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Main technical-productive characteristics of meliponiculture in two locations of the municipality of Calkiní, Campeche

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ABSTRACT

Objective: To identify the main technical-productive characteristics of two meliponiculture production systems —traditional and technical— in two locations of the municipality of Calkiní, Campeche.

Design/Methodology/Approach: Semi-structured interviews of 60 items were applied to bee growers from Pucnanchen and Santa Cruz between August and December 2021. The population of meliponiculturists was established by using the snowball method.

Results: We found a total of 53 bee colonies of the *M. beecheii* species (39 hobones and 14 technified boxes). The interviewed meliponiculturists are over 49 years old and have an average of 13.25 colonies per meliponary. In modern meliponaries, galvanized metal sheets have replaced huano (*Sabal yapa*) leaf roofing. Likewise, some *hobones* have been replaced by technified boxes to breed native bees.

Study limitations/Implications: This study describes the technical-productive characteristics of the two production systems (traditional and technical) used in meliponiculture in two locations of the municipality of Calkiní, Campeche.

Findings/Conclusions: There is a decline in the number of people practicing meliponiculture, an activity still rooted in rural communities and that retains its economic, cultural, and social importance. In rural communities, the use of melipona honey for health purposes persists, as well as the religious customs associated with this type of honey.

Keywords: Meliponiculture, Production methods, *Melipona*, *Scaptotrigona*, Calkiní.

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INTRODUCTION

The term meliponiculture refers to the activity of caring for and breeding native stingless bees (Tribe: *Meliponini*; Nates-Parra and Rosso, 2013; Quezada-Euán *et al*., 2001; Quezada-Euán, 2005). In Mexico, meliponiculture is a cultural, economic, and social activity that was developed by Maya communities, with their own technology, before the arrival of European colonizers (Quezada-Euán *et al*., 2001). Native stingless bees were cultivated in four areas, namely: 1) the Yucatán Peninsula; 2) the Gulf of Mexico coast (mainly Veracruz and Tabasco); 3) the Pacific coast (between Sinaloa and Jalisco); and 4) the Balsas River Basin in Guerrero and Michoacán (González-Acereto, 2012; Reyes-González, 2015).

Image by Hans Benn at Pixabay

Around 16 species of native stingless bees are present in the Yucatán Peninsula. However, the primary species used for honey production in Maya communities are *Melipona beecheii* and *Scaptotrigona pectoralis* (Quezada-Euán, 2011). The Maya peoples marketed the honey and cerumen produced by melipona bees to various regions, from the current border between Campeche and Tabasco to Guatemala and Honduras (Pereira-Nieto, 2005). The commercialization of honey was part of the sociocultural, medicinal, ritualistic, and food-related customs (it was used as a sweetener) of many indigenous peoples (Quezada-Euán, 2005; Carrillo-Magaña, 2004). Between the third and tenth centuries, when the Maya culture was at its peak, honey and cerumen were two of the most abundant trade products, along with salt, dried fish, *henequen*, cloth, and *copal* (Quezada-Euán, 2005; Carrillo-Magaña, 2004). The Maya refined their production methods to a level similar to that of the honey bee management in medieval Europe, reaching densities of up to 500 *hobones* (Quezada-Euán, 2011).

In the Maya culture area, especially in the Yucatán Peninsula, meliponiculture reached heights not found in other parts of Mexico. This was largely due to the development of various management processes such as meliponaries and hobones (Pat-Fernández *et al.*, 2018; Quezada-Euán, 2011; Carrillo-Magaña, 2004). The meliponary or bee house, known in the Mayan language as *Najil kaab*, is a simple structure supported by piles of solid wood, either jabín (*Piscidia piscipula*) or chacté viga (*Caesalpinia platyloba*), and covered with a roof made of Xa'an huano (*Sabal yapa*). The *Najil kaab* is built on the grounds behind the main house, usually with an east-west orientation. This location allows the families to have easy and quick access to the meliponary in order to supervise the bee colonies (Pat-Fernández *et al.*, 2018). Native stingless bees build their nests in pre-existing cavities (hollow trees, termite mounds, underground), using cerumen (wax mixed with resins), mud, and other materials. Brood combs are arranged horizontally or in clusters; honey and pollen are stored in ellipsoidal pots (Nates-Parra and Rosso, 2013). The indigenous peoples housed the bees in the well-known *hobones* or hollow logs where the melipona bees lodge. The *hobones* were placed horizontally so that meliponiculturists could extract honey from the sides (Quezada-Euán, 2011; Carrillo-Magaña, 2004).

According to Contreras-Escareño (1999), there are three different types of management systems for native stingless bees:

a) Rustic farming. Some inhabitants of the Yucatán Peninsula know the needs of melipona bees by direct observation. They open the hives once a year to harvest honey and do not conduct any other type of management. In rustic farming, there is no consistency in management or knowledge, even within the same community.
b) Traditional farming. This system is peculiar to towns with an ethnic history, where bee colonies are housed in containers—either pots or boxes (cardboard or wood) sheltered near their homes. In this case, there is consistency in the use of containers. For example, the Totonaca peoples use wooden boxes, the Maya use hollowed-out trunks, and the Nahua, clay pots.

c) Technified farming. This beekeeping system is conducted in artificial or rational housing. It uses wooden boxes to house native stingless bees. Said boxes are built respecting the architectural characteristics of natural nests and allowing for rational exploitation.

Currently, there is little information about the typology of producers. A lack of homogeneity has led to the formation of clearly differentiated groups. However, this situation facilitates the proposal of more precise public policies, whose effects in the short and medium term may help to achieve goals oriented towards technical and social improvements.

Farming of native stingless bees in Mexico has multiple economic benefits. Nevertheless, the peasants who obtain the products directly from the colonies face income-related obstacles due to their limited marketing channels. Moreover, they deal with problems related to the small amount of product collected per colony, which prevents them from increasing the market demand (Quezada-Euán, 2009). The aim of our study was to identify the main technical-productive characteristics of two meliponiculture production systems —traditional and technical— in two locations of the municipality of Calkiní, Campeche.

MATERIALS AND METHODS

Study area location

The study was conducted between August and December 2021. A semi-structured interview was created based on a schedule and applied to meliponiculturists of two localities: Pucnanchen and Santa Cruz. Both of them belong to the municipality of Calkiní, Campeche, Mexico (89° 53" and 90° 29" W, 20° 10" and 20° 51" N, at an altitude of 10 masl). Both locations were selected based on reports indicating that meliponiculture is practiced there (Pat Hernández *et al.*, 2018). We also used an observation guide to identify the environment of the meliponaries.

Instrument

The interview schedule comprised 60 items —closed and open-ended questions— organized into the following sections: family information, technical-productive characteristics, economy, and organization. To identify melipona honey producers we used the snowball method principles.

Variables

The applied instrument comprised the following sections: a) information on the family nucleus (family members, age, years of schooling); b) technical-productive characteristics (number of colonies per meliponary); c) origin and type of accommodation of the melipona bee colonies; d) characteristics of the meliponaries (roof, floor, and measurements); e) length of the hobones; f) techniques used in honey harvest and production volume; g) economic characteristics (retail price, destination, and form of commercialization of the harvested honey); h) and, finally, organization (form of association, number of partners, and seniority).

Recording and analysis of data

The information obtained through the interview schedules was recorded in an Excel spreadsheet (Microsoft Office®), and then analyzed using parameters and indicators of descriptive statistics (bar graph), as well as measures of central tendency and dispersion (mean and standard deviation).

RESULTS AND DISCUSSION

Maya meliponiculture is a pre-Columbian practice that subsists in some communities in the State of Campeche. Unfortunately, it is at serious risk of disappearing (Negrín-Muñoz and Sotelo-Santos, 2016). In this study, two meliponaries were selected in the town of Santa Cruz and another two in Pucnanchen to contrast production in both localities. Three of the four meliponaries are in private property, each one owned by a single person, and the remaining meliponary belongs to a working group of five women. The three meliponiculturists speak the Mayan language and are *ejidatarios* (members of an *ejido*, a communally owned piece of land). The women in the working group understand the Mayan language but do not speak it. The meliponiculturists are over 49 years old: 50, 60, and 92, respectively. Meanwhile, the working group has been functioning for three years, with meliponiculture as their main economic activity, followed by agriculture and the sale of their labor. According to Pat-Fernández *et al.* (2018), 30 peasant families in the Los Petenes Reserve are dedicated to the breeding of melipona bees, 13 of which live in Tankuché, seven in Pucnachén, four in Chunkanán, three in Concepción, two in Ex-Hacienda Santa Cruz, and one in Santa María.

Number of colonies per meliponary, origin, and accommodation type

We counted a total of 53 bee colonies of the species *M. beecheii* (39 hobones and 14 technified boxes), 25 of which were inherited, 14 were purchased, and 12 were extracted directly from the fields (Figure 1a; 1b).

The colonies are distributed in four meliponaries, with an average of 13.25 colonies per meliponary. According to Pat-Fernandez *et al.* (2018), meliponiculture in the Petenes

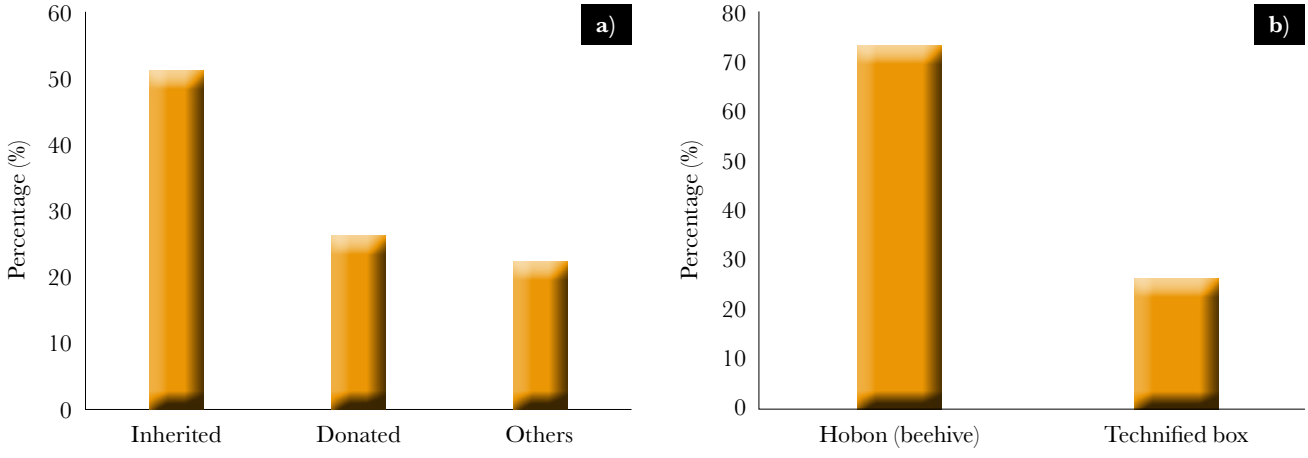

Figure 1. a) Origen of colonies, b) Nest type.

Biosphere Reserve (RBLP) in the State of Campeche underwent major changes in the past when several families abandoned the trade. The same authors argue that some of the main causes for quitting bee farming are the sale of colonies, poor management, drought, floods, among others.

Main characteristics of meliponaries

Modern meliponaries use galvanized metal sheets for roofing, instead of the old huano leaves. They also work with technified boxes rather than hollowed-out trunks to breed native bees (Table 1; Figure 2a; 2b).

These modern implements offer better conditions for handling bees and harvesting honey. They also reduce the possibility of contamination compared to the traditional harvesting process (personal observation). This new management system, based on the knowledge of the species' biology, can increase honey production and thus improve the meliponiculturists' income (Enriquez *et al.*, 2005).

Main characteristics of hobones

The average length of *hobones* (n=39) used in the studied localities is 59.13 cm, with a minimum of 45 cm and a maximum of 84 cm. The average height of each hobón is

Table 1. Construction of meliponaries, main characteristics.

Meliponary	Ceiling	Floor	Base type for colonies	Type of accommodation of the colonies	Meliponary location	Meliponary measurements (m)
1	Huano (palm)	Cement	One colony upon another	Hobon (beehive)	Backyard	4.5×3.0
2	Huano (palm)	Cement	Wooden shelf	Technified box	Backyard	3.0×3.0
3	Galvanized	Dirt floor	One colony upon another	Hobon (beehive)	Outside the house, but inside the community	7.0×3.0
4	Cardboard roofs	Dirt floor	One colony upon another	Hobon (beehive)	Backyard	1.5×1.0

Figure 2. a) Traditional meliponary witth huano roof. b) Meliponary with galvanized metal sheet roof.

27.62 cm, with a minimum of 23 cm and a maximum of 40 cm. They are 3 cm thick. The main wood species used to make *hobones* are cedar (*Cedrela odorata*), chicozapote (*Malnikara zapota*), yaxnik (*Vitex gaumeri*), tzalam (*Lysiloma bahamensis*), and jabín (*Pisidia piscipula*) (Figure 3).

In contrast, technified boxes (Figure 4) are specifically made to facilitate management practices and honey collection without damaging the hive, without wasting product, and, most importantly, in a clean and hygienic way (The Nature Conservancy, n.d.). The advantage of using technified boxes to breed stingless bees is that they can be opened to assess the state of the hives more easily, thus facilitating the honey extraction process without damaging the nest. They also allow for making divisions more comfortably (Enriquez *et al.*, 2005).

Honey harvest technique and production volume

There are two techniques for harvesting honey: the traditional and the technical method. The former consists in removing the clay from one end of the *hobón* and then perforating the honey pots, letting the honey drain over a bucket. A tulle cloth placed over the opening of the bucket serves to filter the honey and remove the clay remains. The technical method

Figure 3. Traditional hobones.

Figure 4. Technified box.

consists in piercing the honey pots with a needle and collecting the honey using a syringe (Figure 5).

Half of the producers harvest honey using the traditional method, while the other half uses the technical one (Figure 6). On average, 0.48 L of honey is collected per colony per year, with a yield of honey per colony per year of 0.50 L in technified boxes and 0.44 L in hobones.

Colony division and artificial feeding

Artificial feeding is a new technology that has spread among meliponiculturists. It consists in feeding the melipona bee colonies with honey of the *Apis mellifera* species (25% of producers implement it). Another practice is not harvesting the melipona colony if the producer does not deem it populated enough.

Sale price and destination of *M. beecheii* honey

The average price for a liter of melipona honey is 850 pesos, with a minimum of 750 and a maximum of 1,000 pesos. Honey is harvested twice a year: first between April and June and then between October and November.

Figure 5. Honey extraction using syringes.

Figure 6. Traditional technique of honey extraction.

Of all the harvested honey, 89.8% is destined for sale and 10.2% for self-consumption. Among the interviewed meliponicultorists, only one registers his activities (in a notebook). One of them transforms honey into other products, mainly soap, which they offer at a price of 60 pesos and sell one unit per month. In addition to selling honey, beekeepers can use melipona bees in greenhouse agriculture production, since bumblebees (Tribe: Bombini) are usually used for pollination (Quezada, 2005; 2009).

Main uses of *M. beecheii* honey

All interviewed meliponiculturists use melipona honey to treat cough and respiratory diseases. They claim to have acquired this knowledge through a relative, mainly the producer's mother or grandfather. Only one of them (25%) uses honey to treat cataracts, something they learned from their grandparents. Meanwhile, three of them (75%) use honey in some Maya ceremonies, mainly first fruits, which are celebrated in April to express gratitude for the first honey harvest. This evidence confirms that using honey in ceremonies is still a common practice in these localities. According to Sánchez-Aroche (2016), a tradition practiced in the States of Yucatán and Quintana Roo is the preparation and consumption of balche' (a drink made from honey and bark from the *Lonchocarpus longistilus* tree). This drink is used in rituals to sanctify and purify both sacred spaces and altars. Among these rituals are Ch'a' Chaak, Alborada (Dawn) or Xchok, Hoch Che', and U Hanli Chaco'ob. However, its production and consumption are kept secret from external agents. It has also been used to treat "ill wind" and a very sore body.

CONCLUSIONS

Although the number of people who practice meliponiculture has decreased, this activity still prevails in Campeche. People still use melipona honey for health purposes. In addition, this type of honey plays an important role in religious customs. Meliponiculture in Campeche is rooted in rural communities and still retains its economic, cultural, and social significance.

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