Short communication

Protein bank to feed Cuban melipon livestock in urban areas[1]

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Abstract

Objective: To elaborate a proposal for a protein bank based on the floral preferences of melipon livestock in Cuban urban environments.

Materials and Methods: The study was carried out in two Cuban stingless bee farms, the first one located in Matanzas city, and the second one in Mayabeque. In order to elaborate the protein bank proposal, the results corresponding to the qualitative melissopalynological and palynological analyses of the honey, silage pollen and larval food substrates of the 24 hives selected for the study were analyzed.

Results: The results concerning the pollen type found in the three analyzed substrates showed five plant species of interest for this livestock, which were included in the proposed protein bank. These were: *Mimosa pudica* L. and *Psidium guajava* L. as the main ones, *Vachellia farnesiana* (L.) Wight & Arn. and *Mimosa pigra* L., if they were previously present in the area of establishment of this one and finally *Bursera simaruba* (L.) Sarg. The preference of these bees for the *Fabaceae* family, which is characterized by its great diversity and floral abundance throughout the year, was striking.

Conclusions: The proposal to create a protein bank from the floral preferences of meliponicultural livestock, guarantees the permanent and close supply of this trophic resource (pollen), to satisfy the nutritional protein needs of the hives throughout the year. This, in turn, contributes to reduce the thermal stress suffered by these bees due to the climate conditions of Cuba.

Keywords: honey bee, beehive, pollen

Introduction

Biological systems need nutritional elements that come from a set of foodstuffs supplied through the diet. For the meliponicultural livestock composed of all managed hives of the *Melipona beecheii* Bennett species, surveyed or not, ensiled pollen, honey and larval food are of utmost importance (Lóriga, 2015). Among them, the first is essential for the development of larvae and responsible for their weight gain and the longevity of adult bees (Andrada and Tellería, 2007). The background on the use of trophic resources by bees allows the identification of plant species that provide nectar and/or pollen and, consequently, from these data, the elaboration of floristic lists and phenological calendars that contribute to better hive management by producers (Flores *et al*., 2015).

Although urban environments are characterized by low floristic diversity due to human activity, the mere fact of the development of a sustainable productive activity with meliponicultural livestock in urban areas constitutes a solution to the problem posed in Cuba by the prohibition of having *Apis mellifera* L. at a minimum distance of 5 km from the city limits (MINAGRI, 2013). However, this environment poses additional challenges for colony sustainability. That is why the objective of this work was to elaborate a proposal for a protein bank based on the floral preferences of melipon livestock in Cuban urban environments.

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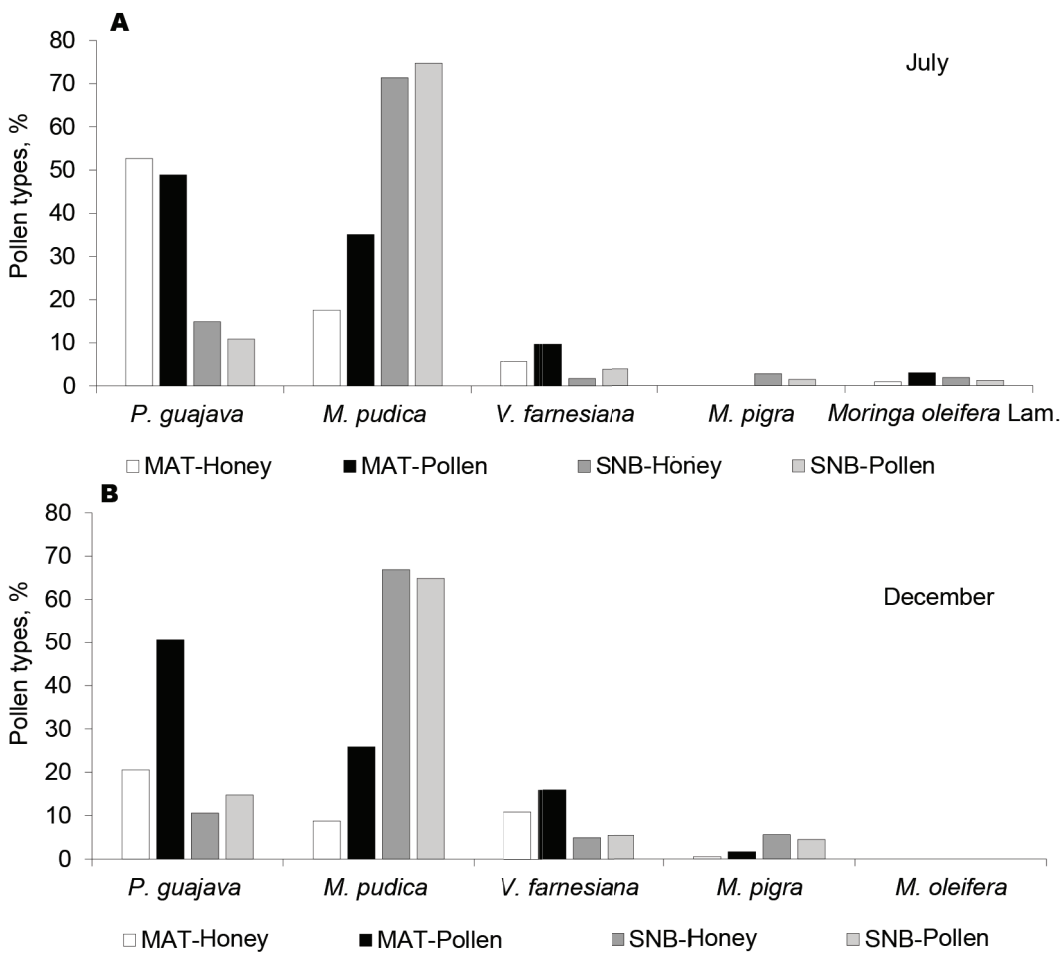
Materials and Methods

Location. The study was carried out in the Cuban meliponaries identified by the acronyms MAT and SNB. The former is located in the Reynold García neighborhood, in Matanzas city (23°02'25'' N and 81°30'58'' W, 14 m.a.s.l.); while the latter, in the North Popular Council of the San Nicolás de Bari town, Mayabeque (22°47'13'' N and 80°55'05'' W, 34 m.a.s.l.). Both are located in a peripheral urban environment.

Experimental procedure. The selection of the plant species that constitute the proposed protein bank was made on the basis of the dominant pollen types observed in the qualitative melissopalynological and palynological analyses of the substrates honey, ensiled pollen and larval food in the samplings carried out in July and December, 2019, to the 24 randomly selected hives, 12 in each locality for this study.

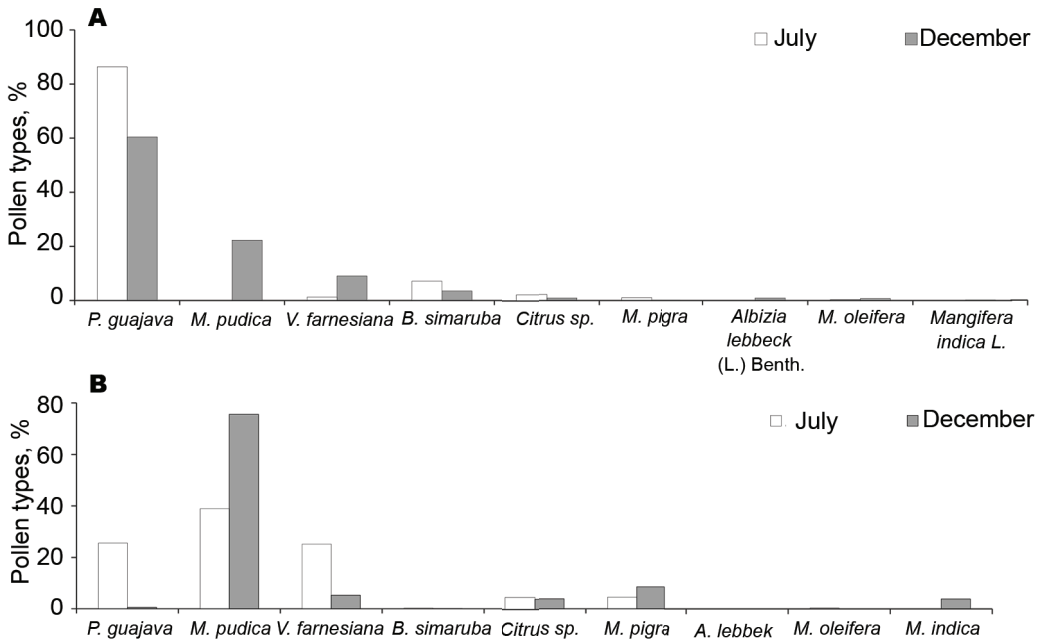
Results and Discussion

According to the predominant pollen types (mean percentage) in the substrates honey, ensiled pollen (figure 1) and larval food (figure 2), in the samplings carried out in July and December in both meliponaries (MAT and SNB), the species that stood out the most, in general, was *Mimosa pudica* L., reported as a source of pollen for bees of the genus *Melipona* Illiger 1806 in Colombia (Rodríguez-Calderón, 2006), in Costa Rica (Landaverde *et al*., 2006) and in other neotropical habitats. In Cuba, previous studies by Leal-Ramos and Sánchez (2013), showed high frequency of the pollen type of



MAT: Meliponary located in the Reynold García neighborhood, in the city of Matanzas; SNB: Meliponary located in the North Popular Council of the of San Nicolás de Bari town, Mayabeque.

Figure 1. Predominant pollen types in honey and ensiled pollen from the MAT and SNB meliponaries, in the July (a) and December (b) samplings.



MAT: Meliponary located in the Reynold García neighborhood, Matanzas city; SNB: Meliponary located in the North Popular Council of the San Nicolás de Bari town, Mayabeque.

Figure 2. Mean percentages of pollen types in larval food, meliponaries MAT (a) and SNB (b), sampled in July and December.

M. pudica, which constituted the highest cumulative percentage of the collection. *Psidium guajava* L., *Vachellia farnesiana* (L.) Wight & Arn. and *Mimosa pigra* L. also stood out, which were found at both times of the evaluated year.

Secondly, the species *P. guajava* was observed, which is a plant reported as a source of pollen and nectar for several species of stingless bees, and in Cuba its pollen has been found in 90 % of the studied samples (Pérez, 2016). However, it is not recognized as an important polliniferous plant for *A. mellifera* (Pérez-Piñeiro, 2007, Verde *et al*., 2013); although it is frequently observed collecting pollen on this species.

These findings support the proposal to establish a protein bank (table 1) to satisfy the trophic demands of Cuban stingless bee livestock in these two meliponaries, located in urban areas where five plant species of interest for this livestock are contemplated, such as *M. pudica* and *P. guajava* as the main ones and that occasionally would be complemented with the presence of others, such as *V. farnesiana* and *M. pigra*, which together would allow covering a good part of the protein needs throughout the year (Lóriga *et al*., 2020). It is important to note that the last two are included in the protein bank because of their contributions, but they are used if they are previously present in the area of establishment.

Barquero-Elizondo *et al*. (2018) state that the *Fabaceae* family is characterized by its great diversity and floral abundance throughout the year,

Table 1. Proposed protein bank for Cuban meliponicultural livestock (*M. beecheii*), based on five botanical species.

Species/month	J	F	M	A	M	J	J	A	S	O	N	D
M. pudica												
P. guajava												
B. simaruba												
V. farnesiana												
M. pigra												

which makes it a stable food source. In addition, the seeding of live poles of *B. simaruba*, although it does not have prolonged flowering (Aguilar-Cabrera *et al*., 2019), would incorporate a small-grained pollen (25 µm), surely very attractive and whose presence was observed, especially in the July larval food samples in MAT. The seeding of this last species has been carried out for some time by the Cuban Beekeeping Company (APICUBA, 2021).

Another aspect to take into account in the location of the protein bank is the proximity to the meliponary, since according to Souza-Junior *et al*. (2020), the thoracic temperature of foraging bees usually exceeds the ambient temperature by several degrees. Thus, in warm tropical climate zones, individuals may reach body temperatures close to their critical thermal maximum values, which could limit their activity. The results of the study conducted by these authors on the stingless bee species *Melipona subnitida* Ducke, which inhabits the warm regions of the Brazilian tropical dry forest, showed that foraging bees suffer from overheating of the head and abdomen rather than the thorax when foraging in high temperatures at distant feeding sites. Thus, heat stress increases with flight distance under these climate conditions and, consequently, bees must feed close to the nest.

Conclusions

The proposal to create a protein bank from the floral preferences of the stingless bee livestock of the meliponaries, guarantees the permanent and close supply of this trophic resource (pollen), to satisfy the protein nutritional needs of the hives throughout the year and thus increase their productivity. Moreover, establishing this protein bank in areas close to the meliponary contributes to reduce the thermal stress suffered by these bees under the climate conditions of the country.

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Conflict of interests

The authors declare that there is no conflict of interests among them.

Authors' contribution

- Leydi Fonte-Carballo. Execution of the experiments and drafting of the manuscript.
- Jorge Demedio-Lorenzo. Research advisory and participation in the interpretation of the results.
- Walberto Lóriga-Peña. Research advisory.
- Mildrey Soca-Pérez. Research advisory.
- Dariel Morales-Querol. Standardization of the used protocols.
- Nancy Altunaga-Pérez. Standardization of the used protocols.
- Yudit Lugo-Morales. Collaboration in the experimental stages.

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