Socio-demographic determinants of traditional knowledge of medicinal plants in the Andean region of Ecuador

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Research

Abstract

Background: Ethnobotany studies provide preservation of traditional knowledge related with plant use with a pharmacovigilance prospective, where socio-demographic and educational factors have shaped traditional knowledge of medicinal plants at a broad level.

Methods: This study presents information on the use of medicinal plants and their relationship with socio-demographic factors in six Andean localities in northern and southern Ecuador. Data were collected through semi-structured interviews with different population groups, 665 interviews were conducted (472 women and 193 men), including age, region, gender, level of education, species, morphological structures used, health disorders treated, mode of preparation, and use. Quantitative ethnobotanical indices as Informant Consensus Factor (ICF) and Fidelity Level (FL) were calculated.

Results: A total of 187 medicinal plants belonging to 70 families and 149 genera were reported, with Asteraceae and Lamiaceae being the families with the highest number of species. Gender and age were determining factors in the use of medicinal plants. The most used plant parts were stem, young branch, bark (48.2%) and whole plant (13.8%) and the most used forms of preparation were infusions, juices and decoctions. Twenty-four disease categories were reported, where the main categories were inflammation and digestive infections (47.4%). Most species were used by a large proportion of informants for each disease category (ICF ≥ 0.65). The diversity of medicinal plant species and the traditional knowledge associated with them are of considerable value to communities in northern and southern Ecuador.

Conclusions: Species (stems, leaves, branches and bark) may have potential in the treatment of anti-tumour and anti-inflammatory diseases related to the treatment of major disorders such as infection and inflammation of the stomach, liver, kidneys, urinary tract, cancer and internal tumors. Gender, age and region were determining factors in the knowledge about the use of plants to treat anti-tumour and anti-inflammatory diseases.

Keywords: Ethno-medicine; Ethnobotanical survey; gender, medicinal plants; biodiversity; Ecuador

Background

Ethnobotany studies provide preservation of traditional knowledge, collection of valuable material for future bioprospecting studies; and update critical information about plant use with a pharmacovigilance prospective (McClatchey 2005; Shaw *et al.* 2012). Moreover, this approach has become historically the first choice for selection of plants to identify different bioactive compounds for treating many pathological conditions, including inflammation, infections and cancer; in food and cosmeceutical industries (Vieira 2010; Syam *et al.* 2011; Atanasov *et al.* 2015; Bailon-Moscoso *et al.* 2015a; Shahidi & Ambigaipalan 2015; Zhang *et al.* 2017; Fongnzossie *et al.* 2017). Compounds that have been identified and extracted from terrestrial plants with medicinal properties, include polyphenols (flavonoids, tannins, curcumin, resveratrol and gallo-catechins), brassinosteroids and taxols (Azmi *et al.* 2005; Khazir *et al.* 2014; Greenwell & Rahman 2015; Konan *et al.* 2015; Abdul *et al.* 2018)

Ecuador is well known for its biodiversity and ancestral richness; thus, many studies have reported that medicinal plants have potential uses related to several common diseases (Tene *et al.* 2007; López-Barrera *et al.* 2020; Sánchez García & Quilumbango Grijalva 2021). For instance, the generalized medicinal plants beverages 'horchata' which is prepared from the decoction of 23 different plants used in traditional medicine (Ríos *et al.* 2017; Guevara *et al.* 2019). Thus, recent studies in Ecuador have shown that medicinal plants have potential uses related to several common diseases, however, most studies have focused on the checklist of species associated with medicinal plant knowledge (Tene *et al.* 2007; Jerves-Andrade *et al.* 2014; Giovannini 2015; Bailon-Moscoso *et al.* 2015b; Andrade *et al.* 2017; Armijos *et al.* 2021; Herrera-Feijoo *et al.* 2023; Bec *et al.* 2024) but to the best of our knowledge, this study analyses the relationships between sociodemographic factors and their use of medicinal plants in the Andean localities of northern and southern Ecuador.

On the other hand, socio-demographic and educational factors have shaped traditional knowledge of medicinal plants at a broad level, for example previous studies indicate that women have greater knowledge of medicinal plants compared to men (Voeks 2007; Azafindraibe *et al.* 2013; Asiimwe *et al.* 2014; Weckmüller *et al.* 2019). In the same line, several studies have shown that older adults have the highest level of medicinal plant knowledge, as they have had the opportunity to accumulate traditional knowledge over time (Corroto *et al.* 2022; Tamene *et al.* 2024)

Generally, current therapies involve drugs that produce serious side effects such as gastric intolerance, bone marrow depression and water and salt retention because of prolonged use of these drugs (Das *et al.* 2014). For this reason, the use of medicinal plants is believed to be an important source of new chemicals and therapies that could be safer and with fewer side effects. This paper presents information on the traditional use of medicinal plants in the north and south of Ecuador and relationship with sociodemographic factors to serve as a reference to be validated in subsequent studies with cur-rent biomedical evidence and thus contribute to promoting knowledge of cultural diversity and rescue of local ancestral knowledge.

Materials and Methods

Study area

The ethnobotanical study was conducted in 2 communities in northern Ecuador (San José de Minas and Nayón) and 4 communities in southern Ecuador (Loja: Larama, Sabiango and Victoria; Zamora Chinchipe: Imbana) (Table 1). The study was conducted from October 2015 to December 2016.

Table 1. Localization of studied area in northern and southern Ecuador.

Province	Parish	Location	Elevation (m.a.s.l.)
Zamora Chinchipe	La Victoria de Imbana	3° 50' 49.7" S, 79° 07' 16" O	2079
Pichincha	San Jose de las minas	0° 10´17.57" S, 78°24´38.51" O	2402
Pichincha	Nayón	0° 09´26.72" S, 78°26´20.52"O	2598
Loja	Sabiango	3° 58'59.50" S, 80° 3' 44.43"O	730
Loja	La Victoria. Macara	4° 25'37.10" S, 79° 46' 2.85"O	1439
Loja	Larama	3° 58'59.63" S, 80° 3' 44.53"O	1070

Design and data collection

A total of 665 informants were interviewed by using purposive sampling. The aim of the study was informed previously to the community president and/or to each informant, to obtain data collection. After receiving their approval, ethnobotanical data were collected using a semi-structured interview, observations and field visits. The information collected was processed under the following variables: common name of the plant, parts used, treated diseases, methods of preparation and dosage.

Plant collection and identification

The herbarium specimens were collected in each sector during the observation phase and the designed semi-structured interviews with informants. The specimens were pressed, photographed and identified by an expert. The nomenclature of the plant families, genus and species follows the Catalogue of Vascular Plants of Ecuador (Jørgensen & León-Yánez 1999). They were then compared in the TROPICOS database (tropicos.org) and Catalogue of Life Checklist (GBIF). Specimens were identified using the different volumes of the Flora of Ecuador and reference material from the herbarium of the "Universidad Técnica Particular de Loja" (HUTPL) and "Universidad Nacional de Loja" (LOJA). The collection of botanical specimens was authorized under the following research permits: N° 001-2013-IC-FLO-DPAP-MAE; MAE-DPAZCH-2015-0839; 006-2015-IC-FLO-DPAP/MA; 006-IC-FLO-DNB/MA; 012-2015-IC-INF-VS-DPL-MA, issued by the Ministry of Environment of Ecuador.

Ethical consideration

This research was conducted in accordance with the code of ethics of the International Society for Ethnobiology (ISE 2008), which is also endorsed by the Society for Economic Botany (SEB). The Principle of Respect, number 9 in the code, recognizes the need for researchers to respect the integrity, morality and spirituality of the culture, traditions and relationships of indigenous peoples, traditional societies and local communities within their worlds. For this purpose, each parish council president and local informants were informed about the main objective of the study before obtaining their permission to conduct the interviews in each parish.

Data analysis

Reported diseases and remedies were grouped into categories based on the main diseases according to the (WHO 2015) for each locality. The categories were: inflammation and infections of the digestive system, systemic antibiotic, unspecified; symptoms and signs involving the skin and subcutaneous tissue; endocrine, nutritional and metabolic diseases; general symptoms and signs; neoplasms; diseases of the nervous system, genitourinary, circulatory, digestive and respiratory, musculoskeletal systems and connective tissue, blood and blood-forming organs and certain disorders involving the immune mechanism, male genital organs, the ear and mastoid process; inflammation of the genitourinary and respiratory system; Inflammation and diseases of the uterus, eye and adnexa; symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified ; certain infectious and parasitic diseases; infections of the genitourinary system; injury, poisoning and certain other consequences of external causes.

Knowledge of the number of plants as a function of age group, education level and locality were analyzed with a Kruskall-Wallis test, and gender and region in relation to knowledge of the number of plants with a Mann-Whitney U test. The data did not present a normal distribution by the Shapiro-Wilk test (p-value>0.05). All analyses were performed with R 3.2.2 software (R Development Core Team 2011)

The informant consensus factor (ICF) was calculated to determine the informant agreement for each treatment, using the formula ICF= nur-nt/nur. Where the number of use citations in each category (nur) minus the number of species used (nt), divided by the number of use citations in each category minus one where nur is the number of use citations and nt is the number of species used (Heinrich *et al.* 1998).

The Fidelity Level (FL) was calculated to determine the percentage of informants that mentioned the use of a medicinal plant as a remedy for the same ailment using the formula FL (%)= Ip/Iu X 100. Where Ip is the number of informants who independently indicated the use of a species for the same ailment and Iu is the total number of informants who mentioned the plant for any major ailment (Friedman *et al.* 1986)

Results and Discussion

Knowledge of medicinal plants among informants and social status.

The informants reported 187 medicinal plants, distributed in 70 families and 149 genera (Table 2). A total of 472 women (71%) and 193 men (29%) were interviewed. The number of different plant species reported by women was 178 and by men was 135.

More species named by women than by men (Figure 1a). The results of the Mann-Whitney U-test also indicated that there are significant differences in the number of species cited and gender ($z=5.40$, p-value<0.0001). Supporting our results, it has

been shown that women have a high level of knowledge about the use of medicinal plants, compared to men, being considered a different cognitive knowledge (Voeks 2007; Azafindraibe *et al.* 2013; Asiimwe *et al.* 2014).

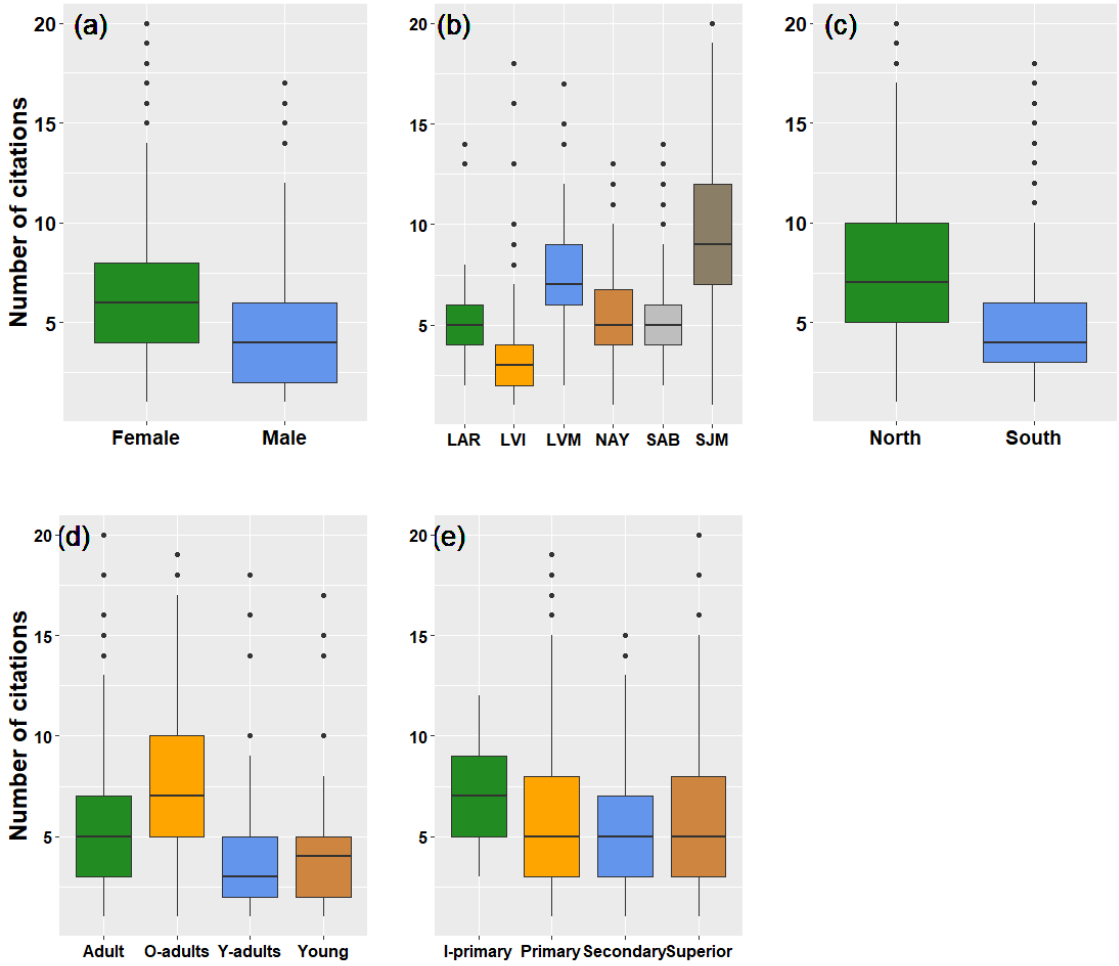

Figure 1. Box plot (a). Gender and number of species cited, (b). Locality and number of species cited, (c). Region and number of species cited, (d). Age and number of species cited, and (e). Education and number of species cited.

In addition, the localities of San José de las Minas and La Victoria de Macará had the highest number of citations, as well as the northern region had the highest number of citations compared to the southern region (Figure 1b and c). The Kruskall-Wallis test indicated that there are significant differences between locality and species cited (H= 285.5, p-value <0.0001). Following this same pattern, the Mann-Whitney U test showed significant differences between the North and South region (z=9.75, p-value <0.0001).

The age range of the informants was between 15 and 89 years. Adults reported 280 species, followed by older adults with 226, young adults with 115 and young with 44 species. The informants between 50 and 80 years of age cited the maximum number of species (10-17) and the youngest (<20 years) mentioned fewer plants (2-6, Figure 1d). The results of the Kruskal-Wallis test showed that there are significant differences in the number of species cited between the different ages (H=112.3, p-value<0.0001), resulting that the number of medicinal plants reported in the study area varies with age, with older informants knowing more medicinal plants than younger informants, situation similar to different contexts (Guimbo *et al.* 2011; Abera 2014; Weckmüller *et al.* 2019; Corroto *et al.* 2022; Tamene *et al.* 2024).

For example, In Ecuador Weckmüller *et al.* (2019), found a positive correlation between an informant's medicinal plant knowledge and age in five Waorani communities located within the Yasuní National Park and Waorani Ethnic Reserve, thus is evident that young people are losing interest in the use of medicinal plants due to the growing influence of modernization and the abandonment of rural life. This leads to the disappearance of traditional knowledge of medicinal plants and interrupts the passing on of knowledge to the next generations.

Table 2. Plants used in the two regions, common name, origin, ICD categories, preparation, mode of administration, source, continent distributions and alien species.

Family	Scientific name [Voucher no.]	Local name	Plant part(s) used	Growth habit	Origin	ICD categories	Preparation	Mode of administration	Source	Continent Distributions	Region in	Alien species
Acanthaceae	*Justicia secunda* Vahl HUTPL:13593	Insulina	S, B	H	N	DGSI	I	D	G	SA, MA	S	YES
Adoxaceae	*Sambucus nigra* L. HUTPL:13700	Tilo, saúco blanco	L, F, S, B	Ab	C	DRS, GSS, DMSCT, DDSIN, DRSIN	I, M	D	G, F, MK	SA, MA, NA, A	N, S	YES
Amaranthaceae	*Alternanthera porrigens* (Jacq.) Kuntze HUTPL:10424	Moradilla	F, R	H	N	DRS, DDSIN	I	D	G, F	SA	S	NO
Amaranthaceae	*Alternanthera porrigens var. piurensis* (Standl.) Eliasson HUTPL:6395	Lancetilla	S, B	H	N	DDSIN	I	D	G	SA	S	NO
Amaranthaceae	*Amaranthus hybridus* L. HUTPL:10339	Ataco, sangorache	F, S, B	Ab	N	GSS, SSISS, DGSI, ENMD	I, C	D, TA	G, F	SA, NA, MA, AM	N, S	YES
Amaranthaceae	*Chenopodium album* L. HUTPL:10439	Palitaria	EP, S, B	H	I	NEO, DGSI, IPCCE, DDSIN	J, I	D	G, F	SA, NA, A, MA, E, O, AM	S	YES
Amaranthaceae	*Dysphania ambrosioides* (L.) Mosyakin & Clemants HUTPL:10438	Palitaria	EP, BD, S, R, B, SD	H	I & C	NEO, DMSCT, DDSIN, DGSI, DDS, DDSI	I	D	F	SA, MA, C, A, NA	S	YES
Amaranthaceae	*Iresine diffusa fo. herbstii* (Hook.) Pedersen HUTPL:13684	Tigresillo, escancel, Sagorache	S, B, BD, L	H	N	DRS, GSS, DDSIN, DGSI	I, M, J	D	G	SA, MA	S	YES
Amaranthaceae	*Iresine diffusa* Humb. & Bonpl. ex Will HUTPL:10386	Escancel, Sangorache verde	S, B, BD, L, R	H	N	CIPD, SSACL, DGS, DRS, DDS, NEO, GSS, CIPD, DDSIN,	J, P, I, CR, M, R, B	D, TA	F, G, MK	SA, MA, C	N, S	YES

						DMSCT, SSISS						
Amaryllidaceae	*Allium cepa* L. HUTPL:855	Cebolla	S	H	I & C	DDSIN	I	D	MK	MA, NA, A, SA	S	YES
Amaryllidaceae	*Allium fistulosum* L. HUTPL:10396	Cebolla de hoja	S	H	I	DDS	I	D	F	SA	S	YES
Amaryllidaceae	*Allium sativum* L. HUTPL:281	Ajo	S	H	I & C	DDSIN	I	D	F	MA, NA, A, SA	S	YES
Amaryllidaceae	*Allium sp.* HUTPL:14399	Azucena	S	H	I & C	DDSIN	I	D	G	SA	S	NO
Annonaceae	*Annona muricata* L. HUTPL:5424	Guanabana	S, B, R, FR	Ar	N & C	NEO, DDSIN	I	D	G, F, MK	MA, SA, C, A, AM	S	YES
Apiaceae	*Apium graveolens* L. HUTPL:10343	Apio	S, B, R	H	I & C	DMSCT, GSS, NEO, DGSI, DGSIN, DDSIN, DNS, SAU, ENMD, DGS, DDS	C, I, J	TA, D	F, G, MK	MA, SA, NA, A, E, AM	N, S	YES
Apiaceae	*Coriandrum sativum* L. HUTPL:1327	Culantro	S, B	H	N	DDSIN	I	D	G	MA, SA, NA, A, AM	N	YES
Apiaceae	*Cyclospermum leptophyllum* (Pers.) Sprague ex Britton & P. Wilson HUTPL:10442	Cominillo	EP, S, B	H	I	DRS, DDSIN	I, M	D	G, F	SA, C, A, NA, MA	S	YES
Apiaceae	Eryngium foetidum L. HUTPL:10443	Culantro extranjero	S, B	H	N	DDS, DDSIN	I	D	G, F	MA, SA, C, NA, A, AM	S	YES
Apiaceae	*Foeniculum vulgare* Mill. HUTPL:10419	Hinojo, eneldo	S, B	H	I	DGSI, DDSIN, DGS	C, I	TA, D	G, F	MA, SA, NA, A, AM	N, S	YES
Apiaceae	Petroselinum crispum (Miller) A. W. Hill. HUTPL:10436	Perejil	S, B	H	I & C	DDSIN, DGSI, DGS	I, J	D	G, MK	SA, NA, A	N, S	YES

Asteraceae	*Ageratum conyzoides* L. HUTPL:10437	Pedorrera	S, B, L, F, R, EP	H	I	DDSIN, DDS, DGSIN	I	D	G, F	SA, MA, C, A, NA, AM	S	YES
Asteraceae	*Ambrosia arborescens* Mill. FT1282	Marco	S, B	Ab	N	CIPD, DDSIN	C, I	TA, D	G, F	SA	N, S	YES
Asteraceae	*Aristeguietia glutinosa* (Lam.) R.M. King & H. Rob. HUTPL:13677	Matico	S, B	Ab	N, C & E	SSISS, GSS, DDS, NEO, DGSI, DBFDMM, DGS	I, O, C, P	D, TA, B	F, G, MK	SA	N	NO
Asteraceae	*Artemisia absinthium* L. HUTPL:8333	Ajenjo	S, B	H	I & C	IDUU, DDSIN	I	D	G, F	A, SA, NA, MA	N	YES
Asteraceae	*Artemisia sodiroi* Hieron. HUTPL:10355	Ajenjo	S, B	H	I	DDS	I	D	G	SA	S	NO
Asteraceae	*Baccharis genistelloides* (Lam.) Pers. HUTPL:10388	Tres filos	S, B	H	N	DGS	I	D	F	SA	S	NO
Asteraceae	*Baccharis latifolia* (Ruiz & Pav.) Pers. HUTPL:10384	Chilca	S, B	Ab	N	NEO	P	TA	F	SA	S	NO
Asteraceae	*Baccharis sp.* HUTPL:10399	Shadán	S, B	Ab	N	GSS	DA	TA	F	SA	S	NO
Asteraceae	*Baccharis trinervis* Pers. HUTPL:5667	Chilca	S, B	Ab	N	ENMD, DDSIN	I	D	F	SA, MA	N	NO
Asteraceae	*Bidens pilosa* L. HUTPL:13704	Guichingue	R, EP	H	N	DDSIN, NEO	I, J	D	F	SA, MA, C, A, NA, O, AM	S	YES
Asteraceae	*Bidens triplinervia* Kunth FT1283	Ñachag	S, B	H	I	DRSIN	I	D	F	SA, MA, A	N	YES
Asteraceae	*Chamomilla recutita* (L.) Rauschert HUTPL:10457	Manzanilla	EP, L, S, F	H	I & C	SSISS, GSS, DDS, DGS, IDUU, SSISS, DRS, DEMP, DDSIN, DEAI	C, I, P, J	W, D, TA, G, B	G, MK	MA	N, S	YES

Asteraceae	*Dahlia pinnata* Cav. HUTPL:10461	Dalia	R	Ab	I & C	DGSI	I	D	G	MA, SA, C, A, NA, O	S	YES
Asteraceae	Fulcaldea laurifolia (Bonpl.) Poir. HUTPL:10452	Gaulpachaque	R	Ar	E	DGSIN	I	D	F	SA	S	NO
Asteraceae	*Gnaphalium domingense* Lam. HUTPL:10348	Lechuguilla	S, B, EP	H	N	SSISS, DDSIN, DGSIN	P, M, I	TA, D	G, F	MA, SA	S	YES
Asteraceae	*Plagiocheilus bogotensis* (Kunth) Wedd. FT1297	Chichira blanca, chichira	S, B	H	N	DRS	DA	R	F	SA	S	NO
Asteraceae	Smallanthus sonchifolius (Poepp.) H. Rob. HUTPL:5363	Jicama	R	H	N	GSS, ENMD	J	D	G, G	SA, A, MA	N	YES
Asteraceae	*Sonchus arvensis* L. HUTPL:8380	Cerraja	S, B	H	I	DRS	I	D	G, F	SA, NA, A, MA, O	S	YES
Asteraceae	*Sonchus oleraceus* L. HUTPL:10374	Canayuyo	S, B	H	I	CIPD	J	D	F	SA, MA, NA, C, A, O, AM	S	YES
Asteraceae	*Tagetes erecta* L. HUTPL:7556	Arrayoza amarilla	F	H	N	DDSIN	I	D	G	MA, SA, C, A, O, AM	S	YES
Asteraceae	*Tagetes filifolia* Lag. HUTPL:5880	Anis de campo	S, B	H	I & C	DDSIN	I	D	F, G, MK	SA, MA	N	YES
Asteraceae	*Taraxacum officinale* F.H. Wigg. HUTPL:10341	Diente de leon, taraxaco	S, B, EP	H	I	GSS, SSISS, NEO, DGS, DGSIN, DDSIN, DDS	P, M, C, I	TA	F, G, MK	SA, C, A, MA, NA, AM, O	N, S	YES
Asteraceae	*Vernonanthura patens* (Kunth) HUTPL:5412	Laritaca o Jujumba	BD, L	Ab	N	NEO	I	D	F	MA, SA	S	NO
Basellaceae	*Basella alba* L. FT1296	Lotoyuyo	S, B	H	N	DMSCT	C	TA	G	A, MA, SA, C, NA, AM, E	S	YES
Begoniaceae	*Begonia cucullata* Willd. HUTPL:10370	Begonia	F, S, B	H	I	DDS, GSS	I, C	D	G	SA, MA	S	YES
Berberidaceae	*Berberis sp.* HUTPL:10362	Pata de gallina	BD, EP	Ab	N	DRS	I, M	D	F	SA	S	NO

Betulaceae	*Alnus acuminata* Kunth HUTPL:10391	Aliso	S, B, BD	Ar	N	GSS, DMSCT, SSISS, DRS	P, C, M, I	TA, D	G, F	SA, MA	S	NO
Bignoniaceae	Amphilophium Kunth HUTPL:10462	Busuluca	S, B	Li	N	DGSI	I	D	F	SA, MA	S	NO
Bixaceae	*Bixa orellana* L. HUTPL:10451	Achiote	S, B, BD, L	Ar	N & C	DMGO, DDSIN, DGSIN	I	D	G	SA, MA, A, C, AM	S	YES
Boraginaceae	*Borago officinalis* L. HUTPL:10344	Borraja	L, S, F, EP	H	I & C	GSS, DRS, DMGO, DGSIN, DGS, DDS	I, C, M, P	D, TA	G, F	SA, NA, MA	N, S	YES
Boraginaceae	*Symphytum officinale* L. HUTPL:10408	Suelda con suelda	S, B	H	I	GSS, DDS	I, C	TA, D	G, F	SA, NA, A,	S	YES
Brassicaceae	*Brassica oleracea* L. HUTPL:1197	Col	EP, S, B	H	I & C	DDSIN, NEO, DGSIN	I	D	G	SA, A, NA, AM	S	YES
Brassicaceae	*Cardamine bonariensis* Pers HUTPL:5089	Berro	S, B	H	N	DRS, DGSIN	I, M, J	D	G, F	SA, MA	S	YES
Brassicaceae	*Rorippa nasturtium-aquaticum* (L.) Hayek HUTPL:161	Berro	S, B, EP	H	I & C	DGSIN, NEO, DDSIN	I, J	D	G, F	SA, AM, MA, NA	S	YES
Bromeliaceae	*Ananas comosus* (L.) Merr. FT1295	Piña de campo, Piña tierna	FR	H	C	DRS, DMGO	I, M	D	G	MA, SA, C, A, AM	S	YES
Cannaceae	*Canna edulis* Ker Gawl. HUTPL:693	Achira negra	S, B	H	N	IPCCE	P	TA	F	SA, MA, C, NA, AM	S	YES
Caprifoliaceae	*Valeriana officinalis* L. FT1294	Valeriana	R	H	I & C	DNS	I	D	G, MK, G	NA, A	N	YES
Caricaceae	*Carica pubescens* (A. DC.) Solms HUTPL:1874	Toronche, babaco	FR	Ab	N	DRS, GSS	C, I, M	D	G	SA, MA	S	NO
Caryophyllaceae	*Dianthus caryophyllus* L. HUTPL:1128	Clavel, clavel blanco	L, F	H	C	CIPD, GSS	P, I	TA, D	G, F	SA, MA, E	S	YES
Caryophyllaceae	*Drymaria cordata* (L.) Willd. ex Schult.	Alberjilla	S, B	H	N	DDSIN	I	D	G, F	SA, MA, C, AM, A, NA	S	YES

	HUTPL:4741											
Commelinaceae	*Callisia gracilis* (Kunth) D.R. Hunt HUTPL:5099	Cachurrillo	S, B, L, F	H	N	DDSIN, DBFDMM, GSS, DGSIN	I	D	G	SA, MA	S	NO
Commelinaceae	*Commelina diffusa* Burm. f. HUTPL:9541	Calzo	S, B	H	N	DDSIN, DBFDMM	I	D	G	SA, MA, C, A, AM, NA	S	YES
Crassulaceae	*Bryophyllum gastonis-bonnieri* (Raym.-Hamet & H. Perrier) Lauz.-March. HUTPL:13618	Dulcamara	S, B	H	I & C	NEO, SSISS	J, I	D	G	NA	N, S	YES
Crassulaceae	*Echeveria sp.* HUTPL:10397	Cóndor coles	S, B	H	N	GSS	DA	R	G	SA	S	NO
Cucurbitaceae	*Cucurbita ficifolia* Bouché HUTPL:10364	Sambo	BD	Li	I	CIPD	P	TA	F	SA, C, MA	S	YES
Cupressaceae	Callitropsis macrocarpa (Hartw. ex Gordon) D.P. Little HUTPL: 13699	Ciprés	S, B	Ar	I	DRS	C	B	G	NA	S	NO
Dioscoreaceae	*Dioscorea sp.* HUTPL:9441	Masache	BK, S,	Li	N	DRS, DDS, DMSCT	C, I	TA, D, B, W	G, F	SA	S	NO
Equisetaceae	*Equisetum bogotense* Kunth HUTPL:10393	Cola de caballo	EP, S, B	H	N	DGS, DDSIN, DMGO, DDS, GSS, DGSIN	I	D	F	SA, MA	S	NO
Equisetaceae	*Equisetum giganteum* L. HUTPL:13687	Caballo chupa	S, B	H	I & C	DGSIN, GSS, DDS, DGS	I	D	G, F	SA, C, MA	N	NO
Ericaceae	Bejaria aestuans Mutis ex L. HUTPL:10345	Payama	F	Ab	N	NEO	J	D	F	MA, SA	S	NO
Ericaceae	Cavendishia bracteata (Ruiz & Pav. ex J. St.-Hil.) Hoerold HUTPL:2237	Salapa	R	Ab	N	IPCCE	I	D	F	SA, MA	S	NO
Euphorbiaceae	*Croton sp.* HUTPL:10389	Sangre de drago	Latex	Ab	N	SSISS, NEO, DDS, DRS, GSS	DA	TA	F	SA	S	NO

Euphorbiaceae	*Jatropha curcas* L. HUTPL:13629	Piñón	Latex	H	I & C	NEO, DGSIN	I	D	F	SA, MA, C, A, AM, NA	S	YES
Fabaceae	*Medicago sativa* L. HUTPL:8245	Alfalfa	S, B, EP	H	I & C	DDS, DBFDMM, ENMD, DCS	J	D	G, MK	SA, NA, C, A, MA	N, S	YES
Fabaceae	*Mimosa albida* Humb. & Bonpl. ex Willd. HUTPL:1417	Uña de Gato	S, B	H	N	GSS, DGS, NEO	I	D	F, MK	MA, SA	N	YES
Fabaceae	*Myroxylon balsamum* (L.) Harms HUTPL:10453	Chaquino	SD, BK, L	Ar	N	DDS, NEO, DDSIN, DMGO	I, J	D	G, F	SA, MA	S	YES
Fabaceae	*Senna pendula* (Humb. & Bonpl. ex Willd.) H.S. Irwin & Barneby FT1293	Retama	S, B	Ab	I	DRSIN, DGS	I	D	F	SA, MA, C, NA	N	YES
Fabaceae	*Trifolium pratense* L. HUTPL:10407	Trébol grande	EP	H	I	SSISS	C	W	G	SA, NA, C, A, MA	S	YES
Fabaceae	*Senna mollissima* (Humb. & Bonpl. ex Willd.) H.S. Irwin & Barneby HUTPL:5956	Chinchin	S, B	Ab	I	GSS	I	D	G, G	SA, MA	N	NO
Fabaceae	*Vicia faba* L. HUTPL:10363	Haba	S, B	H	I	GSS	P	TA	G	SA, NA, A, MA	S	YES
Gentianaceae	*Centaurium minus* Moench HUTPL:10369	Canchalagua	EP	H	I	DRS	I, M	D	MK	SA, NA, C, MA	S	NO
Geraniaceae	*Geranium killipii* R. Knuth HUTPL:10400	Cáncer	EP	H	N	IPCCE	P, M	TA	F	SA	S	NO
Geraniaceae	*Pelargonium graveolens* L'Hér. ex Aiton HUTPL:10352	Esencia de rosa	S, B, BD, R	H	I	DRS, DDSIN	I, J	D	G, F	SA, MA, AM, NA	S	YES
Geraniaceae	*Pelargonium odoratissimum* (L.) L'Hér. HUTPL:10371	Malva Olorosa	S, B, BK, F	H	I	DDS, DDSIN, DGSIN	I, J	D, TA	G, F	SA, AM	N, S	YES
Geraniaceae	*Pelargonium zonale* (L.) L'Hér.	Geranio	L, F, BD, EP	H	I	CIPD, SSISS, GSS, CIPD,	P, C, J, P, I, O	TA, D, B, W	G, F	SA, MA, AM, NA	N, S	YES

	HUTPL:10425					DMSCT, DBFDMM						
Juglandaceae	*Juglans neotropica* Diels HUTPL:10395	Nogal	S, B	Ar	N	DMSCT	I	D	G	SA	S	YES
Lamiaceae	*Melissa officinalis* L. HUTPL:10366	Toronjil	S, B	H	I & C	DDS, GSS, DDSIN, DNS	I, J	D	G, F, MK	SA, A, NA	N, S	YES
Lamiaceae	*Mentha × piperita* L. HUTPL:10356	Menta, Toronjil mellizo	S, B	H	I & C	DDS, DDSIN, DGSIN	I, J	D	G, F	SA, NA, A, MA, AM	N, S	YES
Lamiaceae	*Mentha pulegium* L. HUTPL:2104	Menta	S, B	H	I	DDSIN	I	D	G	SA, A, NA	N	YES
Lamiaceae	*Mentha spicata* L. HUTPL:3712	Hierba buena	S, B	H	C	DDSIN, DDS, DCS, DNS	I	D	G	SA, NA, A, AM	N, S	YES
Lamiaceae	*Mentha suaveolens* Ehrh. FT1284	Hierbabuena	S, B	H	I	GSS, DRS	I	D	G	SA, A, NA	S	YES
Lamiaceae	*Minthostachys mollis* Griseb. HUTPL:1076	Poleo, poleo grande, tipo	EP, S, B	Ab	N	DRS, DDS, DDSIN, GSS	C, I	TA, D	G, F	SA	S	NO
Lamiaceae	*Ocimum basilicum* L. HUTPL:10359	Albaca	S, B	H	I & C	DBFDMM, DNS, GSS, IDUU, DGS	J, I	D	G	MA, SA, A, AM, NA	N, S	YES
Lamiaceae	*Origanum vulgare* L. HUTPL:5302	Orégano	S, B	H	I	DDSIN, DGS, DGSIN	I, J	D	G, MK	SA, NA, A, MA	N, S	YES
Lamiaceae	Rosmarinus officinalis L. HUTPL:13617	Romero	S, B	Ab	C	DRS, SSISS, NEO, DDSIN	I, C	D, W	G, MK	SA, A, MA, NA	N	YES
Lamiaceae	*Salvia officinalis* L. HUTPL:78	Salviareal	S, B	H	I	GSS, DGS	I	D	F	SA, A, NA	N	YES
Lamiaceae	*Satureja nubigena* (Kunth) Briq. HUTPL:10373	Tipo, poleo, poleo chiquito	S, B, EP	H	N	DDS	I	D	G, F	SA	S	NO
Lamiaceae	*Thymus vulgaris* L. HUTPL:4687	Tomillo	S, B	H	I	DDSIN, DRSIN	I	D	G	SA, MA, AM	N	YES
Lauraceae	Laurus nobilis L. FT:1292	Laurel	S, B	Ar	I	DDSIN	I	D	MK	SA, A, AM	N	YES

Lauraceae	Persea americana Mill. HUTPL:10353	Aguacate	S, B, SD	Ar	N	DMSCT	I, C	D, V	G, F	SA, MA, C, A, AM, NA	S	YES
Liliaceae	*Lilium longiflorum* Thunb HUTPL:10347	Azucena	BU	H	I	GSS, IPCCE	P	TA	G	A, MA	S	YES
Linaceae	*Linum usitatissimum* L. HUTPL:10459	Linaza	L, S, F, SD	H	I	DGSIN, DDSIN, GSS	I, M	D	F, G, MK	SA, NA, MA, AM, E	S	YES
Loranthaceae	*Gaiadendron punctatum* (Ruiz & Pav.) G. Don HUTPL:10417	Violeta del campo	F	Ab	N	DRS	I	D	F	SA, MA	S	NO
Loranthaceae	*Struthanthus sp.* HUTPL:1473	Solda, suelda	S, B	H	N	IPCCE, DMSCT	P, M	TA	F	SA	S	NO
Lythraceae	*Punica granatum* L. HUTPL:10433	Granada	FR	Ab	I & C	DDS	J	D	G	MA, SA, A, AM, NA	S	YES
Malvaceae	*Corchorus siliquosus* L. HUTPL:10440	Te	S, B	H	I	DDSIN	I	D	G, F	MA, C, SA, NA	S	YES
Malvaceae	*Heliocarpus americanus* L. HUTPL:10403	Balsa, pasalla, guambo	BK	Ar	N	GSS, DDSIN	I	D	F	SA, MA, C, O	S	YES
Malvaceae	*Malva parviflora* L. HUTPL:8254	Malva Pelada	BK, EP, S, B	Ab	I & C	DDSIN, DGSIN	I	D	G	SA, O, NA, MA, A, E, AM	S	YES
Malvaceae	*Malva sylvestris* L. HUTPL:10380	Malva altea, malva	L, F, BK, S, B	Ab	I	GSS, DGSIN, DRS, DDSIN, DGS	I, M	D	F	NA, SA, MA, AM	S	YES
Malvaceae	*Sida acuta Burm. f.* HUTPL:10411	Wisho	BK	Ab	N	GSS	I, M	D	G	MA, A, SA, AM, NA	S	YES
Malvaceae	*Sida urens* L. HUTPL:10444	Malva Urosa	S, B	Ab	N	DDSIN	I	D	G, F	SA, MA, C, AM, A, NA	S	YES
Malvaceae	*Triumfetta althaeoides* Lam. HUTPL:10460	Cadillo	EP, S, B, BK, R, L	Ab	N	GSS, DGS, DGSIN, DDSIN, DRS, DDS	I, M	D, TA	G, F	SA	S	NO
Moraceae	*Ficus carica* L. HUTPL:13626	Higo	S, B	Ar	I & C	DMGO, GSS, IDUU	I	D	G	SA, A, MA	N, S	YES

Muntingiaceae	*Muntingia calabura* L. HUTPL:2565	Cerezo	S,	Ar	N	IPCCE	I	D	F	SA, MA, C	S	YES
Myrtaceae	*Corymbia citriodora* (Hook.) K.D. Hill & L.A.S. Johnson HUTPL:10387	Eucalipto, Eucalipto aromático	S, B	Ar	I & C	DRS, DRSIN, DGS	C, I	D, B, V	F, G, MK	O, MA	N, S	YES
Myrtaceae	*Eucalyptus globulus* Labill. HUTPL:13721	Eucalipto	S, B	Ar	I	DGSIN, DDSIN	I	D	G, F	SA, O, A, MA, NA	S	YES
Myrtaceae	*Myrcianthes rhopaloides* (Kunth) McVaugh HUTPL:2305	Arrayan	S, B	Ab	I	SSISS	O	TA	G, F	SA	N	NO
Myrtaceae	*Psidium guajava L.* HUTPL:10413	Guayaba	S, B, BD, BK, FR	Ar	N & C	DDS, DDSIN	I, J	D	F, G, MK	SA, MA, C, A, AM, NA	S	YES
Nyctaginaceae	*Pisonia aculeata* L. HUTPL:5962	Uña de gato	BK, S, B	Ar	N	NEO, DGSIN	I	D	F	C, SA, MA, A, AM, NA	S	YES
Onagraceae	*Fuchsia hybrida* Voss HUTPL:10377	Pena pena	F	Ab	I	GSS	I, M	D	G	SA	S	YES
Onagraceae	*Oenothera laciniata* Hill FT1285	Platanillo	S, B	H	N	DCS	I	D	G	SA, O, C, A, MA, AM, NA	N	YES
Onagraceae	*Oenothera rosea* L'Hér. ex Aiton HUTPL:10448	Shullo	L, S, F	H	N	GSS, DGS, DDSIN	I, M	D	G, F	SA, A, MA, AM, NA	S	YES
Passifloraceae	*Passiflora ligularis* Juss HUTPL:10368	Granadilla	S, B	Li	N	DDS	I	D	F	SA, C, MA	S	YES
Phyllanthaceae	*Phyllanthus caroliniensis* Walter FT1291	Chanca piedra	EP	H	N	DDSIN, DGSIN	I	D	G, F	SA, MA, C, NA	S	NO
Piperaceae	*Peperomia ilaloensis* Sodiro HUTPL:13601	Congona	S, B	H	N	DDSIN	I	D	G	SA	S	NO
Piperaceae	*Peperomia inaequalifolia* Ruiz & Pav. HUTPL:4695	Congona	S, B	H	N	DDS, DEMP, GSS	I, J	D, TA	G, F	SA	S	NO
Piperaceae	*Peperomia peltigera* C. DC. HUTPL:6791	Pata con yuyo	S, B	H	N	DCS	I	D	G	SA	N	NO

Piperaceae	*Piper aduncum* L. HUTPL:10455	Matico	S, B	Ab	N & C	DDS, NEO, DDSIN, DGSIN	I	D	G, F	SA, MA, C, NA	S	YES
Piperaceae	*Piper asperiusculum* Kunth HUTPL:10410	Matico	S, B	Ab	N	GSS, DDS, SSISS, DRS	I	D, W, B, TA	G, F	SA	S	NO
Piperaceae	*Piper crassinervium* Kunth HUTPL:10394	Guabiduca	S, B	Ab	N	DDS, DRS, GSS	I	D	G, F	SA, MA	S	NO
Piperaceae	*Piper sp.* HUTPL:1083	Matico S, verde	S, B	Ab	N & C	DDS	I	D	F	SA	S	NO
Piperaceae	*Pothomorphe umbellata* (L.) Miq. FT1286	Santa María del agua	S, B	Ab	N	DGSIN	I	D	G	SA, C, MA	S	NO
Plantaginaceae	*Bacopa procumbens (Mill.) Greenm.* HUTPL:10428	Verbena Gatiadora	S, B	H	N	NEO	I	D	F	MA, C, SA, NA	S	YES
Plantaginaceae	*Plantago major* L. HUTPL:10454	Llantén	S, B	H	I	GSS, DDS, SSISS, DGS, DDSIN, IPCCE, DGSIN, NEO, DMGO	I, J,	D, TA	F, G, MK	SA, E, MA, NA, C, A, AM	S	YES
Poaceae	*Andropogon citratus* DC. ex Nees HUTPL:10412	Hierba luisa	S, B, R	H	I & C	DDSIN, IDUU, DGSIN, DNS, GSS, DDS, DMSCT, DRS	I, J, M, CR	D	G, F, MK	C	S	NO
Poaceae	*Arundo donax* L. FT 1287	Carrizo	R	Ab	I & C	DMGO	I	D	G	A, AM, SA, O, C, E, MA	S	YES
Poaceae	Guadua angustifolia Kunth HUTPL:8786	Guadua	R	Ar	N	DMGO	I	D	G	SA, MA	S	YES
Poaceae	*Bromus catharticus* Vahl HUTPL:1358	Hierba de perro	S, B	H	I	GSS	I	D	F	SA, NA, C, A, MA, AM, E	N	YES
Poaceae	*Capriola dactylon* (L.) Kuntze HUTPL:10593	Grama dulce, grama	S, B	H	I	DDSIN, DGSI, DGS, DCS, DGSIN	I, J	D	G, F	C, NA	N,S	NO

Poaceae	*Hordeum vulgare* L. HUTPL:10458	Cebada	SD	H	I & C	DDSIN, DGSI, DGSIN	I	D	G, MK	SA, O, NA, C, A, MA, AM	S	YES
Poaceae	*Saccharum officinarum* L. FT1279	Caña China	S,	Ab	I & C	DDSIN	I	D	G	SA, A, MA, C, NA	S	YES
Poaceae	*Zea mays* L. FT1290	Maíz	ST	Ab	I & C	DDSIN, DGSIN	I, J	D	G	SA, O, MA, A, NA, CA, AM	S	YES
Polygonaceae	*Muehlenbeckia tiliifolia* Wedd.	Mollentín	R, S, B	Ab	N	DDSIN	I	D	G, F	SA	S	NO
Polygonaceae	*Polygonum hydropiperoides* Michx. HUTPL:10447	Solimán, Picantillo	EP, S, B	H	N	SSISS, GSS	C, P, I	W, TA, D	G, F	SA, NA, MA	S	NO
Polygonaceae	Rumex crispus L. FT1288	Diablo fuerte	S, B	H	I & C	GSS, DDSIN, DBFDMM	O	TA	G, F	E, SA, A, NA, C, MA, AM	N	YES
Polypodiaceae	*Campyloneurum* C. Presl FT1289	Calaguala	S, B	H	N	DDSI, DDSIN	I	D	F	SA, MA, C, NA	S	NO
Portulacaceae	*Portulaca oleracea L.* HUTPL:10449	Verdolaga	S, B	H	N	DGSIN, GSS, DRSIN, DGS	I	D	F	A, AM, E, SA, O, MA, NA, C	N, S	YES
Proteaceae	*Embothrium grandiflorum* Lam. HUTPL:5662	Gañil macho, cucharillo	L, S, F	Ab	N	IPCCE, DMSCT	P, M	TA	F	SA	S	NO
Proteaceae	*Lomatia sp.* HUTPL:10350	Cascarilla	BK	Ab	N	CIPD, GSS	I	D	F	SA	S	NO
Pteridaceae	*Adiantum poiretii* Wikstr. HUTPL:10340	Pata negra, culantrillo, llashipilla	S, B	H	N	DRS, DDS, GSS	I	D	G, F	AM, SA, C, MA, A	S	NO
Pteridaceae	*Adiantum raddianum* C. Presl HUTPL:1974	Culantrillo de pozo	S, B	H	I	GSS, DGS	I	D	G, F	SA, C, MA, AM, NA	N	YES
Rosaceae	*Eriobotrya japonica* (Thunb.) Lindl. HUTPL:1187	Níspero	S, B	Ar	I & C	DGSIN, DDS, DGSI	I	D	G	MA, SA, A, C, NA	S	YES
Rosaceae	*Lachemilla procumbens* (Rose) Rydb HUTPL:10401	Cáncer blanco, cáncer, cáncer lanudo	EP, S, B	H	N	CIPD, SSISS	J, C	D, W	G, F	MA	S	NO
Rosaceae	*Rosa centifolia L.*	Rosas blancas	F	Ab	I	DDSIN	I	D	G	MA	S	NO

	HUTPL:10427											
Rosaceae	*Rosa x alba* L. HUTPL:10365	Rosa blanca	F	Ab	I	DEAI, DEA	C, I	TA, D	G	A	S	YES
Rosaceae	*Rubus niveus* Thunb. HUTPL:10381	Mora	S, B, BD	Ab	I	CIPD, DRS	P, I	TA, D	G, F	A, SA, C, MA	S	YES
Rosaceae	*Rubus idaeus subsp. strigosus* (Michx.) Focke Mora	Mora	L, FR, S, B	Ab	N & C	DRSIN	I	D	G	NA, MA	N	NO
Rubiaceae	*Morinda citrifolia* L. HUTPL:10423	Noni	FR	Ab	I & C	NEO	I	D	G	O, MA, A, C, SA, NA	S	YES
Rutaceae	Citrus × aurantium L. HUTPL:9248	Naranja, Naranja agria	S, B, FR	Ar	I & C	DDSIN	I	D	G, MK	SA, C, A, MA, NA	S	YES
Rutaceae	*Citrus maxima* (Burm.) Merr. HUTPL:119	Naranja	S, B, L, F	Ar	I & C	DDSIN, DRSIN, DNS	I	D	G, MK	SA, MA	N, S	YES
Rutaceae	*Citrus medica* L. HUTPL:120	Limón	FR, S, B, L, F	Ar	I & C	DDSIN, DDS, DRSIN, NEO, DNS, DGSIN	I, J	D	F, G, MK	SA, A, MA, NA	N, S	YES
Rutaceae	*Ruta graveolens* L. HUTPL:13616	Ruda	S, B	Ab	I	DRS, DDS, GSS, DDSIN, SAU, NEO, DCS, DGS	I, M, J	D	G, F, MK, G	SA, NA, A, AM, MA	N, S	YES
Scrophulariaceae	*Buddleja americana* L. HUTPL:10358	Salvia	S, B	Ab	N	GSS	P	TA	F	MA, SA, C	S	NO
Siparunaceae	*Siparuna sp.* HUTPL:10360	Limoncillo	S, B	Ar	N	DMSCT	C	TA	F	SA	S	NO
Solanaceae	*Cestrum mariquitense* Kunth HUTPL:10409	Saúco negro, saúco	BD, S, B	Ab	N	GSS, DRS, SSACL, DGSIN, DDSIN	J, I, C, P, DA	D, TA, B, R	G, F	SA, MA	S	NO
Solanaceae	*Nicandra physalodes* (L.) Gaertn. HUTPL:10595	Cepa del chilalo	R	H	I	DGSI	I	D	G	SA, NA, C, A, MA, AM	S	YES
Solanaceae	*Nicotiana tabacum* L. HUTPL:10382	Tabaco	S, B	Ab	I	GSS	P	TA	G, F	SA, MA, NA, C, A, AM	S	YES

Solanaceae	*Solanum albidum* Dunal HUTPL:10390	tululuche	S, B	Ab	N	IPCCE	P	TA	F	SA	S	YES
Solanaceae	*Solanum americanum* Mill. HUTPL:10434	Mortiño, Hierba mora	S, B, L, F, FR, R	H	N	DRS, SSISS, GSS, DNS, DGS, IDUU, DGSI, DDSIN, DGSIN, DDS	I, C, P, C, W	D, TA, B	G, F	C, SA, MA, NA, A, O, AM	N, S	YES
Solanaceae	*Solanum tuberosum* L. HUTPL:10375	Papa	T	H	N	GSS	P	TA	G	SA, MA, A, AM, NA	S	YES
Tropaeolaceae	*Tropaeolum tuberosum* Ruiz & Pav. HUTPL:5395	Mashua	L, F	H	N & C	DMGO	C	TA	G	SA	N	NO
Typhaceae	*Typha angustifolia* L HUTPL:10426	Totora	S, B	Ab	N	DGSIN	I	D	F	A, SA, O, MA, AM	S	YES
Urticaceae	*Urtica dioica* L. HUTPL:10422	Ortiga	EP, S, B	H	I	DGSIN, DGS	I	D	G, F, MK	A, SA, NA, MA	N, S	YES
Urticaceae	*Urtica urens* L. HUTPL:10367	Ortiga, chine	L, R, EP, S, B	H	I	DRS, GSS, DGS, DMSCT, DDSIN, NEO, ENMD, DDS	I, DA, P	D, R	G, F	SA, NA, A, MA	N, S	YES
Verbenaceae	*Aloysia triphylla* Royle HUTPL:10420	Cedrón	S, B, BD	Ab	I & C	GSS, DDS, DRS, DDSIN, DNS	I,M	D	G, MK	SA	N, S	NO
Verbenaceae	*Phyla dulcis* (Trevir.) Moldenke. HUTPL:10372	Buscapina	S, B, BD	H	I & C	DDS, DDSIN, DRS	I, J	D	G, F	SA, C, MA	S	NO
Verbenaceae	*Verbena litoralis* Kunth HUTPL:10431	Verbena	S, B, BD, EP	H	N	DRS, DDS, CIPD, GSS, DDSIN, DNS, DRSIN, DGS	I, M, C,	D, TA, B	F, G, MK	SA, O, MA, C, AM, NA	N, S	YES
Violaceae	*Viola odorata* L. HUTPL:10446	Violeta	L, F	H	I	DDS, DDSIN, DRSIN, DRS	I, M, J	D	F, G, MK	SA, NA, A, MA	N, S	YES
Winteraceae	*Drimys granadensis* L. f. HUTPL:10405	Lacando	S, B	Ar	N	DDS	P	TA	F	SA, MA	S	NO

Xanthorrhoeaceae	*Aloe vera* (L.) Burm. f. HUTPL:10441	Sábila	L, MU	H	I & C	GSS, NEO, DDS, DNS, DGSI, DGSIN, NEO, DMSCT, DDSIN, SSISS	C, J, M, H, I,	TA, D	G, F, MK	MA, SA, C, A, NA	N, S	YES
Zingiberaceae	*Hedychium coronarium* J. Koenig HUTPL:1053	Caña agria	S, B	Ab	I & C	DGSI, DDSIN, DGSIN	I	D	G, F	SA, MA, C, A, AM, NA	S	YES
Zingiberaceae	*Zingiber officinale* Roscoe HUTPL:5552	Jenjibre	R	H	I & C	NEO, DCS, DDSIN	I	D	F, MK	O, A, MA, SA, AM	N, S	YES
Zygophyllaceae	*Tribulus terrestris* L. HUTPL:9366	Cashamarucha	S, B	H	I & C	DMGO, DGS	I	D	G, F	SA, NA, A, AM, MA	N	YES

Legend:

Parts used: S: stem, B: branches, L: leaves, F: flowers, R: root, EP: Entire plant, SD: seeds, BD: BD, FR: Fruit, BK: Bark, MU: mucilage, T: tuber, BU: Bulbs, ST: stigma

Growth habit: H: herb; Ab: shrub; Ar: Tree; Li: Liana.

Origin: N: Native, C: Cultivated, I: Introduced, E: Endemic

Codes for ICD categories: CIPD: Certain infectious and parasitic diseases; DBFDMM: Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism ; DCS: Diseases of the circulatory system,; DDS: Diseases of the digestive system,; DDSI: Diseases of the digestive system, (Infections); DSIN: Diseases of the digestive system, (Inflammation); DEA: Diseases of the eye and adnexa; DEAI: Diseases of the eye and adnexa (inflammation); DEMP: Diseases of the ear and mastoid process; DGS: Diseases of the genitourinary system,; DGSI: Diseases of the genitourinary system, (Infection); DGSIN: Diseases of the genitourinary system, (Inflammation); DMGO: Diseases of male genital organs ; DRS: Diseases of the respiratory system,; ENMD: Endocrine, nutritional and metabolic diseases; GSS: General symptoms and signs; IDUU: Inflammatory disease of uterus, unspecified; SSISS: Symptoms and signs involving the skin and subcutaneous tissue; DNS: Diseases of the nervous system,; NEO: Neoplasms; DMSCT: Diseases of the musculoskeletal system, and connective tissue; IPCCE: Injury, poisoning and certain other consequences of external causes.

Preparation: I: Infusion, M: Mixture, C: Cooking, J: Juice, P: Poultice, O: Ointment, DA: Direct Application, CR: crushed, R: Roasted, B: Boiled, H: Heated

Mode of administration: D: Drink, TA: TA, B: Bathe, W: Washings, R: Rubbing, G: Gargle, V: Vapors

Source: G: Garden, F: Forest, MK: Marketplace

Continent Distributions: SA: South América; MA: Mesoamerica; NA: North América; A: Asia; C: Caribbean

Region: Ecuador: N: North, S: South

Finally, most of the informants (663) have different levels of education: primary school (398), secondary school (195), superior school (55), and incomplete primary school (17), where a similar number of species cited was observed for all categories of education (Figure 1e). Previous studies shown that higher levels of education influence the knowledge of medicinal plants related with diminishing the traditional culture, knowledge (Reyes-García *et al.* 2013; Corroto *et al.* 2022). However, in our case the Kruskal-Wallis test showed that there is no statistically significant difference between the number of species and the educational level of the informants (H=6.94, p-value=0.07). Thus, the knowledge of medicinal plants can be derived from experience and the degree of cultural contact with the plants used.

Diversity of medicinal plants, lifestyle and habits

The families Asteraceae, Lamiaceae and Poaceae recorded the highest number of species used (Figure 2). Thus, species of the Asteraceae and Lamiaceae families are the most used in northern and southern Ecuador (De la Torre *et al.* 2008, Tinitana *et al.* 2016) to treat antitumor and anti-inflammatory diseases. The presence of several compounds (e.g. isoflavonoids, sesquiterpene lactones, triterpene pentacyclic alcohols, essential oils, alkaloids and various acetylenic derivatives) could be related to the cytotoxic, antibacterial, and analgesic properties in these species of the family (Edeoga & Eriata 2001).

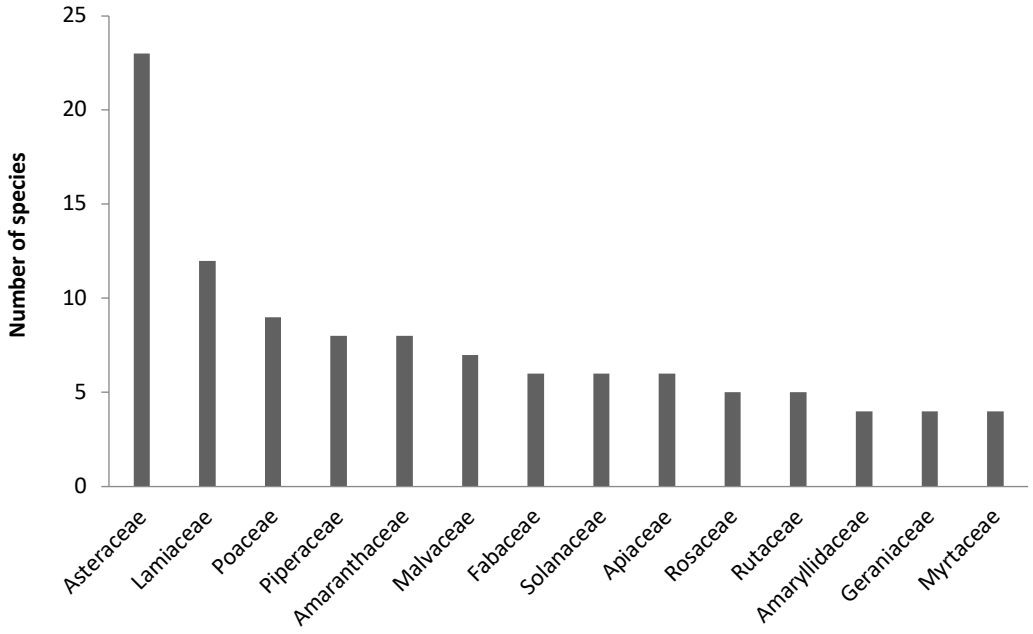

Figure 2. Plant families with the largest number of reported species

The great majority of the medicinal plants are native (98) of which 18 are cultivated, mainly for their medicinal value. There are 92 introduced species, of which 44 are cultivated. These results are like other research reported in Ecuador (Pohle & Gerique 2006; De la Torre *et al.* 2008), and other Andean countries (Bennet & Prance 2000; Arango 2004; Huamantupa *et al.* 2011; Lastres *et al.* 2015). Most medicinal plants are grown in gardens, 57% are herbs, followed by shrubs (27%), while 13% are trees and 3% are lianas, as the least frequent. These results coincide with studies conducted in tropical and temperate countries (Hajdu & Hohmann 2012; Monigatti *et al.* 2013; Teklehaymanot 2017; Singh *et al.* 2017; Zahoor *et al.* 2017).

Preparation and treatment mode

Stem, branches and bark were used in most preparations (48.2%), followed by whole plant (13.8%); leaves, stem, flowers and root (7.5%), flowers (5.7%); young branch and leaves (3.9%), bark and fruits (3.3%); latex and seeds (1.2%, Figure 3). Few remedies are prepared from the bulb; tuber, stigma, leaves and fruits (0.3%). Most of the remedies are prepared from fresh plant parts. The use of stem, branches and bark was the dominant category in our study, even though it is considered the most destructive technique, because it affects the sustainable utilization of the plant. The use of leaves corresponds to the third category of use, for which other studies in-dicate that the use of leaves is less destructive to the plant (Asiimwe *et al.* 2014; Tene *et al.* 2017; Teklehaymanot 2017; Maroyi 2017).

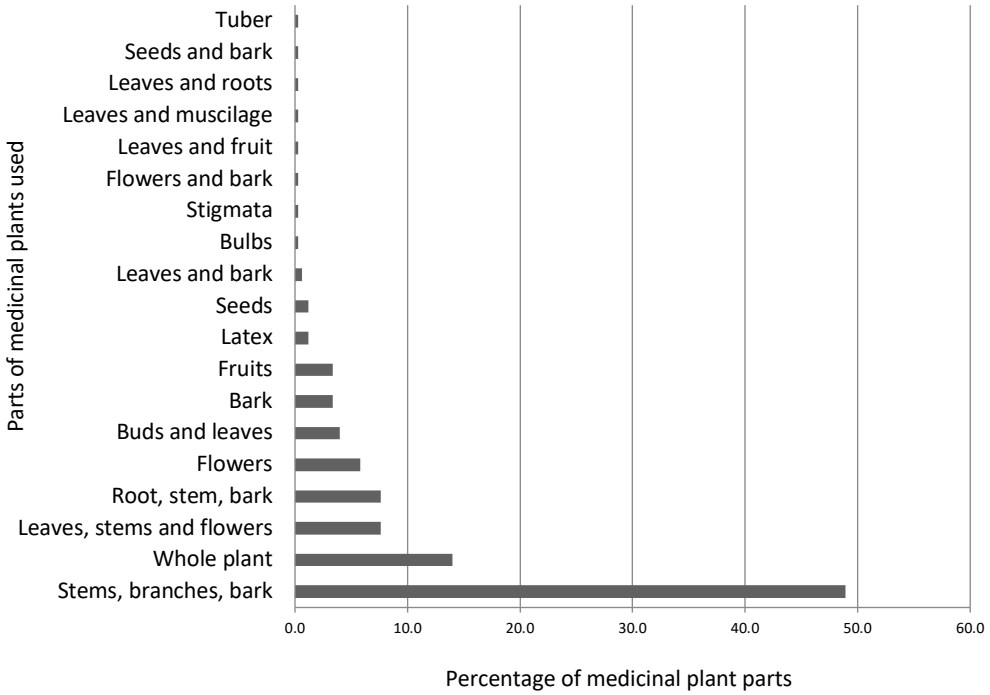

Figure 3. Parts of plants used for the preparation of remedies

Most treatments were prepared from a single plant (99%) and some from a mixture of multiple plants (1%). Infusion was the most used process (81%) followed by juice and decoction (Figure 4). Asiimwe *et al.* (2014) affirms that the use of individual plant species is since they contain chemical compounds that reduce various infections. On the other hand, the use of fresh plant parts and leaves is since the concentration of plant compounds are intact and are used for traditional treatments (Belayneh *et al.* 2012; Megersa *et al.* 2013; Assefa & Abebe 2014; Teklehaymanot 2017). It is important to note that the remedy preparations reported are combinations of different plant parts and methods, thus these plant extracts may have various biological effects, which in the future may help in the development of effective, safe and cost effective phytopharmaceuticals (Darshan & Doreswamy 2004; Ochwangí *et al.* 2014).

Oral administration (90.1%, administered once in the morning or three times in one day or for nine days, depending on the disease) was the main route of administration of treatments, followed by topical (6%) and other forms of body washes. Supporting our results, the oral route is a primary route of administration reported by several studies (Tene *et al.* 2007; De la Torre *et al.* 2008; Megersa *et al.* 2013).

Fidelity Level (FL) and Informant Consensus Factor (ICF)

The fidelity level of plants used in many disease categories ranged from 1 to 100%. Only 6.8% (n = 14) of the species had the highest fidelity level (≥ 60%). Species with a high fidelity level are mainly used for inflammation, diseases of the digestive and genitourinary system; nervous and respiratory system; endocrine, nutritional and metabolic diseases; general symptoms and signs; neoplasms; symptoms and signs affecting the skin and subcutaneous tissue (Table 3).

Species with the highest level of fidelity could be considered to have excellent curative potential and could be selected for further pharmacological evaluation as evidenced in other studies (Lulekal *et al.* 2008; Ugulu & Baslar 2010). In the case of species with less than 50% FL, but with a high consensus for the number of times they are mentioned for a particular disease, they show the dependence of the informants on these species (Song *et al.* 2013). Some species recorded in this research are used for the immune system and control infections and internal inflammations, very common in the preparation of the "Horchata" in the province of Loja (Ríos *et al.* 2017). Some have other therapeutic uses, for instance, *Cymbopogon citratus* has been studied as the source of bioactive anti-cancer and cytotoxic phytoconstituents (Bidinotto *et al.* 2011).

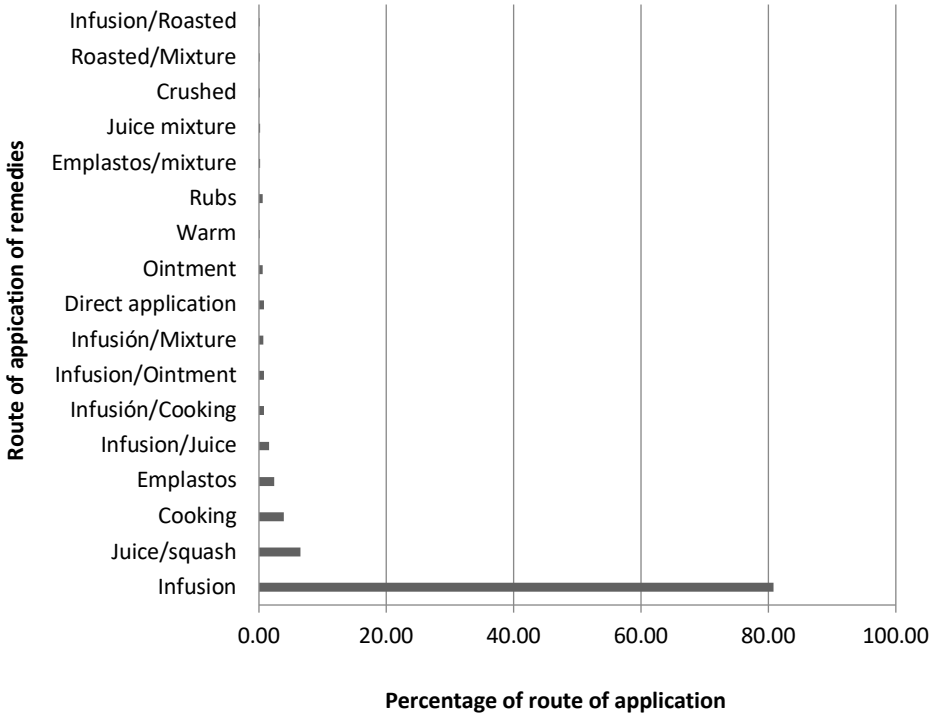

Figure 4. Route application in preparation of remedies

Table 3. Fidelity level (FL) values of the frequently (> 30 informants) reported plants and their major uses.

Plant species used	Therapeutic uses	Number of informants who cited a species for treating a particular disease (Ip)	Total number of citations (Iu)	Fidelity level (%)
Aloe vera (L.) Burm. f.	Inflammation and diseases of the digestive system	61	151	40,40
Aloysia triphylla (L´Hér.) Britton		80	103	77,67
Citrus maxima (Rumph. Ex Burm.) Merr.		34	42	80,95
Cymbopogon citratus (DC.) Stapf		154	184	83,70
Lippia dulcis Trevir.		57	64	89,06
Matricaria recutita L.		346	431	80,28
Mentha × piperita L.		148	183	80,87
Mentha spicata L.		75	86	87,21
Origanum vulgare L.		169	185	91,35
Pelargonium odoratissimum (L.) L'Hér.		155	161	96,27
Plantago major L.		62	123	50,41
Borago officinalis L.	Inflammation and diseases of the genitourinary system	38	78	48,72
Taraxacum officinale F.H. Wigg.		31	88	35,23
Equisetum bogotense Kunth		34	59	57,63
Plantago major L.		39	123	31,71
Solanum americanum Mill.		35	114	30,70
Melissa officinalis L.	Diseases of the nervous system	80	145	55,17
Eucalyptus citriodora Hook. f.	Diseases of the respiratory system	33	33	100,00
Aloe vera (L.) Burm. f.	Neoplasms	31	151	20,53
Urtica urens L.		31	79	39,24
Aristeguietia glutinosa (Lam.) R.M. King & H. Rob.	Symptoms and signs involving the skin and subcutaneous tissue	52	94	55,32
Piper asperiusculum		34	61	55,74

The ICF value for these categories (All the diseases described were sorted in 24 categories) was ranging from 0.17 to 0.96 (Table 4). The average ICF was 0.72. Inflammations and infections of the digestive system was the most frequently cited category (47,4%) followed by general symptoms and signs (8,7%), inflammation and diseases of the genitourinary system (7,2%). Nineteen categories were the least mentioned by in-formants, with less than 5% of citations. According to Rajakumar and Shivanna (Rajakumar & Shivanna 2009), the value of ICF for disease treatment depends upon the availability of plant species in that area. Our results found the highest value of ICF for inflammation and infections of the digestive system (0.96), systemic antibiotic, unspecified (0.95) and diseases of the nervous system (0.93). These results coincide with those found in other studies that report the use of plants for the treatment of diseases of the digestive system (De la Torre *et al.* 2008; Angulo *et al.* 2012; Malla *et al.* 2015; Maroyi 2017; Bussmann *et al.* 2018)

Table 4. Frequency and Informant Consensus Factor of each category of illness

Category of illnesses (list of diseases)	Number of plants cited	Number of informants citing the category	Frequency of citation (%)	Informant Consensus Factor (ICF)
Inflammation and infections of the digestive system	86	481	47,4	0,96
Systemic antibiotic, unspecified	2	21	0,6	0,95
Diseases of the nervous system	13	133	4,2	0,93
Inflammation and diseases of the eye and adnexa	3	20	0,5	0,89
Symptoms and signs involving the skin and subcutaneous tissue	19	125	4,1	0,89
Diseases of the genitourinary system	32	165	6,1	0,87
Endocrine, nutritional and metabolic diseases	6	31	0,8	0,84
Inflammation of the genitourinary system	49	187	7,2	0,83
General symptoms and signs	61	227	8,7	0,83
Neoplasms	30	123	4,1	0,82
Diseases of the circulatory system	7	34	0,9	0,82
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	7	31	0,8	0,81
Inflammation of the respiratory system	11	37	1,3	0,80
Diseases of the digestive system	49	163	5,6	0,78
Diseases of the respiratory system	40	112	4,1	0,76
Inflammatory disease of uterus, unspecified	6	18	0,5	0,74
Diseases of male genital organs	11	29	0,9	0,71
Diseases of the ear and mastoid process	2	4	0,1	0,67
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	2	4	0,1	0,67
Certain infectious and parasitic diseases	10	24	0,7	0,65
Infections of the genitourinary system	13	22	0,7	0,54
Injury, poisoning and certain other consequences of external causes	10	12	0,3	0,18
Diseases of the musculoskeletal system and connective tissue	16	16	0,5	0,17

Conclusion

A total of 187 medicinal plants belonging to 70 families and 149 genera were reported, with Asteraceae and Lamiaceae being the families with the highest number of species. Several species (stems, leaves, branches and bark) may have potential in the treatment of anti-tumour and anti-inflammatory diseases related to the treatment of major disorders such as infection and inflammation of the stomach, liver, kidneys, urinary tract, cancer and internal tumors. Gender, age and region were determining factors in the knowledge about the use of plants to treat anti-tumour and anti-inflammatory diseases. Finally, several species presented high values of fidelity and consensus of informants, therefore, it is important that they require pharmacological research for the discovery of new compounds and potential biological activities that have anti-tumour and anti-inflammatory properties.

Declarations

List of abbreviations: Society for Economic Botany (SEB), Informant Consensus Factor (ICF) and Fidelity Level (FL)

Ethics approval and consent to participate: No special permit was required for this work. This research was conducted in accordance with the code of ethics of the International Society for Ethnobiology (ISE 2008), which is also endorsed by the Society for Economic Botany (SEB). The Principle of Respect, number 9 in the code, recognizes the need for researchers to respect the integrity, morality and spirituality of the culture, traditions and relationships of indigenous peoples, traditional societies and local communities within their worlds. For this purpose, each parish council president and local informants were informed about the main objective of the study before obtaining their permission to conduct the interviews in each parish.

Consent for publication: This article has not been published previously. All authors agreed for submission.

Availability of data and materials: All the information gathered for this research was examined, interpreted, and incorporated into this research

Competing interests: Not applicable

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