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Current status and socioeconomic importance of *capulín* (*Prunus serotina* Ehrh) in the Sierra Nevada of Puebla, Mexico

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ABSTRACT

Objective: To determine the distribution, survival conditions, and socioeconomic and environmental importance of black cherry or *capulín* populations in the Sierra Nevada of Puebla, Mexico.

Methodology: Ethnographic and qualitative methods were used to estimate and describe *capulín* populations in transects, backyards, and orchards. Twenty-six informal interviews were conducted across 10 circuits covering 32 sites in the Sierra Nevada region.

Results: In three circuits, more than 3,600 trees were found to be well-managed. In the remaining circuits, there were between 16 and 74 neglected adult specimens.

Study limitations/implications: The cultivators' assessments of *capulín* populations differ from technical methods.

Findings/Conclusions: *capulín* populations are concentrated in three circuits where they hold notable socioeconomic and environmental importance.

Keywords: Ethnography, Populations, Traditional wisdom, Usage.

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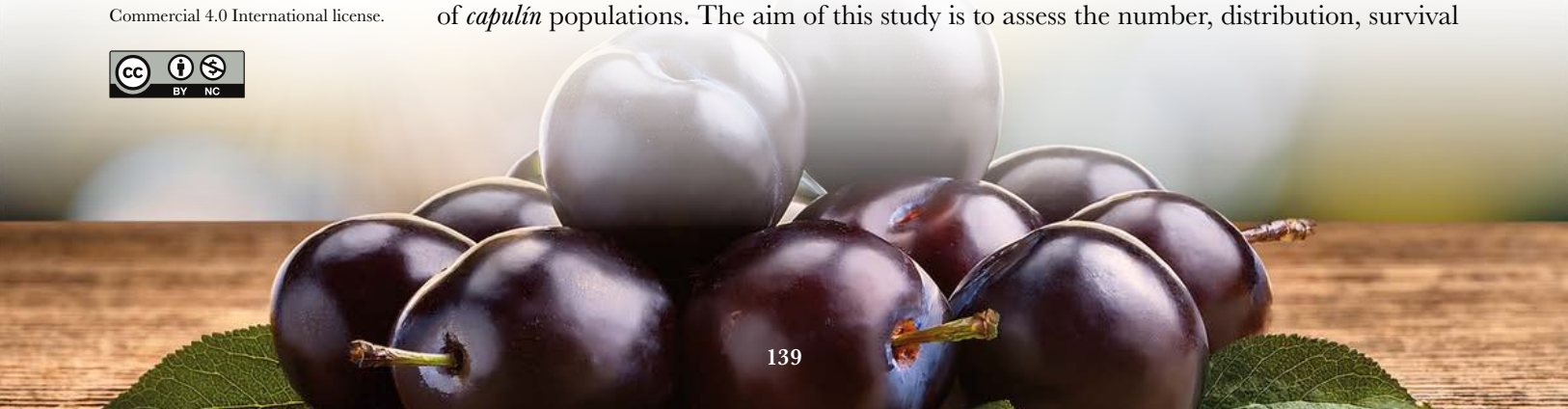
INTRODUCTION

The black cherry or *capulín* (*Prunus serotina* Ehrh) is a tree species native to North America (Guzmán *et al*., 2020). In some regions of the Americas, it has been domesticated (Vázquez-Yanes *et al*., 1999; Avendaño-Gómez *et al*., 2015). In Mexico, *capulín* populations are found at elevations between 2,000 and 2,400 masl. In the state of Puebla, *capulín* trees are present in the Sierra Nevada, the Central Valleys, and the Sierra Norte. Similar to other regions, *capulín* is used by indigenous groups and cultivators for various purposes (SADER, 2017). Studies examining the distribution, environmental conditions, and socioeconomic significance of *capulín* in rural contexts are scarce and outdated. Gutiérrez (1993) researched grafting methods as part of the agronomic management of this species in the Tarascan Plateau in Michoacán. More recently, Guzmán et al. (2020) discussed the forestry potential of *capulín* populations. The aim of this study is to assess the number, distribution, survival



conditions, and socioeconomic and environmental importance of *capulín* trees in the Sierra Nevada of Puebla. The findings will contribute to update knowledge and, as suggested by Páez *et al.* (2013), support its promotion as a factor in rural development.

MATERIALS AND METHODS

This research was based on situated knowledge and therefore took into account local expertise (Cruz *et al.*, 2012). We used ethnographic tools, including direct observation, qualitative techniques, and 26 informal interviews. Tree counts were conducted in 10 transects within 10 circuits, as per Mostacedo and Fredericksen (2000), along roads and highways that connect the 32 study sites in the Sierra Nevada of Puebla.

In each circuit, transects were defined along routes between two or more sites where *capulín* trees were known to be present. Each transect was approximately 3 km in length. For tree recording, we followed the ethnobotanical method proposed by Kvist *et al.* (2001), using a manual counter (M42).

Counts were conducted on both sides of the roads and highways, where the transects were located. Furthermore in backyards (spaces surrounding houses and housing units) and orchards (plots made up of a diversity of agricultural species where the *capulín* stands out). In addition to recording the number of *capulín* trees through direct observation, their physical and sanitary conditions were documented. Informal interviews were conducted with 20 men and six women across eight of the 10 circuits; 24 of these individuals were *capulín* tree owners, and two were traders.

RESULTS AND DISCUSSION

Capulín trees in the study region were primarily found along roadsides and land boundaries, followed by polyculture backyards and orchards (see Table 1).

Interviews estimated a total of 4,288 *capulín* trees, while transects revealed a count of 2,891 young (aged one to five years) and adult (over five years) trees. The majority of these trees were located in Circuit 2 (Huejotzingo-Domingo Arenas), particularly in the municipality of Domingo Arenas, which alone accounted for 2,600 trees. The next highest counts were observed in Circuit 5 (Huejotzingo-Atexcac-Buenavista) with 79 trees, and Circuit 3 (Huejotzingo-San Miguel Tianguizolco-Nepopoalco) with 45 trees.

The circuits with the lowest *capulín* populations were the following: Circuit 10 (San Nicolás de los Ranchos-San Pedro Yancuitlalpan-Teotón) had 34 trees; Circuit 4 (Huejotzingo-San Mateo Capultitlán-San Luis Coyotzingo-Xalmimilulco) had 29; Circuit

Table 1. *Capulín* populations in the Sierra Nevada of Puebla, Mexico

Number of observation units	Description of the site	Number of trees	
		Direct count	Peasant perception
10	Both site of the transect	2544	3936
5	Backyard	27	32
1	Orchard/ha	320	320
Total		2,891	4288

8 (Tochimilco-Tochimizolco-La Magdalena Yancuitlalpan) had 27; Circuits 7 (Atlixco-Axocopan-San Pedro Benito Juárez) and 9 (Calpan-Atzala-San Mateo Ozolco) had 21 trees each; Circuit 6 (Atlixco-Metepec-Tianguismanalco-San Pedro Atlixco-Atlimeyaya) had 19; and Circuit 1 (Cuautlancingo-Cholula-Juan C. Bonilla-Huejotzingo) had 16 trees.

The discrepancies between the estimates of *capulín* populations from direct counts and interviews suggest differing perspectives and methods of understanding the environment between cultivators and technicians (Gerritsen *et al*., 2003). To address this, Rangel-Ch. and Velázquez (1997), Mostacedo and Fredericksen (2000), and Kvist *et al*. (2001) propose methodologies that could improve these approaches.

General appearance of *capulín* populations

Ethnographic observations and informal interviews indicate that *capulín* tree populations exist in three distinct conditions: a) neglect and loss, b) maintenance, and c) appreciation (see Table 2).

Neglect. This condition refers to the absence of tree management or care, which includes practices such as pruning, fertilization, sanitary control, grafting, and other techniques. It suggests that the *capulín* populations are seen as having little value by their owners.

Maintenance. In this condition, the *capulín* trees appear to be in good health despite not receiving any specific attention. Although these trees may begin to be regarded as objects of management, this management is not systematic.

Appreciation. Trees in this condition receive focused attention aimed at improving yields, fruit quality, and overall income. This can be achieved through traditional methods or newly introduced management systems.

Circuits where conditions of neglect and loss were recorded include 1, 3, 4, 6, 7, and 8. Maintained *capulín* trees were observed in circuits 9 and 10, although some interviews revealed that these populations have diminished due to neglect.

In circuits 2 and 5, *capulín* management practices are implemented within polyculture orchards that engage in agroecological innovation and are clearly integrated into local markets. Here, the maintenance of *capulín* trees is part of their revaluation as significant socioeconomic and environmental resources.

In areas with severe neglect, many aging trees were found, along with partial or total felling, serious burn damage, significant parasitism from mistletoe, leaf damage caused by red spider mites, and trees that were partially or completely dead. Additionally, the fruits

Table 2. General appearance of capulín populations.

Circuit	Conditions of the capulín populations
1, 3, 4, 6, 7, 8	In abandonment and loss: trees in small proportion, scattered unattended, high risk of disappearing due to urban advance.
9 y 10	In maintenance and reduction: widely dispersed trees, arranged on roadsides and adges of plots.
2 y 5	In assessment: greater presence of trees in: a) orchards interspersed with annual crops, b) fences and roadsides, c) dispersed in agricultural, forestry and ravine areas.

exhibited severe damage from fruit flies (possibly *Anastrepha ludens* Low). These issues were also observed in transects 9 and 10, though with less severity.

In circuits where *capulín* populations are maintained or show slight increases, the value placed on these trees is evident. Here, despite certain challenges, selection practices are employed on specific types of *capulín* trees propagated through grafting, leading to the categorization of these trees as "grafted" *capulín* trees. These grafted trees differ significantly from "non-grafted" trees in various characteristics, including fruit size, color, consistency, pulp and cuticle thickness, seed size, flavor, and the timing of flowering and ripening. The condition of these trees reflects a wealth of traditional knowledge that is fortunately being preserved.

Socioeconomic and environmental importance of *capulín*

The socioeconomic and environmental importance of *capulín* trees was determined based on their various purposes, uses, and management practices, such as serving as a food source, providing economic income, contributing to cultural identity, and offering environmental services.

As a resource that supports the social reproduction strategies of domestic cultivator groups in the Sierra Nevada of Puebla, a loss or decrease in the numbers of *capulín* trees indicates a greater risk of biocultural fragility.

Interviews reveal that the importance of *capulín* trees can be categorized as: a) "none," b) "little," or c) "high" in the various circuits studied. This indicates a differentiated significance of these trees among the local population. The diverse levels of importance help distinguish at least two groups of circuits based on the size of *capulín* populations, the degree of management, consumption intensity, commercialization, and appraisal of environmental services.

We observed that the socioeconomic and environmental importance of *capulín* trees in the first group (A) is lower than in the second group (B). The towns of Huejotzingo, Nepopoalco, San Nicolás de los Ranchos, Xalmimilulco, San Pedro Benito Juárez, and La Magdalena Yancuitlalpan, located in circuits 1, 4, 6, 7, 8, 9, and 10, belong to group A. The communities of Domingo Arenas, Buena Vista, and Calpan, situated in circuits 2, 3, and 5, belong to group B (see Table 3).

In group A, *capulín* populations largely survive in the wild or with minimal care. The trees are small, scattered, and exhibit physical signs of neglect, such as infestations from mistletoe and fruit flies, which significantly reduce fruit quality. Nevertheless, the fruits are harvested mainly for fresh consumption by local groups known as "*capulineros*."

In contrast, group B has the highest number of polyculture orchards with clearly defined management processes that include pruning, grafting of outstanding local varieties, organic and conventional fertilization, and phytosanitary control (such as trapping and pesticide application). Notably, in the communities of Domingo Arenas, Buena Vista, and Calpan, *capulín* populations show a slight increase. This is largely due to the efforts of local leaders, organizations, and governments, alongside the promotion of strategies such as local fairs and agroecological innovation processes to enhance production and improve fruit and seed quality.

Table 3. Economic and environmental importance of *capulín*.

Community	Number of interviews	Socioeconomic and environmental importance (%)		
		Null	lttle	A lot
Huejotzingo	4		80	20
Nepopoalco	4		80	20
Domingo Arenas	2			100
Buena Vista	2			100
Calpan	4			100
San Nicolás de los Ranchos	2	10	80	10
Xalmimilulco	2	30	70	
San Pedro Benito Juárez	2	30	70	
La Magdalena Yancuitlalpan	2	40	60	
Weighted average		9.2	50	40.8

Fruits are harvested from April to June. In group B, the most notable yields range from 15 to 45 "buckets" per tree (equivalent to 255 to 765 kg/ha), with prices fluctuating between $250.00 at the beginning of the season and $400.00 at the end. These figures translate to an income ranging from $3,750.00 to $6,000.00 based on minimum production, or up to $18,000.00 at maximum production.

A press release indicates that Domingo Arenas is one of the municipalities in the Sierra Nevada of Puebla that produces around 600 tons of *capulín* fruits annually, which are intended for domestic consumption, the local market, and other regions within Puebla and Mexico. Approximately 1,200 families benefit from this activity (Corona, 2019).

In the circuits of Group B, *capulín* represents both a material and immaterial heritage, visibly exhibiting transgenerational cultural elements. It serves as a temporary source of significant economic contributions to the social reproduction strategies of farming communities at both domestic and communal levels.

CONCLUSIONS

The populations of *capulín* trees are primarily found in the circuits that comprise Group B, which includes Domingo Arenas, Buena Vista, and Calpan. In contrast, *capulín* populations are less dense and more dispersed in the other circuits. According to the interviewees, there has been a significant decline in *capulín* populations overall.

The socioeconomic and environmental significance of the *capulín* varies between the circuit groups. In Group B, the importance of the *capulín* is clear, whereas in Group A, it diminishes. This difference aligns with the number of trees, their management and care, and the conditions under which these populations are maintained. Additionally, the variety of uses for *capulín*, including food, medicine, and its role as a commodity in the value chain, is noteworthy. However, the environmental importance of *capulín* is less recognized by the interviewees. They tend to overlook its benefits as a source of food for wildlife, wood, firewood, shade, and as a windbreak barrier, among other uses.

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