The Brazilian Ethnoveterinary Analyzed by the One World-One Health™ Perspective

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ABSTRACT

The research and development of herbal medicines used in Veterinary Medicine are still incipient. The present study pursued the status of ethnoveterinary research in Brazil based on a narrative review of the literature. Medicinal plants, animals, and minerals are used to treat companion and production animals in urban and rural areas. In urban areas, using plants to treat infectious diseases and digestive problems in companion animals is frequent. In contrast, plants to treat livestock are accessed to control bacteria involved in cattle mastitis and pathogens involved in hemorrhagic enteritis in small ruminants, such as Haemonchus spp. Nonetheless, reports describing the use of animal tissues as fat, animal products as honey, and mineral products were described and commented on. Much has yet to be done in terms of systematizing ethnoveterinary in Brazil so that the therapeutic potential of the fauna and flora of Brazil can be accessed. Brazil has the most extraordinary biodiversity in the world, and it is the country that has enormous potential for the development of medicines obtained from natural sources to be used in veterinary, in addition to human medicine, despite being one of the most significant animal protein exporting countries. The One World, One Health concepts are fundamental to support the development of ethnoveterinary, to effectively contribute to building the necessary knowledge to sustain animal welfare, which is essential for the development of a sustainable world based on the preservation of natural resources associated with the promotion of global health.

Keywords: Ethnoveterinary, Medicinal plants, Veterinary phytotherapy, Zootherapy, Mineralotherapy.

INTRODUCTION

Since the nineteenth century, it has been known that pathological processes in animals and humans are similar. However, therapeutic procedures have been developed separately depending on the characteristics of each species. During a period spanning from the late nineteenth century and the beginning of the twentieth century, some scholars, including the German physician Dr. Rudolf Virchow, observed the existence of diseases transmissible from animals to humans, such as trichinellosis (Trichinella spiralis), which was transmitted from pigs to humans. The term “zoonosis”, still used today to define transmissible diseases between animal species, was coined by the same German researcher. During this period, other researchers, such as the Canadian Willian Osler, emphasized the importance of studying animal and human diseases and their inter relationships. After the period of the two World Wars, in the twentieth century, the concept related to epidemics of zoonotic diseases was solidly established, in addition to the idea that the health of animals directly implied public health, in particular with regards to diseases such as rabies, brucellosis, salmonellosis, Q fever, bovine tuberculosis and leptospirosis.¹

From the point-of-view of epidemiology, the studies related to parasitic zoonotic diseases made by Calvin Schwabe had a fundamental importance in the mid-1960s, when he coined the term One medicine in a work in which he proposed that human doctors and veterinarians work together in the fight against these diseases. In 2004, the globalization process was in full swing, and the increase in connections between countries and borders pointed to the fact that the health of animals, humans, and wildlife would be a matter of concern in a globalized world. During this period, the “One World, One Health™” concepts were established in the document describing the Manhattan Principles.¹

Cases of avian flu (H5N1) in Southeast Asia and some other countries in 2005 caused alerts worldwide regarding the pandemic danger of zoonoses. In 2008, the fundamentals related
to “One World, One Health”2,3 were recommended by more than 120 countries and more than 20 organizations to be incorporated as a strategic basis of public policies, which takes into account the trilogy animal, the human being, and the environment,1,2 adopted by 71 countries at the International Ministerial Convention on Avian Influenza and Pandemic Influenza, in Hanoi, Vietnam, in 2010. Subsequent conferences approaching the theme of One Health were made in later years.

Still in the early 2000s, a new zoonosis emerged in China, whose etiological agent was called severe acute respiratory syndrome coronavirus (SARS-CoV), which infected approximately 8,000 people, of which 700 have died. Ten years later, in 2012, the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) caused a similar syndrome in the Middle East region, when 2,500 cases and 800 deaths.3 Although these data were frightening at the time and left the world in a state of alert regarding zoonoses, there was no comparison with the recent pandemic caused by the severe acute respiratory syndrome coronavirus, SARS-COV-2, which originated in the city of Wuhan, also in China, whose disease was perpetuated under the name of COVID-19.4

By September 2022, this virus had already been responsible for more than 612,236,677 confirmed cases, which include 6,514,397 deaths worldwide, according to the World Health Organization.5 The zoonotic character of COVID-19 is still under scrutiny.6,7 However, there are records of the manifestation of the viral infection in domestic animals, wild animals residing in zoos, as well as the transmission of the disease between individuals of the same species,8 which may characterize these animals as reservoirs of the infection transmission to domestic and wild animals from humans, which can strongly influence the origin of possible variants.9,10

The advent of the pandemic taught that the focus on the study of One Health is fundamental and strategic for the consolidation of a healthy future for the coming years. We also have learned that the cost of developing effective tools to combat pandemics is very high and focuses primarily on protecting humans, fundamentally by countries that can afford the purchase of vaccines and supportive drugs. Developing countries are left to depend on the benevolent action of the rich through the free distribution of vaccines for equal access to needy populations, which will be highly operative in 2023.11

The study of zoonoses is an excellent example of the importance of animal and environmental health care. Brazil has one of the largest populations of cattle and other production animals, including chickens, goats, sheep, and pigs,12 and companion animals, particularly dogs, cats, and birds.13 The growth in the use of herbal medicines among humans is reflected in the demand for these products for veterinary use. The area of science that conducts research aimed at developing phytotherapeutics and zootherapeutics based on observational behavioral studies of animals is called “ethnoveterinary medicine.” Ethnoveterinary medicine is defined as the systematic development of science which is based on popular knowledge and beliefs, practices, technologies and resources, social organization, and everything that involves animal health among species created by human beings.14

For some decades, the demand for quality herbal products, as well as the rational use of medicinal plants, has grown, which led to the regulation of the pharmaceutical market for this area, as well as the formation of public policies aimed at the prescription and distribution of herbal medicines by the Brazilian Unified Health System (SUS). To offer a legal basis for distributing such medication, the “National Policy for Integrative and Complementary Health Practices” was created to serve the SUS,15 which included Phytotherapy and 28 other therapeutic practices such as Homeopathy, Acupuncture, Reflexology, Chiropractic, and Traditional Chinese Medicine. In 2008, the National Program of Medicinal and Herbal Medicines, or Programa Nacional de Plantas Medicinais e Fitoterápicos, RENAME,16 was approved. Its objective was to select medicinal plants and include them in the RENAME-National List of Essential Medicines, to make possible their free distribution through the SUS in the entire national territory. Based on the prerogatives for human medicine, there is a lack of legal basis for veterinary therapies.

The guidelines for using new veterinary drugs, whether conventional, herbal, zootherapeutic, or even therapeutic tools, are legally established by the Ministry of Agriculture, Livestock and Supply, MAPA.17 It is observed that there is a demand on the part of tutors and breeders for accessible medicines with less risk of adverse effects, such as those originating from plants, animals, and minerals, for the treatment of diseases in companion and production animals. Consequently, there is an increased demand for knowledge related to the use of herbal medicines as a veterinary therapeutic tool.

Within the context, this narrative literature review aims to understand the current status of ethnoveterinary in Brazil, to access what has been proposed as a treatment for companion and production animals, and to suggest perspectives based on scientific knowledge.

METHODOLOGY

For the development of this narrative literature review, a systematic review was carried out from the PUBMED, SCIELO, PERIÓDICOS CAPES, SCIENCE DIRECT, WILEY, WEB OF SCIENCE, CLARIVATE, SCOPUS, SCHOLAR and SPRINGER LINK databases. There was no year limitation. Papers written in Portuguese and English were included. Survey-type scientific articles, literature reviews, original in vitro or in vivo research articles, clinical research, and case studies were considered. Books, theses, websites, and legal documents were not included. The keywords considered were ethnoveterinary and Brazil.
and their versions in the indicated foreign language. For the selection and classification of the articles, the program State of the Art Through Systematic Review-StArt version 3.4 Beta (lapes.dc.ufscar.br) and the Teams environment (Microsoft) were used to manage and administer the flow of information, whose schematic representation is found in the PRISMA flowchart,[18] in Figure 1.

Each author carried out an independent search of the scientific articles, and after a first round of literature review, it was observed that some themes were more frequent. In a second round of literature search, each author was responsible for prospecting articles related to a specific theme to understand better its extension within the range of papers related to the main subject, ethnoveterinary medicine in Brazil. Articles were selected based on their titles. After choosing the documents, each author included their search result in a StArt file, used to manage the total number of selected articles and refine the selection. From this step, only one author was responsible for refining the articles’ selection, classified as accepted, not accepted, or duplicated.

Then, the articles selected in this first stage were again evaluated by StArt by considering the abstract content and the scientific approach. The final list of articles, with data on the authors, volume, number, pages, and year of publication, as well as the DOI, ISSN, and URL of the journal, were displayed in an Excel spreadsheet. Then, one author was responsible for gathering the articles according to the themes and distributing each set of articles to a determined co-author to read and remove the necessary information to compose the review. A flowchart (Figure 1) based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was made to expose the algorithm used in this work.

In the articles, information on the use of medicinal plants related to their traditional or popular use by companion or production animals was considered, as well as information regarding the use of these plants by their tutors or breeders. During the bibliographic research, articles reporting the use of animal and mineral products for the treatment of animals were also considered in this review.

**RESULTS**

From the listed databases, 125 complete articles were separated. They were included in the StArt, of which 33 were duplicates, 24 were rejected, and 68 were selected for evaluation according to the inclusion and exclusion criteria considered in this review. In a second evaluation, 11 articles of the 68 selected ones were still repeated, and 18 were withdrawn because they did not refer to the main subject proposed, resulting in 39 papers included in this document. Another 63 additional documents were used to support the Introduction and Discussion.

**DISCUSSION**

**Ethnoveterinary and animals to treat animals**

There is an immediate need to document the traditional, cultural and environmental knowledge related to popular veterinary medicines since the passing of time is detrimental to the popular retention of information.[19] Since the beginning of the twentieth century, popular knowledge has been considered relevant in several areas of the natural sciences, including those related to traditional cultures, such as ethnobotany, ethnozoology, and ethnoveterinary.[20]

Plants and animals are traditionally used as sources of medicine in several cultures, both for treating humans and animals. Plants,
in particular, comprise the most significant therapeutic element in traditional practices aimed at animal health.\[19\] The use of biological materials for medicinal purposes has been unrestricted to humans for a long time since they are also used against diseases that affect animals. The domestication of animals, whether for companionship, as sources of protein, or the work animals, has led to increased concern about animal health.\[19,20\]

The therapeutic medical use of animals and their products has been observed since ancient times. It is described in documents such as the Ebers Papyrus, the oldest medical treatise in the world, or historical sources such as the Indian Ayurveda system, as well as archives and ancient writings, such as the famous Chinese work Pen Ts’iao.\[21\]

One of the oldest cultural legacies in history is the development of a close relationship between men and animals, which has led to the use of nature derivatives as sources of medicine for treating human diseases.\[21\] including animal parts, such as honey, fat, wax, among others also considered as food.\[22\] The use of animals and their derivatives as treatments is observed in urban and semi-urban locations in different parts of the Latin America,\[21,22\] particularly in Brazil.\[23\] Registers as old as the Ebers Papyrus describe the use of sperm whale, deer glands, honey, and lizard blood as medicine, while the book De Materia Medica, written by Pedanius Dioscorides, describes more than 10% of animal derivatives that were used as medicines.\[26\]

Currently, approximately 80% of the world’s population supports traditional medicine and uses it to treat human and veterinary diseases, which happens because of limited access to drugs, particularly in developing countries, whose governments do not provide enough medicines to be distributed to the population, and even less for animal care.\[27\] As a fightback, the use of plants and animal derivatives as medicines has become the primary therapeutic tool source in some areas in developing countries.

Sheep fat is commonly used to treat human diseases such as rheumatism and pain.\[27-29\] Residents of the semi-arid region of Paraiba administered fish tallow (Selecta Genera et Species Piscium brasiliensium) in the wounds of their domestic animals, such as dogs and cattle, to stimulate the healing process and the anti-inflammatory effect (Souto et al. 2011b).\[29\] A survey was carried out in the Caatinga in which they reported the popular use of animal derivatives such as bees, reptiles, mammals, and birds as medicine, whose data represent, in a way, the acceptance of animals as a source of therapy by local residents.\[28\]

With the advancement of medicine, traditional medicines began to be replaced by industrialized ones, often becoming inaccessible to large-scale consumption due to the costs, regardless of being for human and veterinary use.\[19\] As a result, knowledge of ethnoveterinary medicine proves to be relevant, especially in rural areas, where veterinary services are sometimes inaccessible. Also, access to specific medications is usually more restricted, particularly to small producers, whose production may need to be improved by the low milk productivity or low animal protein quality.\[19\]

Although the resumption of popular knowledge linked to the use of medicinal plants as a therapeutic tool to be applied in veterinary medicine has recently been highlighted, at the same time that popular information must be rescued and studied, the development of therapeutic tools to be used in animal care must continue to be done. Although popular knowledge transmitted through generations is a rich source of information on ways to treat diseases of veterinary interest, the use of drugs developed specifically for use in veterinary medicine is sometimes more effective because they were developed based on scientific evidence,\[19,20\] which makes more in-depth research on herbal veterinary medicines urgent.

**Survey-like studies in Brazil support popular knowledge about the medical-veterinary use of plants, animals, and minerals**

One of the main foundations of ethnopharmacology seeks to relate scientific processes to traditional empirical knowledge.\[30\] Within a broader context, studies on ethnopharmacology and related areas such as ethnobiology, ethnoveterinary, and ethnozoology, among others, are more extensive in Brazil than in Latin American countries;\[23\] the number of publications dedicated exclusively to ethnoveterinary medicine (five publications) and ethnozoology (26 publications) is still deficient, concerning the total (289 publications).

The field studies are based on observational processes carried out with the animals and their guardians or breeders; that is, they are based on the methods adopted by the guardians when caring for their animals and on animal behavior when looking for plants for self-consumption in the search for getting cured of the disease. Sedimented concepts from the area of ethnopharmacology end up being adopted for ethnoveterinary medicine,\[31\] such as those focused on the area of biology (botany, zoology, ecology), anthropology (behavior, society and human customs adopted for animals), specific ethnomedical issues, quantification and analysis of the information adopted, both in experimental and applied research. From studies previously carried out with the application of structured and unstructured questionnaires and reports of pre-clinical and clinical experiments, it is possible to outline the profile of ethnoveterinary medicine in Brazil, as described below.

Brazil is a cosmopolitan, diverse country. In terms of land extension is one of the largest in the world. The most significant extension of the largest tropical forest in the world, the Amazon, is within its territory, in addition to other very important biomes, classified as hot spots due to the biodiversity and the presence of animals and plants that are in danger of extinction, such as the Cerrado and the Atlantic Forest. The relevance of
conservation of Brazilian biomes is directly related to the climate and the regulation of rainfall, which is fundamental for supplying freshwater reservoirs. Biomes such as the Cerrado, the Pampas, and the Pantanal, specifically in their forest characteristics, share space with areas destined for agriculture and livestock, which is also very important for Brazil as it is responsible for a considerable slice of the trade balance. Brazil is one of the largest exporters of animal protein. Its trading partners are mainly in Europe, China, and the Middle East, each of which has legislation regarding the quality of products containing antimicrobial agents. The introduction of alternative products, such as herbal medicines for treating animals, is essential to expand the market and satisfy commercial partners.

In 2021, Brazil had 149,530 million pets, most of them dogs, cats, birds, and fish, which makes it the second country that most consumes pet products, with expenses of up to US$ 7.2 billion, whose forecast increase is 14% for the year 2022, or something around R$ 58.9 billion, together with the increase in human consumption of alternative therapies, including herbal medicines, whose market reached BRL 2.3 billion in 2018.

Semi-structured interviews were applied to residents of different regions of Brazil, both in rural and urban areas. Of the 13 articles referring to an ethnoveterinary survey, one reports the use of medicinal plants in the metropolitan territory, while eight report data obtained in a rural environment.

One of the works was carried out in three veterinary clinics in São Paulo city, in which 273 people were interviewed. The article reports that approximately 17% of owners use medicinal plants to treat their pets. The most used are boldo-de-jardim (Plectranthus barbatus Andrews), chamomile (Matricaria chamomilla L., or Chamomilla recutita (L.) Rauschert), and fennel (Foeniculum vulgare Mill.), fed to dogs and cats orally, as indicated for human use.

Seven articles report the use of medicinal plants in animals in rural areas, such as the one carried out in the state of Pará, on the Ilha de Marajó, in which 50 semi-structured questionnaires assessed the use of plants used in ethnoveterinary medicine, and reported the use of 50 species, including andiroba (Carapa guianensis Aubl.), copaiba (Copaifera martii Hayne), cabaceira (Crescentia cujete L.), ironwood (Caesalpinia ferrea Mart.), Mastruz (Chenopodium ambrosioides L., or Dysphania ambrosioides (L.) Mosyakin and Clemants), pinhão-de-purga (Jatropha curcas L.) and melon (Momordica charantia L.).

On Ilha de Colares, located in the continental part of the state of Pará, in Marajó Bay, a study was carried out based on 72 semi-structured questionnaires which, after being evaluated, reported the use of 56 plants, including tinhórão (Caladium bicolor (Aiton) Vent.), annatto (Bixa orellana L.), andiroba, pinhão-de-purga and lemongrass (Cymbopogon citratus DC. Stapf), in addition to describing the use of homemade animal products such as lard (Sus scrofa) and chicken fat (Gallus domesticus), and fat from wild animals such as paca (Cuniculus sp.), chameleon (Iguana sp.) and opossum (Didelphis sp.), as anti-inflammatory products and healing agents, in addition to mineral products such as salt, kerosene, and gasoline, especially for dermatological problems, used together with plant products.

Five out of seven studies that report the use of plants in ethnoveterinary medicine were carried out in states in the Northeast of Brazil.

In a study conducted in the city of Bom Príncipe do Piauí, Piauí, 38 participants answered a standardized questionnaire whose analysis resulted in the relationship of 112 species of plants used in the treatment of cattle, horses, and dogs, among the more relevant in ethnobotanical terms are the backwoods mastic (Myracrodruon urundeuva Allemão), mentruz or mastruz and amburana-de-cheiro or Northeastern cumaru (Amburana cearensis (Allemão) A.C.Sm.).

The use of structured questionnaires was also carried out in the study on the use of plants in ethnoveterinary medicine, in the community of Várzea Comprida dos Oliveira, in Pombal, Paraíba. In this study, the questionnaire was applied to 40 people, including 20 men and 20 women, most between 31 and 50 years of age, who answered ten questions on the subject. The study identified three plant species and their used organs: garlic bulb (Allium sativum L.), lemon fruit (Citrus spp.), and mastruz leaves. The main health problems reported were respiratory, digestive, and inflammatory processes.

The knowledge regarding two plant species, aroeira-do-sertão and angico (Anadenanthera colubrina (Vell.) Brenan), in the northeastern semi-arid region, in Pernambuco, in two communities called “Riachão” and “Ameixas,” was assessed. In the first community, 101 people were interviewed, and in the second village, 55 were. Both communities had the same type of knowledge regarding the medicinal application of these two species, with aroeira-do-sertão most used in respiratory problems and angico for issues in the skin and subcutaneous tissues and undefined pain. In both cases, the peels are used as a syrup or decoction.

In the semi-arid region of the Bahia state, researchers assessed the knowledge related to ethnomedicine in the Salamina Putumuju Quilombola community. So, 74 participants, 37 men and 37 women, were submitted to semi-structured interviews in which they reported the use of 118 medicinal plants. The list includes two species, the batata-de-purga (Mirabilis jalapa L.) and the croton (Codiaeum sp.).

In the semi-arid region, work was carried out in Alagoas next to a rural settlement in an area with remnants of Caatinga, the region’s typical vegetation. Thirty participants were interviewed, 20 men and ten women, and 54 plant species were listed as the
basis for treating 33 veterinary diseases. \textit{Aloe vera} (\textit{Aloe vera} (L.) Burm.f.), fish fruit (\textit{Guapira graciliflora} (Mart. ex. J.A.Schmidt) Lundell), garlic, lemon (\textit{Citrus limon} (L.) and Brazilian lemongrass (\textit{Lippia alba} (Mill.) N.E.Br). The community is well-established and has areas producing cattle, poultry, pigs, sheep, goats, horses, and mules. The most cited applications for these plants are dermatological, gastric, and multisystemic problems related to inflammatory processes.

Most of the species used have applications in both human and veterinary diseases. The popular knowledge related to the self-use of medicinal plants by men favors the application in the production and companion animals, despite species differences. It means that studies pertaining to medicinal plants, herbal medicines, and plant or animal derivatives in animals must be intensified.

Ethnoveterinary and microbial infection

\textbf{Bacteria}

The use of medicinal plants as antimicrobial and antiparasitic agents is millenary. Recently, the study focused on veterinary care has been done intensively and begins with collecting popular information, as seen above. There is a growing number of studies concerning verifying the antimicrobial and antiparasitic chemotherapeutic potential of plants and animal derivatives to be used in diseases of veterinary importance.\cite{45}

Brazil is one of the largest producers and exporters of animal protein, and mastitis is one of the most prevalent diseases in cattle. It is an infection of the mammary glands in dairy cows, resulting from the invasion of the teats by \textit{Staphylococcus aureus}, \textit{Staphylococcus agalactiae}, \textit{Mycoplasma bovis}, and \textit{Corynebacterium bovis}, with consequent contamination of the milk. Financial losses related to mastitis occur for both the subclinical and clinical stages of the disease. They include the disposal of contaminated milk, transient reductions in the yield of milk produced, and premature culling of infected cattle. Traditional treatment methods involve the direct application of antibiotics to the cows’ teats, which has been a relevant issue since it may favor the emergence of bacterial resistance.\cite{46}

Sanitary management programs aimed at preventing and controlling mastitis recommend using antiseptic and disinfectant agents to prevent the occurrence and transmission of micro-organisms, which reduces the use of antibiotics; therefore, these drugs become administered only in severe cases of the disease (Avancini \textit{et al.} 2008).\cite{45} Even so, since establishing stricter international standards regarding the use of antibiotics by production animals, the introduction of alternative agents that control the pathogenic bacterial load in these animals has become particularly relevant (Rochford \textit{et al.} 2008).\cite{47}

The antibacterial potential of decoctions obtained from popularly used plant species, such as penicillin (\textit{Alternanthera brasiliana} (L.) Ktze.), fennel (\textit{Foeniculum vulgare} Mill.), aloe or aloe (\textit{Aloe arborescens} Mill.), novalgin (\textit{Achillea millefolium} L.), gorse (\textit{Baccharis trimera} (Less.) D.C.), Brazilian arnica (\textit{Solidago chilensis} Meyen), comfrey (\textit{Symphytum officinale} L.), elderberry (\textit{Sambucus nigra} L.), lemongrass, mastruz (\textit{C. ambrosioides} All.), comfrey, elderberry, mint, basil, angico-vermelho, and sete-sangrias were active against both microorganisms.

\textbf{Fungi and yeast}

Veterinary mycology has a very relevant importance in epidemiology since several groups of fungi and yeasts make up zoonotic diseases, such as malasseziosis, caused by \textit{Malassezia furfur} and \textit{M. pachydermatis}, which mainly affects dogs,\cite{48} but which occurs in other species, including wild animals, dermatophytoses caused by \textit{Microsporum} sp. and \textit{Tricophyton} sp, which affect dogs and cats,\cite{49} sporotrichosis, caused by \textit{Sporothrix schenckii} and mainly affects cats,\cite{50} candidiasis caused by \textit{Candida albicans}, \textit{C. tropicalis}, \textit{C. parapsilosis}, which affects several types of animals, including birds,\cite{51} and cryptococcosis, caused by \textit{Cryptococcus neoformans} or by \textit{C. gattii}, which cause fungal diseases in cats, dogs, birds and wild animals.\cite{52} As they are zoonoses, these diseases can be transmitted to humans, who are more susceptible in conditions of immunosuppression, pregnancy, early or advanced age, or affected by other diseases.

Traditional or popular knowledge regarding managing animal mycoses has been explored in Brazil through studies of the antifungal activity of pharmacological agents in \textit{in vitro} methodologies. Plants popularly known as \textit{quitoco} (\textit{Pterocaulon} spp.) were used to treat skin mycoses.\cite{53} Extracts obtained from Organs aerial organs of three plant species were used, \textit{Pterocaulon alopecuroides} (Lam.) D.C., \textit{P. balansae} Chodat. and \textit{P. polystachyum} D.C., from the Asteraceae family, tested against \textit{Microsporum gypseum}, \textit{Trichophyton rubrum}, \textit{Trichophyton mentagrophytes}, \textit{Cryptococcus neoformans}, \textit{Aspergillus flavus}, \textit{Aspergillus niger}, and \textit{Aspergillus fumigatus} species, in susceptibility models. The authors found that the hexane and dichloromethane extracts obtained from \textit{P. alopecuroides} were active against two species of \textit{Tricophyton}, the hexane extract from \textit{P. interruptum} was active against \textit{Microsporum} sp, and the hexane extract of \textit{P. polystachyum} was active against a species of \textit{Tricophyton}. This same group studied some components present in active extracts,
such as coumarins, prenylamine, and prenylamine methyl ether, which were responsible for the observed antifungal activity.\textsuperscript{[54]}

The methanolic extract of \textit{P. alopecuroides} was tested against many strains of fungi \textit{Fonsecaea pedrosoi}, \textit{Cladophialaphora carrioni}, \textit{Rhinocladiella aquaspersa}, \textit{Exophiala jeaneselme}, and \textit{Phialophora verrucosa}, agents of chromoblastomycosis.\textsuperscript{[55]} They observed that the antifungal concentrations observed for these microorganisms are higher than those obtained for fungi related to dermatomycosis. However, the result is significant for the treatment of chromoblastomycosis but resistant.

The methanolic extracts obtained from the aerial organs of different species of \textit{Pterocaulon} were tested against some fungi.\textsuperscript{[56]} The extracts demonstrated important antifungal activity against clinical isolates of \textit{Sporothrix schenckii}, a pathogenic agent related to sporotrichosis, the most active being that obtained from aerial organs of \textit{P. polistachyum}.

**Ethnoveterinary and helminths**

Livestock breeders in many countries face numerous diseases that ultimately limit productivity, many of which are caused by infestations of ticks and parasitic worms such as helminths.\textsuperscript{[57,58]} Many studies have been conducted to find alternative and ecologically friendly treatments to control helminth infestation, as well as those seeking to prevent drug resistance development.

So, popular knowledge regarding using natural sources as a medicine has been highly considered and scientifically validated after a series of \textit{in vivo} and \textit{in vitro} tests.\textsuperscript{[57]}

In a classic ethnopharmacology study, the use of exotic plant species in treating diseases for which there are no known treatments using native plant species is discussed.\textsuperscript{[59]} It seeks to understand the role of these exotic species in the traditional medical system. The researchers conducted survey-like studies in two rural communities in the Brazilian Northeast. The investigations concerned the use of known exotic and native species related to treating endo and ectoparasites in animals and humans and the acaridical activity of certain extracts. The results indicated that the native plant species \textit{Aspidosperma pyriformium} Mart.; \textit{Anthurium affine} Schott; \textit{Bidens bipinnata} L.; \textit{Melocactus zehntneri} (Britton and Rose) Luetzelb.; \textit{Senna spectabilis} var. excelsa (Schrad.) H.S. Irwin and Barneby, among others, were used in the treatment of ectoparasites and the exotic species \textit{Chenopodium ambrosioides} L.; \textit{Ammonia squamosa} L. \textit{Calotropis procera} (Aiton) W.T. Ailton, and \textit{Helianthus annuus} L. The researchers observed that the exotic species presented effective results similar to those observed for the native species in relation to endoparasitosis. They also observed overlapping results between exotic and native species with therapeutic purposes on diseases linked to ticks.

Concerning acaricidal activity, only two species (\textit{Nicotiana glauca} Graham, and \textit{Croton blanchetianus} Ball.) showed positive results but were insignificant. The researchers concluded that the data obtained do not support the suggested hypotheses since the versatility of exotic species was not used exclusively in treating human and animal parasitic diseases; they also concluded that the results regarding plants with acaricidal potential could have been more interesting.

The leaves and roots of \textit{Turnera ulmifolia} L, leaves and seeds of \textit{Parkia platycephala} Benth, and leaves and bark of \textit{Dimorphandra gardneriana} Tul, plant species that are the staple diet of goats in the Brazilian Cerrado, were used in \textit{in vitro} tests against \textit{Haemonchus contortus}.\textsuperscript{[60]} Hydroacetone and hydroalcoholic extracts were evaluated in models using egg incubation, larval inhibition, and larval development assays. A second assay was carried out to assess the influence of polyphenols on the anthelmintic effects. At the end of the tests, all extracts showed inhibitory activity for at least one of the life stages of \textit{H. contortus} analyzed. Therefore, the researchers concluded that these plant species have a promising potential for use in controlling helminth infections in small ruminants.

The anthelmintic action of \textit{Operculina hamiltonii} (G. Don) D.F. Austin and Staples (batata-de-purga), \textit{Momordica charantia} L. (melão-de-são-caetano), and 0.2% moxidectin were analyzed in 40 female goats aged 6 and 12 months that were naturally infected in the Paraíba semi-arid region (known locally as sertão da Paraíba).\textsuperscript{[61]} For the experiment, the animals were divided into four groups formed according to the application of different treatments for three days (G1: negative control-distilled water; G2: alcoholic extract of \textit{O. hamiltonii}; G3: alcoholic extract of \textit{M. charantia}; G4: positive control moxidectin 0.2%). After treatment, feces were collected from these animals on days 0, 30, and 60 to count eggs per gram of feces and perform a larval culture. At the end of the analyses, it was observed that all samples tested positive for larvae of the Trichostrongyloidea superfAMILY (except for G4 on days 30 and 60), in which \textit{Haemonchus} was the predominant genus of this superfamily in the analyzed feces cultures. The authors concluded that using alcoholic extracts of \textit{Operculina hamiltonii} (G. Don) D.F. Austin and Staples, and \textit{Momordica charantia} are efficient in reducing gastrointestinal helminth eggs found per gram of feces in goats, which are characterized as alternatives for controlling such parasites.

Studies carried out in the Paraíba semi-arid showed a significant difference in combating larvae or in their development regarding the use of medicinal plants typical of the region, such as \textit{melão-de-são-caetano} and potato-de-purga, which caused the reduction of several gastrointestinal helminth eggs present in the feces of the analyzed goats.\textsuperscript{[61]}

The effects of Essential Oil (EO) from \textit{Mentha villosa} Hubs and \textit{M. x piperita} L. (carvone and limonene) collected in Santa Catarina, Brazil, was determined against Larvae (L3) of \textit{Haemonchus} spp. and \textit{Trichostrongylus} spp.\textsuperscript{[62]} The analyzes showed that the larvae of \textit{Haemonchus} spp. and \textit{Trichostrongylus} spp. did not develop in
the presence of *M. villosa* Hubs, *M. x piperita*, and the bioactive carvone, in the *in vitro* tests against gastrointestinal nematodes.

The anthelmintic activity (*in vitro* and *in vivo*) of the essential oil of *Thymus vulgaris* L. was assessed against *Haemonchus contortus*.[63] The relative ineffectiveness of the essential oil was found in *in vivo* tests. Still, the authors point out that such ineffectiveness can be corrected after improvement in extraction techniques so that the bioavailability of the oil is increased. The *in vitro* results legitimized the anthelmintic action of the popular use of *T. vulgaris* oil against *H. contortus*. Both the oil and its main compound, thymol (50.22% of the total composition of the oil), proved to be efficient in the three main stages of development of *H. contortus*; both products were able to inhibit egg hatching, growth, and motility of larvae and adults during the first 8 hr of experimentation. Given these results, the authors point out that it is possible to assume that thymol is the main compound responsible for the essential oil's anthelmintic effect since it is this extract's main component. They conclude that these results are of extreme ethnoparmacological importance in the development of new drugs, including herbal medicines.

Brazil leads the research of ethnoveterinary interest in ruminants, mainly concerning studies focused on the anthelmintic activity of herbal medicines to replace synthetic drugs.[64] The problem of indiscriminate use of synthetic drugs to control parasitism has been highlighted.[65] Aiming the anthelmintic drugs generate residues excreted by animals that are released into the environment, causing damage not only to the production animal and its derivatives but also to the ecosystem itself, which becomes a relevant issue due to drug resistance that requires an increase in the dose dispensed to the animal. In this research, alternative means were raised to control the helminths, such as using herbal medicines of ethnoveterinary interest, which can bring natural and safe benefits for goats and the environment.

*Haemonchus contortus* is described as one of the primary gastrointestinal nematodes that affect goats and sheep in Brazil and cause a significant loss in the production of these animals.[66] The search for alternative medicines of natural origin has grown among producers, and based on this, *Pterogyne nitens* Tul. has been tested as an anthelmintic. From this species, the compounds were isolated to discover which would have the best effect on the pathogen. As a result, extracts containing phenolic acids were more effective against hatching eggs. In a research previously done,[67] the efficacy of ethyl extracts obtained from *Jatropha curcas* seeds was demonstrated, which showed not only the inhibition of egg hatching but also the inhibition of larval development.

Another test demonstrated the effectiveness of the essential oil of *Eucalyptus staigeriana* F. Muell. ex F.M. Bailey in reducing the development of eggs and larvae by 76.57% on the 15th day of administration to goats submitted to the anthelmintic activity efficacy test.[68] The effectiveness of the decoction prepared with the aerial parts of *Spigelia anthelmia* L. on the control of *Haemonchus contortus* was assessed by an *in vitro* test, and the plant was considered effective in inhibiting the hatching of eggs with 99.3% effectiveness and 97.8% and larval growth.[69] The toxic effect was previously tested in mice to guarantee a safe dose to be administered to the sheep. The extract obtained from the fruits of *Piper cubeba* L. f. and lignans was tested for anthelmintic activity and a considerably high effect on the studied activity was achieved.[70]

The control of parasitism caused by *Haemonchus contortus* is frequently explored. The effectiveness of the infusion of *Artemisia annua* L. in the control of *Toxoplasma gondii* was assessed.[71] The authors presented satisfactory results regarding the inhibitory effects in up to 75% and safely and effectively, which places the therapeutic product as a potential agent to control this pathogen.

**RECOMMENDATIONS**

Ethnoveterinary science has recently developed in Brazil, where there is enormous potential for growth once the population of companion and production animals is among the largest in the world. Efforts have been made to register the popular knowledge regarding the use of herbal and zootherapeutic medicines aiming veterinary practices, which are stimulated by increasing demand for such products and by the concept, sometimes distorted depending on the species used as medicine, that medicines obtained from natural sources have fewer side effects and are more affordable.

Surveys have been structured in Brazil within the concepts involved in ethnoparmacological sciences. They are fundamental instruments for triggering the development of specific herbal medicines for veterinary use, even though most plant species are also used by humans, which means that there is already scientific knowledge added to the plant's crude material. It is observed that only some clinical studies directed at companion or production animals have been developed with phytotherapeutics, even less with zootherapeutics. Most of the works assessed in this review described *in vitro* studies in models that mainly cover skin diseases, such as mycoses, and those linked to the digestive system, such as parasitic or even microbial ones. Thus, the field of studies to be explored in ethnoveterinary medicine is vast and encompasses the expansion of prospecting and collection of popular information regarding the use of natural sources as medicines, the increase in the evaluation of the effectiveness of plants and animals against a more significant number of microorganisms in *in vitro* models, as well as the introduction of toxicological and pharmacological studies, both preclinical and clinical, of potential drugs.

Policies to encourage the conduct of quality veterinary clinical trials, which meet international guidelines such as those
Table 1: Lists the plant species mentioned in this review and provides the popular name, scientific name, family, popular use, and the occurrence of the species in the National List of Plants of Interest to SUS (RENISUS).

<table>
<thead>
<tr>
<th>Popular name</th>
<th>Scientific name</th>
<th>Family</th>
<th>Popular/traditional use</th>
<th>Presence in RENISUS 2021</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfavaca/basil</td>
<td><em>Ocimum basilicum</em> L.</td>
<td>Lamiaceae</td>
<td>Gastrointestinal symptoms</td>
<td>No</td>
<td>[73]</td>
</tr>
<tr>
<td>Alho/garlic</td>
<td><em>Allium sativum</em> L.</td>
<td>Alliaceae</td>
<td>Cardiovascular effects, antioxidant, antimicrobial, neuroprotection</td>
<td>Yes</td>
<td>[74,75]</td>
</tr>
<tr>
<td>Amburana-de-cheiro, cumaru-nordestino</td>
<td><em>Amburana cearensis</em> (Allemão) A.C.Sm.</td>
<td>Fabaceae</td>
<td>Breathing problems</td>
<td>No</td>
<td>[76]</td>
</tr>
<tr>
<td>Amendoim-bravo/yvyaro</td>
<td><em>Pterogyne nitens</em> Tul.</td>
<td>Fabaceae</td>
<td>Antimicrobial</td>
<td>No</td>
<td>[77]</td>
</tr>
<tr>
<td>Andiroba</td>
<td><em>Carapa guianensis</em> Aubl.</td>
<td>Meliaceae</td>
<td>Antimicrobial</td>
<td>Yes</td>
<td>[78]</td>
</tr>
<tr>
<td>Angico</td>
<td><em>Anadenanthera colubrina</em> (Vell.) Brenan</td>
<td>Fabaceae</td>
<td>Breathing problems and others</td>
<td>No</td>
<td>[79]</td>
</tr>
<tr>
<td>Angico-vermelho ou angico-gurucaia/angico</td>
<td><em>Parapiptadenia rigida</em> (Benth.) Brenan</td>
<td>Fabaceae</td>
<td>Depurative, hemostatic</td>
<td>No</td>
<td>[80]</td>
</tr>
<tr>
<td>Antúrio/anthurium</td>
<td><em>Anthurium affine</em> Schott</td>
<td>Araceae</td>
<td>Diabetes, cardiac diseases</td>
<td>No</td>
<td>[81]</td>
</tr>
<tr>
<td>Arapabaca, erva-lombrigueira/wormbush</td>
<td><em>Spigelia anthelmia</em> L.</td>
<td>Loganiaceae</td>
<td>Vermifuge</td>
<td>No</td>
<td>[82]</td>
</tr>
<tr>
<td>Arnica-brasileira/Brazilian arnica</td>
<td><em>Solidago chilensis</em> Meyen</td>
<td>Asteraceae</td>
<td>Anti-inflammatory</td>
<td>No</td>
<td>[83]</td>
</tr>
<tr>
<td>Aroeira-do-sertão</td>
<td><em>Myracodruon urandeuwa</em> Allemão</td>
<td>Anacardiaceae</td>
<td>Anti-inflammatory, antimicrobial</td>
<td>No</td>
<td>[84]</td>
</tr>
<tr>
<td>Artemisia/artemisia</td>
<td><em>Artemisia annua</em> L.</td>
<td>Asteraceae</td>
<td>Antimalarial, and other several uses</td>
<td>No</td>
<td>[85]</td>
</tr>
<tr>
<td>Babosa ou aloe/aloé</td>
<td><em>Aloe vera</em> (L.) Burm.f, <em>Aloe arborescens</em> Mill.</td>
<td>Berberidaceae</td>
<td>Immunomodulatory</td>
<td>Yes</td>
<td>[74]</td>
</tr>
<tr>
<td>Batata-de-purga/Marvel of Peru</td>
<td><em>Mirabilis jalapa</em> L.</td>
<td>Nyctaginaceae</td>
<td>Anti-inflammatory</td>
<td>No</td>
<td>[86]</td>
</tr>
<tr>
<td>Batata-de-purga</td>
<td><em>Operculina hamiltonii</em> (G. Don) D.F. Austin and Staples</td>
<td>Convolvulaceae</td>
<td>Depurative, laxative</td>
<td>No</td>
<td>[87]</td>
</tr>
<tr>
<td>Cabaceira/calabash tree</td>
<td><em>Crescentia cujete</em> L.</td>
<td>Bignoniaceae</td>
<td>Breathing problems</td>
<td>No</td>
<td>[88]</td>
</tr>
<tr>
<td>Camomila/chamomile</td>
<td><em>Matricaria chamomilla</em> L., ou <em>Chamomilla recutata</em> (L.) Rauschert</td>
<td>Asteraceae</td>
<td>Anti-inflammatory, digestive problems</td>
<td>Yes</td>
<td>[74]</td>
</tr>
<tr>
<td>Popular name</td>
<td>Scientific name</td>
<td>Family</td>
<td>Popular/traditional use</td>
<td>Presence in RENISUS 2021</td>
<td>References</td>
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<td>------------</td>
</tr>
<tr>
<td>Capim-limão/lemon grass</td>
<td><em>Cymbopogon citratus</em> DC. Stapf.</td>
<td>Poaceae</td>
<td>Digestive stimulant</td>
<td>No</td>
<td>[74]</td>
</tr>
<tr>
<td>Carqueja/gorse</td>
<td><em>Baccharis trimera</em> (Less.) DC.</td>
<td>Asteraceae</td>
<td>Digestion problems</td>
<td>Yes</td>
<td>[74]</td>
</tr>
<tr>
<td>Cária-do-nordeste/American cassia</td>
<td><em>Senna spectabilis</em> var. <em>excelsa</em> (Schrad.) H.S. Irwin and Barneby</td>
<td>Fabaceae</td>
<td>Laxantive</td>
<td>No</td>
<td>[89]</td>
</tr>
<tr>
<td>Charuteira/tree tobacco</td>
<td><em>Nicotiana glauca</em> Graham</td>
<td>Solanaceae</td>
<td>Anti-parasitic, insecticide</td>
<td>No</td>
<td>[90]</td>
</tr>
<tr>
<td>Ciumeira, saco-de-velho/the apple of sodom</td>
<td><em>Calotropis procera</em> (Aiton) R. Br.</td>
<td>Apocynaceae</td>
<td>Anti-ulcer, healing</td>
<td>No</td>
<td>[91]</td>
</tr>
<tr>
<td>Confrei/comfrey</td>
<td><em>Symphytum officinale</em> L.</td>
<td>Boraginaceae</td>
<td>Anti-inflammatory</td>
<td>No</td>
<td>[92]</td>
</tr>
<tr>
<td>Copaiba/copaiba</td>
<td><em>Copaifera martii</em> Hayne</td>
<td>Fabaceae</td>
<td>Various popular uses</td>
<td>Yes</td>
<td>[93]</td>
</tr>
<tr>
<td>Coro-a-de-frade/melocactus</td>
<td><em>Melocactus zehntneri</em> (Britton and Rose) Luetzelb.</td>
<td>Cactaceae</td>
<td>Breathing problems, anti-inflammatory</td>
<td>No</td>
<td>[94]</td>
</tr>
<tr>
<td>Cubeb/tailed pepper</td>
<td><em>Piper cubeba</em> L. f.</td>
<td>Piperaceae</td>
<td>Antiseptic and expectorant</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Erva-cidreira-brasileira/Brazilian lemon grass</td>
<td><em>Lippia alba</em> (Mill.) N.E. Br. ex Britton and P. Wilson</td>
<td>Verbenaceae</td>
<td>Various popular uses</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Eucalipto/eucalyptus</td>
<td><em>Eucalyptus staigeriana</em> F. Muell. ex F.M. Bailey</td>
<td>Myrtaceae</td>
<td>Upper airway disorders</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Faveira, fava-de-boi</td>
<td><em>Parkia platycephala</em> Benth.</td>
<td>Fabaceae</td>
<td>Anthelmintic, antimicrobial</td>
<td>No</td>
<td>[95]</td>
</tr>
<tr>
<td>Faveiro, fava-d’anta/Virgin’s bark</td>
<td><em>Dimorphandra gardneriana</em> Tul.</td>
<td>Fabaceae</td>
<td>Anthelmintic</td>
<td>No</td>
<td>[60]</td>
</tr>
<tr>
<td>Flor-do-guarujá/yellow alder</td>
<td><em>Turnera ulmifolia</em> L.</td>
<td>Passifloraceae</td>
<td>Tonic, diuretic, among others</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Fruta-de-peixe, pau-piranha/pirana wood</td>
<td><em>Guapira graciliflora</em> (Mart. ex. J.A.Schmidt) Lundell</td>
<td>Nyctaginace</td>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Fruta-do-conde, pinha/custard apple</td>
<td><em>Annona squamosa</em> L.</td>
<td>Annonaceae</td>
<td>Upper airway disorders, insecticide</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Fumeiro-bravo/earleaf nightsade</td>
<td><em>Solanum mauritianum</em> Scop.</td>
<td>Solanaceae</td>
<td>Anti-inflammatory</td>
<td>No</td>
<td>[96]</td>
</tr>
<tr>
<td>Funcho/fennel</td>
<td><em>Foeniculum vulgare</em> Mill.</td>
<td>Apiaceae</td>
<td>Antiphlogistic</td>
<td>Yes</td>
<td>[74]</td>
</tr>
<tr>
<td>Girassol/sunflower</td>
<td><em>Helianthus annuus</em> L.</td>
<td>Asteraceae</td>
<td>Anti-inflammatory</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Popular name</td>
<td>Scientific name</td>
<td>Family</td>
<td>Popular/traditional use</td>
<td>Presence in RENISUS 2021</td>
<td>References</td>
</tr>
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<td>--------------------------------------------------</td>
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</tr>
<tr>
<td>Guanxuma/arrowleaf sida</td>
<td><em>Sida rhombifolia</em> L.</td>
<td>Malvaceae</td>
<td>Catarrh, emollient</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Hortelã, menta/mint</td>
<td><em>Mentha villosa</em> Hubs, <em>M. x piperita</em> L.</td>
<td>Lamiaceae</td>
<td>Antiseptic, anti-inflammatory</td>
<td>Yes</td>
<td>[74]</td>
</tr>
<tr>
<td>Limão/lemon</td>
<td><em>Citrus limon</em> L.</td>
<td>Rutaceae</td>
<td>Various popular uses</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Marmeleiro-preto</td>
<td><em>Croton blanchetianus</em> Baill.</td>
<td>Euphorbiaceae</td>
<td>Analgesic</td>
<td>No</td>
<td>[96,97]</td>
</tr>
<tr>
<td>Mastruz, mentruz ou erva-de-santa-maria/ Mexican tea</td>
<td><em>Chenopodium ambrosioides</em> L. ou <em>Dysphania ambrosioides</em> (L.) Mosyakin and Clemants</td>
<td>Amaranthaceae</td>
<td>Insecticide</td>
<td>Yes</td>
<td>[93]</td>
</tr>
<tr>
<td>Melão-de-são-caetano/bitter melon</td>
<td><em>Momordica charantia</em> L.</td>
<td>Cucurbitaceae</td>
<td>Various popular uses</td>
<td>Yes</td>
<td>[98]</td>
</tr>
<tr>
<td>Novalgina/common yarrow</td>
<td><em>Achillea millefolium</em> L.</td>
<td>Asteraceae</td>
<td>Various popular uses</td>
<td>Yes</td>
<td>[93]</td>
</tr>
<tr>
<td>Pau-ferro/ironwood</td>
<td><em>Caesalpinia ferrea</em> Mart.</td>
<td>Fabaceae</td>
<td>Airway disorders, anti-inflammatory</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Penicilina/metal weed</td>
<td><em>Alternanthera brasiliana</em> (L.) Kuntze.</td>
<td>Verbenaceae</td>
<td>Anti-inflammatory, febrifuge</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Peroba, peroba-rosa/pereiro</td>
<td><em>Aspidosperma pyrifolium</em> Mart.</td>
<td>Apocynaceae</td>
<td>Antiplasmodic</td>
<td>No</td>
<td>[99]</td>
</tr>
<tr>
<td>Picão/Spanish needles</td>
<td><em>Bidens bipinnata</em> L.</td>
<td>Asteraceae</td>
<td>Antioxidant</td>
<td>No</td>
<td>[100]</td>
</tr>
<tr>
<td>Pinhão-de-purga/physic nut</td>
<td><em>Jatropha curcas</em> L.</td>
<td>Euphorbiaceae</td>
<td>Various popular uses</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Sabugueiro/American black elderberry</td>
<td><em>Sambucus nigra</em> L.</td>
<td>Viburnaceae</td>
<td>Various popular uses</td>
<td>No</td>
<td>[74]</td>
</tr>
<tr>
<td>Sete-sangrias/Colombian waxweed</td>
<td><em>Cuphea carthagenensis</em> (Jacq.) J.F. Macbr.</td>
<td>Lythraceae</td>
<td>Action on angiotensin, diuretic, anti-inflammatory, laxative, antihypertensive</td>
<td>No</td>
<td>[101]</td>
</tr>
<tr>
<td>Tinhorão/angel wings</td>
<td><em>Caladium bicolor</em> (Aiton) Vent.</td>
<td>Araceae</td>
<td>Use in sores, rheumatism, leprosy, emetic, purgative</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Tomilho/thyme</td>
<td><em>Thymus vulgaris</em> L.</td>
<td>Lamiaceae</td>
<td>Gout, chronic rheumatism, healing</td>
<td>No</td>
<td>[93]</td>
</tr>
<tr>
<td>Umbu/Ombú</td>
<td><em>Phytolacca dioica</em> L.</td>
<td>Fabaceae</td>
<td>Antimicrobial</td>
<td>No</td>
<td>[102]</td>
</tr>
<tr>
<td>Urucum/achiote</td>
<td><em>Bixa orellana</em> L.</td>
<td>Bixaceae</td>
<td>Various popular uses</td>
<td>No</td>
<td>[93]</td>
</tr>
</tbody>
</table>
described for humans, but are adaptable to the veterinary area, such as CONSORT (Consolidated Standards of Reporting Trials), must be implemented to achieve FAO’s demands on the reduction of antimicrobial resistance, one of the priorities of this century within the scope of One Health. Ethnoveterinary knowledge plays a determinant role in that scenario.

Ethnoveterinary is a science concerned with animal welfare that has expanded its role due to the involvement of companion animals, production animals, and wild animals as hosts of pathogens related to zoonotic diseases concerning the use of medicines obtained from natural sources for veterinary therapeutic care. Therefore, Brazil is among the countries that have enormous potential for the development of drugs obtained from natural sources to be used in veterinary medicine, as those reported in Table 1, and to effectively contribute to the consolidation and application of the One Health concepts, so fundamental for the development of a world sustainable for future generations from the preservation of natural resources.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Brazil. Farmacopeia Bras. 2019,II.Plants Medicinalis. 


Brazil. Farmacopeia Bras. 2019,II.Plants Medicinalis. 


Brazil. Farmacopeia Bras. 2019,II.Plants Medicinalis. 


