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Patterns of knowledge and use of tropical plants in homegardens of Southern Morelos, Mexico

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ABSTRACT

The aim of this research is to identify the patterns of use and knowledge of plant species growing in selected tropical homegardens in southern Morelos, Mexico. The method consisted of obtaining informed consent, interviews with homegarden managers, recording socioeconomic data, visits to the interior of each selected homegarden, and personal observations. Data were analyzed through multivariate analyses. The results included a floristic composition (132 species) and eight types of use. Grouping of homegardens by type of use differentiated two main groups: homegardens where principal use is for food plants, and others mainly for ornamental plants. Were found significant differences between homegardens by the number of species and type of use. The grouping of species by number of uses revealed two groups; the patterns of use of plants in homegardens differed according to the user's preferences; multiuse species were appreciated in group two, which dominated the ornamentals. It was found a significant correlation between age and number of plants known for the owners of the homegardens; while occupation, schooling, and income had no correlation. In conclusion, we rejected the hypothesis of nullity due to differences between richness and the preference of species, the management of homegardens, and by the null influence of the socioeconomic factors studied, with the exception of the age owners and their knowledge of the species.

Keywords: Classification & ordination, Floristic Composition, Management and Conservation, Socioeconomic factors, Use value.

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SIGNIFICANCE STATEMENT

Plants grown in homegardens are the basis of subsistence for residents of rural areas; this contributes to satisfying needs for food, products for traditional medicine and the cultivation of ornamental plants. In this work we apply multivariate analysis to determine preference in the use of plants and determine the most frequent types of uses; we also analyze which factors fundamentally affect the patterns of use and exploitation of plant resources in rural communities of Morelos state, Mexico. We consider that this work contributes to the knowledge of the management and conservation of small-scale cultivated plants, important for the subsistence of rural communities in the south of the state of Morelos, Mexico.

INTRODUCTION

The ecological importance of homegardens is in providing multiple ecosystem functions and services that enhance human well-being (Rajagopal et al. 2021). The homegarden is the open space that is directly adjacent to the house, which is managed by the family or household owner (Mazarolli 2011). The selective value of acquiring ethnobotanical knowledge includes exploring, discovering, and recording the numerous names, utilities, and management strategies of undomesticated plants throughout human history (Voeks 2007).

The cultural diversity of human groups in Mexico has generated extensive ethnobotanical knowledge based on plant richness (Caballero et al. 1998), although it is unequally distributed among societies (Arias Toledo et al. 2007; Pérez-Nicolás et al. 2017). According to Thakur et al. (2017), the pattern of change in lifestyle has been the first reason for the decline in some uses of plants. The diversity of individual practices of the population toward its natural resources depends on the particular conditions of the habitat, collective idiosyncrasy, experience and cultural heritage, and personal interest in living through traditional ecological knowledge (TEK), as demonstrated by Benner et al. (2021). The pattern of use and knowledge seems to be independent of the community or the category of examined use (Benz et al. 1994). At least in the case of plants used as food, the persistence of cultivating them in homegardens assures alimentary resource availability.

Whitney et al. (2018) determined the importance of the contribution of homegardens improving the diet of the populations of Uganda, Africa. Their scheme of analysis could also be true for plants in Mexican homegardens because people prefer the availability and proximity of medicinal resources to attend health emergencies, as referred to by Pérez-Nicolás et al. (2017), through the systematic use of plants in a community in Oaxaca state, Mexico. The same occurs with other plants, such as ornamentals, fomented by their beauty and contribution to spiritual welfare, whose role is invaluable for rural populations. These resource groups are well represented in managed homegardens from Morelos, Mexico (Blancas et al. 2016). Here it is worth mentioning the relevance of ornamental plants in the homegardens of southern Morelos, which are also used in ceremonial events. This is important since homegardens are relevant as they provide plant resources for specific uses, but complement each other for different purposes (Pascual-Mendoza et al 2020). Plants in homegardens usually have multiple uses, are frequently linked to the livelihood of the local population, and may reflect characteristic cultural patterns. (Hu et al. 2023). In turn, homegardens are related to the socio-ecological system, where communities seek adaptation strategies according to their needs (Castiñeira et al. 2018).

Resource management and traditional knowledge have been tightly related to cultural aspects, which influence the strategies of use of natural resources by rural settlers (Rangel-Landa et al. 2017). In Mesoamerica, numerous human groups make use of natural resources through exchange, the building of social relationships, the given value to resources cultivated, and the meaning they have in the lives of people (Farfán-Heredia et al. 2018 a, b).

This study proposes the following questions: What uses have the plants of the homegardens in southern Morelos? Are homegardens organized per group of plants with specific uses? Are there plants of multiple use? What is the importance of socioeconomic factors in relation to the management of homegardens?

This research is focused on analyzing the similarities and differences between the main patterns of plant use in some tropical homegardens using multivariate statistics that include some ethnobotanical dimensions of knowledge. We will derive new theoretical information to be used in applied aspects, complementing the traditional ecological knowledge (TEK) with formal ecological knowledge (FEK), using technological tools and research criteria as proposed by Monroy-Ortíz et al. (2018). With these techniques, we reduce subjectivity and avoid bias in the interpretation of what was discussed in the field with resource users. Bias implies the difference between the observations and the potential errors associated with self-reports (Reyes-García et al. 2007).

The relevance of this research based on the TEK-FEK interaction will impact the actions of co-management (participatory management by local people together with social programs) of botanical resources according to the planning strategy on the basis of observed and statistically detected patterns.

Multivariate methods have been used in different aspects of ethnobotanical studies to establish comparisons between the patterns of plant use in different communities in Mexico and the world. Gbedomon et al. (2017) used data on the occurrence and uses of species in 360 homegardens in Benin, West Africa, and through clustering and discriminant canonical analysis, these authors found seven functional groups of homegardens, four with specific functions (food, medicinal, or both food and medicinal) and three with multiple functions. Huai et al. (2011) compared 124 homegardens of eight cultural groups in Southwest China; the authors collected data on the uses of the species and, through classification and ordination by principal components, found floristic differences between homegardens, classifying them into low-altitude and higher-altitude homegardens. Fraser et al. (2011), using data from species richness and abundance in 63 Brazilian homegardens with different types of soil, analyzed agrobiodiversity through nonmetric multidimensional scaling; the authors found that the floristic composition of homegardens was clearly different.

In Mexico, multivariate methods for analyzing ethnobotanical data have been used; some examples in this regard are the studies carried out by Rangel-Landa et al. (2016), who analyzed the function of plants for subsistence, forms of use and management by the inhabitants in a community in Oaxaca, Mexico. Through principal components analysis, these researchers explored the relationship between management and the ecological and cultural importance of species. Additionally, Rangel-Landa et al. (2017) classified plant uses as nutritional, medicinal or ceremonial in Ixcatlán, Oaxaca, Mexico; through analysis of principal components, they calculated the intensity of management, and canonical methods determined the ecological and sociocultural factors that influence the management of plants. Beltrán-Rodríguez et al. (2014) applied nonmetric multidimensional scaling analysis to evaluate the association between socioeconomic variables and ethnobotanical knowledge in a community in southern Morelos, Mexico; these authors concluded that age, gender, agriculture and cattle raising were associated with the knowledge of plant resources.

The objective of this research is to identify patterns of knowledge and use of plants in tropical homegardens from southern Morelos State, Mexico, applying socioeconomic data and multivariate statistics. Another objective is to determine the current trend in the use and management of homegardens at these sites. We hypothesize that there are no differences in floristic composition between homegardens and that the pattern of species use is similar between homegardens, because the people of the community live in close proximity to each other, and encourage and share species of common use; therefore, we anticipate that they will have similar homegarden care activities and species use patterns.

MATERIAL AND METHODS

Study area

This research was carried out in Tilzapotla, Puente de Ixtla municipality, Morelos State, Mexico (18° 37'02" - 18° 38'32" N; 99° 17'27 " - 99° 19'26" W) (Figure 1). Mean altitude is 1004 asl, temperature is 22° C and rainfall is 800 mm, both are annual averages. Climate is warm-subhumid (García 2004). Agriculture is both irrigated and seasonal. Main crops include sorgo (*Sorghum* sp.), corn (*Zea mays* L.), sugar cane (*Saccharum officinarum* L.) and bean (*Phaseolus vulgaris* L.) and are intended for self-supply and sale. Homegardens are traditional with minimal inputs and are complementary to the local economy.

The dominant vegetation of the study area is tropical deciduous forest with remnants of oak forest (Rzedowski, 1978). The dominant species are *Lysiloma acapulcense* (Kunth) Benth. (*tepehuaje*), *L. divaricatum* (Jacq.) J.F. Macbr. (*quebache*), *Ceiba parviflora* Rose (*pochote*), *Leucaena glauca* Benth. (*guaje*), *Bursera morelensis* Ramírez (*cuajiote colorado*), *B. fagaroides* (Kunth) Engl. (*cuajiote amarillo*), *B. odorata* Brandegee (*cuajiote verde*), *B. bipinnata* (DC.) Engl. (*copal*), *Amphipterygium adstringens* (Schltdl.) Standl. (*cuachalalate*), *Guazuma ulmifolia* Lam. (*cuahulote*), *Haematoxylon brasiletto* L. (*brasil*), *Ipomoea murucoides* Roem. & Schult. (*cazahuate*), *Pachycereus weberi* (J, M. Coult.) Backeb. (*organo*), and *Pithecellobium dulce* (Roxb.) Benth. (*guamuchil*), INIFAP (2001).

Sampling design and data collection

The homegardens of the community were counted with the support of orthophotos of the year 2008, at a scale of 1:10000 (INEGI 2010). Subsequently, visits were made to verify in the field what was observed on the maps. The number of homegardens (HG) counted in the images was 265. By random draw and without replacement, 27 HG were selected, corresponding to 10% of the total, in three of which no information was collected, as the owners decided not to participate, therefore we selected 24 homegardens to carry out the study (Figure 1). Twenty-four HG were visited to record data of the plant diversity found in them and the type of uses. The informants were the

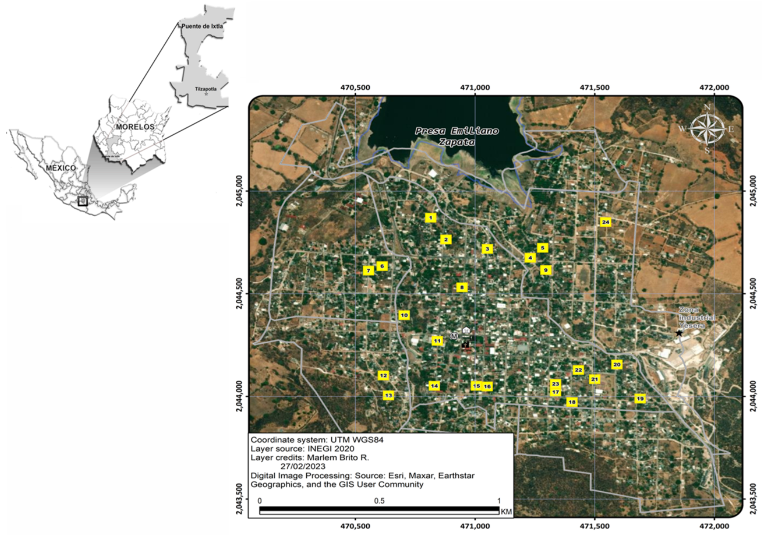

Figura 1. Location of the study area and selected homegardens (1-24).

people who took care of the HG, 19 of whom were women (between 28 and 83 years old, median age 50 years) and 5 men (between 45 and 70 years old, median age 58 years). Before conducting the interviews and communicating the objective of the work, informed consent was requested from the owner for data collection. With respect to the plants in the homegarden, the name, number and use given to the plants that were of interest to the owners of each homegarden were recorded.

The information was obtained through semi-structured interviews with those responsible for the HG, as was carried out by Bernard (2006). Each informant was asked for ethnobotanical and socioeconomic data (Additional Files 1). It was documented which plants they use and which are the most important by means of a free list of information about the care and importance that the homegarden represents for its owners.The registration of the species as well as the number of individuals for each one of them, was carried out by means of visits in each HG in the company of the owner. During the field inspection, a sketch of the homegarden was prepared to locate the distribution of the plants and indicate the management areas by type of use.

A database of species richness in the homegardens and the type of use was developed. The type of uses were recorded and classified in some of the designed categories: alimentary, if some part of the plant is used as food; medicinal, if the part or total plant is used as a traditional medical remedy; ornamental, when the plant is harvested to show off its beauty; and ceremonial, if it is used in religious rituals. Each informant responded regarding which plants they used. The answers served to obtain the list of the most used plants. Botanical material was collected and taxonomically determined and identified with an acronym to be used in statistical analyses. Practices regarding the use of plants were also supported by the ethnographic evidence obtained during the fieldwork.

Data analysis

A two-way clustering analysis was applied to assess the preference of plant use and determine the most common use types. The data for this analysis consisted of a matrix of 132 species. For each homegarden, the number of species harvested and the types of use per species were recorded. The procedure initially consisted of calculating the matrix of similarities between HGs with Sorensen's distance coefficient 1-(2W/A+B), where W is the sum of the shared abundances while A and B are the sum of the abundances in each of the sampling units (McCune and Mefford 2011); subsequently, the grouping of the HGs was based on the flexible beta method (Härdle and Simar 2007). Groups of HGs and their characteristic uses are represented in a dendrogram.

To define the importance of the species by the type of use, a data matrix of 137 species and four types of use was executed; the grouping was based on the procedure described previously. Both analyses were executed with PC-ORD program version 6 (McCune and Mefford 2011).

The multiresponse permutation procedure (MRPP) was applied to test differences in the grouping under the null hypothesis of no differences between the groups of HGs with respect to the use of plants. The Sorensen index calculated the distances of intragroup similarities (Boyce and Ellison

2001). The resulting T statistic describes the separation between the groups; if T is more negative, the differences between the groups are greater (Lesica et al. 1991; McCune and Grace 2002; Mielke and Berry 1976).

With the data obtained from the interviews, a matrix was constructed with the number of references to the species by type of use; this matrix was used to perform a correspondence ordination analysis to determine the trend in the use of species in the homegardens. Two possible trends were expected to be found, either homegardens favoring multipurpose species or homegardens favoring single-purpose species. To determine if there was a pattern of the four main uses of the species in the HGs, a principal coordinate analysis was carried out with 43 species that had more than one use of the four recorded uses. All procedures were carried out with program PC-ORD version 6 (McCune and Mefford 2011).

To understand if the knowledge and use of plants were related to socioeconomic factors, we correlated the number of plants known by the interviewed informants with variables, such as their age, educational level, gender and occupation. Age was recorded by years, while the following three variables were categorized: level of studies: 1) no studies, 2) primary, 3) secondary, 4) high school, or 5) bachelor's degree; gender: 1) female or 2) male; and occupation: 1) house work, 2) peasant, 3) mason, 4) worker, 5) service employee, or 6) industrial employee. The correlation was performed with Spearman's nonparametric method. This analysis was executed in InfoStat software, version 2017 (Di Rienzo et al. 2017).

RESULTS

Species richness

Homegardens were structured by 57 families, 118 genera and 132 useful plant species (Additional Files 2). Information contents in this appendix include the scientific plant names, common names in two languages (English-Spanish), acronyms for identification in some figures, life forms (tree, shrub, or herb), and ID voucher of specimens that are deposited in the HUMO-Herbarium (Morelos, Mexico).

Clustering analysis

Grouping of HGs by type of use (Figure 2) differentiated between the two main groups (G) and some subgroups (SG). G1 contained species used more frequently and for all types of use; SG1 presented species used predominately for food; SG2 was represented by ornamental use, while food, medicinal and religious uses showed a lower frequency of use. G2 consisted of HGs where the number of plants used was lower; within this group, SG1.1 showed plants with a greater diversity of uses, mainly ornamental and less frequently for food and medicinal use. The multiresponse permutation procedure (MRPP) indicated significant differences ($T = -9.4903$, $p < 0.00000603$) in the number of species and type of use among the groups of homegardens defined by the grouping analysis.

The grouping of species by number of uses (Figure 3) indicated the formation of two main groups, which showed important differences. G1 dominated per species used as food, and in G2, the relevant species were ornamentals. Multiuse species were valued in this group, highlighting the subset (SS1.1.2), in which the highest frequency corresponded to alimentary species and medicinals, among them *Verbesina crocata* (Cav.) Less. (Vercro), *Tournefortia hirsutissima* L. (Touhir), *Byrsonima crassifolia* (L.) Kunth (Byrcra), *Dysphania ambrosioides* (L.) Mosyakin & Clemants (Disamb), *Pereskia aculeata* Mill. (Peracu) and *Aloe barbadensis* Mill. (Alobar); also highlighted in another subset (SS1.2.1) were multipurpose use species, such as *Justicia spicigera* (Schltdl.) L.H. Bailey (Jacspi) harvested for four uses, and *Tagetes erecta* L. (Tagere) and *Bougainvillaea glabra* Choisy (Bougla), two species with three different uses. G2 (SG2.1) included ornamentals, and in subset SS2.2.1, there were species for ceremonial use.

Ordination

The correspondence analysis marked that the first two ordination axes contributed with 61.18% and 21.29% of the total variation (Table 1); this analysis makes it possible to understand the preferential use patterns of the plants in the respective homegardens. We can state that the plants maintained in HG 1, 3, 7, 12, and 19 were preferably used for food and combined with ceremonial use, as in HG 19 and 7, while in HG 9, 2, 22, 18, and 17, ornamental-medicinal use was the most frequently observed (Figure 4).This analysis indicates that even when the plants were used for different purposes, there were patterns that indicated their preferential use.

Species such as *Dysphania ambrosoides* (*epazote*), *Byrsonima crassifolia* (*nanche*), *Psidium guajava* L. (*guayaba*), *Mentha canadensis* L. (*hierbabuena*), and others were for alimentary and medicinal uses (Figure 5). In the case of medicinal products, the most commonly used species were *Ruta chalepensis* L. (*ruda*), *Pereskia aculeata* (*uña de gato*), *Aloe barbadensis* (*zábila*), *Piper amalago* L. (*cordoncillo*) and *Senecio salignus* DC. (*jarilla*). Uña de gato and sábila were also used as food. Ornamental plants used in ceremonial rituals included *Achimenes* sp. (*chinos*), *Philodendron* sp. (*teléfono*) and *Catharanthus roseus* (L.) G.

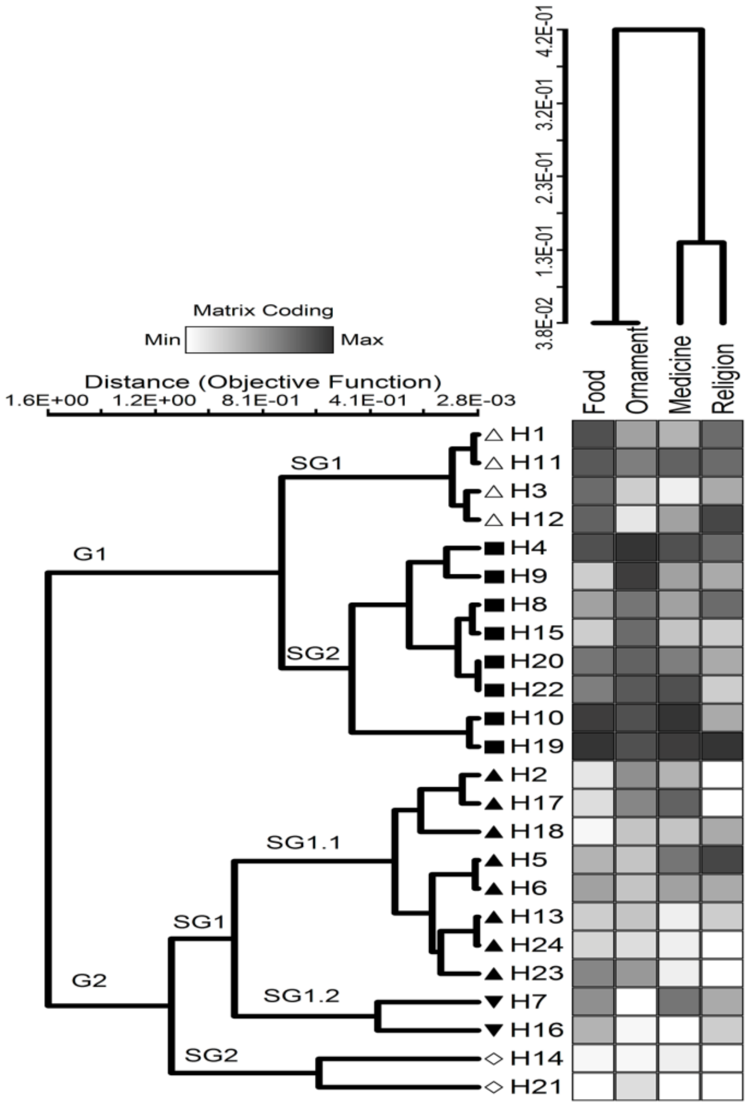

Figura 2. Classification based on main types of plant uses in homegardens in Tilzapotla, Puente de Ixtla, Morelos.

Tabela 1. Eigenvalues and percentage of variance for the correspondence analysis and the principal coordinate analysis.

	Correspondence analysis			Principal coordinates analysis	
	Eigenvalue	**% variance**		**Eigenvalue**	**% variance**
Axis 1	0.10023	61.1	Axis 1	0.12390	60.3
Axis 2	0.0348	21.2	Axis 2	0.38413	18.7

Don (*ninfa*); and in the case of *Piper auritum* Kunth (*hoja santa*), this species was also used for food. *Dieffenbachia* sp. (*gracena*) were classified as species with medicinal and religious uses.

Knowledge and socioeconomic factors

The Spearman correlation coefficient indicated a correlation (r = 0.49, p = 0.0145) between age and the number of known plants (NKP) per manager of the HGs, while with the other social variables (occupa-

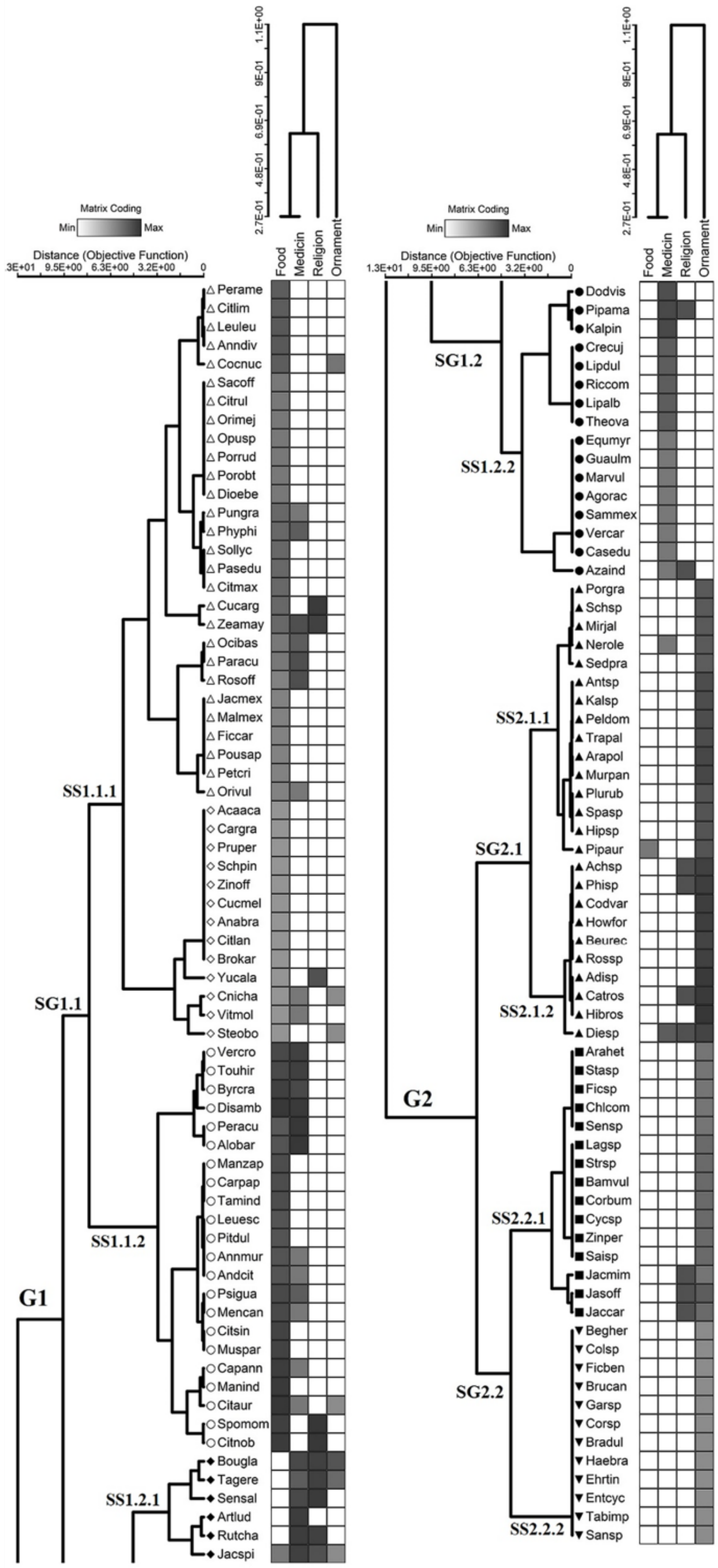

Figura 3. Groups of species by number of uses in homegardens in Tilzapotla, Morelos. Species acronyms and scientific names are identified in Additional Files 2.

tion, schooling, and gender), there was no correlation (Table 2).

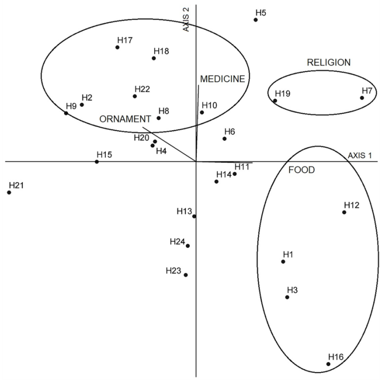

Figura 4. Ordination of tropical homegardens per pattern of preferential use.

Tabela 2. Spearman correlation coefficients between socioeconomic variables and the number of known plants (NKP) in Tilzapotla homegardens.

Variables	N	Spearman correlation coefficients	p-value
Age- NKP	24	0.49	0.0145
Education-NKP	24	0.10	0.6563
Gender-NKP	24	-0.25	0.2345
Occupation-NKP	24	-0.02	0.9276

Importance of multipurpose plants

We observed that the use and management of food plants depended entirely on family preferences. When the family was large, the richness of homegardens mainly contained groups of plants that covered all the needs of the family members, including ceremonial uses. In Tilzapotla, there is a cultural tradition in which boys and girls bring flowers to church for two months. The flowers of all plants are used in this practice; therefore, they are part of the group of multipurpose plants. In HGs 9, 2, 22, 18, and 17, the preferential-use pattern was ornamental-medicinal. The group of people responsible for the HGs consisted of women because they selected flowering plants, such as elderberry (*Sambucus mexicana* C. Presl ex DC.), and *jarilla* (*Senecio salignus* DC.). These species are part of the group of plants preferred for the beauty of their flowers and for their usefulness for respiratory ailments and for cultural diseases in the same order.

The food and medicinal plant production spaces of HGs 11, 14, 19 and 6 showed a pattern of combination of confirmed uses throughout the interviews. The presence of species, such as *Parmentiera aculeata* (Kunth) Seem., *Aloe vera* (L.) Burm., and *Justicia spicigera*, among others, indicated preferred species due to their multiple uses. Some plants are consumed raw as fruit or prepared in water, in tea or cooked. In three HGs of this group, it was observed that the cultivated food species constantly changed. This is an indicator of interest in having a greater diversity of species, according to the season over time.

Women with children managed a greater number of medicinal and food plants, as in HGs 11, 14 and 19 with *zapote negro* (*Diospyros ebenaster* Retz.), *chicozapote* (*Manilkara zapota* (L.) P. Royen, and *nanche* (*Byrsonima crassifolia*).

Spatial arrangement in homegardens

The arrangement of the plants in the HG is in accordance with the size of the properties; there is a positive and significant relationship (r= 0.657, r2=0.41, P=0.0005) between the size of the homegarden and the number of species that are used by the inhabitants of the study area (Figure 6). The correlation coefficient suggests that 41% of the species found in homegardens are explained by the size of the homegarden.

Different arrangements were recorded in the distribution of the plants, in general five common areas were located in all the homegardens (Figure 7), one for ornamental plants, another for those used as condiments near the house, one more for medicinal plants, an area for growing corn-pumpkin, and one more for fruit trees, the one that is furthest from the house; shared areas were frequently presented.

Highlighted results

Five important aspects stand out from the results obtained. 1) Richness in Tilzapotla tropical HGs included 132 species. 2) Groupings of homegardens classified by type of use identified two groups, one where species were used more frequently and for different types of use, and another, where the number of plants used was less but with a greater diversity of uses. The multiresponse permutation procedure (MRPP) indicated significant differences among groups and subsections of homegardens. 3) The grouping of species also showed two groups, one of food species and another of ornamental-ceremonial species. Two-way cluster analysis differentiated the species by the main type of use given by the HG users. 4) Regarding the management of homegardens, the correspondence ordination analysis made it possible to define the main patterns of use of the species. There were HGs specialized in ornamental plants, others in food plants and some others in medicinal plants. 5) The social factors involved pointed to a direct relationship between the age of managers and knowledge of the number and use of plants, regardless of the person's gender, educational level or occupation.

DISCUSSION

Species richness

The species richness recorded in Tilzapotla shows that homegardens are an important reservoir of agrobiodiversity, which is similar to what was described by Bardhan et al. (2012), who mentioned that HG-type agroforestry systems are important sites for biodiversity conservation. These authors compared tree species diversity in natural forest fragments and HG-type agroforestry systems; their results showed similar diversity indices and, in some cases, an evident overlap in species composition between both natural and anthropogenic conditions. A similar case was reported by Huai et al. (2011), who considered that homegardens maintain considerable conservation value as repositories of several species of endangered plants and several species of medicinal plants that are overcollected in the wild.

The inventory of 132 species was similar in richness to the HGs of Tabasco and Yucatán, México (Lope-Alzina and Howard 2012; Serrano-Ysunza et al. 2018). Both localities have different environmental characteristics with respect to those in Tilzapotla and partially share the generalized use of multipurpose species, highlighting the human consumption of various plant species as food.

General pattern of plant use

A pattern observed in all homegardens of Tilzapotla was the presence of multipurpose plants. According to the observations we made, groups of plants were always present as food, as well as groups of medicinal and ornamental plants. Sometimes the HGs showed arrangements of plants with these three categories of use. In the HGs of Tilzapotla, specific areas are set aside for the cultivation of plants for food consumption and medicinal and ornamental use, as is done in other homegardens in different regions of Mexico and the world (Farfán-Heredia et al. 2018 a,b; Nurlaelih et al. 2019; Swandayani et al. 2016).

The importance of having diverse types of plant use is productive to provide food resources and to address health problems both in Mexico and in the world, as considered by Pérez-Nicolás et al. (2017). In Tilzapotla homegardens, the wide range of ornamental plants stands out as an important group, as mainly shown in G1-SG2 (Figure 2), similar to what was found by Neulinger et al. (2013) who recorded a higher percentage of use of ornamental plants than food and medicinal plants in a community in Campeche, Mexico; these authors mentioned that ornamental plants, besides providing an aesthetic value to the house, give distinction to the family.

The floristic results and uses of plant species obtained from Tilzapotla agree with those of the catalog of useful plants from Mexico (Caballero et al. 2010). In both cases, Rutaceae and Fabaceae were the plant families most represented in the category of alimentary use. The floristic composition of Tilzapotla HGs is similar to that of San Rafael Coxcatlán, Puebla, located in a dry-tropical climate due to the predominance of ornamental plants (56%) (Blanckaert et al. 2004). These plant groups are selected for two reasons: aesthetic value (Neulinger et al. 2013) and prestige.

Floristic differences between homegardens and importance of the species

Based on the results of the grouping and comparison analysis using the MRPP method, differences were found among the homegardens in terms of the main type of use of the plants, whether for food, medicinal or ornamental purposes. This is similar to that observed by Huai et al. (2011), who, using multivariate methods, differentiated the homegardens studied into two main groups based on floristic composition determined by use preferences. The above demonstrates that in homegardens both in the study area and

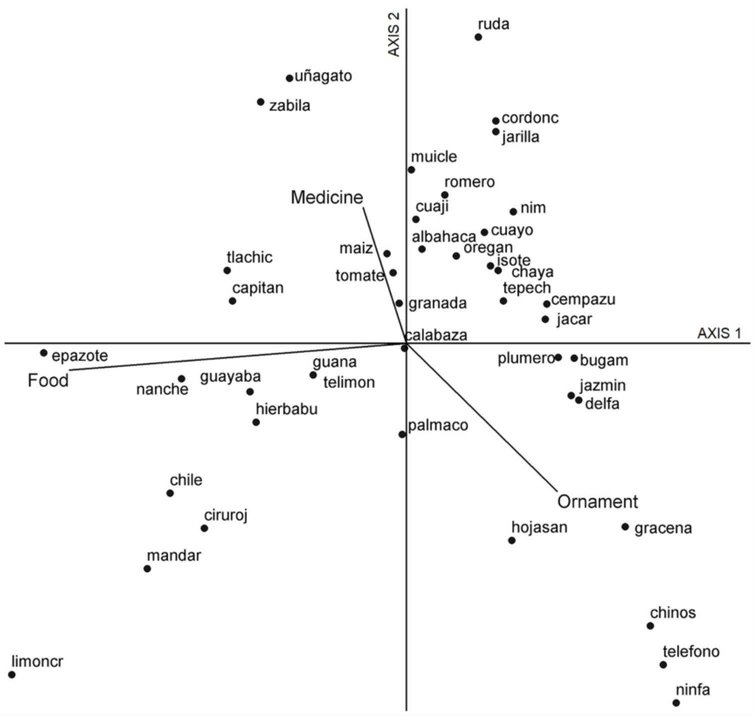

Figura 5. Ordination of plants by preference of use in homegardens. Common names of species and scientific names are identified in Additional Files 2.

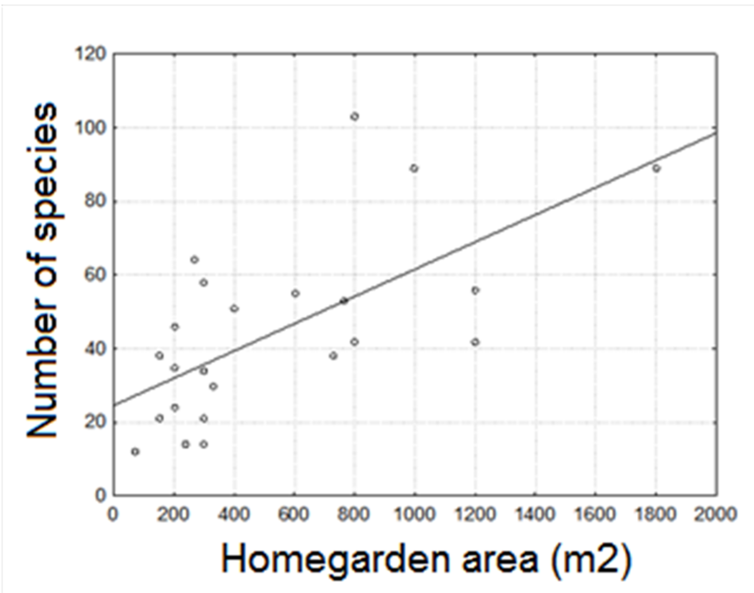

Figura 6. Relationship between the size of the homrgarden and the number of species present in the homegardens of the study area.

those analyzed in other locations in Mexico (Neulinger et al. 2013) and the world, there are differences in species composition due to the preference in the use of plants by homegarden owners.

Homegardens whose floristic composition predominantly contains food plants provide the availability of low-cost food throughout the year, which benefits the family economy as referred to by Cano-Ramírez

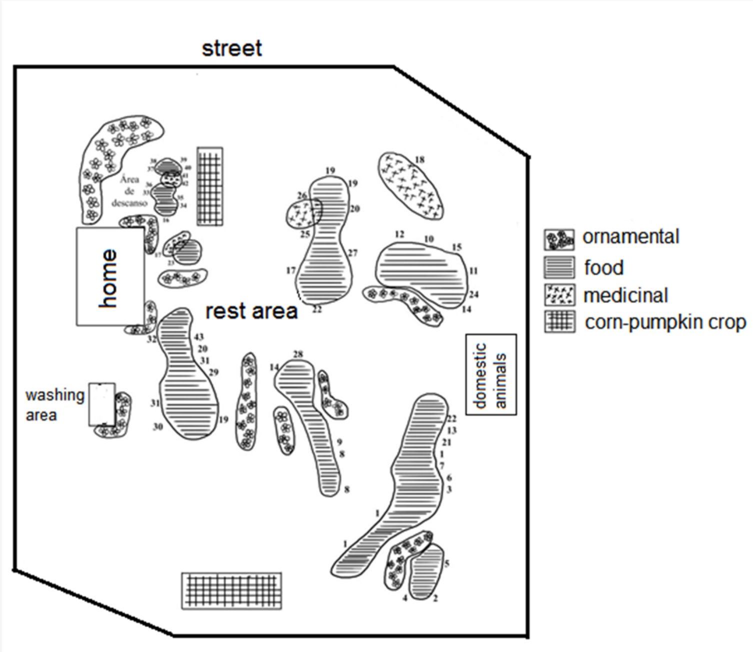

Figura 7. Diagram of the arrangement of plants by type of use in the study area.

et al. (2012), Casas et al. (1996) and Pulido et al. (2008), and further provide numerous ecosystem services (Mattsson et al. (2018). The use of edible plant forms is part of cultural traditions, and the presence of these plants is a generally identifiable pattern in home gardens around the world (Castañeda-Guerrero et al. 2020; Mattsson et al. 2018). In Tilzapotla, corn (*Zea mays*) and squash (*Cucurbita argyrosperma* C. Huber) constitute a group of plants with a specific use as a strategy to guarantee food supply. This form of use of Tilzapotla food plants is consistent with the reported by Neuliger et al. (2013), who commented on the influence of migrants and their customs in establishing other species in their homegardens. For example, immigrants settled in Calakmul, Chiapas, had traditionally cultivated in their place of origin and had retained their cultural roots; so that although they changed settlement, they preferred sowing and establishing the plants they already knew.

This practice would promote a return to the traditional diet. It has been documented since the conquest, and notably in the last 60 years, that the native diet has suffered great changes, due to the substitution or elimination of the milpa agro-ecosystem, because of new structural, socioeconomic and political changes (D'Ambrosio and Puri 2016; Zizumbo-Villarreal et al. 2016). These authors mentioned that the high intake of exotic products changes the native diet, which could explain in part the accelerated increase in the rates of decalcification, cholesterol levels, diabetes, and obesity, among others; whereas before the diet consisted of vegetable products with high contents of fiber, calcium, and potassium. The results from Tilzapotla show a similarity with the HGs of Zimbabwe (Maroyi 2013) in the importance of consuming nutritious food. In Tilzapotla, the interviewees highlighted the benefits to their health by increasing the consumption of fresh products from their HGs.

From the results of the grouping of homegardens, medicinal uses were prominent. Medicinal plants were cultivated by 90% of the interviewees. The floristic composition of Tilzapotla showed Asteraceae and Lamiaceae as the main plants in the category of medicinal use, similar to that reported by Pérez-Nicolás et al. (2017) in humid-tropical homegardens in Oaxaca, Mexico.

Homegarden management

The analysis of homegarden management by preferential use of the plants confirmed food use and the combination of plants with food and ceremonial uses. People's preferences were partially related to family members. The findings confirm the observations in Tilzapotla. For example, during the visits to HGs 1, 3, 7, 12 and 19, those responsible for this group of HGs narrated various experiences on the management of plants that corresponded to a pattern of preferences for the use of food plants. The above referred was highlighted by the analysis of classification and ordination by correspondences, where the preference in some homegardens for the food use of plants was evident; this is in agreement with the results of Rangel-Landa et al. (2017), who, by means of ordination by principal components, found that in Ixcatlán, Mexico, edible plants tended to be managed more intensively than medicinal and ceremonial plants.

On some occasions, homegarden managers pointed out their constant work until obtaining the preferred plants; on others, they spoke of how they brought to the homegardens some specimens of wild species, such as *Jacaratia mexicana* A. DC. and *Verbesina crocata* (Cav.) Less., among others. The above was similar to a case mentioned by Farfán-Heredia et al. (2018 a,b) in the sense that plants that receive selective management are those that have higher management intensity through transplanting, encourangement and cultivation. One more example of management was the tests they performed with other varieties, such as *chile* (*Capsicum* sp.) and corn (*Zea mays*), seeds or vegetative parts that they brought from the field plot, or that they had obtained from exchanges with neighbors or relatives who lived near them in Tilzapotla or as far away as from abroad.

These findings are consistent with those of Linger (2014), who reported an association of fruit species with families where minor children helped with HG work, mainly with the harvesting and consumption of fruits. Our findings are also consistent with those of Hopkins et al. (2015); there is an interest in medicinal plants when families have children, as occurred in HGs 11 and 14. Nanche and black tea (*Ruellia brittoniana* Leonard) are necessary species and are widely harvested because their products are used for digestive problems. Older adults will handle a greater number of medicinal plants due to the extensive knowledge they have about their use and application for different diseases.

In the interviews, the most important reason why people still valued medicinal plant knowledge was asked; the response to this question was their role in treating culture-linked syndromes (Kunwar et al. 2019; Zank et al. 2015). In other words, there is a vision of potential use, which at some point of time will be required. The commented reasons for maintaining resources in the HGs in relation to familiar composition validate the presence of both cultivated and wild medicinal species, although some of them were sometimes recorded as little used. Species availability strongly influences plant knowledge and use for different purposes. Recent studies reported by Muñiz de Medeiros et al. (2021) in a rural community in northeastern Brazil using the local perception of availability instead of conventional ecological tools found that availability may not be disregarded in regard to predicting species relevance for medicinal and food purposes.

Another recent study highlighted the maintenance of traditional medicinal species and the important role of these plants in the Guarani indigenous community in Brazil (Carlotto et al. 2021). The analysis of plant management in Tilzapotla showed the pattern of preferential use of food and medicinal plants such as *D. ambrosoides* and *B. crassifolia*. The use of medicinal plants in this region is consistent with the reports by Pérez-Nicolás et al. (2017) in Oaxacan HGs; in both cases, having the necessary plants very close to the house in case of any health problems is an advantage, and their production is facilitated by the good condition of environments that stimulates the growth of these plants.

The presence of medicinal plants in the HGs according to Arias Toledo et al. (2007) is indicative of the existence of a traditional medical system. People appreciate medicinal plants and their uses coexist with Western medicine, but if diseases are closer to traditional than scientific medicine, they prefer to initiate this treatment.

Referring to the preference of plants in HGs, the person in charge of HG 19 showed the fondness by the flowers, emphasizing ornamental purposes. This confirms the importance of flowers and the formation of groups of ornamental plants in the multivariate analysis. In addition, flowers are easily produced due to the fertility of the soil. On steep slopes where the soil is poor, HGs play a key role in production systems favoring a balance between the maintenance of resources and subsistence needs (Del Angel-Pérez and Mendoza 2004).

Socioeconomic factors

The results among knowledge of the species and socioeconomic factors expressed a relationship only with the age variable. Age plays a determining role in the number of species known to the community. In Tilzapotla, the elderly knew more than the young people. This is consistent with Case et al. (2005) and Beltrán-Rodríguez et al. (2014), who mentioned that age was associated with ethnobotanical knowledge in the sense that the older inhabitants of the communities that they studied knew a greater number of useful plants.

CONCLUSION

This study shows that in the floristic composition of Tilzapotla homegardens, ornamental plants predominate, their validity has a high aesthetic value, but food, medicinal and religious plants also play an important role in the community. Users typically appreciate combinations of plants with multiple uses within gardens.

The patterns of plant uses grown in homegardens change according to the preferences of the users. The pattern of preferential use shown here confirms food use combined with religious use. The patterns of use are better understood when social and biophysical factors are involved.

The results of multivariate analysis exposed the trend in the pattern use of species managed in the homegardens studied and allowed us to reject the hypothesis of nullity due to differences between richness and the preference of species. The management of homegardens represented diverse patterns of species use and determined the null influence of the socioeconomic factors analyzed, with the exception of the age of the managers and their knowledge of the species.

DATA AVAILABILITY

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

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

Conceived of the presented idea: AOS, ARM, CMO and MLC.
Carried out the field work: AOS.
Carried out the data analysis: AOS and MLC.
Wrote the first draft of the manuscript: AOS, ARM and MLC.
Review and final write of the manuscript: AOS, ARM, CMO and MLC.

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Additional Files

Add File 1. Survey format for socioeconomic and ethnobotanic data.

Date__________ Number homegarden____ Surface _______ Set time ________
Owner name ___________________ Origin of the informant ____________
Address________________________Occupation________________
_____________Age_____ Scholarship _______________
What is your monthly income? ________
How many families live here?___________ Number of family members ______
Receive money-remittances? Yes_____ No_____ Frequency ___________ Allocate part of it to the homegarden? ________ How much?________
Do you have farm animals?_______ How many?_______
what type?______________________
Are they for self supply?________ Are they for sale?_________

Ethnobotanical Data

What plants do you use in the homegarden?_____________________
What are the three most important plants for you?____________________
Date _______________________
Number homegarden _____ Nombre(s)_____________________
How did you get the plant?: Bought ____ Exchange ______ Spontaneous ____ Brought from the mountain
Uses: Ornament ______ Shade ______ Religious _______ Food ______ Medicinal ______ Other ________

Food: used part_______way of making_______ conservation _______
Frequency of consumption_____
Medicinal: used part_________
What ailment do you use it for? Mode of preparation ________
Sale _____ sale grade: High ____ Medium ____ Low ____
Price ________ Unit of measurement __________ Fresh ______ Dry ____
Place of sale___________

Add File 2. Scientific name, common name (English and Spanish), acronyms as cited in Figs. 2 and 4, life form, and ID voucher (HUMO Herbarium).

Family	Scientific name	Common name	Acronym	Life form	Use	Presence	Voucher
Fabaceae	*Acacia acatlensis* Benth.	Borrego	Aca aca	Tree	F	1	32988
Gesneriaceae	*Achimenes* sp. Pers.	Chinos	Ach sp	Herb	O	8	32996
Adiantaceae	*Adiantum* sp.	Fern, Helecho	Adi sp	Herb	O	3	32887
Asphodelaceae	*Aloe vera* (L.) Burm.f.	Zabila	Alo ver	Herb	F, M	6	32930
Bromeliaceae	*Ananas bracteatus* (Lindl.) Schult. & Schult. f.	Pineapple, Piña	Ana bra	Herb	F	1	32956
Poaceae	*Andropogon citratus* DC	Lemon grass, Te limón	And cit	Herb	O, F	5	33035
Annonaceae	*Annona diversifolia* Safford	Ilama, Ilama	Ann div	Tree	F	5	32893
Annonaceae	*Annona muricata* L.	Soursop, Guanábana	Ann mur	Tree	F	1	32892
Araceae	*Anthurium* sp. Schott	Anthurium, Anturio	Ant sp	Herb	O, R	2	32905
Araceae	*Aralia polyscias* Spreng. ex Seem	Large, Buena suerte	Ara pol	Herb	O	3	32913
Araucariaceae	*Araucaria heterophylla* (Salisb.) Franco	Star pine, Araucaria	Ara het	Tree	O	1	32915
Asteraceae	*Artemisia ludoviciana* subsp. mexicana (Willd. ex Spreng.) D.D. Keck.	Estafiate	Art lud	Herb	M	5	32932
Meliaceae	*Azadirachta indica* A. Juss	Nim	Nim	Tree	M	1	33016
Poaceae	*Bambusa vulgaris* Schrad.	Bamboo, Bambú	Bam vul	Shrub	O	2	33034
Begoniaceae	*Begonia heracleifolia* Schltdl.& Cham.	Begonia	Beg her	Herb	O, R	3	32942
Asparagaceae	*Beuacarnea recurvata* Lem.	Ponytail Plant, Pata de elefante	Beu rec	Herb	O	2	32925
Nyctaginaceae	*Bougainvillea glabra* Choisy	Bugambilia	Bou gla	Shrub	O, R	5	33023
Arecaceae	*Brahea dulcis* (Kunth) Mart.	Palma brahea	Bra dul	Tree	O	1	32916
Bromeliaceae	*Bromelia karatas* L.	Timbiriche	Bro kar	Herb	F	1	32957
Solanaceae	*Brugmansia candida* Pers.	Floripondio	Bru can	Shrub	M, R	1	33060
Malpighiaceae	*Byrsonima crassifolia* (L.) Kunth	Nanche	Byr cra	Tree	F, M	10	33012
Solanaceae	*Capsicum annuum* L.	Piquin pepper, Chile piquin	Cap ann	Herb	F	10	33061
Caricaceae	*Carica papaya* L.	Papaya	Car pap	Tree	F	1	32961
Apocynaceae	*Carissa grandiflora* (E. Mey.) A. DC.	Carisa	Car gra	Shrub	F	1	32897
Apocynaceae	*Catharanthus roseus* (L.) G. Don	Ninfa	Cat ant	Herb	F, R	3	32898
Arecaceae	*Chamaedora elegans* Mart.	Palma	Cha ele	Herb	O	7	32917
Asparagaceae	*Chlorophytum comosum* (Thunb.) Jacques	Mala madre	Chl com	Tree	O	3	33010
Cucurbitaceae	*Citrulus lanatus* (Thunb.) Mansf.	Sandía	Cit lan	Herb	F	1	32973
Rutaceae	*Citrus limetta* Risso	Sweet Lime, Lima	Cit lim	Tree	F	5	33048
Rutaceae	*Citrus limonia* (L.)Osbeck	Limón real	Cit rul	Tree	F	3	33049
Rutaceae	*Citrus maxima* (Burm.) Merr.	Grapefruit, Toronja	Cit max	Tree	F	2	33050
Rutaceae	*Citrus nobilis* Lour.	Tangerine, Mandarina	Cit nob	Tree	F	1	33051
Rutaceae	*Citrus sinensis* (L.) Osbeck	Sweet orange, Naranjo	Cit sin	Tree	F	12	33052
Rutaceae	*Cnidoscolus chayamansa* McVaugh	Chaya	Cni cha	Shrub	F, M	1	32983

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Arecaceae	*Cocos nucifera* L.	Coco	Coc nuc	Tree	O	7	
Euphorbiaceae	*Codiaeum variegatum* (L.) Rumph. ex. A. Juss.	Croto	Cod var	Herb	O	3	32985
Lamiaceae	*Coleus* sp. Lour.	Coleo	Col sp	Herb	O	3	33000
Asparagaceae	*Cordyline* sp. Comm. ex R. Br.	Muñeca	Cor sp	Herb	O, R	1	32931
Cactaceae	*Coryphantha bumamma* Britton & Rose	Bisnaga	Cor bum	Herb	O, M	2	32959
Bignoniaceae	*Crescentia cujete* L.	Cuatecomate manso	Cre cuj	Tree	M	1	32946
Cucurbitaceae	*Cucumis melo* L.	Melón	Cuc mel	Herb	F	1	32974
Cucurbitaceae	*Cucurbita argyrosperma* K. Koch	Calabaza	Cuc arg	Herb	F	1	32975
Cycadaceae	*Cycas* sp. L.	Cyca	Cyc sp	Herb	O	1	32977
Araceae	*Dieffenbachia* sp. Schott	Gracena	Die sp	Herb	O	1	32906
Ebenaceae	*Diospyros ebenaster* Retz.	Zapote negro	Dio ebe	Tree	F	1	32979
Sapindaceae	*Dodonaea viscosa* Jacq.	Chapulixtle	Dod vis	Shrub	M	1	33055
Amaranthaceae	*Dysphania ambrosioides* (L.)	Epazote	Dys amb	Herb	F, M	11	32963
Boraginaceae	*Ehretia tinifolia* L.	Palo prieto	Ehr tin	Tree	S	3	32954
Fabaceae	*Enterolobium cyclocarpum* (Jacq.) Griseb.	Parota	Ent cyc	Tree	S	2	32989
Equisetaceae	*Equisetum myriochaetum* Schlecht. & Cham.	Cola de caballo	Equ myr	Herb	M	1	32980
Moraceae	*Ficus benjamina* L.	Ficus	Fic ben	Tree	S	3	33017
Moraceae	*Ficus carica* L.	Higo	Fic car	Tree	F	1	33018
Moraceae	*Ficus* sp. L.	Laurel de la India	Fic sp	Tree	S	2	33017
Rubiaceae	*Gardenia* sp. J. Ellis	Gardenia	Gar sp	Herb	O, R	1	33045
Sterculiaceae	*Guazuma ulmifolia* Lam.	Cuaulote	Gua ulm	Tree	M	1	33065
Fabaceae	*Haematoxylum brasiletto* G. Karst.	Palo Brasil	Hae bra	Tree	M	1	32990
Malvaceae	*Hibiscus rosa-sinensis* L.	Tulipán	Hib ros	Shrub	O, R	4	32952
Amaryllidaceae	*Hippeastrum* sp. Herb.	Mancuerna	Hip sp	Herb	O, R	1	32889
Arecaceae	*Howea forsteniana* (F.Muell.) Becc.	Hawaiana	How for	Shrub	O, R	3	39456
Bignoniaceae	*Jacaranda mimosifolia* D. Don	Jacaranda	Jac mim	Tree	O, R	1	32947
Caricaceae	*Jacaratia mexicana* A. DC.	Bonete	Jac mex	Tree	F	2	32962
Acanthaceae	*Jacobinia carnea* (Lindl.) G. Nicholson	Plumero rosa	Jac car	Shrub	O, R	2	32884
Oleaceae	*Jasminum officinale* L.	Jazmín	Jas off	Herb	O, R	1	33025
Acanthaceae	*Justicia spicigera* Schltdl.	Muicle	Jus spi	Herb	F, M	8	32885
Crassulaceae	*Kalanchoe pinnata* (Lam.) Pers.	Sinvergüenza	Kal pin	Herb	M	2	32968
Crassulaceae	*Kalanchoe* sp. Adans.	Kalanchoe	Kal sp	Herb	O	2	32967
Lythraceae	*Lagerstroemia* sp. L.	Astronómica	Lag sp	Shrub	O, R	2	33011
Fabaceae	*Leucaena esculenta* (Moc. & Sessé ex A.DC) Benth. ssp. esculenta	Guaje rojo	Leu esc	Tree	F	5	32991
Fabaceae	*Leucaena leucocephala* (Lam.) de Wit. ssp. glabrata (Rose) Zárate	Guaje	Leu leu	Tree	F	10	32992

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Fabaceae	*Lippia alba* (Mill.) N.E. Br. ex Britton & P. Wilson	Salvia	Lip alb	Herb	M	2	33059
Fabaceae	*Lippia dulcis* Trevir.	Hierba dulce	Lip dul	Herb	M	1	33069
Malpighiaceae	*Malpighia mexicana* Juss.	Guachocote	Mal mex	Tree	F	1	33013
Anacardiaceae	*Mangifera indica* L.	Mango	Man ind	Tree	F, M	18	32090
Sapotaceae	*Manilkara zapota* (L.) P. Royen	Chicozapote	Man zap	Tree	F	3	33056
Lamiaceae	*Mentha canadensis* L.	Hierbabuena	Men can	Herb	F, M	7	33002
Nyctaginaceae	*Mirabilis jalapa* L.	Maravilla	Mir jal	Herb	O	1	33024
Rutaceae	*Murraya paniculata* (L.) Jack	Limonaria	Mur pan	Shrub	O	1	33053
Musaceae	*Musa paradisiaca* L.	Plátano	Mus par	Shrub	F	9	33020
Apocynaceae	*Nerium oleander* L.	Olenader, Delfa	Ner ole	Herb	O, R	5	32899
Lamiaceae	*Ocimum basilicum* L.	Albahaca	Oci bas	Herb	M	3	33004
Cactaceae	*Opuntia* sp. Mill.	Nopal	Opu sp	Shrub	F	2	32958
Lamiaceae	*Origanum mejorana* L.	Mejorana	Ori mej	Herb	F	2	33005
Lamiaceae	*Origanum vulgare* L.	Orégano	Ori vul	Herb	F	2	33006
Bignoniaceae	*Parmentiera aculeata* (Kunth)Seem.	Cuajilote	Par acu	Tree	F, M	4	32948
Passifloraceae	*Passiflora edulis* Sims	Maracuyá	Pass edu	Shrub	F	3	33029
Geraniaceae	*Pelargonium domesticus* L.H. Bailey	Geranio	Pel dom	Herb	O, R	3	32995
Cactaceae	*Pereskia aculeata* Mill.	Uña de gato	Per acu	Shrub	F, M	7	32972
Lauraceae	*Persea americana* Mill.	Aguacate	Per ame	Tree	F	2	33009
Apiaceae	*Petroselinum crispum* (Mill.) Fuss	Perejil	Pet cri	Herb	F	2	32895
Araceae	*Philodendron* sp. Schott	Teléfono	Phi sp	Herb	O	6	32907
Solanaceae	*Physalis philadelphica* Lam. (Brot. ex Hornem) Sobr.	Tomate	Phy phi	Herb	F	7	33063
Piperaceae	*Piper amalago* L.	Cordoncillo	Pip ama	Herb	M	1	33031
Piperaceae	*Piper auritum* Kunth	Hoja santa	Pip aur	Shrub	F, M	3	33032
Fabaceae	*Pithecellobium dulce* (Roxb.) Benth.	Guamúchil	Pit dul	Tree	F	8	32993
Apocynaceae	*Plumeria rubra* L.	Cacaloxóchitl blanco	Plu rub	Tree	O, R	1	32900
Asteraceae	*Porophyllum obtusifolium* DC.	Pipitzca	Por obt	Herb	F	2	32934
Asteraceae	*Porophyllum ruderale* var. *macrocephalum* (DC.) Cronquist	Pápalo	Por rud	Herb	F	1	32935
Portulaceae	*Portulaca grandiflora* Hook.	Amor de un rato	Por gra	Herb	O	2	33039
Sapotaceae	*Pouteria sapota* (Jacq.) H.E. Moore & Stearn	Mamey	Pou sap	Tree	F	3	33057
Rosaceae	*Prunus persica* (L.) Batsch	Durazno	Pru per	Tree	F	1	33042
Myrtaceae	*Psidium guajava* L.	Guayaba	Psi gua	Tree	F,M	5	33022
Lythraceae	*Punica granatum* L.	Granada	Pun gra	Tree	F,M	3	33041
Euphorbiaceae	*Ricinus communis* L.	Castor Oil plant, Higuerilla	Ric com	Shrub	M	2	32987
Rosaceae	*Rosa* sp. L.	Rose, Rosa	Ros sp	Herb	O, R	1	33043

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Lamiaceae	*Rosmarinus officinalis* L.	Rosemary, Romero	Ros off	Herb	M	2	33008
Rutaceae	*Ruta chalepensis* L.	Ruda	Tur cha	Herb	M, R	5	33054
Poaceae	*Saccharum officinaram* L.	Caña de azúcar	Sac off	Herb	F	7	33036
Gesneriaceae	*Saintpaulia* sp. H. Wendl.	Violeta	Sai sp	Herb	O	1	32997
Asparagaceae	*Sansevieria* sp.Thunb.	Viborilla	San sp	Herb	O	4	32888
Araliaceae	*Schefflera* sp. J.R. Forst. & G.Forst.	Aralia	Sch sp	Herb	O	6	32910
Asteraceae	*Schkuria pinnata* (Lam.) Kuntze ex Thell.	Escoba	Sch pin	Herb	D	1	32936
Crassulaceae	*Sedum praealtum* A. DC.	Siempre viva	Sed para	Herb	M	1	32971
Asteraceae	*Senecio salignus* DC.	Jarilla	Sen sal	Shrub	M, R	4	32937
Asteraceae	*Senecio* sp. L.	Tipo margarita	Sen sp	Herb	O	1	39457
Solanaceae	*Solanum lycopersicum* L.	Tomato, Jitomate	Sol lyc	Herb	F	4	33062
Araceae	*Spathiphyllum* sp. Schott	Cuna de moisés	Spa sp	Herb	O	3	32908
Anacaridiaceae	*Spondias mombin* L.	Ciruela roja	Spo mom	Tree	F	1	32891
Apocynaceae	*Stapelia* sp. L.	Huele feo	Sta sp	Herb	O	1	32922
Apocynaceae	*Stemmadenia obovata* var. *mollis* (Benth.) Woodson	Tepechicle	Ste obo	Tree	O	1	32901
Strelitziaceae	*Strelitzia* sp. Aiton	Ave de paraíso	Str sp	Herb	O	3	33021
Bignoniaceae	*Tabebuia impetiginosa* (M. Martens ex DC.) Standl.	Tlamiahual	Tab imp	Tree	O	2	32951
Asteraceae	*Tagetes erecta* L.	Pericón	Tag ere	Herb	M	1	32939
Fabaceae	*Tamarindus indica* L.	Tamarindo	Tam ind	Tree	F	7	32994
Apocynaceae	*Thevetia ovata* (Cav.) A. DC.	Yoyote	The ova	Tree	M	1	32902
Heliotropiaceae	*Tournefortia hirsutissima* L.	Tlachichinol	Tou hir	Herb	F	8	32955
Commelinaceae	*Tradescantia pallida* (Rose) D.R. Hunt	Hierba del pollo	Tra can	Herb	O	2	32964
Asteraceae	*Verbesina crocata* (Cav.) Less.	Capitaneja	Ver cro	Herb	F, M	10	32940
Lamiaceae	*Vitex mollis* Kunth	Cuayotomate	Vit mol	Tree	F,M	1	33071
Asparagaceae	*Yucca alaifolia* L.	Izote	Yuc ala	Tree	O	1	39458
Poaceae	*Zea mays* L.	Maíz	Zea may	Herb	F	2	33037
Zingiberaceae	*Zingiber officinale* Roscoe	Jengibre	Zin off	Herb	F	1	33072
Asteraceae	*Zinnia peruviana* (L.) L.	San Miguel	Zin per	Herb	O	2	32941