Colegio de Postgraduados

Characterization of production and commercialization systems of camedor palm (*Chamaedorea elegans* Mart.)

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ABSTRACT

Objective: To describe the cultivation systems of *C. elegans* through the analysis of production and commercialization in three municipalities in the high mountain region of Veracruz, Mexico.

Design/Methodology/Approach: The study was conducted in Tepatlaxco, Zongolica, and Omealca, Veracruz, Mexico. From January to July 2022, a survey was administered to 84 producers of Camedor palm using convenience sampling. In addition, interviews with key informants and participant observation were conducted.

Results: Camedor palm production occurs in small production units ranging from 1±0.05 to 7.0 hectares, primarily managed by male producers (93%) with an average age of 48 years and 6 years of schooling. Planting densities range from 35,000 to 100,000 plants per hectare, and leaf cutting is conducted on a quarterly basis, yielding between 1000 to 3700 rolls per hectare at an average price of $14.00 Mexican pesos per roll paid to the producer. Prior to cultivating Camedor palm, 56% of producers were growing coffee. The main driving factor for cultivation is the steady generation of income.

Limitations/Implications: This is a specific case study; therefore, the results are limited to descriptive statements about the study area.

Findings/Conclusions: Producers utilize non-timber forest products as alternatives to crises in other crops and investment constraints within production units. The production of *C. elegans* is accessible, requires low investment, and is compatible with family farming. However, yields in some cases are low, and the marketing network shows high intermediation.

Keywords: Foliages, livelihoods, Chamaedorea.

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INTRODUCTION

Non-timber forest products (NTFPs) are biological goods derived from forests that are tangible objects distinct from wood (FAO, 2020). They are widely used by rural communities as a means of livelihood (Awono *et al.*, 2016), and their cultivation or collection has low ecological impact (Téllez-Velazco, 2017), making them promoted as an option for rural development (Belcher *et al.*, 2005) and conservation (Huynh *et al.*, 2016). The growing use of NTFPs has globally driven research (Timko *et al.*, 2010), the development of public policies (Bárcena, 2018), and standards for their commercialization (UNEP-CITES, 2021). In

Mexico, in 2017, 256 permits were issued for the use of NTFPs (covering 380,000 hectares), mainly in the states of San Luis Potosí, Zacatecas, and Veracruz, which concentrated 86% of the production totaling 562,000 tons. Of these, 477,700 tons consisted of leaves, with the remainder being stems, inflorescences, roots, and fibers, primarily cultivated in *ejidos* (communal land) and communities (SEMARNAT, 2019).

In 2022, the export value of Mexican NTFPs reached nearly 25 million US dollars, marking a 48% increase compared to 2020. The primary destinations included the United States of America, Netherlands, Canada, and Japan (Banxico, 2022), where foliage has shown growing demand (AIPH, 2019). *C. elegans* is particularly valued for its attractive foliage (Castillejos-Musálem, 2014) and its role in generating employment and economic resources in the communities where it is harvested (Blancas Vázquez *et al.*, 2017).

In the state of Veracruz, some reports highlight the importance of the species *C. elegans*, leading to studies focused on diversifying agroforestry systems with palms (Meneses *et al.*, 2012) and canopy cover (Lascurain-Rangel *et al.*, 2019). However, there is limited information regarding the dynamics of change in cultivation patterns, production, and commercialization processes in these plantations. Therefore, this study aimed to characterize the production of *C. elegans* in three municipalities of Veracruz, Mexico, through analyzing the dynamics of production and commercialization systems.

MATERIALS AND METHODS

The study was conducted in the high mountain region of Veracruz, Mexico, specifically in the municipalities of Tepatlaxco, Zongolica, and Omealca. These municipalities were selected due to their significance in the production of *C. elegans* and their shared natural, social, and economic characteristics.

From January to July 2022, a survey was administered to n=84 producers of camedor palm. Convenience sampling was employed, and the survey covered: characteristics of the producers, production unit details, production aspects, and commercialization practices. Data collection was conducted using the KoboToolbox platform (https://www.kobotoolbox.org/). In addition to the survey, techniques such as interviews with key informants (Hay, 2016) and participant observation (Flowerdew & Martin, 2005) were utilized. Interviews and participant observation data were analyzed using ATLAS.ti software to construct the marketing network. Land use change trends were analyzed using conditional probability methods (Borovcnik, 2012).

RESULTS AND DISCUSSION

Production unit characterization

Camedor palm production takes place in remote areas with limited access to services. Producers have an average age of 48 years, and the majority are men (93%). The average educational level is 6 years, with 14% having not completed basic education (Table 1). Similar characteristics are reported by the Agricultural Census of Mexico (INEGI, 2022), which indicates that the agricultural sector is predominantly male and has an average educational attainment at the primary level.

Table 1. Characteristics of the producers and production unit.

Socio-economic factor	Median value	Low level	High level	Std. Deviation	Confidence interval (0.05)	%
Age	48	17	79	16.6	3.56	
Level of formal education	6	0	16	3.7	0.89	
Plot size (ha)	1	0.05	7	0.9	0.19	
Altitude (masl)	1272	801	1530	249	78.14	
Land property (communal)						13
Land property (private)						87

* Original work based on 2022 survey data.

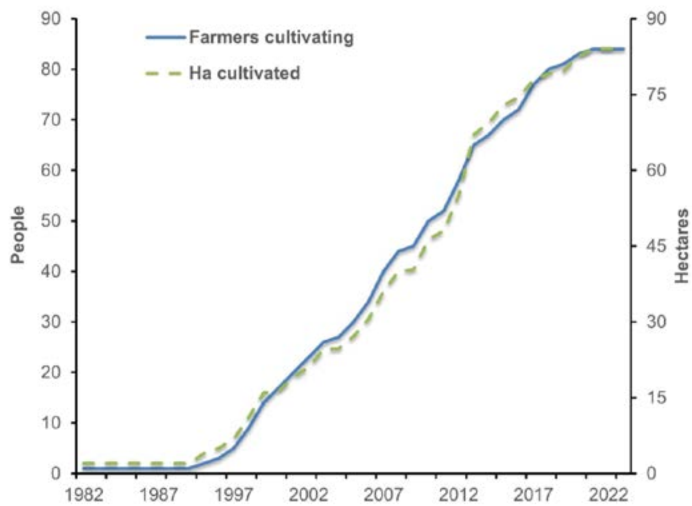

Figure 1. Evolution of producers and cultivated area of *C. elegans*. Survey 2022.

The cultivation is recent, with an average experience of ∼12 years, a maximum of 40 years, and a minimum of three years (Figure 1).

The average plantation size is one hectare, which aligns with the findings of Sánchez (2007), who found that in the municipality of Pajápan, Veracruz, 90% of *C. elegans* producers have less than one hectare. The *C. elegans* crops in the study region are distributed between 800 and 1600 meters above sea level, under the canopy of lowland evergreen forests and cloud forests, with slopes exceeding 30%. These conditions match those described by Perez & Geissert (2008). Planting density in the study area varies depending on the slope and the history of land use. In Tepatlaxco, densities of more than 100,000 plants per hectare were found, while in Zongolica and Omealca, the average is ∼30,000 plants per hectare (Figure 2). These differences impact crop management, income, and ecosystem effects. The densities in Tepatlaxco exceed INIFAP's recommendations by 40% (Cervantes, 1999).

Land Use Change Dynamics to NTFPs

Foliage cultivation began as an alternative to generate income but has gradually become the primary crop. According to survey data, 56% of producers indicated that

Figure 2. Plantations of *C. elegans* A) Without planting framework and low density in Zongolica; B) With planting framework and high density in Tepatlaxco. J. Orlando Ávila Castro (2022).

the space currently used for foliage cultivation was previously occupied by coffee crops, 26% by forest, 5% by secondary vegetation, and the remaining 13% by maize and banana. This land use change process was also reported by Granados (2004) in producing communities in the municipality of Cuichapa, Veracruz. The land use change process indicates that *C. elegans* cultivation will continue to expand at the expense of coffee cultivation (Figure 3).

In the region, foliage crops are associated with unfavorable soil conditions, steep slopes (>30%), and a high percentage of rocky areas, which hinder the development of other crops. Additionally, respondents mentioned that the cultivation of *C. elegans* is driven by various factors, including continuous economic income, low labor demand, and low investment requirements (Figure 4). Authors such as Sánchez (2007) mention that cultivation is encouraged by the lack of productive options, low coffee prices, consistent income, public incentives, and ease of trade. These factors make it a viable option for the livelihoods of communities, consistent with the findings of Aguirre-Cadena *et al.* (2016).

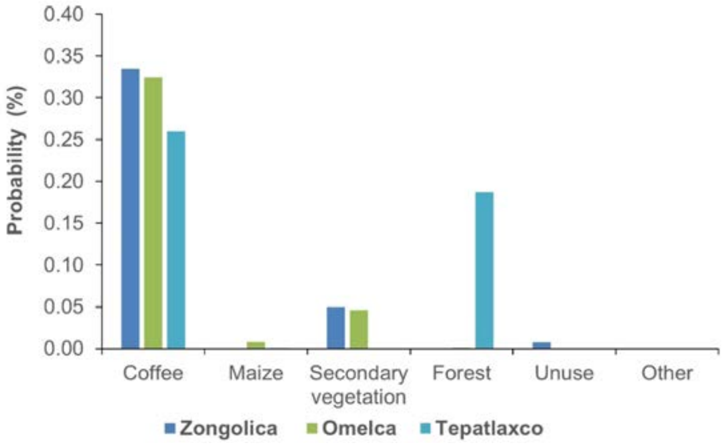

Figure 3. Conditional probability, land use change to *C. elegans*. Survey 2022.

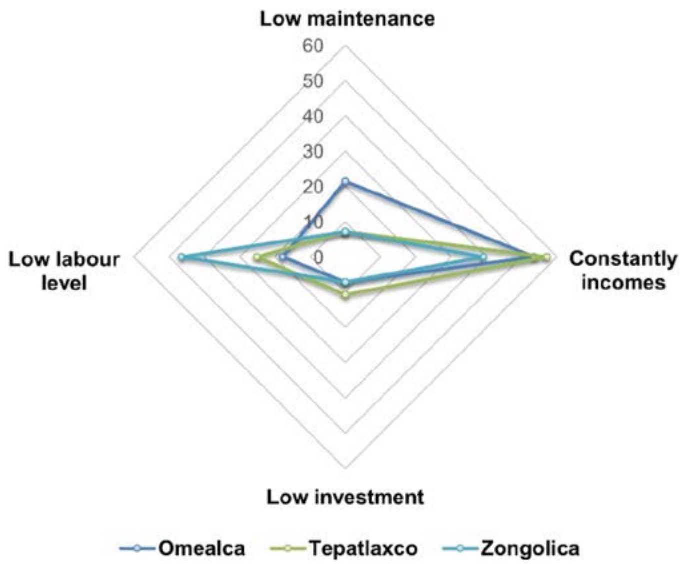

Figure 4. Factors favoring the cultivation of *C. elegans*, in percentages. Survey 2022.

In remote rural areas, NTFPs are cultivated or collected on small plots of marginal land with steep slopes (>30%), where other activities are not profitable.

Productivity of *C. elegans* systems

Leaf cutting is conducted quarterly in 75% of cases. Plantations smaller than one hectare yield an average of 1000 rolls (each rolls contains ~40 leaves) per hectare, whereas plantations larger than two hectares exceed 3700 rolls per hectare. Leaves are harvested using various techniques and tools, such as natural fiber threads and knives (Figure 5-A). For sales, producers use different units of measurement agreed upon with intermediaries.

The palm is regularly sold in rolls containing ~40 leaves each, at an average price of MX $14.00 per rolls (Figure 6-B), which are organized into bunches of 60 rolls (Figure 5-D).

Commercialization

The commercialization network is characterized by a high degree of intermediation (Figure 6). The distribution channel consists of producers, intermediaries, retailers, and consumers, operating within an informal system where each actor operates independently. The latter complicates communication and increases the complexity of commercial relationships. Similar systems are observed across the country among palm producers (CONABIO, 2003). These production systems, like other agricultural products, feature long distribution channels under an informal buying and selling system, where producers receive a minimal proportion of the product's value. This situation is exacerbated by the unregulated status of these productive activities (D. Sánchez & Valtierra, 2003; Scudder *et al.*, 2019).

Figure 5. A: Cutting process, B: Bunch preparation, C: Bundles, D: Packaging (right side). By J. Orlando Ávila Castro (2022).

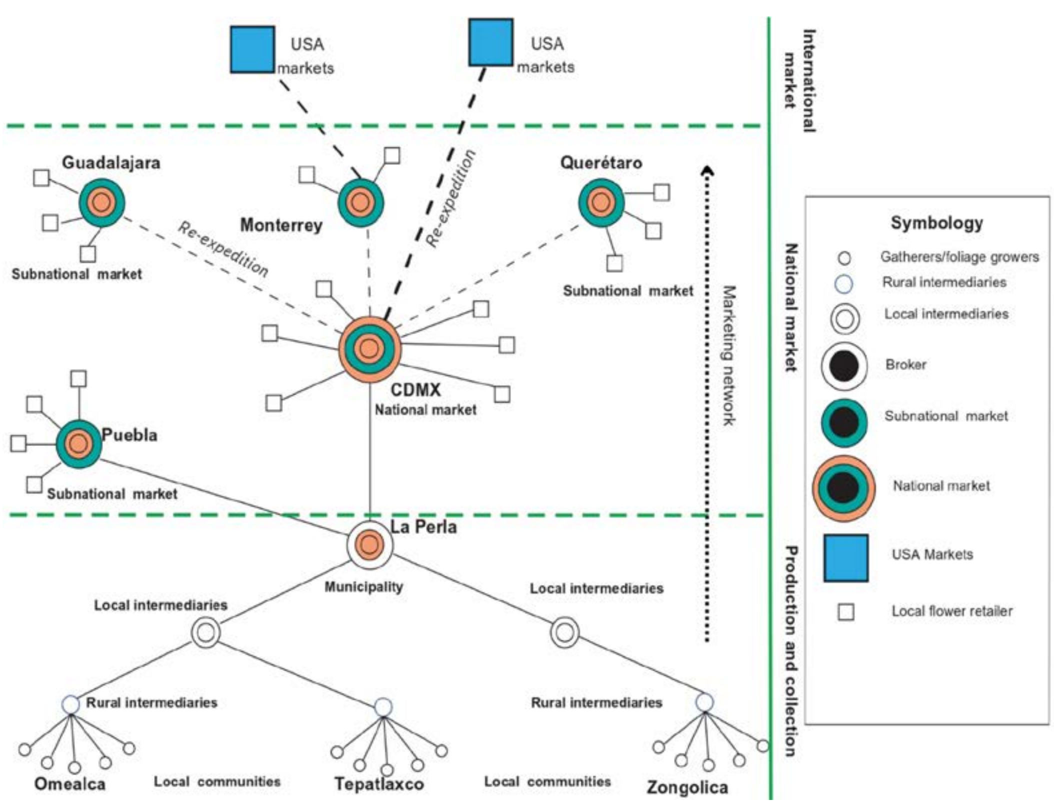

Figure 6. Commercialization network. Data from key informants (2022).

CONCLUSIONS

Small-scale producers in the high mountain regions of Veracruz cultivate NTFPs because they represent one of the few sources of income in these areas. Activities related to *C. elegans* are accessible and require low investment. They are compatible with small-scale agriculture and traditional gender roles, where men perform production activities and women participate in harvesting. Although yields are low in some locations in Zongolica, their importance lies in income generation and reducing income risks from other crops. NTFPs are also crucial for food security, climate change adaptation, and replacing declining crops such as coffee. The socioeconomic contributions of NTFPs in the study communities are affected by factors like intermediation in commercialization.

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