Green World Journal
ISSN: 2737-6109

CaMeRa Editorial

RESEARCH ARTICLE

Use of medicinal plants according to the ancestral knowledge of the indigenous peoples of the Yacuambi Canton, Zamora Chinchipe-Ecuador

Robinson J. Herrera-Feijoo [1,+] Luzmila Morocho [2,+] Diego Vinueza [3] Rolando Lopez-Tobar [1,*] Cristhian Chicaiza-Ortiz*[2,4,5,6]

[1] Facultad de Ciencias Agrarias y Forestales, Universidad Técnica Estatal de Quevedo (UTEQ), Quevedo Av. Quito km, 1 1/2 Vía a Santo Domingo de los Tsáchilas, Quevedo 120550, Ecuador

[2] Faculty of Life Sciences, Amazon State University (UEA), Luis Imaicela, El Pangui – Zamora Chinchipe, Ecuador

[3] Natural Products Laboratory, Polytechnic School of Chimborazo (ESPOCH), Panamericana Sur km 1 ½, Riobamba, Ecuador

[4] Biomass to Resources Group, Amazon Regional University (IKIAM), Tena, Napo 150150, Ecuador

[5] Programa de posgrado en Cambio Climático, Sustentabilidad y Desarrollo. Área de ambiente y sustentabilidad. Universidad Andina Simón Bolívar, Quito, Ecuador

[6] China–UK Low Carbon College, School of Environmental Science and Engineering, Shanghai Jiao Tong University, China.

[+] Both names are first authors

Correspondencia: cristhianchicaiza@hotmail.com + 593 0980563032

DOI/URL: https://doi.org/10.53313/gwj61063

Abstract: Ancestral knowledge about medicinal plants plays a fundamental role in health. Despite this, this knowledge has received little attention, linked to the loss of cultural identity. Under this context, the present research is developed, whose objective is to document the use of medicinal plants, preparation technique, route of administration and the diseases treated, based on the ancestral knowledge of the indigenous peoples of the Yacuambi canton. Regarding the methodology used: semi-structured interviews were applied to 53 people over 40 years of age, from eight rural communities, belonging to three parishes of the canton, which allowed gathering information on the species of plants used, their vegetative parts, preparation techniques and route of administration. Among the results, 103 species of medicinal plants distributed in 47 families were recorded, being Lamiaceae the most representative with 12 species, followed by Asteraceae with 11 species; women use more plants than men, whose age varies mainly between 40 – 45 years; most use the leaves and the most common technique of preparation was the infusion, to treat different diseases, by oral administration. Among the most used species are *Clinopodium brownei* (Sw.) Kuntze (1) and *Solanum americanum* Mill. (0.92), which represents the highest knowledge richness index and the highest use-value index. These species are of great importance because they may have the greatest potential for future use as a resource for the pharmaceutical industry

Keywords: Ecuador; Yacuambi; Indigenous peoples; Medicinal plants; ethnobotany

Check for updates

Cita: Herrera-Feijoo, R. J., Morocho, L., Vinueza, D., Lopez-Tobar, R., & Chicaiza-Ortiz, C. (2023). Use of medicinal plants according to the ancestral knowledge of the indigenous peoples of the Yacuambi Canton, Zamora Chinchipe-Ecuador. Green World Journal, 6(1), 63. https://doi.org/10.53313/gwj62063

Received: 03/Mar /2023
Accepted: 08/May /2023
Published: 13/May /2023

Prof. Carlos Mestanza-Ramón, PhD.
Editor-in-Chief / CaMeRa Editorial
editor@greenworldjournal.com

1. Introduction

The use of medicinal plants comprises empirical practices, which represent the confluence of knowledge, skills, beliefs, and experiences of different cultures, which have been used to treat illnesses [1–4]. Some species of medicinal plants have played and continue to play an essential role in the religious rites of ancient cultures [2,5–7]. Additionally, medicinal plants have been an integral part of the human experience, particularly for indigenous peoples who rely on plant resources to treat their maladies, and have been a tradition passed down through centuries [8–10].

El In Ecuador, 5172 useful species are reported, of which 60% are medicinal, 55% are a source of materials for construction use, 30% are edible, and 20% are used in so-called social uses, including religious rites similar practices. The sum of these percentages exceeds 100%, which means that many species have multiple uses [11]. Moreover, in the country, the Kichwa Saraguro nationality has 370 useful species for medicinal purposes, highlighting the province of Loja with the most extensive record of the use of medicinal plants, while the Shuar nationality has 781 useful species for medicinal purposes [11].

In this context, in the Yacuambi canton, a city located in the south of the Amazon region, the ancestral knowledge has been relegated in many cases due to the lack of interest of the current generations, the lack of valuation, and the need for a proper legal order, oriented to its conservation [12–14]. One of the main reasons is the lack of economic resources in the indigenous families, which conditions them to migrate to the cities. This fact leads to a change of lifestyle. Therefore, they are influenced by new aesthetic paradigms of the dominant culture; young people being exposed to external influences, it becomes more challenging to preserve their cultural identity with such knowledge, leading to cultural erosion [15,16]

Therefore, in response to the ongoing loss of information about natural resource-based medicine, we propose to conduct this research from an ethnobotanical perspective to document the indigenous peoples of the canton Yacuambi's use of medicinal plants, their preparation technique, route of administration, and the diseases treated, all based on ancestral knowledge

2. Materials and Methods

2.1 Study area

The research was conducted in eight rural communities in the Yacuambi canton, province of Zamora Chinchipe, in the southern Amazon region of Ecuador (Figure 1). In four communities, there is a prevalence of the Kichwa Saraguro nationality (Sayupamba, Chonta Pamba, Guandus, and Cambana) and four of the Shuar nationality (Napurak, Washikia, Kurintza, and Kim).

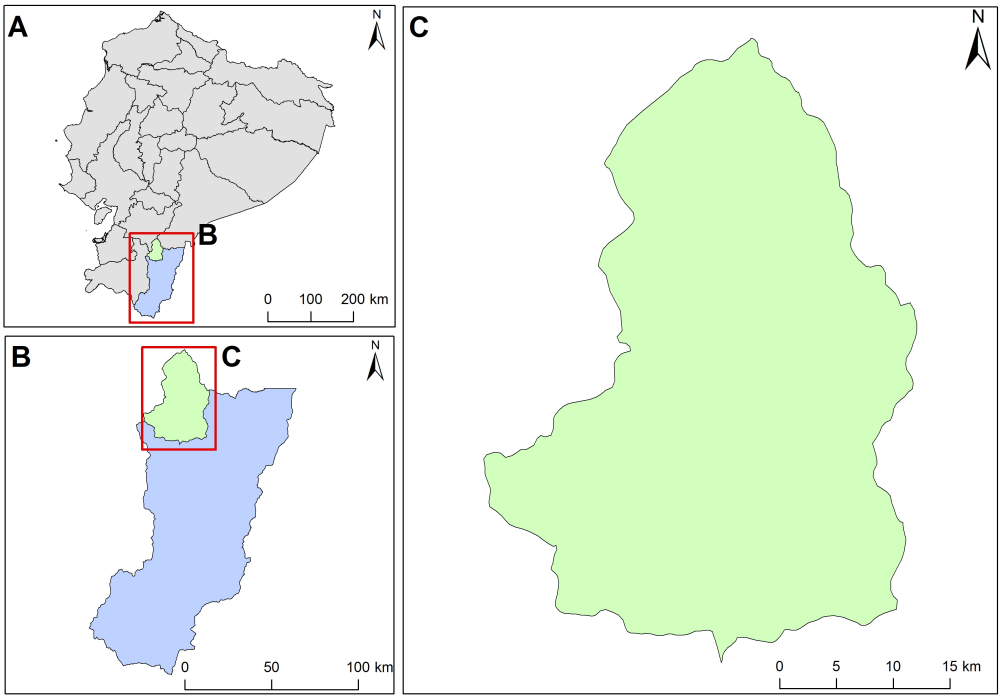

Figura 1. Study area; (a) Ecuador; (b) Zamora Chinchipe Province; (c) Yacuambi Canton.

2.2 Population, sample and data processing

The total population of the canton is approximately 7,121 inhabitants, which is composed of the following ethnic groups: indigenous (Saraguro and Shuar) with 71.71%, mestizo with 27.08% and less than 1% correspond to blacks, montubios and 17 whites[17]. The following formula was applied to calculate the sample size [18].

$$n = \frac{N * Z^2 * p * q}{e^2 * (N-1) + Z^2 * p * q}$$

where:
n = Sample size required
N = Population Size or Universe
Z^2 = Statistical parameter that depends on the Confidence Level (LC).
e = Maximum accepted estimation error
p = Probability of occurrence of the studied event (success).
q = (1 – *p*) = Probability that the event under study does not occur.

Replacing the values in the formula, a sample size of 280 persons was obtained for the application of surveys and interviews. Due to the COVID-19 pandemic and the political situation, at that time, due to the campaigns for the election of the president of Ecuador, it was not possible to comply with the established number of samples because it was difficult to access their communities since many people were afraid of being infected by the virus. However, 53 people were interviewed, of which 36 belonged to the Kichwa Saraguro nationality and 17 to the Shuar nationality.

According to López-Santiago et al. [19] , the minimum accepted sample size to consider the research as reliable is 30 units. Therefore, it can be said that 53 is the considerable sample size for this research. The following is the methodology used to conduct the study on medicinal plants. Semi-

structured interviews were conducted with the help of a questionnaire with people over 40 years of age because they have greater knowledge about the uses of ancestral medicine in their communities, which allowed information to be gathered about the plants used to treat a disease, traditional medicinal uses, methods of preparation, route of administration and parts of the plant. In addition, information was collected on sociocultural aspects such as age and sex. Each plant reported for medicinal use was photographed, described, collected and herborized. Identifications were made at the ECUAMZ Herbarium of the Universidad Estatal Amazónica with the help of Dr. David Neill and Dr. Diego Gutiérrez. The scientific names were revised and written according to the databases of Trópicos Home.

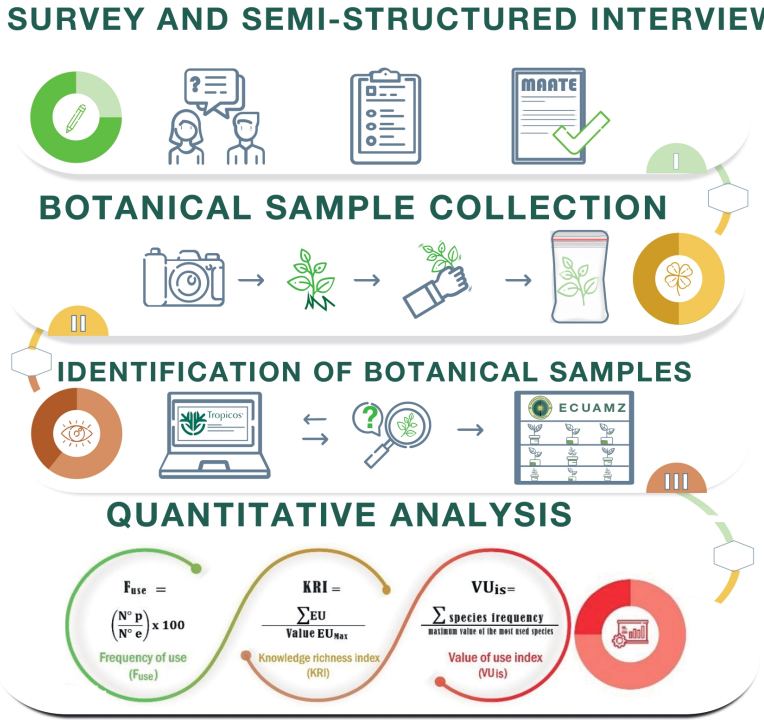

Figura 2. Methodology used to carry out the study on the use of medicinal plants.

Table 1. Sampling points with their respective geographical coordinates

Place	Nationality	Altitude	Latitude	Longitude
Napurak	Shuar	980m	03°43'50.06"S	078°52'46.72"W
Washikia	Shuar	1010m	03°41'34.05"S	078°51'25.37"W
Kurintza	Shuar	884m	03°46'74.3"S	078°53'38.41"W
El Kiim	Shuar	980m	03°47'5.19"S	078°54'4.33"W
Sayupamba	Saraguro	1488.57m	03°32'44.67"S	078°55'29.23"W
Conta Pamba	Saraguro	1588.66m	03°37'2.06"S	078°57'13.4"W
Guandus	Saraguro	1277m	03°63'46.9"S	078°92'75.7"W
Cambana	Saraguro	1200m	03°39'46.12"S	078°54'42.39"W

2.3 Richness, value y frequency of use

In order to quantify and statistically validate the information collected, the richness indexes were calculated. (KRI), value of use (VUis) and frequency of use (Fuse), according to the methodology adapted from [20].

2.3 Richness, value y frequency of use

In order to quantify and statistically validate the information collected, the richness indexes were calculated. (KRI), value of use (VUis) and frequency of use (Fuse), according to the methodology adapted from [20].

2.3.1 Knowledge richness index (KRI)

Refers to the wealth of knowledge that a user has about the possibilities of using plants in his community:

$$KRI = \frac{\sum EU}{Value\ EU\ max}$$

where:

KRI= richness of knowledge of a user of identified medicinal species in relation to the totality of the species found.

EU = number of useful species recorded by a user.

Value EU max= total value of species recorded in the study.

2.3.2 Value of use index (VUis)

Means the importance of a given species according to the degree of its use and compared to other species.

$$VUis = \frac{\sum species\ frequency}{Maximum\ value\ of\ the\ most\ used\ species}$$

where:

VU_{is} = is the index of use-value of the species *is*.

$Maximum\ value\ of\ the\ most\ used\ species$ = is the maximum value of the species that obtained the highest report in the whole sample, by the users, that is, the most used.

The UV_{is} is varies between 0 and 1, with 1 being the species with the highest use-value, which is why it is appreciated and sought after for its high utility [20].

2.3.2 Frequency of use (Fuse)

Refers to the number of times a user uses a species

$$Fuse = \left(\frac{N°\ p}{N°\ e}\right) x\ 100$$

where:

Fuse= frequency of use of the medicinal plant.

N⁰ p = number of times the species was mentioned.

N⁰ e = total number of interviews conducted.

The data were processed in Microsoft Excel®. Origin 2019® and IBM SPSS Statistics 25® were used to generate the figures.

3. Results

3.1. Demographic characteristics

According to the results generated (Figure 3), it is evident that 58.82% of the interviewed persons of the Shuar nationality are in the 40–45 age range. The rest corresponds to an age range between 45–50 years old (23.53%); while 36.11% corresponds to the Kichwa Saraguro nationality, which is in the 40–45 age range, and 22.22% is in the 50–55 age range. Considering the total population interviewed, 43.40% were in the 40–45 age range, and the minor proportion fluctuated between 75 and 80 years of age (7.50%).

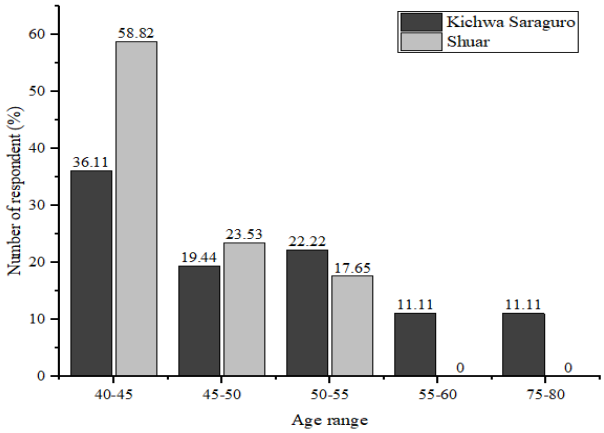

Figura 3. Age of the surveyed inhabitants of the two nationalities Kichwa Saraguro and Shuar

3.2. Gender

The information collected according to the gender of the people interviewed were women, 88.89 % corresponded to the Kichwa Saraguro nationality and 11.11 % to the male gender; while 36.11 % corresponded to women of the Shuar nationality and 11.11 % to the male gender. Of the total interviewed, 84.91% were women, and 15.09% were men (Figure 4).

Figura 4. Age of the surveyed inhabitants of the two nationalities Kichwa Saraguro and Shuar

There were 103 species of medicinal plants, recorded from interviews with at least one medicinal use, corresponding to 47 vascular plant families, of which the best-represented plant families mentioned are the Lamiaceae with 12 species equivalent to 11.76% of the total, followed by Asteraceae with 11 species (10.78%), and Solanaceae with five (4.9%). The Malvaceae and Urticaceae families were represented with four species equivalent to (3.92%). The three species were

represented by the Brassicaceae, Lauraceae, Orchidaceae, and Rosaceae families. The rest of the families had only two and one species, respectively (Table 2).

Tabla 2. Main plants used, with their respective vegetative parts, methods of preparation, route of administration for different diseases.

Family name	Botanical name	Vernacular name	Plant part used	Method of preparation	Route of administration	Ethno-medicinal uses
Acanthaceae	*Justicia secunda* Vah.l	Biblia	Flowers	Infusion	Oral	Cough
Aloeaceae	*Aloe vera* (L.) Burm. F.	Sábila	Leaves	Infusion	Oral	Head, Headache, Cangrene and Inflammation of the stomach
Amaranthaceae	*Chenopodium ambrosioides* L.	Paico	Leaves	Bath	Topical	Bad air, Bad air big, Bad cold air and Memory
Amaranthaceae	*Iresine* sp.	Escancel	Leaves and Stem	Infusion	Oral	Head, Cangrene and Fever
Amarilidaceae	*Allium sativum* L.	Ajo	Seed	Chewed	Oral	Cough and Baudeagua
Amarilidaceae	*Allium cepa* L.	Cebolla	Bulb and Roots	Infusion	Oral	Cirrhosis
Anacardiaceae	*Mangifera* sp.	Mango	Leaves	Infusion	Oral	COVID-19
Annonaceae	*Annona muricata* L.	Guanabana	Leaves	Infusion	Oral	COVID-19
Apiaceae	*Daucus carota* L.	Zanahoria	Bulb	Juice	Topical	Sight
Apiaceae	*Petroselinum crispum* (Mill.) Mansf.	Perejil	Roots	Juice	Oral	Menstruation irregular
Aquifoliaceae	*Ilex guayusa* Loes.	Guayusa	Leaves	Infusion	Oral	Antiparasitic, Toothache and Shamanic Rituals
Asteraceae	*Acmella brachyglossa* Cass.	Sesa	Leaves	Infusion	Oral	Diarrhea
Asteraceae	*Elephantopus* sp.	Oreja de conejo 1	Whole plant	Infusion	Oral	COVID-19
Asteraceae	*Tanacetum parthenium* (L.) Sch. Bip.	Santa maría de Sierra	Leaves	Bath	Topical	Jamalli and Baudeagua
Asteraceae	*Matricaria chamomilla* L.	Manzanilla	Whole plant	Infusion and Bath	Oral	Stomachache
Asteraceae	*Tagetes erecta* L.	Haya rosas	Flowers	Chewed	Topical	Baudeagua and Jamalli
Asteraceae	*Tagetes elliptica* Sm.	Haya rosas	Flowers	Chewed	Topical	Baudeagua and Jamalli
Asteraceae	*Gamochaeta americana* (Mill.) Mié.	Lechuguilla	Whole plant	Juice	Oral	Diarrhea
Asteraceae	*Ambrosia peruviana* Willd.	Marco	Leaves	Bath	Topical	Jamalli
Asteraceae	*Ambrosia artemisioides* Meyen y Walp.	Marco	Leaves	Bath	Topical	Jamalli
Asteraceae	*Baccharis genistelloides* (Lam.) Pers.	manos de Dios	Whole plant	Infusion	Oral	Cirrhosis, Stomachache, Colic to the liver and Liver problems
Asteraceae	*Pseudelepnantopus spicatus* (B. Juss. ex Aubl.) C.F. Baker	Oreja de conejo 2	Whole plant	Infusion	Oral	COVID-19
Balsaminaceae	*Impatiens hawkeri* W. Bull	Begonia rojo	Flowers	Infusion	Oral	Head
Begoniaceae	*Begonia cucullata* Willd.	Sacha begonia	Whole plant	Decoction	Oral	Head
Begoniaceae	*Tynanthus panurensis* (Mesa) Sandwith	Clavo huasca	Leaves	Maceration	Topical	Female aphrodisiac
Brassicaceae	*Nasturtium officinale* WT Aiton	Berro	Branches	Poultice	Oral	Anemia
Brassicaceae	*Rorippa bonariensis* (Poir.) Macloskie	Berro	Branches	Poultice	Oral	Anemia
Brassicaceae	*Lepidium bipinnatifidum* Desv.	Chichira	Branches	Infusion	Oral	Ricaida
Caryophyllaceae	*Dianthus caryophyllus* L.	Clavel	Flower	Infusion	Oral	vomiting
Crassulaceae	*Kalanchoe fedtschenkoi* Raym.-Hamet y H. Perrier	Condorcoles	Leaves	Infusion	Oral	Head
Costaceae	*Cheilocostus* sp.	Caña agria	Stem	Decoction	Oral	COVID-19 and Diabetes
Cucurbitaceae	*Cucurbita ficifolia* Bouché	Zambo	Br	Infusion	Oral	Stomach colic and Purgative.

Chloranthaceae	*Hedyosmum cumbalense* H. Karst.	Guayusa del cerro	Leaves	Infusion	Oral	Stomachache
Equisetaceae	*Equisetum bogotense* Kunth	Cola de Caballo	Whole plant	Infusion	Oral	Infections
Euphorbiaceae	*Croton lechleri* Mull. Arg.	Sangre de drago	Re		Topical	Cicatrizant, Varicella, Gastritis and Ulcers
Euphorbiaceae	*Acalypha diversifolia* Jacq.	Ushu	Stem	Chewed	Topical	Grain on the skin
Gentianaceae	*Potalia resinifera* Mart.	Curarina	Leaves	Poultice	Topical	Paludisme and Snake bite
Heliconaceae	*Heliconia marginata* (Griggs) Pittier	Shacha platanillo	Bu, Rz	Juice	Topical	Bad air big
Lauraceae	*Ocotea quixos* (Lam.) Kosterm.	Ishpink	Leaves	Infusion	Oral	Flu
Lauraceae	*Nectandra* sp.	Inshpingo	Fruit	Chewed	Topical	A cold
Lauraceae	*Cinnamomun* sp.	Canela	Bark	Infusion	Oral	COVID-19 and A cold
Lamiaceae	*Clinopodium brownei* (Sw.) Kuntze	Poleo	Whole plant	Juice	Topical	Bad air and Bad cold air
Lamiaceae	*Hyptis* sp.	Pedorrera	Branches	Infusion	Oral	Diarrhea
Lamiaceae	*Hyptis eriocephala* Benth.	Poleo negro	Branches	Infusion	Oral	Stomachache
Lamiaceae	*Ocimum campechianum* Mill.	Albahaca	Branches	Infusion	Oral	Stomachache
Lamiaceae	*Melissa officinalis* L.	Toronjil	Branches	Infusion	Oral	Nerves
Lamiaceae	*Mentha piperita* L.	Menta	Branches	Infusion	Oral	Stomach colic
Lamiaceae	*Mentha spicata* L.	Hierba buena	Roots and Leaves	Infusion	Oral	Stomach colic
Lamiaceae	*Origanum vulgare* L.	Orégano	Leaves	Infusion	Oral	Stomachache and Stomach colic
Lamiaceae	*Salvia rosmarinus* Schleid.	Romero	Branches	Decoction	Oral	Hair loss
Lamiaceae	*Minthostachys mollis*Grisets.	Poleo grande	Leaves	Juice	Topical	Stomachache and Bad air
Lamiaceae	*Salvia tiliifolia* Vahl	Chía cimarrona	Branches	Infusion	Oral	COVID-19
Lamiaceae	*Origanum majorana* L.	Orégano	Branches	Infusion	Oral	Stomachache and Stomach colic
Loranthaceae	*Psittacanthus* sp.	Suelda suelda	Leaves	Poultice	Topical	Blows
Lythraceae	*Cuphea strigulosa* Kunth	Kumpia	Branches and Leaves	Poultice	Topical	Snakebite and Hypertension
Lycopodiaceae	*Lycopodium* sp.	Trencilla	Whole plant	Infusion	Topical	Stomachache, Fright, Jamalli, Bad air
Malpighiaceae	*Banisteriopsis caapi* (Spruce ex Griseb.) CV Morton	Ayahuasca /Natem	Vines	Infusion	Oral	Shamanic Rituals
Malvaceae	*Sida poeppigiana* (K. Schum.) Fryxell	Willuk	Leaves	Poultice	Topical	Jamalli
Malvaceae	*Malva* sp.	Malva blanca	Flowers	Infusion	Oral	Infection and Settled heat
Menispermaceae	*Abuta grandifolia* (Mart.) Sandwith	Tsank Numi	Roots	Infusion	Oral	Female sterility and /Anemia
Malvaceae	*Malachra alceifolia* Jacq.	Malva amarillo	Flowers	Infusion	Oral	Diarrhea, Head and Vomit
Moraceae	*Maclura tinctoria* (L.) D. Don ex Steud.	La mora/uña de gato	Bark	Chewed	Topical	Cancer
Musaceae	*Musa paradisiaca* L.	Guineo tocho	Fruit	Poultice	Topical	Head
Myrtaceae	*Eucalyptus* sp.	Eucalipto	Leaves	Bath	Topical	Cold
Myrtaceae	*Psidium guajava* L.	Guayaba	Fruit and Leaves	Infusion	Oral	COVID-19 and Diarrhea
Olacaceae	*Heisteria acuminata* (Bonpl.) Engl.	Chuchuguazo	Bark	Poultice	Topical	Rheumatic pains, Muscle aches and Blows
Orchidaceae	*Epidendrum* sp.	Espíritu blanco	Flowers	Infusion	Oral	Bad air
Orchidaceae	*Epidendrum* sp.	Espíritu naranja	Flowers	Infusion	Oral	Bad air
Orchidaceae	*Epidendrum calanthum* Rchb. F. & Warsz.	Espíritu rosado	Flowers	Infusion	Oral	Bad air
Passifloraceae	*Passifora sp.*	Granadilla	Leaves	Poultice	Topical	Baby pushes
Plantaginaceae	*Plantago major* L.	Llantén	Leaves	Infusion	Oral	Infection, Head and Settled heat
Piperaceae	*Piper aducum* L.	Matico	Leaves	Bath	Topical	Infection

Piperaceae	*Piper* sp.	Matico	Leaves	Bath	Topical	Infection
Piperaceae	*Piper* sp.	Matico rosado	Leaves	Infusion	Oral	COVID-19
Piperaceae	*Piper* sp.	Sacha matico	Leaves	Bath	Topical	Cold and Jamalli
Piperaceae	*Piper umbellatum* L.	Santa maría	Leaves	Bath	Topical	Cold and Jamalli
Piperaceae	*Piper* sp.	Huaviduca	Leaves	Infusion	Oral	Infection
Piperaceae	*Peperomia* sp.	Congona	Whole plant	Infusion	Oral	Diarrhea and Stomachache
Poaceae	*Cymbopogon citratus* (DC.) Stapf	Hierba Luisa	Leaves and Roots	Infusion	Oral	Nerves, Stomachache and Diarrhea
Poaceae	*Zea mays* L.	Maíz blanco	Seed	Infusion	Oral	Head and Stomachache
Phytolaccaceae	*Phytolacca rivinoides* Kunth y CD Bouché	Rabo de ratón	Fruit	Bath	Topical	Dandruff
Rosaceae	*Rubus ulmifolius* Schott	Mora silvestre	Leaves	Poultice	Topical	Cangrene
Rosaceae	*Acaena* sp.	Tintinilla	Leaves	Infusion	Oral	Nerves
Rosaceae	*Rosa* sp.	Rosas blancas	Flowers	Infusion	Oral	Head and Infection
Rubiaceae	*Alibertia patinoi* (Cuatrec.) Delprete & CH Press.	Borojó	Fruit	Juice	Oral	Memory
Rubiaceae	*Chinchona* sp.	Cascarilla	Bark	Maceration	Topical	COVID-19
Rutaceae	*Ruta graveolens* L.	Ruda	Branches	Cleans	Topical	Bad air big, Bad air, Jamalli and Cold
Rutaceae	*Citrus x limon* (L.) Osbeck	Limón pequeño	Fruit	Juice	Oral	Flu, COVID-19 and Head
Solanaceae	*Cestrum peruvianum* Willd. ex Roem. & Schult.	Sauco negro	Leaves	Bath	Topical	Fever
Solanaceae	*Nicotiana tabacum* L.	Tabaco/Tsaank	Leaves	Maceration	Topical	Flu and Baudeagua
Solanaceae	*Solanum americanum* Mill.	Mortiño	Leaves	Juice	Topical	Bad air and Fever
Solanaceae	*Brugmansia suaveolens* (Humb. & Bonpl. Ex Willd.)Bercht. & C. Presl	Floripondio/Maikiua	Leaves	Maceration	Topical	Rheumatism, Snake bite and Heal wounds
Solanaceae	*Solanum tuberosum* L.	Papas	Seed	Poultice	Topical	Head
Plantaginaceae	*Scoparia dulcis* L.	Tiatina	Branches	Bath	Topical	Stomach gases
Urticaceae	*Urera* sp.	Yana chini	Roots and Leaves	Juice	Topical	Spider bite and Bad air

3.3. Plants parts of medicinal plants

The quantification of the vegetative parts used in each plant species made it possible to determine that, depending on the species, the whole plant or only some of its parts can be used. Ten different parts that are extracted for their use were identified (Figure 5), in which it was evident that the most used vegetative parts are the leaves with 50.42% for the Kichwa Saraguro nationality and 44.6% for the Shuar nationality, followed by the branches with a fraction of 16.8% and 12.9%, the other parts of the plant mentioned by the people interviewed do not exceed 11% in the cases. Considering the total population, most people use leaves (49.13%), followed by branches (15.94%). These results show that most people use the vegetative parts (leaves), because they contain a higher concentration of bioactive principles.

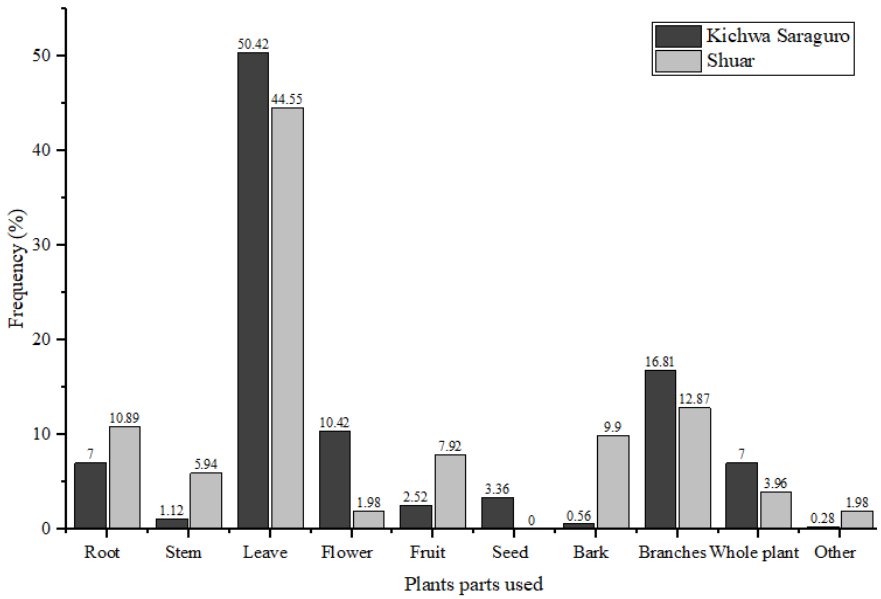

Figura 5. Plants parts of plants used by the Kichwa Saraguro and Shuar nationalities.

3.4. Method of preparation

To treat their ailments, the people interviewed prepare medicinal plants in different ways (Figure 6). For the Shuar nationality, it was found that most of the preparations correspond to decoction (40.59%), followed by infusion (29.70%); the most common form of preparation for the Kichwa Saraguro nationality corresponds to infusions (38.81%), followed by maceration (31.16%). When comparing the form of preparation between the two nationalities, it can be said that there is a significant difference, because each nationality has different worldviews. where it shows that the Shuar nationality has six different forms of preparation of the different species, highlighting the most common form of cooking (21 spp) and less common in infusion (3 spp).

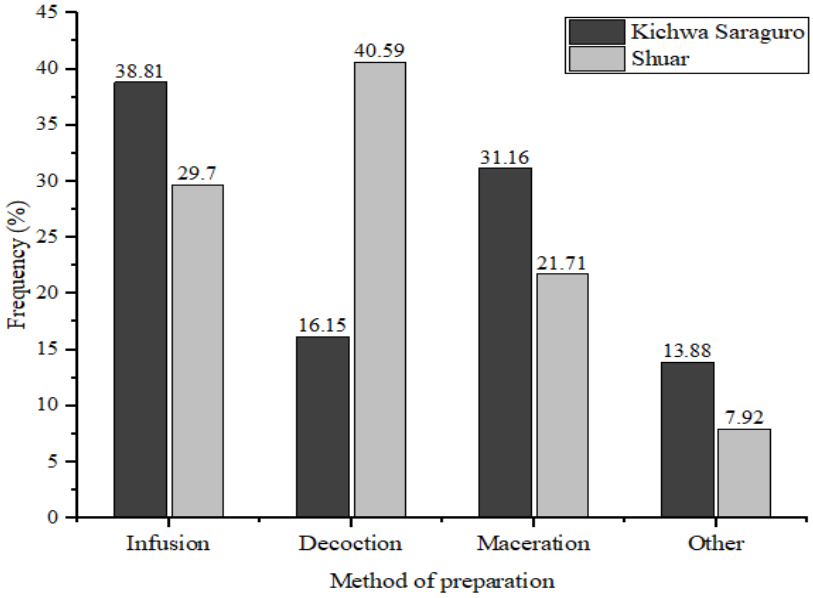

Figura 6. Method of preparation of medicinal plants used by the Kichwa Saraguro and Shuar nationalities.

3.5. Administration methods

The administration methods most used by the Kichwa Saraguro nationality is topical 55.31%, while the oral route corresponds to the Shuar nationality with 71.57% (Figure 7). This makes a difference when accessing medicinal plants from their localities.

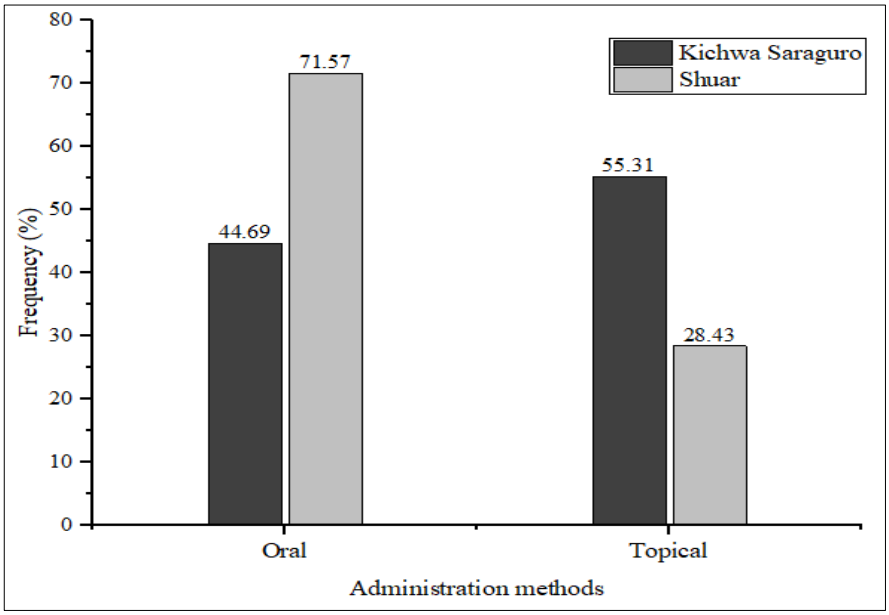

Figura 7. Administration methods of medicinal plants used by the Kichwa Saraguro and Shuar nationalities.

3.6. Knowledge wealth index, frequency of use and value of use

The highest knowledge richness index (KRI) corresponded to poleo (*Clinopodium brownei* (Sw.) Kuntze) with a value of 0.25, followed by mortiño (*Solanum americanum* Mill.) with a value of 0.23. The medicinal plants with the highest frequency of use were found within the families Lamiaceae, Solanaceae, Aloeaceae, Amaranthaceae and Rutaceae, which presented frequencies higher than 30 (Table 2). The highest frequency of use corresponded to *Clinopodium brownei* (Sw.) Kuntze, (49.06) followed by the species *Solanum americanum* Mill. (45.28), *Aloe vera* (45.28), *Chenopodium ambrosioides* L. (41.51), *Ruta graveolens* L. (33.96). In terms of the use-value of medicinal species, after *Clinopodium brownei* (Sw.) Kuntze (1), *Solanum americanum* Mill. y *Aloe vera* had the highest indices with 0.92 and the lowest shared by 44 species with a use-value of 0.04, which coincides with the lowest indices of knowledge richness.

Tabla 2. Knowledge richness index, frequency of use and use value of medicinal plant species identified in the communities of two nationalities (Kichwa Saraguro and Shuar), Yacuambi – Zamora Chinchipe, Ecuador

Family name	Botanical name	Number of mentions	KRI	Frequency of use	Value of use
Lamiaceae	*Clinopodium brownei* (Sw.) Kuntze	26	0.25	49.06	1
Solanaceae	*Solanum americanum* Mill.	24	0.23	45.28	0.92
Aloeaceae	*Aloe vera* (L.) Burm. F.	24	0.23	45.28	0.92
Amaranthaceae	*Chenopodium ambrosioides* L.	22	0.21	41.51	0.85
Rutaceae	*Ruta graveolens* L.	18	0.17	33.96	0.69
Amaranthaceae	*Iresine* sp.	14	0.14	26.42	0.54
Lamiaceae	*Melissa officinalis* L.	14	0.14	26.42	0.54
Poaceae	*Cymbopogon citratus* (DC.) Stapf	14	0.14	26.42	0.54
Rutaceae	*Citrus x limon* (L.) Osbeck	14	0.14	26.42	0.54

Piperaceae	*Piper aducum* L.	13	0.13	24.53	0.5
Rosaceae	*Rosa* sp.	11	0.11	20.75	0.42
Urticaceae	*Urtica* sp.	12	0.12	22.64	0.46
Verbenaceae	*Verbena officinalis* L.	12	0.12	22.64	0.46
Balsaminaceae	*Impatiens hawkeri* W. Bull	10	0.1	18.87	0.38
Zingiberaceae	*Zingiber officinale* Roscoe	10	0.1	18.87	0.38
Urticaceae	*Urera* sp.	10	0.1	18.87	0.38
Solanaceae	*Cestrum peruvianum* Willd. ex Roem. & Schult.	10	0.1	18.87	0.38
Piperaceae	*Piper umbellatum* L.	9	0.09	16.98	0.35
Urticaceae	*Urtica* sp.	6	0.06	11.32	0.23
Euphorbiaceae	*Croton lechleri* Mull. Arg.	5	0.05	9.43	0.19
Piperaceae	*Piper* sp.	5	0.05	9.43	0.19
Plantaginaceae	*Plantago major* L.	5	0.05	9.43	0.19
Asteraceae	*Tanacetum parthenium* (L.) Sch. Bip.	4	0.04	7.55	0.15
Asteraceae	*Matricaria chamomilla* L.	4	0.04	7.55	0.15
Asteraceae	*Ambrosia peruviana* Willd.	4	0.04	7.55	0.15
Solanaceae	*Nicotiana tabacum* L.	4	0.04	7.55	0.15
Lamiaceae	*Mentha piperita* L.	4	0.04	7.55	0.15
Myrtaceae	*Eucalyptus* sp.	4	0.04	7.55	0.15
Olacaceae	*Heisteria acuminata* (Bonpl.) Engl.	4	0.04	7.55	0.15
Amarilidaceae	*Allium sativum* L.	3	0.03	5.66	0.12
Aquifoliaceae	*Ilex guayusa* Loes.	3	0.03	5.66	0.12
Asteraceae	*Gamochaeta americana* (Mill.) Mié.	3	0.03	5.66	0.12
Equisetaceae	*Equisetum bogotense* Kunth	3	0.03	5.66	0.12
Menispermaceae	*Abuta grandifolia* (Mart.) Sandwith	3	0.03	5.66	0.12

Family name	Botanical name	Number of mentions	KRI	Frequency of use	Value of use
Piperaceae	*Piper* sp.	3	0.03	5.66	0.12
Poaceae	*Zea mays* L.	3	0.03	5.66	0.12
Solanaceae	*Brugmansia suaveolens* (Humb. & Bonpl.) Ex Willd.) – Bercht & C. Presl.	3	0.03	5.66	0.12
Urticaceae	*Urtica* sp..	3	0.03	5.66	0.12
Violaceae	*Viola odorata* L.	3	0.03	5.66	0.12
Amarilidaceae	*Allium cepa* L.	2	0.02	3.77	0.08
Acanthaceae	*Justicia secunda* Vahl	2	0.02	3.77	0.08
Asteraceae	*Tagetes erecta* L.	2	0.02	3.77	0.08
Asteraceae	*Tagetes elliptica* Sm.	2	0.02	3.77	0.08
Brassicaceae	*Nasturtium officinale* WT Aiton.	2	0.02	3.77	0.08
Brassicaceae	*Lepidium bipinnatifidum* Desv.	2	0.02	3.77	0.08
Crassulaceae	*Kalanchoe fedtschenkoi* Raym. –Hamet y H. Perrier	2	0.02	3.77	0.08
Costaceae	*Cheilocostus* sp.	2	0.02	3.77	0.08

Gentianaceae	*Potalia resinifera* Mart.	2	0.02	3.77	0.08
Lauraceae	*Nectandra* sp.	2	0.02	3.77	0.08
Lamiaceae	*Hyptis* sp.	2	0.02	3.77	0.08
Lamiaceae	*Minthostachys mollis* Grisets.	2	0.02	3.77	0.08
Lythraceae	*Cuphea strigulosa* Kunth	2	0.02	3.77	0.08
Malvaceae	*Sida poeppigiana* (K. Sthum) Fryxell	2	0.02	3.77	0.08
Moraceae	*Maclura tinctoria* (L.) D. Don ex Steud.	2	0.02	3.77	0.08
Myrtaceae	*Psidium guajava* L.	2	0.02	3.77	0.08
Rubiaceae	*Alibertia patinoi* (Cuatrec.) Delprete & CH Press.	2	0.02	3.77	0.08
Rubiaceae	*Chinchona* sp.	2	0.02	3.77	0.08
Solanaceae	*Solanum tuberosum* L.	2	0.02	3.77	0.08
Anacardiaceae	*Mangifera* sp.	1	0.01	1.89	0.04
Annonaceae	*Annona muricata* L.	1	0.01	1.89	0.04
Apiaceae	*Daucus carota* L.	1	0.01	1.89	0.04
Apiaceae	*Petroselinum crispum* (Mill.) Mansf.	1	0.01	1.89	0.04
Asteraceae	*Acmella brachyglossa* Cass.	1	0.01	1.89	0.04
Asteraceae	*Elephantopus* sp.	1	0.01	1.89	0.04
Asteraceae	*Ambrosia artemisioides* Meyen y Walp.	1	0.01	1.89	0.04
Asteraceae	*Baccharis genistelloides* (Lam.) Pers.	1	0.01	1.89	0.04
Asteraceae	*Pseudelepnantopus spicatus* (B. Juss. ex Aubl.) C.F. Baker	1	0.01	1.89	0.04
Begoniaceae	*Begonia cucullata* Willd.	1	0.01	1.89	0.04
Begoniaceae	*Tynanthus panurensis* (Mesa) Sandwith	1	0.01	1.89	0.04

Family name	Botanical name	Number of mentions	KRI	Frequency of use	Value of use
Brassicaceae	*Rorippa bonariensis* (Poir.) Macloskie	1	0.01	1.89	0.04
Caryophyllaceae	*Dianthus caryophyllus* L.	1	0.01	1.89	0.04
Cucurbitáceas	*Cucurbita ficifolia* Bouché	1	0.01	1.89	0.04
Chloranthaceae	*Hedyosmum cumbalense* H. Karst.	1	0.01	1.89	0.04
Euphorbiaceae	*Acalypha diversifolia* Jacq.	1	0.01	1.89	0.04
Heliconaceae	*Heliconia marginata* (Griggs) Pittier.	1	0.01	1.89	0.04
Lauráceas	*Ocotea quixos* (Lam.) Kosterm.	1	0.01	1.89	0.04
Lauráceas	*Cinnamomun* sp.	1	0.01	1.89	0.04
Lamiaceae	*Hyptis eriocephala* Benth	1	0.01	1.89	0.04
Lamiaceae	*Ocimum campechianum* Mill	1	0.01	1.89	0.04
Lamiaceae	*Mentha spicata* L.	1	0.01	1.89	0.04
Lamiaceae	*Origanum vulgare* L.	1	0.01	1.89	0.04

Lamiaceae	*Salvia rosmarinus* Schleid.	1	0.01	1.89	0.04
Lamiaceae	*Salvia tiliifolia* Vahl	1	0.01	1.89	0.04
Lamiaceae	*Origanum majorana* L.	1	0.01	1.89	0.04
Loranthaceae	*Psittacanthus* sp.	1	0.01	1.89	0.04
Lycopodiaceae	*Lycopodium* sp.	1	0.01	1.89	0.04
Malpighiaceae	*Banisteriopsis caapi* (Spruce ex Griseb.) CV Morton	1	0.01	1.89	0.04
Malvaceae	*Malva* sp.	1	0.01	1.89	0.04
Malvaceae	*Malachra alceifolia* Jacq.	1	0.01	1.89	0.04
Musaceae	*Musa paradisiaca* L.	1	0.01	1.89	0.04
Orchidaceae	*Epidendrum* sp.	1	0.01	1.89	0.04
Orchidaceae	*Epidendrum* sp.	1	0.01	1.89	0.04
Orchidaceae	*Epidendrum calanthum* Rchb. F. & Warsz.	1	0.01	1.89	0.04
Passifloraceae	*Passifora* sp.	1	0.01	1.89	0.04
Piperaceae	*Piper* sp.	1	0.01	1.89	0.04
Piperaceae	*Piper* sp.	1	0.01	1.89	0.04
Piperaceae	*Peperomia* sp.	1	0.01	1.89	0.04
Phytolaccaceae	*Phytolacca ribinoides* Kunth y CD Bouché	1	0.01	1.89	0.04
Rosaceae	*Rubus ulmifolius* Schott	1	0.01	1.89	0.04
Rosaceae	*Acaena* sp.	1	0.01	1.89	0.04
Plantaginaceae	*Scoparia dulcis* L.	1	0.01	1.89	0.04
Verbenaceae	*Aloysia citrodora* Palaú	1	0.01	1.89	0.04
Zingiberaceae	*Renealmia alpinia* (Rottb.) Maas	1	0.01	1.89	0.04

4. Discussion

In ethnobotanical studies, traditional knowledge with medicinal plants is dynamic, and responds to socio-cultural and ecological changes that have occurred throughout history [21]. In this sense, according to other research such as De la Torre et al. [11], more than 80% of the population relies on traditional medicines to treat human pathologies. The history of this planet shows that without the use of medicinal plants it is not possible [22]. However, the present generation does not have enough knowledge about the uses and applications of indigenous medicinal plants. Therefore, it is very important to transmit this valuable ethnobotanical knowledge of our ancestors to future generations, thus preserving the millenary cultural wealth [1,3,23].

According to Campos-Saldaña et al. [20], mentions that " women play a unique and key role in health care with their ethnomedical and ethnobotanical knowledge, as well as older people are usually those who possess more ethnobiological information, particularly in human groups that are facing social changes". In this sense, the results generated in this research show that indigenous women of the two nationalities of Yacuambi canton possess specific knowledge about the applications and use of medicinal plants [24].

Currently, 5172 species of useful plants have been registered in Ecuador, of which 60% are used for medicinal purposes This means that hundreds of native and introduced medicinal plants constitute a fundamental basis for human health and well-being. Most people use the leaves for medicinal use, due to the higher concentration of bioactive principles found in them [2,25].

Zambrano-Intriago et al. [26], mentions that each particular plant has its different processing techniques and specific preparation according to the particular condition to be treated. In this sense and according to the results generated by Ordóñez & Reinoso [27] it is evidenced that most use in the form of infusion to heal different diseases of the human being. According to research conducted by Bricio & Naranjo [28], the most used route of administration is oral, because they are popular to prepare as beverages, and also are more eficases to heal some ailment of the patient.

Several species identified with higher richness index, frequency of use and use value, have been identified with medicinal properties in other studies. For example, Campos-Saldaña et al. [20] reported *Verbena officinalis* L. with the highest knowledge richness index. Regarding the frequency of use according to studies by Abbaszadeh et al. [29], the Lamiaceae family is found to be most used, followed by Boraginaceae. Regarding the use value of medicinal species, after *Verbena officinalis* L., *Matricaria chamomilla* L., and *Ocimum campechianum* Mill. had the highest rates.

In a general sense, between one and five medicinal plant species per family were found, which partially coincides with the results published by Campos-Saldaña et al. [20], who also reported 10 species of medicinal use within the Asteraceae family. This study could be replicated in other contexts within the Amazon [30].

5. Conclusions

The results of this research highlight the importance of ethnopharmacology in the identification and documentation of medicinal plants used by indigenous communities in the Andean region of southern Ecuador. A total of 103 medicinal plant species were found with at least one documented medicinal use, which shows a great diversity of natural resources available in the region. In addition, it was observed that most of the vegetative parts used correspond to leaves and branches, suggesting that these parts may contain a higher concentration of bioactive principles.

Regarding the form of preparation, it was found that infusions and decoctions were the most common forms of preparation, and that oral administration was the most used by the Shuar population, while the Kichwa Saraguro population preferred topical administration. These findings indicate the existence of significant differences in practices and beliefs related to traditional medicine among indigenous communities, highlighting the importance of addressing cultural particularities and local knowledge in ethnopharmacological research. It is recommended that further studies be conducted in the region to document the richness of the medicinal flora and to investigate the molecular mechanisms underlying the pharmacological activities of these plants. In addition, it is suggested that the conservation and sustainable use of natural resources be promoted to ensure their long-term availability.

Author Contributions: Conceptualization, R.J.H.F., L.M. and C.C.O; methodology, R.J.H.F., C.C.O. and L.M.; software, R.L.T and D.V; validation, R.J.H.F., L.M. and C.C.O; formal analysis, R.J.H.F., L.M and C.C.O; writing—original draft preparation, R.J.H.F., L.M., C.C.O., R.L.T. and D.V.; writing—review and editing, R.J.H.F., L.M., C.C.O., R.L.T. and D.V.; supervision, R.J.H.F. and C.C.O. All authors were involved in developing, writing, commenting, editing, and reviewing the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Weckmüller, H.; Barriocanal, C.; Maneja, R.; Boada, M. Factors Affecting Traditional Medicinal Plant

Knowledge of the Waorani, Ecuador. *Sustainability* **2019**, *11*, 4460.

2. Cruz, O.V.; Lee, J.; Lee, C.; Kim, H.J.; Villota, S.; Narváez-Trujillo, A.; Íñiguez, J.; Navarrete, H. *Bioknowledgy of the Ecuadorian Flora. Some Medicinal Plants and Their Uses.*; Pontificia Universidad Católica del Ecuador, 2022; ISBN 9978776311.
3. Caballero-Serrano, V.; McLaren, B.; Carrasco, J.C.; Alday, J.G.; Fiallos, L.; Amigo, J.; Onaindia, M. Traditional Ecological Knowledge and Medicinal Plant Diversity in Ecuadorian Amazon Home Gardens. *Glob. Ecol. Conserv.* **2019**, *17*, e00524.
4. Rivero-Guerra, A.O. Uso Tradicional de Especies de Plantas En Trece Provincias de Ecuador. *Collect. Bot.* **2021**, *40*, e002–e002.
5. Swami, D. V; Anitha, M.; Rao, M.C.S.; Sharangi, A.B. Medicinal Plants: Perspectives And Retrospectives. In *Medicinal Plants*; Apple Academic Press, 2022; pp. 1–28 ISBN 1003277403.
6. Armijos, C.; Ramírez, J.; Salinas, M.; Vidari, G.; Suárez, A.I. Pharmacology and Phytochemistry of Ecuadorian Medicinal Plants: An Update and Perspectives. *Pharmaceuticals* **2021**, *14*, 1145.
7. Corr, R. Strange Seeds: Ethnohistorical Testimonies of the Clandestine Culture of Sacred Plants in Colonial Ecuador. *Anthropol. Conscious.* **2022**, *33*, 153–174.
8. Erazo-Garcia, M.P.; Guadalupe, J.J.; Rowntree, J.K.; Borja-Serrano, P.; Espinosa de los Monteros-Silva, N.; Torres, M. de L. Assessing the Genetic Diversity of Ilex Guayusa Loes., a Medicinal Plant from the Ecuadorian Amazon. *Diversity* **2021**, *13*, 182.
9. Sirén, A.; Uzendoski, M.; Swanson, T.; Jácome-Negrete, I.; Sirén-Gualinga, E.; Tapia, A.; Dahua-Machoa, A.; Tanguila, A.; Santi, E.; Machoa, D. Resilience against the Covid-19 Pandemic among Indigenous Kichwa Communities in Ecuadorian Amazonia. **2020**.
10. Armijos, C.; Ramírez, J.; Vidari, G. Poorly Investigated Ecuadorian Medicinal Plants. *Plants* **2022**, *11*, 1590.
11. De la Torre, L.; Navarrete, H.; Muriel, P.; Macía, M.J.; Balslev, H. *Enciclopedia de Las Plantas Útiles Del Ecuador (Con Extracto de Datos)*; Herbario QCA de la Escuela de Ciencias Biológicas de la Pontificia ..., 2008; ISBN 9978771352.
12. Minga, S.R.; Díaz, N.J.; Aguirre, Z. Productos Forestales No Maderables de Origen Vegetal de Cinco Comunidades Del Cantón Yacuambi, Zamora Chinchipe. *Bosques Latid. Cero* **2017**, *7*.
13. Alonso, A.M.; Finegan, B.; Brenes, C.; Günter, S.; Palomeque, X. Evaluación de La Conectividad Estructural y Funcional En El Corredor de Conservación Podocarpus-Yacuambi, Ecuador. *Caldasia* **2017**, *39*, 140–156.
14. Quezada-Sarmiento, P.A.; Chango-Cañaveral, P.M.; Fraiz-Brea, J.A.; Armijos-Lanchi, K.M.; Ponce, M.P.A. Tourism and Gastronomy Management through an Educational Web Platform on Yacuambi of the Province of Zamora Chinchipe-Ecuador. *WCSE* **2020**, *2020*, 10th.
15. Sorokin, P. *Social and Cultural Dynamics: A Study of Change in Major Systems of Art, Truth, Ethics, Law and Social Relationships*; Routledge, 2017; ISBN 1351490605.
16. Savage, M. *The Return of Inequality: Social Change and the Weight of the Past*; Harvard University Press, 2021; ISBN 0674988078.
17. INEC Encuesta Nacional de Empleo, Desempleo y Subempleo - ENEMDU.
18. López-Santiago, J.G.; Casanova-Lugo, F.; Villanueva-López, G.; Díaz-Echeverría, V.F.; Solorio-Sánchez, F.J.; Martínez-Zurimendi, P.; Aryal, D.R.; Chay-Canul, A.J. Carbon Storage in a Silvopastoral System Compared to That in a Deciduous Dry Forest in Michoacán, Mexico. *Agrofor. Syst.* **2019**, *93*, 199–211, doi:10.1007/s10457-018-0259-x.
19. Santiago, M.A.L. La Valoración de Los Servicios Ecosistémicos Desde La Cosmovisión Indígena Totonaca. *Madera y bosques* **2019**, *25*.
20. Campos-Saldaña, R.A.; Solís-Vázquez, O.O.; Velázquez-Nucamendi, A.; Cruz-Magdaleno, L.A.; Cruz-Oliva, D.A.; Vázquez-Gómez, M.; Rodríguez-Larramendi, L.A. Saber Etnobotánico, Riqueza y Valor de Uso de Plantas Medicinales En Monterrey, Villa Corzo, Chiapas (México). *Boletín Latinoam. y del Caribe plantas Med. y aromáticas* **2018**, *17*, 350–362.
21. Parthiban, R.; Vijayakumar, S.; Prabhu, S.; Yabesh, J.G.E.M. Quantitative Traditional Knowledge of Medicinal Plants Used to Treat Livestock Diseases from Kudavasal Taluk of Thiruvarur District, Tamil Nadu, India. *Rev. Bras. Farmacogn.* **2016**, *26*, 109–121.
22. Hussain, S.; Hussain, W.; Nawaz, A.; Badshah, L.; Ali, A.; Ullah, S.; Ali, M.; Hussain, H.; Bussmann, R.W.

Quantitative Ethnomedicinal Study of Indigenous Knowledge on Medicinal Plants Used by the Tribal Communities of Central Kurram, Khyber Pakhtunkhwa, Pakistan. *Ethnobot. Res. Appl.* **2022**, *23*, 1–31.

23. Kumar, A.; Kumar, S.; Ramchiary, N.; Singh, P. Role of Traditional Ethnobotanical Knowledge and Indigenous Communities in Achieving Sustainable Development Goals. *Sustainability* **2021**, *13*, 3062.
24. Morocho Tene, M.L.; Chicaiza Ortiz, C.D. *GUÍA DIDÁCTICA DE PLANTAS MEDICINALES DE LOS PUEBLOS INDÍGENAS DEL CANTÓN YACUAMBI, ZAMORA CHINCHIPE- ECUADO*; 2021; ISBN 978-9942-40-433-6.
25. Hart, G.; Gaoue, O.G.; de la Torre, L.; Navarrete, H.; Muriel, P.; Macía, M.J.; Balslev, H.; León-Yánez, S.; Jørgensen, P.; Duffy, D.C. Availability, Diversification and Versatility Explain Human Selection of Introduced Plants in Ecuadorian Traditional Medicine. *PLoS One* **2017**, *12*, e0184369.
26. Zambrano-Intriago, L.F.; Buenaño-Allauca, M.P.; Mancera-Rodríguez, N.J.; Jiménez-Romero, E. Estudio Etnobotánico de Plantas Medicinales Utilizadas Por Los Habitantes Del Área Rural de La Parroquia San Carlos, Quevedo, Ecuador. *Univ. y Salud* **2015**, *17*, 97–111.
27. Ordóñez Ruilova, D.M.; Reinoso Herrera, J.M. Uso de Plantas Medicinales Por Personas de Sabiduría Del Cantón Sígsig. 2015. **2015**.
28. Bricio Arriaga, E.A.; Naranjo Ortega, N.M. Plantas Medicinales Utilizadas Para Tratar La Fiebre En Menores de Cinco Años En La Comunidad de Acchayacu, 2018.
29. Abbaszadeh, S.; Teimouri, H.; Farzan, B. An Ethnobotanical Study of Medicinal Plants with Antianxiety and Antidepressant Effects in Shahrekord. *Egypt. J. Vet. Sci.* **2019**, *50*, 81–87.
30. Chicaiza Ortiz, C. D., Logroño Vintimilla, W., Chicaiza Ortiz, Ángel, Núñez Chávez, W., & Ortiz Cañar , M. E. (2022). Environmental Management Strategies in Kichwa Communities of the Amazon of Ecuador. CIENCIA UNEMI, 15(39), 27-34. https://doi.org/10.29076/issn.2528-7737vol15iss39.2022pp27-34p