Ethnoveterinary Knowledge and Practice Applied to Domestic Animals Raised in the Ukraine Colonization Community of Palmital, Paraná State, Brazil

Sarita Teresinha Burei[1], Diógenes Adriano Duarte Santana[1], Bruna Broch Lopez[1], Cristina Santos Sotomaior[1], Luiz Antônio Acra[1], Saulo Henrique Weber[1], and Rüdiger Daniel Ollhoff[1] (ORCID)

[1] School of Life Sciences, Pontifícia Universidade Católica do Paraná (PUCPR), Curitiba, Paraná, Brazil

*Corresponding author; e-mail: daniel.ollhoff@pucpr.br

Animals Raised in the Ukraine Colonization Community of Palmital, Paraná State, Brazil. Although Brazil is one of the world's major cattle producers and has rich social, ethnic, and biological diversity, ethnoveterinary studies are rare in Southern Brazil. Knowledge of plant use by farmers in the rural areas of the Ukrainian colony of Palmital, southern Brazil, can contribute to understanding the relationships among plants, smallholder farmers, and their livestock. Semi–structured interviews were conducted with non–random sampling following the "snowball" method. The information collected included local plant names, plant parts used, mode of preparation, route of administration, domestic animal species, and diseases requiring treatment. The informants were encouraged to show the plants, which were collected, identified, and stored. The informant consensus factor (ICF) and the use value (UV) were calculated. Thirty women and 20 men reported a total of 45 native and introduced plant species belonging to 29 families that are used for ethnoveterinary practices, mostly for cattle and goats, with the highest ICF for mastitis and antiparasitic treatments. Cattle are the most important livestock species bred in the community; therefore, most plant treatments were for cattle health problems. Similar studies on European immigrant communities in Brazil are lacking and could be a valuable source of information about how immigrant culture translate into local knowledge of veterinary medicinal plants.

Key Words: Ethnoveterinary medicine, Medicinal plants, Livestock diseases, Cattle, European American traditional knowledge, Ethnobotany

Introduction

Ethnoveterinary medicine is practiced to maintain health or treat domestic animal illnesses in different regions of the world, such as Benin (Dassou et al. 2020), Brazil (Barboza et al. 2007; Monteiro et al. 2011; Ritter et al. 2012; Souto et al. 2012; Stein et al. 2005), Ethiopia (Feyera et al. 2017; Teklehaymanot et al. 2007), India (Balaji and Chakravarthi 2010; Sharma et al. 2012; Verma 2014), Kenya (Njoroge and Bussmann 2006), Nepal (Rokaya et al. 2010), Nigeria (Alawa et al. 2002), South Africa (McGaw et al. 2020), Spain (Benítez et al. 2012), Switzerland (Mayer et al. 2017; Stucki et al. 2019), Trinidad and Tobago (Lans and Brown 1998), Pakistan (Dilshad et al. 2008), and Uganda (Tabuti et al. 2003). Regarding the targeted animal species, specifically for pastoral people, ruminants are highly valued and

are therefore more often medicated in countries where ruminants still are free–range herded (Alawa et al. 2002; Harun et al. 2017; Lans and Brown 1998; Maphosa and Masika 2010; Mthi et al. 2018; Syakalima et al. 2018).

Globally, ethnoveterinary knowledge has developed over centuries in different communities, and because lifestyles and animal breeding introduce changes and commercial drugs are becoming more available even in the most remote rural areas (Mathias 2007), this ethnoveterinary knowledge could disappear before becoming fully understood. In rural areas, ethnoveterinary medicine is often the only option because state–of–the–art treatments are expensive or require monitoring and administration by a veterinarian (Campos and Itaya 2016; Ghafar et al. 2020). Local knowledge, use, and practice do not remain unaltered with the arrival of another cultural group or technology (Doane 1999). Additionally, ethnoveterinary medicinal knowledge is not immutable, although it is anchored by traditions that evolved over centuries through the blend of different cultures (Mayer et al. 2017; Stucki et al. 2019). This mutual sharing of knowledge was described by Kujawska et al. (2017) as an intercultural interaction.

Brazil is one of the most biodiverse countries in the world (Giulietti et al. 2005), and there have been many studies of native plants in the Amazon and northeastern regions (Barboza et al. 2007; Monteiro et al. 2011; Ritter et al. 2012). However, in many areas of Brazil, particularly in the southern regions of the country, colonization has transformed traditional knowledge (Ludwinsky et al. 2020). This intercultural interaction, together with widespread animal husbandry, results in a promising foundation for studies in ethnoveterinary science. Therefore, this study adopted the general plant use value hypothesis of Phillips and Gentry (1993a, b) and determined the types and uses of plants by smallholder farmers that evolved in a Ukrainian immigrant settlement in southern Brazil. We hypothesize that these Eastern European immigrants, because of their relative cultural isolation, would use mainly European plants for their ethnoveterinary practices.

Methods

STUDY TERRITORY

The municipality of Palmital has a territory of 817 km^2 with 14,329 inhabitants (IBGE 2010). It is situated in the central west region of Paraná State in South Brazil. The municipal center is located at latitude 24° 53' 35" S and longitude 52° 12' 10" W, with an average altitude of 840 m above sea level. Farmers of 11 rural communities (Barra Grande, Divisor dos Antunes, Sanga Funda, Linha Cantuana, Duas Casas, Guaraipo, Vila Burei, Linha Nova, Passo do Xaxim, Palmitalzinho, and Linha São Paulo) were interviewed between November 2011 and January 2012 (Fig. 1). The communities are in an ecotone between the araucaria forest (mixed ombrophilous forest) and the subtropical forest (seasonal semideciduous forest) with a climate characterized as "Cfa" according to the Köppen system, a subtropical temperate area with average temperatures above 22°C in the warmest month and below 18°C in the coldest month, with no dry season and few frosts (Wrege et al. 2012). The territory was colonized by Ukrainian (Ruthenian) immigrants between the late 19th century and the early 20th century, who occupied areas formerly controlled by native Guarani Indigenous Peoples (Guérios 2013).

DATA COLLECTION

One of the authors (STB) is from the Ukrainian community, which facilitated the first contact and authorizations. This study was conducted in accordance with guidelines developed by the National Health Counsel by means of the Research Ethics Committee (Resolution 196/96), and the protocol was approved by the committee (CAAE 00517312.0.0000.0020). Semi–structured interviews were applied with a non–random sampling of residents (hereafter "informants") using the "snowball" method (Albuquerque et al. 2014). All informants had experience in animal husbandry. The interviews were based on a questionnaire with 17 open and closed questions in Portuguese, and only began once the objectives of the study had been explained and informant approval was
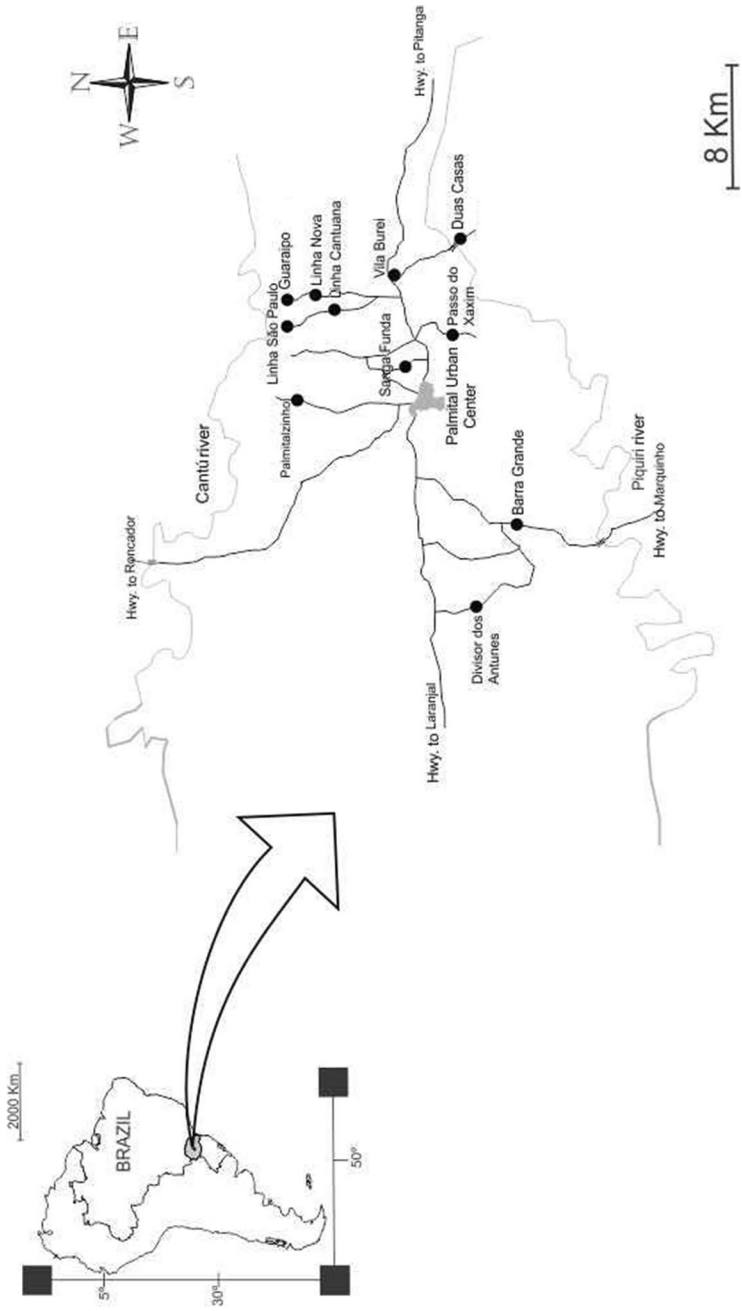
Fig. 1. Map of the 11 communities (Barra Grande, Divisor dos Antunes, Sanga Funda, Linha Cantuana, Duas Casas, Guaraipo, Vila Burei, Linha Nova, Passo do Xaxim, Palmitalzinho, Linha São Paulo) located in the municipality of Palmital, Paraná state, South Brazil.

received. The questionnaire was focused on the livestock bred by the informant, the informant's knowledge of medicinal plants, the plant parts used, processing of plant material, livestock diseases and symptoms that were treated, any side effects observed, disease diagnosis in the community, knowledge origins, and the reasons for using medicinal plants in the community. The informants were encouraged to show the plants used, and these were then photographed and specimens were collected to identify the family, genus, and species. Specimens were deposited in the HUCP herbarium at the Pontifical Catholic University of Paraná, Curitiba, for storage.

Data Analysis

Data were tabulated using spreadsheets and analyzed using the following ethnobotanical methods: the informant consensus factor (ICF) and use value (UV) (Trotter and Logan 1986). The ICF was calculated using the formula ICF $= (N_{ur} - N_t/(Nur - 1)$, where "$N_{ur}$" is the number of use reports cited by each informant for the particular medicinal plant, and "N_t" is the total number of informants interviewed that mentioned the specific medicinal plant (Jan et al. 2020; Trotter and Logan 1986). The UV was calculated using the formula, $UV = U_i/N_i$ where "U_i" is the number of use reports cited by each informant for the particular medicinal plant, and "N_i" is the total number of informants interviewed that mentioned the specific medicinal plant (Amorim et al. 2019; Jan et al. 2020). Students' t–test evaluated differences in knowledge between genders ($p < 0.05$).

Results

Informants

After obtaining their informed consent, 50 interviews were conducted with 20 male and 30 female residents of 11 localities in the rural area of Palmital. The arithmetic average age of informants was 49 (min. 29 – max. 83) years old. Of these, 36 (72%) used medicinal plants for the treatment of animal health problems and to treat their own human diseases, with no distinction between human and animal, and the remaining 14 informants (28%) claimed to have no knowledge about medicinal plants. All informants who knew medicinal plants used them. Women reported using a higher number of plant species than men did ($p <0.001$).

Most frequently (66%), disease diagnosis was made by the owner of the farm, who indicated that knowledge about diseases and the knowledge of medicinal plants had been learned through oral communication from relatives (50%), traditionally passed down from ancestors; i.e., mother, grandmother (22.2%), or from neighbors, books, or other means of information (27.8%). In serious cases, or if the medications used did not have a satisfactory effect, a veterinarian was called to the farm.

Informant Consensus Factor (ICF) of Animal Diseases

Among all animals included in the study, cattle and goats were responsible for most cases of medicinal plant use, 91.7% and 2.8%, respectively. The combined use of medicinal plants in horses, fowl, and swine represented the rest (5.6%). The specific diseases, as defined by veterinarians, that were treated were not always identified or provided by the informants, but sometimes deduced by an experienced veterinarian using the description of the symptoms. As cattle were predominant, we used this species for further calculations (ICF and UV).

In total, 12 veterinary use categories were identified as being treated with medicinal plants: antibiotic, anti–inflammatory, mastitis, antiparasitic, antitoxin, constipation, dyspepsia, insect repellent, intestinal diseases, retained placenta, skin injury, and warts (Table 1).

Characteristics of Ethnoveterinary Uses of Medicinal Plants and Their Use Value (UV)

A total of 45 plant species belonging to 29 families were used in the region for ethnoveterinary practices (see Electronic Supplementary Material—ESM). The families Asteraceae (eight species) and Lamiaceae (five species)

TABLE 1. VETERINARY USES OF MEDICINAL PLANTS IN DOMESTIC ANIMALS OF FARMERS ($N = 50$) FROM THE MUNICIPALITY OF PALMITAL, PARANÁ, BRAZIL, AND THEIR INFORMANT CONSENSUS FACTORS (ICF).

Veterinary uses	Use report	Plant species per category	ICF
Antibiotic	1	1	0.00
Anti–inflammatory	2	2	0.00
Mastitis	27	10	0.65
Antiparasitic	17	5	0.75
Antitoxin	3	3	0.00
Constipation	1	1	0.00
Dyspepsia	1	1	0.00
Insect repellent	17	7	0.63
Intestinal diseases	7	7	0.00
Retained placenta	8	6	0.29
Skin injury	20	10	0.53
Warts	2	2	0.00

were the most representative. Other important families were Malvaceae, Rutaceae, Fabaceae, and Myrtaceae, with two species each. The most mentioned species during the interviews were *Allium ampeloprasum* L., *Ilex paraguariensis* A. St.–Hil., and *Urera baccifera* (L.) Gaudich. ex Wedd., with 11, 8, and 7 mentions, respectively.

Over half of the informants (58%) used these plants in ethnoveterinary practices together with other products, such as salt, alcohol, soy oil, animal fat, beeswax, cachaça (sugarcane liquor), vinegar, and coffee powder. Salt was the most frequently used, added to macerated plant material (24%), or to an infusion of the plant (12%). Water was the main vehicle, mentioned 52% of the time in the preparation of medicinal plants.

All parts of the plant were used to prepare veterinary ointments. Most commonly, leaves (75.5%), followed by roots (14.2%), bulbs (9.4%), stems (4.7%), bark (2.8%), seeds (2.8%), fruits (1.9%), and flowers (1.9%). In 26% of the uses, two different parts, leaves and roots, were prepared as infusions and used as insect repellents for cattle. Routinely, these preparations were applied externally (61.6%) and administered orally less often (38.4%). The plants were used as infusions (57%), ointments (20%), macerated (13%), *in natura* (4%), toasted (3%), fried (2%), and dehydrated (1%).

For nearly half of the informants (46%), medicinal plants were used only on their domestic animals, with 20% of informants also using them to treat human diseases. The majority of these plants grow on the farm; some are spontaneous in different types of environments, such as roadsides, along streams, lawns, abandoned pastures, and are predominantly herbaceous plants (33%), trees (26%), and shrubs (21%). Of the 45 identified species, 55.6% were of exotic origin, and 44.4% were native plants. When assessing the form of use, 77.06% of the plants mentioned were used immediately after harvest. Twenty–eight informants reported that harvesting occurred year–round for 21 plant species.

The informants were asked to declare their motivation for ethnoveterinary practices. The results showed that 42% of them wanted to help their sick animal, and while 26% declared that medicinal plants were better than commercial veterinary medicines, such medicines were not available for 14% of informants. Medicinal plants were considered cheaper (24%) than commercial veterinary medicine. Doses were not standardized, and treatment was continued until the clinical signs decreased. The UV was generally low, with the highest value reaching 0.22 for *Allium ampeloprasum,* followed by two native species, *Ilex paraguariensis* and *Urera baccifera*, with scores of 0.16 and 0.14, respectively) (ESM).

Discussion

TRADITIONAL ETHNOVETERINARY KNOWLEDGE

Medicinal plants are traditionally used by different societies to treat human and animal health problems (Dassou et al. 2020; Lans and Brown 1998). Brazil is a country that has received immigrants from all over the world during the last 500 years (Amaral and Fusco 2005). Although Brazil ranks as one of the most diverse countries in the world, from biodiversity to ethnic composition, previous Brazilian ethnoveterinary studies that focused on plants (Ritter et al. 2012; Stein et al. 2005) and their traditional uses (Barboza et al. 2007) did not attempt to verify how much of this knowledge was passed on by ancestors from a

specific immigrant background, or how much was passed on by the native indigenous population to the newcomer. The possibility of a trial–and–error self–made learning process seems unlikely in the specific community of Ukrainian origin because of the relatively recent immigration (Guérios 2013).

Ethnoveterinary knowledge is commonly transmitted by oral tradition, as seen by Monteiro et al. (2011) in Brazil, Benítez et al. (2012) in Spain, and Verma (2014) in India. Despite cultural and language barriers, being located within a common political border might have facilitated the adoption of ethnoveterinary practices using local native plants, supposed to be known only to natives. Political separation influences ethnoveterinary practices (Sõukand and Pieroni 2016), which did not play a role in the present study. The fact that there was an important learning process was supported by the proportions of non–Brazilian, exotic (55.6%), and native plants (44.4%) used by the community.

As verified by Sharma et al. (2012), Palmital ethnoveterinary practices were also applied mostly by women, which are mainly involved in animal husbandry. The milk industry, as a primary production sector, predominantly employs women in Paraná, while farm management is dominated by men (93%) (IPARDES 2009). Cattle husbandry accounts for 45% of the local economy. Begossi et al. (2002) stated that women have a more profound knowledge of medicinal plants, but men know more species. Women were often more familiar with the act of identifying, naming, and describing the use of plant species in their environment, and assume the role of disseminating knowledge and the use of plant resources (Pfeiffer and Butz 2005; Voeks 2007). Other studies also showed that women are more specialized in medicinal plant use than men (Guimarães 2016; Kainer and Duryea 1992; Milliken and Albert 1997), but this might depend on the social environment; for example, in Ethiopia, men dominate traditional medicine practice (Feyera et al. 2017). Traditional knowledge relies on older, more experienced people in the community, as found in other Brazilian studies (Amorim et al. 2019; Barboza et al. 2007; Monteiro et al. 2011).

To our knowledge, this study is the first to document the traditional veterinary medicinal plant knowledge of an Eastern European immigrant group in Brazil. The results will allow a future comparison of the data with the literature on the place of origin (Ukraine) as done by Stucki et al. (2019) for Swiss ethnoveterinary practices. In addition, this knowledge is under threat due to the extinction of smallholder farmers, lifestyle changes, and the advance of commercial drugs (Mathias 2007).

PLANTS USED TO TREAT ANIMAL HEALTH PROBLEMS

The Asteraceae and Lamiaceae families represented the highest number of plants reported in this study, which is consistent with previous studies (Bennett and Prance 2000). Ethnobotanical surveys carried out in the Amazon region (Monteiro et al. 2011; Pinto and Maduro 2003; Ritter et al. 2012) and in other countries (Giday et al. 2009; Ketzis and Brown 2003; McGaw et al. 2020) underline the importance of species of the Asteraceae family for ethnoveterinary practice, whereas the Lamiaceae family represents the first introduced medicinal plants in South America (Bennett and Prance 2000).

The species *Allium ampeloprasum*, *Ilex paraguariensis*, and *Urera baccifera* had the highest ICF and UV values, and these three plants were used in the treatment of mastitis, the most serious disease with respect to milk losses in dairy cattle farming (Bradley 2002). *Allium ampeloprasum* has also been used as an antiparasitic, a major concern for cattle in tropical regions of Brazil (Grisi et al. 2014). *A. ampeloprasum* was reported to have cytoprotective and anti–inflammatory properties (Adão et al. 2011), which could explain its use in cattle mastitis. The other two commonly mentioned plants were also used to treat mastitis. *Urera baccifera* has antimicrobial and anti–inflammatory activities (Gindri et al. 2014), and *Ilex paraguariensis* is used in Argentina against mastitis (Martínez and Luján 2011). Yerba maté, included in the diet of dairy cows, has the potential to improve milk production (Barbato et al. 2019; Celi and Raadsma 2010) and improve the immune system of lambs (Lobo et al. 2020).

A previous study by Souza Júnior et al. (2014) in a region approximately 160 km away from Palmital listed the 10 most common medicinal plants used by farmers, and *U. baccifera* was also used against mastitis. Other plants in this list that were common to our study included *Aloe vera*, *Psidium guajava*, *Leonurus sibiricus*, *Mentha × piperita,* and *Symphytum officinale*, whereas *Datura stramonium, Corymbia citriodora,* and *Dysphania ambrosioides* (respectively *Eucalyptus citriodora* and *Chenopodium ambrosioides* in the cited article) were not mentioned.

The similarity in the proportion of exotic (non–Brazilian) to native plant species found in our study could be partially explained by a cultural exchange process (Kujawska et al. 2017), where new practices and customs are incorporated into traditional habits, most likely propelled by the curiosity and necessity of rural people (Bennett and Prance 2000). This proportionality of knowledge of native to introduced plant species was previously reported in northeastern Brazil (de Albuquerque 2006), although there was a significantly higher use of native plants in that region.

The preference for Palmital farmers to use leaves contributes to the survival of the plant species, thereby not endangering them severely in comparison to the use of the whole plant or stems, bark, or roots (Poffenberger et al. 1992). Most of the studies conducted elsewhere in Brazil indicated that leaves are the most frequently used plant part (Amorim et al. 2019; Amorozo 2002; Monteiro et al. 2011), but Silva et al. (2018) indicated that the bark of the plants is the most common part, probably because most of the species described were shrubs and trees.

The most common preparation mode was to use water mainly for boiling plant material, but also for soaking or macerating it. Water was also the main extraction method and vehicle used in other ruminant ethnoveterinary studies (Alawa et al. 2002; Feyera et al. 2017; Giday and Teklehaymanot 2013; Gradé et al. 2009; Lans and Brown 1998; Njoroge and Bussmann 2006; Sharma et al. 2012; Tabuti et al. 2003). Interestingly, several preparations used salt to macerate or combine with water for ointment preparation. Salt was often added to improve palatability (Lans and Brown 1998) of infusions that were administered orally (Gradé et al. 2009; Tabuti et al. 2003), especially for dairy cattle (Sharma

et al. 2012). As a lick, salt preparations are surprisingly uncommon; for this purpose, ashes, kaolin, potassium (Alawa et al. 2002), or $CaCO_3$ (Gradé et al. 2009) have been reported. Some studies have claimed that a mixture of plant extracts with different materials, such as fats and oils, charcoal, alcohol, sugar, and honey (Ritter et al. 2012; Syakalima et al. 2018) can reduce the active ingredients of the plant (Dilshad et al. 2008; Jabbar et al. 2006; Monteiro et al. 2011; Sharma et al. 2012).

As reported in other studies (Farooq et al. 2008; Giday et al. 2009; McCorkle 1986; Monteiro et al. 2011; Tabuti et al. 2003), the informants did not report a standardization of dosages, and the treatment duration was based on the remission of clinical symptoms. Although there is a risk of incorrect usage of medicinal plants, because toxic or other adverse effects exist (McGaw et al. 2020; Souza 2015), no side effects were reported in this study.

According to Trotter and Logan (1986), plants with higher informant consensus factor (ICF) values are thought to have better potency than medicinal plants with lower values. The ICF of 17 plant species by different groups was null in our study, which is either a sign of randomly chosen plants or no information exchange about their use (Gazzaneo et al. 2005). However, plants used as antiparasitics (ICF 0.75), mastitis (ICF 0.65), insect repellents (ICF 0.63), and for skin injuries (ICF 0.53) had higher values, which might indicate better selection criteria for these plants or higher exchange of information. The ailment categories are common in veterinary ruminant medicine, contributing to a better exchange of knowledge. Although placenta retention is a common problem in cattle, this topic received a low score (ICF 0.29). Compared to dairy cattle ethnoveterinary medicine practiced in India (Sharma et al. 2012), our ICF scores were lower, indicating that traditional knowledge about medicinal plants is at risk of gradual disappearance (Anyinam 1995; Ludwinsky et al. 2020), or that there is improved access to commercial veterinary medicine as in ethnoveterinary practices in communities of the Ukrainian/Romanian border (Sõukand and Pieroni 2016). On the other hand, one reason for not using modern veterinary medicine in our study was the high cost compared to the use of plant medicine. Ethnoveterinary practices are considered to

contribute to lower veterinary health costs for livestock animals (Balaji and Chakravarthi 2010; Rokaya et al. 2010).

Conclusions

This study described a list of 45 plants used in ethnoveterinary practices by farmers of Ukrainian origin and cultural background living in a rural area of the state of Paraná, southern Brazil. Most plants were used to treat health problems in cattle that are the most important livestock species raised in the community. Similar ethnoveterinary studies with European communities of immigrants in Brazil are unknown and could be a valuable source of information on how possible intercultural interactions translate themselves into the knowledge of medicinal plants. In addition, this information could be used in future comparative studies of historical medicinal plant use development in the immigrant's country of origin and in the new homeland. Women and oral traditions for the transfer of ethnoveterinary knowledge were essential for this community.

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