Article

Phenotypic diversity of chilli Amashito from Tabasco and Chiapas, Mexico

Roberto Gutiérrez-Burón[1]
Luís Latournerie-Moreno[1§]
René Garruña-Hernández[1]
Esaú Ruiz-Sánchez[1]
Alicia Ruby Lara-Martín[1]
Guillermo Castañón-Nájera[2]

[1]National Technology of Mexico-IT Conkal. Technological Av. s/n, Conkal, Yucatán, México. CP. 97345. (roberto.gutierrez@itconkal.edu.mx; rene.garruna@itconkal.edu.mx; esau.ruiz@itconkal.edu.mx; alicia.lara@itconkal.edu.mx). [2]Academic Division of Biological Sciences-Autonomous Juárez University of Tabasco. Villahermosa-Cárdenas highway km 0.5, junction Saloya forests, Villahermosa, Tabasco, Mexico. CP. 86139. (guillermo-corazon-valiente@hotmail.com).

[§]Corresponding author: luis.latournerie@itconkal.edu.mx.

Abstract

The objective of the work was to carry out the ethnobotanical exploration, collection and *in situ* characterization of populations of chilli Amashito (Capsicum annuum var. Glabriusculum) from the states of Tabasco and Chiapas. The work was carried out from July to December 2017 in 24 communities in the state of Tabasco and 15 communities in the north of the state of Chiapas, Mexico. Exploration sites were chosen based on the survey of key informants (recognized collectors), market information and available literature. A survey was applied to 39 collectors, one for each study site. The sample size to collect varied between 3 and 5 plants. Twenty morphological descriptors of plant, flower and fruit from 98 populations were measured in situ. The data were analyzed by means of principal component analysis and hierarchical clusters with the 13 variables that explained the greatest morphological variation. The collectors identify nine morphotypes of chilli Amashito that are distinguished mainly by color, pigmentation, shape and size of the fruit, and these grow mainly in ecosystems of cacao, acahual, banana and milpa farms. The first three main components explain 50.2% of observed morphological variation. The populations of chilli Amashito are differentiated and grouped according to the geographical characteristics of the study sites. The populations of the northern region of Chiapas were characterized by presenting elongated and larger fruits compared to those of the Tabasco communities. It was also found that in the neighboring areas where the two study regions converge, a group of populations that shared morphological similarities was distinguished.

Keywords: *in situ*, characterization, morphotypes, traditional knowledge, wild populations.

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Introduction

The *Capsicum* genus is made up of 37 species, among which *C. annuum* L., *C. frutescens* L., *C. pubescens*, *C. chinense* Jacq and *C. baccatum* L. stand out as the most important cultivated species (Pickersgill, 1984, 1997; Zhang *et al*., 2016; Velázquez-Ventura *et al*., 2018). Mexico is considered the center of origin and domestication of *Capsicum annuum* (Laborde and Pozo, 1984), the above based on the archaeological remains of seeds found in the field caves, Tamaulipas (7 000-5 000 BC), Coxcatlan in the Tehuacan Valley, Puebla (6 000-4 000 BC) and in the caves of Guilá Naquitz, Oaxaca (600-1 521 AD) (Evans, 1993).

In this regard, Aguilar-Melandez *et al*. (2009) affirm that the region of the Yucatan Peninsula represents another center of diversity and potential center of domestication, due to the high genetic diversity found and in particular to the presence of seven unique haplotypes of chili in the region. Wild chili *C. annuum* var. Glabriusculum, in Mexico depending on the region, is called Amashito, Max, Piquin, Chiltepin, among others, which has been identified as the parent and wild relative of domesticated forms.

Therefore, it is recognized as the closest ancestor of cultivated chili varieties (Eshbaugh, 1979; Pickersgill, 1997; Pozo and Ramírez, 2003). The natural populations of chilli Amashito are distributed throughout almost the entire Mexican Republic, which indicates a wide environmental adaptability given its genetic diversity and the wild nature of the species. The populations of chilli Amashito are exploited by the inhabitants of the rural environment, by harvesting the fruit in different ecosystems and selling it, because it is highly demanded as a condiment, which is why it has great economic importance in the country (Pozo, 1981; Montes *et al*., 2006; Hernández-Verdugo *et al*., 2012).

However, currently in some areas of the country, wild populations of chilli Amashito have decreased their natural variability, so the loss of such a valuable genetic resource is at risk due to the alteration of its ecosystem and its unsustainable use (García *et al*., 2010). In this sense, Ramírez-Meraz *et al*. (2015) point out that there is a high risk of losing the genetic wealth of wild chili, in part because most of the farmers in the north of the country cut the branches of the plant to facilitate the harvest, damaging it and sometimes causing plant death.

If the destruction of the natural habitat in which it reproduces is added to the above, there is a risk of the possible loss of this germplasm in the country. In this regard, Narez-Jiménez *et al*. (2014) mention that the alterations of the ecosystem are due to demographic changes, droughts, hurricanes, floods, and deforestation, mainly. On the same Tewksbury *et al*. (1999) indicated that the overexploitation by human and animal groups was decreasing wild chili populations.

In Mexico, various works have been carried out in chilli Amashito or Piquin; among which those carried out by Hernández-Verdugo *et al*. (2012) who studied the phenotypic variation in populations of wild chilies (Piquin or Amashito) in northwestern Mexico, who found high variation between populations and report that temperature, altitude and annual mean precipitation are important factors for the differentiation of wild populations growing in natural conditions. In the

Huasteca Tamaulipeca region, Ramírez-Meraz *et al*. (2015) characterized wild and semi-domesticated chilies *in situ* and reported 10 racial groups, where the Piquín and the Piquin Huasteco stand out for their abundance.

While for the Sierra Gorda and semi-desert region of Querétaro and Guanajuato, Ramírez *et al*. (2018) found high variation between and within Piquín chilli populations. In this regard, in Chiapas, Bran *et al*. (2012) carried out the morphological characterization of the variability of the Timpinchile (*Capsicum annum* L. var. Glabriusculum), reported that the greatest diversity of chilli was found in the mountainous area with the largest number of plants, and there were adequate conditions for the conservation of *in situ* variability.

In particular, in the state of Tabasco, the *in situ* characterization of chilli populations has been carried out, reporting the presence of *Capsicum frutescens* var. Tabasco, *Capsicum annuum* and *Capsicum annuum* var. Glabriusculum, in addition to some intraspecific crosses between wild types; this diversity of chilies grows at any time of the year due to the edaphoclimatic conditions of the referred state (Castañón *et al*., 2008; Pérez-Castañeda *et al*., 2008).

In a study of morphological diversity of wild and semi-wild chili populations carried out by Gálvez *et al*. (2018) in communities of the municipality of Reforma, Chiapas and of the municipalities of Teapa, Tacotalpa, Cárdenas and Macuspana, in the state of Tabasco, report that the qualitative and quantitative variables with which the morphological diversity of the evaluated populations were identified were, leaf color, leaf shape, stem shape, fruit shape, fruit length, number of seeds per fruit, plant height and stem diameter.

The wild populations of chilli Amashito, in the communities of Tabasco and northern Chiapas, are found in lowland and acahual ecosystems, and in production systems (cocoa farms, coconut plantations, banana plantations, paddocks, roadside and orchards mainly), these ecosystems being strategic sites for the conservation and use of this valuable genetic resource, since the harvesting of the fruit is an important part of the family economy of rural communities in these regions (Castañon-Nájera *et al*., 2008).

The lack of information on the variability and geographical distribution of wild chili (Amashito) in southeastern Mexico leads to limited knowledge (Narez-Jiménez *et al*., 2014), as well as the possibility of better sustainable use. This genetic resource is an important and valuable reservoir of genes that conserve the natural evolutionary processes present in their populations and are potential to solve future agricultural problems (Hayano-Kanashiro *et al*., 2016; de la Cruz-Lázaro *et al*., 2017) hence the importance of knowing and preserving it. Due to the importance of the chilli, the objective of the present investigation was to carry out ethnobotanical exploration, collect and characterize in situ the phenotypic diversity of the chilli Amashito (*Capsicum annuum* L. var. Glabriusculum) in the states of Tabasco and Chiapas.

Materials and methods

The study was carried out in two regions: 1) Tabasco Plain (17° 15’ 00’’ north latitude and 90° 58’ 08’’ west longitude), located in the coastal plain of the Gulf of Mexico, whose territorial extension is 24 738 km^2, the climate is warm humid Am (f)” (i’) g with precipitation and annual average temperature between 2 500 and 3 000 mm and 25 °C, respectively (INEGI, 2015). 2) The ‘Pie de Monte’ region of northern Chiapas (16° 13’ 41’’ north latitude and 92° 25’ 42’’ west longitude), which is part of the Gulf Coast Plain and Northern Chiapas Mountains. The relief of the terrain is formed by mountains and hills whose height varies from 3 to 2 260 masl, its territorial extension is 3 429.8 km^2, the predominant climate of the area is warm humid with rains all year round, followed by the warm humid climate with abundant summer rains in the northern part of the region (INEGI, 2015).

The collection of the chili Amashito populations was carried out from July to December 2017. The exploration communities were selected based on previous studies carried out by Castañon-Najera *et al*. (2008), interviews with curators and delegates of the study sites, field trips with the locals, and information from sellers of wild chilies in markets of the explored municipalities. For the selection of collection sites in the communities of each municipality, those areas with the highest collection activity and diversity were considered based on the criteria of the locals (key informants).

In total, 24 communities from eight municipalities in Tabasco and 15 communities from five municipalities in northern Chiapas were selected (Figure 1). The sample size collected was from 3 to 5 plants, at each selected site 10 mature fruits were harvested per plant. In each explored community, ethnobotanical data were recorded as the type of vegetation where the chilies grow, common name, chili variants identified by the producers and georeference data from the collection site, mainly.

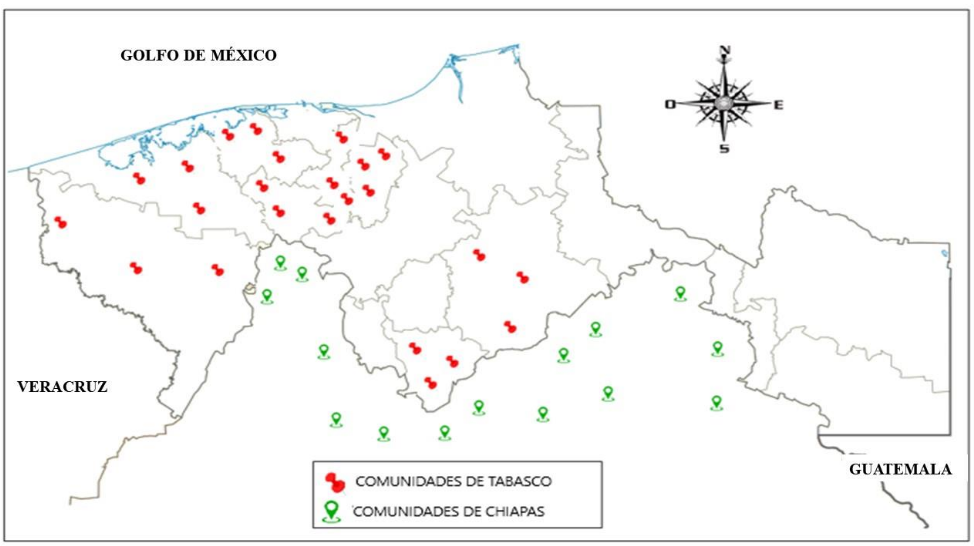

Figure 1. Geographical location of the chilli Amashito (*Capsicum annuum* var. Glabriusculum) collection sites in the physiographic regions of Tabasco and northern Chiapas.

For the characterization, 20 quantitative and qualitative morphological descriptors (13 of plant, 3 of flower and 4 of fruit) were evaluated (IPGRI, AVRDC and CATIE, 1995), the data were taken from a sample that varied between 3 and 10 plants (Hernández-Verdugo *et al*., 2012). With the means or fashions of the variables measured from the populations, a first descriptive statistical analysis and a principal component analysis (PCA) were performed with the data standardized to $\mu = 0$ and $\sigma^2 = 1$.

With the results of the first PCA, the 13 variables that best described the variability of the evaluated populations were determined. Then a second PCA was performed, as well as an analysis of hierarchical clusters (AC) with the average linkage method (UPGMA), with the Euclidean distance as a measure of dissimilarity and with the distance matrix, the dendrogram was constructed.

Results and discussion

Traditional knowledge of the diversity of chilli Amashito

In total, 98 populations of chilli Amashito were collected in the plain of the state of Tabasco and northern Chiapas, these populations were classified by and the collectors into nine morphological variants (morphotypes) of wild chilli Amashito (*Capsicum annuum* var. Glabriusculum) based on mainly immature fruit color, shape and size characteristics: Amashito verde, Amashito ojito de cangrejo, Amashito blanco, garbancillo blanco, garbancillo verde, Amashito grande or gigante, Amashito bolita, Amashito muela and colmillo de lagarto ((Table 1).

Table 1. Different morphotypes of chilli Amashitos identified by producers in the harvesting regions of the state of Tabasco and northern Chiapas.

No.	Common name	Distinctive features related to the common name of the chilli Amashito.
1	Amashito verde	Fruit of dark green color in the state of initial maturity (tender), which remains until the intermediate maturity (seasoning) and in the mature state changes to deep red.
2	Ojito de cangrejo	The fruit is almost round and presents an intense green color with purple spots, which give it the appearance of a crab eye, in the state of initial maturity (tender) and remains until intermediate maturity, and in the mature state it is dark red.
3	Amashito blanco	It presents elongated fruits of milky white color in a state of initial maturity (tender) and intermediate maturity (seasoning), in a mature state it is light red.
4	Garbancillo blanco	Almost round fruits of milky white color when green (tender at the time) and pale orange at maturity. Color and shape is the reason why they associate it with chickpea.
5	Amashito grande	It is characterized by the large size of the fruit, elongated (the form is associated with the chickpea, hence the name) and deep green when green; in a mature state the fruit is red in color.
6	Garbancillo verde	It has light green fruits and an almost round shape. At maturity the fruit is light red.
7	Amashito muela	Fruits light yellow in green and dark red at maturity. The name is due to the shape of the fruit at the base, which they associate with the shape of a tooth.
8	Amashito bolita	This fruit is almost round in shape and light green when green and becomes light orange at maturity.
9	Colmillo de lagarto	Fruits of conical shape and pointed apex of intense red color in mature state.

That is, the gatherers name the variants of the chilli Amashito based on their characteristics of the fruit. In general, the fruits of the Amashito verde, garbanzo, ojito de cangrejo and bolita morphotypes are mainly characterized by having almost round shapes. In this sense, according to Hernández-Verdugo *et al*. (1998); Mongkolporn and Taylor (2011); Bosland and Votava (2012); Hayano-Kanashiro *et al*. (2016); Velázquez-Ventura *et al*. (2018), mention that the almost round shape of the fruit is one of the main features presented in the wild chili (*Capsicum annuum* var. Glabriusculum).

In previous studies carried out in the state of Tabasco, only 3 to 4 morphotypes have been reported: Amashito verde, ojitos de cangrejo, garbanzo and muela (Castañón-Nájera *et al*., 2008; Prado-Urbina *et al*., 2015; Velázquez -Ventura *et al*., 2018) while, in Chiapas, Bran *et al*. (2012) mention wild chili as Timpinchile without specifying the variation between them. This indicates that the phenotypic variation of this type of chili in the study regions is possibly not well understood. In ethnobotany, the morphotype is the first level of diversity, but there is also intra-morphotype diversity that can be exploited for conservation and use purposes (Latournerie *et al*., 2002).

It was observed that the diversity of chilli Amashito by region (municipality) was greater in the municipalities of Huimanguillo, Cunduacan and Comalcalco in the state of Tabasco with 7, 6 and 5 morphotypes, respectively (Table 2). Which is also related to the regions where the greatest number of collections were obtained (between 8 and 12). While a smaller number of variants was found in the municipalities of Juárez and Salto de Agua that correspond to northern Chiapas, with 2 morphotypes of chilli Amashito each.

Regarding the abundance by morphotype type of chili Amashito collected, the largest number of populations collected correspond to the Amashito verde (36.7%), followed by ojito de cangrejo (12.3%), Amashito blanco and garbancillo blanco with 11.2% each. On the other hand, the colmillo de lagarto morphotype was only found in two localities (common Malpasito of the municipality of Tecpatan, Chiapas and in the Libertad municipality of Huimanguillo, Tabasco) that are located very close to each other, so they could be lost due to the low frequencies in which they are found in a region (Table 2).

Table 2. Diversity and frequency of chilli Amashito collected by municipalities in the state of Tabasco and northern Chiapas.

Chilli Amashito diversity			Morphotypes and their frequency			
Municipality	No. of collections	No. of morphotypes	No.	Common name (morphotypes)	No. of collections	Percentage (%)
Huimanguillo	12	7	1	Amashito verde	36	36.7
Cárdenas	9	3	2	Ojito de cangrejo	12	12.3
Cunduacan	9	6	3	Amashito blanco	11	11.2
Jalpa	9	4	4	Garbancillo blanco	11	11.2
Comalcalco	8	5	5	Amashito grande	9	9.2
Nacajuca	7	4	6	Amashito muela	6	6.1

Chilli Amashito diversity			Morphotypes and their frequency			
Municipality	No. of collections	No. of morphotypes	No.	Common name (morphotypes)	No. of collections	Percentage (%)
Macuspana	7	4	7	Garbancillo verde	6	6.1
Tacotalpa	7	3	8	Amashito bolita	5	5.1
Ostuacan	7	4	9	Colmillo de lagarto	2	2.1
Tecpatan	7	4		Total	98	100
Pichucalco	7	3				
Juárez	6	2				
Salto de Agua	3	2				

In this regard, Ramírez-Meraz *et al*. (2015) point out that it is evident that there is a risk of the potential disappearance of this wild chili, because the natural reproduction of this genetic resource is difficult since the area of native vegetation of the regions where the chili grows is reduced every year and with it the natural habitat of many birds that participate in its dispersion is destroyed.

The results of the interviews carried out with 39 collectors of the study sites, 100% of them identify the Amashito verde (Table 3), while 35.9% know the ojito de cangrejo and the Amashito blanco and 25.6% the garbancillo blanco. In other words, these four morphotypes of chilli Amashito are the best known in the study regions. The lesser-known morphotypes of the inhabitants are the Amashito bolita (10.3%) and the colmillo de lagarto (2%), a result that coincides with the few samples collected from these morphotypes in the study area (Table 2).

Table 3. Morphotypes of chilli Amashito and reproduction ecosystems known to the collectors in the Tabasco plain and northern Chiapas.

Chilli Amashito morphotypes			Reproduction ecosystems of the chilli Amashito		
Common name	Frequency	(%)	Breeding habitat	Frequency	(%)
Amashito verde	39	100	Cocoa farm	32	82.1
Ojito de cangrejo	14	35.9	Acahual	29	74.4
Amashito blanco	14	35.9	Banana trees	21	53.8
Garbancillo blanco	10	25.6	Milpa system	21	53.8
Amashito grande	9	23.1	Paddocks	18	46.2
Garbancillo verde	6	15.4	Roadside	15	38.5
Amashito muela	6	15.4	Fields	11	28.2
Amashito bolita	4	10.3	Fruit trees	10	26.6
Colmillo de lagarto	2	5.1	Citrus orchards	8	20.5

On the other hand, the most common morphotypes identified by the collectors in this study, mostly coincide with those reported by Castañón-Nájera *et al*. (2008); Velázquez-Ventura *et al*. (2018); Gálvez *et al*. (2018), which were Amashito verde, ojito de cangrejo, garbanzo and muela. This indicates that these morphotypes are the best known and present in the studied areas.

On the other hand, the collectors identify nine ecosystems (habitat) where the chilli Amashito grows (Table 3): cocoa farm, acahual, banana trees, cornfields, paddocks, roadside, fields, fruit orchards and citrus. Being more frequent to find the chilli Amashito in the cacao farms (82.1%), acahuales (74%), plantains and cornfields (53.8% each) and paddocks (46.2%). The ecosystems where the least presence of chilli Amashito, less than 30%, are located are fields, and fruit and citrus orchards. Presenting the Amashito verde in most ecosystems. Furthermore, an apparent relationship between ecosystems and some particular morphotype was not observed.

Phenotypic diversity analysis

Table 4 shows the results of the principal component analysis (PCA) with the 98 populations of chilli Amashito with the 13 selected morphological variables. The first three main components explain 50.2% of the observed morphological variability. The PC1 contributed to explain 22.8% of the total variation and an eigenvalue of 3, mainly associated with the variables leaf shape (FH), leaf length and width ratio (LH/AH) in a positive way and in a negative way with leaf margin, ratio of plant height and stem diameter (AP/DT).

Table 4. Vectors and eigenvalues of the first three main components (PC) estimated with 13 plant, flower and fruit variables in 98 populations of chilli Amashito (*C. annuum* var. Glabriusculum) collected in the states of Tabasco and northern Chiapas.

Variables	PC1	PC2	PC3
Ratio. AP/AC[£]	0.064	0.253	0.526
Ratio: AP/DT	-0.36	0.125	0.487
Leaf length (LH)	0.253	0.271	0.019
Ratio LH/AH	0.377	- 0.116	0.317
Leaf density	0.157	0.058	-0.213
Leaf Color	0.197	0.069	-0.287
Leaf shape	0.412	-0.282	0.227
Leaf margin	-0.42	0.16	-0.229
Flower position	-0.21	0.14	-0.201
Fruit length (LF)	0.346	0.176	-0.244
Ratio: LF/AF	-0.181	0.246	0.221
Ripe fruit color	0.19	0.522	0.041
Fruit shape	-0.135	-0.58	0.059
Own value	3	2	1.5
Variation explained (%)	22.8	15.7	11.7
Accumulated variation (%)	22.8	38.5	50.2

[£]AP= plant height; AC= cup width; DT= stem diameter; AH= leaf width; AF= fruit width.

In other words, this component was defined to a greater degree by variables of the plant structure. This coincides with studies of morphological diversity of wild chilies, where it is reported that the first main component was explained by leaf and plant descriptors (Castañón-Nájera *et al*., 2010; Moreno-Pérez *et al*., 2011; de la Cruz -Lázaro *et al*., 2017).

In this sense, Villota-Cerón *et al*. (2012) report that the first three main components contributed to explain 61.9% of the variation observed in different types of chilies (*Capsicum* spp.), While Gálvez *et al*. (2018) in *in situ* morphological diversity studies with 9 descriptors of wild and semi-wild populations (*C. annuum* var. g*labriuculum* and *C. frutescens*) found that the first three main components explained 58.3% of the variation.

According to the first two main components (PC1 and PC2), the germplasm was distributed in the four quadrants and four large groups were formed, in addition to two collections that were separated from the rest, forming an individual group each (Figure 2). Group 1 (G1) was formed with 22 populations of chilli Amashito distributed in quadrants I and IV. These were collected in the most remote communities in the mountainous area of Chiapas (560 to 800 masl), in the municipalities of Ostuacan, Malpaso and Juárez. The collections are characterized by presenting plants with greater height (between 1.4 to 2.4 m), large leaves with an average length of 4.4 cm and 6.2 cm in width, elongated fruits of greater size (from 1.9 to 2.6 cm in length and diameter of 0.7 to 2.5 cm).

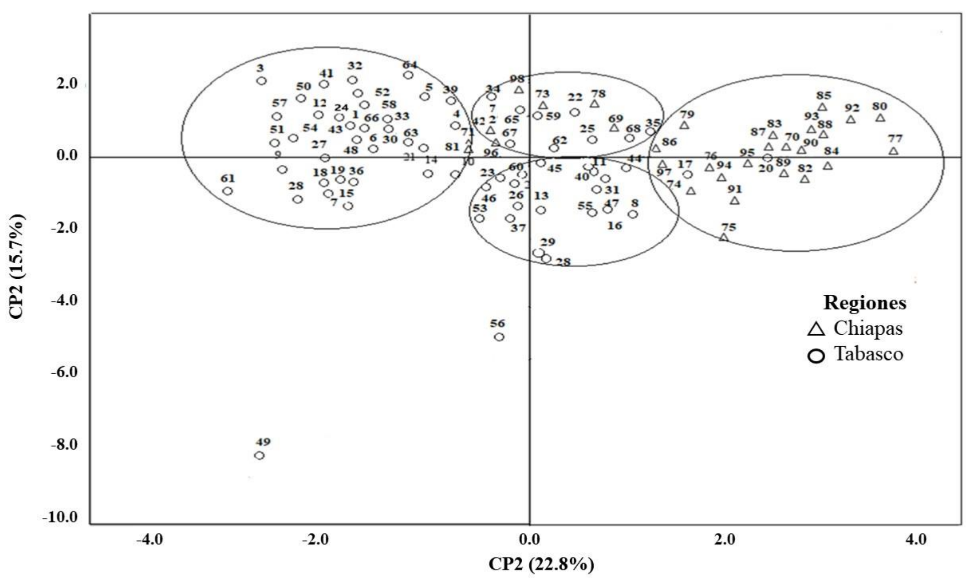

Figure 2. Distribution of 98 populations of chilli Amashito (*C. annuum* var. Glabriusculum) from Tabasco and northern Chiapas, Mexico according to the two main components.

In general, it was observed that the variation explained in the chilli Amashito due to its morphological characteristics of the plant and fruit of the northern regions of Chiapas and the plain of the state of Tabasco are distributed in distant groups, indicating diversity based on the region where they are distributed, given that each region is physically separated and distant with different physiographic characteristics and conditions in altitude, soil and vegetation, so the Tabasco region is on a plain and that of northern Chiapas in the hills and mountains.

In this regard, Hernández-Verdugo *et al*. (2012) found a positive correlation between morphological variation and climatic factors (temperature and water) at the sites of origin of the studied populations of *C. annuum* var. Glabriusculum. Furthermore, they point out that the populations of wild *C. annuum* in northwestern Mexico have high variation in their morphological characteristics measured within and between them, indicating that this species is a valuable genetic resource that must be studied to improve its use and conservation.

Group 3 (G3) consisted of 19 populations that were distributed in the first and second quadrant (Figure 2), formed by germplasm that comes from both studied regions and that are located in neighboring communities (communities of the municipalities of Tacotalpa, Huimanguillo and Cardenas de Tabasco and by Ostuacan, Malpaso and Pichucalco of northern Chiapas), so the flow of commercial activities among the inhabitants of these communities, as well as birds, among others, favors the flow of biological material, which it leads to these populations showing a certain relationship. Group 4 (G4), located in the third and fourth quadrant, was formed by 21 populations of communities from the municipalities of Cunduacan, Jalpa and Nacajuca, in the state of Tabasco, with altitudes less than 10 m.

Population 56 formed a single group (G5), this population was collected in the La Granja Belen ranch in the municipality of Macuspana, Tabasco, it has distinctive characteristics of average plant heights of 1.4 m, leaves with averages of 5 cm in length and 4 cm wide, medium fruit size (1.5 cm long and 0.8 cm in diameter) and fruit color at maturity light red. On the other hand, in the Topotzingo community, Nacajuca municipality, Tabasco, the 49th population that formed the G6 group was collected.

Based on the criteria of group formation (Núñez-Colín and Escobedo-López, 2011), the analysis of conglomerates at a Euclidean distance of 4, was complemented by what was observed in the analysis of principal components, due to the similarity in the way each analysis grouped the evaluated populations. Figure 3 shows that a large group (G1) was formed that included the Chiapas and Tabasco germplasm (differentiated into four well-integrated subgroups: S1G1, S2G1, S3G1 and S4G1) and populations 49 and 56 that each individual groups formed.

Subgroup 1 (SG1) was made up of eight populations from the Tabasco region and they are distinguished by having almost round small fruits that grow mainly on cocoa and milpa farms. SG2 made up of 29 populations that are distributed in neighboring communities between the Chiapas and Tabasco regions were found in ecosystems of cacao and acahual estates. These populations are distinguished by presenting small and mainly round fruits. In S3G1, 20 populations with distinctive characteristics of larger and elongated fruits were grouped, as well as plants of greater height, which were found in the mountainous area of northern Chiapas (560 to 800 masl).

S4G1 was made up of 18 populations from the lower Tabasco zone (less than 10 masl). Furthermore, within group 1, there were 6 independent populations (32, 13, 46, 79, 10 and 1) that did not form a defined subgroup, most of them from the state of Tabasco. Populations 56 and 49 that were collected in Tabasco defined groups 2 and 3, respectively.

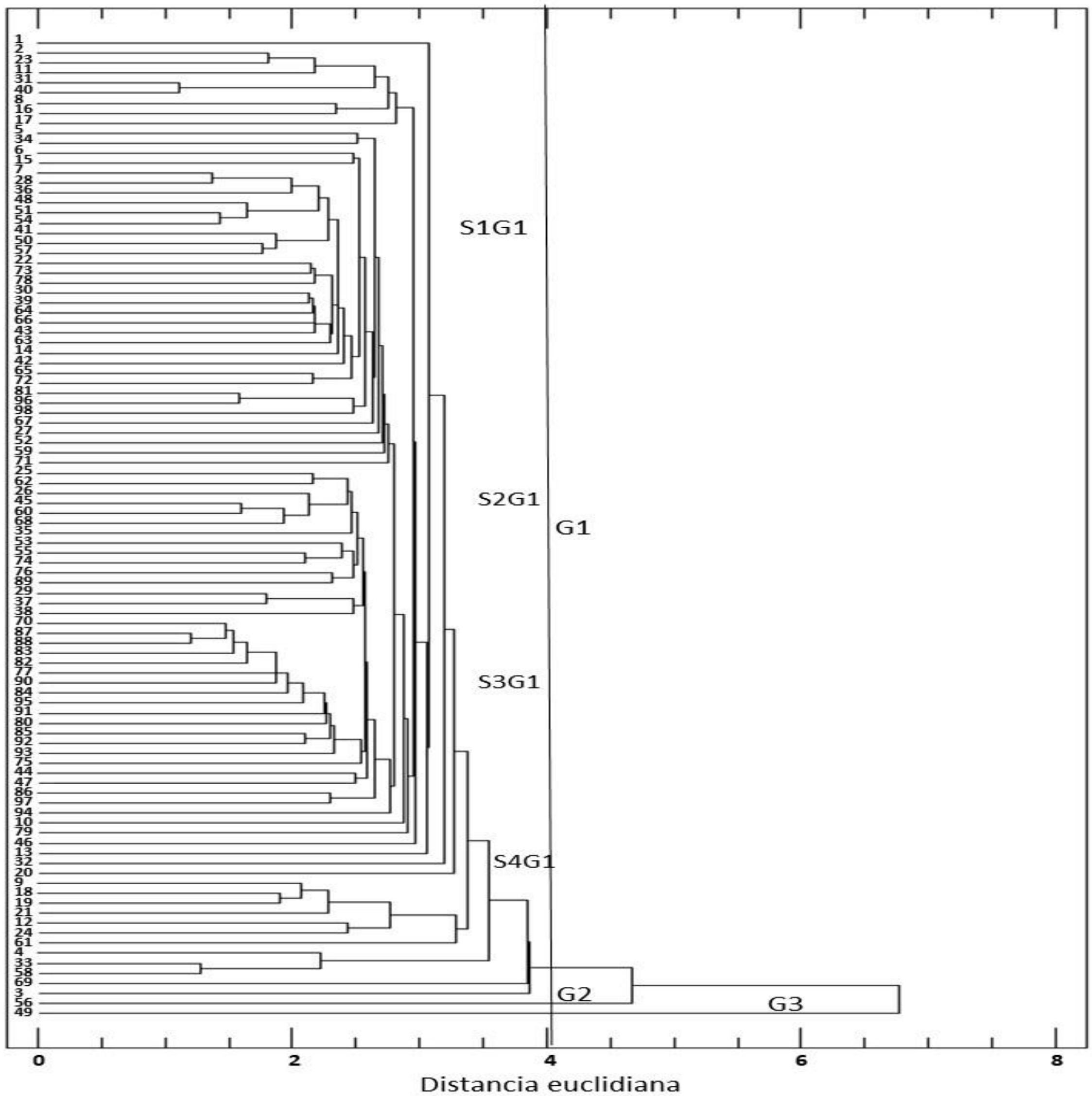

Figure 3. Dendrogram of 98 populations of chilli Amashito (*C. annuum* var. Glabriusculum) collected in the state of Tabasco and northern Chiapas.

In general, the classification of diversity at the level of morphotypes handled by collectors in the study sites of the chilli Amashito, did not coincide with the way in which the variation in the phenotypic diversity study was grouped. This is explained by the fact that the gatherers name the variants based on distinctive characteristics of personal appreciation, mainly of the fruit, such as the shape of the anthocyanin stains of the fruit, for example: crab eye, the shape of the fruit with a pointed finish, for example: colmillo de lagarto, shape of the base of the fruit, for example: muela, shape of the fruit almost round, for example, Amashito bolita, among others; which does not correspond to the descriptors for *Capsicum* (IPGRI, AVRDC and CATIE, 1995).

Conclusions

The collectors identify nine morphological variants (morphotypes) of wild chili Amashito that they name based on particular characteristics of the color, pigmentation, shape and size of the fruit. The most common morphotypes are Amashito verde, blanco and ojito de cangrejo. The chilli Amashito is most frequently found in ecosystems of cacao, acahual, banana and milpa farms. The first three main components explained 50.2% of the phenotypic variation observed in the 98 collected populations. The populations of wild chilli Amashito were differentiated, distributed and grouped according to the geographical characteristics of the study regions, where the populations of the northern region of Chiapas were characterized by presenting elongated and larger fruits compared to those from which they come of the Tabasco plains. It was also found that in the neighboring areas where the two study regions converge, a group of populations that shared morphological similarities was distinguished.

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