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Natural pharmacopoeia used in traditional Toba medicine for the treatment of parasitosis and skin disorders (Central Chaco, Argentina)

Gustavo J. Martínez [a,*], Gloria E. Barboza [b]

[a] Conicet, Museo de Antropología, Universidad Nacional de Córdoba, Hipólito Irigoyen 174, CP 5000 Córdoba, Argentina
[b] Instituto Multidisciplinario de Biología Vegetal (IMBIV-CONICET) and Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, CC 495, CP 5000 Córdoba, Argentina

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ABSTRACT

Aim of the study: To assess the knowledge and use of natural pharmacopoeia for the treatment of parasitosis and skin disorders, as well as for the control of their etiological agents or vectors, of a Toba community in Central Chaco, Argentina.
Materials and methods: Information was obtained by open, extensive and recurrent interviews and semi-structured surveys. Plant and animal pharmacopoeia was documented by collecting material in field assays carried out in the company of informers. The list of applications with the greatest consensus of uses, the list of species with most medicinal applications and the list of species with the highest reputation (according to the level of fidelity) for the aforementioned disorders were obtained using quantitative methods.
Results: A total of 178 medicinal uses were documented corresponding to 87 species (72 plant and 15 animal species) belonging to 51 different families (39 plant and 12 animal families). The most represented families according to the number of species were Solanaceae (7 species), Asteraceae (6 species) and Fabaceae (5 species) for plants, and Bovidae (3 species) for animals.
Conclusions: Although the list of medicinal species includes some symbolical applications, others are supported by phytochemical information. In other cases the applications coincide with other pharmacopoeias of the Gran Chaco region indicating the presence of an active exchange of knowledge through interethnic contacts.

1. Introduction

The environmental degradation suffered over the last decades has encouraged the emergence or revival of tropical diseases in Latin America, including the region of the Gran Chaco, Argentina, together with a greater prevalence for chronic or endemic pathologies such as parasitosis and infectious diseases (Palma, 1985; Epstein, 1995; Pignatti, 2004). Identified as significant health problems, the etiology of parasitosis and skin disorders clearly evidence the close relationship that exists between an individual's health and his natural and sociocultural environment. Studies on the prevalence of diseases, especially those concerning infant populations in underdeveloped countries, show high rates of parasitosis and skin disorders, like pyoderma, scabies and superficial mycosis, the latter being one of the most common medical consultations in primary health care centres (Mahé et al., 1995; Mahé et al., 2005). Likewise, and due to their highly visible symptomatology, skin disorders have, together with digestive, gynaecological and obstetric disorders, the greatest number of medicinal treatments in many of the native pharmacopoeias around the world (Cox, 1994). As proposed in other countries (Inngjerdingen et al., 2004), deep knowledge on natural remedies allows selecting a collection of species of external use with proven pharmacological efficacy to be implemented in primary health care attention, thus encouraging the incorporation of traditional medicines to the local health system according to the criteria recommended by the WHO (2002).

Traditional ethnobiological knowledge has provided answers for the treatment of these disorders and the elimination of vectors using a rich herbalist medicine, as well as the use of repellent or insectifuge substances that in many cases have provided natural products and drugs with diverse applications (anti-malarial drugs, insecticides, and others). Among the ethnobiological investigations regarding issues related to parasitosis and vector-borne diseases we can mention the work by Karunamoorthia et al. (2009), who documented plant insect repellents in Africa, and that of Pochettino et al. (2003), who studied the ethnobiology of parasitosis of the Mbyá-Guaraníes in Argentina. On the other hand, Inngjerdingen

* Corresponding autor at: Laboratorio de Etnobiología, Museo de Antropología, Universidad Nacional de Córdoba, Hipólito Irigoyen 174, CP 5000 Córdoba, Argentina. Tel.: +54 351 4331058; fax: +54 351 4331058.
E-mail addresses: gustmart@yahoo.com (G.J. Martínez), gbarboza@imbiv.unc.edu.ar (G.E. Barboza).

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et al. (2004), Ram et al. (2004), Geber-Miriam et al. (2006), Saikia et al. (2006), Njoroge and Bussmann (2007) and Martínez (2008a) showed the relevance and versatility of medicinal plants in the treatment of skin disorders.

The Tobas, also known as *qom* or *qoml'ek*, are an indigenous group belonging to the Guaycurú linguistic family that comprises a population of allied bands with about 60,000 members and whose current habitat is mostly confined to the area of Central and Southern Chaco (in the provinces of Chaco and Formosa, Argentina) and a small nucleus in the Northern Chaco area in Paraguay (ENDEPA, 1986; Arenas, 1997; Censabella, 2000). Previous information on the ethnobotany of different Toba groups can be found in Franzé (1925), Martínez Crovetto (1964), Martínez Crovetto (1968), Vuoto (1981), Vuoto (1999b), Arenas (2000), Martínez (2007a), Martínez (2008b), Hecht et al. (2008), in addition to other ethnozoological studies (Zacarías, 1993; Martínez Crovetto, 1995; Vuoto, 1999a; Arenas, 2003). Together, these studies evidence the extensive use these natives make of natural resources and show that their vast natural pharmacopoeia is one of the features that greatly enriches their culture.

Within the framework of a project regarding the relationship between ethnoecology and environmental health in the Tobas of Central Chaco, the object of the present study was to evaluate the knowledge and use of natural pharmacopoeia for the treatment of parasitosis, skin disorders and for the control of their etiological agents or vectors.

2. Materials and methods

2.1. Ethnobotanical survey area

The study area belongs to the Gran Chaco region in the province of Chaco (Northeast Argentina), in the surroundings of the river Bermejito (Fig. 1). According to its phytogeographical features, the area corresponds to the Neotropical region in the Chaco Domain, Chaco Province, with species belonging to the Central Chaco forests according to Prado (1993), or to the transition between the Oriental or humid Chaco and the Occidental or semiarid Chaco according to Cabrera (1994). The landscape vegetation pattern is characterized by marked fluvial modelling (Morello and Adámoli, 1974) and the vegetation consists of a xerophytic deciduous forest together with savannas, halophytic steppes, cardonal montes, grasslands and shrublands.

From an economical point of view, the Tobas subsist on a combination of hunting, fishing and gathering, together with an incipient agriculture, management of goat herds, apiculture and paid handwork for cotton harvesting, selling resources from the forest, the participation in non-governmental organisms, as well as the aid of government help plans.

The local health system is characterized by a multiple sanitary context that includes shamanism (carried out by specialists known as *pi'oxonac*), domestic or homemade medicine and the official medicine (biomedicine) of health care centres run by doctors and Toba sanitary agents. Despite this pluralism, traditional Toba medicine is still not incorporated to the official medicine even though the use of natural remedies and the shamanic cures are one of the main therapeutic options to which local inhabitants appeal (Martínez, 2007b). The morbidity of this region is characterized by a diversity of clinical cases and disorders. There is no official or statistical information on the prevalence of these disorders among the Toba population; however, the health care staff highlights the incidence of skin disorders (like pyoderma, impetigo and scabies) and the high rates of parasitosis (oxyuriasis, amoebiasis, ascariasis and, to a lesser degree, taeniasis). Cases of Chagas disease are also very frequent due to the presence of the "vinchuca" (*Triatoma infestans*) associated not only to the cultural housing and lifestyle ways of this people but also to the lack of attention given to this issue by public health authorities.

2.2. Study methods and techniques

Between the years 2004 and 2008, information on the medical use of medicinal plants and animals was collected in the study area as part of a general survey on Toba medical ethnobotany. Open, extensive and recurrent interviews as well as semi-structured surveys were carried out with members of the community of different sex and age, and health care professionals. For this, a survey was prepared on the subject based on the ethnobotanical guide proposed by Arenas (1995). This information was complemented with participative observations. All the plant material was collected in field assays in the company of local informers. Information was documented in field logbooks, magneto-phonic tapes and photographs. Reference samples were deposited in the herbarium of the Botanical Museum (CORD) of the Instituto Multidisciplinario de Biología Vegetal at the Universidad Nacional de Córdoba (IMBIV, UNC). Plant materials were mainly identified by the authors with the help of specialists in cases of taxa difficult to ascertain, and the nomenclature was verified in the catalogue of Argentine Vascular Plants (Zuloaga and Morrone, 1996; Zuloaga and Morrone, 1999) and its electronic on-line update for the Southern Cones (Zuloaga et al., 2008). The invertebrate zoological material was identified by specialists and is part of the first author's particular collection (housed at the Museo de Antropología, Córdoba). Vertebrates were identified with local informers using photographs and images from field guides, and were then corroborated with ethnobiological references on the Gran Chaco region (Martínez Crovetto, 1995; Arenas, 2003).

Six field assays were carried out which involved staying for more than 100 days at different Toba settlements located in the surroundings of the river Bermejito belonging to the Río Bermejito intendancy (Department of General Güemes, Province of Chaco). Most interviews were carried out at the community of El Colchón (Fig. 1) and the majority of the plant material was also collected at this site. Before being interviewed the members of the communities were briefed on the research project and its academic objectives; financial compensation was provided to informants for the field trips. Conversations with specialists and inhabitants were based on a common objective: to improve the local health situation, increase knowledge regarding natural remedies and develop educational materials of local interest, as suggested in the guidelines of the International Society of Ethnobiology Code of Ethics (ISECE, 2008).

Qualitative, quantitative and participative methods were used alternately in different recurring instances throughout the entire period of the investigation, trying to improve each new instance with previous results and following the basic scheme of an ethnobotanical study: field work and laboratory work.

Qualitative methods: The symptomatology and etiology of disorders were interpreted by open, extensive interviews. Additional information on the lexicon of skin diseases was obtained using a collection of photographs on skin disorders taken from a dermatology Atlas (Cohen and Lehmann, 2009) to attain a more specific translation into occidental medical categories.

Quantitative methods: Sixty informers comprised of specialists (shamans, midwives and elderly people) and community members (youngsters and adults of both sexes) were subjected to a previously designed semi-structured thematic questionnaire. Quantitative assessments were based on the number of uses reported for each species (categorised according to the frequency of mention) and the proportion they represented in the total number of reports. The medicinal use of species was validated when

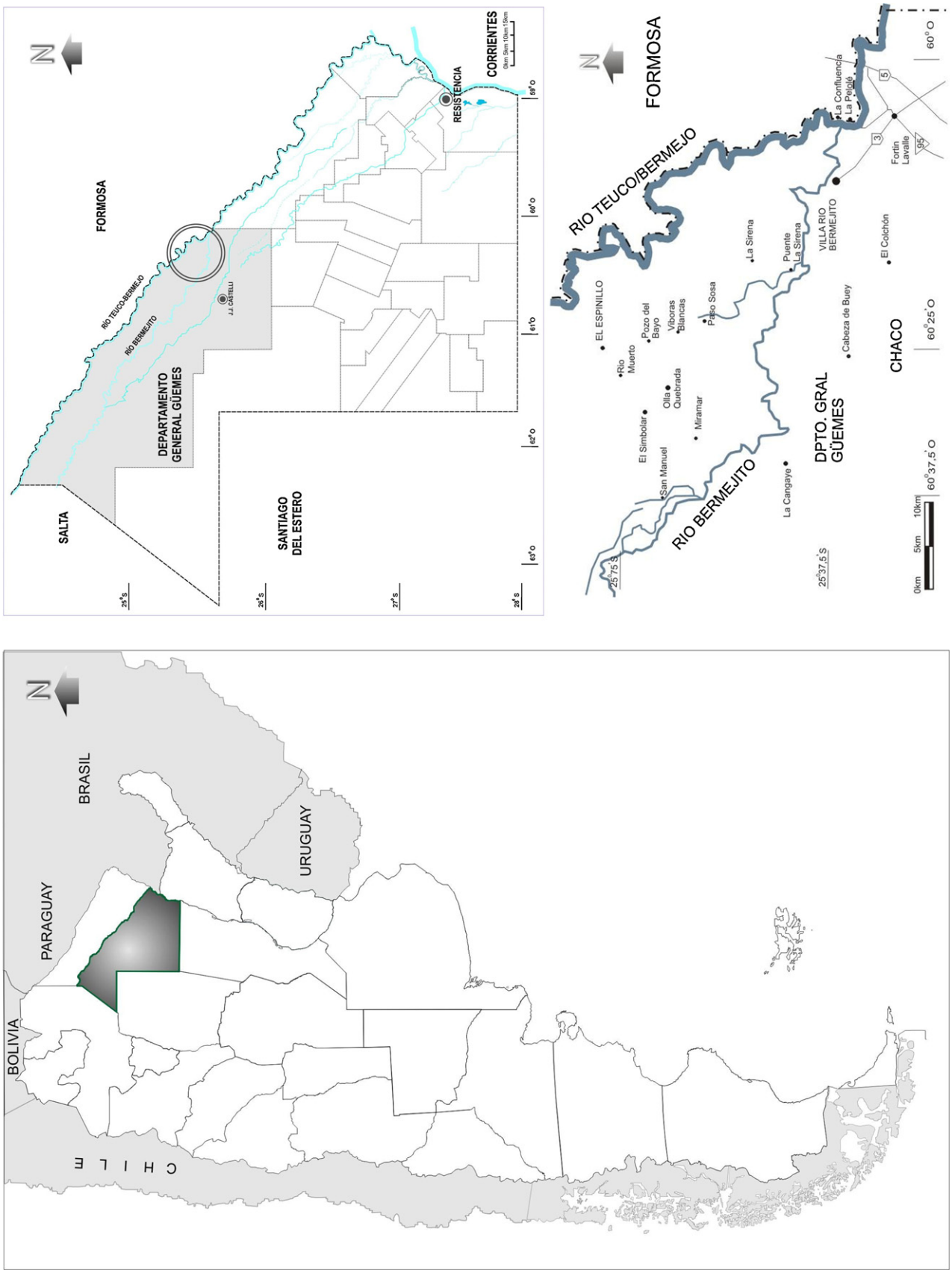

Fig. 1. Study area comprising the centre Province of Chaco, in Northeast of Argentina.

the answers of at least two informers coincided in an identical application for the same part of a plant, regardless of the method of preparation. Unique data were included when they were supported by other ethnobotanical studies of the area (Scarpa, 2004). Thus, the list of applications with the greatest consensus of use was obtained for the aforementioned disorders, in addition to the list of species with highest number of medicinal applications. The fidelity level (FL), according to Friedman et al. (1986), was used to evaluate consensus and popularity among the people.

Ethnoecological research methods: A participative rural diagnosis (PRD) and a fast rural diagnosis (FRD) (Ardón Mejía, 2001) were used to characterize the sanitary context of the study area and population. For this, a workshop on health and prevention of water-related diseases and parasitosis was organized to confirm the knowledge obtained by informers. Additionally, doctors, nurses and agents of the sanitary posts of Río Bermejito and surrounding areas were interviewed.

The standard Toba alphabet (Buckwalter and Litwiller de Buckwalter, 2001) was used for writing the Toba language due to its widespread diffusion and use among the community members. Phonetic conventions have been previously detailed (Martínez, 2007a; Martínez, 2007b).

3. Results

3.1. Nomenclature, etiology and symptomatology of the disorders

Among the most common skin disorders mentioned by the local inhabitants or identified by photographs we can mention the following: blisters and water or blood vesicles caused by insect bites or skin friction (*lchepaloxo*); allergic or contact dermatitis, urticaria (*poqo*; *poqo late'e*; *ỹaviguec*); scalded skin syndrome (vgr. *Staphilococcus aureus*) (*ỹaviguec*); burns (*lavigaxa*); warts (*nquerela*); sties (*qatonaxa*); acne and face pimples (*shenaxa*); body spots that do not form abscesses and leishmaniasis lesions (*lhueta*); furuncles or spots forming pus abscesses (*nỹelogoe* or *ñilgoxoi*); eruptive diseases like measles, chickenpox, eruptive xanthoma, and others (*querellic*); eczema and rashes (*npoxolaxa*), candidiasis and oral herpes lesions (*alap*), among others. In addition, other skin manifestations with more diffuse symptomatology and difficult to define have, in some cases, features of a serious infection or ulceration (*cancer* or *cagaxai*); others, like gangrenous pyoderma (San Antonio fire or *lotaxai lailatec*) or impetiginous dermatitis (*pielita*) are associated by the locals to the feverish condition generated by the infections. Together with natural etiologies, these diseases admit other causal explanations related to certain transgressions. Thus, furuncles are originated by eating the fruits of *Cleistocactus baumanii* (Cactaceae), as they resemble the spotty appearance, and therefore children are not allowed to eat them. Likewise, the *shiyic* orchid (*Cyrtopodium punctatum*, Orchidacea) is a plant animated with a morbid spirit capable of producing this affection intentionally if it is not gathered according to certain safety measures. One of the mentioned causes for *cagaxai* is being defecated on by a howling monkey or *huoỹim* (*Alouatta caraya*). Similarly, sties are originated when a child witnesses the copulation of dogs and acne is multiplied if the affected person looks into a mirror.

With different linguistic terms, Tobas recognise the most common vectors and parasitic agents of pediculosis (*lalaxat*), fleas (*pioc lalaxat*), ticks (*pela*), scabies (*lquesaxa*), uncinariasis or hookworm disease (*unca*), intestinal worms and parasites, particularly oxiurus (*nashiỹe*), as well as the "vinchuca" (*chiincha*) that transmits the Chagas trypanosome.

3.2. Reported plant and animal uses

A total of 87 species (72 plants and 15 animals) belonging to 51 families (39 plant and 12 animal families) are applied for treating the diseases considered in this study. The most represented families according to the number of species were Solanaceae (7 species), Asteraceae (6 species) and Fabaceae (5 species) for plants, and Bovidae (3 species) for animals. Table 1 summarizes the proportion of plant and animal citations (82% for plants and 18% for animals) of a total of 178 medicinal uses, according to the medicinal subcategories defined for the treatment of skin disorders (86%) and parasitosis (14%).

Based on these categories, Fig. 2 shows that the medicinal applications for treating skin diseases and parasitosis correspond with 22 different effects attributed to these remedies. Regarding the treatment of parasitic diseases, the most important plant uses are as anti-parasitic agents (of external use) and vermifuges; for the treatment of skin disorders, the most important uses are dermatopathic, anti-pruritic, cicatrizant, anti-alopecic and resolutive applications. Although with slightly less consensus, uses like anti-wart, anti-mycotic, insectifuge, disinfectant, anti-eruptives, alexiteric and anti-seborrheic agents are also significant.

The range of applications for the animal pharmacopoeia is much more reduced compared to that of plants which are used for almost all the disorders mentioned. In both cases external applications are predominant (94%) and the most commonly used parts are the leaves and aerial sections of plants, and animal fats. The most frequent forms of administration for skin disorders and ectoparasites are topical infusions or decoctions plant applications (washes, baths, poultices), or application by friction for animal parts. On the other hand, infusions and decoctions in water are used for treating intestinal parasites.

In general, decoctions and infusions in water are administrated as hot beverages (tea) made of monoherbs, or as part of a hot or cold infusion of *Ilex paraguariensis* – known as "mate" or "terere", respectively (ca. 200 ml) – this species is used as an excipient. This way of administration, both in "mate" or "terere" infusion, is common in the Chaco region, and in general in Argentina. The method of preparing this kind of infusion is identical to the ones described by Scarpa (2004) for the medicine of the "criollos" from the west of Formosa (Argentina).

Informants gave variable information about proportions and doses for the preparation of infusions. In some cases, a number of leaves (4 or 5 aromatic leaves), fragments of roots (3 roots in *Hyptis lappacea*) or a branch (in *Chenopodium ambrosioides*) are selected; in other cases, ca. 20–100 g of plant, depending on the part of the plant, are used in different volumes of water and in different containers: 500 ml in a small jug, or most commonly 1 l in a kettle, and up to 5 l in a basin for soaking of feet or body (*Schinopsis balansae, Capparis tweediana*).

In cases of macerated preparations in water for washings, the volumes of plant material are usually higher than the previous ones. An example is the use of 5 fruits (ca. 5–6 cm diameter each) of *Capparis salicifolia* macerated in 750 ml of water. In a similar way, volumes for burning and smoke for driving away insects are considerable, due to the fire is continuously fed with fragments of bark and/or wood.

For plasters and poultices, leaves and/or fragments of stem or fruits are crushed (*Jaborosa integrifolia*, *Nicotiana glauca*, *Capsicum chacoënse*, *Opuntia elata*). The affected surface is covered with a thin layer of the crushed preparation (ca. 0.5 cm thick), and in some cases it is wrapped with a cloth.

Spores, latex, sap, and animal products (ashes and fats) are used in external topical applications. The treatment is repeated as often as it is considered appropriate. The amount of plant and animal collected is the necessary for an immediate preparation of

Table 1
Natural pharmacopoeia used in treating skin diseases and parasitosis in Central Chaco.

Vegetal pharmacopoeia							
Family	Species (voucher number)	Local name	Origin (status)	Plant part use; Way of preparation and administration (Recipe)	Application	QF+ (%)	Proportion of citations for the species
Amaryllidaceae	*Hippeastrum parodii* Hunz. & Cocucci (GJM 212)	lache late'e, lache	N (w)	Bulb/Unprepared/Frictions and massages	Acne and facial pimples	*	2.68
					Skin spots	**	
					Pimples	**	
					Warts	**	
	Zephyranthes carinata Herb. (GJM 536)	lache late'e	N (w)	Bulb/Unprepared/Frictions and massages	Acne and facial pimples	**	2.57
					Skin spots	**	
					Pimples	**	
					Warts	**	
					Skin spots	**	
					Mycosis	**	
					Eruptive diseases (chickenpox, measles, others)	*	
					Resolutive		
				Leaves/Mucilage/Wash	Alopecia	**	
					Dandruff and seborrhea	**	
				Development and care of female hair			
				Leaves/Poultice Leaf is cut, then disinfect the bite with alcohol gall and vinegar	Snakebite (alexiteric)	**	
Anacardiaceae	*Schinopsis balansae* Engl. (GJM 244)	cotapic	N (w)	Sap/Infusion or decoction/Wash	Mycosis	**	2.13
				Sap/Unprepared/External use (Apply the caustic sap that is released by cutting a leaf)	Warts	**	
					Pimples	*	
	Schinus fasciculata (Griseb.) I.M. Johnst. var. *fasciculata* (GJM 336)	toroloquiic	N (w)	Thorn/Incision/(warts are crossed with two thorns)	Warts	**	1.23
				Leaves/Infusion or decoction/Wash (It bathes the children)	Itching, irritation, rash	**	
				Leaves/Infusion or decoction/Wash	Scabies	**	
				Leaves/Infusion or decoction/Beverage	Internal parasites (vermifuge)	*	
	Schinus molle L. (GJM 334)		N (w)	Leaves/Macerated in water/Wash	Alopecia	**	0.45
Apocynaceae	*Aspidosperma quebracho-blanco* Schltdl. (GJM 432)	noyic, noshec	N (w)	Bark/Infusion or decoction/Wash	Scabies	**	1.45
					Itching, irritation, rash	**	
				Root, Bark/Infusion or decoction/Wash	Boils and abscesses	**	
					Gangrene and severe ulceration	*	
	Vallesia glabra (Cav.) Link (GJM 15)	samañic	N (w)	Fruits/Squeezed/Wash	Acne and facial pimples	*	3.24
				Branches or twigs/Infusion or decoction/Wash	Pimples	*	
					Pediculosis	**	
					Scabies	*	
				Leaves are used to sweep the floors	Fleas	****	2.91
Aquifoliaceae	*Ilex paraguariensis* A. St.-Hil.	yerba mate	N (c)	Leaves/milled/External use	Wounds and injuries	****	

Table 1 (*Continued*)

Asclepiadaceae	*Morrenia odorata* (Hook. & Arn.) Lindl. (GJM 243)	luaxai	N (w)	Latex/Unprepared/External use	Skin spots	****	1.78
				Aerial part/Use magic-symbolic: Around like a necklace	Snakebite (Alexiteric)	***	
Asphodelaceae	*Aloe saponaria* Haw. (GJM 555)	alove	I (c)	Leaves/Mucilage/poultice	Burns	**	4.14
Asteraceae	*Artemisia absinthium* L. (GJM 552)	chemaxarai	I (c)	Leaves/Infusion or decoction/Beverage	Intestinal parasites	**	0.34
	Baccharis notosergilia Griseb. (GJM 245)	pagrenquelogaxanaqte	N (w)	Aerial part/Infusion or decoction/Wash	Alopecia	**	0.34
	Eupatorium hecatanthum (DC.) Baker (GJM 63)	ronai laue	N (w)	Aerial part/Infusion or decoction/Wash	Gangrene and ulceration	**	0.89
				Aerial part/Infusion or decoction/Wash	Pimples	**	
	Parthenium hysterophorus L. (GJM 166)	chemaxaraicchimaxadaic	N (w)	Aerial part/Infusion or decoction/Wash	Scabies	***	3.36
					Cicatrise palometas bites.	**	
					Itching, irritation, rash	***	
					Pimples	***	
	Pluchea sagittalis (Lam.) (GJM 199)	vioxanaxaic	N (w)	Root/Infusion or decoction/Beverage	Intestinal parasites	*	0.22
	Xanthium spinosum L. (GJM 65)	naxadai laue	N (w)	Thorn/Incision. Warts are crossed with two thorns	Warts	*	0.22
Bignoniaceae	*Tabebuia impetiginosa* (Mart. ex DC.) Standl. (GJM 514)	aỹajlai'	N (w)	Wood/Incineration (embers)/Exposed to smoke Sawdust of lapacho (lsoxoche) is used	Insect repellent (Culicidae)	**	0.89
Cactaceae	*Opuntia elata* var. *cardiosperma* (K. Schum.) R. Kiesling (GJM 138; MERL)	cocha'q, dayamí	N (w)	Cladodes/Unprepared/Poultice. Cladodes are cut in half and their thorns are removed. They have to be placed to the dew the night before use	Maturation of boils and abscesses	*	0.22
	Rhipsalis lumbricoides (Lem.) Lem. (GJM 428)	sallaxataxaic	N (w)	Whole plant/Macerated in water/Wash and then applies "yerba mate" (*I. paraguariensis*).	Wounds and injuries	*	8.28
				Whole plant/Macerated in water/Wash. It is used for the development and care of female hair	Dandruff and seborrea	*****	
					Alopecia	*****	
Capparaceae	*Capparis salicifolia* Griseb. (GJM 387)	neelque	N (w)	Fruits/Macerated in water/Wash.	Feet mycosis	***	1.12
	Capparis tweediana Griseb. (GJM 7)	querellic, quirillic	N (w)	Leaves/Infusion or decoction/Wash	Scabies	**	6.15
				30–40 Leaves/Infusion or decoction/Wash	Itching, irritation rash	****	
				Branches or twigs/Infusion or decoction (500 g of leaves in 5 l of water)/Wash	Eruptive diseases (chickenpox, measles, others).	****	
Caricaceae	*Carica quercifolia* (A. St.-Hil.) Hieron. (GJM 264)	callmaic	N (w)	Leaves/Unprepared/Poultice	Pimples	**	1.90
				Latex/Unprepared/External use	Pimples	**	
					Acne and facial pimples	***	
Celastraceae	*Maytenus vitis-idaea* Griseb. (GJM 410)	satachec, chiqpi'	N (w)	Leaves/Unprepared/Place them in the armpits or in the pockets of clothing	Insect repellent (tick)	*	0.22

Table 1 (*Continued*)

Chenopodiaceae	*Chenopodium ambrosioides* L. (GJM 255)	huesaxa lqo, davioxon	N (c)	Aerial part/Infusion or decoction/Beverage Prepare a piece in a kettle	Intestinal parasites	*	0.22
Commelinaceae	*Commelina erecta* L. var. *angustifolia* (Michx.) Fernald (GJM 159)	paato lmi', paato l'aite, paato naship, lmalaxa lauoxo, azul lauoxo	N (w)	Mucilage/Unprepared/External use	Feet mycosis	*	0.22
Convolvulaceae	*Dichondra microcalyx* (Hallier f.) Fabris (GJM 422)	micha ltela	N (w)	Whole plant/Infusion or decoction/Wash	Dermatopathic (skin spots). For wounds herpetiformis	**	1.12
				Whole plant/Infusion or decoction/Wash	Itching, irritation, rash	**	
	Ipomoea batatas (L.) Poir. (GJM 655)	batata	N (c)	Aerial part/Use magic-symbolic: Wrap as a necklace of the person or animal bitten	Snakebites	**	0.56
Cucurbitaceae	*Citrullus lanatus* (Thumb.) Mars. & Mak subsp. *vulgaris* (Schrad.) Tursa (GJM 554)	egaxa	N (c)	Fruits/Unprepared/External use. Moisten the skin with the juice inside the shell of the fruit	Itching, irritation, rash	**	0.67
	Cucurbitella asperata (Gillies ex Hook. & Arn.) Walp. (GJM 280)	quemoxon	N (w)	Root/Infusion or decoction/Wash	Boils and abscesses	**	0.56
Euphorbiaceae	*Croton bonplandianus* Baill. (GJM 240)	qoto' lqo, namaic	N (w)	Sap/Unprepared/External use	Warts	**	0.45
	Euphorbia serpens Kunth var. *serpens* (GJM 287)	potaxanaxaq alo'q, qapalax-anaxaic,	N (w)	Whole plant/Infusion or decoction/Wash	Itching, irritation	**	0.56
	Ricinus communis L. (GJM 411)	huaqavic	I (w)	Seeds/Incineration/Frictions and massages.	Dog bites	*****	5.15
				Use magic-symbolic: Rubbed into the affected area. Treatment with this plant produces a reversal of the effect in animals, causing injuries and death, so some prefer not to use it or use it as a form of revenge.			
				Leaves/Infusion or decoction/Beverage. Avoids that fever caused by measles gets into the body.	Eruptive diseases (chickenpox, measles, others)	*	
Fabaceae	*Acacia aroma* Gillies ex Hook. & Arn. (GJM 372)	paxaic	N (w)	Leaves, Root/Infusion or decoction/Wash	Wounds and injuries	*	0.89
				Leaves/Infusion or decoction/Wash	Pimples	**	
	Acacia caven var. *microcarpa* Aronson (GJM 299)	paxaic	N (w)	Leaves/Infusion or decoction/Beverage	Pimples	**	0.45
	Albizia inundata (Mart.) Barneby & J.W. Grimes (GJM 242)	natallec	N (w)	Leaves/Frictions and massages	Acne and facial pimples	**	0.45
	Geoffroea decorticans (Gillies ex Hook. & Arn.) Burkart (GJM 475)	tacaic	N (w)	Bark/Infusion or decoction/Beverage	Eruptive diseases (chickenpox, measles, others)	*	0.45
	Prosopis kuntzei Harms (GJM 58)	tareguec	N (w)	Leaves/Incision	Warts	**	0.56

Table 1 (*Continued*)

				Wood/Incineration (embers)/A glowing ember is approached to the region affected by the bite	Insect bites	*	
Lamiaceae	*Hyptis lappacea* Benth. (GJM 488)	huashiito lqolac	N (w)	Whole plant (4 leaves and 3 roots)/Infusion or decoction/Beverage	Intestinal parasites	**	0.78
Liliaceae	*Allium cepa* L.	lache	I (c)	Cataphylls/Milled/Poultice	Warts	*	0.22
	Allium sativum L.		I (c)	Bulb/Milled/Poultice or food intake. Consume two cloves of garlic or use a poultice	Bites (dogs, snakes, palometas)	**	0.78
Loranthaceae	*Struthanthus angustifolius* (Griseb.) Hauman (GJM 42)	etaxat lqaic	N (w)	Leaves/Macerated in water/Wash	Scabies	**	0.22
					Itching, irritation, rash	**	
				Leaves/Infusion or decoction/Wash	Alopecia	**	
Lycoperdaceae	*Lanopila bicolor* (Lev.) Pat. (GJM 442)	huaqajñi l'atec	N (w)	Spores/Unprepared/External use	Boils	*	0.78
	Mycenastrum corium (Guers.) Desv. (GJM 464)	huaqajñi l'atec	N (w)	Spores/Unprepared/External use	Boils	*	1.34
	Vascellum pampeanum (Speg.) Homrich (GJM 360)	huaqajñi l'atec	N (w)	Spores/Unprepared/External use	Boils	*	0.11
Malvaceae	*Hibiscus striatus* Cav. (GJM 330)	lalaco'jña	N (w)	Aerial part/Infusion or decoction/Wash	Itching, irritation, rash	*	0.22
	Sida spinosa var. *spinosa* L. (GJM 182)		N (w)	Aerial part/Infusion or decoction/Wash	Alopecia	*	0.45
					Pediculosis	*	
	Sphaeralcea bonariensis (Cav.) Griseb. (GJM 249)	lquedoxo lata', nqueroxo lata', ȳaiguiolec lqueroxo lata', lapagaxai laue,	N (w)	Leaves/Infusion or decoction/Beverage	Scabies	**	1.90
				Leaves/Infusion or decoction/Wash	Itching, irritation, rash	**	
					Boils and abscesses	**	
				Leaves/Unprepared/Poultice	Pimples	**	
Meliaceae	*Melia azederach* L. (GJM 4)	paraíso	I (adv)	Leaves/Infusion or decoction/household. Sweep the floor or pour a decoction inside the house or in the body of the affected person. The same use is given to the ashes of the leaves	Insect repellent (Fleas)	*****	3.36
Moraceae	*Broussonetia papyrifera* (L.) Vent. (GJM 263)	catalco	I (adv)	Latex/Unprepared/External use	Skin spots	*	0.78
					Mycosis	**	
Nyctaginaceae	*Pisonia zapallo* Griseb. var. *zapallo* (GJM 508)	nashevec, nashivic	N (w)	Wood/Incineration (ashes)/Exposed to smoke. Twigs are burned to ward off mosquitoes (Culicidae) and "polvorines" (Psychodidae)	Insect repellent (mosquitoes and gnats)	*	0.22
Orchidaceae	*Cyrtopodium punctatum* (L.) Lindl. (GJM 557)	shiyic	N (w)	Leaves/Infusion or decoction/Wash	Boils and abscesses	**	0.45
				Wash with the decoction or apply leaves directly on the boils that arise from the use of this plant without the necessary precautions (a rag or a red tape has to be left as an offering)			

Table 1 (*Continued*)

Parmeliaceae	*Usnea angulata* Ach. (GJM 151)	ahuol	N (w)	Whole plant/Unprepared	plantar callosities (emollient)	**	4.03
				Whole plant/Unprepared (As a pad inside the shoe)	Mycosis pedic	*	
					Deodorant	*****	
Parmeliaceae	*Usnea subflorida* (Zahlbr.) Mot. (GJM 40)	ahuol	N (w)	Whole plant/Unprepared	Plantar callosities (emollient)	**	4.03
				Whole plant/Unprepared (As a pad inside the shoe)	Feet Mycosis	*	
					Deodorant	*****	
Phytolaccaceae	*Petiveria alliacea* L. var. *alliacea* (GJM 187)	shepatoq, shipatoq	N (w)	Root/Infusion or decoction/Wash	Scabies	*	0.22
Poaceae	*Imperata brasiliensis* Trinius (GJM 496)	pogoyaq	N (w)	Whole plant and roots/Macerated in water/Wash	Dandruff and seborrhea	****	3.58
					Dandruff and seborrhea	****	
				Use magic-symbolic			
	Saccharum officinarum L.	azúcar	N (c)	Industrial preparation/External use	Burns	**	0.34
Polygonaceae	*Polygonum hispidum* Kunth (GJM 291)	taqaq lchi, taqaq lche	N (w)	Whole plant	Irritant	**	1.79
				Leaves/Infusion or decoction/ Unprepared/Frictions and massages.	Pimples	*	
					Itching, irritation, rash	**	
				Whole plant/Infusion or decoction/Wash	Eruptive diseases (chickenpox, measles, others)	**	
					Itching, irritation, rash	**	
	Polygonum punctatum Elliot (GJM 292)	taqaq lchi, taqaq lche	N (w)	Whole plant	Irritation	**	1.23
				Leaves/Infusion or decoction/ Unprepared/Frictions and massages	Pimples	*	
					Itching, irritation, rash	**	
				Whole plant/Infusion or decoction/Wash	Eruptive diseases (chickenpox, measles, others)	**	
					Itching, irritation, rash	**	
Polyporaceae	*Trichaptum fumoso-avellaneum* (Romell) Rajchenb. & Bianch. (GJM 49)	piilaga ltela	N (w)	Basidiocarp/Incineration (ashes)/Frictions and massages	Pimples	*	0.22
Ranunculaceae	*Clematis montevidensis* Spreng. (GJM 66)	naqolo	N (w)	Root/Infusion or decoction/Wash	Pediculosis	*	0.22
Rhamnaceae	*Ziziphus mistol* Griseb. (GJM 137)	na'allaic; na'ala (fruto)	N (w)	Bark/Infusion or decoction/Wash	Dandruff and seborrhea	**	0.67
Rutaceae	*Fagara naranjillo* (Griseb.) Engl. (GJM 101)	peraxañec		Leaves/Infusion or decoction/Beverage	Eruptive diseases (chickenpox, measles, others)	*	0.45
					Alopecia	**	
Sapindaceae	*Sapindus saponaria* L. (GJM 512)	huerainconaquiic,	N (w)	Fruits/Macerated in water/Wash. By breaking the fruit in water releases white foam which acts as a shampoo	Dandruff and seborrhea	**	1.79
					Alopecia	**	
Solanaceae	*Capsicum chacoënse* Hunz. (GJM 190)	chemaxarai	N (w)	Fruits/Milled/Poultice	Snakebite (alexiteric)	**	0.34
	Jaborosa integrifolia Lam. (GJM 412)	tapañi laue	N (w)	Leaves/Unprepared/Poultice. It is especially indicated for bites of the fish line (*Potamotrygon* sp. and others)	Wounds and injuries	**	1.79

Table 1 (*Continued*)

				Leaves/Unprepared/Poultice	Palometas bites (*Serrasalmus* sp.)	***	
	Lycium cuneatum Dammer (GJM 105)	chiqpi	N (w)	Leaves/Infusion or decoction/Wash	Pimples	*	0.22
	Nicotiana glauca Graham (GJM 284)	huaaca lamanax-anaxa	N (w)	Leaves/Unprepared/Poultice	Boils and abscesses	**	1.90
					Dog bites	**	
					Wounds and injuries	*	
				Leaves/Macerated in water/Wash	Eruptive diseases (chickenpox, measles, others).	*	
	Solanum argentinum Bitter & Lillo (GJM 210)	pioq laayec	N (w)	Root/Infusion or decoction/Wash	Scabies	*	0.22
	Solanum aridum M. Nee (GJM 18)	mañic lqo, naxarax-anaaq lqo	N (w)	Fruits/Unprepared/Frictions and massages	Insect bites	*	2.35
					Acne and facial pimples	**	
					Pimples	**	
					Skin spots	**	
	Solanum palinacanthum Dunal (GJM 569)	mañic lqo, naxarax-anaaq lqo	N (w)	Fruits/Unprepared/Frictions and massages	Acne and facial pimples	**	0.45
Viscaceae	*Phoradendron hieronymi* Trel. (GJM 481)	etaxat lqaic	N (w)	Leaves/Macerated in water/Wash	Scabies	**	1.57
					Itching, irritation, rash	**	
					Alopecia	**	
					Dandruff and seborrea	*	
Zygophyllaceae	*Bulnesia sarmientoi* Lorentz ex Griseb. (GJM 608)	delliquic	N (w)	Branches or twigs/Infusion or decoction/Beverage	Intestinal parasites	*	2.13
				Wood/Incineration (embers)/Exposed to smoke	Insect repellent (Culicidae) and "polvorines" (Psychodidae)	****	
				Wood/Macerated in alcohol/Wash. Prepare a lotion with timber, alcohol and salt	Insect bites	*	

Animal pharmacopoeia CLASS Family	Species	Local name	Origin	Plant part use Way of preparation and administration (Recipe)	Application	Frequency (%)	Proportions of citations for the species
Bivalvia							
Unionidae	*Anodontites trapesialis*	coneq	N	Shell/Incineration (ash)/External use. It is especially indicated for bites of the fish line (*Potamotrygon* sp.)	Wounds and injuries	*	3.91
					Bites	**	
Osteichthyes							
Curimatidae	*Prochilodus platensis*	nỹaq	N	Fat/Unprepared/External use. Fat from abdomen is preferred, especially in cases of scratches and claws	Wounds and injuries	**	2.65
Reptilia							
Teiidae	*Tupinambis rufescens*	(toxoxaraic) qolliguesaq	N	Fat/Unprepared/Frictions and massages. It applies in the vicinity of the inflamed eye by the bite of the insect vector	Chagas disease (Antiinflammatory)	**	1.99
	Tupinambis teguixin	(lairaxaic) (naigoxon-axa) qolliguesaq	N	See *T. rufescens*	Chagas disease (Antiinflamnatory)	**	17.22
				Fat/Unprepared/Frictions and massages	Boils and abscesses	**	
					Pimples	**	
					Wounds and injuries	*	

Table 1 (*Continued*)

					Skin blisters	**	
					Warts	**	
				Chew fat iguana or pass on the bite. It is also used the brain of the iguana over the injuries, since this animal tolerates them without dying	Snakebites	**	
Amphibia							
Bufonidae	*Bufo* spp.	qoloxoloxo	N	Frictions and massages. It is believed that the toad is the "owner of npoxolaxa" (itching), so the animal is rubbed on the skin to relieve discomfort. It must also be expressly request the animal to carries the disease	Itching, irritation, rash	**	7.28
				Tie a live toad in the bite until it dies in a way that allows the doctor to arrive on time	Snake bites	**	
Aves							
Cariamidae	*Chunga burmeisteri*	lashenec, lashinec	N	Manure/Unprepared/Poultice	Boils and abscesses	***	6.62
Rheidae	*Rhea americana*	mañic	N	Fat/Unprepared/Frictions and massages	Wounds and injuries	*	1.32
Phasianidae	*Gallus gallus*	olgaxa	I	Eggs/Unprepared/Poultice	Burns	*****	29.14
				Fat/Frictions and massages	Pimples	**	
					Wounds and injuries	*	
					Chagas disease (antiinflammatory)	****	
Tyrannidae	cfr. *Euscarthmus meloryphus*	pichaqchic	N	Nest/Incineration (ash)/External use	Boils and abscesses	*	1.32
Mammalia							
Bovidae	*Bos taurus*	huaaca	I	Manure/Incineration (ash)/Wash	Acne and facial pimples	*	7.95
				Dissolve in 1 l of water a tablespoon of dried cow manure; the supernatant fluid is used to wash pimples once they were cleaned with soap and water	Pimples	*	
				Manure/Incineration (ash)/Exposed to smoke	Insect repellent (Culicidae y Psychodidae)	**	
				Bones/Unprepared/Frictions and massages. Marrow is used as soap, in regions where spots occur	Skin spots	**	
	Capra hircus	ketaq	I	Fat/Frictions and massages	Skin blisters	*	2.65
				Blood/Fried/Food intake. It gives the child a fried blood of a newborn animal	Intestinal parasites (pinworm)	*	
	Ovis aries	qagueta	I	Blood/Fried/Food intake. It gives the child a fried blood of a butchering animal	Intestinal parasites (pinworm)	*	1.32
Dasypodidae	*Dasypus septemcinctus*	tapinec	N	Fat/Unprepared/Frictions and massages	Skin blisters	*	7.95
					Dog bites	**	
					Pimples	**	
				Fat/Unprepared/External use	Burns	*	
	Euphractus sexinctus	napam	N	Fat/Unprepared/External use	Burns	**	3.31
Myrmecophagidae	*Myrmecophaga tridactyla*	potai'	N	Hair/Incineration (ash)/Frictions and massages	Itching, irritation, rash	**	5.30
				Fat/Unprepared/External use	Burns	**	

List of abbreviations used: GJM: Gustavo J. Martínez; N: Native; I: Introduced; w: wild; c: cultivated; adv: adventitious. + Quotation frequency: '*' <5% of the informants; '**' 5–15% of the informants; '***' 15–25% of the informants, '****' 25–50% of the informants, '*****' >50% of the informants.

the medicine; however, rarely and only certain species or preparations are stored in the homes, preserved in small bundles, bags or other containers. This latter situation occurs particularly with fatty creams.

While in traditional Toba medicine, it is common the use of mixtures of more than one plant species (Martínez, 2007a; Martínez, 2008b), this practice is not applied in the affections treated in this work since the treatments are based predominantly on single species.

3.3. Species consensus, origin and fidelity level

The list of most cited species is headed by two native plants (*Rhipsalis lumbricoides* and *Capparis tweediana*), followed by two

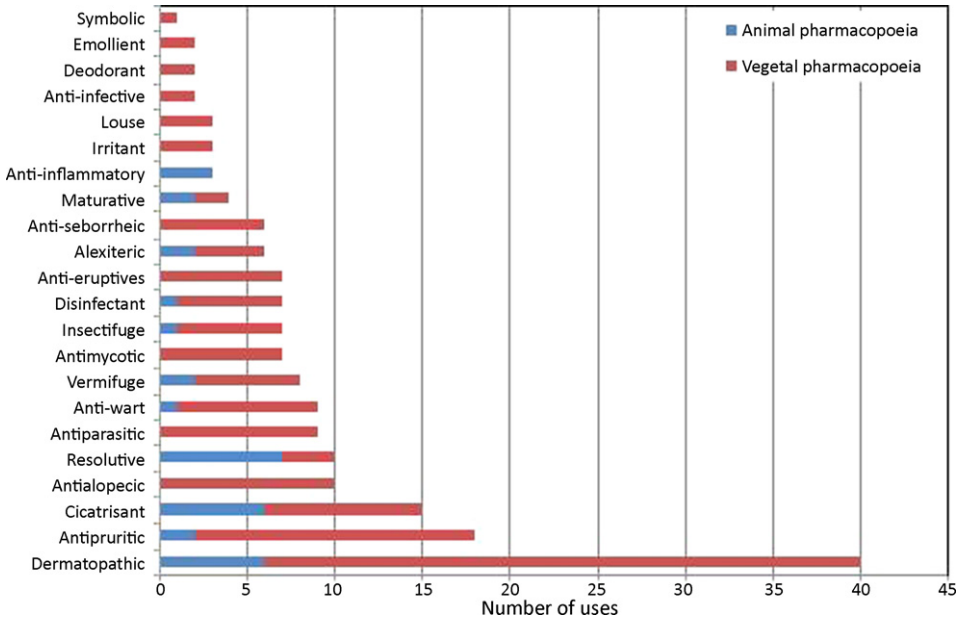

Fig. 2. Number of medicinal uses of plant and animal pharmacopoeia for the treatment of skin diseases and parasitosis.

introduced species (*Ricinus communis* and *Aloe saponaria*). The frequency analysis of spontaneous citations suggests that the highest values of consensus for plant uses corresponds to applications that, as further detailed in the discussion, involve symbolic cures as in the case of *Ricinus communis* seeds, *Rhipsalis lumbricoides* stems and *Imperata brasiliensis* roots.

Evidencing a more pharmacological criterion of efficiency, insect repelling plants also have a noticeable consensus of use such as the application of *Vallesia glabra* as a fleacide and the bark of *Bulnesia sarmientoi* as a repellent against Culicidae and Psychodidae. Likewise, the skin disease treatments with greatest consensus include the use of *Ilex paraguariensis* as a cicatrizant, *Morrenia odorata* as a dermatopathic and *Capparis tweediana* for treating eczemas and eruptive diseases (measles, chickenpox and others). The use of poultices has the greatest consensus for animal pharmacopoeia, as for example the use of preparations with hen eggs (*Gallus gallus*) for burns and the manure of *Chunga burmeisteri* for furuncles and abscesses; similarly, the use of hen fat is a very popular remedy for treating the Romaña sign caused by *Triatoma infestans* bites, vector of Chagas disease.

Considering the origin of the species used, there is a predominance of native species in both the plant (91%) and animal (73%) pharmacopoeia showing the importance of the Chaco monte as a source of therapeutic resources for this culture. Among the introduced species, we found the use of cultivated plants with well-known uses in both Argentine and worldwide pharmacopoeia, as in the case of *Aloe saponaria* Haw, *Artemisia absinthium* L., *Allium cepa* L. and *Allium sativum*, and adventitious species like *Melia azederach* L. and *Broussonetia papyrifera* L. Likewise, 27% of the animal species correspond to introduced domestic animals from the Bovi-

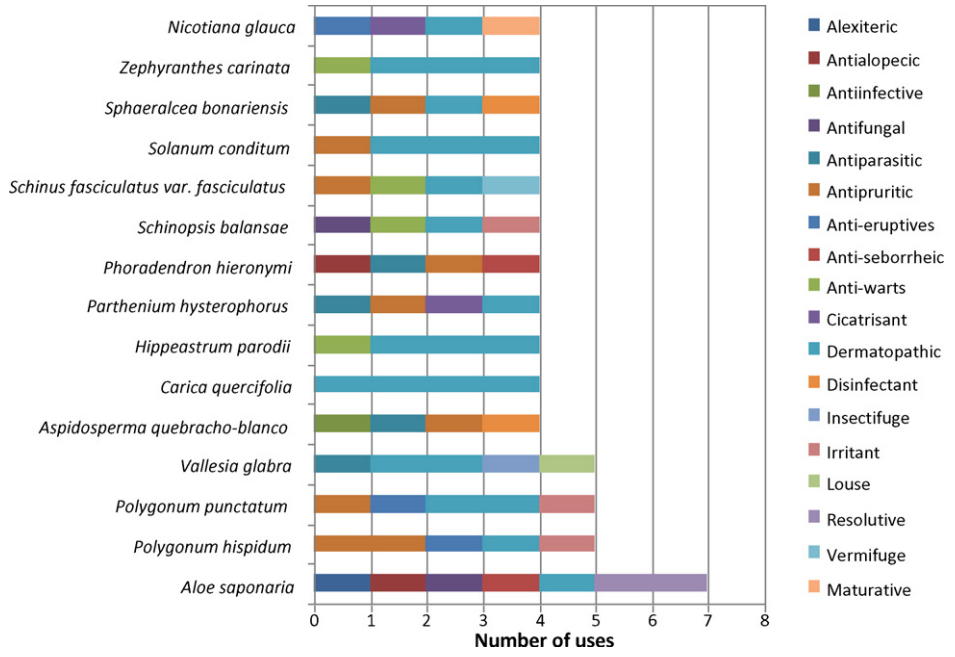

Fig. 3. Proportion of dermatological and parasitological uses in plant species with the largest number of medicinal uses.

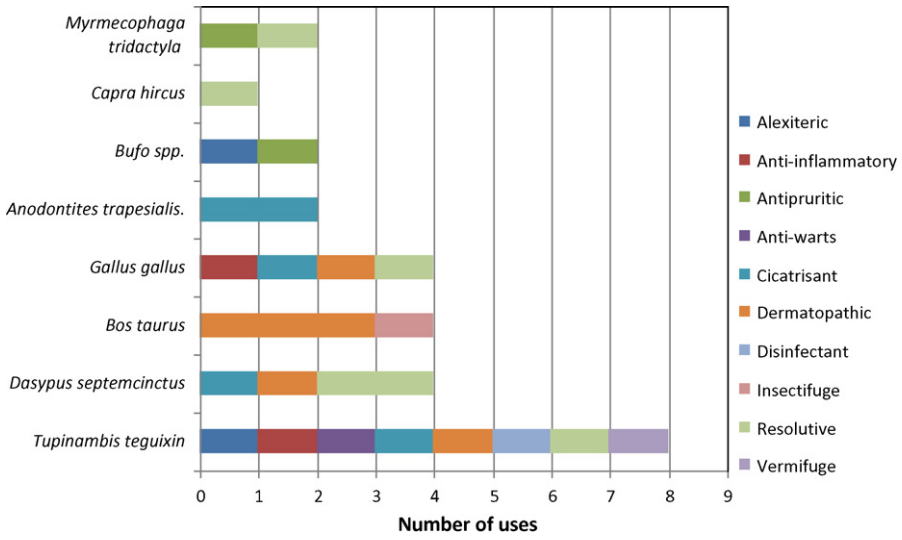

Fig. 4. Proportion of dermatological and parasitological uses in animal species with the largest number of medicinal uses.

dae (goats, cows and sheep) and Phasianidae families (hens), the application of which corresponds to recent acquisitions following the conquest of these people.

Regarding the number of different medicinal uses of the plant pharmacopoeia (Fig. 3), we can see that an introduced species, namely *Aloe saponaria*, is at the head of the list followed by *Polygonum hispidum*, *Polygonum punctatum* and *Vallesia glabra*, all of which are native. In the case of the animal pharmacopoeia (Fig. 4), we find the reptile *Tupinambis teguixin* at the top of the list with 7 medicinal uses followed by the edentate *Dasypus septemcinctus* with 4 uses. Both these animals are native species that are obtained by the traditional hunting activity which is still a highly important occupation among the members of this culture. We also find introduced domestic species with 4 medical applications, such as cows (*Bos taurus*) and hens (*Gallus gallus*), which evidence the acquisition of new medical knowledge from the interaction and interethnic relationships established between the Tobas and their criollo farming neighbours.

The highest values of fidelity level (Table 2) correspond to *Ricinus communis* (Euphorbiaceae), an introduced species used as a cicatrizant, followed by the native *Rhipsalis lumbricoides* used as an anti-alopecic and anti-seborrheic. Then follows *Melia azederach* (Meliaceae) cited for its insectifuge properties. Species of the Amaryllidaceae (*Hippeastrum parodii* and *Zephyranthes carinata*) and Capparacea (*Capparis tweediana* and *C. salicifolia*) families have also reputed applications for skin disorders (chickenpox, eruptions and mycosis), possibly indicating the presence of active components shared within a same plant family. On the other hand, the mollusc species *Anodontites trapesialis* (Unionidae) is first on the FL list of animal pharmacopoeia for its popularity as a cicatrizant.

Table 2
List of species with specific therapeutic indications according to decreasing values of their fidelity level (FL). (FL ≥ 10.00).

Species	Indication and therapeutic effect attributed	FL (%)
Ricinus communis	Cicatrisant	45.00
Rhipsalis lumbricoides	Anti-alopecic	37.00
Rhipsalis lumbricoides	Anti-seborrheic	37.00
Melia azederach	Insecticide	31.00
Usnea angulata/Usnea subflorida	Deodorant	30.00
Phoradendron hieronymi	Refreshing	29.00
Capparis tweediana	Against measles	28.00
Struthanthus angustifolius	Refreshing	28.00
Ilex paraguariensis	Cicatrisant	27.00
Anodontites trapesialis	Cicatrisant	24.00
Hippeastrum parodii	Dermatopathic	23.00
Solanum aridum	Dermatopathic	22.00
Zephyranthes carinata	Dermatopathic	22.00
Carica quercifolia	Dermatopathic	21.00
Gallus gallus	Resolutive	21.00
Gallus gallus	Anti-inflammatory	20.00
Capparis tweediana	Anti-pruritic	20.00
Capparis salicifolia	Anti-fungal	11.00
Aloe saponaria	Alexiteric	11.00
Chunga burmeisteri	Maturative	11.00
Bos taurus	Dermatopathic	11.00

3.4. Other Toba therapeutic practices

Other remedies of diverse origins evidence the versatility and dynamics of Toba ethnomedicine as well as the recent inclination towards new medicines. These involve industrialized materials and drugs incorporated from the occidental culture and the traditional peasant medicine, as well as symbolic activities using materials related to cosmology or mythical tales. As examples we can mention poultices made of oil, human urine, kerosene, rubber from tyres that are used as cicatrizants for cuts and wounds, or the use of creoline for eliminating parasites and acetylsalicylic acid for avenging dog bites (in a symbolic procedure similar to that described for *Ricinus communis* seeds). The use of *norec qalo lpoco* (primitive earth) is the only reference made to the use of a remedy of mineral origin; it consists of limestone originated in the primeval fire capable of curing severe affections like *lotaxai lailaatec*, of which the most visible symptoms are skin burns. Similarly, a ritualistic healing is used for the treatment of sties that involves saluting the handle of a pestle and asking it to take away the illness.

4. Discussion and conclusions

While the Tobas have many etiologies for skin diseases and parasitosis, their cure is mainly based on the use of natural remedies, especially native medicinal plants. Although the use of animal pharmacopoeia is more reduced as shown by the number of species involved and their uses, it is relevant to mention it as it is scarcely described in previous ethnobotanical studies.

Most of the plants used for treating skin disorders possibly have other additional properties like anti-inflammatory, anti-microbial, anti-viral, cicatrizant, haemostatic, analgesic effects that require pharmacological confirmation (Barboza et al., 2009). A revision on the biological activity of the medicinal uses presented in this

study shows that there is limited information on many of these plant species. On the other hand, the phytochemical information on some species supports the uses given by the Tobas. Thus, the antimicrobial and anti-fungal properties of dichloromethane extracts of *Polygonum punctatum* (Penna et al., 2001), the bactericidal effects of *Acacia aroma* (Arias et al., 2004), and the dermatopathic effects of different species of *Aloe* spp. (Grace et al., 2008) have been corroborated.

Although there is no pharmacobotanical information supporting the dermatological application of *Morrenia odorata*, *Vallesia glabra, Aspidosperma quebracho-blanco*, *Citrullus lanatus*, *Petiveria alliacea*, coincidences have been found with the pharmacopoeia of the criollos in Northeast Chaco (Scarpa, 2004). Likewise, the use of *Schinus fasciculata* var. *fasciculata*, *Sphaeralcea bonariensis* and *Solanum aridum* (sub nom. *S. conditum*) is similar to the Pilagá pharmacopoeia (Filipov, 1994; Filipov, 1997), another ethnical group from Chaco neighbouring the study region, while the use of *Struthanthus angustifolius* is similar to that of the Maká in the Paraguayan Chaco (Arenas, 1987). Similarly, and even though the consensus of use in this study is low, the application of fungi spores of the Lycoperdaceae family (Gasteromycetes) for treating skin diseases as cicatrizants or anti-microbials has been mentioned repeatedly in ethnobotanical studies of the Gran Chaco (Filipov, 1994; Filipov, 1997; Scarpa, 2004), and other regions of the world (Palmese et al., 2001; Viegi et al., 2003; Dulger, 2005). Similar considerations are valid for species of the Capparaceae family, especially *Capparis tweediana*, that apart from its high level of consensus and citation, and great reputation for its use in eruptive diseases and other skin disorders, also coincides with the use given by the oriental Tobas (Franzé, 1925; Martínez Crovetto, 1964), the criollos of Northwest Chaco (Scarpa, 2004), the Ayoreos (Schmeda-Hirchsmann, 1998), and the Maká in the Paraguayan Chaco (Arenas, 1987). All this evidences the fluid exchange of knowledge by interethnical contacts in the Gran Chaco region. Furthermore, the consensus between ethnical groups provides a limited list of botanical species and families that might yield interesting evidences of pharmacological efficiency.

The best known anti-parasitic and insecticidal plants are *Melia azedarach,* for its compounds with proven ovicidal, pediculicidal, anti-feedant, repellent and insecticidal activity (Carpinella et al., 2007), and *Chenopodium ambrosioides* that contains ascaridol, an anti-helminthic and vermifuge agent (Alonso, 1998; Singh et al., 2008). Regarding the control of disease vectors, the consensus for *Vallesia glabra* as a fleacide and the bark of *Bulnesia sarmientoi* as insect repellent is highly relevant, both traditional applications whose effects still remain to be studied.

In order to confirm the medicinal uses documented in this study, phytochemical, pharmacological and toxicological studies must be carried out on the plants identified in the Toba ethnobotany, especially those with a high level of fidelity or high frequency of citations. Demonstrating the bioactivity of extracts from these plants in correspondence with their traditional use will justify the incorporation and use of these natural remedies for the primary health care of local inhabitants, which in turn will provide a greater articulation and understanding between the different forms of medical practice.

Apart from the species with pharmacological relevance, high consensus applications based on symbolical efficacy can also be identified. Such is the case of the use of *Ricinus communis* seeds for dog bites, the cure of which is based on the logic of the circulation of symptoms (Laplantine, 1999), or the application of the epiphyte *Rhipsalis lumbricoides* and the *Imperata brasiliensis* grass for the care and treatment of hair, based on the clear morphological similarity between the epiphytic stems and roots of both plants, respectively. The knowledge of this sort of innocuous applications is also important for the local health centres in order to promote the integration between medical practices and supplement the official medicine with elements from the vernacular medicine.

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References

Alonso, R., 1998. Tratado de Fitomedicina, Bases Clínicas y Farmacológicas. ISIS Edit., Buenos Aires.
Ardón Mejía, M., 2001. Métodos e instrumentos para la investigación etnoecológica participativa. Etnoecológica 6, 129–143.
Arenas, P., 1987. Medicina and magic among the Maka indians of the Paraguayan Chaco. Journal of Ethnopharmacology 21, 279–295.
Arenas, P., 1995. Encuesta etnobotánica aplicada a indígenas del Gran Chaco. Hacia una nueva carta étnica del Gran Chaco 6, 161–178. Centro del Hombre Antiguo Chaqueño, Las Lomitas, Formosa, Argentina.
Arenas, P., 1997. Las fuentes actuales y del pasado para la etnobotánica del Gran Chaco. Monografías del Jardín Botánico de Córdoba 5, 17–25. Córdoba, España.
Arenas, P., 2000. Farmacopea y curación de enfermedades entre algunas etnias del Gran Chaco, en: Amat, A.G. (Coord.), Farmacobotánica y Farmacognosia en Argentina (1980–1998). Ediciones Científicas Argentinas, La Plata, pp. 87–118.
Arenas, P., 2003. Etnografía y alimentación entre los Toba Ñachilamole#ek y Wichí-Lhuku'tas del Chaco Central (Argentina). Edic. del autor, Buenos Aires.
Arias, M.E., Gomez, J.D., Cudmani, N.M., Vattuone, M.A., Isla, M.I., 2004. Antibacterial activity of ethanolic and aqueous extracts of *Acacia aroma* Gill. ex Hook et Arn. Life Sciences 75, 191–202.
Barboza, G.E., Cantero, J.J., Núñez, C., Pacciaroni, A., Ariza Espinar, L., 2009. Medicinal plants: a general review and a phytochemical and ethnopharmacological screening of the native Argentine Flora. Kurtziana 32, 7–365.
Buckwalter, A., Litwiller de Buckwalter, L., 2001. Vocabulario toba. Edición Revisada. Equipo Menonita. Mennonite Board of Missions. Elkhart, Indiana, USA.
Cabrera, A.L. 1994. Regiones fitogeográficas argentinas. Enciclopedia Argentina de Agricultura y Jardinería. Tomo II (1) Acme, Buenos Aires.
Carpinella, M.C., Miranda, M., Almirón, W.R., Ferrayoli, C.G., Ludueña Almeida, F., Palacios, S.M., 2007. In vitro pediculicidal and ovicidal activity of an extract and oil from fruits of *Melia azedarach*. Journal of the American Academy of Dermatology 56, 250–256.
Censabella, M., 2000. Las lenguas indígenas de la Argentina. Una mirada actual. EUDEBA, Buenos Aires.
Cohen, B.A., Lehmann, C.U., 2009. Dermatlas.org. Dermatology Images Atlas. Johns Hopkins University (available on http://dermatlas.med.jhmi.edu/derm/).
Cox, P.A., 1994. The ethnobotanical approach to drug discovery: strengths and limitations. In: Prance, G.T., Chadwick, D.J., Marsh, J. (Eds.), Ethnobotany and the Search for New Drugs. John Wiley & Sons, New York, pp. 25–41.
Dulger, B., 2005. Antimicrobial activity of ten Lycoperdaceae. Fitoterapia 76, 352–354.
ENDEPA, 1986. Aborígenes en Argentina. Equipo Nacional de Pastoral Aborigen. Formosa, pp. 28.
Epstein, P.R., 1995. Emerging diseases and ecosystem instability: new threats to public healt. American Journal of Public Health 85, 168–172.
Filipov, A., 1994. Medicinal plants of the Pilagá of Central Chaco. Journal of Ethnopharmacology 44, 181–193.
Filipov, A., 1997. La farmacopea natural en los sistemas terapéuticos de los indígenas pilagá. Parodiana 10, 35–74.
Franzé, D., 1925. Erbe medicinali del Chago e legnami industriali argentini. Contributo delle Missioni Francescane della Repubblica Argentina all'Esposizione Missionaria Vaticana. Pubblicazioni dell Istituto Cristoforo Colombo, Roma.
Friedman, J., Yaniv, Z., Dafni, A., Palewitch, D., 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desrt, Israel. Journal of Ethnopharmacology 16, 275–287.
Geber-Miriam, T.G., Neubert, R., Schimdt, P.C., Wutzler, P., Schmidtke, M., 2006. Antiviral activites of some Ethiopian medicinal plants used for the treatment of dermatological disorders. Journal of Ethnopharmacology 104, 182–187.
Grace, O.M., Simmonds, M.S.J., Smith, G.F., van Wyk, A.E., 2008. Therapeutic uses of Aloe L. (Asphodelaceae) in southern Africa. Journal of Ethnopharmacology 119, 604–614.

Hecht, A.C., Martínez, G.J., Cúneo, P., 2008. Infancia toba y mundo natural: De la atención del malestar físico a las pautas de socialización infantil. Acta Americana 16, 81–106.
Inngjerdingen, K., Nergard, C.S., Diallo, D., Mounkoro, P.P., Paulsen, B.S., 2004. An ethnopharmacological survey of plants used for wound healing in Dogonland, Mali, West Africa. Journal of Ethnopharmacology 92, 233–244.
International Society of Ethnobiology Code of Ethics (with 2008 additions). http://ise.arts.ubc.ca/global_coalition/ethics.php (Active in February 2010).
Karunamoorthia, K., Ilango, K., Endale, A., 2009. Ethnobotanical survey of knowledge and usage custom of traditional insect/mosquito repellent plants among the Ethiopian Oromo ethnic group. Journal of Ethnopharmacology 125, 224–229.
Laplantine, F., 1999. Antropología de la enfermedad. Estudio etnológico de las representaciones etiológicas y terapéuticas en la sociedad occidental contemporánea. Ediciones del Sol, Buenos Aires.
Mahé, A., Faye, O., Thiam NïDiaye, T., Ly, F., Konaré, H., Kéita, S., Traoré, A.K., Hay, R., 2005. Definition of an algorithm for the management of common skin diseases at primary health care level in sub-Saharan Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene 99, 39–47.
Mahé, A., Prual, A., Konaré, M., Bobin, P., 1995. Skin diseases of children in Mali: a public health problem. Transactions of the Royal Society of Tropical Medicine and Hygiene 89, 467–470.
Martínez, G.J., 2007a. La farmacopea natural en la salud materno-infantil de los Tobas del Río Bermejito. Kurtziana 33, 39–63.
Martínez, G.J., 2007b. Vienen buscando la vida (Ilotaique nachaalataxac): Las trayectorias terapéuticas de los tobas del Río Bermejito (Chaco), In: Idoyaga Molina, A. (Ed.), Los caminos terapéuticos y los rostros de la diversidad. Tomo I. CAEA–IUNA, Buenos Aires, pp. 401–424.
Martínez, G.J., 2008a. La farmacopea natural y el tratamiento de las afecciones de la piel en la medicina tradicional de los campesinos de las sierras de Córdoba, Argentina. Dominguezia 24, 27–46.
Martínez, G.J., 2008b. La farmacopea natural en la etnomedicina de los Tobas del Río Bermejito (Chaco, Argentina). Tesis Doctoral. Facultad de Ciencias Agropecuarias. Universidad Nacional de Córdoba. pp. 289.
Martínez Crovetto, R., 1964. Estudios etnobotánicos. I. Nombres de plantas y su utilidad, según los indios tobas del este del Chaco. Bonplandia 1, 279–333.
Martínez Crovetto, R., 1968. Los indios tobas y las plantas. Actas y Memorias del XXXVII Congreso Internacional de Americanistas, República Argentina, vol II, pp. 625–629.
Martínez Crovetto, R., 1995. Zoonimia y etnozoología de los pilagá, toba, mocoví, mataco y vilela. Archivo de Lenguas Indoamericanas, Colección Nuestra América, Facultad de Filosofía y Letras, Buenos Aires, pp. 188.
Morello, J., Adámoli, J., 1974. Las Grandes Unidades de Vegetación y Ambiente del Chaco Argentino II. Vegetación y Ambiente de la Provincia del Chaco. INTA, Centro de Investigaciones de Recursos Naturales. Serie fitogeográfica 13. Ed. Coni, Buenos Aires.
Njoroge, G.N., Bussmann, R.W., 2007. Ethnotherapeautic management of skin diseases among the Kikuyus of Central Kenya. Journal of Ethnopharmacology 111, 303–307.
Palma, N.H., 1985. Algunos aspectos de la situación médico-sanitaria de los aborígenes del Chaco Argentino, en el marco de sus pautas culturales. Kallawaya 1, 9–24.
Palmese, M.T., Uncin Manganelli, R.E., Tomei, P.E., 2001. An ethnopharmacobotanical survey in the Sarrabus districtžsouth-east Sardinia. Fitoterapia 72, 619–643.
Penna, C., Marino, S., Vivot, E., Cruañes, M.C., Muñoz, J. de D., Cruañes, J., Ferraro, G., Gutkind, G., Martino, V., 2001. Antimicrobial activity of Argentine plants used in the treatment of infectious diseases. Isolation of active compounds from Sebastiania brasiliensis. Journal of Ethnopharmacology 77, 37–40.
Pignatti, M.G., 2004. Saúde e Ambiente: As doenças emergentes no Brasil. Ambiente & Sociedade 7, 133–147.
Pochettino, M.L., Martínez, M.R., Arenas, P.M., Crivos, M., Navone, G., Digiani, C., 2003. Fitoterapia Mbya: Análisis y evaluación del tratamiento de las parasitosis. Delpinoa 45, 301–310.
Prado, D.E., 1993. What is the Gran Chaco vegetation in South America? I. A review. Contribution to the study of flora and vegetation of the Chaco. Candollea 48, 145–172.
Ram, A.J., Bhakshu, L.Md., Venkata Raju, R.R., 2004. In vitro antimicrobial activity of certain medicinal plants from Eastern Ghats, India, used for skin diseases. Journal of Ethnoparmacology 90, 353–357.
Saikia, A.P., Ryakala, V.K., Sharma, P., Goswami, P., Bora, U., 2006. Ethnobotany of medicinal plants used by Assamese people for various skin ailments and cosmetics. Journal of Ethnopharmacology 106, 149–157.
Scarpa, G.F., 2004. Medicinal plants used by the Criollos of Northwestern Argentine Chaco. Journal of Ethnopharmacology 91, 115–135.
Schmeda-Hirchsmann, G., 1998. Etnobotánica ayoreo. Contribución al estudio de la flora y vegetación del Chaco. XI. Candollea 53, 1–50.
Singh, H.P., Batish, D.R., Kohli, R.K., Mittal, S., Yadav, S., 2008. Chemical composition of essential oil from leaves of *Chenopodium ambrosioides* from Chandigarh, India. Chemistry of Natural Compounds 44, 378–379.
Viegi, L., Pieroni, A., Guarrera, P.M., Vangelisti, R., 2003. A review of plants used in folk veterinary medicine in Italy as basis for a databank. Journal of Ethnopharmacology 89, 221–244.
Vuoto, L.D., 1999. Recolección animal entre los tobas de Formosa, en: Aschero, C. et al. (Eds.), En los tres reinos: Prácticas de recolección en el Cono Sur de América. Instituto de Arqueología y Museo. Facultad de Ciencias Naturales e Instituto Miguel Lillo, Tucumán, pp.253–260.
Vuoto, P.M., 1981. Plantas útiles entre los Toba-Taksék. Entregas del Instituto Tilcara (Jujuy, Argentina) 10, 12–76. Instituto Tilcara, FFyL, Universidad de Buenos Aires.
Vuoto, P.M., 1999. Recolección y poder. La vegetación entre los Toba del este de Formosa, en: Aschero, C. et al. (Eds.), En los tres reinos: Prácticas de recolección en el Cono Sur de América. Instituto de Arqueología y Museo. Facultad de Ciencias Naturales e Instituto Miguel Lillo, Tucumán, pp. 239–250.
WHO, 2002. Estrategia de la OMS sobre medicina tradicional 2002–2005. OMS, Ginebra, pp. 78.
Zuloaga, F.O., Morrone, O., 1996. Catálogo de las plantas vasculares de la República Argentina I. Pteridophyta, Gymnospermae y Angiospermae (Monocotyledoneae). Missouri Botanical Garden Press, Saint Louis.
Zuloaga, F.O., Morrone, O., 1999. Catálogo de las plantas vasculares de la República Argentina II. Tomo 1: Acanthaceae-Euphorbiaceae (Dycotyledoneae). Tomo 2: Fabaceae-Zygophyllaceae (Dycotyledoneae). Missouri Botanical Garden Press, Saint Louis.
Zuloaga, F.O., Morrone, O., Belgrano, M.J., 2008. Catálogo de las plantas vasculares del Cono Sur (Argentina, sur de Brasil, Chile, Paraguay y Uruguay). Missouri Botanical Garden Press (available at http://www2.darwin.edu.ar/Proyectos/FloraArgentina/FA.asp. Active in December 2009).
Zacarías, D., 1993. Elementos naturales y su utilización en Pampa del Indio. Hacia Una Nueva Carta Etnica del Gran Chaco 5, 215–217. Centro del Hombre antiguo Chaqueño, Las Lomitas, Formosa, Argentina.