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Constitution and characteristics of the Iberoño herbolarium: a case study within Iberá wetlands (Corrientes, Argentina)

[Constitución y características de la herbolaria iberoña: estudio de caso etnobotánico en los humedales del Iberá (Corrientes, Argentina)]

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Abstract: This work is based in the investigation about the persistence of the use of medicinal plants in the communities inhabiting the wetlands within Iberá Natural Reserve. From the participant observation and semi-structured interviews, together with the collection of reference plants, the use of 90 medicinal plants to treat 171 ailments, distributed in 12 body systems was recorded. In addition, the informant consensus factor was also calculated and a correspondence analysis was made. It was concluded that the use and knowledge associated to medicinal plants remains active, depending mostly of the native species. For this reason, the maintenance and access to the native flora by ancestral communities is suggested, to conserve the biological and cultural diversity of the Iberá Natural Reserve.

Keywords: Folk medicine; Medicinal plants; Traditional botanic knowledge; Wetlands; Northeastern Argentina.

Resumen: El presente trabajo se basó en la indagación acerca de la persistencia del uso de las plantas medicinales por parte de comunidades que habitan los humedales circunscritos dentro de la Reserva Natural Iberá. A partir de la observación participante y de entrevistas semi-estructuradas, junto a la colecta de los vegetales testigo, se registró el uso de 90 plantas medicinales para tratar 171 afecciones, distribuidas en 12 sistemas corporales. Además, se calculó el índice de uso del consenso de informantes y se realizó un análisis de correspondencias. Se concluyó que el uso y los saberes vinculados a las plantas medicinales se mantienen activos, dependiendo en mayor medida de las especies nativas. Por este motivo, se sugiere mantener el acceso hacia la flora nativa por parte de las comunidades ancestrales con el fin de conservar la diversidad biológica y cultural presentes en la Reserva Natural Iberá.

Palabras clave: Medicina tradicional; Plantas medicinales; Conocimiento botánico tradicional; Humedales; Nordeste Argentina.

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INTRODUCTION

Traditional medicine is an ensemble of empirical practices included in the knowledge of a social group, which are orally transmitted from generation to generation with the intention of solving health problems, which affect the local population. These practices are based on hundreds of years of beliefs and observations developed prior to modern medicine. Estimations proposed by the World Health Organization (WHO, 1987) indicate that a high percentage of world population continues to depend largely on traditional medicine. In Latin America, traditional medicine uses different medicinal plants to satisfy the need of primary health care and enduring the lack of official medicine as a consequence of its high costs (Ladio & Lozada, 2008).

At present, there are many articles dedicated to the exploitation of plant resources with medicinal properties that emerge from an ethnobotanical basis for their realization (Leonti *et al.*, 2002; Albuquerque, 2006; Estomba *et al.*, 2006; Molares & Ladio, 2009; Alencar *et al.*, 2010; Cartaxo *et al.*, 2010; Gonzales *et al.*, 2010; Albuquerque *et al.*, 2012; Medeiros *et al.*, 2013; Ribeiro *et al.*, 2014; Soares *et al.*, 2016; Ribeiro *et al.*, 2017; Medeiros *et al.*, 2017).

It has been observed that these practices with medicinal plants are mostly carried out in rural populations for historical and cultural reasons, which are perpetuated within them (Upadhyay *et al.*, 2010). Among the “Iberaños”, ancestral inhabitants of the wetland system commonly known as “Iberá”, located in north-central Corrientes province, Argentina, such practices still persist and an important herbarium for the region it is recognized (Martínez Crovetto, 1981; Arbo & Tresens, 2002; Pirondo, 2016).

These men and women continue largely depending on the natural resources there available, carrying out activities such as hunting, agriculture, and gathering of wood and non-wood vegetal resources, which include medicinal plants. However, and in spite of the important role that plays “home medicine” in these communities with scarce resources and limited access to health centers, the continuity of the use of medicinal plants, is threatened as consequence of climatic change and use restrictions of their ancestral territory, due to the advance of the agricultural frontier and the restrictions which generates the creation of a protected area (Pirondo & Keller, 2014).

In this sense, the main interest of this work was to investigate the use of medicinal plants in the rural communities inhabiting inside the Iberá Natural Reserve (Corrientes, Argentina). From this, other more specific objectives arose, such as documentation of ailments and disorders more frequently treated with medicinal plants, the form of their preparation, the main persons who act as sanitary agents, and the identification of the gathering patterns and identification of medicinal plants.

Study area

The selected communities for this investigation were: Yahaveré (28° 30' 41.73'' S - 57° 45' 15.98'' W), Ñupy (28° 29' 32'' S - 57° 38' 13'' W), Gallo Sapucay (28° 42' 25.0'' S - 58° 08' 15.7'' W), and Montaña (28° 03' 13.2'' S - 57° 34' 42.6'' W), which are located deeply inside of the Iberá Natural Reserve, with boundaries coincident with the Iberá watershed (Figure No. 1). It has to be mentioned that due to its extension of 1.300.000 ha, we have limited to work in depth only in the southeastern region of the reserve. The reasons why those communities were selected as study area were the cultural and environmental continuity of the territory.

From the phytogeographic point of view, the study region is characterized by having a high number of plant species that in its total represents the 26% of the floristic richness of the Corrientes province (Arbo & Tresens, 2002). From a physiognomic point of view, the vegetation is composed mainly of herbaceous plants, and in a lesser extent of woody plants, which are dispersed presenting scarce significance regarding partial and total area (Carnevali, 2003). According to the seasonal classification of Troll, the region would be included in a humid subtropical climate.

Socio-cultural context: past and present

It is hitherto known that the original territory of the area named “Iberá” was inhabited by the linguistic group *ge* (*caingang* and *guayana*) before the arrival of the *Guarani* people (Poensitz, 2012). However, there is little evidence of this group of inhabitants at present, of other culture, the *Guarani*, of which currently communities are recognized.

This inhabitant of the Iberá confined to live in a peculiar geography, typical of a wetland, continues to depend for its subsistence mainly of the natural resources there available. However, most of

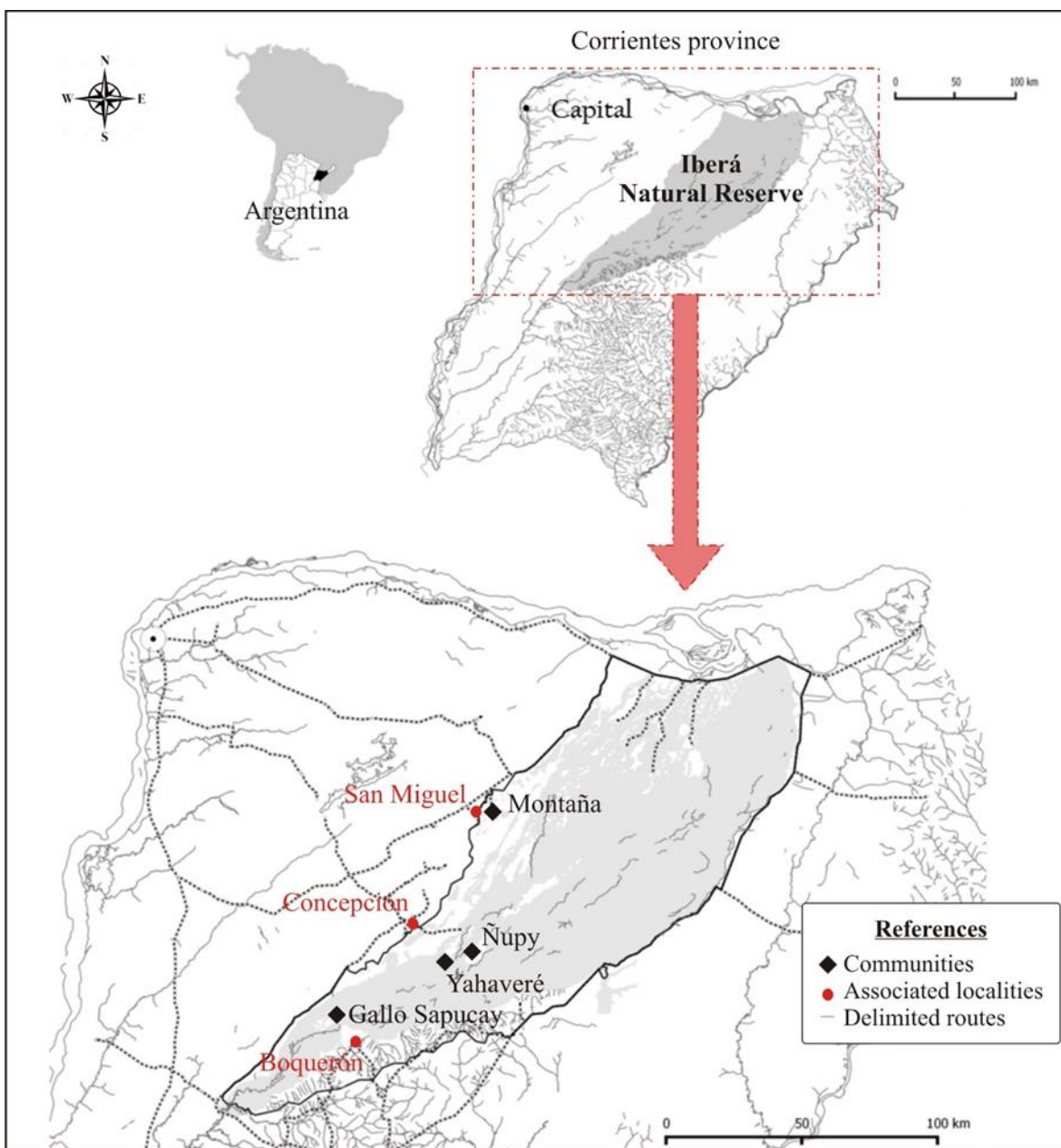


Figure No. 1
Geographical location of the study area: A) Corrientes province in Argentina; B) Iberá Natural Reserve; C) Communities located to the southeastern region of the Iberá Natural Reserve.

the traditional practices have been reducing, while others were completely eliminated as “salir a mariscar” (wild animals hunting) or the rotation of cultivation areas in different zones in a common territory, as consequence of the advance of the agricultural frontier and various touristic activities which have emerged together with the creation of the reserve. For this reason, and as occurs in other rural zones, these inhabitants had to opt for a dual economy which comprises a double role as producers of subsistence and market (Toledo *et al.*, 2008). Therefore, they currently continue to carry out some of the traditional activities as wild animals hunting to family consumption, fishing, gathering of wood and non-wood forest products (wood, medicines, among others), among other practices of local management. In addition, they carry out other occasional activities, such as rural workers, forest rangers of the reserve, and temporary jobs in localities surrounding the Reserve, such as Concepción, Loreto, Chavarría, San Miguel, Mercedes, among others.

Generally, all the communities behave as a large family through which the inhabitants generate their political, social, and economic relationships either inside or outside the community. Regarding to the organization socio-spatial, the domestic unit with a circular arrangement, integrated by the dwelling and the home garden, is where related or unrelated inhabitants share the residence. The remaining subsistence activities are organized around this habitable nucleus towards the external area. In fact, each dwelling is distant from each other, and the spaces between them are of community use being reserved the domestic area for own use of each family.

MATERIALS AND METHODS

Data collection

The data collection was made between 2009 and 2014 through 16 campaigns in the field distributed at different times of the year to observe the influence of the biological and cultural events.

In the four selected communities to start field work, the informed consent of the informants was obtained through the explanation of the objectives and implications of the investigation.

The selection of the participants for this research combined the random sampling with the snow ball technique (Albuquerque *et al.* 2010a; Bailey, 1994), in order to include all population and

not only the qualified informants. In total, 78 informants, 42 females and 36 males between 12 and 70 years old, were interviewed with different participation according to the application of the different methodologies carried out throughout this investigation.

The selected methodologies consisted in the participant observation and the application of open-ended and semi-structured interviews, together with the collection of plant specimens to testify the data as proposed by different ethnobotanical manuals (Cotton, 1996; Cunningham, 2001; Tuxill & Nabhan, 2001; Albuquerque *et al.*, 2008). The proposed methodologies were oriented at all times to the uses, availability, and gathering of the medicinal plant.

The collection of the plant specimens associated with the local knowledge consisted in collecting a fragment of the plant including branches, leaves, flowers, and fruits, while in the case of the herbaceous plants the entire plant was collected. This collection also included photographs to illustrate its environment.

For the nomenclatural update, the Catálogo de las Plantas Vasculares del Cono Sur (online 2018) criterion was used, consulting other databases available on the web (MOBOT trópicos) for particular cases.

Information processing

The information processing consisted in the systematization of the collected data in audio recordings, field notes and the graphics derived from the proposed methodologies for the data collection.

For the data verification, the validity criterion used was that at least two informants have repeated the same data during field work (Scarpa, 2012). In those cases in which the data have been mentioned only once, they were validated through relevant literature (Suárez, 2014).

However, there were data in which there was no need to be check in the laboratory, since their validation was made in the field through the techniques of cross (to submit the information provided by an informant to another informant) and repeated information (reiterate the same question after a while to the same informant) (Albuquerque *et al.* 2010b).

The categorization of the data, consisted in the plant classification according to: a) biogeographical origin, using the categories of **native**

for those species belonging to the region, and **exotic** for the plants which have been introduced to the region from outside the country, based on Zuloaga & Morrone (1999); b) gathering site, which has been delimited according to the distances of the medicinal plants from the domestic area or dwelling. For this, three categories of areas or gathering sites were defined: **external area**, which includes the plants localized further than 1000 m of the dwelling or domestic area, **internal area** to denominate the domestic area around the dwelling less than 1000 m, and the **commercial area** containing the plants which are commercialized at local markets; c) degree of dependence of the plants regarding to the management of the inhabitant with them, differentiating the **wild plants** which grows without the intervention of the man, the **cultivated plants**, and the **acquired plants** which are entered into the community from the purchase at local market.

The diseases and/or physical manifestations mentioned during the interviews, were grouped according to the Statistical Classification of Diseases and related Health Problems (CIC-10), proposed by World Health Organization (WHO, 2016). For this, the following body systems were used: **urinary system, digestive system, skin diseases, circulatory system, female reproductive system, osteo-muscular system, respiratory system, antiparasitary, eye disorders, and tooth diseases.**

It has to be mentioned that it was followed as a general criterion that for those terms that lack of an English equivalent, they were maintained in Spanish, using quotation marks to differentiate them.

Data analyses

To identify the body systems that were highlighted at a local level, the Informant Consensus Factor (ICF) was calculated according to the following formula proposed by Trotter & Logan (1986).

$$ICF = (n_{ur}-n_t)/(n_{ur}-1),$$

where:

n_{ur} = number of citations of uses in each body system.

n_t = number of species used in the body system.

Thus, the maximum value that a body system may reach is 1 indicating a larger concordance among

the informants regarding to the mentioned plants for the body system.

In addition, a correspondence analysis based on the medicinal species and the categories of the three treated variables (biogeographical origin, gathering site, and degree of dependence) was made. This allowed representing in a space of two dimensions the similarities among the categories of a variable regarding to the categories of the other and, on the other hand, the relation among the categories of each variable separately. This analysis was made with the software PAST 1.68 (Hammer *et al.*, 2001).

Furthermore, different graphic representations were made with the software Excel in order to graph and obtain a better visualization of the results.

RESULTS AND DISCUSSION

Constitution and characteristics of the Iberoño herbarium

Within the pharmacopoeia of the study area, the use of 90 plants species belonging to 80 genera and 48 families was recorded (Table No. 1). Of this total, 7 plants were identified at generic level and only 1 could not be identified. The most relevant families regarding to the number of species were: Asteraceae (11), Euphorbiaceae (6), Lamiaceae (6), Apiaceae (4), Boraginaceae (3), and Fabaceae (3).

The species richness found in studied rural populations resulted low comparing the only similar work made by Martínez Crovetto (1981) in an urban area located in the northwestern region of Corrientes province, in which he studied the medicinal plants available at popular markets of Corrientes city and surroundings. However, such richness is not low when comparing with that found in other studies referring to the regional medical ethnobotany, which have been made in rural communities in different regions of Argentina: northwestern 163 species (Scarpa, 2004), Patagonia 89 species (Estomba *et al.*, 2006), and Pampa-Cuyana 85 species (Muiño, 2011).

This Iberoño herbarium includes native and exotic plants, with a higher proportion of native plants (66) in relation to the number of exotic plants (23). It was recorded that this inclusion of exotic species is a result of the exchange of native and foreign plants that are being carried out since historical times. In this sense, it was recognized that were the migratory processes from and inwards the communities in study, from which different medicinal plants have been included to the Iberoña

list. Such inclusions are made through the recommendations of relatives or acquaintances which live in nearby localities or which have migrated to large distant cities, where a fluid contact permits the exchange of such knowledge. This phenomenon or integration process, such as explained by Ladio &

Albuquerque (2014) for urban contexts, does not imply the homogenization or mixture of knowledge systems, but rather refer to the idea that all knowledge systems coexist in the same space, referring thus to the hybridization concept from an ethnobiological perspective.

Table No. 1
MEDICINAL PLANTS CITED BY THE IBERÁ INHABITANTS

Plant (scientific name and common name)	Use (incidence in body system)	Part used/ preparation	Degree of dependence	Biogeographical
Equisetaceae				
<i>Equisetum giganteum</i> L. (cola de caballo)	Urinary system	Aerial part/infusion	Wild	N
Pteridaceae				
<i>Adiantum pseudotinctum</i> Hieron (culantrillo)	Digestive system	Fronde/Infusion	Wild	N
Amaranthaceae				
<i>Althernantera pungens</i> Kunth (yerba del pollo)	Skin diseases	Aerial part/Infusion	Wild	N
Apiaceae				
<i>Pimpinella</i> cfr. <i>Anisum</i> L. (anis)	Skin diseases	Seeds/Washings	Acquired	E
<i>Anethum graveolens</i> L (eneldo)	Digestive system	Aerial part/Infusion	Acquired	E
<i>Eryngium</i> cfr. <i>Elegans</i> Cham. & Schldtl. (turutu tu'i)	Circulatory system	Branches/Infusion	Wild	N
<i>Petroselinum crispum</i> (Mill.) Fuss (perejil)	Female reproductive system	Aerial part/Infusion	Cultivated	E
Apocynaceae				
<i>Tabernaemontana catharinensis</i> A. DC. (sapiro)	Digestive system	Leaves and fruits/ Decoction	Wild	N
Areaceae				
<i>Acrocomia aculeata</i> (Jacq.) Lodd. ex Mart. (mbocaja)	Female reproductive system	Fruits/Infusion	Wild	N
Araucariaceae				
<i>Araucaria angustifolia</i> (Bertol.) Kuntze	Osteo-muscular	Cortex/Macerating	Cultivated	N

(pino Paraná)	system			
Aristolochiaceae				
<i>Aristolochia elegans</i> Mast. (mil hombre)	Circulatory system	Aerial part/Infusion	Wild	N
<i>Aristolochia fimbriata</i> Cham. (contrayerba)	Digestive system	Branches/Infusion	Cultivated	N
Asphodelaceae				
<i>Aloe</i> cfr. <i>vulgaris</i> Lam. (aloe)	Digestive system	Branches/Infusion	Cultivated	E
	skin diseases respiratory system	Branches/Plaster Branches/Gargies		
Asteraceae				
<i>Achyrocline satureoides</i> (Lam) DC. (marcelita)	Digestive system	Leave/flowers/ Infusión	Wild	N
<i>Artemisia absinthium</i> L. (ajenjo)	Digestive system	Aerial part/ Infusion	Cultivated	E
<i>Artemisia</i> sp. (altamisa)	Digestive system	Aerial part/Infusion	Cultivated	E
	Antiparasitary	Aerial part/Infusion		
<i>Chaptalia nutans</i> (L.) Pol. (diente de león)	Circulatory system	Aerial part/Infusion	Wild	N
<i>Conyza glandulitecta</i> Cabrera	Digestive system	Branches/Infusion	Cultivated	N
<i>Gamochaeta pensylvanica</i> (Willd.) Cabrera (vira-vira)	Skin diseases	Aerial part/infusion, washings	Cultivated	N
<i>Pluchea sagittalis</i> (Lam.) Cabrera (yerba lucera)	Digestive system	Aerial part/Infusion	Cultivated	N
<i>Matricaria chamomilla</i> L. (manzanilla)	Osteo-muscular system	Aerial part/Infusion	Acquired	E
<i>Sisyrinchium</i> sp. (canchalagua)	Circulatory system	Branches/Infusion	Wild	N
<i>Xanthium spinosum</i> L. var. <i>spinosum</i> (abrojo)	Digestive system	Aerial part/Infusion	Wild	N
	skin diseases	Aerial part/Infusion		

Basellaceae				
<i>Anredera cordifolia</i> (Ten.) Steenis (etas)	Female reproductive system	Aerial part/Infusion	Wild	N
Boraginaceae				
<i>Heliotropium elongatum</i> Hoffm. ex Roem. & Schult. (kururu ka'a)	Respiratory system	Leaves/Infusion	Wild	N
<i>Varronia curassavica</i> Jacq. (maría negra)	Digestive system	Branches/Infusion	Wild	N
Brassicaceae				
<i>Lepidium auriculatum</i> Regel & Körn. (mascuarcito)	Antipyretic	Aerial part/Infusion, washings	Wild	N
Celastraceae				
<i>Maytenus ilicifolia</i> Mart. ex Reissek (kangorosa)	Circulatory system	Aerial part/Infusion	Cultivated	N
Celtidaceae				
<i>Celtis ehrenbergiana</i> (Klotzsch) Liebm. (tala)	Respiratory system	Leaves/Infusion	Wild	N
<i>Celtis iguanaea</i> (Jacq.) Sarg. (tala)	Respiratory system	Leaves/Infusion	Wild	N
Commelinaceae				
<i>Commelina erecta</i> L. (sata lucia)	Eye disorders	Washings	Wild	N
Convolvulaceae				
<i>Dichondra sericea</i> Sw. var. <i>tomentosa</i> H.T. Buck ex Tronc. & Bacigalupo (oreja de gato)	Digestive system	Leaves/Infusion	Wild	N
<i>Cuscuta</i> sp. (cabello de ángel)	Digestive system	Aerial part/Infusion	Wild	N
Chenopodiaceae				
<i>Dysphania ambrosioides</i> (L.) Mosyakin et Clemants (ka'a re)	Digestive system	Aerial part/Infusion	Wild	N
	Antiparasitary	Aerial part/Infusion	Wild	
Euphorbiaceae				
<i>Croton glandulosus</i> L. (canilla puntá)	Digestive system	Aerial part/Infusion	Wild	N
<i>Euphorbia seloi</i> (Klotzsch & Garcke) Boiss.	Digestive	Aerial part/Infusion	Wild	N

(yerba de la vida)	system			
<i>Euphorbia serpens</i> Kunth (china meona)	Urinary system	Aerial part/Infusion	Wild	N
<i>Jatropha isabelli</i> Müll. Arg. (jagua nambi)	Respiratory system	Flowers/Infusion	Wild	N
	circulatory system	Aerial part/Infusion		
<i>Sapium haemospermum</i> Müll. Arg. (kurupí)	Tooth disease	Latex/Unguent	Wild	N
Fabaceae				
<i>Acacia caven</i> (Molina) Molina var. <i>caven</i> (santa fé)	Skin diseases	Leaves/flowers	Wild	N
		Washings		
<i>Bauhinia forticata</i> Link (pata buey)	Urinary system	Leaves/Infusion	Wild	N
<i>Caesalpinia paraguariensis</i> (D. Parodi) Burkart (guayacán)	Circulatory system	Cortex/Decoction	Cultivated	N
<i>Sesbania virgata</i> (Cav.) Pers. (café)	Respiratory system	Seeds/Toasted seeds ingestion	Wild	N
<i>Senna occidentalis</i> (L.) Link (taperyga)	Skin diseases	Leaves/Washings	Wild	N
Lamiaceae				
<i>Lavandula</i> sp. (alhucema)	Digestive system	Leaves/Infusion	Acquired	E
<i>Mentha rotundifolia</i> (L.) Huds. (yerba buena)	Digestive system	Leaves/Infusion	Cultivated	E
<i>Mentha</i> sp. (yerba mota)	Digestive system	Leaves/Infusion	Acquired	E
<i>Menta</i> sp. (menta)	Digestive system	Aerial part/Infusion, washings	Cultivated	E
<i>Pogostemon cablin</i> Benth. (pachulí)	Osteo-muscular system	Aerial part/alcohol rub	Cultivated	E
<i>Rosmarinus officinalis</i> L. (romerito)	Skin diseases	Aerial part	Acquired	E

Malpighiaceae				
<i>Heteropterys glabra</i> Hook. & Arn. (tilo de campo)	Nervous system	Leaves/flowers/ infusión	Cultivated	N
Malvaceae				
<i>Sida rhombifolia</i> L. (typycha ratá)	Female reproductive system	Leaves/Infusion, washings	Wild	N
<i>Malva parviflora</i> L. (malva)	Osteo-muscular system	Aerial part/infusión, washing	Cultivated	E
Moraceae				
<i>Ficus luschnatiana</i> (Miq.) Miq. (guapo'y)	Respiratory system	Aerial part/Infusion	Wild	N
Myrtaceae				
<i>Eucalyptus</i> sp. (eocalito)	Respiratory system	Leaves/Steam	Cultivated	E
<i>Eugenia uniflora</i> L. (ñangapiry)	Circulatory system	Leaves/Infusion	Wild	N
<i>Eugenia myrcianthes</i> Nied. (uvajay)	Circulatory system	Fruits/Infusion	Wild	N
<i>Psidium guajava</i> L. (arasa)	Digestive system	Leaves/Infusion	Wild	N
Phyllanthaceae				
<i>Phyllanthus tenellus</i> Roxb. (rompre piedra)	Urinary system	Leaves/Infusion	Wild	E
Orchidaceae				
<i>Gomesa bifolia</i> (Sims) M.W. Chase & N.H. Williams (periconita)	Digestive system	Leaves/Infusion	Cultivated	N
Papaveraceae				
<i>Argemone subfusiformis</i> G.B. Ownbey (cardo santo)	Circulatory system	Aerial part/Infusion	Wild	N
Passifloraceae				
<i>Passiflora caerulea</i> L. (mburucujá)	Nervous system	Aerial part/Infusion	Wild	N
Phyllanthaceae				
<i>Phyllanthus sellowiana</i> (Klotzsch) Müll. Arg (sarandi)	Circulatory system	Branches/cortex/ Decoction	Wild	N

Phytolaccaceae				
<i>Petiveria alliacea</i> L. (pipi)	Osteo-muscular system	Aerial part/Washings	Cultivated	N
Plantaginaceae				
<i>Plantago tomentosa</i> Lam. ssp. <i>tomentosa</i> (llantén)	Respiratory system	Leaves/infusión, gargles	Wild	N
Poaceae				
<i>Gymnopogon spicatus</i> (Spreng.) Kuntze (tacuarilla)	Respiratory system	Aerial part/infusion	Wild	N
Polygonaceae				
<i>Polygonum hydropiperoides</i> Michx. var. <i>hydropiperoides</i> (cataí)	Osteo-muscular system	Aerial part/Infusion	Wild	N
<i>Muehlenbeckia sagittifolia</i> (Ortega) Meisn. (zarza mora)	Digestive system	Root/Decoction	Cultivated	N
Pontederiaceae				
<i>Eichhornia crassipes</i> (Mart.) Solms (aguape)	Digestive system	Aerial part/Infusion	Wild	N
Portulacaceae				
<i>Portulaca oleracea</i> L. (verdolaga)	Osteo-muscular system	Aerial part/Washings	Wild	N
Rosaceae				
<i>Prunus persica</i> (L.) Batsch (durazno)	Skin diseases	Leaves/infusión, Washings	Cultivated	E
Rubiaceae				
<i>Galianthe</i> cfr. <i>centranthoides</i> (Cham. & Schltld.) E.L. Cabral (charrúa)	Urinary system	Root/Decoction	Cultivated	N
Rutaceae				
<i>Citrus x limon</i> (L.) Osbeck (limón)	Circulatory system	Juice/Infusion, "quemadillo"	Cultivated	E
<i>Citrus x aurantium</i> L. (naranja)	Respiratory system	Juice/Infusion, "quemadillo"	Cultivated	E
Sapindaceae				
<i>Allophylus edulis</i> (A. ST.-Hil., A. Juss. & Cambess.) Hieron. Ex Niederl. (cocú)	Digestive system	Leaves/Infusion	Wild	N

Sapotaceae				
<i>Chrysophyllum gonocarpum</i> (Mart. & Eichler) Engl. (aguaí)	Osteo-muscular system	Leaves/infusion, Washings	Wild	N
Smilacaceae				
<i>Smilax campestris</i> Griseb. (zarza parrilla)	Urinary system	Leaves/Infusion	Wild	N
Solanaceae				
<i>Nicotiana tabacum</i> L. (tabaco)	Skin diseases	Leaves/Unguent	Cultivated	E
<i>Solanum sisymbriifolium</i> Lam. (tuña)	Osteo-muscular system	Root/Decoction	Wild	N
<i>Brugmansia</i> sp. (floripón)	Respiratory system	Leaves/Infusion	Cultivated	E
Urticaceae				
<i>Cecropia pachystachya</i> Trécul (amba'y)	Respiratory system	Leaves/Infusion	Wild	N
<i>Urtica spatulata</i> Sm. (ortigueta)	Osteo-muscular system	Aerial part/Washings	Wild	E
<i>Parietaria debilis</i> G. Forst. (paletaria)	Digestive system Skin diseases	Aerial part/Infusion Aerial part/Washings	Cultivated	N
Verbenaceae				
<i>Aloysia citriodora</i> Palau (cedrón)	Digestive system	Leaves/Infusion	Cultivade	N
<i>Aloysia polystachya</i> (Griseb.) Moldenke (burro ka'a)	Digestive system	Leaves/Infusion	Cultivated	N
<i>Lippia alba</i> (Mill.) N.E. BR. (salvia)	Osteo-muscular system	Leaves/Infusion, Washings	Wild	N
<i>Stachytarpheta cayennensis</i> (Rich.) Vahl. (colita de tatu)	Digestive system	Leaves/Infusion	Cultivated	N
<i>Aloysia gratissima</i> (Gillies & Hook) Tronc ka'a ovecha / yerba de la oveja	Skin diseases	Leaves/Washings	Cultivated	N

Magical-religious plants

A separate section deserves the use of magical-religious plants, as they are also included in the Iberoñeño cultural baggage. This is the reason for which a border area where empirical medicinal knowledge, religion, and magic are inextricably mixed exists. Such complex nature of traditional medicine in the Iberoña culture, as in other sites of Corrientes province, reveals the Amerindian heritage (Martínez Crovetto, 1981) responsible of the syncretism with elements that have been introducing during the conquest and have extended during the colonial period to the present. For the category of magical-religious plants from an *etic* point of view, may be mentioned plants which: a) are used with preventives purposes as personal amulets, b) are placed in front of the dwellings to dispel negative intentions which might bring diseases and emotional disturbances into their homes, and c) are used as aromatic smoke on key dates in order to heal the dwelling; are highlighted.

Diseases and most recurrent disorders

This inventory of 90 medicinal plant species was indicated to treat a total of 171 diseases, which are manifested in 12 body systems. All these data were supported by the ICF values, confirming the incidence of disorders in the body systems indicated by the local population (Table No. 2).

In first place, the digestive system (0.70) was highlighted as the most cited body system, regarding to the number of plants used to treat recurrent disorders, remaining to confirm whether they are caused by the ingest of a high fat-protein content derived from daily meat consumption or, as previously proposed in other studies, due to the facility of the treatment of gastrointestinal ailments in the domestic area (Macia *et al.*, 2005; De la Cruz *et al.*, 2007; Scarpa, 2012). This data coincides also with the more frequently found disorders in other regions of the world, which also recognized a higher use of medicinal plants to treat gastrointestinal disorders (De la Cruz *et al.*, 2007; Molares & Ladio, 2009; Campo-Navarro & Scarpa, 2013). The diseases related to the digestive system cause headaches, “retorcijones de panza” (stomach ache), vomits, liver and intestine inflammations or a general malaise.

Secondly, the diseases related to the respiratory system (0.54) were distinguished, which were mentioned as “tos” (cough), “gripas”

(influenza), “resfríos” (cold), and “dolor de garganta” (sore throat). These diseases mostly occur in colder months of the year and are most frequent in adults that carry out activities during hours in which the intensity of the sun decrease (dawn and sunset) being exposed to cold and contact with water.

Thirdly, different ailments of the body, bones or head were frequently mentioned and described, which were assigned from an *etic* point of view to the osteo-muscular system (0.50). However, from the *emic* point of view, they recognized that these disorders or physical ailments are produced repeatedly because of their lifestyle and environment in which they live, as reported for other areas of the country (Martinez *et al.*, 2004; Richeri *et al.*, 2013). Pains of the body and bones are mainly suffered by men carrying out horse riding activities, during long physically demanding journeys. These pains due to blows or extremities sprains were also mentioned, which are more frequent in children and occasional in adults, equally in both genders, as consequence of horse riding. Regarding to headaches, most of the interviewed inhabitants mentioned that they feel them after journeys with high temperature, where people must be exposed to the sun and gets insolated, generating headaches, cloudy vision, and general malaise.

Finally, a high number of diseases related to the skin (0.18), were highlighted such as “picazón” (itch), “hinchazón” (swelling), “lastimadura” (wound), “verruca” (wart), “quemadura” (burn), “picaduras” (sting), which are generally treated with animal fat unguents or washings in affected parts with preparations derived from the medicinal plants indicated for these treatments.

Remedies preparation

Among the prescriptions indicated to use the previously mentioned medicinal plants, the infusion was highlighted as the main form of preparation, being prepared as tea or “mate”. The former consists in a preparation in which the water should be boiled and then put the medicinal plant in the recipient with the boiled water, for then drinking the infusion, which might be sweetened or not, at a lower temperature. However, the infusion drunk through “mate” has to be prepared making a mixture of the portion of the medicinal plant indicated to treat the disease together with the “yerba mate” (*Ilex paraguariensis*) in a recipient denominated

“porongo” in which the “mate” is “cebado” (served) with the previously heated water.

Table No. 2
Informant Consensus Factor (ICF).

Use (incidence body system)	Use citation	% all species	% all use citacion	ICF
digestive system	74	33	43	0.70
respiratory system	25	13	15	0.54
circulatory system	14	12	12	0.23
osteo-muscular system	21	12	8	0.50
skin diseases	12	11	7	0.18
urinary system	7	7	4	0.16
female reproductive system	6	4	3	0.40
antiparasitary	3	3	2	0.00
nervous system	3	2	2	0.50
antitermico	3	1	2	1.00
eye disorders	1	1	1	0.00
tooth disease	2	1	1	1.00

In second place, those prescriptions, which require treating the diseases directly over the part of the body through washings, rubbings, and unguents, were mentioned. To perform the washings, the water resulting of a decoction with the portion of the indicated plant is used. However, the rubbings use a preparation containing alcohol with the indicated fragment of the selected plant, and the unguents use fat derived from domestic animals such as chicken (*Gallus gallus domesticus* Linnaeus) or wild animals such as the capybara (*Hydrochoerus hydrochaeris* Linnaeus).

Other types of prescriptions, were also recognized, as the macerates which use only roots or bark; the poultice, indicated for plants such as the aloe (*Aloe* sp.) which has fleshy leaves; the “quemadillos” used for children, consists in cooking the sugar with the part of the prescript plant; the inhalations; the “buches” (mouthwashes), in which the liquid must be maintained in the mouth, without swallowing it, and then spit, and finally the gargles, which differs from the mouthwashes in that the liquid is maintained in the throat without swallowing it, but the breath must be expulsed.

Regarding to the dosage of each recipe, it depends on the part of the plant to be used, such as leaves, flowers, stems, portions of bark, among

others. However, in cases in which it is not used a specific part of the plant is dosed by handfuls, alluding to the amount or portion of herbs, which fit in a hand. Recipes which consist of combinations of two or three medicinal species were also recognized, not to increase the effect, but as part of the formula. Among these prescriptions, the variation of some of the plant species is tolerated if it is a generalized disorder, but when it is treated of specific diseases the formula has to be composed of each of the prescript species.

Regarding to the plants preservation, it was recognized that, in general, they are used fresh when they are gathered around the dwellings. The plants are only stored, previously dried, when the inhabitants have limited access for different reasons, such as: a) located at large distances, b) those in which only the flower is used, c) located in areas with limited access for being currently private lands, and d) those confined to sites affected by the seasonal periods of the wetland.

It is significant to consider that for the study area, most of these healings, such as was recognized by Poenitz (2012), are impregnated with elements of the ancestral shamanic practices, which attempted to be removed during the Jesuit evangelization period. However, these elements were kept hidden through

time with rituals of the Catholic liturgy for the study area. For this reason, the healing practices besides including medicinal plants, continue using prayers and invocation to diverse images of saints or local “gauchillos”, among other symbolism, which contribute to give strength to the healing. Thus, the small family sanctuaries in which several images and holy cards, ribbons with allegorical colors, flowers, candles, among other elements are found, play an important role behaving as the sacred space in which the medicinal plants are placed a few days before their use to strengthen their healing properties.

It must be mentioned that some of these practices are not only used when the disease is already instated, but they are also indicated with preventive purposes avoiding future ailments. In this section referred to the preventive techniques, the “mate” must be mentioned as the main procedure for dosing a wide range of preventive medicines, while others indications are the tea infusions with medicinal plants to prevent future digestive disorders, after eating food with high-fat content or when a higher quantity than normal was ingested. In addition, other preventive procedures were indicated, for example, the use of the “amba’y” (*Cecropia pachystachya*) or the “tártago” (*Ricinus communis*) leaves, which are large in size, palmate, and with a whitish underside to avoid insolation. For this, the inhabitants place these leaves under their hat to refract the sunrays avoiding the intense heat in their heads.

People in charge of the community health care

It was recorded that are the women who are in charge of the health care, being them who have a wider knowledge referring to the plants with their associated uses and prescription forms. However, few adult women inside the communities were distinguished by having a larger knowledge and recognition of the medicinal plants, reason for which young women with small children use to turn to them to consult regularly. In addition, some people in charge of healing diseases through a secret that only have some people of the communities of both genders were recognized. This kind of diseases, that we designed as cultural in this work are those, which are defined through syndromes, which signs and symptoms have multiple origins and their diagnostic, and treatment are chosen from within specific cultural and symbolic contexts (Estomba *et al.*,

2006). Among these diseases, the “empacho” was widely cited, recognized through symptomatology as indigestion or stomachache (Campos-Navarro & Scarpa, 2013).

It was recognized that the domestic area behaves as the healing context par excellence, as in most rural population (Idoyaga Molina, 1999). However, it was observed that only for occasions, in which the malaise lasted, to turn to the hospital to look for of alternative or complementary healings, or continuing with the indications of their own medicine in communion with the indications provided by the hospital. It was recorded that those visits to health centers have included in the cultural heritage prescriptions of diseases as diabetes, asthma, uric acid, among others, which have been diagnosed in health centers.

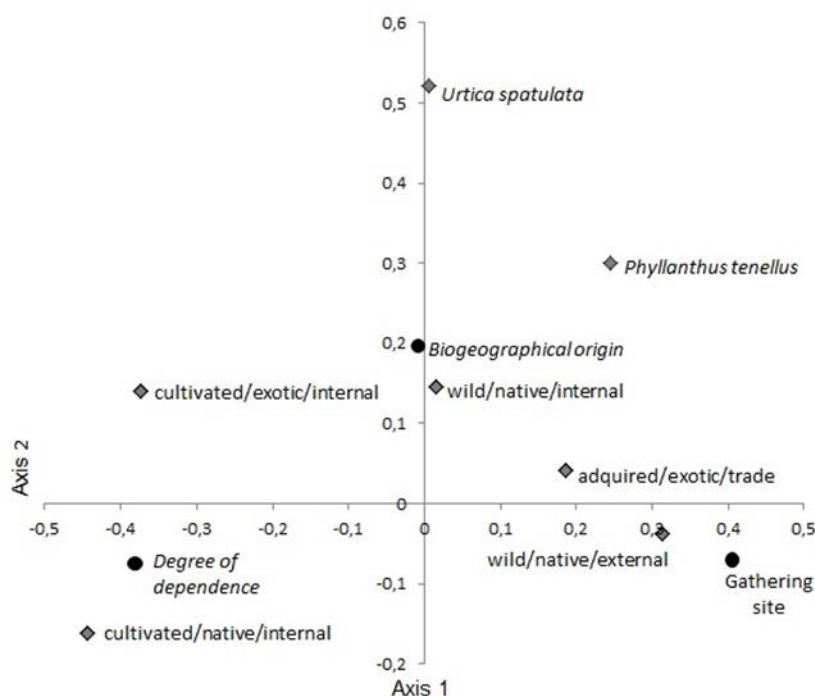
Gathering patterns and identification of medicinal plants

According to the correspondence analysis (Figure No. 2) performed, the axis 1 explains the 88.8% of the variance, whereas axis 2 reveals only the 11.8%. Both distribute the medicinal species and the variables mostly in five groups according to the degree of dependence, the origin, and gathering site. The two remaining dots correspond to two wild species with an exotic origin, and an internal (*Urtica spatulata*) and external (*Phyllanthus tenellus*) gathering site respectively.

Therefore, regarding to the gathering patterns of the examined medicinal plants, it has been confirmed that what determines them in first instance would be their degree of dependence on man, distinguishing those wild, those cultivated, and those acquired in dry state ready to be consumed in local markets.

It was observed among wild plants a high proportion of medicinal plants of native origin, which are gathered in the external area, manifesting the dependence of the wild areas that still maintain the inhabitants regarding to health field, reason for which they recognize the environment and growth periods of the medicinal species located in different areas of the wetland. This fact was already documented for the study area in an article where the acute perception of the inhabitants of their Iberoñeño landscape is recognized (Pirondo & Keller, 2014). In addition, within this group of wild plants of native origin a

Figure No. 2



Correspondence analysis of the medicinal species according to the variables: biogeographical origin, degree of dependence, and gathering site. Black dot: variables. Gray diamond: groups of species/species

small group within the domestic areas was distinguished, manifesting that the dwellings are located in “montes” which historically behaved as resource islands as proposed by Posey (1984) for the Kayapó from Amazonas, in reference to the sites where resources with an aggregated distribution are found.

In relation to the cultivated plants, it was observed the division in two proportional groups, regarding to the number of species according to its native or exotic origin, manifesting a long history of introduction of species to the region, as product of exchange among inhabitants and foreign visitors, which includes also their indication and form of preparation of the plants as remedies. However, such data also reaffirm the continuity of ancestral practices of cultivating those frequently used wild medicinal species found in external areas, reason for which they are cultivated near the dwelling. From the *emic* point of view, it is recognized that both facts have historically increased the availability of medicinal plants, and thus the socio-environmental resilience as

proposed by Richeri *et al.* (2013) in their study about the herbarium of the descendant of the native people *Mapuche-Tehuelche*. Our results also support the hypothesis presented by Pochettino & Lema (2008) that the traditional botanical knowledge besides being community and dynamic, involves change and innovation processes as well as of degradation and loss.

Finally, the plants of exotic origin which are acquired from stores, which are usually bought, were grouped maintaining the name and form of preparation according to the indications of the sellers.

Regarding to the isolated dots represented in the graphic by two wild species of exotic origin located in both external and internal areas, have demonstrated that in the behavior of the socio-ecosystem no defined limits exist, as expected for study area, but diffuse sites or spaces which occasionally behaves differently than expected (Fabiatti, 2005).

Regarding to the gathering patterns and identification of wild and cultivated medicinal plants,

it was recorded that, among the Iberoñero people, as exposed by Tengö & Belfrage (2004), the recognition of the medicinal plants and their associated uses are constructed and preserved through the use of the traditional ecological knowledge, which is result of a combination of locally generated knowledge through the practice and experience with information incorporated from other sources. It is for this reason that within the identification and gathering patterns, the use of the "hot and cold" syndrome and the doctrine of signature, both acquired over time and the contact other human groups, are also included. The first case it is used to identify the plants according to the categories cold or hot present in certain ailments, which have been derived from the Hippocratic medicine introduced in the conquest period in the baggage of knowledge of the Iberá communities. Such Hippocratic theory includes categories to the corporal humor as hot and cold, interpreting that its imbalance in the human body is the beginning of the disease (Scarpa, 2004). This is how the characterization of the diseases as cold or hot, according to the excess of hot or cold in some part of the body arises, implying the use of medicines of opposite characters to the symptomatology, as the plants denominated as hot or cold to treat the ailments. However, the second case performs the healing of the diseases through the election of the medicinal plants which have morphological features or different characteristics in the plant with correspondences analog to the ailments or part of the body that should be treated (Dafni & Lev, 2002; Keller, 2007). Similarly, diverse peasant communities (Balée, 1994), also universally use such features recognized for the Iberoñero people.

CONCLUSION

In conclusion, we affirm that the Iberoñero herbarium behaves as an effective and secure alternative for the treatment of the more recurrent ailments in the studied area, depending mainly of the gathering of wild plants located in external areas, in a lesser extent of the plants which are cultivated around the dwelling, and finally of those plants which are acquired from stores in neighboring localities. This maintenance of the historical practices of gathering and peridomestic crops, would be indicating processes of social-ecological resilience that ensure the self-sufficiency of the local herbarium, together with thorough traditional ecological knowledge

present among members of the communities, which not only generate strategies of access and maintenance of the diversity of medicinal species, but is also the guarantee to give continuity over time to the use of the medicinal resource involved in health problems in communities with scarce economic resources and limited access to urban centers as the Iberoñeros communities.

Additionally, it was recognized as diversification strategy of the Iberoñero herbarium the incorporation of exotic species with their associated knowledge, a fact that demonstrates mechanisms of hybridization of ancestral knowledge with the incorporation of new elements from diverse origins.

For all exposed, we can affirm that this ensemble of knowledge associated with the traditional medicine of the study area remains active depending mostly on the native species of the environment where they live. For this reason, it is suggested the maintenance and access to the native flora by ancestral communities which inhabit the Iberá macrosystem, to conserve the biological and cultural diversity of the Iberá Natural Reserve.

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