Fecha de recepción: 6-septiembre-2020 Fecha de aceptación: 1-febrero-2021

ETHNOBOTANICAL TREATMENT OF TROPICAL DISEASES, MALARIA AND DENGUE, PRESCRIBED BY *BIOENERGÉTICO* PRACTITIONERS AND PROFILE OF THE INVOLVED POPULATION IN MERIDIONAL AMAZON

Diene Gonçalves Larocca[1], Norberto Gomes Ribeiro Júnior[1], Ricardo Eduardo Vicente[1*], Ivone Vieira da Silva[1]

[1]Laboratório de Anatomia Vegetal, Centro de pesquisa e tecnologia da Amazonia Meridional (CEPTAM), Departamento de Ciências Biológicas, Universidade do Estado de Mato Grosso (UNEMAT), Campus II, Av. Perimetral Rogério Silva, 4930, Jardim Flamboyant, 78580-000, Alta Floresta-MT, Brazil.

*E-mail: ricardomyrmex@gmail.com

ABSTRACT

The World Health Organization has been encouraging public policies in several countries to implement alternative methods for their complementary health systems. One of the most expressive alternative movements in Brazil, known as "*Bioenergético*" or "*Araminho*", was disseminated in the 2000s, mainly in the Amazon region, regions that are developing and with high rates of tropical diseases. Thus, this study aimed to conduct an ethnobotanical survey with *Bioenergético* teams through the application of semi-structured questionnaires to 14 pairs of practitioners, in order to list the species of plants used in the treatment of malaria and dengue and observe the socioeconomic types of the participants. As for the socioeconomic profile, the proportion of men and women is the same among the participants, who generally are maried are between 33 and 62 years old, live in the countryside and are all catholic. Fifty six species from 31 botanical families were mentioned, of which 37 species were used for the treatment of malaria and 54 for dengue, with many plants being used in both treatments. The most used plant species for the treatment of malaria are *Baccharis trimera* (Less.) DC, *Aristolochia trilobata* L., *Momordica charantia* L., *Esenbeckia leiocarpa* Engl., *Abuta grandifolia* (Mart.), *Strychnos pseudoquina* A. St.-Hil. and *Stachyterpheta cayennensis* (Rich.) Vahl. For the treatment of dengue the most used species are *Baccharis trimera* (Less.) DC, *Aristolochia trilobata* L., *Momordica charantia* L., *Chenopodium ambrosioides* L., *Ocimum gratissimum* L., *Strychnos pseudoquina* A. St.-Hil. and *Stachyterpheta cayennensis* (Rich.) Vahl. It was possible to verify that *A. trilobata*, *S. pseudoquina*, *C. ambrosioides* and *M. charantia* are the common species in the treatment of both diseases. Socioeconomic, cultural and religious conditions had a direct influence on the popularization of the *Bioenergético* method in Alta Floresta, MT, Brazil, dominated by people of rural origin and who even with access to conventional medicine seek this method of treatment.

KEYWORDS: alternative treatment, ethnobiology, medicinal plants, traditional knowledge.

TRATAMENTO ETNOBOTÂNICO DE DOENÇAS TROPICAIS, MALÁRIA E DENGUE, PRESCRITO PELOS PRATICANTES DE BIOENERGÉTICO E PERFIL DA POPULAÇÃO ENVOLVIDA NA AMAZÔNIA MERIDIONAL

RESUMO

A Organização Mundial da Saúde vem incentivando políticas públicas em vários países para a implementação de metodos alternativos a fim de complementar seus sistemas de saúde. Um dos movimentos alternativos mais expressivos no Brasil, conhecido como Bioenergético ou Araminho, foi disseminado, principalmente na região amazonica nos anos 2000, regiões estas em desenvolvimento e com altas taxas de doenças tropicais. Assim, este estudo teve como objetivo realizar um levantamento etnobotânico com equipes do Bioenergético através da aplicação de questionários semiestruturados a 14 duplas de atendentes, a fim de listar as espécies de plantas utilizadas no tratamento da malária e da dengue e observar fatores socioeconômicos dos participantes. Quanto ao perfil socioeconômico, a proporção de homens e mulheres é igual entre os participantes, que geralmente são casados, possuem entre 33 a 62 anos, moram na zona rural e são todos Católicos. Foram citadas 56 espécies de 31 famílias botânicas, das quais 37 espécies para o tratamento da malária e 54 para a dengue, sendo muitas plantas usadas em ambos os tratamentos. As espécies mais utilizadas para o tratamento da malária são *Baccharis trimera* (Less.) DC, *Aristolochia trilobata* L., *Momordica charantia* L., *Esenbeckia leiocarpa* Engl., *Abuta grandifolia* (Mart.), *Strychnos pseudoquina* A. St.-Hil. e *Stachyterpheta cayennensis* (Rich.) Vahl. Para o tratamento da dengue destacam-se *Baccharis trimera* (Less.) DC, *Aristolochia trilobata* L., *Momordica charantia* L., *Chenopodium ambrosioides* L., *Ocimum gratissimum* L., *Strychnos pseudoquina* A. St.-Hil. e *Stachyterpheta cayennensis* (Rich.) Vahl. Foi possível verificar que *A. trilobata*, *S. pseudoquina*, *C. ambrosioides* e *M. charantia* são as espécies comuns no tratamento de ambas doenças. As condições socioeconômicas, culturais e religiosas tiveram influência direta na popularização do metodo Bioenergético em Alta Floresta, MT, Brasil, dominada por pessoas de origem rural e que mesmo com acesso à medicina convencional procuram este método de tratamento.

PALAVRAS-CHAVE: conhecimento tradicional, etnobiologia, plantas medicinais, tratamento alternativo.

INTRODUCTION

Local biodiversity has always been closely linked to people's daily lives, which they have been exploring as food, cultural and religious articles or even medicines (Svanberg and Berggren, 2019; Altaf *et al*., 2020; Auqui-Calle *et al*., 2020; Cunha *et al.*, 2020; Fongnzossie *et al*., 2020). Considering medicinal uses of the biodiversity, plants are the most commonly used throughout human history, resulting in an accumulation of valuable information about the use and management of medicinal plants (Luna-Morales, 2002; Pasa, 2011). This accumulation of information led the Chinese, Egyptians, Indians and Greeks to be the first to catalog medicinal herbs, classifying them according to their shape, color, flavor and aroma, including also their links with the stars and with magical attributes (Ponzi *et al.,* 2010).

In the last decades, the World Health Organization (WHO) acted effectively in the process of disseminating traditional knowledge, creating the Traditional Medicine Program in the 1970s. Since then, member countries have been reformulating and implementing their public health systems with the help of traditional knowledge, stimulating the development of research in this area (Ministério da Saúde, 2006). One of the most expressive movements in Brazil, knowdege as "Bioenergético" or "Araminho", was disseminated as an alternative therapy method around the country, mainly in the Amazon region in the 2000s, by the Catholic Church under the responsibility of the National Council of Bishops of Brazil (CNBB) (Fernandes, 2002). This movement reconciles the

non-invasive diagnostic method described as Bi-Digital O-Ring Test (Omura, 1993) and traditional botanical knowledge.

The realization of ethnobotanical studies with *Bioenergético* practitioners becomes very important due to their knowledge about native plants of the region where they work and, therefore, often unknown to science. It is important to emphasize that this ethnobotanical knowledge of local species is not limited to the treatment of diseases, but also, incorporates ecological, biological, historical, cultural and socio-economic aspects (Cuevas *et al.,* 2010; Bottasso, 2019; Maldonado *et al*., 2020). For these reasons, this movement has revolutionized conditions of life of many people in interior regions, mainly in the periods of malaria epidemic and more recently dengue (Fernandes, 2002).

The municipality of Alta Floresta, located in the north of the State of Mato Grosso, Brazil, and belonging to a region considered "Portal da Amazônia" for being in the contact area between the Amazon rainforest and urban centers. There, since its origin in the 1970s, all the environmental, social and economic characteristics related to the foundation of the municipality, led to the proliferation of typical Amazon diseases, such as malaria and dengue. It is a fact that from 1980 to 2003 the municipality registered a very high rate of malaria occurrence (200-399.9 cases / 1000 inhabitants), including cases of death (Bacani *et al.,* 2011). These high rates of malaria are related to the colonization process in the region, with the installation of mining and openings for farming in forest areas in this municipality (Atanaka-Santos *et al.,* 2006). As of the 2000s, malaria cases in the municipality are not as alarming as in the recent past, however, many cases are still registered every year (Ministério da Saúde, 2020). On the other hand, dengue presented alarming records in Alta Floresta in more recent years, with about 70 cases and more than 620 notifications in 2014, leading the municipality to be considered a priority in the identification of dengue outbreaks and cases (Mato Grosso, 2020). Given the impact of this disease in the region and the number of people involved in the *Bioenergético* moviment, in this study we investigated the plants used to treat malaria and dengue, as well as the socioeconomic profile of the *Bioenergético* practitioners, in order to suggest future studies of species with potential in the treatment of these diseases.

MATERIAL AND METHODS

Study area. The research was carried out in the municipality of Alta Floresta, located in the north of the state of Mato Grosso, Brazil (Figure 1). It presents a hot and humid climate with four dry months, whose main characteristic is the frequency of high temperatures, being able to reach during its warmer days, temperatures over 40ºC, with annual average temperature around 26ºC (Caioni *et al.,* 2014). Rainfall can reach very high averages, sometimes exceeding 2,000 mm in the rainier periods of the year from October to March (Alvares *et al.,* 2013). These characteristics favor the reproduction of malaria and dengue vectors (Mato Grosso, 2020). The municipality of Alta Floresta was colonized in 1976 by INDECO/SA (Integração, Desenvolvimento e Colonização) and currently the municipality has an estimated population of 49,991 inhabitants, counting on a territorial unit of 8,927,204 km² and being located to approximately 800 Km from the capital Cuiabá (IBGE, 2020).

Data collection. We held a meeting in September 2014 at the Centro de pesquisa e tecnologia da Amazonia Meridional (CEPTAM - UNEMAT / AF) with the *Bioenergético* practitioners to present the objectives, methods and team members of this research. We drafted Free and Informed Consent Terms (ICF) and registered the research project with the Research Ethics Committee of the Universidade do Estado de Mato Grosso under number 43556315.7.0000.5166, opinion substantiated 1225.978. With the approval of the project, in March 2015 we started the interviews with 14 representatives of the *Bioenergético* method, totaling 7 pairs working in the municipality of Alta Floresta. All semi-structured questionnaires were carried out with a previously scheduled date, time and place and the questionnaire was applied in order to preserve the principle of the "snowball" (Albuquerque and Lucena, 2004). Each

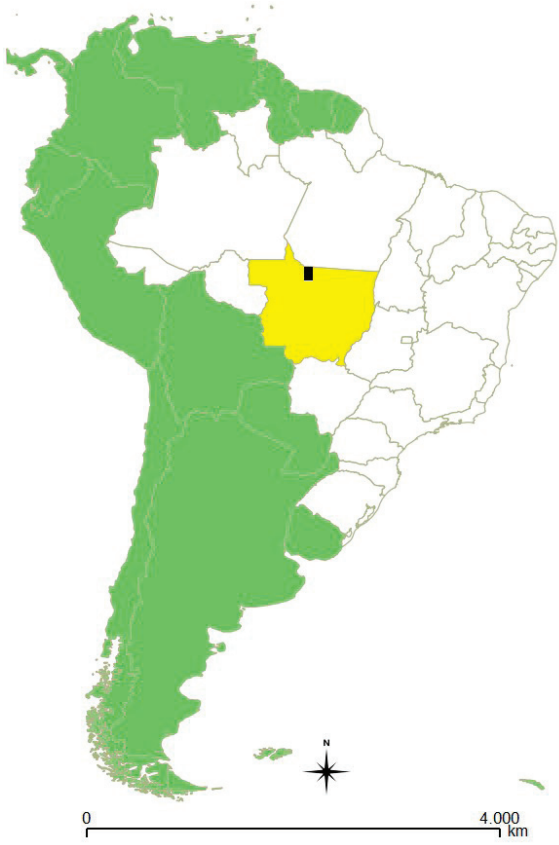

Figure 1. Location map of study area, municipality of Alta Floresta (black rectangle), within the state of Mato Grosso (in yellow), Brazil (in white) and South America (in green).

Bioenergético pratictioner was visited only once to apply the questionnaire and collect botanical samples. The visits took place between March and June 2015.

The semi-structured questionnaire contained 22 questions, covering questions related to socioeconomic, cultural, religious data, *Bioenergético* method, time and form of treatment for malaria and dengue. In addition to the questionnaire-guided dialogue, we also carryied out participatory observations, in order to better understand the *Bioenergético* method and its history of implementation in the municipality (Figure 2). These techniques were adopted taking into account that semi-structured interviews freely addresse the proposed theme, allowing for deepening elements that may arise during the interview and have great flexibility (Neto, 1994; Viertler, 2002; Albuquerque and Lucena, 2004). The names of the informants were kept confidential as provided for in Resolution of the National Health Council No. 466 of December 12, 2012 (Ministério da Saúde, 2012).

Botanical samples of the plant species mentioned in the interviews with the *Bioenergético* practitioners were collected for identification shortly after the application of the questionnaire. Exsiccates were made with these botanical samples collected and were taken to Herbário da Amazônia Meridional - HERBAM, where they were identified with the help of specialized references such as Fernandes (2002) and Lorenzi and Matos (2002), and with the assistance of the researchers Dr. José Martins Fernandes and Ricardo Ribeiro. Exsiccates of native species were deposited in HERBAM and exicatas of non-native species were stored in the Laboratório de Anatomia Vegetal, Unersidade do Estado de Mato Grosso. After identifying the species, we consulted in specialized literature, mainly in the Scielo and Google academic database (http://www.scielo.br/; https://scholar.google.com/), in order to obtain a survey of works already published in the areas of botany and ethnobotany with the species mentioned in the ethnobotanical survey. We highlight references that demonstrate experimental evidence

Figure 2. Photos during the visit to the *Bioenergético* practitioners' property in the municipality of Alta Floresta, MT, Brazil. We can see one of the interviewees showing the area where the plants are grown for food and for use as medicine (A), another demonstrates the properties of one of the plants used as medicine (B), and it can be seen that the plants are also grown in the household perimeter (C) and those indicated for the treatment of Dengue and Malaria were identified in Herbário da Amazônia Meridional.

about the plant extract or compounds in the treatment of the Dengue and Malaria disease. This bibliographic review was carried out in order to verify the potential of the use of these plants and to suggest future studies that may scientifically support the use of these plants in the treatment of Malaria and Dengue (Annex I). Finally, we cauculated the Cultural Value Index (VC) because it is based on the versatility of using a plant and its popularity (Gutiérrez, 2017). To calculate the Cultural Value Index, we used the formula developed by Reyes-García *et al*., (2006) and derived by Gutiérrez, 2017:

$$VCe = \left(\frac{NUe}{NC}\right) \times \left(\frac{FCe}{N}\right) \times \sum_{u=u1}^{uNC} \times \sum_{i=i1}^{iN} URiu/_{N}$$

Where: NU*e* = Number of use categories of species *e*, NC = Number of use categories considered in the study, FC*e* = Frequency of citation, N = Total number of informants participating in the study, URiu = Total number of reported uses.

RESULTS

Socioeconomic Profile. Fourteen *Bioenergético* practitioners participated equally in the research comprising 50% of men and 50% of women, and 86% of them being married. They ranged in age, declaring to be 33 years old (14%), 47 years old (14%) and 62 years old (14%), with the lowest age being 25 years old with 7% tied with the others ages (48, 50, 55, 58, 66, 67 and 68 years). Most live in the rural area (71%), but they carry out varied occupational activities such as Farmer (36%), Housewife (29%), Student (14%), Entrepreneur, Cattleman, Health agent (7% each). Nevertheless, most *Bioenergético* practitioners have lived in the municipality for a long time, ranging from 36 to 40 years (36 %), 26 to 30 years (29 %), 31 to 35 years (21 %), 20 to 25 years (14 %). All the people interviewed declared themselves to be Catholic Apostolic Romans. Most representatives of *Bioenergético* (2/3) had been assisting people for over 10 years with this technique, with half of the interviewees having the same partner since the beginning of the activity. All the respondents declared that the *Bioenergético* technique was taught to them in courses offered by Pastoral da Saúde.

Representatives of *Bioenérgetico* stated that there is no predominance of age or gender among patients treated for malaria. They declared that the *Bioenérgetico* consultation has a variable duration according to the number of "positives" accused during the Bi-Digital O-Ring Test, with the majority of the interviewees reporting an average duration of consultation of between 15 and 20 minutes (57%), which mostly occured (86 %) in a reserved place in the house of the representatives of *Bioenergético* called the consulting room.

Treatment and forms of use and cultivation of medicinal plants. Most respondents (57%) reported that the treatment of dengue takes around 10 to 15 days and that the treatment of malaria takes around of 15 to 20 days. However, all agree that the treatment time varies according to the stage of the disease, the regimen carried out during treatment, the conditions and response of the organism. Considering the records kept by the *Bioenergético* practitioners, of people treated by *Bioenergético* for malaria or dengue, 79% had clinical confirmation carried out by the public health network (laboratory tests), indicating that even having access to traditional means of diagnosis, many people seek care from alternative methods.

We identified a wide variety of botanical families used in the treatments, 31 in total. All of them had at least one species used to treat dengue, the main ones being: Lamiaceae (10.5%), Asteraceae (9.9%), Aristolochiaceae (7.2%) and Loganiaceae (7.2%). For malaria, species distributed in 23 botanical families were mentioned, the most representative of which were: Asteraceae (12.4%), Aristolochiaceae (10.1%), Curcubitaceae (9.3%) and Loganiaceae (9.3%) (Table 1).

Furthermore, 56 plant species were mentioned by the *Bioenergético* practitioners for both diseases. Among these species, 54 are used in the treatment of dengue, among which, the most frequently mentioned by respondents were *Baccharis trimera* (Less.) DC, *Aristolochia trilobata* L., *Momordica charantia* L., *Chenopodium ambrosioides* L., *Ocimum gratissimum* L., *Strychnos pseudoquina* A. St.-Hil. and *Stachyterpheta cayennensis* (Rich.) Vahl (Table 1). For malaria, 37 species were reported, the most significant species being *Baccharis trimera*, *Aristolochia trilobata*, *Momordica charantia*, *Esenbeckia leiocarpa* Engl., *Abuta grandifolia* (Mart.), *Strychnos pseudoquina* and *Stachyterpheta cayennensis* (Table 1). The plant species with the highest CV were identified for both diseases, and are among the most frequently pointed out by practitioners for at least one of the diseases, such as *Strychnos pseudoquina* (CV= 1.175), *Stachytarpheta cayennensis* (CV= 0.613), *Momordica charantia* (CV= 0.511).

Regarding the origin of the plants used in the treatments for malaria and dengue, the *Bioenergético* practitioners reported that part of the species is collected in woods close to their homes and that shrub and herbaceous species are grown in backyards and gardens, with some species that are not easily found in the region or do not adapt to the domestic environment, being bought in pharmacies and natural products stores.

DISCUSSION

Most *Bioenergético* practitioners live in the countryside and attend people from nearby rural communities. However, they do not fit into a classification of people isolated from urban centers, on the contrary, all pairs of practitioners interviewed report the acquisition of some of their inputs used for the production of medicines in urban businesses in the municipality of Alta Floresta, MT, Brazil. Another evidence of this study was that despite receiving the traditional diagnosis of malaria and dengue through the Sistema Único de Saúde - SUS (about 3/4 of the people attended by the interviewees) these people are still looking for alternative "more natural" treatments. It is common to use pharmaceutical products to treat malaria, and medicinal plants are used mainly to treat symptoms such as headache, fever, body aches, liver problems and anemia (Tomchinsky *et al.,* 2017). Rural communities are closely linked to the use of medicinal plants, due to their broad relationship with the environment that surrounds them and, in many cases, especially in more isolated communities, as is the case here, the only most accessible and available resource for the treatment of diseases (Pasa *et al.,* 2005; Pedro-Pinto *et al.,* 2006; Roque *et al.,* 2010). However, the use of medicinal plants also occurs with residents of the urban area where the low-income and less frequent population, of middle class, consume these resources (Pedro-Pinto *et al.,* 2006).

It is important to consider the socioeconomic characteristics of the *Bioenergético* practitioners. These are between 25 and 68 years old, the youngest locally born, they are mostly married who attend at their own residence, using most of the day for work activities in the field and domestic services, with patient care at night and on weekends. They make it a practice that spans 10 to 20 years with a single partner. Some of these characteristics are common to the rural population of the region, since the municipality of Alta Floresta was colonized in 1976 and is the result of a model of privatized colonization (Alves-Junior, 2003). The people come mainly from the South and Southeast of Brazil (Cunha, 2006), mainly small farmers, sharecroppers, housewives, tenants and even wage earners (Guimarães-Neto, 2002; Cunha, 2006).

Considering this history of colonization of the municipality, the implementation of the *Bioenergético* technique occurred between the 1980s and 1990s, exactly in the periods of greatest need and difficulty that the population settled in the region encountered (Coelho *et al.,* 2003). In these places, health care and access to medicines were precarious, mainly due to the distance from the capital and also due to the conditions of the road network in the state (Fernandes, 2002; Coelho *et al.,* 2003; Costa and Silva, 2014). These factors make treatment more difficult and can lead to deaths, which in the case of malaria are justified for males through exposure to work activities and in females by intra and peridomestic household activities (Atanaka-Santos *et al.,* 2006). Thus, it is clear that the influence of environmental conditions, housing and access to sanitary vehicles are determining factors in the transmission and cure of infected people, requiring reflection on the inadequacy of medical conduct and methodologies traditionally developed in medicine in relation to the popular class (Gomes and Merhy, 2014).

It is important to note that potentially medicinal botanical families tend to be strongly represented in ethnobotanical studies, with a high level of agreement, with several informants agreeing on the same therapeutic use. This may suggest real effectiveness in the treatment of diseases (Pilla *et al.,* 2006; Maldonado *et al*., 2020). Regarding plant species, a peculiar aspect noted during participatory observation, which occurred at different times and with different interviewees, was the statement that the same plants used for the treatment of malaria could be used in the treatment of dengue, with a greater number of plants exclusive to the treatment of dengue (Table 1). This concomitant use of species to treat both diseases is clear when we look at the four most frequently used species *Aristolochia trilobata*; *Strychnos pseudoquina*, *Chenopodium ambrosioides* and *Momordica charantia* (Table 1). Many of these plants used to treat malaria and dengue have bitterness in common and there is a culture among Amazonian populations that plants that are bitter cure malaria or dengue (Brandão *et al.,* 1992; Tomchinsky *et al.,* 2017). Species such as *Senna occidentalis, Bidens pilosa* and *Strychnos pseudoquina* and species belonging to the genus *Aspidosperma*, in

Table 1. List of plant species cited by *bioenergetico* agents for the treatment of dengue and malaria in Meridional Amazon municipality of Alta Floresta, Mato Grosso state, Brazil, and studies about these species. *Local Plant Status: Na: Native; Ex: Exotic. °Plant origin: C: Cultivation; W: Wild. +Used part: Bk: Bark; Fl: Flower; Ft: Fruit; Lf: Leaf; Ln: Liana; Rt: Root; Rz: Rhizome; Se: Seed. $Method of use: B: bath; I: inhalation; P: poultice; Te: tea; Ti: tincture. #Indicative potential: D: Dengue; M: Malaria. The numbers in the last two columns refer to the studies present in the literature and which are listed in the Annex I.

FAMILY/SPECIES	COMMON NAME	LOCAL PLANT STATUS*	PLANT ORIGIN°	USED PART+	METHOD OF USE$	INDICATIVE POTENTIAL#	CULTURAL VALUE INDEX	BOTANICAL STUDIES**	STUDIES EVIDENCING THE POTENTIAL EFFECT OF THE PLANT EXTRACT IN THE TREATMENT OF	
									DENGUE	MALARIA
Adoxaceae										
Sambucus canadensis L.	Sabugueiro	Ex	W	Lf	I / Te	D / M	0.153	31; 138	41	-
Asteraceae										
Achillea millefolium L.	Pronto Alivio/ Mil em ramas	Ex	W	Lf	Te	D / M	0.255	186; 156; 191	-	-
Artemisia absinthium L.	Losna	Ex	W	Lf	Te	D / M	0.153	7; 88; 181; 153	-	154
Baccharis trimera (Less.) DC.	Carqueja	Na	W	Lf	Te / Ti	D / M	0.306	2; 94; 118; 150	-	-
Bidens pilosa L.	Picão	Na	W	Lf	B / Te	D / M	0.153	21;140; 200; 150	-	11; 28
Tagetes minuta L.	Cravo de defunto	Ex	W	Lf	Te	D	0.051	42; 105; 106	112	166
Tithonia diversifolia (Hemsl.) A. Gray	Flor da Amazônia	Ex	W	Lf	Te / Ti	D / M	0.102	73; 136	-	137
Aristolochiaceae										
Aristolochia trilobata L.	Cipó Mil Homem	Ex	W	Bk/Fl	I / P / Te / Ti	D / M	0.306	146; 157; 189	-	-
Alismataceae										
Echinodorus grandiflorus Mitch.	Chapéu de Couro	Na	W	Lf	Te	D / M	0.102	29; 100; 171	-	-
Amaranthaceae										
Alternanthera brasiliana (L. Kuntz)	Cibalena / Terramicina	Na	W	Lf	Te	D	0.102	57; 139; 173	-	-
Apocynaceae										
Aspidosperma macrocarpon Mart. & Zucc.	Casca d´anta	Na	W	Bk	Te / Ti	D / M	0.153	95; 131	-	117
Aspidosperma polyneuron Muell. Arg	Peroba Rosa	Na	W	Bk/Rt	Te	D / M	0.306	13; 51; 90	-	60
Arecaceae										
Euterpe oleracea Mart.	Açaí Jussara	Na	W	Ft	Ti	D	0.102	71; 115; 160; 189	-	64
Bignoniaceae										
Crescentia cujete L.	Coité	Ex	C	Lf	Te	D / M	0.204	61; 76; 79; 145	-	-
Tabebuia aurea (Silva Manso) Benth & Hook. F ex S. Moore	Carobinha	Ex	W	Bk	Te	D	0.102	20; 39; 160; 170	-	-
Burseraceae										
Trattinnickia burserifolia Mart	Amescla	Na	W	Bk/Ft	Te	D	0.102	101; 134; 159	-	-
Bixaceae										
Bixa orellana L.	Colorau	Na	W	Se	Te	D / M	0.204	103; 167; 190	174	50
Caricaceae										
Carica papaya L.	Mamão	Na	C	Fl	Te	D	0.102	89; 99; 202	43; 46	183
Celastraceae										
Maytenus ilicifolia Mart. ex Reissek	Espinheira Santa	Na	W	Lf	Te / Ti	D / M	0.102	147; 162; 142	-	-
Cupressaceae										
Thuja orientalis L.	Tuia	Ex	C	Lf	Te	D	0.102	6; 84; 85	-	-

Table 1. Continuation

FAMILY/SPECIES	COMMON NAME	LOCAL PLANT STATUS*	PLANT ORIGIN°	USED PART+	METHOD OF USE$	INDICATIVE POTENTIAL#	CULTURAL VALUE INDEX	BOTANICAL STUDIES**	STUDIES EVIDENCING THE POTENTIAL EFFECT OF THE PLANT EXTRACT IN THE TREATMENT OF	
									DENGUE	MALARIA
Curcubitaceae										
Cayaponia tayuya (Vell.) Congn.	Taiuiá	Na	W	Lf	Te	D	0.102	77; 86; 148	-	-
Momordica charantia L.	Melão São Caetano	Ex	C	Lf	Te / Ti	D / M	0.511	12; 169	-	68
Chenopodiaceae										
Chenopodium ambrosioides L.	Erva Santa Maria	Ex	W	Lf	Te / Ti	D / M	0.255	82; 124; 201	-	54
Euphorbiaceae										
Croton cajucara Benth.	Sacaca	Na	W	Bk	Te	D / M	0.204	9; 78; 102; 120	-	-
Phyllanthus niruri L.	Quebra Pedra	Na	W	Lf	Te	D	0.051	56; 63; 128	-	122
Fabaceae										
Bauhinia forficata Link	Pata de Vaca	Na	W	Lf	Te	D / M	0.358	53; 67; 143	-	-
Erythrina mulungu Mart. Ex Benth	Mulungu	Na	W	Bk	Te	D / M	0.153	25; 155; 159	-	-
Senna occidentalis (L.) H.S. Irwin & R.C. Barneby	Fedegoso	Na	W	Lf	Te	D / M	0.409	38; 125	-	121
Lamiaceae										
Leonotis nepetifolia (L.) R.Br.	Cordão de Frade	Ex	W	Lf	Te	D / M	0.204	23; 81; 110; 132	-	-
Leonurus sibiricus L.	Rubim/ Cibalena	Ex	C	Lf/Fl	Te	D / M	0.204	109; 168; 198	-	-
Mentha pulegium L.	Poejo	Ex	C	Lf / Bk/ Rt	Te / B	D / M	0.051	1; 5; 108	-	-
Ocimum basilicum L.	Manjericão	Ex	C	Lf/Fl	Te	D	0.102	18; 83; 152; 182	-	121
Ocimum gratissimum L.	Alfavaca	Ex	C	Lf/Fl	Te	D / M	0.409	66; 91; 152	-	-
Plectranthus barbatus Benth.	Boldo	Na	C	Lf	Te / Ti	D / M	0.153	10; 27; 72	-	-
Lauraceae										
Cinnamomum zeylanicum Breyn.	Canela	Ex	C	Ft	Te	D	0.102	92; 187; 192	-	-
Persea americana Mill.	Abacate	Ex	C	Lf	Te	D / M	0.204	3; 4; 26; 199	196	-
Lecythidaceae										
Bertholletia excelsa Bonpl.	Castanheira	Na	W	Bk	Te	D	0.102	35; 127; 159	-	133
Loganiaceae										
Strychnos pseudoquina A. St.-Hil.	Quina	Na	W	Lf / Rt/ Bk	Te	D / M	1.175	24; 163; 175	-	-
Myrtaceae										
Corymbia citriodora (Hook.) K.D.Hill & L.A.S.Johnson	Eucalipto	Ex	C	Lf	Te / I	D	0.077	59; 123; 194	-	-
Eugenia uniflora L.	Pitanga	Na	C	Lf	Te	D	0.102	16; 70; 75; 158	58	-
Psidium guajava L.	Goiaba	Ex	C	Lf	Te	D	0.102	15; 111;172	185	-
Syzygium cumini (L.) Skeels	Jambo	Ex	C	Se	Te	D	0.102	17; 65; 114; 180	-	-
Menispermaceae										
Abuta grandifolia (Mart. Sandwith	Abuta	Ex	C	Lf/ Rt/Se	Te	D / M	0.511	32; 48; 49; 165	-	69
Meliaceae										
Cabralea canjerana (Vell. Mart.	Cangerana	Ex	W	Lf/ Bk	Te	D / M	0.204	40; 97	-	-

Table 1. Continuation

FAMILY/SPECIES	COMMON NAME	LOCAL PLANT STATUS*	PLANT ORIGIN°	USED PART+	METHOD OF USE$	INDICATIVE POTENTIAL#	CULTURAL VALUE INDEX	BOTANICAL STUDIES**	STUDIES EVIDENCING THE POTENTIAL EFFECT OF THE PLANT EXTRACT IN THE TREATMENT OF	
									DENGUE	MALARIA
Cedrela odorata L.	Cedro	Ex	W	Lf/ Bk	Te	M	0.102	74; 45; 96; 113; 159	-	107
Guarea guidonia (L.) Sleumer	Camboatã	Ex	W	Bk	Te	D	0.102	19; 93; 129	-	14
Melia azedarach L.	Cinamomo	Ex	W	Lf/ Bk	Te / Ti	M	0.051	30; 126; 193	-	44
Papaveraceae										
Chelidonium majus L.	Figatil	Ex	C	Lf	Te	D / M	0.204	22; 164; 195	-	-
Fumaria officinalis L.	Fél da Terra	Ex	C	Lf/ Bk/ Fl/Rt	Te	D / M	0.102	33; 47; 179	-	-
Rutaceae										
Esenbeckia leiocarpa Engl.	Guarantã	Na	W	Bk	Te	D / M	0.409	104; 144; 177	-	-
Solanaceae										
Solanum paniculatum L.	Jurubeba	Ex	W	Lf	Te	D / M	0.204	116; 151; 184; 188	-	-
Theaceae										
Camellia sinensis (L.) Kuntze	Cragiru ou Chá da Índia	Ex	C	Lf	Te	D / M	0.102	36; 141	-	-
Tiliaceae										
Luehea paniculata Mart.	Açoita Cavalo	Na	W	Bk	Te	D	0.102	8; 34	-	-
Verbanaceae										
Stachytarpheta cayennensis LC. Rich. Vahl	Gervão	Na	W	Lf	Te	D / M	0.613	55; 98; 178	-	130
Zingiberaceae										
Alpinia zerumbet B. L. Burtt & R. M. Smith	Água de Colônia	Na	W	Se	Te	D	0.102	52; 62; 197	-	-
Curcuma longa L.	Açafrão	Ex	C	Rz	Te	D / M	0.102	37; 66; 119; 176	80	149

**The papers cited in this table in Published studies are found in Annex I, and serve as a reference to understand the relevance of these species as an object for scientific studies; it does not constitute an objective of this survey to exhaust the bibliographic sources of citation of studies of these species.

general are widely used in the treatment of these two diseases in the Amazon region (Meneguetti *et al.,* 2014), with recurrence of bitterness. This strong representativeness of specifical plant species to the specifical deasese treatment in ethnobotanical studies can facilitate the species selection process for pharmacological tests that can investigate for the presence of compounds, their quantity and effectiveness (Antoun *et al*., 1993; Garavito *et al*., 2006).

It is still worth noting that, some species widely used in popular medicine such as *Sambucus canadensis*, *Mentha pulegium* and *Plectranthus barbatus* appear in this study with relatively low frequency of citations. Among the justifications we can consider the fact that these plants, common in forest yards and vegetable gardens (Guarim-Neto and Macedo, 2009; Carniello *et al.,* 2010), have been used for many years by our ancestors to the cure of "low complexity" diseases such as mumps, chicken pox or colds (Lima and Santos, 2006). The use in folk medicine of these and other plants generates interest from the scientific community, with a range of basic studies available in scientific literature (Table 1). Studies based on traditional knowledge are more efficient in the search for plants with medicinal potentials than research without support from traditional populations (Oliveira *et al*., 2015; Maslachah *et al.*, 2019).

Among all the 56 plant species cited by *Bioenérgitico* practitioners, few species (only 25) are investigated as

to their pharmacological potential (Table 1). Some of these studies demonstrate that the plant extract had weaker effects than chloroquine (Charturvedi *et al.*, 2006) or did not have effects in isolation, but potentiate the effect of this drug (Maslachah *et al.*, 2019). This potentiation of another drug may occur in other cases, even in the case of polyherbal extracts. An interesting case was the use of a polyherbal anti-malarial compound of the Cameroonian folklore medicine called Nefang. This compound has the extract of six plants, *Mangifera indica* L. (bark and leaf), *Psidium guajava*, *Carica papaya*, *Cymbopogon citratus* (DC.), *Citrus sinensis* L. Osbeck, *Ocimum gratissimum* (leaves). In an experiment where rats and mice were inoculated with *Plasmodium* spp., and received doses of Nefang, or other combinations of extracts, individuals who received the Nefang polyherbal extract, had a better response than *Psidium guajava* alone or administered together with *Mangifera indica* (Tarkang *et al.* 2014). This study demonstrates that *Psidium guajava* alone has no effect on malaria. In our inventory, the interviewees indicated the species only in the treatment of Dengue and not as antimalarial. This indication is reinforced by Trujillo-Correa *et al.* (2019), that in a study combining in vitro and in silico evaluations, identified promising compounds of *Psidium guajava* in the treatment against Dengue. In the Nefang, it still has extract from two other plants mentioned by the interviewees, and *Ocimum gratissimum* has no studies indicating its effectiveness in the treatment of malaria, or dengue. The other plant is *Carica papaya*, which has a study showing that its compound exhibited good activity against strains of *Plasmodium falciparum* and was non-toxic to healthy uninfected human red blood cells (Teng *et al.*, 2019).

The mention by the *Bioenergético* practitioners of native species in the Amazon biome as *Euterpe oleracea* and *Bertholletia excelsa* (Table 1), even with lower frequencies is notable. The fact that these typically Amazonian plants are cited by representatives of the *Bioenergético* shows that the people interviewed have contact with the local flora, being knowledgeable about the Amazonian flora, being able to use and manage it for their benefit (Fonseca-Kruel *et al.,* 2005; Pasa *et al.,* 2005). In our inventory, respondents inform that these two species are indicated for the treatment of dengue. However, studies with these species show their potential use for the treatment of malaria (Ferreira *et al*., 2019; Oliveira *et al*., 2015). This demonstrates that the Amazonian flora needs to be better studied in terms of its use and its components in the treatment against tropical diseases, because after all, it is evident that native species have studies in other sub-areas of Botany with greater emphasis in species of great economic interest, such as *Aspidosperma macrocarpon* and *Bertholletia excelsa*.

Therefore, it is evident more studies about potentially medicinal plants are required, the best way that society can use these resources, considering that such studies promote cultural rescue and the recording of this knowledge (Oliveira *et al*., 2015; Maslachah *et al.*, 2019) and can support the use of local plants in treatments for populations that have difficult in access to conventional medicine, either by geographical distance or financial conditions, in addition to valuing local natural resources and Amazonian biodiversity.

CONCLUSION

The socioeconomic profile of the *Bioenergético* pactioners in the Amazon matogrossensse region is comprised mostly of people from the countryside who are visited by neighbors and even people from the urban environment at night and on weekends. Both *Bioenergético* practitioners and patients are people with access to traditional methods of medication who often opt for natural treatments and have a vast ethnobotanical knowledge.

We identified 25 of the 56 species mentioned for the treatment of malaria and dengue, which have studies evidencing the possible efficiency in the use of the plants. Most of the species cited by the interviewees are the subject of studies, but they lack pharmacological and medical studies that can provide greater security as to their effectiveness and even possible use and cration of new drugs.

ACKNOWLEDGMENTS

Authors thank the people who agreed to be interviewed, and to Dr. José Matins Fernandes and Ricardo Ribeiro to the assistance in identifying plants. REV thanks Fundação de Amparo à Pesquisa do Estado de Mato Grosso (FAPEMAT – nº 0602346/2017) and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq - nº 313839/2019-0) to Desenvolvimento Cientifico Regional (DCR) support.

CITED LITERATURE

Albuquerque, U. P. y R. F. P. Lucena. 2004. *Métodos e técnicas na pesquisa Etnobotânica*. Ed. Livro Rápido/ NUPEEA, Recife.

Altaf, M., A. M. Abbasi, Umair, M., Amjad, M. S., Irshad, K., y A. M. Khan. 2020. The use of fish and herptiles in traditional folk therapies in three districts of Chenab riverine area in Punjab, Pakistan. *Journal of Ethnobiology and Ethnomedicine* 16(1): 1-21. DOI: 10.1186/s13002-020-00379-z

Alvares, C. A., J. L. Stape, P. C. Sentelhas, J. L. Moraes Gonçalves y G. Sparovek. 2013. Köppen's climate classification map for Brazil. *Meteorologische Zeitschrift* 22(6): 711-728. DOI: 10.1127/0941-2948/2013/0507

Alves-Junior, G. T. 2003. O planejamento governamental e seus reflexos na estrutura fundiária de Mato Grosso. *Caminhos de Geografia* 4(9): 17-30.

Antoun, M. D., L. Gerena y W. K. Milhous. 1993. Screening of the flora of Puerto Rico for potential antimalarial bioactives. *International journal of pharmacognosy* 31(4): 255-258. DOI: 10.3109/13880209309082950

Atanaka-Santos, M., D. Czeresnia, R. Souza-Santos y R. M. Oliveira. 2006. Comportamento epidemiológico da malária no Estado de Mato Grosso, 1980-2003. *Revista da Sociedade Brasileira de Medicina Tropical* 39(2): 187-192. DOI: 10.1590/S0037-86822006000200011

Auqui-Calle, E. G., L. A. T. Tuguminago, L. A. B. Esparza y F. Auqui-Calle. 2020. Conocimiento etnobiológico de la serpiente *Bothrops asper* (Garman 1884) en La Parroquia Alluriquín, Santo Domingo de los Tsáchilas– Ecuador. *Etnobiología* 18(2): 67-77.

Bacani, D. A., P. Zeilhofer y E. S. Santos. 2011. Análise espacial da ocorrência de malária no estado de Mato Grosso - Brasil. *Revista Geográfica de América Central* 2(47): 1-16.

Bottasso, N. 2019. Sistemas y prácticas de medicina ancestral para el desarrollo sostenible. *Etnobiología* 17(3): 5-19.

Brandão, M. G. L., T. S. M. Grandi, E. M. M. Rocha, D. R. Sawyer y A. U. Krettli, 1992. Survey of medicinal plants used as antimalarials in the Amazon. *Journal of Ethnopharmacology* 36: 175-82. DOI: 10.1016/0378-8741(92)90018-M

Caioni, C., S. Caioni, T. L. Parente, A. C. Silveiro y W. V. Claudino. 2014. Dinâmica da temperatura superficial no perímetro urbano de Alta Floresta/MT. *Enciclopédia Biosfera* 10(18): 3853-3863.

Carniello, M. A., R. S. Silva, M. A. B. Cruz y G. Guarim Neto. 2010. Quintais urbanos de Mirassol D'Oeste - MT, Brasil: uma abordagem etnobotânica. *Acta Amazônica* 40(3): 451-470. DOI: 10.1590/S0044-59672010000300005

Charturvedi, P., B. H. Raseroka y O. Ntshebe. 2006. Evaluation of antimalarial activity of *Melia azedarach*. *Journal of Applied Zoological Researches* 17(1): 109-113.

Coelho, M.F.B., P. Costa Junior y J. L. D. Dombroski. Diversos olhares em etnobiologia, etnoecologia e plantas medicinais. In: Barbieri, M. P. *O Bioenergético e as plantas medicinais*. Unicen, Cuiabá, Mato Grosso.

Costa, G. y P. S. Silva. 2014. Tratamento Bioenergético: Estudo Etnofarmacológico de Plantas Medicinais da Pastoral da Saúde Alternativa de Cotriguaçú, MT. *Biodiversidade* 13(1):115-124.

Cuevas, M. S.; L. W. Olascoaga y C. Z. Gómez. 2010. Plantas medicinales de la comunidad de San Pablo Huantepec, Municipio de Jilotepec, Estado de México. In: Fuentes, A.M., M. T. P. Silva, R. M. Méndez, R. V. Azúa, P. M. Correa y T. V. G. Santillán. *Sistemas Biocognitivos Tradicionales - Paradigamas en la conservacion Biológica y el Fortalecimento Cultural*. Asociación Etnobiológica Méxicana / Global Diversity Foundation / Universidad Autónoma del Estado de Hidalgo / El Colegio de la Frontera Sur / Sociedad Latinoamericana de Etnobiología.

Cunha, E. L., L. Leonardo, L. D. A. Guimarães y S. X. Santos. 2020. Scientometrics of global scientific production about ethnomycology. *Etnobiología* 18(3): 61-77.

Cunha, J. M. P. 2006. Dinâmica migratória e o processo de ocupação do Centro-Oeste brasileiro: o caso de Mato Grosso. *Revista brasileira de estudos de População* 23(1): 87-107. DOI: 10.1590/S0102-30982006000100006

Fernandes, J. M. 2002. *Plantas medicinais de Alta Floresta: Com contribuição á etnobotânica*. Ed. Cidade, Alta Floresta, Mato Grosso.

Ferreira, L. T., V. P. Venancio, T. Kawano, L. C. Abrão, T. A. Tavella, L. D. Almeida, G. S. Pires, E. Bilsland, P. Sunnerhagen, L. Azevedo, S. T. Talcott, S. U. Mertens-Talcott y F. T. Costa. 2019. Chemical genomic profiling unveils the in vitro and in vivo antiplasmodial mechanism of açaí (*Euterpe oleracea* Mart.) polyphenols. ACS omega, 4(13), 15628-15635. DOI: 10.1021/acsomega.9b02127

Fongnzossie, E. F., C. F. B. Nyangono, A. B. Biwole, P. N. B. Ebai, N. B. Ndifongwa, J. Motove y S. D. Dibong. 2020. Wild edible plants and mushrooms of the Bamenda Highlands in Cameroon: ethnobotanical assessment and potentials for enhancing food security. *Journal of ethnobiology and ethnomedicine* 16(1): 1-10. DOI: 10.1186/s13002-020-00362-8

Fonseca-Kruel, V. S., I. M. Silva y C. U. B. Pinheiro. 2005. O Ensino Acadêmico da Etnobotânica no Brasil. *Rodriguésia* 56(87): 97-106. DOI: 10.1590/2175-78602005568707

Garavito, G., J. Rincón, L .Arteaga, Y. Hata, G. Bourdy, A. Gimenez, R. Pinzón y E. Deharo. 2006. Antimalarial activity of some Colombian medicinal plants. *Journal of Ethnopharmacology* 107(3): 460-462. DOI: 10.1016/j.jep.2006.03.033

Gomes, L.B. y E. E. Merhy. 2014. A educação popular e o cuidado em saúde: um estudo a partir da obra de Eymard Mourão Vasconcelos. *Interface* 18(2):1427-1440. DOI: 10.1590/1807-57622013.0466

Guarim-Neto, G. y M. Macedo. 2009. Utilização de vegetais na medicina tradicional. I. *Serjania erecta* Radlk. (cinco-folhas). *FLOVET* 1(1): 14-20.

Guimarães-Neto, R.B. 2002. A Lenda do Ouro Verde: Política de Colonização no Brasil Contemporâneo. UNICEN, Cuiabá, Mato Grosso.

Gutiérrez, X.F.G. 2017. Etnobotánica cuantitativa de la comunidad nativa infierno, Madre de Dios-Perú. *Etnobiología* 15(3): 24-40.

IBGE, Instituto Brasileiro de Geografia Estatística. 2020. *IBGE Cidades*. Disponible in: http://cidades.ibge.gov.br/xtras/perfil.php?codmun=510025 (Accessed in 20 December 2019).

Lima, M. R. y M. R. A. Santos. 2006. Aspectos Etnobotânicos da Medicina Popular no Município de Buritis, Rondônia. *Revista Fitos* 2(2): 36-41.

Lorenzi, H. y F. J. A. Matos. 2002. *Plantas medicinais no Brasil nativas e exóticas*. 2nd. ed. Instituto Plantarum, Nova Odessa, SP, Brazil.

Luna-Morales, C. D. C. (2002). Ciencia, conocimiento tradicional y etnobotánica. *Etnobiología* 2(1): 120-136.

Maldonado, A. M., M. S. Aparicio y A. E. Castro-Ramírez. 2020. Etnobotánica medicinal de comunidades Ñuu Savi de la Montaña de Guerrero, México. *Etnobiología* 18(2): 78-94.

Maslachah, L., R. Sugihartuti y R. S. Wahyuni. 2019. Hematologic changes and splenic index on malaria mice models given *Syzygium cumini* extract as an adjuvant therapy. *Veterinary World* 12 (1): 106-111. DOI: 10.14202/vetworld.2019.106-111

Mato Grosso, Secretaria de Estado de Saúde. 2020. *Boletim Epidemiológico da Dengue, Chikungunya e Zika no Estado de Mato Grosso - Semana 47/2015 nº39*. Disponible in: http://www.saude.mt.gov.br/upload/noticia/1/arquivo/111215120921-SES-MT-A-boletim-epidem-dengue---ses---sem-47.pdf (Accessed in 10 February 2020).

Meneguetti, D. U. O., R. M. Cunha, R. A. Lima, F. A. S. Oliveira, D. S. S. Medeiros, G. M. Passarini, P. S. M. Medeiros, J. S. L. T. Militão y V. A. Facundo. 2014. Antimalarial ethnopharmacology in the Brazilian Amazon. *Revista de Ciências Farmacêuticas Básica e Aplicada* 35(4): 577-587.

Ministério da Saúde. 2020. *DATASUS*. Disponible in: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sinannet/cnv/malamt.def (Accessed in 02 February 2020).

Ministério da Saúde. *Portaria nº 971, 03 de maio de 2006*. 2006. Diário Oficial da República Federativa do Brasil, Poder Executivo, Brasília, DF. Disponible in: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2006/prt0971_03_05_2006.html (Accessed in 10 February 2021).

Ministério da Saúde. *Resolução nº 466, de 12 de dezembro de 2012*. 2012. Diário Oficial da República Federativa do Brasil, Poder Executivo, Brasília, DF. Disponible in: http://conselho.saude.gov.br/resolucoes/2012/Reso466.pdf (Accessed in 10 February 2021).

Neto, O. C. 1994. O trabalho de campo como descoberta e criação. In: Minayo, C. S. (org.) *Pesquisa social: teoria, método e criatividade*. Vozes, Petrópolis, RJ, Brazil.

Oliveira, D. R., A. U. Krettli, A. C. C. Aguiar, G. G. Leitão, M. N. Vieira, K. S. Martins y S. G. Leitão. 2015. Ethnopharmacological evaluation of medicinal plants used against malaria by quilombola communities from Oriximiná, Brazil. *Journal of ethnopharmacology* 173: 424-434. DOI: 10.1016/j.jep.2015.07.035

Omura, Y. 1993. U.S. Patent No. 5,188,107. Washington, DC: U.S. Patent and Trademark Office.

Pasa, M. C. (2011). Saber local e medicina popular: a etnobotânica em Cuiabá, Mato Grosso, Brasil. *Boletim do Museu Paraense Emílio Goeldi. Ciências Humanas* 6(1): 179-196. DOI: 10.1590/S1981-81222011000100011

Pasa, M. C., J. J. Soares y G. Guarim Neto. 2005. Estudo etnobotânico na comunidade de Conceição-Açu (alto da bacia do rio Aricá Açu, MT, Brasil). *Acta Botanica Brasilica* 19(2): 195-207. DOI: 10.1590/S0102-33062005000200001

Pedro-Pinto, E. P., M. C. M. Amorozo y A. Furlan. 2006. Conhecimento popular sobre plantas medicinais em comunidades rurais de mata atlântica - Itacaré, BA, Brasil. *Acta Botânica Brasilica* 20(4): 751-762. DOI: 10.1590/S0102-33062006000400001

Pilla, M.A.C., M. C. M. Amorozo y A. Furlan. 2006. Obtenção e uso das plantas medicinais no distrito de Martim Francisco, Município de Mogi-Mirim, SP, Brasil. *Acta Botânica Brasílica* 20(4): 789-802. DOI: 10.1590/S0102-33062006000400005

Ponzi, E. A. C., T. L. Oliveira, I. A. Ferrer-Morais, J. J. Silva Júnior, M. M. Gerbi, I. A. Souza, M. N. C. Psiottano y H. S. Xavier. 2010. Atividade antimicrobiana do extrato de *Momordica charantia* L. *Revista de Cirurgia Traumatologia Buco-Maxilo-facial* 10(1): 89-94.

Reyes-García, V., T. Huanca, V. Vadez, W. Leonard y D. Wilkie. 2006. Cultural, Practical, and Economic Value of Wild Plants: A Quantitative Study in the Bolivian Amazon. *Economic Botany* 60(1): 62-74. DOI: 10.1663/0013-0001(2006)60[62:CPAEVO]2.0.CO;2

Roque, A. A.; R. M. Rocha y M. I. B. Loiola. 2010. Uso e diversidade de plantas medicinais da Caatinga na comunidade rural de Laginhas, município de Caicó, Rio Grande do Norte (nordeste do Brasil). *Revista Brasileira de Plantas Medicinais* 12(1): 31-42. DOI: 10.1590/S1516-05722010000100006

Svanberg, I. y Å. Berggren. 2019. Ant schnapps for health and pleasure: the use of *Formica rufa* L.(Hymenoptera: Formicidae) to flavour aquavit. *Journal of ethnobiology and ethnomedicine* 15(1): 1-6. DOI: 10.1186/s13002-019-0347-7

Tarkang, P. A., F. A. Okalebo, L. S. Ayong, G. A. Agbor y A. N. Guantai. 2014. Anti-malarial activity of a polyherbal product (Nefang) during early and established Plasmodium infection in rodent models. *Malaria journal* 13(1): 1-11. DOI: 10.1186/1475-2875-13-456

Teng, W. C., W. Chan, R. Suwanarusk, A. Ong, H. K .Ho, B. Russell, L. Rénia y H. L. Koh. 2019. In vitro antimalarial evaluations and cytotoxicity investigations of Carica papaya leaves and carpaine. *Natural Product Communications* 14(1): 1934578X1901400110. DOI: 10.1177/1934578X1901400110

Tomchinsky, B., L. C. Ming, V. F. Kinupp, A. D. F. Hidalgo y F. C. M. Chaves. 2017. Ethnobotanical study of antimalarial plants in the middle region of the Negro River, Amazonas, Brazil. *Acta Amazonica* 47(3): 203-212. DOI: 10.1590/1809-4392201701191

Trujillo-Correa, A. I., D. C. Quintero-Gil, F. Diaz-Castillo, W. Quiñones, S. M. Robledo y M. Martinez-Gutierrez.

2019. In vitro and in silico anti-dengue activity of compounds obtained from Psidium guajava through bioprospecting. *BMC complementary and alternative medicine* 19(1): 1-16. DOI: 10.1186/s12906-019-2695-1

Viertler, R. B. 2002. Seminário de Etnobiologia e Etnoecologia do Sudeste. In: Amorozo, C. M. *et al.* (ed.). *Métodos Antropológicos como Ferramenta para Estudos em Etnobiologia e Etnoecologia*. SBEE, Rio Claro, SP, Brazil.