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TRADITIONAL KNOWLEDGE CONCERNING THE USE AND CONSERVATION OF TEQUELITE CHICO IN CHIPAHUATLAN, OLINTLA, PUEBLA

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ABSTRACT

The small tequelite (*Peperomia peltilimba* C. DC. ex Trelease) is a wild plant, native to Mexico, considered vulnerable to extinction. The aim of this study was to document knowledge and attitudes towards conservation and use of the small tequelite in the Totonac community of Chipahuatlan, Olintla, in the state of Puebla (Mexico). 53 semi-structured interviews were applied to a sample of the population; the number of families was considered to be representative. The interview consisted of the following sections; knowledge about the species, conservation, commercialization, uses and benefits. We explored the natural habitat of the species to document accompanying flora and fauna. Results indicated that the stems and leaves of the small tequelite are used to prepare traditional foods such as mole (sauce), broths, tamales, and boiled beans; with or without sesame seeds. The species is obtained from its natural habitat and in local markets, although some families grow plants in their home gardens. Traditional knowledge about the small tequelite relates to flora and fauna; only the most developed plants are used and those with buds or inflorescences are preserved. We discovered interest in conserving this resource because of its cultural and economic importance; although its commercial value is low, it offers additional income for families, who are dedicated to its collection. These results summarize Totonac knowledge and the perception they have regarding the conservation and use of small tequelite.

Keywords: biocultural heritage, native species, *Peperomia peltilimba*, totonac culture.

INTRODUCTION

The Piperaceae family consists of approximately 3,600 species, which are distributed throughout tropical and subtropical regions of the world and include herbaceous plants, shrubs, trees, epiphytes, terrestrial and climbing plants; generally perennial (Cházaro-Basáñez *et al.*, 2012; Samain and Tebbs, 2020). The genus *Peperomia* forms part of this family with approximately 1600 species distributed throughout Mexico, Central America and South America. Many of the species are native to the Andes and the Amazon region, while others are considered endemic to Mexico and Central America (Basurto-Peña *et al.*, 1998; Vergara, 2013).

One of the native species with biocultural importance in Mexico is *Peperomia peltilimba* C. DC. ex Trealease, which is a shade, epiphytic, rupicolous, creeping and fleshy plant (Cházaro-Basáñez *et al.*, 2012). Its distribution includes Veracruz, Oaxaca, Chiapas, Guerrero, Hidalgo, Tabasco, Querétaro and Puebla (Martínez-Bautista *et al.*, 2019; Guerra-Ramírez *et al.*, 2020; DGRU, 2021). In the latter state, it is distributed throughout the regions of Huauchinango, Huehuetla, Sierra Negra, Teziutlán, Xicotepec and Zacapoaxtla (Blancas *et al.*, 2014; Guerra-Ramírez *et al.*, 2020 and DGRU, 2021).

In the Sierra Norte de Puebla, *P. peltilimba* is known in the Totonac language as xalaktsu kuksasan and in Spanish as tequelite chico (Vergara, 2013, Guerra-Ramírez *et al*., 2020). In the Sierra Negra of Puebla and the central area of Veracruz, it is known as cilantro de monte or cilantro cimarrón in allusion to it's flavor similar to coriander (*Coriandrum sativum*) (Basurto-Peña *et al*., 1998; Vergara, 2013; Pérez-Nicolás *et al*., 2018).

In the state of Veracruz, small tequelite is used as a substitute for coriander in salads and as a condiment to prepare different traditional dishes, including boiled beans with ground sesame seeds, salt and chili, for which the leaves and stems are used. (Vergara and Krömer, 2011). Among the Chinanteca and Zapotec cultures in the state of Oaxaca, this species is used as a medicinal plant to treat foot inflammations (Pérez-Nicolás *et al*., 2018; Martínez-Bautista *et al*., 2019).

P. peltilimba is considered vulnerable to extinction (Samain and Tebbs, 2020) and consequently traditional knowledge about this plant species is also at risk. However, it is still possible to discern some knowledge about the small tequelite in Totonac communities. The biocultural heritage of our country deserves to be valued and thus included in national development policies, as well as in those designed for the management and conservation of resources and territories, where native peoples reside (Bernal-Ramírez *et al*. 2019).

Correspondingly, the aim of this study was to document traditional knowledge and perception about the conservation and use of the small tequelite in the Totonac community of Chipahuatlan, in Olintla, Puebla.

MATERIALS AND METHODS

Description of the study area

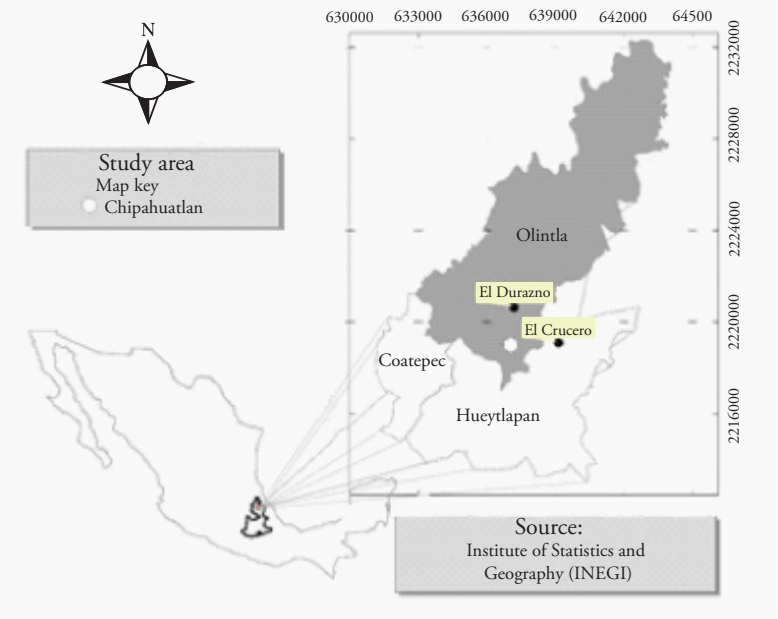
The community of Chipahuatlan is a settlement pertaining to the Totonac culture, located in the municipality of Olintla in the state of Puebla, Mexico, at an altitude of 900 m. This locality has a humid semi-warm climate with rain all year round, an average temperature range of 18-24 ºC and annual rainfall of 2,400 to 3,600 mm (INEGI, 2010).

The total population consists of 1,148 inhabitants, consisting ot 561 men and 587 women; mostly Totonac language speakers. There are 236 private residences, and the commnity is classified as suffereing from a very high degree of marginalization (SEDESOL, 2013).

The community of Chipahuatlan borders to the north with the El Durazno neighborhood of the Bibiano Hernández Auxiliary Board, pertaining to the municipality of Olintla, to the west with the municipality of Coatepec, to the east with the El Crucero community, in the municipality of Hueytlalpan and to the south with the municipality de Hueytlalpan (INEGI, 2010) (Figure 1).

Location of natural habitat

A key informant indicated the site closest to the Chipahuatlan community, where *P. peltilimba* grows naturally. The site was located in the municipality of Hueytlalpan, at an altitude of 1,015 m. we made records of the flora and birds associated with *P. peltilimba*. Subsequently, the flora was identified according to botanical characteristics,



Source: elaborated by the authors in ArcGis® 10.5, using vectoral information from INEGI (2019).

Figure 1. Location of study area: the Totonac community of Chipahuatlan, in Olintla, Puebla (México).

using information available in the Biological Collection of the UNAM Open Data Portal (DGRU, 2021) and the Catalog of Useful Plants from the Sierra Norte de Puebla (Martínez *et al.*, 1995). The names in the Totonac language and in Spanish were also registered. Birds were identified by the Mexican Bird Knowledge Network (AvesMx.net) of the National Commission for Knowledge and Application of Biodiversity (CONABIO, 2015).

Interviews and sample size

Semi-structured interviews were applied, each one made up of 26 questions distributed between the sections as follows: knowledge about the species (ethnobotany and ecology) (14 questions), conservation (8 questions), commercialization (2 questions) and also uses and benefits (2 questions). The population studied consisted of the 236 families, living in the community of Chipahuatlan, Olintla, Puebla. Sample size was obtained by qualitative sampling, applying the equation (Castañeda-Guerrero *et al.* (2020):

$$n = \frac{NZ^2_{\alpha/2}pq}{Nd^2 + Z^2_{\alpha/2}pq}$$

where N: Size of the population (236); $Z_{\alpha/2}$: 95 % reliability (1.96); p=0.5; q=0.5; d: precision (0.12).

Sample size was defined to include 53 interviews. Interviews were applied during a visit to the head of the family in their homes and by interpreting the Totonac language. 23 men and 30 women were interviewed, with an age span of 20 to 80 years. During the interviews, photographs of the small tequelite were used to indicate the species of interest (*P. peltilimba*). Data collected was systematized in a database and then analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Ethnobotanical knowledge

Peperomia peltilimba or Xalaktsu kuksasan, as it is called in Totonac in the community of Chipahuatlan (Olintla, Puebla, Mexico) is identified as a small tequelite due to the size of its leaves, compared to *P. maculosa*, which has larger leaves (UNIBIO, 2010 ; Villa-Ruano *et al*., 2018). In field observations, small tequelite leaves were 4 to 9 cm long and 4 to 6 cm wide. *P. maculosa* is also used in the study area for preparing food; although it is less popular because it can sometimes cause nausea or stomach upset (Guerra-Ramírez *et al*., 2020).

According to answers from interviewees, small tequelite is used in the Chipahuatlan community solely for food purposes, as it is a component for preparing various dishes and flavors in the region, such as mole, bean tamales, meat tamales, broths, or combined with other plant sprouts from the Sierra Norte region of Puebla, such as barbarón or mafafa (*Xanthosoma robustum*), five plant sprouts *(Cyclanthera dissecta)*, quintonil *(Amaranthus hybridus*) and boiled beans; with or without sesame seeds. This last dish, which incorporates the use of small tequelite for its preparation, has also been documented in other regions of Mexico (Basurto-Peña *et al*., 1998; Vergara and Krömer, 2011; Mapes and Basurto, 2016).

Uses in the study area differ from those in the Zapotec and Chinanteca cultures of Oaxaca, where small tequelite is used for medicinal purposes to treat foot inflammations (Pérez-Nicolás *et al.,* 2018; Martínez-Bautista *et al*., 2019). Guerra-Ramírez *et al*., (2020) mentioned that the components in the essential oil of *P. peltilimba* have pharmacological properties. However, no studies have focussed specifically on its medicinal properties.

The leaf is the part of the plant principally used to flavor and season stews, broths and sauces; the leaves are also used together with the stem, in both cases the purpose is for food (Figure 2). This is similar to what was reported by Vergara and Krömer, (2011), who documented that in Veracruz the leaves of *P. peltilimba* are used to prepare regional dishes. Of interviewees 4% mentioned very frequent consumption of small tequelite, whereas 36% indicated occasional consumption and 55%, rare (Figure 3).

Leaves and stems are obtained by collecting small tequelite from its natural habitat, or from local street markets that take place once a week. Likewise, some families mentioned that they propagate the plant in their home gardens for personal consumption. Moreover, people who sell it in the markets also obtain it from places where the small tequelite grows wild, and is available for consumption and collection.

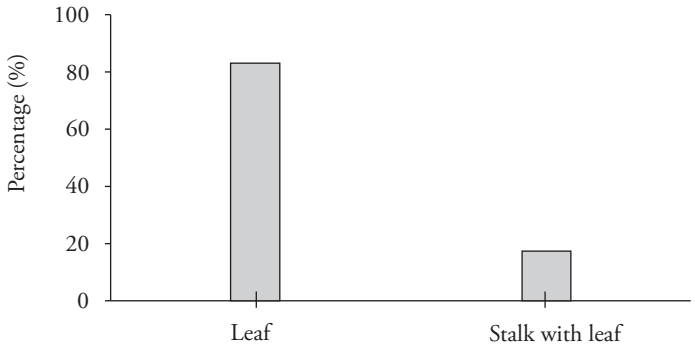
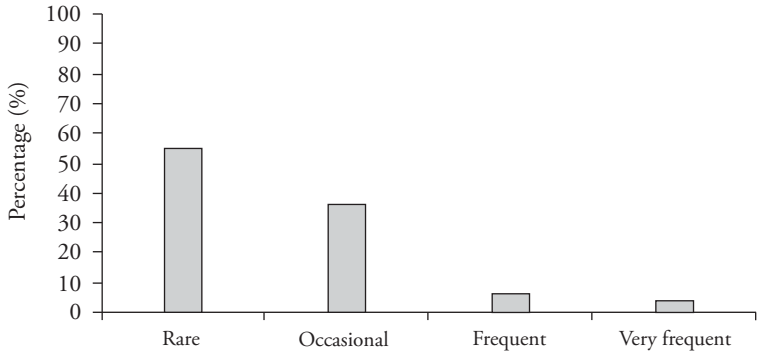


Figure 2. Parts of small tequelite (*Peperomia peltilimba*) used in the totonac community of Chipahuatlan, in Olintla, Puebla (Mexico).

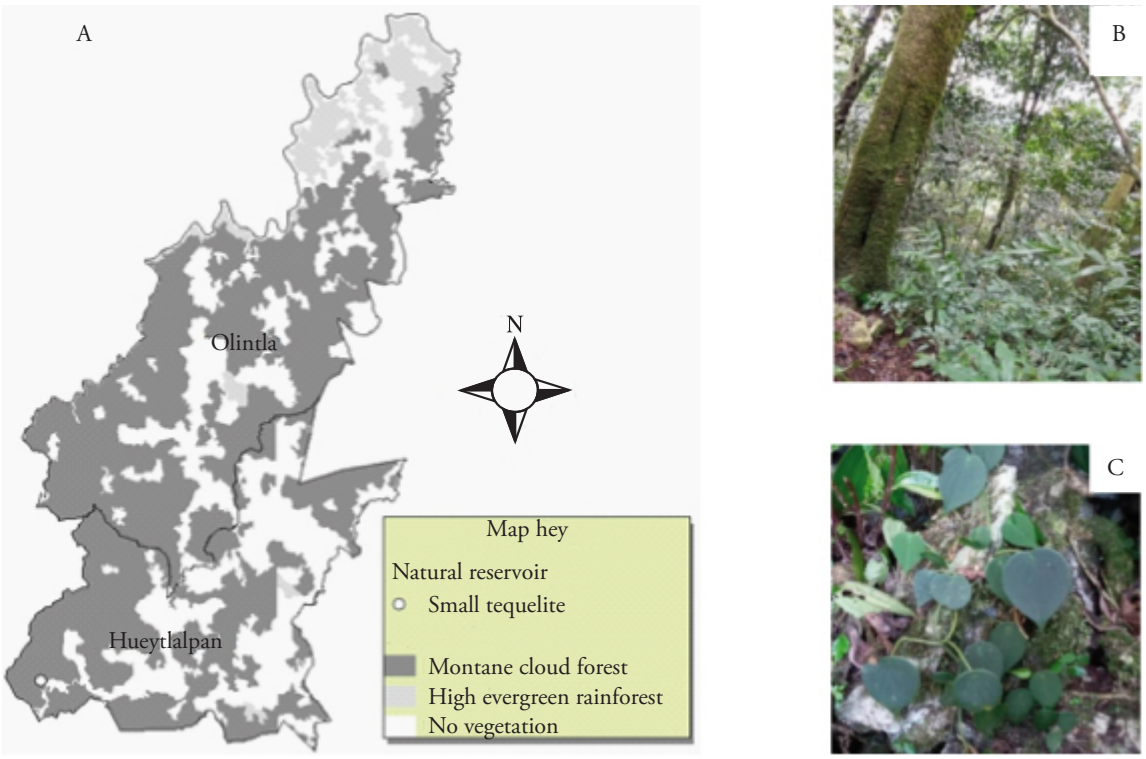
A bunch of approximately five to six leaves on a stem sells for $10 MXN pesos. The sale of small tequelite in local markets has been recorded in other regions of Mexico, particularly in the municipality of Huejutla de Reyes, in the state of Hidalgo (Linares and Bye, 2015).

Ecological knowledge

Interviewees mentioned that *P. peltilimba* grows in moderately shaded and relatively inaccessible areas, due to steep slopes and the presence of rocks. This description coincides with the ecological conditions described for other *Peperomia* species (Mathieu *et al*., 2011). *P. peltilimba* has been reported in deciduous forests, pine-oak forests, as well as in high and medium-height rain forests (Vergara and Kromer, 2011; Vergara, 2013; Samain and Tebbs, 2020). In this study, the wild population of small tequelite was located in Hueytlalpan, in mountainous cloud forest undergoing transformation due to agricultural activities (SNIGF, 2014) (Figure 4).



†Consumption frequency rare: twice a year, occasional: 3 to 4 times a year, frequent: 5 to 6 times a year, and very frequent: 2 to 3 times a month.
Figure 3. Frequency† of consumption of small tequelite (*Peperomia peltilimba*) in the Totonac community of Chipahuatlan in Olintla, Puebla (Mexico).

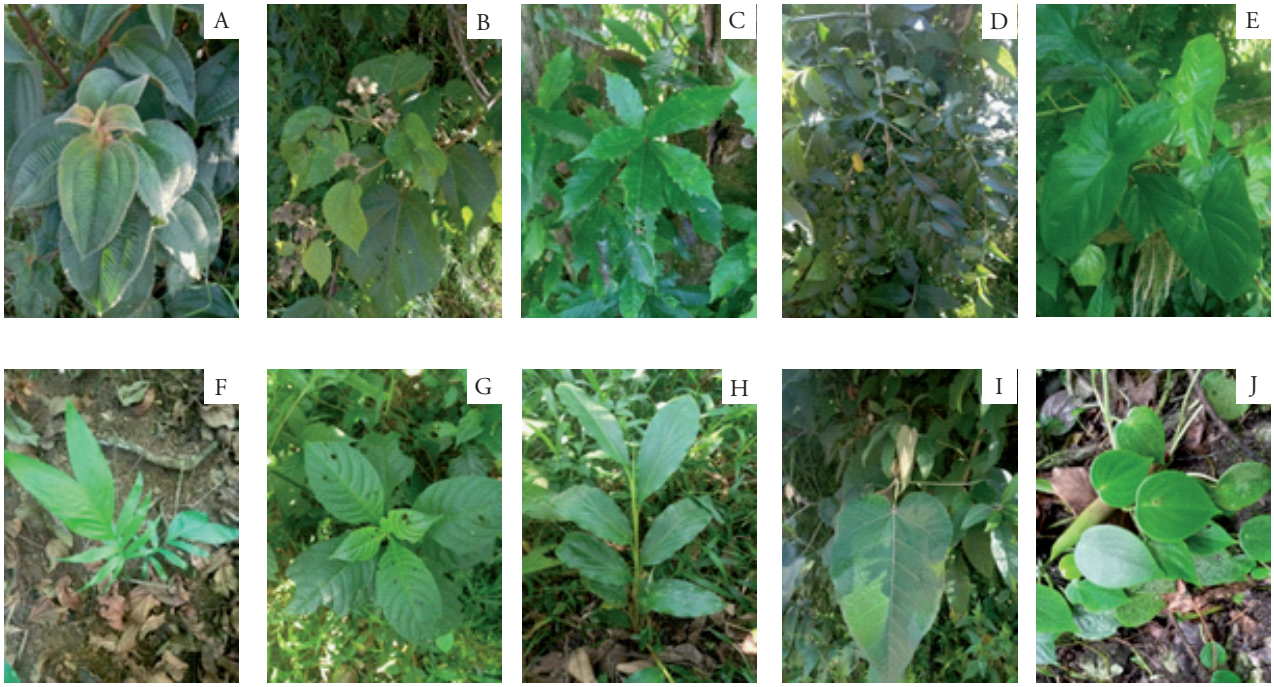


Source: elaborated by the authors inn ArcGis® 10.5 with data obtained from SNIGF (2014) and INEGI (2019).
Figure 4. Habitat of the small tequelite (*Peperomia peltilimba*) in Hueytlalpan, Puebla. A: montane cloud forest; B: associated vegetation in the habitat of the small tequelite; C: small tequelite at a natural site (September 2019).

Arboreal vegetation associated with the natural habitat of *P. peltilimba* includes trees; jonote (*Heliocarpus appendiculatus* Turcz.), oak (*Quercus* sp.), and dragon's blood (*Croton draco*). Shrub species included; capulin (*Conostegia xalapensis* (Bonpl.) D. Don ex DC.), cola de zorra (*Justicia* sp.), nogma (*Vernonia patens* HBK), night blooming jasmine (*Cestrum nocturnum L.*) and tepejilote (*Chamaedorea oblongata* Mart.) (Figure 5).

Peperomias grow under conditions of shade and high humidity (Samain and Tebbs, 2020); so the arboreal and shrubby vegetation of the mountain cloud forest favor these conditions. They also provide organic matter through leaf compost, and residue from branches and trunks. The interviewees also mentioned the association of fauna with the small tequelite, which includes some wild birds that use it as refuge or as food (Table 1).

A member of the community pointed out the presence of defoliation on the shoots and leaves of the small tequelite, caused by a cutworm that commonly feeds on the young leaves and sometimes on the entire plant (Figure 6). Childers and Rodrigues (2005) identified the presence of mites from the Tarsonemidae family (*Polyphagotarsonemus latus*) on other species of the *Peperomia* genus, however mites were not observed in the natural habitat and neither did the people interviewed mention them.



Source: elaborated by the authors; Code names ND: Without data, CNa: Common name, TN: Totonac name, ScN: Scientific name. A) CNa: capulin, TN: mujut, ScN: *Conostegia xalapensis* (Bonpl.) D. Don ex DC; B) CNa: jonote, TN: xunik, ScN: *Heliocarpus appendiculatus* Turcz.; C) CNa: oak, TN: kukat, ScN: *Quercus* sp.; D) CNa: Night blooming jasmine, TN: ND, ScN: *Cestrum nocturnum* L.; E) CNa: ND, TN: chapiso, ScN: *Syngonium podophyllum* Schott; F) CNa: Palm or tepejilote, TN: lilhtampan, ScN: *Chamaedorea oblongata* Mart; G) CNa: Cola de zorra, TN: cruz tuwan, ScN: *Justicia* sp.; H) CNa: ND, TN: xkijit, ScN: *Renealmia alpinia* (Rottb.) Maas; I) CNa: Dragon's blood, TN: puklhnankiwi, ScN: *Croton draco*; J) CNa: tequelite chico, TN: xalaktsu kuksasan, ScN: *Peperomia peltilimba.*

Figure 5. Principal flora associated with small tequelite in Chipahuatlan, Olintla, Puebla (Mexico).

According to Vergara and Krömer (2011) the ecological attributes of *P. peltilimba* remain unknown. For this reason, the relationship of the species with the local flora and fauna is a topic that requires study to better understand its importance in the ecosystem.

Table 1. Native traditional ecological knowledge associated with small tequelite, in the Totonac community of Chipahuatlan, in Olintla, Puebla (Mexico).

Common name	Totonac name	Scientific name	Relationship with small tequelite
Chachalaca	Lhpatekg	*Ortalis vetula*	Eats leaves of small tequelite
Grackle	Chakglhna	*Quiscalus mexicanus*	
Warbler	Laktsu spitu	*Sethopaga* spp.	Refuge
Clay-colored thrush	Xtokgno	*Turdus grayi*	

Source: elaborated by the authors with data from the study area.

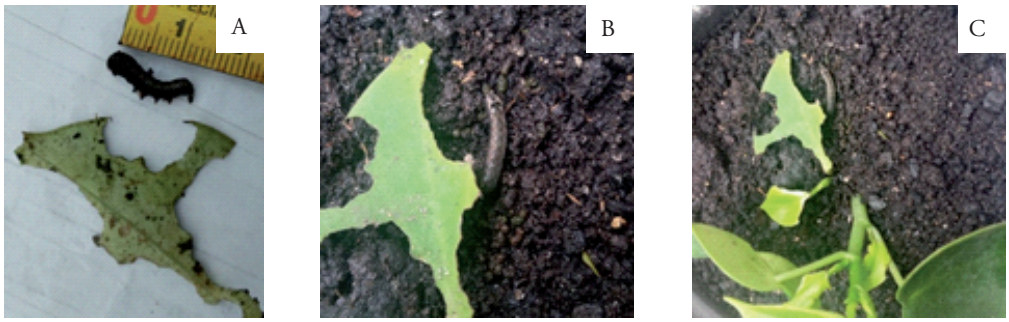


Figure 6. Damage caused to *Peperomia peltilimba.* A, B: by a cutworm; C: defoliation of small tequelite shoots, caused by a cut worm.

Traditional uses

The use of the small tequelite in its natural habitat is not limited to a specific season, it continues throughout the year. This information coincides with that reported in Jonotla, Puebla (Guerra-Ramírez *et al*., 2020). Activities carried out during collection relate to the growth stages of the plant (Table 2 and Figure 7).

Another way to obtain small tequelite is from the home garden. 34% of those interviewed mentioned that they know how to propagate this species as a result of personal experience. 66% learned about its propagation from their parents and grandparents; however, only 45% of children or grandchildren have applied this knowledge.

For the propagation of the small tequelite, cuttings, with or without leaves are used (Figure 8); these are transplanted into substrates consisting of mountain soil, rotten trunks of trees from the region (jonote), dry leaves and tree bark, ash, composted coffee husks, organic fertilizer made from kitchen waste (tomato, chili and onion, among others) and totomoxtle.

Of those interviewed 38% considered the species be of limited abundance in its natural habitat, and only 9% considered it extremely abundant. However, 40% of the population considered its conservation very important due to its cultural importance in gastronomy, as food and for its commercial value (Figure 9).

Table 2. Traditional practices performed in a Totonac community relating to use of small tequelite (*Peperomia peltilimba*) in its natural habitat.

Practices	Observations
Conservation of plants with shoots	
Conservation of growing plants	No observations
Pruning of leaves from old plants	
Pruning of most developed plants	Other terms: old and of good size
Conservation of plants in bloom	This stage occurs at the beginning of february

Source: elaborated by the authors with data from this study site.

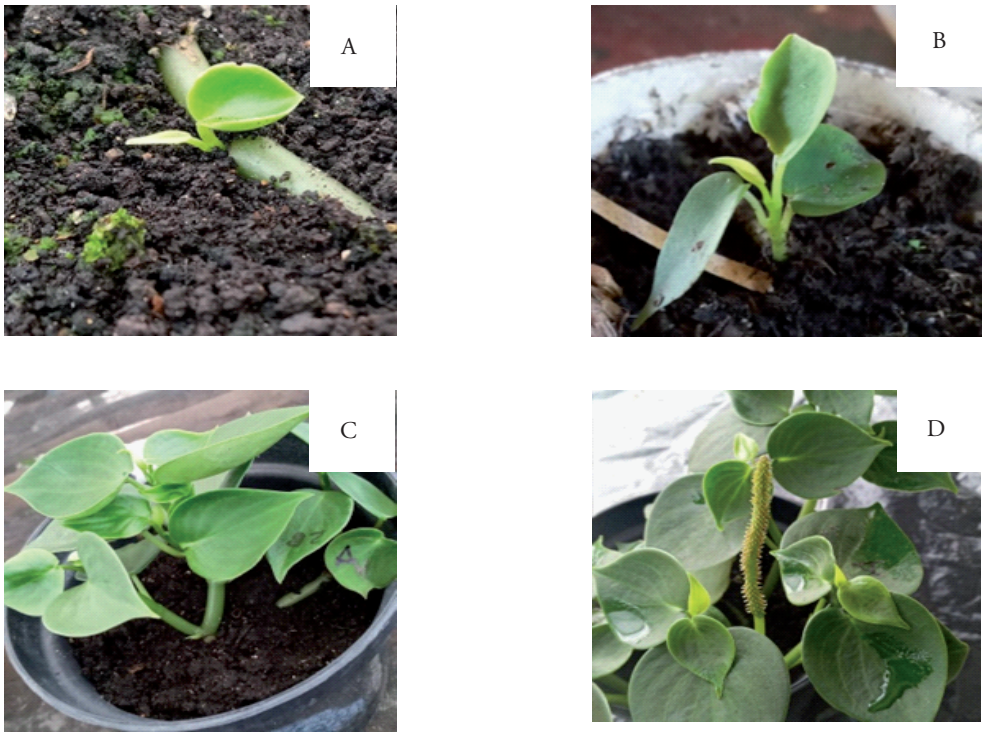
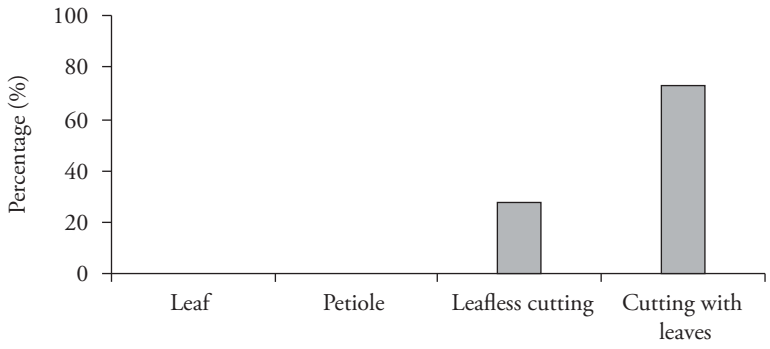


Figure 7. Growth stages of the small tequelite (*Peperomia peltilimba*). A, B, C: vegetative stages (emission of buds), D: reproductive stage (in bloom).

In the Sierra Negra of the state of Puebla, the inhabitants also perceive a decrease in this plant genetic resource (Blancas *et al.,* 2014):



Source: elaborated by the authors, using plants collected in the field.
Figure 8. Native traditional knowledge about the parts used for the propagation of the small tequelite (*Peperomia peltilimba*) in the Chipahuatlan Totonac community, in Olintla, Puebla (Mexico).

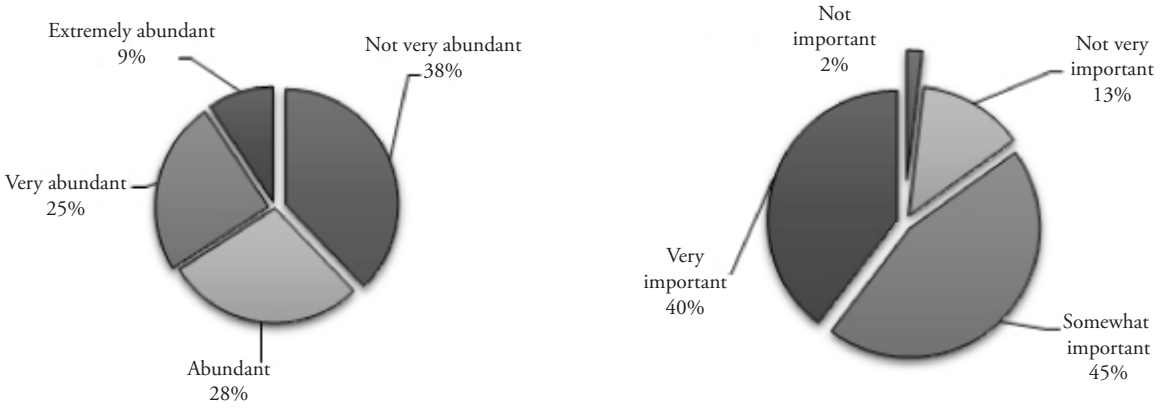


Figure 9. Perception concerning availability and conservation of small tequelite (*Peperomia peltilimba*) in the Totonac community of Chipahuatlan in Olintla, Puebla (Mexico). A: perception of availability, B: perception of conservation.

"There in the hot area, the small tequelite (*P. peltilimba*) grows among the rocks that are always wet. I think it was about ten years ago that it began to be sold in Tehuacán. From Aticpac to Eloxochitlán it used to grow ...now you have to walk...in Aticpac there are no more… it's over. Now, if you want to collect it to sell, you have to walk in the mountains for about four hours from Aticpac" (Blancas *et al*., 2014).

For this reason, we need studies that address the abundance and distribution of the small tequelite, as well as techniques that allow the efficient propagation of this species, which can be combined with knowledge from the communities where *P. peltilimba* coexists with the natural environment. In this sense, an alternative would be the establishment of nurseries to cultivate the species, in order to gradually reduce the collection of plants from their natural habitat. By investigating its establishment in nurseries, substrates for the vegetative propagation of tequelite could also be evaluated, as well as its propagation *in vitro*.

CONCLUSIONS

Small tequelite (*Peperomia peltilimba*) is used, following collection from the natural habitat, both for direct consumption and for sale in local markets. During the collection of leaves and stems, the inhabitants from the Chipahuatlan community apply conservation practices handed down by traditional knowledge, regarding the growth and development of the plant. The most relevant are the conservation of plants with vegetative or floral buds and restriction of cutting to only those plants with more developed and mature leaves.

In the natural habitat, the chachalaca, grackle, warbler, and clay-colored thrush, which take refuge in, or feed on the small tequelite, were observed. The vegetation of the natural habitat consisted of cola de zorra, night blooming jasmine, tepejilote, capulin, dragon's blood, jonote and oak. This vegetation provides shade, humidity and organic matter for the growth of the small tequelite, which is also produced in home gardens; although up until now it has been considered a non-cultivated species.

Apparently, 40% of interviewees consider that it is very important to conserve this species due to its importance in traditional gastronomy and its commercial value. Accordingly, it is necessary to promote actions that contribute to the conservation of the species in both *in situ* and *ex situ* conditions, as well as to partake in the sustainable use of this native genetic plant resource, while applying related traditional knowledge.

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