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Stingless Bee Honey: An Integrative Review on Its Physicochemical Characterization

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Abstract: Meliponiculture is widespread in all regions of Brazil since the biodiversity of the Brazilian flora makes it possible to obtain honey from different blooms, during all months of the year, with unique colors, aromas, and flavors. The aim of this study is to present the physical-chemical characteristics of honey produced by native bees and evaluate its quality as a commercial product. The research is descriptive and quantitative in nature, using a narrative literature review to examine the physical-chemical characteristics and quality of honey from native bees. The literature review revealed that the average humidity was 23.2%, while the free acidity and ash content ranged from 71.68-81.01 mEq kg^{-1} and 0.9-1.41%, respectively. The research concludes that utilizing honey produced by native bees in studies can bolster rural development and enhance the quality of honey generated by family producers. Additionally, it can aid public officials in devising policies aimed at augmenting the production of stingless bee honey in the country.

Key words: native bees, quality control, meliponiculture

1. Introduction

Stingless bee honey is a type of food produced by stingless bees. It is made from the nectar of flowers or secretions coming from living parts of plants or from excretions of sap-sucking insects that live on the portions of plants. The bees collect these substances, transform them, add their own specific ingredients, and then store them in hive jars to mature [1].

According to Pereira (2005) [2], there are over 400 known species of stingless bees in Brazil, which display great variation in terms of color, size, shape, nesting habits, and nest population. Some adapt to management others do not. Although advantageous, the rational breeding of these bees is hindered by the limited availability of biological and zootechnical information, as many have not even been identified to the species level.

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It is important to highlight that, in current bee farming, the two main lines of study are Beekeeping and Meliponiculture. Recently, Meliponiculture has gained attention due to the unique flavor and aroma of meliponid honey, despite its low productivity, which greatly enhances this product in the market [3].

In this sense, it is crucial to evaluate the quality of honey to provide support activities that would assist both small and large producers in their development. These activities should prioritize the entire honey production chain, from the field to its commercialization, in addition to guiding public managers in planning and actions that will contribute to monitoring quality and guaranteeing a safe product. The purpose of this literature review was to present the physicochemical characteristics of native bee honeys and their quality as a commercial product.

2. Objective

Based on the research question motivating this investigation, the objective was to compare the

physical-chemical characteristics of native bee honey, as well as their quality as a commercial product. The methodological resource for developing the research was a narrative literature review. The search for works to be consulted does not follow explicit and/or systematic criteria, such as literature reviews of the types: integrative review and systematic review. According to Cordeiro et al. (2007), a narrative-type literature review "doesn't necessarily have to exhaust [all] sources of information" or use "sophisticated and exhaustive search strategies". Regarding the selection of studies and the interpretation of information, these "may be subject to the subjectivity of the authors". This type of methodology is quite "suitable for the theoretical foundation of articles, dissertations, theses, course completion works", among others.

3. Development

Santos et al. (2017) [4] evaluated the physicochemical characteristics of honey from *Frieseomelitta trichocerata* bees produced in a meliponary located in the state of Roraima. They found that the average humidity of the honey was 23.2%. However, upon comparing this result to the maximum humidity limit of 20% set by Brazilian legislation for monitoring honey quality [5, 6], it's clear that the current law doesn't match the humidity characteristics of the honey evaluated.

Lira et al. (2014) [3] evaluated meliponine honey and found that it had a higher percentage (ranging from 23-29%) than the maximum allowed (20%) by Brazilian law for *A. mellifera* honey [5]. This difference is probably due to the different plants visited, which has already been verified by Silva (2009) [7], who observed that in plants where *Apis* is present in the nectar collection, *Melipona* was not found. Furthermore, the amount of water in meliponine honey is the main difference between this product and *Apis mellifera* honey, as shown in several studies [3]. However, the humidity content of honey is one of its most important characteristics. It directly influences the viscosity, specific weight, maturity, crystallization, flavor, palatability, and conservation of the product [8].

On the other hand, according to Lira et al. (2014) [3], the acidity levels of meliponine honey for *Scaptotrigona* sp. and *T. angustula* were found to be 81.01 and 71.68 mEq kg^{-1}, respectively, which is higher than the permitted levels for Africanized bee honey [5]. Honey produced by stingless bees has different physical-chemical characteristics, such as high acidity and humidity, when compared to honey from *Apis mellifera*, produced on a large scale in Brazil.

The ash content in honey samples analyzed by Santos et al. (2021) [9] ranged between 0.09 to 1.41%. According to Gois et al. (2013) [10], the minerals present in honey are reflected in the ash content. The ash content also influences the color of honey, with darker honey having a higher concentration of minerals. However, the proportion of minerals can vary due to factors such as the floral origin of the honey, region, bee species, and the type of management used.

According to a study conducted by Oliveira and Santos (2011) [11], *S. bipunctata* honey had an average reducing sugar value of 60.01±1.15%, with a range of 58.14 to 61.35%. The authors observed that all samples of native bee honey presented reducing sugar values above those recommended by legislation, which is at least 65 g/100 g of honey.

Based on a study by Lira et al. (2014) [3], the reducing sugar levels in honey from straw bees (*Scaptotrigona* sp.) were between 50.95% to 58.69%, while those from jatái bees (*T. angustula*) were between 62.30 to 64.60%. The average result obtained for both types of honey is within the parameters required for *Apis* honey, which has a minimum limit of 65% [5]. According to literature data, melipona honey has a lower sugar content (70%) and a sweeter taste [12].

The reducing sugars present in honey are glucose and fructose they can reduce copper ions in an alkaline solution. Native bee honey has a lower sugar content

and a sweeter flavor. The fructose will favor the sweetness of the honey, and the glucose will act in the crystallization. Honey with high fructose levels may remain for years or may never crystallize [13].

As per Santos (2021) [9], all honey samples analyzed showed an acidic character, which is typical of honey. The pH values obtained during the first month ranged from 3.05 to 3.91, during the second month they ranged from 3.05 to 4.02, and during the third month, the range was from 3.05 to 3.97. However, there were no significant variations between the samples within these three months. In contrast, the results found by Silva (2018) [14] varied between 3.68 and 4.16. Similarly, Carvalho et al. (2005) [15] reported pH values ranging from 3.15 to 3.83. It's important to note that the pH levels of honey are influenced by its botanical origin. Generally, the pH is lower than 4.0 for honey of floral origin and higher than 4.5 for honeydew honey. Thus, it can be seen that the honeys analyzed come from floral origins.

4. Conclusion

The research data, collected from studies conducted with honey from native bees, can directly support activities and rural development, guiding public managers towards planning and actions that contribute to monitoring the quality of honey, and ensuring the achievement of a safe food.

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