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Medicinal plants and their popular use in Boa Esperança Settlement, Piracanjuba, Goiás, Brazil

[Plantas medicinales y su uso popular en el asentamiento de Boa Esperança, Piracanjuba, Goiás, Brasil]

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Abstract: The present study showed medicinal plants and their popular use in the rural settlement Boa Esperança, in Piracanjuba, GO, Brazil. Data were collected from November 2017 to February 2018. A total of 176 species (mostly native) were sampled with the predominance of use to treat respiratory, gastrointestinal problems, kidney stones and various types of infections. The species with the highest number of informations were *Dilodendron bipinnatum* Radlk.; *Morus* sp.; *Pterodon emarginatus* Vogel; *Qualea grandiflora* Mart. and *Cochlospermum regium* (Mart. ex Schrank) Pilg. With the exception of *C. regium*, the others species had the maximum use agreement value. The study showed a high richness of species used by settlers. The dissemination of this knowledge of medicinal plants, with an emphasis on native plants, can assist in strengthening the cultural knowledge of the local community, encouraging the environmental conservation of various medicinal species used in the region.

Keywords: Cerrado; Tradicional knowledge; Ethnobotany; Popular medicine; Agrarian reform.

Resumen: El presente estudio mostró plantas medicinales y su uso popular en el asentamiento rural Boa Esperança, en Piracanjuba, GO, Brasil. Los datos se recolectaron desde noviembre de 2017 hasta febrero de 2018. Se muestrearon un total de 176 especies (en su mayoría nativas) con predominio de uso para tratar problemas respiratorios, gastrointestinales, cálculos renales y diversos tipos de infecciones. Las especies con mayor número de información fueron *Dilodendron bipinnatum* Radlk.; *Morus* sp.; *Pterodon emarginatus* Vogel; *Qualea grandiflora* Mart. y *Cochlospermum regium* (Mart. ex Schrank) Pilg. Con la excepción de *C. regium*, las otras especies tuvieron el valor de acuerdo de uso máximo. El estudio mostró una gran riqueza de especies utilizadas por los colonos. La difusión de este conocimiento de las plantas medicinales, con énfasis en las plantas nativas, puede ayudar a fortalecer el conocimiento cultural de la comunidad local, fomentando la conservación ambiental de diversas especies medicinales utilizadas en la región.

Palabras clave: Cerrado; Conocimiento tradicional; Etnobotánica; Medicina popular; Reforma agraria.

INTRODUCTION

The Cerrado is a Brazilian phytogeographic domain of great importance for its extension, ecological diversity, carbon stocks and hydrological function. Added to this is the presence of a sociocultural diversity consisting of indigenous communities, quilombolas and small agroextractivist producers (Silva & Peixoto, 2013; Camargo *et al.*, 2014; Bicalho & Miranda, 2015; Dutra & Souza, 2017; Pitta & Vega, 2017; Porto-Gonçalves, 2019).

The sociocultural diversity culminates in valuable traditional knowledge especially those inherent to the various uses of the Cerrado flora. This knowledge about the uses of plants is valued by ethnobotanical science and supports consistent arguments for the conservation of the Cerrado in the process of economic development (Silva & Peixoto, 2013; Camargo *et al.*, 2014; Bicalho & Miranda, 2015; Dutra & Souza, 2017; Pitta & Vega, 2017; Porto-Gonçalves, 2019).

There is still a great lack of ethnobotanical surveys and extractive potential in the cerrado, mainly in rural settlements, although much of the flora in the cerrado is widely explored by popular knowledge.

It is estimated that in the Cerrado there are more than 600 medicinal plant species, which justifies studies on the medicinal potential of local plants (Guarim Neto & Morais, 2003). Among these studies, the ethnobotanical inventory in a given locality is anchored and based on knowledge about the management of native species such a medicinal, food, tintorial, timber, textiles, ornamentals, among others. Ethnoknowledge is intrinsic to the experiences of traditional communities whether indigenous, rural or urban, which bring in their bulge great cultural diversity (Almeida *et al.*, 1998).

In this context, medicinal plants continue to occupy a prominent place in the therapeutic arsenal and it is often the only resource of several Brazilian communities (Maciel *et al.*, 2002), especially those located in the rural area, with difficult access to urban areas or where people don't have means of movement. Thus, the present study aimed to sample medicinal plants and their popular use in the rural settlement Boa Esperança, Piracanjuba, GO.

MATERIAL AND METHODS

Characterization of the study area

The research was carried out in the Boa

Esperança settlement, located in the municipality of Piracanjuba, Goiás, Brazil (Figure No. 1). The settlement was created on July 1995 and has an area of 1,743.1 hectares. The distance from the settlement to the urban area is about 14 kilometers (17°18'38.62"S - 48°52'57.31"W).

The settlement consists of 50 families. Each family legally settled in the communities by INCRA (National Institute of Colonization and Agrarian Reform) received a plot of approximately 5 hectares (INCRA, 2017). The plots, as lots are called, are used for agriculture under family economy. Cattle raising is the main economic activity based on milk production. Agriculture is subsistence with the planting of corn, tobacco, cassava and vegetables.

The predominant vegetation around the settlement is dry forest, mainly in the legal reserve of the rural property. There is occurrence of deciduous dry forest at the top of the hill with predominance of rocky outcrop and, at the base, semi-deciduous dry forest. The water courses present gallery forest (at the headwaters) and riparian forest. There are also small fragments of savanna vegetation.

Survey of floristic and ethnobotanical data

The present study has a record in the National System of Management of Genetic Heritage and Associated Traditional Knowledge (SisGen) according to Law 13,123 of 05/20/2015 (Brazil, 2015), which revoked Provisional Measure 2,186 of 08/23/2001 (Brazil, 2001) under the number A5E365D. Item V of the sole paragraph of Resolution 510 of April 7, 2016 (CNS, 2016) establishes that there will be no record or evaluated by the CEP/CONEP system (Research Ethics Committees/National Research Ethics Committee) research with databases without possibility of individual identification. Because we understand that the data of the present study is within this item, there was no submission of the study in the Committee of Ethics in Research with Human Beings.

Data collection started through an informal conversation with the president of the Boa Esperança Settlement Association with information about the objective and relevance of the research. We present to each participant the importance and objectives of the research and the guarantee of confidentiality as an ethical premise between researcher and interviewees. The consent of the participants was formalized through a Consent Form, as required by Resolution

Number 466, of December 12, 2012, of the National Health Council of the Ministry of Health (CNS,

2012).

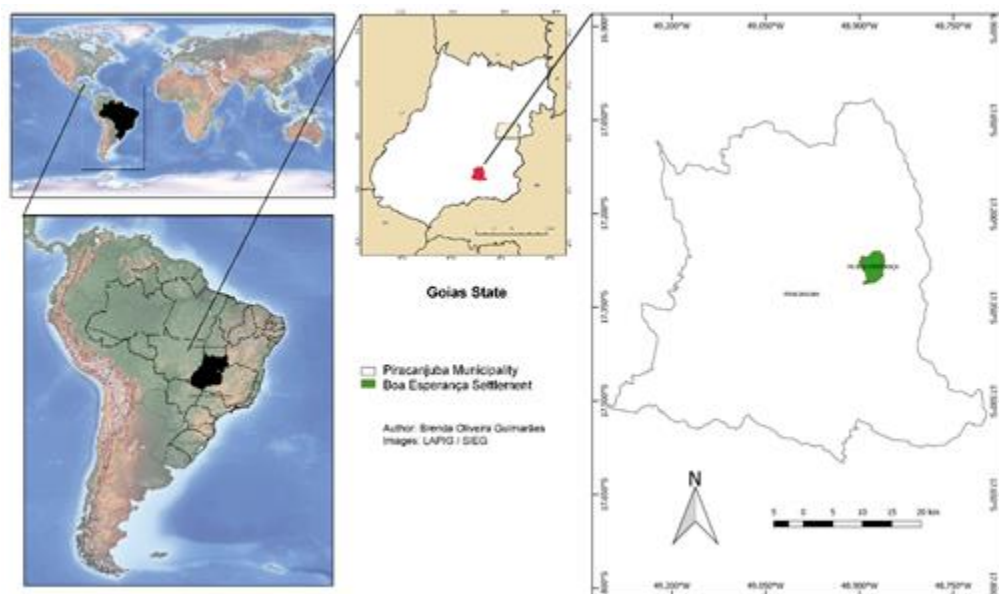


Figure No 1
Map of the study area: Boa Esperança Settlement in Piracanjuba, Goiás, Brazil

The selection of the target audience was based on information provided by the local community about which people had knowledge about the use of medicinal plants. After the first indication, one person indicated another, and thus successively, until exhausting the number of people in the settlement with ethnobotanical knowledge. This technique is called “snowball” (Albuquerque, 2009). Twelve people belonging to ten families of the settlers were selected. Data collection consisted of semi-structured interviews using a questionnaire containing 21 questions (adapted from Martin (1995)). During the interviews, written and recorded records were performed to ensure the maintenance of reliable information to the reports.

The plants mentioned and found in the plots of the interviewees or in nearby locations were photographed and collected. At that moment, data on habit, collection site and morphological characteristics of the specimens were recorded. These collections were followed by each interviewee. The collected material was herborized and incorporated into the collection of Herbarium José Ângelo Rizzo (JAR), from the State University of Goiás (UEG), Southwest Campus - Quirinópolis.

Native plants were classified according to threat status (IUCN, 2017); whether it is the first occurrence for the state of Goiás, endemic or not of Brazil and its distribution in the Brazilian phytogeographic domains according to the Flora do Brasil 2020 website (2018). Exotic plants were classified according to origin according to data provided by the Missouri Botanical Garden (MOBOT, 2018).

Based on the data from the questionnaires, the plants were organized into eleven categories of medicinal uses: DT = diseases associated with the digestive tract; RS = diseases associated with the respiratory system; DP = diseases associated with dermatological problems; IP = diseases associated with inflammation and pain; NS = diseases associated with the nervous system; CS = diseases associated with the cardiovascular system; UP = diseases associated with urological problems; PD = parasitic diseases; GD = gynecological diseases; OP = orthopedic problems; and SGS = symptoms and general signs, those with symptoms of various non-specific diseases and or of cultural origin (Amorozo 2002; Medeiros *et al.*, 2004; Silva *et al.*, 2010; Guimarães *et al.*, 2019).

To verify the relative importance of the plants used in the community in terms of the number of informants and the agreement of the mentioned uses, the plants mentioned by three or more informants were listed. For the analysis of relative

agreement of the species, the percentage of agreement regarding the main uses (PMU) was calculated using the following formula (Amorozo & Gély, 1988):

$$\text{PMU} = \frac{\text{number of informants who cited main use} \times 100}{\text{number of informants who cited the use of the species}}$$

The Correction Factor (CF) was calculated for each species, based on the frequency of citation of each species in relation to the citation of the most cited species:

CF = number of informants who cited the species/number of informants who cited the most cited species

Then the corrected PMU (PMU_c) was obtained by the formula: PMU_c = PMU x CF.

The high degree of agreement (one that has several informants indicating the same therapeutic purpose) may be indicative of the effectiveness in the treatment of the disease (Friedman *et al.*, 1986). Thus, the greater the agreement, the greater the chances that the mentioned plant contains some chemical compound that validates its use (Pilla *et al.*, 2006). This information supports the selection of plant species for pharmacological tests in order to prove the efficacy of active ingredients in the treatment of a given disease (Pinto *et al.*, 2006).

To evaluate the diversity of sampled plants, the Shannon-Wiener diversity index was performed (H')

$H' = - \sum (p_i) (\ln p_i)$, where H' = Shannon-Wiener diversity index, $p_i = n_i/N$, where n_i = number of citations per species and N = total number of citations (Magurran, 1988).

The Pielou Equability Index is derived from the Shannon-Wiener diversity index and expresses the uniform distribution of individuals among existing species (Pielou, 1966). This index has a range from 0 (minimum uniformity) to 1 (maximum uniformity). The Pielou equitability index or uniformity was obtained using the formula:

$e = H' / \log S$, where e = Pielou equitability index or uniformity; H' = Shannon-Wiener diversity index and S = richness or number of species present in the community (Krebs, 1989).

Floristic similarity (comparing studies conducted with other communities and rural settlements in the Cerrado) was investigated using the Jaccard similarity index. The clustering dendrogram based on the Jaccard coefficients was made using the UPGMA (Unweighted Pair Group Method with Arithmetic Mean) with the PAST program.

RESULTS AND DISCUSSION

Interviewee profile

Twelve interviews were carried out in 10 families, representing 20% of the number of families in the settlement. The interviewees were nine women and three men. The greatest female representation was also registered in the study by Silva *et al.* (2010) on the use of medicinal plants in rural communities in the southwestern region of Goiás. Women, in addition to taking care of their children, among other relatives when they are sick, also take care of food crops, handicrafts, and ornaments made with local plants (Pasa *et al.*, 2015). In the case of the interviewees, in addition to taking care of the cultivated plants, they constantly attend the nearby Cerrado vegetation types.

Research participants are aged between 26 and 69 years. The two most frequent age groups, in an equal number of respondents, were 51 to 60 and 61 to 70 years old (41.67%, n=5, each). Other studies showed a greater number of people in the age group above 60 years (Mota *et al.*, 2015; Duarte & Pasa, 2016; Brito *et al.*, 2017; Guimarães *et al.*, 2019). In Brazil, most young people are not interested in treatment with medicinal plants, and for this reason, they are unaware of them (Oliveira & Menini Neto, 2012). This has culminated in the loss of ethnobotanical knowledge over the generations (Löbler *et al.*, 2014).

As for the naturalness of the participants, two

are from Bahia, one from Tocantins, one from Minas Gerais and eight are from Goiás (of these two are from Piracanjuba). All participants are of rural origin, with the majority living in the settlement since its implementation (66.67%). The education level of the majority of the interviewees is, in equal numbers, complete high school and incomplete elementary school (33.33%, n=4, each), followed by illiterate (16.67%, n=2) and incomplete high school and complete elementary school (8.33%, n=1, each). This result differs from the results of most ethnobotanical studies in the country, in which most respondents are illiterate, in equal numbers, complete high school and incomplete elementary school (33.33%, n=4, each), followed by illiterates (16.67%, n=2) and education incomplete high school and complete elementary school (8.33%, n=1, each). This result differs from the results of most ethnobotanical studies in the country, in which a large part of the interviewees is illiterate (Cunha & Bortolotto, 2011; Oliveira & Menini Neto, 2012; Löbler *et al.*, 2014; Mota *et al.*, 2015; Pasa *et al.*, 2015).

The knowledge about medicinal plants acquired by the target audience was diversified, with different contributions for the same interviewee. The majority affirmed, in equal numbers, having obtained this knowledge through their parents and participating in courses offered by entities that work in the settlements, such as INCRA and SENAR (33.33%, n=7, each); followed by the teachings of grandparents (19.05%, n=4); and, to a lesser extent, through friends and neighbors (9.52%, n=2). According to them, most of the interviewees are regularly sharing plant seedlings and medicinal recipes. In this context, traditional knowledge is, most of the time, produced in social relations and transmitted and disseminated orally (Dias & Laureano, 2009).

Ethnobotanical data

A total of 176 medicinal plant species were recorded (Figure No. 2), distributed in 71 families and 155 genera (Table No. 1). Fabaceae (16 species), Asteraceae (15) and Lamiaceae (13) were the families with the highest species richness. These families were also the richest in other ethnobotanical studies (Cunha & Bortolotto, 2011; Rodrigues & Andrade, 2014; Costa & Marinho, 2016; Gois *et al.*, 2016).

The richest genera in species were *Allium* L.,

Citrus L. and *Mentha* L., all with four species each. In other ethnobotanical studies, in a Cerrado area, similar results were found (Amorozo, 2002; Borba & Macedo, 2006; Silva & Proença, 2007; Alves & Povh, 2013; Ferreira *et al.*, 2015; Guimarães *et al.*, 2019).

Among the medicinal species mentioned, most are native (55,11%, n=97), followed by exotics (28,40%, n=50) and naturalized (16.47%, n=29) (Table No. 1). Among the native ones eight are endemic to Brazil: *Adenocalymma nodosum*, *Cayaponia tayuya*, *Dorstenia cayapia*, *Jacaranda rufa*, *Smilax brasiliensis*, *Solanum cernuum*, *Vochysia elliptica* and *Zeyheria montana*. The use of medicinal species, the majority of which are native, has also been recorded by other ethnobotanical research (Oliveira *et al.*, 2010; Cunha & Bortolotto, 2011; Leandro *et al.*, 2017; Guimarães *et al.*, 2019). There was a predominance of herbaceous habit (72), followed by arboreal (59), shrub (55), sub-shrub (23) and liana (14). A similar result was found in the ethnobotanical study with medicinal plants carried out in rural settlements in southwest Goiás (Silva *et al.*, 2010).

Most of the 93 native species (91.76%) are found in the Cerrado phytogeographic domain. However, these species are not exclusive to this domain and they are shared mainly with the Atlantic Forest (74.12%), Amazon (67.06%) and Caatinga (65.88%) (Figure No. 3). Among these species, four are exclusive to a Brazilian phytogeographic domain, being *Aristolochia esperanzae*, *Gomphrena arborescens* and *Lafoensia pacari* for the Cerrado; *Sambucus australis* and *Myrocarpus frondosus* for the Atlantic Forest, and *Myroxylon balsamum* for the Amazon.

Regarding threat status (Flora do Brasil, 2020), most of the native medicinal species mentioned were not evaluated (40%, n=39) (Table No. 1). Therefore, it is important to expand the studies to evaluate the threat status of these species to establish future conservation strategies. For *Baccharis crispa*, *Cecropia pachystachya* and *Vochysia elliptica* this evaluation is ongoing. For *Xylopia aromatica*, *Zeyheria montana*, *Maytenus ilicifolia*, *Mikania glomerata*, *Myracrodruon urundeuva*, *Dioscorea trifida*, *Dipteryx alata*, *Stryphnodendron adstringens*, *Hymenaea courbaril*, *Genipa americana*, *Dilodendron bipinnatum* and *Terminalia argentea* status is least concern (LC),

while for *Lychnophora ericoides*, *Amburana cearenses* and *Handroanthus impetiginosus* the status is near threatened (NT), requiring studies to prevent possible risks of extinction. The species *Anemopaegma arvense* is in the threat category as

endangered (EN), being at a very high risk of extinction of nature. This species was found at the study site in the reproductive period, the which demonstrates the importance of ethnobotanical studies for the conservation of plant species.

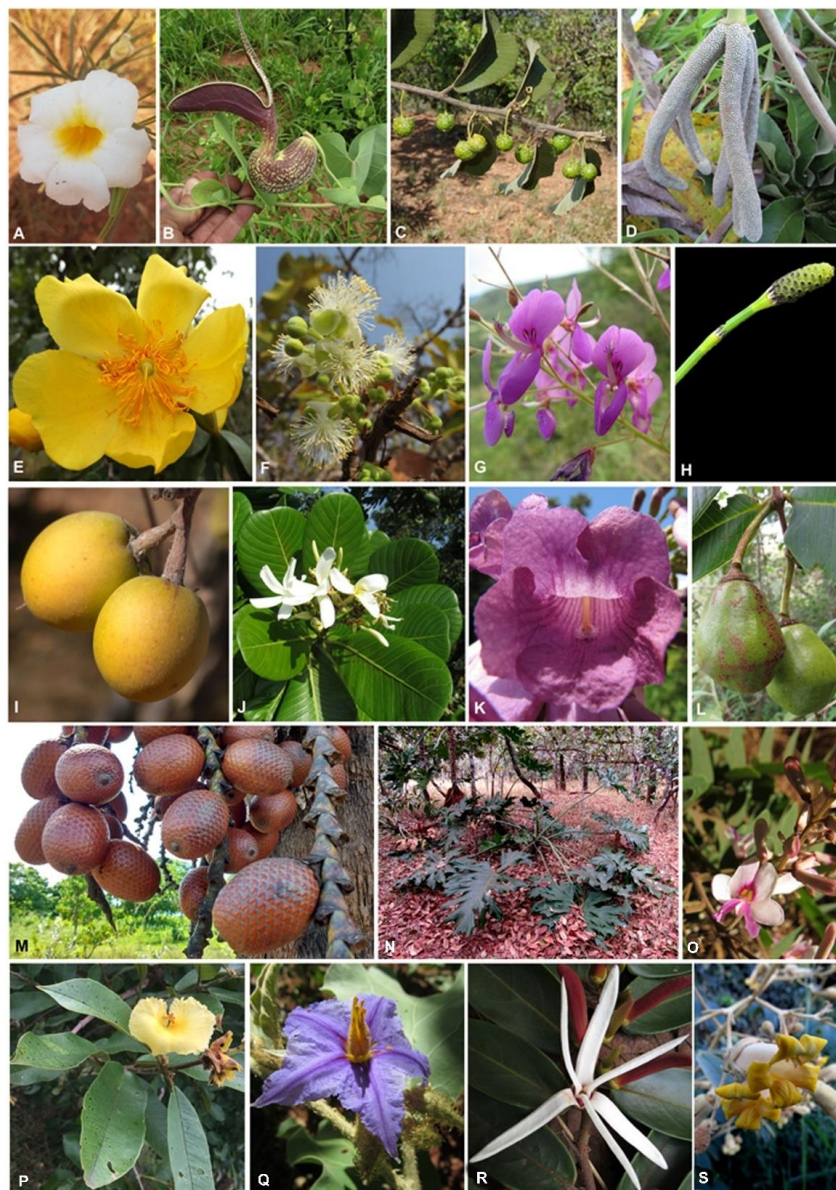


Figure No 2

Some of the medicinal species sampled in the study area Boa Esperança Settlement in Piracanjuba, Goiás, Brazil. A) *Anemopaegma arvense*; B) *Aristolochia esperanzae*; C) *Brosimum gaudichaudii*; D) *Cecropia pachystachya*; E) *Cochlospermum regium*; F) *Curatella americana*; G) *Desmodium incanum*; H) *Equisetum giganteum*; I) *Hancornia speciosa*; J) *Himatanthus obovatus*; K) *Jacaranda rufa*; L) *Lafoensia pacari*; M) *Mauritia flexuosa*; N) *Philodendron bipinnatifidum*; O) *Pterodon emarginatus*; P) *Qualea grandiflora*; Q) *Solanum lycocarpum*; R) *Xylopia aromatica*; S) *Zeyheria montana*.

Table No. 1

List of medicinal plants used in the Boa Esperança rural settlement of Piracanjuba, GO. Habit: H = herbaceous; Ar = arboreal; S = shrub; Sb = sub-shrub; L = liana. IUCN (International Union for Conservation of Nature) for native species: NE = Not evaluated, NT = Near threatened, EN = Endangered, LC = Least concern

Family	Species	Habit	Source	IUCN/Endemic to Brazil/ Phytogeographic domains
Acanthaceae	<i>Justicia pectoralis</i> Jacq.	H	native	NE/no/Amazon, Cerrado
Adoxaceae	<i>Sambucus australis</i> Cham. & Schldl.	S, Ar	native	NE/no/Atlantic Forest
Alismataceae	<i>Echinodorus grandiflorus</i> (Cham. & Schltr.) Micheli	H	native	NE/no/Caatinga, Cerrado, Atlantic Forest
Amaranthaceae	<i>Alternanthera brasiliana</i> (L.) O. Kunt	H, Sb	exotic (Egypt)	-
	<i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants	Sb	naturalized (Colombia)	-
	<i>Gomphrena arborescens</i> L.f.	Sb	native	NE/ no/Cerrado
Amaryllidaceae	<i>Allium cepa</i> L.	H	exotic (Asia)	-
	<i>Allium fistulosum</i> L.	H	exotic (Asia)	-
	<i>Allium porrum</i> L.	H	exotic (Asia)	-
	<i>Allium sativum</i> L.	H	exotic (Middle East)	-
Anacardiaceae	<i>Mangifera indica</i> L.	Ar	exotic (India)	-
	<i>Myracrodruon urundeuva</i> Allemão.	S	native	LC/no/Caatinga, Cerrado, Atlantic Forest
Annonaceae	<i>Annona muricata</i> L.	Ar	naturalized (Central America)	-
	<i>Xylopia aromatica</i> (Lam.) Mart.	S, Ar	native	LC/no/Amazon, Cerrado
Apiaceae	<i>Eryngium foetidum</i> L.	H	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa, Pantanal
	<i>Cuminum cyminum</i> L.	H	exotic (Mediterranean)	-
	<i>Daucus carota</i> L.	H	naturalized (Europe, Asia)	-
	<i>Foeniculum vulgare</i> Mill.	H	naturalized (Mediterranean)	-
	<i>Petroselinum crispum</i> (Mill.) Fuss	H	exotic (likely Europe)	-
Apocynaceae	<i>Catharanthus roseus</i> (L.) Don	H	naturalized (Madagascar)	-
	<i>Hancornia speciosa</i> Gomes	Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Himatanthus obovatus</i> (Müll. Arg.) Woodson	Ar	native	NE/no/Amazon, Caatinga, Cerrado
	<i>Mandevilla velame</i> (A.St.-Hil.) Pichon	Sb	native	NE/no/Cerrado, Pampa

	<i>Peltastes peltatus</i> (Vell.) Woodson	L	naturalized	NE/no/Cerrado, Atlantic Forest
	<i>Thevetia peruviana</i> (Pers.) K. Schum	Ar, S	native	NE/no/Amazon, Cerrado
Araceae	<i>Philodendron bipinnatifidum</i> Schott	H	native	NE/no/Cerrado, Atlantic Forest
	<i>Xanthosoma sagittifolium</i> (L.) Schott	H	naturalized (America)	-
Arecaceae	<i>Mauritia flexuosa</i> L.f.	H	native	NE/no/Amazon, Caatinga, Cerrado
Aristolochiaceae	<i>Aristolochia esperanzae</i> Kuntze	L	native	NE/no/Cerrado
	<i>Aristolochia trilobata</i> L.	L	native	NE/no/Amazon, Caatinga, Atlantic Forest
Asphodelaceae	<i>Aloe vera</i> (L.) Burm. f.	H	exotic (Africa)	-
Asteraceae	<i>Achillea millefolium</i> L.	H	exotic (Europe, Asia)	-
	<i>Achyrocline satureioides</i> (Lam.) DC	H	native	NE/no/Cerrado, Atlantic Forest, Pampa
	<i>Acmella oleraceae</i> (L.) R. K. Jansen	H	naturalized (South America)	-
	<i>Ageratum conyzoides</i> L.	H, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa, Pantanal
	<i>Artemisia absinthium</i> L.	Sb	exotic (Asia, Europe)	-
	<i>Baccharis crispa</i> Spreng.	Sb	native	NE/no/Caatinga, Cerrado, Atlantic Forest, Pampa
	<i>Bidens pilosa</i> L.	H	naturalized (likely America)	-
	<i>Dasyphyllum brasiliense</i> (Spreng.) Cabrera	S, Ar	native	NE/no/Cerrado, Atlantic Forest
	<i>Lychnophora ericoides</i> Mart.	Ar	native	NT/yes/Caatinga, Cerrado
	<i>Matricaria recutita</i> L.	H	exotic (Europe, Africa)	-
	<i>Mikania glomerata</i> Spreng.	L	native	LC/ no/Cerrado, Atlantic Forest
	<i>Solidago chilensis</i> Meyen	Sb	native	NE/no/Caatinga, Cerrado, Atlantic Forest, Pampa
	<i>Tagetes patula</i> L.	H	native	NE/no/there is no information
	<i>Tanacetum parthenium</i> (L.) Sch. Bip.	H	exotic (Europe)	-
<i>Vernonanthura polyanthes</i> (Sprengel) Vega & Dematteis	S	native	NE/no/there is no information	
Balsaminaceae	<i>Impatiens balsamina</i> L.	H	naturalized	NE/no/Atlantic Forest
Bignoniaceae	<i>Adenocalymma nodosum</i> (Silva Manso) L.G.Lohmann	S	native and endemic to Brazil	NE/yes/Caatinga, Cerrado, Atlantic Forest

	<i>Anemopagma arvense</i> (Vell.) Stellfeld ex de Souza	S	native	EN/no/Amazon, Cerrado, Atlantic Forest.
	<i>Handroanthus impetiginosus</i> (Mart. ex DC.) Mattos	Ar	native	NT/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Jacaranda rufa</i> Silva Manso	S	native and endemic to Brazil	NE/yes/Cerrado, Atlantic Forest
	<i>Zeyheria montana</i> Mart.	S	native and endemic to Brazil	LC/Yes/Amazon, Caatinga, Cerrado, Atlantic Forest
Bixaceae	<i>Bixa orellana</i> L.	S, Ar	native	NE/no/Amazon, Cerrado, Atlantic Forest
	<i>Cochlospermum regium</i> (Mart. ex Schrank) Pilg.	S, Sb	native	LC/no/Amazon, Caatinga, Cerrado, Pantanal
Boraginaceae	<i>Symphytum officinale</i> L.	H	exotic (Europe and Asia)	-
Brassicaceae	<i>Brassica sylvestris</i> (L.) Mill.)	H	exotic (Europe)	-
	<i>Eruca sativa</i> Mill.	H	exotic (Mediterranean, Asia)	-
Cannabaceae	<i>Celtis iguanea</i> (Jacq.) Sarg.	S, Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa, Pantanal
Caricaceae	<i>Carica papaya</i> L.	Ar, S	naturalized (India)	-
Celastraceae	<i>Maytenus ilicifolia</i> (Schrad.) Planch.	S	native	LC /no/Cerrado, Atlantic Forest, Pampa
Chenopodiaceae	<i>Beta vulgaris</i> L.	H	exotic (Europe)	-
Combretaceae	<i>Terminalia argentea</i> Mart.	S, Ar	native	LC/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Convolvulaceae	<i>Operculina macrocarpa</i> (L.) Urb.	L	native	LC/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Costaceae	<i>Costus spiralis</i> (Jacq.) Roscoe	H	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
Crassulaceae	<i>Kalanchoe laetivirens</i> Desc.	H	exotic (Africa)	-
	<i>Kalanchoe pinnata</i> (Lam.) Pers.	H	naturalized (likely Madagascar)	-
	<i>Sedum dendroideum</i> DC.	H	exotic (Africa)	-
Cucurbitaceae	<i>Cayaponia tayuya</i> (Vell.) Cogn.	L	native and endemic to Brazil	NE/yes/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Cucurbita pepo</i> L.	L	exotic (Mexico)	-
	<i>Cucumis anguria</i> L.	L	native	NE/no/Amazon, Cerrado, Atlantic Forest
	<i>Luffa operculata</i> L. Cogn.	L	native	NE/no/Cerrado, Atlantic Forest
	<i>Momordica charantia</i> L.	L	naturalized (Asia)	-
Dilleniaceae	<i>Curatella americana</i> L.	Ar, S	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Dioscoreaceae	<i>Dioscorea trifida</i> L. f.	L	native	LC/no/Amazon, Cerrado
Equisetaceae	<i>Equisetum giganteum</i> L.	H	native	NE/no/Cerrado, Atlantic Forest.

Euphorbiaceae	<i>Croton antisiphiliticus</i> Mart.	H, S, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Croton urucurana</i> Baill.	Ar	native	NE/no/Amazon, Cerrado, Atlantic Forest
	<i>Euphorbia hirta</i> L.	h	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa
	<i>Manihot esculenta</i> Crantz.	S	native	NE/no/Amazon, Cerrado
	<i>Ricinus communis</i> L.	S	naturalized (Africa)	-
Fabaceae	<i>Amburana cearenses</i> (Allemão) A. C. Sm.	Ar	native	NT/no/Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Anadenanthera colubrina</i> (Vell.) Brenan	S, Ar	native	NE/no/Caatinga, Cerrado, Atlantic Forest
	<i>Apuleia ferrea</i> (Mart.) Baill.	Ar	exotic (Africa)	-
	<i>Bauhinia variegata</i> L.	Ar	naturalized (China)	-
	<i>Cajanus cajan</i> (L.) Huth	S	Exotic (India)	-
	<i>Copaifera langsdorffii</i> Desf.	Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Desmodium incanum</i> (Sw.) DC.	Sb	naturalized (America)	-
	<i>Dipteryx alata</i> Vogel	Ar	native	LC/no /Amazon, Caatinga, Cerrado
	<i>Erythrina verna</i> Vell.	Ar	native	NE/yes/Amazon, Cerrado, Atlantic Forest
	<i>Hymenaea courbaril</i> L.	Ar	native	LC/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Myroxylon balsamum</i> (L.) Harms	Ar	native	NE/no/Amazon
	<i>Periandra mediterranea</i> (Vell.) Taub.	S, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Plathymenia reticulata</i> Benth.	Ar	native	LC/no/Amazon, Caatinga, Cerrado, Atlantic Forest
<i>Pterodon emarginatus</i> Vogel	Ar	native	NE/no/Amazon, Caatinga, Cerrado, Pantanal	
<i>Senna occidentalis</i> (L.) Link	S, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal	
<i>Stryphnodendron adstringens</i> (Mart.) Coville	Ar	native	LC/no/Amazon, Caatinga, Cerrado	
Gentianaceae	<i>Centaurium erythraea</i> Rafn	H	naturalized (Europe)	-
Juncaceae	<i>Juncus effusus</i> L.	H	native	NE/no/Atlantic Forest
Lamiaceae	<i>Leonotis nepetifolia</i> (L.) R.Br.	H	naturalized (Africa)	-
	<i>Mentha canadensis</i> L.	H	exotic (China)	-
	<i>Mentha x officinalis</i> Hull	S	exotic (Mediterranean)	-
	<i>Mentha pulegium</i> L.	H	exotic (Europe)	-
	<i>Mentha spicata</i> L.	H	exotic (Europe)	-

	<i>Ocimum basilicum</i> L.	Sb	exotic (Asia, Africa)	-
	<i>Ocimum gratissimum</i> L.	Sb	naturalized (Asia and Africa)	-
	<i>Origanum majorana</i> L.	Sb	exotic (Asia)	-
	<i>Plectranthus barbatus</i> Andrews	H	exotic (Africa)	-
	<i>Plectranthus amboinicus</i> (Lour.) Spreng.	H	exotic (Africa)	-
	<i>Rosmarinus officinalis</i> L.	Sb	exotic (Europe)	-
	<i>Tetradenia riparia</i> (Hochst.) Codd	Ar	exotic (Africa)	-
Lauraceae	<i>Persea americana</i> Mill.	Ar	naturalized (America)	-
	<i>Cinnamomum verum</i> J.Presl	Ar	exotic (Asia)	-
Loganiaceae	<i>Strychnos pseudoquina</i> A.St.-Hil.	Ar, S	native	NE/no/Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Lafoensia pacari</i> St. Hil.	Ar	native	LC/no/Cerrado
Lythraceae	<i>Punica granatum</i> L.	S, Ar	exotic (Asia)	-
	<i>Gossypium herbaceum</i> L.	S	naturalized (America)	-
Malpighiaceae	<i>Byrsonima verbascifolia</i> (L.) DC.	S, Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest.
Malvaceae	<i>Guazuma ulmifolia</i> Lam.	Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Helicteres brevispira</i> A.St.-Hil.	S	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
Melastomataceae	<i>Miconia albicans</i> (Sw.) Triana	S, Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Meliaceae	<i>Guarea guidonia</i> (L.) Sleumer	Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Moraceae	<i>Brosimum gaudichaudii</i> Trécul	Ar, S	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Dorstenia cayapia</i> Vell.	H	native	LC/yes/Caatinga, Cerrado, Atlantic Forest
	<i>Maclura tinctoria</i> (L.) D. Don ex Steud.	Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Morus alba</i> L.	Ar, S	exotic (China)	-
Moringaceae	<i>Moringa oleifera</i> Lam.	S	exotic (India)	-
Musaceae	<i>Musa paradisiaca</i> L.	H	naturalized (Nicaragua)	-
Myrtaceae	<i>Eucalyptus citriodora</i> Hook.	Ar	exotic (Australia)	-
	<i>Eucalyptus globulus</i> Labill	Ar	exotic (Australia)	-
	<i>Psidium guajava</i> L.	Ar	naturalized (America)	-
Orchidaceae	<i>Cyrtopodium saintlegerianum</i> Rchb.f.	H	native	NE/no/Amazon, Caatinga, Cerrado
	<i>Vanilla planifolia</i> Jacks. ex Andrews	H	native	NE/no/Amazon, Atlantic Forest

Passifloraceae	<i>Passiflora edulis</i> Sims	L	native	LC/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
Phyllanthaceae	<i>Phyllanthus niruri</i> L.	H, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Phytolaccaceae	<i>Petiveria alliacea</i> L.	Sb	naturalized (Africa)	-
Piperaceae	<i>Piper aduncum</i> L.	S	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa, Pantana
	<i>Piper nigrum</i> L.	S, L	exotic (India)	-
Plantaginaceae	<i>Plantago major</i> L.	H	naturalized (Europe)	-
Proteaceae	<i>Roupala montana</i> var. <i>brasiliensis</i> (Klotzsch) K. S. Edwards	S, Ar	native	NE/no/Cerrado, Atlantic Forest
Poaceae	<i>Coix lacryma-jobi</i> L.	S	naturalized (India)	-
	<i>Cymbopogon citratus</i> (DC.) Stapf	H	naturalized (India)	-
	<i>Cymbopogon nardus</i> (L.) Rendle	H	naturalized (Africa and Asia)	-
	<i>Melinis minutiflora</i> P. Beauv.	H	naturalized (Africa)	-
Polygalaceae	<i>Polygala longicaulis</i> Kunth.	H	native	NE/yes/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa, Pantanal
Polygonaceae	<i>Rumex acetosa</i> L.	H	naturalized (Asia)	-
Pteridaceae	<i>Adiantum capillus-veneris</i> L.	H	native	NE/no/Atlantic Forest
Rosaceae	<i>Prunus domestica</i> L.	Ar	exotic (China)	-
	<i>Rosa alba</i> L.	S	exotic (Asia)	-
Rubiaceae	<i>Alibertia edulis</i> (Rich.) A.Rich.	S, Ar	native	NE/no/Amazon, Cerrado
	<i>Genipa americana</i> L.	S, Ar	native	LC/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Morinda citrifolia</i> L.	S	exotic (Asia)	-
	<i>Palicourea coriacea</i> (Cham.) K.Schum	S, Sb	native	NE/no/Amazon, Caatinga, Cerrado
	<i>Palicourea rigida</i> Kunth.	S, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa
	<i>Rudgea viburnoides</i> (Cham.) Benth.	S	native	NE/no/Amazon, Caatinga, Cerrado
Rutaceae	<i>Citrus aurantium</i> L.	Ar	exotic (Asia)	-
	<i>Citrus aurantiifolium</i> (Christm.) Swingle	Ar	exotic (Asia)	-
	<i>Citrus limon</i> (L.) Osbeck	Ar	naturalized (Asia)	-
	<i>Citrus sinensis</i> (L.) Osbeck	Ar	exotic (Asia)	-
	<i>Ruta graveolens</i> L.	H	Exotic (Europe)	-

Salicaceae	<i>Casearia sylvestris</i> Sw.	Ar, S, Sb	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa, Pantanal
Sapindaceae	<i>Dilodendron bipinnatum</i> Radlk.	Ar	native	LC/no/Amazon, Cerrado, Atlantic Forest
Sapotaceae	<i>Pouteria caimito</i> (Ruiz Pav.) Radlk.	Ar	native	NE/no/Amazon, Cerrado, Atlantic Forest
Siparunaceae	<i>Siparuna guianensis</i> Aublet	S, Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
Smilacaceae	<i>Smilax brasiliensis</i> Spreng.	S, Sb, L	native and endemic to Brazil	NE/yes/Cerrado
Solanaceae	<i>Atropa belladonna</i> L.	S	exotic (Australia)	-
	<i>Solanum cernuum</i> Vell.	S	native and endemic to Brazil	NE/yes/Cerrado, Atlantic Forest
	<i>Solanum lycocarpum</i> St. Hil.	Ar, S	native	NE/no/Cerrado, Atlantic Forest
	<i>Solanum paniculatum</i> L.	S	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Urticaceae	<i>Cecropia pachystachya</i> Trécul	H	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
Verbenaceae	<i>Lantana trifolia</i> L.	S	native	NE/no/Amazon, Cerrado, Atlantic Forest
Vochysiaceae	<i>Vochysia elliptica</i> Mart.	Ar	native	NE/yes/Amazon, Caatinga, Cerrado, Atlantic Forest, Pantanal
	<i>Qualea grandiflora</i> Mart.	S, Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
	<i>Qualea parviflora</i> Mart.	S, Ar	native	NE/no/Amazon, Caatinga, Cerrado, Atlantic Forest
Zingiberaceae	<i>Curcuma longa</i> L.	H	exotic (India)	-
	<i>Curcuma zedoaria</i> (Christm.) Roscoe	H	exotic (Asia)	-
	<i>Zingiber officinale</i> Roscoe	H	exotic (Asia)	-

The richest genera in species were *Allium* L., *Citrus* L. and *Mentha* L., all with four species each. In other ethnobotanical studies, in a Cerrado area, similar results were found, such as those of Amorozo (2002); Borba & Macedo (2006); Silva & Proença (2007); Alves & Povh (2013); Ferreira et al. (2015) and Guimarães et al. (2019).

Among the medicinal species mentioned, most are native (55,11%, n=97), followed by exotics (28,40%, n=50) and naturalized (16,47%, n=29) (Table No. 1). Among the native ones eight are endemic to Brazil: *Adenocalymma nodosum*, *Cayaponia tayuya*, *Dorstenia cayapia*, *Jacaranda rufa*, *Smilax brasiliensis*, *Solanum cernuum*,

Vochysia elliptica and *Zeyheria montana*. The use of medicinal species, the majority of which are native, has also been recorded by other ethnobotanical research (Oliveira et al., 2010; Cunha & Bortolotto, 2011; Leandro et al., 2017; Guimarães et al., 2019). There was a predominance of herbaceous habit (72), followed by arboreal (59), shrub (55), sub-shrub (23) and liana (14). A similar result was found in the ethnobotanical study with medicinal plants carried out in rural settlements in southwest Goiás (Silva et al., 2010).

Most of the 93 native species (91.76%) are found in the Cerrado phytogeographic domain. However, these species are not exclusive to this

domain and they are shared mainly with the Atlantic Forest (74.12%), Amazon (67.06%) and Caatinga (65.88%) (Figure No. 3). Among these species, four are exclusive to a Brazilian phylogeographic domain, being *Aristolochia esperanzae*, *Gomphrena*

arborescens and *Lafoensia pacari* for the Cerrado; *Sambucus australis* and *Myrocarpus frondosus* for the Atlantic Forest, and *Myroxylon balsamum* for the Amazon.

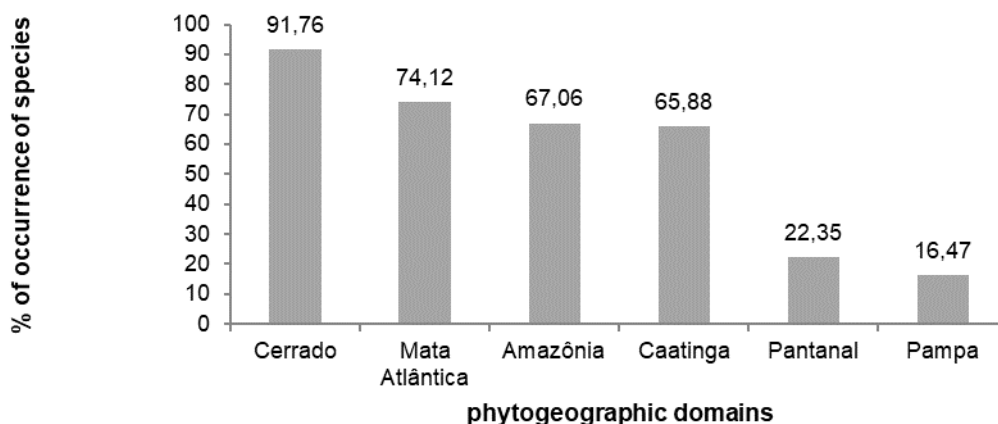


Figure No .3

Percentage of medicinal plant species used in the Boa Esperança Settlement in Piracanjuba, GO, according to the occurrence in the Brazilian phylogeographic domain

Regarding threat status (Flora do Brasil, 2020), most of the native medicinal species mentioned were not evaluated (40%, n=39) (Table No. 1). Therefore, it is important to expand the studies to evaluate the threat status of these species to establish future conservation strategies. For *Baccharis crispa*, *Cecropia pachystachya* and *Vochysia elliptica* this evaluation is ongoing. For *Xylopia aromatica*, *Zeyheria montana*, *Maytenus ilicifolia*, *Mikania glomerata*, *Myracrodruon urundeuva*, *Dioscorea trifida*, *Dipteryx alata*, *Stryphnodendron adstringens*, *Hymenaea courbaril*, *Genipa americana*, *Dilodendron bipinnatum* and *Terminalia argentea* status is least concern (LC), while for *Lychnophora ericoides*, *Amburana cearensis* and *Handroanthus impetiginosus* the status is near threatened (NT), requiring studies to prevent possible risks of extinction. The species *Anemopaegma arvense* is in the threat category as endangered (EN), being at a very high risk of extinction of nature. This species was found at the study site in the reproductive period, the which demonstrates the importance of ethnobotanical studies for the conservation of plant species.

There was a predominance of use of plants to treat diseases related to airway problems (77%) and digestive system (75%), followed by diseases associated with inflammation and pain (50%) and dermatological problems (33%) (Table No. 2; Figure No. 4). Diseases related to the gastrointestinal and respiratory system are among the most cited in other ethnobotanical studies in the country (Pinto *et al.*, 2006; Silva *et al.*, 2010; Guimarães *et al.*, 2019). In the Northeast region of Brazil, the most treated disorders by medicinal plants are gastrointestinal and respiratory tract disorders (Rodrigues & Andrade, 2014; Brito *et al.*, 2017). The lack of basic sanitation may also justify the large number of citations for the categories of disorders of the digestive and respiratory systems.

As for the part of the plant most used for the preparation of home remedies, the leaves (54.49%) were mentioned in decreasing order, followed by the root (17.98%) and barks, stem and fruit barks (17.42%). Other parts were mentioned, such as seeds, shoots, resins and the entire plant. In addition, it was mentioned the combination with other medicinal species and the use of other ingredients in the

preparation, such as: vinegar, alcohol, honey and wines (Table No. 2). The greater use of leaves for the preparation of herbal medicines can be justified because it contains most of the active ingredients of

the plants, in addition to its greater availability throughout the year (Vasquez *et al.*, 2014; Costa & Marinho, 2016; Gomes & Lima, 2017).

Table No. 2
Recommendation of the use of plants, used part and instructions for use and/or preparation of medicinal plants used in the Boa Esperança rural settlement of Piracanjuba, GO

Species	Recommendation	Used part	Instructions for use and/or preparation
<i>Achillea millefolium</i>	Fungicide	leaves	Infusion
<i>Achyrocline satureioides</i>	Dysentery and digestive problems	leaves, branches	Infusion
<i>Acmella oleraceae</i>	Antifungal, antiseptic, antiviral, diuretic and immune system stimulant	leaves	Food and tea
<i>Adenocalymma nodosum</i>	Laxative, purgative, blood purifier	leaves	Infusion
<i>Adiantum capillus-veneris</i>	Flu, cold, cough	leaves	Tea
<i>Ageratum conyzoides</i>	Analgesic, prickly heat, indigestion, menstrual cramps	leaves and roots	Infusion, baths
<i>Alibertia edulis</i>	Anti-inflammatory urinary tract, diarrhea, hemorrhoids	leaves	Tea por infusion and syrup
<i>Allium cepa</i>	Flu, cough, throat	bulb	Syrup with lemon, saffron, garlic, chives, honey and water
<i>Allium fistulosum</i>	Flu, cough, throat	leaves	Syrup with lemon, saffron, garlic, chives, honey and water
<i>Allium porrum</i>	Infections	bulb	Spice
<i>Allium sativum</i>	Flu, cough, throat, anti-inflammatory	bulb	Syrup with lemon, saffron, garlic, chives, honey and water
<i>Aloe vera</i>	Healing, emollient, antimicrobial, hemorrhoids, gastritis, ulcer	leaves	Tea
<i>Alternanthera brasiliana</i>	Anti-inflammatory, healing, painkiller	leaves	Tea, plaster
<i>Amburana cearenses</i>	Circulatory problems	bast, seeds	Infusion
<i>Anadenanthera colubrina</i>	Bronchitis, asthma	bast, resin	Tea, syrup
<i>Anemopagma arvense</i>	Aphrodisiac, kidneys	leaves, root, whole plant	Infusion, pill
<i>Annona muricata</i>	Antitumor	leaves, fruits	Tea and juice
<i>Apuleia ferrea</i>	Diabete, arthritis, rheumatism	bard, seeds	Decoction, pill

<i>Aristolochia esperanzae</i>	Stomach burn, heartburn, indigestion	leaves	Infusion
<i>Aristolochia trilobata</i>	Diarrhea, dysentery, ulcer	whole plant	Infusion
<i>Artemisia absinthium</i>	Herpes, erysipelas, skin wounds and diabetes, stomach disorders	leaves, root	Infusion, maceration
<i>Atropa belladonna</i>	erysipelas	flowers	Bath
<i>Baccharis crispa</i>	Liver problems, stomach disorders, intestinais, anti-inflammatory, diuretic, digestive, antianemic, antiasthmatic, antibiotic, antidiarrheal, antidisepctic, antigripal, anti-hydropic, anti-rheumatic, laxative, sweating and deworming, diabetes	leaves	Infusion, powder, pill
<i>Bauhinia variegata</i>	Diabetes, chest pain, heart	flower	Infusion
<i>Beta vulgaris</i>	Expectorant	tuber	Put beet and onion pieces, let it rest, and drink the syrup
<i>Bidens pilosa</i>	Hepatite, anemia, icterus, healing, wounds, mycoses	leaves, whole plant	Infusion, baths
<i>Bixa orellana</i>	Anemia, anti-inflammatory	leaves, fruits	Infusion, powder
<i>Brassica sylvestris</i>	Gastritis	leaves	Juice
<i>Brosimum gaudichaudii</i>	Vitiligo, ulcers, dewormer	bark of roots, fruits, leaves	Decoction of roots and leaves and use in the bath
<i>Byrsonima verbascifolia</i>	Cold, antioxidant	fruits	Food
<i>Cajanus cajan</i>	Anti-inflammatory, sinusitis	seed	Food
<i>Carica papaya</i>	Asthma, flu, diabetes, dewormer and to eliminate warts	latex, seeds, flowers	Fresh latex is used to eliminate warts. It is common to use dry and ground seeds in the form of tea as a dewormer and for influenza
<i>Casearia sylvestris</i>	In the treatment of pulmonary emphysema, gastritis and Ulcer, spine, rheumatism, diarrhea, hemorrhoids	leaves	Maceration
<i>Catharanthus roseus</i>	Fungicide, cancer	flowers	Infusion
<i>Cayaponia tayuya</i>	Against pain in general	roots	Decoction

	and as a blood purifier		
<i>Cecropia pachystachya</i>	Diabetes, Kidneys, pain in general, cancer	broto, leaves, bast	Tea, cream
<i>Celtis iguanea</i>	Kidney problems	leaves	Infusion
<i>Centaurium erythraea</i>	Liver, indigestion, gallbladder, gastrointestinal disorder	leaves	Infusion
<i>Cinnamomum verum</i>	Cold, sore throat	leaves, bark e bast	Tea, hot chocolate with other ingredients (egg, alfavaca, honey)
<i>Citrus aurantiifolium</i>	In the treatment of sinusitis and to regulate blood pressure	fruits	Remove the bark of the fruit; after washing, place it in a glass jar with alcohol and smell
<i>Citrus aurantium</i>	Constipation	fruits	Food
<i>Citrus limon</i>	Gastritis, antiseptic use indicated mainly to prevent infectious diseases, flu, cold, expectorant	fruit juice	Drink the fruit broth with water. Drink with honey, saffron, garlic and lemon.
<i>Citrus sinensis</i>	indigestion	bark	Peel with water, coffee powder, boil and drink
<i>Cochlospermum regium</i>	Infections, blood purifier	root	Tea
<i>Coix lacryma-jobi</i>	Diuretic, antiseptic respiratory and urinary tract and antirheumatic	leaves, fruits	Infusion
<i>Copaifera langsdorffii</i>	Pneumonia, healing	oil	Burn the oil in alcohol and apply to the pain site
<i>Costus spiralis</i>	Reins, kidney stones, tumors	stem, leaves	Infusion
<i>Croton antisiphiliticus</i>	Infections, infection in the uterus, ovary, cyst, fibroid, discharge, gastritis, ulcer, hemorrhoid, diarrhea, scarring and as a blood purifier	root, leaves, whole plant	Infusion, decoction
<i>Croton urucurana</i>	Uterine infection, healing, infections, gastritis, to eliminate erysipelas and skin rashes	bark, sap, resin	Tea
<i>Cucumis anguria</i>	aphrodisiac	fruits, leaves	Food
<i>Cucurbita pepo</i>	Worms	seeds	Toasting and grinding
<i>Cuminum cyminum</i>	Increases immunity	Leaves, fruits	Tea
<i>Curatella americana</i>	Kidney infections	leaves	Infusion
<i>Curcuma longa</i>	In the treatment of cough and diseases of the	rhizomes	Tea or syrup

	respiratory tract, antifungal, bactericidal, anti-caries, depression, cancer		
<i>Curcuma zedoaria</i>	Vermifuge, vomit, digestive	leaves, root	Tea, plaster
<i>Cymbopogon citratus</i>	Soothing, antidepressant in the treatment of flu	leaves	Infusion
<i>Cymbopogon nardus</i>	Repellent	leaves	Infusion by alcohol
<i>Cyrtopodium saintlegerianum</i>	Stomach and boil problems	sap, bulb, root	Syrup
<i>Dasyphyllum brasiliense</i>	Kidney problems	leaves	Infusion
<i>Daucus carota</i>	Increases immunity	root	Juice beaten with passion fruit, lemon, cabbage and orange or in food
<i>Desmodium incanum</i>	Kidney stones, kidney problems	leaves	Infusion
<i>Dilodendron bipinnatum</i>	Body pain, low back pain treatment, back problems	leaves, bark	Tea por decoction and infusion
<i>Dioscorea trifida</i>	Blood purifier, female fertility	rhizome	Food
<i>Dipteryx alata</i>	Kidney problems, kidney stones	bast fruits, seeds	Infusion
<i>Dorstenia cayapia</i>	Anti-inflammatory, diarrhea	root	Food
<i>Dysphania ambrosioides</i>	Anti-inflammatory, healing, anesthetizing, worms	leaves, fruits	Maceration tea; plaster of the leaf with little vinegar (put on the wound); beat the leaf in the blender with mint and milk; shaped candy
<i>Echinodorus grandiflorus</i>	Kidney stones, anti-inflammatory, liver problems	leaves	Infusion
<i>Equisetum giganteum</i>	Kidney problems	whole plant	Tea
<i>Eruca sativa</i>	Infections	root	Tea
<i>Eryngium foetidum</i>	Digestive, infections	whole plant	Spice
<i>Erythrina verna</i>	Hepatitis, soothing	bast, bark	Infusion
<i>Eucalyptus citriodora</i>	Repellent, flu, sinusitis	leaves	Infusion
<i>Eucalyptus globulus</i>	Pneumonia	leaves	Infusion
<i>Euphorbia hirta</i>	Hemorrhage, warts	root, latex	Tea
<i>Foeniculum vulgare</i>	Flu and blood pressure regulator	seeds, leaves and root	Infusion tea
<i>Genipa americana</i>	Kidney infections, expectorant	bast	Infusion, syrup
<i>Gomphrena arborescens</i>	Fever and diarrhea	root	Decoction
<i>Gossypium herbaceum</i>	Antibiotic, infections treatment, kidney	leaves	Infusion, maceration

	infection, cough		
<i>Guarea guidonia</i>	Stomach problems	leaves e fruits	Decoction
<i>Guazuma ulmifolia</i>	Spine problems, hair tonic, astringent and sweat	sap	Shampoo, cream
<i>Hancornia speciosa</i>	Ulcer	resin, fruits	Food
<i>Handroanthus impetiginosus</i>	Anti-inflammatory and antibacterial, bronchitis, asthma	bast	Infusion
<i>Helicteres brevispira</i>	Blood purifier	leaves, roots	Tea, infusion
<i>Himatanthus obovatus</i>	Blood purifier	rhizome	Food
<i>Hymenaea courbaril</i>	Bronchitis, throat infection, bones, prostate	bark, bast, resin	Maceration
<i>Impatiens balsamina</i>	Skin lesions	leaves, stems	Punched leaves and stems can be applied directly to the affected parts
<i>Jacaranda rufa</i>	Masks, wounds, healing, blood purifier	leaves, root, whole plant	Bath, Tea
<i>Juncus effusus</i>	Female infections	root	Infusion by alcohol
<i>Justicia pectoralis</i>	Vertigo	leaves	Infusion, decoction
<i>Kalanchoe laetivirens</i>	Gastritis, ulcer	leaves	Maceration
<i>Kalanchoe pinnata</i>	Natural expectorant, gastritis, ulcer	leaves	Maceration, juice
<i>Lafoensia pacari</i>	Diarrhea, intestinal problems	bark, bast	Infusion
<i>Lantana trifolia</i>	Belly pain with infection, cough	whole plant	Tea
<i>Leonotis nepetifolia</i>	Diarrhea, asthma, rheumatism	whole plant, root	Infusion
<i>Luffa operculata</i>	Sinusitis	fibrous fruit loofah	Put a coffee spoon of salt in a teacup of water. Peel the buchinha and cut a piece with 2 cm and put in the cup of water and salt, letting it rest for 5 days and strain. Drip 2 drops into each nostril, morning and evening, without blowing your nose, letting it flow naturally
<i>Lychnophora ericoides</i>	Bruises, relieve swelling and pain in the legs, repellent and anti-inflammatory	whole plant	Infusion in alcohol, soap, cream, gel
<i>Maclura tinctoria</i>	Infections in the tooth	latex	Skin
<i>Mandevilla velame</i>	Anti-inflammatory, infections and blood purifying	root	Decoction

<i>Mangifera indica</i>	Bronchitis	leaves	The leaves must be dried in the sun, in a ventilated place and without humidity, and then they must be stored in cloth or paper bags. Making tea by infusion
<i>Manihot esculenta</i>	Strengthen bones	leaves	Flour, food
<i>Matricaria recutita</i>	Soothing, indigestion and intestinal problems	flowers	Infusion
<i>Mauritia flexuosa</i>	Snake bite	leaves	Apply the juice of the leaves to the bite
<i>Maytenus ilicifolia</i>	Reins, kidney stones	leaves	Infusion
<i>Melinis minutiflora</i>	Rheumatism	leaves	Infusion
<i>Mentha canadensis</i>	Flu and asthma	leaves	Infusion
<i>Mentha pulegium</i>	Cure navel and jaundice	leaves	Infusion
<i>Mentha spicata</i>	Soothing and gases	leaves	Infusion
<i>Mentha x officinalis</i>	Labyrinthitis, high blood pressure	leaves	Infusion
<i>Miconia albicans</i>	Anti-inflammatory, back pain, joints, for arthritis, osteoarthritis, urine infection	leaves, roots	Maceration, cream
<i>Mikania glomerata</i>	Pneumonia, cough, Bronchitis and hoarseness, throat infection	leaves	Infusion, syrup
<i>Momordica charantia</i>	Diabetes, roundworm, fungicide, bactericide, repellent	leaves	Use fresh leaf juice diluted with water. Put it in alcohol, boil it in water and let it repel insects. Shampoo, soap
<i>Morinda citrifolia</i>	In the treatment of bedsores and various diseases	fruits, leaves	Bath, juice, maceration
<i>Moringa oleifera</i>	Anemia, malnutrition	leaves, flowers	Infusion
<i>Morus alba</i>	Treatment of thrush, menopause, natural hormone, kidney problems	leaves, fruit	Tea, juice
<i>Musa paradisiaca</i>	Clear lung, bronchitis, pneumonia and hepatitis	bud	Syrup
<i>Myracrodruon urundeuva</i>	Antimicrobial, erysipelas, blood purifier, mycoses, some types of cancer, cleansing the skin, itches, acne, spots on the skin, diarrhea, disinfection of wounds and fractures	bast	Bottled, external application in the form of antiseptic, for fractures and exposed wounds. In the form of lotions, gels or soaps.

<i>Myroxylon balsamum</i>	Infections	leaves, bast	Tea
<i>Ocimum basilicum</i>	Soothing	leaves	Infusion
<i>Ocimum gratissimum</i>	Flu, sinusitis, expectorant, lung problems	leaves	Infuse in the preparation of anti-flu baths. Beat the yolk with cinnamon, honey and add the alfavaca tea
<i>Operculina macrocarpa</i>	Blood purifying	rhizome	Food
<i>Origanum majorana</i>	Indigestion, constipation	leaves	Infusion, spice
<i>Palicourea coriacea</i>	Treats skin diseases, lowers blood pressure and helps treat syphilis	leaves, bark	Decoction
<i>Palicourea rigida</i>	Heart problems, circulation, wounds, prevention of stretch marks	leaves	Infusion
<i>Passiflora edulis</i>	Immunity, soothing	fruits	Juice
<i>Peltastes peltatus</i>	Uterus infection, female infertility	leaves, stalk	Infusion
<i>Periandra mediterranea</i>	Infection of throat and flu	root, rhizome	Syrup
<i>Persea americana</i>	Cholesterol, kidney stones, kidney infection	leaves, fruits, root, whole plant	Food, infusion
<i>Petiveria alliacea</i>	Cough and flu, analgesic, body aches	leaves, root	Infusion
<i>Petroselinum crispum</i>	Uterus infection	root, whole plant	Tea
<i>Philodendron bipinnatifidum</i>	Back pain, rheumatism	leaves, fruits	Infusion in alcohol, cream
<i>Phyllanthus niruri</i>	Infections and urinary problems, stomach disorders	whole plant	Infusion
<i>Piper aduncum</i>	Wounds, healing, spice	leaves, fruits	Infusion
<i>Piper nigrum</i>	In the treatment of inflammation, sinusitis and digestion problems	fruits	Spice
<i>Plantago major</i>	Throat	leaves	Infusion
<i>Plathymenia reticulata</i>	Gastritis, ulcer, stomach infections	bast	Infusion, pill
<i>Plectranthus amboinicus</i>	Soothing, colds, cough, fungicide	leaves	Infusion, maceration, syrup
<i>Plectranthus barbatus</i>	Digestive problems, labyrinthitis	leaves	Infusion or by maceration, compressed powder
<i>Polygala longicaulis</i>	Cold, flu	root	Tea
<i>Pouteria caimito</i>	Diabetes	fruits	Food
<i>Prunus domestica</i>	Cough, high pressure	fruits	Syrup
<i>Psidium guajava</i>	Toothache, acne, hair loss, throat infection, diarrhea	leaves, bud	Infusion, soap

<i>Pterodon emarginatus</i>	Indigestion, throat infections	bark, seeds	Maceration
<i>Punica granatum</i>	Throat infection	seeds, fruit and trunk bark, root bark	Decoction of 1/4 of the peel of a fruit for 10 minutes in a glass of water
<i>Qualea grandiflora</i>	Intestinal and liver problems	leaves, bast	Infusion
<i>Qualea parviflora</i>	Bronchitis, cough	seeds	Infusion
<i>Ricinus communis</i>	Emollient and healing	oil	Skin
<i>Rosa alba</i>	In the treatment of boils, skin infections	flowers	Boiling in milk
<i>Rosmarinus officinalis</i>	Soothing, chest and heart pain	leaves	Infusion
<i>Roupala montana var. brasiliensis</i>	Diarrhea, rheumatism, anti-inflammatory, blood purifier	leaves, bast	Infusion
<i>Rudgea viburnoides</i>	Prevention of stretch marks, high blood pressure, arterial problems	leaves	Infusion, pill
<i>Rumex acetosa</i>	Diarrhea	leaves	Infusion
<i>Ruta graveolens</i>	In sty treatment, delayed menstruation	leaves	Infusion by alcohol
<i>Sambucus australis</i>	Colds, sinusitis, catarrh elimination, measles and arthritis	flowers and bast	Infusion
<i>Sedum dendroideum</i>	Ear pain, healing, natural throat infection	leaves	Maceration, Infusion
<i>Senna occidentalis</i>	Pneumonia, flu	root	Tea
<i>Siparuna guianensis</i>	erysipelas, skin problems	leaves	Bath, cream, soap, infusion
<i>Smilax brasiliensis</i>	Infection, snakebite	root, juice	Cream, infusion
<i>Solanum cernuum</i>	Infection, post surgery	leaves	Infusion
<i>Solanum lycocarpum</i>	Diabetes, cholesterol, lung infection, expectorant, bronchitis, hepatitis pneumonia, gastritis and ulcers, skin cancer	flowers, fruits	Pill, cream, shampoo, soap
<i>Solanum paniculatum</i>	Liver problems, Digestive problems, flu	root, fruto	Tea, food
<i>Solidago chilensis</i>	Bruises, relieve swelling and pain in the legs, as repellent and anti-inflammatory	whole plant	Infusion in alcohol, soap, cream, gel
<i>Strychnos pseudoquina</i>	In the treatment of urinary infections, liver and stomach problems	leaves, bast, root	Infusion

	and diabetes		
<i>Stryphnodendron adstringens</i>	Healing of skin wounds, gastritis, ulcer, infection in the uterus and vaginal discharge, leukorrhea, bactericide and fungicide	bast, leaves	Tea
<i>Symphytum officinale</i>	Infection, contusion, baldness	leaves	Plaster
<i>Tagetes patula</i>	Joint pain, rheumatism	leaves, flowers	Tea
<i>Tanacetum parthenium</i>	Helps purify the body in the postpartum period and regulate menstruation	leaves	Tea
<i>Terminalia argentea</i>	Flu and breathing problems	bast	Tea
<i>Tetradenia riparia</i>	Burns, antibacterial, antifungal	leaves	Maceration
<i>Thevetia peruviana</i>	Dandruff, seborrhea, cosmetics	fruits	Cosmetics
<i>Vanilla planifolia</i>	Gastritis, ulcers	fruits	Maceration
<i>Vernonanthura polyanthes</i>	Flu, Asthma, Bronchitis	leaves, root	Infusion, syrup
<i>Vochysia elliptica</i>	Heart problems, High blood pressure, poor circulation, varicose veins, gastritis, Ulcers, diabetes, Bronchitis and pneumonia	bark, bast	Pill, infusion
<i>Xanthosoma sagittifolium</i>	Ulcer, bone pain	leaves	Sprinkle, food
<i>Xylopia aromatica</i>	Indigestion, gases, constipation, sexual impotence	fruits, seeds, bast	Infusion, maceration and plaster tea
<i>Zeyheria montana</i>	Infections	leaves, whole plant	Infusion
<i>Zingiber officinale</i>	Thermogenic, accelerates metabolism	rhizomes	Tea, powder, food

The guidelines for collecting the plants made by some of the interviewees were for this to occur at the time of preparation of the medicine, being on the side where the sun rises and before 10 am and, in the

specific case of collecting the bark, this must be done from a meter high in the soil so as not to harm the plant, there is no specific period or time for collection.

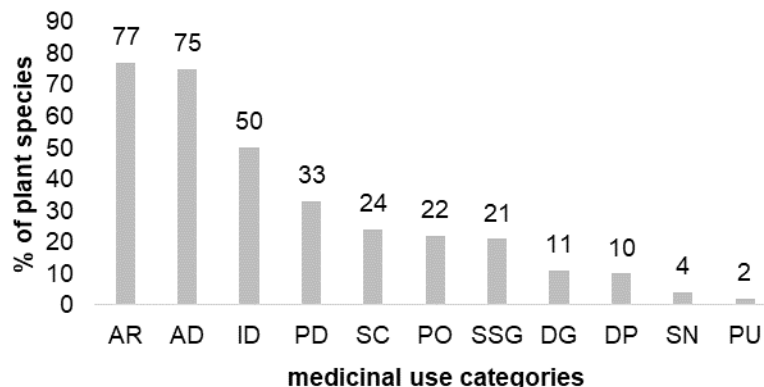


Figure No. 4

Percentage of medicinal plant species used in the Boa Esperança Settlement of Piracanjuba, GO, according to the categories of medicinal uses

The main form of preparation used with medicinal plants is tea (55.42% of the species mentioned are consumed in this way) (Table No. 2). The use of tea as the main form of preparation of home remedy has been observed in other ethnobotanical studies (Silva *et al.*, 2012; Costa & Marinho, 2016; Alves *et al.*, 2018; Guimarães *et al.*,

2019). According to the interviewees, teas can be prepared by infusion or decoction, depending on the part of the plant to be used. For them, infusion is recommended when using plant parts such as leaves, flowers, inflorescences and fruits, it is important not to boil the plant. Decoction is used for the hardest parts of plants, such as bark, roots, seeds and stems.

Table No 3

Percentage of agreement regarding the main use (s) of the species mentioned by five or more informants. ICUS - number of informants who cited the use of the species; ICMU - number of informants who cited main use; PMU - usage agreement index; CF - correction factor; PMUc - Corrected PMU, at the Boa Esperança Settlement, Piracanjuba, GO

Specie	Main Use	ICUS	ICMU	PMU	CF	PMUc
<i>Dilodendron bipinnatum</i>	Spine	6	6	100	1	100
<i>Morus</i> sp.	Natural hormone	6	6	100	1	100
<i>Pterodon emarginatus</i>	Sore throat	6	6	100	1	100
<i>Qualea grandiflora</i>	Liver problems	6	6	100	1	100
<i>Aloe vera</i>	Gastritis	6	5	83,33	1	83,33
<i>Cochlospermum regium</i>	Infection	5	5	100	0,83	83,33
<i>Copaifera langsdorffii</i>	Bronchitis	6	5	83,33	1	83,33
<i>Croton antisiphiliticus</i>	Female infection	5	5	100	0,83	83,33
<i>Cymbopogon citratus</i>	Soothing	6	5	83,33	1	83,33
<i>Dipteryx alata</i>	Kidneys	5	5	100	0,83	83,33
<i>Hymenaea courbaril</i>	Ulcer	5	4	80	0,83	66,66
<i>Stryphnodendron adstringens</i>	Healing	5	4	80	0,83	66,66

The species cited by all respondents were *Morus* sp., *Cochlospermum regium*, *Aloe vera*, *Stryphnodendron adstringens*, *Dipteryx alata*, *Cymbopogon citratus*, *Copaifera langsdorffii*, *Croton antisiphiliticus*, *Pterodon emarginatus*, *Dilodendron bipinnatum*, *Qualea grandiflora* and *Hymenaea courbaril* (Table No. 3). Most of these species are native, with *Aloe vera* exotic and *Cymbopogon citratus* naturalized. The species that obtained the maximum use agreement value were *Morus* sp., *Dilodendron bipinnatum*, *Pterodon emarginatus* and *Qualea grandiflora*.

The diversity of medicinal species used by the interviewees is high ($H'=4.84$), as well as the

Pielou equitability index ($J' = 0.94$). These results are similar to the values found by other studies in Cerrado areas (Table No. 4). The high diversity index suggests that the settlement's residents have significant ethnobotanical knowledge when using a large number of species from the local biodiversity, in addition to species from other areas. In addition, the greater the local floristic diversity, the greater the availability of species to be used (Begossi, 1996). This is also corroborated by the high level of fairness, which indicates that knowledge about the uses of medicinal plants has a relatively uniform distribution among the interviewees (Amoroza, 2002; Cunha & Bortolotto, 2011).

Table No 4

Comparison between the Shannon-Wiener (H') and Pielou (J') diversity indexes between ethnobotanical studies from different sites in the Cerrado phytogeographic domain. NI = number of informants; NC = number of citations; NS = number of species

Place	H'	J'	NI	NC	NS	Authors
Boa Esperança – Piracanjuba, GO.	4,84	0,94	12	398	178	This manuscript
Monjolinho – Anastácio, MS	5,03	0,94	35	-	209	Cunha & Bortolotto, 2011
Furna São José – Cacéres, MT	3,28	0,87	34	-	62	Mendes <i>et al.</i> (2012)
Corixo- Cacéres, MT	2,91	0,82	29	-	57	

Jaccard's similarity indexes show little or no floristic similarity between this study and other ethnobotanical research carried out in settlements and rural communities (Table No. 5; Figure No. 5). It can

be inferred that the low similarity is related to the great diversity of native and cultivated species that are intrinsic to each region of the Cerrado phytogeographic domain.

Table No. 5

Jaccard similarity index (JS) between settlements and rural communities in the Cerrado area. A = this work, B = Monjolinho, MS, (Cunha & Bortolotto, 2011), C = Vale Verde, TO (Bessa *et al.*, 2013), D = Santa Rita, MG (Alves & Povh, 2013) and E = Conceição-Açu, MT (Pasa *et al.*, 2005)

Communities	A	B	C	D	E
A	1	0,22	0,03	0,06	0,24
B	0,22	1	0,04	0,04	0,21
C	0,03	0,01	1	0	0,02
D	0,06	0,04	0	1	0,09
E	0,24	0,21	0,02	0,09	1

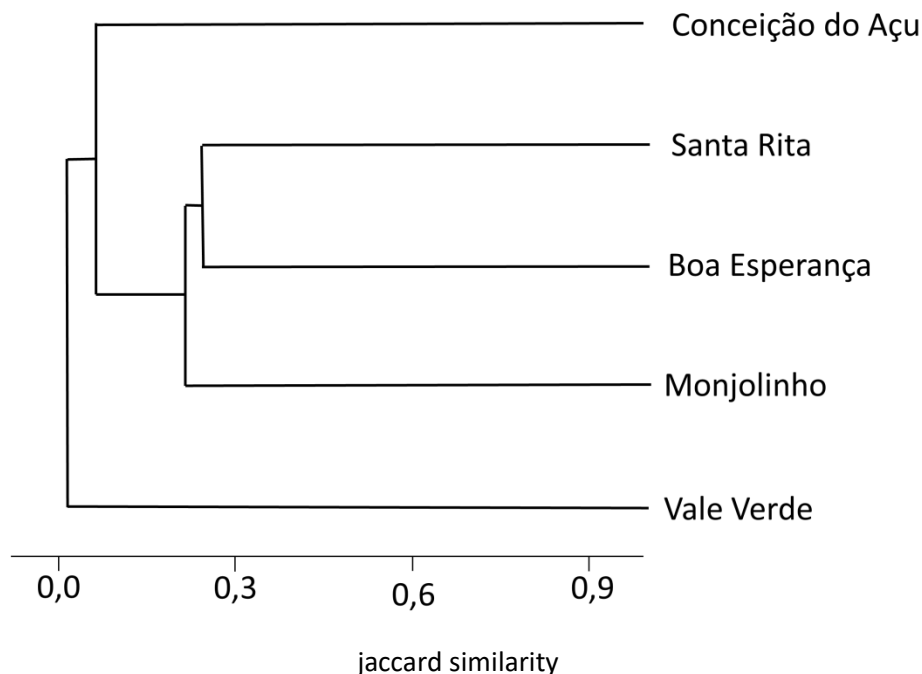


Figure No. 5

Dendrogram generated from the Jaccard similarity index (JS) between the work carried out in settlements and rural communities and the present work. A = this work, B = Monjolinho, MS (Cunha & Bortolotto, 2011), C = Vale Verde, TO (Bessa et al., 2013), D = Santa Rita, MG (Alves & Povh, 2013) and E = Conceição -Açu, MT (Pasa et al., 2005)

CONCLUSIONS

The diversity of medicinal species recorded in the present study shows the importance and frequent use of ethnobotanical knowledge by the studied community. The low or no floristic similarity between this study and other ethnobotanical research carried out in settlements and rural communities corroborates the occurrence of a high diversity of native and cultivated species, which are intrinsic to each region of the Cerrado phytogeographic domain. However, further studies are needed to prove whether this pattern persists in space and time among traditional Cerrado communities. As for the threat

status, the fact that most of the aforementioned native medicinal species have not been assessed is worrying. Therefore, it is important to expand studies to assess the threat status of these species in order to establish future conservation strategies.

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