Journal of Ethnopharmacology 144 (2012) 346–352

Contents lists available at SciVerse ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jep

Ethnoveterinary knowledge and practices at Colares island, Pará state, eastern Amazon, Brazil

Rhuan Amorim Ritter [a], Maria Vivina Barros Monteiro [a,*], Frederico Ozanan Barros Monteiro [b], Silvane Tavares Rodrigues [c], Marina Lira Soares [b], Jean Carlos Ramos Silva [d,e], Maria das Dores Correia Palha [b], Germano Francisco Biondi [f], Sheila Canevese Rahal [f], Manoel Malheiros Tourinho [b]

[a] Universidade Federal do Pará (UFPA), Faculdade de Medicina Veterinária, Castanhal, Pará, Brazil
[b] Universidade Federal Rural da Amazônia (UFRA), Programa de Pós-graduação em Saúde e Produção Animal na Amazônia. Belém, Pará, Brazil
[c] Embrapa Amazônia Oriental. Belém, Pará, Brazil
[d] Programa de Pós-graduação em Ciências Veterinárias, Universidade Federal Rural de Pernambuco (UFRPE). Recife, Pernambuco, Brazil
[e] Instituto de Medicina da Conservação—Tríade. Recife, Pernambuco, Brazil
[f] Universidade Estadual Paulista (UNESP), Faculdade de Medicina Veterinária e Zootecnia (FMVZ), Botucatu, SP, Brazil

ARTICLE INFO

Article history:
Received 16 June 2012
Received in revised form
5 September 2012
Accepted 12 September 2012
Available online 18 September 2012

Keywords:
Ethnoveterinary medicine
Medicinal plants
Zootherapy
Use value
Ethnobotany

ABSTRACT

Ethnopharmacological relevance: The lack of ethnoveterinary surveys in Brazil, especially in the Amazon region, results in losses in the veterinary phytopharmacology field and in scientific documentation of the cultural traditions of plant use in the treatment of animal diseases.
Aim of the study: To catalog, analyze and disseminate the ethnoveterinary knowledge of the inhabitants of Colares Island, Pará state, eastern Amazon, Brazil.
Materials and methods: A total of 72 interviews were conducted, and semi-structured questionnaires were answered by 18 men and 54 women. The data obtained were quantitatively analyzed using the informant consensus factor (ICF) and use value (UV). The plants with a reported medicinal use for domestic animals were harvested, herbalized and botanically identified.
Results: Fifty-six plants, distributed in 49 genera and 35 families, were indicated to have 23 different medicinal uses, divided into six categories of use. The highest ICF (0.80) was obtained for the antiparasitic class. The Euphorbiaceae family exhibited the highest number of citations, and the species with the highest UVs were *Caladium* cf. *bicolor*, *Bixa orellana*, *Carapa guianensis*, *Jatropha curcas* and *Cymbopogon citratus*. The parts of the 56 plants that were most frequently used to prepare ethnoveterinary medications were the leaves (46%), bark (15%), roots and fruit (10%). The use of the macerated leaves was the most common method of application, used by 43% of the interviewees, and the majority of the preparations (87.3%) used a single plant. In addition to medicinal plants, the interviewees reported the use of products of animal and mineral origin.
Conclusion: The present study contributed to the establishment of an inventory of plants used in ethnoveterinary practices in this region of the Brazilian eastern Amazon. Future phytochemical and pharmacological studies are needed to confirm the efficacy and safety of the identified plants, enabling communities to use them in a more economic, effective and safe manner.

1. Introduction

Ethnoveterinary medicine is the science that studies the beliefs, knowledge, techniques, methods and practices used in the care and promotion of animal health (Barboza et al., 2007). Some factors, such as the increased cost of veterinary services and difficulty of acquiring synthetic drugs, have contributed to the interest in developing this science, especially with regard to the use of phytotherapy (Monteiro et al., 2011a).

Ethnoveterinary knowledge is acquired by communities over many years and passed between generations through oral tradition. Today, with rapid cultural changes, this knowledge is being lost, necessitating its scientific documentation (Mathias, 2001). There have been many ethnoveterinary surveys from around the world regarding the use of plants in therapeutic protocols (McGaw and Eloff, 2008; Farooq et al., 2008; Benitez et al., 2012; Sharma et al., 2012). According to Barboza et al. (2007), in Brazil this type of study is still scarce, particularly in Amazonia. As one of the most biologically diverse regions of the planet, the

* Corresponding author. Tel.: +55 91 32265208; fax: +55 91 32105139.
E-mail addresses: vivinabm@gmail.com, vivinabm@hotmail.com (M.V.B. Monteiro).

0378-8741
http://dx.doi.org/10.1016/j.jep.2012.09.018

Amazon encompasses a large number of plants with medicinal properties and others whose therapeutic effects are still unknown (Pimentel, 1994). In addition to plant diversity, which is estimated at 25,000 to 30,000 endemic plant species (Cunningham, 1996), the Amazon is home to several cultures, including those of indigenous and quilombola peoples, and people with mixed ethnicities. The numerous possibilities arising from the interactions between the biome and various Amazonian cultures give this region a rich and complex knowledge of the therapeutic potential of the Brazilian flora (Rodrigues, 2006).

In this context, it is important to conduct studies that document the ethnoveterinary knowledge of Amazonian communities, as rapid urbanization, the dominance of allopathic medicine and the acculturation of the population may contribute to the disappearance of such knowledge. In addition, popular knowledge can provide important information for the selection of natural alternatives for treating animal diseases and contribute to the discovery of new drugs. Therefore, the purpose of this study was to document and analyze the ethnoveterinary knowledge of the inhabitants of Colares Island, Pará state, eastern Amazon.

2. Materials and methods

2.1. Study area

The town of Colares is located at latitude 00°55′38″ south and longitude 48°17′04″ west of Greenwich (Fig. 1) and is situated 100 km from Belém, the capital of the state of Pará, Brazil. Colares is an island of approximately 609.8 km^2 on the shores of the Marajó bay, in the Salgado region, separated by "Furo da Laura" and the Guajará-Mirim river (Lima da Silva et al., 2001).

The area has forest fragments, mangrove, secondary vegetation and flooded forests. Currently, the predominant type of vegetation is secondary forests, which is the result of severe deforestation for the cultivation of short-cycle agricultural species (Acevedo, 2004). The population of the municipality is estimated at 11,381 inhabitants, with approximately 67.83% (IBGE, 2010) distributed in 22 communities located in rural areas.

The economy of the municipality is predominantly based in governmental services, and agriculture accounts for 25% of the economic activity. Extractive activities are intensive, especially related to subsistence fishing and harvesting of açaí (*Euterpe oleracea*) and other native fruits. The health status of the municipality is revealed by the absence of hospitals. There are a total of 2.36 community health agents (CHA) per 1,000 inhabitants/year.

There are no stores that sell veterinary products or technical veterinary care in the municipality. The main species of domestically raised animals are dogs, cats, cattle, buffaloes, horses, pigs and poultry.

2.2. Data collection

Data collection was conducted from November 2011 to March 2012, and 20 rural communities and the town were visited. Before the fieldwork was conducted, a meeting was held with the Community Health Agents (CHAs) of the town of Colares to explain the objectives and work methodology. The CHAs are part of the National Family Health Program of the Brazilian Department of Health (Brasil, 2002) and are people chosen within the community to work with the population on individual, collective and environmental health maintenance. Furthermore, CHAs identify, in every sense, with their community, especially in terms of culture, language and customs (Silva and Dalmaso, 2002). Because they have direct and permanent contact with communities, CHAs were chosen to designate the first interviewees, who were required to have experience in animal breeding and use of medicinal plants. In the selection of interviewees, non-random sampling was used, using the snowball method (Albuquerque et al., 2008), after the initial contact with the community, the first interviewee is identified and suggests another one and so forth, until all the people with the desired knowledge are interviewed.

The interviews and application of semi-structured questionnaires only began after explaining the objectives of the study to the subjects and obtaining verbal consent and a signature of the informed consent form. The questionnaires were divided into three parts covering the following areas: (1) data on the personal characterization of the interviewed subject; (2) data on animal

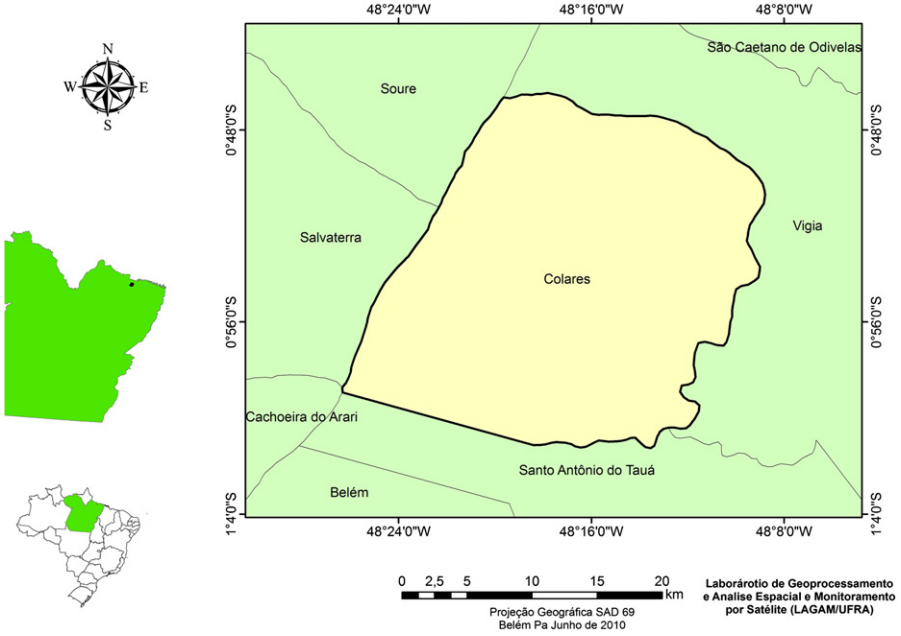

Fig. 1. The town of Colares is located at latitude 00°55′38″ south and longitude 48°17′04″ west of Greenwich and is situated 100 km from Belém, the capital of the state of Pará, Brazil.

breeding; and (3) data on the occurrence of diseases, diagnostic procedures and natural treatments for animals.

Samples of the plants with reported medicinal uses for animals were photographed, collected, herbalized and remitted to the herbarium of the eastern Amazon Brazilian Agricultural Research Corporation (Empresa Brasileira de Pesquisa Agropecuária—EMBRAPA) for storage and botanical identification by Silvane Tavares Rodrigues.

Data were tabulated in Microsoft Excel spreadsheets and analyzed using 2 quantitative ethnobotanical methods: informant consensus factor (ICF) and use value (UV).

To calculate the ICF, the cited species were grouped into six categories of medicinal uses based on the diseases reported by the respondents: antiparasitic, dermatological, gastrointestinal, anti-inflammatory, treatment of respiratory diseases and miscellaneous. The miscellaneous category included changes that were not well defined by the interviewees, such as weakness, eye problems, enhancing the sense of smell of hound dogs, use as a bat repellent and as protectors against evil eye (it is a look that is believed by many cultures to be able to cause injury or bad luck for people or animals to whom it is directed, for reasons of envy or dislike).

The IFC was calculated using the formula ICF = nur − nt/nur − 1, where nur represents the number of citations in each use category and nt represents the number of species cited (Sharma et al., 2012).

The UV was calculated using the formula proposed by Phillips and Gentry (1993). To calculate the use value of a species for an informant (UV_{is}), the formula $UV_{is} = \Sigma U_{si}/n_{is}$ was used, where U_{si} is the number of uses mentioned by the informant for the species and n_{is} is the number of interviews with the informant. For the present study, n_{is} was always 1 because there was only one interview per informant. Therefore, the UV_{is} value was always equal to the U_{si} value. To calculate the use value of each species (UV_s), the formula $UV_s = \Sigma UV_{si}/n$ was used, where UV_{si} equals the use value of a species for an informant and n is the total number of informants. The n value corresponds to the ns value identified by Phillips and Gentry (1993), given that all species can be cited by any informant.

The research was approved by the research ethics committee of the Federal University of Pará, obtaining a certificate of application for ethical review number 012.0073.073-11.

3. Results

A total of 72 interviews were conducted with 18 men and 54 women, aged 56.4 ± 14.9 and 57.9 ± 12.0 years (mean ± SD), respectively. Respondents reported 56 plants useful in ethnoveterinary treatments. This plants identified were distributed in 49 genera and 35 families. The majority of the cited species belong to the families Euphorbiaceae (5 species), Anacardiaceae and Arecaceae (4 species) and Bromeliaceae and Lamiaceae (3 species); the remaining families were represented by only one or two species. Thirty-eight percent of the species were trees, 36% were herbs, 22% were shrubs and 4% were lianas.

The species with greater use values were "tajá" (*Caladium* cf. *bicolor* (Aiton) Vent.) ($UV_s = 0.56$), "urucum" (*Bixa orellana* L.) ($UV_s = 0.43$), "andiroba" (*Carapa guianensis* Aubl.) ($UV_s = 0.37$), "pião-branco" (*Jatropha curcas* L.) ($UV_s = 0.36$) and "capim-marinho" (*Cymbopogon citratus* (DC.) Stapf) ($UV_s = 0.34$). Table 1 describes all of the plants listed with their respective indications, method of use and parts used to prepare the ethnoveterinary medicines. The plants reported by the interviewees were indicated for all domestic animals in the study area, but there was a predominance of indications for dogs and birds.

The plant parts most often used to prepare ethnoveterinary medications were the leaves (46%), bark (15%), roots (10%), fruit (10%), exudate (9%) and seeds (5%). The use of the entire plant, pods and flowers were reported less frequently The most widely used method for the preparation of ethnoveterinary medications was the macerated leaves (43%), tea (39%), followed by juice (18%) and poultice (15%), and the other forms were reportedly used less frequently. Topical use was reported as the main method of administering the medication. Some preparations are also administered orally, inhaled or seeds, leaves or fruit are burnt to create a smoke with medicinal properties.

In addition to medicinal plants, 49.3% (29/72) of the interviewees reported the use of animal products in ethnoveterinary treatments. The studied population mainly uses products of domestic animals for therapeutic purposes, such as pig lard (*Sus scrofa*) and chicken fat (*Gallus domesticus*). The use of fat from wild animals such as pacas (*Cuniculus* sp.), chameleons (*Iguana* sp.) and opossums (*Didelphis* sp.) was also reported less frequently. In general, the fat of these animals was used mainly as an anti-inflammatory and wound healing. The interviewees also reported the use of oil extracted from the electric eel (*Electrophorus* sp.) and from Sotalia dolphins (*Sotalia* sp.) for dermatological problems. In some instances, the animal products are used alone or in conjunction with medicinal plants or some products of mineral origin, such as salt, kerosene, cresol and gasoline.

Most preparations (87.3%) used a single plant, whereas in 12.7% of preparations, one or more medicinal plants were used. The doses were not standardized, and the duration of treatment was not well established. All interviewees reported that they administer the herbal preparation until they observe improvement of the animal.

The 56 plants identified were indicated for 23 different medicinal uses, grouped into six categories of use. The interviewees mentioned that the more observed symptoms in the animals were related to intestinal worms, diarrhea, scabies and wounds. The values for the informant consensus factor (ICF) are described in Table 2. The highest ICF values, 0.80 and 0.71, were obtained for antiparasitic (34 species and 169 reports of use) and gastrointestinal (21 species and 72 reports of use) uses, respectively. The lowest IFC value was obtained for the miscellaneous category (8 species and 14 reports of use).

4. Discussion

A major contribution to ethnoveterinary studies is to present a list of plant species with reports of medicinal uses by the communities. The information generated can be used for the conservation and sustainable use of local flora (Njoroge and Busssmann, 2006), documentation of traditional knowledge (Gradé et al., 2009) and use as a reference for scientific research on popular knowledge validation (Dilshad et al., 2008).

In Brazil, despite the great biological and cultural diversity, ethnoveterinary studies are scarce, especially in the Amazon, the planet's largest rainforest. In the Amazon biome, there has only been one study (Monteiro et al., 2011c), conducted at Ilha do Marajó, state of Pará, on the folk traditions of plant use to treat animal illnesses. This work prompted the in vitro scientific validation of the action of *Jatropha curcas* L., one of the plants with the highest use value for the studied population in Marajó Island (Monteiro et al., 2011b). The existence of plants with therapeutic potential that have yet to be studied would be one of the reasons to protect tropical forests, which are currently exposed to high rates of extinction of plant and animal species (Gurib-Fakim, 2006).

Table 1
Plant species used in ethnoveterinary medicine practiced in Colares, Pará, Brazil according to families, medical indication, plant parts used and method of use.

Scientific name, family, (voucher no.)	Local name	UV_{is}	UV_s	Medicinal indication	Animal species	Part used	Method of use
Alternanthera sp., Amaranthaceae, (187105)	Meracilina	3	0.04	Wound healing	Ca/Eq/Bo/Fe	L	Macerated leaves/ Poultice applied topically
Anacardium giganteum W. Hancock ex Engl., Anacardiaceae, (187760)	Caju-açu	2	0.02	Mange	Only Ca	B	Infusion with water (topically)
				Diarrhea		B	Tea
Anacardium occidentale L., Anacardiaceae, (187751)	Caju	7	0.09	Wound healing	Ca/Fe	B	Infusion with water
				Fly repellant	Ch	Fr	fruit burnt to create a smoke
				Vomit	Bu		Tea
				Diarrhea	Ca	BE	In milk or food
Annona mucosa Jacq., Annonaceae, (187767)	Biribá	2	0.02	Anthelmintic	Only Ca	E	In Milk, food or water
				Tick infestation		L	Poultice
Annona muricata L., Annonaceae, (187770)	Graviola	1	0.01	Snake bite	Ca/Eq/Bo/Fe	L	Macerated leaves
Astrocaryum vulgare Mart., Arecaceae, (187775)	Tucumã	1	0.01	Eye problems	Ca	Fr	Juice
Bactris gasipaes Kunth., Arecaceae, (187745)	Pupunha	4	0.05	Anthelmintic	Ca	L	Macerated leaves in water or food
Bixa orellana L., Bixaceae, (187746)	Urucum	31	0.43	Fowlpox	Ch	S	Seeds ground applied topically
				Mange	Ca	S	Seeds ground applied topically
				Alopecia	Ca	S	Seeds ground applied topically
Bromelia sp., Bromeliaceae, (187795)	Croatá	3	0.04	Mange	Ca	L	Macerated leaves applied topically
Ananas comosus (*L.*) Merr., Bromeliaceae, (187744)	Abacaxi	4	0.05	Anthelmintic	Ca	Fr	Juice
						L	Macerated leaves
Bromelia sp., Bromeliaceae, (184122)	Ananá	1	0.01	Anthelmintic	Ca	L	Macerated leaves
Caladium cf. bicolor (Aiton) Vent., Araceae, (187743)	Tajá	41	0.56	Myiasis	Ca	R	Poultice applied topically
Carapa guianensis Aubl., Meliaceae, (187748)	Andiroba	27	0.37	Mange	Ca	B/Fr	Infusion Water/Poultice (topically)
				Coryza of poultry	Ch	S	Oil from seeds in water
				Wound healing	Eq/Ca/Fe	S	Oil applied topically
				Anti-nflammatory	Eq/Ca/Fe	S	Oil pure for massage
				Cough	Ca	S	Oil pure with juice of *C. limon*
				Fowlpox	Ch	S	Oil pure applied topically
				Tick infestation	Ca	S	Oil pure applied topically
Carica papaya L., Caricaceae, (187766)	Mamão	8	0.11	Alopecia	Ca	L	Tea
				Anthelmintic	Ca/Eq/Bo/Fe	Fr	In food or water
						Fl/R	Tea
						S	Seeds powder in food
						E	In Milk, food or water
Chelonanthus alatus (Aubl.) Pulle., Gentianaceae, (187776)	Tabacurana	8	0.11	Tick infestation	Only Ca	L	Macerated leaves
				Mange		L	Macerated leaves
				Wound healing		L	Macerated leaves
Chenopodium ambrosioides L., Amaranthaceae, (187753)	Mastruz	14	0.19	Anthelmintic	Only Ca	L	Macerated leaves adding water
				Anti-inflammatory		L	Poultice for massage
				Colic		L	Tea
Cinnamomum verum J. Presl., Lauraceae, (187773)	Canela	3	0.04	Diarrhea	Only Ca	L	Tea
				Vomit		L	Tea
Citrus X aurantium L., Rutaceae, (187089)	Laranja da terra	11	0.15	Weakness	Only Ca	L	Tea
				Stench		Fr	Juice
				Alopecia		L/Fr	Tea/Juice applied topically
				Stimulant to improve the smell of dogs		Fr	Fruit burnt to create a smoke
				Myiasis		Fr	Juice applied topically
				Diarrhea		B	Tea
				Tick infestation		B	Tea applied topically
Citrus X limon (L.) Osbeck., Rutaceae, (187798)	Limão galego	15	0.20	Myiasis	Ca	Fr	Juice applied topically
				Coryza of poultry	Ch	Fr	Juice in water
				Tick infestation	Ca	Fr	Juice applied topically
				Wound healing	Ca	Fr	Juice applied topically
				Mange	Ca	Fr	Juice applied topically
Clibadium surinamense L., Asteraceae, (187771)	Cunambi	2	0.02	Anthelmintic	Only Ca	L	Tea
				Tick infestation		L	Macerated leaves applied topically
Clidemia capitellata (Bonpl.) D.Don., Melastomataceae, (187794)	Remela de cachorro	2	0.02	Wound healing	Only Ca	L	Poultice
				Mange		L	Poultice
Plectranthus sp., Lamiaceae, (187111)	Boldo	3	0.04	Colic	Ca	L	Tea
Croton cajucara Benth., Euphorbiaceae, (187113)	Sacaca	2	0.02	Colic	Only	L	Tea
				Wound healing	Ca	B	Bark powder applied topically
Cymbopogon citratus (DC.) Stapf., Poaceae, (187793)	Capim marinho	25	0.34	Colic	Ca	L/R	Tea
				Diarrhea	Ca/Fe	R/L	Tea/Macerated leaves
				Anthelmintic	Ca	L	Tea/Macerated leaves in water or food
				Vomit	Ca	L	Tea/Macerated leaves
Dalbergia monetaria L.f., Leguminosae-Pap., (187779)	Verônica	10	0.13	Diarrhea	Ca	B	Tea
				Wound healing	Ca	B	Bark powder applied topically
				Vomit	Ca/Bu	B	Infusion with water

Table 1 (*continued*)

Scientific name, family, (voucher no.)	Local name	UV_{is}	UV_s	Medicinal indication	Animal species	Part used	Method of use
Derris spruceana (Benth.) Ducke., Leguminosae-Pap., (187764)	Timbozinho	8	0.11	Mange	Only	R	Infusion with water
				Myiasis	Ca	R	Infusion with water
				Tick infestation		R/L	Infusion with water/Macerated leaves
Dieffenbachia seguine (Jacq.) Schott., Araceae, (187103)	Aninga	1	0.01	Myiasis	Ca	E	Applied topically
Eleutherine bulbosa (Mill.) Urb., Iridaceae, (187756)	Najazinho	14	0.19	Mange	Only Ca	R	Tea applied topically
				Diarrhea		L	Macerated leaves
				Colic		L	Macerated leaves
Endopleura uchi (*Huber*) *Cuatrec*., Humiriaceae, (187778)	Uchi	3	0.04	Diarrhea	Only Ca	B	Seed powder in water or food
				Wound healing		B	Tea applied topically
Cocos nucifera L., Arecaceae, (184129)	Coco	3	0.04	Eye problems	Only Ca	Fr	Oil passing the animal eye
				Anthelmintic		Fr	Milk from mature coconut
				Alopecia		Fr	Oil applied topically
Euphorbia prostrata Aiton., Euphorbiaceae, (187759)	Pirichi	1	0.01	Wound healing	Only Ca	L	Poultice applied topically
Euterpe oleracea Mart., Arecaceae, (187797)	Açaí	3	0.04	Diarrhea		R	Tea
				Vomit		R	Tea
Gossypium barbadense L., Malvaceae, (187755)	Algodão	3	0.04	Anthelmintic	Only Ca	L	Tea
				Colic		L	Macerated leaves
				Cough		L	Macerated leaves
Jatropha curcas L., Euphorbiaceae, (187750)	Pião branco	26	0.36	Colic	Ca	S	Seed powder in food or water
				Anthelmintic	Ca/Fe	L	Macerated leaves
				Diarrhea	Ca	L	Tea
				Wound healing	Ca/Fe	E	Poultice
				Cough	Ca	L	Tea
Jatropha gossypiifolia L., Euphorbiaceae, (187109)	Pião roxo	1	0.01	Alopecia	Ca	L	Tea applied topically
Kalanchoe pinnata (Lam.) Pers., Crassulaceae, (187758)	Pirarucu	8	0.11	Mange	Ca	L	Macerated leaves
				Tick infestation	Ca/Eq	L	Macerated leaves
				Wound healing	Ca	L	Macerated leaves
Lecythis pisonis Cambess., Lecythidaceae, (187774)	Sapucaia	2	0.02	Myiasis	Ca/Bu	L	Macerated leaves
				Mange	Ca	L	Macerated leaves
Libidibia ferrea (Mart. ex Tul.) L.P.Queiroz., Leguminosae-Caesalp., (187794)	Jucá	2	0.02	Wound healing	Ca	P/B	Infusion with water applied topically
Lippia alba (Mill.) N.E.Br., Verbenaceae, (187757)	Erva Cidreira	8	0.11	Anthelmintic	Only Ca	R	Tea
				Diarrhea		L	Tea
				Colic		L	Tea
Mangifera indica L., Anacardiaceae, (184111)	Manga	2	0.02	Vomit	Only Ca	B	Tea
				Wound healing		E	Applied topically
Manihot sp., Euphorbiaceae, (187762)	Maniva	14	0.19	Wound healing	Only Ca	R	Infusion with water
				Tick infestation		R	Infusion with water
				Anemia		R	Infusion with water
				Alopecia		R	Infusion with water applied topically
Mansoa alliacea (Lam.) A.H.Gentry., Bignoniaceae, (187094)	Cipó d'alho	5	0.06	Bat repellent	Ca/Ch/Su	L	Leaves burnt to create a smoke
				Weakness	Ca	L	Macerated leaves
Ocimum gratissimum L., Lamiaceae, (187749)	Alfavacão	4	0.05	Cough	Ca	L	Macerated leaves
				Fowlpox	Ch	L	Macerated leaves in water
				Coryza of poultry	Ch	L	Macerated leaves
				Eye problems	Ch	L	Macerated leaves
Ocimum minimum L., Lamiaceae, (187101)	Manjiricão	1	0.01	Coryza of poultry	Ch	L	Macerated leaves in water or food
Ouratea aquatica Engl., Ochnaceae, (187761)	Barbatimão	3	0.04	Mange	Ca	B	Infusion with water
				Anti-inflammatory	Ca	B	Tea
				Wound healing	Ca/Eq/Bo/Fe	B	Bark powder applied topically
Paspalum sp., Poaceae, (187796)	Grama	2	0.02	Diarrhea	Only Ca	L	Macerated leaves
				Vomit		L	Macerated leaves
Petiveria alliacea L., Phytolaccaceae, (187091)	Mucura caá	2	0.02	Evil eye	Only Ca	R	Infusion with water and passing in the animal to remove evil eye
				Fly repellant		R	Infusion with water applied topically
Piper callosum Ruiz & Pav., Piperaceae, (187772)	Elixir parigórico	3	0.04	Diarrhea	Only Ca	L	Tea
				Vomit		L	Tea
Polygala spectabilis DC., Polygalaceae, (187754)	Camembeca	3	0.04	Colic	Only Ca	L	Tea
				Anthelmintic		L	Tea
				Diarrhea		L	Macerated leaves in food
Portulaca pilosa L., Portulacaceae, (187763)	Amor crescido	6	0.08	Tick infestation	Only Ca	L	Macerated leaves applied topically
				Wound healing		L/EP	Poultice
				Anti-inflammatory		L/EP	Macerated leaves for massage
				Myiasis		L	Poultice
Psidium guineense Sw., Myrtaceae, (187769)	Goiaba	2	0.02	Diarrhea	Only Ca	B	Tea
				Wound healing		B	Infusion with water applied topically
Quassia amara L., Simaroubaceae, (187768)	Quina	4	0.05	Tick infestation	Only Ca	L	Macerated leaves applied topically
				Anthelmintic		L	Tea

Table 1 (*continued*)

Scientific name, family, (voucher no.)	Local name	UV_{is}	UV_s	Medicinal indication	Animal species	Part used	Method of use
Sambucus nigra L., Adoxaceae, (187097)	Sabugueiro	1	0.01	Coryza of poultry	Ch	L	Macerated leaves in water
Spondias mombin L., Anacardiaceae, (187792)	Taperebá	2	0.02	Wound healing	Ca	B	Bark powder applied topically
Tithonia diversifolia (Hemsl.) A. Gray., Asteraceae, (187747)	Girassol	1	0.01	Mange	Ca	L	Macerated leaves applied topically
Vismia guianensis (Aubl.) Choisy., Hypericaceae, (187777)	Lacre	1	0.01	Wound healing	Ca	B	Infusion with water applied topically

L—leaves, B—bark, R—root, E—exudate, S—seeds, P—pod, Fr—fruit, Fl—flower, EP—entire plant. Ca- canine, Fe- feline, Ch- Chicken, Bo- bovine, Eq- equine, Bu- buffalo.
UV_{is}—use value of one species for one informant
UV_s—use value of each species

Table 2
Medicinal use categories and informant consensus factors (ICFs).

Medicinal use categories	Species	Number of citations	ICF
Antiparasitic	34	169	0.80
Dermatologic	26	68	0.62
Anti-inflammatory	4	9	0.62
Gastrointestinal	21	72	0.71
Treatment of respiratory diseases	8	20	0.63
Miscellaneous	8	14	0.46

At Colares Island, the most highly cited species were members of the Euphorbiaceae family. This family is also the most reported in ethnoveterinary (Viu and Viu, 2011; Monteiro et al., 2011c) and ethnobotanical surveys (Rodrigues, 2006; Monteles and Pinheiro, 2007) conducted in other regions of Brazil and in countries such as Ethiopia (Mesfin et al., 2009) and Tanzania (Moshi et al., 2012). The Euphorbiaceae family was likely the most frequently cited as having medicinal properties because it is widely distributed in the West Indies and in South America (Webster, 1994).

To identify the most important use categories for the population studied, the informant consensus factor (ICF) was calculated, and antiparasitic (0.80) and gastrointestinal categories (0.71) exhibited the highest values. According to Sharma et al. (2012), the ICF are low (near zero) when the plants are randomly chosen or when the informants do not exchange information about their use. High ICF values (close to one) are obtained when the selection criteria are well defined and the usage information is shared among informants.

The main conditions included in the categories with higher ICF values were worms, myiasis, diarrhea, vomiting, scabies and other ectoparasite infestations. These types of illnesses and clinical signs are common in domestic animals and are more easily identified by the interviewees, which may explain why these categories exhibited the largest ICF values. In most of the ethnoveterinary surveys, the main indications for the use of medicinal plants involve less severe diseases/injuries (Alawa et al., 2002; Tabuti et al., 2003). In these cases, ethnoveterinary can be an effective and low cost alternative to treat animals (Mathias, 2001).

The use value (UV) is a quantitative method that demonstrates the relative importance of species and/or plant family for a population (Vendruscolo and Mentz, 2006). This index was calculated to establish a relationship between each species and the uses assigned to it by analyzing the index in relation to the use categories. The five species with highest UV (*Caladium bicolor* (Aiton) Vent., *Bixa orellana*, *Carapa guianensis* Aubl., *Jatropha curcas* and *Cymbopogon citratus*) were indicated for the treatment of diseases and/or clinical signs of the category with highest ICF. This finding reinforces the idea that these species are the most important for the population studied and that the informants share knowledge about practices and plants used in ethnoveterinary practice at Colares Island.

For species with higher UV reported in this work there are already scientific reports on phytochemical composition and pharmacological activities. Chemical compounds in *J. curcas* seeds include tannins, catechins and triterpenes, these secondary metabolites are implicated in anthelmintic activity on *Haemonchus contortus* (Monteiro et al., 2011b). The *C. guianensis* oil and its limonoid-rich fraction showed antiplasmodial activity (Miranda Júnior et al., 2012). According to Penido et al. (2006), tetranortriterpenoids isolated from *C. guianensis* present antiinflammatory effect. The ethanolic extracts of seeds of *B. orellana* showed antimicrobial (Fleischer et al., 2003) activity, phytochemical investigations have revealed the presence of fixed oil, reducing sugars, saponins and flavonoids. The polyphenols of leaves from *C. citratus* have shown antiinflamamatory activity (Figueirinha et al., 2010). Despite reports of toxicity, the *C. bicolor* is used in ethnomedicine for treating bruise, sores and wounds (Ajibesin et al., 2008), as the predominant constituents in the specie are saponins and oxalates (Santos, 2011).

Most ethnoveterinary medications used only one medicinal plant. The use of two or more plants reflects the idea of synergy, where the association of plants can result in increased therapeutic efficacy (Giday et al., 2007). The use of leaves, bark and roots were the most frequently reported plant parts used; these results are similar to those obtained by Monteiro et al. (2011c) in a survey also conducted in eastern Amazon.

All informants did not report standardized dosing, method of use or treatment duration. This finding was also observed in other ethnoveterinary surveys (Hussain et al., 2008; Giday et al., 2009; Monteiro et al., 2011c). The lack of precision is common in ethnoveterinary medicine (McCorkle, 1986; Mathias, 2001) and is the main reason for skepticism by veterinarians using allopathic veterinary medicine (Farooq et al., 2008).

The interviewees also cited the use of products derived from domestic and wild animals. This practice is common in the traditional medicine of several countries and is called zootherapy (Alves and Rosa, 2005). In the Amazon region, there are reports of the use of animal products for the treatment of diseases in humans (Luz, 2001; Pinto and Maduro, 2003; Rodrigues, 2006; Ribeiro et al., 2007) and, more recently, in animals (Monteiro et al., 2011c).

5. Conclusions

The inhabitants of Colares, in the state of Pará, eastern Amazon of Brazil, use medicinal plants to treat the illnesses of their domestic animals. The present study contributes to the creation of an inventory of plants used in ethnoveterinary practices that

can serve as a database for future work or scientific validation. The scientific confirmation of the pharmacological properties of plants and of clinical efficacy and toxicity by the veterinarian can subsidize the development of new, low-cost drugs that are environmentally friendly, safe and effective for treating animals.

Acknowledgments

Thanks to the Community Health Agents of Colares and all informants who contributed their valuable knowledge; to the City Council of Colares for logistical support; to the Federal Rural University of the Amazon (Universidade Federal Rural da Amazônia—UFRA) and the Federal University of Pará (Universidade Federal do Pará—UFPA) for logistical support and the Scientific Initiation grant; to the Brazilian Federal Agency for the Support and Evaluation of Graduate Education (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior—CAPES) for providing a scholarship (CAPES-REUNI); and to the New Frontiers National Program of Academic Cooperation (Edictal PROCAD-NF, No 21/2009) for financial support.

References

Acevedo, M.R.E., 2004. Julgados da terra. Cadeia de apropriação e atores sociais em conflito na Ilha de Colares, Pará. Editora Universitária, Belém.

Ajibesin, K.K., Ekpo, B.A., Bala, D.N., Essien, E.E., Adesanya, S.A., 2008. Ethnobotanical survey of Akwa Ibom State of Nigeria. Journal of Ethnoparmacology 115, 387–408.

Alawa, J.P., Jokthan, G.E., Akut, K., 2002. Ethnoveterinary medical practice for ruminants in the subhumid zone of northern Nigéria. Preventive Veterinary Medicine 54, 79–90.

Albuquerque, U.P., Lucena, R.F.P., Cunha, L.V.F.C., 2008. Métodos e técnicas na pesquisa etnobotânica, segunda ed. Comunigraf, Recife.

Alves, R.R.N., Rosa, I.L., 2005. Why study the use of animal products in traditional medicines? Journal of Ethnobiology and Ethnomedicine 1, 1–5.

Barboza, R.R.D., Souto, W.M.S., Mourão, J.S., 2007. The use of zootherapeutics in folk veterinary medicine in the district of Cubati, Paraíba State, Brazil. Journal of Ethnobiology and Ethnomedicine 3, 1–14.

Benitez, G., González-Tejero, M.R., Molero-Mesa, J., 2012. Knowledge of ethnoveterinary medicine in the Province of Granada, Andalusia, Spain. Journal of Ethnopharmacology 139, 429–439.

Brasil, 2002. Modalidade de Contratação de Agentes Comunitários de Saúde—Um pacto tripartite. Secretaria de Políticas de Saúde. Departamento de Atenção Básica, Ministério da Saúde, Brasília.

Cunningham, A.B., 1996. Professional ethics and ethnobotanical research In: Alexiades, M.N. (Ed.), Selected Guidelines for Ethnobotanical Research: A Field Manual. The New York Botanical Garden, New York, pp. 19–51.

Dilshad, S.M.R., Ur-Rehman, N., Iqbal, Z., Muhammad, G., Iqbal, A., Ahmed, N., 2008. An inventory of the ethnoveterinary practices for reproductive disorders in cattle and buffaloes, Sargodha district of Pakistan. Journal of Ethnopharmacology 117, 393–402.

Farooq, Z., Iqbal, Z., Mushtaq, S., Muhammad, G., Iqbal, M.Z., Arshad, M., 2008. Ethnoveterinary practices for the treatment of parasitic diseases in livestock in Cholistan desert (Pakistan). Journal of Ethnopharmacology 118, 213–219.

Figueirinha, A., Cruz, M.T., Francisco, V., Lopes, M.C., Batista, M.T., 2010. Anti-inlammatory activity of *Cymbopongo citratus* Leaf infusion in lipopolysaccharide-stimulated dentritic cells: contribuition of the polyphenols. Journal of Medicinal Food 13, 681–690.

Fleischer, T.C., Ameade, E.P.K., Mensah, M.L.K., Sawer, I.K., 2003. Antimicrobial activity of the leaves and seeds of *Bixa Orellana*. Fitoterapia 74, 136–138.

Giday, M., Asfaw, Z., Woldu, Z., 2009. Medicinal plants of the Meinit ethnic group of Ethiopia: an ethnobotanical study. Journal of Ethnopharmacology 124, 513–521.

Giday, M., Teklehaymanot, T., Animut, A., Mekonnen, Y., 2007. Medicinal plants of the Shinasha, Agew-awi and Amhara peoples in northwest Ethiopia. Journal of Ethnopharmacology 110, 516–525.

Gradé, J.T., Tabuti John, R.S., Van Damme, P., 2009. Ethnoveterinary knowledge in pastoral Karamoja, Uganda. Journal of Ethnopharmacology 122, 273–293.

Gurib-Fakim, A., 2006. Medicinal plants: traditions of yesterday and drugs of tomorrow. Molecular Aspects of Medicine 27, 1–93.

Hussain, A., Khan, M.N., Iqbal, Z., Sajid, M.S., 2008. An account of the botanical anthelmintics used in traditional veterinary practices in Sahiwal district of Punjab, Pakistan. Journal of Ethnopharmacology 119, 185–190.

IBGE, 2010. Sinopse do Censo Demográfico 2010, Pará. 〈http://www.censo2010.ibge.gov.br/sinopse/index.php?uf=15&dados=1〉.

Lima da Silva, J.M., Gama, J.R.N.F., Rodrigues, T.E., Valente, M.A., Santos, P.L., Lobo, W.T., 2001. Zoneamento agroecológico do município de Colares, estado do Pará. Embrapa Amazônia Oriental, Belém.

Luz, F.J.F., 2001. Plantas medicinais de uso popular em Boa Vista, Roraima, Brasil. Horticultura Brasileira 19, 88–89.

Mathias, E., 2001. Introducing ethnoveterinary medicine. Bergisch Gladbach, Germany, Source.

McCorkle, C.M., 1986. An introduction to ethnoveterinary research and development. Journal of Ethnobiology 6, 129–149.

McGaw, L.J., Eloff, J.N., 2008. Ethnoveterinary use of southern African plants and scientific evaluation of their medicinal properties. Journal of Ethnopharmacology 119, 559–574.

Mesfin, F., Demissew, S., Teklehaymanot, T., 2009. An ethnobotanical study of medicinal plants in Wonago Woreda, SNNPR, Ethiopia. Journal of Ethnobiology and Ethnomedicine 5, 1–18.

Miranda Júnior, R.N.C., Dolabela, M.F., Silva, M.N., Póvoa, M.M., Maia, J.G.S., 2012. Antiplasmodial activity of the andiroba (*Carapa guianensis* Aubl., Meliaceae) oil and its limonoid-rich fraction. Journal of Ethnopharmacology 142, 679–683.

Monteiro, M.V.B., Bevilaqua, C.M.L., Camurça-Vasconcelos, A.L.F., 2011a. Metodologia aplicada a levantamentos etnoveterinários. Veterinária em Foco 9, 76–87.

Monteiro, M.V.B., Bevilaqua, C.M.L., Morais, S.M., Machado, L.K.A., Camurça-Vasconcelos, A.L.F., Campello, C.C., Ribeiro, W.L.C., Mesquita, M.A., 2011b. Anthelmintic activity of *Jatropha curcas* L. seeds on *Haemonchus contortus*. Veterinary Parasitology 182, 259–263.

Monteiro, M.V.B., Bevilaqua, C.M.L., Palha, M.D.C., Braga, R.R., Schwanke, K., Rodrigues, S.T., Lameira, O.A., 2011c. Ethnoveterinary knowledge of the inhabitants of Marajó Island, Eastern Amazonia, Brazil. Acta Amazonica 41, 233–242.

Monteles, R., Pinheiro, C.U.B., 2007. Plantas medicinais em um quilombo maranhense: uma perspectiva etnobotânica. Revista de Biologia e Ciências da Terra 7, 38–48.

Moshi, M.J., Otieno, D.F., Weisheit, A., 2012. Ethnomedicine of the Kagera Region, north western Tanzania. Part 3: plants used in traditional medicine in Kikuku village, Muleba District. Journal of Ethnobiology and Ethnomedicine 8, 2–11.

Njoroge, G.N., Busssmann, R.W., 2006. Herbal usage and informant consensus in ethnoveterinary management of cattle diseases among the Kikuyus (Central Kenya). Journal of Ethnopharmacology 108, 332–339.

Penido, C., Conte, F.P., Chagas, M.S.S., Rodrigues, C.A.B., Pereira, J.F.G., Henriques, M.G.M.O., 2006. Antiinflammatory effects of natural tetranortriterpenoids isolated from *Carapa guianensis* Aublet on zymosan-induced arthritis in mice. Inflammation Research 55, 457–464.

Phillips, O., Gentry, A.H., 1993. The useful plants of Tambopata, Peru: I. Statistical Hypotheses tests with a new quantitative technique. Economic Botany 47, 15–32.

Pimentel, A.A.M.P., 1994. Cultivo de Plantas Medicinais na Amazônia. Faculdade de Ciências Agrárias do Pará, Belém.

Pinto, A.A.C., Maduro, C.B., 2003. Produtos e subprodutos da medicina popular comercializados na cidade de Boa Vista, Roraima. Acta Amazonica 33, 281–290.

Ribeiro, A.S.S., Palha, M.D.C., Tourinho, M.M., Whiteman, C.W., Silva, A.S.L., 2007. Utilização dos recursos naturais por comunidades humanas do Parque Ecoturístico do Guamá, Belém, Pará. Acta Amazonica 37, 235–240.

Rodrigues, E., 2006. Plants and animals utilized as medicines in the Jaú National Park (JNP), Brazilian Amazon. Phytotherapy Research 20, 378–391.

Santos, A.P.B., 2011. A Beleza, a Popularidade, a Toxicidade e a Importância Econômica de Espécies de Aráceas. Revista Virtual de Química 3, 181–195.

Sharma, R., Manhas, R.K., Magotra, R., 2012. Ethnoveterinary remedies of diseaes among milk yielding animals in Kathua, Jammu and Kashmir, India. Journal of Ethnopharmacology 141, 265–272.

Silva, J.A., Dalmaso, A.S.W., 2002. O agente comunitário de saúde e suas atribuições: os desafios para os processos de formação de recursos humanos em saúde. Interface—Comunicação, Saúde, Educação 6, 75–96.

Tabuti, J.R.S., Dhillion, S.S., Lye, K.A., 2003. Ethnoveterinary medicines for cattle (*Bos indicus*) in Bulamogi county, Uganda: plant species and mode of use. Journal of Ethnopharmacology 88, 279–286.

Vendruscolo, G.S., Mentz, L.A., 2006. Estudo da concordância das citações de uso e importância das espécies e famílias utilizadas como medicinais pela comunidade do bairro Ponta Grossa, Porto Alegre, RS, Brasil. Acta Botanica Brasilica 2, 367–382.

Viu, A.F.M., Viu, M.A.O., 2011. Cerrado e etnoveterinária: o que se sabe em Jataí—GO? Revista Brasileira de Agroecologia 6, 49–61.

Webster, G.L., 1994. Synopsis of the genera and suprageneric taxa of Euphorbiaceae. Annals of Missouri Botanical Garden 81, 33–144.