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ORIGINAL PAPER

Traditional Plants Used by Remaining Healers from the Region of Grande Dourados, Mato Grosso do Sul, Brazil

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Abstract

Although the traditional use of medicinal plants is a very widespread practice in Brazil, there are still few studies aimed at native prescribers, known as healers. The aim of this work was to catalog the medicinal species prescribed by remaining healers of the Grande Dourados region, Mato Grosso do Sul, Brazil. Semi-structured interviews were conducted with support of a standardized questionnaire for remaining healers selected using the "snowball" technique. The medicinal species selected were collected, identified, and classified according to the British National Formulary. Remaining healers were identified in seven municipalities in the region of Grande Dourados. Family, divine revelation, and participation of the Catholic Church were the most important sources of knowledge. Seventy-one medicinal species, mainly herbaceous belonging to Asteraceae, Lamiaceae, Amaranthaceae, and Verbenaceae families, were the most prescribed. Most species are used in the treatment of digestive and cardiovascular diseases, in addition to immune and respiratory diseases. Healers from the region of Grande Dourados maintain considerable ethno-knowledge about the medicinal properties of different medicinal species. Sharing this information values their culture and preserves the knowledge for future generations.

Keywords Ethnobotany · Medicinal plants · Popular medicine · Traditional knowledge

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Introduction

In Brazil, traditional knowledge about medicinal plants is the basis of popular medicine. Derived from a mixture of Indigenous, European and African cultures, the practice is not exclusively carried out by rural communities, but also by different people living in the entire Brazilian territory (Manzali de Sá et al. 2012). In the different traditional communities in Brazil, oral communication is the main tool through which knowledge is transmitted. In fact, the transmission of knowledge requires intense contact between younger and older generations, which usually occurs more easily in indigenous or rural societies, in which learning comes from within the kinship group without the need for mediating institutions. Often, holders of this popular knowledge, known as "raizeiros" or "curandeiros" (healers), are responsible for indications and information regarding methods of preparation and use of medicinal plants. However, while generations are being replaced, some of this information is lost, which justifies the need for this knowledge to be retrieved and transcribed (De Medeiros et al. 2013).

Brazilian biodiversity is an inexhaustible source for research, since it has 6 different biomes (tropical rainforest "Amazônia"; tropical grassland and savannah "Cerrado"; tropical deciduous forest "Mata Atlântica"; tropical scrub forest "Caatinga"; subtropical prairies or grasslands "Pampa"; and flooded grassland "Pantanal") with unique biological diversity (Werneck 2011). The Brazilian "Cerrado", the second largest biome in the country with approximately 2.8 million km^2, stands out for its great biodiversity, occupying 61% of the state of Mato Grosso do Sul. In addition to the fact that it has about 20% of biological species registered in the country, the geographic position of this biome in South America allows extensive contact and floristic exchange with other biomes, which characterizes its flora as the richest among savannas in the world (Beuchlea et al. 2015; Ciconini et al. 2013).

Despite the rich biodiversity, very few ethnobotanical surveys have been conducted in the region of Grande Dourados, located in the southern state of Mato Grosso do Sul, Brazil. This vast region includes 13 municipalities and is home to different social cultures made up of different ethnic groups, including African and European descendants, as well as a large native population consisting mainly of mestizo, riverine, and more than 20,000 indigenous people from different ethnic groups, including Guarani-Kaiowá and Terena (Bueno et al. 2005).

Before the white man's colonization, Terena and Guarani-Kaiowá tribes inhabited the region of Grande Dourados, and the presence of its descendants is remarkable until the present day, constituting one of the largest indigenous populations of Brazil (Sacchi et al. 2013). Around 1861, the region was invaded by Paraguay, an initial fact of one of the bloodiest conflicts in South America, the Paraguayan War. With the end of the war, several immigrants from other parts of Brazil came to the region in search of new land for cultivation. Given the marked progress made in the region and the news about the high land fertility, new colonizers were enlisted to exploit the numerous native herbs, driven by the action of "Mate Laranjeira" company, which monopolized the "Erva Mate" exploitation (*Ilex paraguariensis* A. St.-Hil.) in the region until the mid-1920 s (Campestrini and Guimarães 1991). After this period, there was a progressive degradation of native vegetation, leaving few areas of preservation generally linked to native populations (Brannstrom et al. 2008; Jepson 2006). These in turn, in addition to withdrawing their own sustenance from the preservation areas, still use them as a source of raw material for obtaining medicines, mostly on the guidance of the few remaining healers.

Thus, this study presents an ethnobotanical survey conducted with remaining healers from the region of Grande Dourados, MS, Brazil. The aim of this work was to catalog vegetal species used in the popular medicine in the region to recover the knowledge and the relationship of these populations with medicinal plants.

Methodology

Study Area

The region of Grande Dourados is located in the southern state of Mato Grosso do Sul, Brazil. It is currently divided into 13 municipalities, namely "Caarapó" (22°38′02″S 54°49′19″O), "Deodápolis" (22°16′33″S 54°09′54″O), "Douradina" (22°02′24″S 54°36′46″O), "Dourados" (21°13′15″S 54°48′21″O), "Fátima do Sul" (22°22′26″S 54°30′50″O), "Glória de Dourados" (22°25′04″S 54°13′58″O), "Itaporã" (22°04′44″S 54°47′20″O), "Jateí" (22°28′55″S 54°18′10″O), "Maracaju" (21°36′50″S 55°10′04″O), "Nova Alvorada do Sul" (21°27′57″S 54°23′02″O), "Rio Brilhante" (21°48′07″S 54°32′45″O), "Vicentina" (22°24′32″S 54°26′09″O), and "Juti" (22°51′39″S 54°36′10″O) (Fig. 1). According to data from the Brazilian Institute of Geography and Statistics (IBGE), the territory of Grande Dourados covers an area of 26,545.10 km^2 and has population density of 18 inhabitants per km^2. Its population is approximately 389,444 inhabitants, of which 54,532 live in the rural area, which correspond to 14% of the total. It has 7,337 family farmers, 2083 settled families, 2 "quilombola" communities and 8 indigenous lands. Its mean human development index (HDI) is 0.76 (Brasil 2016).

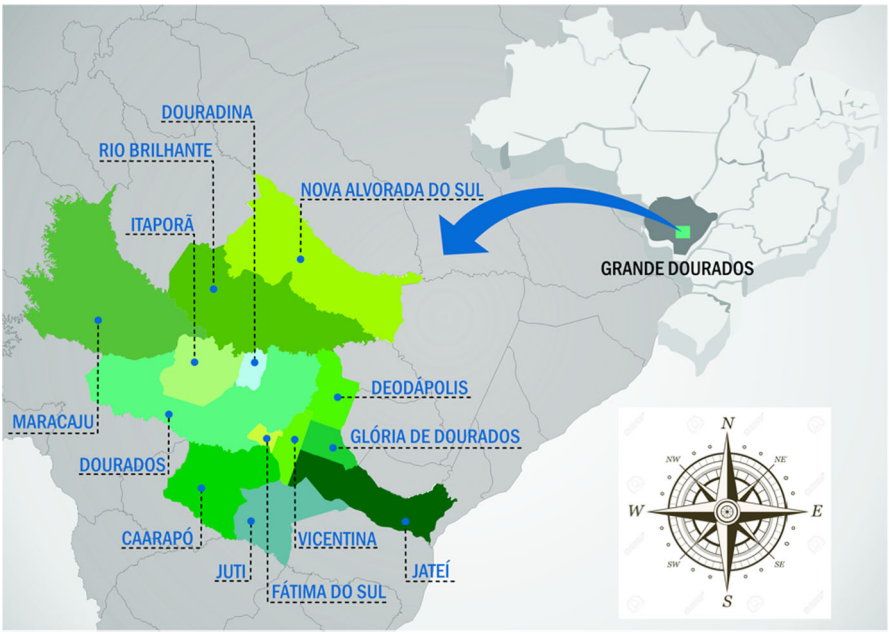

Fig. 1 Geographical location of the study area

According to data from the National Institute of Meteorology (INMET), the region presents tropical altitude climate with mild summers, dry in the winter and humid tropical in the summer, with average annual temperature ranging from 22 to 24 °C.

Ethnobotanical Survey

The study has been previously authorized by the Research Ethics Committee (CEP) of the Federal University of Grande Dourados (UFGD) (CAAE 64164516.7.0000.5160). All methodologies used in this study are in accordance with the ethical standards determined by the National Commission for Research Ethics (CONEP) according to Resolution 466/2012 of the National Health Council of Brazil (CNS).

The study was divided into three stages. First, the identification of healers in each municipality was carried out using the "snowball" sampling methodology (Biernacki et al. 1981). This technique is a non-probabilistic sample form used in social research. Thus, the initial participants of the study indicate new participants, which in turn indicate new participants and so on, until the "saturation point" is reached. The "saturation point" is reached when new interviewees begin to repeat the contents already obtained in previous interviews, without adding new information relevant to the research (World Health Association 1994). As a starting point for the study, we interviewed the sanitary authority responsible for each municipality, who indicated the first healer, who successively indicated other individuals who perform similar activities in the same municipality. This methodology was repeated in all 13 selected municipalities.

In the second stage of this study, a semi-structured interview with all identified healers after formal presentation and signing a prior consent form was conducted. Confidentiality of information and anonymity were guaranteed at all interviewed. Healers were interviewed about the socioeconomic profile and the traditional knowledge about medicinal plants used in the region. Information on the plant part used, method of preparation, doses used, routes of administration and main clinical indications were collected. In a last step, interviewees were invited to walk through the vegetation for the *"in situ"* collection of plant species.

Species Collection and Herborization

All medicinal species recognized by healers and at the reproductive stage were collected and herborized. For each species, data on popular name, habitat, collector's name and collection site were recorded. All samples were deposited at the UFGD herbarium, Brazil. The identification of the botanical material was performed by Dr. Zefa Valdivina Pereira (Faculty of Biological and Environmental Sciences, UFGD, Brazil) using comparisons with herbarium exsiccates and/or digital library database.

Data Analysis and Quantitative Factors

The reported medical uses were classified according to the British National Formulary (British Medical Association 2009). The indications mentioned by healers were grouped into 11 categories of pathologies, symptoms and effects (CSD: cardiovascular system diseases; DSD: gastrointestinal system diseases; ENM: endocrine system diseases; GUS: obstetrical, gynecological and urinary-tract diseases; IPD: infectious diseases; IPO: immunological diseases, poisoning and others; MCT: musculoskeletal and joint diseases;

NEP: malignant diseases; NSD: central nervous system diseases; RSD: respiratory system diseases; and SST: skin, eye, ear, nose and oropharynx diseases), being categorized according to amount of use claims. All data obtained were re-evaluated and compared with the available literature (Brandão et al. 2009).

For the analysis of the general use of species, the Informant Consensus Factor (ICF) was used according to methodology proposed by Cartaxo et al. (2010) using the following formula: ICF = Nur − Nt/Nur − 1, where Nur is the number of use citations in each category and Nt is the number of medicinal plants indicated in each category. The relative importance of species (use value; UV) was calculated according to methods described by Gürdal and Kültür (2013) using the following formula: UV = U/N, where UV is the use value of a given species, U refers to the number of citations per species, and N refers to the number of informants.

Results

Demographic Characteristics

Remaining healers were identified only in seven municipalities in the region of Grande Dourados (Caarapó, Deodápolis, Dourados, Fátima do Sul, Itaporã, Rio Brilhante, and Vicentina). Among these, only Caarapó presented two healers, while all other municipalities presented only one participant (Table 1). Interviewees were composed of 6 women and 2 men aged 30–70 years. The profile of respondents was as follows: education up to elementary school and semi-illiterate (5), high school (2), and higher education (1). As for the ethnic group, Brazilians predominated (6); however, one of the respondents was Russian and the other German. Healers have been living in the region for a period ranging from 1.5 to 55 years. Regarding the origin of the knowledge about medicinal plants, family (oral communication), divine revelation (God's breath), and participation of the Catholic Church were the most important.

Table 1 Municipalities where the remaining healers from the region of Grande Dourados were found, use report and species cited

	City	Distance from Campo Grande[b] (km)	Population[a] (Inhabitants)	Use report	Species cited	Sample fraction	Sample size (n)
1	Caarapó	273	28,867	89	28	0.250	2
2	Deodápolis	264	12,712	20	9	0.125	1
3	Dourados	228	215,486	211	18	0.125	1
4	Fátima do Sul	258	19,200	22	13	0.125	1
5	Itaporã	234	23,220	33	8	0.125	1
6	Rio Brilhante	160	35,465	19	7	0.125	1
7	Vicentina	250	6034	12	9	0.125	1
Total		–	340,984	406	–	1.000	8

[a]*Source* (Brazil 2016)

[b]Campo Grande: capital city of the State of Mato Grosso do Sul

Medicinal Plats and Associated Knowledge

The healers interviewed reported the use of 71 plant species (Table 2). The species belong to 40 botanical families, of which Asteraceae (n = 13), Lamiaceae (n = 8), Amaranthaceae (n = 4), and Verbenaceae (n = 3) were the most species-rich (Fig. 2). Herbaceous plants were the most used (HE = 40 spp.), followed by shrubs (SHR = 16 spp.), trees (AR = 12 spp.), and climbers (CL = 3 spp.). The most used plant parts were leaves (LE = 45.7%), followed by whole plant (WP = 31.3%), roots and tubers (ROT = 13.2%), barks and stalks (BAS = 4.8%), flowers (FL = 3.7%), and fruits (FR = 1.3%). Infusions were the most common method of preparation (IN = 67.0%), followed by maceration (MA = 14.1%), plaster (PL = 4.7%), tincture (TI = 3.5%), decoction (DE = 2.4%), shake (SH = 2.4%), juice (JU = 1.2%), and seat bath (SB = 1.2%).

The majority of medicinal species were used to treat gastrointestinal system diseases (DSD = 32), followed by cardiovascular system diseases (CSD = 31), immunological system diseases, poisoning and others (IPO = 26), respiratory system diseases (RSD = 26), skin, eye, ear, nose and oropharynx diseases (SST = 21), obstetrical, gynecological and urinary-tract diseases (GUS = 20), central nervous system diseases (NSD = 20), musculoskeletal and joint diseases (MCT = 15), infectious diseases (IPD = 13), endocrine system diseases (ENM = 13), and malignant diseases (NEP = 5) (Fig. 3).

General Analysis of Data

The most significant UV were found for *Costus spicatus* (Jacq.) Sw., *Curcuma zerdoaria* (Christm) Roscoe, and *Phyllanthus niruri* L. (0.375); *Alternanthera brasiliana* (L) Kuntze, *Ageratum conyzoides* L., *Arrabideea chica* (Humb. & Bonpl.) B. Verlt., *Maytenus ilicifolia* Mart. Ex Reiss., *Equisetum arvense* L., *Pelargonium graveolens* L'Hér., *Rosmarinus officinalis* L., *Morus celtidifolia* Kunth, *Verbena officinalis* L., *Aloysia polystachya* (Griseb) Moldenke, and *Zingiber officinalis* Roscoe (0.250) (Table 2).

Gastrointestinal system diseases had the highest ICF value (DSD = 0.61), followed by obstetrical, gynecological and urinary tract diseases (GUS = 0.48), central nervous system diseases (NSD = 0.47), cardiovascular system diseases (CSD = 0.42), skin, eye, ear, nose and oropharynx diseases (SST = 0.42), immunological diseases, poisoning and others (IPO = 0.41), respiratory system diseases (RSD = 0.40), endocrine system diseases (ENM = 0.33), musculoskeletal and joint diseases (MCT = 0.26), infectious diseases (IPD = 0.25), and malignant diseases (NEP = 0.20) (Table 3).

From a total of 406 use reports (Table 1), 80 were intended for the treatment of gastrointestinal system diseases (DSD), followed by cardiovascular system diseases (CSD = 56), immunological diseases, poisoning and others (IPO = 50), respiratory system diseases (RSD = 44), obstetrical, gynecological and urinary tract diseases (GUS = 41), central nervous system diseases (NSD = 39), skin, eye, ear, nose and oropharynx diseases (SST = 34), musculoskeletal and joint diseases, endocrine system diseases (MCT = 20), endocrine system diseases (ENM = 19), infectious diseases (IPD = 17), and malignant diseases (NEP = 6) (Table 3).

Table 2 Traditional plants uses by remaining healers from the region of Grande Dourados, Mato Grosso do Sul, Brazil

Family/scientific name	Common name	Voucher	Habit	Parts used	Use categories	Preparation method	Use value (UV)
Acanthaceae							
Justicia pectoralis Jacq.	Erva-lisa	5674	HE	WP	DSD/MCT	IN	0.125
Adoxaceae							
Sambucus nigra L.	Sabugueiro	5673	SHR	WP	IPO/RSD	IN	0.125
Amaranthaceae							
Alternanthera brasiliana Kuntze	Terramicina	4707	HE	LE	IPD/IPO	IN	0.250
Celosia cristata L.	Crista-de-galo	5636	HE	LE	CSD/IPD	IN	0.125
Chenopodium ambrosioides L.	Erva-de-santa-maria	5643	HE	LE	SST/IPD	IN/TI	0.125
Pfaffia glomerata (Spreng.) Pedersen	Ginseng	5558	SHR	LE/ROT	CSD/ENM/GUS/IPO/NEP/NSD/MCT/RSD	IN/MA	0.125
Annonaceae							
Annona muricata L.	Graviola	5232	AR	LE	CSD/ENM/IPO/RSD/SST	IN	0.125
Apiaceae							
Foeniculum vulgare Mill.	Funcho	5663	SHR	ROT	DSD/NSD	IN	0.125
Pimpinella anisum L.	Erva-doce	2296	SHR	WP	DSD	IN/MA/JU	0.125
Asteraceae							
Acanthospermum hispidum DC.	Chifrinho-de-carneiro	5649	HE	LE/ROT	CSD/GUS	IN/MA	0.125
Achillea millefolium L.	Novalgina	1986	HE	LE	CSD/IPO	IN	0.125
Ageratum conyzoides L.	Mentrasto	5634	HE	LE	GUS/NSD	IN/SB	0.250
Arctium lappa L.	Badana, Gobo	4713	HE	WP	CSD/DSD/ENM/GUS/IPD/IPO/MCT/NSD/RSD/SST	IN	0.125
Artemisia absinthium L.	Losna	1642	HE	WP	DSD	IN	0.125
Artemisia camphorata Vill.	Cânfora	5713	HE	LE	RSD/SST	PL	0.125
Chamomilla recutita (L.) Rauschert	Camomila	5653	HE	LE/ROT	DSD/NSD/RSD/SST	IN	0.125

Table 2 continued

Family/scientific name	Common name	Voucher	Habit	Parts used	Use categories	Preparation method	Use value (UV)
Chaptalia nutans (L.) Polak	Língua-de-vaca	5642	HE	LE	CSD/MCT/SST	IN	0.125
Cynara scolymus L.	Alcachofra	2288	SHR	LE	CSD/DSD/ENM/IPO/GUS/MCT/RSD	IN	0.125
Mikania glomerata Spreng.	Guaco	2285	CL	LE	RSD	IN	0.125
Taraxacum officinale Weber	Dente-de-leão	5708	HE	LE	GUS/IPD	IN	0.125
Tithonia diversifolia subsp. glabriscula S.F.Blake	Flor-da-amazônia	5710	AR	BAS/LE	DSD	IN	0.125
Zinnia elegans Jacq.	Zinia	5656	HE	WP	GUS/IPO	IN	0.125
Asparagaceae							
Sansevieria trifasciata Prain	Espada-de-são-jorge	5666	HE	WP	CSD/MCT/SST	MA	0.125
Bignoniaceae							
Amphilophium crucigerum (L.) L.G. Lohmann	Pente-de-macaco	5714	HE	FR	IPO	UN	0.125
Arrabidaea chica (Humb. & Bonpl.)B. Verlt.	Cajuru	2297	SHR	WP	CSD/GUS/IPD/IPO	IN	0.250
Boraginaceae							
Borago officinalis L.	Borraja	5640	HE	LE	MCT/RSD/SST	IN	0.125
Symphytum officinale L.	Confrei	2008	HE	LE	NSD/SST	IN/PL	0.125
Brassicaceae							
Coronopus didymus (L.) Sm.	Mentruz	5647	HE	LE	DSD	SH	0.125
Cannabaceae							
Celtis iguanaea (Jacq.) Sarg.	Esporão-de-galo	5585	AR	LE/ROT	DSD/MCT	IN	0.125
Celastraceae							
Maytenus ilicifolia Mart. Ex Reiss.	Espinheira-santa	4882	AR	LE	CSD/DSD/GUS/IPO/NSD/SST	MA	0.250

Table 2 continued

Family/scientific name	Common name	Voucher	Habit	Parts used	Use categories	Preparation method	Use value (UV)
Costaceae							
Costus spicatus (Jacq.) Sw.	Caninha-do-brejo, Cana-de-macaco	5645	HE	WP	CSD/GUS/IPO/MCT	IN	0.375
Cucurbitaceae							
Momordica charantia L.	Melão-de-são-caetano	5638	CL	LE	ENM/IPD/NEP	IN/MA	0.125
Equisetaceae							
Equisetum arvense L.	Cavalinha	5670	HE	WP	CSD/DSD/GUS/IPD/IPO/MCT/RSD	IN	0.250
Euphorbiaceae							
Croton urucurana Baill.	Sangue-de-grau,Pau-sangue	5536	AR	WP	CSD/DSD/ENM/IPD/IPO/NEP/RSD/SST	IN	0.125
Jatropha gossypiifolia L.	Pinhão-roxo	5652	SHR	LE	IPO	UN	0.125
Fabaceae							
Hymenaea courbaril L.	Jatobá	3487	AR	FL/ROT	ENM/NSD/RSD	IN	0.125
Geraniaceae							
Pelargonium graveolens L'Hér.	Gerânio, Malva-rosa	5664	HE	FL/LE	DSD/ENM/GUS/IPO/NSD/RSD/SST	IN	0.250
Juglandaceae							
Carya illinoensis K. Koch	Nogueira-pecam	5711	AR	WP	CSD/GUS	MA/TI	0.125
Lamiaceae							
Lavandula angustifolia Mill.	Lavanda	5662	HE	WP	NSD	IN	0.125
Leonurus sibiricus L.	Rubim	5661	SHR	WP	DSD/ENM	IN/TI	0.125
Melissa officinalis L.	Erva-cidreira	3720	HE	BAS/WP	CSD/NSD	IN/MA	0.125
Ocimum basilicum L.	Manjericão, Alfavaca	5659	HE	LE	CSD/ENM/IPD/MCT/RSD	IN	0.125
Ocimum selloi Benth.	Anis, Manjericão-do-mato	5641	HE	WP	CSD/DSD/IPO/NSD	IN	0.125
Origanum vulgare L.	Orégano	5651	HE	WP	CSD/DSD/IPD/NEP/NSD	IN	0.125

Table 2 continued

Family/scientific name	Common name	Voucher	Habit	Parts used	Use categories	Preparation method	Use value (UV)
Rosmarinus officinalis L.	Alecrim	1946	HE	WP	NSD	IN	0.250
Salvia officinalis L.	Salvia-italiana	1328	HE	LE	DSD/IPO/RSD	IN	0.125
Loganiaceae							
Strychnos brasiliensis (Spreng.) Mart.	Quina-quina	5712	AR	ROT	CSD/DSD/IPD	MA	0.125
Lythraceae							
Punica granatum L.	Romã	5602	AR	LE/WP	DSD/IPD/RSD/SST	DE	0.125
Malvaceae							
Gossypium herbaceum L.	Algodoeiro	5709	SHR	WP	SST	IN	0.125
Hibiscus sabdariffa L.	Hibiscos	5564	SHR	FL	CSD/DSD/ENM/NSD/RSD	IN	0.125
Myrtaceae							
Eugenia uniflora L.	Pitanga	5660	AR	LE	IPO/RSD/SST	IN	0.125
Moraceae							
Morus celtidifolia Kunth	Amora	5648	AR	LE	ENM/GUS/NSD	IN	0.250
Nyctaginaceae							
Boerhavia diffusa L.	Erva-tostão, Agarra-pinto	5637	HE	ROT	CSD/DSD/GUS/NSD	IN	0.125
Piperaceae							
Piper umbellatum L.	Caapeba, Pariparoba	5655	HE	LE	CSD/DSD/GUS/IPO/MCTRSD/SST	IN	0.125
Pteridaceae							
Adiantum capillus-veneris L.	Avenca	5658	HE	LE	CSD/DSD/RSD/SST	MA	0.125
Poaceae							
Melinis minutiflora P. Beauv.	Capim-gordura	2225	HE	WP	MCT	IN	0.125
Phyllantaceae							
Phyllanthus niruri L.	Quebra-pedra	5650	HE	WP	CSD	IN/MA	0.375
Plantaginaceae							
Plantago major L.	Tansagem	5644	HE	LE	CSD/IPD/IPO/RSD	IN/MA	0.125

Table 2 continued

Family/scientific name	Common name	Voucher	Habit	Parts used	Use categories	Preparation method	Use value (UV)
Guettarda viburnoides Cham. & Schltdl.	Veludinha-do-campo	4749	AR	BAS	IPO/SST	DE/PL	0.125
Rutaceae							
Ruta graveolens L.	Arruda	5079	SHR	LE	RSD	PL	0.125
Solanaceae							
Solanum nigrum L.	Erva-moura	5665	HE	LE	DSD	UN	0.125
Solanum paniculatum L.	Jurubeba	5657	SHR	LE	DSD	IN	0.125
Smilacaceae							
Smilax papyracea Duhamel	Salssaparilha	1992	SHR	LE	CSD/DSD/GUS/IPD/IPO/RSD	IN	0.125
Talinum paniculatum (Jacq.) Gaertn.	Bunda- mole, Galinha-gorda	5539	HE	LE	CSD/GUS/IPO	IN	0.125
Verbenaceae							
Lippia citrata Willd.	Salvia-do-rio-grande	5639	SHR	LE/BAS	DSD/GUS/IPD/IPO/MCT/NSD/RSD/SST	IN	0.125
Verbena officinalis L.	Gervão	5646	SHR	WP	DSD/IPD/MCT	IN	0.250
Aloysia polystachya (Griseb.) Moldenke	Burrito	892	SHR	WP	CSD/DSD/GUS/SST/NSD	IN	0.250
Violaceae							
Anchietia salutaris A. St.Hil.	Suma-roxa, Cipó suma	2211	CL	ROT/LE	CSD	IN	0.125
Xanthorrhoeaceae							
Aloe vera L.	Babosa	5715	HE	WP	NEP/SST	IN	0.125
Zingiberaceae							
Curcuma zerdoaria (Christm) Roscoe	Açafrão	908	HE	ROT/WP	CSD/DSD/ENM/IPO/NSD/RSD	IN/SH	0.375

Table 2 continued

Family/scientific name	Common name	Voucher	Habit	Parts used	Use categories	Preparation method	Use value (UV)
Zingiber officinalis Roscoe	Gengibre	5438	HE	LE/ ROT	DSD/IPD/RSD	IN	0.250

Habit (AR) tree, (CL) climbing, (HE) herbaceous, and (SHR) shrub

Parts used (BAS) bark/stalk, (FL) flowers, (FR) fruits, (LE) leaves, (ROT) root/tuber, and (WP) whole plant

Preparation method (DE) decoction, (IN) Infusion, (JU) juice, (MA) maceration, (PL) plaster, (SB) seat bath, (SH) shake, (TI) tincture, and (UN) uninformed

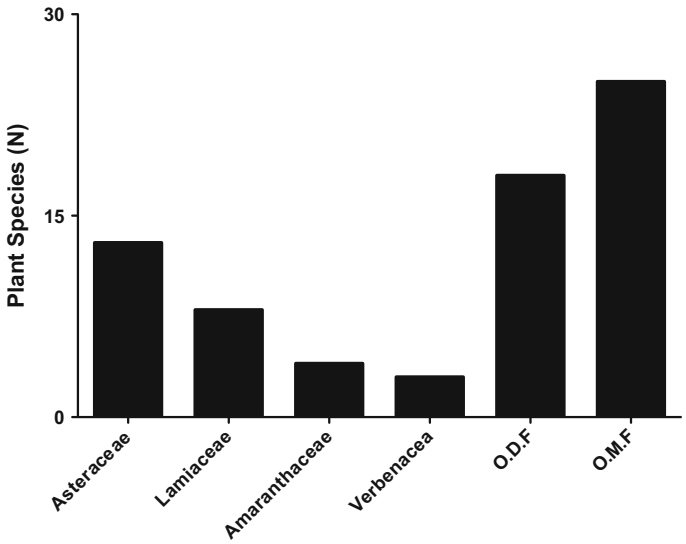

Fig. 2 Number of plant species by family. *ODF* others dispecific families, *OMF* others monospecific families

Discussion

In Brazil, healers are part of the tradition of practically all regions of the country. Brazilian tradition classifies healers as those who heal through prayers, witchcraft, use of teas, roots, and other practices drawn from nature or its relationship with "spiritual beings" (Rodrigues et al. 2006). They are known by the names of "curandeiros", "feiticeiros", "benzedores", "exorcistas", "videntes", "pais-de-santo", and/or "sacerdotes". In many regions, they are welcomed as partners in organizing measures to improve community health, and it is believed that providing them with appropriate training and exploiting their capabilities can benefit different communities in primary health care. In practice, it is not enough for the healer to call himself a healer; he must be recognized as so by the

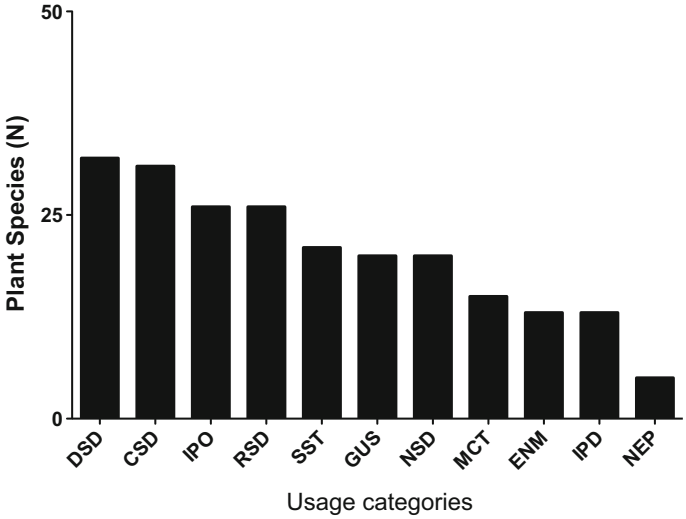

Fig. 3 Most frequently treated disease. *CSD* cardiovascular system diseases, *DSD* gastrointestinal system diseases, *ENM* endocrine system diseases, *GUS* obstetrical, gynecological and urinary tract diseases, *IPD* infectious diseases, *IPO* immunological system diseases, poisoning and others, *MCT* musculoskeletal and join diseases, *NEP* malignant diseases, *NSD* central nervous system diseases, *RSD* respiratory system diseases, *SST* skin, eye, ear, nose and oropharynx disease

community for its "effectiveness". Although scattered throughout the country, the number of healers has been dramatically reduced. This is mainly due to globalization, increasing reliance on marked economies, reducing access to botanical sources, and increasing the supply of industrialized drugs (Brosi et al. 2007). In fact, in this study, only 8 remaining healers from Grande Dourados (Mato Grosso do Sul, Brazil) were identified, a vast and culturally rich region. The information obtained allowed the registration and scientific dissemination of this knowledge, which could often be lost during the industrialization process, or even by the advance of large agricultural areas.

Of all municipalities included in this study, those with the largest amount of species and use reports were the municipalities of Dourados and Caarapó (Table 1). These two municipalities presented a significant peculiarity, which is the coexistence of several Indian reservations, where there are more than 20,000 Indians from different ethnic groups, including Guarani-Kaiowá and Terena (Bueno et al. 2005). Although our research is not specifically directed to indigenous peoples, the influence of these peoples in the local "*modus vivendis*" is undeniable. As indigenous peoples frequently use medicinal plants as primary therapeutic agents, information on the mode of preparation and therapeutic indications is likely to have been directly influenced by them. In fact, many of the species used by healers have popular names of indigenous origin, including "sabugueiro", "cajuru", "borraja", "sangue-de-grau", "jatobá", "caapeba", "pariparoba", and "suma-roxa".

Another peculiar feature of our study is the high number of female healers. Of the 8 healers identified, 75% were women aged 30–60 years. Several studies in Brazil have pointed to gender differences in ethnobotanical surveys (Voeks 2004), with peak ethnobotanical knowledge varying between ages of 29 and 58 years (De Albuquerque et al. 2011; De Santana et al. 2016). This fact is probably related to the culture of the Brazilian countryside, where the figure of the woman as caretaker and holder of great spirituality is

Table 3 Quantitative ethnobotanical analysis of the categories of pathologies, symptoms and effects

Ailments	ICF	Use-report	% Ur_{tot}	Taxa	% Taxa	% Leaf/aerial part	% Root/tuber	% Bark/stalk	% Flowers	% Whole plant
Gastrointestinal system diseases (DSD)	0.61	80	19.70	32	13.85	33.75	13.75	0.00	1.25	51.25
Obstetrical, gynecological and urinary tract diseases (GUS)	0.48	41	10.10	22	9.52	47.06	5.88	0.00	0.00	47.06
Central nervous system diseases (NSD)	0.47	39	9.61	21	9.09	25.64	5.13	0.00	2.56	66.67
Cardiovascular system diseases (CSD)	0.42	56	13.79	33	14.29	29.09	3.64	0.00	1.82	65.45
Skin, eye, ear, nose and oropharynx diseases (SST)	0.42	34	8.37	20	8.66	45.00	5.00	10.00	5.00	35.00
Immunological disease, poisoning and others (IPO)	0.41	50	12.32	30	12.99	53.06	0.00	4.08	0.00	42.86
Respiratory system diseases (RSD)	0.40	44	10.84	27	11.69	61.37	0.00	2.27	2.27	34.09
Endocrine system diseases (ENM)	0.33	19	4.68	13	5.63	26.32	0.00	0.00	5.26	68.42
Musculoskeletal and join diseases (MCT)	0.26	20	4.93	15	6.49	30.00	0.00	0.00	0.00	70.00
Infectious diseases (IPD)	0.25	17	4.19	13	5.63	47.06	0.00	5.88	0.00	47.06

Table 3 continued

Ailments	ICF	Use-report	% Ur_{tot}	Taxa	% Taxa	% Leaf/aerial part	% Root/tuber	% Bark/stalk	% Flowers	% Whole plant
Malignant diseases (NEP)	0.20	6	1.47	5	2.16	16.67	0.00	0.00	0.00	83.33

Total number of use-reports is 406; total number of taxa is 231

ICF Informant Consensus Factor

%Urtot, percentage of use-reports that contributed to the total amount of use-reports by the respective illness category; Taxa, total amount of plant species contributing to the use-reports of the respective illness category; %Taxa, percentage of the plant species reported for an illness category with respect to the total amount of reported plants species; %Bark, percentage of use-report for the respective illness category which indicate barks; %Leaf/aerial part, percentage of use-report for the respective illness category that indicate leaves or aerial parts; %Root/tuber, percentage of use-report for the respective illness category which indicate roots or tubers; %Bark/stalk, percentage of use-report for the respective illness category which indicate bark and stalk; %Flowers, percentage of use-report for the respective illness category which indicate flowers; and %Whole plant, percentage of use-report for the respective illness category which indicate whole plant

still evident. In general, 6 of the identified healers were typical of the Brazilian countryside. They have had a direct relationship with nature for several years, and few had the opportunity to complete higher education. In fact, the proximity of places where medicinal species grow spontaneously and sometimes the difficulty of moving to urban centers increase the interest for the medicinal tools available in nature.

Among the medicinal species identified were found native, naturalized and cultivated plants. Many of these species can be considered invasive and have often followed the evolution of agricultural areas in the region. As the ethno-knowledge is formed by a continuous process of learning, the experimentation and the possible effectiveness of these plants allowed their incorporation into the therapeutic arsenal over time (De Medeiros et al. 2013). Furthermore, as population of the region of the Grande Dourados is formed basically by immigrants, it is natural that bring some species that, besides the medicinal benefits already known, favored the maintenance of the cultural identity of these groups. Moreover, with the advancement of the means of communication the dissemination of well-known species in medical practice became evident. Thus, with the easy access to seeds and seedlings several of these species were systematically cultivated.

Among the 71 identified species, the majority belongs to different families. In fact, 25 of them belong to exclusive families, and 09 other families have only 02 species each. This finding reflects the biodiversity of this region, where spots of native "Cerrado" cohabits with areas of transition to other biomes (Ciconini et al. 2013). As a result, herbaceous plants and shrubs were predominant, and consequently, leaves and whole plants were the parts most used for the preparation of medicinal formulations.

Approximately 70% of herbal preparations prescribed by local healers were in the form of infusion. The most commonly reported preparation is the use of 200 ml of boiling water directly poured into an amount of crushed plant equivalent to a "closed hand". The infusion is capped and remains at rest for approximately 15 min. This way of preparation is very

traditional throughout Brazil (Rodrigues and Carlini 2006) and also reflects a local indigenous praxis, where the practicality of the preparation and the presence of abundant raw material favor its use.

When we turn our attention on medicinal plants associated with the 11 categories of pathologies, symptoms and effects, it could be observed that most species were indicated for cardiovascular, gastrointestinal, immunological and respiratory diseases. The great amount of species used for the treatment of cardiovascular and gastrointestinal system pathologies reflects a great social affliction with diseases of high prevalence, such as dyspepsia, indigestion, dyslipidemia, and hypertension (Souza et al. 2016). In fact, the three species most cited by healers from the region of Grande Dourados, *Costus spicatus*, *Curcuma zerdoaria,* and *Phyllanthus niruri* are mainly indicated as diuretic, hypotensive, and lipid-lowering agents. Although most of the local population uses conventional medicine in these situations, the use of different medicinal species as an alternative and complementary therapy is very common. In addition, as in the region infectious diseases such as tuberculosis are still quite prevalent (Sacchi et al. 2013), the use of different natural products that have some effect on the respiratory system and the immune response is very evident. In this sense, several species with high use value such as *Alternanthera brasiliana*, *Arrabideea chica*, *Equisetum arvense*, *Pelargonium graveolens*, *Verbena officinalis*, and *Zingiber officinalis* are prescribed in these situations.

In summary, the region of Grande Dourados has a rich flora and presents valuable ethnobotanical knowledge that can help improve the living conditions of the population. Efforts of public management to fund advanced research, in addition to strengthening family agriculture and the systematic cultivation of native medicinal species, can provide autonomy for local producers and encourage the deployment of en effective phytotherapy program in local public health systems.

Conclusions

Healers from the region of Grande Dourados maintain considerable ethno-knowledge about the medicinal properties of different medicinal species. Sharing this information values their culture and preserves the knowledge for future generations.

Limitations

The study sample employed in the present work was small, and nom-random. A larger sample (multicenter trial) can enhance the generalizability of the study.

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Compliance with Ethical Standards

Conflict of interest The authors declare that there is no conflict of interest regarding the publication of this paper.

Ethical Standards All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975.

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