

## Article

# Ethnobotany in Iturbide, Nuevo León: The Traditional Knowledge on Plants Used in the Semiarid Mountains of Northeastern Mexico

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**Abstract:** Iturbide is in the Northeast of Mexico, it has a rich native and exotic flora, however, there are no ethnobotanical records, therefore, it requires attention in the documentation of traditional knowledge and practices of its botanical resources. In 2021, twelve field trips were carried out, applying 110 semi-structured interviews. Plant samples were collected, identified and deposited in an herbarium. We used the Chi-square test to compare the anthropocentric categories concerning others reported in Mexico. To determine the cultural importance, three ethnobotanical indices were applied (UVI, ICF and FL). We recorded 250 species with ethnobotanical implications associated with 121 genera and 83 families, including 140 native and 110 exotic species. The most common plant families were Asteraceae, Lamiaceae, and Fabaceae. The main categories of uses were; ornamental, medicinal and food. The species with the highest UVI values were *Lepidium peruvianum*, *Ocimum basilicum* and *Salvia rosamrinus*. The multifunctionality of the native and exotic flora demonstrates the extensive knowledge associated with botanical resources. Examples, the role of ornamental plants, with a direct impact on human well-being, the resilience of healers and traditional inhabitants by using different species for the treatment of various ailments. or indigenous edible plants in the daily diet.

**Keywords:** ethnobotanical indices; ethnobotanical uses; native and exotic species; local community; semi-structured interviews; natural resources in mountains areas; traditional knowledge and management; ornamental plants

## 1. Introduction

Worldwide, ethnobotany is a discipline with extensive contributions from its beginnings to the present, with work on all continents, highlighting remote regions and different indigenous groups. It is surprising how much ethnobotanical information is available. *E.g.* a study in the Kathua region of the Himalayas describes the knowledge and use of 121 plant species by various indigenous groups, Duggars, Paharis, Punjabis and Gujjars; who, furthermore, share their ancestral knowledge [1]. These results are strengthened by other research in the same region of Kupwara, where there is a high diversity of medicinal plant used, highlighted the transmission of traditional medical knowledge directly from the elderly to the young is [2]. Another recently explored region is Pakistan in the Shivalik Range, where its population depends directly on wild flora for their livelihood [3]. Same subsistence case for the Nauka (language in danger of extinction), settled in the Bering Strait, Russia; who, in addition to depending on wild plants, were forced to change their ancestral knowledge and practices due to armed conflicts [4].

Other areas of the planet and their diverse cultures contribute with spectacular ethnobotanical works, *e.g.* the groups originating in Australia, the Bunganditj, who have deep traditional medical knowledge, in addition, they collaborate with researchers to design protocols for prospecting the use of their medicine [5]. One of the zones with the greatest ethnobotanical records is the Mapuche region, Patagonia, Argentina; where 505 medicinal flora species are reported; highlighting an interesting mix of native and exotic species [6]. Another of the most diverse regions of the planet is the Amazon, where 274 species of medicinal native plants are reported for a single community in the Brazilian Region [7].

Relating the richness and diversity of worldwide ethnobotany, we can say that Mexico, is one of the countries with a deep ethnobotanical tradition, that is, the human groups established in the different ecoregions have developed a wide perception, knowledge and use of plant [8,9]. Mexican ethnobotanical documentation estimates the knowledge and exploitation of between 5,000 and 7,000 plant species, among which a wide range of native and introduced species stand out, using different parts of them, many with strong cultural and multifunctional roots [9].

Mexican ethnobotany as well as in other regions of the world, reflects socio-ecological patterns of a complex socio-cultural dimension, highlighting the forms of transmission of traditional ecological knowledge (TEK) between different generations [10], inter-ethnic and intra-ethnic differences [11], gender [12], between ecosystems and in biodiversity [13], including environmental changes [14], as well as the anthropocentric characterization of utilization [15], the complex systems of traditional medicine and food [9]. These socio-ecological patterns consist of a set of local knowledge and practices specific to each cultural group, defined as: Traditional Ecological Knowledge (TEK; [16,17]). The TEK is integrated into three main conceptual fields, a) perception=*kosmos* (set of beliefs associated with plants, *e.g.* ceremonial and ritual uses), b) cognitive=*corpus* (sets of knowledge about plant resources, *e.g.* flock nomenclature, knowledge about biological and ecological aspects), and c) practical=*praxis* (set of utilization and/or exploitation practices, *e.g.* categories of use, domestication, [18]). Ethnobotanical studies in the country have contributed to the development and consolidation of global ethnobotanical knowledge, *e.g.* Hunn [19], with the Tzeltal Indians, where he proposes one of the bases for the study of traditional classification. Later, he reaffirms his work, studying the lifestyles of the Zapotec Indians of San Juan Gbee, where he documents more than 700 names of plants in the indigenous language [20]. Novel ethnobotanical research is currently continuing, *e.g.* Nabhan and collaborators [21], have shown the role that plants play in a socio-ecosystem, and its relevance for human health in the face of climatic stress; during the monsoons (rains in the Sonoran Desert, where the Comcaac indigenous people lives) when terpenes are released from the desert plants, in which more than 60 species have been identified with 115 biogenic volatile oils, contribute to human health by improving sleep patterns, regulating emotional hormones, improving digestion and reducing depression and anxiety; preventing oxidative stress diseases [21].

The distribution of indigenous groups in Mexico is concentrated in the central, southern, and south-southeastern areas, mainly, where there is a high diversity of geofoms, climates, ecosystems, and a high biological diversity; the established indigenous groups have a profound knowledge of their biocultural diversity and their ethnobotanical resources [8]. Some indigenous groups settled in the northern region of the country, grouped in the Northwestern area. Therefore, in the Northeast region, there are only the Kipapo and Negros Mascogo settlements (migrants from the United States settled in the mid-1800s [22]). In general, the North of Mexico is characterized by being a wide extension of arid and semi-arid zones, forming one of the most diverse desert regions on the planet [23], due to its local environmental heterogeneity, mainly in the Northeast region; in this area, there are hundreds of mestizo rural communities, which, like the indigenous communities, have a deep knowledge of their ethnobotanical biocultural diversity [13,24-27]. This is due in part to the fact that rural populations tend to live more isolated, using natural resources of their surroundings as medicine, food, ornamental, firewood, or domestic tools [24-27].

The ethnobotany in the north of the country and particularly in the northeast zone is as relevant as that documented in other regions, and even in indigenous areas, even when comparing different types of ecosystems where the richness of species is varied [13]. Unfortunately, this knowledge is at risk due to socio-cultural factors such as migration [28], and lack of interest in younger generations, contrary to what has been documented for some indigenous people [2]. Other factors are associated with changes in economic systems [29]; to socio-ecological factors, such as changes in traditional medicine practices and local food systems, so it is necessary to safeguard important taxa as part of the biocultural heritage food [30]. In addition, there are changes in agroecological systems, where there is a threat and loss of related wild crops [31]. The degradation of ethnobotanical TEK is even associated with environmental changes and loss of biological diversity [32]. A respite in the face of the notable loss of ethnobotanical biocultural wealth is given through the documentation and local revaluation of knowledge and practices of plants [1-7], where the new generations and women have an important role [10, 33]; as well as, linking communities with the academic sector, generating regulation and bioprospecting protocols [5].

The objectives of this ethnobotanical research are: a) to know the diversity of flora taxa with ethnobotanical potential; b) to compare the diversity of plants with ethnobotanical implications with those reported in other regions of northeastern Mexico; c) to document the knowledge and traditional uses of native and exotic flora; and d) analyze the traditional medical knowledge of local plant species, their forms of administration and parts used; through the application of quantitative indexes used in etnobiology: Informant Consensus Factor (ICF), Use Value Index (UVI), and Fidelity Index (FI). All this would help preserve the ethnobotanical knowledge and traditional practices of plant taxa used in this area by their community, facilitating environmental education and the sustainable development of Iturbide, in the face of the increasing loss of ecosystems, a low economy in the area and migration of the young population.

## **2. Materials and Methods**

### **2.1. Study site**

In general, the relief of Mexico is among the most rugged on the planet. This particular orography is one of the factors that confer the existence of diverse and unique flora in many parts the country. The northern region ecologically is characterized by large extensions of different types of scrublands and deserts, forming heterogeneous habitats, due to the interspersed presence of temperate and tropical forests [34].

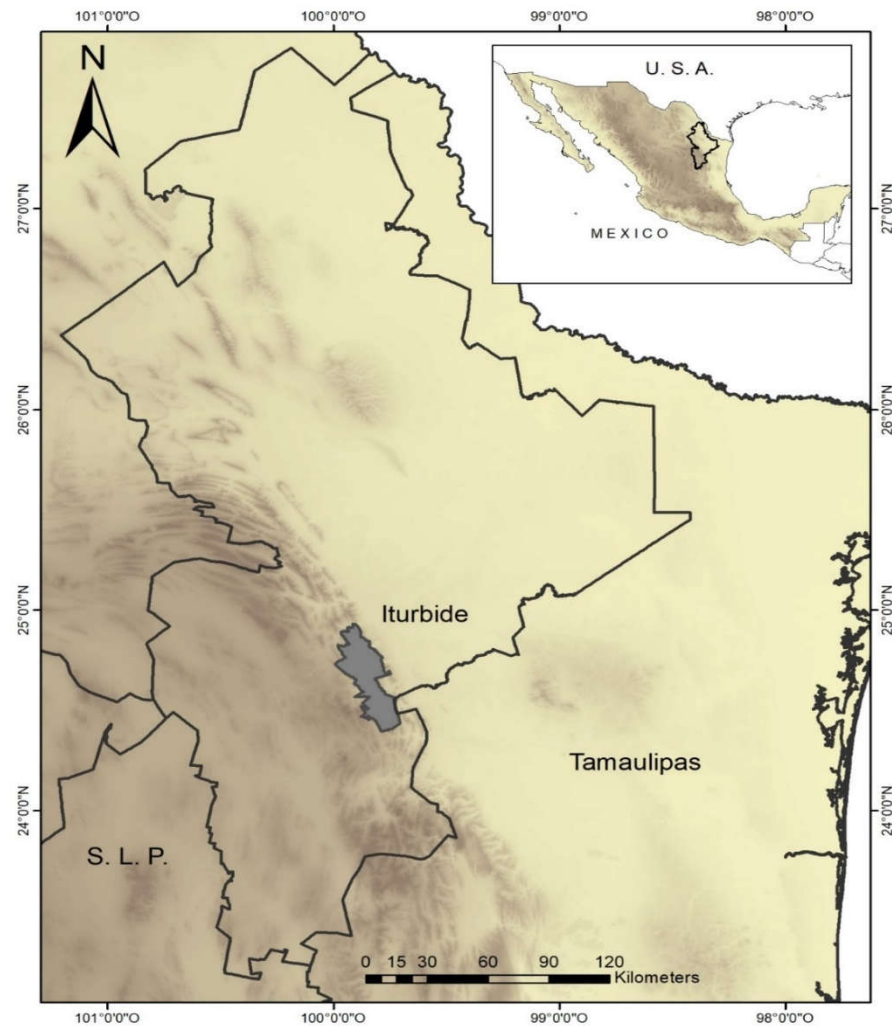
Geographically the state of Nuevo León, is characterized by its extensive lowland, high plains and mountains that, in some cases, can reach up to 3,600 meters above sea level [35], where the local population is mestizo [36]. Our study area, Iturbide, is a small municipality located in the semiarid mountains in the southern reaches of the state of Nuevo León [36] with a landscape comprised of 85% rugged surface and 15% flat areas.

The two main vegetation types found in the municipality of Iturbide are semiarid scrubland and oak-pine forest, both of them hosting a very rich flora with high levels of endemism. The Sierra Madre Oriental (state of Nuevo León) contains almost 269 endemic plant species [37]. Almost 60 of these species are considered exclusive of the municipality of Galeana, adjacent to Iturbide. Among these species, it highlights some with high levels of endemism, belonging to the families, Asteraceae (*Ageratina* Spach, *Erigeron* L., 1753, and *Verbesina* L.), Cactaceae (*Mammillaria* Haw. and *Turbinicarpus* (Backeb.) Buxb.&Backeb.), and Fabaceae (*Dalea* Ulbr. [38]). Most of the native and exotic flora is widely used by the local community, in order to satisfy different anthropocentric needs [13, 24-27].

According to the 2010 National Population and Housing Census, approximately 3,600 people inhabit Iturbide Municipality, with 95% living in the town of Iturbide and the remainder in surrounding rural areas. On average, half of the residents of Iturbide Municipality are male and half are female [36]. The primary local language is Spanish. The main economic activities in Iturbide are agriculture and livestock, which highlights the relevance of the study of natural resources in this area. The main crops are corn, wheat and oats, as well as fruit harvesting, principally apples, plums, apricots, quince and peaches [36]. Local artisans produce wooden furniture, embroidery and other handmade products, thereby using natural resources for their creations. The federal government offers subsidized training for the development of technical skills such as baking, sewing, carpentry and blacksmithing. Additionally, there is federal financial support for disabled people. However, in Iturbide, there are relatively few inhabitants aged 17-25 years. This is because the young people of Iturbide have begun to emigrate to larger cities and regions with higher access to education and diverse employment opportunities that offer higher salaries [36].

The origin of its population is related to the establishment of cattle ranches in 1800, its current population is totally mestizo, proud to belong to the "northern culture". Education levels are high compared to other municipalities in the entity, there is basic, upper secondary and higher education, highlighting the School of Forest Sciences and the Astronomical Observatory of the Autonomous University of Nuevo León. In recent years, tourism has been promoted as an economic alternative, mainly associated with ecotourism due to its natural and scenic beauty.

Iturbide is located in south-central Nuevo Leon, 24°23' N 99°59' W (Figure 1 and Figure 2a). It is placed in the Sierra Madre Oriental and it is comprised of mountains, extensive valleys and canyons, as well as plateaus above 1,200 m altitude. Iturbide is located in the dry part of the mountains on the leeward side. Its climate has two variants: at lower elevations (1,200 m) it is semi-warm, while at higher elevations (2,400 m), the climate is cold, temperate and subhumid. The annual precipitation ranges from 300 mm to 950 mm, with a mean precipitation of 705 mm. The driest months are from December to March; the rainiest months are from July to September. The average annual temperature ranges between 12° to 18° C, with the hottest months being April and May and the coldest from November to January [38]. There are two permanent rivers in the municipality of Iturbide: The San Antonio River, which crosses the municipality from North to South, and the La Muralla River, located at the extreme North. The highest parts of the area with a temperate climate are covered by oak and oak-pine forest, while the driest parts shelter microphyllous scrublands [38,39].



**Figure 1.** Location of the study area, Iturbide, Nueva León, Mexico.

## 2.2. Field work and interviews

A total of twelve field trips were made for plant identification and collection. Two previous exploratory visits were made in June 2021. The first was held to explore the plant communities adjacent to Iturbide and collect plant specimens of the native flora, representative of the area, and the second one to interview people (see below) regarding local plants and their uses. We obtained the permission of local authorities to collect plants in public areas and talk with private property owners for the same purpose [13]. From July to December 2021, 12 field trips for plant species collection were carried out. All species recorded were photographed to create an ethnobotanical database containing all information and data gathered. The taxonomic identification of plant was based on the study of the flora of the state of Nuevo León, as well as monographs of families and genera distributed in this area [38,39]. When possible, the interviewed individuals accompanied us on field trips to identify species *in situ*. All collected and identified specimens were stored at the CFNL herbarium of the Faculty of Forest Sciences, Autonomous University of Nuevo León. The collection number belongs to Eduardo Estrada (EE), and the identified species were corroborated with herbarium specimens [40].

Based on ethnobotanical studies previously carried out in the Northeast of the country, we focused our interview on housewives, shepherds, bricklayers, elementary teachers, business owners, midwives, and healers older than 30 years [24]. The ages of the interviewees ranged from 32 to 84 years. Each interviewee had lived continuously in the area for at least 20 years. To maximize data collection and allow interviewees to speak freely, interviews were semi-structured [41]. Four questions were asked to all interviewed: 1) What is the name of the plant? 2) What are the uses you know of this plant? 3) What



parts of the plant are utilized (root, stem, leaf, inflorescence, flower, fruit)? and 4) How is the product/utensil prepared (raw, cooked, roasted, ground)? [42-43]. All interviews were conducted with the prior informed consent of each of the informants (<http://ethnobiology.net/codeofethics/>; [42]). During the interviews, we showed pictures of the regional plant species found to additionally confirm species identification by local people (ethnographic technique of visual stimuli [43]). All interviews were recorded in Spanish. In Figure 2b and 2c, we can observe the work team and the relationship that was established with the informants to obtain the ethnographic information.

### 2.3. Data analysis

In order to know the ethnobotanical significance of Iturbide with respect to other localities in Mexico studied, (Nuevo León, Coahuila, Baja California, Puebla, and Michoacán), a Chi-square test was applied using PAST software [44,45]. The chi-square test is used by means of contingency tables to examine the relationship between two or more categorical, non-numerical variables. It is also used to explore the distribution of a categorical variable among different samples [44]. This test works with frequencies (observed and expected), and its calculation is based on the degrees of freedom and the level of significance to determine which hypothesis is accepted (the null or the alternate). The null hypothesis is rejected when the number of known plant species at other sites is similar to that of Iturbide ( $p < 0.05$ ). To quantitatively analyze the ethnobotanical information collected, three indexes were applied: 1) Use Value Index (UVI [13]; 2) the informant consensus factor (ICF [46]), and 3) Fidelity Level (FL [47]), these commonly used in the ethnobotanical research [1,2,13].

The UVI analyzes the local relevance of each of the ethnobotanical species, it is obtained applying the formula:  $UVI = \sum U_i / n$ , where  $U_i$  corresponds to the number of uses known by each informant for the species  $i$ , and  $n$  = the total sample number ethnographic (interviewees). The IFC evaluates the relative importance of the ethnobotanical species within each medicinal category, is calculated as:  $IFC = n_{ur} - n_t / n_{ur} - 1$ , the subindex  $n_{ur}$  = frequency of medicinal mention for the species  $i$ , and  $n_t$  = sum of the species mentioned for each of the medicinal categories. The premise in this index indicates that the species that obtain the highest values are those that are considered by the informants, as more effective in the treatment of certain diseases. Finally, through the Fidelity Index, the relative importance of each species  $i$  in a specific medicinal category is calculated, with respect to the total degree of consensus among the informants. It is calculated as:  $FL(\%) = I_p / I_u (100)$ , where:  $I_p$  = total number of interviewees who independently indicated the use of species  $i$  to treat the disease particular; and  $I_u$  = corresponds to the frequency of informants who mention the species  $i$  to counteract a specific disease, within a category of specific medicinal use.

## 3. Results and Discussion

### 3.1. Taxa diversity, origin and life forms

A total of 250 taxa with ethnobotanical importance from 121 genera and 83 families, were recorded in this research (Table 1), of which are 140 native and 110 introduced (Appendix A). The diversity of native species is mediated by the environmental heterogeneity associated with the topography, a fundamental characteristic in richness and composition of plant communities [38] and leads to contrasting vegetation patterns between northern and southern areas [37]; while the diversity of introduced taxa is associated with anthropocentric needs [25-27]. Table 2 shows contrasting physiognomic vegetation among northeastern, northwestern, central and southern Mexico, where ethnobotanical research have been carried out: these sites are characterized by heterogeneous scrublands and oak-pine forests. However, relatively similar vegetation was found in northwestern (Baja California, [48]) and southern Mexico, as, for instance, in the Monarch Butterfly Biosphere Reserve (Michoacán, [49]).

Our results affirm that rural mestizo communities also have a deep ethnobotanical tradition, compared to works carried out in inhospitable regions and with different

indigenous groups, *e.g.* Shigh and collaborators [1] report 121 species, 105 genera, and 53 families in the Himalayas. Silva et al. [7] report 274 ethnobotanical taxa used exclusively in traditional medicine for inhabitants of the Brazilian Amazon. However, a greater effort is still needed in the ethnobotanical documentation of extensive rural mestizo areas, to compare data such as those reported for the Mapuche in Patagonia (505 species of medicinal and edible flora, [6]).

The difference in plant biocultural diversity among the above mentioned, regions was significant at every taxonomic level: at the family level ( $X^2_{d.f.=7}= 24.23$ ,  $p< 0.001$ ), genus level ( $X^2_{d.f.=7}= 103.25$ ,  $p< 0.001$ ), and species level  $X^2_{d.f.=7}= 133.60$ ,  $p< 0.001$ ). Regions with heterogeneous vegetation communities (Iturbide, Cumbres de Monterrey National Park (CMNP, [26]), Rayones [27], Bustamente [25], Cuatrociénegas [13], and Zapotitlán [50]) contain more plant species with ethnobotanical uses than regions having relatively more homogeneous vegetation such as coniferous, oak-pine forests (Michoacán, [49]) or scrublands (Baja California, [48]; Table 2).





**Figure 2.** Ethnobotanical work in Iturbide, Nuevo León, Mexico. NOTE: Prior and informed consent was obtained during the application of the interviews, for the taking of photographs, as well as the authorization of informants photographed for publication [42,43], (a) Local square of the municipality of Iturbide, (b,c) Work team during the application of the interviews, (d) Sale of ornamental plants through the streets of various colonies of Iturbide, (e) Caring for ornamental plants in private gardens by residents, (f) Taking photographs of ornamental plants for their taxonomic identification, (g) Kitchen table used as a support to cut fruits, vegetables and meats; for food preparation.



**Table 1.** Richness of ethnobotanical taxa known and used by residents of Iturbide, Nuevo León, Mexico. These plants were separated between eudicots, monocots, conifers and allies, and ferns and allies.

	Eudicots	Monocots	Conifers and Allies	Ferns and Allies	TOTAL
Families	65	13	3	2	83
Genera	82	31	6	2	121
Species	204	34	10	2	250

We found that the most abundant and species rich plant families in Iturbide are Asteraceae, Fabaceae, Poaceae, Euphorbiaceae, and Cactaceae (Figure 3a), the same pattern of taxonomic families is predominant in the northern, central and southern of Mexico [38,39]; as well as, in other regions of the world, where the two main reported families are, Asteraceae and Fabaceae [1,2,6,7]. Furthermore, it is common that the local abundance of plants in a given taxon correlates with the number of ethnobotanical uses identified for that taxon; therefore, the families with the highest species richness are constantly those with the highest frequency of mention in ethnobotanical studies [46]. The enormous number of ethnobotanical applications registered in Iturbide is evidenced by the great variety of taxa used for ethnobotanical purposes, especially in small and rural areas, far from large cities and were using plant species for diverse ethnobotanical utilizations is a strongly rooted tradition, greatly extended in the day-to-day needs of some communities [3,7,9,13].

Of the ethnobotanical exploitations registered in Iturbide, 140 are native while 110 are exotic (Appendix A). The introduced plants represent a high value, as in other zones of the Northeast [13], but lower than in other remote regions [1,6]. Herbaceous taxa were the most abundant (120), followed by shrubs (58), trees (55), and succulents (17). The relatively cool climatic conditions allow the presence of a varied flora most of the year. The streets, parks, and sidewalks are predominantly dominated by evergreen vegetation and many herbaceous plants that flower even in the coldest months (December and January).

The most common uses of the plant species in Iturbide are ornamental, medicinal, food, forage, wood, and fuel (Figure 3b). These patterns of plant harnessing are similar to other works from the northeast region [13,24-27]. We observe that, unlike other sites in Mexico, ornamental plants are highly relevant [13], displacing the medicinal and edible categories in second and third place (Figure 3b). This new phenomenon of cultural appreciation of ornamental plants may be related to the need to mitigate solar radiation in gardens and public parks, as well as in homes [13]. While on the other hand, it is currently known that plants in desert regions of northwestern Mexico provide health benefits in the face of climatic stress, generating a feeling of euphoria and relief among the population; an effect associated with the monsoons (torrential summer rains) and the release of terpenes from plants, these biogenic organic compounds are considered to help mitigate oxidative stress diseases, improve sleep quality, stabilize emotional hormones, improve digestion, they increase mental clarity and reduce depression and anxiety [18]. Therefore, the inclusion of ornamental species in the ethnobotanical cultural baggage of Iturbide and other regions of northeastern Mexico may have a similar effect to that reported for the northwestern part of the country, since the climatic and vegetation conditions are very similar [13,24,38,39]. In addition, species such as *Sambucus canadensis*, *Baccharis salicifolia*, *Prosopis glandulosa* and *Larrea tridentata* are shared between both regions and reported in both investigations [18].

**Table 2.** Diversity of taxa with ethnobotanical applications recorded in northeastern (NE), north-western (NW), central-west (CW) and southern (S) Mexico.

	Locations	Families	Genera	Taxa	Habitats
NE, Mexico	Iturbide, Nuevo León	83	121	250	Oak-pine, desert scrub
NE, Mexico	Cumbres de Monterrey National Park (CMNP), Nuevo León; [26]	69	170	240	Oak-pine forest, and desert scrub
NE, Mexico	Rayones, Nuevo León; [27]	91	228	252	Mainly desert scrub, and oak-pine forest
NE, Mexico	Bustamante, Nuevo León; [25]	66	176	218	Desert scrub, oak-pine forest
NE, Mexico	Cuatro Ciénegas, Coahuila; [13]	57	132	158	Desert scrub
NW, Mexico	Sierra Juarez, Baja California; [48]	27	39	48	Desert homogeneous scrubland
CW, Mexico	Monarch butterfly Biophere Reserve, Michoacán; [49]	65	132	213	Oak-pine, pine forest
S, Mexico	Zapotitlán de las Salinas, Puebla; [50]	79	219	298	Different scrublands

NOTE: Column two represents the sites located in the Northeast region and other regions of the country, where other ethnobotanical works have been carried out, with which we have compared our results in terms of taxonomic richness (families, genera, and species).

### 3.2. Ethnobotanical uses

#### 3.2.1. Ornamental

The individuals interviewed showed a greater knowledge of the ornamental utilization of plants, recognizing 132 taxa, corresponding to 52.8% of the total, concerning the medicinal ones, with only 100 (Appendix A). This phenomenon differs from the results of other ethnobotanical studies conducted in Nuevo León [26,27], and other regions of Mexico [10,48,50]. Currently, the importance of ornamental plants is documented, for example, in Cuatrociénegas, Coahuila; where they are important in gardens and public squares [13]. As in Cuatrociénegas, in Iturbide the presence of ornamental plants is noticeable in streets and private properties. In addition, on weekends, plant vendors come to the area to sell exotic herbaceous and shrubby species, which is why the inhabitants of Iturbide use introduced ornamental species more, instead of native ones (Figure 2d-2f). This phenomenon is associated with the adaptation of the taxa to the environmental conditions of the place, as well as the care that the owners provide them. Therefore, ornamental plants have a socio-cultural relevance on the well-being of local inhabitants, through landscape beauty [51]. In addition, very possibly, as in the Sonoran Desert, they provide well-being in human health, through the release of biogenic organic compounds [18].

Among the exotic species, herbaceous plants (37) presented the highest frequency of mention, followed by trees (22) and shrubs (19; Appendix A). The most abundant herbaceous species were *Hypoestes phyllostachya*, *Dianthus caryophyllus*, *Cymbopogon citratus*, *Vinca minor*, *Zantedeschia aethiopica*, *Asparagus setaceus*, *Canna indica*, *Impatiens hawkeri*, *Tulipa gesneriana*, *Pelargonium hortorum*, and *Lavandula angustifolia*. The most abundant shrubs were *Lagerstroemia indica*, *Alcea rosea*, *Cascabela thevetioides*, *Lonicera japonica*, *Euphorbia milii*, and *Hibiscus syriacus*. Among the most frequently mentioned ornamental exotic trees in Iturbide were *Schinus molle*, *Cupressus lousitanica*, *Cupressus sempervirens*, *Thuja occidentalis*, *Sapium sebiferum*, *Punica granatum*, *Ficus carica*, and *Prunus persica*. In private gardens, it is common also to see orange, lemon, barreta, peach, and apricot trees as ornamental species. These taxa are commonly found also in many other areas and importantly, are being used in botanical gardens for ethnobotanical purposes [52].

Among the most common herbaceous native species appreciate ornamentally are *Beloperone gutatta*, *Spathiphyllum wallisii*, *Dahlia coccinea*, *Zinnia elegans*, *Commelina coelestis*, *Plumbago pulchella*, and *Nephrolepis exaltata*. The most common shrubs were *Rhus trilobata*, *Tecoma stans*, *Euphorbia pulcherrima*, *Bauhinia purpurea*, and *Parthenocissus quinquefolia*. Many of these taxa have similar ethnobotanical implications in other

regions of Mexico or in other regions of northern Latin America [53]. The most common native trees with ornamental use in Iturbide were *Acer negundo*, *Juniperus flaccida*, *Carya illinoensis*, *Juglans major*, *Magnolia grandiflora*, *Morus celtidifolia*, *Pinus cembroides*, *Casimiroa pringlei*, *Salix nigra*, *Fraxinus americana*, and *Quercus virginiana*. Of the ornamental species, 45 have other types of exploitation such as food, medicine, and construction material (Appendix A). Some of these species hold multiple ethnobotanical uses, such as *Matricaria recutita*, and different species of *Opuntia*, *Quercus*, *Prunus*, *Citrus*, and *Capsicum*. According to interviewees, ornamental herbaceous taxa are specially selected for their physiognomy. The selection of ornamental shrubs and trees is based on their general appearance, life form, maximum height and forms of exploitation, such as providing shade in cities, food, firewood, and construction material (Appendix A). Some shrubby or ornamental tree species with succulent stems are used as living fences, notably the columnar cacti [54].

### 3.2.2. Medicinal

Medicine was the second relevant anthropocentric category in the study, with 100 species, representing 40% of the total flora found. A value was raised considering that it is a mestizo region in comparison with the number of species reported for indigenous regions [1,2,7,49]. The mentioned taxa are used to cure or alleviate different illnesses. At least 36 different plant families have some medicinal application, with Asteraceae (16 genera and 16 species), Lamiaceae (12/13), Euphorbiaceae (5/5), and Cactaceae (3/6), being the most represented, the first families reported around the world [1,2,7]. These medicinal families are recurrent in different areas of Mexico [9,55]. In Iturbide, the plants are used in their entirety for some medicinal purposes (Figure 3c). Leaves from 67 different species are frequently used for medical purposes, of which 64 are native herbaceous species. Among the most common native herbaceous species mentioned by interviewees were *Equisetum laevigatum*, *Monarda citriodora*, *Chrysactinia mexicana*, *Hedeoma drummondii*, *Eryngium heterophyllum*, *Artemisa ludoviciana*, *Euphorbia dentata*, and *Tagetes lucida*. The most common exotic herbaceous species in local medicine were *Matricaria recutita*, *Ocimum basilicum*, *Allium sativum*, *Ruta graveolens*, and *Zingiber officinale* (Appendix A).

The stems of some shrubby species are frequently used as medicine, including *Baccharis salicifolia*, *Flourensia cernua*, *Croton suaveolens*, *Jatropha dioica*, and *Leucophyllum frutescens*. A total of 20 taxa of trees (11 native, and nine exotic) have medicinal properties, with the leaves, bark and fruits being the most used components. Among the most commonly mentioned medicinal native tree species were *Carya illinoensis*, *Juglans major* and *Persea americana*, while the most mentioned exotic species were *Azadirachta indica*, *Moringa oleifera*, *Eucalyptus camaldulensis*, *Eriobotrya japonica*, *Citrus limon*, and *Citrus sinensis*. The fruits of 12 taxa (seven native and five exotic) are used to heal several ailments. The most frequently used were *Cordia boisieri*, *Crataegus mexicana*, *Ficus carica*, *Citrus* spp., and *Capsicum annuum*. It is noteworthy that although only one species and one variety (*Capsicum annuum* var. *glabriusculum*) is mentioned, there are several forms of this species with varying flavors and levels of spice (Appendix A), which interviewees identified by their common names, such as chili piquín, Japanese chili, serrano pepper and jalapeño pepper (Appendix A). Some dry fruits (pecans) including *Carya illinoensis*, and the immature fruits of *Sida rhombifolia* and *Malva parviflora* are used to treat varicose veins and digestive discomfort. Species with medicinal fruits are commonly cultivated in private gardens, developing a dual role of utilization. Some of these are seasonal, as in the case of tejocote (*Crataegus mexicana*), níspero (*Eriobotrya japonica*) and guayaba (*Psidium guajaba*), although they can be dried or prepared as a syrup and stored for later use. Except for *Eriobotrya* fruits, medicinal fruits are collected and sold in the local market. The medicinal application of inflorescences is highly correlated to the use of stems and leaves, more frequently in herbaceous and aromatic species. Stems and leaves are almost always combined and boiled [55], particularly those of *Gnaphalium viscosum*, *Chenopodium ambosioides*, *Grindelia inuloides*, *Tagetes lucida*, *Hedeoma drummondii*, and *Turnera diffusa* [24]. The medicinal roots used in Iturbide all come from exotic plant taxa and are mainly used boiled or raw to

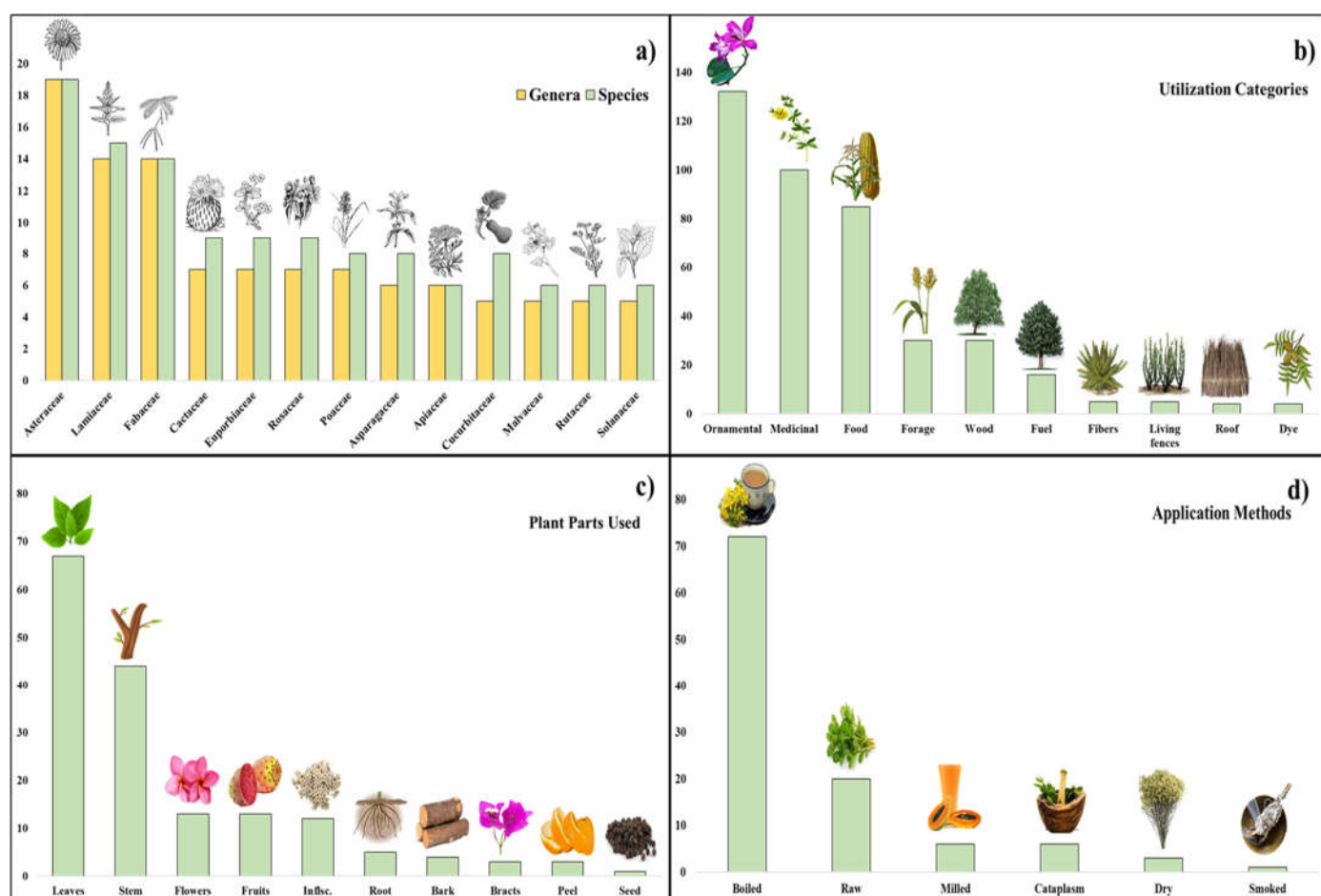


alleviate digestive ailments. These include *Lepidium peruvianum*, *Raphanus sativus*, *Aloe vera*, and *Zingiber officinale*. The root of the native plant *Eryngium heterophyllum*, is used to dissolve kidney stones and to treat hemorrhoids, diabetes, and high cholesterol [73]. Other native medicinal plants of Juglandaceae, *Juglans* (one species) and *Carya* (two species) are used as hair dye and also as antifungal and antibacterial agents, such antibacterial properties are proven [56].

Other medicinal treatments, involving the use of bracts and fruit shells, the boiled bracts of *Bougainvillea*, are frequently used to treat angina pain and cough, but they also have antibacterial and antidiabetic properties [57]. Lemon and orange peels, along with the leaves, are boiled and the solution is used to relieve chest pains, colds cough, and throat pain. Among the most common methods for the preparation of medicinal plants in Iturbide, it is highlighted boiling, grinding, creating poultice and consuming raw, the same use with same results, these applications are similar to others reported in scrub and desert regions in Mexico (Figure 3d, Appendix A, [58,59]).

The most frequent illnesses mentioned by the interviewees were digestive, respiratory, nervous, endocrine, and circulatory ailments (Table 3). This result correlates with the classification of diseases and related health problems recorded by the World Health Organization [60]. Digestive and respiratory ailments are mainly cured with boiled leaves in form of infusion. Almost all medicinal taxa recorded in Iturbide are prepared this way, and the majority of them are herbaceous and shrubby species belonging to the families Asteraceae (*Gnaphalium viscosum*, *Grindelia inuloides*, *Flourensia cernua*, *Matricaria recutita*, and *Tagetes lucida*), Euphorbiaceae (*Croton suaveolens*, *Euphorbia dentata*, and *Tragia ramosa*), as well as almost all genera of Lamiaceae, *Allium cepa*, *A. sativum*, *Moringa oleifera*, *Eucalyptus camaldulensis*, *Purshia plicata*, *Verbena canescens* and *Larrea tridentata*. On the other hand, raw leaves, stems, roots and fruits is the second most frequent way to alleviate symptoms. The most commonly harvested taxa are, *Apium graveolens*, *Eryngium heterophyllum*, *Kalanchoe daigremontiana*, *Rorippa officinale*, *Lophophora williamsii*, *Opuntia ficus-indica*, *Jatropha dioica*, *Psidium guajaba*, and *Larrea tridentata*. *Apium graveolens* roots are used also against the toxicity of trace elements [618]. *Kalanchoe daigremontiana* has antitumor, antihistamine and anti-inflammatory properties [62]. In addition to treating arthritis and muscle pain in the back and neck, *Lophophora williamsii* has compounds that produce hallucinations and cognitive impairment. In addition to hair dye and a skin antifungal agent uses, it is mentioned that the roots of *Jatropha dioica* are crushed and placed directly on the gums as a preventive method in tooth loss.

In many cases, medicinal plant parts are used raw and do not require preparation, those are only disinfected with chlorine and crushed or ground, then applied as poultices to heal superficial wounds. They are also chewed and consumed to control blood sugar concentration, cholesterol, and high blood pressure. Some local people mentioned that they consume garlic, onion, coriander and parsley periodically to reduce the risk of diabetes and high blood pressure. Raw stems of several Cactaceae are very commonly used to heal endocrine illnesses, digestive issues and low cholesterol; they are prepared by washing the cladodes (stems), removing the thorns, grinding the material and drinking the solution. The milled pulp (*Lophophora*) is frequently mixed with alcohol and marijuana to be used as a cataplasm to heal arthritis and muscle pain in the limbs, a very common method of healing in Mexican culture [13, 59]. A variety of plant families are prepared as poultices, including most of their parts, used in different ways: boiled, ground and raw. In Iturbide, one of the most common genera prepared in this way is *Amphipterygium*, whose bark is boiled and applied as a cataplasm to serve as an antibiotic. Its bark is used to prevent cytotoxic proliferation, as an antibacterial agent [63], and to heal gastritis and stomach pains. The leaves of plants in the genus *Buddleja* are used as a cataplasm to heal epidermic wounds, these taxa, they have photoprotective effects on the skin, due to their production of secondary phenolic metabolites [64]. *Opuntia* and *Cylindropuntia* stems are commonly used as forage, food and poultice in Iturbide, but also to treat diarrhea.



**Figure 3.** (a) Best represented families, in terms of genera (in yellow) and species (in green) of ethnobotanical importance in the study site (Iturbide, Nuevo León, Mexico), (b) Main ethnobotanical uses of plants registered in the flora, according to the interviewed, (c) Number of mentions of the plant part used to heal ills and diseases by the interviewed individuals, (d) Identified methods by the interviewed for the medical use of the sampled species in Iturbide, Nuevo León.

A solution of *Lophophora* stems mixed with alcohol is common in rural areas to treat arthritis in northern Mexico, but is also traditionally used as a hallucinogen [65]. Similarly, female *Cannabis inflorescences* are mixed with alcohol and used as a poultice to relieve arthritis and muscle pains, and the dried inflorescences are also smoked for recreational purposes [13]. The former use may be closely related to the fact that the contents of flavonoids, cannabinoids, and terpenoids reportedly have anti-inflammatory, anticancer and neuroprotective properties [66]. Leaves from *Thymus* genus are frequently used to relieve respiratory and gastrointestinal ailments and skin infections. However, currently, derivatives from its essential oils are more widely used due to their reported antimicrobial and anticancer effects [67]. In Iturbide, *Melia* has properties to cure gastrointestinal symptoms, and *Melia* leaves in cold water have also been reported to cure diarrhea in South Africa [68]. Similarly, raw or boiled *Lycopersicon* fruits are used as a poultice for their antibacterial, antifungal and antiviral properties derived from its peptides. Parts of *Jatropha dioica* are crushed and milled, and the resulting pulp is applied directly to the hair, due to its black dyeing property, it is also used to prevent hair loss, control dermic head infections (dandruff) and it is frequently used as a shampoo. Its antifungal properties are due to the presence of alkaline esters, and certain diterpenes such as: citralitriene, jatropha-triene, jatropha-lone A, and jatropha-lone B, present in stems and roots [69].

Traditional medicinal use of *Plectranthus coleoides* occurs from the drying drying, grinding it with glycerine, and spreading it on the chest and nostril, to treat respiratory problems such as: chest pain and runny nose, among others. Other species of this genus also have a medicinal application to treat toothache, dermatitis, throat pain, antiseptic,

vomiting, nausea, ear infections and burns. Blending *Capsicum annuum* fruits in water generates a relatively spicy solution that is consumed to treat coughs and extract phlegm. Other studies have reported that it is effective as a circulatory stimulant, and that can be also used as an antioxidant, anti-inflammatory, and gastric anticancerigen [70]. The plant parts of some taxa are used completely dry; the most commonly used in Iturbide are *Larrea tridentata* to treat foot odor, and three species of Lamiaceae, *Monarda citriodora*, *Hedeoma drummondii*, and *Poliomintha longiflora*, whose dry leaves and branches are put under the pillow at night to reduce the effects of insomnia. *Monarda citriodora* is also used to treat wounds, skin infections, regulate body temperature and against diseases of the respiratory system. *Hedeoma drummondii* is used to treat infections and sore throats (Appendix A).

### 3.2.3. Food

The edible category was the third most common plant exploitation in Iturbide with 87 species (45 native and 42 exotic species; Appendix A), a considerable number with respect to other ethnobotanical works [3,6]. Most consumed plants are herbaceous (48 species), followed by trees (21), shrubs (14), and succulents (4). The parts of the plant with the greatest use are the fruits followed by leaves, seeds, roots and flowers. The most frequently consumed fruits belong to introduced species such as *Mangifera indica*, *Ananas comosus*, *Citrullus lanatus*, *Cucumis melo*, *Cucurbita ficifolia*, *Ficus carica*, *Malus domestica*, *Prunus* spp., *Citrus* spp. The fruits of several common native taxa are also used, including *Celtis pallida*, *Carica papaya*, *Cucurbita moschata*, *Persea americana*, and *Physalis philadelphica*. Several of these species are widely used as food and are also traded in food markets in Mexico [9,10,20], as well as in many other parts of the world.

Many of the fruit trees that are commonly consumed in northeastern Mexico [10,13,25-27] are part of relatively large gardens, which also contain various applications, such as providing shade, beauty and food. This pattern is observed in Iturbide, where fruit trees such as *Punica granatum*, *Prunus persica*, *Malus domestica*, *Citrus limon*, *Ficus carica*, *Persea americana*, and *Eriobotrya japonica* are common, and all species are exotic (Appendix A).

Other taxa with an edible exploitation are *Apium graveolens*, *Spinacea oleracea*, *Coriandrum sativum*, *Origanum mejorana*, and *Petroselinum crispum*; similar uses have been reported in Italy [71]. The leaves of two exotic taxa are frequently used raw as ingredients in salads or are cooked with other species, *Portulaca mundula* (verdolaga) and *Portulaca oleracea*. *Portulaca mundula* is very common in Iturbide, it grows in abandoned farm fields and on sidewalks and roadsides. *Portulaca oleracea* is considered a “medicinal food”, due to its richness in omega-3 polyunsaturated fatty acids [72]. *Rorippa officinale* (berro) grows in urban riparian systems and is consumed raw or cooked. It is suggested that its consumption can potentially reduce the probability to get cancer [73] due to its antioxidant activity [74].

Seeds are the third most commonly consumed plant part in Iturbide as food. The most important seed-producing species in the area are *Phaseolus vulgaris* (beans) and *Zea mays* (corn). These important food products are part of Mexican diets nation-wide, which have been cultivated and consumed since pre-Hispanic times [75]. The bean, of Mesoamerican origin [76], is considered the most important domesticated legume in America and together with *Zea* and *Cucurbita* constitutes the widespread food triad of the Mesoamerican culture. *Phaseolus vulgaris*, is currently distributed throughout the globe, occupying other cultural roles, for example, in the Republic of Benin, it also has religious, forage, and medicinal uses, the medicinal of which is derived from the leaves, and seeds [77]., in Morocco, *Zea mays* is also commonly used a medicinal species, since this species has been popular for curing diseases of the genitourinary system [78].

The seeds of *Pinus cembroides* are commonly used as food and as an ingredient in various regional candies. Historically, the seeds of pinyon pine (piñonero) have been used by indigenous tribes of the southern USA and northern Mexico. They are rich in protein,



low in starch and contain seven of the nine essential amino acids, they are especially rich in cystine and tryptophan [79].

Other introduced taxa whose seeds are widely used as a complementary part of the diet belong to the Leguminosae and Poaceae families. *Lens culinaris*, *Pisum sativum*, *Cicer arietinum* and *Avena sativa* have been historically used as food [80], and they are widely consumed around the world [81,82]. These seeds function as nutraceuticals, e.g. *A. sativa*, which contain several groups of psychoactive phytochemicals that have been shown to improve cognitive function [83].

In addition to seeds, the roots of several taxa are used in meal preparation, especially *Solanum tuberosum* (papa), *Ipomoea batatas* (camote), *Pachyrhizus erosus* (jícama), and *Daucus carota* (zanahoria). There are several Neotropical legumes with edible roots including *Vigna*, *Pedimelum*, *Apios* and *Pachyrhizus*. Of these only *P. erosus*, a species native to Mexico, is widely cultivated in gardens or for export. It is cultivated throughout Mesoamerica, and with a strong introduction in southeast Asia [84]. The potato *Solanum tuberosum* is an important food for the people of Iturbide, it is grown, but it is mainly bought in stores and supermarkets. Two native root species are used to make alcoholic beverages: *Dasyllirion* and *Agave*. In addition, the sap of *Agave americana* is widely harnessed in Mexico for the extraction of “agua miel” (honey water, raw) or syrup or honey (cooked, [85]). *Dasyllirion* is utilized for the manufacture of “sotol” (alcoholic beverage) and its leaves in many parts of Mexico are used for making handicrafts, in the specific case of Rarámuri women for crafting baskets [86].

Within the Cactaceae family, the flowers of two native species *Yucca*, *Y. treculeana* and *Y. filifera*, are collected seasonally and cooked with eggs to increase the flower’s protein content [87]. These are also cooked with chili, tomato and onion to prepare a classic regional dish from the Northeast of the country [25-27]. The stems of the native *Echinocactus platyacanthus* (biznaga burra) are cooked with white and brown sugar to make crystalized candies, this plant also has ornamental and medicinal uses [88] and serves as fodder for goats [25-27]. These practices are currently prohibited and regulated by Mexican legislation (NOM-059-SEMARNAT-2010). The stems of *Opuntia* are widely utilized for food or forage, *Opuntia ficus-indica* is a cactus of cultural and economic importance, due to its multiplicity of uses, typical of its long history of domestication [89]. Many other *Opuntia* species produce sweet fruits (tunas) which are sold in markets throughout Mexico and worldwide [90].

#### 3.2.4. Forage

Given that cattle raising and farming are common occupations in Iturbide, ranchers cultivate or collect forage to feed domestic livestock instead of purchasing it. Forage almost always consists of native plants when livestock is grazed in open areas, compared with a mixed diet of native and exotic species when livestock are kept within town limits.

We registered at least 30 forage taxa where the consumed material consists mainly of leaves and fruits. Several Cucurbitaceae including *Cucurbita mochata*, *C. pepo*, *C. ficifolia*, *Citrullus lanatus*, *Cucumis melo*, and *C. anguria* are utilized for food, but also, the dry leaves and fruit peel of them are given to the cattle as fodder, same practices carried out in Yucatan, Mexico (*Cucumis anguria*, common name: meloncillo, [91]). Another example is the use of two cultivated species of *Cucurbita* (*C. pepo* and *C. moenchii*), which are an important part of traditional farming polyculture systems called milpas (the milpa is a farming system made up of the so-called triad: corn, beans and squash), these species help control erosion, and maintaining moisture by limiting solar penetration through the canopy and reducing the growth of weeds. The most common way to feed livestock is after harvesting the fruit, it is common to introduce directly (cows, pigs, sheep, or goats) to feed on plant debris.

Several Poaceae such as *Sorghum bicolor*, *S. halepense* and *Bouteloua curtipendula*, are among the most common forage species used to feed cattle. *Sorghum halepense* has become a pest species in both natural and agricultural areas and due to its abundance, it is often used as forage in Iturbide. It is considered the sixth weed with the highest rate of invasion

to different crops in more than 50 countries, and affecting millions of hectares [92]. In Iturbide, this species is not a pest since the climate is not suitable for its development. Other forage species are: *Carya illinoensis* and *Juglans major* that are collected after falling from the tree and given to cattle. On the other hand, taxa frequently found in abandoned farmlands and used as grazing areas are *Chenopodium ambrosioides* and *Amaranthus palmeri* (both *Amaranthaceae*), *Helianthus annuus* and *Taraxacum officinale* (both *Asteraceae*), *Turnera diffusa* (*Turneraceae*), *Acalypha hederacea* (*Euphorbiaceae*), and *Arachis hypogaea* (*Fabaceae*).

Other multipurpose shrubs are widely used also as forage. The leaves of *Rhus virens*, *Calliandra conferta*, *Prosopis glandulosa*, and *Vachellia farnesiana* constitute an important part of the diet of domestic animals in the region. As well as the dry or fleshy fruits of several native shrubs and trees such as *Cordia boissieri*, *Diospyros palmeri*, *Quercus virginiana*, *Quercus canbyi*, *Quercus polymorpha*, *Prosopis glandulosa*, and *Vachellia farnesiana* (Appendix A), which are used as seasonal forage. The fruits of other taxa such as *Diospyros* spp. are used in similarly way in Ethiopia [93]. The acorns from *Quercus* spp. are used as food in Slovakia [94] and at least seven other species of *Cordia* have edible fruits and are utilized in the same way in Mexico [95]. Two species of *Cactaceae* that are important in the diet of cattle are the native *Opuntia ficus-indica* and *O. lindheimeri*. Both are cut with a machete and their thorns scorched to provide easy, efficient, cheap and nutritious livestock feed. *Opuntia* spp. are extremely useful livestock forage, providing digestible energy, vitamins, and water; although they are mainly used for cattle, this species is also used as forage for pigs.

### 3.2.5. Construction and fuel

Of the 30 taxa ethnobotany harnessed for construction, 80% are trees. Also, 27 of these species are native, exception of *Cupressus lousitanica*, *C. sempervirens*, and *Thuja occidentalis*. Only four shrub species, *Rhus virens*, *R. trilobata*, *Agave americana*, and *A. aff. scabra* is used for construction. The wood of the first two species is mainly used to make tools for use in the home or for agricultural activities such as handles for brooms, machetes, rakes and hoes. The huge, dried peduncles (called quiote) of *Agave* inflorescences are used as gates on rural properties, livestock guards, and clothesline supports. Since the houses and buildings in Iturbide are entirely made of concrete, and the gas is utilized as a heat source, wood is used mainly to build storage rooms, columns and ceilings for rest rooms, corrals and chairs. In northern Mexico, wood is stored to be used as fuel for barbecuing and to heat water for bathing. Wood from conifers (e.g. *Pinus*, *Cupressus*, *Juniperus*, and *Thuja*), *Fabaceae* (*Prosopis* and *Vachellia*), and oak (*Quercus*) is the most frequently used as a heat source due to their hardness and durability. In Turkey, the wood of conifers and oaks such as *Cupressus*, *Juniperus*, *Pinus*, and *Quercus* are used also as firewood and to make fences [96]. The wood of *Helietta parvifolia* is very hard, durable and resistant to pests, which makes it excellent for use as fence posts that last up to 20 years [25,27]. *Prosopis laevigata* and *Vachellia farnesiana* are among the 33 multipurpose species; their branches are used for fuelwood and fodder. The stems of *Fouquieria splendens* are cut, allowed to dry for several weeks and used to make pens for chickens or pigs; some species of this genus also have ornamental uses because of the beauty of their flowers. DNA sequencing of coprolites has shown that our prehistoric ancestors also consumed *Fouquieria* plants [97]. The wood of *Carya* is used to make chairs, tables, and benches. Its wood is excellent for use in tool handles because of its strength and shock resistance. This species is considered the most important nut tree native to North America. Its nuts are also a high-quality food source due to their high protein and fat contents.

### 3.2.6. Fibers

The exploitation of natural fibers has decreased dramatically in northeastern Mexico. Interviewees in Iturbide noted that it is not economically lucrative to sell goods made from natural fibers. Very few people work with plant fibers as a permanent job, but those who do use *Agave lechuguilla*, *A. americana*, *Yucca carnerosana*, and less commonly, *Hechtia*

*podantha*. The fiber collection and handling process remain the same as it was 50 years ago: (1) travel to locate and collect the plant, (2) bundle it, (3) use a mule or donkey to transport it, (4) extract the fiber with relatively artisanal instruments, and (5) dry it to sell the fiber.

### 3.2.7. Live fences

The construction of living fences in rural areas of northern [25,27] and southern [98] Mexico is common and has several objectives. Live fences serve as a barrier to natural elements and prevent entry to private property. The utilization of live fences is less expensive than the construction of block and cement fences, and it contributes to the beautification of the property. Due to their large size, uniform structure and durable leaves and thorns, the succulent species of the Asparagaceae, Cactaceae and Fouquieriaceae families are the most frequently used as live fences. The most used taxa in Iturbide are *Myrtillocactus geometrizans*, *Agave americana*, *Yucca filifera*, *Y. treculeana* and *Fouquieria splendens*. The rich diversity of columnar cacti used as living fences is manifested in the south-central region of southern Mexico, where at least 14 taxa of cacti are exploited as components of living fences: *Escontria chiotilla*, *Myrtillocactus geometrizans*, *M. schenkii*, *Pachycereus hollianus*, *Polaskia chende*, *P. chichi*, *Stenocereus griseus*, *S. stellatus*, *S. treleasei*, *S. fricii*, *S. queretaroensis*, *S. quevedonis*, *S. beneckeianus*, and *S. satnaeii* [99]. The light green and yellow-bordered leaves of *A. americana* var. *americana* can reach up to 2.5 m in length and their scape (peduncle) can measure up to 4.5 m in height with extremely showy inflorescences in yellow panicles that attract multiple pollinators. *Agave americana* is also cultivated in Ecuador as a live fence to delimit land for grazing and farming [97]. The flowers of this and other species of *Agave* are eaten cooked, including *A. salmiana* and *A. mapisaga* (called “gualumbos”), both species are two of the most commercialized flowers and with the largest number of ways of cooking in popular cuisine of origin Otomí, in the Center of Mexico (Pachuca, Hidalgo; [100]).

When live fences are constructed by planting *Yucca* plants directly adjacent to one another, they form a practically insurmountable barrier. Their resistant stems and thorny, leathery leaves cannot be easily broken by domestic cattle, and they reach up to 4 m in height. In addition, their flowers are edible and provide delicious seasonal food; which is also consumed in the Center of the country in the State of Hidalgo [100]. In drier areas of Iturbide, dried stems from *Fouquieria splendens* are widely used as barriers, for instance, to fence goats and chickens.

### 3.2.8. Dye

Natural dyes obtained from plants have been widely used in Mexican since the pre-hispanic era. Indigenous cultures in the western United States have used various plant species as dyes [98], several of which are also found in Iturbide, including *Arundo donax*, *Cucumis melo*, *Gutierrezia sarothrae*, *Juglans major*, *Juniperus deppeana*, *Larrea tridentata*, *Opuntia engelmannii*, *Phaselus vulgaris*, *Prunus persica*, *Taraxacum officinale*, and *Zea mays*. In Iturbide, we have registered the use of five species with dyeing properties (Appendix A). The leaves, branches and fruits of species of Juglandaceae (*Carya* and *Juglans*) are boiled in water to create black or dark brown dye used to color hair. In eastern North America, *Juglans cinerea* is used as a dye, but also in construction as veneer, wood carvings, furniture and cabinetry [101]. The ripe and raw fruits of *Hylocereus undatus* (Cactaceae) and *Morus celtidifolia* (Moraceae) provide intense bright red and dark purple colors of great beauty which are used directly or boiled in water to create dye for clothes, tablecloths and fibers. Currently, in Iturbide, the use of these techniques is sporadic and practiced by very few people, especially older adults from neighboring towns who continue practicing artisan staining methods. The betacyanins extracted from the fruit of *Hylocereus polyrhizus* are used as a natural colorant in the manufacture of traditional ice cream; its application causes color changes in the raw material, similar to artificial colorant, having greater acceptability than the artificial colorant [102].



### 3.2.9. Roof

Dry leaves of Arecaceae species such as *Washingtonia* and *Brahea* and stems of Poaceae such as *Bambusa* and *Arundo* are excellent elements for making roofs. The leaves are intertwined or spliced one on top of the other and tied, the large interwoven surface that the leaves provide creates an effective barrier against sun, wind and rain. The stems of the grasses *Bambusa* and *Arundo* are cut to a homogeneous size and tied with twine to create roof panels, although these are more fragile and less resistant to inclement weather, however, they are common in many of Itubide's house. This custom extends in the northwestern region of Mexico (Sonora), where in addition to roofing houses, brooms are made. Their trunks (*Bambusa*) are also used for construction, and the fruit, the palm heart for food [103].

### 3.3. Quantitative ethnobotanical indices (IFC, UVI, FL)

Nowadays, the harnessed botanical taxa and the importance that people give to the medicinal properties are relevant factors to determine the ethnobotanical value of the regional flora [1,4,5,6,13,20,24,55]. According to the number of uses recorded for the different ailments, the highest IFC values were obtained for the respiratory (0.92), genitourinary (0.91), ophthalmic (0.90), digestive (0.89), and nervous (0.88) systems (Table 3). These systems represent the main health problems recognized by the World Health Organization (WHO, [60]), as well as in research on the documentation of traditional medicine [1,2,7]. Among the taxa that had the most mentions to heal respiratory illnesses were those from the families Lamiaceae, (*Ocimum basilicum*, *Mentha piperita*, *Monarda citriodora*), Asteraceae (*Tagetes lucida*), Liliaceae (*Allium sativa*) and Rutaceae (*Citrus limon*). These taxonomic families are reported for others traditional peoples in different parts of the world, e.g. in the Himalayas, Amazon, and Australia. This is because plant families share common biochemistry (chemosystematics), which helps us understand traditional ethnobotanical knowledge around the world [104].

Few species were cited for the treatment of genitourinary and circulatory diseases, but those seemed to be particularly effective, especially *Turnera difussa*, *Eryngium heterophyllum*, and *Equisetum laevigatum*. The most commonly mentioned species included *Eryngium heterophyllum*, which has proven to be an excellent remedy for high cholesterol levels [105], and the multipurpose medicinal species *Petroselinum crispum*, which is used as a diuretic, a carminative, a gastronomic agent, an anti-inflammatory, these properties of the plant have been corroborated in formal studies [106]. Moreover, this species is used to treat amenorrhea, cardiac disease, gastrointestinal disorder, hypertension, urinary disease, otitis, nasal congestion, diabetes and several dermal diseases. It is worth noting that, although there are only three species used for the cure of ophthalmic ailments, *Matricaria recutita*, *Echeveria simulans*, and *Sedum palmeri*, they are invariably used for that particular purpose. Although the IFC value for the gastrointestinal system ranked fourth, it is almost quantitatively equal to the respiratory, genito urinary, and ophtalmic systems.

**Table 3.** The diseases mentioned by Iturbide's informants were classified into 10 categories, based on the WHO International Statistical Classification of Diseases and Related Health Problems [60]. Each category presents a variation in the frequency of mention (nt), therefore, different values in the Informant Consensus Factor (IFC) index.

Category of use (system)	Number of species mentioned (nt)	nur	FIC
Digestive (XI)	29	259	0.89
Respiratory (X)	20	249	0.92
Skin and subcutaneous (XII)	17	38	0.57
Endocrin (IV)	16	74	0.79
Circulatory (IX)	13	73	0.83
Nervous (VI)	13	99	0.88
Musculoskeletal (XIII)	11	38	0.73
Infectious (I)	8	61	0.88
Genitourinary (XIV)	6	57	0.91
Ophtalmic (VIII)	3	22	0.90

**Table 4.** Plant species with medicinal uses that obtained the highest UVI values in Iturbide, Nuevo León, Mexico. The letter 'E' and 'N' refer to the Exotic and Native origin of each species, respectively.

Scientific name	UVI	Origin
<i>Lepidium peruvianum</i> G.Chacón	3	E
<i>Ocimum basilicum</i> L.	2.4	E
<i>Rosmarinus officinalis</i> L.	2.29	E
<i>Mentha piperita</i> L.	2.25	E
<i>Cinnamomum verum</i> J.Presl.	2.06	E
<i>Plectranthus coleoides</i> Benth.	2	E
<i>Thymus vulgaris</i> L.	2	E
<i>Citrus sinensis</i> (L.) Osbeck	2	E
<i>Amphipterygium adstringens</i> (Schltdl.) Standl.	2	N
<i>Conyza filaginoides</i> (DC.) Hieron	2	N
<i>Taraxacum officinale</i> (L.) Weber ex F. H.Wigg.	1.86	E
<i>Psidium guajava</i> L.	1.86	N
<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry	1.75	E
<i>Eucalyptus camaldulensis</i> Dehnh.	1.73	E
<i>Zea mays</i> L.	1.72	N

The Use Value (UVI) is interpreted as the potential use of a particular species that is used to cure or counteract a specific ailment. Therefore, higher values determine the frequency of medicinal species [13]. In our study, it is interesting to note that the highest UVI values were obtained for exotic species, which reflects the importance of their inclusion in the traditional medicine of the Iturbide residents.. The species in order of incending importance are *Lepidium peruvianum* (3), *Ocimum basilicum* (2.4), *Rosmarinus officinale* (2.29), *Mentha piperita* (2.25), *Cinnamomum verna* (2.06), and *Plectranthus coleoides* (2, Table 4). The native species with the greatest UVI values were *Conyza filaginoides* (2), *Psidium guajava* (1.86), and *Zea mays* (1.72). All interviewees mentioned that *Lepidium peruvianum* relieves gastrointestinal, endocrine (prostate), and urinary (kidney) ailments.

The other mentioned species, especially those belonging to the Lamiaceae family, are frequently cited in the literature as having medicinal properties, especially to treat ailments of the respiratory system [107]. A total of 17 medicinal taxa obtained 100% of Fidelity Level. These plants were the most commonly mentioned to heal a specific type of disease. A total of 13 medicinal taxa with the highest Fidelity Level are native and four are exotic, with the families Asteraceae [108] and Lamiaceae [107] being the most well-represented (Table 5). Moreover, at least 11 families are used for medicinal purposes (Appendix

A), and the fact that almost all species used have a fidelity level of 100% indicates that these species are quite well known for their healing properties. The taxa with the highest number of mentions were *Equisetum laevigatum*, *Turnera diffusa*, *Artemisia ludoviciana*, *Flourensia cernua*, *Ficus carica*, and *Verbena canescens*.

**Table 5.** The highest values obtained in the Fidelity Label (FL%) index determine the ethnobotanical species with greater relevance in the medicinal categories. Its weighting is given from the number of informants who mention the species *i* to cure a specific disease (Ip), with respect to the frequency of mention of the mentioned species (Iu).

Plant species	Ailment	Ip	Iu	FL(%)
<i>Chenopodium ambrosioides</i> L.	Gastro-intestinal system	16	16	100
<i>Eryngium heterophyllum</i> Hemsl. & Rose	Circulatory system	15	16	94
<i>Artemisia ludoviciana</i> Nutt.	Gastro-intestinal system	17	17	100
<i>Calea oliveri</i> B.L.Rob. & Greenm.	Gastro-intestinal system	14	14	100
<i>Chrysactinia mexicana</i> A. Gray	Gastro-intestinal system	18	18	100
<i>Flourensia cernua</i> DC.	Gastro-intestinal system	17	17	100
<i>Gnaphalium viscosum</i> Kunth	Respiratory system	14	14	100
<i>Equisetum laevigatum</i> A. Braun	Genito-urinary system	28	28	100
<i>Hedeoma drummondii</i> Benth.	Nervous system	16	16	100
<i>Monarda citriodora</i> var. <i>austromontana</i> (Epling) B.L.Turner	Respiratory system	24	26	92
<i>Punica granatum</i> L.	Gastro-intestinal system	14	14	100
<i>Ficus carica</i> L.	Endocrin system	17	17	100
<i>Moringa oleifera</i> Lam.	Endocrin system	9	9	100
<i>Purshia plicata</i> (D.Don) Henr.	Gastro-intestinal system	10	10	100
<i>Citrus x limon</i> (L.) Osbeck	Respiratory system	16	16	100
<i>Turnera diffusa</i> Willd. ex Schult.	Genito-urinary system	19	19	100
<i>Verbena canescens</i> Kunth	Nervous system	17	17	100

## 5. Conclusions

Iturbide presents a high biocultural diversity of ethnobotanical taxa, this diversity is made up of native and exotic species, in general, it is very similar to that of other nearby areas with similar climate, relief and vegetation in the state of Nuevo León [13,24-27], for the Northeast zone [59], the Northern macro-region [48,86], and general for arid and semi-arid zones in Mexico [50]. In addition, this diversity at the local level has a relationship with the variation of altitude within Iturbide, being possible to find several types of vegetation, including scrub vegetation at lower altitudes, and coniferous forests at higher altitudes, forming an ecotone between these vegetations. This heterogeneity means that there are no differences in its diversity, even concerning pine-oak forest sites [49].

Comparing the level of knowledge and use of ethnobotany in Iturbide, and the significance with respect to other sites shown in the investigation. We can conclude that there is a strong cultural attachment to native and exotic flora; and it is complete with a multi-functional roll. The traditional ethnobotanical knowledge of the local inhabitants of the Iturbide mestizo region is highly important. Our results contribute to the ethnobotanical biocultural diversity in Northeast Mexico, and in general the North of the country. We maintain that the knowledge and practices of plants use in rural mestizo regions, in arid and semi-arid zones, as well as in transition zones, are as relevant as those rooted in localities of indigenous tradition and high biological diversity.

In the study site, the inclusion of exotic species concerning to the native ones is important, this has also been reported in other localities of the region [13]. This pattern demonstrates the learning capacity of local communities in the face of the entry of new plant species, creating new knowledge and taking advantage of them, and even promoting a phenomenon of co-evolution.



Both native and exotic plants play a multifunctional role, taking advantage of various anthropocentric categories, and highlighting the ornamental use. Regarding the ornamental flora, it shows the abundance of species for this purpose, which are cultivated in public parks and private gardens. This phenomenon has been documented in other localities [13], and its relevance is associated with the population's interest in mitigating solar radiation, enhancing the landscape beauty of arid and semi-arid areas; contributing significantly to the reduction of stress caused by climate change, improving physical and emotional human health and well-being [18].

Despite showing cultural changes, where medicinal and food plants go into the background, after being more relevant for their role in primary human functions, they continue to be important and are used to cure a series of diseases. Interestingly, species with higher use value (UVI) are introduced, further promoting these cultural changes and meeting new health needs of local residents. However, the level of fidelity (FL) maintains certain native species to address problems with the digestive and respiratory systems. Regarding edible plants, these are seasonal and continue to be included in the local gastronomy. All this shows that traditional knowledge, despite undergoing adaptations, continues to prevail and is transmitted from generation to generation. However, they are at risk from the increasing loss of the younger population.

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**Appendix A.** Families, genera, species and their uses in Iturbide, Nuevo León, Mexico. The letter after author name indicates: N = Native, E = Exotic. The collection number belongs to Eduardo Estrada (EE).

Scientific name	Common name	Uses (system)	Part used	Method of use
<b>ACANTHACEAE</b>				
<i>Hypoestes phyllostachya</i> Baker, E, EE25323	Paleta de pintor	Ornamental	Whole plant	Planted in private gardens
<i>Beloperone gutatta</i> Brendegee, N, EE25325	Camarón	Ornamental	Whole plant	Planted in private gardens
<b>ACERACEAE</b>				
<i>Acer negundo</i> L., EE25383	Maple	Ornamental	Whole plant	Planted in public parks and private gardens
<b>ACTINIDIACEAE</b>				
<i>Actinidia deliciosa</i> (A.Chev.) C.F.Liang & A.R.Ferguson, E, EE25447	Kiwi	Food	Fruit (pulp)	Raw
<b>ADOXACEAE</b>				
<i>Sambucus canadensis</i> L., N, EE25384	Sauco	Ornamental	Whole plant	Planted in public parks and private gardens
		Medicinal (respiratory system)	Inflorescences and flowers	Boiled, drink the infusion
<b>AMARANTHACEAE</b>				
<i>Amaranthus palmeri</i> S.Watson, N, EE25326	Quelite	Food	Leaves and inflorescences (young)	Cook with oil or raw (previously disinfected with chlorine in water)
		Forage	Whole plant	Raw
<i>Beta vulgaris</i> subsp. <i>adanensis</i> (Pamukç.) Ford-Lloyd & J.T. Williams, E, EE25448	Betabel	Food	Leaves	Boiled, lique
		medicinal (gastrointestinal system), detoxify the gut	Leaves	Raw, boiled or cooked
		Dye	Root	Raw, squeezed
<i>Beta vulgaris</i> L. var. <i>cicla</i> L., E, EE25371	Acelga	Food	Leaves	Raw, boiled or fried.
<i>Chenopodium ambrosioides</i> L., N, EE25324	Epazote	Food	Leaves, inflorescences and flowers	Boil or cook with beans (to add flavor)
		Medicinal (gastrointestinal system), to eliminate intestinal worms	Leaves, stems, inflorescences and flowers	Boiled, drink the solution
		Condiment	Leaves and stems	Dry, crushed, added to flavor the food
		Forage	Whole plant	Raw
<i>Spinacia oleracea</i> (L.) E.H.L.Krause, E, EE25449	Espinaca	Food	Leaves	Raw (previously disinfected with chlorine in water)
		Medicinal (gastrointestinal system)	Leaves	Lique, raw, to eliminate amoeba.
<b>AMARYLLIDACEAE</b>				
<i>Crinum asiaticum</i> L., E, 25450	Lirio listado	Ornamental	Whole plant	Planted in private gardens

<i>Clivia miniata</i> (Lindl.) Bosse, E, EE25451	Clivia	Ornamental	Whole plant	Planted in private gardens
<b>ANACARDIACEAE</b>				
<i>Amphipterygium adstringens</i> (Schltdl.) Standl., N, EE25452	Cuacharalate	Medicinal (dermic system), antiseptic, antibiotic	Bark	Boiled, used as cataplasm, wound washing
<i>Mangifera indica</i> L., E, EE25454	Mango	Food	Fruit	Raw, and mixed with green salads
		Ornamental	Whole plant	Planted in private gardens
<i>Rhus trilobata</i> Nutt., N, EE25455	Lantrisco, jobo	Ornamental	Whole plant	Planted in private gardens
		Construction	Trunks and branches	Dry, to make columns of houses, tools and fuel
<i>Rhus virens</i> Lindh. ex A. Gray, N, EE25456	Lantrisco	Construction of tools and fuel	Trunks and branches	Dry, to make columns of houses, tools and fuel
		Forage	Leaves	Raw
<i>Schinus molle</i> L., E, EE25457	Pirul	Rites (soul cleansing) and religion	Small branches and leaves	The leaves are rubbed all over the individual's body while praying
		Ornamental	Whole plant	Planted in private gardens
<b>ANNONACEAE</b>				
<i>Annona muricata</i> L., N, EE25453	Guanábana	Food	Fruit	Raw, or liqued to make fruit drinks
<b>APIACEAE</b>				
<i>Apium graveolens</i> L., E, EE25327	Apio	Food	Leaves	Raw, in salads
		Medicinal (blood system), low cholesterol	Leaves and stems	Raw
<i>Coriandrum sativum</i> L., EE25328	Cilantro	Food (condiment)	Leaves	Raw or cooked in broth
<i>Cuminum cyminum</i> L., E, EE25329	Comino	Food (condiment)	Seeds	Cooked with rice and meat
<i>Daucus carota</i> L., E	Zanahoria	Food	Root	Raw or cooked with different vegetables
<i>Daucus carota</i> L., E, EE25330	Hierba del sapo	Medicinal (urinary system), dissolve kidney stones	Leaves and stems	Boiled, drink the solution
<i>Eryngium heterophyllum</i> Hemsl. & Rose, N, EE25504	Perejil	Medicinal (blood system), Low cholesterol and triglycerides	Root	Boiled, drink the solution
		Food	Leaves and stems	Raw or cooked with different vegetables
<i>Petroselinum crispum</i> (Mill.) Fuss, E, EE25331		Medicinal (Urinary system)	Leaves	Prevent bladder infections
		Medicinal (blood system)	Leaves	Purifies the blood
<b>APOCYNACEAE</b>				
<i>Cascabela thevetia</i> (L.) Lippold, E, EE25503	Cascabel	Ornamental	Whole plant	Planted in private gardens
<i>Plumeria rubra</i> L., N	Ramo de novia	Ornamental	Whole plant	Planted in private gardens
<i>Vinca minor</i> L., E, EE25220	Teresita	Ornamental	Whole plant	Planted in private and public gardens
<b>ARACEAE</b>				
<i>Spathiphyllum wallisii</i> Regel, N, EE25502	Cuna de Moisés	Ornamental	Whole plant	Planted in private gardens
<i>Anthurium magnificum</i> Linden, N, EE25501	Anturio, lampazo	Ornamental	Whole plant	Planted in private gardens



<i>Zantedeschia aethiopica</i> (L.) Spreng., E, 25500	Alcatraz	Ornamental	Whole plant	Planted in private gardens
ARECAECEAE				
<i>Brahea berlandieri</i> (Kunth) Mart., N, EE25499	Palmito	Ornamental	Whole plant	Planted in private gardens
		Rites	Leaves	Ornaments in floral bouquets
		Construction	Leafs	Roofs of houses and cabins
<i>Cocos nucifera</i> L., E, EE25385	Coco	Food	Fruit	Raw pulp and its water, and to make candies
<i>Washingtonia filifera</i> (Linden ex André) H.Wendl. ex de Bary, N, EE25386	Palma	Ornamental	Whole plant	Planted in private gardens
		Construction, roofs	Leaves	Dry
ASPARAGACEAE				
<i>Agave lechuguilla</i> Torr., N, EE25251	Lechuguilla	Healthy hair	Root	Milled, raw, used as shampoo
		Fibers	Leaves	Leaves are divided into multiple fibers used to make woven products
		Food	Root	Boiled and fermented (to prepare alcoholic beverages)
		Living fences	Whole plant	Planted in private gardens
<i>Agave americana</i> L. var. <i>americana</i> , N, EE25251b	Maguey	Food	Root	Aguamiel (sap), raw or cooked to make syrup
		Food (quite)	Peduncle	Cooked in a well, with hot stones and firewood, covered for 24 hours
		Food	Flowers	Cooked
		Food	Root	Boiled and fermented (to prepare alcoholic beverages)
		Ornamental	Whole plant	Planted in public and private gardens
		Construction	Peduncle (dry)	Livestock keeper
		Living fences	Whole plant	Planted in private gardens
<i>Agave aff. scabra</i> Ortega, N, EE25251c	Maguey, bronco	Food (quite)	Peduncle	Cooked in a well, with hot stones and firewood, covered for 24 hours
		Fibers	Leaves	Used to make ties
		Living fences	Whole plant	Planted in private gardens
		Living fences	Whole plant	Planted in private gardens
<i>Asparagus setaceus</i> Kunth, E, EE25332	Hoja elegante	Ornamental	Whole plant	Planted in private gardens
<i>Dasyllirion berlandieri</i> S. Watson, N, EE25253	Sotol	Food	Root	Boiled and fermented (to prepare alcoholic beverages)
		Rites and religion	Leaves (base)	With the base of the leaves, structures similar to flowers are made that adorn the main square and streets in the celebration of the patronal feast of San Pedro
<i>Polianthes tuberosa</i> L., N, EE25254	Nardo	Ornamental	Whole plant	Planted in private gardens
<i>Sansevieria trifasciata</i> Prin., E, EE25498	Lengua de suegra	Ornamental	Whole plant	Planted in private and public gardens
<i>Yucca filifera</i> Chabaud, N, EE25155	Palma china	Food	Flowers (called chochas)	Raw, collected before opening and the reproductive structures are removed so that when cooking they do not make the food bitter
		Food	Fuits (called dátiles)	Raw

<i>Yucca filifera</i> Chabaud, N, EE25155	Palma china	Food Ornamental	Fruit Whole plant	Raw Raw
<i>Yucca treculeana</i> Carrière, N, EE25155b	Palma samandoca	Food Live fences	Flowers (called chochas) Whole plant	Raw, collected before opening and the reproductive structures are removed so that when cooking they do not make the food bitter Planted in private gardens
<b>ASPHODELACEAE</b>				
<i>Kalanchoe blosfeldiana</i> Poelln., E, EE25152	Brujita	Ornamental, for its beautiful fleshy leaves	Whole plant	Planted in private gardens
<i>Kalanchoe digremontiana</i> Raym.-Hamet & H. Perrier, E, EE25333	Urania	Medicinal (endocrin system), anti inflammatory Medicinal (gastric system), heal gastrointetinal problems Ornamental	Sap Leaves (pulp) Whole plant	Raw, drink the sap Raw, milled, drink the sap Planted in private gardens
<b>ASTERACEAE</b>				
<i>Artemisia ludoviciana</i> Nutt., N, EE25256, EE25334	Estafiate	Medicinal (gastrointestinal system), diarrhea, flatulences	Leaves and stems	Boiled, drink infusion
<i>Baccharis salicifolia</i> Nutt, N, EE25258	Jara, jarilla	Medicinal (gastro-intestinal system), diarrhea, flatulences	Leaves and stems	Cut into pieces, boil in water, drink the solution
<i>Calea oliveri</i> B.L.Rob. & Greenm., N, EE25368	Ámbula	Medicinal (nervous system), insomnia	Leaves	Boiled in water, drink the solution
<i>Chrysactinia mexicana</i> A. Gray, N, EE25370	Hierba de San Nicolás	Medicinal (Reproductive system), aphrodisiac	Leaves	Boiled in water, drink the solution
<i>Chrysanthemum morifolium</i> Ramat., EE25222	Crisantemo	Ornamental	Whole plant	Planted in private gardens
<i>Conyza filaginoides</i> (DC.) Hieron, N, EE25497	Simonillo	Ornamental Medicinal (gastro-intestinal system), diarrhea, colic Medicinal (endocrin system), diabetes and cancer	Whole plant Leaves and stems Leaves and stems	Planted in private gardens Boiled in water, drink the solution Boiled in water, drink the solution
<i>Dahlia coccinea</i> Cav., N, EE25388	Dalia (the representative plant of Mexico)	Ornamental, by its showy and big inflorescences with red external flowers	Whole plant	Planted in private gardens
<i>Flourensia cernua</i> DC., N, EE25387	Hojasé	Medicinal (gastro-intestinal system), constipation	Leaves	Boil only 3-4 leaves, very astringent effect and very bitter taste
<i>Gnaphalium viscosum</i> Kunth, N, EE25389	Gordolobo	Medicinal (respiratory system), cough, throat pain	Stems, leaves, inflorescences and flowers	Boiled in water, drink the solution

<i>Grindelia inuloides</i> Willd. var. <i>inuloides</i> , N, EE25390	Árnica	Medicinal (Skeletal-muscular system), external wounds	Leaves and inflorescences, boiled, the solution use as	Boiled in hot wtaer, drink the solution
<i>Gutierrezia sarothrae</i> (Pursh) Britton & Rusby, N, EE25496	Amargosa	Medicinal (broken bones),	Leaves	Used as plaster (glutinous stems, sticky)
<i>Gymnopserma glutinosum</i> Less., N, EE25369	Marica	Fibers	Branches	Dry, they
<i>Helianthus annuus</i> L., N, EE24495	Girasol	Household items	Leaves and stems	Dried, intertwine and tie and attach to a stick to make homemade brooms
<i>Lactuca sativa</i> L., E, EE25391	Lechuga	Forage	Whole plant	Raw
<i>Machaeranthera tanacetifolia</i> (Kunth) Nees, N, EE25494	Árnica	Food	Leaves	Raw, previosly disinfected with chlorine
<i>Matricaria recutita</i> L., E, EE25493	Manzanilla	Medicinal	Leaves and inflorescences	Boiled, the solution used as cataplasm
<i>Parthenium hysterophorus</i> L., N, EE25492	Amargoso	Medicinal (gastro-intestinal system), colic, stomach ache	Leaves	Boiled, drink the solution
<i>Tagetes lucida</i> (Sweet) Voss, N, EE25491	Yerbanís	Mosquito repellent	Whole plant (dry)	Burning in the yard, the smoke produced repels insects and other pests
		Household items	Leaves and stems	Dried, intertwine and tie and attach to a stick to make homemade brooms
		Beverage	Leaves, stems, inflorescens, and flowers	Boiled, drink as tea
		Medicinal (gastro-intestinal system), stomach ache, colic, ulcer	Leaves, stems, inflorescens, and flowers	Boiled, drink as tea
<i>Tanacetum parthenium</i> (L.) Sch.Bip., E, EE25490	Altamisa	Mosquito repellent	Whole plant	Alive, inside the house
		Medicinal (gastric system), stomach ache	Leaves and stems	Boiled, drink the solution
<i>Taraxacum officinale</i> (L.) Weber ex F. H.Wigg., E, EE25489	Diente de león	Food	Leaves	Raw (previously disinfected with chlorine)
<i>Trixis californica</i> Kellogg, N, EE25488	Árnica	Forage	Whole plant	Raw
<i>Zinnia elegans</i> L., N, EE25335	Cartulina	Medicinal	Leaves and stems	Boiled, drink the solution
<b>BALSAMINACEAE</b>		Ornamental	Whole plant	Planted in private and public gardens
<i>Impatiens hawkeri</i> W. Bull, E, EE25219	Belén	Ornamental	Whole plant	Planted in private gardens
<b>BEGONIACEAE</b>				
<i>Begonia gracilis</i> Kunth, N, EE25236	Begonia	Ornamental	Whole plant	Planted in private gardens
<b>BIGNONIACEAE</b>				
<i>Chilopsis linearis</i> (Cav.) Sweet, N, EE25487		Ornamental, by its beautiful flowers	Whole plant	Planted in private and public gardens
<i>Tecoma stans</i> (L.) Juss. ex Kunth, N, EE25218	Tronadora, San Pedro	Ornamental	Whole plant	Planted in public and private gardens
<b>BORAGINACEAE</b>				

<i>Cordia boissieri</i> A. DC., N, EE25157	Anacahuita	Medicinal (Respiratory system), pneumonia	Flowers and fruit (pulp)	Boiled, drink the infusion
		Ornamental	Whole plant	Planted in public and private gardens
		Forage	Fruits	Raw
<i>Ehretia anacua</i> (Terán & Berland.) I. M. Johnst., N, EE25163	Anacua	Ornamental	Whole plant	Planted in public and private gardens
<b>BRASSICACEAE</b>				
<i>Brassica oleracea</i> L., E, EE25486	Repollo	Food	Leaves	Raw or cooked with other vegetables.
<i>Lepidium peruvianum</i> G. Chacón, E, EE25336	Raíz peruana	Medicinal (gastrointestinal, endocrin, and urinary systems)	Root	Boiled, drink the infusion
<i>Rorippa officinale</i> R. Br., E, EE25485	Berro	Medicinal (endocrin system), prostate problems	Leaves and stems	Boiled, eat and drink infusion
		Food	Leaves	Raw (previously disinfected with chlorine in water) or cooked with other vegetables
<i>Raphanus sativus</i> L., E, EE25484	Rábano	Food	Root	Raw, in salads
		Medicinal (respiratory system), asthma problems	Root	Raw, pulp
		Medicinal (Blood system), lower blood pressure	Root	Raw, pulp
<b>BROMELIACEAE</b>				
<i>Ananas comosus</i> (L.) Merr., E, EE25483	Piña	Food	Fruit	Raw
		Food	Fruit juice	Meat tenderizer
<i>Hechtia podantha</i> Mez, N, EE25392	Guapilla	Fibers	Leaves	Leaves are divided into multiple fibers used to make woven products (ties)
<i>Tillandsia usneoides</i> (L.) L., N, EE25231	Paixtle	Rites and religion	Leaves	Dry, decorate the christmas tree
		Manufacture of articles	Leaves	To make pillows
<b>BUDDLEJACEAE</b>				
<i>Buddleja cordata</i> ssp. <i>tomentella</i> (Standl.) E.M.Norman, N, EE25393	Tepozán	Medicinal (skeletal-muscular system), general pain	Leaves	Boiled in water, the solution used as cataplasm
<b>CACTACEAE</b>				
<i>Cylindropuntia imbricata</i> (Haw.) F.M.Knuth, N, EE25246	Coyonoxtle	Medicinal (skeletal-muscular system), breaks, breaks and fissures of bones	Stems pulp	Raw, use as cataplasm, smear the pulp on the injured area and bandage
<i>Cylindropuntia leptocaulis</i> (DC.) F.M.Knuth, N, EE25246b	Tasajillo	Medicinal (endocrin system) cancer	Stems pulp	Boiled, drink the infusion
<i>Echinocactus platyacanthus</i> Link & Otto, N, EE25482	Biznaga burra	Food	Stem pulp	Cooked with piloncillo (brown sugar) to make candies
<i>Hylocereus undatus</i> (Haw.) Britton & Rose, N, EE25377	Pithaya	Food	Fruit	Raw, blended with water to make drinks
		Ornamental	Whole plant	Planted in private gardens
		Dye	Fruit	Raw, squeezed



<i>Lophophora williamsii</i> (Lem. ex Salm-Dyck) J.M. Coult., N, EE25394	Peyote	Spiritual-religious	Whole plant	Raw, eaten in pieces or blended in water and drink the potion
		Medicinal (Skeletal-muscular system)	Whole plant or cut into pieces inside alcohol and mixed with marijuana (Cannabis sativa),	Raw, cataplasm, rubbing on sore joints
		Medicinal (nervous system), insomnia	Pieces of plant	Raw, eaten in pieces or blended in water and drink the potion
<i>Mammillaria heyderi</i> Muehlenpf., N, EE25395	Chilitos	Ornamental	Whole plant	Planted in private gardens
<i>Myrtillocactus geometrizans</i> (Mart. ex Pfeiff.) Console, N, EE25396	Garambuyo	Living fences	Whole plant	Planted in private gardens
		Ornamental	Whole plant	Planted in private gardens
<i>Opuntia ficus-indica</i> (L.) Mill., N, EE25397	Nopal sin espina	Ornamental	Whole plant	Planted in private gardens
		Forage	Stems (cladodes)	Raw, cut into pieces and scorched (to remove thorns)
		Food	Stems (cladodes) and fruits	Peeled and cut into pieces, raw or cooked; fruit eaten raw
		Medicinal (endocrine system), low cholesterol	Stems	Raw, cut into pieces and eat
<i>Opuntia lindheimeri</i> Engelm., N, EE25249	Nopal	Forage	Stems (cladodes) and fruits	Raw, cut into pieces and scorched (to remove thorns); fruits eaten raw
		Food	Stems	Raw
		Medicinal (endocrine system), low cholesterol	Stems	Raw, stem pulp
		Medicinal (gastrointestinal system), improve digestion	Stems	Raw, stem pulp, liquefied
<b>CANNABACEAE</b>				
<i>Celtis leavigata</i> Willd., N, EE25233b	Palo blanco	Ornamental	Whole plant	Planted in private gardens
<i>Celtis pallida</i> Torr., N, EE25233	Granjeno	Food	Fruits	Raw or boiled to make syrup
		Ornamental	Whole plant	Planted in private gardens
<b>CANNABINACEAE</b>				
<i>Cannabis sativa</i> L., E, EE25481	Mariguana	Medicinal (Skeletal-muscular system)	Female inflorescences and leaves into alcohol and mixed with peyote	Cataplasm, rubbing on sore joints
		Recreational playful use	Female inflorescences	Smoked
<b>CANNACEAE</b>				
<i>Canna indica</i> L., E, EE25240	Coyol	Ornamental, for its beautiful flowers	Whole plant	Planted in private gardens
<b>CAPRIFOLIACEAE</b>				
<i>Lonicera japonica</i> Thunb., E, EE26167	Madreselva	Ornamental, for the delicious aroma of its flowers	Whole plant	Planted in private gardens
<b>CARICACEAE</b>				

<i>Carica papaya</i> L., N, EE25480	Papaya	Food	Fruit	Raw, or in fruit salads
<b>CARYOPHYLLACEAE</b>				
<i>Dianthus caryophyllus</i> L., E, EE25224	Clavel	Ornamental, for its beautiful flowers	Whole plant	Planted in private gardens
<i>Dianthus deltoides</i> L., E, EE25440	Clavelina	Ornamental, for its beautiful flowers	Whole plant	Planted in private gardens
<i>Gypsophila paniculata</i> L., E, EE25441	Ilusión	Ornamental, for its beautiful flowers	Whole plant	Planted in private gardens
<b>COMMELINACEAE</b>				
<i>Commelina coelestis</i> Willd., N, EE25442	Hierba del pollo	Ornamental, for its beautiful flowers	Whole plant	Planted in private gardens
<b>COSTACEAE</b>				
<i>Costus igneus</i> N. E. Br., E, EE25443	Insulina	Medicinal (endocrin system), diabetes	Leaves	Boiled, drink the infusion
<b>CONVOLVULACEAE</b>				
<i>Ipomoea batatas</i> (L.) Lam., N, EE25444	Camote	Food	Root	Rosted or boiled
<i>Ipomoea purpurea</i> (L.) Roth, N, EE25445	Manto de la virgen	Ornamental, for its beautiful purple flowers	Whole plant	Planted in private gardens
<b>CRASSULACEAE</b>				
<i>Echeveria simulans</i> Rose, N, EE25446	Siempreviva	Ornamental, for its beautiful fleshy leaves	Whole plant	Planted in private gardens
		Medicinal (ophthlmic system), red eyes, irritated eyes	Sap	Eye drops
<i>Sedum diffusum</i> S. Watson, N, EE25437	Chismes	Ornamental, for its beautiful fleshy leaves	Whole plant	Planted in private gardens
		Medicinal (ophthlmic system), red eyes, irritated eyes	Sap	Eye drops
<i>Sedum palmeri</i> S. Watson, N, EE25438	Deditos	Ornamental, for its beautiful fleshy leaves	Whole plant	Planted in private gardens
<b>CUCURBITACEAE</b>				
<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai, E, EE25151	Sandía	Food	Fruit	Raw, cut into pieces
<i>Cucumis anguria</i> L., E, EE25364	Pepinillo	Forage (pigs) Food	Fruit peel Fruit	Raw Boiled, into brine
<i>Cucumis melo</i> L., E, EE25365	Melón	Forage Food	Fruit Fruit	Raw Raw, cut into pieces
<i>Cucurbita ficifolia</i> Bouché, E, EE25366	Chilacayote	Forage (pigs) Food	Fruit peel Fruit	Raw Boiled in water with sugar to make candies
		Forage Food	Fruit Fruit	Raw Cooked with other vegetables
<i>Cucurbita moschata</i> Duchesne, N, EE25367	Calabaza	Food	Fruit	Cooked or boiled in water with sugar to make candies
<i>Cucurbita pepo</i> L., N, EE25439	Calabaza	Forage Food Food	Leaves Fruit Seeds	Raw Cooked Raw, dried, toasted and salty

<i>Luffa aegyptiaca</i> Mill., E, EE25435	Estropajo	Forage Fibers	Leaves and fruits Inner part of dried fruit	Raw To wash dishes or to carve skin for bathing
<i>Sechium edule</i> (Jacq.) Sw., N, EE25479	Chayote	Food	Fruit	Raw, cut into pieces or boiled
<b>CUPRESSACEAE</b>				
<i>Cupressus arizonica</i> Greene, N, EE25153	Cedro	Ornamental Fuel Furniture Rites-religion Construction	Whole plant Wood Wood Sap (resin) Wood	Planted in public and private gardens Dry Dry Used as incense during religious prayers Dry, to make columns and beams of houses
<i>Cupressus lousitanica</i> Mill., E, EE25153a	Ciprés	Ornamental Furniture Fuel Construction	Whole plant Wood Wood Wood	Planted in public and private gardens Dry Dry Dry, to make columns and beams of houses
<i>Cupressus sempervirens</i> L., E, EE25378	Pincel	Ornamental Fuel Construction	Whole plant Wood Construction	Planted in public and private gardens Dry Wood, Dry, to make columns and beams of houses
<i>Juniperus flaccida</i> Schldl., N, EE25436	Táscate	Ornamental	Whole plant	Planted in public and private gardens
<i>Thuja occidentalis</i> L., E, EE25172	Tuya	Fuel Construction Ornamental	Wood Wood Whole plant	Dry Dry, to make columns and beams of houses Planted in public and private gardens
<b>CYCADACEAE</b>				
<i>Cycas revoluta</i> Thunb., N, EE25434	Chamal, cica	Ornamental	Whole plant	Planted in public and private gardens
<i>Dioon edule</i> Lindl., N, EE25375	Chamal	Ornamental Food	Whole plant Seeds	Planted in public and private gardens To make flour and tortillas
<b>EBENACEAE</b>				
<i>Diospyros palmeri</i> Eastw., N, EE25432	Chapote	Ornamental Forage Fuel Construction	Whole plant Fruits Trunks and branches Wood	Planted in public and private gardens Raw, for cattle, sheeps, goats and pigs Dry Dry, to make columns and beams of houses
<b>EQUISETACEAE</b>				
<i>Equisetum laevigatum</i> A. Braun, N, EE25433	Cola de caballo	Medicinal (urinary system), kidney pain	Stems	Boiled, drink the infusion
<b>EUPHORBIACEAE</b>				
<i>Acalypha hederacea</i> Torr., N, EE25173	Hierba del cáncer	Medicinal (endocorin system), cancer Forage	Leaves and stems Whole plant	Boiled, drink the solution Raw
<i>Croton suaveolens</i> Torr., N, EE25478	Salvia	Medicinal (blood system), anemia	Leaves and stems	Boiled in water, drink the infusion

<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch, N, EE25156	Noche buena	Ornamental	Whole plant	Planted in public and private gardens
<i>Euphorbia dentata</i> Michx., N, EE25261	Golondrina	Medicinal (Respiratory system), sinusitis	Leaves and stems	Boil in water, e infusion used a nasal drops
<i>Euphoria milii</i> Des Moul., E, EE25261b	Corona de Cristo	Ornamental	Whole plant	Planted in public and private gardens
<i>Jatropha dioica</i> Sessé, N, EE25431	Sangre de Drago	Medicinal (dermatologic system), hair growth, fungi Medicinal (gastric system), harden the gums	Leaves and stems	Milled, the pulp used as shampoo Milled, chew and spit out the pulp
<i>Ricinus communis</i> L., E, EE25159	Higuerilla	Ornamental	Whole plant	Planted in public and private gardens
<i>Sapium sebiferum</i> (L.) Roxb., E, EE25164	Sapium	Ornamental	Whole plant	Planted in public and private gardens
<i>Tragia ramosa</i> Torr., N, EE25363	Mala mujer	Medicinal (urinary system), kidney diseases	Leaves	Boiled, drink the infusion
<b>FABACEAE</b>				
<i>Arachis hypogaea</i> L., E, EE25429	Cacahuete	Food Forage	Seeds Leaves	Raw Raw
<i>Bauhinia purpurea</i> L., N, EE25225	Pata de vaca	Ornamental Medicinal (gastrointestinal system)	Whole plant Leaves	Planted in public and private gardens Boiled, drink the infusion
<i>Calliandra conferta</i> A.Gray, N, EE25430	Charrasquillo	Forage	Leaves and fruits	Raw
<i>Cercis canadensis</i> L., N, EE25165	Duraznillo	Ornamental	Whole plant	Planted in public and private gardens
<i>Cicer arietinum</i> L., E, EE25379	Garbanzo	Food	Seeds	Cooked
<i>Erythrostemon mexicanus</i> (A. Gray) Gagnon & G. P. Lewis, N, EE25229	Potro	Ornamental	Whole plant	Planted in public and private gardens
<i>Eysenhardtia texana</i> Scheele, N, 25477	Palo azul	Ornamental	Whole plant	Planted in public and private gardens
<i>Lens culinaris</i> Medik, E, EE25428	Lenteja	Food	Seeds	Cooked
<i>Pachyrhizus erosus</i> (L.) Urb., N, EE25476	Jícama			
<i>Phaseolus vulgaris</i> L., N, EE25475	Frijol	Food	Seeds	Cooked
<i>Pisum sativum</i> L., E, EE25474	Chícharo	Food	Seeds	Cooked
<i>Prosopis glandulosa</i> var. <i>torreyana</i> (L.D.Benson) M.C.Johnst., N, EE25473	Mezquite	Construction	Tunks and branches	Dry, to make columns and beams of houses
		Fuel	Tunks and branches	Charcoal
<i>Vachellia farnesiana</i> (L.) Wight & Arn., N, EE25234	Huizache	Forage Construction	Leaves and fruits Tunks and branches	Raw Dry
		Fuel	Tunks and branches	Charcoal
<i>Vicia faba</i> L., E, EE25238	Haba	Forage Food	Leaves and fruits Seeds	Raw Cooked



<b>FAGACEAE</b>				
<i>Quercus virginiana</i> Mill., N, EE25166	Encino	Construction	Wood	Dry, to manufacture furniture and household goods
		Forage	Seeds (called bellotas)	Raw
		Fuel	Wood	Dry, cut into pieces
<i>Quercus canbyi</i> Trel., N, EE25427	Encino	Ornamental	Whole plant	Planted in public and private gardens
		Ornamental	Whole plant	Planted in public and private gardens
		Construction	Wood	Dry, to manufacture furniture, household goods, and columns and beams of houses
		Forage	Seeds (called bellotas)	Raw
		Fuel	Wood	Dry, cut into pieces
		Construction	Wood	Dry, to manufacture furniture, household goods, and columns and beams of houses
<i>Quercus polymorpha</i> Schltldl. & Cham., N, EE25426	Encino	Ornamental	Whole plant	Planted in public and private gardens
		Ornamental	Whole plant	Planted in public and private gardens
		Forage	Seeds (called bellotas)	Raw
		Fuel	Wood	Dry, cut into pieces
		Construction	Wood	To manufacture furniture and household goods
<b>FOUQUERACEAE</b>				
<i>Fouquieria splendens</i> Engelm., N, EE25380	Ocotillo, albarda	Living fences	Stems	Stems are cut and planted in rows, eventually producing root and leaves (living fences)
		Ornamental	Whole plant	Planted in private gardens
<b>GERANIACEAE</b>				
<i>Pelargonium hortorum</i> L.H. Bailey, E, EE25227	Geranio	Ornamental	Whole plant	Planted in private gardens
<b>GESNERIACEAE</b>				
<i>Tulipa gesneriana</i> L., E, EE25472	Tulipán	Ornamental	Whole plant	Planted in private gardens
<b>HYDRANGEACEAE</b>				
<i>Hydrangea macrophylla</i> (Thunb.) Ser., E, EE25471	Hortensia	Ornamental	Whole plant	Planted in private gardens
<b>JUGLANDACEAE</b>				
<i>Carya illinoinensis</i> (Wangenh.) K. Koch, N, EE25168	Nogal	Forage	Leaves	Raw
		Food	Fruit	Raw
		Construction	Wood	Dry
		Fuel	Wood	Dry
		Ornamental	Whole plant	Planted in public and private gardens
		Medicinal (endocrin system), diabetes	Fruit	Raw
		Medicinal (dermic system), hair dye	Bark	Boiled in water, wash hair with solution
<i>Carya myristiciformis</i> (F. Michx.) Nutt. ex Elliott, N, EE25470	Nogal	Ornamental	Whole plant	Planted in public and private gardens
		Medicinal (dermic system), hair dye	Bark	Boiled in water, wash hair with solution

<i>Juglans major</i> (Torr.) A. Heller, N, EE25469	Nogal de nuez encarcelada	Forage	Leaves	Raw
		Food	Fruit	Raw
		Construction	Wood	Dry
		Fuel	Wood	Dry
		Ornamental	Whole plant	Planted in public and private gardens
		Medicinal (dermic system), hair dye	Bark	Boiled in water, wash hair with solution
		Medicinal (gastrointestinal system), colics	Leaves	Boiled in water
<b>LAMIACEAE</b>				
<i>Hedeoma drummondii</i> Benth., N, EE25468	Poleo	Medicinal (Nervous system), to fall asleep	Whole plant	Boiled, drink the infusion
<i>Lavandula angustifolia</i> Mill., E	Lavanda	Ornamental	Whole plant	Planted in public and private gardens
<i>Marrubium vulgare</i> L., E, EE25424	Marrubio	Medicinal (gastro-intestinal system)	Leaves	Boiled, drink the solution
		Medicinal (respiratory system), cough	Leaves and stems	Boiled, drink the infusion, chew and swallow leaves and stems
<i>Melissa officinalis</i> L., E, EE25425	Toronjil	Ornamental, for its delicious aroma and to repel mosquitoes	Whole plant	Planted in private gardens
		Medicinal (gastro-intestinal system), colics	Leaves and stems	Boiled, drink the infusion
		Medicinal (respiratory system), cough	Leaves and stems	Boiled, drink the infusion
<i>Mentha piperita</i> L., E, EE25241	Yerbabuena	Medicinal (respiratory system), cough	Leaves and stems	Boiled, drink the infusion, chew and swallow leaves and stems
		Medicinal (respiratory system), fever and cold	Leaves and stems	Boiled, drink the infusion
<i>Mentha spicata</i> L., E, EE25241b	Yerbabuena	Medicinal (gastro-intestinal system), spasms	Leaves and stems	Boiled, drink the infusion
		Medicinal (respiratory system), flu and asthma	Leaves	Boiled, drink the infusion
<i>Monarda citriodora</i> var. <i>austromontana</i> (Epling) B.L.Turner, N, EE25381	Poleo cabezón, betónica	Medicinal (respiratory system), cough	Leaves and stems	Boiled, drink the infusion, chew and swallow leaves and stems
		Medicinal (Nervous system), to fall asleep	Leaves	Dry, put a piece of branch under the pillow at night
		Ornamental, for its delicious aroma and beautiful flowers	Whole plant	Planted in private gardens
<i>Ocimum basilicum</i> L., E, EE25242	Albahaca	Medicinal (Nervous system), used agians	Leaves and stems	Boiled, drink the infusion

		insomnia, to fall asleep		
		Religious rites	Whole plant	Part of the flower bouquets used in pilgrimages
<i>Origanum majorana</i> L., E, EE25257	Orégano	Food (condiment)	Leaves	Dry, added to broths and soups
		Medicinal (respiratory system), cough and cold	Leaves and stems	Boiled, drink the infusion
<i>Plectranthus coleoides</i> Benth., E, EE25362	Vaporú	Medicinal (respiratory system), cough	Leaves and stems	Milled, mixed with glycerine and spread on the chest and nostrils
		Religious rites	Whole plant	Dry, milled, used as incense
		Ornamental, by its delicious aroma and beautiful flowers	Whole plant	Planted in private gardens
<i>Poliomintha longiflora</i> A.Gray, N, EE25259	Orégano de montaña	Food (condiment)	Leaves and stems	Dry, added to broths and soups
		Medicinal (respiratory system), cough, throat pain	Leaves and stems	Boiled, drink the infusion
		Ornamental, by its beautiful flowers and aroma	Whole plant	Planted in private gardens
<i>Rosmarinus officinalis</i> L., E, EE25382	Romero	Medicinal (gastro-intestinal system) colics	Leaves	Boiled, drink the infusion
		Medicinal (respiratory system), nasal congestion	Stems, leaves and flowers	Cut into pieces, boiled, drink the infusion
		Ornamental, by its beautiful flowers and aroma	Whole plant	Planted in private gardens
		Condiment	Leaves	Dry, added to flavor the food
<i>Scutellaria</i> sp., N, EE25422	Mirto	Ornamental, by its beautiful flowers and aroma	Whole plant	Planted in private gardens
<i>Teucrium cubense</i> L., N, EE25423	Verneba	Medicinal (fever)	Leaves and stems	Boiled, drink the solution
		Medicinal (respiratory system), cough and expectorant	Leaves and stems	Boiled, drink the infusion
<i>Thymus vulgaris</i> L., E, EE25360	Tomillo	Medicinal (dermic system), dermic infections	Leaves	Boiled, use as cataplasm
		Food (condiment)	Leaves and stems	Dry, add to stews, soups and broths
<b>LAURACEAE</b>				
<i>Cinnamomum verum</i> J.Presl., E, EE25361	Canela	Medicinal (gastro-intestinal system), stomach pain, vomit	Bark	Boiled, drink the infusion
		Medicinal (respiratory system), cough and throat pain	Bark	Boiled, drink the infusion

		Medicinal (endocrinal system), diabetes	Bark	Boiled, drink the infusion
		Medicinal (blood system), improve blood circulation	Bark	Boiled, drink the infusion
<i>Litsea glausceces</i> Kunth, N, EE25359	Laurel	Food (condiment)	Leaves	Dry, add to stews, soups and broths
		Ornamental, by its showy green stems	Whole plant	Planted in private gardens
<i>Persea americana</i> Mill., N, EE25170	Aguacate	Food	Fruit	Raw, used in multiple ways
		Medicinal (respiratory system), asthma	Leaves	Boiled, drink the infusion
		Medicinal (circulatory system), arterial hypertension	Leaves	Boiled, drink the infusion
<i>Persea podadenia</i> S. F. Blake, N	Salsafrás	Medicinal (circulatory system), anemia	Bark	Cut into pices, boiled, drink the infusion
<b>LILIACEAE</b>				
<i>Allium cepa</i> L., E, EE25358	Cebolla	Food	Stem	Raw or boiled
		Medicinal (respiratory system), cough, asthma, flu	Stem	Boiled, drink the infusion along with honey bee
		Medicinal (circulatory system), improve blood circulation	Stems	Boiled, drink the infusion
<i>Allium sativum</i> L., E, EE25421	Ajo	Medicinal (circulatory system), low cholesterol, improve circulation	Stems	Boiled, drink the infusion, raw cutt into pieces, milled
		Medicinal (dermic system), dermic wounds	Cloves	Ground garlic cloves, the pulp is smeared on the wound
		Medicinal (auditive system), earache	Cloves	Milled, pulp is semeared inside the ears
		Food (condiment)	Bulb (clove)	Raw or boiled, added to mutiple foods
		Religious-rites	Complete bulb	Dry, several bulbs are braided and hung at the entrance of the houses to ward off bad vibes
<i>Allium</i> sp., N, EE25467	Cebollín	Medicinal (auditive system)	Bulb	Raw, milled, the pulp is meared inside the ears
<i>Lilium candidum</i> L., E, EE25466	Lirio	Ornamental, by its beautiful flowers	Whole plant	Planted in private gardens
<b>LOMARIOPSIDACEAE</b>				
<i>Nephrolepis exaltata</i> (L.) Schott, N, EE25465	Helecho	Ornamental, by its beautiful perennial foliage	Whole plant	Planted in pots in private gardens
<b>LHYTRACEAE</b>				
<i>Heimia salicifolia</i> (Kunth) Link, N, EE25169	Jarilla	Medicinal (dermic system), dermatitis	Leaves	Milled, boiled in water, use as cataplam



<i>Lagerstroemia indica</i> L., E, EE25244	Crespón	Ornamental, by its beautiful perennial foliage and showy flowers	Whole plant	Planted in pots in public and private gardens
<i>Punica granatum</i> L., E, EE25154	Granada	Ornamental	Whole plant	Planted in private gardens
		Medicinal (gastro-intestinal system), diarrhea	Peel	Boiled in water, drink the solution
		Food	Fruit	Raw
<b>MAGNOLIACEAE</b>				
<i>Magnolia grandiflora</i> L., N, EE25171	Magnolia	Ornamental, by its perennial foliage and beautiful white flowers	Whole plant	Planted in public and private gardens
<b>MALVACEAE</b>				
<i>Alcea rosea</i> L., E, EE25357	Malva rosa	Ornamental, by its big and beautiful flowers	Whole plant	Planted in private gardens
<i>Hibiscus denudatus</i> Benth., N, EE25174	Hibisco	Ornamental, by its beautiful flowers	Whole plant	Planted in private gardens
<i>Hibiscus syriacus</i> L., E, EE25417	Malva	Ornamental, by its beautiful flowers	Whole plant	Planted in private gardens
<i>Malva parviflora</i> L., N, EE25418	Malva de patio	Medicinal (circulatory system), varicose veins	Fruits and leaves	Boiled, drink the solution and chew and swallow the ground fruits and leaves
<i>Tilia mexicana</i> Schltdl., N, EE25419	Tila	Medicinal (nervous system) insomnia	Dried flowers	Boiled in water, drink the solution
		Ornamental	Whole plant	Planted in private gardens by its majestic bearing
<i>Sida rhombifolia</i> L., N, EE25420	Hierba del cochino	Medicinal (gastro-intestinal system) diarrhea	Immature fruits	Boiled in water, drink the infusion
<b>MELIACEAE</b>				
<i>Azadirachta indica</i> A.Juss., E, EEE25265	Neem (Nim)	Medicinal (gastro-intestinal system), stomach pain, cramps, constipation	Bark	Boiled in water, drink solution
		Ornamental	Whole plant	Planted in private gardens
<i>Melia azedarach</i> L., E, EE25266	Canelo	Medicinal (dermic system), wound, skin irritation	Bark and leaves	Boiled, the infusion used as cataplasm in the wounded area
		Ornamental	Whole plant	Planted in public and private gardens
<b>MORACEAE</b>				
<i>Ficus carica</i> L., E, EE25268	Higo	Food	Fruit	Raw or boiled and canned fruit
		Ornamental	Whole plant	Planted in private gardens
<i>Morus celtidifolia</i> Kunth, N, EE25349	Mora	Medicinal (endocrine system), diabetes	Fruits; leaves	Raw; leaves boiled, drink the infusion
		Medicinal (endocrine system), diabetes	Fruits	Boiled, drink the solution
		Ornamental	Whole plant	Planted in public and private gardens
		Food	Fruits	Raw
		Dye	Fruits	Raw, squeezed
<b>MORINGACEAE</b>				

<i>Moringa oleifera</i> Lam., E, EE25351	Moringa	Medicinal (endocrin system), diabetes	Leaves	Boiled, drin the infusion
<b>MUSSACEAE</b>				
<i>Mussa x oleifera</i> Lam., E, EE25415	Plátano	Food	Fruit	Raw
<b>MYRTACEAE</b>				
<i>Eucalyptus camaldulensis</i> Dehnh., E, EE25416	Eucalipto	Ornamental	Whole plant	Planted in private gardens
		Medicinal (respiratory system), nasal congestion	Leaves	Boiled, drink the infusion
		Medicinal (nervous system) stress	Leaves	Boiled, drink the infusion
<i>Psidium guajava</i> L., N, EE25228	Guayaba	Medicinal (gastro-intestinal system), fever	Leaves	Boiled, drink the infusion
		Medicinal (gastro-intestinal system), diarrhea	Fruit	Raw, eat several fruits
		Food	Fruit	Raw, and canned fruits
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<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry, E, EE25350	Clavo	Medicinal (endocrin system), diabetes	Leaves	Boiled, drink the infusion
		Food (condiment)	Floral buds (immature and dry)	Raw or bolied used in multiple ways
		Medicinal (gastro-intestinal system), constipation	Fruits	Boiled, drink the infusion or chewed
<b>NYCTAGINACEAE</b>				
<i>Bougainvillea spectabilis</i> Willd., N, EE25223	Bugambilia	Ornamental, by its showy flowers	Whole plant	Planted in public and private gardens
		Medicinal (respiratory system)	Bracts and flowers	Boiled in water, drink the solution
<i>Mirabilis jalapa</i> L., N, EE25252	Maravilla	Ornamental, by its showy and besutiful flowers	Whole plant	Planted in private gardens
<b>OLEACEAE</b>				
<i>Fraxinus americana</i> L., N, EE25255b	Fresno	Ornamental	Whole plant	Planted in public and private gardens
		Construction	Wood	Dry, to make columns and bems of houses
<i>Fraxinus cuspidata</i> Torr., N, EE25255	Fresno	Ornamental, by its beautiful flowers	Whole plant	Planted in public and private gardens
<i>Fraxinus greggi</i> A. Gray, N, EE25255c	Barretilla	Ornamental	Whole plant	Planted in public and private gardens
		Construction	Wood	Dry, piles and columns for houses
		Fuel	Wood	Dry
<i>Jasminum floridum</i> Bunge, E, EE25372	Jazmín	Ornamental	Whole plant	Planted in private gardens
<i>Jasminum officinale</i> L., E, EE25372b	Jazmin			
<i>Ligustrum japonicum</i> Thunb., E, EE25162	Trueno	Ornamental	Whole plant	Planted in public and private gardens
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<b>ONAGRACEAE</b>				

<i>Oenothera rosea</i> L'Hér. ex Aiton, N, EE25413	Hierba del golpe	Medicinal (dermic system), extenal wounds	Whole plant	Raw, milled, smear in the wounded area
<b>PAPAVERACEAE</b>				
<i>Hunnemannia fumariifolia</i> Sweet, N, EE25348	Amapola de campo	Ornamental, by its showy yellow flowers	Whole plant	Planted in private gardens
<b>PINACEAE</b>				
<i>Pinus cembroides</i> Zucc., N, EE25353	Piñonero	Food Fuel Ornamental	Seeds Wood Whole plant	Raw Dry Planted in private gardens
<i>Pinus greggii</i> Engelm. ex Parl., N, EE25354	Pino	Fuel	Wood	Dry
<i>Pinus pseudostrobus</i> Lindl., N, EE25414	Pino blanco	Ornamental Fuel	Whole plant Wood	Planted in private gardens Dry
		Ornamental Rites-religious	Whole plant Resin	Planted in private gardens In prayer altars
<b>PIPERACEAE</b>				
<i>Piper nigrum</i> L., E, EE25356	Pimienta	Food (condiment)	Seeds	Mixed with different meals
<b>PLANTAGINACEAE</b>				
<i>Antirrhinum majus</i> L., E, EE25459	Perritos	Ornamental, by its beautiful flowers	Whole plant	Planted in private gardens
<i>Plantago lanceolata</i> L., N, EE25458	Llantés	Medicinal (endocrin system), cancer	Leaves	Boiled in water, drink the infusion
<b>PLUMBAGINACEAE</b>				
<i>Plumbago pulchella</i> Boiss., E, EE25158	Júdica	Ornamental	Whole plant	Planted in private gardens
		Medicinal (dermic system)	Stems and leaves	Boiled, use the solution as catpalsm
<b>POLYGONACEAE</b>				
<i>Polygonum punctatum</i> Elliot, N, EE25407	Chilillo	Ornamental	Whole plant	Planted in private gardens
<b>POACEAE</b>				
<i>Arundo donax</i> L., E, EE25408	Carrizo	Religious-rites Construction	Stems Stems	Religious ornaments Roofs
<i>Avena sativa</i> L., E, EE25373	Avena	Food	Seeds	Raw or boiled
<i>Bambusa</i> sp., E, EE25374		Religious-rites Construction	Stems Stems	Religious ornaments Roofs
<i>Bouteloua curtipendula</i> (Michx.) Torr., N, EE25409	Banderita	Forage	Whole plants	Raw
<i>Cymbopogon citratus</i> (DC.) Stapf, E, EE25410	Zacate limón	Ornamental	Whole plant	Planted in private gardens
		Medicinal (gastron-intestinal system)	Stems and leaves	Boiled, drink the infusion
<i>Sorghum bicolor</i> (L.) Moench, E, EE25411	Sorgo	Forage	Whole plants	Raw
<i>Sorghum halepense</i> (L.) Pers., E, EE25412	Zacate Johnson	Forage	Whole plants	Raw
<i>Zea mays</i> L., N, EE25347	Maíz	Food Medicinal (gastro-intestinal system), parasites	Fruits (seeds) Styles (female flowers)	Boiled or cooked with mutiple foods Boiled in water, drink the solution

		Medicinal (urinary system), kidney problems	Seeds	Milled, boiled, drink the solution
PORTULACACEAE				
Portulaca mundula I. M. Johnston, E, 25216	Verdolaga	Food	Leaves and stems	Raw (previously disinfected with chlorine), or cooked with different foods
		Ornamental	Whole plant	Planted in private gardens (pots)
RANUNCULACEAE				
Clematis drummondii Torr. & A.Gray, N, EE25405	Barba de chivo	Ornamental	Whole plant	Planted in private gardens
RHAMNACEAE				
Colubrina greggii S.Watson, N	Colubrina	Ornamental	Whole plant	Planted in private gardens
ROSACEAE				
Crataegus mexicana Moc. & Sessé ex DC., N, 25355	Tejocote	Medicinal (endocrin system), diabetes	Fruit	Raw or boiled, drink the fruit pulp
		Medicinal (blood system)	Fruit	Raw or boiled, drink the fruit pulp
Cydonia oblonga Mill., E, EE25346	Membrillo	Food	Fruit	Raw or boiled to make canned fruits
Eriobotrya japonica (Thunb.) Lindl., E, EE25406	Níspero	Food	Fruit	Raw
		Medicinal (endocrin and blood system), diabetes and arterial hipertension	Fruit	Raw, liquefied in water
Malus domestica Borkh., E, EE25343	Manzana	Food	Fruit	Raw
		Food	Canned fruits	Boiled
		Alcoholic beverages	Fruit	Fermented
Prunus armeniaca L., E, EE25344	Chabacano	Food	Fruit	Raw
		Ornamental	Whole plant	Planted in private gardens
Prunus domestica L., E, EE25345	Ciruelo	Food	Fruit	Raw
Prunus persica (L.) Batsch, E, EE25150	Durazno	Food	Fruit	Raw
		Ornamental	Whole plant	Planted in private gardens
Purshia plicata (D.Don) Henr., N, EE25460	Rosa de castilla	Medicinal (gastro-intestinal system), diarrhea	Leaves	Boiled, drink the solution
Rosa montezumae Humb. & Bonpl. ex Redout & Thory, N, EE25461	Rosa	Ornamental	Whole plant	Planted in private gardens
RUTACEAE				
Casimiroa pringlei (S. Wats.) Engl., N, EE25342	Manguito	Ornamental	Whole plant	Planted in public and private gardens
		Food	Fruit	Raw
Citrus limon (L.) Osbeck, E, EE25404	Limón	Food	Fruit	Raw
		Medicinal (respiratory system), cough, chest pain, throat pain	Leaves and fruit juice	Boiled, drink the solution
		Ornamental	Whole plant	Planted private gardens
Citrus sinensis (L.) Osbeck, E, EE25341	Naranja	Food	Fruit	Raw
		Medicinal (respiratory system),	Leaves and fruit peel and fruit juice	Boiled, drink the solution



<i>Helietta parvifolia</i> (A. Gray) Benth., N, EE25215	Barreta	cough, chest pain, throat pain Ornamental	Whole plant	Planted in public and private gardens
		Ornamental	Whole plant	Planted in public and private gardens
		Construction	Wood	Dry, piles and columns for houses, fences (very durable wood)
		Ornamental	Whole plant	Planted in public and private gardens
<i>Ruta graveolens</i> L., E, EE25221	Ruda	Medicinal (respiratory system), cold	Leaves and stems	Boiled
<i>Zanthoxylum fagara</i> (L.) Sarg., N, EE25247	Colima	Construction	Wood	Dry, piles and columns for houses
		Forage Medicinal	Leaves	Raw
		(respiratory system), asthma	Leaves	Boiled, drink the solution
		Medicinal (skeletal- muscular system), arthritis	Leaves	Boiled, drink the solution
SALICACEAE				
<i>Populus mexicana</i> Wesm. Ex DC., N, EE25248	Álamo, chopo	Ornamental	Whole plant	Planted in public and private gardens
<i>Salix nigra</i> Marshall, N, EE25462	Sauce	Ornamental Fuel	Whole plant Wood	Planted in public and private gardens Dry
SAPINDACEAE				
<i>Koelreuteria paniculata</i> Laxm., E, EE25238	Alfombrilla	Ornamental, by its showy, psrsisten fruits	Whole plant	Planted in private gardens
SCROPHULARIACEAE				
<i>Leucophyllum frutescens</i> (Berland.) I. M. Johnst., N, EE25161	Cenizo	Medicinal (endocrin system), hepatitis	Whole plant	Cut into the pieces, boiled, drink and take a bath with the solution
		Ornamental	Whole plant	Planted in public and private gardens
		Religious-rites	Branches and leaves	Part of the floral bouquets used in prayers and pilgrimages
SOLANACEAE				
<i>Capsicum annum</i> var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill, N, EE25217	Chile piquín, chile quipín	Food (condiment)	Fruit	Raw
		Ornamental	Whole plant	Planted in public and private gardens
<i>Capsicum annum</i> var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill, N, EE25217b	Chile japonés	Medicinal (respiratory system), cough, phlegm	Fruit (milled)	Liquefied in water, drink (very spicy drink)
		Food (condiment)	Fruit	Raw
<i>Capsicum annum</i> var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill, N, EE25217c	Chile morrón	Ornamental	Whole plant	Planted in public and private gardens
		Food (condiment)	Fruit	Raw
<i>Capsicum annum</i> var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill, N, EE25217d	Chile jalapeño	Food (condiment)	Fruit	Raw

<i>Capsicum annum</i> var. <i>glabriusculum</i> (Dunal) Heiser & Pickersgill, N, EE25217e	Chile serrano	Food (condiment)	Fruit	Raw
		Medicinal (respiratory system), cough, phlegm	Fruit (milled)	Liquefied in water, drink (very spicy drink)
<i>Datura stramonium</i> L., N, EE25339	Toloache	Falling in love	Leaves and seeds	Leaves (boiled in water, drink the solution), seeds (raw, chew and swallow)
<i>Lycopersicon esculentum</i> Mill., E, EE25403	Tomate	Food	Fruit	Raw or cooked with other foods
		Medicinal (skeletal- muscular system), muscular pain	Fruit	Raw, pulp, use as cataplasm
<i>Physalis philadelphica</i> Lam., N, EE25260	Tomate de fresadilla	Food	Fruit	Mixed with other foods, broths, sauces and stews
<i>Solanum ovigerum</i> Dunal, E, EE25463	Huevitos	Ornamental, by its fruits (egg-like)	Whole plant	Planted in private gardens
<i>Solanum tuberosum</i> L., E, EE25464	Papa	Food	Root	Mixed with other foods, broths, sauces and stews
<b>TURNERACEAE</b>				
<i>Turnera diffusa</i> Willd. ex Schult., N, EE25340	Damiana, hierba del venado	Medicinal (genito- urinary system)	Leaves, stems and inflorescences	Boiled in water, drink the solution
		Forage	Whole plant	Raw
<b>URTICACEAE</b>				
<i>Urtica dioica</i> L., N, EE25402	Hiedra	Medicinal (blood system), purify the blood	Whole plant	Boiled in water, drink the solution
<b>VERBENACEAE</b>				
<i>Lippia graveolens</i> Kunth, N, EE25400	Orégano	Food (condiment)	Leaves	Dry, added to different foods, broths and stews
<i>Verbena canescens</i> Kunth, N, EE25401	Verbena	Medicinal (nervous system), insomnia	Leaves and stems	Boiled in water, drink solution, and bathe with the solution
<b>VITACEAE</b>				
<i>Parthenocissus quinquefolia</i> (L.) Planch., N, EE25160	Viña virgen	Ornamental	Whole plant	Planted in private gardens
<i>Vitis berlandieri</i> Planch., N, EE25338	Parra, vid	Ornamental Food	Whole plant Fruit	Planted in private gardens Raw
<b>XANTHORRHOACEAE</b>				
<i>Aloe vera</i> (L.) Burm.f., E, EE25250	Sábila	Medicinal (gastro- intestinal system), gastritis	Leaves	Pulp, milled, liquefied, drink the solution
		Medicinal (dermic system), hair restoration; dermical wounds	Leaves	Pulp, smear the pulp all over the hair; raw, smear the milled pulp in the wounded area
		Ornamental	Whole plant	Planted in private gardens
<b>ZYGOPHYLLACEAE</b>				
<i>Larrea tridentata</i> (Sessé & Moc. ex DC.) Coville, N, EE25399	Gobernadora	Medicinal (gastro- intestinal system), spasms	Leaves	Boiled in water, drink the solution

		Medicinal (dermic system), bad smell	Leaves	Boiled in water, wash bad smelling parts of the body
		Smelly feet	Leaves	Dry, put leaves inside shoes
		Cleaning the interior of car radiators	Leaves	Boiled in water, drain the hot solution into the radiator
<b>ZINGIBERACEAE</b> <i>Zingiber officinale</i> Roscoe, E, EE25398	Jengibre	Food (condiment)	Root	Raw, cut into the pieces
		Medicinal (gastro-intestinal system), intestinal inflammation, fever	Root	Raw, iquefied, drink the solution
		Medicinal (dermic system), external wounds	Root	Raw, milled, smear in the wounded areas