

# Ethnobotanical study of medicinal plants used by *Mocho* community in Chiapas, Mexico

## AUTHORS

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## ABSTRACT

The use of medicinal plants is currently demanded by the locals in small communities, 80% of them are users of medicinal plants. This research aimed to document traditional knowledge about medical plants and its usage by the locals of the *Mocho* community, in the state of Chiapas, Mexico.

Ethnobotanical and socio-demographical data was collected through questionnaires from 43 local informants. In addition, quantitative approaches were used to determine medicinal use value (MUV), use report (UR), the relative frequency of citation(RFC) and informant consensus factor (ICF).

A total of 83 medicinal plant species belonging to the 44 botanical families were documented in this research. *Asteraceae* was the most dominant family (6 species) followed by *Lamiaceae* and *Rutaceae* (5 species each). The most used parts are leaves (46 %), decoction is the common method of preparation. Diseases of the digestive and gastrointestinal system were dominated with 102 use-reports (27.57 %) and diseases of the reproductive system had the highest ICF index (0.76) among other ailment categories. According to RFC and MUV index the most important species were *Verbena litoralis* Kunth, *Matricaria chamomilla* L, *Bursera simaruba* (L.) Sarg., *Dysphania ambrosiodes* (L.) Mosyakin and Clemants and *Ruta graveolens* L. The results of this study support the conservation of ancestral knowledge about the use of medicinal plants, It is also culturally important to the knowledge for future generations.

**Key words:** Asteraceae, Ethnobotany, Lamiaceae, Traditional medicine, *Verbena*

*litoiralis* Kunth.

## 1. INTRODUCTION

In Mexico a large percentage of unreported diseases occurs in rural areas, being one of the biggest problems presented by indigenous people, and particularly indigenous women, is the fact of having the worst health indicator from all over the country: high general mortality, high infant mortality, high maternal mortality and high prevalence of malnutrition. It is also a population with high fertility rates and with short inter genetic periods. Based on the epidemiological study of indigenous peoples of Mexico, about 70% of the main problems to be treated in communities with an indigenous population are: surgery (10.8%), pediatrics (15.6%), internal medicine (13), gynecology and obstetrics (17.8%), trauma (9.9%). In the state of Chiapas the main diseases faced by indigenous people are: heart disease (12%), malignant tumors (7.7%) accidents (6.3%), infectious intestinal diseases (5, .8%), diabetes melitus (4.5%), renal failure (4.3%), pneumonia (3.9%) mainly liver (3.3 %) and cerebrovascular (3.3%) diseases. (Hernández et al., 2012; Lozano et al., 2013).

Mexico has 68 ethnic groups and 25 million 694,928 people who self-identify as indigenous, that represents 21.5% of the country's total population. The State of Chiapas is inhabited by 11 ethnic groups (14.2%) with valuable ancestral knowledge in the management and use of medicinal plants that are transmitted orally from generation to generation (Berlin and Berlin, 1993; CONAPO, 2009; Smith et al. 2009). However due to different problems, such as the transfer of knowledge in closed groups, migration, disinterest among the younger generation in traditional medicine, and the loss of biodiversity of medicinal plants the knowledge is being lost. In order to maintain traditional knowledge for the next generations (Matthia et al. 2016, Lara et al. 2019), this research was focused on documentation of traditional knowledge uses by "Mochó" indigenous community in the Motozintla in state of Chiapas, Mexico. The data collected have described the most cultural important species and the main epidemiological problems to be treated by the indigenous.

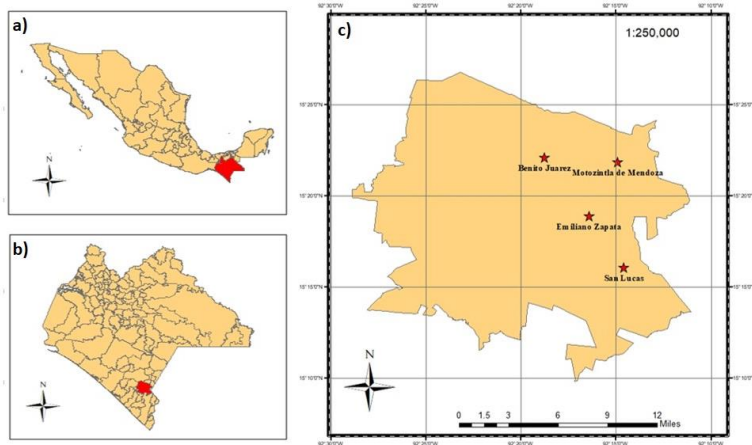
## 2. MATERIALS AND METHODS

### 2.1. Data of study area

Chiapas is located in the southeast of Mexico, with geographical coordinates: north 17°59', south 14°32' N; east 90°22', west 94°14' W. Motozintla has the highest concentration of Mocho indigenous people in the region (Figure 1). The members of this town call themselves *mochós* or *motozintlecos*, as the linguists also call them regionally. The municipality of Motozintla is located in southeast of the state, at an altitude of 1300 meters above sea level. It borders with Guatemala in the east, and its territorial extension is 782 square kilometers. The *motozintleco* language (*mochó*) is spoken approximately by 400 people in Chiapas and it is almost extinct. The tongue is classified within the Mayan language. In the region where the *Mochós* live, there is also the Mam and the Kaqchikel *pearele* which languages is also belonging to the Maya and the first one is the predominant language in this region (González, 2009).

The climate is mostly tropical and humid. The rainfall average can more than 3000 mm per year. In the past, natural vegetation in this region was low land with tall perennial rainforest, but it has been completely cleared out to agriculture and ranching (González, 2009). From the economic point of view, the *mochós* depend fundamentally of agriculture (57.7 %), which is the main activity of the family group. They plant corn, beans, chili and tomatoes coffee, potatoes and cocoa are grown for sale. Avocados, oranges and bananas are a secondary importance. The raising of livestock and poultry, particularly chicken and turkey, to a lesser extent beef, and farming fish are also major economic activities. In the second place is tourism and services (29.2 %). Many indigenous people are employed in the production of traditional clothing and fabrics, and producing wood items and traditional goods. Thus, manufacturing industry takes the third place (11.2 %) (Schmal, 2012).

### Study Location of Mocho Communities, Chiapas



**Figure 1.** Map of Mexico (a), state of Chiapas (b) and Motozintla municipality (c).

#### 2.2. Data collection and identification of plant species

Fieldwork was carried out from March to October 2016 in four communities of *Motozintla* (*Motozintla* de Mendoza, Benito Juárez, Emiliano Zapata, and San Lucas) Chiapas. All the informants were indigenous and permanent residents of the community “Mocho”. The consent of the local authorities was obtained for the development of this research.

The data was collected by semi-structured interviews, samplings were based on the methodology with a random sampling (Bernard 2006). Ethical approval for the study was first obtained from the informants (<http://www.ethnobiology.net/what-we-do/core-programs/ise-ethics-program/code-of-ethics/>). After the informants gave their oral informed consent, they were interviewed on general demographics and ethnobotanical knowledge. The interviews were made in Spanish. The interview contained two specific parts: the first part as focused in registering sociodemographic aspects such as: age, gender, residence location, and occupation.

The second part was focused on the ethnobotanical information, it included sources of traditional knowledge, uses of the plants, mode of administration, plant parts harvested, and dosage for each

remedy. The interview included an open discussion of the status of traditional knowledge and the perception of current trends. Plants were also collected over the course of several visits.

All plant material was collected, dried, pressed, and identified taxonomically with periodic visits to different botanical gardens and the herbarium of Chapingo Autonomous University. The botanical names of species were verified with The Plant List (<http://www.theplantlist.org>) and Biblioteca Digital de la Medicina Tradicional Mexicana ([www.medicinatradicionalmexicana.unam.mx/indehp](http://www.medicinatradicionalmexicana.unam.mx/indehp)).

### 2.3. Ethnobotanical indices

Collected data were transformed into Use Report (UR: stands for the number of uses for each plant species medicinal) and Relative Frequency of Citation (RFC: it is important for quantitative determining of well-known and most useful species in the area) (Kufner et al. 2005; Tardio and Santayana, 2008).

a) Medicinal Use Value (MUV): The MUV is modification of UV (is calculated to demonstrate the relative importance of the species for medicinal purposes. MUV was calculated using following formula suggested by Šavikina et al. (2013).  $MUV = \sum a MU / N$ ; where MU is the number of medicinal uses mentioned by each informant for a given plant, and the N is the number of all people participating in the survey.

b) Informant Consensus Factor (ICF): The ICF is calculated for each category of medicinal uses to show the homogeneity of knowledge about using the species in each disease's category among the populations. The ICF was calculated using following formula proposed by Heinrich et al. (1998).  $ICF = (n_{ur} - n_t) / (n_{ur} - 1)$ , where "n<sub>ur</sub>" is the number of use reported in each category of diseases, and "n<sub>t</sub>" is the number of species used for particular category by all informants.

To calculate ICF, the reported ailments were classified to 11 different disease categories (Table 2).

## 3. RESULTS

## 2.1.Socio-Demographic characteristics of the informants

A total of 43 local informants (81 % male, 19 % female) participated in survey, the number of informants in the groups of age were almost homogenous (Table 1). On average the informants cited 12.5 plants (annual average expenditure was \$174). The greatest knowledge of plant use, as demonstrated by number of species cited, was shown by participants aged 41–50 years (average 17.63 species) and above 63 years (13.89 species). Male cited slightly more species (average 12.71 species) than women (average 11 species). Although we can notice a small difference in the number of plants cited by men and women, no conclusion can be made about differentiation of knowledge, because the percentage of men and women interviewed is not the same. Remarkably, the male informants are used to spend more money (\$194.29 MXN) buying the medicinal plants than the women (\$80.00 MXN) per year. Labourers and others generally spend twice more money for the plants (\$300.00MXN) than the farmers (\$185.71MXN) and house wives (\$80.00MXN). The expenditure for plants during the year (average \$180.00MXN) is equivalent to two or three days of work for the informants (Table 1).

**Table 1.** Demographic variables per number of informants and the annual expenses in plants.

Demographic variable	Demographic category	Number of informants	%	annual expenses (MXN:Mexican pesos \$)	Mean number of plant species cited
<b>Gender</b>	Female	8	19	\$80	11
	Male	35	81	\$194.29	12.71
<b>Age</b>	>20	2	5	0	1
	21–30	7	16	\$100	5.75
	31–40	8	19	\$250	11.63
	41–50	8	19	\$150	17.63
	51–60	9	21	\$222.22	12.89

	Above 61	9	21	\$177.78	13.89
	House wives	5	12	\$80	11
	Farmers	14	33	\$185.71	16.79
	Traders	10	23	\$220	9
<b>Occupation</b>	Students and professors	5	12	\$40	4.6
	Labourers and others	9	21	\$300	16.17
<b>Public health insurance</b>	Insured	20	47	\$189.47	14.79
	Uninsured	23	53	\$171.43	10.43

## 2.2. Taxonomic classification

A total of 83 medicinal plant species, belonging to the 44 families were documented (Table 2).

*Asteraceae* was the most dominant family (six species), followed by *Lamiaceae* and *Rutaceae* (five species each), *Myrtaceae* and *Poaceae* (four species each). *Verbenaceae*, *Solanaceae*, *Lauraceae*, *Euphorbiaceae*, *Cucurbitaceae* (three species each), while other families were represented by two or one species only (Figure 2).

## 2.3. Used part of the plant and preparation methods

Leaves were the most common part used of plant with 46 % applications in traditional recipes, followed by whole plant/stem (22 %), seed (9%), flower (8 %), root (6 %), and fruit (6 %) and bark (1 %) (Figure 3). Decoction (47 %), is the common method to use plants, followed by the infusion (37 %), raw plants (6 %), bath (3 %), fume and dermal application (2 % each), fermented and liquefied (1 % each) (Figure 4). Most of the plants are applied or consumed fresh (55 %), dry (30 %) and some of could be used in the both ways (15 %). The percentage of preparing plants is usually used in fresh (55%) and dried (30%) both (15%). The consumption of fresh plants is due to the availability of these in the region.

## 2.4 Ethnomedicinal data

The highest RFC was calculated for *Verbena litoralis* (0.581), followed by *Matricaria chamomilla* (0.395), *Dysphania ambrosioides* and *Bursera simaruba* (0.372 each), *Persea americana* (0.349) and *Ruta graveolens* (0.326) (Table 2).

The highest ICF index had diseases of the reproductive system (0.76). Medicinal plants are used to treat reproductive discomforts, such as menstrual pain, gynecological and hormonal problems.

The Medicinal use values (MUV) of recorded plant species have been calculated with the highest number of values for *Verbena litoralis* – 0,186 MUV, *Matricaria chamomilla*– 0,163 MUV, *Foeniculum vulgare*, *Bursera simaruba*, *Ananas comosus*, *Ruta graveolens*, *Dysphania ambrosioides*, *Mentha × piperita* – 0,140 MUV each (table 1). The medicinal use values in the use of these plants are similar, which means that users tend to consume these plants frequently and they can be part of their daily diet to treat different ailments.

## 4. DISCUSSION

According to the results, 93 % of the total participants used traditional medicine to solve health problems; it is known that a high percentage of the local population does not have affiliation to the national health system; a current problem in rural and indigenous areas of the country, and 80 % of the indigenous population lives in poverty and health vulnerability (Juarez et al. 2014). Furthermore, studies such as Torres et al. (2016) demonstrated that there is no gender-based pattern for knowledge on different scales. Regarded to the occupation, farmers reported the highest number of species (average 16.79 species), followed by laborers and others (average 16.17 species).

### 4.1. Taxonomic classification

The *Asteraceae* family is apparently a crucial component of the floristic richness of the environment in Central Mexico and rainforest areas, and is widely supported by different studies (Balleza and



Villasenor, 2016), with rich number of species and their uses (medicinal, agricultural, and industrial) (Burgos et al. 2014; Dominguez et al. 2015).

Studies in Mexico show that several states in the county such as Chiapas, Oaxaca, Veracruz, Jalisco and Chihuahua are outstanding and rich in genera of *Asteraceae* family (Luis et al. 2013).

#### 4.2. Description of the most important medicinal plants in study area

*Matricaria chamomilla* L. was cited by 59 % of the informants, it is one of the most demanded medicinal plants. The leaves and flowers are used for a wide range of conditions, such as ailments of the respiratory system, digestive system, colic pains, fever, diaphoretic, emollient charges and eye problems (Sosa et al. 2002).

*Verbena litoralis* Kunth is commonly used in the treatment of stomach pain, stomach cramps, ulcers, vomiting, diarrhea, cough infections, typhoid, bronchitis, dermatitis, malaria, diabetes, fever, and some sexually transmitted diseases (Pérez 1978; Ocampo and Maffioli 1987; Umaña and Castro 1990; b, Li et al. 2001a, b).

*Bursera simaruba* (L.) Sarg. Ethnobotanical studies indicate that the bark is a common topical remedy for skin affections like sores, measles, sunburns, insect bites and rashes (Essential et al. 2007). Leaves, and especially the bark of this tree contain sticky and aromatic resins, that has medicinal virtues.

26

*Dysphania ambrosioides* (L.) Mosyakin and Clemants in Mexico it is usually called Epazote. This plant has been used to treat intestinal parasites of humans and domestic animals. Previous studies have indicated strong antioxidant and antifungal activity against different ailments, microorganisms, intestinal parasites, cramps, ulcers, indigestion, colds, asthma, flu and pneumonia (Nascimento et al. 2006; Pollio et al. 2008).

Finally, among the three major categories found in this study, diseases of the digestive and gastrointestinal system were dominated with 102 use-reports, followed by general symptoms and

diseases of the respiratory system (69 and 52 use-reports, respectively). Similar results had appeared in other study, conducted in Mexico, where Maya and Nahua communities had mentioned diseases of the gastrointestinal system as a category with the largest number of use-report since those communities have been studied in the past century (De la Torre *et al.* 2008, Berlin and Berlin, 1993). While women prefer the use of medicinal plants more towards to treat pre-post Partum hormonal problems, apparently men use traditional knowledge for skin problems, this may be due to the sexual division of labor, where men are more exposed to falls, burns, blows, and use of agrochemicals. In both genders, they showed great use of plants for the treatment of general problems and gastric problems, which may be related to the lack of hygiene in the consumption and handling of food.

#### **4. CONCLUSION**

This study was the first documentation of medicinal plants usage by *Mochó* community in Chiapas, Mexico. Traditional medicine plays an important role in primary every day health care. For treating 11 categories of diseases, 83 species of medicinal plants were registered. Among all the categories, diseases of gastrointestinal system had the highest number of references and use-reports. Nevertheless, it was seen a tendency of problems related with diseases of the skin and reproductive system among locals.

In Chiapas, the ethnomedicine is promoted in closed groups and the knowledge are transmitted from generation to generations. It is necessary to carry out more ethnobotanical studies and inventories to preserve this knowledge for future generations, remarkably, there is not control in the wild gathering of the used plants by the locals, and it could affect the future availability of the plants in the surrounding ecosystems. Mexican biodiversity is very rich, so it is important to protect it and carry out more studies in order to explore the medicinal properties in plants. Then traditional medicine could be a good source of information for the developing new drugs in pharmaceutical industry.