaluated by the species accumulation curve, through the rarefaction method, and by the non-parametric richness estimation by Bootstrap (Efron 1979) and Chao (Chao 1984, 1987) estimators, calculated with the help of the R (R Development Core Team 2019).

Identification of plant species

For the species cited as medicinal, and for the floristic survey of the areas, species found in the reproductive stage were collected with duplicates, by authorization of the Biodiversity Authorization and Information System - SISBIO, by nº63983-2, and taken to the Laboratory of Plant Ecology of the Regional University of Cariri, processed according to the usual techniques of herborization (Mori et al. 1989), and identified by the team of the Cariri Herbarium Dárdano de Andrade-Lima of the Universidade Regional do Cariri- URCA, by comparison with previously identified material and based on specialized literature. Those whose identification was not possible were sent to specialists from other herbaria for proper botanical identification.

Calculation for woody species with conservation priority.

As a quantitative analysis tool for the assessment of threatened species, the score- based technique developed by Dzerefos & Witkowski (2001) and modified by Albuquerque et al. (2011) was used to identify possible species with priority for conservation. The criteria used to establish the scores are explained in Table I. The conservation priority index (CP) was calculated based on the formula: PC = 0.5 (EB) + 0.5 (RU), where EB corresponds to the Biological Score and RU to the Risk of Use. EB was calculated using the formula: EB = D x 10, where D corresponds to a score value (see Table I), assigned based on the relative density of each taxon (DRi) in the sampling. RU was calculated by the formula RU = 0.5 (H) + 0.5 (U) x 10, where H corresponds to the collection risk of the species (see a score in Table I) and U corresponds to the value of use, being determined by the sum of the means of local importance (L) and the diversity of use (V) of the species. The local importance value (L) was determined by the percentage of the number of informants who indicated a certain species as medicinal (Table I). The diversity of use (V) was scored based on the number of use types attributed to a species, ranging from 1 to 10. The use of wood for some species was associated with the calculations, adding 10 points (Table I). The PC index calculation allowed classifying medicinal plants into three categories (Dzerefos & Witkowski 2001): category 1: with a score value >80, including species that require high conservation priority, with the need for controlled collection and establishment of alternatives for their conservation; category 2: includes species with scores between 60 and 80, which have the potential to be collected, according to location and specific quotas; category 3: includes species with a value <60, which support higher collection intensity in the sampled area.

The relationship between the value of the use of the resource and its availability in the forests was evaluated through multiple regression, with a progressive stepwise procedure a posteriori, with the value of use being the independent variable and the relative pairings density, frequency and dominance the dependent variables. The analysis was performed with the help of the BioEstat 5.0 Program.

Table I. Score criteria for plants used, relative density, collection risk, local importance and diversity of use.

Criteria	Scores
A. Relative Density in the patch (D)	
Unregistered - very low (0-1)	10
Low (>1<3.5)	7
Medium (3.5<7)	4
High (≥7)	1
B. Collection risk (H)	
Destructive collection of the plant, or over exploitation of the roots or bark. Collection represents the removal of the individual.	10
Collection damaging perennial structures such as bark and roots, and removal of part of stem for latex extraction. Collection without causing the death of the individual.	7
It collects damaging permanent aerial structures such as leaves, which are removed. Collection that can affect the energy investment of plants survival and long-term reproductive success.	4
Collection by impairing the plant's transient aerial structures, such as flowers and fruits that are removed. The regeneration of the population can be altered in the long term by seed bank collections but the individual is not affected.	1
C. Local use (L)	
High (quoted by >75% of local informants) 10	10
Moderately high (cited by 50 ≤75% of local informants)	7
Moderately low (cited 25<50% of local informants)	4
Very low (quoted <25% <10% of local informants)	1
D. Diversity of use	
One point is added for each use, maximum 10 points	1-10

RESULTS

Diversity of medicinal plants of FLONA and APA do Araripe

The richness of medicinal species cited in the ethnobotanical studies was 107 species, belonging to 39 families and 83 genera (Table II), of which 92 species, 36 families and 70 genera registered in the cerrado areas and 47 species, 25 families and 39 genera registered in the carrasco areas. Of the 107 species, 31 were common to both types of vegetation. The most representative families for the cerrado and carrasco areas, respectively, were: Fabaceae (20 spp and 12 ssp), Euphorbiaceae (9 ssp and 5 ssp) and Apocynaceae (9 spp 5 spp).

The majority of species, from the cerrado and carrasco (aprox. 73%), had their medicinal uses linked to perennial structures (bark 29%, weaves 23% and roots 26%), also occurring the use of non-perennial structures (leaves 12%, fruits 8%, seeds 1%, and flowers 1%) and 66% of the species showed indication ofse of more than one structure and 34% had an indication of a single structure (Table II).

A total of 147 diseases were recorded, being coughs, colds, inflammations, scarring, and pain in general the most common (Table II). The diversity of therapeutic indications in the region of FLONA Araripe has been treated with the use of teas, emplasts, decoctions, lickers, baths with

the use of species occurring in native vegetation, as well as with the use of exotic species, kept in the backyards and/or bought in free fairs.

The species with the greatest diversity of medicinal uses attributed by the population were: *Copaifera langsdorffi* and *Ximenia americana* (22 types of uses each), *Hancornia speciosa* (19 types of uses), *Roupala montana* (16 types of uses), *Caryocar coriaceum, Himatanthus drasticus, Stryphnodendron rotundifolim* (15 types of uses each), *Myracrodruon urundeuva, Croton heliotropiifolius, Hymenaea courbaril* (14 types of uses each*), Rauvolfia sp 2, Libidibia ferrrea, Hybanthus ipecacuanha, Rosamarinus officinalis* (13 types of uses each), *Bowdichia virgilioides, Dimorphandra garderiana* (12 types of uses each), *Anacardium occidentale, Mentha spicata* (11 types of uses each), *Ziziphus joazeiro, Ruta graveolens, Kalanchoe pinata* (10 types of uses each).

Availability of species in the cerrado and carrasco areas

In all four sampled areas there was sufficient floristic sampling, based on the species accumulation curves with rarefaction (Figure 2) and the Chao and Boot richness estimators (Table III). However, of the 92 woody medicinal plants reported by the interviewees for the cerrado areas, only 54 (59%) were present in the phytosociological surveys. In the carrasco area, of the 47 medicinal species reported, only 18 (38%) occurred in vegetation sampling (Tables IV and V).

In cerrado vegetation, the highest relative densities were *Myrcia* sp in the conserved área (C1) and *Lochocarpus araripensis* in the o area anthropogenic (C2) (Tables IV and V). The most frequent species in the sampled (*Byrsonima sericea* Fr 5.87 C1 and Fr 5.39 C2, and *Myrcia* sp Fr 6.29 C1 and Fr 3.47 C2) did not have relevant importance for local use. The dominant species were *Byrsonima sericea* and *Copaifera langsdorffii*, both by the size of their populations and the sum of their basal areas in both C1 and C2 (Table IV) and these had higher medicinal indications (Table II). Only *Copaifera langsdorffi* and *Ximenia americana*, species with higher indications in ethnobotanical surveys, were among those with higher densities and frequencies in the sampling. All other species indicated for medicinal use by the communities had low population densities or did not occur in the sampling. Some of them such as: *Stryphnodendron rotundifolium, Anacardium microcarpum, Dimorphandra gardneriana, Croton heliotropiifolius, Hancornia speciosa* and *Roupala montana* showed considerable versatility of medicinal use.

In the carrasco vegetation, the highest population density was recorded for *Copaifera langsdorffii* (Table V) and the highest frequencies were recorded for *Maytenus rigida*, *Copaifera langsdorffii*, *Roupala montana* and *Psidium myrsinites* (Table V) for both analyzed areas. Among these species, only *Copaifera langsdorffii* and *Roupala montana* were indicated with diverse medicinal uses in ethnobotanical studies. As in the cerrado areas, the species of low density or low frequency in the area sampled by the carrasco had diversified medicinal uses.

Species use values (Tables IV and V) had no significant relationship with their availability in the areas sampled in cerrado 1 ($F(3.38)=0.76$; $p=0.52$), cerrado 2 ($F(3.30)=0.80$; $p=0.50$) and carrasco 2 ($F(3.10)=1.07$; $p=0.04$), considering the relative parameters, density, frequency and dominance (Tables IV and V), but had a relationship in the area of Carrasco 1 ($F(3.14)=3.24$; $p=0.053$, being the frequency the only variable with significant explanatory power in the analysis ($R^2=38.5\%$; $p=0.006$).

Table II. Species with indications for use by the communities of the Chapada do Araripe, near cerrado (a) and carrasco (b) areas in northeastern Brazil .

Families/Species/ vulgar name cerrado (a) carrasco (b)	Indication therapy	Part used	NH	Data source
Anacardiaceae				
Anacardium microcarpum L.- Cajuí (a)	Ulcer (a), wounds (a), external inflammation (a), snake bite (a), healing (a), gingivitis (a)	Cc (a), Fr (a)	9252	Macêdo et al. 2014; Ribeiro et al. 2014.
Anacardium occidentale L. - Cajú (a, b)	Cicatrizant (a b), diabetes (a), dental pain (a), inflammation in the dental (a), inflammation in the skin (a), inflammation in the mouth (b), aphids (b), flu (b), antipyretic (b), headache (b), inflamed throat (b)	Cc (a), Fr (a), Ec (a b), Fo (b)	9250	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016
Astronium fraxinifolium Schott. - Gonçalo-Alves (a)	Cough (a), flu (a), expectorant (a), bronchitis (a).	Ec (a), Cc (a)	9256	Ribeiro et al. 2014; Macêdo et al. 2016
Annonaceae				
Annona coriacea Mart. - Araticum (a, b)	Cobra mince (a), Dermatite (b), depurative (b)	Cc (a), Fo (a b), Ra (a), Fr (b)	9261	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016
Apocynaceae				
Ditassa sp. - Caninana (a)	Rheumatism (a)	Ra (a) , Fo (a).	9841	Ribeiro et al. 2014.
Hancornia speciosa Gomes - Mangaba (a b)	Strokes (a), inflammation of the uterus (a), stomach pains (a), gastritis (a b), varicose veins (a b), hernia (a) (abdominal), ulcer (a b), inflammation in general (a b), scarring (a), cancer (a b), uterine myoma (a), inflammation of the skin (a), cholesterol (a b), hypertension (b), depurative (b), heart disease (b), thyroid (b), inflammation of the intestines (b), stomach disease (b).	La (a b), Cc (a), Fr (a)	9254	Souza et al. 2014; Ribeiro et al. 2014; Macêdo et al. 2016
Himatanthus drasticus (Mart.) Plumel - Janaguba (a, b)	Cancer (a b), cough (a), gastritis (a b), ulcer (a b), diabetes (a), inflammation of the liver (a), hernia (a) (abdominal), worm (a), prostate cancer (a), inflammation of the spine (a), inflammation (b), stomach ailments (b), heart ailments (b), inflammation of the intestine (b), myoma (b).	Cc (a), Fo (a), La (a b)	9253	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Rauvolfia sp. 1 - Chacuaçá (a)	Dysentery, (a) bellyache	Ra (a), Cc (a)	9281	Ribeiro et al. 2014; Saraiva et al. 2015.
Rauvolfia sp. 2 - Quina-Quina (a)	Coryza (a), sinusitis (a), flu (a), headache (a), fever (a), internal inflammation (a), rheumatism (a), nasal congestion (a), bone pain (a), inflammation in the mouth (a), infection (a), sinusitis (a), rhinitis (a).	Cc (a), Ec (a), Fo (a)		Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Secondatia floribunda A.DC. -Catuaba-de-rama (a, b)	Aphrodisiac (a), sexual impotence (a b), Rheumatism (a), nerves (a), lung inflammation (a), depression (a).	Fo (a), Cc (a b), Ra (a)	9259	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.

Table II. Continuation

Secondatia diversiflora A. DC - Caninana (a)	Rheumatic pain (a), back pain (a), bone pain (a), muscle pain (a).	Ra (a)		Ribeiro et al. 2014; Macêdo et al. 2016.
Tabernaemontana catharinensis A. DC. - Grão de galo (a)	Maldigestion (a)	Ra (a)		Saraiva et al. 2015; Macêdo et al. 2016.
Aracaceae				
Acrocomia aculeata (Jacq.) Lodd. ex Mart. - Macaúba (a)	Problems with bones (a), arthrosis (a), nerve (a) .	Fr (a), Se (a)		Ribeiro et al. 2014; Saraiva et al. 2015
Syagrus oleracea (Mart.) Becc. - Catolé (a)	Inflammation of the urethra (a) and bladder (a)	Ra (a)		Saraiva et al. 2015
Asteraceae				
Acanthospermum hispidum DC. - Espinho de cigano (a)	Cough (a), flu (a), expectorant (a), bronchitis (a).	Ra (a)		Ribeiro et al. 2014; Saraiva et al. 2015
Barrosoa betonicaeformis (DC.) R.M.King & H.Rod. - Balaio de velho (a)	Constipation (a).	Fo (a), Cc (a), Ec (a), Ra(a)		Saraiva et al. 2015
Solidago chilensis Meyen - Arnica (a)	Inflammation (a), rheumatism (a), arthritis (a), arthrosis (a), pain in general (a).	Cc (a), Ec (a)		Saraiva et al. 2015
Artemisia absinthium L. - Losna (b)	Poor digestion (b), congestion (b), bellyache (b), colic (b).	Fo (b)	-	Souza et al. 2014.
Cnicus benedictus L. - Cardo-santo (b)	Bronchitis (b)	Se (b)		Souza et al. 2014.
Boraginaceae				
Cordia rufescens A. DC. - Uva-brava (a)	Earache (a)	Fr (a)	9260	Ribeiro et al. 2014.
Heliotropium indicum (L.) Lehm - Crista de galo (a)	Flu (a), headache (a), tiredness in the vision (a), inflammation (a), edema (a).	Fo (a), Fl (a), Ra (a), Ec (a)		Saraiva et al. 2015
Varronia leucomalloides (Taroda) J.S.Mill - Moleque duro (a)	Eye pain (a)	Fo (a)		Saraiva et al. 2015
Bignoniaceae				
Tabebuia impetiginosa (Mart. ex DC.) Standl. - Pau d'arco roxo (a)	Tuberculosis (a)	Cc (a)		Ribeiro et al. 2014.
Handroanthus sp. - Pau d'arco (a)	General pain (a), inflammation (a), cancer (a).	Cc (a)		Ribeiro et al. 2014; Saraiva et al. 2015
Jacaranda brasiliana (Lam.) Pers. - Caroba (b)	Cicatrizant (b)	Cc (b)	-	Souza et al. 2014.
Burseraceae				

Table II. Continuation

Protium heptaphyllum (Aubl.) Marchand - Amescla (a)	Headache (a).	Ra(a)		Macêdo et al. 2016.
Cactaceae				
Cereus jamacaru DC. - Mandacarú (a)	Blood thinner (a), asthma (a), fever (a), kidney failure (a), kidney stones (a), cyst in the ovaries (a), menstrual regulation (a).	Cc(a), Ra (a)		Ribeiro et al. 2014.
Harissia adscendens (Gürke) Britton Rose - Rabo-de- raposa (b)	Heartburn (b)	Ec (b)	6293	Souza et al. 2014.
Caryocaraceae				
Caryocar coriaceum Wittn. - Pequi (a, b)	Bronchitis (a b), cough (a b), general swelling (a), flu (a b), rheumatism (a b), expectorant (a b), throat inflammation (a), blows (a b), fever (a), burns (a), poor digestion (a), body aches (a), pneumonia (a), inflammation (b), antipyretic (b).	Fr (a), Fl (a b), Ol (b)	9245	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Celastraceae				
Celastraceae sp. 1 - Inharé (a)	Verminosa (a)	Ra (a)		Ribeiro et al. 2014; Saraiva et al. 2015;
Maytenus sp. - Engorda-bode (a)	Capillary invigorating (a)	Fr (a)	9290	Ribeiro et al. 2014.
Maytenus rigida Mart. - Bom nome (a, b)	Inflammation in uterus (a b), inflammation in general (a b), healing (a b).	Fr (a), Cc (b)		Souza et al. 2014; Macêdo et al. 2016.
Convolvulaceae				
Operculina macrocarpa (L.) Urb. -Batata de purga (a, b)	Worms (a), Hemorrhoid (b)	Ra (a b)		Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015.
Curcubitaceae				
Luffa operculata (L.) Cogn. - Cabacinha (b)	Sinusitis (b)	Fo (b), Fr (b)	-	Souza et al. 2014.
Erythroxylaceae				
Erythroxylum vacciniifolium Mart. - Catuaba de madeira (a, b)	Aphrodisiac (a), impotence (a b), depression (a).	Cc (a b), Fo (a)		Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015.
Erythroxylum sp. - Murta (a)	Cancer (a)	Fo (a)		Macêdo et al. 2016
Euphorbiaceae				
Croton sp. - Marmeleiro (a b)	Bellyache (a), poor digestion (a b).	Cc (a)	9283	Ribeiro et al. 2014; Saraiva et al. 2015.
Croton limae A. P. Gomes. M.F. Sales & P. E. Berry - Marmeleiro-preto (b)	Bellyache (b)	Cc (b)	6302	Souza et al. 2014.
Croton zehntneri Pax & K. Hoffm. - Velame-Branco (a)	Blood thinner (a), skin inflammation (a), wounds (a), infection (a), inflammation (a), influenza (a), blood thinner (a), cancer (a), boil (a).	Ra (a), Fo (a)	9286	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015.

Table II. Continuation

Croton argyrophylloides Mull Arg. - Caçatuba (a)	Stomach pain, bellyache, liver, diarrhea, poor digestion.	Ec (a), Ra (a)		Ribeiro et al. 2014; Saraiva et al. 2015.
Croton conduplicatus Kunth - Quebra faca (a)	Flu (a), tooth inflammation (a).	Fo (a), Cc (a)		Souza et al. 2014; Saraiva et al. 2015.
Croton heliotropiifolius Kunth - Velame preto (a, b)	Rheumatism (a), toothache (a), depurative (a), bellyache (a), fever (a), body pain (a), stomach problems (a), boils (a), flu (a), pain in general (a), inflammation (a), malaise (b), poor digestion (b), back pain (b).	Ra (a b), Fo (a b)	6300	Souza et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Jatropha molissima (Pohl) Baill. - Pinhão-branco ou manso (a, b)	Epilepsy (a), thrombosis (a), snake bite (a), depression (a), stroke (b).	Se (a), La (a b)	5775	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015.
Jatropha curcas L. - Pinhão brabo (a)	Dog bite (a), seal sting and scorpion (a).	La (a)		Saraiva et al. 2015.
Jatropha gossypiifolia L. - Pinhão roxo (a)	Headache (a), fatigue in sight (a)	Fo (a), La (a)		Souza et al. 2014; Saraiva et al. 2015.
Manihot sp. - Maniçoba (a)	Gripe (a), cough (a).	Ra (a), Fr (a).	10561	Ribeiro et al. 2014.
Phylanthus urinaria L. - Quebra- pedra (b)	Renal problems (b)	Ra(b) ou planta inteira (b)	6286	Souza et al. 2014; Saraiva et al. 2015.
Fabaceae				
Acosmium dasycarpum Benth. - Pau pra tudo (a)	Tosse(a), hernia(a).	Cc (a)		Macêdo et al. 2016.
Bauhinia cheilantha (Bong.) Steud. - Mororó (a, b)	Diabetes (a), high blood pressure (a), cholesterol (b)	Fo (a b)	9266	Souza et al. 2014; Ribeiro et al. 2014.
Bowdichia virgilioides Kunth. - Sucupira (a, b)	Back pain (a b), rheumatism (a b), aphrodisiac (sexual impotence) (a b), bone pain (a), inflammation of the skin (a b), arthrosis (a), cough (a b), flu (a b), kidneys (a), fever (a b), back pain (a), rheumatism (a b).	Cc (a b), Ec (a b)	9268	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Centrosema sp. - Alcançu (a, b)	Flu (a), sore throat (a), cough (b), asthma (b).	Ra (a b)		Souza et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016
Copaifera langsdorffii Desf. - Pau d'óleo ou Copaíba (a, b)	Flu (a b), rheumatism (a), headache (a), general pain (a), inflammation of the uterus (a b), fractures (a), wounds (a), kidney complications (a), gastritis (a), angina (a), swelling of the knee (a), beatings (a), healing (a b), cancer (a), inflammation (a b), constipation (a), depression (a), nerve (a), bellyache (a), lung inflammation (a), bellyache (b).	Cc (a b), Fo (a b), Re (a), Ec (a)	9833	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Dimorphandra garderiana Tull. -Faveira (a, b)	Cancer (a), general pain (a), conjunctivitis (a), cough (a b), healing (a b), flu (a), heart (a), wound (a), lung phlegm (a), herniated disc (a b), parrot beak (a b), depurative (a b).	Fr, Se, Cc	10564	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.

Table II. Continuation

Senna spectabilis (DC.) H.S. Irwin & Barneby - Canafístula-de-boi (b)	Itchy Skin (b)	Fo (b)	-	Souza et al. 2014.
Acacia langsdorffii Benth - Jiquiri (b)	Renal problems (b)	Fo (b)	-	Souza et al. 2014.
Dioclea grandiflora Mart. ex. Benth. - Mucunã (a)	Injury (a), inflammation of the skin (a).	Cc (a), Se (a)	9257	Ribeiro et al. 2014.
Enterolobium contortisiliquum (Vell.) Morong - Tamboril ou Timbaúba (a)	Asthma (a), ulcer (a), vaginal inflammation (a), bladder inflammation (a)	Cc (a), Ra (a)	9277	Ribeiro et al. 2014; Saraiva et al. 2015.
Erythrina velutina Willd. - Mulungu (a)	Menopause (a), improve healing (a)	Ec (a)		Ribeiro et al. 2014; Saraiva et al. 2015.
Hymenaea courbaril L. - Jatobá (a, b)	Cough (a b), flu (a b), bronchitis (a b) expectorant (a b), constipation (a), pulmonary and nasal clearance (a), intoxication (a), blood problems (a), antipyretic (b), headache (b), healing (b), pain in general (b), Inflammation (b).	Ec (a), Cc (a b), Fr (a b), La (b)	9837	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016
Hymenaea sp. - Jatobá roxo (a)	Influenza (a), tuberculosis (a), pneumonia (a).	Cc (a)		Saraiva et al. 2015.
Libidibia ferrea (Mart. ex Tul.) L.P.Queiroz - Pau-Ferro (a, b)	Blows (a), back pain (a) , cough (a), general pain (a), flu (a), internal and external inflammation (a), bone pain (a), fracture (a), bleeding (a), infections (a), Herniated disk (a), parrot beak (a).	Cc (a), Se (a), Ec (a), Fr (b)	9273	Ribeiro et al. 2014; Souza et al. 2014; Saraiva et al. 2015.
Lochocarpus araripensis Benth. - Angelim (a)	Skin allergy (a)	Fr (a)	9244	Ribeiro et al. 2014.
Machaerium acutifolium Vogel - Coração de Negro (a)	General pain (a), external and internal inflammation (a)	Ra (a), Ec (a)	4368	Ribeiro et al. 2014.
Mimosa tenuiflora (Willd.) Poir. - Jurema-preta (a)	General pain (a), external inflammation (a), healing (a), toothache (a).	Cc (a)	9251	Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Mimosa sensitiva L. - Malisa (a)	Fever (a)	Fo (a)		Saraiva et al. 2016.
Periandra mediterranea (Vell.) Taub. - Alcançu (a)	Lung inflammation (a), influenza (a), tuberculosis (a), cough (a), nasal clearance (a).	Ra (a)		Saraiva et al. 2016.
Stryphnodendron rotundifolium Mart. - Barbatimão (a, b)	Inflammation of the uterus (a b), genital affection (a), injury (a), inflammation in general (a b), cancer (a b), healing (a b), inflammation of the skin (a), pain in the belly (a), vaginal inflammation (a), pain in general (a), tuberculosis (a), respiratory fatigue (b), bleeding (b), depuration (b), inflammation of the ovary (b).	Cc (a b), Ec (a)	9263	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Anadenanthera macrocarpa (Benth.) Brenan - Angico (a, b)	Expectorant (a), flu (a), leukemia (a), bronchite (b)	Ec (a), La (b)		Souza et al. 2014; Ribeiro et al. 2014.
Senna occidentalis (L.) Link. - Manjirioba (a)	Headache (a), thrombosis (a), cough (a), flu (a), stroke (a).	Ra (a), Fr (a)		Saraiva et al. 2015; Macêdo et al. 2016.

Table II. Continuation

Senna sp. - Canafístula (b)	Dermatitis(b)	Fo (b)	6308	Souza et al. 2014.
Lecythidaceae				
Eschweilera ovata (Cambess.) Mart. Ex. Miers - Imbiriba (a, b)	Gases (a b)	Fr (a), Fl (b)	5838	Souza et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Malpighiaceae				
Byrsonima sericea DC. - Murici (a)	High cholesterol (a), healing (a), wounds and dermatoses (a)	Cc (a), Ec (a)	9291	Ribeiro et al. 2014; Saraiva et al. 2016.
Malvaceae				
Ceiba glaziovii (Kuntze) K.Schum. - Barriguda (a)	Spinal pain (a), general pain (a), inflammation of the prostate (a)	Cc (a), Ec (a)		Ribeiro et al. 2014; Saraiva et al. 2016.
Myrtaceae				
Psidium sp. - Araçá de veado (a, b)	High blood pressure (a), nerve (a), healing (a b), tummy ache (a b), ulcer (a b), diarrhea (a b), poor digestion (b).	Cc (a b), Fo (a b) Ra (b)	5778	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Myrcia sp. - Chumbinho (a)	Skin allergy (a), itching (a)	Cc (a), Fr (a)		Ribeiro et al. 2014
Paramyrciaria cf. strigipes (O.Berg.) Sobral - Cambuí (a, b)	Inflammation in general (a), toothache (a), cramp (b), oedema (b), bellyache (b).	Cc (a b), Fr (a), Fo (b)	9246	Ribeiro et al. 2014; Souza et al. 2014;
Psidium myrsinites DC. - Araçá ou Goiabinha (a, b)	Bellyache (a b), diarrhoea (a b), healing (b), ulcer (b)	Fo (a b), Cc (a b), Fr (a), Ra (b)	9279	Souza et al. 2014; Ribeiro et al. 2014.
Nyctaginaceae				
Guapira oppositia (Vell.) Reitz - Pau piranha (a)	Cleanses the uterus after delivery (a)	Cc (a)		Saraiva et al. 2016.
Olacaceae				
Ximenia americana L. - Ameixa (a, b)	Inflammation of the skin (a), healing (a b), pain in the spine (a), injury (a), gynecological inflammation (a b), internal inflammation (a b), inflammation in the throat (a), kidney pain (a), bone contusion (a), blister (a), inflammation of the prostate (a), bumps (a), cough (a), flu (a), infection (a), pain in general (a), dermatitis (b), antipyretic (b), headache (b), diabetes (b), boil (b), edema (b)	Cc (a b), Ec (a b)	5912	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Passifloraceae				
Passiflora cincinnata Mast. - Maracujá-do-Mato (a, b)	Calming (a b), nervousness (a), insomnia (a), kidney failure (a), high blood pressure (a b), inflammation (a)	Fr (a), Ra (a), Fo (a b)	9276	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016
Turnera ulmifolia L. Chanana (b)	Teething child (b), Coughing (b)	Fo (b)	6294	Souza et al. 2014.
Phytolaccaceae				

Table II. Continuation

Petiveria alliacea L. - Tipí ou pau pra tudo (a, b)	Spinal pain (a), inflammation of the kidneys (b)	Ra (a), Fo (b)	6319	Souza et al. 2014; Saraiva et al. 2015.
Piperaceae				
Piper aduncun L - Pimenta-de-nico (b)	Gases (b)	Fo (b)	5771	Souza et al. 2014.
Plantaginaceae				
Scoparia dulcis L. - Vassourinha (a, b)	Cough (a), flu (a, b), tooth birth (a), kidney inflammation (a, b), measles (a), fever (a), menopause (a), chickenpox (a, b).	Ra (a)	9288	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015.
Polygalaceae				
Bredemeyera brevifolia (Benth.) Klotzsch ex A.W. Benn. - Mau-vizinho (a)	Kidney pain (a), back pain (a)	Cc (a)	9834	Ribeiro et al. 2014.
Bredemeyera floribunda Willd. - Pau-gemada (a)	Fortificant (a), stomach problems (a)	Cc (a), Ra (a)		Ribeiro et al. 2014.
Coccoloba sp. - Croaçú (b)	Verminose (b)	Raiz (b)	-	Souza et al. 2014.
Proteaceae				
Roupala montana Aubl. - Congonha (a, b)	Nervousness (a), tranquilizer (a), menstrual cramps (a), high blood pressure (a), migraine (a), muscle cramps (a), heart disease (a), fever (a), stomach (a), gastritis (a), against cancer (a), kidney pain (b), malaise (b), tranquilizer (b), leg pain (b), spine (b).	Fo (a b)	9267	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015; Macêdo et al. 2016.
Rhamnaceae				
Colubrina cordifolia Reissek - João-vermelho (a)	Furious (a), healing (a).	Fo (a).		Ribeiro et al. 2014.
Rubiaceae				
Coutarea haxandra (Jacq.) K. Schum - Quina-quina da flor roxa (a, b)	Rheumatism (a), flu (a), sinusitis (b), inflammation in teeth and mouth (b)	Cc (a b), Fo (b)	9289	Souza et al. 2014; Ribeiro et al. 2014.
Guettarda viburnoides Cham. & Schltdl. Angélica (a)	Inflammation in the throat (a), pain in general (a)	Fo (a), Cc (a)	9287	Ribeiro et al. 2014.
Tocoyena formosa (Cham. & Schlecht.) Schum. - Jenipapo-Brabo ou jenipapinho (a, b)	Fractures (a), twists (a), bone contusion (a), blows (a), swelling by blows (a), animal sting (a), healing (b)	Fo (a), Cc (a), Ec (a), La (b)	9274	Souza et al. 2014; Ribeiro et al. 2014; Macêdo et al. 2016.
Rutaceae				
Zanthoxylum gardneri Engl. - Laranjinha (a)	Inflamed wounds (a), influenza (a), diarrhoea (a), headache (a)	Ec (a), Fo (a), Fr (a)		Ribeiro et al. 2014; Macêdo et al. 2016.
Sapindaceae				
Serjania laruotteana Cambess. - Croapé (a b)	Toothache (a), inflammation in the tooth (a b), inflammation in the gums (a)	Fo (a), Ra (a b), Cc (a).	9249	Souza et al. 2014; Ribeiro et al. 2014.

Table II. Continuation

Scrophulariaceae				
Scoparia dulcis L. - Vassourinha (a, b)	Inflammation (a,b), uterine inflammation (b)	Ra (a, b)	-	Souza et al. 2014; Ribeiro et al. 2014; Saraiva et al. 2015.
Sapotaceae				
Sideroxylon obtusifolium (Roem. & Schult.) T.D.Penn. - Quixabeira (a)	Internal inflammation (a), intestinal obstruction (a), strokes (a), oedema (a), inflammation in utero (a).	Cc (a), Ec (a)		Ribeiro et al. 2014.
Smilacaceae				
Smilax japecanga Griseb. - Japecanga (a)	Inflammation of the tooth (a), rheumatism (a), edema (a), kidney problems (a).	Ra (a)	9839	Ribeiro et al. 2014; Saraiva et al. 2015.
Solanaceae				
Solanum paniculatum L. - Jurubeba (a)	Cough (a), flu (a), liver pain (a), gallstones (a), câncer (a), kidney inflammation (a).	Ra (a), Fr (a), Fo (a).	9275	Ribeiro et al. 2014; Saraiva et al. 2015.
Solanum sp. - Sacatinga (a)	Hemorrhoid (a), worms (a)	Ra (a)	9284	Ribeiro et al. 2014.
Solanum sp. - Velame-Roxo (a)	Rheumatism (a)	Ra (a)	9285	Ribeiro et al. 2014.
Solamum aculeatissimum Jacq. - Melancia da praia ou gogoia (a)	Inflammation of the kidneys (a), pain in the urine (a)	Fo (a), Ra (a)		Saraiva et al. 2015.
Urticaceae				
Cecropia pachystachya Trécul - Toré ou Torem (a)	Renal complications (a)	Fo (a), Cc (a)		Ribeiro et al. 2014; Saraiva et al. 2015.
Verbenaceae				
Lantana camara L. - Camará ou Chumbinho (a, b)	Body aches (a), cough (b)	Fo (a), Fl (b)	9269	Souza et al. 2014; Ribeiro et al. 2014.
Morphospecies				
Morphospecies 1 - Erva de peba (a)	Febre (a), rheumatism (a), colunna dors (a), muscle dors (a)	Ra (a)		Saraiva et al. 2015.
Morphospecies 2 - Nogueira (a)	Rheumatism (a), inflammation (a).	Se (a)		Saraiva et al. 2015.

(Cc = bark, Fr = fruit, Fl = flower, Ec = weaves, Fo = leaf, Ra = root, La = latex, Ol = oil, Se = seed, HN: herbarium number).

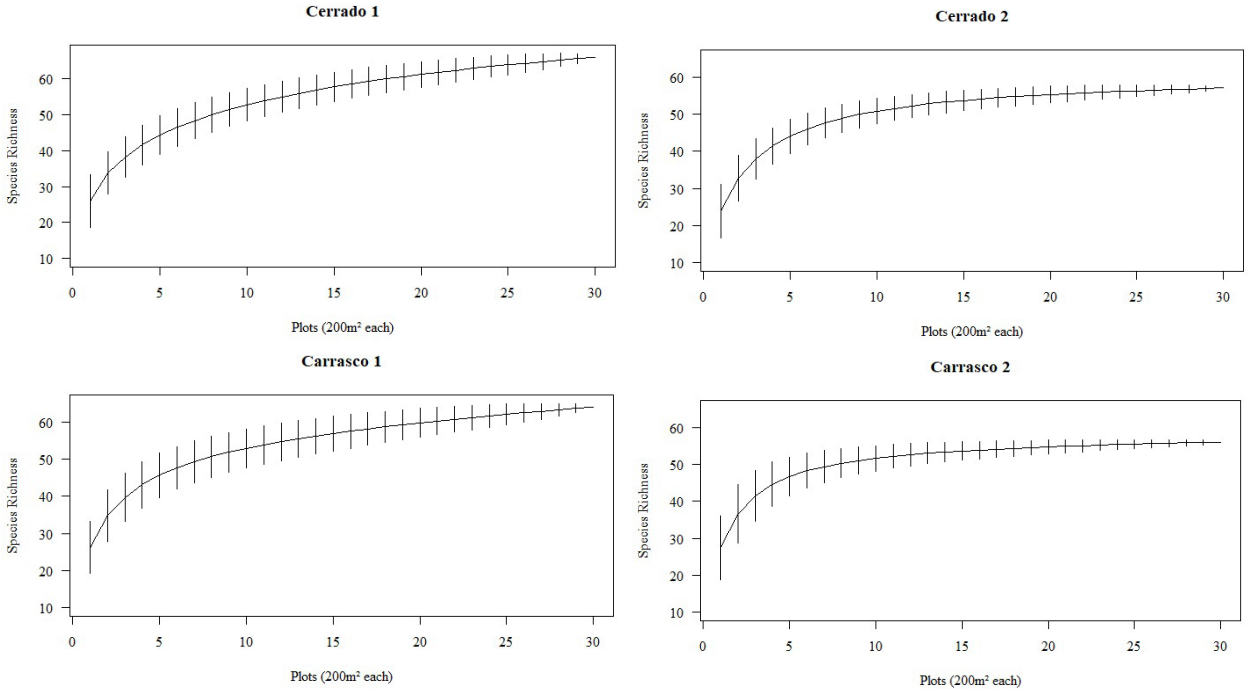

Figure 2. Species accumulation curve, with rarefaction, for Cerrado and Carrasco areas.

Table III. Estimation of sampling sufficiency by Chao and Boot estimators, with their respective standard deviations.

Areas	Species all	Estimator Chao	Estimator Boot
Cerrado 1	66	66.77±8.88	71.37±2.22
Cerrado 2	57	59.5±3.38	59.02±1.2
Carrasco 1	64	75.69±9.4	68.76±2.13
Carrasco 2	56	58.17±3.29	57.47±1.01

Priority of conservation of medicinal plants

The conservation priority index (CP) allowed the separation of the cerrado species (54) and the carrasco (18) in the three conservation categories (Tables VI and VII).

Included in category 1 (highest conservation need) were 13 and 7 species in areas 1 and 2 of the Cerrado, and 3 and 4 species in areas 1 and 2 of the carrasco, respectively. The highlight of the category 1 species is perhaps because they presented low densities, frequencies, dominance and IVI, associated with a large number of citations of medicinal uses, and the indication of the use of their perennial structures. The species with the highest conservation priority scores within category 1 were *Croton zehntneri* and *Secondatia floribunda* in the cerrado, but *C. zehntneri* was only recorded in the most conserved area. In the carrasco the species were *Ximenea americana, Croton heliotropifolius* and *Bowdichia virglioides*, all having a record in both vegetation areas, although with higher importance value in the more conserved environment. In general, the species with the highest indications of use in folk medicine (Table II) appear in category 1, which is the most critical for conservation (Tables VI and VII).

Most species were classified in categories 2 or 3, which still support collection pressure in protected areas because they are still relatively available in vegetation. In category 2 there were 23 and 25 species in areas 1 and 2 of the cerrado

Table IV. Availability of species in cerrado areas near (cerrado1) and far (cerrado 2) from the community. Chapada do Araripe.

	Cerrado 1					Cerrado 2				
Species	**N**	**DRi**	**FR**	**DoR**	**VI**	**N**	**DRi**	**FR**	**DoR**	**VI**
Anacardium occidentale	10	0.23	1.89	0.68	2.80	05	0.11	0.78	0.71	1.60
Anacardium microcarpum	2	0.09	0.16	0.24	0.49	-	-	-	-	-
Annona coriacea	7	0.32	0.05	0.96	1.33	1	0.02	0.19	0.00	0.22
Astronium fraxinifolium	7	0.02	0.22	0.15	0.38	-	-	-	-	-
Bauhinia cheilantha	4	0.18	0.06	0.72	0.96	3	0.18	0.06	0.72	0.96
Bowdichia virgilioides	09	0.23	1.89	4.09	6.21	14	0.34	1.93	1.69	3.96
Bredemeyera brevifolia	61	0.53	3.24	0.37	4.14	2	0.05	0.39	0.04	0.47
Bredemeyera floribunda	-	-	-	-	-	1	0.02	0.13	0.02	0.16
Byrsonima sericea	128	2.91	5.87	24.04	32.82	196	3.08	5.39	24.37	32.85
Caryocar coriaceum	4	0.34	1.89	3.89	6.12	-	-	-	-	-
Celastraceae sp	-	-	-	-	-	27	0.65	3.47	0.16	4.28
Colubrina cordifolia	-	-	-	-	-	4	0.10	0.77	0.09	0.96
Copaifera langsdorffi	144	3.47	5.39	6.35	15.22	77	1.44	4.40	4.17	10.02
Cordia rufescens	47	2.12	0.75	3.61	6.47	-	-	-	-	-
Croton argyrophyllus	-	-	-	-	-	5	0.05	0.26	0.02	0.33
Croton sp.	-	-	-	-	-	4	0.10	0.58	0.12	0.80
Croton zehntneri	5	0.23	0.28	0.48	0.98	-	-	-	-	-
Croton conduplicatus	4	0.10	0.58	0.12	0.80	-	-	-	-	-
Croton heliotropiifolius	5	0.05	0.26	0.02	0.33	-	-	-	-	-
Dimorphandra gardneriana	8	0.45	2.94	1.48	4.87	3	0.07	0.58	0.11	0.77
Dioclea grandiflora	11	3.27	5.45	1.12	9.84	30	0.72	3.08	0.21	4.02
Ditassa sp.	-	-	-	-	-	9	0.22	1.73	0.05	2.00
Erytrhoxylum sp.	23	0.09	0.84	0.05	0.98	6	0.07	0.39	0.03	0.49
Erythroxylum vacciniifolium	6	0.14	0.77	0.04	0.95	12	1.17	0.11	1.49	0.22
Guettarda viburnoides	1	0.05	0.01	0.24	0.30	-	-	-	-	-
Hancornia speciosa	1	0.05	0.42	0.01	0.48	-	-	-	-	-
Handroanthus sp.	2	0.07	0.63	0.06	0.76	-	-	-	-	-
Himatanthus drasticus	10	0.45	0.22	0.72	1.39	-	-	-	-	-
Hymenaea courbaril	6	0.11	0.84	0.05	1.00	7	0.17	0.77	1.90	2.84
Lantana camara	2	0.09	2.55	0.48	3.12	-	-	-	-	-
Lochocarpus araripensis	-	-	-	-	-	52	20.37	5.78	5.29	31.4
Machaerium acutifolium	2	0.05	0.22	0.16	0.43	2	0.05	0.39	0.01	0.44
Manihot sp.	3	0.03	0.22	0.05	0.30	1	0.05	0.06	0.24	0.35
Morphospecies 1	-	-	-	-	-	1	0.02	0.13	0.01	0.16
Morphospecies 2	-	-	-	-	-	10	0.11	0.65	0.04	0.79
Myrcia sp.	107	39.36	6.29	12.48	58.13	31	0.75	3.47	0.14	4.36
Maytenus rigida	-	-	-	-	-	27	1.07	2.63	0.60	4.30
Paramyrciaria cf. strigipes	640	5.47	5.62	2.01	13.10	272	6.55	5.78	2.35	14.68
Passiflora cincinnata	1	0.02	0.22	0.00	0.23	3	0.07	0.39	0.01	0.47
Protium heptaphyllum	17	0.72	2.73	0.30	3.75	16	0.39	1.73	0.14	2.26
Psidium myrsinites	5	0.07	0.63	0.02	0.71	8	0.23	1.73	0.05	2.01
Psidium sp.1	26	0.16	1.08	0.07	1.32	1	0.08	0.26	0.31	0.64
Rauvolfia sp.						3	0.14	0.03	0.48	0.65
Roupala montana	5	0.05	0.65	0.02	0.72	7	0.17	0.58	0.02	0.77
Secondatia floribunda	7	0.09	0.63	0.02	0.74	15	0.16	0.91	0.03	1.10
Secondatia diversiflora	6	0.07	0.39	0.01	0.47	-	-	-	-	-
Solanum paniculatum	-	-	-	-	-	10	0.45	0.96	0.32	1.73
Serjania laruotteana	2	0.02	0.22	0.02	0.25	-	-	-	-	-
Smilax japecanga	8	0.05	0.42	0.07	0.53	-	-	-	-	-
Stryphnodendron rotundifolium	3	0.09	0.84	0.05	0.98	-	-	-	-	-
Tabernaemontana catharinensis	40	0.34	1.73	0.10	2.18	-	-	-	-	-
Tocoyena formosa	7	0.07	0.65	0.04	0.75	-	-	-	-	-
Ximenia americana	179	8.07	2.21	5.05	15.3	-	-	-	-	-
Zanthoxylum gardneri	9	0.41	0.08	0.96	1.45	-	-	-		-

(N = number of individuals; DRi = relative density; FR = relative frequency; DoR = relative dominance; VI = value of importance).

and 8 and 2 species in areas 1 and 2 of the carrasco, respectively. In category 3 there were 4 and 2 species in areas 1 and 2 of the cerrado and 6 and 9 species in areas 1 and 2 of the carrasco, respectively (Tables VI and VII). Some species in categories 2 and 3 had diversified medicinal use, such as *Roupala montana* and *Hymenaea courbaril* (Table II) and others, although with diversified uses did not occur in the sampling, such as *Libidibia ferrea* (Tables III and IV).

DISCUSSION

Medicinal resources and conservation problems in protected forests

The gathered knowledge on medicinal plants showed that many diseases are treated by local populations with the use of species from the Araripe region, especially the Fabaceae, Euphorbiaceae and Apocynaceae families (Souza et al. 2014, Ribeiro et al. 2014, Saraiva et al. 2015, Macedo et al. 2016), both in the cerrado vegetation and in the carrasco (Table II). This finding was expected, since such families generally present considerable species richness in the different vegetational types of semi-arid environments (Tunholi et al. 2013, Souza et al. 2014, Saraiva et al. 2015, Ribeiro et al. 2014, 2019, Santos et al. 2019, Macêdo et al. 2018, Silva et al. 2019).

Besides, the local ethnobotanical knowledge compiled (Souza et al. 2014, Ribeiro et al. 2014, Saraiva et al. 2015, Macedo et al. 2016) showed

Table V. Availability of the species in the areas de carrasco close (carrasco 1) and far away (carrasco 2) from the community, Chapada do Araripe.

	carrasco 1					carrasco 2				
Species	**N**	**DR**	**FR**	**DOR**	**VI**	**N**	**DR**	**FR**	**DOR**	**VI**
Secondatia floribunda	1	0,02	0,32	0,001	0,34 2	13	1,59	2,64	1,92	1,496
Harissia adscendens	1	0,02	0,32	0,05	0,393	4	1,45	1,27	0,42	1,468
Maytenus rigida	184	3,92	3,17	1,74	8,834	97	2,45	1,58	0,56	5,342
Erythroxylum vaccinifolium	18	0,38	1,59	0,2	2,172	17	1,93	2,63	1,2	3,928
Croton limae	10	0,21	1,27	0,17	1,657	3	0,19	1,04	0,13	0,645
Croton sp.	3	0,06	0,63	0,01	0,707	-	-	-	-	-
Croton heliotropifolius	7	0,12	0,63	0,15	0,745	5	0,11	0,32	0,01	0,431
Copaifera langsdorffii	515	10,98	3,17	15,04	29,194	127	8,25	2,84	11,5	9,653
Dimorphandra gardineriana	10	0,21	1,59	0,57	2,37	28	1,58	2,14	1,08	3,91
Senna cearensis	33	0,7	1,9	1,05	3,658	4	0,18	0,97	1,03	0,179
Bowdichia virglioides	19	1,74	1,92	1,83	2,753	11	0,23	1,9	0,9	3,036
Acacia langsdorffii	1	0,02	0,32	0,01	0,354	-	-	-	-	-
Paramyrciaria cf. strigipes	24	0,51	2,86	0,23	3,599	47	2,97	2,50	0,95	3,932
Psidium myrsinites	18	0,38	2,22	0,12	2,729	31	0,71	4,35	1,45	3,968
Ximenea americana	54	1,06	2,78	0,75	4,794	27	0,58	1,59	0,35	2,508
Coccoloba sp.	1	0,02	0,32	0,001	0,342	-	-	-	-	-
Roupala montana	55	1,17	3,17	0,47	4,82	62	2,97	5,93	2,51	5,620
Tocoyena formosa	6	0,13	0,63	0,02	0,779	-	-	-	-	-

(N = number of individuals; DRi = relative density; FR = relative frequency; DoR = relative dominance; VI = value of importance).

that more than 70% of the species in the Araripe region have perennial structures such as bark/ weaves and roots used in the treatment of diseases, confirming the emphasis given to these structures in other studies (Martínez-Moreno et al. 2017, Bussman et al. 2007, Oliveira et al. 2007, Monteiro et al. 2010, Marinho et al. 2011, Macêdo et al. 2018, Silva et al. 2019). Many species have renewable structures, such as leaves, as a part used in medicinal use (Hamayun et al. 2006, Kar & Borthakur 2007, Monteiro et al. 2010), which generates fewer problems for conservation. The use of perennial structures tends to be more harmful to the conservation of plant species, especially if other aspects are taken into account, such as collection technique and intensity, marketing of the resource, versatility of uses and the availability of the resource in forests.

Although the medicinal resource is locally important for the treatment of human health, the collection, depending on the technique used, may cause injuries that compromise the plant life (Bernal et al. 2011, Feitosa et al. 2017), or may directly generate its death, in the case of root collection that often involves the removal of the entire plant from the substrate.

In addition, the form of collection may generate negative pressure for the renewal of the resource in forests (Oliveira et al. 2007, Monteiro et al. 2010, Ribeiro et al. 2019, Feitosa et al. 2017, Macêdo et al. 2018). Another aspect that increases the problem of conservation of marketed resources is the place of residence of local populations, because if they live far from the forests, people tend to collect and stock more of the resource to compensate for the cost of its locomotion (Lopes et al. 2011, Soldati & Albuquerque 2012, Feitosa et al. 2018).

The versatility of medicinal use of the species is another characteristic that has implications on the conservation of the resource, especially if the species also has non- medical uses, by increasing its collection pressure in the region. This is the case, for example, of *Ximenia americana* and *Caryocar coriaceum* which were indicated for the treatment of 22 and 15 diseases, respectively (Table II). The diversity of medicinal uses of these species was found in other studies (Monteiro et al. 2011, Macedo et al. 2016, Silva et al. 2019), but these species also have food and wood uses (Souza Júnior et al. 2013, Cavalcanti et al. 2015, Campos et al. 2015, Nascimento et al. 2019), which makes them target of greater impact in the region. In addition, some species had different parts (roots, flowers, seeds, bark) collected for medicinal use, as recorded for *Psidium myrsinites*, which also increase the anthropic pressure on the resource.

In addition, the fact that a species has high versatility of medicinal use does not imply that it is highly available in the forest to support the pressure of local use. In this study, woody species with many indications of medicinal use, such as *Ximenia americana, Stryphnodendron rotundifolium, Dimorphandra gardneriana* and *Hancornia speciosa* did not have high density in phytosociological sampling. Other species, such as *Coutarea hexandra*, had a considerable indication of medicinal use, but showed a small population size in the sample (Tables II, III and IV).

It is worth noting that this study recorded a low occurrence of woody medicinal species in the sampling plots, both in the cerrado (59%) and in the carrasco (38%). However, this low percentage does not necessarily indicate insufficient floristic sampling, as demonstrated by the rarefaction curve and Boot and Chao richness estimators. It is necessary to remember that the uses of medicinal plants were retrieved from secondary data from studies done in past times, while the sampling of vegetation was done in the present time (primary data). Thus, other

Table VI. Conservation priority index (PC) of the medicinal plants of the Chapada do Araripe, northeastern Brazil.

	Cerrado 1								Cerrado 2							
Species/ common name	**EB**	**H**	**IL**	**V**	**U**	**RU**	**PC**	**Categ.**	**EB**	**H**	**IL**	**V**	**U**	**RU**	**PC**	**Categ.**
Bowdichia virgilioides - Sucupira	100	7	4	10	7	70	85	1	100	7	4	10	7	70	85	1
Croton zehntneri - Velame	100	10	1	9	5	75	87,5	1	-	-	-	-	-	-	-	-
Hancornia speciosa – Mamgaba	100	7	4	10	7	70	85	1	-	-	-	-	-	-	-	-
Croton heliotropiifolius - Velame preto	100	7	4	10	7	70	85	1	-	-	-	-	-	-	-	-
Himatanthus drasticus -Janaguba	100	7	4	10	7	70	85	1	-	-	-	-	-	-	-	-
Secondatia floribunda - Catuaba de rama	100	10	4	6	5	75	87,5	1	100	10	4	6	5	75	87,5	1
Secondatia diversiflora - Caninana	100	10	1	4	2,5	62,5	81,25	1	-	-	-	-	-	-	-	-
Ximenia americana - Ameixa	100	7	4	10	7	70	85	1	-	-	-	-	-	-	-	-
Passiflora cincinnata - Maracujá do mato	100	´10	1	6	3,5	67,5	83,75	1	100	10	1	6	3,5	67,5	83,75	1
Protium heptaphyllum - Amescla	100	10	4	1	2,5	62,5	81,25	1	100	10	4	1	2,5	62,5	81,25	1
Smilax japecanga - Japecanga	100	10	1	4	2,5	62,5	81,25	1	-	-	-	-	-	-	-	-
Stryphnodendron rotundifolium -Barbatemão	100	7	4	10	7	70	85	1	-	-	-	-	-	-	-	-
Dimorphandra gardneriana -Faveira	100	7	4	10	7	70	85	1	100	7	4	10	7	70	85	1
Morphospecies 1 - Erva de peba	-	-	-	-	-	-	-	-	100	10	1	4	2.5	62,5	81,25	1
Solanum paniculatum - Jurubeba	-	-	-	-	-	-	-	-	100	10	1	6	3,5	67,5	83,75	1
Anacardium occidentale Cajú	100	7	4	6	5	60	80	2	100	7	4	6	5	60	80	2
Anacardium microcarpum - Cajuí	100	7	4	5	4,5	57,5	78,75	2	-	-	-	-	-	-	-	-
Annona coriacea - Araticum	100	7	1	1	1	40	70	2	100	7	1	1	1	40	70	2
Astronium fraxinifolium - Gonçalo-Alves	100	7	4	4	4	55	77,5	2	-	-	-	-	-	-	-	-
Bauhinia cheilantha - Mororó	100	4	4	2	3	35	67,5	2	100	4	4	2	3	35	67.5	2
Bredemeyera brevifolia - Mau vizinho	100	7	1	2	1.5	42,5	71,25	2	100	7	1	2	1,5	42,5	71,25	2
Bredemeyera floribunda - Pau gemada	-	-	-	-	-	-	-	-	100	7	1	2	1,5	42,5	71,25	2
Byrsonima sericea - Murici	70	7	4	4	4	55	62,5	2	70	7	4	4	4	55	62,5	2
Caryocar coriaceum - Pequi	100	4	4	10	7	55	77,5	2	-	-	-	-	-	-	-	-
Celastraceae sp. - Inharé	-	-	-	-	-	-	-	-	100	10	1	1	1	55	77,5	2
Colubrina cordifolia - João vermelho	-	-	-	-	-	-	-	-	100	4	1	2	1.5	27,5	63,75	2
Croton conduplicatus - Quebra faca	100	7	1	2	1.5	42,5	71,25	2	-	-	-	-	-	-	-	-

Table VI. Continuation

Copaifera langsdorffi - Pau d'óleo	70	7	4	10	7	70	70	2	70	7	4	10	7	70	70	2
Erythroxylum vacciniifolium - Catuaba	100	7	4	3	3,5	52,5	76,25	2	70	7	4	3	3.5	52,5	76,25	2
Croton argyrophyllus - Caçatuba	-	-	-	-	-	-	-	-	100	7	1	5	3	50	75	2
Croton sp. - Marmeleiro	-	-	-	-	-	-	-	-	100	7	4	2	3	50	75	2
Ditassa sp. - Caninana	-	-	-	-	-	-	-	-	100	10	1	1	1	55	77,5	2
Erytrhoxylum sp. - Murta	100	4	1	1	1	25	62,5		100	4	1	1	1	25	62,5	2
Handroanthus sp. - Pau d'arco	100	7	4	3	3,5	52,5	76,25	2	-	-	-	-	-	-	-	-
Hymenaea courbaril - Jatobá	100	7	1	9	5	60	80	2	100	7	1	9	5	60	80	2
Lantana camara - Camará ou Chumbinho	100	4	1	2	1,5	27,5	63,75	2	-	-	-	-	-	-	-	-
Lochocarpus araripensis - Angelim	-	-	-	-	-	-	-	-	10	4	1	1	1	25	62,5	2
Machaerium acutifolium - Coração de nego	100	7	1	2	1,5	42,5	71,25	2	100	7	1	2	1.5	42,5	71,25	2
Manihot sp. - Maniçoba	100	10	1	2	1,5	57,5	78,75	2	100	10	1	2	1.5	57,5	78,75	2
Morphospecies - II nogueira	-	-	-	-	-	-	-	-	100	4	1	2	1.5	27,5	63,75	2
Myrcia sp. - Chumbinho	100	7	1	2	1,5	42,5	71,25	2	100	7	1	2	1.5	42,5	71,25	2
Maytenus rigida - Bom nome	-	-	-	-	-	-	-	-	70	7	4	3	3.5	52,5	61,25	2
Psidium myrsinites - Araçá goiabinha	100	7	4	2	3	50	75	2	100	7	4	2	3	50	75	2
Psidium sp.1 - Araçá de veado	100	7	4	6	5	60	80	2	100	7	4	6	5	60	80	2
Rauvolfia sp. - Quina quina	-	-	-	-	-	-	-	-	100	7	1	2	1.5	42,5	71,25	2
Roupala montana - Congonha	100	4	4	10	7	55	77,5		100	4	4	10	7	55	77,5	2
Serjania laruotteana - Croapé	100	10	1	3	2	60	80	2	-	-	-	-	-	-	-	-
Tabernaemontana catharinensuis - Grão de galo	100	10	1	1	1	55	77,5	2	-	-	-	-	-	-	-	-
Tocoyena formosa - Jenipapo brabo	100	7	1	6	3,5	52,5	76,25	2	-	-	-	-	-	-	-	-
Zanthoxylum gardneri - Laranjinha	100	7	1	4	2,5	47,5	73,75	2	-	-	-	-	-	-	-	-
Paramyrciaria cf. strigipes - Cambuí brabo	40	7	1	2	1,5	42,5	41,25	3	40	7	1	2	1.5	42,5	41,25	3
Cordia rufescens - Uva braba	70	4	1	1	1	25	47,5	3	-	-	-	-	-	-	-	-
Dioclea grandiflora - Mucunã	70	7	1	2	1.5	42,5	56,25	3	100	7	1	2	1,5	42,5	56,25	3
Guettarda viburnoides - Angelica	100	7	1	2	1,5	42,5	56,25	3	-	-	-	-	-	-	-	-

(EB = biological score; H = collection risk; IL = local importance; V = diversity of use, U = value of use, RU = risk of use).

possible explanations for the low recording of medicinal species in the plots could be: 1. Some species existed in the past, but are presently of low abundance or no longer exist in the area; 2. Some people may have used medicinal plants that were cultivated in their gardens; 3. It is possible that some species have an aggregate distribution pattern, and have not been recorded in the plots; 4. It is also possible that some are more typical of vegetational formations different from the cerrado and carrasco, for example, *Mimosa tenuiflora*, which is frequent in the caatinga vegetation and widely exploited also for other uses (Figueirôa et al. 2006).

However, although we have not evaluated the reason for the inclusion or not of the species in the sampling, the fact is that often the collection is done without considering the real availability of the resource in the forest. According to Maldonado et al. (2013), the frequency was the phytosociological attribute that most influenced the value of the use of the species in central Mexico, in the categories medicinal, food, construction and firewood. However, in the case of medicinal use, density was another parameter that maintained a significant relationship in the use of the species. In the present study these findings was not confirmed for three of the sampled areas, which had already been observed in the study by de Silva et al. (2019) at FLONA Araripe. Only in carrasco area 1 there was a significant relationship between the value of use and the frequency of the resource, indicating that there is not always a clear relationship between the value of the use of the species and its local availability in the forests.

Ecologically, although destructive collection practices are negative for the conservation of the collected resource, the human action of removing a plant from the forest can be positive for the occurrence and or increase of populations of other species in the forest that need more illuminated environments for their growth. This is the case of *Byrsonima sericea* and the species of the genus *Myrcia*, which according to Araujo et al. (1998), are considered pioneers and it needs a greater demand for light for their establishment. Although those species did not have presented high densities in the sampled area, despite their medicinal importance.

The low availability recorded in this study for some of the resources used in FLONA Araripe indicates that the establishment of conservation units, despite being an important strategy (Archibald et al. 2020), is not sufficient for forest conservation. In many protected areas the adequate use of the resource is not guided and monitored. According to Brites & Morsello (2017), non-oriented resource uses tend to generate negative effects on biological diversity, such as alteration of the structure or reduction in population size, overloading of plant parts that are used, and possible changes in species richness of the community.

Untargeted resource uses have been recorded in other regions (Martins 2012, Andrade et al. 2015, Ulloa-Ulloa et al. 2017), indicating diversity conservation and UC management a global challenge. In order to increase the efficiency of the UCs in the protection of biological diversity, it has been indicated that it is necessary that UC managers develop strategies to better understand the needs of local populations, with the promotion of actions that favor interaction with them and minimize local conflicts. It is also necessary that they consider the traditional ecological knowledge of the communities on the spatial distribution of species, collection areas, and ways of using and managing the resource (Hanazaki 2003). Furthermore, it has been indicated the need for ecological studies more directed to the resource accessed, to evaluate its capacity to support

Table VII. Conservation priority index (PC) of the medicinal plants of the Chapada do Araripe, northeastern Brazil.

	Carrasco 1								Carrasco 2							
Species/ common name	**EB**	**H**	**IL**	**V**	**U**	**RU**	**PC**	**Categ.**	**EB**	**H**	**IL**	**V**	**U**	**RU**	**PC**	**Categ.**
Croton heliotropifolius - Velame preto	100	10	4	5	4,5	72,5	86,25	1	100	10	4	5	4,5	72,5	86,25	1
Dimorphandra gardineriana -Faveira	100	7	7	5	6	65	82,5	1	70	7	7	5	6	65	67,5	3
Bowdichia virglioides - Sucupira	100	7	7	8	7,5	72,5	86,25	1	70	7	7	8	7,5	72,5	86,25	1
Ximenea americana - Ameixa	100	7	7	10	8,5	77,5	88,75	1	100	7	7	10	8,5	77,5	88,75	1
Secondatia floribunda - Catuaba.	100	7	4	1	2,5	47,5	73,75	2	70	7	4	1	2,5	47,5	58,75	3
Harissia adscendens - rabo-de-raposa	100	7	1	1	1	40	70	2	70	7	1	1	1	40	50	3
Acacia langsdorffii -Jiquiri	100	4	1	1	1	25	62,5	2	-	-	-	-	-	-	-	-
Erythroxylum vaccinifolium - Catuaba-de-madeira	100	7	4	1	2,5	47,5	73,75	2	70	7	4	1	2,5	47,5	58,75	3
Croton. limae - Marmeleiro preto	100	7	1	1	1	40	70	2	100	7	1	1	1	40	70	2
Croton sp.	100	7	1	1	1	40	70	2	-	-	-	-	-	-	-	-
Coccoloba sp.	100	10	1	1	1	55	77,5	2	-	-	-	-	-	-	-	-
Tocoyena formosa - Jenipapo	100	7	4	1	2,5	47,5	73,75	2	-	-	-	-	-	-	-	-
Senna cearenses – Pé de bode	100	4	4	1	2,5	32,5	66,25	3	100	4	4	1	2,5	32,5	66,25	3
Maytenus rigida - Bom nome	40	7	7	3	5	70	55	3	70	7	7	3	5	70	70	2
Copaifera langsdorffii - Pau d'óleo	10	7	10	5	7,5	72,5	41,25	3	10	7	10	5	7,5	72,5	41,25	3
Paramyrciaria cf. strigipes - Cambuí	100	7	7	3	5	70	85	3	70	7	7	3	5	70	85	3
Psidium myrsinites - Goiabinha	100	7	4	5	4,5	57,5	78,75	3	100	7	4	5	4,5	57,5	78,75	3
Roupala montana - Congonha	70	4	10	5	7,5	57,5	63,75	3	70	4	10	5	7,5	57,5	63,75	3

(EB = biological score; H = collection risk; IL = local importance; V = diversity of use, U = value of use, RU = risk of use).

collection pressure and the time needed for renewal of its populations (Guedje et al. 2007, Shackleton & Pandey 2014, Andrade et al. 2015, Gaoue et al. 2016).

The hypothesis of this study was confirmed, since the most versatile medicinal species necessarily were not the same ones with high abundance in the sampling. According to maximization theory (Albuquerque et al. 2019) this fact could be justified by the need that populations have to optimize time and energy in obtaining the resource. This need leads people to use the most easily found resources. In addition, other variables affect people's use and knowledge of medicinal resources, such as socioeconomic variables (Albuquerque & Faria 2018). Another fact that must be considered is that many of the medicinal species are used by local populations for other purposes, such as firewood for example (Santos et al. 2015), which increases local use pressure. The interaction of all these factors can have a major effect in explaining the availability of the resource in the area and need to be considered also in defining priority species for conservation.

Conservation priorities and importance of conservation actions

The findings of this study showed that 13 species in the cerrado (*B. virgilioides,* C. zehntneri, H. speciosa, C. heliotropiifolius, H. drasticus, S. floribunda, S. diversiflora, *X. americana, P. cincinnata, P. heptaphyllum, S. japecanga, S. rotundifolium* and *D. gardneriana*) and four in the carrasco (*C. heliotropifolius, D. gardineriana, B. virglioides and X. americana*), according to the criteria adopted in the classification (Table I) (Dzerefos & Witkowski 2001) no longer support the collection pressure and needs priority conservation actions. Of these, only four (*H. drasticus, B. Virgilioides, H. speciosa* and *S. rotundifolium*) were indicated as priorities for conservation based on the perception of people from three communities in the region (Silva et al. 2019).

Other species, like *C. langsdorfi* (Tables V and VI), which based on the calculated index still support collection pressure, in the study by Silva et al. (2019) were indicated a priority for local conservation, based on people's perception. This difference in the indication of species may have occurred because the communities evaluated by Silva et al. (2019) were different from those analyzed in the secondary data of the works considered in this study (Souza et al. 2014, Ribeiro et al. 2014, Saraiva et al. 2015, Macedo et al. 2016), but even if the localities and methodologies were different, the findings of this study reinforce the need for a priority look for *B. virgilioides, H. drasticus, H. speciosa* and *S. rotundifolium*. With the exception of the first specie, the others are: widely marketed, source of livelihood for many families in the region and are already on the lists of endangered species of the Ministry of Environment and the International Union for Conservation of Nature and Natural Resources-IUCN (MMA 2008, Souza Júnior et al. 2013, IUCN 2019, Baldauf & Santos 2013, Fereira Jr. et al. 2016, Feitoza et al. 2017, 2018).

However, attention is still recommended for species classified in category 2, which allows restricted use, especially for those with perennial structures (bark, weaves and roots) as the exploited part, as such uses may cause mortality and decrease of the exploited population in the future (Albuquerque et al. 2009, 2011), which reveals the need for actions to ensure the sustainability of these practices.

Environments considered conserved for both phytophysiognomies, had high species richness, as expected because the free access of local populations for collection of the resource was not allowed. Consequently, the areas conserved had more species in each category of

the conservation. While areas of greater contact with the communities, had lower specific richness, followed by fewer species in each category.

The estimation of priority species for conservation, although it may be influenced by factors not considered in the indices adopted (Dzerefos & Wikowski 2001, Albuquerque et al. 2011), is an important tool and assists in conservationist decisions (Dhar et al. 2000, Oliveira et al. 2007), especially in megadiverse countries such as Brazil, which has biodiversity hotspots (Myers et al. 2000), with many endemic species in some vegetational formations. According to Eken et al. (2004) it is necessary to consider the occurrence of endemism in the forest, because on a local scale endemic species can be rapidly extinct if negative environmental stochastic events occur, especially if the size of their populations are naturally reduced or have been reduced because they are intensely collected and used in the region, and a reduction in the planet's biodiversity may occur.

CONCLUSIONS

The species with the highest indication of use do not coincide with those with the highest indices of availability. Thus, some are figuring within a expectro of necessary care, considering their uses and parts that are exploited. Calculating conservation priority alone is not fully effective in predicting which species need conservation plans, and it is necessary to combine factors such as intensity, frequency and type of use with the biological variables of the resource to better determine the conservation priorities of an area.

This research shows that ethnobiological studies combined with ecological studies are basic tools and need to be carried out periodically to define adjusted conservation actions, which can mitigate possible conflicts and local conservation problems. In areas with species of known conservation priorities, a species-by-species analysis is recommended to determine all factors involved in generating impacts on plant species and local populations.

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