

## CHARACTERIZATION OF MELIPONICULTURE IN THE PROVINCE OF CIENFUEGOS, CUBA

### Caracterización de la meliponicultura en la provincia de Cienfuegos, Cuba

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#### Abstract

The research was carried out in the province of Cienfuegos, with the objective of characterizing the management system and state of health of the *Melipona beecheii* stingless bee hives. In order to evaluate the state of meliponiculture in this territory, all persons keeping colonies of *M. beecheii* bees were surveyed. In five municipalities of the province of Cienfuegos, 22 meliponiculturists were identified. The total number of people who are dedicated to the cultivation of the *Melipona* species do not carry out the activity professionally; they reveal another occupation. The level of schooling reflects that 59.08% have an intermediate level, 22.72% finished high school and 18% have a higher level with an average age of 42 years. Different models for the manufacture of *Melipona beecheii* hives were identified, showing a living space per hive of maximum capacity and good health.

**Key words:** *melipona beecheii*, meliponiculture, health.

#### Resumen

La investigación se desarrolló en la provincia de Cienfuegos, con el objetivo de caracterizar el sistema de manejo y estado de salud las colmenas de abejas sin aguijón *Melipona beecheii*. Para evaluar el estado de la meliponicultura en este territorio fueron encuestadas todas las personas con tenencia de colonias de abejas *M. beecheii*. En cinco municipios de la provincia de Cienfuegos fueron identificados 22 meliponicultores. El total de personas que se dedican al cultivo de la especie *Melipona* no realizan la actividad de manera profesional, revelan otra ocupación laboral. El nivel de escolaridad refleja que el 59,08 % tienen nivel medio el 22,72% concluyeron la secundaria y el 18 % cuentan con nivel superior con una edad promedio de 42 años. Fueron identificados diferentes modelos para la fabricación de colmenas de *Melipona beecheii*, mostrando un espacio vital por colmena de máxima capacidad y buen estado de salud.

**Palabras clave:** *melipona beecheii*, meliponicultura, salud.

## 1. INTRODUCTION

*Melipona beecheii* Bennett belongs to the group of “stingless bees” and is known in Cuba as the “earth bee”. It is, together with *Apis mellifera* Linnaeus, the only two species of social bees living on the island, where they are bred and managed by humans to use their products or services in the pollination of agricultural crops.

In the last decades, although the breeding of meliponae has aroused more interest every day, proof of this is the growing participation of professionals and students in scientific events, the publication of articles, as well as the appearance of journalistic news on television or web pages alluding to meliponiculture, with the will to increase and stimulate its management in all regions of Cuba. On many occasions, outdated or erroneous information is handled or published; papers are presented in scientific events that are never published or research results are published in journals with very little international circulation [1].

In the mid-2000s, projects led by the Agrarian University of Havana began to be developed in Cuba, with the aim of showing results on the state of meliponiculture in the western region of the country [2].

In the province of Cienfuegos, there are insufficient references of studies that provide elements on good management practices and biological characteristics of the species *Melipona beecheii* Bennett. In this context, some research is reported, such as the study of morphometric characters to identify the similarities and differences between *Melipona beecheii* bee populations in the municipality of Cienfuegos [3].

Brood population and food reserves in rational hives of *Melipona beecheii* Bennett as basic factors for their health. Important biological parameters of *Melipona beecheii* Bennett have been little studied in Cuba and even less in relation to health. Their determination favors the promotion of the species on the basis of a correct management, especially in rational hives. [4].

## 2. MATERIALS AND METHODS

The study area covered five municipalities in the province of Cienfuegos, where the survey technique was used in the diagnostic process and evaluation of results. It allowed to know the needs of the meliponiculturists, their aptitudes and attitudes, years of experience, among other variables.

Due to the lack of any registry that controls the meliponica activity in the province, the population and sample do not coincide. The hives that were identified were classified according to the type of housing as rustic or natural, according to the method used by [2].

Additionally, the dimensions (length, width and height) were taken using a tape measure and the volume of the lodges was calculated from the formula (Volume = Length × Width × Height). The thickness of the wood and the diameter of the entrance structure were measured using a caliper.

The data obtained were subjected to a Kolmorov test and a descriptive statistical analysis with the Statgraphics Plus version 5.1 package.

## 3. RESULTS AND DISCUSSION

100% of meliponiculturists belonged to the male sex, for a total of 22 meliponiculturists identified. The age range was diverse, showing the predominance of older people, with 64.70 % of them over 50 years of age, with an average age of 42 years; a situation similar to that reported in the Yucatan Peninsula where it is argued that the use of meliponiculture resources is in the hands of older people, due to cultural deterioration in Mayan communities and the migration of young people to the cities of the country and abroad, causing the abandonment of traditions and even their rejection [6].

According to the results obtained on the level of schooling of the respondents, five melipon farmers have a high school degree (22.72%), three (36.36%) have a technical

high school degree, three have a pre-university degree (22.72%) and three (18.18%) have a university degree.

According to the occupational occupation, the sample was very heterogeneous, 20 of the people who carry out this work have another trade or profession (90.9%). It should be noted that none of those surveyed had a professional activity in Meliponiculture. The professions found were: beekeeper, policeman, Ministry of the Interior (MINIT) officer, electronics technician, small farmer, agronomy student, agricultural worker, custodian, bricklayer, self-employed, driver, heavy equipment operator and sailor [1].

In the literature consulted, there is little detailed information on the professions of the people involved in stingless bee cultivation, although there are mainly groups of peasants and native settlers, as in Costa Rica, where [7] states that it is mainly in the hands of indigenous groups. In Mayabeque province obtained very heterogeneous results in terms of labor occupation [2], while [9] in Pinar del Río Province, reported that 63 % of the sample is made up of beekeepers, 17 % are agricultural workers and the remaining 20 % is distributed in other categories.

On average, the producers have had their colonies for 11.5 years, less than the average of 16 years reported by [9] for Pinar del Río and similar to the results obtained by [5] in Mayabeque province.

Fifty percent of the producers started the activity because of the influence of other producers, 27.27% because of family tradition and the rest referred to other motivations. The total number of colonies found in the province of Cienfuegos was 785. In spite of the fact that in Cienfuegos the meliponiculture activity has been going on for a few years, the study confirmed that the largest number of hives identified in Cuba is concentrated in this territory. Being the meliponiculturists of the town of Juraguá, Popular Council belonging to the municipality of Abreu, province of Cienfuegos; those who concentrated the largest number (400).

The organization and management system of the group of beehives (160) and meliponaries, due to their performance in meliponiculture, was located in the Horquita Agricultural Enterprise; the only known experience of Meliponiculture associated to a state enterprise in Cuba. The rest of the producers have between 1 and 45 hives.

Among all the producers, only those belonging to Juraguá rented their colonies for pollination in the various crop units belonging to the Ministry of Agriculture (MINAGRI) in their locality. This action could have a double impact; contributing to an increase in crop yields due to its incidence on crop pollination, and to a greater availability of food for meliponines.

The range of rental prices for a melipona colony fluctuates between 200 and 250 CUP per month, which reveals the potential interest of this activity. [10], affirm that greater advantages can be obtained in the pollination service in crops of the agricultural company where the hive is located.

The colonies studied were in different housing systems, 635 (80.89 %) in systems with drawers or supers, 23 (2.92 %) in tree trunks and 14 (1.78 %) in rustic boxes, all of them in simple systems.

The colonies of *M. beecheii* are able to occupy the entire volume of the rational housing with food reserves (the pollen pots surrounding a portion of the brood chamber and the rest of the housing occupied by the well-organized honey reserve pots).

Regarding the housing systems of the colonies, the highest percentage (80.89%) corresponds to technified designs, belonging to the breeders of Juraguá, Empresa Agropecuaria de Horquita and San Fernando de Camarones; more experienced producers who have consulted Nogueira-Neto's studies. The rest of the hives are personal confections, manufactured without any technical criteria and which exceed, in most cases, the appropriate dimensions for the species.

Only the meliponiculturists belonging to Juraguá, Horquita and San Fernando de Camarones (3), increase the number of colonies by dividing the hives or artificial multiplication (76%), and the rest of the meliponiculturists do not multiply them artificially and do not know the methodology to do it, this perpetuates the extraction of the colonies from the environment with the damages that it causes. This situation has changed little since the observations of [11], who refers that in Cuba the colonies of these bees are being domesticated and located near the houses of farmers who, without any training or preparation, use wild colonies for this purpose, which is why they are disappearing from natural areas.

This situation coincides with that reported by [5], in Mayabeque. Referring to the average yield of honey harvested, 15 respondents obtained 1400 ml of honey/hive, with a minimum of 500 ml and a maximum of 2500 ml. Studies by [12] in San Jose de las Lajas, Mayabeque province in this aspect reported higher honey yield/hive, with an average production record of 1 066 ml of honey per hive, a minimum of 330 ml and the maximum of 2 250 ml.

The results of the research affirmed that ten (45.45%) use honey mainly for medicinal purposes, ophthalmic problems and flu-like conditions; nine (40.90%), as food, five (18.18%), with dual purpose three (13.63%), do not know about the use of honey. This high percentage of those who use honey for medicinal purposes is due to the curative properties of various ailments that popular tradition attributes to this product, among which according to [9], are ocular cataract, pterygium, infectious and traumatic conjunctivitis, wounds and ulcers of the eye, hard-to-heal skin sores, hemorrhoiditis, skin blemishes, laryngitis, sinusitis and bronchitis.

Of the meliponiculturists identified, six (27.27 %) harvest honey between October, three (13.63 %) in any month of the year, three (13.63 %) in December and March, two (2.09 %) in October, one (4.54 %) in December, one (4.54 %) in March and another (27.27 %) stated that they do not castrate honey due to lack of knowledge.

In general, meliponiculturists harvest honey in the last quarter of the year, coinciding with the flowering season, when they obtain the highest yields in the country, obtaining 41.79% of *Apis mellifera* honey, according to data from 1992-2010 [13]. In relation to floral species, [2] state that colonies of the Cuban variety of *Melipona beecheii* Bennett (1831), in its natural state, visit a wide diversity of plants.

The meliponiculturists surveyed recognized a total of 19 botanical species of meliponicultural interest, although the degree of knowledge ranges from one (1) to ten (10) species, with an average of 1.81, showing a scarce knowledge of the area's meliflora and, therefore, of the food base on which these bees depend. The above is supported by the reports of [14] and [5] who state that the main plants of the melliferous flora in Cuba reach 54 species, grouped in 34 botanical families. Regarding the main contribution of these bees to man and nature, 9 (40.91 %) responded affirmatively during the study with the correct answer (pollination), one respondent (5.88 %) attributed the importance to honey and the remaining four (23.53 %) stated that they did not know the answer.

In this aspect, [15] reported higher results and pointed out that only 12% of the respondents considered pollination as a contribution of bees to man and nature. In the five municipalities where melon growers were identified, the total number of producers (22) reported not having received any training in topics related to the biology and management of this species. Only 5 producers (22.73%) have consulted specialized bibliography and writings on the internet, 7 (31.82%) through the exchange with producers and family members with more experience in the activity.

Table 2 shows the dimensions of the rustic hives, obtaining as a result that the parameter with the least variability is the diameter of the taphole, which shows a mean value of 1.05 cm, a structure of generally uniform dimensions in the species; similar values were obtained by [16] in Matanzas and [16] in Yucatán, who reported mean values for this parameter of 1 and 1.15 cm, respectively.

The dimensions and thickness of the wood of the hives do not conform to the recommended designs for the rearing of the *Melipona beecheii* bee species and do not coincide with the measurements reported by [18] in Yucatán.

The disproportionate number of hives made by meliponiculturists in Table 2 shows that stingless beekeepers build their hives without taking into account any technical element, negatively influencing colony development and inadequate conditions for efficient thermoregulation, an extremely important

factor to consider for the multiplication of meliponine colonies. Providing adequate conditions for this activity can determine the success or failure in the acclimatization of a colony to a new housing [16].

Figure 1 shows the interior of a hive and corroborates the use of inadequate dimensions of the hives inspected during the study, a situation that can generate alterations in the colonies, difficulties in thermal regulation, excessive energy expenditure for the colony during its development, which can lead to its death [17].

**Table 2.** Descriptive statistics of the dimensions of rustic accommodations.

Indicators	Statistics					
	X	Min.	Max.	D.S	C.V %	E.E. (±)
<b>Length (cm)</b>	39,38	17,00	82,00	18,27	45,30	2,558
<b>Width (cm)</b>	19,62	6,00	54,00	6,62	22,58	0,9265
<b>Height (cm)</b>	20,23	10,00	40,00	11,04	37,76	1,546
<b>Diameter of the entrance (cm)</b>	1,05	0,9	1,2	0,070	6,67	0,0099
<b>Wood thickness (cm)</b>	1,86	1,0	2,6	0,307	16,51	0,0430
<b>Volume of the hive (dm3)</b>	29,99	12,15	79,71	14,23	47,47	1,99



**Figure 1.** Colony housed in a rustic hive of inadequate dimensions: note that half of the space is left over. **Source:** author, 2023.

#### 4. CONCLUSIONS

The total of people who are dedicated to the cultivation of the *Melipona* species do not carry out the activity professionally, they reveal another work occupation. The level of schooling reflects that 59.08% have an intermediate level, 22.72% finished high school and 18% have a higher level with an average age of 42 years. Different models for the manufacture of *Melipona beecheii* hives were identified, showing a living space per hive of maximum capacity and good health.

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