Full Length Research Paper

Ethnobotanical and ethnoveterinary study of medicinal plants used in the municipality of Bom Princípio do Piauí, Piauí, Brazil

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Knowledge of medicinal plants has accumulated over centuries and often represents the only therapeutic resource of small municipalities in the interior of Brazil. The objective of this study was to evaluate the knowledge and use of medicinal plants by the population of the municipality of Bom Princípio do Piauí, Piauí state, for the treatment of diseases in humans and domestic animals. Interviews were conducted with 38 residents using standardized questionnaire forms, with the "snowball" technique. Fifty nine families, 98 genera and 112 species were recorded. Of these, 22.3% were indicated for the treatment of diseases in animals and 9.8% were said to cause adverse effects. The families with most species were Fabaceae (14), Euphorbiaceae (11) and Lamiaceae (6). The species with greatest use value (UV) were *Myracrodruon urundeuva* Allemão (0.65), *Dysphania ambrosioides* (L.) Mosyakin and Clemants (0.63) and *Amburana cearensis* (Allemão) A.C.Sm. (0.42). The leaves were the parts most frequently used (26.8%), followed by bark (21.0%). Of the 15 used categories listed in this study, those with the highest number of recorded species were related to illnesses associated with the digestive tract (102), diseases of the genitourinary system (72) and diseases of the respiratory system (60). This study revealed the importance of knowledge and use of medicinal plants in caring for the health of people and domestic animals in the municipality. In addition, the study provided information on plants of the local flora with pharmacological potential.

Key words: Caatinga, medicinal plant, herbal medicine, popular knowledge.

INTRODUCTION

Around 50,000 plant species have recorded medicinal uses and the World Health Organization estimates that

about 80% of the world´s population still rely on such plants for their primary source of medicines (Wood et al., 2010). Brazil is one of the countries with the greatest diversity of plants in the world, with an estimated 20% of all species on the planet (Carvalho et al., 2007), and more than 46,000 accepted species currently recorded (Lista de Espécies da Flora do Brasil, 2015).

Research in Brazil shows that 91.9% of the population make use of some or other medicinal plants, and that 46% cultivate these plants in home gardens (Ethur et al, 2011). Traditional knowledge about the use of these plants is vast and it is in many cases the only practical recourse available to the rural population for treating ailments (Pasa et al., 2005).

Much knowledge of native plants held by rural communities has been lost due to rapid environmental degradation and reduction of plant diversity in areas where the original vegetation has been replaced by croplands and pastures (Castelleti et al., 2003; Shen et al., 2010). Environmental degradation can lead to desertification, especially in areas within the semi-arid caatinga biome (MMA, 1998). As traditional links with the land are weakened by modernization and more intensive contact with urban centers, the transmission of folk knowledge of medicinal plants may be reduced and ultimately lost (Pilla et al., 2006). Salvaging popular knowledge of medicinal plants is important not only as part of cultural preservation but also because it can provide reliable information for modern bio-prospection and environmental management models that promote the conservation of natural resources (Albuquerque and Andrade, 2002).

Ethnoveterinary medicine embodies traditional knowledge and veterinary practices concerning the health care of domestic animals in rural areas (Mathias-Mundy et a., 1989) and represents an affordable and inexpensive option for farmers (Mathias, 2004). Despite the crucial role of ethnoveterinary medicine in most developing countries, very little of this knowledge has been documented (Yinenger et al., 2007). In Brazil, although such knowledge is widespread (Confessor et al., 2009), we know of no published ethnoveterinary studies for the state of Piauí.

Given the above, the objective of the present study was to carry out a survey of plant species used in traditional medicine for the treatment of humans and domestic animals and also to record their adverse effects as recognized by residents of the municipality of Bom Princípio do Piauí.

MATERIALS AND METHODS

The municipality of Bom Princípio do Piauí has an area of 521,572 km^2 with its principal town situated at 03°11'27"S and 41°38'42"W in the *Litoral Piauiense* micro-region. To the north it borders with the municipalities of Luís Correia and Parnaíba, to the south with Buriti

dos Lopes and Cocal, to the east with Cocal and Luís Correia, and to the west with Buriti dos Lopes and Parnaíba. Minimum temperatures are 22°C and maximum 36°C, average annual rainfall is 800-1600 mm, and the area has a warm tropical climate, a five to six month rainy season and a dry season for the rest of the year (Aguiar et al., 2004; IBGE, 2014). The vegetation of the study area includes hypoxerophytic caatinga, transitional vegetation types, hyperxerophytic caatinga and areas of intermixed cerrado and carrasco vegetation (Aguiar et al., 2004).

The population of the municipality is estimated at 5,304 inhabitants, of which 68.8% live in the countryside, having a nominal average monthly per capita income of R$ 201 (IBGE, 2014). There is only one health center, a single Joint Health Unit and a single pharmacy. The incidence of poverty is 49.06% (IBGE, 2014). The nearest hospital is located 51 km away in the town of Parnaíba, Piauí.

The study was conducted between November 2012 and March 2013. Standardized questionnaire forms were used. These contained structured and semi-structured questions to measure independent variables of the interviewee (gender, age, education, income level) and issues related to knowledge of the use of medicinal plants, such as which plants are known to the interviewee as medicinals, reason for their use, method of use, how the plant is acquired, plant part(s) used and undesirable effects observed. The information obtained in the interviews was recorded or transcribed only after the purpose and methods of the study had been explained and the respondents had given their prior permission and signed a document registering their Free and Informed Consent (Termo de Consentimento Livre e Esclarecido).

The "snowball" technique was used to identify interviewees and followed this sequence: a local mediator indicates the key community informants who have the greatest knowledge about medicinal plants, and these, in turn, will indicate new informants, until the cycle is closed and no further informants are indicated (Bailey, 1994).

Medicinal plant species in the municipality were collected in flower or fruit by means of excursions guided by local informants (Albuquerque et al., 2010). The collected plant specimens were labelled and preserved as herbarium vouchers following the methodology described by Mori et al. (1989). Species identification was carried out by consultation of the specialized taxonomic literature, using identification keys and comparison with herbarium specimens already identified in the Herbaria of the Universidade Federal do Piauí (HDELTA), where the entire collection of this study was later incorporated. Unidentified material was sent to taxonomic experts. The family classification follows APG III (2009). The names and authors of botanical taxa are in accordance with the standard works by Brummitt et al. (1992) and The International Plants Names Index (2015). Data on the origin of the species (native to Brazil or exotic) followed Lista de Espécies da Flora do Brasil (2015).

To quantify the survey results, we employed the Use Value (UV) for each species cited by informants, a methodology proposed by Phillips et al. (1993) and modified by Rossato et al. (1999). Use Value is given by the formula $UV = \Sigma U/n$, where UV = Use Value; U = number of citations (or uses) of the ethnospecies per informant and n = total number of informants.

A measure of agreement among informants in the use of the species was calculated as the Informant Consensus Factor (FCI), according to the formula: $FCI = (nur - nt)/(nur - 1)$, adapted from Trotter et al. (1986), where nur = number of use citations made by informants to a category of ailments; nt = number of species listed in each ailment category. The maximum value of FCI is 1 when there is complete consensus among informants within the ailment category.

The therapeutic indications were grouped into 15 ailment categories based on Almeida and Albuquerque (2002) and Cartaxo

et al. (2010) with modifications; namely, ailments of the respiratory system, nervous system, digestive system, genitourinary system, musculoskeletal and connective tissue system, injuries caused by poisoning and its consequences, inflammation and pain in general, infectious and parasitic diseases, neoplasms, ailments of the circulatory system, the skin and subcutaneous tissue, endocrine glands, nutrition and metabolism, disorders of the sensory system (eyes), the sensory system (ears) and "cultural illness". This last category was used for plants indicated for other non-medical purposes, such as 'evil eye' or "envious eye" (Amorozo, 2002).

RESULTS AND DISCUSSION

Medicinal plants are used by the population of the municipality of Bom Princípio for the treatment of ailments that affect both people and domestic animals. Respondents varied in age from 35 to 86 years, with a mean of 60 years, showing that older people tend to have more knowledge of medicinal plants. This has been observed in another study (Silva et al., 2015), where people over 50 years had most knowledge of medicinal plants and younger people showed very little interest in the subject. More men (55.26%) than women were represented among the respondents, also observed by Oliveira et al. (2010). This could be because men's daily work generally requires closer and more regular contact with local native plants and vegetation, promoting greater acquisition of knowledge about the medicinal properties of plants (Ming, 2006).

Among the respondents, 42.1% had not completed elementary school education, 39.5% were illiterate, 15.8% could read and write and 2.6% had completed elementary school. Most respondents (72.0%) were from the rural zone and 55.3% had a family income of a single minimum wage. These figures may reflect the limited availability of local employment coupled with low wages and the main economic activities in the municipality being subsistence agriculture and small businesses. A prevailing family income of a single minimum wage was also recorded by Oliveira (2010) in rural communities of Oeiras in the semi-arid region of Piauí state, and by Silva et al. (2015), in communities of the municipality of Luís Correia, in Piauí's littoral region.

Overall, this study recorded 112 species of plants used in traditional medicine, distributed in 98 genera and 59 families (Table 1). The families with most species were Fabaceae (14), Euphorbiaceae (11) and Lamiaceae (6). Similar results were obtained in studies conducted in the municipality of Abreu e Lima, in Pernambuco state (Rodrigues et al., 2014).

The large number of medicinal plant species recorded in this study shows that they are widely used in the area, as also observed in studies such as that of Ribeiro et al. (2014) conducted in a caatinga area the municipality of Assaré, Ceará state. The use of medicinal plants to cure various ills has a long tradition in some regions of Brazil

and demonstrates people's wealth of knowledge. A chronic lack of industrialized medical drugs in the public health services (Matos, 1998) and their high cost (Souza et al., 2012), tend to make the population more reliant on medicinal plants.

As regards the origin of the medicinal species, 66.1% are native to Brazil, which demonstrates the importance of the region's useful plants to local people. A different result was reported by the study of Ribeiro et al. (2014), where the use of exotic species predominated over natives.

The species with the highest UV were *Myracrodruon urundeuva* Allemão (0.65), *Dysphania ambrosioides* (L.) Mosyakin and Clemants (0.63) and *Amburana cearensis* (Allemão) A.C.Sm. (0.42) (Table 1). These use values are a measure of the importance of these taxa to the region's population and also underlines the importance of biological conservation of the local flora. Lack of guidance for the sustainable harvesting of native species for therapeutic use could lead to the disappearance or drastic reduction of natural populations, as with *M. urundeuva* and *A. cearensis*. These two species have been included in the Brazilian Ministry of Environment's official list of endangered species, according to Normative Instruction Nº 6, of 23 September 2008 (Brasil, 2008). The threat of extinction of these two species is enhanced by their popularity as medicinal plants which leads to unsustainable harvesting of their bark and consequent death of individual trees. Sustainable management would allow these plants a long life as the source of medicinal raw material for local people and such practices need to be implemented as soon as possible (Shiki, 1997).

In this study, the use of *M. urundeuva* was recorded as an anti-inflammatory for the human intestine and uterus and for the treatment of reproductive problems in cows (Table 1). This taxon is also used for inflammation of the reproductive tract in traditional communities in the municipality of Soledade, state of Paraíba (Lucena et al., 2011). The pharmacological potential of this species has been indicated by its antimicrobial and antiulcerogenic effects and as a protecting agent for gastric mucosa (Alves et al., 2009; Carlini et al., 2010).

It is noteworthy that 22.3% of the species recorded in this study were cited for veterinary use by the majority of respondents (73.7%). Such species are used primarily for the treatment of parasitic diseases (10) and for retention of the placenta in cows (7) (Table 1). Ethnoveterinary medicine is commonly carried out in the municipality of Bom Princípio do Piauí, where cattle, horses and dog species are treated.

D. ambrosioides is one of the most commonly used plants in folk medicine in almost all of Brazil, especially in the Northeast (Matos, 2007). Some effects indicated by respondents, such as its ability to combat flu, treat worms and consolidate fractures (Table 1) are also described by

Table 1. Plant species used in traditional medicine by the people of the municipality of Bom Princípio do Piauí, Piauí, Brazil.

Family/Species	CN	PU	FU	TI	VS	UV	St
Acanthaceae							
Justicia pectoralis Jacq.	Anador	Le	Infusion	Headache	Castro, KNC 114	0.03	N
Amaranthaceae							
Alternantera dentata (Moench) Stuchlík ex R.E.Fr.	Cibalena	Le	Infusion	Headache	Castro, KNC 121	0.03	N
Alternanthera brasiliana (L.) Kuntze	Penicilina	Le	Decoction	Stomach ache, anti-inflammatory	Castro, KNC 115	0.03	N
Dysphania ambrosioides (L.) Mosyakin & Clemants	Mastruz	Le, Sm	Maceration, juice, cataplasm, bath	Nerves, fever, ovarian cyst, worms, tuberculosis, pneumonia, healing, flu and animal ticks	Castro, KNC 13	0.63	Ex
Gomphrena elegans Mart.	Pustemeira	Sb	Decoction	Prostatitis, uterine inflammation	Castro, KNC 78	0.03	N
Anacardiaceae							
Anacardium occidentale L.	Cajuí-da-mata	Sb	Cataplasm, Decoction	Inflamed tooth, healing, inflamed throat, anti-inflammatory	Castro, KNC 72	0.16	N
Myracrodruon urundeuva Allemão	Aroeira	Sb	Maceration, Decoction	Back pain, healing, anti-inflammatory for bowel and uterus, fungal dermatitis, cow placenta retention	Castro, KNC 19	0.65	N
Spondias purpurea L.	Seriguela	Le	Decoction	Diarrhoea	Castro, KNC 26	0.03	Ex
Annonaceae							
Annona muricata L.	Graviola	Le	Decoction	High cholesterol	Castro, KNC 48	0.03	Ex
Asparagaceae							
Asparagus pyramidalis Kar, D.K.	Milindo	Wp	Decoction	Accelerated heart	Castro, KNC 44	0.05	Ex
Apocynaceae							
Aspidosperma pyrifolium Mart.	Pereira	Sb	Maceration, bath	Animal fleas and ticks	Castro, KNC 06	0.03	N
Himatanthus drasticus (Mart.) Plumel	Janaguba	La	Ingestion, *in natura*	Fracture, anti-inflammatory, for everything	Castro, KNC 15	0.16	N
Campanulaceae							
Hippobroma longiflora (L.) G.Don	Arrebenta-boi	Vi, Ro	Infusion, Decoction	Anti-inflammatory, kidney stone, back pain	Castro, KNC 14	0.05	N
Araceae							
Dieffenbachia seguine (Jacq.) Schott	Comigo-ninguém-pode	Wp	Planted	Evil eye	Castro, KNC 107	0.05	N
Arecaceae							
Cocos nucifera L.	Côco-da-praia	Fr	Decoction	Diarrhoea	Castro, KNC 126	0.03	Ex
Asteraceae							
Acanthospermum hispidum DC.	Maroto	Le	Decoction	Inflamed tooth	Castro, KNC 114	0.03	N
Bignoniaceae							
Fridericia dichotoma (Jacq.) L.G.Lohmann	Açoita-cavalo	Sb, Ro, Le	Maceration, decoction	Anemia, thinning the blood, diarrhoea	Castro, KNC 07	0.13	N
Handroanthus impetiginosus (Mart. ex DC.) Mattos	Ipê-roxo	Sb	Maceration	Prostatitis, anti-inflammatory, anemia	Castro, KNC 09	0.11	N

Table 1. Cont'd.

Handroanthus serratifolius (Vahl) S.Grose	Ipê-amarelo	Sb	Maceration, infusion	Prostatitis, anti-inflammatory	Castro, KNC 85	0.05	N
Bixaceae							
Bixa orellana L.	Urucum	Se	Maceration Decoction	Intoxication, flu, asthma	Castro, KNC 41	0.05	N
Boraginaceae							
Heliotropium indicum L.	Crista-de-galo	Le	Cataplasm	Canine and bovine scabies	Castro, KNC 47	0.03	N
Burseraceae							
Commiphora leptophloeos (Mart.) J.B.Gillett	Imburana-de-espinho	Sb	Maceration,inhalation decoction	Bladder inflammation, stomach ache, sinusitis	Castro, KNC 58	0.08	N
Cactaceae							
Cereus jamacaru DC.	Mandacaru	Wp, Fr	Planted, maceration	Evil eye, colic	Castro, KNC 84	0.05	N
Capparaceae							
Crateva tapia L.	Jenipapinho	Sb	Cataplasm	Fractures, dislocation	Castro, KNC 124	0.11	N
Caricaceae							
Carica papaya L.	Mamão	Fl, Se	Decoction with salt, *in natura*	Gastritis, worms	Castro, KNC 122	0.05	Ex
Cecropiaceae							
Cecropia cf. saxatilis Snethl.	Torém	Le	Maceration	Kidney inflammation	Castro, KNC 61	0.03	N
Chrysobalanaceae							
Licania rigida Benth.	Oiticica	Sb	Maceration	Cow placenta retention	Castro, KNC 77	0.05	N
Cleoamaceae							
Tarenaya spinosa (Jacq.) Raf.	Muçambê	Ro, Sb	Maceration, decoction	Tuberculosis, flu	Castro, KNC 02	0.13	N
Clusiaceae							
Platonia insignis Mart.	Bacuri	Se	Oil	Inflamed tooth	Castro, KNC 24	0.03	N
Combretaceae							
Combretum leprosum Mart.	Mufumbo	Sb, Ro, Fl	Cataplasm, infusion, bath, decoction	Bleeding, anti-inflammatory, liver, diarrhoea, colic, itching and hair loss in horse	Castro, KNC 68	0.26	N
Convolvulaceae							
Ipomoea batatas (L.) Lam.	Batata-doce	Le	Decoction, gargle	Inflamed tooth	Castro, KNC 90	0.03	Ex
Operculina alata (Ham) Urb	Batata-de-tiú	Ro	Decoction, infusion	Intoxication, snakebite and bovine worms	Castro, KNC 63	0.11	N
Operculina hamiltonii (G.Don) D.F.Austin & Staples	Batata-de- purga	Ro	Decoction, maceration	Diarrhoea, worms, horse appetite stimulant, thinning the blood, flu, soothing	Castro, KNC 64	0.13	N

Table 1. Cont'd.

Crassulaceae							
Kalanchoe pinnata (Lam.) Pers.	Coirama	Le	Juice, cataplasm	Gastritis, expel foreign body, pneumonia, bleeding	Castro, KNC 43	0.24	Ex
Cucurbitaceae							
Luffa operculata (L.) Cogn.	Paulista	Fr	Maceration, *in natura*, decoction	Anemia, worms, indigestion, sinusitis, cough animal, appetite stimulant, cow placenta retention	Castro, KNC 60	0.18	Ex
Momordica charantia L.	Melão-de-são-caetano	Fr	Maceration, bath	Fleas, ticks and animal mange	Castro, KNC 35	0.08	Ex
Cyperacaceae							
Schoenoplectus californicus (C. A. Mey.) Soják	Junco	Ro	*In natura*	Snakebite	Castro, KNC 89	0.03	N
Dilleniaceae							
Curatella americana L.	Sambaíba	Sb	Maceration	Thinning the blood, get pregnant	Castro, KNC 10	0.03	N
Euphorbiaceae							
Cnidoscolus urens (L.) Arthur	Cansanção	La	*In natura*	Inflamed tooth	Castro, KNC 81	0.03	N
Croton heliotropiifolius Kunth	Velame	Le, Wp	Juice, Decoction	Toothache, painkiller, gastritis, sexually transmitted disease	Castro, KNC 52	0.25	N
Croton sonderianus Mull.Arg.	Mameleiro preto	Sb	Decoction, maceration	Diarrhoea, indigestion, liver, stomach, nausea, sinusitis	Castro, KNC 10	0.24	N
Croton urucurana Baill.	Urucurana	La	Cataplasm	Itch	Castro, KNC 102	0.03	N
Euphorbia tirucalli L.	Cachorro-pelado	La	Cataplasm	Erisipela	Castro, KNC 91	0.03	Ex
Jatropha gossypiifolia L.	Pinhão-roxo	Le	Cataplasm	Evil eye, headache	Castro, KNC 70	0.16	N
Jatropha mollissima (Pohl) Baill.	Pinhão manso	La, Se	*In natura*	Healing, worms in dog	Castro, KNC 50	0.05	N
Jatropha sp.	Pinhão branco	La	*In natura*	Convulsion	Castro, KNC 44	0.03	N
Manihot sp.	Manipeba	Ro	Cataplasm	Healing, burns	Castro, KNC 101	0.03	N
Phyllanthus orbiculatus Rich.	Quebra-pedra	Ro, Wp	Decoction	Kidney stones, gallbladder stones	Castro, KNC 33	0.24	Ex
Ricinus communis L.	Mamona	Se, Le	Oil, cataplasm	Laxative for pets and children, worms, headache	Castro, KNC 108	0.11	Ex
Fabaceae							
Amburana cearensis (Allemão) A.C.Sm.	Imburana-de-cheiro	Sb, Se	Maceration, decoction, bath, *in natura*	Fungal dermatitis, snakebite, cow placenta retention, conjunctivitis, flu, sinusitis, headache, vaginal discharge.	Castro, KNC 82	0.42	N
Anadenanthera peregrina (L.) Speg.	Angico-branco	Sb	Maceration	Malaria, anemia, healing, analgesic	Castro, KNC 25	0.16	N
Bauhinia sp.	Mororó	Le, Sb	Decoction	Diabetes	Castro, KNC 37	0.03	N
Bowdichia nitida Spruce ex Benth.	Sucupira	Se	Grind and add honey	Sore throat, indigestion in cow	Castro, KNC 20	0.05	N
Hymenaea courbaril L.	Jatobá ou jataí	Sb, Re	Infusion, bath, inhalation	Prostate cancer, gastritis, anti-inflammatory, back pain, vaginal discharge, nosebleed.	Castro, KNC 16	0.21	N
Libidibia ferrea (Mart. ex Tul.) L.P.Queiroz	Jucá	Sb, Fr, Se	Maceration	Anti-inflammatory, kidneys, bruises, back pain, healing, analgesic	Castro, KNC 125	0.24	N
Mimosa acutistipula (Mart.) Benth.	Jurema-preta	Sb	Maceration	Diarrhoea	Castro, KNC 13	0.03	N
Mimosa caesalpiniifolia Benth.	Sabiá	Sb	Decoction, cataplasm	Diarrhoea, healing	Castro, KNC 17	0.05	N
Poincianella bracteosa (Tul.) L.P.Queiroz	Catingueira-preta	Sb	Decoction	Diarrhoea	Castro, KNC 11	0.03	N
Senna alata (L.) Roxb.	Mata-pastão	Fl, Ro	Decoction	Flu, worms	Castro, KNC 100	0.05	N

Table 1. Cont'd.

Stryphnodendron adstringens (Mart.) Coville	Barbatimão	Sb	Decoction, maceration	Healing, bone pain	Castro, KNC 21	0.05	N
Tamarindus indica L.	Tamarindo	Le	Decoction, cataplasm	Hemorrhoid, varicose veins	Castro, KNC 22	0.05	Ex
Vachellia farnesiana (L.) Wight & Arn.	Coronha	Fr, Se	Decoction, maceration	Fever, anemia, dores, kidney stone, liver, colics, infection, the flu	Castro, KNC 30	0.24	N
Vigna unguiculata (L.) Walp.	Feijão	Se	Maceration	Infection	Castro, KNC 95	0.03	Ex
Iridaceae							
Eleutherine bulbosa (Mill.) Urb.	Palmeirinha	Ro	Decoction, infusion	Diarrhoea	Castro, KNC 29	0.16	Ex
Lamiaceae							
Hyptis suaveolens (L.) Poit.	Bamburral	Le	Maceration, decoction	Colics on horseback, heart	Castro, KNC 75	0.05	N
Mentha arvensis L.	Vick	Le	Infusion, chew	Flu, expectorant, headache	Castro, KNC 45	0.05	Ex
Mentha sp.	Hortelã	Le	Decoction, juice, infusion	Period pains, stomach ache, high cholesterol, constipation, cough, flu, hiccups, bronchitis, fever	Castro, KNC 28	0.21	Ex
Ocimum basilicum L.	Alfavaca	Le	Decoction, juice	Indigestion, flu, earache	Castro, KNC 65	0.11	Ex
Plectranthus barbatus Andrews	Boldo [1]	Le	Infusion, decoction	Laxative, stomach pain, indigestion, nausea, liver, thinning blood	Castro, KNC 46	0.37	Ex
Rosmarinus officinalis L.	Alecrim	Le	Decoction, maceration	Animal ticks, sinusitis	Castro, KNC 87	0.05	N
Lauraceae							
Persea americana Mill.	Abacate	Se	Moer, cataplasm	Healing	Castro, KNC 112	0.03	Ex
Lecythidaceae							
Lecythis pisonis Cambess.	Sapucaia	Fl	*In natura*	Animal ticks	Castro, KNC 21	0.03	N
Lythraceae							
Cuphea carthagenensis (Jacq.)J.F.Macbr.	Sete-sangria	Le	Maceration	Thinning the blood	Castro, KNC 106	0.03	N
Malvaceae							
Gossypium hirsutum L.	Algodão	Le, Fr	Infusion, decoction, gargle	Asthma, cough, the flu, tiredness, inflamed tooth, retained placenta cow	Castro, KNC 22	0.11	N
Hibiscus sabdariffa L.	Quiabo	Se	Toast	Asthma	Castro, KNC 88	0.05	Ex
Meliaceae							
Azadirachta indica A. Juss.	Nim	Le, Fr	Maceration, bath	Animal ticks	Castro, KNC 26	0.03	Ex
Cedrela odorata L.	Cedro	Sb	Maceration	Joint pain, abortive	Castro, KNC 48	0.05	N
Moraceae							
Ficus insipida Willd.	Gameleira	La	Cataplasm	Fracture, wart, healing for man and animal	Castro, KNC 103	0.08	N
Rubus brasiliensis Mart.	Amora	La, Sb	Maceration, cataplasm	Analgesic, thin the blood, itch in skin	Castro, KNC 53	0.08	Ex
Musaceae							
Musa paradisiaca L.	Bananeira	Sm	Juice	Indigestion on animal, lung, healing	Castro, KNC 99	0.05	Ex

Table 1. Cont'd.

Myrtaceae							
Eucalyptus globulus Labill.	Eucalipto de cheiro	Le	Decoction	Fever, body ache	Castro, KNC 49	0.08	Ex
Psidium guajava L.	Goiabeira	Le	Decoction	Diarrhoea	Castro, KNC 27	0.32	Ex
Eugenia sp.	Ubaia	Le, Ro	Decoction	Diarrhoea, colic	Castro, KNC 69	0.03	N
Eugenia uniflora L.	Pitangueira	Le	Decoction	Diarrhoea	Castro, KNC 76	0.03	N
Nyctaginaceae							
Guapira tomentosa (Casar.) Lundell	João mole	Sb	Decoction, maceration	Retained placenta cow, fungus	Castro, KNC 18	0.21	N
Olacaceae							
Ximenia americana L.	Ameixa	Sb	Maceration, cataplasm, gargle	Gastritis, diarrhoea, liver, cancer, anemia, antibiotic, tooth inflammation, menstrual pain, analgesic, anti-inflammatory, healing, retained cow placenta	Castro, KNC 74	0.37	N
Oxalidaceae							
Averrhoa carambola L.	Carambola	Fr	Juice	Kidney pain	Castro, KNC 113	0.03	Ex
Passifloraceae							
Passiflora edulis Sims	Maracujá	Le	Decoction	Insomnia	Castro, KNC 120	0.03	N
Passiflora sp.1	Maracujá da mata	Le	Decoction	Soothing	Castro, KNC 116	0.03	N
Passiflora sp.2	Maracujazinho	Fr	Juice	Prostatitis, urinary infection	Castro, KNC 80	0.03	N
Pedaliaceae							
Sesamum indicum L.	Gergelim	Se, Ol	Maceration, cataplasm	Fever, the flu, malaria, headache	Castro, KNC 94	0.13	N
Phytolaccaceae							
Petiveria alliacea L.	Tipi	Ro, Wp	Decoction	Rheumatism, body aches	Castro, KNC 05	0.08	N
Piperaceae							
Piper aduncum L.	Pimenta de macaco	Se	Grind, infusion	Indigestion, gases	Castro, KNC 38	0.03	N
Plantaginaceae							
Scoparia dulcis L.	Vassourinha	Le	Decoction, juice	Evil eye, kidney ailments, calf worms	Castro, KNC 42	0.11	N
Poaceae							
Cymbopogon citratus (DC.) Stapf	Capim-santo	Le	Decoction	High pressure, soothing	Castro, KNC 45	0.08	Ex
Saccharum officinarum L.	Cana-de-açúcar	Sm	Decoction, juice	High pressure, weight loss, increase milk production	Castro, KNC 127	0.08	Ex
Polygonaceae							
Punica granatum L.	Romã	Fr	Juice, chew	Conjunctivitis, indigestion, sore throat, hoarseness	Castro, KNC 40	0.26	Ex

Table 1. Cont'd.

	CN	PU	FU	TI	VS	UV	St
Punicaceae							
Triplaris gardneriana Wedd.	Pajeú	Sb	Decoction, cataplasm	Inflamed tooth and mouth, healing	Castro, KNC 03	0.05	N
Rhamnaceae							
Ziziphus joazeiro Mart.	Juá	Sb	Maceration, mounthwash	Gingivitis	Castro, KNC 56	0.03	N
Rubiaceae							
Carapichea ipecacuanha (Brot.) L.Andersson	Papeconha	Wp	Decoction	Worms	Castro, KNC 79	0.03	N
Coutarea hexandra (Jacq.) K.Schum.	Quina-quina	Sb	Maceration	Prostate inflammation, abortion, malaria, diabetes	Castro, KNC 55	0.11	N
Morinda citrifolia L.	Noni	Fr	*In natura*, maceration	Uterine inflammation, cancer, prostatitis	Castro, KNC 27	0.05	Ex
Rutaceae							
Citrus aurantium L.	Laranja	Le, Fb	Infusion, decoction	High pressure, soothing, indigestion, diarrhoea, stomach ache	Castro, KNC 71	0.18	Ex
Citrus limon (L.) Burm. f.	Limão	Fr	Juice, decoction	Sore throat, cholesterol, high blood pressure	Castro, KNC 36	0.11	Ex
Citrus sp.	Mexirica	Fb	Maceration, inhalation	Sinusitis	Castro, KNC 46	0.03	Ex
Ruta graveolens L.	Arruda	Le	Decoction	Evil eye, thinning blood, uterine inflammation, indigestion, muscle pain	Castro, KNC 109	0.11	Ex
Solanaceae							
Capsicum frutescens L.	Pimenta malagueta	Ro	Grind, infusion	Cardiac arrhythmia	Castro, KNC 39	0.03	Ex
Turneraceae							
Turnera ulmifolia L.	Shanana	Ro, La	Decoction, *in natura*	Uterine inflammation, pain, anti-inflammatory	Castro, KNC 04	0.11	N
Urticaceae							
Urtica dioica L.	Urtiga mansa	Ro	Decoction	Gallstones	Castro, KNC 59	0.03	N
Verbenaceae							
Lippia alba (Mill) N.E. Br. ex Britton & P. Wilson	Erva cidreira	Le	Infusion, decoction	High pressure, soothing, indigestion, diarrhoea	Castro, KNC 32	0.21	N
Xanthorrhoeaceae							
Aloe vera (L.) Burm. f.	Babosa	Le	In natura, cataplasm	Prostate cancer, burns, itch, hair loss in man and horse, healing	Castro, KNC 30	0.18	Ex
Zingiberaceae							
Zingiber officinale Roscoe	Gengibre	Ro	Juice, gargle	Hoarse Hoarseness	Castro, KNC 123	0.05	N

Legend: CN: common name; PU: portion used; FU: form of use; TI: therapeutic indication; VS: Voucher sample number in the herbarium of HDelta- UFPI, Brasil; UV: use value; St: status; Sm: stem; Fb: fruit bark; Vi: Vine; Sb: stem bark; Fl: flower; Le: Leaf; Fr: Fruit; La: latex; Ol: Oil; Wp: Whole plant; Ro: Root; Re: Resin; Se: seed; N: Native; Ex: exotic.

Morais et al. (2005) and Matos (2007). Action on fractures has been demonstrated in a test with rabbits (Pinheiro Neto et al., 2005), while wound healing activity was observed in experiments with rats (Sérvio et al., 2011).

The efficacy of extracts of *A. cearensis* as a bronchodilator, analgesic and antinflammatory was observed in preclinical studies by Leal et al. (2000) and its antibacterial action against

Table 2. Informant Consensus Factor (FCI) based on the use of medicinal species by the informants of the municipality of Bom Princípio do Piauí, Piauí, Brazil.

Categories of medicinal use	No. of citations given by informants	No. of species	FCI
Diseases involving the digestive system	102	48	0.5
Diseases of the genito-urinary system	72	29	0.6
Respiratory conditions	60	27	0.6
Diseases of the circulatory system	36	26	0.3
Diseases associated with inflammation, pain and fever	47	25	0.5
Infectious and parasitic diseases	32	24	0.3
Diseases of the skin and nails	39	22	0.4
Diseases of the musculoskeletal system	41	19	0.6
Mental and behavioral disorders	21	15	0.3
Endocrine, nutritional and metabolic disorders	19	14	0.3
Culture diseases	11	5	0.6
Injuries caused by poisoning and its consequences	7	4	0.5
Neoplasms	4	4	0.0
Disorders of the sensory system (eyes)	3	2	0.5
Disorders of the sensory system (ears)	2	1	1.0

Staphylococcus aureus and *Escherichia coli* was shown by Figueiredo et al. (2013).

The leaf was the plant part most frequently reported for medicinal use, representing 26.8% of the citations, followed by the bark (21.0%). The leaves of many species are not available throughout the year because they fall during the dry season and in these cases the collectors dry and store them for later use (Silva et al., 2015).

The category of therapeutic agents for problems of the digestive system had the highest number of citations (102) and the highest number of species (48), *P. barbatus* being the most frequently cited. According to Matu and Staden (2003), extracts of *P. barbatus* have antibacterial and antiinflammatory activities. However, this plant should not be used by pregnant women, infants, children, hypertensive patients and those with biliary obstructions, because this species has toxic and abortifacient properties (ANVISA, 2011).

The greatest value of the Informant Consensus Factor (FCI) was related to disorders of the sensory system (ears) (FCI = 1), followed by ailments of the genitourinary system and musculoskeletal, respiratory and cultural problems (FCI = 0.6 each) (Table 2). There is greater consensus when a species is indicated by several informants for signs and symptoms of a disease category (Trotter et al., 1986).

The Agência Nacional de Vigilância Sanitária (ANVISA) maintains a list of 66 traditional medicinal plants which have scientifically proven medicinal effects and indicates their correct usage. Fifteen species cited by informants are included in this list and despite their adverse effects according to ANVISA (2013), none of the respondents

cited these effects, suggesting they were unaware of the health risks linked to their usage. On the other hand, 18.4% of respondents indicated eleven species as the cause of adverse effects (Table 3), demonstrating that there is partial knowledge within the population of the municipality of Bom Princípio do Piauí of the health risks associated with the use of some medicinal plant species. The World Health Organization recognizes the importance of the therapeutic potential of plants, but it cautions against their use because of the dangers posed by inadequate preparation of traditional medicines and the frequent lack of knowledge of their possible adverse side effects (Calixto, 2000).

Various traditional medicinal species cited in this study possess toxicity, even when this was not recognized by informants. The seeds of *Ricinus communis* L., for example, may cause irritation of the gastrointestinal mucosa and in severe cases can lead to convulsions, coma and death (Plantas Tóxicas no Brasil, 2009), *Acanthospermum hispidum* DC. has abortifacient and teratogenic action (Lemonica et al., 1994), while *Aloe vera* (L.) Burm. f. exhibits properties toxic to the kidneys (Wagner et al., 2006) and liver (Yang et al., 2010). Moreover, the toxicity of some plants used in traditional medicine is sometimes described only after the occurrence of many cases of intoxication (Silveira et al., 2008) and the toxic potential of many other species has not yet been identified.

Medicinal plants are recognized as such by the effects they produce and many of the therapeutic indications provided by local informants are in agreement with results reported in the scientific literature, even though the local population is unaware of the active plant

Table 3. Adverse effects from the use of medicinal plants cited by the informants of Bom Princípio of Piauí, Piauí, Brazil.

Species	Adverse effects
Asparagus pyramidalis Kar, D.K.	Pressure fall
Bowdichia nitida Spruce ex Benth.	Red spots on the skin, intoxication
Cereus jamacaru DC.	Nausea
Cnidoscolus urens (L.) Arthur	Breaking the tooth
Coutarea hexandra (Jacq.) K.Schum.	Vomit
Dysphania ambrosioides (L.) Mosyakin & Clemants	Pressure drop, abortive, weakens bones
Himatanthus drasticus (Mart.) Plumel	Stiffens the joints
Luffa operculata (L.) Cogn.	Nosebleed
Myracrodruon urundeuva Allemão	Bleeding
Operculina hamiltonii (G.Don) D.F.Austin & Staples	Diarrhoea, vomiting and malaise
Senna alata (L.) Roxb.	Tremors

constituents (Bertini et al., 2005). However, plants contain complex mixtures of chemicals that can elicit biological and pharmacological actions (Sousa et al., 2008) and while some may have beneficial effects, others may be injurious to humans or animals.

Conclusion

This study verified the existence of an important practical dependence of the people of the municipality of Bom Princípio do Piauí on local medicinal plant species used for both humans and domestic animals. The knowledge of medicinal plants harboured by this community was shown to be important for local health care and to provide a strong additional argument for the conservation of the local flora.

Conflict of Interests

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

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