Description of the Jipijapa palm (*Carludovica palmata* Ruiz & Pavón) agroecosystem in Santa Cruz Ex Hacienda, Calkiní, Campeche

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ABSTRACT

Objective: To describe the socioenvironmental and cultural components of the Jipijapa palm (*Carludovica palmata* Ruiz & Pavón) agroecosystem in the community of Santa Cruz Ex Hacienda, Calkiní, Campeche.

Design/methodology/approach: The sample included 10% of the farmers and artisans of Jipijapa palm (*Carludovica palmata*), selected after observing these plants in their backyards and through voluntary participation. A semi-structured questionnaire with 82 questions organized into five sections was designed and applied by means of interviews with 20 inhabitants of the community. The information obtained was analyzed through descriptive statistics using the Excel Microsoft Software.

Results: Of the interview respondents, 35% are men and 65% women, all originally from the locality and Maya speakers. The average age is 47 years, with the farmers being older than the artisans; 85% of the economic activities are developed locally, and the production of fine hats stands out. *Carludovica palmata* is the main species cultivated, but climate change, pests like moles, and the unsustainable use of shoots and leaves from the plant are affecting the crops and placing their production at risk. Results suggest that mothers are the ones that transmit knowledge about production and the skill. However, 63% of the community is not interested in continuing with these activities largely because of a tendency towards migration in the search for better opportunities.

Limitations on study/implications: The study presents limitations due to the reduced size of the sample (10% of the population), and the selection of participants based exclusively on current producers of Jipijapa plants.

Findings/conclusions: The community faces significant challenges, among them low schooling, youth migration, scarcity of raw materials due to climate change and pests, as well as dependency on intermediaries to sell their products. Although sustainable agricultural practices are implemented, it is fundamental to innovate in the productive management of the palm, to optimize agricultural techniques, and to strengthen commercial channels to guarantee the viability of production and the preservation of local productive traditions.

Keywords: Farmers, sustainability, productive systems.

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INTRODUCTION

In southeast Mexico, four species of the *Carludovica* genus have been identified, which belong to the family Cyclanthaceae: *C. chiapensis* Matuda, *C. tabascana* Matuda,

C. druidei and *C. palmata* (Haas *et al*., 2016). From these, *C. palmata* Ruiz & Pav. is known as Jipijapa and is native to Center and South America (Bennett *et al*.,1992; Muñoz and Tuberquia, 1999). Its morphology is composed of five main structures: petioles, adult leaves, shoots (young leaves), infructescence, and rhizomes, each with specific functions and different levels of exploitation (Haas *et al*., 2016; Suárez-Yagual, 2018). Its capacity for adaptation to different edaphoclimatic conditions influences the quality of the fiber, making it a key source of raw materials and economic income for farmers and artisans (Cetzal-Ix *et al*., 2018).

Historically, in Santa Cruz Ex Hacienda, Calkiní, Campeche, there was a plantation of approximately nine hectares where fruit trees were cultivated, as well as black-eyed peas (*Vigna unguiculata*), corn (*Zea mays*), squash (*Cucurbita*), henequen (*Agave fourcroydes*), and Jipijapa palm (*Carludovica palmata*), whose products were traded in nearby communities (Pinto de Estrada,1975). Throughout the years, in addition to trading raw materials, the community began to transform Jipijapa into handicrafts, with the production of hats standing out (Medina-Vidal, 2018). However, faced with the lack of fiber, farmers opted for transplanting Jipijapa rhizomes to their backyards, establishing agroforestry agroecosystems (Muñóz-Sánchez *et al*., 2021) of approximately two hectares (Perera-Hau *et al*., 2025), which integrate agriculture with artisanal production (Gutiérrez-Cedillo *et al*., 2008; Fernández and Bahena, 2012). However, asexual reproduction through rhizomes can lead to a homogeneous genetic structure, which could cause the loss of genetic variability, and consequently increases the vulnerability of this crop. In this context, it is essential to describe the Jipijapa agroecosystem in the community of Santa Cruz Ex Hacienda, to identify the problems associated with the sustainability of the species, the management of natural resources, and the preservation of artisanal practices.

MATERIALS AND METHODS

The study was conducted in the period of September to December 2024, in the community of Santa Cruz Ex Hacienda, Calkiní, Campeche, located on coordinates 90° 14' 25.869" W and 20° 23' 52.336" N and altitude of 3 masl, with average temperature of 28.1 °C and mean annual precipitation of 945 mm. The community has a total population of 1421 inhabitants, of which 703 are men and 718 women. The economically active population amounts to 510 people, of whom 322 are devoted to agricultural activities, including work with the Jipijapa palm (INEGI, 2020).

A methodology based on participatory action research was used for the study (Ander-Egg, 2003), actively integrating the members of the community (Zapata and Rondan, 2016), with the objective of fostering free participatory work. Of the total number of farmers and artisans in the locality, 10% were considered, selected systematically.

A semi-structured questionnaire made up of 82 open and closed questions was designed, organized into five sections: interview respondent's data, socioeconomic information, management of the crop and backyard, as well as cultural and environmental dimensions. The information collected was captured and organized in an Excel spreadsheet and analyzed using descriptive statistics.

RESULTS AND DISCUSSION

General information of farmers and artisans

In total, 20 people were interviewed, all originally from the community and Maya speakers; 35% were men and 65% women. The average age was 47.1 years (Figure 1), with a range between 26 and 77 years, which is comparable to the average age of Jipi artisans in Sucre and Bolívar, Colombia, which is 46 years (González-Vizcaya, 2021), and with that of agricultural corn producers in the state of Campeche, whose average age is 54 years (Uzcanga *et al.*, 2015).

The people who work with Jipijapa carry out two main activities: handcrafts and farming. In this sense, the artisans are in the range of 31 to 40 years old, while the farmers are between 61 and 80 years old. This age difference reflects the lack of generational replacement in farmers, attributed mostly to the indifference of young people, which places at risk both the continuity of the crop and the transmission of knowledge associated with its management. A similar situation is present in Barcelona and Ecuador, where only 9% of young people between the ages of 1 and 18 years participate in activities with the Jipi crop (Suárez-Yagual, 2018).

Regarding the time that they have been performing these activities, the farmers accumulate 33 years of experience, while artisans an average of 28.87 years. This result reveals that, initially, the inhabitants were devoted to the production of Jipi palm to obtain fiber, and then they made incursions into handcraft making. The community of Santa Cruz has been consolidated as the main producer of fiber in the northern region of the state of Campeche, and it is traded in the locality of Becal, Campeche (Medina-Vidal, 2018; Poot-Pool *et al.*, 2018).

When it comes to the time that they have been performing these activities, the study finds that both farmers and artisans accumulate broad experience, reflecting a sustained trajectory in the practice and transmission of knowledge related with the use of the Jipijapa palm. In this sense, one of the artisans described that the man who is his children's godfather was the first in the community to learn the art of weaving, thus becoming the first master in Santa Cruz Ex Hacienda. He taught all the men interested in learning, who

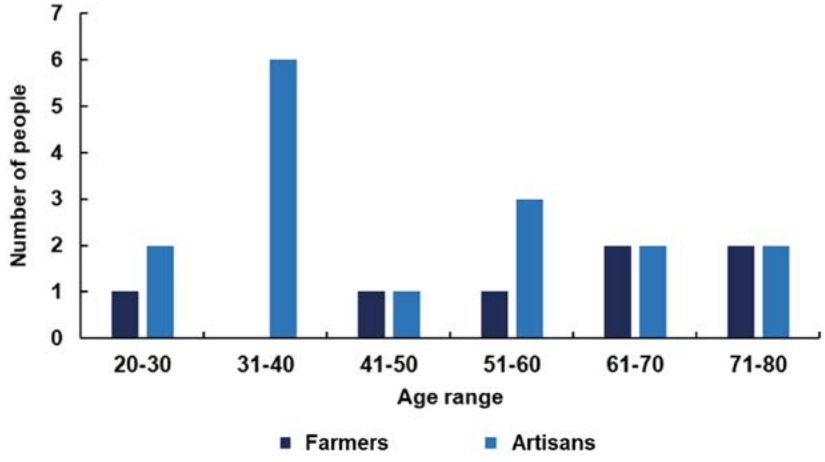

Figure 1. Ages of farmers and artisans from the community of Santa Cruz Ex Hacienda, Campeche, Mexico.

later transmitted the knowledge to their wives, and they in turn to their children, beginning the artisanal chain in the community. This type of transference of knowledge constitutes intangible heritage that strengthens collective identity and cultural continuity, similar to what happened in the community of Colosó and Huila, Colombia, where the networks of artisanal learning fulfill a central role in the preservation of ancestral knowledge (Pulecio and Cabrero, 2021).

The average level of schooling of interview respondents is 7.25 years; 25% do not have any studies, 20% finished primary school, 15% have not finished secondary education, 30% have studied high school, and 10% have finished higher education. This educational level is higher than what was reported for members of the cooperative "Loól Xa'án" with average schooling of 5.3 years (Fernández and Bahena, 2012).

Regarding the activities carried out by farmers and artisans, they were grouped into four main categories (P, A, AP and APR); 85% are carried out in the community and 15% are carried out in other municipalities in the state of Campeche and Yucatán; the latter include teachers, master bricklayers, and students. The category P includes those who are devoted solely to crop management, harvest and sale of green shoots to the artisans. Category A corresponds to people who elaborate handcrafts, acquiring raw material that is already processed or through a "handiwork" system, where the intermediary provides inputs and pays only for labor. The category AP groups those who are self-sufficient: they produce raw materials and elaborate their own handcrafts. Finally, category APR groups professionals who participate in artisanal activity as an additional source of income during vacation periods. The percentage of artisans and farmers with professional studies is reduced, and this is attributed to the fact that professionals tend to dissociate from family labor in favor of better paid jobs when they obtain a degree or migrate outside the community (Echeverría-Echeverria, 2018) (Figure 2). Likewise, when comparing with data reported by Fernández and Bahena (2012), a significant decrease in the number of farmers-artisans is observed, where 85% are classified as category AP, 8% as P, and 4% as producers-artisans-peasants.

Figure 2. Main activities in the Jipijapa agroecosystems. A) Farmers: cutting leaves and shoots, B) Farmer: reviewing the plantation, c) Artisan: selecting shoots, and D) Artisan: elaborating a hat.

Management of the Jipijapa agroecosystem

In relation to the selection of palm species within the agroecosystem, 45% of the producers indicated that they cultivate exclusively *C. palmata*, because of the preference of artisans for its quality of fiber and adaptability to the soil characteristics (Fadiman, 2001; Perera-Hau *et al*., 2025). On the other hand, 10% mentioned that they plant both *C. palmata* and *C. drudei*, while another 10% mentioned that they cultivate three species, *C. palmata*, *C. drudei* and *Sabal mexicana*. The latter, although it increases plant diversity in the community, is not used commercially to obtain fiber. Finally, 35% of the interview respondents pointed out that they do not have any plant species that provide fiber to make handcrafts, a situation that could be attributed to diverse conditions, such as a lack of available lands for the crop, ignorance about the crop management, or disinterest for this activity.

The study identified that the agroecosystem is established by the interaction of *Carludovica* spp. with another 31 plant species distributed in 23 families (Table 1). Results show that the most abundant family in the agroecosystem is Rutaceae, followed by Moraeae and Zapotaceae. From the species recorded in this study, Pinto de Estrada (1975) mentions that the Jícara tree (*Crescentia cujete*) was the most abundant plant in the agroecosystems, followed by mango, avocado, Coyol palm, nance.

Table 1. Plant species with interaction in the Jipijapa agroecosystem.

Family	Species	Uses and contribution to the agroecosystem
Annonaceae	*Annona muricata*	Food and shade for the crop
Moraceae	*Artocarpus heterophyllus*, *Brosimum alicastrum*	Food-Shade, Fodder for livestock and shade
Malpighiaceae	*Byrsonima crassifolia*	Food-sale, shade
Meliaceae	*Cedrella odorata*	Timber-shade
Rutaceae	*Citrus sinensis*, *C. aurantium*, *C. latifolia*, *C. aurantifolia*, *C. paradisi*, *C. reticulata*	Food-sale, shade
Arecaceae	*Cocos nucifera*, *Acrocomia aculeata*	Food-sale, shade
Boraginaceae	*Cordia angiocarpa*	Food and timber, shade
Bignoniaceae	*Crescentia cujete*	Tools, moisture retention
Anacardiaceae	*Mangifera indica*	Food-sale, shade
Sapindaceae	*Melicoccus bijugatus*	Food-sale, shade
Musaceae	*Musa paradisiaca*	Food-sale of leaves, moisture retention
Lauraceae	*Persea americana*	Food-sale, shade
Euphorbiaceae	*Phyllanthus acidus*	Food-moisture retention
Piperaceae	*Piper auritum*	Medicinal-moisture retention
Sapotaceae	*Pouteria sapota*, *Chrysophyllum cainito*	Food-sale, shade
Rosaceae	*Prunus domestica*	Food-sale, shade
Lythraceae	*Punica granatum*	Food-moisture retention
Poaceae (Bambusoideae)	*Rhipidocladum pittieri*	Timber-sale, moisture retention
Cactaceae	*Selenicereus undatus*	Food, without contribution to the crop
Fabaceae	*Tamarindus indica*	Food, shade
Combretaceae	*Terminalia catappa*	Without added value-shade for the crop

Regarding the interaction with domestic fauna, the presence of cattle (*Bos taurus*), pigs (*Sus scrofa domesticus*), hens (*Gallus gallus domesticus*), turkeys (*Meleagris gallopavo domestica*), and ducks (*Anas platyrhynchos domesticus*) was identified. Drops from these animals are used as manure in the crops, which contributes to the recycling of nutrients inside the agroecosystem. In addition, it is recognized that backyard birds fulfill an important function in biological control, since they feed on insects considered pests (Figure 3).

Regarding the necessary soil conditions for the growth and development of the crop, 65% of the interview respondents pointed out that the species prefers black soil lands; 5% indicated that it can adapt to different types of soil, while 10% considered that its development is most favorable in red soil lands. The remaining 10% manifested not knowing which are the optimal soil conditions. This information agrees with what was reported by Jiménez *et al.* (2023), who highlight the importance of the black soil lands for productivity and vitality of the Jipijapa plantations. From an agroecological perspective, black soil lands (boox lu'um) are characterized by their high content of organic matter, good aeriation, and excellent capacity for moisture retention, which provides favorable conditions for root development and nutrient absorption. These properties allow better stability in the availability of water during dry periods, and foster a more active soil microbiome, which can improve the resilience of the crop in face of environmental stressors. In this context, the preference for *C. palmata* in such soils responds not only to cultural and fiber quality factors, but also to a favorable interaction between the soil environment and the physiological demands of the plant.

Among the main problems identified, 52% of the interview respondents mentioned rotting of rhizomes and yellowing of leaves, while 13% reported the fall of petioles, and 35% manifested not knowing the causes that affect the crop. Leaf yellowing has been attributed to an unidentified fungus (Hass *et al.*, 2016), although its presence does not generate significant damage in the plantations. Another pest that negatively affects the crop is the mole (*Heterogeomys hispidus*), because they carve out tunnels in the soil and weaken the support for petioles, causing the plant to fall.

Figure 3. Animal species in the Jipijapa agroecosystem.

To minimize the loss of plants, interview respondents mentioned that it is fundamental to establish a daily irrigation regime of five hours, as well as performing periodical pruning. These two activities are considered essential for an optimal development of the crop (Suárez-Yagual, 2018). Regarding the pruning and management of plant waste, diverse variations were identified; however, most of the interview respondents agree in performing an evaluation of the state of the plants every six months. The residues from pruning are burnt and used as fertilizer, depositing the residues in high areas for them to be dragged towards the plantation through irrigation and to contribute to fertilizing the soil. Some producers decide to leave the plant residues directly around the plant, using them as mulch to conserve the soil moisture and reduce the evaporation.

Of the participants, 75% manifested that they do not use chemical products in their agroecosystems, favoring more sustainable agricultural practices, such as ecological agriculture. For their part, the remaining 25% indicated that they do use chemical products, highlighting that their use began less than two years ago, motivated by the participation in government programs from which they obtain these products.

Transference of knowledge

Regarding knowledge about the weaving techniques for handcrafts, 50% are from the mother, 30% from the father who fosters plant care, 5% is given by sisters, and in-laws (parents-in-law, brother- or sister-in law, etc.) represent 15% (Figure 4). This transmission dynamics of artisanal knowledge reflects not only a functional distribution of knowledge according to gender and family roles, but also the strength of affective links as catalysts of learning. The fact that 50% of the knowledge comes from the mother figure evidences her role as an educational and cultural nucleus in the heart of the household. At the same time, the participation of the father in 30% of the cases, centered on productive management, complements an integral model of teaching where the crop and the artisanal transformation are intertwined. The presence of sisters and in-laws as intermediaries or facilitators of generational transmission exposes an extended network of horizontal learning that is characteristic of communities which value cultural continuity beyond the immediate

Figure 4. Incorporation of young people in productive activities of the Jipijapa agroecosystem.

nucleus. In this context, the artisanal practice not only represents an economic activity, but also an expression of the economy of care, where work is carried out collectively, in spaces of coexistence and reciprocity. This interrelation between work, affection and memory allows for artisanal weaving to become, literally, a living metaphor of the community fabric.

Despite this, 63% of the interview respondents manifested not being interested in preserving the artisanal activity, 25% consider it to be unattractive, and 10% indicated that their priority is to continue studying or seeking new work opportunities outside the community. This trend reflects a symbolic and territorial process of migration, driven by the aspiration of a more individualized model of development and disconnected from local traditions (Figure 5).

In the presence of this scenario, it is essential to create conditions that encourage rootedness, articulating personal development with the strengthening of identity and cultural values. Artisanal activities, beyond their economic value, constitute expressions of collective memory, situated knowledge, and community cohesion. In this sense, working with children through workshops and courses promoted by local agencies (Campeche, 2024) represents a valuable strategy of cultural revitalization.

From a perspective of sociocultural sustainability, these efforts can be understood as practices of symbolic re-territorialization: actions that bring back meaning, belonging, and possibility to the community space in face of global homogenization. Recovering the value of tradition does not imply forcing its reproduction but rather offering tools and spaces where young people can redefine it from their own contexts and aspirations.

Commercialization of handcrafts and shoots

Traditionally, producers and artisans have taken economic advantage of shoots and rhizomes of Jipijapa as part of a system of integral exploitation (Poot-Pool *et al.*, 2018; Cetzal-Ix *et al.*, 2018). In the artisanal sector, the main income comes from the elaboration of hats; these articles have the highest demand and represent 70% of the preferences in sales. This trend contrasts with other artisanal regions from Colombia, like Colosó and

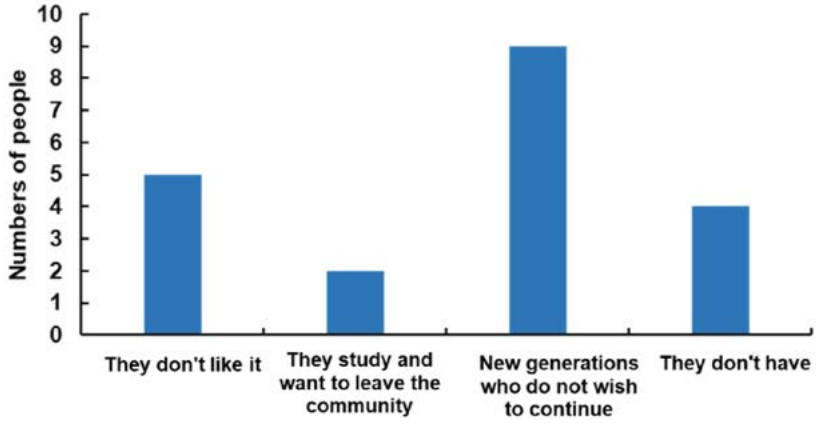

Figure 5. Reasons for loss of artisanal and agronomic work with the palm.

Sucre, where they elaborate mainly bomboneras, or localities from the Atlantic, Nariño and Caldas, which stand out from the commercialization of bags woven from Jipijapa fibers (Beltrán-Ayazo and Narváez-Santis, 2021).

In the community of Santa Cruz Ex Hacienda, commercialization of hats or shoots is carried out in 80% through local intermediaries, which reflects a strong dependency on the domestic market. These products are sold with an average income of 259.2 pesos. For their part, traders inside the community, who act as connections with external intermediaries, attain an average income of 280.5 pesos, which shows an economic gap between the artisans. The other 20% of the sales are channeled through external intermediaries that reach the community directly, acquiring the products at the same price as local re-sellers.

These commercialization models reflect the combination of local and external strategies to place the artisanal products in the market. Although economic differences between local traders are not markedly significant, important contrasts are identified in the value chain when the products reach external re-sellers, who obtain profit margins which double the incomes of original producers. This situation emphasizes the urgency of improving the distribution channels and strengthening the mechanisms of fair trade, given that one of the central problems mentioned by artisans is the deficiency in payment received for their products.

CONCLUSIONS

The study conducted in Santa Cruz Ex Hacienda confirms that agroecosystems of Jipijapa (*C. palmata*) continue to be a central activity in the community, both in the productive and in the cultural aspects. However, they face significant challenges, among them the scarcity of raw materials derived from the lack of adequate land, which affects the crop's productivity; the commercialization of handcrafts and shoots carried out through intermediaries causes a decrease in incomes, as well as a lack of motivation and social devaluation of handcrafts.

Although knowledge of palm cultivation and production has been kept in the family nucleus, ageing of producers and artisans, and migration of young people towards other economic opportunities threatens the continuity of these traditions. Therefore, it is crucial to implement strategies that foster interest in new generations for preserving this legacy and optimizing the conditions for a more sustainable production; also, investing in training, improving trade channels, and promoting the use of sustainable biotechnological and agricultural technologies that guarantee the future of artisanal and agricultural production in the region, as well as the certification or cultural denomination of origin.

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