Final report of the research stay

" Study and monitoring of stingless bees in the Karen Mogensen Reserve, Nicoya Peninsula - Costa Rica"

"Bioclimatic Research Station Italy-Costa Rica"

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1. Introduction

1.1. Biodiversity and the importance of bioindicators

Biodiversity is defined as the variability of all forms of life on Earth. It includes diversity within species (genetics), between species and between ecosystems (Stock, 1992). In 2019, a United Nations report (UN, 2019) raised the alarm about the extinction of one million species (out of an estimated 8 million), many of which are in danger of disappearing within a few decades (EU, 2020). The causes of biodiversity loss are manifold. On a global scale, the main factors are the destruction, degradation and fragmentation of habitats due both to natural disasters (floods, fires, etc.) and to anthropogenic changes in land use (Ispra). In particular, deforestation of tropical areas appears to be the greatest threat to local and global biodiversity. Tropical forests are home to over 70% of all living species on the planet. They constitute important gene banks of biodiversity and represent one of the main producers of oxygen for the planet (Rhett, 2020). FAO says that the area covered by forests worldwide continues to decline: since 1990, the planet has lost 420 million hectares of forests due to deforestation (FAO, 2020). Countries like Costa Rica are witnessing a decline in biodiversity on a daily basis due to the economic benefits of activities such as cattle ranching, agricultural development and mining, which require drastic deforestation for land clearing. It should be noted, however, that in the last five years (2015-2020) the trend towards total loss is decreasing. Indeed, in the last five years (2015-2020), deforestation affected 10 million hectares of forest cover, compared to 12 million hectares in 2010-2015 and 16 million hectares in 1990-2000 (FAO, 2020). It is therefore in this context that the monitoring of biodiversity for its protection will assume an extremely important role. The first step in designing an environmental monitoring program is the selection of "bioindicator" organisms. A bioindicator is "a species (or a group of species) that responds in a predictable way to one or more external factors, the presence of which is indicative of the maintenance of certain environmental conditions" (Burgio *et al.*, 2013). Pollinators play a vital role in nature as a regulatory service of ecosystems. A third of the food we eat is available through pollination and about half of the insects that pollinate plants are bees. Domestic and wild bees are responsible for about 70% of the pollination of all plant species (Ispra). Bees feed almost exclusively on pollen and nectar and have to visit a large number of flowers every day to meet their needs. The pollination efficiency of any insect depends on the floral biology of the flower visited and on the foraging behavior of the insect itself (Nates Parra, 2005). The climatic and anthropic changes lead to several negative outcomes in pollinator-plant relationships, including habitat loss, toxicity due to the use of some pesticides, the spread of pathogens and the loss of co-evolutionary adaptations in the various ecological niches (Quigley *et al.*, 2019). It is in this context that pollinator populations, specifically *Apoidea* , can become effective bioindicators capable of directly perceiving changes in natural and agricultural systems. Currently seven families of bees are recognized worldwide: five with short tongues (*Stenotritidae*, *Colletidae*, *Andrenidae*, *Halictidae*, *Melittidae*) and two with long tongues (*Megachilidae* and *Apidae*) (Michener, 2000), but social behavior is present in fewer of 10% of the species, dividing the bees into two large families: *Alictidae* and *Apidae* (Snelling, 1981). Most of the social groups belong to the tribes *Apini* (which includes the genus *Apidi*) and *Meliponini* (stingless bees), where a queen lives in a complex colony formed by several individuals, of at least two generations, divided into castes (Nates Parra, 2005). In the case of the study site, Costa Rica, the main *Apoidea* of agroecological interest are members of the *Apidi* and *Meliponini families* and, although bees of the genus *Apis* (*Apidi*) were introduced to the new continent in relatively recent times by the "*conquistadors* ", they have adapted and naturalized with indigenous peoples (Nates Parra, 2005). Today both *Apis* and *Melipona* collaborate in the pollination of agricultural and forestry species, however, since the introduced honeybee belongs to the Italian subspecies *Apis mellifera ligustica*, it avoids rainforest areas, where only *Melipona* performs the pollination service (Wille, 1976). Given the importance of this genus, the *Melipona* bee will be the subject of research.

1.2. *Meliponini*, stingless bees

The *Meliponini* have been divided into 5 genera, of which the genera *Trigona* and *Melipona* are the most important. *Trigona* species are found on all continents except Europe, which has no tropical regions, while the genus *Melipona* is not found outside the Americas. *Trigona* bees are about 2 mm long and have long wings; *Melipona* bees tend to be larger, some being as large as *Apis mellifera* (up to 13-15 mm) (Crane, 1992). The bee *Melipona*, note as "stingless bee", it is native to the tropical region of the Americas and has a natural distribution ranging from Mexico to Costa Rica (Ala, 1999). The breeding and management of this bee has been practiced since the time of the Maya civilization, but the populations are today threatened by intense deforestation (de Jesús Mayo-Itzá *et al.*, 2009). In Costa Rica, bees of the genus *Melipona* are called *jicotes* . All species of the tribe are highly social bees (complex eusocials), as they live in permanent colonies, made up of individuals of at least two generations (mother and daughters) and differentiated into castes (workers, drones and queen). Castes differ behaviorally and physiologically. The genus *Melipona*, restricted to the neotropical region, includes about 25 species, of which only three have been reported from Mexico, Guatemala, El Salvador, Honduras and Nicaragua, while five are known from Costa Rica (Wille, 1976). Of the entire *Meliponini* tribe, the bees of the genus *Melipona* (from the Greek *meli* = honey, *ponos* = work) produce the best honey, both in terms of quality and quantity. The economic importance of these bees therefore lies in two aspects: as pollinators and as producers of honey and wax (Wille, 1976). However, despite the importance of this tribe, the *Meliponini* have been little studied and their treatment and classification is still incomplete (Quezada- Euán *et al*.; 2007 and Melo, 2013).

1.3. Objectives

- Preparation of a report on the presence of *Meliponini* in the Karen Reserve.
- Bee sampling and monitoring on the Karen Reserve
- Identification of the different species present
- Study of the social and individual behavior of *Meliponini*
- Study of the ecological value of *Meliponini*
- Study of the economic value of *Meliponini*
- Study and bibliographic research on the presence of the *Meliponini* in Costa Rica
- Ethnographic research, through interviews, on traditional methods of beekeeping and meliponiculture .

2. The context

About 20 genera and 59 species of native stingless bees are known in Costa Rica, many of which have great ecological and economic importance (Camargo *et al.*, 2007). However, the excessive exploitation of ecosystems, in particular of forests, is having consequences that are not yet quantifiable on the presence of native stingless bees, which are the most widespread in tropical and subtropical forests (Thompson, 2012). Furthermore, the lack of information on the richness, diversity, taxonomy and distribution of native bees in Latin America is one of the main problems for their conservation (Prendas -Rojas, 2015).
Faced with a scenario of expansion of meliponiculture, for the family economy, but also for tourism and repopulation, research and effective management methodologies are needed that can promote their knowledge and the conservation of their natural habitats.

3. Study area

The study area is located in the Nicoya Peninsula, Costa Rica. The Nicoya Peninsula is the largest in the country, with an area of 5,130 km². It is bordered by the Pacific Ocean and bordered by the Gulf of Papagayo to the north and the Gulf of Nicoya to the east and south. The peninsula is dominated by a landscape of dense tropical vegetation, a consequence of the hot and sub-humid climate. There are many nature reserves, including the Karen Mogensen Reserve.

The "Karen Mogensen Wildlife Refuge Reserve", located in the SE part of the peninsula (Figure 1), is a mountainous area between 9.85 and 9.88 degrees latitude (N) and 85.04 and 85.08 degrees longitude (W). It is part of the biological corridor of the peninsula, thanks to the forest regeneration that took place through the purchase of land by the "Ecological Association of Paquera, Lepanto and Cóbano" (ASEPALECO) and the private donations of the "GEV Modena-Foreste per Sempre ODV Association".

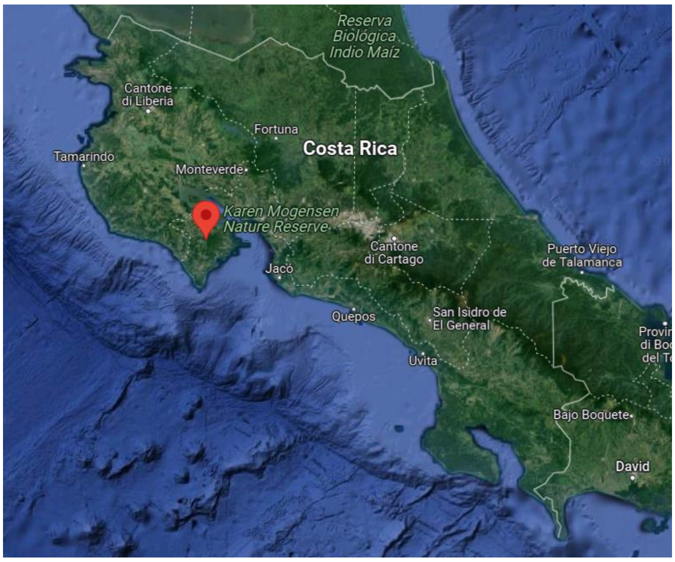


Figure 1. Satellite orthophoto of the area. Source: Google Maps

The reserve covers 1,000 hectares of protected forest. It is mainly a transitional secondary forest with portions of dry forest and portions of moist forest. In fact, next to the extensive dry forest typical of northwestern Costa Rica, the presence of several streams and streams provided the growth conditions for a wet-type forest. Gallery forests are found in some parts of the area. The innermost part of the Karen

Mogensen Reserve has parts of primary forest, with the remainder being result of secondary growth of different ages (from 20 to more than 50 years), partly as a result of the conservation measures adopted since the 1990s, which have promoted the natural regeneration of the soil previously used for grazing livestock and subsistence farming. The lower areas of the Karen Mogensen Reserve show a transition from grassland and grassland to regenerative secondary forest. The Reserve is currently bordered by some cattle pastures and other partially protected or partially unprotected second growth forest areas, covering nearly 12,000 hectares of land.

3.1. Climatic characterization of the study area

The climatic characterization of the reserve is supported by the data obtained from the instrumentation installed at the "Italy-Costa Rica bioclimatic research station", active since 2017, which integrates the data obtained from the Meteoblue station. The air climate is tropical, hot humid with high rainfall. Precipitation in the area is about 2,200 mm of rain per year, concentrated mainly in the rainy season from May to November, with October being the wettest month (up to about 400 mm of rain). Average annual temperatures approach 25°C, with a minimum of 20°C and a maximum of 30°C. The trend, according to historical data of the last 30 years, shows an increase in temperatures in line with the global trend due to climate change, and an interesting correlation can be observed with the cyclical El Niño phenomenon (Figure 2).

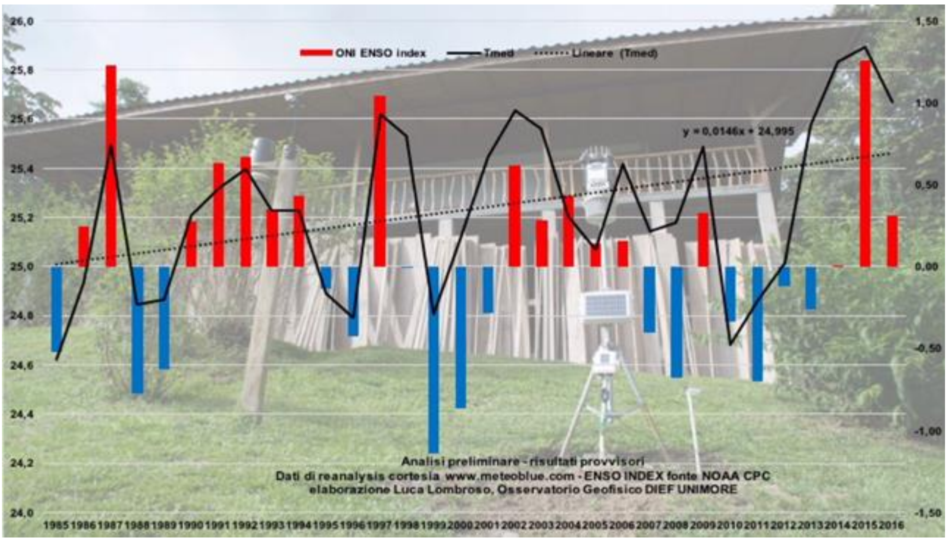


Figure 2. Time series of annual average temperatures from 1985 to 2017 obtained from Meteoblue Re- analysis, with respect to El Niño. Source: Luca Lombroso-https://www.biometeo.org/clima/

4. Materials and methods

The research period included my fixed stay from 7 January to 5 March at the "Italy-Costa Rica Bioclimatic Research Station" and then moved to the area of the province of Puntarenas to carry out ethnoentomological interviews.

4.1. Monitoring, sampling and identification

Between January and March, the period corresponding to the dry season, 15 monitoring were carried out inside the Reserve. Given the extent of the entire reserve, it was decided to carry out monitoring only along the marked paths (Figure 3), for a total of 10 paths covering approximately the entire area.

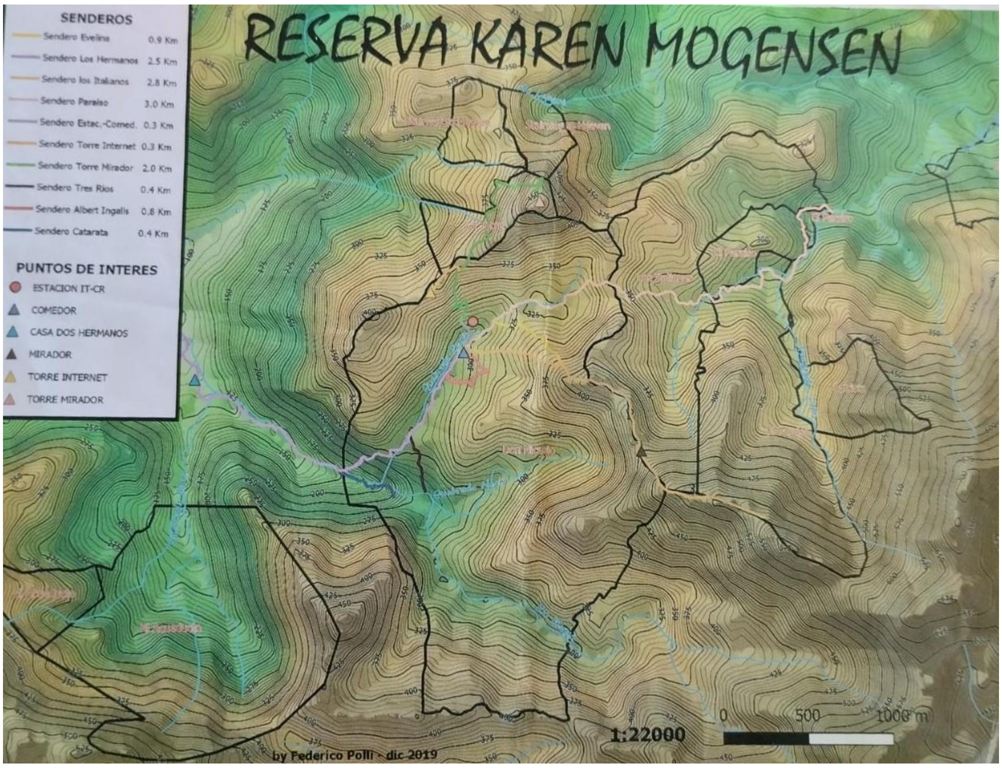


Figure 3. Map of the Reserve

Monitoring focused on the presence of natural nests of stingless bees. Information was collected on the spatial distribution (GPS points, altitude and exposure) and information on the botanical species in which the nest was located and, of course, on the entomological species (Barquero - *Elizondo et al*, 2019). A map of nest distribution was then created with the monitoring data.

Furthermore, the field work involved the sampling of all the species belonging to the *Apoidea superfamily* present in the reserve and their subsequent determination during the entire period of stay. As part of this research, the database was created as follows: collection with entomological tools (nets and containers), microscopic identification and subdivision into families, tribes and species, and archiving of the images. Identification was made using dichotomous keys, scientific guides for the classification of Costa Rican bees and bibliographic material.

4.2. Ethnoentomological research

7 interviews were carried out in the province of Puntarenas to learn about the characteristics of beekeeping and meliponiculture in the country. Thanks to the producers, breeders and associations that participated, a sampling of fundamental data was carried out, based on their knowledge, on beekeeping, but in particular on meliponiculture . A first phase of this survey consisted of open interviews, after which the information obtained was statistically processed. The type of informal and semi-structured interview is illustrated below (Figure 4).

	Interview for the Associations
1	How many members are there?
2	What market is the product intended for?
3	What kind of production is done? What is the quantity?
4	What is the level of preparation of beekeepers?
5	Is there competition between honey from Apis mellifera and Melipona?
6	What is the price paid to producers and the final price of the product?
7	What are the main problems in the field and in the laboratory?

	Interview for Meliponiculturists-Beekeepers
1	How many hives do you have? in how many meliponari?
2	Where are? and how are they arranged? what is the vegetation nearby?
3	Are the hives purchased or handmade?
4	How many species do you have?
5	Were the bees bought or captured?
6	What diseases do you know? did you have any problems?
7	How often do you visit them?
8	How did you learn? Is it your main job?
9	How is the production of each species?
10	When and how is honey produced?
11	What is the price of each type? Who is the honey sold to?
12	How has beekeeping and honey production changed in recent years?

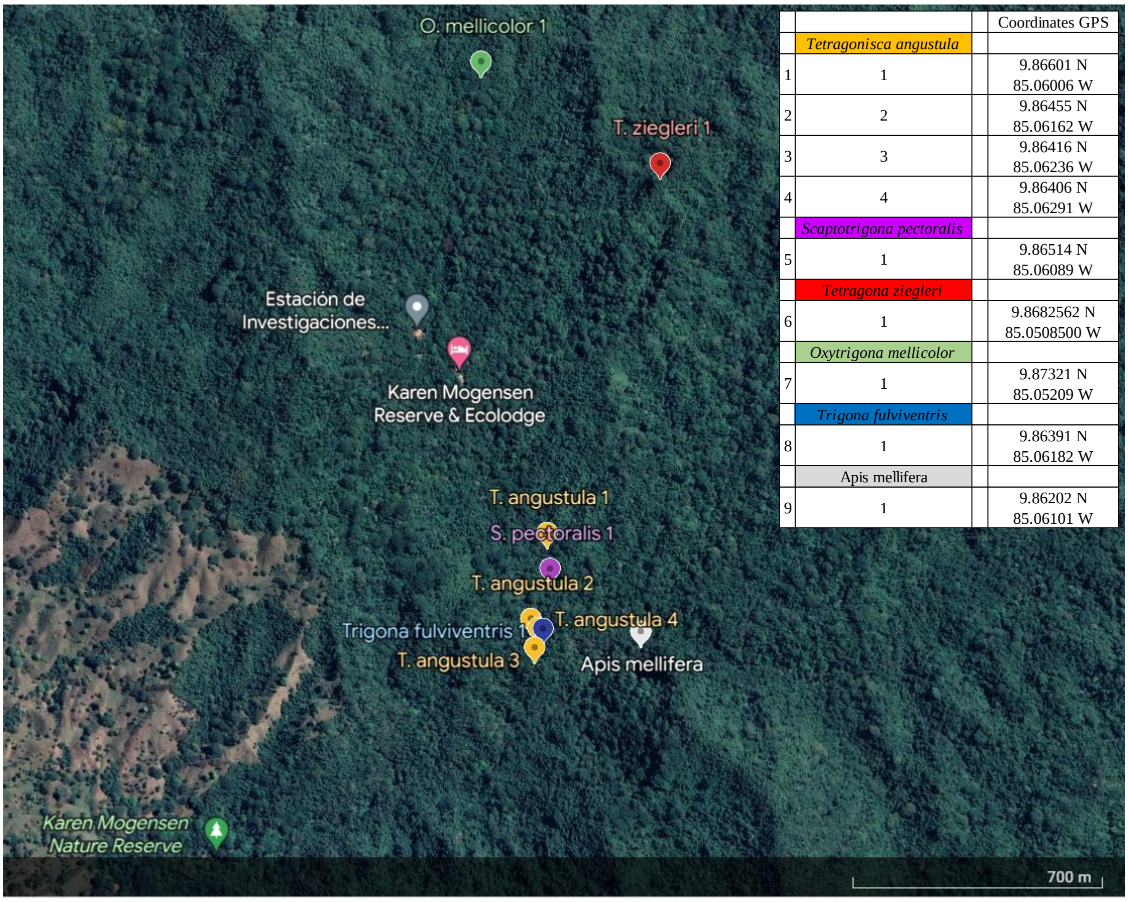
Figure 4. Model of the interviews conducted

4.3. Meliponarium

The research work also included the study and maintenance of the meliponario present in the Reserve. During the two months, the families present, belonging to three different species of stingless bees (*Tetragonisca angustula*, *Melipona beecheii*, *Scaptotrigona pectoralis*), were visited periodically. Their characteristics have been studied and monitored. Transfers of nuclei and maintenance of the hives present were carried out. In addition, traps have been placed along the paths and information material has been produced to facilitate visits to the meliponarium.

5. Results and discussion

- During the monitoring, a total of 9 nests were found, 8 of which belong to the *Meliponini tribe* and one of *Apis mellifera* (Figure 5). The total number of meliponine species detected is 5 (*Tetragonisca angustula*, *Scaptotrigona pectoralis*, *Tetragona ziegleri*, *Oxytrigona mellicolor* and *Trigona fulviventris*). Each species was represented by a single specimen, except for the *Tetragonisca angustula* species for which four nests have been found.



		Coordinates GPS
	Tetragonisca angustula	
1	1	9.86601 N 85.06006 W
2	2	9.86455 N 85.06162 W
3	3	9.86416 N 85.06236 W
4	4	9.86406 N 85.06291 W
	Scaptotrigona pectoralis	
5	1	9.86514 N 85.06089 W
	Tetragona ziegleri	
6	1	9.8682562 N 85.0508500 W
	Oxytrigona mellicolor	
7	1	9.87321 N 85.05209 W
	Trigona fulviventris	
8	1	9.86391 N 85.06182 W
	Apis mellifera	
9	1	9.86202 N 85.06101 W

Figure 5. Nest map

Information on nests is reported in Table 1. In general, the lowest sampling altitude was 206 m asl, while the highest was 414 m asl. The nests were exposed for 37.5 % to NW, for a first 25 % to NE, for a second 25 % to SE and for 12.5 % to W. Except for the nest of *Trigona fulviventris* which, according to literature, was on the ground near the roots of *Coccoloba guanacastensis* (*Polygonaceae*), the remaining nests were found inside trunks of live tree plants. The height of the nests ranged from 0.10 cm to 2.46 m above the ground. Analyzing the botanical species, however, a preference emerged for plants belonging to the *Fabaceae* (37.5 %) and *Moraceae* (37.5 %) families, followed by *Anacardaceae* (12.5 %) and *Polygonaceae* (12.5 %). For the four nest samples of *T. angustula, on the other hand, it is the Moraceae* family (50 %) that is preferred, with the species *Ficus velutina* and *Brosimum Alicastrum*.

			Coordinates GPS	Altitude	Exposure	Height	Position
	Tetragonisca angustula						
1	1		9.86601 N 85.06006 W	254 m	NW	2,46 m	*Ficus velutina* (*Moraceae*)
2	2		9.86455 N 85.06162 W	253 m	NW	0,32 m	*Hymenaea courbaril* (*Fabaceae*)
3	3		9.86416 N 85.06236 W	250 m	NE	0,10 m	*Astronium graveolens* (*Anacardiaceae*)
4	4		9.86406 N 85.06291 W	225 m	W	0,20 m	*Brosimum alicastrum* (*Moraceae*)
	Scaptotrigona pectoralis						
5	1		9.86514 N 85.06089 W	260 m	NE	1,92 m	*Cassia grandis* (*Fabaceae*)
	Tetragona ziegleri						
6	1		9.8682562 N 85.0508500 W	414 m	SE	0,41 m	*Caesalpinia eriostachys* (*Fabaceae*)
	Oxytrigona mellicolor						
7	1		9.87321 N 85.05209 W	319 m	NW	1,70 m	*Brosimum guianense* (*Moraceae*)
	Trigona fulviventris						
8	1		9.86391 N 85.06182 W	255 m	SE	Ground	Near *Coccoloba guanacastensis* (*Polygonaceae*)
	Apis mellifera						
9	1		9.86202 N 85.06101 W	206 m	-	-	-

Table 1. List of nests divided by species

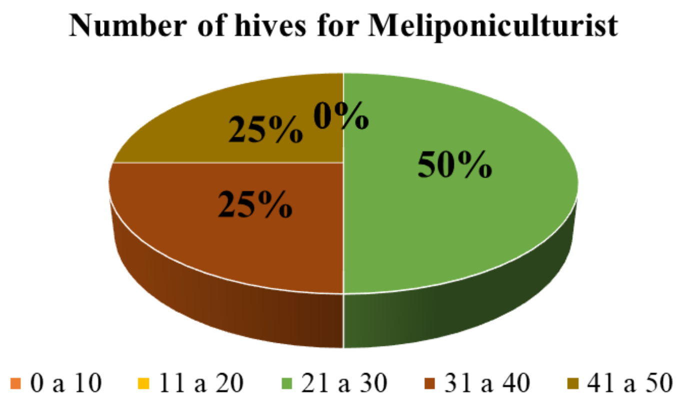
- The census recorded a total of 18 species belonging to the superfamily *Apoidea* and of these, 11 belong to the *Meliponini tribe*. Meliponine species are represented by 7 genera: *Cephalotrigona*, *Dolichotrigona*, *Melipona, Nannotrigona*, *Oxytrigona*, *Scaptotrigona* and *Trigona* (Table 2).

	Order	Superfamily	Family	Tribe	Species	Common name	Reported by
1	*Hymenoptera*	*Apoidea*	*Apidae*	*Apini*	***Apis mellifera***	abeja domestica/abeja africanizada	Verdiana Petroselli & Alexander Bolaños
2	*Hymenoptera*	*Apoidea*	*Apidae*	*Centridini*	***Centris adani***		Verdiana Petroselli & Alexander Bolaños
3	*Hymenoptera*	*Apoidea*	*Apidae*	*Centridini*	***Centris trigonoides***		Verdiana Petroselli & Alexander Bolaños
4	*Hymenoptera*	*Apoidea*	*Apidae*	*Emphorini*	***Melitoma segmentaria***		Verdiana Petroselli & Alexander Bolaños
5	*Hymenoptera*	*Apoidea*	*Apidae*	*Euglossini*	***Euglossa villosa***		Verdiana Petroselli & Alexander Bolaños
6	*Hymenoptera*	*Apoidea*	*Apidae*	*Euglossini*	***Eulaema cingulata***	Abeja anillo negro de orquídea	Verdiana Petroselli & Alexander Bolaños
7	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Cephalotrigona zexmeniae***	Tamagá amarilla	Verdiana Petroselli & Alexander Bolaños
8	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Dolichotrigona schulthessi***	Chupaojos	Verdiana Petroselli & Alexander Bolaños
9	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Melipona beecheii***	Jicote gato/estrella	Verdiana Petroselli & Alexander Bolaños
10	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Nannotrigona mellaria***	Chicopipe	Verdiana Petroselli & Alexander Bolaños
11	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Nannotrigona perilampoides***	Chicopipe	Verdiana Petroselli & Alexander Bolaños
12	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Oxitrigona mellicolor***	Peladora	Verdiana Petroselli & Alexander Bolaños
13	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Scaptotrigona pectoralis***	Soncuano	Verdiana Petroselli & Alexander Bolaños
14	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Trigona (Tetragona) ziegleri***	Miel de leche/Mariolón	Verdiana Petroselli & Alexander Bolaños
15	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Trigona (Tetragonisca) angustula***	Mariola/Mariquita	Verdiana Petroselli & Alexander Bolaños
16	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Trigona corvina***	Enredacabello/Atarrá/Arragre	Verdiana Petroselli & Alexander Bolaños
17	*Hymenoptera*	*Apoidea*	*Apidae*	*Meliponini*	***Trigona fulviventris***	Culo de buey/culo de señora	Verdiana Petroselli & Alexander Bolaños
18	*Hymenoptera*	*Apoidea*	*Apidae*	*Xilocopini*	***Xylocopa fimbriata***		Verdiana Petroselli & Alexander Bolaños
19	*Hymenoptera*	*Apoidea*	*Megachilidae*	*Antidini*	***Anthodioctes costaricensis***		Verdiana Petroselli & Alexander Bolaños

Table 2. List of surveyed species

- The sampling data, compared with the national ones (a total of 20 genera and 59 species), show that 35 % of the genera present throughout the country and 18.6 % of the total species are present within the Reserve. Considering that the monitoring was carried out only along the paths, a further margin of presence must be considered.
- The photographic material of the collected samples can be found in Attachment 1.
- The information obtained from the interviews was divided into the following categories: meliponiculturists, beekeepers and associations.

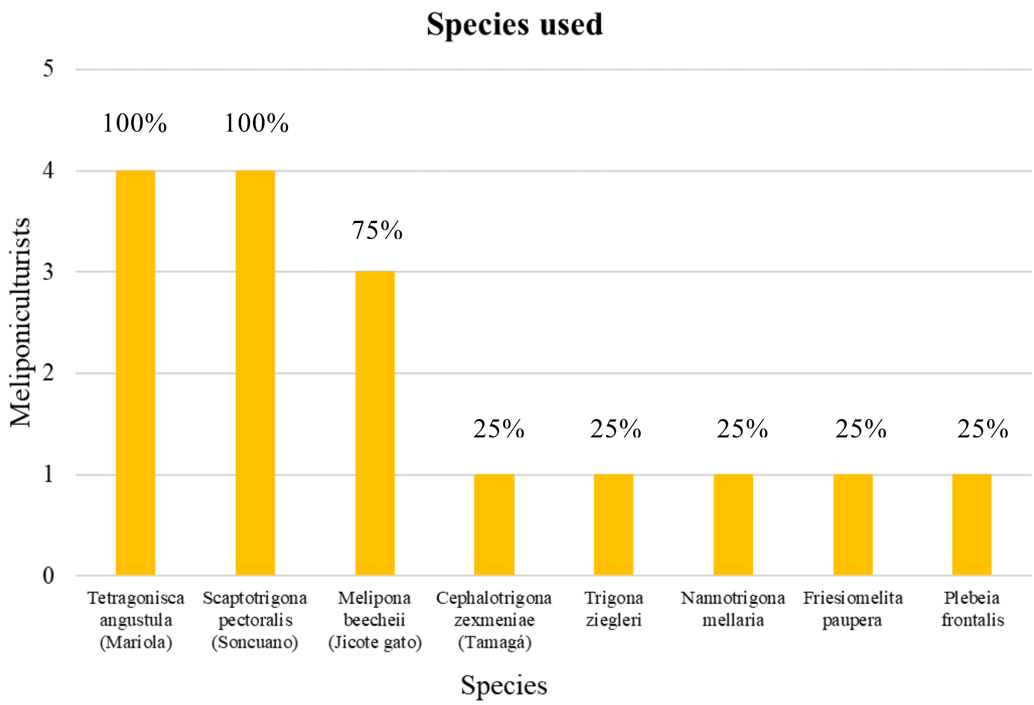
  As regards meliponiculturists, it emerged that most of them (50 %) have a number of families ranging from 21 to 30, while the remaining 25 % have a number of beehives ranging from 31 to 40 and the other 25 % from 41 to 50 (Graphic 1). 75 % of meliponiculturists brought their families together in a meliponarium and 25 % in three different meliponarium.



Graphic 1. Number of hives for meliponiculturist

All meliponiculturists have declared that their hives are in the countryside, near the woods. As regards the hives, 50 % of the beekeepers built them by hand, while the remaining 50 % received them from their own associations.

All the species have been captured and the species raised by the meliponiculturists are 8 in total, but the only ones in common are: *Tetragonisca angustula* (Mariola) and *Scaptotrigona pectoralis* (Soncuano) (Graphic2).



Graphic 2. Number and type of species by apple grower

All meliponiculturists have stated that the main problem for stingless bees is the bug fly (*Pseudohypocera kerteszide*) of the family *Phoridae*.

As far as visits are concerned, based on the answers, it can be seen that there is no standard in frequency, but that it depends on the observation of the entrances to the hives and on any problems that may arise.

All meliponiculturists interviewed raise stingless bees as a second job. 50 % of them achieved current knowledge through experience, while the remaining 50 % received training.

25 % of them raise stingless bees for environmental education and reproduction, while 75 % raise stingless bees for honey production and of these, 50 % are associated with foreign associations.

Honey extraction for stingless bees, as all honey growers confirm, takes place only once a year. Production and prices vary according to the species (Table 3).

Species	Production l/hive/year	Price ₡/l
Tetragonisca angustula (Mariola)	0,50-0,75	50.000-60.000
Scaptotrigona pectoralis (Soncuano)	1,00-2,50	50.000-60.000
Melipona beecheii (Jicote gato)	3,75	not marketed by respondents

Table 3. Production and price of honey for each species

As shown in Table 3, the highest production is that of *Melipona beecheii* (up to 3.75 l/hive/year), then the second most productive species is Soncuano (*Scaptotrigona pectoralis*) with productions ranging from 1 to 2.5 l/hive/year and finally Mariola (*Tetragonisca angustula*) (0.5-0.75 l/hive/year). The price per liter is 50,000-60,000 colones.

Another interesting aspect of this research is that, even though anomalous temperature and rainfall trends have occurred in recent years due to climate change, all beekeepers state that production has increased compared to the beginning. This is explained by the fact that most of them have made improvements in management in recent years and therefore the bees are healthier. This means that, although there is still no standard management for honeybee farming, the recent interest in training and information on this type of farming is already giving its results.

- As for beekeepers, only two were interviewed. One big beekeeper who has 500 hives and one who has 30. Both are professional beekeepers and do this as their first job. From the responses to the interviews it appears that both have placed the apiaries in fields near water sources, with no more than 30 hives per apiary. Both built their own hives and families were captured and reproduced. One, the beekeeper who in addition to having 30 years of experience has also done training courses, said he knew various problems of the *Apis mellifera* such as the varroa (*Varroa destructor*), the nosema (*Nosema apis*) and the *Aethina tumida*; visits the hives every 15 days, collects honey twice a year and manages to produce 40-45 kg per year per hive. The second beekeeper, who only has the knowledge acquired through experience, is only able to recognize the problem of Varroa in the field, produces honey once a year and has an annual production of around 15 kg per hive. Again, we can see how training can make a difference in bee and honey production.

- A final interview was in fact conducted with an association of *Apis mellifera* beekeepers which only welcomes new members if they pass certain prerequisites.

  The association consists of 30 members throughout the Nicoya Peninsula who not only produce honey, but also specialize in select queen rearing and pollination services for agricultural crops.

  From the responses of the association we know that the product is intended for the national market, where only one type of honey is sold. Total production is around 100,000 kg per year, with an average of 6,000 kg per producer. The price to producers is 2,435 colones per kg and the selling price for a one kg jar is 5,000 colones.

  Before being extracted and packaged, the honey is checked to verify its compliance with the established standards, so the analyzes showed that the association has never encountered any health problems in the laboratory. While he reports that Varroa is the biggest problem for the field.

  Apis honey market is not in competition with that of stingless bees, as the former is specialized for food purposes, while the latter is more for medicinal/cosmetic purposes.

  This figure is also confirmed by honey growers, who see most of the production and sale of honey, at higher prices, going to associations that produce medicinal and cosmetic products.
- Attachment 2 contains the information material prepared for dissemination, on *Meliponini* in general and on the species present in the meliponary of the Reserve.

6. Conclusions

This work represents only a first approach to the research of data on native stingless bees, both in the wild and in meliponiculture, concentrated in the province of Puntarenas, in particular in the Karen Mogensen Reserve. Faced with the growing interest in the *Meliponini* tribe, from an ecological, economic, and cultural point of view, it is necessary to encourage research to produce useful material for the understanding and conservation of these bees.

7. Acknowledgments

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