The Ethnopharmacological Literature: An Analysis of the Scientific Landscape in the Cerrado in Central-Western Brazil

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Received: July 21, 2020      Accepted: August 31, 2020      Online Published: October 15, 2020
doi:10.5539/jas.v12n11p307          URL: https://doi.org/10.5539/jas.v12n11p307

Abstract

Research on pharmacology and phytochemistry originating from medicinal plants has resulted in various publications highlighting the Cerrado in central-western Brazil, which has a remarkable diversity of plant species. The reserve area selected was the Cerrado stricto sensu settlement “17 April”, Mato Grosso do Sul (MS), Brazil. However, no ethnopharmacological review focusing on the plants present in the reserve area exists, even though the consumption of medicinal plants is a widespread practice. The aims of this study were to 1) survey and document the medicinal plants present in the reserve area; 2) provide an overview of recent ethnopharmacological, phytochemical and pharmacological studies of these species; and 3) provide insight for future studies. A literature search was conducted, and relevant information was collected from authentic resources using databases such as Science Direct, PubMed, Google Scholar, Web of Science and Scopus, as well as peer reviewed articles, books and theses. Eighty-nine species belonging to 39 different families were found; the most abundant were Fabaceae (n = 13), Myrtaceae (n = 7), Rubiaceae (n = 7) and Bignoniaceae (n = 5). In terms of its empirical use, the most utilized parts were leaves (41%), bark (22%) and roots (15%). The most widespread traditional use, according to the literature review of the following plants involves the treatment of gastro-intestinal system diseases (41 spp). Chemical studies reported a high presence of terpene, phenol, and alkaloid classes. Only three are listed in the RENISUS: Casearia sylvestris, Copaifera langsdorffii and Stryphnodendron adstringens. This study demonstrated a large number of medicinal plants in an area of the Cerrado in the state of Mato Grosso do Sul, Brazil. Noting the importance of biodiversity for the development of new pharmacological approaches, many studies prove the empirical use of medicinal plants.

Keywords: Cerrado, Mato Grosso do Sul, medicinal plants, review

1. Introduction

Brazil is characterized by some of the greatest biodiversity on the planet due to the presence of different biomes, such as the Amazon (tropical forest), Caatinga (thorn forest), Pantanal (flooded pasture), Pampas (subtropical pastures or pastures), Atlantic Forest (deciduous forest) and Cerrado (savanna) (Guerra et al., 2020). The Cerrado is the second largest biome in South America, occupying an area of approximately 22% of the Brazilian territory, and had the second greatest biodiversity richness (Sano et al., 2019). The state of Mato Grosso do Sul is located in midwestern Brazil, and most of its territory is occupied by the Cerrado (Amaral et al., 2017). Nevertheless, 46% of the original Cerrado area has been converted to pasture and cropland and is continually threatened by the indiscriminate use of fire (Durigan & Ratter, 2015; Strassburg et al., 2014).

The study of ethnopharmacology is closely related to sustainable development, as it is an effective way to develop medicines from the perspective of traditional plant use. In this sense, the importance of studies in this area is clear, as they contribute to the improvement of the traditional application of natural products, and they emphasize the importance of biodiversity for the sustainability of local populations (Di Stasi et al., 2002). In this context, the Brazilian government encourages the use of herbal remedies and medicinal plants as a strategy to improve the use of Brazil’s biodiversity and public access to herbal medicines.

In this study, we conducted a 1) literature survey and documented the medicinal species present in the reserve area of the settlement “April 17”, MS, Brazil, in the Cerrado biome; 2) Exhaustive research has evaluated the
current status of scientific knowledge related to the popular use and phytochemical and pharmacological properties of these species; 3) We also discuss the species found in the study area that are noted in research on herbal medicines. The population residing in this area is characterized by agriculture and their means of subsistence, with different natural resources used for different purposes. Considering the abundant vegetation and the scarcity of financial resources, the local population often uses natural resources to treat diseases without any knowledge of scientific evidence. After the identification of all the species found in this area, a survey of scientific studies involving these species is absolutely relevant and necessary, aiming to contribute to the safety and well-being of those who commonly use these plants, both in the target region of this study and in others.

2. Material and Methods

2.1 Study Sites
In the framework of this study, the selected area, Cerrado stricto sensu (21°46′54.6″S and 53°13′23.6″W), comprised the reserve area of the settlement “17 April”, located in Casa Verde district, Nova Andradina city, MS (Figure 1).

2.2 Collection and Identification of Species
The collections of the species present in this area were carried out between 09/2017 and 01/2018. Botanical material was identified by Dr. Zefa Valdevina Pereira (Faculty of Biological and Environmental Sciences) and deposited in the herbarium of the Federal University of Grande Dourados-UFGD. Each specimen generated an identification protocol number (DDMS) (Table 1).

2.3 Bibliographic Survey
A review of the popular use and phytochemical and pharmacological data of species found in the reserve region of the settlement “April 17” was performed using online journals and books that were published in English, Portuguese and Spanish. The information related to this article was collected from scientific literature databases including Science Direct, PubMed, Scopus and Google Scholar. Articles were selected according to the family, gender, and species (including synonymous species). Due to the widespread use of terms transcribed (traditional use of diseases, symptoms and effects) in review the species were grouped under 12 categories.

3. Results and Discussion
For the first time, 89 medicinal plants belonging to 39 families were documented in the study area; the documented plants included trees (n = 60), bushes (n = 19), and shrubs (n = 1) (Table 1). Fabaceae (n = 13),
Myrtaceae \((n = 7)\), Rubiaceae \((n = 7)\) and Bignoniaceae \((n = 5)\) were the most species-rich families (Table 1). The leaves (41%), bark (22%) and roots (15%) were the most commonly reported plant parts for popular use (Table 1). Table 1 presents information on previous scientific research, describing the forms of use of the plants, as well as the useful part of the plant and its use.

These plant species are used for the treatment and prevention of many ailments and due to the widespread use of terms transcribed in review the species were grouped under 10 specific and 2 general categories diseases. The most widespread traditional use, according to the literature review of 10 specific categories diseases of the following plants involves the treatment of gastro-intestinal system diseases (DSD, 44 spp), followed by the endocrine system diseases (ENM, 24 spp), infectious diseases (IPD, 20 spp), musculoskeletal and joint diseases (MCT, 20 spp), respiratory system diseases (RSD, 19 spp), skin, eye, ear, nose and oropharynx diseases (SST, 18 spp), obstetrics, gynecology and urinary-tract diseases (GUS, 18 spp), malignant diseases (NEP, 9 spp), cardiovascular system diseases (CSD, 8 spp) and central nervous system diseases (NSD, 6 spp) (Figure 2). Many species have been reported grouped into 2 general categories, as for the treatment inflammatory diseases (ID, 16 spp) and other diseases (OD, 41 spp) (Figure 2).

The symptoms and effects mentioned for DSD includes antidiarrheal, carminative, abdominal disorders, dysentery, purgative, laxative, hemorrhoids, hernia, gastritis, ulcer, liver and spleen diseases, flatus, liver abnormalities, gallstones, heartburn, kidney pain and intestinal colic. According to the World Health Organization, gastro-intestinal system diseases (diarrhoeal) are the main cause of death in children under five years old, and there are almost 1.7 billion cases of childhood diarrhoea every year, with approximately 525,000 deaths (Kirk et al., 2017). The OD category include as an example snake bites, aphrodisiac, tonic, emetic, astringent, scurvy, anthelmintic, swelling, malaise and stings insects.
Table 1. Identification of the species found and recorded in the literature (name, popular use and utilized part) in the reserve area of the settlement “April 17”, located in Casa Verde district, Nova Andradina city, MS, Brazil

| Family                  | Botanical taxon (DDMS)/Habit | Popular name                                                                 | Popular uses (Used parts and application)                                                                                                                                                                                                 |
|------------------------|------------------------------|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Amaranthaceae          | Gomphrena officinalis Mart.  | “Para-tudinho”, “para-tudo”                                                  | Roots: Tone, counteracts weakness, general debility & panacea for all ills (Almeida et al., 1998; Alzugaray & Alzugaray, 1983; Balbach, 1979; Lorenzi & Matos, 2002)                                                                                                                                 |
|                        | (4629)/Bush                  |                                                                              | Purgative, diarrhoea, anti-inflammatory, astrignent & external ulcers (Port & Pott, 1994; Thomas & Filho, 1985; Vila Verde et al., 2003; Agra et al., 2007a)                                                                                                 |
| Anacardiaceae          | Anacardium humile A. St. Hil | “Cajuzinho-do-cerrado”, “caju do campo”                                       | Leaves: Allergies, anti-inflammatory, anti diarrhoeal & ulcers (Viana et al., 1997, Silva et al., 2011b; Resende et al., 2015)                                                                                                           |
|                        | (5418)/Bush                  |                                                                              | Leaves: Antibacterial; treatment of malaria, leishmaniasis & syphilis (David et al., 1998; Roumy et al., 2009)                                                                                                                       |
|                        | Astronium fraxinifolium Schott | “Gonçalo-alves”                                                             | Barks: Anti-leishmanial, anti-plasmodial, antibacterial & anti-fungal, snake bites, oral thrush & sore throat (Debaro et al., 2001; Roumy et al., 2009; Zaghibi et al., 2014; Vásquez et al., 2015) |
|                        | (5107)/Tree                  |                                                                              | Leaves: Stomach diseases, stomatitis, neuralgia, headache, anti-rheumatic & anthelmintic (Morais Cardoso et al., 2013); treatment of chronic diarrhoea (Rodrigues & Carvalho, 2001) |
| Arecaceae              | Tapirira guianensis Aubl.    | “Tapirirá”, “pau-pombo”, “cupiúva”, “tatapiririca”, joho, “cedovo”, “fresmo” | Roots: Malignar (de Mesquita et al., 2007)                                                                                                                                                                                         |
|                        | (6035)/Tree                  |                                                                              | Fruits: Carminative & aphrodisiac (Oliveira et al., 2014)                                                                                                                                                                           |
| Apocynaceae            | Annona coriacea (5818)/Tree  | “Araticum”, “maroho”, “araticum-liso”                                       | No reports                                                                                                                                                                                                                            |
|                        | Annona caudiflora Mart.      | “Araticum-do-cerrado”, “araticum-do-campo”                                  | No reports                                                                                                                                                                                                                            |
|                        | (6164)/Tree                  |                                                                              | No reports                                                                                                                                                                                                                            |
|                        | Annona dioica A.St.-Hil.     | “Ceraticum”, “arixicum”, “ariticum”                                         | Leaves: Rheumatism, anti diarrhoeal, sedative & anti catarrhal (Port & Pott, 1994)                                                                                                                                                  |
|                        | (6037)/Tree                  |                                                                              | Leaves: Malignar (de Mesquita et al., 2007)                                                                                                                                                                                         |
|                        | Xylopia aromatica (Lam.) Mart.| “Pimenta de macaco”                                                      | Fruits: Carminative & aphrodisiac (Oliveira et al., 2014)                                                                                                                                                                           |
| Bignoniaceae           | Apidosperma macrocarpa Mart. | No reports                                                                   | No reports                                                                                                                                                                                                                            |
|                        | (4835)/Tree                  |                                                                              | No reports                                                                                                                                                                                                                            |
|                        | Apidosperma tomentosum Mart. | “Guatambu”                                                                            | No reports                                                                                                                                                                                                                            |
|                        | (3528)/Tree                  |                                                                              | No reports                                                                                                                                                                                                                            |
|                        | Hancornia speciosa Gomes     | “Mangabeira”, “mangaba”                                                        | No reports                                                                                                                                                                                                                            |
|                        | (5822)/Tree                  |                                                                              | No reports                                                                                                                                                                                                                            |
| Himantanthus ochutana | Arg. Woodson                 | “Tiborna”, “pau-de-leite”, “jagatuba”                                         | Leaves: Cancer, herpes & worms (Mesquita et al., 2005)                                                                                                                                                                              |
| Araliaceae             | Schellera macrocarpa (Cham. & Schnidl.) Fodin/Tree | “Mandioclo”, “mandiocao-do-campo”, “caixeira”, “caxieiteiro” | No reports                                                                                                                                                                                                                            |
|                        | Ailagoptera campestris (Mart.) Kuntze (4939)/Tree | “Buri-do-campo”, “pissando”, “paissanda”, “pissanda”, “coqueiro-pissandö” | No reports                                                                                                                                                                                                                            |
| Areceae                | Syagrus flexuosa (Mart.) Becc. | “Coquinho-bubala”, “acumã”, “coco do campo”                                   | No reports                                                                                                                                                                                                                            |
| Bignoniaceae           | Anemopaegma arvense (Vell.) Steiffeld & J.F. Souza | “Vergateza”, “vergateso”, “catuaba-do-cerrado”, “catuaba”, “pau-de-resposta”, “alecrim-do-campo” | Roots & leaves: Aphrodisiac, nervous system stimulator, treatment of inflammation in the ovaries & varicose veins, stimulant, insomnia, neurasthenia, nervousness, hypochondria, poor memory, in recovery from serious illness, asthma, anxiety, chronic bronchitis, bronchial asthma & sexual impotence (Barros, 1982; Guarin Neto, 1987; Britkko, 1991; Lorenzi & Matos, 2002; Longhini et al., 2017) |
|                        | (5247)/Shrub                 |                                                                              | Young branches, roots & leaves: Anti-syphilitic, dysuria, hydrops, water retention, poultice, syphilitic ulcers, fever, headache & invigorating baths (Siqueira, 1982; Guarin Neto, 1987; Sanz-Lisiet et al., 2009; Breitbach et al., 2013) |
| Bignoniaceae           | Cyrtostachys antisiphilitica (Mart.) (4763)/Tree | “Carobinha verde”, “caroba de flor verde”, “ipé-mandioca”, “ipé-de-flor-verde”, “pê-de-anta”, “cinco-em-folhas”, “ipé-mirim”, “ipé-amarelo” | Stem bark: Anti-rheumatic, anti-arthritic, anti-cancer, anti-malarial & healing of ulcers (Llorente et al., 2016)                                                                                                                                 |
|                        | Handroanthus ochraceus (Cham.) Matos | “Mangabeira”, “mangaba”                                                  | Leaves: Diabetes, anti-hypertensive & obesity prevention (Hirschmann & Arias, 1990; Rodrigues & Carvalho, 2001; Macedo & Ferreira, 2004; Pereira et al., 2015b) |
|                        | (Cham.) Matos                |                                                                              | Inflammatory diseases, infections, syphilis, rheumatism, dermatological diseases, treatment of diarrhoea & dysentery, blood cleanser, wound healing in the uterus & ovary, prostate inflammation, allergies, diabetes, hyperlipidaemia & rheumatic problems (Nunes et al., 2003; Trevenzol et al., 2007; Gachet & Schäibly, 2009; Bieski et al., 2012; Neiva et al., 2014) |
| Jacaranda decurrens Cham. (5565)/Bush | “Carobinha”, “carobinha-do-campo” | | |
Tabeuhia aurea (Silva Manso) Benth. & Hook.f. ex S.Moore (5348)/Tree  
“Paranado”, “craibeira”, “carabera”,  
“caroba-do-campo”, “cinco-em-rama”,  
“cinco-felhas-do-campo”,  
“pé-amarelado”, “craibeira”,  
“pé-amarelado-do-cerrado”, “pau-d’arco”  
Stem bark: Cancer, wounds, snakebite, colds, bronchitis, rheumatism, malaria, abdominal disorders, kidney disorders, anti diarrhoeal & dysentery (Nunes et al., 2003; Agra et al., 2007a; Hajdu & Hohmann, 2012; Reis et al., 2014)

Bixaceae  
Coccolobium griffithii (Mart. ex Schrank) Pilg. (5941)/Bush  
“Algodão-do-campo”, “algodaozinho”  
Shell: Cholesterol, blood depurative, treatment of inflammation in the uterus, ovaries & skin (Nunes et al., 2003)

Bursaraceae  
Protium hextaphyllum (Aubl.) Marchand (6142)/Tree  
“Almácega”, “bresa branco”, “anesca”, “bres”, “almiscar”  
analgesic, expectorant, insect repellent, antioxidant, respiratory disorders (Pernet, 1972; Guarim Neto, 1987; Susunaga et al., 2001; Aragão et al., 2006; Marques et al., 2010)

Calophyllaceae  
Kielmevrea coriacea Mart. & Zucc. (5443)/Tree  
“Pau-santo”  
Leaves: Schistosomiasis, leishmaniasis, malaria, fungal & bacterial infections (Alves et al., 2000; Albernaz et al., 2010)

Caryocaraceae  
Caryocar brasiliense Cambess (5957)/Tree  
“Pequi”, “piqui”, “pequiá”, “amêndoa de espírito”, “grao de cavalho”, “amêndoa de Brasil”  
Chestnut oil & galls: Asthma, bronchitis, pertussis, colds, aphrodisiac & tonic (Rodrigues & Carvalho, 2001; Lima et al., 2007)

Celastraceae  
Planchonella popoluea Reissek (6169)/Tree  
“Marmelinho”, “marmeleiro-do-campo”  
Leaves & branches: Allergy & wound healing (Rodrigues & Carvalho, 2001)

Combretaceae  
Terminalia argentea Mart. (6063)/Tree  
“Capitão”, “pau-garrote”, “caxaporra-do-gentio”  
Purgative (Pott & Pott, 1986; Ricardo et al., 2017)

Connaraceae  
Connaraceae subetiousa Planch. (6038)/Tree  
No reports  
Shell: Antidiarrhoeal (Costa et al., 2014)

Connaraceae  
Rouea indica Planch. (5345)/Tree  
“Chapucinhina”, “pau de porco”, “campeira”  
Leaves: Chagas disease & anti-rheumatic (Kalegari et al., 2014a)

Cucurbitaceae  
Cayaponia espelina (Silva Manso) Cogn./Vine (6033)/Bush  
“Espelina”, “purga-de-carijó”, “tomba”, “breu”, “espelina-verdadeira”, “tomba”, “purga-de-carijó”, “aspirina”, “espelina”, “purga-de-carijó”, “tomba”, “espelina”, “purga-de-carijó”, “pirma”, “cerejeira-de-purga”, “espelina”, “tomba”  
Whole plant: Tonic, stomachic, purgative, emetic, liver disorders, strokes, injuries, depurative, rheumatism, arthritic, bronchopulmonary diseases & secondary syphilitic manifestations (Cardoso Júnior, 2017; Ricardo et al., 2017; Sangalli et al., 2002)

Dilleniaceae  
Curatella americana L. (6168)/Bush  
“Cajueiro-bravo”, “lixia”, “lixzera”, “sambaiba”  
Aerial parts: Hypertension (Garcia-Barriga, 1974)

Dilleniaceae  
Davisilla elliptica A.St.-Hil. (5951)/Tree  
“Lixeirinha”, “lixera”, “sambaiba”, “muricizinha”, “pau-de-bugre”, “cipó-caboclo”  
Leaves: treatment of hemorrhoids, hernia & anti diarrhoeal, & in topical applications as an antiseptic in wound cleaning (Soares et al., 2005)

Ebenaceae  
Diospyros hispida Warm. (5754)/Tree  
“Caequi-do-cerrado”, “olho de boi”  
Leprosy, skin eruptions, eye infections & other infectious diseases (Mallavadhani et al., 1998; Albernaz et al., 2010)

Erythroxylacea  
Erythroxylum campestre A.St.-Hil. (5933)/Tree  
“Cabeça-de-negro”  
Barks & stumps: Laxative, astringent in case of bleeding (Rodrigues & Carvalho, 2001)

Erythroxylacea  
Erythroxylum suberosum A.St.-Hil. (5944)/Tree  
“Cabelo-de-negro”  
Leaves: Astringent, infectious diseases, anti diarrhoeal, anaesthetics, anti rheumatic & indigestion (Violante et al., 2012; de Oliveira et al., 2015; Rodrigues et al., 2015)

Erythroxylacea  
Erythroxylum tomentosum Mart. (6194)/Bush  
“Cabelo-de-negro”  
Anti-inflammatory, bronchitis & asthma (Cano & Volpato, 2004; González-Guevara et al., 2006)

Euphorbiaceae  
Mabea fusulifera Mart./Tree  
“Canudo-de-pito, canuduzeto”, “mamoninha do mato”, “leiteira preta”  
No reports

Euphorbiaceae  
Sapium abovatum Klotzsch ex Müll. Arg.  
“Sará-do-cerrado”  
Omatic pain, headache (Ribeiro et al., 2017)
Acanthus subelegans
(Mohlenbr.) Yakovlev
(5968)/Tree
“Genciã”, “perobinha-do-campo”, “leptolobia”
Roots & stems: soothing, tranquilizing & sedative nervous system (Oliveira et al., 1994)

Anadenanthera peregrina (L.) Spec.
(5848)/Tree
“Angico”
No reports

Andrea humilis Mart. ex Benth.
(5926)/Tree
“Angelim rasteiro”, “angelim-do-campo”, “mata-barata”
Roots: Diabetes & anthelmintic (Periotti et al., 2004; Conceição et al., 2011)

Bauhinia raja (Bong.) Steud.
(6029)/Tree
“Pata-de-boi”, “patevaca”, “patebuey”, “pata de vaca”
Fruits: Renal disorders, diuretic & diabetes (Heiski et al., 2015)
Leaves: Anti-hyperlipidaemic (Silva et al., 2010a)

Bowdichia virgilioides
Kunth/Tree
“Sucupira”, “sucupira-preta”
Barks: Wound healing, ulcer & diabetes prevention (Macedo & Ferreira, 2004)

Byrsonima intermedia A. Juss.
(5735)/Bush
“Murici pequeno”
Leaves: Antidiarrhoeal, dysentery, anti-fungal & anti-inflammatory activity (Rodrigues & Carvalho, 2001)

Byrsonima coccolobifolia Kunth
(6169)/Bush
“Murici”, “murici-de-flor-rósea”, “angelim-do-campo”
Trunk bark: Antidiarrhoeal, dysentery, anti-fungal & anti-inflammatory activity (Rodrigues & Carvalho, 2001)

Byrsonima basiloa A. Juss.
(6030)/Tree
“Murici”
Leaves: Antidiarrhoeal & gastric ulcer (Figueiredo et al., 2005; Lira et al., 2008)

Copaifera langsdorffii Desf.
(5939)/Tree
“Copaiba”
Trunk resin oil: Sore throat, urinary & pulmonary infections, ulcer & wound healing (Cardoso et al., 2017)

Copaifera voigeli A. Juss.
(5995)/Tree
“Baru”
Seed oil: Snake bites antirheumatic & menstrual regulator (Lorenzi, 1992; Sano et al., 2004; Puebla et al., 2010; Ferraz et al., 2012)

Dalbergia miscolobium
(5947)/Tree
“Sucupira”, “sucupira-branca”, “faveira”, “barbatimão-de-folha-miúda”, “barbatimão-branco”
Leaves, roots, bark & sap: Gastritis, ulcers, bloody diarrhoea, venereal diseases, fever, boil, syphilis, worms, cancer, detoxification, diabetes, obesity, haemorrhoids, swelling, labyrinthitis, pneumonia, tuberculosis, heartburn, liver, indigestion, gallstones, back pain, uterine inflammation, diuretic & burn (Ribeiro et al., 2017; Pereira et al., 2018)

Dimorphandra mollis
Benth.
(5924)/Tree
“Brinco-de-princesa”, “louro-de-Goiás”, “urinosa”, “vergatera”
Leaves: Aphrodisiac (Moraes, 2005; Maier, 2016)

Dipteryx alata
(4906)/Tree
“Falso barbatimão”, “quina-do-cerrado”, “barbatimão-verdadeiro”, “casca-da-virgindade”, “faveira”, “barbatínamo-branco”, “barbatínamo-de-folha-miúda”
Bark: Uterine & vaginal conditions, urinary tract infections, skin lesions, ulcer wounds, antidiarrhoeal, inflammation of the throat, bleeding, scurry, pulmonary complications & respiratory infections (Herzog-Soares et al., 2002; Brasil, 2014; de Freitas et al., 2018)

Fagraea fragrans
(5848)/Tree
“Amargoso”, “maleiteira”, “angelim-do-cerrado”
Stem bark: Diabetes & mycoses (Oliveira et al., 2008)

Guarea spp.
(5848)/Tree
“Quina-quina”
Fruits: Renal disorders, diuretic & diabetes (Bieski et al., 2015)

Lauraceae Juss.

Aisoca trinervis Meisn.
(5924)/Tree
“Brinco-de-princesa”, “louro-de-Goiás”, “urinosa”, “vergatera”
Leaves: Aphrodisiac (Moraes, 2005; Maier, 2016)

Ocotea minarum (Nees & Mart.) Mez/Tree
“Canelinha”, “canela vassoura”
Cândiasis (Rodrigues et al., 2014)

Loganiaceae

Strychnos pseudoxina A.St.-Hil.
(5405)/Tree
“Guareeba”, “quina-do-cerrado”, “quina-branca”, “quina-quina”
Shell: Tonic, antipyretic, antimalarial, liver, spleen & stomach diseases, fever & malaria (&rade-Neto et al., 2003; Honório-França et al., 2008; Bonamin et al., 2011)

Lycopodiaceae

Lycopodium clavatum L.
(5934)/Herb
“Licopódio”, “pe-de-lobo”, “clavatum”, “mussa-terrestre”
Liver abnormalities, flatulent dyspepsia, abdominal distention & headaches related to digestive disorders (Henriquê da Silva et al., 2015; Farmacopeia Brasileira, 2017)

Lythraceae

Lysimachia pacaria A.St.-Hil.
(6049)/Tree
“Mangava-brava”, “pataca”, “dedeuleiro”, “louro-da-serra”
Leaves, roots, bark & sap: Gastritis, ulcers, bloody diarrhoea, venereal diseases, fever, boil, syphilis, worms, cancer, detoxification, diabetes, obesity, haemorrhoids, swelling, labyrinthitis, pneumonia, tuberculosis, heartburn, liver, indigestion, gallstones, back pain, uterine inflammation, diuretic & burn (Ribeiro et al., 2017; Pereira et al., 2018)

Magnoliaceae

Magnolia ovanata (A.St.-Hil.) Spreng.
(5954)/Tree
“Pinha-do-brejo”, “baguaçu”
Trunk bark: Fever & diabetes (Kassuya et al., 2009; Mori et al., 2011)

Malpighiaeae

Byrsonima intermedia A. Juss.
(5735)/Bush
“Murici pequeno”
Leaves: Antidiarrhoeal, dysentery, anti-fungal & anti-inflammatory activity (Rodrigues & Carvalho, 2001)
| Family          | Species                                      | Common Names                                      | Uses                                                                 |
|-----------------|----------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------|
| Proteaceae Juss.| Alibertia edulis (Rchb.) A.Rich.             | “Mame-nha”, “pitangobí”, “pitangobí-azul-do-cerrado” | Leaves: Anti-inflammatory, anti-diarrhoeal, urinary infection, anti-depressant, antihypertensive, rheumatism, hypocholesterolaemia, treatment of cystitis & urethritis, antiseptic & stomach disorders. |
|                 | Campomanesia adamantium (Cambess.) O.Berg.   | “Guruvir”                                         | Leaves: Anti-diarrhoeal, diabetes, jaundice, kidney disease, bladder infections, laxative & cardiovascular diseases. |
|                 | Eugenia aurata O. Berg                      | “Marrinha”, “pitangobí”, “pitangobí-azul-do-cerrado” | No reports                                                               |
|                 | Eugenia dysonterica (Mart.) DC.             | “Cagaita”, “cagaita”                               | No reports                                                               |
|                 | Eugenia pitanga (O. Berg) Kieserk. 6111     | No reports                                        | No reports                                                               |
|                 | Eugenia punicefolia (Kunth) DC.             | “Pitanga do campo”, “murta vermelha”, “pedra-ume-caí”, “pitanga-do-cerrado”, “muta” | No reports                                                               |
|                 | Myrcia guianensis (Aubl.) DC.               | “Pitanga-miúda”, “pedra-ume-caí”                  | No reports                                                               |
| Oxalidaceae     | Doratia spectabilis (Mart. Engl.)           | “Folha-da-serra”                                   | Gastric & rheumatic disorders.                                         |
| Primulaceae     | Myrione umbilata Cham. & Schltdl. 6416      | “Coporoca”, “piorocea”                              | Snake bites, tumours & wounds.                                         |
| Proteaceae Juss.| Roupa montana Aubl. 6049                     | “Carvalho brasileiro”, “cane de vaca”, “congonha”, “caxauí”, “farinha-seca” | Leaves: Pain in the kidneys, legs & spine; malaise; & soothing pain.   |
| Rubiaceae Juss. | Alhertia edulis (Rich.) A.Rich.             | “Marmelada-bola”, “marmelo-do-cerrado”             | Hypertension (de Santana Aquino et al., 2017)                           |
|                 | Cordia sessilis (Vell.) Kuntez (6145)       | “Marmelinho”, “marmelada-de-cachorro”              | Leaves: Skin diseases (Rodrigues & Carvalho, 2001)                     |
|                 | Guettarda viburnoides Cham. & Schltdl. 6416 | “Veludo-branco”                                    | Stalk: Anti-inflammatory, anti-diarrhoeal, respiratory diseases, rheumatism, fever, diabetes & hepatitis. |
|                 | Psilotrachelo gigantea Mill. Arg. (520)     | “Arbusto da boca dolorida”, “lábios de fogo”, “beijo”, “beijo de negra”, “chapéu do diabo” | Leaves: Gastrointestinal disorders, pain, stomach pain, dyspepsia, anti-inflammatory for bites & stings (snakes, insects & scorpions), fever, infection, diabetes, oral abortifacient, wounds & rashes, cuts & bleeding. |
|                 | Sicyonya formosa (Cham. & Schltdl.) K.Schum. (6202) | “Jenipapo-do-bravo”                                | Coughs, torsion, cystitis, rheumatism, & renal & cardiac problems.    |
|                 | Sicyonya brasiliensis Mart. 6174            | “Jenipapo”                                         | Burns & rheumatism (Souza et al., 2013)                                |
|                 | Tocoyena formosa (Cham. & Schltdl.) K.Schum. (6202) | “Jenipapo”                                         | Burns & rheumatism (Souza et al., 2013)                                |

*Note: Uses are based on traditional uses and may vary in different regions.*
Another prominent category is infectious diseases, among which some species, such as Tapirira guianensis, Annona coriacea, A. crassiflora, Xylopia aromatica, Himatanthus obovatus, Jacaranda decurrens, Cochlospermum regium, Kielmeyera coriacea, Diospyros hispida, Erythroxylum suberosum, Strychnodendron adstringens, Ocotea minarum, Strychnos pseudoquina, Byrsonima intermedia, Brosimum gaudichaudii, Campomanesia adamantium and Eugenia dysenterica, have popular indications and associated studies that prove their effects (Table 1, 2). These data show high herbal diversity among medicinal plants in the reserve area of the settlement “April 17”, located in Casa Verde district, Nova Andradina city, MS, Brazil, as well as great potential for further studies on therapeutic activities. Moreover, the conservation of biodiversity ensures the sustainability of natural resources and allows the maintenance of various services essential to human well-being.

In the review, only twelve species were not chemically studied, and fourteen did not have associated pharmacological studies. Among the studied species for which contents were isolated, the predominant class of substances was terpenes, followed by phenolic compounds and alkaloids (Table 2).
Table 2. Pharmacological and chemical studies of the species found in the reserve area of the settlement “April 17”, located in Casa Verde district, Nova Andradina city.

| Species | Pharmacological studies | Chemical studies |
|---------|-------------------------|-----------------|
| *Gomphrena officinalis* Mart. | No reports | No reports |
| *Anacardium humile* A. St. Hil. | Larvicide (Porto et al., 2008); gastric lesion reduction (Luiz-Ferreira et al., 2008; Luiz-Ferreira et al., 2010); antihelminthic (Nery et al., 2010); anti-microbial (Pereira et al., 2011; Perim et al., 2018) & anti-hypoglycaemic effects (Urzédka et al., 2013) | Tannins, flavonoids, terpenes, coumarins, saponins (Agro et al., 2007a); tannins, flavonoids, alkaloids (Nery et al., 2010); flavonoids (Luiz-Ferreira et al., 2010); phenolic compounds, catechins & terpenes (Cecílio et al., 2012) |
| *Astronium fraxinifolium* Schott. | Antiviral (Cecílio et al., 2012); antibacterial (Montanari et al., 2012); gastroprotective & antioxidant effects (Martins et al., 2017) | Terpenes (Montanari et al., 2012) |
| *Tapirira guianensis* Aubl. | Cytoxic (David et al., 1998; Taylor et al., 2013); anti-protozoal, antibacterial, anti-fungical (Kouny et al., 2009); anti-proliferative (Silva-Oliveira et al., 2016); vasodialatory & antioxidant effects (Rodrigues et al., 2017) | Terpenoids (Correia et al., 2003, 2008; Zoghbi et al., 2014); flavonoids (Silva-Oliveira et al., 2016); flavonoids (Silva-Oliveira et al., 2016; Rodrigues et al., 2017); norisoprenoids (Silva-Oliveira et al., 2016); tannins (Rodrigues et al., 2017); flavonoids & phenolic acids (Martins et al., 2017) |
| *Annona coriacea* Mart. | Insecticidal (Coeelho et al., 2007; Costa et al., 2012; Freitas et al., 2014); phytotoxic (Formaggio et al., 2010; Novaes et al., 2016); anti-protozoal (Toledo et al., 2011; Siqueira et al., 2011); antioxidant (Bentes et al. 2015; Novaes et al., 2019); anti-proliferative, enzymatic inhibitor (Formaggio et al., 2015); cytoprotective (Júnior et al., 2016); anti-tumour (Tundis et al., 2017; Gomes et al., 2019); anti-fungal (Almeida-Apolonio et al., 2019); anti-inflammatory, anti-nociceptive & anti-depressant effects (Monteiro et al., 2020) | Terpenoids (Mussini et al., 1973; Siqueira et al., 2011); acetylcholinesterase (Yu et al., 1994; Silva et al., 1996; Silva et al., 1997; Silva et al., 1998); alkaloids (Machado et al., 2013); phenolic compounds (Freitas et al., 2014; Júnior et al., 2016); Novaes et al., 2018; Novaes et al., 2019; Monteiro et al., 2020) & tannins (Bentes et al. 2015) |
| *Annona crassifolia* Mart. | Antioxidant (Santos et al., 1996; Reissler et al., 2006, 2011; de Souza et al., 2012; Justino et al., 2016); cytoxic (Santos et al., 1996); larvicide (Pinenta et al., 2003); antimutagenic (Vilar et al., 2008); anti-arthritic, anti-plasmodial (de Mesquita et al., 2007); anti-bacterial (Silva et al., 2014); anti-glycemic (Justino et al., 2016) & pancreatic lipase inhibitory effects (Pereira et al., 2017) | Flavonoids (de Souza et al., 2012; Formaggio et al., 2013) & alkaloids (Justino et al., 2016) |
| *Annona diotica* A.St.-Hil. | Anti-inflammatory, anti-hypoglycaemic, anti-proliferative & antioxidant effects (Formaggio et al., 2013) | Flavonoids (de Souza et al., 2012; Formaggio et al., 2013) & alkaloids (Justino et al., 2016) |
| *Xylopia aromatica* (Lam.) Mart. | Anti-malarial (Garavito et al., 2006); larvicide (Rodrigues et al., 2006); anti-plasmodial (de Mesquita et al., 2007); cytoxic (Suffredini et al., 2007; Taylor et al., 2013); anti-tumour, anti-protease (Paes et al., 2008) & anti-inflammatory effect (Oliveira et al., 2014) | Terpenes (Martins et al., 1998); phenolic acids (de Souza et al., 2012) & flavonoids (Oliveira et al., 2014) |
| *Apidopesperma macrocarpa* Mart. | Antioxidant effect (Silva et al., 2009) | Indole alkaloids (Bolzani et al., 1987) |
| *Apidopesperma tumensium* Mart. | Anti-nociceptive & anti-inflammatory effects (Aquino et al., 2013a) | Indole alkaloids (Pereira et al., 2007; Dolabela et al., 2012) |
| *Hancornia speciosa* Gomes | Anti-hypertensive (Ferreira et al., 2007a; Ferreira et al., 2007b); checmopreventive (Endringer et al., 2009b); antioxidant & anti-inflammatory effects (Endringer et al., 2009a; Silva et al., 2011a) | Terpenoids, steroids & tannins (Honda et al., 1990; Brão et al., 2010) |
| *Humatanthus obovatus* (Mill. Arg.) | Anti-tumour & anti-microbial effects (Mesquita et al., 2009; Toledo et al., 2011) | Iridoids (Lima, 2005) |
| *Woodsonia deuterocarpa* (Cham. & Schltdl.) Frodin | No reports | No reports |
| *Allagoptera campestris* (Mart.) Kunze | No reports | No reports |
| *Syagrus flexuosa* (Mart.) Becc. | Antioxidant (Tabanca et al., 2007); anti-plasmodial (de Mesquita et al., 2007) & anti-fungal effects (Costanzo et al., 2013) | Flavonolignans (Tabanca et al., 2007) & flavonoids (Costanzo et al., 2013) |
| *Cybistax antisiphilitica* (Mart.) Mart. | Activity against *Aedes aegypti* larvae (Rodrigues et al., 2005) | Iridoids (Felicio et al., 1994) & quinones (Rodrigues et al., 2005) |
| *Hundraanthus ochraceus* (Cham.) Mattos | Cytoxic effects (Correia et al., 2016) | Glycerides, carboxylic acids, phytosteroid & terpenoids (Salatino et al., 2020) |
| *Jacaranda decurrens* Cham. | Cytoxic (Subbaramaiah et al., 2000; Casagráke et al., 2014); antiviral (Carvalho et al., 2007a); anti-microbial, chemopreventive effects (Zatta et al., 2009); effects on the development of the reproductive system in male rats (Arena et al., 2012); anti-inflammatory (Santos et al., 2012a) & anti-obesity effects (Antunes et al., 2016) | Triterpenes (Vairka et al., 1992; Subbaramaiah et al., 2000; Carvalho et al., 2009) & flavonoids (Blatt et al., 1998; Antunes et al., 2016) |
| *Tabebuia aura* (Silva Manso) Benth. & Hook.f. ex S. Moore | Anti-microbial (Barbosa-Filho et al., 2004a; Santos et al., 2015); anti-inflammatory, myotoxic, anti-haemorrhagic (Reis et al., 2014) & anti-demagenetic effects (Santos et al., 2015) | Phenolic acids & terpenes (Barbosa-Filho et al., 2004a) |
Cochlospermum regium (Mart. ex Schrank) Plg.

Cytotoxic (Coschini & Campos, 2006; Taylor et al., 2013); antioxidant, anti-diabetic, antioxidant, anti-cholinesterase (Agra et al., 2007b); gastroprotective (Hajdú & Hohmann, 2012); antibacterial & anti-fungal effects (Carvalho et al., 2018)

Phenolic acids, flavonoids & condensed tannins (Mirka Pedroso et al., 2019)

Protium heptaphyllum (Aubl.) Marchand

Carcinoidal (Frischkern et al., 1978); non-opioid analgesic (Susunaga, 1996); anti-inflammatory-related (Siani et al., 1999); gastroprotective (Oliveira et al., 2004a; Araujo et al., 2011); possible antiparitic (Oliveira et al., 2004b); hepatoprotective (Oliveira et al., 2005); anti-anticipetive (Lima-Júnior et al., 2006); anti-microbial, antioxidant (B&eira et al., 2006; Violante et al., 2012); anti-inflammatory (Hol&a Pinto et al., 2008; Melo et al., 2011); anti-hyperglycaemic, hypolipidaemic (Santos et al., 2012b; Carvalho et al., 2017; de Melo et al., 2019); anti-mutagenic (de Lima et al., 2016), & vasorelaxant effects (Mobin et al., 2017)

Xanthones (Mesquita et al., 1987; García Cortez et al., 1998; Cortez et al., 2002; Martins et al., 2006; Zagoto et al., 2006) & triterpenes (Biesdorf et al., 2012)

Kielmeyera coriacea Mart. & Zucc.

Anti-fungal (Pauwels et al., 2002); antioxidative (Rooser et al., 2008); cytotoxic (Braga et al., 2017); peritonic toxicity (Fonseca et al., 2018); endothelial vasorelaxation (Oliveira et al., 2018) & anti-microbial effects (Moreira et al., 2019)

Flavonoids (Mink-Vilela et al., 2009); Roche et al., 2015; fatty acids & carotenoids (Moreira et al., 2019)

Caryocar brasiliense Cambess.

Leishmanicidal, anti-fungal (Costa et al., 2014) & anti-protozoal effects (Charmeau et al., 2016)

Benzoxiquinones (Costa et al., 2014)

Plenckia populnea Reissek

Anti-microbial effects (Gonçalves de Lima et al., 1972)

Triterpenes (de Souza et al., 1990; Espindola et al., 2018); anti-microbial effects (Gonçalves de Lima et al., 1972); anti-pathogenic (Sela et al., 2010; de Mesquita et al., 2011); cytotoxic (de Mesquita et al., 2011), & panicytolytic effects (Biesdorf et al., 2012)

Phenolic acids (Mink-Vilela et al., 2009); Roche et al., 2015; fatty acids & carotenoids (Moreira et al., 2019)

Terminalia argentea Mart.

Non-cytotoxic & anti-genotoxic effects (Bessera et al., 2018)

Triterpenoids, lignan, flavonoids (Garc&ez et al., 2003); flavonoids, saponins, & phytosterols (Bessera et al., 2018)

Cononurus suberosus Planch.

Haemolytical (Kalegari et al., 2011); antibacterial, antioxidant, allelopathic (Kalegari et al., 2012); antioxidant, potential hepatoprotective (Kalegari et al., 2014a) & anti-anticipetive effects (Kalegari et al., 2014b)

Flavonoids (Kalegari et al., 2011; Kalegari et al., 2014b)

Rosaea indica Planch.

Cogn. No reports

No reports

Curatella americana L.

Anti-inflammatory, peripheral analgesic (Alex&re-Moreira et al., 1999; Guravena et al., 2011); gastroprotective, healing (Hiruma-Lima et al., 2009); genotoxic (Vilar et al., 2009); anti-fungal (Toldeo et al., 2015); antioxidant, hypolipidaemic (Lopes et al., 2016) & antioxidant effects (Fujishima et al., 2018; Nunes et al., 2018)

Phenolic compounds (El-Azizi et al., 1980; Lopes et al., 2016); flavonoids, saponins, terpenes, tannins (Costa et al., 2008) & proanthocyanidins (Hiruma-Lima et al., 2009)

Davilla elliptica A.St.-Hil.

Modulatory (Carlos et al., 2005); anti-microbial (Michelin et al., 2005); anti-mycobacterial (Lopes et al., 2007); anti-anticipetive, anti-danterior, gastroprotective (Azvedo et al., 2007; Campos et al., 2013; Kushima et al., 2009); immunomodulatory, anti-Helicobacter pylori (Kushima et al., 2009); anti-tumour (Carli et al., 2009) & mutagenic effects (Biso et al., 2010)

Flavonics, saponin heteroside compounds, steroids, coumarins, tannins, steroids, triterpenes (Michelin et al., 2005; Soares et al., 2005; Biso et al., 2010); flavonoids (Carlos et al., 2005; Michelin et al., 2005; Biso et al., 2010) & derivatives of phenolic acids (Biso et al., 2010)

Diospyros higipida Warm.

Anti-microbial & anti-fungal effects (Gu et al., 2004; Albnear et al., 2010)

Triterpenes (Ganapathy et al., 2005) & alkaloids (Aylinian et al., 1974; Pereira et al., 2015b)

Erythroxylym suberosum A.St.-Hil.

Lethal against Artemia salina (do Nascimento et al., 2012a); anti-microbial, antioxidant, cytotoxic (Violante et al., 2012); anti-rheumatic & anti-inflammatory effects (de Oliveira et al., 2015)

Phenolic structures (Bohm et al., 1988)

Erythroxylym tortuosum Mart.

Anti-inflammatory, anti-bronchitis & anti-asthma effects (Can& et Volpato, 2004; González-Guevara et al., 2006)

Tannins (Ishino et al., 2004)

Mabea fistulifera Mart.

Antioxidant & anti-inflammatory effects (Coqueiro, 2006)

Flavonoids (Kinghorn, 2001) & flavanone glycosides (Coqueiro et al., 2007)

Sapium obtusatum Klotsch ex Müll.Arg.

No reports

No reports
| Species                                   | Compounds/Effects                                                                 | References                                                                 |
|------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Acoxia subuligaea (Mohlsch.)             | Anti-convulsant effects (Sousa et al., 2009)                                     | Alkaloids (Oliveira et al., 1994)                                        |
| Yacovlev                                 |                                                                                  |                                                                          |
| Anadenanthera peregrina (L.) Spec.       | No reports                                                                       | Phenolic compounds (Carneiro et al., 2012; Sartori et al., 2014; Mota et al., 2017) |
| Andira humilis Mart. ex Benth.           | Proteinase inhibitory (Nakahata et al., 2001; Vilela & Sampiao, 2008); anti-fungal (Duarte-Almeida et al., 2004; Correia et al., 2016) & thrombolytic effects (Silveira et al., 2016) | Phenolic compounds (Garcia et al., 2010)                                   |
| Bauhinia rufa (Bong.) Steud.             |                                                                                  |                                                                          |
| Bondotis virgilioides Kunth              | Cytotoxic (Torrenegra et al., 1989); anti-malarial (Dehario et al., 2001); anti-microbial (Almeida et al., 2006; Agra et al., 2013); anti-nociceptive, anti-inflammatory (Barros et al., 2010; Thomaz et al., 2010; Silva et al., 2010; Silva et al., 2010b); antibacterial (Leite et al., 2014a); muscular damage & oxidative stress protective (dos Santos et al., 2014); larvicidal (Beezerra-Silva et al., 2015) & anti-hyperglycaemic effects (Silva et al., 2015) | Terpenes (Duarte-Almeida et al., 2004)                                      |
| Copaifera langsdorffii Desf.             | Gastroprotective (Paiva et al., 2004; Motta et al., 2018); ischaemia/reperfusion of intestinal tissue protective (Paiva et al., 2004); anti-fungal (Amorim et al., 2004; Zimmermann-Franco et al., 2013); larvicidal (Mendonça et al., 2005); immunomodulatory (Rosario et al., 2008); antibacterial (Souza et al., 2011); anti-inflammatory (Germelin et al., 2013); chemopreventive (Senedese et al., 2013); anti-psychotic (Germelin et al., 2013); antioxidant (Germelin et al., 2013; Batista et al., 2016); antibacterial (Bonan et al., 2015); apoptotic (Cardoso et al., 2017) & colon carcinogenesis protective effects (Cardoso et al., 2017; Tobouti et al., 2017) | Terpenes, xyloligcans & phenolic compounds (Rosario et al., 2008; de Nascimento et al., 2012b; Gelmini et al., 2013; Senedese et al., 2013; Baldissera et al., 2014; Nogueira et al., 2015) |
| Dalbergia miscolobium Benth.             | No reports                                                                        | Phenolic compounds (Gregson et al., 1978; Vasudeva et al., 2009; Kite et al., 2010) & triterpenoids (Salatino et al., 2020) |
| Dimorphandra mollis Benth.               | Anti-dematogenic (Mello et al., 2006); anti-toxic (Feres et al., 2006); antioxidiant (Pizzaci et al., 2010) & anti-triptic effects (Mendes et al., 2013) | Flavonoids (Feres et al., 2006) & tanins (Mendes et al., 2013)             |
| Diploxy alata Vogel                      | Anti-fungal (Narazoto et al., 2010; Puebla et al., 2010; Ferraz et al., 2012; Yoshida et al., 2015); non-mutagenic (Estevs-Pedro et al., 2012; Yoshida et al., 2015); antioxidiant, hypolipidaemic (Bento et al., 2014; Fernandes et al., 2015a); leishmanicidal effects (Ribeiro et al., 2014); reduction in abdominal adiposity & increase in HDL (de Souza et al., 2018) | Phenolic compounds & terpenoids (Puebla et al., 2010; Marques et al., 2015) |
| Dipsychandra auranticaa Tul.             | No reports                                                                        | No reports                                                               |
| Pterodon pallescens (Benth.)             | Non-cytotoxic, non-toxic, non-mutagenic, anti-proliferative (Pinto Coelho et al., 2001; Vieira et al., 2008); anti-nociceptive (Nucci et al., 2012; Nucci-Martins et al., 2015); & potential anti-inflammatory effects (da Silva Martins et al., 2016; Hoscheid et al., 2017) | Terpenes (Hoscheid et al., 2012; Nucci-Martins, 2015)                       |
| Strphnodendron adstringens (Mart.) Coville| Anti-inflammatory (Lima et al., 1998); antioxidiant (Lima et al., 1998; Souza et al., 2007; Santos Filho et al., 2011); antibacterial (Lima et al., 1998; Souza et al., 2007; Hasenack et al., 2008; Soares et al., 2008); anti-ulcerogenic (Audi et al., 1999); trypanocidal (Herzog-Soares et al., 2002, 2006); anti-mutagenic (Costa et al., 2010); anti-genic (Santos Filho et al., 2011) & anti-fungal effects (de Freitas et al., 2012; Nucci-Martins et al., 2015) & anti-hyperglycaemic effects | Promastigotins, phenolic compounds (Palazzo de Mello et al., 1996a; Palazzo de Mello et al., 1999; Costa et al., 2010); prorobinetinidines (Palazzo de Mello et al., 1996b) & tanins (Santos et al., 2002) |
| Vitaceae macracarpa (Benth.)             | Edematogenic (Alencar et al., 2003) & anti-hyperglycaemic effects (Oliveira et al., 2008) | No reports                                                               |
| Ducke                                    |                                                                                  |                                                                          |
| Alnua trinervis Meis.                    | Anti-proliferative (Garcia et al., 2005a) & trypanocidal effects (Maier, 2016)   | Lignans (Garcia et al., 2005a) & butanolide (Tsai et al., 2002)            |
| Ocotea minarum (Nees & Mart.)            | Antioxidant, anti-microbial (Rodrigues et al., 2019) & anti-fungal effects (Rodrigues et al., 2014) | Indole alkaloids (Vecchiari et al., 1979), phenolic compounds & terpenoids (Garcez et al., 2005b) |
| Mez                                      |                                                                                  |                                                                          |
| Strychnos pseudomorina A.St.-Hil.        | Hypoglycaemic, cicatrizative (Honório-França et al., 2008); antibacterial (Bonamin et al., 2011); anti-leishmanial (Lage et al., 2013); anti-HSV, anti-inflammatory (Boff et al., 2016); healing (Santky et al., 2018); anti-hyperglycaemic & anti-hyperlipidaemic effects (Cosenza et al., 2019) | Alkaloids (Mourao et al., 1969; Jardim-Neto et al., 2003; Silva et al., 2005; Bonamin et al., 2011); flavonoids (Lage et al., 2013); alkaloids, flavonoids, polyphenols & tanins (Cosenza et al., 2019) |
| Scientific Name                        | Common Names                         | Reported Activities                                                                                      |
|--------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------|
| Lycoperdon clavatum L.               |                                      | Acetylcholinesterase inhibitory (Orhan et al., 2003; Rollinger et al., 2005); anti-inflammatory (Orhan et al., 2007a); antibacterial, anti-fungal (Orhan et al., 2007b); hepatoprotective (Pathak et al., 2009); HeLa cell growth inhibitory (Makal et al., 2010); human keratinocyte, skin tissue protective effects (Das et al., 2013) & reduction in the pathogenic progression of Chagas disease (Brustolin Alexo et al., 2017) |
| Laphoeas dactylifera                   |                                      | Anti-inflammatory (Kassuya et al., 2009); anti-fungal (Kassuya et al., 2009); anti-inflammatory (Mori et al., 2011) & analgesic effects (Mori et al., 2011) & antioxidant effects (Pereira et al., 2015b) |
| Magnolia ova (A.St.-Hil.) Spreng.     |                                      | Anti-typtic (Kassuya et al., 2009); anti-inflammarory (Kassuya et al., 2009); anti-inflammatory (Kassuya et al., 2009); anti-inflammatory (Michelin et al., 2008); anti-inflammatory; anti-nociceptive (Ort&i et al., 2011); mutagenic (Sanno&i et al., 2007), anti-ulcer, anti-microbial, anti-diarrhoeal (Santos et al., 2012c); antioxidant, anti-inflammatory & anti-peptic ulcer effects (Santos et al., 2019) |
| Byrsonima basiloba A. Juss.           |                                      | Anti-diarrhoeal (Figueiredo et al., 2005); anti-mutagenic (Lira et al., 2010); anti-inflammatory, anti-haemorrhagic, anti-diarrhoeal, anti-inflammatory, anti-nociceptive (Ort&i et al., 2011); mutagenic (Sanno&i et al., 2007), anti-ulcer, anti-microbial, anti-diarrhoeal (Santos et al., 2012c); antioxidant, anti-inflammatory & anti-peptic ulcer effects (Santos et al., 2019) |
| Byrsonima coccolobifolia Kunth        |                                      | Anti-microbial, anti-haemorrhagic, anti-diarrhoeal, anti-inflammatory (Corrêa, 1984; Pinto & Bertolucci, 2002; Moreira et al., 2011); anti-microbial (Michelin et al., 2008); anti-inflammatory, anti-nociceptive (Ort&i et al., 2011); mutagenic (Sanno&i et al., 2007), anti-ulcer, anti-microbial, anti-diarrhoeal (Santos et al., 2012c); antioxidant, anti-inflammatory & anti-peptic ulcer effects (Santos et al., 2019) |
| Diploterans subpictata (A.Juss.)      |                                      | No reports                                                                                              |
| Eriotheca gracilipes (K.Schum.) A.Rohyn |                                      | Fatty acids (Mayworm & Salatino, 1996) & Phenic compounds, triterpenoids & phenotosterols (Tirion et al., 2018) |
| Luehea divaricata Mart. & Zucc.       |                                      | Diuretic, hypotensive, anti-fungal, antioxidant, neuroprotective, anti-inflammatory, analgesic, immunomutator & anti-cholinesterase effects (Tirion et al., 2018) |
| Miconia albicans (Sw.) Triana         |                                      | Anti-microbial (Alves et al., 2000); analgesic (Vasconcelos et al., 2003); anti-inflammatory (Vasconcelos et al., 2006); DNA protective (Serpeloni et al., 2011); antioxidant (Pieroni et al., 2011); anti-diabetic (Ort&i-Martinez et al., 2016; Lima et al., 2018); anti-microbial (Tomé et al., 2019) & antioxidant effects (Pasta et al., 2019) |
| Brosimum gaudichaudii Trécul          |                                      | Anti-microbial effects ( Borges et al., 2017); stimulation of migration & pigmentation of melanocytes ( Quintão et al., 2019) & antioxidant effects (Ferreira et al., 2019) |
| Campomanesia adamantium (Cambess.) O. Berg |                                      | Anti-oxidant, anti-hyperlipaemia (Ramos et al., 2007; Espindola et al., 2016); antioxidant (Vallilo et al., 2006; Coutinho et al., 2009; Pascoal et al., 2011); anti-microbial (Coutinho et al., 2009; Pavan et al., 2009; Cardoso et al., 2010; Moura-Costa et al., 2012; Breda et al., 2016); anti-nociceptive (Ferreira et al., 2013); anti-proliferative (Pascoal et al., 2014; Campos et al., 2017; Ferreira et al., 2013; Fernandes et al., 2015b; Lima e Silva et al., 2018); anti-inflammatory (Viscardi et al., 2017) & anti-depressant effects (Souza et al., 2014) |
| Eugenia aurita O. Berg                |                                      | Anti-inflammatory effects (Costa et al., 2016) & Anti-fungal (Costa et al., 2000); molluscicidal (Bezzerra et al., 2002); laxative (Lima et al., 2010); diuretic (Lima et al., 2011; Galheigo et al., 2016); anti-tirnial (Cecilio et al., 2012); tyrosinase inhibitory (Souza et al., 2012); gastroprotective (Prado et al., 2014); obesity preventive (Donado-Pestana, 2015); anti-proliferative, acetylcholinesterase inhibitory (Gasca et al., 2017); antioxidant (Daniel Daza et al., 2017; Ferreira-Nunes et al., 2018); neuroprotective (Thomaz et al., 2018); wound healing (Silva et al., 2018); hypotensive (Fidelis-de-Oliveira et al., 2020); angiogenic & antibacterial effects (Silva et al., 2020) |
| Eugenia dyserentica (Mart.) DC.       |                                      | No reports                                                                                              |
| Eugenia pitanga (O. Berg)             |                                      | No reports                                                                                              |
| Plant Name                        | Effects                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Eugenia punicifolia (Kunth) DC.  | Anti-diabetic (Brunetti et al., 2006; Sales et al., 2014); anti-inflammatory (Leite et al., 2010; Basting et al., 2014; Leite et al., 2014b; Costa et al., 2016); anti-nociceptive & gastroprotective effects (Basting et al., 2014); increases the exocytotic release of catecholamines from bovine adrenal chromaffin cells stimulated with ACh or K+ (Pascual et al., 2011); cytostatic effects & activation of skeletal muscle remodelling (Leite et al., 2014b); antioxidation & inhibition of enzymes related to metabolic syndrome (Lopes et al., 2014) |
| Myrcia bella Cambess.           | Anti-inflammatory & antioxidant effects (Naressi et al., 2015) Iridoids (Naressi et al., 2015) |
| Myrcia guianensis (Aubl.) DC     | Polyphenolic compounds (dos Santos et al., 2018) |
| Ourea specabilis (Mart.) Engl.   | Phenolic compounds (Felicio et al., 1995; Patel et al., 2012); Flavonoids (Basting et al., 2014; Sales et al., 2014), phenolic compounds & tannins (Brunetti et al., 2006; Costa et al., 2016) |
| Myrsine umbellata Mart.         | No reports                                                                                                                                |
| Roupala montana Aubb.           | Terpenes (Cunha et al., 2012); flavonoids, carotenoids & saponins (Francieli et al., 2014; Kuster & Vale, 2016) |
| Alberitia edulis (Rich.) A. Rich.| Flavonoids, terpenoids & saponin (Brochioni et al., 1994); tannins, alkaloids & carotenoids (Soto-Sobenis et al., 2001); Cândida da Silva et al., 2008; Menegati et al., 2016 |
| Cordiera sessili (Vell.) Kuntze  | Terpenes, phenolic compounds & saponins (Aquino et al., 2013b) |
| Guettarda viburnoides Cham. & Schidl. | Anti-inflammatory & antioxidant effects (Naressi, et al. 2015) |
| Palicourea coriacea (Cham.) K. Schum. | Anti-genotoxic effects (Saldanha et al., 2008); diuretic, hypotensive & anti-hypertensive effects (De Santana Aquino et al., 2017) |
| Psychotria poeppigiana Müll. Arg. | Vasoactive effects (Coe & Piersson, 1996) |
| Ticsoyena brasiliensis Mart.    | Terpenoids, saponins & flavonoids (Hamerski et al., 2005) |
| Ticsoyena formosa (Cham. & Schidl.) K. Schum. | Anti-fungal (Bolzani et al., 1996); antioxidant (David et al., 2007); anti-nociceptive (Cesário et al., 2018) & anti-inflammatory effects (Cesário et al., 2019) |
| Casearia sylvestris Sw.          | Inhibition of angiotensin converting enzyme (ACE) & β-glucuronidase, cytotoxicity to KB cells (Arisawa et al., 1989); anti-hepatotoxic effects (Hoffmann-Bohm et al., 1992); negative ionotropic effects (Matsunaga et al., 1997); antioxidiant, anti-microbial, low toxic effects (Tirilino et al., 2015); antioxidiant, anti-microbial & anti-inflammatory effects (Trevizan et al., 2016) |
| Allophylus edulis (A.St.-Hil. et al.) Hieron. | Triterpenoids, alkaloids & anthocyanidins (B&oni et al., 2013); cyanolipid, triacylglycerol (Ascholz et al., 1997); phenolic compounds (Arisawa et al., 1989) |
| Pouteria torta (Mart.) Radlk.    | Flavonoids (Costa et al., 2014) |
| Solanum lycocarpu A.St.-Hil.    | Phenols, tannins, flavonoids, steroids, terpenes, saponins, alkaloids (Aruijo et al., 2010; Munari et al., 2012; Torralbo et al., 2012) & pectin (Torralbo et al., 2012) |
| Qualea grandiflora Mart.        | No reports |

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Qualea multiflora Mart. | Molluscicidal (de Souza et al., 1984); cytotoxic (Nasser et al., 2008) & mutagenic effects (Santos et al., 2011) | Terpenes, steroids (Santos et al., 2011) & ellagic acid derivatives (Nasser et al., 2008; Carnevale Neto et al., 2011)

Qualea parviflora Mart. | Antioxidant (Bonacorsi et al., 2013); in vitro mutagenic (Santos et al., 2011); gastroprotective, anti-diarrhoeal, anti-haemorrhagic & mutagenic effects (Mazzolin et al., 2010) | No reports

Vochysia tucanorum Mart. | Gastroprotective effects (Gomes et al., 2009) | Polyphenols, flavonoids & condensed tannins (Franco et al., 2019)

3.2 Brazilian Government—Public Access to Herbal Medicines

In Brazil, the Unified Health System (SUS) is in place and consists of a public health system that covers everything from primary care to organ transplantation, guaranteeing full, universal and free access by the entire country's population. Among the existing projects of the SUS is the RENISUS (National List of Medicinal Plants of Interest to the SUS), which contains medicinal plants that have the potential to generate products of interest to the SUS. Among the listed species are 71 plants popularly used and scientifically confirmed. The purpose of the list is to guide studies and research that can support elaboration of the list of herbal medicines available for safe and effective use by the population to treat a certain disease (De Aquino et al., 2019).

Considering the relevance of the plant species found in the RENISUS list, we researched which were present in the studied area (Settlement 17 de Abril) and related them to their popular uses and associated scientific studies. Of the 89 species found in the April 17 settlement, only three are listed in the RENISUS: Casearia sylvestris, *Copaifera* spp * (Copaifera langsdorffii) and *Stryphnodendron adstringens*.

**Casearia sylvestris**, popularly known as “guacatonga”, is used in folk medicine for purification and to treat diarrhoea, fever, rheumatism, skin disorders and snake bites (Table 1). Scientific studies report anti-ulcerogenic, anti-inflammatory, anti-tumour, anti-hyperlipidaemic, anti-coagulant, trypanocidal, leishmanicidal, anti-microbial, genotoxic, allelopathic, anti-hyperalgesic, antioxidant, phospholipase A2 inhibitory and anti-parasitic effects of leaves (Table 2). The bark demonstrated anti-tumour activity (Table 2). Phytochemical studies report the presence of flavonoids in the leaves and aerial parts and terpenes in the leaves of this species (Table 2).

*Copaifera langsdorffii* is popularly known as “copaiba”, and resin-extracted oil from its trunk is used by the population to treat inflammation, sore throat, urinary and pulmonary infections, and accelerate wound and ulcer healing (Table 1). Studies conducted on the leaves of this species report potential gastroprotective, anti-inflammatory and antifungal effects and significant genotoxicity (Table 2). Phytochemical studies reported the presence of galloquinquinic acids in the leaves. Oil extracted from the trunk, which is popularly used in folk medicine, has been shown in biological studies to induce cell cycle arrest and apoptosis, with a protective effect against colon carcinogenesis, cytotoxicity, embryotoxicity and bacteria (Table 2). The seeds present immunomodulatory activity and the presence of xyloglucans and galloquinquinic acids (Table 2). Another part of this species is the fruits, which present antioxidant activity (Table 2).

The barbed bark from *Stryphnodendron adstringens*, “barbatimão”, is widely used in two different ways: externally for the treatment of uterine conditions, vaginal conditions, urinary tract infections, skin lesions, ulcers, inflammation, infections and skin infections; and internally for diarrhoea, throat inflammation, bleeding, scurvy, pulmonary complications, and respiratory infections. Additionally, internal use can be used to treat diarrhoea, sore throat, bleeding, scurvy, pulmonary complications, and respiratory infections (Table 1). Scientific studies have validated the popular indications, highlighting some biological activities in the stem bark of this species. Studies report trypanocidal, anti-fungal, antibacterial, antioxidant, anti-ulcerogenic, antigenic, anti-inflammatory and anti-mutagenic effects, as well as the presence of proanthocyanidins, flavonoids, prorobinetinidines and tannins (Table 2).

The presence of these species demonstrates the importance of further scientific studies to prove their ethnopharmacological action against diseases, as well as ensuring secure access to and the rational use of medicinal and herbal plants, the development of technologies and innovations, the strengthening of chains and productive arrangements, the sustainable use of Brazilian biodiversity and the development of the Health Productive Complex.

4. Conclusion

This study provides 89 medicinal plants belonging to 39 families documented from the study area (reserve area of the settlement “17 April”, MS, Brazil) for the first time. The most widespread traditional use, involves the
treatment of gastro-intestinal system diseases (41 spp) and the most utilized parts were leaves (41%), justifying the conservation of biodiversity. Thus, future studies should be focused to establish the links between the traditional uses, active compounds and reported pharmacological activities. Additionally, three species are listed in the National Program for Medicinal and Phototherapeutic Plants (Casearia sylvestris, Copaifera langsdorffii and Stryphnodendron adstringens).

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Abbreviations
CSD, Cardiovascular System Diseases; DDMS, Protocol number specimen; DSD, Gastro-intestinal System Diseases; ENM, Endocrine System Diseases; ID, others Inflammatory Diseases; IPD, Infectious Diseases; GUS, Obstetrics, Gynecology and Urinary-tract Diseases; MCT, Musculoskeletal and Joint Diseases; MS, Mato Grosso do Sul; NEP, Malignant Diseases; NSD, Central Nervous System Diseases; OD, Others Diseases; RENISUS, National list of medicinal plants of interest to the SUS; RSD, Respiratory System Diseases; SUS, Unified health system; SST, Skin, Eye, Ear, Nose and Oropharynx Diseases; WHO, World Health Organization.

Supplementary Files
References listed in Tables 1 and 2 can be retrieved from http://admin.ccsenet.org/press/index.php/galley/download/article/43938/id/46206

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