

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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Received 21 December, 2015; Accepted 22 March, 2016

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

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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 al., 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 km² 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 $UV = \sum U/n$, 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" (Amoroza, 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 N° 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 | | | | | | | |
| <i>Justicia pectoralis</i> Jacq. | Anador | Le | Infusion | Headache | Castro, KNC 114 | 0.03 | N |
| Amaranthaceae | | | | | | | |
| <i>Alternanthera dentata</i> (Moench) Stuchlik ex R.E.Fr. | Cibalena | Le | Infusion | Headache | Castro, KNC 121 | 0.03 | N |
| <i>Alternanthera brasiliana</i> (L.) Kuntze | Penicilina | Le | Decoction | Stomach ache, anti-inflammatory | Castro, KNC 115 | 0.03 | N |
| <i>Dysphania ambrosioides</i> (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 |
| <i>Gomphrena elegans</i> Mart. | Pustemeira | Sb | Decoction | Prostatitis, uterine inflammation | Castro, KNC 78 | 0.03 | N |
| Anacardiaceae | | | | | | | |
| <i>Anacardium occidentale</i> L. | Cajuí-da-mata | Sb | Cataplasm, Decoction | Inflamed tooth, healing, inflamed throat, anti-inflammatory | Castro, KNC 72 | 0.16 | N |
| <i>Myracrodruon urundeuva</i> 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 |
| <i>Spondias purpurea</i> L. | Seriguela | Le | Decoction | Diarrhoea | Castro, KNC 26 | 0.03 | Ex |
| Annonaceae | | | | | | | |
| <i>Annona muricata</i> L. | Graviola | Le | Decoction | High cholesterol | Castro, KNC 48 | 0.03 | Ex |
| Asparagaceae | | | | | | | |
| <i>Asparagus pyramidalis</i> Kar, D.K. | Milindo | Wp | Decoction | Accelerated heart | Castro, KNC 44 | 0.05 | Ex |
| Apocynaceae | | | | | | | |
| <i>Aspidosperma pyriforme</i> Mart. | Pereira | Sb | Maceration, bath | Animal fleas and ticks | Castro, KNC 06 | 0.03 | N |
| <i>Himatanthus drasticus</i> (Mart.) Plumel | Janaguba | La | Ingestion, <i>in natura</i> | Fracture, anti-inflammatory, for everything | Castro, KNC 15 | 0.16 | N |
| Campanulaceae | | | | | | | |
| <i>Hippobroma longiflora</i> (L.) G.Don | Arrebenta-boi | Vi, Ro | Infusion, Decoction | Anti-inflammatory, kidney stone, back pain | Castro, KNC 14 | 0.05 | N |
| Araceae | | | | | | | |
| <i>Dieffenbachia seguine</i> (Jacq.) Schott | Comigo-ninguém-pode | Wp | Planted | Evil eye | Castro, KNC 107 | 0.05 | N |
| Areceaceae | | | | | | | |
| <i>Cocos nucifera</i> L. | Côco-da-praia | Fr | Decoction | Diarrhoea | Castro, KNC 126 | 0.03 | Ex |
| Asteraceae | | | | | | | |
| <i>Acanthospermum hispidum</i> DC. | Maroto | Le | Decoction | Inflamed tooth | Castro, KNC 114 | 0.03 | N |
| Bignoniaceae | | | | | | | |
| <i>Fridericia dichotoma</i> (Jacq.) L.G.Lohmann | Açoita-cavalo | Sb, Ro, Le | Maceration, decoction | Anemia, thinning the blood, diarrhoea | Castro, KNC 07 | 0.13 | N |
| <i>Handroanthus impetiginosus</i> (Mart. ex DC.) Mattos | Ipê-roxo | Sb | Maceration | Prostatitis, anti-inflammatory, anemia | Castro, KNC 09 | 0.11 | N |

Table 1. Cont'd.

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|---|---------------------|------------|---------------------------------------|--|-----------------|------|----|
| <i>Handroanthus serratifolius</i> (Vahl) S.Grose | Ipê-amarelo | Sb | Maceration, infusion | Prostatitis, anti-inflammatory | Castro, KNC 85 | 0.05 | N |
| Bixaceae | | | | | | | |
| <i>Bixa orellana</i> L. | Urucum | Se | Maceration Decoction | Intoxication, flu, asthma | Castro, KNC 41 | 0.05 | N |
| Boraginaceae | | | | | | | |
| <i>Heliotropium indicum</i> L. | Crista-de-galo | Le | Cataplasm | Canine and bovine scabies | Castro, KNC 47 | 0.03 | N |
| Burseraceae | | | | | | | |
| <i>Commiphora leptophloeos</i> (Mart.) J.B.Gillett | Imburana-de-espinho | Sb | Maceration, inhalation decoction | Bladder inflammation, stomach ache, sinusitis | Castro, KNC 58 | 0.08 | N |
| Cactaceae | | | | | | | |
| <i>Cereus jamacaru</i> DC. | Mandacaru | Wp, Fr | Planted, maceration | Evil eye, colic | Castro, KNC 84 | 0.05 | N |
| Capparaceae | | | | | | | |
| <i>Crateva tapia</i> L. | Jenipapinho | Sb | Cataplasm | Fractures, dislocation | Castro, KNC 124 | 0.11 | N |
| Caricaceae | | | | | | | |
| <i>Carica papaya</i> L. | Mamão | Fl, Se | Decoction with salt, <i>in natura</i> | Gastritis, worms | Castro, KNC 122 | 0.05 | Ex |
| Cecropiaceae | | | | | | | |
| <i>Cecropia cf. saxatilis</i> Sneath. | Torém | Le | Maceration | Kidney inflammation | Castro, KNC 61 | 0.03 | N |
| Chrysobalanaceae | | | | | | | |
| <i>Licania rigida</i> Benth. | Oiticica | Sb | Maceration | Cow placenta retention | Castro, KNC 77 | 0.05 | N |
| Cleomaceae | | | | | | | |
| <i>Tarenaya spinosa</i> (Jacq.) Raf. | Muçambê | Ro, Sb | Maceration, decoction | Tuberculosis, flu | Castro, KNC 02 | 0.13 | N |
| Clusiaceae | | | | | | | |
| <i>Platonia insignis</i> Mart. | Bacuri | Se | Oil | Inflamed tooth | Castro, KNC 24 | 0.03 | N |
| Combretaceae | | | | | | | |
| <i>Combretum leprosum</i> 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 | | | | | | | |
| <i>Ipomoea batatas</i> (L.) Lam. | Batata-doce | Le | Decoction, gargle | Inflamed tooth | Castro, KNC 90 | 0.03 | Ex |
| <i>Operculina alata</i> (Ham) Urb | Batata-de-tiú | Ro | Decoction, infusion | Intoxication, snakebite and bovine worms | Castro, KNC 63 | 0.11 | N |
| <i>Operculina hamiltonii</i> (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.

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

Table 1. Cont'd.

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

Table 1. Cont'd.

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

Table 1. Cont'd.

| | | | | | | | | |
|---|-------------------|--------|-------------------------------|--|--|-----------------|------|----|
| Punicaceae | | | | | | | | |
| <i>Triplaris gardneriana</i> Wedd. | Pajeú | Sb | Decoction, cataplasm | Inflamed tooth and mouth, healing | | Castro, KNC 03 | 0.05 | N |
| Rhamnaceae | | | | | | | | |
| <i>Ziziphus joazeiro</i> Mart. | Juá | Sb | Maceration, mouthwash | Gingivitis | | Castro, KNC 56 | 0.03 | N |
| Rubiaceae | | | | | | | | |
| <i>Carapichea ipecacuanha</i> (Brot.) L.Andersson | Papeconha | Wp | Decoction | Worms | | Castro, KNC 79 | 0.03 | N |
| <i>Coutarea hexandra</i> (Jacq.) K.Schum. | Quina-quina | Sb | Maceration | Prostate inflammation, abortion, malaria, diabetes | | Castro, KNC 55 | 0.11 | N |
| <i>Morinda citrifolia</i> L. | Noni | Fr | <i>In natura</i> , maceration | Uterine inflammation, cancer, prostatitis | | Castro, KNC 27 | 0.05 | Ex |
| Rutaceae | | | | | | | | |
| <i>Citrus aurantium</i> L. | Laranja | Le, Fb | Infusion, decoction | High pressure, soothing, indigestion, diarrhoea, stomach ache | | Castro, KNC 71 | 0.18 | Ex |
| <i>Citrus limon</i> (L.) Burm. f. | Limão | Fr | Juice, decoction | Sore throat, cholesterol, high blood pressure | | Castro, KNC 36 | 0.11 | Ex |
| <i>Citrus</i> sp. | Mexirica | Fb | Maceration, inhalation | Sinusitis | | Castro, KNC 46 | 0.03 | Ex |
| <i>Ruta graveolens</i> L. | Arruda | Le | Decoction | Evil eye, thinning blood, uterine inflammation, indigestion, muscle pain | | Castro, KNC 109 | 0.11 | Ex |
| Solanaceae | | | | | | | | |
| <i>Capsicum frutescens</i> L. | Pimenta malagueta | Ro | Grind, infusion | Cardiac arrhythmia | | Castro, KNC 39 | 0.03 | Ex |
| Turneraceae | | | | | | | | |
| <i>Turnera ulmifolia</i> L. | Shanana | Ro, La | Decoction, <i>in natura</i> | Uterine inflammation, pain, anti-inflammatory | | Castro, KNC 04 | 0.11 | N |
| Urticaceae | | | | | | | | |
| <i>Urtica dioica</i> L. | Urtiga mansa | Ro | Decoction | Gallstones | | Castro, KNC 59 | 0.03 | N |
| Verbenaceae | | | | | | | | |
| <i>Lippia alba</i> (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 | | | | | | | | |
| <i>Aloe vera</i> (L.) Burm. f. | Babosa | Le | <i>In natura</i> , cataplasm | Prostate cancer, burns, itch, hair loss in man and horse, healing | | Castro, KNC 30 | 0.18 | Ex |
| Zingiberaceae | | | | | | | | |
| <i>Zingiber officinale</i> 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 anti-inflammatory 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 anti-inflammatory 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 |
|---|--|
| <i>Asparagus pyramidalis</i> Kar, D.K. | Pressure fall |
| <i>Bowdichia nitida</i> Spruce ex Benth. | Red spots on the skin, intoxication |
| <i>Cereus jamacaru</i> DC. | Nausea |
| <i>Cnidoscopus urens</i> (L.) Arthur | Breaking the tooth |
| <i>Coutarea hexandra</i> (Jacq.) K.Schum. | Vomit |
| <i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants | Pressure drop, abortive, weakens bones |
| <i>Himatanthus drasticus</i> (Mart.) Plumel | Stiffens the joints |
| <i>Luffa operculata</i> (L.) Cogn. | Nosebleed |
| <i>Myracrodruon urundeuva</i> Allemão | Bleeding |
| <i>Operculina hamiltonii</i> (G.Don) D.F.Austin & Staples | Diarrhoea, vomiting and malaise |
| <i>Senna alata</i> (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

The authors especially thank the local population of Bom Princípio do Piauí for their kindness and their essential and major contribution to the implementation of this study. To João Batista Alves de Souza and Antonio da Silva Nascimento for participating in collections.

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