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Medicinal plants of the Argentine Yungas plants of the Las Yungas biosphere reserve, Northwest of Argentina, used in health care

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Abstract. We have compared the species richness of medicinal plants and the differential patterns of use amongst settlements in the Andean communities of Northwest Argentina which have differing levels of isolation. About 259 ethnoespecies, belonging to 74 plant families, were included, representing between 70 and 80% of the total estimate. The results indicate that *Coronopus didymus* is the most relevant and important species. The method of use of medicinal plants and the ailments treated by *rural doctors* compared to those of the layperson is different. Native and exotic plants are used differently according to the body system treated. There are some relationships between internal and external use and body systems and recipes. The greater medicinal species richness found in the less isolated locations is due to external enriching cultural influences.

Introduction

The main goal of early Ethnobotanical studies was the documentation of endangered knowledge whilst today many projects collect data for biodiversity conservation and community development, focusing on the ecological feasibility of the indigenous management strategies (Frei et al. 2000). An implicit assumption of these studies is that plants are economically, culturally and ecologically important (Frei et al. 2000; Hersh-Martínez 2002). The recognition of this human component of the traditional ecological knowledge and of forest landscape management held by the resident cultures has led to a model of ‘community-based’ conservation (Gadgil et al. 1993). But it is important to recognize that, in many cases, local people have developed behaviors which have had a conservational impact without these initial aims; practices that, in general, look for the best results in local economy. It is important to remember that management of natural resources is foremost a question about social relations, that is to say, about the social net who is regulating the access to these resources (Kalland 2000).

In the same sense, Ethnobotanical studies have become increasingly valuable in the development of health care and conservation programs in different parts of the world (Balick 1996). In each culture the importance of each medicinal plant varies; some are hardly ever used, while others are important medicinal resources. Even so, numerous papers have called attention to the lack of information on the relative importance of medicinal plants (or other useful plants) within a culture (Moerman 1996; Ankili et al. 1999).

Many rural populations throughout the tropics rely on medicinal plants because of their effectiveness, the lack of modern alternatives and their cultural preferences. However, the distribution and extent of local knowledge and the use of medicinal plants in these societies are being altered by exposure to modern culture, increased trade and access to modern conveniences (including modern medicines). In fact, local knowledge cannot be treated as an insulated domain, since the majorities are interacting with exogenous knowledge (Osseweijer 2000).

On the other hand, forest conversion and land degradation can reduce the availability of medicinal plants and can also affect local knowledge of interests in medicinal plant use (Caniago and Siebert 1998).

In the present work the use of medicinal plants in populations residing within the Argentine Yungas Biosphere Reserve is investigated. Within the zone studied are the Baritú National Park and the National Reserve 'El Nogalar.' Both reserves are of recent creation (in 2002 and 2003, respectively) but the National Park dates back to 1974. According to Brown (1995) and Brown et al. (2001), this region has the highest biodiversity levels and rural population numbers in the Montane Cloud Forest of Argentina, but also it represents one of the biomes within the national territory most threatened by productive activities such as logging, grazing forest conversion into cropland.

Today, Pre-Columbian and Spanish colonial influences are still to be seen in the area but modern influences are constantly altering the traditional medical systems and the use of medicinal plants, as noted by Frei et al. (1998) with respect to Mexican communities. Recently, several studies concerning the use of medicinal plants have been undertaken in Northwestern Argentina (Iharlegui and Hurrell 1992; Hurrell and de la Sota 1996; Lupo and Echenique 1997). The community health issue has also been investigated on a few occasions from an anthropological viewpoint (Torres 1982; Palma 1994; Madrid de Zito Fontan and Palma 1997). Some studies on ethnomedicine have been undertaken in neighboring areas of the Salta province (Hurrell 1990, 1991; Martinez and Pochettino 1992) but there is only one ethnopharmacological study dealing specifically with the medicinal plants used within the Yungas biogeographic province (Hilgert 2001).

Ellen and Harris (2000) have defined indigenous knowledge as local, orally transmitted and constantly reinforced by experience; they have also expressed the importance of not placing local knowledge outside culture. Taking into account the above mentioned concept, the goals of the present paper are the documentation of the usage of medicinal plants in rural communities of the Yungas Biosphere Reserve of Northwest Argentina. Besides, the methods of use, the parts of the plant used and the documentation of the cultural value of the use of medicinal plants are analyzed. Finally, how this knowledge is distributed among the population and the comparison among communities with different socio-economic features and environmental conservation status are also treated.

Methods

Study site

The area is located on the eastern slope of the Cordillera Oriental in the north of the Province of Salta, Argentina, close to the Bolivian border. The localities studies were; Abra de Minas, Lipeo and Baritú, located at the limit and within the Baritú National Park, and the neighboring areas of La Mamora (Bolivia), El Condado, La Misión, Los Toldos and El Arazay (Figure 1). The climate is tropical continental with hot and rainy summers and cold and dry winters. Mean annual temperatures range from 14 to 26.5 °C with orographic rains (rains that occur by condensation of humid air rising up high mountain slopes) concentrated between September and March and with an annual rainfall of 700–1400 mm (Bianchi and Yánez 1992; Hunzinger 1995).

From a biogeographic point of view the area corresponds to the Yungas Province (Montane Cloud Forest) within the Amazonian Domain within the Neotropical Region. This biome can be divided into three environmental units: the Submontane Subtropical Forest, the Montane Moist Forest and the Temperate Cloud Forest (which includes Fog Grasslands) (Cabrera 1976).

The communities under study are considered to be part of the Andean cultural world. The inhabitants of these settlements are Andean with strong Spanish influence. They speak only Spanish although many Quechuan expressions are found in their speech. For the most part the inhabitants live under marginal socio-economic conditions. A brief analysis of the regional economy shows the coexistence of shifting agriculture, transhumance, harvesting, nomadic cattle-breeding, hunting and fishing and finally, access to paid work in temporary or permanent jobs (Hilgert 2001).

In order to gain access to the area it is necessary to leave the country via the frontier crossing, drive approximately 70 km on Bolivian roads, and then re-enter Argentina. Up to 2001 and before the inauguration of an international bridge, it was necessary to cross two river beds, which were impassable during some or all of the rainy season. At the present time Abra de Minas, Lipeo and Baritú only have communication by foot or horse for most of the year and these settlements. Table 1 provides a comparing the key socio-economic and environmental features of each study area.

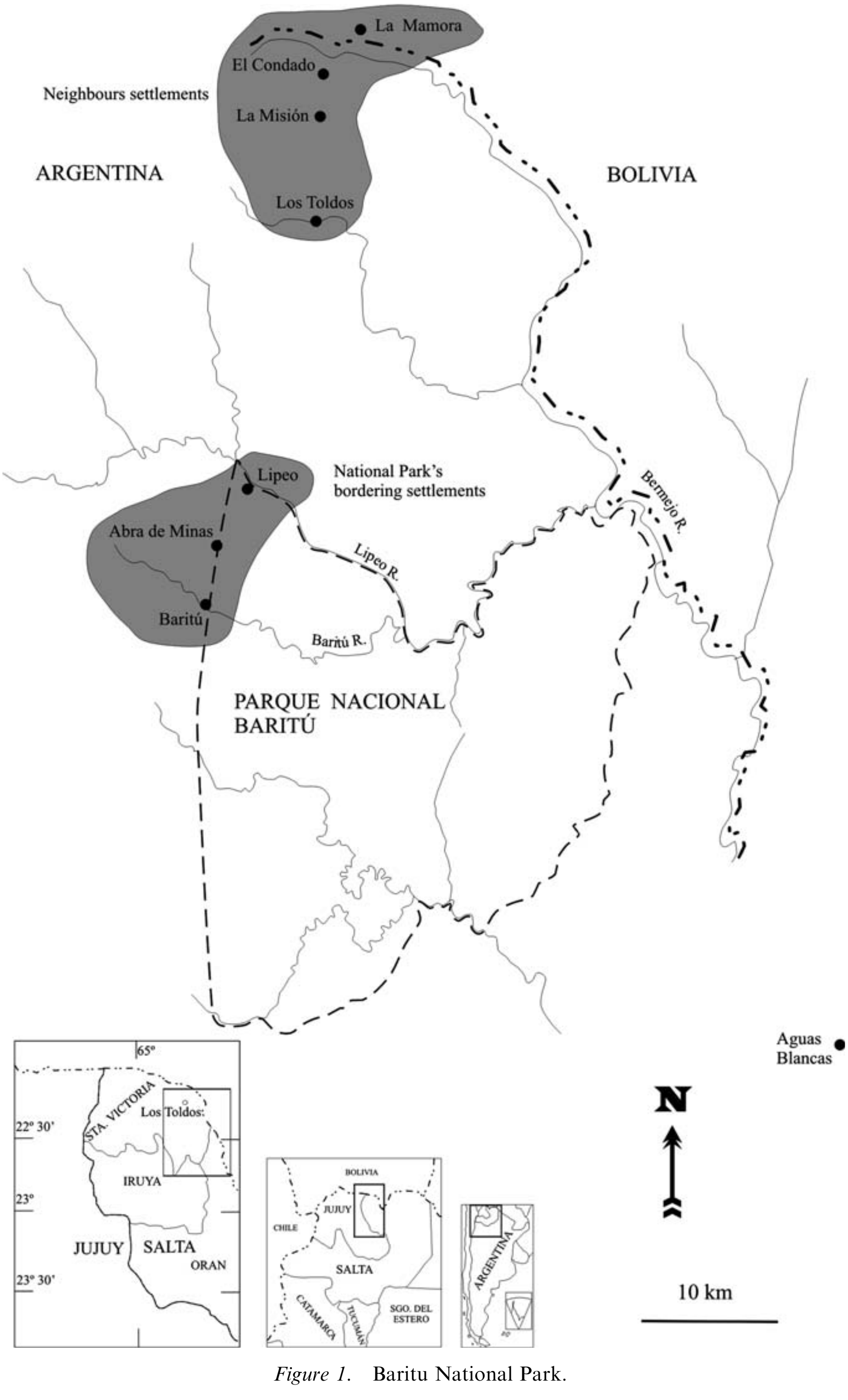

Figure 1. Baritu National Park.

Table 1. Socio-economic and environmental features of each study area.

	NP settlements			Neighbors settlements			
	Baritú	Abra de Minas	Lipeo	Los Toldos	La Misión	El Condado	La Mamora
MOSL	1500	1800	1100	1600	1100	900	1100
Vegetation type	Temperate cloud and Montane moist forest	Temperate cloud forest	Montane moist and Submontane subtropical forest	Temperate cloud and Montane moist forest	Montane moist and Submontane subtropical forest	Submontane subtropical forest	Montane moist and Submontane subtropical forest
Disturb level	Low	Low	Low	Medium	Medium	High	High
# Families	16	2	21	124	102	101	no data
First degree school	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Second degree school	No	No	No	Yes	No	No	No
Percentage analphabet mothers	74	no data	65	42	57	66	no data
Hospitals	No	No	No	Yes	No	No	Yes
Health centers	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stores	No	No	Yes	Yes	Yes	Yes	Yes
Telephone	No	No	No	Yes	No	No	Yes
Electricity	No	No	No	Yes	Yes	Yes	Yes
Car roads	In dry season	In dry season	In dry season	All year	All year	All year	All year
Public means of transportation	No	No	No	Yes	Yes	Yes	Yes

Data collection

During seven visits from 1994 to 2000 a total of 104 surveys were undertaken of 39 rural families interviewed using a semi structured questionnaire. For the present article these families were considered as two groups. The first group consisted of 19 families from Abra de Minas, Lipeo and Baritú, where a total of 39 families live (i.e. the work was undertaken using 48% of the inhabitants of or near to the Baritú National Park). The second group consisted of 18 families divided among the populations of El Condado, La Misión, Los Toldos and El Arazay in Argentina and 2 families in La Mamora (Bolivia). So, in Argentina the second group represents 5.5% of the total 327 families, we have no data about this percentage for the Bolivian city. The individuals were asked about the medicinal plants they used, the parts of the plant used, the methods of preparation and administration, the dosage, the duration of the treatment and the illness being treated. Plants were collected with the local help and were pressed and dried at the Museo de Ciencias Naturales of the Universidad Nacional de Salta, Argentina. The nomenclature used follows Zuloaga et al. (1994) and Zuloaga and Morrone (1996, 1999).

Data analysis

An 'event' is defined as the process of asking an individual on one day about the uses they know for one species, according to methods proposed by Phillips and Gentry (1993) and Phillips (1996).

The theoretical total of locally used medicinal plants was estimated in addition to the percentage representation of the species mentioned in the present study. Due to the distinct level of isolation and historical characteristics, these calculations considered separately the locations at the limit of, or within, the Baritú National Park (Abra de Minas, Lipeo and Baritú) and other more distant neighboring places (La Mamora, El Condado, La Misión, Los Toldos, El Arazay). Non-parametric estimators were used (Chao2, Jacknife1, Jacknife2) taking each informant as a sampling unit and using the EstimateS 6.0b1 program (Colwell 2000). Based on the values of species for sample calculated by EstimateS (an average of 50 simulations randomizing the observed samples) the smoothing to the species accumulation functions (Clench equation, logarithmic and linear dependence models) was analyzed with the statistical software Statistica 98 Edition (StatSoft Inc. 1998). We consider that Chao1 calculations are not applicable to this type of data as this estimator is based on rare species which are represented by only one or two individuals (in our case, verbal references) in a sample (informant) and the species that have only one or two uses will be only referenced once. As such, this type of species will deflect the calculations, resulting in overestimations of the total expected species. For this case, the individuals (references) of a survey differ from those of a natural population of a live species in which it is possible to record numerous individuals of a species by sample (Moreno 2000). The relative importance (RI) for each species was estimated, according to Bennet and Prance (2000), based on the normalized number of pharmacological properties attributed by each species and the normalized number of body systems affected by each one. Spearman correlations were undertaken between the RI and the methods of administration and the recipes. In order to analyze the differential use of native and exotic species we classify its following Zuloaga et al. (1994) and Zuloaga and Morrone (1996, 1999) adding data about natives endemics of Argentina and naturalized adventitious (Table 2). The amounts of native/exotic species used for body systems were compared using a Chi squared test. The same operation was undertaken to compare the method of application and the types of recipes used by the individuals known as 'médicos rurales' (*rural doctors*) to those of the rest of the interviewed individuals, using the number of events for each case. For these last two comparisons a discriminant analysis was also undertaken using native/exotic and *rural doctor*/layperson respectively as classificatory variables, using the frequency of the reference of each species by body system for the first case and the method of use and the recipe for the second case. All the statistical tests were undertaken using the SPSS software application for Windows (SPSS Inc. 2000).

Results

Health system

The inhabitants of the region maintain traditional health practices and therefore the underlying notion of the origin of a disease is very important for determining diagnosis and treatment. They recognize three origins for ailments; natural, socio-cultural (i.e. when a food taboo is not respected), and supernatural (i.e. witch-craft, air diseases). The last two types can be diagnosed and treated only by a *rural doctor*. Diseases of natural origin, like cough, dyspepsia, headache, postpartum pain are usually solved within the family and it is not necessary to have formal training nor to carryout any ritual process.

The hot and cold theory holds an important place in the local medicine lore. This is the theory as described by the inhabitants of the Zenta River Basin, near to the present area, (Hilgert 2001) who consider a healthy body to have a certain corporal temperature that can be altered by the influence of external factors, i.e. sun, water, or an inadequate behavior. For example if some person ate 'cold' food (like lettuce) in excess, this cold would cause a templary imbalance and he or she would have digestive problems afterwards he or she is considered to be suffering from 'cold.' The imbalance also could become from an excessive exposure to cold and humidity, or heat and dryness these may cause cold or hot.

Against 'hot' and 'cold' diseases, usually plants with an opposite condition are used, however sometimes neutral condition's beverages are prepared to

Table 2. Relative importance value of medicinal plants.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Coronopus didymus (L.), Brassicaceae (H 1987 MCNS)	quimpe, quimpy	11	1	30	1	100.0	NA
Rosa sp., Rosaceae (H 2261 MCNS)	rosa, rosa remedio	11	1	13	0.43	71.5	EX
Citrus limon (L.) Burm., Rutaceae (H 1590 MCNS)	limón	9	0.81	17	0.56	68.5	EX
Sambucus nigra L. subsp. *peruviana* (Kunth) R. Bolli, Caprifoliaceae (H 2142 MCNS)	mololo	9	0.81	17	0.56	68.5	NA
Citrus sinensis (L.) Osbeck, Rutaceae (H 2053 MCNS)	naranja, naranja dulce	10	0.91	13	0.43	67.0	EX
Malva parviflora L., Malvaceae (H 2503 MCNS)	malva	9	0.81	16	0.53	67.0	AD
Erythroxylum coca Lam. var. *coca*, Erythroxylaceae (H 2108 M-MCNS)	coca	8	0.72	18	0.60	66.0	EX
Nicotiana tabacum L., Solanaceae (H 2368 MCNS)	tabaco	9	0.81	13	0.43	62.0	EX
Acacia macracantha H. B. K., Fabaceae (H 2581 MCNS)	churqui, tusca	7	0.63	14	0.46	54.5	NA
Myroxylon peruiferum L.f., Fabaceae (H 2377 MCNS)	quina colorada, quina del campo, quina	8	0.72	11	0.36	54.0	NA
Ruta chalepensis L., Rutaceae (H&A 1399 MCNS)	ruda	7	0.63	13	0.43	53.0	EX
Plantago australis Lam., Plantaginaceae (H 2534 MCNS)	llantén	8	0.72	9	0.30	51.0	NA
Cinchona ledgeriana Monees., Rubiaceae (H 1631 M-MCNS)	quina amarilla, quina blanca, quina castilla	8	0.72	8	0.26	49.0	EX
Cortaderia selloana (Schult. et Schult. f) Asch. Et Graebn., Poaceae (H 1772 MCNS)	cortadera	8	0.72	8	0.26	49.0	NA
Verbena litoralis Kunth, Verbenaceae (H 2499 MCNS)	verbena	8	0.72	8	0.26	49.0	NA
Cinnamomum porphyrium (Griseb.) Kosterm, Lauraceae (H 2022 M-MCNS)	laurel del campo	7	0.63	9	0.30	46.5	NA
Eucalyptus camaldulensis Dehnh., Myrtaceae (H 1845 MCNS)	eucaliptus	7	0.63	9	0.30	46.5	EX
Matricaria recutita L., Asteraceae (H 2438 MCNS)	manzanilla	7	0.63	9	0.30	46.5	AD
Solanum palitans C. V. Morton, Solanaceae (H 1618 MCNS)	ñusco	7	0.63	9	0.30	46.5	EN

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Acacia aroma Gill. ex Hook et Arn., Fabaceae (H 2400 MCNS)	tusca	7	0.63	8	0.26	44.5	NA
Allium sativum L., Liliaceae (N 1578 M-MCNS)	ajo	7	0.63	8	0.26	44.5	EX
Linum usitatissimum L., Linaceae (N 1621 M-MCNS)	linaza	7	0.63	8	0.26	44.5	EX
Ocimun basilicum L., Lamiaceae (H 2058 MCNS)	albahaca	7	0.63	8	0.26	44.5	EX
Salvia gilliesii Benth., Lamiaceae (H 2321 M-MCNS)	salvia gateadora, salvia del cerro	7	0.63	8	0.26	44.5	NA
Schinus molle L., Anacardiaceae (H. 2540 MCNS)	molle	7	0.63	8	0.26	44.5	AD
Melissa officinalis L., Lamiaceae (H 1059 M-MCNS)	toronjil	6	0.54	10	0.33	43.5	EX
Xanthium catharticum HBK, Asteraceae (H 2167 MCNS)	espinillo	6	0.54	10	0.33	43.5	NA
Petiveria alliaceae L., Phytolaccaceae (H 2383 MCNS)	calaschi	7	0.63	7	0.23	43.0	NA
Zea mays L. var. *ocho rayas*, Poaceae (H 1563 MCNS)	maíz	7	0.63	7	0.23	43.0	EX
Ageratum conyzoides L., Asteraceae (H&Lo 969 MCNS)	borraja del campo, borrajilla	5	0.45	9	0.30	42.0	NA
Buddleja brasiliensis Jacq. ex Spreng., Buddlejaceae (H 2182 MCNS)	san juan c'ora	6	0.54	9	0.30	42.0	NA
Maytenus cuezzoi Leg., Celastraceae (H 2565 M-MCNS)	lloque	6	0.54	9	0.30	42.0	EN
Citrus aurantium L., Rutaceae (H 2051 MCNS)	naranja agria	6	0.54	8	0.26	40.0	EX
Fagara coco (Gill.) Engler, Rutaceae (H 2199 M-MCNS)	sauco	6	0.54	8	0.26	40.0	NA
Rosa rubiginosa L., Rosaceae (H&A 1445 MCNS)	rosa, rosa remedio	6	0.54	8	0.26	40.0	EX
Rosmarinus officinalis L., Lamiaceae (H 2103 MCNS)	romero	6	0.54	8	0.26	40.0	EX
Taraxacum officinale Weber ex F. H. Wigg., Asteraceae (H 1436 MCNS)	retama, achicoria, k'ana yuyo	6	0.54	8	0.26	40.0	AD
Satureja boliviana (Benth.) Briquet, Lamiaceae (H 2528 MCNS)	muña	5	0.45	10	0.33	39.0	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Pavonia sepium St. Hil., Malvaceae (H 1099 MCNS)	abrojo	6	0.54	7	0.23	38.5	NA
Prunus amygdalus Batsch., Rosaceae	almendras	6	0.54	7	0.23	38.5	EX
Senencio crepidifolius DC., Asteraceae (H 2500 MCNS)	arnica	6	0.54	6	0.20	37.0	NA
Anthemis cotula L., Asteraceae (H&A 1410 MCNS)	manzanilla	5	0.45	8	0.26	35.5	AD
Satureja parvifolia (Phil.) Epling, Lamiaceae (H 2269 M-MCNS)	muña	5	0.45	8	0.26	35.5	NA
Peperomia alata Ruiz et Pav., Piperaceae (H&G 2391 MCNS)	anís del monte	6	0.54	5	0.16	35.0	NA
Achyrocline alata (Kunth) DC, Asteraceae (H 2481 MCNS)	amaicha blanca, vila vila	5	0.45	7	0.23	34.0	NA
Jacaranda mimosifolia D. Don, Bignoniaceae (H&G 2397 MCNS)	tarco	5	0.45	7	0.23	34.0	NA
Piper anduncum L. var. *anduncum*, Piperaceae (H&G 2336 MCNS)	matico	5	0.45	7	0.23	34.0	NA
Plantago myosurus Lam., Plantaginaceae (H 2222 MCNS)	llantén	5	0.45	7	0.23	34.0	NA
Tanacetum parthenium (L.) Sch. Bip, Asteraceae (H&A 1479 M-MCNS)	ajenco, a. amarillo	5	0.45	7	0.23	34.0	EX
Peperomia fiebrigii C. DC., Pieraceae (H&G 2345 MCNS)	siemprevida	4	0.36	9	0.30	33.0	NA
Equisetum bogotense H. B. K., Equisetaceae (H&A 1394 MCNS)	cola de caballo chica	5	0.45	6	0.20	32.5	NA
Tagetes campanulata Griseb., Asteraceae (H&A 1478 MCNS)	rosa amarilla, rosa pascua	5	0.45	6	0.20	32.5	NA
Artemisia absinthium L., Asteraceae (H 2433 MCNS)	ajenco, a. blanco	4	0.36	8	0.26	31.0	EX
Lepechinia vesiculosa (Benth.) Epling., Lamiaceae (H 1899 MCNS)	salvia grande, salvia blanca	4	0.36	8	0.26	31.0	NA
Amaranthus hypochondriacus L. var. *powellii* (S. Watson) Ped., Amaranthaceae (H 1976 MCNS)	aroma	5	0.45	5	0.16	30.5	NA
Dahlia sp., Asteraceae (H 1975 MCNS)	dalia	5	0.45	5	0.16	30.5	EX
Dianthus caryophyllus L., Caryophyllaceae (H 2468 MCNS)	clavel de huerta	5	0.45	5	0.16	30.5	EX

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Equisetum giganteum L., Equisetaceae (H&L 1617 MCNS)	cola de caballo grande	5	0.45	5	0.16	30.5	NA
Eugenia uniflora L., Myrtaceae (H 2057 MCNS)	arrayán, a. colorado	5	0.45	5	0.16	30.5	NA
Ilex paraguariensis A. St. Hill., Aquifoliaceae (H 1565 M-MCNS)	yerba	5	0.45	5	0.16	30.5	EX
Tagetes sp., Asteraceae	comadrita	5	0.45	5	0.16	30.5	NA
Arundo donax L., Poaceae (H 2577 MCNS)	caña hueca	4	0.36	7	0.23	29.5	AD
Citrus aurantifolia (Christm.) Sw., Rutaceae (H&G 2388 MCNS)	lima	4	0.36	7	0.23	29.5	EX
Macfadyena unguis-cati (L.) A. H. Gentry, Bignoniaceae (H 2192 MCNS)	garra de gato	5	0.45	4	0.13	29.0	NA
Helianthus annuus L., Asteraceae (H 1327 MCNS)	mirasol	5	0.45	4	0.13	29.0	EX
Opuntia ficus indica (L.) Mill., Cactaceae (H&L 1859 M-MCNS)	penca, tuna	5	0.45	4	0.13	29.0	AD
Baccharis trimera (Less.) DC., Asteraceae (H 2501 MCNS)	carqueja	4	0.36	5	0.16	26.0	NA
Cajophora lateritia (Hook.) Koltzch, Loasaceae (H 2225 MCNS)	itapalla	4	0.36	5	0.16	26.0	NA
Duranta serratifolia (Griseb.) Kuntze, Verbenaceae (H 2147 MCNS)	espinillo	4	0.36	5	0.16	26.0	NA
Not identified	livi livi	4	0.36	5	0.16	26.0	
Origanum x appli (Domin) Boros, Lamiaceae (H 2242 MCNS)	orégano	4	0.36	5	0.16	26.0	EX
Stachytarpheta cayennensis (Rich) M. Vahl. f., Verbenaceae (H&A 2387 MCNS)	verbena	4	0.36	5	0.16	26.0	NA
Tabebuia impetiginosa (Mart. ex DC.) Standl., Bignoniaceae (Krap. 26581 CTES)	lapacho morado	4	0.36	5	0.16	26.0	NA
Urera caracasana (Jacq.) Gris., Urticaceae (H&G 2394 MCNS)	itapalla, orteguilla	4	0.36	5	0.16	26.0	NA
Amaranthus quitensis Kunth., Amaranthaceae (H&G 2393 MCNS)	aroma	4	0.36	4	0.13	24.5	NA
Anredera cordifolia (Ten.) Steenis, Basellaceae (H 2256 MCNS)	papa santa, hierba santa	4	0.36	4	0.13	24.5	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Canna indica L., Cannaceae (H 1972 MCNS)	achera	4	0.36	4	0.13	24.5	NA
Cucurbita ficifolia Bouché, Cucurbitaceae (H 1571 M-MCNS)	cayote	4	0.36	4	0.13	24.5	EX
Cydonia oblonga Mill., Rosaceae (H&A 1456 M-MCNS)	membrillo	4	0.36	4	0.13	24.5	EX
Prunus persica (L.) Batsch., Rosaceae (H 2049 MCNS)	durazno	4	0.36	4	0.13	24.5	EX
Rhipsalis lorentziana Griseb., Cactaceae (H&A 1462 MCNS)	huasca huasca, peinquillita	4	0.36	4	0.13	24.5	NA
Roripa nasturtium-aquaticum (L.) Hayek, Brassicaceae (H&G 2404 MCNS)	berro	4	0.36	4	0.13	24.5	AD
Saccharum officinarum L., Poaceae (H 1583 M-MCNS)	azúcar, caña dulce	4	0.36	4	0.13	24.5	EX
Scoparia dulcis L., Scrophulariaceae (H 2162 MCNS)	yerba de víbora	4	0.36	4	0.13	24.5	NA
Solanum trichoneuron Lillo, Solanaceae (H 2161 MCNS)	hediondilla	4	0.36	4	0.13	24.5	EN
Tillandsia usneoides (L.) L., Bromeliaceae (H 2187 MCNS)	sacha blanca	4	0.36	4	0.13	24.5	NA
Tournefortia paniculata Cham., Boraginaceae (H 1088 MCNS)	alcanflor	4	0.36	4	0.13	24.5	NA
Trichocereus arboricola Kimnach, Cactaceae (H&G 2399 M-MCNS)	cardón, c. blanco	4	0.36	4	0.13	24.5	NA
Pluchea sagittalis (Lam.) Cabrera, Asteraceae (H 2392 MCNS)	cuatro cantos	3	0.27	6	0.20	23.5	NA
Punica granatum L., Punicaceae (H 1643 M-MCNS)	granada castilla	3	0.27	6	0.20	23.5	EX
Aloe vera (L.) Burm. F., Liliaceae	penca aloe vera, sabila	4	0.36	3	0.10	23.0	EX
Cynodon dactylon L., Poaceae (H 2164 MCNS)	brama blanca	4	0.36	3	0.10	23.0	AD
Adiantum lorentzii Hieron., Pteridaceae (H&A 1457 MCNS)	culandrillo	3	0.27	5	0.16	21.5	NA
Aloysia polystachya (Griseb.) Mold., Lamiaceae (H 2409 M-MCNS)	burrito	3	0.27	5	0.16	21.5	NA
Apium graveolens L., Apiaceae (H&A 1447 MCNS)	apio	3	0.27	5	0.16	21.5	AD

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Mimosa polycarpa Kunth. var *subandina* Barneby, Fabaceae (H 2220 MCNS)	celosita chica	3	0.27	5	0.16	21.5	NA
Solanum sisymbriifolium Lam.var. *sisymbriifolium*, Solanaceae (H 2637 MCNS)	vila vila	3	0.27	5	0.16	21.5	NA
Oreopanax kuntzei Harms, Araliaceae (H 1375 MCNS)	higuerilla	4	0.36	2	0.06	21.0	NA
Borago officinalis L., Boraginaceae (H 2462 M-MCNS)	borraja castilla, b. de huerta	3	0.27	4	0.13	20.0	AD
Chrysanthemum sp., Asteraceae (H 2255 MCNS)	papa de margarita, margarita	3	0.27	4	0.13	20.0	EX
Mentha x piperita L. var. *citrata* (Ehrh.) Briq., Lamiaceae (H 1640 MCNS)	menta	3	0.27	4	0.13	20.0	EX
Microgramma squamulosa (Kaulf.) de la Sota, Polypodiaceae (H&G 2346 MCNS)	pori pori, poli poli, canchalagua	3	0.27	4	0.13	20.0	NA
Persea americana Mill., Lauraceae (H 2074 MCNS)	palta anisada	3	0.27	4	0.13	20.0	AD
Rhipsalis floccosa Pfeiff. subsp. *tucumanensis* (Web.) Barth., Cactaceae(H 2024 MCNS)	huasca huasca, calaguala	3	0.27	4	0.13	20.0	NA
Smilax campestris Griseb., Smilacaceae (H 2320 M-MCNS)	zarzaparilla	3	0.27	4	0.13	20.0	NA
Acaulimalva nubigena (Walp.) Krapov., Malvaceae (H 2465 M-MCNS)	altea	3	0.27	3	0.10	18.5	NA
Achyrocline flaccida (Weinm) DC, Asteraceae (H 2435 MCNS)	amaicha, vila vila	3	0.27	3	0.10	18.5	NA
Amburana cearensis (Allemao) A. C. Sm., Fabaceae (H 1620 M-MCNS)	roble	3	0.27	3	0.10	18.5	NA
Bocconia integrifolia Humb. y Bonpl., Papaveraceae (H 2541 MCNS)	mil hombres, palo amarillo	3	0.27	3	0.10	18.5	NA
Capsicum annuum L., Solanaceae (H 1894 MCNS)	ají	3	0.27	3	0.10	18.5	EX
Cedrella lilloi DC, Meliaceae (H 2634 MCNS)	cedro	3	0.27	3	0.10	18.5	NA
Cinnamomum zeylanicum Blume, Lauraceae (H 2330 M-MCNS)	canela	3	0.27	3	0.10	18.5	EX

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Cucurbita maxima Duchesne var . *maxima*, Cucurbitaceae (H 1961 MCNS)	zapallo	3	0.27	3	0.10	18.5	EX
Dodonaea viscosa Jacq., Sapindaceae (H 1012 MCNS)	chacatea	3	0.27	3	0.10	18.5	NA
Eupatorium bupleurifolium DC., Asteraceae (H&Lo 950 MCNS)	prementina	3	0.27	3	0.10	18.5	NA
Fagara naranjillo (Griseb.) Engl., Rutaceae (Jörg. 2585 SI)	naranjillo	3	0.27	3	0.10	18.5	NA
Gochnatia palosanto Cab., Asteraceae (H 1619 M-MCNS)	palo santo	3	0.27	3	0.10	18.5	NA
Hordeum vulgare L., Poaceae (H 1581 M-MCNS)	cebada	3	0.27	3	0.10	18.5	EX
Lactuca sativa L., Asteraceae (H 1569 M-MCNS)	lechuga	3	0.27	3	0.10	18.5	EX
Laurus nobilis L., Lauraceae (N 1576 M-MCNS)	laurel	3	0.27	3	0.10	18.5	EX
Lavandula sp., Lamiaceae	alhucema	3	0.27	3	0.10	18.5	EX
Myristica fragans Houtt., Myristicaceae (H 2104 M-MCNS)	nuez moscada	3	0.27	3	0.10	18.5	EX
Phoradendron tucumanense Urb., Viscaceae (H 1347 MCNS)	suelda con suelda	3	0.27	3	0.10	18.5	NA
Plantago major L., Plantaginaceae (H 2439 MCNS)	llantén	3	0.27	3	0.10	18.5	EX
Schinus meyeri Barkley, Anacardiaceae (H. 2149 MCNS)	chirimolle	3	0.27	3	0.10	18.5	NA
Schkuhria pinnata (Lam.) Kuntze, Asteraceae (H 2507 MCNS)	hallapichana	3	0.27	3	0.10	18.5	NA
Solanum sp., Solanaceae	yerba del golpe	3	0.27	3	0.10	18.5	NA
Solanum tuberosum L., Solanaceae (H 1907 MCNS)	papa	3	0.27	3	0.10	18.5	NA
Syzygium aromaticum (L.) Merr. et Perry, Myrtaceae (H 1580 M-MCNS)	clavo de olor	3	0.27	3	0.10	18.5	EX
Tournefortia lilloi M. Johnston, Boraginaceae (H&A 1428 MCNS)	alcanflor	3	0.27	3	0.10	18.5	NA
Triticum aestivum L., Poaceae (H 1584 M-MCNS)	trigo	3	0.27	3	0.10	18.5	EX
Chaptalia nutans (L.) Polak., Asteraceae (H 2521 MCNS)	pelodilla, marancel, rejón	2	0.18	5	0.16	17.0	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Chenopodium ambrosioides L., Chenopodiaceae (H 1978 MCNS)	paico	2	0.18	5	0.16	17.0	NA
Tripodanthus acutifolius (Ruiz et Pav.) Tiegh, Loranthaceae (H 1096, 2248 MCNS)	corpo	2	0.18	5	0.16	17.0	NA
Blumembachia sp., Loasaceae (H 2599 M-MCNS)	itapalla del cerro	3	0.27	2	0.06	16.5	NA
Acantholippia salsoloides Griseb., Verbenaceae (H 1612 M-MCNS)	rica rica	2	0.18	4	0.13	15.5	NA
Citrus medica L., Rutaceae (H 2328 M-MCNS)	sidra, cidra	2	0.18	4	0.13	15.5	EX
Tagetes filifolia Lag., Asteraceae (H 2180 MCNS)	anís del campo	2	0.18	4	0.13	15.5	NA
Tecoma stans (L.) Juss., Bignoniaceae (H 2532 MCNS)	guaran guay	3	0.27	1	0.03	15.0	NA
Anadenanthera colubrina (Vell.) Bernan var. *cebil* (Griseb.) Alts, Fabaceae (H&G 2398 MCNS)	cebil	2	0.18	3	0.10	14.0	NA
Apium sp., Apiaceae	apio del campo	2	0.18	3	0.10	14.0	NA
Bidens pilosa L. var. *minor* (Bl.) Sherff., Asteraceae (H&Lo 990 MCNS)	saitilla blanca, saitilla	2	0.18	3	0.10	14.0	NA
Buddleja tucumanensis Griseb., Buddlejaceae (H 2570 MCNS)	san juan c'ora	2	0.18	3	0.10	14.0	NA
Coffea arabica L., Rubiaceae (H 1641 M-MCNS)	café	2	0.18	3	0.10	14.0	EX
Cuminum cyminum L., Apiaceae (H 1593 M-MCNS)	comino	2	0.18	3	0.10	14.0	EX
Fagara rhoifolia (Lam.) Engl., Rutaceae (H&Lo 982 MCNS)	sauco hediondo, sauquillo	2	0.18	3	0.10	14.0	NA
Mentha x rotundifolia (L.) Huds., Lamiaceae (H 1639 M-MCNS)	yerba buena	2	0.18	3	0.10	14.0	AD
Not identified	oreja de perro	2	0.18	3	0.10	14.0	
Not identified (H 2267 MCNS)	alcanflor	2	0.18	3	0.10	14.0	
Not identified (H 2484 MCNS)	oreja de palo	2	0.18	3	0.10	14.0	
Ocotea puberula (Rich.) Nees, Lauraceae (N 2197 M-MCNS)	laurel	2	0.18	3	0.10	14.0	NA
Peperomia arifolia Miq., Piperaceae (H 2036b MCNS)	anís del monte	2	0.18	3	0.10	14.0	NA
Peperomia tetraphylla (G. Forst) Hook et Arn., Piperaceae (H 1426 MCNS)	siemprevida chica	2	0.18	3	0.10	14.0	NA
Peperomia theodori Trelease, Piperaceae (H 1105 MCNS)	siempreviva	2	0.18	3	0.10	14.0	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Senecio cremeiflorus Mattf., Asteraceae (H&A 1442 MCNS)	lampazo	2	0.18	3	0.10	14.0	EN
Vassobia breviflora (Sendtn.) Hunziker, Solanaceae (H 2411 MCNS)	pucancho, uchucho	2	0.18	3	0.10	14.0	NA
Viola sp. L., Violaceae (H 2455 M-MCNS)	violeta	2	0.18	3	0.10	14.0	EX
Achyrocline hyperchlora Blake, Asteraceae (H&Lo 974 MCNS)	amaicha	2	0.18	2	0.06	12.0	NA
Argenome subfusiformis Ownbey, Papaveraceae (H&L 1834 MCNS)	cardo santo	2	0.18	2	0.06	12.0	NA
Baccharis coridifolia DC, Asteraceae (H 2157 MCNS)	romerillo	2	0.18	2	0.06	12.0	NA
Baccharis grisebachii Hieron, Asteraceae (H 2460 M-MCNS)	quinchamal	2	0.18	2	0.06	12.0	NA
Campyloneurum aglaolepis (Alston) de la Sota, Polypodiaceae (H&A 1427 MCNS)	pori pori, poli poli, canchalagua	2	0.18	2	0.06	12.0	NA
Canavalia sp., Fabaceae	habilla	2	0.18	2	0.06	12.0	NA
Diatenopteryx sorbifolia Radlk., Sapindaceae (H 2376 MCNS)	suiquillo	2	0.18	2	0.06	12.0	NA
Eupatorium hookerianum Griseb., Asteraceae (H&Lo 995 MCNS)	hediondilla negra	2	0.18	2	0.06	12.0	NA
Euphorbia sp., Euphorbiaceae (H 2455 MCNS)	piedrita	2	0.18	2	0.06	12.0	
Gunnera apiculata Schindl., Gunneraceae (H&L 1745 MCNS)	querusilla colorada, quirusilla	2	0.18	2	0.06	12.0	NA
Malus sylvestris Mill., Rosaceae (H&A 1409 MCNS)	manzana	2	0.18	2	0.06	12.0	EX
Manihot esculenta Crantz., Euphorbiaceae (H&L 1616 M-MCNS)	mandioca	2	0.18	2	0.06	12.0	EX
Mimosa debilis H. B. K. ex. Willd., Fabaceae (H&Lo 947 MCNS)	celosita grande	2	0.18	2	0.06	12.0	NA
Not identified	muela hedionda	2	0.18	2	0.06	12.0	
Not identified (H 2041 MCNS)	polvillo	2	0.18	2	0.06	12.0	
Not identified (H 2509 MCNS)	violeta del campo	2	0.18	2	0.06	12.0	
Oncidium bifolium Sims, Orchidiaceae (H 2276 MCNS)	banderilla, pajarilla	2	0.18	2	0.06	12.0	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Phaseolus vulgaris L. var. *vulgaris*, Fabaceae (H 1930 MCNS)	poroto amarillo, p. blanco, p. negro, p. negro guillador	2	0.18	2	0.06	12.0	NA
Polygonum sp., Polygonaceae (H&Lo 996 MCNS)	picantilla	2	0.18	2	0.06	12.0	
Solanum sp., Solanaceae (H 2519 MCNS)	yerba mora	2	0.18	2	0.06	12.0	
Theobroma cacao L., Sterculiaceae	chocolate	2	0.18	2	0.06	12.0	EX
Tipuana tipu (Benth.) Kuntze, Fabaceae (H 2109 MCNS)	tipa	2	0.18	2	0.06	12.0	NA
Tunilla soherensii (Britton et Rose) Hunt& Illiff var. *soherensii*, Cactaceae (H 1637 M-MCNS)	airampo	2	0.18	2	0.06	12.0	NA
Ullucus tuberosus Lozano, Basellaceae (H 1305 M-MCNS)	papa verde	2	0.18	2	0.06	12.0	NA
Vriesea friburgensis Mez var. *tucumanensis* (Mez.) L. B. Sm., Bromeliaceae (H 2290 MCNS)	payo	2	0.18	2	0.06	12.0	NA
Petroselimun crispum (Mill.) A. W. Hill, Apiaceae (H 1959 MCNS)	perejil	1	0.09	3	0.10	9.5	EX
Aechmea distichantha Lem. var. *distichanta*, Bromeliaceae (H&A 1517 MCNS)	taraca	1	0.09	2	0.06	7.5	NA
Aloysia citriodora Palau, Verbenaceae (H 2574 MCNS)	cedrón	1	0.09	2	0.06	7.5	NA
Celtis iguanaea (Jac.) Sarg., Celtidaceae (H 2148 MCNS)	tala	1	0.09	2	0.06	7.5	NA
Citrus reticulata Blanco, Rutaceae	mandarina	1	0.09	2	0.06	7.5	EX
Commelina erecta L., Commelinaceae (H&A 1496 M-MCNS)	santa lucía	1	0.09	2	0.06	7.5	NA
Lagenaria siceraria (Molina) Standl., Cucurbitaceae (H 1343 MCNS)	porongo	1	0.09	2	0.06	7.5	AD
Minthostachys mollis Griseb., Lamiaceae (H 2489 MCNS)	toronjil cerreño	1	0.09	2	0.06	7.5	NA
Not identified (H 2464 MCNS)	flor de tierra, huaji	1	0.09	2	0.06	7.5	
Not identified (H 2473 M-MCNS)	siete vueltas	1	0.09	2	0.06	7.5	
Psidium aff guineense Swartz, Myrtaceae (H 2639 MCNS)	arazay	1	0.09	2	0.06	7.5	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Tabebuia lapacho (Schum.) Sandw., Bignoniaceae (H 2003 MCNS)	lapacho amarillo	1	0.09	2	0.06	7.5	NA
Tillandsia australis Mez, Bromeliaceae (H&A 1523 MCNS)	payo	1	0.09	2	0.06	7.5	NA
Adiantopsis chlorophylla (Sw.) Fée, Pteridaceae (H 2448 MCNS)	ala de cuervo	1	0.09	1	0.03	6.0	NA
Allium cepa L., Liliaceae (N 1577 M-MCNS)	cebolla	1	0.09	1	0.03	6.0	EX
Anethum graveolens L., Apiaceae (H 2538 MCNS)	eneldo	1	0.09	1	0.03	6.0	EX
Asclepias flava Lillo, Asclepiadaceae (H 1052 MCNS)	leche tres	1	0.09	1	0.03	6.0	NA
Azorella compacta Phil., Apiaceae (H&G 1044 MCNS)	yareta	1	0.09	1	0.03	6.0	NA
Bougainvillea stipitata Griseb., Nyctaginaceae (H 1015 MCNS)	huancar	1	0.09	1	0.03	6.0	NA
Brassica sp., Brassicaceae	mostaza	1	0.09	1	0.03	6.0	EX
Camellia sinensis (L.) Kuntze, Teaceae	té	1	0.09	1	0.03	6.0	EX
Capsicum frutescens L., Solanaceae (H 1373 MCNS)	ají amarillo	1	0.09	1	0.03	6.0	EX
Senna spectabilis (DC.) H. S. Irwin & Barneby, Fabaceae (H 2102 MCNS)	carnaval	1	0.09	1	0.03	6.0	EX
Senna crassiramea (Benth) H. S. Irwin & Barneby, Fabaceae (H 2466 M-MCNS)	sumalagua	1	0.09	1	0.03	6.0	NA
Chenopodium quinoa Willd., Chenopodiaceae (H 1893 M-MCNS)	quiuna, quinoa	1	0.09	1	0.03	6.0	NA
Chrysophyllum gonocarpum (M. & E.) Engler, Sapotaceae (H 2638 MCNS)	aguaí	1	0.09	1	0.03	6.0	NA
Tanacetum parthenium (L.) Sch. Bip., Asteraceae (H 2482 M-MCNS)	ajenco	1	0.09	1	0.03	6.0	AD
Cissampelos pareira L., Menispermaceae	níspero	1	0.09	1	0.03	6.0	EX
Citrus paradisi Macf., Rutaceae (H 2105 MCNS)	pomelo	1	0.09	1	0.03	6.0	EX
Cucurbita maxima Duchesne, Cucurbitaceae (H 1573 MCNS)	guinea	1	0.09	1	0.03	6.0	NA
Cyclanthera pedata (L.) Schrad., Cucurbitaceae (H 1338 MCNS)	achoscha	1	0.09	1	0.03	6.0	NA

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Cymbopogon citratus (DC) Stapf., Poaceae (H 2043 M-MCNS)	cedrón paja	1	0.09	1	0.03	6.0	EX
Cynara scolymus L., Asteraceae (H 2470 M-MCNS)	alcachofa	1	0.09	1	0.03	6.0	EX
Datura feroz L., Solanaceae (H 2285 MCNS)	chamico	1	0.09	1	0.03	6.0	EX
Erythrina falcata Benth., Fabaceae (H 1795 MCNS)	ceiba	1	0.09	1	0.03	6.0	NA
Escallonia resinosa (Ruiz et Pav.) Pers., Saxifragaceae (HG&M 1212 MCNS)	chachacoma	1	0.09	1	0.03	6.0	NA
Eupatorium sp., Asteraceae (H 2498 MCNS)	borrajilla	1	0.09	1	0.03	6.0	
Gorgonidium vermicidum (Speg.) Bogner & Nicolson, Araceae (H 1924 MCNS)	papa de víbora	1	0.09	1	0.03	6.0	NA
Gunnera schindleri L. E. Mora, Gunneraceae	querusilla blanca	1	0.09	1	0.03	6.0	NA
Hypolepis repens (L.) C. Presl., Dennstaedtiaceae (H&Lo 960 MCNS)	ala de cuervo	1	0.09	1	0.03	6.0	NA
Hyptis mutabilis (Rich.) Briq., Lamiaceae (H 2520 MCNS)	salvia mora	1	0.09	1	0.03	6.0	NA
Illicium verum Hook. f., Illiciaceas	anís estrellado	1	0.09	1	0.03	6.0	EX
Inga sp., Fabaceae	pacay	1	0.09	1	0.03	6.0	
Juglans australis Griseb., Juglandaceae (H 1107[a] MCNS)	nogal	1	0.09	1	0.03	6.0	NA
Juglans regia L., Juglandaceae	nogal castillo	1	0.09	1	0.03	6.0	EX
Krameria lappacea (Dombey) Burdet et Simpson, Krameriaceae (H 2300 M-MCNS)	chipichape	1	0.09	1	0.03	6.0	NA
Leonurus sibiricus L., Lamiaceae (H 2573 MCNS)	papa de paloma	1	0.09	1	0.03	6.0	AD
Lepidium meyenii Walp., Brassicaceae (GS 165 SI)	papa macaia, macaia	1	0.09	1	0.03	6.0	NA
Lippia alba (Mil.) N. E. Br., Verbenaceae (H 2632 MCNS)	cedrón árbol	1	0.09	1	0.03	6.0	NA
Malva sp., Malvaceae (H&A 1483 M-MCNS)	malva loca	1	0.09	1	0.03	6.0	
Not identified	carallanta	1	0.09	1	0.03	6.0	
Not identified	c'uru	1	0.09	1	0.03	6.0	
Not identified	yurito malva	1	0.09	1	0.03	6.0	
Not identified	zacatera	1	0.09	1	0.03	6.0	
Oryza sativa L., Poaceae (H 1582 M-MCNS)	arroz	1	0.09	1	0.03	6.0	EX

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Passiflora tenuifila Killip, Passifloraceae (H&A 1515 MCNS)	granadilla	1	0.09	1	0.03	6.0	NA
Peumus boldus (Molina), Monimiaceae	boldo	1	0.09	1	0.03	6.0	EX
Pimpinella anisum L., Apiaceae (H 1624 M-MCNS)	anís castillo	1	0.09	1	0.03	6.0	EX
Piper aduncum L., Piperaceae (H 2564 MCNS)	matico	1	0.09	1	0.03	6.0	NA
Pisum sativum L., Fabaceae (H 1450 M-MCNS)	arveja	1	0.09	1	0.03	6.0	EX
Pleopeltis macrocarpa (Bory ex Willd) Kaulf., Polypodiaceae (H 2451 MCNS)	pori pori, poli poli, canchalagua	1	0.09	1	0.03	6.0	NA
Polylepis australis Bitter, Rosaceae	queñua	1	0.09	1	0.03	6.0	EN
Smallanthus macrosyphus (Baker) A. Grau, Asteraceae (H 1250a MCNS)	pucunillo	1	0.09	1	0.03	6.0	NA
Prosopis nigra (Griseb.) Hieron., Fabaceae (H&G 1038 MCNS)	algarroba	1	0.09	1	0.03	6.0	NA
Ricinus communis L., Euphorbiaceae	tártago	1	0.09	1	0.03	6.0	E
Salix humboldtiana Willd., Salicaceae (Zul. 2782 SI)	sauce	1	0.09	1	0.03	6.0	NA
Scoparia plebeja Cham. Et. Schltdl., Scrophulariaceae (H 1067 MCNS)	yerba de víbora	1	0.09	1	0.03	6.0	NA
Senecio bomanii R. E. Fries, Asteraceae (H 2009 MCNS)	cosillo	1	0.09	1	0.03	6.0	NA
Sida poeppigiana (K. Schum.) Frytell, Malvaceae (H 1982 MCNS)	afata	1	0.09	1	0.03	6.0	NA
Sida rhombifolia L., Malvaceae (H 2505 MCNS)	afata	1	0.09	1	0.03	6.0	NA
Smallanthus sonchifolia (Popp. Et Endl.) Robinson, Asteraceae (H 1903 M-MCNS)	yacón	1	0.09	1	0.03	6.0	EX
Solanum tucumanense Griseb., Solanaceae (H&G 2406 MCNS)	hediondilla	1	0.09	1	0.03	6.0	NA
Tagetes terniflora H. B. K., Asteraceae (H&L 1689)	suico	1	0.09	1	0.03	6.0	NA
Tanacetum vulgare L., Asteraceae (H 2260 MCNS)	santa maría	1	0.09	1	0.03	6.0	AD
Valeriana officinalis L., Valerianaceae	valeriana	1	0.09	1	0.03	6.0	EX

Table 2. Continued.

Species, family (Herbarium number according to collector)	Vernacular name	#BS	Rel BS	#PH	Rel PH	RI	Status
Vanilla mexicana Mill., Orchidiaceae	vainilla	1	0.09	1	0.03	6.0	EX
Vicia faba L., Fabaceae (H 2263 MCNS)	haba	1	0.09	1	0.03	6.0	EX

BS – number of body systems treated; Rel BS – relative number of body systems treated (normalized to maximum value of 1); PH – number of pharmacological properties; Rel PH – relative number of pharmacological properties (normalized to maximum value of 1); RI – relative importance (Rel PH + Rel BS) 2×100(CTES) – Herbario del Instituto de Botánica del Nordeste, Corrientes; (MCNS) – Herbario del Museo de Ciencias Naturales Salta, Universidad Nacional de Salta; (M-MCNS) – Herbario del Museo de Ciencias Naturales Salta, Universidad Nacional de Salta. Sample section; (SI) – Herbario del Instituto Darwinion, San Isidro; GS – Gómez Sosa, E. V.; H&A – Hilgert, N. I. & Arenas, P.; H&G – Hilgert, N. I. & Gil, G. E.; H & L – Hilgert, N. I. & Lamas, M. L.; H&Lo – Hilgert, N. I. & Lomáscolo S.; H – Hilgert, N. I.; HG&M – Hilgert, N. I., Gil, G. E. & Marino, G.; Jörg. – Jörgensen, P.; Krap. – Krapovickas, A.; Zul. – Zuloaga, F. O.; NA – native; EN – endemic; EX – exotic; AD – naturalized adventitious.

avoid the shock of any remedy of opposite condition. These affections are considered to be of natural origin and they can promote other diseases. In these situation usually the *rural doctor* should help the patient.

Species diversity and relative importance

To estimate the theoretical total number of species used medicinally in the locations of the National Park the curve of species accumulation that best fits the Clench Model ($R = 0.999$) gives an asymptotic value of 266, that is to say the amount found (188) represents 71% of the stated total, whereas the estimators yield the following results: Chao2: 227, Jacknife1: 240, Jacknife2: 257, i.e. the observed species are between 73 and 83% of the estimated totals. For the neighboring villages the Clench model ($R = 0.998$) was also smoothed, giving an asymptote in 290. Consequently, the 230 observed species correspond to 79% of this total. The estimators gave the following values: Chao2: 288, Jacknife1: 295, Jacknife2: 323, consequently, the resultant percentage was found to be between 71 and 80% of these calculations.

The neighboring populations to the Baritú National Park (that is to say, those with a lower grade of isolation) resulted in having a greater species richness of medicinally used plants than Abra de Minas, Lipeo and Baritú, as also predicted by the estimators and species accumulation curves. The difference found represents 18.3% whilst the final estimates are between 9.3 and 21.2%.

According to the present results all local populations use at least 259 ethnospecies for medicines, comprising of 230 plants and 2 mushrooms (in addition to 16 species which have been identified by Genera, 4 by Family and 7 unidentified species purchased as fragments). The known species include 69 families of flowering plants and 5 Pteridophyta families. Ten families (Asteraceae, Fabaceae, Lamiaceae, Rutaceae, Solanaceae, Poaceae, Malvaceae, Apiaceae, Piperaceae and Verbenaceae) comprise nearly half of the total. These medicinal plants encompass 53 pharmacological properties; analgesic agents, antibiotic agents, gastrointestinal agents and respiratory agents are especially common. One species has been assigned 30 pharmacological properties (*Coronopus didymus*), 5 species (*Erythroxylum coca* var. *coca*, *Citrus limon*, *Sambucus nigra* subsp. *peruviana*, *Malva parviflora*, *Acacia macracantha*) have 14 or more properties and 65 species have only one pharmacological property (Table 2).

The values of RI vary between 6 and 100, being highest for *Coronopus didymus* (Table 2). No correlations were found between the RI and the methods of administration or the recipes.

Methods of use

In Table 3 can be seen how many species were cited for known illnesses in the 11 body systems or the systemic affections (BS) considered in the area, how many references were reported, and the method of administration. At the same time is shown the amount of possible affections in each body system (BS). It can be seen that the hot and cold syndrome, digestive and reproductive BS's contribute to more than half (55.6%) of the total reported affections and that these represent the treatments which involve the greatest diversity of species.

In relation to the method of administration, there is practically no difference in the reported totals, 50.2% are for external use and 49.8% for internal use. For external administration the use of combined species is predominant (53.5%) followed by the use of individual species (36.5%). For internal administration the use of one species only (63.8%) for recipes predominates, followed by the use of combinations of plants (29.3%). In both cases, mixtures with minerals, excrements or other elements are given in lower proportions (10% and 6.9% respectively). The method for internal administration was correlated with recipes of an individual species (Coef.: 0.654, Sig. $<$ 0.001), although this type of recipe also correlates with the method of external administration (Coef.: 0.364, Sig. $<$ 0.001). In any case, the predominance of each type of use changes according to the affection being treated. In both types of application the parts of the plant 'above ground' represent the parts most used, followed by the reproductive organs. For external use, and in third place, is the use of bark and wood, and for internal use are roots (Table 3).

The comparison between the administration methods and the recipes of the *rural doctors* with the rest of the informants gave significantly different results ($\chi^2 = 10.36$, DF $= 4$, $\alpha = 0.05$). In this case the *rural doctors* apply more external and less internal recipes than expected and more recipes of combined species and less of individual species than expected (Table 4). Discriminant analysis, based on the type of informant, correctly classified 91.9% of the

Table 3. Number of genera, families and medicinal species referred to and the method of administration for each body system or systemic affection (BS).

Body systems or systemic affections	Number of illnesses	Number of family	Number of genera	Number of species	Number of event	Use																			
						External										Internal									
						T	#1	#2	#3	#A	#B	#C	#D	#E	#F	T	#1	#2	#3	#A	#B	#C	#D	#E	#F
Hot and cold syndrome	3	54	110	144	743	536	176	341	19	40	47	66	344	38	1	207	150	43	14	14	8	67	110	7	1
Digestive	10	48	110	134	553	35	13	19	3	4	1	6	24	0	0	518	367	124	27	52	24	126	291	18	7
Reproductive	16	49	87	97	391	115	47	62	6	8	13	12	73	8	1	276	164	76	36	32	13	52	149	29	1
Skeletal-muscular system	11	40	71	81	237	219	61	136	22	16	29	24	139	9	2	18	16	2	0	3	3	2	6	4	0
Respiratory	8	25	45	54	210	72	12	43	17	7	8	23	34	0	0	138	69	60	9	8	0	49	76	3	2
Socio-cultural or supernatural	7	33	61	67	203	117	50	55	12	9	3	15	81	5	4	86	49	32	5	1	1	26	50	5	3
Nervous system	12	35	62	73	201	164	100	51	13	18	5	55	74	5	7	37	17	17	3	1	1	10	24	1	0
Urinary	3	37	63	69	185	45	11	22	7	2	6	11	20	5	1	140	73	65	2	34	6	28	69	3	0
Dermatological	6	25	38	44	159	149	63	49	37	5	33	17	80	10	4	10	9	0	1	1	3	2	3	1	0
Infections	10	19	25	26	67	51	16	26	9	8	18	7	14	3	1	16	13	0	3	0	4	5	5	0	2
Cardiovascular	5	17	19	20	47	2	2	0	0	0	1	0	1	0	0	45	33	11	1	7	6	11	18	2	1
Fiber	1	12	20	22	35	17	6	11	0	1	1	12	1	0	2	18	3	13	2	2	1	3	10	1	1
Total					3031	1522	557	815	145	118	165	248	885	83	23	1509	963	443	103	155	70	381	811	74	18

Internal – Inhalations, enemas, smoke, ingestion, aromatherapy; External – vapors, bathing, oral, local application, compresses y vapors, gargling, lavages, 'limpias,' 'compostura,' magic, tourniquets; T – total; 1 – plants used alone; 2 – plants combined with other species; 3 – plants combined with resins, ashes, salt, oil, human urine, bicarbonate, alcohol, sugar, human milk, human or chicken excrement, pig fat, kerosene, alum or earth; A – roots, rhizomes, bulbs, tubers, pseudo bulbs, and their derivatives, ashes o starch; B – bark and woods; C – reproductive organs and derivatives (fruits, flowers, nectar, petals, placenta, juice, spores); D – aerial parts (leaves and shoots and their modifications); E – complete plant; F – others (gum, oil, water accumulated in bracts, sap, etc.).

registered cases according to the frequency of use of the species by the method of administration and the type of recipe.

On the other hand, no relation was noted between the specializations of the individuals who apply medicinal plants and the body systems or systemic affections most mentioned, or that more species were involved in their cures. This includes not only sicknesses treated exclusively by consultation and participation of the *rural doctor* (the hot and cold syndrome) but also those assisted by domestic methods or with the help of an herbal doctor (digestive and reproductive diseases).

The medicinal plants include 8 life forms with herbs predominating (48.2%) followed by trees (26.6%), shrubs (14.3%), epiphytes (6.5%), vines (1.3%), saprophytes (0.8%) and hemi parasitic (0.4%). Of all the medicinal species found, 91 species are exotic, 17 of which are naturalized adventitious, and 146 are native, 5 of which are endemics of Argentina. On comparing the use of native and exotic species significance differences were found ($\chi^2 = 11$, DF = 11, $\alpha = 0.05$). A greater than expected use of native species was recorded in the treatment for the hot and cold syndrome, the skeletal-muscular system and for dermatological disorders, meanwhile exotic species were used at a higher than anticipated level for the treatment of the respiratory and digestive systems (Table 5). Discriminant analysis based on the origin of the species correctly classifies 67.14% of the observed cases according to the frequency of use of the species per body system.

Discussion

The practices observed in the area coincide in the main with those described for Northwest Argentina by Palma (1978) and Hilgert (2001). With respect to medicine practiced within the family context, no evidence was seen of the

Table 4. Comparison between the use of species for distinct body systems between *rural doctors* and the remainder of the informants.

	Number of events observed in rural doctors	Number of events expected in rural doctors	Number of events observed in common people	Number of events expected in common people	Totals
Internal	111	129.91	1186	1167.09	1297
External	142	123.10	1087	1105.90	1229
1	112	126.30	1149	1134.70	1261
2	121	106.27	940	954.73	1061
3	20	20.43	184	183.57	204
Totals	506	506.00	4546	4546.00	5052

Contingency table for the Chi squared test.
1 – Plants used alone; 2 – plants combined with other species; 3 – plants combined with resins, ashes, salt, oil, human urine, bicarbonate, alcohol, sugar, human milk, human or chicken excrement, pig fat, kerosene, alum or earth.

Table 5. Comparison of the use of native and exotic medicinal plants and exotic in the distinct body systems.

	Number of native species observed	Number of native species expected	Number of exotics species observed	Number of exotics species expected	Totals
Socio-cultural or supernatural	47	46	29	29	76
Hot and cold syndrome	97	9	57	5	154
Respiratory	31	4	36	25	67
Cardiovascular	19	18	11	11	30
Digestive	86	8	60	5	146
Fiber	11	11	8	7	19
Nervous system	50	52	36	3	86
Skeletal-muscular system	61	53	27	3	88
Reproductive	64	6	41	40	105
Urinary	50	47	28		78
Infections	19	18	11	11	30
Dermatological	39	34	18	2	57
Totals	574	5	362	3	936

Contingency table for the Chi squared test.

inseparable relation between the use of prayer and the use of wild plants, in difference to the proposal of Hurrel (1995). On the other hand, this relation is evident in treatments applied by *rural doctors* where prayer and the magic-religious factor is the principal agent for curing, using the plant only as a vehicle; concurring with Pérez de Nucci (1988). The hot and cold theory involves similar concepts to those described for the inhabitants of the Zenta River Basin situated to the south (Hilgert 2001).

The estimation of the total of medicinal species for each group of localities (villages of the National Park and neighbors of the same) is restricted to the spatial scale of the samples and is not open to extrapolation (Moreno 2000). Consequently, in the case of Abra de Minas, Lipeo and Baritú, it can be considered that the total number of medicinal species used would be very close to the value found in this present work; as to the rest, even though we have a better number of surveyed individuals this is not representative of the total of these populations. The difference between the medicinal species detected in the locations within the Baritú National Park and the total estimated may in part result from the addition of new species from the surveys of the neighboring villages (85).

No positive relation was found between the level of isolation and the species richness, in agreement with the statements of Levy et al. (1997). The neighboring localities (less isolated) resulted in having greater species richness. This is probably due to the better possibilities of access by these villagers to consultation with Bolivian *rural doctors* and the herbal markets of the country, within which the villages maintain a strong hereditary herbal tradition of the Kallawayas (Madrid de Zito Fontan and Palma 1997).

Of the 10 botanical families with the most widely used species, 8 coincide with references by Hilgert (2001) for rural populations which inhabit the Yungas area to the south of the area studied. Additionally, 6 families show as pointers in a ranking carried out by Moerman (1996) to analyze the botanical families in relation to the therapeutic categories in which the native flora of North America are used and also in an analysis of the botanical families most used for medicinal purposes in distinct regions of the world (Moerman et al. 1999).

Phillips and Gentry (1993) proposed an index of value of use (UV) for the species. The UV assists in the consensus of the informants in function of the proportion of individuals who independently make reference to a determinate use of a certain form. On the other hand, the RI used in this work reflects the total usages and does not attempt to quantify the relative importance of each use (Phillips 1996). The UV and RI indexes do not respond in a similar way for the same species with the same base data due to the fact that they are based on and correspond to distinct variables, belonging to two differing approximations. It is considered that the RI better reflects the importance of use of the species as it coincides to a greater part with the order in which the informants mention the species. This order, according to the proposal of some sampling techniques, reflects the value that each species has for the informant (Bernard 2000).

The order of importance found in the present study does not coincide with that found previously by Hilgert (2001) in which digestive and reproductive illnesses were the most important.

The correlation found between recipes of an individual species and the internal method of use, which is higher than external use, could be an indicator of a common understanding based on traditional practice and observation.

Considering that hardly any herbs have been found to be useful in ways which had not already been recognized by traditional phytotherapists (Barsh 1997), the differential use of the same species for distinct sicknesses (high RI, Table 2) is valuable data for those interested in finding new active substances.

The proportions found between external and internal use do not coincide with that cited for medicinal plants of North America, where species for internal use predominate (Moerman 1996). We suppose that these differences are based on cultural aspects that define the perception of the sickness and, with this, the way to treat it, or, as proposed by Ososki et al. (2002), they could be based on the preferences of *rural doctors*. Nevertheless, as with the references made by Ososki et al. (2002) there is an agreement between the method of administration of the treatments and the relative location of the affected BS. For example, for 'external' problems (skeletal-muscular system, dermatological) there are external uses and for 'internal' sicknesses (urinary or respiratory system) the uses are internal. Although it is possible to demonstrate that the majority of ailments considered within the nervous system are treated by external means, coincidently the greater parts of these are considered as a consequence of complications of socio-cultural or supernatural illnesses.

On comparing the use of medicinal plants by the layperson and by *rural doctors* differences were found in the method of administration and the type of recipes. This could be explained by the specialization in treating sicknesses that require 'limpias' (ritual cleansing), 'composturas' (ritual accommodation of organs, bones, etc), bathing, or a whole range of therapeutic treatment, that involve the use of ointments and potions of complex preparation. The use of the same species for distinct affections, combined with distinct plants, occasionally is due to increase in or canceling out of a certain bioactive substance according to the mixtures used. In consequence, we can assume that the *rural doctor* prepares remedies in ways which isolate their most bioactive compounds or remove toxic ones, combining plants in ways they create medically significant synergistic effects, as proposed by Barsh (1997).

On the other hand, it is important to emphasize that in the cures effected by rural doctors, the vegetable element provides the medium to create the suitable conditions, but the rituals and prayers are considered the true elements that make possible the cure, in agreement with the statements by Pérez de Nucci (1988).

In agreement with Bennet and Prance (2000), some exotic species such as *Saccharum officinarum* or *Cymbopogon citratus* are included as flavoring; however, these in turn possess bioactive substances.

In the local populations, the unique distinction that is made between the exotic species and native ones is that the major part of the first ones are 'castillas' (home-grown) which according to explications only survive after having been cultivated locally and do not really allude in the majority of cases to their introduction by Spaniards.

According to Voeks (1996) the predominance in the use of herbs and the none differential use between exotic species and native ones can be interpreted a result of the cultural adaptation to the use of those species with a greater availability in peridomestic surroundings, frequently in disturbed areas. According to the same author, this can also reflect the difficulty in finding areas of pristine vegetation or is a product of cultural changes and in the long term, the destruction of basic knowledge about the medicinal properties of the primary forests. Given the good conditions of environment conservation in the study area it is considered that an acceptable explication for the region can be found in the first conclusion. On the other hand, *Myroxylon peruiferum* is very rare in the region and *Cinchona ledgeriana* does not grow at all there, despite which, both possesses an elevated RI.

Conclusion

The populations studied live in an Argentine region of great botanical diversity that can be a source of many phytotherapeutic elements. Although the population has access to health centers and some industrial medicines the use of traditional alternative medicines is very common. The species registered represent a high percentage (between 70–80%, according our calculations) of the estimated total of herbalist medicines of the area studied. The species with the greater RI are *Coronopus didymus*, *Rosa* sp., *Citrus limon, Sambucus nigra* L. subsp. *peruviana, Citrus sinensis, Malva parviflora y Erythroxylum coca* Lam. var. *coca*, all of which are readily accessible within the region as they grow wild, they are cultivated, are ruderal or they are bought in markets or stores.

Taking into account Cox's (1990) proposal, which states that a group that has lived a long time in an environment and has a conservative 'medical tradition', it could be an interesting site to look for new drugs, the RI value and the method of use of the species are important tools for the selection of plants to be studied more exhaustively. In our study, the results can be interpreted as a reflex of the cultural syncretism, because it is possible to find both native and exotic species sharing the high scores of RI.

Native species and exotic species are used differently according to the body system to which they are applied. It could be interesting to investigate the origin of the introduction of the exotic species, as mentioned by Bennet and Prance (2000) it is very probable that some have been introduced as foodstuffs, others as ornaments and only some as therapeutics.

The rural doctors use different administration methods and recipes compared to the rest of the population, although this does not necessarily signify a greater understanding of the medicinal properties of the plants, rather a different role in the traditional medical system.

There remains the future task of evaluating the differences in the local herbalist knowledge, with deeper investigation of the capabilities of the population to recognize useful species and their application. Upon deeper investigation of those aspects that are considered in choosing the plant to be used (the state of the plant, the suitable phenological moment for harvesting, the quality of the environment where the plant grows, etc.) the quality and the depth of the herbal knowledge of all the population may be estimated since errors in the selection or the preparation can result in a non effective or a lethal potion.

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