Preferences of Farmers Regarding the Consumption and Knowledge of Wild and Cultivated Chili Peppers

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ABSTRACT

For Mexican society, chili peppers are an essential seasoning that adds flavor to food consumed across all social strata; without chilies on the table, the cultural hallmark of consuming spicy food is missing. This study aimed to conduct a qualitative analysis of the preferences and traditional knowledge held by farmers regarding wild and cultivated chili peppers in the community of Coapilla, in the state of Chiapas, Mexico. The methodology was based on the botanical taxonomic descriptors for the genus *Capsicum*, involving farmers who participate in a food security program. The results indicate that agriculture is the primary activity for producers in the study area, and all of them are knowledgeable about—and show a preference for—the various wild and cultivated chili varieties found in the region. According to the farmers, wild chilies grow spontaneously in specific zones that they regard as conservation areas. The variety most frequently consumed is known as "Timpinchile," favored for its flavor and moderate level of pungency; most families consume some type of chili on a daily basis. These chilies are typically grown in pots, alongside other cultivated varieties such as the jalapeño; they are used for family consumption and also sold within the community. Producers lack technical support and have limited access to credit, both of which are limiting factors for production. One advantage for these producers is the nature of their land, which is rich in chili genetic resources; these could serve as a source of income, given the existence of a diverse range of chili varieties that have yet to be studied.

Keywords: Wild, descriptor, spicy, culture, consumption

INTRODUCTION

In Mexico, there is a great diversity of chili peppers belonging to the genus *Capsicum*, among which is the habanero chili (*Capsicum chinense* Jacq.). This species has become a symbol and a benchmark for pungency, owing to the exceptionally high capsaicin content found in its fruit (Nuez et al., 2013). Currently, the cultivation area for habanero chilies has expanded across various regions of the country, driven by the development of a wide range of products—including pharmaceutical preparations, ointments, culinary items, industrial goods, and pepper spray—in which it serves as an active ingredient, partly due to its high corrosive potential. Studies conducted to assess the diversity within the genus *Capsicum* have relied on descriptive methods based on the morphological characteristics of the plant, flower, and fruit (Pérez et al., 2011).

The Mezcalapa region is located within the municipality of Coapilla and is considered culturally significant. This area is characterized by a great diversity of chili peppers, as well as its strategic location in a region with a pleasant climate, where a wide variety of chili peppers can be found in local markets. This serves as evidence of the significant diversity of chili peppers present in these commercial hubs a diversity that warrants attention for the purposes of research, as well as *in situ* and *ex situ* conservation.

Another aspect relevant to its preservation is the cultural level of the region, which is part of a larger community known as the Zoque. This group possesses deep, indigenous roots and a clear understanding of the various types of chili peppers found throughout their communities. These characteristics reflect a region with strong ties to local traditions evident in its gastronomy, attire, languages, and social organization with agriculture serving as the primary means of subsistence.

In this municipality, the cultivation of a chili pepper known as Timpinchile has gained significant economic importance in recent years as a food source, becoming a staple in the local diet. Its popularity is clearly growi-

ng even among children and young people and it is in high demand in local markets. It has even come to replace the chili peppers commonly referred to by the local population as "siete caldos" ("seven broths" chilies)—a variety traditionally consumed in certain parts of the Mezcalapa region, specifically in the municipalities of Ocotepec, Tapalapa, and Coapilla.

Coapilla is the municipality where the presence of these chili peppers is most notable, whereas in other municipalities within the region, the primary economic activity is the cultivation of corn and beans. This research aims to assess preferences regarding the management of both wild and cultivated chili peppers. Furthermore, it seeks to establish that the local population possesses the necessary knowledge about these various types of chili peppers, which could enable them to develop an alternative economic activity alongside the municipality's existing primary economic pursuits.

Study objective

The objective of this research is to understand the preferences of farmers regarding the consumption of wild and cultivated chili peppers, as well as their knowledge of where these peppers can be found, in the community of Coapilla, located in the state of Chiapas, Mexico.

Hypotheses

Alternative hypothesis: There is an association between knowledge and the locations where wild and cultivated chili peppers are found.

Null hypothesis: There is no association between knowledge and the locations where wild and cultivated chili peppers are found.

LITERATURE REVIEW

Importance of wild and cultivated chili Peppers

In studies conducted in the states of Oaxaca and Mexico, a group of researchers identified 341 individuals belonging to wild, semi-wild, and cultivated populations of *Capsicum annuum*, as well as *C. frutescens* and *C. chinense*. They documented levels of genetic diversity and evidence of gene flow between wild populations and cultivated varieties. The researchers highlighted the importance of *in situ* conservation, which can help maintain semi-wild populations and the unique alleles present in local varieties. This serves as an important reservoir for genetic variability and diversity, as these populations remain linked to environmental conditions, resulting in distinct phenotypic variants (Pérez-Martínez et al., 2022).

Hernández-Pérez et al. (2020) published a comprehensive review on *Capsicum annuum*. The authors note that its fruits are significant as a food source, seasoning, coloring agent, and medicinal resource; they also contain vitamins, minerals, flavonoids, carotenoids, and capsaicinoids. Capsaicin and other compounds exhibit antioxidant, antimicrobial, and analgesic potential, as well as other biological effects, although some medicinal properties still require further clinical research.

Saldaña et al. (2023) described an important chili pepper in Chiapas known as seven broths. This chili is cultivated on the Comiteca Tojolabal Plateau, within the municipalities of Independencia, La Trinitaria, and

Comitán de Domínguez. It is an annual plant that produces chili peppers consumed fresh; they are widely used in broths or soups, and are also utilized for marinades, pickles, and brines.

Genetic variability and diversity

The research group led by Toxqui-Tapia et al. (2022) analyzed populations of C. annuum from the wild, home gardens, and cultivated settings in Oaxaca. The study found high levels of genetic diversity across these different management systems and concluded that the domesticated chili peppers present in traditional agricultural systems contain unique gene pools, serving as reservoirs of genetic variation and contributing to the conservation of biodiversity.

Parry et al. (2021) noted that wild Capsicum relatives represent a significant source of genetic diversity and can provide traits of interest for the improvement of cultivated chili peppers. The study focused specifically on the relationships between genetic similarity, phenotypic similarity, and interspecific hybridization capacity. These aspects are important because the conservation of wild chili peppers should not be viewed merely as the conservation of species, but also as the preservation of genes that could be useful for developing cultivated varieties with superior agronomic traits.

Bernau et al. (2020) studied wild chili peppers and local varieties from different environments in southern Mexico and evaluated their germination under water stress. They found significant differences among genotypes and environments of origin. Some materials from drier environments exhibited responses that can be interpreted as adaptive mechanisms to conditions of lower water availability.

Furthermore, McCoy et al. (2022) found that geographic origin and the level of domestication influence the response of chili peppers to water deficit. Local varieties may possess useful adaptations for tolerating drought conditions. A study of significant international relevance is that published by Qin et al. (2023) in *Nature Communications*, in which researchers analyzed 1,296 accessions from nine *Capsicum* species and developed a core collection of 500 accessions that captured approximately 97.5% of the genetic diversity analyzed. They also identified genomic regions associated with traits such as flowering time, flavor, and resistance to biotic and abiotic stresses.

Gálvez-Muñoz et al. (2025) analyzed 26 wild *Capsicum* populations using microsatellite markers. They found considerable genetic variability: the markers identified 278 alleles, 92 of which were polymorphic. The study concludes that the markers used were effective for identifying genetic diversity and that wild materials can serve as sources of genes for developing new varieties and contributing to germplasm conservation.

Ramírez-Rodas et al. (2026) analyzed the diversity and conservation of Capsicum genetic resources in Oaxaca, addressing the conservation of chili peppers as part of agrobiodiversity and plant genetic resources.

Conservation of chili pepper plant genetic resources

In a study involving rural communities in Oaxaca and Chiapas, Mexico, García-Vásquez et al. (2023) examined varieties of *Capsicum annuum* conserved by indigenous communities in Mexico, analyzing their nutritional and bioactive compounds.

Sclavo (2024) presents a particularly interesting perspective: the chili pepper should be analyzed not merely as an agricultural product, but as a component of Mexico's culture, identity, diet, and biocultural conservation. The work examines the role of local varieties and genetic resource conservation programs in Mexico, linking them to food security, local dietary preferences, and the preservation of agricultural diversity.

Morales-Valenzuela and Villegas-Ramírez (2025) studied wild chili peppers in two Ch'ol communities in Tacotalpa, Tabasco. They identified eight morphotypes corresponding to *C. annuum* and *C. frutescens*. The chili peppers are primarily used as food, but they also have medicinal and ritual applications. Furthermore, the

authors note that habitat destruction poses a threat to these resources and recommend conservation and sustainable management strategies.

Lee and Lee (2026) evaluated 100 *Capsicum* accessions to identify drought resistance. They identified accessions with superior recovery capabilities following water deficit, as well as favorable physiological traits. The authors consider these materials useful for breeding programs aimed at developing varieties capable of coping with conditions associated with climate change.

Bran et al. (2025) stated that the consumption of chilies from Chiapas offers a unique experience, as they possess an incomparable flavor one that is further intensified by the quality of their natural habitat. These chilies thrive in environments such as forests and tree-covered Mountains landscapes characteristic of the Chiapas region, which remain lush and green year-round. This natural habitat for wild chilies is a resource that demands conservation and care; it serves as both a home and a food source for many living organisms, including birds, which act as the primary dispersers of the chilies' seeds. The survival of these birds and, by extension, the continued existence of these chili species depends on the resources available within local communities and the active involvement of human populations. It is essential to recognize the value of wild and native (criollo) chilies, as they represent a local resource worthy of appreciation and protection. Consequently, it is necessary to encourage the public to contribute to the conservation of these species in a conscious manner for instance, by cultivating them in various settings, such as home gardens, backyards, or other small spaces thereby supporting the community in preserving the rich diversity of Chiapas chilies.

Different uses of plant genetic resources

Along with corn, beans, and squash, chili peppers are considered to have been part of the basic diet in Mexico for 5,000 years; they are a significant source of vitamin C, and our ancestors also used them as medicine, currency, and as a form of tribute, among other purposes (Aguirre and Muñoz, 2015).

Saldaña et al. (2023) describe a variety of chili peppers in Chiapas and state that the Simojovel chili is used in tamal bola, broths, refried beans, and stews known as cihuamonte (consisting of roasted meat boiled with vegetables). It is possible that this chili is used in chili-based seasoning powders similar to those known as Tajín due to how quickly it matures and dries naturally; these chilies evolved in parallel with chiltepines, timpinchiles, and piquín peppers.

Materials and Methods

Location of the study area

This research was conducted over a six-month period in the municipality of Coapilla, Chiapas, Mexico, as part of a food security program for rural areas; the municipality comprises several distinct communities. It belongs to the state’s socioeconomic Region III, known as the Mezcalapa Region. Its geographic coordinates are 17°05′37″N, 93°12′38″W, and it is situated at an altitude ranging from 1,617 to 1,623 meters above sea level. In this region, the mean annual temperature ranges from 16°C to 32°C, and annual precipitation is 2,200 mm (INEGI, 2020). This municipality is primarily agricultural; its location in a region with favorable climatic conditions makes it well suited for the production of coffee, chayote, apples, avocados, blackberries, peaches, plums, pears, and strawberries. Nevertheless, the local population focuses mainly on the cultivation of corn and beans a practice deeply rooted in their traditional Zoque culture. Additionally, residents engage in small-scale, backyard livestock farming for personal consumption, raising animals such as pigs, sheep, goats, and various types of poultry, all of which hold significance within the community.

METHODOLOGY

Target population and sample size

According to Muñoz (2025), the municipality of Coapilla has a total of 1,630 members (communal landholders); therefore, the sample size was determined using a formula for finite populations proposed by

Yamane (1967), assuming a 95% confidence level, an expected proportion of 0.5, and a margin of error of 10%. The process was as follows:

Population (N) = 1,630 members (communal landholders)

Confidence level = 95% (Z = 1.96)

Expected proportion = 0.5 (p = 0.5)

q = 0.5

Sampling error = 10% (e = 0.10)

Cochran's (1977) formula for sample size is as follows:

$$n = \frac{NZ^2pq}{e^2(N-1) + Z^2 pq}$$

Substituting values:

$$n = \frac{1630\ (1.96)^2\ (0.5)\ (0.5)}{(0.10)^2\ (1630-1) + (1.96)^2\ (0.5)\ (0.5)}$$

$$n = \frac{1565.83}{17.25}$$

n= 90.77

n= 91 members (communal landholders)

The sample obtained from 91 ejidatarios was sufficient, adequate and selected for the application of the structured questionnaire aimed at the study population, however, it had to be applied to 21 more farmers, with a total of 122 ejidatarios who are the participating members in the FAO Strategic Food Security Project for rural areas. In the selected sample an attempt was made to locate the members of the aforementioned project. The questionnaire consisted of 15 questions (Hernández-Sampiere and Mendoza, 2018) related to the level of knowledge of chili peppers and conservation areas, production areas, types of chili peppers and their different uses, local and regional marketing.

The selection criteria for the questions were structured based on an exploration within the same community, carrying out different tours and asking about aspects related to wild chili peppers specifically, although cultivated chili peppers were also considered. The questions from the applied survey are attached.

Table 1. Questions about wild and cultivated chili peppers

N.º	Questions	Answer options
1	Are you aware of any chiles that you have seen around these parts?	1) Yes; 2) No
2	Where are chili peppers most commonly found?	1) In orchards; 2) In the forest; 3) Producer's land; 4) Other
3	What type of regional chili do you consume the most?	1) Miraparriba; 2) Timpinchile; 3) Jalapeno; 4) Others.
4	What is the reason why you consume more of those chili peppers?	1) Flavor; 2) Aroma; 3) Color; 4) Itching; 5) Other.
5	What regional chili or other type of	1) Miraparriba; 2) Timpinchile; 3) Siete caldos;

	chili do you buy the most for the family?	4) Chile blanco; 5) Other.
6	How much chili do you buy per gram?	1) 0–500 g; 2) 600–800 g; 3) More than 1 kg.
7	How many family members consume chili?	1) 1 to 3; 2) 3 to 5; 3) 6 to 10; 4) 10 to more 5) Other.
8	Do you plant any type of chili?	1) Miraparriba; 2) Timpinchile; 3) Siete caldos; 4) Chile blanco; 5) Other.
9	How much land do you allocate for planting chili?	1) A quarter of a hectare; 2) Less than 1,000 m²; 3) Half a quarter of a hectare 4) Half a hectare 5) Other.
10	Who is dedicated to planting chili?	1) Husband; 2) Wife; 3) Children; 4) Others.
11	Do you sell wild or cultivated chili peppers?	1) Yes; 2) No; 3) Other.
12	Where do you sell the chilies?	1) Local market; 2) In other towns
13	What nutritional properties or health benefits do you know about wild chili peppers?	1) Controls gastritis; 2) Controls uric acid and triglycerides; 3) Other.
14	How important are chili peppers to you in general?	1) They are part of the diet; 2) They generate income; 3) They are a consumption tradition
15	How often do you consume chili?	1) Diary; 2) Once to twice a week; 3) Once a month

Statistical analysis

Analyzes were carried out with quantitative and qualitative or mixed data. Frequency analyzes were carried out for each question or qualitative variable, with the numbered answers a data matrix was created in Excel, converting the questions into quantitative results, the frequency analysis allows us to demonstrate through the number of participants the percentage issued according to the total number of members of the mentioned program. Different crossed contingency tables were used through the crossed questions. The Pearson chi-square test of independence (X^2) was used (La Cruz, 2014), the Contingency Coefficient (X^2C) was used using a scale applied to the Social Sciences to evaluate the significant association between two qualitative or categorical variables.

Contingency value (C)Values from 0 to 1	**Guidance interpretation**
Close to 0 NA	Very weak or non-existent association.
0.10–0.29*	Weak association.
0.30–0.49**	Moderate association.
0.50 or more***	Relatively strong association.

With this test, some approaches or hypotheses that would probably occur based on the questions asked to the producers were tested. The questions were crossed taking as reference the number one with three, four up to 15 to know the level of association between the two. As follows:
Is there an association between the farmers' knowledge of some chiles they have seen in those places where they are most frequently found?
Is there an association between farmers' knowledge of some chili peppers with the type of regional chili used in those chili peppers?
Is there an association between farmers' knowledge of some chiles and the reason why they consume more?
Is there an association between farmers' knowledge of some chili peppers and the regional chili or other types of chilies that they acquire more for their family?
Is there an association between farmers' knowledge of some chili peppers and the amount of chili they buy in grams?

Is there an association between the farmers' knowledge of some chiles and how many family members consume chiles?
Is there an association between farmers' knowledge of some chilies with the planting of some type of chili?
Is there an association between farmers' knowledge of some chili peppers and the amount of land they allocate for chili planting?
Is there an association between farmers' knowledge of some chili peppers and those who are dedicated to chili planting?
Is there an association between farmers' knowledge of some chiles and who markets wild or cultivated chiles?
Is there an association between farmers' knowledge of some chili peppers and where chili peppers are sold?
Is there an association between farmers' knowledge of some chili peppers and what nutritional properties or health benefits they know about wild chili peppers?
Is there an association between farmers' knowledge of some chiles and the importance of chiles in general for you?
Is there an association between farmers' knowledge of some chiles and how often they consume chiles? With the data of the results obtained from the applied survey, frequency analyzes were carried out between the evaluated variables.

Variables evaluated

Are you aware of any chiles that you have seen around these parts?
Where are chili peppers most commonly found?
What type of regional chili do you consume the most?
What is the reason why you consume more of those chili peppers?
What regional chili or other type of chili do you buy the most for the family?
How much chili do you buy per gram?
How many family members consume chili?
Do you plant any type of chili?
How much land do you allocate for planting chili?
Who is dedicated to planting chili?
Do you sell wild or cultivated chili peppers?
Where do you sell the chilies?
What nutritional properties or health benefits do you know about wild chili peppers?
How important are chili peppers to you in general?
How often do you consume chili?
The statistical analysis was carried out with the SPSS version 24 program, the data base was carried out with Excell

RESULTS AND DISCUSSION

According to the results of the survey carried out, 86.1% of those surveyed claimed to know wild and cultivated chili peppers, 13.9% stated that they did not know them (Table 2). Most of it is identified by its ovoid shape manifested in the wild chili commonly called Timpinchile, it is the most recognized by producers, although there is another fruit called Bolita or Redondito considered by farmers as wild, although, on some occasions they cultivate it. This characteristic is attributed to the common shape that the fruit represents and they relate it to the round or ball shape. The characteristics of these chili peppers are also well known by Long (1986) who stated that Timpinchile or little balls is known as the Chiapas chili.

Table 2. Are you aware of any chiles that you have seen in these places?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Yes	105	86.1	86.1	86.1
No	17	13.9	13.9	100
Total	122	100	100	

In the results obtained regarding where wild and cultivated chili peppers are most frequently found (Table 3), 26.2% in cultivated orchards, 31.1% in the forest, 41.0% of farmers identify it on the same land as the producers and 1.6% in other places such as roads and trails. One of the specific indicators is the presence of these chiles in the markets, in rainy seasons it is accentuated and in summer it decreases or does not exist. It is likely that climate and temperature conditions favor the presence of this species. Regarding where cultivated and wild chili peppers are frequently found, Aguilar et al., (2010) stated that chili peppers are associated with the dynamics of the cultivated or wild populations of the chili variant and that we can find them in the region of Miahuatlán and Sierra Sur, however, some common names of chili pepper such as: 'Piquín' and 'Paradito' are almost exclusively collected in the lands near the cultivation areas and plots.

Table 3. Where are chili peppers most commonly found?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
In orchards	32	26.2	26.2	26.2
In the forest	38	31.1	31.1	57.4
Producer's land	50	41	41	98.4
Other	2	1.6	1.6	100
Total	122	100	100	

Crosstab Knowledge*Frequency							
Where are chili peppers most commonly found?							
			Orchards	Forest	Producer land	Other	Total
Are you aware of any chiles that you have seen around these parts?	yes	Count	27	31	45	2	**105**
		Expected count	27.5	32.7	43	1.7	105
	No	Count	5	7	5	0	**17**
		Expected count	4.5	5.3	7	0.3	17
Total		Count	32	38	50	2	122
		Expected count	32	38	50	2	122
x^2= 0.641							
x^2C= 0.641***							

X^2= Chi square; X^2C=Contingency coefficient

Timpinchile has great economic and social importance, mainly because some residents are culturally linked to all the generations that have consumed its fruit. 45.1% (Table 4) of the farmers consider Timpinchile as part of the diet and traditional importance for the region. 26.9% prefer the jalapeño pepper, 18.9% like the miraparriba pepper because they consider it easy to find and consume. For 9.1% of people, it is important when preferring other chili variants. These results indicate that most of the residents consider this chili very important, since it is part of the diet and they are referring to the fact that its consumption is essential as it is part of the basic food basket in our environment. The most significant relationships occurred between the local chili that is most consumed, and with which it can be purchased most easily. This is of cultural relevance and convenient for the conservation of the gene pools of local chili peppers, because it indicates, to a certain extent, a conviction in the consumption preferences of regional chili peppers as part of cultural reaffirmation (Long, 2008).

Table 4. What type of regional chili do you consume the most?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Timpinchile	55	45.1	45.1	63.9
Jalapeño	32	26.2	26.2	90.2
Miraparriba	23	18.9	18.9	18.9
Others	12	9.8	9.8	100
Total	122	100	100	

Cross table knowledge*región							
What type of regional chili do you consume the most?							
			Miraparriba	Timpinchile	Jalapeño	Others	Total
Are you aware of any chiles that you have seen around these parts?	Yes	Count	22	46	26	11	105
		Expected count	19.8	47.3	27.5	10.3	105
	No	Count	1	9	6	1	17
		Expected count	3.2	7.7	4.5	1.7	17
Total		Count	23	55	32	12	122
		Expected count	23	55	32	12	122
x^2= 0. 397							
x^2 C= 0.397**							

X^2= Chi square; X^2C=Contingency coefficient

The 51.6% of farmers consume chili as a fresh food and for the flavor of different types, 34.4% consume it for the spiciness (Table 5), 9.1% for the aroma, 4.1% for the odors that different types of chili give off and 0.8% consume it for other reasons. One of these chili peppers is the Timpinchile, considered to have a good flavor and which is mostly consumed by the population. This is a specific indicator for the presence of these chili peppers in the markets. The inhabitants of Mesoamerica have always eaten chili for the pleasure of its flavor and heat. The contact of capsaicin with sensory neurons results in the release of opioids, such as endorphins, which are pain-blocking substances that cause a pleasurable state. The successive consumption of chili would then cause a greater release of these endorphins, so that the consumption of chili would be more pleasurable than the pain it could cause (López, 2009).

Table 5. What is the reason why you consume more of these chili peppers?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Flavor	63	51.6	51.6	51.6
Scent	11	9	9	60.7
Color	5	4.1	4.1	64.8
Itching	42	34.4	34.4	99.2
other	1	0.8	0.8	100
Total	122	100	100	

Cross table knowledge*Consumption								
What is the reason why you consume more of those chili peppers?								
Are you aware of any chiles that you			Flavor	Ascent	Color	Itching	Other	Total

have seen around these parts?	Yes	Count	55	9	5	35	1	105
		Expected count	54.2	9.5	4.3	36.1	0.9	105
	No	Count	8	2	0	7	0	17
		Expected count	8.8	1.5	0.7	5.9	0.1	17
Total		Count	63	11	5	42	1	122
		Expected count	63	11	5	42	1	122
x^2= 0.830								
x^2C= 0.830***								

The consumption and preference of wild chili peppers and those cultivated within the family of producers, consider that 41.0% of these (Table 6) prefer the Timpinchile, therefore, 29.5% consider that the consumption of the white chili is better, 20.5% of the families answered that they prefer the miraparriba chili, 9.0% stated that the seven broth chili is better.

The most significant relationships occurred between the local chili that is consumed the most with the reasons and forms of consumption and the local chili that is purchased the most. This is of cultural relevance and convenient for the conservation of the gene pools of local chili peppers, because it indicates, to a certain extent, a conviction in the consumption preferences of regional chili peppers as part of cultural reaffirmation (Long, 2008).

Table 6. What regional chili or other type of chili do you buy the most for your family?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Timpinchile	50	41.0	41.0	61.5
Chile blanco	36	29.5	29.5	100.0
Miraparriba	25	20.5	20.5	20.5
Siete caldos	11	9.0	9.0	70.5
Others	0	0	0	0
Total	122	100.0	100.0	

Crosstab Knowledge*family What regional chili or other type of chili do you buy the most for the family?								
			Miraparriba	Timpinchile	Siete caldos	Chile blanco	Other	Total
Do you know of any chiles that you have seen in these places?	Yes	Count	23	40	9	5	28	105
		Expected count	20.7	40.5	9.5	6.0	28.4	105.0
	No	Count	1	7	2	2	5	17
		Expected count	3.3	6.5	1.5	1.0	4.6	17.0
Total		Count	24	47	11	7	33	122
		Expected count	24.0	47.0	11.0	7.0	33.0	122.0
x^2= 0.493								
x^2C= 0.493***								

X^2= Chi square; X^2C=Contingency coefficient

The 70.5% of the participants consider that they buy chili up to 500 grams (Table 7), although they consider

that they take as a reference what they buy in local markets, mainly wild chili peppers, 18.9% buy approximately 600 to 800 grams and 10.7% of those surveyed indicated that they buy more than 1 Kg. Morales-Valenzuela and Villegas-Ramírez (2025) stated in the communities Choles from Tabasco, the residents buy wild chili peppers. They consider that they buy and consume chili peppers in different ways and do so for medicinal and ritual uses; they do not specify the amount they buy and consume.

Table 7. How much chili do you buy per gram?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
0–500 g	86	70.5	70.5	70.5
600–800 g	23	18.9	18.9	89.3
More than a 1 kg.	13	10.7	10.7	100.0
Total	122	100.0	100.0	

Cross table Knowledge*Purchase						
How much chili do you buy per gram?						
Are you aware of any chiles that you have seen around these parts?			**1**	**2**	**3**	Total
	yes	Count	74	21	10	105
		Expected count	74	19.8	11.2	105
	No	Count	12	2	3	17
		Expected count	12	3.2	1.8	17
Total		Count	86	23	13	122
		Expected count	86	23	13	122
x^2= 0.489						
x^2C= 0.489**						

X^2= Chi square; X^2C=Contingency coefficient

Family consumption of chili is very important, because it is part of a regional culture, when buying the different types of chili they consume, 100% of the farmers stated that they only buy 0 to 500 grams. 53.3% (Table 8) of the family members stated that they consume chili more frequently and do so with 1 to 3 members, 33.6% are 3 to 5 members and 10.7% are more than 5 people who consume chili peppers from the region. Aguilar et al., (2010) stated that in a range of 1 to 6 people who make up the family, they can consume chili peppers such as 'Jalapeño' and serrano; The same authors mentioned that these chiles are the most consumed and local variants have their market niche, although not with high volumes.

Table 8. How many family members consume chili?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
1 a 3	64	52.5	52.5	52.5
3 a 5	41	33.6	33.6	86.1
6 a 10	14	11.5	11.5	97.5
10 to more	2	1.6	1.6	99.2
Other	1	.8	.8	100.0
Total	122	100.0	100.0	

Crosstab Knowledge*Integrant How many family members consume chili?

			1 a 3	3 a 5	6 a 10	10 to more	Other	Total
Are you aware of any chiles that you have seen around these parts?	Yes	Count	52	38	12	2	1	105
		Expected count	55.1	35.3	12.0	1.7	0.9	105.0
	No	Count	12	3	2	0	0	17
		Expected count	8.9	5.7	2.0	0.3	0.1	17.0
Total		Count	64	41	14	2	1	122
		Expected count	64.0	41.0	14.0	2.0	1.0	122.0
x^2=0.521								
x^2C=0.521***								

X^2= Chi square; X^2C=Contingency coefficient

The 38.5% of the producers stated that they plant any other type of chili, these because of the attraction of trying new varieties and with a different flavor (Table 9), 32.0% harvest the Miraparriba because it is the best-known chili in the region and easy to adapt, 20.5% sow the wild Timpinchile chili, this type of chili is very difficult to germinate, according to the producers' comments they refer to the fact that it is possible that they will harvest it in areas in which where it reproduces naturally. And 6.6% are inclined to plant the seven broths and 2.5% have planted white chili at least once. In nine cities in the states of Coahuila, Nuevo León and Tamaulipas. This is attributed, in part, to the fact that 'Jalapeño' and 'Serrano' chiles are the most produced and marketed in Mexico (SIAP, 2010).

Table 9. Do you plant any type of chili?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Timpinchile	25	20.5	20.5	20.5
Miraparriba	39	32.0	32.0	52.5
Siete caldos	8	6.6	6.6	59.0
Chile blanco	3	2.6	2.5	61.5
Other	47	38.5	38.5	100.0
Total	122	100.0	100.0	

Cross table Knowledge*Type								
Do you plant any type of chili?								
Do you plant any type of chili?			Miraparriba	Timpinchile	Siete caldos	Chile blanco	Other	Total
Are you aware of any chiles that you have seen around these parts?	Yes	Count	24	31	8	3	39	105
		Expected count	21.5	33.6	6.9	2.6	40.5	105
	No	Count	1	8	0	0	8	17
		Expected count	3.5	5.4	1.1	0.4	6.5	17
Total		Count	25	39	8	3	47	122
		Expected count	25	39	8	3	47	122
x^2= 0.229								
x^2C=0.229*								

X^2= Chi square; X^2C=Contingency coefficient

According to the results of the size of the planting area, 37.7% of those surveyed (Table 10) plant a quarter of a hectare, in turn 28.7% less than a thousand m², 26.2% plant in other places that correspond to land of half a hectare, 4.9% have an area of half a quarter of a hectare and 2.5% plant in small backyard spaces. Mexico contributed 73% of the chilies and peppers imported by the USA, followed by Canada, which contributed 20% of peppers. Challenges and opportunities (SAGARPA 2010) mention that in Mexico there are 12 thousand producers in Mexico with various degrees of technology and surface areas ranging from 1 to 40 hectares dedicated to the production of this crop.

Table 10. How much land do you allocate for planting chili?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
A quarter of a hectare	46	37.7	37.7	37.7
Less than 1000 m²	35	28.7	28.7	42.6
Half quarter	6	4.9	4.9	71.3
Half a hectare	32	26.2	26.2	97.5
Other	3	2.5	2.5	100
Total	122	100	100	

Cross table KNOWLEDGE*TERREIN How much land do you allocate for planting chili?								
Are you aware of any chiles that you have seen around these parts?			2500 m²	Less than 1000 m²	1200 m²	2500 m²	Other	Total
	Yes	Count	41	6	29	26	3	105
		Expected count	39.6	5.2	30.1	27.5	2.6	105.0
	No	Count	5	0	6	6	0	17
		Expected count	6.4	.8	4.9	4.5	.4	17.0
Total		Count	46	6	35	32	3	122
		Expected count	46.0	6.0	35.0	32.0	3.0	122.0
x^2=0.603								
x^2C=0.603***								

X^2= Chi square; X^2C=Contingency coefficient

The 74.6% of the producers mentioned that only they are in charge of the activity (Table 11), but 13.1% mention that only other external people help the crop. In the same way, 7.4% the son has participation in the cultivation and finally 4.9%. The wives are the ones who help in the cultivation.

Bran et. al., (2007) mention that the representation of women is important, due to the direct participation they have in the management of the orchards, since they represent 49.50% of the population of Chiapas. It should also be taken into account that, in recent decades, the male population has decreased as a result of migration; Consequently, peasant women are left in charge of household responsibilities.

Table 11. Who is dedicated to planting chili?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Husband	90	73.8	73.8	73.8
Wife	7	5.7	5.7	79.5
Children	9	7.4	7.4	86.9
Others	16	13.1	13.1	100
Total	122	100	100	

Cross table KNOW*DEDICA							
Who is dedicated to planting chili?							
Are you aware of any chiles that you have seen around these parts?			Husband	Wife	Children	Other	Total
	Yes	Count	77	7	9	12	105
		Expected count	77.5	6	7.7	13.8	105
	No	Count	13	0	0	4	17
		Expected count	12.5	1	1.3	2.2	17
Total		Expected count	90	7	9	16	122
		Expected count	90	7	9	16	122
x^2=0.236							
x^2C=0.236*							

The Pingali (2004) mentions that the institutionality and dispersion of producers in rural areas has somewhat delayed the integration of farmers in the region. In this panorama, a strong association is required that promotes commercialization and transformation, to have a better living condition.

The 58.2% of the producers mentioned that if they market some type of chili on a smaller scale (Table 12), 40.2% do not market any type of chili, some are buyers or are only self-consumers and 1.6% mentioned that they have another type of activity regarding marketing.

Table 12. Do you market wild or cultivated chili peppers?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Yes	71	58.2	58.2	58.2
No	49	40.2	40.2	98.4
Other	2	1.6	1.6	100
Total	122	100	100	

Crosstab Knowledge*Marketing Do you sell wild or cultivated chili peppers?						
Are you aware of any chiles that you have seen around these parts?			Yes	No	Other	Total
	Yes	Count	61	42	2	105
		Expected count	61.1	42.2	1.7	105.0
	No	Count	10	7	0	17
		Expected count	9.9	6.8	.3	17.0
Total		Count	71	49	2	122
		Expected count	71.0	49.0	2.0	122.0
x^2=0.848						
x^2C=0.848***						

X^2= Chi square; X^2C=Contingency coefficient

According to the results obtained, it can be observed (Table 13) that 88.5% of the producers market their chili

harvest in the same community. The reasons for this local marketing are because they buy other types of chili, which helps them increase their diversity and 11.5% of the producers market their product in other communities with better profits.

Table 13. Where do you sell chili peppers?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Local market	108	88.5	88.5	88.5
In other towns	14	11.5	11.5	100.0
Total	122	100.0	100.0	

According to Hernández et al., (2010) stated that in the state of Yucatán in the southeast of Mexico, they produced 3,390 tons of habanero chili in 2006, which represents almost half of the total production of this product, of which 25% is exported. It is estimated that, of the total production, 75% is intended for fresh consumption, 22% is used by the industry in the production of sauces and 3% is intended for obtaining seeds.

Cross table CONOCIM*ENDONDE Where do you sell the chilies?					
			Local market	In other towns	Total
Are you aware of any chiles that you have seen around these parts?	Yes	Count	93	12	105
		Expected count	93.0	12.0	105.0
	No	Count	15	2	17
		Expected count	15.0	2.0	17.0
		Count	108	14	122
Total		Expected count	108.0	14.0	122.0
x^2=0.968					
x^2C=0.968***					

X^2= Chi square; X^2C=Contingency coefficient

The 64.8% of the producers (Table 14) stated that chili controls gastritis because at some point they used it to have that benefit, 6.6% commented that it controls triglycerides and 28.6% consider that it helps in other aspects or are unaware of any type of benefit. They mention (Surh, 2002). According to Lugo et al., (2010) Capsaicin gives the spicy characteristic to chili fruits. This compound has analgesic and anti-inflammatory activity, and is used therapeutically to treat pain caused by rheumatoid arthritis and diabetic neuropathy. However, arguments of benefits or harmful effects of capsaicin are controversial; Some references point out that capsaicin is a carcinogen, co-carcinogen or tumor promoter, while others highlight its chemo preventive and chemotherapeutic effects.

Table 14. What nutritional properties or health benefits do you know about wild chili peppers?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Control gastritis	79	64.8	64.8	64.8
Controls uric acid and triglycerides	8	6.6	6.6	71.3
Other	35	28.6	28.6	100.0
Total	122	100.0	100.0	

Cross table KNOW*PROPERTY What nutritional properties or health benefits do you know about wild chili peppers?						
¿ Do you know			Control gastritis	Control uric acid and	Other	Total

of any chiles that you have seen in these places?				triglycerides		
	Yes	Count	66	7	32	105
		Expected count	68.0	6.9	30.1	105.0
	No	Count	13	1	3	17
		Expected count	11.0	1.1	4.9	17.0
Total		Count	79	8	35	122
		Expected count	79.0	8.0	35.0	122.0
x^2=0.529						
x^2C=0.529***						

X^2= Chi square; X^2C=Contingency coefficient

The producers surveyed (Table 15) stated that 49.2% consider that it is only a tradition of consuming chili, because they have been consuming it for a long time, 39.3% consider that it generates income from the sale of some type of chili and 12.3% consider it as part of the diet, because a chili cannot be missing from their daily meal.

Saldaña et al., (2023) describe that in Chiapas there are different types of chili peppers and one of the most important is the so-called Simojovel chili. This chili is very popular in the population, because they are consumed with different dishes, including combined with beans and tamales, mainly. It is considered that after the Timpinchile, the Simojovel chili occupies second place in importance, due to its flavor and moderate heat. In local markets they can be found very easily and at a good price. The treatment they give it is sunbathing after cutting it or roasting it over low heat, without burning it because it loses its flavor.

Table 15. How important are chili peppers to you in general?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
They are part of the diet	15	12.3	12.3	12.3
They generate income	47	39.3	39.3	50.8
They are a consumption tradition	60	49.2	49.2	100.0
Total	122	100.0	100.0	

Cross table KNOWLEDGE*IMPORTANCE How important are chili peppers to you in general?						
Are you aware of any chiles that you have seen around these parts?			They are part of the diet	They generate income	They are a consumption tradition	Total
	Yes	Count	14	41	50	105
		Expected count	12.9	40.5	51.6	105.0
	No	Count	1	6	10	17
		Expected count	2.1	6.5	8.4	17.0
Total		Count	15	47	60	122
		Expected count	15.0	47.0	60.0	122.0
x^2=0.581						
x^2C=0.58***						

X^2= Chi square; X^2C=Contingency coefficient

The 58.2% of the producers mention that they only consume chili twice a week in different types of food (Table 16), 36.9% of the producers have a daily consumption and 4.9% consume it once a month, for some special occasion in the form of sauces. Morales-Valenzuela and Villegas-Ramírez (2025), these researchers found in two communities of Tabasco two species of important chili peppers (*C. annuum* and *C. frutescens*), of which they observed that the majority of farmers use it mainly as food, although they also have medicinal and ritual uses. These traditions also occur in Chiapas, the same two species are reported in the Frailesca region, Chiapas by Bran et al., (2025) where different types of chiles belonging to these two species were reported.

Table 16. How often do you consume chili?

	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Diary	45	36.9	36.9	36.9
1-2 times a week	71	58.2	58.2	95.1
Once a month	6	4.9	4.9	100.0
Total	122	100.0	100.0	

cross table CONOCIM*CONSUMCHI How often do you consume chili?						
Are you aware of any chiles that you have seen around these parts?			Diary	1-2 times a week	Once a month	Total
	Yes	Count	40	60	5	105
		Expected count	38.7	61.1	5.2	105.0
	No	Count	5	11	1	17
		Expected count	6.3	9.9	0.8	17.0
Total		Count	45	71	6	122
		Expected count	45.0	71.0	6.0	122.0
x^2=0.787						
x^2C=0.787***						

X^2= Chi square; X^2C=Contingency coefficient

CONCLUSIONS

The 100% of the producers have knowledge of wild and cultivated chili peppers. It is possible that the tradition of consumption of wild and cultivated chili peppers has allowed local knowledge. It is evident that the preference for wild chiles and those grown with producers focuses on the consumption of wild ones called Timpinchile. Probably the flavor and heat levels are the factors that the producer considers to be the most preferred. The producer has extensive knowledge of where wild chilies are most frequently found and they know how to plant them. The Timpinchile is the only one that the family prefers to consume, usually consumption is done by 1 to 3 members per family. The family is also aware of the benefits of this wild chili. The producers of this region know and prefer the wild Timpinchile chili; however, they plant them on a smaller scale at the garden level, but they also participate in food security production programs and are benefited with jalapeño chili seeds, for local consumption and in some cases for marketing. Most of the variables evaluated are associated with the knowledge of wild and cultivated chili peppers, indicating the interest that the population of this place has in the conservation of chili plant genetic resources.

RECOMMENDATIONS

It is recommended that there be a symbiosis between farmers and students so that they share with new generations their knowledge about the original names of chili peppers, their characteristics, their production

system and their traditional periodic tasks that they carry out as part of the conservation of their customs and ways of living healthily. The value of wild chilies is incalculable due to their origin, their flavor, aroma, level of spiciness and uses in Mexican cuisine, they are part of our idiosyncrasy and ways of life of each family. It is important to protect these genetic resources, avoiding as much as possible the field handling of plants when collecting them. It is recommended to avoid bending the plants and their natural habitats where they develop and live. Do not cut the nurse plants that are found around wild plants, mainly the Timpinchile, which are part of the genetic base of the Capsicum and are living fossils that, if mistreated, will take time to recreate and reproduce.

It is important to create awareness among farmers and guide them in the management of these wild plants. An important way is to establish family gardens to grow the chili peppers that they traditionally consume. This in situ conservation can contribute to improving their availability and conserving wild populations. Treat as much as possible the indiscriminate use of agrochemicals, mainly in the plots where chili peppers are grown. It is recommended to apply integrated pest management practices and use authorized products only when necessary, following safety instructions to protect human health and the environment.

It is recommended to exchange germplasm or native seeds to raise awareness about the conservation of wild and cultivated chili, specifically those most appreciated by farmers. It is advisable to maintain different local varieties and avoid depending exclusively on a single type of chili. Diversity can favor adaptation to different environmental conditions and contribute to preserving the agricultural heritage of communities. It is recommended that farmers continue to take advantage of wild and responsibly grown chili peppers, combining their traditional knowledge with sustainable agricultural practices. Likewise, it is important to recognize that consumption preferences vary between communities and families; Therefore, decisions about cultivation, in situ and ex situ conservation must consider the customs, needs and experiences of the native population to continue being used so that they are always in the same conservation place for future generations.

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