

Socioeconomic diagnosis of a group of meliponiculturists in the locality of San Antonio Cayal, Campeche, Mexico

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ABSTRACT

Objective: To identify the economic, technical, and social characteristics of a group of meliponiculturists established in the locality of San Antonio Cayal, Campeche, Mexico.

Design/methodology/approach: An interview card was applied to ten members of a group of meliponiculturists, and each card consisted of 20 open and closed questions distributed in the following sections: general data, technical aspects, characteristics of the meliponary, production, market, and perspectives of meliponiculture. An observation guide was also applied.

Results: It was found that in the locality of San Antonio Cayal, meliponiculture is a recent activity (four years); the activity started with a total of ten people, with ages between 47 and 64, using modernized boxes and the honey extraction technique using syringes. However, currently the activity is only practiced by two people.

Limitations on the study/implications: Meliponiculture is a scarcely practiced activity in the locality, and therefore, there are few records of this activity.

Findings/conclusions: The study allowed us to understand the limitations of the group of meliponiculturists that caused the dispersion of the group, and allowed finding different areas of opportunity (management, production) to strengthen the activity.

Keywords: Meliponiculture, *Melipona beecheii*, honey.

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INTRODUCTION

Native stingless bees (NSLBs) (Apidae: Meliponini) are characterized by the absence of a functional sting (Ayala, 1999; Michener, 2007), the reduction of veining of the anterior wings, and by having simple nails and presenting a line of thick hairs as a comb on the distal margin of the posterior tibia (Márquez-Luna, 1994; Arnold *et al.*, 2018a). NSLBs are distributed in the tropical and subtropical regions of Australia, Asia, Africa and America (Michener, 2007). In America there are approximately 400 species, distributed from Argentina to northern Mexico (Yáñez-Ordóñez *et al.*, 2008; Michener, 2007; Arnold *et al.*, 2018a). Mexico has 16 genera and 46 species of bees belonging to the Meliponini tribe, found in Puebla, San Luis Potosí and Veracruz (Salazar *et al.*, 2017; Ayala *et al.*, 2013), Guerrero (González-



Acereto, 2012; Padilla *et al.*, 2014; Patlán *et al.*, 2014), Oaxaca (Arnold *et al.*, 2018ab), Michoacán (Reyes *et al.*, 2017), Chiapas (Guzmán *et al.*, 2011), and Tabasco (Murillo, 1984; Cano *et al.*, 2013; Arnold and Burguete, 2015; Chan *et al.*, 2019). According to Contreras-Cortés *et al.* (2020), the genera that present the most species are: *Plebeia* (11), *Melipona* (7), *Trigona* (5) and *Trigonisca* (5) (Ayala, 1999; Ayala *et al.*, 2013; Quezada-Euán 2018).

In the Yucatan Peninsula (YP), there are records about NSLBs representing an important resource for the Maya people and that they took advantage of it since Pre-Hispanic times, with the trade of honey and wax. However, with the introduction of European bees, meliponiculture was gradually displaced by apiculture (Villanueva-Gutiérrez and Collí-Ucan, 1996). Based on archaeological information and the current geographic distribution, it is likely that meliponiculture had its origins in the YP (Kent, 1984; Narez, 1988; Crane, 1992; González-Acereto, 2012; Ayala *et al.*, 2013; Quezada-Euán, 2013).

Mayan culture developed meliponiculture at a level compared to the management of western honeybees in medieval times in Europe, with the result of a great impact in the economy (Cortopassi *et al.*, 2006; Quezada-Euán *et al.*, 2013). The NSLBs were an important part of the Mayan worldview and mythology, which considered meliponiculturists as guardians and keepers of the *Melipona beecheii* bee, known in the Mayan language as “Xunan-kab”, because it is believed that they were given directly to them by the major god “Yun ’ku” or “Yumbil dios” (Quezada-Euán, 2011).

NSLBs fulfill an important role as pollinators of wild and cultivated plants, and they are also of cultural importance in different ethnic groups; in addition, the honey produced is attributed to have medicinal value for various respiratory, dermatological, and gastrointestinal conditions (Vit *et al.*, 2004; González-Venegas *et al.*, 2018). However, the effect of disturbances caused in tropical ecosystems such as demographic growth, livestock production, and the increase of extensive agriculture as a result of the high demand for foods, shows an important reduction of their natural habitats (Guzmán *et al.*, 2011; Mérida and Arnold, 2016; Ayala and Ortega, 2018; Vásquez *et al.*, 2021). NSLBs have faced numerous pests and predators such as the “nenem” fly (*Pseudohypocera kertezi*), the “xulab” ant (*Eciton burchelli*), the “sanjol” (*Eira barbara*), and the “muuch” (*Chaunus marinus* and *Cranopsis valliceps*), among others (Pat-Fernández *et al.*, 2018a; Camberos-Sánchez, 2019). Despite the ecological and economic importance of the *M. beecheii* bee, economic aspects have still not been evaluated in a general way (Martínez-Puc *et al.*, 2022), and this is why the objective of this study was to identify the main economic, technical and social characteristics of the group of meliponiculturists in the locality of San Antonio Cayal, Campeche, Mexico.

MATERIALS AND METHODS

Location of the study area

The locality of San Antonio Cayal is in the municipality of Campeche (−90. 175000°, 19.743056° at 50 masl), in Campeche, Mexico. According to the Koppen classification modified by García (1988), the climate of the locality is classified as Aw1(i)gw' warm sub-humid with abundant to very abundant summer rains, with an annual precipitation that

ranges from 1,200 to 2,000 mm. The type of vegetation in the community is medium sub-deciduous forest, and in addition it has three different types of soil: Gleysol, Vertisol and Regosol. This locality has a population of 502 inhabitants, 257 men and 245 women (INEGI, 2020).

Data collection methods

Between February and June 2022, a total of ten interviews were carried out with meliponiculturists of the locality, who were identified through the referenced method with the aim of understanding the main socioeconomic, cultural and productive characteristics and the perspectives on meliponiculture of the group. Each interview respondent received a questionnaire that consisted of 20 open and closed questions, distributed in the following sections: general data (age, sex, marital status), technical aspects (harvest season, harvest technique, diseases, pests and treatments), use of workforce (hours devoted to meliponiculture), construction costs of the meliponary (investment in infrastructure), production and marketing (amount of honey obtained, sale price), and perspectives of meliponiculture (training, government backing, problems). The information gathered was analyzed through descriptive statistics.

RESULTS AND DISCUSSION

The interviews were carried out with the group of meliponiculturists from the locality of San Antonio Cayal (SAC), Campeche, Mexico, which does not have a properly established name; this group is made up of six women and four men, with an age that ranges between 47 and 64 years, they practice stingless beekeeping since four years ago, they devote two hours to it approximately every 15 days, since the members of the group have other types of occupations, such as paid work, domestic work, and farming. The group began with four hives, and currently they have 12.

Structure and investment in infrastructure and equipment for the meliponary

The traditional meliponary was built in the patio of the ejido commissioner's office, for which a right of usufruct contract was elaborated to be able to carry out the construction; the main components of the meliponary are the support structure and the roof. The first part is constituted by components commonly known as "horcón" and "balo". The second part is formed by crossbeams or "pachna" lateral beams, and the "hunquiche" vertical grafting rests on them, and on top of these the "hill" is placed which supports the "huano" palms (*Sabal mexicana*), and lastly, the "holná-che" trestle is placed on the upper part, which is also where the lateral grafting rests (Figure 1, Table 1).

The meliponary is named in Maya as "Najil kaab"; this structure provides the hives with shade and protection from the rain and it is oriented east to west (Pat-Fernández *et al.*, 2018ab; Quezada-Euán, 2018; Harvey-Lemelin, 2019). Camberos-Sánchez (2019) mentions that in the Mayan community of Felipe Carrillo Puerto, Quintana Roo, the construction of the meliponary is carried out in two to four weeks with an approximate cost of US\$475.00, like what was invested for the construction of the meliponary in SAC.



Figure 1. Side view of the meliponary.

Table 1. Measures and material used for the elaboration of the meliponary.

Roof		
Description	Quantity	Measured
Hill (length)	10	5.70 m
Hill (width)	10	3.70 m
Huano	500	2.00 m
Easel	1	4.00 m
Support structure		
Descripción	Quantity	Measured
Horcon	8	2.00 m
Side beams (length)	2	6.00 m
Side beams (width)	2	4.00 m
Balo	1	4.00 m

Technical characteristics of meliponiculture management

The members of the group carry out honey harvesting between March and June, because this season is when the hive is the strongest and there is a greater floristic resource. Likewise, in this harvest period, approximately 300 to 500 mL of honey are obtained per hive. However, not all the hives are harvested each year. The harvest is done through the modernized process by which they use a syringe and a knife to perforate the superior part of the jars to extract the honey, which is deposited into recycled soda plastic containers with a capacity of 500 or 1000 mL (Figure 2). On the other hand, the practice of dividing hives is carried out between April and May.

Abandonment of the activity

The honey harvested from the *M. beecheii* bee (Figure 3) is used for auto-consumption and in traditional medicine to treat colds, coughs, fleshiness in the eyes, or to heal



Figure 2. Syringe extraction of honey from *Melipona beecheii*.



Figure 3. *Melipona beecheii* in the Yucatan Peninsula.

wounds; because of this, meliponiculturists do not trade the honey harvested, they do not know the economic value that it can reach and they do not have training to diversify the production which could help to improve their economy. Another limitation is the loss of interest; during the development of the study, four members of the group abandoned the activity, because there was no economic income from it; two from lack of time since they preferred to work in agricultural activities such as growing corn (*Zea mays*) and fruit tree management (*Mangifera indica*), which has a higher economic profitability; two other members lost interest in the activity, and it should be mentioned that, by the end of the study, eight meliponiculturists abandoned the activity and they are currently devoted to apiculture.

In the YP, the detriment of this activity is very evident; for example, in the Mayan zone of Quintana Roo, between the years 1981 and 2004, the decrease in hives was 93% (Villanueva *et al.*, 2005a); by 2011, a loss of 6.6% was reported (Villanueva *et al.*, 2013). In this study, the abandonment of meliponiculture was primarily due to the inexistent economic income, the lack of interest for meliponiculture, and the change in activity for apiculture where honey productivity is higher compared to meliponiculture (Villanueva-Gutiérrez *et al.*, 2005; Pat-Fernández *et al.*, 2018).

Although meliponiculture is an activity that is decreasing, some authors state that this activity allows improving the quality and economic income of families. However, it is important to give an added value to the honey to improve the quality of life of meliponiculturists (Montenegro *et al.*, 2014).

In Maní, Yucatán, four groups of meliponiculturists are reported which receive an income between US\$50 and US\$100 monthly from the sale of honey, pollen, propolis, jobones, or modernized boxes. The sale of hives fluctuates between US\$150 and US\$100. It should be highlighted that the success of this group of meliponiculturists is also because of the economic support and technological support from various institutions (Parra-Argüello *et al.*, 2018). Likewise, in the locality of “Ich ek”, municipality of Hopelchén, Campeche, there is the group “Kooel Kab”, which is devoted to meliponiculture since 1995; they maintain the activity as a result of the sale of packaged honey and the added value from trading it in cosmetics (facial cream and soaps), as well as in eye droppers (for ophthalmic treatment), which they offer in their locality, fairs, by order or internet purchases, and in addition they have an advertising strategy through brochures, exhibitions, and promotion via internet (Pumares-Chab, 2019; Martínez and Vázquez, 2019).

In the last 20 years, different initiatives have been presented to promote the knowledge, management and rescue of meliponiculture in the YP. The School of Veterinary Medicine at Universidad of Yucatán has offered courses-workshops to meliponiculturists from the YP, addressing topics such as the transference of bee nests to modernized hives, reproduction, division of the hives, and honey production; the courses-workshops are offered in Yucatán, Campeche and Quintana Roo, with the main result of an increase in 8% of meliponiculturists (González-Acereto *et al.*, 2006).

Likewise, manuals have been made about breeding and management of the “Xunancab” bee in the YP (González-Acereto and Araujo Freitas, 2005; Villanueva *et al.*, 2005a; Pat-Fernández *et al.*, 2018a), and there was even a box designed, called González-Acereto con Bisagras (T.I.B.G.A), for *M. beecheii*, *Scaptotrigona pectoralis*, and *Nanotrigona perilampoides* bees, which can be used for breeding.

The efforts mentioned for the promotion and rescue of meliponiculture have been found through various studies, to understand the sites where meliponiculture is practiced and to learn about the traditional knowledge and management of NSLBs in Campeche (Moo-Huchin *et al.*, 2015; Negrín and Sotelo, 2016; Pat-Fernández *et al.*, 2018ab, Vázquez and García, 2019 and Uchin-Mas, 2021), Yucatán (Quezada-Euán *et al.*, 2001; González-Acereto *et al.*, 2006; Catzin-Ventura *et al.*, 2008; Pinkus-Rendón, 2013; Moo-Huchin *et al.*, 2015; Parra-Argüello *et al.*, 2018), and Quintana Roo (Villanueva-Gutiérrez *et al.*, 2005; Villanueva-Gutiérrez *et al.*, 2013; Moo-Huchin *et al.*, 2015).

The analysis of the economic, technical and social characteristics of meliponiculture allows understanding the producers’ needs and problems, and to identify opportunities for the development of projects that favor management of the bees, to increase honey production, and to provide an added value to the byproducts obtained from the hive. This would increase the economic income of the families that practice this activity. Meliponiculture in Campeche has been studied more in the northern part of the state

(Tenabo, Calkiní and Hecelchakán); in Hopelchén, it is still necessary to conduct studies to understand more deeply the sites where meliponiculture continues to be practiced.

CONCLUSIONS

The group of meliponiculturists studied in SAC presented a low interest for meliponiculture, which is why 80% of the members of the group abandoned the activity and are currently devoted to apiculture. Although the members of the group know the procedure to harvest honey with syringes and to divide hives, they do not know the procedure to trade the honey and therefore they consider meliponiculture to be of low profitability.

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