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Is it the plants we know that we use? Unraveling the determining factors of traditional botanical knowledge in a rural community in Central Mexico

Leonardo Beltrán-Rodríguez[1], Jesús Gutiérrez-García[2], Gabriel Flores-Franco[3], Alfredo Saynes-Vásquez[4], Belinda Maldonado-Almanza[3], José Blancas[3] and Amanda Ortiz-Sánchez[3*]

ABSTRACT

The knowledge and use of plant resources are constantly evolving. In this work, the socio-cultural and economic factors that influence the traditional botanical knowledge of a mestizo community in Mexico were analyzed, and the correspondence of two cultural indices that asses the theoretical and practical ethnobotanical dimensions was determined to identify the magnitude of the significance and utility of each one of the useful plants. The study was carried out through semi-structured interviews with 44 local informants. Free lists were applied, and the indexes of use value and practical value were used to document the most culturally important plants. With an analysis of covariance (ANCOVA), the differences in traditional botanical knowledge between gender and the effect of socioeconomic covariates on it were evaluated. 223 species were recorded in 54 botanical families and 86 genera, of which 48% were herbs and just over 60% of the total were recorded in homegardens. The Asteraceae family had the highest number of useful species followed by Fabaceae and Rosaceae. Of a total of 10 categories of use, medicinal, food, and ornamental plants were the most representative. A weak correspondence was found between the cultural indices at the species level, but there was consistency at the level of use categories. The ANCOVA showed that there is no statistically significant difference between the genders and none of the covariates have a significant influence ($p>0.05$) on traditional botanical knowledge. However, there was a consensus between men and women on the importance they give to medicinal and food plants.

Keywords: Ethnobotanical theory; knowledge dynamics; theoretical knowledge; practical dimension; Morelos; Sierra de Huautla Biosphere Reserve.

1 Jardín Botánico, Instituto de Biología, Universidad Nacional Autónoma de México, Ciudad de México, 04510, Mexico.
2 Facultad de Ciencias Biológicas, Universidad Autónoma del Estado de Morelos, Av. Universidad 1001, Col. Chamilpa, Cuernavaca, México.
3 Centro de Investigación en Biodiversidad y Conservación, Av. Universidad 1001, Col. Chamilpa, Cuernavaca, México.
4 Instituto Saynes de Investigaciones sobre Cultura, Lengua y Naturaleza, 70000, Juchitán, Oaxaca, México.
* Corresponding author ✉. E-mail address: LBR (leonardo.beltran@ib.unam.mx), JGG (blue_jesus@hotmail.com), GFF (gabrielflores@uaem.mx), ASV (pichossaynes@gmail.com), BMA (bely@uaem.mx), JB (jose.blancas@uaem.mx), AOS (amanda@uaem.mx)

SIGNIFICANCE STATEMENT

The factors associated with the acquisition of traditional botanical knowledge worldwide appear to be consistent. Age, level of education, productive activities, monetary income and being a monolingual indigenous person tend to influence this cognitive universe. However, the motives that determine the transition from the corpus (theoretical dimension) to the praxis (practical dimension) of this knowledge remain scarcely explored even in ethnobotanical research. This study presents a quantitative analysis of the socio-cultural and economic factors that affect traditional botanical knowledge in a mestizo community in Central Mexico, and explores, for the first time in the Mexican ethnobiological literature, the mechanisms that influence individual decisions to use and select a group of floristic resources regardless of whether the cognitive basis suggests greater cultural importance of certain taxa.

INTRODUCTION

Traditional botanical knowledge (TBK) is understood as an accumulated body of knowledge, beliefs and practices about plants, generated through adaptive processes and transmitted through generations orally, visually and bodily (Pilgrim et al. 2007, 2008; Pretty et al. 2009). This knowledge has been documented in various cultural groups around the world, particularly in indigenous communities (Andressa-Poderoso et al. 2017; Blancas et al. 2013; Hopkins et al. 2015; Saynes et al. 2013). In these societies, it has been shown that each plant species has a category of knowledge and a practical use (Lévi-Strauss 1964). Thus, useful plants can be multipurpose according to an individual or collective experience, and a type and degree of management. That is, in function on people's preferences and the meaning that plants represent for them, these have more or less known and used and therefore managed (Adriamparany et al. 2014; Dassou et al. 2015; Martínez-Balleste et al. 2006; Ryan et al. 2005; Toledo et al. 2002; Weenalei et al. 2017).

Berkes (2008) states that communities in deep interaction with nature are constantly evolving because their knowledge and perceptions are often being constructed and modified. On the other hand, industrialized communities that have little direct contact with the environment show no responsibility in managing natural resources but tend to have domination over them (Berkes 2008). Consequently, it has been argued that the conservation of plant diversity in territories inhabited by rural communities essentially depends on the conservation of TBK (Albuquerque et al. 2019; Berkes and Folke 2000). The foregoing highlights the importance of ethnobotany in the conservation of biocultural diversity (Pretty et al. 2009; Maffi et al. 2001, 2005). This is due to the fact that TBK is acquired and manifested given the interaction of humans with their environment, particularly plants. However, it can also be eroded as a result of factors that condition and modify this relationship in time and space (Aswani et al. 2018; Saynes et al. 2016a,b).

Although Mexico is recognized worldwide for the vast ethnobotanical experience that various rural societies have generated in their interaction with the environment (Lira et al. 2016; Toledo 2002; Toledo et al. 2003), it is also one of the most important countries around the world in terms of ecosystems loss (FAO and UNEP 2020). Thus, TBK of a large number of rural peoples in this country is threatened, because they are more often less the opportunity to reproduce it in the absence of ecosystems with which they interact, as evidenced by Saynes et al. (2013).

There are worldwide patterns that point out some factors directly related to the level of TBK. For example, in traditional or mestizo communities older people tends to know more plants that younger people (Benz et al. 2000; Saynes et al. 2013), particularly when it have been living in the same community for a long time (Lawrence et al. 2005; Souto and Ticktin 2012), or when is uncommon the access to external monetary incomes (Beltrán-Rodríguez et al. 2014; Holmes 2003) and where the formal education level is low (Adriamparany et al. 2014; Saynes et al. 2016a). Regarding gender, research on medicinal plants knowledge suggest a not clear pattern of differentiation in the knowledge structure between sexes (Torres-Avilez et al. 2016), a tendency that may change in function of the natural resource type (Andressa-Poderoso et al. 2017; Ernane et al. 2018). Despite this, each human group develops differently according to its environment; they generate, learn and transmit knowledge, creating their own identity (Caballero and Cortés 2001). In this way, there is a meaning and a value for each resource as a result of the sociocultural importance that it represents (Reyes-García et al. 2007, 2009).

Measuring the theoretical and practical cultural value that resources have is a central concern in ethnobotany (Silva et al. 2006; Medeiros et al. 2011; Reyes-García et al. 2007). For this, some authors have proposed indices that evaluate the use value (theoretical dimension) of plants at the individual and group level (Faruque et al. 2018; Hoffman and Gallaher 2007; Phillips and Gentry 1993; Tardío and Pardo de Santayana 2008); while a small number have developed and applied approaches to determine the practical (practical dimension sensu Reyes-García et al. 2006a) and the integral value of this knowledge, as well as its correspondence with the theoretical dimension (Reyes-García et al. 2006b).

Approaching this cognitive phenomenon can provide: i) information about the processes associated with the selection and management of a specific group of plant resources, ii) key clues about the factors that influence decisions about which resources to use based on the knowledge background, and iii) novel data on the variation in the knowledge and use of plants in communities that interact greatly with urban areas, such as some peasant communities in Central Mexico (Arjona-García et al. 2021; Beltrán-Rodríguez et al. 2014; Tegoma 2019). In a comprehensive manner, this analysis will provide theoretical elements on the mechanisms that favor the creation, loss, and persistence of intracommunity traditional botanical knowledge, in order to avoid its erosion (Fabrega and Silver 1973; Garro 1986).

In the state of Morelos, Mexico, the change in land use associated with urban growth has exacerbated the deterioration of biotic resources and the TBK that the inhabitants have (Arjona-García et al. 2021; Guerrero 2020; Monroy-Martínez and Ayala 2003). The southern of this region is an interesting site for ethnobotanical research, given the transformation that ecosystems have undergone in recent decades, having environmental and social impacts. For example, the Tropical Deciduous Forest (TDF), the dominant ecosystem in the region shows a decrease in its territorial extension of approximately 80% (Guerrero 2020). It has induced changes regarding the knowledge, use and disuse of local floristic resources (Arjona-García et al. 2021; Monroy-Ortíz et al. 2013). It has also encouraged the population to make adaptations in their spaces to conserve species of daily use in small managed areas (Ortiz-Sánchez et al. 2015).

This study documents the relationship between two cultural indices to identify the magnitude of the significance and utility of each of the ethnofloristic resources present in a mestizo community located in the south of Morelos State, in Central Mexico. It also evaluates the effect of eight socio-cultural and economic factors on the acquisition of TBK. Based on the main cultural, social, and economic variables associated with TBK in different societies of the world, it is proposed that the original inhabitants of this locality, with low economic status, without schooling, and of adult age will have greater TBK than the rest of the population, and that this will be different between men and women. In addition, since theoretical botanical knowledge (plants they know) is directly associated with practical knowledge (plants they use) (Reyes-García et al. 2007), it is expected that there will be no differences in the cultural indices applied to wild and cultivated plants at the species level. So, the plant species that the people know will be the same that they use to satisfy their social needs.

MATERIAL AND METHODS

Study Area

The research was carried out in the "El Zapote" community. It is located in Central Mexico, Southwest of the state of Morelos, between coordinates 18°27' and 18°43' north latitude and meridians 99°11' and 98°23' west longitude (Figure 1). The locality is part of the Sierra de Huautla Biosphere Reserve (REBIOSH) (Dorado et al. 2005), where it is established mainly in three types of vegetation: Tropical Deciduous Forest (TDF), Oak-Pine Forest, and small areas of Pine Forest (Rzedowski 2006; Figure 2). The climate is semi-warm subhumid (A)C(w2), with an annual temperature between 18-24 °C and average annual rainfall of 889 mm (INEGI 2009). The main economic activities of the population are seasonal agriculture (Figure 3a), dedicated to the cultivation of corn and beans for self-consumption. Other activities that are mainly for self-consumption and also generate income are livestock farming (Figure 3b), the production of products derived from milk, the production of wine with "uva cimarron" (*Vitis tiliifolia* Humb. & Bonpl. ex Roem. & Schult.) (Figure 3c), the collection of food species such as "jumiles" (*Euchistus crenatur*), "ciruela cuernavaqueña" (*Spondias purpurea* L.), "hongo azul" (*Lactarius indigo* (Schwein.) Fr.), "hongo amarillo" (*Cantharellus tubaeformis* Fr.), "cilantro de campo" (*Peperomia campylotropa* A.W. Hill), and commercial harvest of medicinal plant species such as "pega hueso" (*Sapium macrocarpum* Müll. Arg.), "espinosilla" (*Loeselia mexicana* (Lam.) Brand), "prodigiosa" (*Brickellia cavanillesii* (Cass.) A. Gray) and "palo dulce" (*Eysenhardtia polystachya* (Ortega) Sarg.) among others. In addition, about 60% of the population depends on remittances they receive from relatives who are in the United States of North America and other parts of the Mexican Republic (Gutiérrez-García 2020).

Data collection

Semi-structured interviews were applied individually (Bernard 2004) to all the heads of the family (man and woman) of the dwellings in the community (n = 44 inhabitants). With the verbal permission and informed consent of each person, following the Code of Ethics of the International Society of

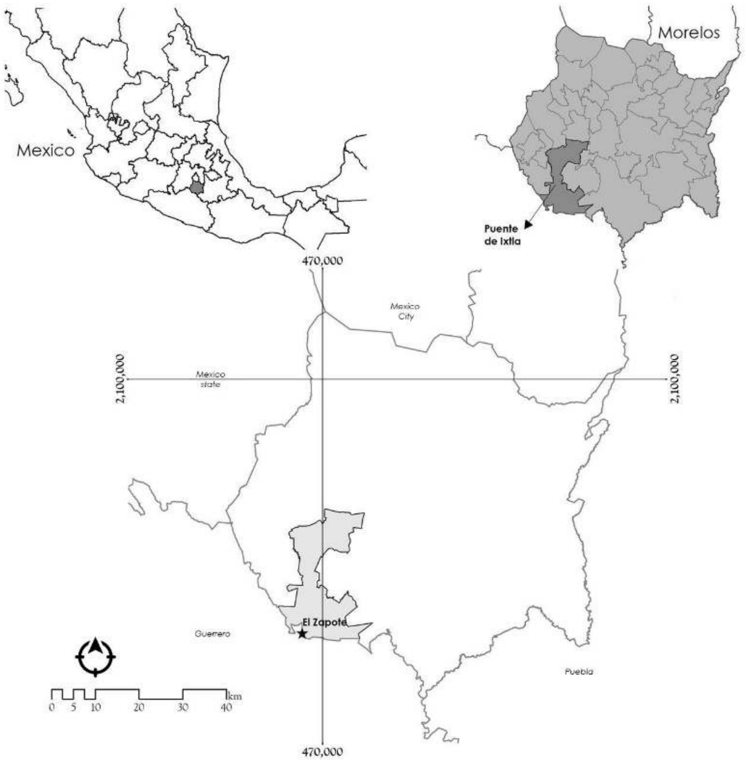

Figure 1. Location of the study area "El Zapote" community, Central Mexico.

Ethnobiology (ISE 2006) and the Code of Ethics for Research, Research-Action and Ethno-Scientific Collaboration in Latin America (SOLAE 2015), interviews collected social, cultural and economic aspects of each person (Table 1).

After the interviews, we used the "free listing" technique to document all the most important plant species that the participant knows (Martin 2004) considering different use categories. With the names of the first 10 species referred by category of use per person, we proceeded to elaborate the use value indices of the useful flora in accordance with Phillips and Gentry (1993) modified by Rossato (1999). For the recognition of the plants' practical value, we conducted monthly interviews from May 2016 until December 2017. Every month, at the end of a day chosen at random, we visited each dwelling and asked each adult present in it by the name of all the plants that had been brought to the dwelling during the previous 24 hours (Reyes-García et al. 2006a). We counted each species brought by each adult as one, without taking into account the amount brought. When two different adults in the same household during the same day reported the same species, we recorded them as two observations. We conducted a total of 37 scan observations, one by each of the 30 dwellings in the community that collaborated in the research. In some cases, more than one person by household was interviewed ($n = 7$).

The collection of the plants mentioned during the interviews was carried out in natural and socially transformed environments with the support of the informants. The botanical material was determined with the support of taxonomical specialists from the Herbarium (HUMO) of the Universidad Autónoma del Estado de Morelos (UAEM). The nomenclature of the species was compared with the database of tropicos.org (Missouri Botanical Garden).

Data analysis

All the ethnobotanical information collected in the interviews, informal talks and field trips was systematized in a database. To determine the link between the knowledge and use of plants (theoretical and practical dimensions *sensu* Reyes-García et al. 2007) by the settlers and at the species level, the use value index of Phillips and Gentry (1993) modified by Rossato (1999) and the practical value index of Reyes-García et al. (2006a) were used, following the methodological recommendations suggested by Reyes-García et al. (2006b). Regarding the use value index, it was obtained at the level of all informants (UVs, the use value was added for a species and divided by the total number of informants). Thus, the use value represents the average of uses reported

Figure 2. Socioecologycal systems in the "El Zapote" community, Central Mexico. A. Homegardens. B. Transitional zone between tropical deciduous forest and oak forest. C. Oak Forest. D. Farmland with forest patches on the edge.

for each species by the total number of informants. The calculation was made based on the following algorithms: $UV_s = \frac{(\sum UVis)}{(ni)}$, where: UV_s is the use value for a species among all the informants, UVis are all the uses mentioned by each person for a plant specifically, and n_i is the total number of informants interviewed for the species.

For the practical value index, the following equation was used: $PV_s = Up_s \cdot Ip_s \cdot Dup_s$, where: Up_s=number of different uses observed for a species (s) that was recorded during scan observations divided by the 10 use categories considered in this study, Ip_s=Number of times that a species (s) was brought home divided by the total number of participants in the scan observations (37), Dup_s=the assignment of duration for each species incorporated into the home for different uses divided between the 37 participants of the scan observations. The first two variables capture the share of participants who use the species, whereas Dup_s expresses the duration of each use.

According to Reyes-García et al. (2006a,b), the calculation of the practical value is biased because some uses are more frequent than others. For example, people bring to their households plants to make handicrafts or a wood tool only occasionally, but several days a week they bring firewood. Thus, some species may rank higher than others when calculating

Figure 3. Main economic activities in "El Zapote" community - Central Mexico. A. Seasonal agriculture. B. Livestock farming. C. Harvest of "uva cimarron" (*Vitis tiliifolia* Humb. & Bonpl. ex Roem. & Schult.) to the production of wine. D. Collection and storage of firewood.

Table 1. Sociocultural and economic features of rural people in "El Zapote" community, Central Mexico.

	Men	**Women**
Age	58.95 ± 15.97	52.54 ± 17.63
Level of education	2.05 ± 0.88	2.50 ± 1.06
Productive activity	2.93 ± 0.92	1.62 ± 0.82
Birth place	2.90 ± 2.02	3.16 ± 2.20
Average incomes	2040.50 ± 1934.56	1087.50 ± 1369.00
Remittances	1.35 ± 0.48	1.50 ± 0.51
Goverment support	1.70 ± 0.47	1.66 ± 0.48

Legend: Factors were calculated as follows. Level of education: 1=without formal studies, 2=elementary school concluded, 3= high school concluded; Productive activity is the sum of activities associated with the life strategies of each person (natural resource collector, farmer, cattle rancher, bricklayer, blacksmith, and day laborer). Birth place: 1= Iguala, Guerrero; 2= El Zapote community; 3= Jojutla, Morelos; 4= Buenavista de Cuellar, Guerrero; 5= Chichila, Guerrero; 6= Miacatlán, Morelos; 7= Tilzapotla, Morelos; 8= Temixco, Morelos. Remittances: No= 1; Si= 2. Goverment support: No= 1; Si= 2. All covariables express the mean number ± standard deviation.

practical value. For this reason, we applied the term Dup_s in order to correct the bias through the assignation of a period of time for the plants used by a specific activity. Based on previous ethnographic fieldwork in the same community (Gutiérrez-García 2020) and the suggestions of Reyes-García et al. (2006a,b), we assigned one day to the species brought for food and firewood, five days to the species brought for medicinal uses, 15 days to the species brought to beautify the household or grace an altar for a civic or religious date, 30 days to the species brought to make tools, handicrafts or other objects to sale, and 90 days to the species brought for construction in the house or as live fences. For example, if a species was brought on seven occasions as food ($7 \cdot 1$ days) and on three more occasions as a medicinal ($3 \cdot 5$ days), the species would have a duration (Dup_s) of $0.59 = \frac{(7+15)}{37}$ days, where 37 is the total number of scan observations.

We test for the normality of the sample from both indices using the Shapiro-Wilk test. Since our data were not normally distributed, we used non-parametric statistics. To determine the degree of relationship at the species level between the theoretical and the practical dimension we applied the Spearman rank correlation coefficients.

To find out if there were differences in the population's TBK about floristic resources between genders and to evaluate the influence of socioeconomic and cultural variables, the normality and homoscedasticity of the data was first checked and then an analysis of covariance (ANCOVA) was performed (Huitema 2011). The ANCOVA was used to compare the gender factor and the remaining seven factors were considered covariates (age, education, occupation, place of origin, income, remittances, and government support). The information was analyzed with SPSS v. 24.0 (SPSS, 2018).

RESULTS

Useful plants richness

A total of 223 species were recorded in 86 genera, corresponding to 54 botanical families (Additional File 1), while nine corresponded to fungi. The family with the highest species richness is Asteraceae ($n = 23$ species, 10%), followed by Fabaceae ($n = 18$, 8%), Rosaceae ($n = 10$, 4.4%) and Lamiaceae ($n = 9$, 4%). The documented species are used in 10 categories of use: medicinal, food, ornamental, firewood, construction, handicrafts, living fences, sale, tools and religious. The highest number of citations was concentrated in medicinal plants (93; 41%), next to food (66; 29%) and ornamental plants (52; 23%) (Additional File 1).

According to the morphological structure, the most used part is the leaf (32%), followed by the fruit (23%), flower (22%), and stem (10%). The habitats of which the people know a greater number of resources are: homegardens (58.29%), Tropical Deciduous Forest (24.21%), Oak Forest (10.76%), and

Table 2. Number of species, life forms, and habitat where people harvest plants in "El Zapote" community, Central Mexico.

Life form	Oak forest	Homegarden	Tropical deciduous forest	Farmland	Total
Tree	8	33	24	0	65
Shrub	2	30	10	0	42
Herb	6	67	29	5	107
Mushroom	8	0	1	0	9
Total	24	130	64	5	223

farmlands (2.24%) (Table 2; Figure 2).

Use value and practical value of the species

The use value ranged from 0.01 − 1.05, while the practical value ranged from 0 − 16.45. It is highlighted that 10 species have the greatest importance by use value (> 0.5) and only three species managed to be ranked with highest practical values (> 1.0). The highest use values and practical values are related to the use categories with the highest species richness, which are used for food, firewood, and medicine. All the species with the highest use value were trees, while the species with the highest practical values showed variation in life forms. According to the Spearman's Rank-Order Correlation, there was a weak correspondence at the species level between the theoretical and the practical dimension ($R2 = 0.45$, $p = 0.001$). Guava (*Psidium guajava* L.), Chinese oak (*Quercus castanea* Née), White oak (*Quercus acutifolia* Nee.) and "ciruela cuernavaqueña" (*S. purpurea*) had the highest use value. The species with the highest practical value are mainly those used as firewood (*Quercus acutifolia* Nee., *Ipomoea murucoides* Roem. & Schult.) and food (*Dysphania ambrosioides* L.; *S. purpurea*). Table 3 shows the 10 plant species per index with the highest values recorded in the study area.

Sociocultural and economic factors associated with traditional botanical knowledge

The ANCOVA applied to TBK based on the number of species mentioned was compared between men ($38.1 \pm SD12.32$) and women ($32.17 \pm SD10.78$). There were no statistically significant differences between genders ($F(1.34) = .484$; $p = .491$), with a partial eta squared (ηp^2) of 0.014. Likewise, the rest of the socio-cultural and economic covariates (gender, age, level of education, productive activity, birthplace, incomes, remittances, and government support) that were analyzed in the study did not significantly influence the acquisition of TBK in the study location (Table 4).

DISCUSSION

Useful flora trends

The ethnofloristic richness present in the El Zapote community follows a global (Díaz-Forestier et al. 2019; Gras et al. 2021; Moerman 1991, 1999), national (Benz et al. 2000; Bye 1995; Caballero and Cortés 2001; Casas et al. 2001; Toledo et al. 2003; Soto 2010) and regional pattern (Maldonado 1997; Maldonado et al. 2013; Beltrán-Rodríguez et al. 2014) in terms of the most socially recognized botanical families (eg Asteraceae, Fabaceae and Lamiaceae).

The highest proportion of useful species according to their life forms also follows a regional (Maldonado 1997; Beltrán-Rodríguez et al. 2014) and national trend (Caballero and Cortés 2001), with herbs (50%), trees (30.3%), and shrubs (19.7%) dominating. According to Casas et al. (2001), the dominance of these life forms may be as a result of *in situ* management and artificial selection of this group of resources in the environment. But as observed in the study area, it may also be due to the anthropogenic transformation process that has occurred in the landscapes of Central Mexico in recent decades (Monroy-Martínez and Ayala 2003), which has promoted secondary forests and synanthropic flora, with high representation of herbaceous plants (Arjona-García et al. 2021; Guerrero 2020). Another possible explanation is the cultural relevance of trees and shrubs as firewood in the community, which are the principal vegetable elements used locally in the preparation of several traditional

Table 3. Cultural importance of the ten more relevant plant species per index in the "El Zapote" community, Central Mexico. UVs = use value index; Pve = practical value index. Use categories (Uc): 1 =Food; 2= Medicinal; 3= Ornamental; 4= Firewood; 5= Construction; 6= Sale; 7= Handicrafts; 8= Lliving fence; 9= Tool; 10= Religious. Life forms (Lf): T= Tree; S= Shurb; H= Herb; Mu= Mushroom. Habitat (Ha): OF= Oak forest; TDF= Tropical deciduous forest; HO= Homegardens; FA= Farmland.

Scientific name	Uvs	Uc	Lf	Ha	Scientific name	Pve	Uc	Lf	Ha
Psidum guajava L.	1.04	1,2	T	HO	*Quercus acutifolia* Née	16.45	4,5,8	T	OF
Quercus castanea Née	0.97	4,5,8	T	OF	*Spondias purpurea* L.	2.82	1,6	T	TDF
Quercus acutifolia Née	0.93	4,5,8	T	OF	*Dysphania ambrosioides* L.	1.27	1,2	H	HO
Spondias purpurea L.	0.89	1,6	T	TDF	*Lactarius indigo* L. ex Fr. Gray	0.97	1,6	Mu	OF
Prunus persica (L.) Batsch	0.84	1	T	OF	*Lysiloma acapulcense* (Kunth) Benth.	0.67	2,4,8	T	TDF
Lysiloma acapulcense (Kunth) Benth.	0.82	2,4,8	T	TDF	*Pleurotus ostreatus* (Jacq.) P. Kumm.	0.64	1,6	Mu	TDF
Quercus magnoliifolia Née	0.72	4,5,8	T	OF	*Opuntia* sp.	0.59	1	S	TDF
Malus pumila Mill.	0.72	1	T	HO	*Psidum guajava* L.	0.32	1,2	T	HO
Erythrina americana Mill.	0.69	1,8	T	TDF	*Cymbopogon citratus* (DC.) Stapf	0.3	2	H	HO
Casimiroa edulis La Llave	0.67	2,1	T	TDF	*Mammilaria* sp.	0.21	1	S	OF

dishes, and to get cash when these are sold outside.

The highest number of uses of the registered morphological structures (leaf, fruit, and flower) coincides with the reports of Beltrán-Rodríguez et al. (2014) in a mestizo neighboring community to El Zapote, with Estrada-Castillón et al. (2014) in another mestizo community located in Nuevo León, Mexico, Saltos-Abril et al. (2016) in the Ecuadorian Amazon and with Rakotoarivelo et al. (2015) in Madagascar. According to Blancas et al. (2013) and Rangel-Landa et al. (2017), this can be attributed to the fact that these morphological structures have greater succulence with respect to the rest of the plant parts and are directly related to food and health care, which are the main social needs that require attention in the community.

The results also show the importance of three use categories of the 10 registered. These data coincide with Reyes-García et al. (2006a) regarding the fact that medicinal, food and ornamental plants are possibly the most important worldwide, and with Caballero and Cortés (2001), Beltrán-Rodríguez et al. (2014), Estrada-Castillón et al. (2014) and Ávila et al. (2015), in its relevance at the national and Latin American level, respectively.

The outstanding importance and presence of medicinal plants could be related to the lack of coverage of the health service in the El Zapote community, since it has been documented that the absence of public health services or the remoteness of this assistance favors the role of plants in the maintenance of traditional medical practices (Liu et al. 2020; Rangel-Landa et al. 2017). Overall, a great proportion (40.76%) of these medicinal plants was recorded in homegardens, which explains the relevance of this place as a driver to the local reservoir of native and exotic species in the community (Additional File 1). Future research may confirm the level of TBK that is fostered in homegardens in El Zapote, as well as the environmental and sociocultural factors that impact the knowledge and use of medicinal plants and enrich the local ethnopharmacopeia, as has been suggested by other authors in urban and rural localities (Arjona-García et al. 2021; Ávila et al. 2015); which in turn would contribute to theoretical knowledge about the diversification hypothesis in ethnobotany (Gaoue et al. 2017). The last is in addition to the local interest in the conservation of

Table 4. Analysis of covariance of the socioeconomic and cultural variables associated with the traditional botanical knowledge of men and women in Central Mexico.

Source	Sum of squares type II	df	Mean square	F	Sig.	Partial square eta
Corrected model	818.835[a]	8	102.354	.737	.658	.148
Intersection	2399.328	1	2399.328	17.281	.000	.337
Age	55.564	1	55.564	.400	.531	.012
Level of education	51.188	1	51.188	.369	.548	.011
Incomes	314.370	1	314.370	2.264	.142	.062
Remittances	45.052	1	45.052	.324	.573	.009
Government support	191.249	1	191.249	1.377	.249	.039
Productive activity	46.598	1	46.598	.336	.566	.010
Birth Place	5.717	1	5.717	.041	.840	.001
Gender	67.214	1	67.214	.484	.491	.014
Error	4720.607	34	138.841			
Total	59199.000	43				
Total, corrected	5539.442	42				

$R^2 = 0.148$; R^2 adjusted=-0.053

these resources, particularly when medicinal use is linked to their magical-religious importance (Silva et al. 2021), which potentiates the benefits of homegardens as socio-ecological systems for human well-being (Rajagopal et al. 2021).

In the second place, food plants are a necessity for human survival and food security (Bye 1995; Dassou et al. 2015; Blancas et al. 2013). The visible knowledge of the food and medicinal plants present in the socially transformed environments of El Zapote converges with the fact that the most culturally important species are those that are managed to support daily needs (Ávila et al. 2015; Farfán-Heredia et al. 2018). According to González-Insuasti et al. (2008), the number of management practices that a species receives is related to the economic benefit that it grants to the family. In the community El Zapote several medicinal and edible plants are sold in regional markets generating monetary benefits for families dedicated to this activity. Also, many trees wild fruits are tolerated in farmlands or transplanted to homegardens, enriching the agrobiodiversity of these areas, particularly in households where there are children because as Linger (2014) points out, these are the ones who consume more fruits throughout the year in rural areas of Africa. This is unlike other cases where species and their uses of wild habitats are more recognized (Adriamparany et al. 2014; Beltrán-Rodríguez et al. 2014), in which, particularly fruit trees are food and medicine (Mattalia et al. 2021).

The importance of ornamental plants for the population of El Zapote is in agreement with Neulinger et al. (2013), who documented that the preference for certain flowers is due to their meaning and aesthetic value, as well as the luxury that they can represent (Moreno-Calles et al. 2013). The population of El Zapote indicates the presence of certain ornamental species in the community because they "look pretty" and because it helps to have a fresh environment (Figure 2a). In addition, they point out that among these are plants that are useful as medicine. These topics can be associated with the approaches of Blancas et al. (2013) and Rangel-Landa et al. (2017) in indigenous communities of Mexico, who suggest having ornamental plants is a symbol of social prestige, associated with a whole wisdom of the multiple uses of each species. This assertion is one more example that shows it is important for the inhabitants to conserve plant resources in general. It is not just to meet their tangible and intangible needs but also due to the particular meaning of ornamental/edible/medicinal plants for community health self-management.

Correspondence between known and used plants

The cultural indices used in this study are defined by the frequency of mention and use, and allow us to identify the magnitude of significance and usefulness of each of the natural resources. Our results indicate that the use value (theoretical dimension) of an ethnospecies does not necessarily correspond to its practical value (practical dimension), as is the case of the "manzana" (*Malus pumila* Mill.) and "zapote blanco" (*Casimiroa edulis* La Llave) since they are rarely used, but frequently mentioned as food and medicine. In contrast to the "nopal" (*Opuntia* sp.) and the "rodilla de viejo" (*Mammilaria* sp.), there are plants that are frequently used as food and medicine but were very rarely mentioned in the interviews. These novel results suggest that it is not necessarily what people know that they use to satisfy their social needs. This coincides with the findings generated by Reyes-García et al. (2006a,b) in the Bolivian Amazon, as well as with Ladio and Lozada (2004) studies in a Mapuche community in Northwestern Patagonia.

The difference detected between these two indices could be interpreted as a change in individual or collective choice according to the availability of the species in the environment or derived from the daily needs and preferences of the interviewees. In fact, recent studies by Medeiros et al. (2021) in a rural community in Brazil indicate that the local people's perception of availability is a valuable tool for predicting the cultural relevance of species for medicinal and nutritional purposes; so its inclusion in studies of cultural importance cannot be ignored. Also, the synergic impacts of complex socio-cultural and economic drivers generated by the integration of rural economies into a global economy postulated in the phenomenon that some authors have called the "new rurality" (De Grammont 2004), have leaded changes in the lifestyles of multiple rural communities in Mexico and Latin America. Thus, it is possible that the inhabitants of El Zapote still have knowledge about the useful species of the community that used to use, but the recent social needs have influenced the decisions about which species to use and what to use them for.

The foregoing adds to the relevance of the use of medicinal plants in a health contingency, a clear example of why they are privileged from past generations. The population of El Zapote mentions that they know what their grandparents taught them and that they would like the young people to continue with this knowledge. This reinforces that the continuous use that the inhabitants make of medicinal plants favors the transmission and knowledge conservation of these resources. However, our study detected that there are also recently shifts in medical practices related to the economic level of some families in El Zapote, due that sometimes people say that it is easier to visit the doctor or buy a pill at the pharmacy to treat a health problem.

Another case is the practice of selling food resources such as "ciruela" (*Spondias mombin* L.), guava (*P. guajaba*), and several species of fungi (Table 3), resources, which in other socio-ecological landscapes are the source of livelihood for families (Caballero 1992; Caballero et al. 2010; Mariaca 2012). In the exact words of the inhabitants of El Zapote, 'the sale of collected natural resources, whether in natural or managed environments is business and helps since it is a way of obtaining secondary income'. The population identifies this activity as a periodic economic contribution, which has been conserved for a long time. Possibly, this monetary contribution has promoted changes in the interest for a selected group of resources. This could explain that the practical knowledge of the population is concentrated above all on those taxa that benefit them economically and help to cover their daily needs. Examples of such are food plants and firewood (Figure 3c, d; Table 3).

In Table 3 it can be seen that the highest use values and practical values are related to the level of food and firewood use categories. Regarding firewood, four of the ten recorded species are within the Fagaceae family. These data are similar to those found by Tardío and Pardo (2008), who evaluated cultural indices in Spain and found a trend in preferences of *Quercus* sp. and *Crataegus monogyna* Jacq. for firewood, and *Corylus avellana* L. for food. Similarly, Lawrence et al. (2005) recorded the preference of the inhabitants of Madre de Dios, Peru, for fruit, firewood, and timber species. In this sense, it is worth highlighting the value of homegardens as one of the environments managed by rural people as a provider of food resources in many regions around the world (Kumar and Nair 2004; Mariaca 2012; Pulido et al. 2008; Rajagopal et al. 2021), as well as the importance of natural environments in the supply of timber plants for firewood (Caballero and Cortés 2001).

Our data about the species with high use values are also similar to those recorded by Beltrán-Rodríguez et al. (2014), highlighting the use of species for construction and firewood. In addition, both studies deal with multipurpose species (3-6 uses), where the categories of use that occupy an important place are food and timber. Similar results were also recorded by Ernane et al. (2018) in a semiarid region of Brazil, with higher importance values in food plants when comparing different indexes of use value between three different populations. Despite this clear trend in the importance of fruit and timber species worldwide, it has been suggested that the general use value should not be used only as a representation of the whole, since it can disguise certain information by overvaluing or reducing the importance of the species used (Ernane et al. 2018).

Traditional botanical knowledge: determinants and questions

The results generated in the present investigation point out that there is no statistically significant difference between men and women with respect to TBK. Similarly, no statistical significance was found in the influence of the seven covariates evaluated on it. This suggests that TBK is uniformly distributed among the people interviewed, so neither gender nor any other variable (age, education, occupation, place of origin, income, remittances, government support) has any influence on the way in which knowledge and use of useful plants are held in the study location. This finding contrasts considerably with other investigations carried out worldwide, in which it has been shown that sex, age, education, origin, productive activities, language, monetary income, etc., influence the maintenance and transmission of TBK (Andriamparany et al. 2014; Akerreta et al. 2007; Ávila et al. 2015; Beltrán-Rodríguez et al. 2014; Benz et al 2000; Byg and Balslev 2004; Dassou et al. 2015; Hopkins et al. 2015; Lawrence et al. 2005; Ryan et al. 2005; Saynes et al. 2013, 2016a,b; Voeks and Leony 2004).

The lack of significance of each one of the factors and covariates analyzed in El Zapote can be attributed to the fact that a high percentage of the population is related by family, all of them are adults with a similar average age between sexes, carry out similar socioeconomic activities, and have been living in the community for an average of more than 30 years, even though their birthplace is far away (Table 1). So the sample is homogeneous, and consequently, the variation of intra-community knowledge is minimal. Also, El Zapote community is quite inaccessible and far away from the closest cities or urban centers, so there is an isolation that forces self-sufficiency from local plant resources, which may induce a weak variation in TBK. This aspect has already been pointed out by Blancas et al. (2013) in some indigenous communities of the Sierra Negra, Mexico, which suggests that isolated sites with low intercommunity interaction and limited flow of natural resources can induce homogenization of TBK, especially in small communities with little variation in the age of their inhabitants.

In Papua New Guinea, Ryan et al. (2005) found that age determines the level of TBK, since younger informants have lower levels of knowledge in all use categories, unlike adults. Similarly, Saynes et al. (2016a) revealed that the TBK of the Zapotecs of Oaxaca, Mexico, increases according to age. It should be noted that the average age of those interviewed by these authors was 55.4 years (Saynes et al. 2016a), similar to the mean age of men and women of El Zapote (Tabla 1), but in this case, they also interviewed young people; therefore, their sample was more heterogeneous, which influenced the significant association between age and TBK that they reported (Saynes et al. 2016a). Studies such as that of Cortés-González (2007) and Zent (1999, 2001) show that at 30 years of age rural people already concentrate most of the TBK that is needed to know for subsistence. In fact, Poncet et al. (2021) demonstrated that the only difference in the knowledge of plants between adults of different ages is the tendency to enumerate more species. For this reason and due to the homogeneity in age previously explained in El Zapote, we consider that our sample is representative and has the potential to explain the lack of significance of age with TBK in this community.

Regarding the gender factor, in El Zapote certain trends were also found in the importance of resources when comparing between genders even when they were not significant (Table 4). Women of El Zapote made more reference to plants for food and medicine, while men showed greater interest in timber forest plants. These findings are consistent with research in Latin America (Beltrán-Rodríguez et al. 2014; Byg and Balslev 2004; Camou-Guerrero et al. 2016; Estrada-Castillón et al. 2014; Lawrence et al. 2005; Phillips and Gentry 1993; Prance et al. 1987; Reyes-Garcia et al. 2007); which could be explained by the greater time that men spend in the forest to collect firewood and timber plants. However, the assumption that women know more about medicinal and food plants because they are housewives does not always apply. Due to the transfer of knowledge that takes place in households, women may also be familiar with the species used for firewood for use in the kitchen. Similar to our results, the meta-analysis by Torres-Avilez et al. (2016) revealed that there is no difference in the TBK of medicinal plants between men and women worldwide. This suggests that there are different interpretations of the role of gender with the TBK in function of the socioecological system that is being analyzed, and that exists a complex diversity of rural strategies according to the role that each family member takes for the subsistence of their homes, favoring the division of labor that a specific gender develops and the construction of knowledge associate with a specific natural resource (Andressa-Poderoso et al. 2017; Ávila et al. 2015; Poncet et al. 2021; Torres-Avilez et al. 2016).

Martínez-Balleste et al. (2006) showed that there is some significance of the level of TBK with the formal education variable. Overall, people with a higher level of education have poor TBK because they have less contact with their parents and the environment, while people without or with a lower level of education have extensive knowledge (Andriamparany et al. 2014; Saynes et al. 2013, 2016a,b; Weenalei et al. 2017; Voeks and Leony 2004). In the El Zapote community just over 80% of those interviewed finished some grade in elementary school, with some rare cases, especially women, who have studied up to high school, and with almost 18% of people without formal studies. However, in general, there were no differences in the TBK of those interviewed in El Zapote due to the level of education (Table 4), possibly because it is to much similar (Table 1), and because those who have studied a little more have not returned to the community to live, but they are young and were not considered as part of the sample of this study.

Saynes et al. (2016a,b) indicate that another representative variable associated with TBK is occupation since people related to primary activities have a greater knowledge of plants than those with secondary or tertiary activities. Therefore, farmers and ranchers tend to have almost twice the TBK as people who are engaged in other activities (Adriamparany et al. 2014; Akerreta et al. 2007; Byg and Balslev 2004; Dassou et al. 2015; Velásquez-Milla et al. 2011). In El Zapote all the interviewers were primarily farmers, cattle ranchers, or natural resource collectors, regardless of gender, activities that combine in some cases with recently new jobs like bricklayer, blacksmith, and day laborer, which have emerged as part of the support of government programs or for the extra money generated by remittances in the community (Table 1). Thus, the level of ethnobotanical knowledge in El Zapote did not change in function of the diversity of socio-economical activities, because being a person who lives primarily from the countryside and from the resources that the forests offer is something common among the inhabitants of El Zapote.

Finally, based on universal ethnographic and theoretical information (Ferreira Júnior et al. 2020; Gaoue et al. 2017; Leonti et al. 2020; Reyes-García 2010), it is possible to argue that other variables not included in the analysis could explain in the best way the determinants factors of TBK in El Zapote community (beliefs, religion, family size, ethnicity, migration) (Andriamparany et al. 2014; Dassou et al. 2015; Saltos-Abril et al. 2016; Weenalei et al. 2017). Particularly, the case of migration in El Zapote is a phenomenon ongoing, due to many young people migrating to work as agricultural laborers in different close regions of Mexico, while others go to the United States. In the case of regional migration, it is temporary, and young people tend to come back to the community with new knowledge and even bring plants from other environments previously unknowledge to try to adapt them to their homegardens. This migration process has been observed in other places like Sau Paulo, Brazil, in which the mobility of the population broadened the knowledge in relation to the therapies available in a large city. The interviewees stated that they chose to maintain the use of certain species, in addition to incorporating new plants (Carvalho et al. 2018).

CONCLUSION

The importance of ethnobotanical studies in mestizo communities must be weighed in the international ethnobiological agenda, both because of the area in which they are currently distributed and the wealth of knowledge and practices that they have been shown to possess. The populations that live there depend to a great extent on plant resources to complement their multiple needs, both in natural and managed environments. The management of their natural resources is based on their traditional botanical knowledge of biological systems, in addition to responding to economic, social, and cultural factors that vary spatially and temporally at the intra- and inter-community level. The use value (theoretical knowledge) is a useful tool for addressing the manifestations of a population from the socioeconomic and cultural aspects. This allows knowing which resources are most valued by the community and what are the trends regarding the uses of plants. In this research, it was found that there were no statistically significant differences between genders, and the socio-cultural and economic covariates that were analyzed did not significantly influence the acquisition of traditional botanical knowledge. However, there was consensus on the importance that men and women give to medicinal plants. This could be related to the lack of health service coverage in the community. The same happened for food plants, which speaks of a need to meet daily requirements for food safety, without leaving out ornamental plants, which occupied the third order of importance for the population. The preference for flowers has aesthetic significance and value as a cultural response. It was also shown that there is no direct correspondence at the species level between the plants that people know (theoretical dimension) and the ones they use (practical dimension); but there is evident importance at the use category level, where two groups of basic resources for subsistence and earning dominate the rest: food and firewood. This represents a specific feature of this locality and a theoretical advance in the consolidation of the predictive bases of the dichotomy knowledge vs. implicit practices in all ethnobiological knowledge. However, to consolidate the theory, similar studies are yet to be replicated to find explanations about the motives that direct the selection of certain plant resources on a broader cognitive basis.

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DATA AVAILABILITY

The data used to support the findings of this study are available from the corresponding author upon reasonable request.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

LBR, AOS, JGG conceived the presented idea.
JGG, GFF carried out the experiment.
ASV, LBR carried out the data analysis.
AOS, LBR wrote the first draft of the manuscript.
AOS, LBR, JB, BMA reviewed and did the final write-up.
LBR, AOS supervised the work.

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Additional Files

Add File 1. List of useful plants in El Zapote, Morelos, Mexico. Use categories: 1 = Food; 2 = Medicinal; 3 = Ornamental; 4 = Firewood; 5 = Construction; 6 = Sale; 7 = Handicrafts; 8 = Lliving fence; 9 = Tool; 10 = Religious. Life form: T = Tree; S = Shurb; H = Herb; Mu = Mushroom. Habitat: OF = Oak forest; TDF= Tropical deciduous forest; HO = Homegardens; FA = Farmland.

Family	Scientific name	Common name	Use categories	Life form	Habitat
ACANTHACEAE	*Justicia brandegeeana* Wassh. & L.B. Sm.	Camarón	3	H	HO
	Justicia spicigera Schlechtendal	Muicle	2	H	HO
	Megaskepasma erythrochlamys Lindau	Plumero	3	S	HO
ADOXACEAE	*Sambucus canadensis* L.	Sanguinaria	2	H	TDF
AGAVACEAE	*Agave* sp.	Maguey	2	S	TDF
AMARANTHACEAE	*Amaranthus hybridus* L.	Quintonil	1	H	HO
	Guilleminea densa Humb. & Bonpl. Ex Schult	Rosa cimarrona	2	H	OF
AMARYLLIDACEAE	*Agapanthus africanus* L.	Agapando	3	H	HO
	Eucharis grandiflora Planch. & Linden	Plato y taza	3	S	HO
	Hippeastrum vittatum L. Her.	Mancuerna	3	H	HO
ANACARDIACEAE	*Amphipterygium adstringens* Schltdl.	Cuachalalate	2	T	BTC
	Mangifera indica L.	Mango	1	T	HO
	Spondias purpurea L.	Ciruela cuernavaqueña	1.6	T	BTC
ANNONACEAE	*Annona muricata* L.	Guanábana	1	T	HO
APIACEAE	*Coriandrum sativum* L.	Cilantro	1	H	HO
	Eryngium foetidum L.	Cilantro veracruzano	1	H	HO
	Eriyngium carlinae F. Delaroche	Hierba del sapo	2	H	BTC
	Foeniculum vulgare Mill.	Hinojo	2	H	HO
APOCYNACEAE	*Adenium obesum* (Forssk.) Roem. & Schult.	Rosa del desierto	3	S	HO
	Lochnera rosea (L.) Rchb.	Ninfa	3	H	HO
	Nerium oleander L.	Delfa	3	T	HO
	Plumeria rubra L.	Rosal	10	T	HO
	Thevetia thevetioides (Kunth) K. Schum.	Yoyote	7	T	HO
ARACEAE	*Anthurium andreanum* Linden	Anturio	3	H	HO
	Caladium sp.	Corazón de Jesús	3	S	HO
	Epipremnum aureum (Linden & André) G.S. Bunting	Teléfono	3	H	HO
	Monstera deliciosa Liemb	Costilla de Adán	3	S	HO
	Spathiphyllum montanum (R.A. Baker) Grayum	Cuna de Moisés	3	S	HO
	Zantedeschia aethiopica (L.) Spreng.	Alcatraz	3	H	HO
ARAUCARIACEAE	*Araucaria heterophylla* (Salisb.) Franco	Araucaria	3	T	HO
ARECACEAE	*Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf.	Palma ornamental	3	S	HO
	Washingtonia filifera (Linden ex André) H. Wendl. ex de Bary	Palma	7	T	HO

[Go on...]

Family	Scientific name	Common name	Use categories	Life form	Habitat
ASPARAGACEAE	*Beaucarnea recurvata* Lem.	Pata de elefante	3	S	HO
	Dracaena fragans (L.) Ker Gawl.	Palo de Brasil	3	S	HO
ASPHODELACEAE	*Aloe vera* (L.) Burm. f.	Sábila	2	C	HO
ASTERACEAE	*Artemisia absinthium* L.	Ajenjo	2	H	HO
	Artemisia ludoviciana	Estafiate	2	H	HO
	Barkleyanthus salicifolius (Kunth) H. Rob. & Brettell	Jarilla	2	S	BTC
	Brickellia cavanillesii (Cass.) A. Gray	Prodigiosa	2	H	BTC
	Chrysanthemum sp.	Crisantemo	3	S	HO
	Conyza filaginoides (DC.) Hieron.	Simonillo	2	H	BTC
	Cosmos bipinnatus Cav.	Chuchupal	3	H	HO
	Dahlia sp.	Dalia	3	S	HO
	Dyssodia porophyllum (Cav.) Cav.	Árnica	3	H	HO
	Helianthus tuberosus L.	Flor de acahual	5	H	BTC
	Matricaria recutita L.	Manzanilla	2	H	HO
	Montanoa grandiflora DC.	Vara blanca	5	S	BTC
	Porophyllum sp.	Pápalo	1	S	HO
	Schkuhria pinnata (Lam.) Kuntze ex Thell.	Escoba	9	H	BTC
	Tagetes erecta L.	Cempasúchil	10	H	HO
	Tagetes filifolia Lag.	Anís	1	H	BTC
	Tagetes lucida Cav.	Pericón	2,10,9	H	BTC
	Tagetes lunulata Ortega	Flor de muerto	10	H	BTC
	Tanacetum parthenium (L.) Sch. Bip.	Altamisa	2	H	HO
	Taraxacum officinale F.H. Wigg.	Diente de león	2	H	BTC
	Verbesina crocata (Cav.) Less.	Capitaneja	1	S	OF
	Zinnia violacea Cav.	San miguel	2	H	BTC
BALSAMINACEAE	*Impatiens balsamina* L.	Belenes	3	H	HO
BEGONIACEAE	*Begonia semperflorens* Link & Otto	Begonia	3	H	HO
	Begonia sophie L.	Ala de ángel	3	H	HO
BIGNONIACEAE	*Crescentia alata* Kunth	Cuatecomate	2	T	BTC
	Tecoma stans (L.) Juss. ex Kunth	Flor tronadora	2	T	HO
BIXACEAE	*Cochlospermum vitifolium* (Willd.) Spreng.	Paniacua	2	T	BTC
BORAGINACEAE	*Cordia morelosana* Standl.	Palo prieto	2	T	HO
	Tournefolia hirsutissima L.	Tlachichinole	2	H	BTC
BRASSICACEAE	*Lepidium virginicum* (Greene) Thell.	Mishishi	2	H	BTC
	Raphanus sativus L.	Rábano	1	H	HO
BURSERACEAE	*Bursera fagaroides* kunth	Cuajiote blanco	8	T	BTC
	Bursera galeottiana Engl.	Cuajiote rojo	8	T	BTC

[Go on...]

Family	**Scientific name**	**Common name**	**Use categories**	**Life form**	**Habitat**
	Bursera glabrifolia (Kunth) Engl.	Copal	8,1	T	BTC
CACTACEAE	*Coryphantha elephantidens* (Lem.) Lem.	Biznaga	2	H	BTC
	Epiphyllum sp.	Huele de noche	3	H	HO
	Hylocereus undatus (Haw.) Britton & Rose	Pitaya	1	H	BTC
	Mammilaria sp.	Rodilla de viejo	2	H	OF
	Opuntia sp.	Nopal	1	H	SBC
	Schlumbergera x buckleyi (T. Moore) Tjaden	Nopal navideño	3	H	HO
CANNACEAE	*Canna* sp.	Platanillo	3	S	HO
CANTHARELLACEAE	*Cantharellus tubaeformis* (Schaeff.) Quél.	Hongo amarillo	1	Mu	OF
	Cantharellus cibarius Fr.	Hongo de San Juan	1	Mu	OF
CAPPARACEAE	*Cleome gynandra* L.	Barba de chivo	2	H	BTC
CAPRIFOLIACEAE	*Valeriana officinalis* L.	Valeriana	1	H	HO
CASUARINACEAE	*Casuarina equisetifolia* L.	Casuarina	4	T	HO
CHENOPODIACEAE	*Chenopodium berlandieri* Moq.	Huauzontle	1	H	HO
	Dysphania ambrosioides L.	Epazote	1,2	H	HO
COMMELINACEAE	*Tradescantia zebrina* hort. ex Bosse	Pico de pollo	2	H	HO
CONVOLVULACEAE	*Ipomoea batatas* (L.) Lam.	Camote Liso	1	H	BTC
	Ipomoea murucoides Roem. & Schult.	Cazahuate	4,8	T	BTC
CRASSULACEAE	*Echeveria* sp.	Siempre viva	2	C	HO
	Kalanchoe daigremontiana Raym. -Hamet & H. Perrier	Espinazo del diablo	2	H	HO
	Sedum morganianum E. Walther	Cola de ratón	3	H	HO
	Sedum pachyphyllum Rose	Dedo de dios	2	H	HO
CUCURBITACEAE	*Cucurbita ficifolia* Bouché	Chilacayote	1	H	FA
	Cucurbita moschata Duchesne	Calabaza Dulce	1	H	FA
	Cucurbita sp.	Calabaza	1	H	HO
	Luffa cylindrica M. Roem.	Estropajo	9	H	FA
	Sechium edule (Jacq.) Sw.	Chayote	1,2	H	HO
CUPRESSACEAE	*Cupressus* sp.	Cedro	5	T	HO
	Cupressus sp.	Pino ornamental	3	T	OF
CYCADACEAE	*Cycas revoluta* Thunb.	Cica	3	T	HO
EPHEDRACEAE	*Ephedra antisyphilitica* Berland. ex C.A. Mey.	Tepopote	2	S	BTC
EQUISETACEAE	*Equisetum hyemale* L.	Cola de caballo	2	H	HO
ERICACEAE	*Rhododendron* sp.	Azalea	3	H	HO
	Arbutus xalapensis kunth	Madroño	2,4	S	OF
	Aleurites moluccana (L.) Willd.	Nuez de la India	1	T	HO
	Euphorbia leucorephala Lotsy	Blanca navidad	3	T	HO
EUPHORBIACEAE	*Euphorbia milii* Des Moul.	Corona de cristo	3	S	HO

[Go on...]

Family	**Scientific name**	**Common name**	**Use categories**	**Life form**	**Habitat**
	Euphorbia pulcherrima Willd. ex Klotzsch	Pascua	3	S	HO
	Euphorbia tanquahuete Sessé & Moc	Pega hueso	2	T	HO
	Acacia angustissima (Mill.) Kuntze	Timbre	2	T	BTC
	Acacia bilimekii J.F. Macbr.	Tehuixtle	4,8	S	BTC
	Acacia cochliacantha Humb. & Bonpl. ex Willd.	Cubata	4,7	T	BTC
	Acacia pennatula (Schltdl. & Cham.) Benth.	Espino blanco	2	S	BTC
	Acaciella angustissima (Mill.) Britton & Rose	Timbrillo	2	T	BTC
	Conzattia multiflora (B.L. Rob.) Standl.	Guayacán	2	T	BTC
	Erythrina americana Mill.	Zompancle	1	T	BTC
	Eysenhardtia polystachya (Ortega) Sarg.	Palo dulce	2,4	T	BTC
FABACEAE	*Leucaena esculenta* (DC.) Benth.	Guaje rojo	1	T	BTC
	Leucaena leucocephala (Lam.) de Wit	Guaje	1	T	BTC
	Lupinus elegans Kunth	Cola de coyote	2	H	BTC
	Lysiloma acapulcensis (Kunth) Benth.	Tepehuaje	2,4,8	T	BTC
	Lysiloma tergemina Benth.	Pata de cabra	3	H	HO
	Pithecellobium dulce (Roxb.) Benth.	Guamúchil	1	T	BTC
	Senna hirsuta (L.) H.S. Irwin & Barneby	Cornezuelo	2	H	BTC
	Senna siamea (Lam.) H.S. Irwin & Barneby	Paraca	2	H	BTC
	Vachellia farnesiana (L.) Wight y Arn.	Huizache	2	S	BTC
	Quercus acutifolia Née	Encino blanco	4,5,8	T	OF
FAGACEAE	*Quercus conspersa* Benth.	Encino roble	4,5,8	T	OF
	Quercus magnoliifolia Née	Encino amarillo	4,5,8	T	OF
	Quercus castanea Née	Encino chino	4,5,8	T	OF
GERANIACEAE	*Pelargonium* x *hortorum* L.H. Bailey	Geranio	3	H	HO
GOMPHACEAE	*Ramaria botrytis* (Pers.) Ricken	Hongo escobeta	1	Mu	OF
HYDRANGEACEAE	*Hydrangea macrophylla* E.M. McClint.	Hortensia	3	S	HO
HYPOCREACEAE	*Hypomyces lactifluorum* (Schwein.) Tul. & C.Tul.	Hongo trompa de marrano	1	Mu	OF
IRIDACEAE	*Gladiolus* x *gandavensis* Van Houtte	Gladiola	3	H	HO
JUGLANDACEAE	*Juglans mollis* Engelm.	Nogal	2	T	HO
	Marrubium vulgare L.	Marrubio	2	H	SBC
LAMIACEAE	*Mentha* sp.	Poleo	2	H	HO
	Ocimum basilicum (Willd.) Benth.	Albacar	1,2	H	HO
	Origanum majorana L.	Mejorana	2	H	HO
	Plectranthus hadiensis (Forssk.) Schweinf. ex Sprenger	Vaporub	2	H	HO
	Plectranthus scutellarioides (L.) R. Br.	Capas	3	H	HO
	Plectranthus sp.	Orégano	1	H	HO
LAMIACEAE	*Rosmarinus officinalis* L.	Romero	2	H	HO

[Go on...]

Family	**Scientific name**	**Common name**	**Use categories**	**Life form**	**Habitat**
	Salvia coccineae Benth.	Mirto	2	H	HO
	Salvia farinaceae Epling	Salvia	2	H	HO
	Thymus vulgaris L.	Tomillo	1,2	H	HO
LAURACEAE	*Litsea glaucescens* Kunth	Laurel	1	S	HO
	Persea americana Mill.	Aguacate	1	T	HO
LILIACEAE	*Lilium candidum* L.	Lirio	3	H	HO
LOASEACEAE	*Mentzelia aspera* L.	Pega ropa	2	S	BTC
LOMARIOPSIDACEAE	*Nephrolepis* sp.	Helecho	3	S	HO
LORANTHACEAE	*Cladocolea mcvaughii* Kuijt	Injerto de huizache	2	H	BTC
LYTHRACEAE	*Lytrum alatum* Pursh	Mosquito	3	S	HO
MALPIGHIACEAE	*Byrsonima crassifolia* (L.) Kunth	Nanche	1,2	T	HO
	Malpighia mexicana A. Juss.	Guajocote	1	T	HO
MALVACEAE	*Ceiba speciosa* (A. St.-Hil.) Ravenna	Pochote	7	T	BTC
	Hibiscus rosa-sinensis L.	Tulipán	3	S	HO
	Malva sp.	Malva	2	H	HO
	Sida rhombifolia L.	Alache	2	H	BTC
MELIACEAE	*Melia azedarach* L.	Árbol de paraíso	3	T	HO
MORACEAE	*Dorstenia contrajerva* L.	Contrayerba	2	H	BTC
	Ficus benjamina L.	Ficus	3	T	HO
	Ficus carica L.	Higo	1	T	HO
MORINGACEAE	*Moringa oleífera* Lam.	Moringa	3	T	HO
MUSACEAE	*Musa* x *paradisiaca* L.	Plátano	1	H	HO
MYRTACEAE	*Eucalyptus globulus* Labill.	Eucalipto	2	T	HO
	Psidium guajava L.	Guayabo	1,2	T	HO
NYCTAGINACEAE	*Bougainvillea glabra* Choisy	Bugambilia morada	2	S	HO
OLEACEAE	*Fraxinus uhdei* (Wenz.) Lingelsh.	Fresno	2	T	HO
	Jasminum officinale L.	Jazmín	3	S	HO
ONAGRACEAE	*Ludwigia octovalvis* (Jacq.) P.H. Raven	Clavillo	2	H	BTC
ORCHIDACEAE	*Laelia autumnalis* (Lex.) Lindl.	Orquídea	6	H	OF
PASSIFLORACEAE	*Passiflora edulis flavicarpa* O. Deg.	Maracuyá	1	H	HO
	Passiflora edulis Sims	Maracuyá morada	1	H	HO
PINACEAE	*Pinus pseudostrobus* Brongn	Pino ocote	5,7	T	OF
PIPERACEAE	*Peperomia campylotropa* AW Hill	Cilantro de campo	1	H	OF
	Piper auritum Kunth	Hoja santa	1,2	H	BTC
PLEUROTACEAE	*Pleurotus ostreatus* (Jacq.) P. Kumm.	Hongo de cazahuate	1,6	Mu	BTC
	Zea mays (Schrad.) Iltis	Cabello de elote	2	H	FA
POACEAE	*Arundo donax* L.	Otate	5	S	BTC

[Go on...]

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	Cymbopogon citratus (DC.) Stapf	Te de caña	2	H	HO
POLEMONIACEAE	*Loeselia mexicana* (Lam.) Brand	Espinosilla	2	H	OF
PORTULACACEAE	*Portulaca oleracea* L.	Verdolaga	1	H	HO
PUNICACEAE	*Punica granatum* L.	Granada	1	T	HO
ROSACEAE	*Citrus limon* Burm.	Limón real	1	T	HO
	Crataegus mexicana DC.	Tejocote	1	T	HO
	Eriobotrya japónica (Thunb.) Lindl.	Níspero	1,2	T	HO
	Fragaria vesca L.	Fresa	1	H	HO
	Malus pumila Rehder	Manzano	1	T	HO
	Prunus persica (L.) Batsch	Durazno	1	T	OF
	Prunus serotina Ehrh.	Capulín	1	T	OF
	Prunus x *domestica* L.	Ciruela chabacano	1	T	HO
	Rosa gallica L.	Rosa de castilla	2	S	HO
	Rosa sp.	Rosa ornamental	3	S	HO
RUBIACEAE	*Gardenia* sp.	Bertha	3	S	HO
	Ixora coccinea L.	Cerillo	3	H	HO
RUSSULACEAE	*Lactarius deliciosus* L. ex Fr. Gray	Hongo de leche	1	Mu	OF
	Lactarius indigo (Schwein.) Fr.	Hongo azul	1,6	Mu	OF
RUTACEAE	*Casimiroa edulis* La Llave	Zapote blanco	1,2	T	BTC
	Citrus limon (L.) Osbeck	Limón	1	T	HO
	Citrus x *aurantium* L.	Naranjo	1	T	HO
	Ruta chalepensis L.	Ruda	2	H	HO
	Zanthoxylum arborescens Rose	Uña de gato	2	H	HO
SAPINDACEAE	*Dodonaea viscosa* Jacq.	Chapulixtle	2,5	S	BTC
SCROPHULARIACEAE	*Buddleja cordata* Kunth	Tepozán	2	H	BTC
	Buddleja sessiliflora Kunth	Lengua de vaca	2	H	HO
	Verbascum thapsus L.	Gordo lobo	2	H	BTC
SELAGINELLACEAE	*Selaginella lepidophylla* (Hook. & Grev.) Spring	Flor de piedra	2	H	BTC
SOLANACEAE	*Brugmansia arborea* (L.) Lagerh.	Floripondio	2	S	HO
	Datura stramonium (L.) Torr.	Toloache	2	H	BTC
	Lycopersicum esculentum Mill	Jitomate	1	H	HO
	Nicotiana glauca Graham	Tabaco	2	H	HO
	Solandra maxima (Sessé & Moc.) P.S. Green	Copa de oro	3	S	HO
	Solanum tuberosum L.	Papa	2	H	FA
STRELITZIACEAE	*Strelitzia reginae* Aiton	Ave de paraíso	3	H	HO
THEACEAE	*Camellia sinensis* (L.) Kuntze	Te negro	2	H	HO
TRICHOLOMATACEAE	*Clitocybe gibba* (Pers.) P. Kumm.	Hongo frijolito	1	Mu	OF

[Go on...]

Family	**Scientific name**	**Common name**	**Use categories**	**Life form**	**Habitat**
TROPAEOLACEAE	*Tropaeolum majus* L.	Mastuerzo	2	H	BTC
VERBENACEAE	*Phyla dulcis* (Trevir.) Moldenke	Hierbabuena	1	H	HO
VITACEAE	*Vitis tiliifolia* Humb. & Bonpl.ex Roem. & Schult.)	Uva cimarrona	1,6	H	OF
ZINGIBERACEAE	*Hedychium coronarium* J. Koenig	Paloma	3	S	HO