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Ethnobotany and regional knowledge: combining popular knowledge with the biotechnological potential of plants in the Aldeia Velha community, Chapada dos Guimarães, Mato Grosso, Brazil

[Etnobotánica y conocimiento regional: Combinando conocimiento popular con el potencial biotecnológico de plantas en la comunidad de Aldeia Velha, Chapada dos Guimarães, Mato Grosso, Brasil]

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Abstract: Ethnobotanical studies were conducted in the Aldeia Velha community (Mato Grosso, Brazil) through semi-structured interviews. The majority of participants were women who have resided for more than 20 years in the community. Seventy-two species (39 families) were cataloged; leaf tea was the most common form of preparation. Over 80% were medicinal, with much of it is used for inflammation and disorders of the respiratory, digestive or genitourinary systems. Finally, seven species occurring in the Chapada dos Guimarães cerrado have biotechnological potential, especially Amburana cearensis, Mikania glomerata and Pseudobrickellia brasiliensis, where conservation measures are necessary due to their high risk of extinction and/or vulnerability.

Keywords: Traditional knowledge, medicinal plants, regional biodiversity, plant conservation

Resumen: El presente trabajo muestra resultados de un estudio etnobotánico realizado en la comunidad Aldeia Velha (Mato Grosso, Brasil). La información de uso de las especies fue colectada a través de entrevistas semiestructuradas, aplicadas a mujeres que residen hace más de 20 años en ese local. Adicionalmente fueron catalogadas 72 especies distribuidas en 39 familias. Entre las especies catalogadas más del 80% fueron informadas como medicinales, generalmente utilizadas para el tratamiento de inflamaciones, trastornos del sistema respiratorio, digestivo y genitourinario. Entre las formas de preparacióno la infusión de hojas fue la forma de consumo más común. En este trabajo fueron identificadas especies presentes en el Cerrado Chapadense que muestran un importante potencial biotecnológico destacándose Amburana cearensis, Mikania glomerata y Pseudobrickellia brasiliensis; debido a su alto riesgo de extinción y/o vulnerabilidad por ello son necesarias medidas conservacionistas de esa biodiversidad.

Palabras clave: conocimiento tradicional, plantas medicinales, biodiversidad regional, conservación vegetal.

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INTRODUCTION

Tropical biological diversity has been studied under three general questions: (i) description of the extraordinary diversity; (ii) understanding of its origins and maintenance; and (iii) functional estimates of how this diversity responds to natural and anthropogenic changes (Bawa *et al.*, 2004). In addition, we can include a fourth important function in the production of biotechnology, or bioproducts, from material such as wood, fibers, resins, organic chemicals and genes, expanding the knowledge for application in biotechnology, including medicines and cosmetics (Alho, 2008). This can help improve income distribution and sustainable regional development (Davidson & Artaxo, 2004). However, much of this biodiversity is under increasing threat from anthropogenic processes, primarily deforestation, agricultural activities, illegal logging (Morton *et al.*, 2006) and urban sprawl. Thus, it is probable that important components of biodiversity, as well as the environmental services they provide, are under some type of threat, and are neglected in the planning of environmental management, mainly due to a lack of information on distribution and ecology (Garrido-Filho, 2002; Fearnside, 2006).

By using the knowledge of local populations acquired and passed down through the generations, as demonstrated by their interactions with the environment in which they live, allied and aligned with scientific research aimed at the sustainable management of tropical ecosystems, we can find sustainable solutions for the use of these ecosystems. In this regard, ethnobotany is a multidisciplinary science that unites and links anthropology and other disciplines with botany (Albuquerque, 1999), and provides a record of traditional botanical knowledge (Guarim-Neto *et al.*, 2000). This allows more extensive use of ecological information when exploiting plant resources (Prance, 1991), which can be used as a component of sustainable development in protected areas.

The plants are primarily used as a food source, although other uses are worth mentioning such as handicrafts, perfume, ritual and medicinal use. The popular use of medicinal plants is what many communities rely on as an alternative for treatment of diseases or maintaining health. However, their continuity can be threatened by the interference of factors external to the social dynamics of the group, for example: the community's increased exposure to surrounding society and, consequently, external economic and cultural pressures (Amorozo & Gély, 1988; Amorozo, 2002); greater ease of access to modern medicine services (Nolan & Robbins, 1999; Lima *et al.*, 2000; Amorozo, 2002); and displacement of people from their natural environment to urban regions, which leads to the loss of the utilitarian character of popular knowledge accumulated over several generations and, consequently, to its disappearance (Valle, 2002).

In the vegetative context of Mato Grosso, the traditional and even contemporary knowledge of plants persists and diversifies in response to specific characteristics of the regions inhabited by communities, confirmed by numerous studies such as Farnsworth (1981), Guarim-Neto (1984), De La Cruz & Guarim-Neto (1996), Faria (1998), Pasa & Guarim-Neto (2005, 2006), Borba & Macedo (2006), Guarim-Neto & Carniello (2007) and Pasa (2007, 2011a, 2011b), among many others. Thus, Aldeia Velha in Chapada dos Guimarães show to this day their traditional knowledge of cerrado plants and even exotic cultivated species.

MATERIAL AND METHODS

Study area

The study area is located in the Baixada Cuiabana, in the Municipality of Chapada dos Guimarães, Mato Grosso (Brazil), about 60 km from the capital Cuiabá (Figure 1). It is delimited by the geographic coordinates 15º30' and 15º40' S and 55º35'and 55º50' W (MMA, 2009). The study's target community was the Aldeia Velha, also the name of the municipality's first district. The study area was chosen based on observations of traditional plant use within the Chapada dos Guimarães region, being used by traditional healers, witch doctors, herbal sellers and midwives – traditional personalities known within the region (Neves, 1994). According to Vieira Jr. *et al.* (2011), its vegetation is characterized by distinct phytophysiognomies, with a prevalence of savannah grasslands with differing densities of trees and shrubs (*cerrado sentido restrito* and *campo sujo*). According to the records, Aldeia Velha (Figure 2) was the first settlement within the municipality.

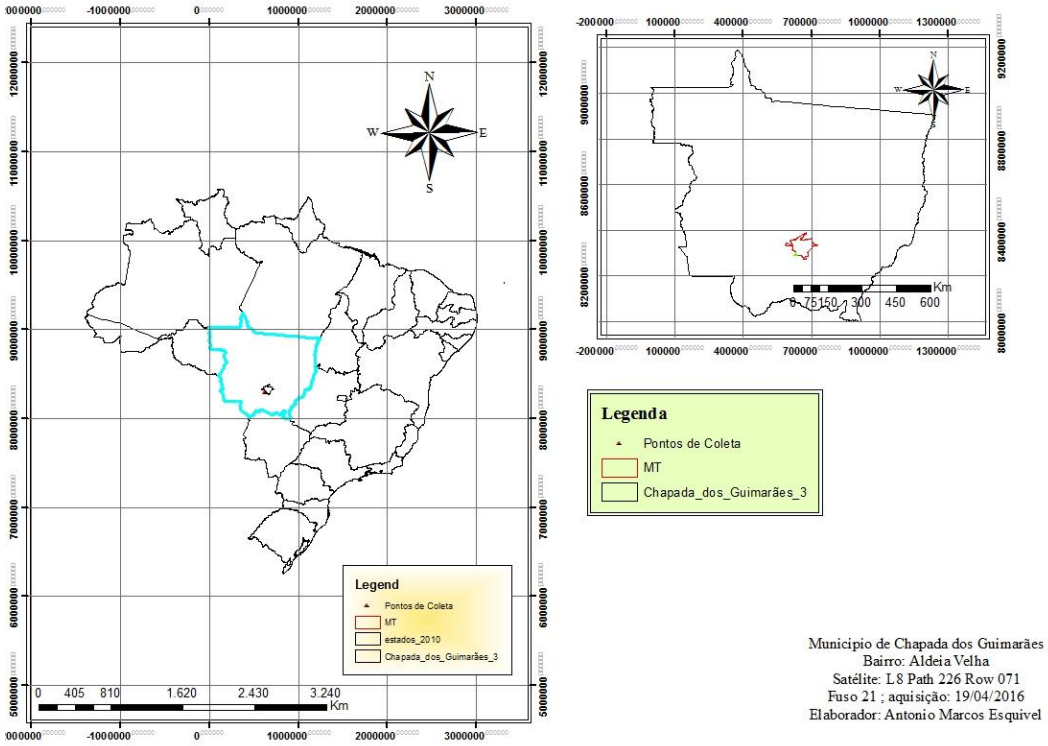

Figure Nº 1
Map of Mato Grosso and its biomes, with the study's target area – the Municipality of Chapada dos Guimarães highlighted

Botanical material collection

Botanical material indicated by the community was first identified by the popular name attributed to the plant by the participants, followed by the formal identification of the cited species with the scientific name according to the current classification system, APG IV (2016). Scientific names have been updated based on the *Flora do Brasil 2020* (2016), as well as the Plant List and the Missouri Botanical Garden (Tropicos) websites.

For plant specimens where there existed doubts about the nomenclature, 3 to 5 samples in good condition were collected for subsequent formal identification, i.e. identification keys and specialized literature were used to obtain the scientific name of the species. Specimens were dried, pressed and mounted. All material collected in a fertile state and of relative importance to the work was deposited at the *Centro-Norte-Mato-Grossense* Herbarium (CNMT), *Universidade Federal de Mato Grosso* (UFMT), Sinop campus, and was also deposited at the UFMT Central Herbarium, Cuiabá campus when requested.

Ethnobotanical survey

Interviews were carried out using semi-structured questionnaires to define the group's profile (Alexiades, 1996). Each participant completed and signed a consent form detailing the information to be passed on. The technique used for sampling and selection of participants was the "snowball" technique proposed by Bernard (1995) and described by Albuquerque & Lucena (2004), where from an initial contact, a "local specialist" interviewed indicates another and so on. This is one of the techniques used today, for two basic reasons: the timeliness and low cost involved in collecting the information (Maciel *et al.*, 2002; Albuquerque & Hanazaki, 2006). In addition to the recruitment of local experts, other participants who showed an interest in taking part in the research were also included. The research conducted was of an eminently qualitative nature. In total there were about 30 participants from a total of 17 residences, primarily from the oldest part.

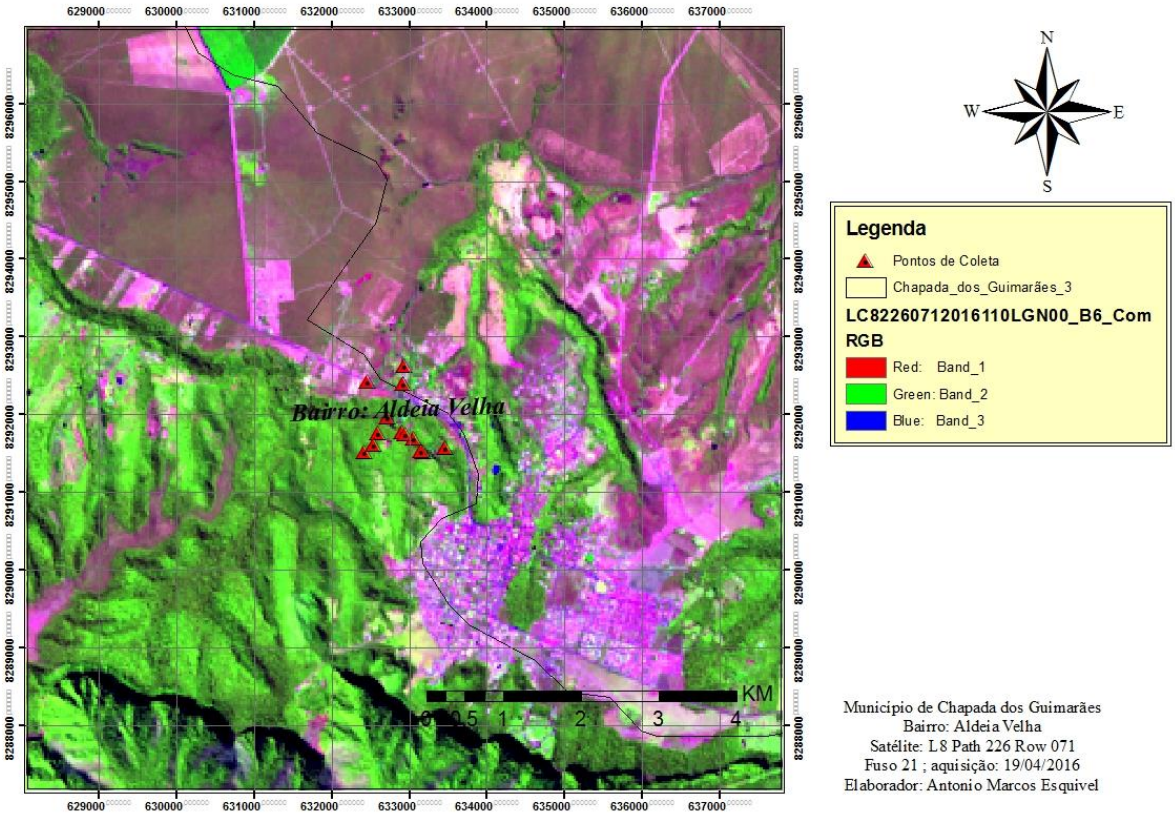

Figure Nº 2
Aldeia Velha community with collection points marked

For the purpose of data analysis, the medicinal applications of each plant were grouped and classified in accordance with the Economic Botany Data Collection Standard (EBDCS) described by Cook (1995) and presented in Table Nº 1, and also used in the work of Bieski *et al.* (2015). The categories presented, including cultural disorders and rituals/magical uses, provide a picture that combines traditional medicine with ethnomedicine, expanding the range of medical/cultural disorders.

RESULTS AND DISCUSSION

Socioeconomic profile of the Aldeia Velha community

The participants were mostly married women ranging from 33 to 81 years of age. The number of children ranged from 1 to 12. The community primarily consisted of people who have been living there long-term (more than 20 years). Most participants had incomplete elementary schooling.

The results obtained support the majority of ethnobotanical works where older women (over 50 years) are the keepers of knowledge (Amorozo, 2002; Bieski *et al*., 2012; Amorozo *et al*., 2006; Amaral & Guarim-Neto, 2008; Nanyingi *et al*., 2008; Giraldi & Hanazaki, 2010; Pasa & Ávila, 2010; Vásquez *et al*., 2014; Bieski *et al*., 2015; David & Pasa, 2015).

A worrying finding in this study is related to age group, where knowledge is eminently held by older individuals and young people do not seem to know or show interest in the subject. However, this result is expected because according to Baptistel *et al*. (2014), the older generation has greater experience and experimentation. According to Almeida *et al*. (2010) and Silva *et al*. (2011), the younger generations know less than the older ones, thus not representing a loss of knowledge or "acculturation." In contrast, some of the participants stated that they take the children with

them to collect plants and try to pass on that knowledge already acquired by their predecessors such as parents and grandparents. An interesting fact is the presence of a resident who has taken the medicinal plants course offered by the Rural Union of the city, where the community's interest in the subject is maintained by these initiatives.

Table Nº 1
Groups of cultural diseases according to Cook's Classification

Group	Systems of the body	Initials
I	**Blood system disorder**	**SAG**
II	**Circulatory system disorder**	**CIR**
III	**Digestive system disorder**	**DIG**
IV	**Endocrine system disorder**	**END**
V	**Genitourinary system disorder**	**GEN**
VI	**Immune system disorder**	**IMU**
VII	**Infections and infestations**	**INF**
VIII	**Inflamation**	**IFM**
IX	**Injury**	**INJ**
X	**Mental disorder**	**MEN**
XI	**Metabolic system disorder**	**MET**
XII	**Musculoskeletal system disorder**	**MUS**
XIII	**Neoplasms**	**NEO**
XIV	**Nervous system disorder**	**NER**
XV	**Nutritional disorder**	**NUT**
XVI	**Pain**	**DOR**
XVII	**Poisoning**	**ENV**
XVIII	**Pregnancy and/or postnatal disorder**	**PAR**
XIX	**Respiritory system disorder**	**RES**
XX	**Skin, cellular and subcutaneous tissue disorder**	**DE**
XXI	**Unspecified medical disorders**	**NE**

Data analyzed from the questionnaires was able to verify that 100% of the participants use the plants in their day to day life and cultivate them within their place of residence. Approximately 85% of respondents use the plants all the time (15% from time to time); 65% actively collect plants from their local woods or other places, those who do not actively seek out the plants have opportunistically collected, and 90% of respondents can recognize them.

Ethnobotanical survey

This study cataloged 72 species belonging to 39 families (Table Nº 2). The families with the highest number of species recorded were: Asteraceae with nine species, Lamiaceae with seven species, Fabaceae with four species and Poaceae, Rutaceae, Solanaceae and Zingiberaceae with three species each. In addition to possessing the highest number of species (Souza & Lorenzi, 2012), these families are also cosmopolitan, harboring both native cerrado and common exotic plants introduced into the country. According to Guarim-Neto & Morais (2003), the more common the plant, the greater the probability that it will be used by the population. For example Asteraceae is one of the largest botanical families; Fabaceae is one of the most representative families within the cerrado biome, while Lamiaceae, although smaller in number of species, is a popularly cultivated family due to its high aromatic potency and large number of exotic herb species commonly used by the population.

Table Nº 2
List of plants recorded by residents and additional information

*Scientific name	Common name	Plant part utilized	Form of utilization	General indication
Adoxaceae				
Sambucus nigra L.	Sabugueiro	Leaf	Tea Bath	Measles, Chickenpox
Alismataceae				
Echinodorus grandiflorus (Cham. & Schltr.) Micheli	Chapéu-de-couro	Leaf	Tea	Inflammation, Diuretic
Amaranthaceae				
Alternanthera brasiliana (L.) Kuntze	Terramicina	Leaf	Tea Leaf juice in bandage	Inflammation, Wounds, Blood
Dysphania ambrosioides (L.) Mosyakin & Clemants	Erva-de-Santa-Maria, Mentruz, Mastruz	Leaf	Tea Leaf juice in bandage	Vermifuge, Inflammation, Wounds
Amaryllidaceae				
Allium sativum L.	Alho	Garlic clove	*In natura*	Coughing, Seasoning
Apiaceae				
Eryngium foetidum L.	Coentro-do-Pará	Leaf	In natura	Seasoning
Foeniculum vulgare Mill.	Erva-doce	Fruit, seed	Tea, *In natura*	Stomach, Seasoning
Apocynaceae				
Mandevilla velame (A.St.-Hil.) Pichon	Velame	Root	Juice alcohol	Wounds
Arecaceae				
Acrocomia aculeata (Jacq.) Lodd. ex Mart.	Chiclete-cuiabano Bocaiuva	Fruit	*In natura*	Food
Mauritia flexuosa L.f.	Buriti	Fruit, stem	Dried fruits, Bark Wood	Crafts
Asteraceae				
Achyrocline satureioides (Lam.) DC.	Marcela	Leaf	Tea	Stomach, Stomach pain
Ageratum conyzoides L.	Mentastro	Leaf	Tea	Colic in babies
Artemisia absinthium L.	Losna	Leaf	Tea	Vermifuge, Fever
Baccharis crispa Spreng.	Carqueja	Leaf	Tea	Stomach, Weight loss
Galinsoga parviflora Cav.	Picão-branco	Whole plant	Bath	Itch relief, Wounds
Lactuca sativa L.	Alface	Leaf	Tea, *In natura*	Soothing agent, Food
Matricaria chamomilla L.	Camomila	Leaf, flower	Tea	Stomach ache Soothing agent
Mikania glomerata Spreng.	Guaco	Leaf	Tea, Syrup	Cough, Influenza
Pseudobrickellia brasiliensis (Spreng.) R.M.King & H.Rob.	Arnica	Leaf	Juice alcohol	Inflammation
Bignoniaceae				
Tabebuia aurea (Silva Manso) Benth. & Hook.f. ex S.Moore	Paratudo	Leaf	Tea	Various

Bixaceae				
Bixa orellana L.	Colorau, Urucum	Leaf, Seed	Tea, Seeds in water	Diabetes, Blood
Convolvulaceae				
Ipomoea carnea Jacq.	Algodãozinho Algodão-roxo	Leaf	Tea, Leaf juice	Inflammation, Infection, Wounds, Colic, Uterus
Costaceae				
Costus spicatus (Jacq.) Sw.	Cana-do-brejo	Leaf, Rhizome	Tea	Kidney
Crassulaceae				
Kalanchoe crenata (Andrews) Haw.	Saião	Leaf	Leaf juice	Hernia, Lung, Insect bites
Cucurbitaceae				
Lagenaria siceraria (Molina) Standl.	Cabaça	Fruit	*In natura*	Craft
Momordica charantia L.	Melão-de-São-Caetano	Leaf, Fruit	Tea, Leaf juice	Dengue, Diabetes, Malaria, Food
Dioscoreaceae				
Dioscorea alata L.	Cará Cará-do-ar	Fruit Rhizome	*In natura*	Food
Equisetaceae				
Equisetum giganteum L.	Cavalinha	Whole plant	Tea	Rim, Bladder
Fabaceae				
Amburana cearensis (Allemão) A.C.Sm.	Imburana	Bark, Seed	In alcohol	Inflammation, Analgesic
Poincianella pluviosa var. peltophoroides (Benth.) L.P.Queiroz	Sibipiruna	Leaves	Tea	Inflammation
Senna occidentalis (L.) Link	Fedegoso	Leaf	Tea, Leaves in alcohol	Abortive, Fever
Tamarindus indica L.	Tamarindo	Fruit	*In natura*	Food
Gentianaceae				
Centaurium erythraea Rafn.	Tea-porrete Coração-de-Jesus	Leaf	Tea	Dengue, Malaria, Viral disease Stomach pain
Tachia guianensis Aubl.	Caferana	Leaf	Tea	Stomach
Lamiaceae				
Melissa officinalis L.	Erva-cidreira Melissa	Leaf Flowers	Tea Bath	Soothing agent Wounds
Mentha pulegium L.	Poejo	Leaf	Tea, Syrup	Cough, Influenza Colic in babies
Mentha x piperita L.	Hortelã	Leaf	Tea, *In natura*	Worms, Influenza Seasoning
Ocimum basilicum L.	Alfavaca	Leaf	Tea	Cough
Plectranthus barbatus Andr.	Boldo	Leaf	Tea, Leaf juice	Stomach, Liver
Rosmarinus officinalis L.	Alecrim	Leaf	Tea, *In natura*	Heart, Seasoning Soothing agent
Salvia officinalis L.	Sálvia	Leaf	*In natura*	Seasoning
Lythraceae				
Lafoensia pacari A.St.-Hil.	Mangaba-brava	Bark	Tea	Gastritis, Insect bites

Malvaceae				
Guazuma ulmifolia Lam.	Mutamba, Chico-magro	Stem/Vine	*In natura*	Crafts
Malva sylvestris L.	Malva	Leaf	Tea	Infection, Bronchitis, Ulcer
Moraceae				
Ficus carica L.	Figo	Leaf	Tea	Asthma, Bronchitis
*Morus nigr*a L.	Amora	Leaf	Tea	Insomnia
Musaceae				
Musa paradisiaca L.	Banana	Pedúnculo floral (coração)	Tea	Cough
Myrtaceae				
Eugenia uniflora L.	Pitangueira	Leaf	Tea	Heart
Psidium guajava L.	Goiabeira	Bark, Shoots	Tea, *In natura*	Stomach pain Aphthous sores
Nyctaginaceae				
Boerhavia diffusa L.	Erva-tostão Pega-pinto	Leaf	Tea	Various
Pedaliaceae				
Sesamum indicum L.	Gergelim-preto	Seed	*In natura*	Food
Phyllanthaceae				
Phyllanthus niruri L.	Quebra-pedra	Leaf	Tea	Kidney
Phytolaccaceae				
Petiveria alliacea L.	Guiné	Leaf	Tea, Bath	Magic
Piperaceae				
Piper anisum (Spreng.) Angely	Jaborandi	Leaf	Tea	Fever, Cough
Plantaginaceae				
Scoparia dulcis L.	Vassourinha	Leaf, Roots	Juice	Wounds
Poaceae				
Cymbopogon citratus (DC.) Stapf	Capim-cidreira	Leaf	Tea	Soothing agent
Cymbopogon winterianus Jowitt ex Bor	Citronela	Leaf	In alcohol	Insect repellent
Merostachys multiramea Hack.	Taquá	Leaf	Bath	Wounds
Polygonaceae				
Polygonum punctatum Elliott	Erva-de-bicho	Leaf	Tea, Bath	Dengue, Fever, Cough
Rubiaceae				
Morinda citrifolia L.	Noni	Fruit	*In natura*	Cancer, Various
Rutaceae				
Pilocarpus jaborandi Holmes	Jaborandi Jaborandi-do-cerrado	Leaf	Tea	Headache, Hair, Kidney
Ruta graveolens L.	Arruda	Leaf	*In natura*, in alcohol	Headache, Insect repellent Magig
Zanthoxylum rhoifolium Lam.	Mamica-de-porca	Leaf, Roots, Bark	Tea	Stomach, Fever, Aphrodisiac

Solanaceae				
Capsicum frutescens L.	Pimenta	Fruit	*In natura*	Food
Solanum paniculatum L.	Jurubeba	Fruit	Syrup	Bronchitis
Solanum sisymbriifolium Lam.	Juá, Joá	Fruit	Juice	Boils
Urticaceae				
Cecropia pachystachya Trécul	Embaúba	Buds	Tea	Cough, Bronchitis
Verbenaceae				
Stachytarpheta jamaicensis (L.)Vahl	Gervão	Roots	Tea	Urinary
Xanthorrhoeaceae				
Aloe vera (L.) Burm.f.	Babosa	Leaf	Juice Tea	Hair, Hernia, Cancer, Prostate, Urine
Zingiberaceae				
Alpinia zerumbet (Pers.) B.L.Burtt & R.M.Sm.	Colônia	Leaf (latex)	Tea	Heart Cancer
Curcuma longa L.	Açafrão-da-terra	Rhizome	*In natura*	Influenza, Throat, Diabetes
Zingiber officinale Roscoe	Gengibre	Rhizome	Tea, *In natura*	Throat

***All scientific names were confirmed from data available from the *Flora do Brazil 2020*, The Plant List, and Tropicos.**

Plant forms represented from the study were 62.5% herbaceous, 22.23% trees, 9.72% shrubs and sub-shrubs and 5.55% were vines. The higher percentage of herbaceous plants was expected, as these are more common and also easier to collect.

Leaves were the most commonly used parts of the plant with 74.01% of respondents recording leaf use. This data is also in accordance with the literature, as leaves are more common (they are always present), easy to access (Guarim-Neto & Morais, 2003), safer to use, available all year (Albuquerque & Hanazaki, 2006) and it is in the leaves where most of the plant's secondary metabolites, or active ingredients, are concentrated (Gonçalves & Martins, 1998).

Among the forms of preparation for use of these plants, 70% of respondents used tea (infusion) as the most common preparation, followed by the *in natura* form with 16.15%, leaf juice (maceration) with 9.23% and use in baths with 4.62%. This data corresponds with the works of Martins *et al.* (2000), Matos (2002), Reis & Bellini (2011), and Bieski *et al.* (2012, 2015) in which the most common form of preparation was tea (infusion); this method of heating the plant (usually leaves, flowers and other above ground parts) with water facilitates the extraction of the active ingredients, making the home remedy faster and more efficient (Castellani, 1999).

Within the sampled size, 81.94% were considered medicinal, 18.05% food and 4.17% used for handicrafts and rituals. Thus, to date, within the plants considered medicinal, the majority are used for inflammation and disorders of the respiratory, digestive, metabolic, and genitourinary systems, as can be observed in Figure Nº 3.

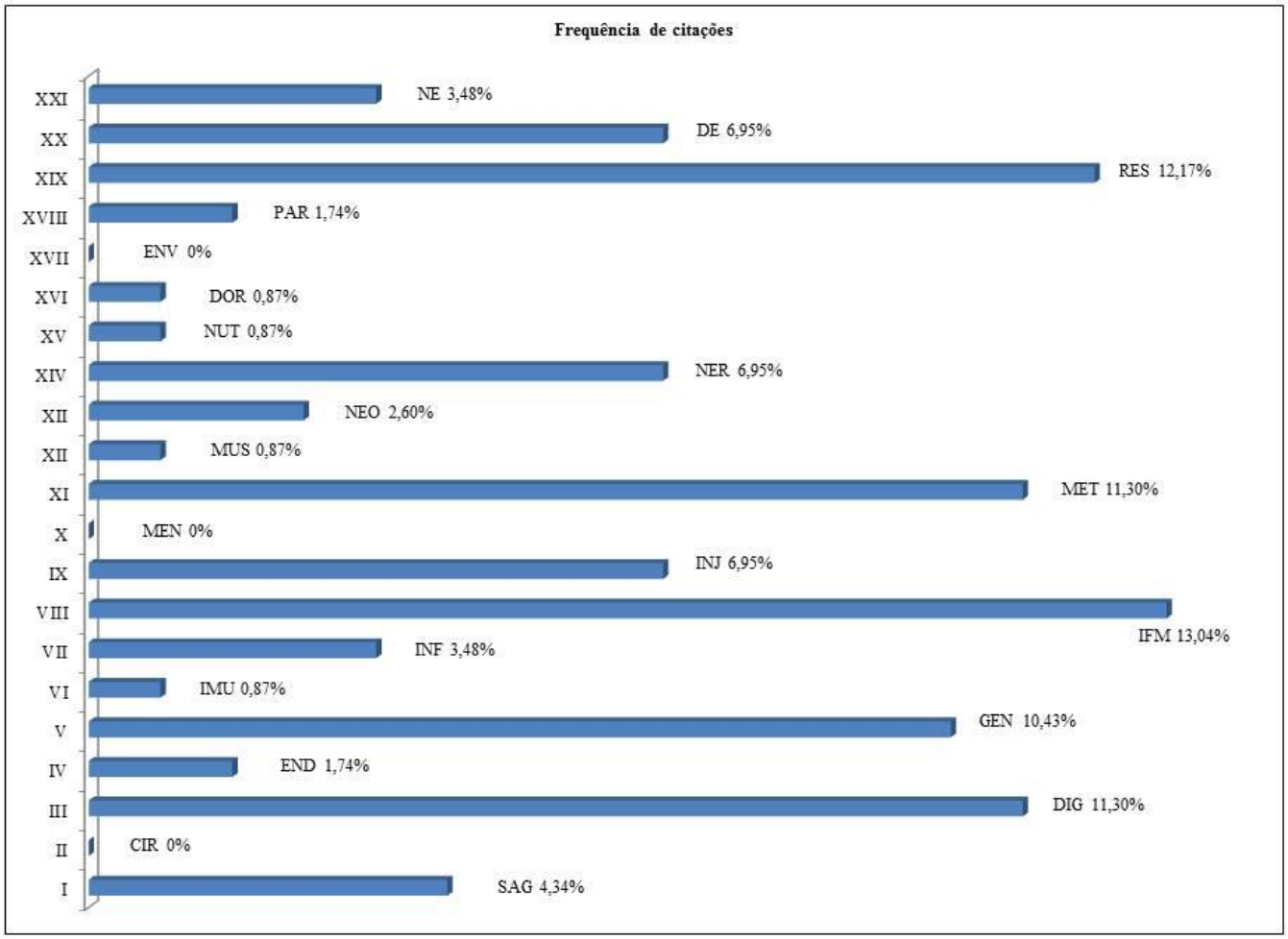

Figure Nº 3
Diseases cited by informants according to categories proposed by Cook, 1995 (see Table Nº 1)

The results were in accordance with those expected in that the plants are primarily used for the treatment of more common diseases as well as primary care such as kidney problems, wounds, worm treatment, Influenza and stomach problems (Pasa *et al.*, 2005). In this study, one of the most cited plants was the Cotton or Purple Cotton (*Ipomoea carnea* Jacq.), very common in the sampled areas, with its application related to the treatment of inflammation and uterine infections as well as in the treatment of wounds (injuries). According to the literature, the use of latex and leaves (maceration) is reported with the presence of alkaloids with antibacterial, immunological and uterine treatment properties, mainly with animal tests (Haraguchi *et al.*, 2003; Hueza *et al.*, 2003; Hueza *et al.*, 2005; Melendez & Capriles, 2006; Hueza *et al.*, 2007; Armien *et al.*, 2011).

Other plants commonly mentioned were Chamomile (*Matricaria chamomilla* L.), used as tea for its sedative effects and treatment of bellyache, Erva-de-Santa-Maria (*Dysphania ambrosioides* (L.) Mosyakin & Clemants) used as a worming agent, against inflammations and wounds, and Terramicina (*Alternanthera brasiliana* (L.) Kuntze), also used in the treatment of inflammation, wounds and blood problems; both used in the form of tea or macerated as patches.

Biotechnological potential of plants: some indications

From this survey seven plants drew attention as to the number of citations and their use by the community. They are considered native to the Chapadense cerrado and their effectiveness has been proven in some related works, as can be observed in Table Nº 3.

Table Nº 3
Biotechnological potential of some Chapadense cerrado plants

Species	Occurrance	Description of uses and associated scientific works
Amburana cearensis (Allemão) A.C.Sm. (Fabaceae) – Imburana, Amburana-de-cheiro, Cerejeira-do-nordeste	Present in the phytogeographical domains of the Caatinga, Cerrado and Atlantic Forest. It has confirmed occurrence for the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Goiás, Espírito Santo, Minas Gerais, Rio de Janeiro. In Mato Grosso few specimens were found in the chapadense cerrado.	MEDICINAL: common cold, bronchitis, asthma, anti- cancer properties, anti-inflammatory and muscle-relaxant, antibiotic, antimitogenic, influenza anti-microbial (Leal *et al.*, 2003; Marinho *et al.*, 2004; Canuto & Silveira 2006; Oliveira *et al.*, 2009; Figueredo *et al.*, 2013; Lima *et al.*, 2013; Lorenzi, 2014); AGRONOMICS: insect repellent, seed mutagen (Lima *et al.*, 2013; Lorenzi, 2014); ECONOMIC/COMMERCIAL: carpentry, perfumery (Lorenzi, 2014); ETHNOBOTANICAL: species vulnerability (Gomes *et al.*, 2008; Martinelli & Morais, 2013).
Equisetum giganteum L. (Equisetaceae) - Cavalinha	Typical plant of the cerrado and Atlantic forest. It occurs in the states of Rondônia, Bahia, Paraíba, Pernambuco, Piauí, Distrito Federal, Goiás, Mato Grosso, Mato Grosso do Sul, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul e Santa Catarina.	MEDICINAL: diuretic, anti-inflammatory, healing, digestive, hypoglycemic, remineralizing, hypotensive and antioxidant, fungicide against stomatitis, diabetes (Caetano *et al.*, 2002; Teixeira & Melo, 2006; Vieira *et al.*, 2006; Agra *et al.*, 2008; Santo-Dantas *et al.*, 2008; Lopes-Correa, 2010; Reuter & Salvador-Garcia, 2010; Zeni & Bosio, 2011; Alavarce *et al.*, 2015); AGRONOMICS: protection against environmental stresses, pest attack, fungicidal action (Bertalot *et al.*, 2010; Mello & Budel, 2014); VETERINARY: antithymic activity (Alvin-Carneiro, 1948; Riet-Correa *et al.*, 2002).
Lafoensia pacari A.St.-Hil. (Lythraceae) – Mangava-brava, dedaleira, didal, pacari.	Typical plant of the cerrado. It occurs in the states of	MEDICINAL: gastritis, ulcer, antifungal action, antibiotic effect, antimicrobial

	Tocantins, Bahia, Maranhão, Distrito Federal, Goiás, Mato Grosso do Sul, Mato Grosso, Minas Gerais, São Paulo e Paraná.	activity, asthma (Solon *et al.*, 2000; Souza *et al.*, 2002; Guarim-Neto & Moraes, 2003; Lima *et al.*, 2006; Menezes *et al.*, 2006; Batista, 2008; Rogerio *et al.*, 2008; Cabral & Pasa, 2009; Silva-Jr. *et al.*, 2010; Sampaio *et al.*, 2011; Tamashiro-Filho *et al.*, 2012); VETERINARY: canine parasitosis (Rogerio *et al.*, 2003). ETHNOBOTANICAL: species vulnerability (Martinelli & Morais, 2013)
Mikania glomerata Spreng. (Asteraceae) - Guaco	Plant found in the Cerrado and Atlantic Forest biomes. It has a confirmed occurrence for the states of Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul, Santa Catarina. Specimens were found in Mato Grosso growing in backyards, but there are reports of collection in the Chapadense cerrado.	MEDICINAL: anti-inflammatory, broncho-dilator, ulcers, snake venom, antiparasitic activity, bactericidal, antiallergic, antidiarrheal (Frutuoso *et al.*, 1994; Fierro *et al.*, 1999; Valverde *et al.*, 2001; Maiorano *et al.*, 2005; Salgado *et al.*, 2005; Iscan *et al.*, 2006; Kviecinski *et al.*, 2008; Napimoga & Yatsuda, 2010; Kviecinski *et al.*, 2011). ETHNOBOTANICAL: species vulnerability (Martinelli & Morais, 2013).
Momordica charantia L. (Cucurbitaceae) – Melão-de-São-Caetano, Erva-de-São-Vicente, Fruta-de-cobra, melãozinho.	A climber of tropical climate originating in Asia and Africa and fully naturalized Brazil, mainly in the Amazon and Cerrado. It occurs in the states of Acre, Amapá, Tocantins, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Goiás, Mato Grosso do Sul, Mato Grosso, Minas Gerais, Rio de Janeiro, São Paulo, Rio Grande do Sul e Santa Catarina.	MEDICINAL: diabetes, anti-bacterial, antiulcerogenic, anti-inflammatory, antityldemic, hypoglycemic, antihypertensive, anticancer, abortive, larvicidal, immunosuppressive, abortive, antihelmintic, contraceptive, dysmenorrhoea, antimalarial, laxative, rheumatism, some cancers, dengue (Anila & Vijayalakshmi, 2000; Basch *et al.*, 2003; Grover & Yadav, 2004; Konishi *et al.*, 2004; Nerurkar *et al.*, 2006; Dans *et al.*, 2007; Fernandes *et al.*, 2007; Braca *et al.*, 2008; Kobori *et al.*, 2008; Tan *et al.*, 2008).
Polygonum punctatum Elliott (Polygonaceae) – Erva-de-bicho.	Common plant in the Amazônia, Caatinga, Cerrado, Mata Atlântica, Pampa, and Pantanal biomes. It occurs	MEDICINAL: decrease in vascular permeability, antipyretic action and decrease in blood pressure, fungicidal action; antimicrobial activity, anti-

	practically all over Brazil, in the states of Acre, Amazonas, Pará, Roraima, Alagoas, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Sergipe, Distrito Federal, Goiás, Mato Grosso do Sul, Mato Grosso, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Rio Grande do Sul, Santa Catarina.	inflammatory action, biological control against *Schistossoma mansoni* (Simões *et al.*, 1989; Pontier *et al.*, 1991; Gorzalczany *et al.*, 1996; Alves *et al.*, 2001; Penna *et al.*, 2001).
Pseudobrickellia brasiliensis (Spreng.) R.M.King & H.Rob. (Asteraceae) – Arnica, arnica-do-mato	Typical plant of the cerrado and very common in the Chapada dos Guimarães region. Distributed in the states of Amazonas, Tocantins, Rondônia, Piauí, Ceará, Bahia, Mato Grosso, Goiás, Distrito Federal, Mato Grosso do Sul, Minas Gerais e São Paulo.	MEDICINAL: anti-inflammatory activity, immunomodulatory, allelopathy (Amorim, 2012; Amorim *et al.*, 2012, 2016; Sivieri *et al.*, 2015; Ribeiro *et al*., 2016). ETHNOBOTANICAL: species vulnerability (Martinelli & Morais, 2013).

Of the plants indicated as having biotechnological potential, almost half are included in some category of threat. This analysis is related to the extinction risk to which the species are subject to, with data obtained by consulting the Red Book of Flora (Martinelli & Moraes, 2013) and *Flora do Brazil 2020*. Species are divided into the threat categories vulnerable, critically endangered and endangered.

This large number of endangered species can be explained by the concept promoted by Diamond (1989), who attributed the extinction of species to four great pillars, called the "Evil Quartet": anthropogenic activities such as habitat destruction, over-exploitation, introduction of exotic species and extinction chains. More recently, the effects of climate change have emerged as a new potential threat (Thomas *et al.*, 2004). Although synergistically all of these factors may result in a greater than expected risk (Brook *et al.*, 2008). In Mato Grosso state, the conversion of natural habitats into areas of crops and pastures, as well as the expansion of the urban frontier, appear to be the main threats to biodiversity conservation (Baillie *et al.*, 2004).

Pseudobrickellia brasiliensis (Spreng.) R.M.King & H.Rob. (Arnica) and *Mikania glomerata* Spreng. (Guaco) are among the threatened plants. Another feature that can increase this number even further is related to the large number of endemic species such as *Mikania* that is among the 20 most diversified genera of Brazilian flora, with 70% of the national species considered endemic; of these, 40 were evaluated and more than 50% of them are threatened (Martinelli & Morais, 2013).

Another plant cited by the participants and listed in the Red Book of Flora is *Amburana cearensis* (Allemão) A.C.Sm. (Fabaceae), considered vulnerable, but not in the main list. This species is framed in the list of species as possessing economic value with verified or projected decline. This is also one of those species that we indicate as having biotechnological potential. Fabaceae is a cosmopolitan family; however this species has a restricted distribution in the cerrado. *Lafoensia pacari* A.St.-Hil. (Lythraceae) is listed in the minor concern

category, but it is faced with risks due to exploitation and loss of habitat by deforestation and expansion of agricultural and urban borders.

CONCLUSIONS

Brazil is a megadiverse country, both in terms of biology and culture, and Mato Grosso, because it is situated within three large biomes (Cerrado, Pantanal and Amazonia), deserves special mention. Studies aimed at reporting on and conserving this biodiversity have been frequent and increasingly urgent. In Chapada dos Guimarães, the participants showed themselves to be aware of the importance of the natural resources offered by the regional cerrado, and seek to enjoy them positively, primarily in obtaining medicinal plants.

One of the concerns of Ethnobotany is related to the search for new plant derived products, especially for industrial application, such as new food plants, manufacturing and particularly in the discovery of new drugs derived from medicinal plants. In addition, there is concern with human development issues such as the maintenance of native populations, conservation of nature and the conscious use of resources, bringing scientific research closer to society.

The need for biodiversity conservation in the Chapada dos Guimarães region is becoming more urgent, particularly as this region possesses plant species that are under severe threat, whether through deforestation, urban sprawl and/or over-exploitation. Finally, seven species present within the Chapadense cerrado have biotechnological potential, particularly *Amburana cearensis*, *Mikania glomerata* and *Pseudobrickellia brasiliensis*, where conservation measures are deemed necessary due to the high danger of extinction and/or vulnerability.

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