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Research Article

# Diversity and use of Plants in Carlos Concha, Esmeraldas, Ecuador

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## Abstract

In Carlos Concha, Esmeraldas province, a survey was conducted in order to determine the level of use of local plants by the local population. It was determined that 49 species, belonging to 28 botanical families are used. Most of the latter belong to the Asteraceae, Cucurbitaceae, Fabaceae, Piperaceae, and Solanaceae families, which include 17.85% of all reported species. All collected plants were collected in the field, pressed, dried, and mounted as herbarium samples. Most of the inhabitants of Carlos Concha practice subsistence agriculture with cacao (*Teobrama cacao*), maize (*Zea mays*), cassava (*Manihot esculenta),* plantains (*Musa paradisiaca*), and bananas (*Musa acuminata)* the principal crops. Of the plants reported as useful, 50.1% are used as medicine, insect repellent, and wound healing. As much as 24.4% of the reported species are used as food, three species are used as construction materials, whereas uses related to handicraft manufacturing and ritual activities are less frequent, with only one species used for these purposes. Additionally, 9 species were reported to be used for other purposes, including fuel (coal), forage and ornamental uses.

## Introduction

Ethnobotany is a discipline that is responsible for studying the place that plants occupy in the culture of people, as well as the interaction between people and plants [1]. The use of plants by the inhabitants of a certain region is the result of the co-evolution of social systems and natural resources since they are molded and adapted to various factors such as production cycles, ecological niches, and social transformations, among others. others [2]. Therefore, ethnobotany is deeply linked to the ancestral knowledge of the population and adapts to different spatiotemporal contexts and the ethnic group that uses it, being, in many cases, a cultural demand of the people [3].

Plants are mainly used in traditional medicine and for food, being also used as fuel, construction material, material for fences and corrals, and raw material for crafts, in addition to magical-religious uses [1,4]. In this sense, previous studies highlight the importance of native plants for the food security of indigenous populations and rural populations in general [5]. Regarding medicinal uses, previous evidence reflects that, in less developed countries, more than 80% of the population turns to medicinal plants to alleviate their ailments [6]. In fact, medicinal plants constitute a form of first aid for an important part of the inhabitants of remote areas, where medical care is scarce or non-existent [7]. The use of medicinal plants is, therefore, a valid alternative in rural areas of less developed countries [3]. These backgrounds reflect the importance of medicinal plants for the well-being of residents of rural areas.

However, factors such as the penetration of the market economy, the migration of the young population, and the adoption of consumption habits considered "modern" bring with them the imminent risks of cultural erosion and loss of historical memory about the use of plants [1]. In this sense, ethnobotanical research is important to record and preserve ancestral knowledge related to the use of plants. In Ecuador there are 408 studies related to the use of plants, with the Amazon, with 107 documents, being the geographical area where the most research has been carried out [3,4].

This study expands the state of the art of ethnobotanical research in tropical areas of Ecuador by analyzing biodiversity



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and plant uses in the Carlos Concha parish, on the northern coast of Ecuador. This area is located in the Choco Andino ecosystem, an ecosystem that is characterized by its rich biodiversity of species [8]. Apart from this Introduction, this manuscript is structured as follows: the following section describes the study area and the procedures used for sample collection and identification. Subsequently, the main findings of the study are detailed and discussed, while the final section presents the conclusions.

## Materials and methods

Next, the study area and the methodologies used to carry out surveys on plant uses, collect samples, and identify them are described.

### Study location

This work was carried out in the rural parish of Carlos Concha (Figure 1), which is located 32 km from the Esmeraldas canton and has an area of 286.74 km2. The parish is located within the buffer zone of the Mache Chindul Ecological Reserve and includes the enclosures of Chichivine, Selva Alegre, Taripa, Poza de Chile, El Condor, San Antonio, Cupa, Valle Ene, Unión Manabita, Moncaune, Veinte de Mayo, Paraíso, Bocana Ene, Morachigue, Bunca and Huele.

The parish has a population of 2,500 inhabitants, of which 43% are women and 57% are men. The majority of the population defines itself as mestizo (46.77%), while 38.53% of it considers itself black, Afro-Ecuadorian or mulatto [9]. Most of the population practices subsistence agriculture with cocoa (*Teobrama cacao*), tagua seed (*Phytelephas macrocarpa*), corn (*Zea mays*), cassava (*Manihot esculenta*), plantain (*Musa paradisiaca*), and banana. (*Musa acuminata*), as the main crops. These producers are affected by the parish's poor road network, which makes it difficult to transfer production to adjacent markets. On the other hand, livestock and poultry farming are still incipient activities. Given the scarcity of income-generating sources, a good part of the population is dedicated to the exploitation of wood, an activity that is carried out without any control or management plan, which constitutes a risk for the rich biodiversity of the area [10].

Deforestation is one of the main problems in Carlos Concha. Factors such as population growth and the advance of the agricultural frontier constitute the main threat to the conservation, not only of the biological resources but also of the cultural resources of the area. This has serious environmental implications, since, as mentioned above, the parish is located in the buffer zone of the Mache Chindul Ecological Reserve [10].

### Data collection

The data for this study were collected during the months of October 2019 and July 2020. The information was collected on-site through surveys, which were applied at the Health Center of the parish capital, for this purpose, the heads of households were summoned by the president of the parish council. The only selection criteria to be included in the sample were being the head of the household residing in the parish, regardless of the age, sex, and ethnicity of the person surveyed.

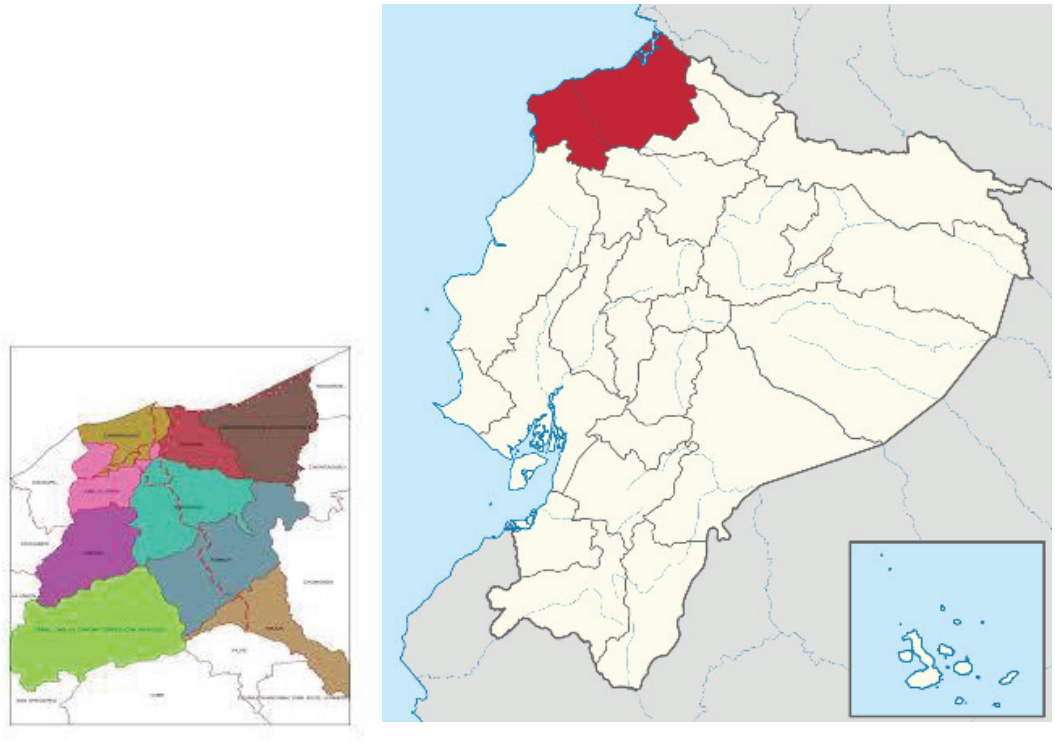

**Figure 1:** Location of the Carlos Concha Parish, Esmeraldas canton, Ecuador.
Esmeralda's canton and its parishes.
Study area, lower zone of the province of Esmeraldas, in Ecuador.



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The questionnaire was designed to collect demographic, socioeconomic, productive information, and medicinal uses of plant species. Prior to its application, the questionnaire was validated in the territory with the help of residents of the area. The surveys were administered by a group of university students previously trained in the structure and application of the instrument.

In total, 200 surveys were collected. The data were entered into an Excel database from which frequency tables were made and the number and species used by the Carlos Concha population were determined.

To demonstrate the oral information provided by the respondents, a collection of plant specimens for the herbarium was made, in 4 transects of 100 linear m and one meter wide with the help of a guide knowledgeable about local plants. The samples were collected with flowers or fruits, placed on newspaper, and labeled with a marker, assigning a code to each specimen. Several duplicates were taken from each specimen. Subsequently, the plants were placed in wooden presses and transferred to the Biology laboratory of the Central University of Ecuador, where they were made up and dried in a homemade electric stove for two days until they were completely dry. Subsequently, the samples were assembled. A label with the corresponding herbarium data was placed on each sample.

To establish the species of each sample, comparison patterns were used and plant databases available online (e.g., tropicos.org) were consulted. Through this procedure, the family, genus, and species of each of the collected plants were established.

## Results

The procedure described in the previous section allowed us to determine that in the Carlos Concha parish, a total of 49 species are used, corresponding to 28 families. The results indicate that the families with the highest number of species are Asteraceae, Cucurbitaceae, Fabaceae, Piperaceae, and Solanaceae, which concentrate 17.85% of all reported species (Table 1). More than half of the recorded species (50.1%) are used for medicinal purposes, with uses as insect repellent and wound healing being the most common among the local population. It can also be seen that 24.4% of the reported plant species are used for food purposes. Three species are used by the population as construction materials, while uses related to the production of crafts and rituals are the least frequent with only one species used for these purposes, respectively. Additionally, a group of 9 species was reported that are used for various purposes such as fuel (charcoal), forage, material for stakes, and ornamental uses.

**Table 1:** Plants used in Carlos Concha, Esmeraldas, Ecuador.

| Family | Species | Common name | Used part | Applications | | | | | | Plants Used |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Medicine | Food | Construction | Craft | Ritual | Others | |
| ACANTHACEAE | *Justicia secunda* Vahl. | Insulina | leaves flowers | x | | | | | | Lowers blood sugar |
| ACANTHACEAE | *Trichanthera gigantea* (Bonpl.) Nees | Nacedero | leaves flowers | x | | | | | | So that the wounds do not become infected |
| ANNONACEAE | *Annona conica* Ruíz & Pav. Ex G. Don | Raimondia | fruits | x | | | | | | Anticancer |
| ANNONACEAE | *Annona muricata* L. | Guanabana | Fruit, seeds, leaves | x | x | | | | x | food, medicine, repellent |
| APIACEAE | *Eryngium foetidum* L. | Quillangua | whole plant | | x | | | | | Seasoning |
| APOCYNACEAE | *Asclepias curassavica* L. | Mata caballo | latex | x | | | | | | dental caries |
| APOCYNACEAE | *Catarantus roseus* (L.) G. Don | Cataranto | leaves | x | | | | | x | Anticancer repellent |
| ARACEAE | *Caladium bicolor* (Aiton) Vent. | Mandi | leaves | x | | | | | | Snakebite |
| ARACEAE | *Colocasia esculenta* (L.) Schott. | Papa China | stem | | x | | | | | Food |
| ARECACEAE | *Bactris gasipaes* Kunth. | Chonta | stem, fruits | | x | | | | | Palm heart, flour |
| ARECACEAE | *Socratea exorrhiza* (Mart.) Wendl | Pambil | steam | | | x | | | | Poles |
| ARECACEAE | *Astrocaryum standleyanum* LH Bailey | Moriche | fruits | | x | | | | | Flour bread |
| ASTERACEAE | *Emilia sonchifolia* (L.) DC. | Lechuguilla | whole plant | x | | | | | | Antiinflamatory |
| ASTERACEAE | *Adenostema lavenia* (L.) Kuntze | Mama Juana | whole plant | x | | | | | | Diarrhea in children |
| ASTERACEAE | *Neurolaena lobata* (L.) Cass. | Tres puntas | leaves, flowers | x | | | | | | Dengue and chikungunya |
| ASTERACEAE | *Tagetes patula* L. | Flor de muerto | whole plant | | | | | | x | Insects repellent |



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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| BIGNONIACEAE | *Crescentia cujete* L. | Mate | fruit | x | | | | | x | cholesterol low, containers |
| BIXACEAE | *Bixa orellana* L. | Achiote | seeds | | | | | | x | Colorant, insect repellent |
| CARICACEAE | *Carica microcarpa* Jacq. | Col de monte | leaves | | x | | | | | foods |
| COMMELINACEAE | *Commelina diffusa* Burm. F. | Quilon quilon | whole plant | x | | | | | | Wound healing |
| COMMELINACEAE | *Zebrina pendula* Schnizt. | Moradilla | whole plant | x | | | | | | Diuretic |
| COSTACEAE | *Costus scaber* Ruiz y Pav. | Caña Agria | stem, leaves | x | | | | | | Clean urinary tract |
| CUCURBITACEAE | *Luffa cylindrica* M. Roem. | Esponja vegetal | fruits | | | | | | x | exfoliant |
| CUCURBITACEAE | *Momordica charantia* L. | Meloncillo | fruits | x | | | | | | Lowers blood sugar |
| CUCURBITACEAE | *Sicana odorifera* (Vell.) Naudin | Calabaza roja | fruits | | | | | | x | Sponge |
| CYCLANTHACEAE | *Carludovica palmata* Ruiz & Pav. | Rampira | leaves | | | | x | | x | Making hat shigra, roofing |
| EUPHORBIACEAE | *Cnidoscolus aconitifolius* (Mill.) MI Johnst | Chaya | leaves latex | x | x | | | | | Antileukemic |
| EUPHORBIACEAE | *Croton lechlerii* Mull. Arg. | Drago | latex | x | | | | | | Healing |
| EUPHORBIACEAE | *Aleurites montanus* (Lour.) EH Wilson | Almendra | fruits | | x | | | | x | omegas, coal, food |
| FABACEAE | *Cassia fistula* L. | Caña fistula | fruits | x | | | | | | Throat diseases. Flu, cough |
| FABACEAE | *Erythrina crsitagalli* | Caraca | stem | | | | | | x | posts, stakes, animal food |
| FABACEAE | *Inga spectabilis* (Vahl.) Willd. | Guaba machete | fruits | | x | x | | | x | foods, posts, forage |
| FABACEAE | *Phaseolus lunatus* L. | Haba manaba | seeds | | x | | | | | foods |
| GESNERIACEAE | *Columnea tandapiana* (Wielher) Skog & Kvist | Carpa dorada | whole plant | | | | | | x | ornament |
| LAMIACEAE | *Occimum basilicum* L. | Chirarán | whole plant | | x | | | | | Condiment, stomachache |
| MALVACEAE | *Hibiscus roseus* Thore | Cucarda | leaves | x | | | | | | headache |
| MORACEAE | *Artocarpus altilis* (Parkinson) Fosberg | Frutepan | seeds | | x | | | | | foods, animal foods prevent hair loss |
| MUNTINGIACEAE | *Muntingia calabura* L. | Niguito | fruits | | x | | | | | Refresh, foods |
| MUSACEAE | *Musa acuminata* Colla | Plátano | Fruits, leaves fibers | x | | | x | | | foods, handicrafts |
| NYCTAGINACEAE | *Bouganvillea spectabilis* Willd | Papelillo | flowers | | | | | | x | ornament |
| PETIVERIACEAE | *Petiveria alliaceae* L. | Ajo de monte | leaves flowers | x | | | | | | Antitumor |
| PHYLLANTHACEAE | *Phyllanthus niruri* L. | Chanca piedra | whole plant | x | | | | | | urinary tract stones |
| PIPERACEAE | *Piper aduncum* L. | Cordoncillo | leaves | x | | | | | | heart, stress |
| PIPERACEAE | *Piper carpunya* L. | Guaviduca | leaves | x | | | | | | cold |
| PIPERACEAE | *Piper umbellatum* L. | María panga | leaves | x | | | | | | Energizing |
| PLANTAGINACEAE | *Scoparia dulcis* L. | Teatina | whole plant | x | | | | | | Prostate, rash |
| POACEAE | *Cenchrus maximum* Jacq. | Saboya | whole plant | | | | | | x | Animal food |
| RUBIACEAE | *Coffea canephora* Pierre ex A. Froehner | Café | fruits | | | | | | x | stimulating |
| SOLANACEAE | *Brunfelsia grandiflora* D. Don | Chiriguayusa | leaves | x | | | | | | Energysin, cold |
| SOLANACEAE | *Solanum pimpinelliflium* L. | Tomatillo | fruits | | x | | | | | vegetable |
| SOLANACEAE | *Witteringia solanacea* L'Hér | Simbío | whole plant | x | | | | x | | Lowers blood sugar, terror |
| VERBENACEAE | *Stachytarpeta cayennense* (Rich.) Vahl. | Vebena | whole plant | x | | | | | | Antiviral |



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In terms of which part of the plant is used, the results reflect that the leaves are the most frequently used part, with 30.61% of the species collected. The fruits are the part used for 25.53% of the reported species, while the stems are used in 10.20% of the cases. The latex of the plant is used in 6.12% of the reported species, while the entire plant is used in 22.48% of the cases.

## Discussion

Among the species used for medicinal purposes, *Cnidoscolus aconitifolius* stands out, which is mainly used for the treatment of diabetes [11]; *Piper aduncum*, which is used to mitigate stress [12,13]; *Croton lechlerii*, which is used as an internal healing agent [14]; and *Cassia fistula*, used to treat respiratory problems [15]. These findings indicate that the population, not having access to health services, self-medicate with the plants available in their natural environment. This is consistent with the work of [16], who state that deficiencies in health systems in rural areas of less developed countries make the inhabitants of these areas use ethnobotany to treat their problems. ailments. The species that are reported with other uses mostly belong to different botanical families. Among them, are *Bixa orellana* stands out, which are used as a food coloring [17], and *Luffa cylindrica*, which is used as a skin exfoliant [18].

The area presented little diversity of plants for food use, with only 10 species used for this purpose. Among these are *Annona muricata* L., *Phaseolus lunatus*, *Inga spectabilis* (Vahl.) Willd.m., *Musa acuminata* and *Solanum pimpinelliflium* L. stand out. This number is low if one considers that the number of species used at the national level is 2016 [19]. The use of *Cenchrus maximum* for animal consumption is also reported. This species is introduced and reported as animal food by [20].

It should be noted that the species *Astrocaryum standelyanum*, *Bactris gasipaes*, *Eryngium foetidum*, and *Peperomia pellucida* are not cultivated, but rather consumed in the wild. The consumption of these species was also reported in other studies in South America: *Bactris gasipaes* in Ecuador, [21-24] report the food use of the species *Bactris gasipaes*.

Among the species used for construction, none is cultivated, *Socratea exhoriza* is only used from wild trees, remnants of the humid forests present in the area, after the felling of the primary forest for the establishment of pastures for livestock [25,26]. Of the species used as raw material for the production of crafts, *Carludovica palmata* is the most used, however, it is not cultivated in the area, so the local population takes advantage of the wild material that nature offers in its environment, in addition, this species is given other uses as coverage for roofing houses and animal sheds, and also as raw material for the production of "Panama hats" [27].

*Witheringia solanacea* is a species used in the ritual field to "cure fear" in children, it is also used for medicinal purposes to reduce the blood sugar content of diabetic people as mentioned [28]. This use differs from that described by (Velásquez, et al. 2016), who, in a study carried out in communities of the Chachi ethnic group, also in the province of Esmeraldas, report that *W. solanacea* is used primarily to treat skin rashes. This suggests that different ethnic groups may have different uses for the same species, even in the same area [11].

In terms of the part of the plant that is used, of the total number of species reported, in sixteen cases the leaves are the used part of the plant, these being the plant organs most used for the preparation of medicines, as well as food, since be it human or animal. In some cases, the leaves are used for covering purposes in construction [27]. In four species the use of leaves and flowers is reported, which suggests that these organs are generally used together in the preparation of herbal teas or medicinal waters. This is consistent with the work of [29], who argues that in most medicinal plant species the most used parts are the leaves and flowers.

In 14 plants the fruits are used, mainly as food. This result is not surprising, since it is one of the plant organs that is most consumed for this purpose [30]. Of 11 species, the entire plant is used. In these cases, they are small herbs that are consumed whole or plants whose useful components are distributed throughout the plant [11]. The use of plant latex is reported in three species since this is a viscous liquid that can be easily extracted from plant tissues. Its use is widely known, especially in species of the Euphorbiaceae family, which is known for its colorful latexes, within which there are femuric starches, which are used as medicine for the treatment of various diseases [31]. The use of stems is reported for five species. This denotes that wood is used, either as construction material or as posts for supporting vine crops [27].

## Conclusion

The residents of the Carlos Concha parish basically define themselves as being of mixed and black ethnicity. This population preserves the memory of the use of several plant species, which, being in the buffer zone of the Mache Chindul reserve, did not show a wide diversity of species used by the resident population. This shows that the use of plants is determined by the cultural characteristics of the resident population. The most used plant families were Asteraceae, Cucurbitaceae, Fabaceae, Piperaceae, and Solanaceae, which show the greatest number of species and diversity of reported uses, such as human food, animal food, medicinal, crafts, and construction throughout the area.

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