Agricultura, Sociedad y Desarrollo

SOCIAL AND CULTURAL FACTORS THAT FAVOR RICHNESS OF FRUIT TREES IN FAMILY GARDENS

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ABSTRACT

Family gardens (FGs) are complex due to the evolutionary process of the relationship between society and nature. In San Andrés Nicolás Bravo, FGs are seen to conserve an important diversity, particularly of fruit species. The objective of the study was to analyze the sociocultural factors that allow the existence of the richness of fruit tree species. To identify which of the factors are significant, as well as associations between them, 50 people from San Andrés Nicolás, 38% women and 62% men, were interviewed. With results from the interviews, a χ^2 test was used to identify social and cultural factors that allow or affect the richness of species in FGs. The significant social factors were the occupation of the person in charge of the FG, the education of those in charge and the age of the person responsible for maintaining the FG; the significant cultural factors were religion and uses of the fruit species. Meanwhile, the non-significant social factors were age, total surface of the family garden, surface for fruit species and gender of the person responsible for the FG. The richness of fruit species is related to their use, the family's religion and the characteristics of the person responsible for the garden; the age and size of the garden did not influence their richness and neither did the gender of the person responsible for the garden. Family gardens in San Andrés Nicolás Bravo are a clear example that it is possible to use and conserve biodiversity and that biocultural heritage is preserved through management practices.

Keywords: agrobiodiversity, local knowledge, conservation, Malinalco Mexico, use of species.

Citation: Guadarrama-Martínez Noemí, Chávez-Mejía MC. 2023. Social and cultural factors that favor richness of fruit trees in family gardens. Agricultura, Sociedad y Desarrollo https://doi.org/10.22231/asyd.v20i4.1530

ASyD 20(4): 425-438

Editor in Chief:
Dr. Benito Ramírez Valverde

Received: March 29, 2022.
Approved: February 16, 2023.

Estimated publication date:
September 28, 2023.

INTRODUCTION

In Mexican rural zones, families resort to various subsistence strategies and one of them is having family gardens (Mariaca, 2012). The family designs various strategies to produce and use plants for food, medicine, ornament, fodder, rituals and other uses, in addition to raise domestic animals for their own consumption, sale, exchange and to farm the land, such as traction animals (García *et al.*, 2016a). Thus, family gardens (FGs) are spaces for agriculture and livestock production, but they are also for family and community socialization (García *et al.*, 2018), which results in a broad diversity of plant and animal species (Salazar *et al.*, 2015); all this contributes to the family and community economy (Bautista *et al.*, (2016). Therefore, they are considered an important family life strategy for peasant and rural households (Cano *et al.*, 2016) and spaces for the conservation of biocultural heritage (Calvet-Mir *et al.*, 2016).

Family gardens are diverse with regards to structure and biodiversity, because their complexity is related to specific environmental, economic, social and cultural contexts (Calvet-Mir *et al.*, 2012; García *et al.*, 2016a). In some cases, the gender, occupation, education and religion of the family influence the floristic richness of the FGs (Manfredo

et al., 2016). In others, the gender does not influence the diversity of the FGs, but the age of the garden owner does (Gbedomon *et al*., 2015), and in some cases the ethnicity has an influence (Caballero-Serrano *et al*., 2016). These examples show the diversity of factors that influence the composition of the FGs, which are relevant for the subsistence of families and for the conservation of biodiversity, particularly because some exotic species are kept in them (Rayol *et al*., 2019).

Family gardens in the municipality of Malinalco, Estado de México, as others in the country, change in structure but stand out for their floristic diversity (White *et al*., 2013). San Andrés Nicolás Bravo, municipality of Malinalco, is characterized by the richness of species (59 species) destined primarily to the sale at the local and regional level (Guadarrama *et al*., 2018; Guadarrama *et al*., 2021). Fruit species are of utilitarian importance; they are a significant food resource for families, since they are traded and exchanged; and they are also used as limits for the gardens and agricultural lands. Although FGs are relevant in the family life, internal and external dynamics influence the conservation and loss of biodiversity (Moctezuma, 2014), and in some cases the interest for the consumption of garden products is even lost (Cruz-Bautista *et al*., 2021), or the space devoted to plants and animals is reduced, and instead, houses are built (González-Jácome, 2012). Because of this, the objective of the research was to identify the sociocultural factors that influence the richness of fruit species.

THEORETICAL DISCUSSION

Ethnobotany, from an interdisciplinary approach, allows the analysis of the complexity of biological diversity of family gardens as socioecological and biocultural systems (Alayón and Morón, 2014; Balick and Cox, 2021), in which plant diversity reflects family life strategies (García *et al*., 2019). One of the characteristics that influences their dynamics is that they are spaces where the family lives and reproduces (Lópe-Ancina *et al*., 2018) and where members carry out activities to care for the gardens and make decisions about what biodiversity to conserve or replace (Colín *et al*., 2013; Manzanero-Medina *et al*., 2018), according to changing needs and interests (Leach *et al*, 1999). They are spaces where the family lives, where goods are obtained to satisfy daily needs, so the existence of plants and animals for food stands out, as well as medicinal and ornamental plants. These elements are sustained through traditional knowledge of men and women, which are constructed, acquired, transmitted and socialized (Gispert, 2010), generating a biocultural memory (Toledo and Barrera-Bassols, 2008). Because they are millenary agroecosystems and biocultural manifestations, they are considered to be part of the biocultural heritage of indigenous and peasant peoples (Boege, 2008).

Thus, the composition of family gardens is diverse, because environmental and sociocultural factors influence their vertical and horizontal structure; they are multifunctional and within them, there is constant interaction between their elements, so they are considered to be agroecosystems (Mariaca, 2012; Bautista *et al*., 2016) that are changing but which persist. Taking into account that the arrangement and the composition of the gardens

are related to their particular ecological, sociocultural and economic context, the study identifies which sociocultural factors influence the diversity of family gardens in San Andrés Nicolás Bravo.

METHODOLOGY

San Andrés Nicolás Bravo (SANB) is an *ejido* in the municipality of Malinalco, Estado de México, located at a mean altitude of 1,200 masl, with an extension of 217.99 km^2, and vegetation of low deciduous forest (Rzedowski, 2006). In 2020 the total population was 1,619 inhabitants, of which 803 were men and 816 women. In SANB there are 138 households, from which 50 were chosen using the snowball technique, with gardens that are locally known to have the greatest plant diversity. For this purpose, an *ejidatario* was presented with the purpose of the research and his family was contacted; their consent was requested to conduct the interview about their family garden, and they were asked to point to the gardens with most vegetation. During the time available for the field work, from October 2020 to March 2021, the owners of the gardens were interviewed and they were informed about the study's objective and asked for their consent. Interviews were applied to 19 women and 31 men, who were between 40 and 93 years old. Each garden was visited twice or three times to carry out the interview. The following social factors about the person responsible for the garden were recorded: education, gender, occupation and age; and as social factors of the garden's structure, the following were taken into account: total surface of the family garden, surface devoted to plants, and age of the garden. The cultural factors analyzed were religion practiced by the family and uses of the fruit species. To identify which factors are significant, as well as the association between them, the χ^2 test with a level of confidence of 95% was conducted (Fowler *et al.*, 1998).

RESULTS

Socioeconomic and cultural characterization of the families

The age of the interview respondents varied between 40 and 93 years. The number of members of the family is four to seven. The religion of the families studied was 64% Catholic, 28% Jehovah's Witnesses, and 8% Adventist.

The family occupation is: seller-homemaker (36%), seller (28%), collector-seller (16%), bricklayer-seller (8%), blacksmith (4%) and others (8%).

Structure of family gardens

In SANB, the FGs vary in size and shape; the one with smallest surface measures 510 m^2 and the largest is 750 m^2 and the surface devoted to plants also varied from 75 m^2 for the smallest surface to the largest with 325 m^2. The fruit species are in the back of the house in 56% of the cases, 26% to the side of the house, and 18% in the front part. One characteristic of the FGs in SANB is that tree and shrub species predominate as limits bordering between the other neighboring FGs. Because of the vertical and horizontal arrangement of the family gardens in SANB, they have a quadrangular, rectangular or irregular shape.

Richness of fruit species

In SANB the vertical structure of the FGs is composed of three strata: arboreal, shrubby and herbaceous; there are 37 fruit-tree species (77.1%), in second place there are 7 shrubs (14.5%), and 4 herbs (8.3%). Regarding the diversity of the species, a total of 38 genera, 22 families and 48 fruit species were found (Table 1). The most representative family is Rosaceae, with seven species, which is 14.5% of the total, followed by the family Rutaceae with five species, 10.4%, and Myrtaceae with four species, 8.33% of the total species.

Table 1. Richness of fruit species in family gardens.

Taxon	Local name(s) in Spanish	Biological form	Origin	Number of FGs*
Anacardiaceae				
Mangifera indica L.	Mango	Tree	I	50
Spondia purpurea L.	Ciruela	Tree	N	27
Spondia mombin L.	Ciruela de bola	Tree	N	12
Crescentia alata Kunth	Cirian, socos	Tree	N	17
Bignoniaceae				
Parmentiera aculeata (Kunth) Seem.	Cuajilote	Tree	N	18
Bromeliaceae				
Bromelia karatas L.	Timbiriche	Herbaceous	N	16
Cactaceae				
Pereskia aculeata Mill.	Uña de gato	Shrub	N	13
Caricaceae				
Jacaratia mexicana A. DC	Bonete	Tree	N	11
Carica papaya L.	Papaya	Shrub	N	14
Cucurbitaceae				
Melothria pendula L.	Sandia de ratón	Herbaceous	N	15
Ebenaceae				
Diospyros nigra (J.F. Gmel.) Perr.	Zapote negro	Tree	N	14
Fabaceae				
Inga spuria Humb. & Bonpl.	Cuajinicuil	Tree	N	20
Leucaena leucocephala (Lam.).	Huaje	Tree	N	18
Tamarindus indica L.	Tamarindo	Tree	I	44
Pithecellobium dulce (Roxb.) Benth.	Huamuchil	Tree	N	16
Juglandaceae				
Juglans regia L.	Nuez	Tree	N	11
Lauraceae				
Persea americana Mill.	Aguacate	Tree	N	14
Lythraceae				
Punica granatum L.	Granada roja	Tree	N	12
Malpighiaceae				
Byrsonima crassifolia (L.) Kunth	Nanche	Tree	N	14
Malpighia mexicana A. Juss.	Huachocote, jocotes	Tree	N	11

Table 1. Continuation.

Taxon	Local name(s) in Spanish	Biological form	Origin	Number of FGs*
Moraceae				
Artocarpus heterophyllus Lam.	Yaca	Tree	I	6
Musaceae				
Musa spp. L.	Plátano	Shrub	N	8
Myrtaceae				
Psidium guajava L.	Guayaba blanca	Tree	N	22
Psidium montanum Mill.	Guayaba rosa	Tree	I	16
Psidium sartorianum (O. Berg) Nied.	Arrayán	Tree	N	13
Syzygium jambos (L.) Alston	Poma rosa	Tree	N	14
Oxilidaceae				
Averrhoa carambola L.	Carambolo	Tree	I	10
Passifloraceae				
Passiflora edulis Sims	Maracuyá	Herbaceous	I	16
Passiflora tarminiana Coppens & *V.E. Barney*	Granada	Herbaceous	I	14
Passiflora ligularis Juss.	Granada de moco	Herbaceous	N	6
Rosaceae				
Crataegus mexicana DC.	Tejocote	Tree	I	39
Eriobotrya japonica (Thunb.) Lindl.	Níspero	Tree	I	9
Malus domestica Borkh	Manzana	Tree	N	10
Morus nigra L.	Berry	Shrub	I	12
Prunus persica (L). Batch	Durazno criollo	Tree	I	10
Rutaceae	Capulín	Tree	I	8
Casimiroa edulis La Llave	Zapote blanco	Shrub	I	15
Citrus aurantifolia Swingle	Noni	Tree		8
Citrus medica L.	Lima	Tree	I	40
Citrus reticulata Blanco.	Limón	Tree	N	17
Salicaceae	Cidra	Tree	I	12
Xylosma flexuosa (Kunth) Hemsl.	Mandarin	Tree	N	20
Sapotaceae				
Pouteria sapota (Jacq.) H.E. Moore & *Stearn*	Huismarines	Tree	N	8
Chrysophyllum cainito L.	Caimito	Tree		16
Manilkara zapota (L.) P. Royen	Chico zapote	Tree	N	12
Pouteria campechiana (Kunth) *Baehni*	Zapote borracho	Tree	I	10

Note: *Number of family gardens where the fruit species is found. All common names are presented in Spanish to reflect the information gathered during the interviews.
Source: Prepared by the authors based on Guadarrama *et al.* (2020).

Social and cultural factors: their relationship with the richness of fruit species

The χ^2 test (Table 2) indicates that the significant social factors were occupation of the person in charge of the FG, their level of studies and age; and the significant cultural factors were religion and uses of the fruit species. Meanwhile, the non-significant social factors were

Table 2. Social and cultural factors that allow a wide richness of species in the family garden.

Factors	χ^2	Df	P
Occupation of the person in charge of the FG	22.16	8	0.01
Religion	15.28	2	0.00
Uses	15.24	6	0.03
Age of the person in charge	13.34	14	0.49
Education	12.30	12	0.49
Age of the FG	7.07	4	0.15
Total sur. FG	6.12	4	0.23
Sur. for FS	5.66	2	0.03
Gender of the person responsible	0.65	2	0.58

Total sur. FG: total surface of the family garden; Sur. for FS: surface for fruit species.
Source: prepared by the authors from data obtained in the field.

age of the family garden (FG), total surface of the family garden (Total sur. FG), surface for fruit species (Sur. for FS), and gender of the person responsible for the FG.

Social factors

Most (90%) are sellers of fruit species in the municipal and local street markets (*tianguis*). The fruit species that they trade are obtained from the FGs with the aim of obtaining economic income, which is why they procure to conserve a biodiverse garden and thus offer a variety of fruits in the *tianguis* throughout the year.

The education of the person responsible for the garden was a significant factor that influences the richness of fruit species; 42% of the men and 32% of the women studied only primary school, while 20% of the men and 6% of the women were illiterate. According to the interviews, they did not have the opportunity of studying primary, secondary, high school or an undergraduate degree. However, when they form a family, men and women acquire new responsibilities, as providers for the children, so that having a garden allows them to have goods available to satisfy certain needs of the family. They point out that the garden is a space for community and family socialization.

These families consider that it is important that their children study, so they support them while they study a technical or university degree. The sale of fruit from the garden allows them to obtain economic income with which to cover some school expenses of their children.

The age of the person in charge of maintaining the family garden was also significant, since it influences the richness of fruit species. Of them, 38% are 36 to 49 years old and 62% are 50 to 93 years old; women and men of this age know how to manage the garden well, and they put into practice the knowledge that their parents transmitted to them through the execution of activities to maintain the garden. Now they teach the new generations the management of the garden for its better use.

Those of age 36 to 65 are able to conserve species for family consumption and for sale, while the people 66 years and older conserve species for the family's benefit.

Cultural factors

The religion practiced by the family influences the richness of fruit species; 64% are Catholic. These families carry out family and community religious festivities and rituals for the establishment and management of the garden, and for the cultivation of agricultural lands, and they also practice rituals during the life cycle of a person.

As part of the family's life cycle, when a couple gets married, the father and the mother of the new husband places a fruit offering (arrayán (*Psidium sartorianum* (O. Berg) Nied.), poma rosa (*Syzygium jambos* (L.) Alston), mandarina (*Citrus reticulata* Blanco.), mango (*Citrus reticulata* Blanco.), among others) in the middle of the surface where the new family will establish its own family garden. With the offering of fruits, families plead for a biodiverse and productive garden.

In the celebration of a religious wedding, they adorn the church with flowers and fruits like arrayán, limón (*Citrus limon* (L.) Osbeck), guayaba (*Psidium guajava* L.) and granada (*Punica granatum* L.). In addition to decorating, these symbolize good management of the garden and at the same time, they are offered to plead for the economic prosperity of the new couple.

In the other 18 cases, 26% of the families practice Christianism in their denominations (Adventist and Jehovah's Witnesses). The people from these gardens consider that species such as huamúchil (*Pithecellobium dulce* (Roxb.) Benth.), ciruela (*Spondia mombin* L.), nogal (*Juglans regia* L.), carambolo (*Averrhoa carambola* L.), huismarin (*Xylosma flexuosa* (Kunth) Hemsl.), and zapote borracho (*Pouteria campechiana* (Kunth) Baehni) symbolize harmony, peace, equilibrium, family unity, and economic prosperity.

The richness of fruit species in their gardens is not the same as in the gardens of Catholic families; they prefer having a smaller number of species giving a special arrangement to their FGs since they arrange the species all around those that are tall like walnut, huismarin, plum, huaje, while in the central part they conserve species such as shrubs of which they only have papaya (*Carica papaya* L.) and moras (*Morus nigra* L.).

As part of the life cycle rituals, when a person in baptized, generally at the age of 21 years old, the baptized carry with them a branch from a fruit tree with a single fruit, which is generally a citrus, symbolizing that the person can make their own decisions and can now be part of their religious community.

The use of fruit species is the significant cultural factor that influences their diversity; they are used as food for the family, in the traditional medicine, and fruit species are also of ornamental, ritual use and for personal hygiene and for barter. The use of greatest importance is for food, fruits are consumed fresh, or in salads, sauces and *mole* and to prepare refreshments, liquors and ice-creams, among others. The medicinal use is the second most important, in addition to being part of their culture, resorting to herbal medicine because there are no health services 24 hours per day in the community. For their ornamental and ritual use, they are seen in arrangements, offerings, adornments and centerpieces (for example: zapote, granada, limón, guayaba and chico zapote).

In every garden, the families consume fresh fruits and they also sell them: mango, guayaba, lima, bonete (*Jacaratia mexicana* A. DC), durazno (*Prunus persica* (L). Batch), mamey (*Pouteria sapota* (Jacq.) H.E. Moore & Stearn), noni (*Citrus aurantifolia* Swingle), mandarina; with medicinal use (92% of the families), poma rosa, mango, guayaba, zapote (*Casimiroa edulis* La Llave), and granada (*Passiflora tarminiana* Coppens & V.E. Barney), among others; and for ornamental use (72% of the families), arrayán, huamúchil and naranja (*Citrus sinensis* (L.) Osbeck).

Non-significant social factors

The non-significant social factors were: age of the family garden, total surface of the family garden, surface for fruit species and gender of the person responsible of the FG.

The age of the family garden does not influence significantly the biodiversity of the gardens; on average the gardens are 74 years old, where the oldest is 98 years and the youngest 20 years. According to the dynamics of the family life cycle, the gardens are generally subdivided to give part of them to a new family. However, in some cases, as in the FG 50, although the original garden was subdivided, it increased its species richness from 16 to 22, adding huamúchil, manzana (*Malus domestica* Borkh), chico zapote (*Manilkara zapota* (L.) P. Royen), limón, plátano, and carambolo (*Averrhoa carambola* L.). The FG 23 was subdivided four times, for which they removed nine of the 26 fruit species; in this garden there is no longer poma rosa, arrayán, yaca (*Artocarpus heterophyllus* Lam.), nanche (*Byrsonima crassifolia* (L.) Kunth), guayaba blanca, granada roja, huaje (*Leucaena leucocephala* (Lam.)), huamúchil or tamarindo (*Tamarindus indica* L.).

The total surface of the garden and the one destined to fruit species also has a low influence on biodiversity. On average, the total surface is 704 m^2, the largest extension is 750 and the smallest 490 m^2; the surface for fruit species is 195 m^2 on average, the largest 245 m^2 and the smallest 75 m^2. On average, there are 14 fruit species in the gardens, and the garden with most diversity has 31 species while the one with least diversity has eight species.

Lastly, the gender of the person responsible for the FG is also not significant for biodiversity; both carry out activities to care and maintain the garden. The women are in charge of the activities of cleaning the garden and domestic tasks: household chores, caring for the family, preparing food, taking care of plants, watering, harvesting those of short growth habit, selling surpluses, and informing their husbands which plants are infested or have a disease. The men make earthenware pots, control pests and diseases, and sell fruits from the garden in boxes or by tree. In addition to this, they consider the gardens to be a space for socialization and transmission of traditional knowledge for the management of FGs.

DISCUSSION

Structure of the family gardens

The arrangement and composition of the family gardens contributes to the understanding of their social, economic, productive and cultural dynamics (Mariaca *et al.*, 2007). The horizontal structure in family gardens in SANB is varied; 84% of them have a pool and a

washing place near the fruit species since sometimes the women or members of the family irrigate the plants with the water they use for washing; 76% have a patio; 32% have a specific area for coexistence (path that they leave between fruit species and the home); and 7% destine a space for condiment plants; the home and the area where fruit species are located were found in all FGs. Likewise, Juan (2013) and García *et al*. (2016b) mention the basin, patio, living area, and area for plants of diverse uses, as common elements of the gardens in the southeast of Estado de México.

In SANB, the limits in terms of the general arrangement of family gardens have an irregular shape, where the species serve as bordering limits. A similar case is mentioned by Chablé *et al*. (2015) and Salazar *et al*. (2015) regarding the family gardens of southern Mexico in Yucatán and Tabasco; the spatial arrangement and the distribution of their components depend on the shape and size of the land, the uniformity and the slope of the ground, as well as the interest of each family in conserving certain diversity of species. Thus, the variety in arrangements of the components in the gardens is one of the characteristics that make them complex.

Social and cultural factors: their relationship with the wealth of fruit species Social factors

The occupation of the person in charge of the FG is a significant social factor for the richness of fruit species in SANB; men and women trade fruits in their community, as well as in the *tianguis* in Malinalco, which is a tourist attraction. The sale of fruits allows them to obtain a certain weekly income, so they make sure to conserve diverse species, to guarantee the sale of fruits during the whole year. Cahuich (2012) and García *et al*. (2018) also mention that the occupation of the person responsible for the garden influences its biodiversity. For their part, García *et al*. (2019) highlight the fact that taking care of the garden influences its plant richness, but also influences the management of the garden since as the years go by, they acquire experience to better care for it; this practice allows the transmission of traditional ecological knowledge.

Education was also a significant factor, which favors the plant species richness of family gardens. Of the participants, 26% do not know how to read or write and, 74% only studied primary school. The level of education does not allow them to be employed in other activities, so having a family garden provides them with work, occupation and through their work in the garden they conserve and transmit traditional knowledge for the conservation of species of their interest. However, they also express that they would have liked to be career people and perhaps not devote themselves to caring for the garden. Now they observe that their children and grandchildren are not so interested in caring for the garden, although they do help in performing the activities to maintain it.

The age of the person responsible for the family garden was also a significant factor that has an impact on plant species richness. They are between 36 and 69 years old. They have children to care for, so they try to conserve as much variety of species as possible, both for the family's diet and for sale to obtain economic resources and to acquire other goods that

they do not obtain from the garden. In the case of people older than 70 years, although they no longer have a family to take care of, managing the garden allows them to take care of themselves as well as to obtain all the benefits that FGs provide as source of foods, medicine, fruits for sale, etc. Bautista-García *et al*. (2016) also report for the case of family gardens in Ejido La Encrucijada, Cárdenas, Tabasco, that the age of the owners influences the richness of species, in addition to the benefits obtained, and older people are in charge of their care.

Cruz-Bautista *et al*. (2021) mention that in gardens in communities of Veracruz, adult women (between 42 and 54 years old) are the ones in charge of the management of the family garden, and they conserve fruit species such as: maracuyá, aguacate, anona, nanche, granada, guayaba, mango, ciruelo, mandarina and naranja.

Cultural factors

Religion resulted as a significant factor for the conservation of fruit species; both Catholic and Jehovah's Witnesses and Adventists use them in their ceremonies for people's life cycle and in ceremonies to plead for abundance of fruits in the garden. García *et al*. (2019) mention a similar case for communities of Malinalco, Tenancingo and Villa Guerrero, municipalities of Estado de México, where the richness, care, management and exploitation of family gardens are related to ritual practices; for example, they bless the seeds and plead for good production of the species in the garden, particularly those used for food.

Cahuich-Campos *et al*. (2014) point out that in Ejido X-Mejía, Hopelchén, Campeche, products from the family garden are used in ceremonies to plead for rainfall and for a good harvest, which reflects a strong relationship with their agricultural practices. In addition to this, the products from these spaces are also used in ceremonies for the life cycle of these families, particularly in baptism, first communion, and girl's fifteenth birthday parties.

In SANB, the uses that are given to the fruit species influence significantly diversity of FGs, with food and medicinal uses standing out, although the fruits are also traded, have ritual and ornamental use, and are used for personal hygiene; it is noticeable that species are multipurpose. Toledo *et al*. (2008) also mention that plant species, whether those found in the *milpa* or in family gardens, have the characteristic of being for multiple uses where the main one is for food, followed by medicinal and ornamental.

Salazar *et al*. (2015) also point out that the use given to plants influences the richness of family gardens in the state of Hidalgo; the main uses are edible, medicinal and timber-yielding, relevant in daily life and therefore in the local culture.

Concerning the contribution of resources to food security, Chi-Quej *et al*. (2014) mention that through products from the garden it is possible to cover 15 to 30% of the requirements for proteins and vitamins, and the production obtained from these can cover at least 20% of the total cost of food. For the case of SANB, it is necessary to calculate the contribution of fruit species to the family's diet, although without a doubt the availability of fruits throughout the year has an impact on the diversification of their daily foods, as described by Guzmán *et al*. (2012) and Rivas (2014).

Some authors mention diverse uses of FGs, similar or different to those found in this study; one study is the one by White *et al*. (2013) about the medicinal flora in San Nicolás, Estado de México, where they found 23 fruit species that are used for food and medicine.

Non-significant social factors

The total surface of the garden and the surface destined to fruit species were non-significant; either in small or large spaces, people procure species that are of interest for the benefit of the families, which is the opposite of what was found by García *et al*. (2019), who mention that the surface of the garden does have an impact, since these spaces are presently reduced and with this, the existing diversity is lost. According to their results, 40% of the interview respondents mention that the decrease of the surface, in addition to the scarce time destined to maintenance, result in loss of local knowledge, water scarcity, and health problems of the person responsible for the garden.

For his part, Moctezuma (2014) identifies that gardens in southwestern Tlaxcala have changed from being a source of species for food to ornamental, destined to sale. Thus, in some cases, the size of the garden is related to the floristic diversity, but what matters the most for the floristic composition are the preferences of the family to conserve certain species (Rayol *et al.,* 2019). In SANB, the richness of species is important, although the surface is not a limiting factor for them to have a broad diversity in their family gardens. Santana *et al*. (2015) highlight that in household gardens of the Otomí Tepehua region in Hidalgo, the surface of the garden does influence the plant richness. According to their results, the gardens vary from 100 to 400 m^2 so with more space, there can be a higher number of useful species within the gardens. These authors highlight that people in the Otomí Tepehua region tend to conserve citruses.

Regarding the gender factor of the person responsible for the garden's management, in SANB women and men carry out activities to care for the FGs, such as fertilization, reproduction of species of interest, fruit collection, etc., but they both decide which species to conserve. In family gardens from three municipalities in Estado de México, Malinalco, Villa Guerrero and Tenancingo, the woman is the one mainly responsible for decision making about management of the garden (García *et al*., 2016b).

Likewise, Paz and Cobo (2017) mention that the garden is a primarily feminine space given that it is related to domestic tasks such as caring for the family and maintaining the home; the authors highlight that for the women in Morelos the FG is a pleasant place, they have the liberty of deciding what their garden will be like, what tree species to plant, what vegetables to grow, and what type of animals to raise.

On the other hand, Cruz-Bautista *et al*. (2021), in their study about plant diversity in gardens, mention that their management by women represents a strategy for the family's food security, which allows solving the effect of the economic crisis in the poorest and less favored Mexican families. The women carry out an important role in the economy and subsistence of the family, through the sale of surpluses of products obtained from the gardens, contributing monetary income for the family.

CONCLUSIONS

In San Andrés Nicolás Bravo, Malinalco, Estado de México, there are various factors that allow the existence of an important species richness, such as the occupation of the person in charge of the FG, which is to be sellers, an economic activity that allows the family to have some income. The education, age of the person in charge of the garden, religion and uses of the fruit species enable a broad diversity to be conserved in family gardens, since depending on the knowledge of inhabitants about the species, they give a variety of uses and benefits to satisfy the needs of the family members.

The family gardens are a clear example that it is possible to use and conserve biodiversity, and based on the management practices the biocultural heritage is preserved. The main uses of fruit species for the family's diet and health care are related to the conservation of local cuisines and traditional medicine.

Through traditional ecological knowledge, people are interrelated with the sociocultural conditions of the local context for the care of the family garden and the adaptation of species of interest.

As it happens with other native traditions, it is a virtually global phenomenon: people safeguard customs, traditions, beliefs, ideologies and social structures that are specific to their geographic areas. Therefore, family gardens are agroecosystems that contribute to biological conservation, which confirms the objectives of international policies for the sustainable use of natural resources.

Acknowledgements

The authors wish to thank the *Consejo Nacional de Ciencia y Tecnología* for the scholarship given to carry out Postdoctoral research; and the families from San Andrés Nicolás Bravo, Malinalco, for their participation and collaboration for the study.

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