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ORIGINAL

The Impact of Producers' Knowledge of Meliponini Bees on Colony Health and Productivity

El impacto del conocimiento del productor sobre las abejas Meliponini en la salud y productividad de las colonias

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ABSTRACT

This study explores the Meliponini bee production system as a crucial component in the preservation of tropical ecosystems and sustainable agricultural production. Through research in Florencia (Caquetá, Colombia), the interactions between traditional knowledge and the management practices of producers are analyzed, with an emphasis on how technical training and institutional support affect the health and productivity of the colonies. Using a mixed-methods approach, the research aims to identify the key factors that determine the functionality and sustainability of this production system, highlighting the importance of technical training, institutional regulation, and the link between bees and agriculture. The results reveal that the success of meliponiculture depends on the integration of technical knowledge, appropriate management practices, and public policies that promote the development of the activity. Furthermore, it is concluded that the synergy between these elements is essential to ensure the future viability of meliponiculture in rural communities, promoting both the well-being of native species and the economic and ecological development of the region.

Keywords: Meliponini; Meliponiculture; Sustainability; Beekeeping Management; Technical Training.

RESUMEN

Este estudio explora el sistema de producción de abejas meliponini, como un componente crucial en la preservación de los ecosistemas tropicales y la producción agrícola sostenible. A través de una investigación en Florencia (Caquetá, Colombia); se analizan las interacciones entre los conocimientos tradicionales y las prácticas de manejo de los productores, esto con énfasis en cómo la capacitación técnica y el respaldo institucional afectan la salud y productividad de las colonias. Utilizando un enfoque metodológico mixto, la investigación busca identificar los factores claves que se determinan la funcionalidad y sostenibilidad de este sistema productivo; destacando la importancia de la formación técnica, la regulación institucional, el vínculo entre las abejas y la agricultura. Los resultados revelan que el éxito de la meliponicultura depende de la integración de conocimiento técnico, prácticas adecuadas de manejo y políticas públicas que favorezcan el desarrollo de la actividad. Asimismo, se concluye que la sinergia entre estos elementos es fundamental para asegurar la viabilidad en el futuro de la meliponicultura en las comunidades rurales, promoviendo tanto el bienestar de las especies autóctonas como el desarrollo económico y ecológico de la región.

Palabras clave: Meliponini; Meliponicultura; Sostenibilidad; Manejo Apícola; Capacitación Técnica.

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INTRODUCTION

The production system of Meliponini bees is far from just a profitable economic activity; it is a bridge between nature and rural communities. These silent, stingless bees are key elements in the balance of tropical ecosystems; various studies have highlighted their vital role in the reproduction of native plants, emphasizing that preserving these bees is essential to maintaining biodiversity in tropical areas.[1] In reality, their ability to pollinate particular flowers that other species cannot do transforms them into silent custodians of the natural balance.

From an economic point of view, meliponiculture not only generates honey with a high medicinal value but also has a direct influence on the efficiency of agricultural production; research has indicated that crops located next to meliponaries experience higher rates of pollination, this has a favorable impact on agricultural productivity.[2]This symbiotic connection between bees and agriculture has been widely documented in the scientific literature, underlining the interrelationship between these elements for the sustainable progress of rural communities. Another essential factor is the role of public policy and institutional support. Current research, technical training, and institutional support are crucial elements for the success of meliponiculture.[3] Producers with access to technical resources and specialized knowledge can better adapt to environmental challenges, thus ensuring the sustainability of the production system.

This study aims to investigate the crucial elements in the functioning of the Meliponini bee production system, taking into account the complexity of the ecological, economic, and institutional interactions that underpin it. The viability of this system is primarily based on the synergy between conventional knowledge, technical support, and industry-oriented public policies.

METHOD

Location

The research was carried out in Florencia, the capital of the department of Caquetá, Colombia. This city is located at coordinates 1°36′15″ North latitude and 75°37′12″ West longitude, at an average altitude of 335 meters above sea level. Located about 50 kilometers from the Amazon region, Florencia acts as a key administrative and commercial node, offering access to resources for local producers. The company Árbol & Miel stands out within this area, a collective dedicated to meliponiculture and promoting sustainable practices.

Population and sample

Population

The study focused on the melatonin bee producers in Árbol Miel. This collective brings together small producers from Florencia, Caquetá, committed to conserving biodiversity and sustainable development. The organization seeks to strengthen the production and commercialization of honey and other products derived from stingless bees, integrating traditional and modern techniques into its management practices.

Sample

Producer members of Árbol & Miel willing to participate in the research were selected. This criterion ensures the collection of direct and relevant information on the challenges, production dynamics, and the impact of the producers' knowledge on the sustainability and functionality of the production system.

Research paradigm: Mixed.

The paradigm used was mixed, combining qualitative and quantitative methods. This approach allows for a comprehensive understanding of the phenomenon studied. According to [4] the combination of methods facilitates a broader and more detailed analysis, integrating both the producers' experiences and quantitative data relevant to the production of Meliponini bees.

Type of research: Explanatory.

The research was classified as explanatory, focusing on identifying cause-and-effect relationships between institutional and productive variables. This type of study is fundamental for understanding how these factors influence the functionality of the melatonin bee production system. [5] emphasize that explanatory research allows for exploring the causes and consequences of phenomena, providing an in-depth view of the interactions between the variables studied.

Approach: Historical-hermeneutic.

The historical-hermeneutic approach was adopted, which is ideal for exploring the evolution and historical context of meliponiculture and interpreting the producers' perceptions and experiences. This approach, based on [6] emphasizes the interpretation of meanings and experiences, providing an enriched understanding of the social and cultural dynamics that frame the productive activity.

The method

Analyze how the producer's knowledge of Meliponini bees affects the health and productivity of the colonies. (Examine how the producer's knowledge of Meliponini bees impacts the health and productivity of the colonies)

The interview tool will be used to gather the required information. Conducting interviews with Meliponini bee producers will be crucial to understanding how their knowledge, experience, and the health of these bees contribute to the productivity of the

colonies. Through this interview, we want to obtain valuable information on management practices, identification of problems, and solutions implemented in the production process. By exploring the producers' understanding of aspects such as bee biology, disease management, and the use of local resources, it will be possible to identify correlations between their knowledge level and the colonies' performance. This will contribute to improving current practices and enable the design of more effective training programs, thus promoting the sustainability of meliponiculture in the region.

RESULT

The term "production" is related to terms such as "breeding," "system," and "material," which shows the relevance given to management techniques and the resources used in meliponiculture; previous research has emphasized that the success of this activity is based on the implementation of correctly established strategies, including the creation of appropriate boxes for stress management in the colonies.[7] Furthermore, the production of honey and its derivatives seems to be at the center of the production system, with an interest in optimizing both the quality and the quantity of the product. Expressions such as "fear," "problem," and "impact" represent the most significant challenges perceived by producers. Specifically, these concerns may be linked to environmental effects, decreased biodiversity, and threats to colonies caused by external elements such as pests or predators. According to [8] habitat degradation and the use of pesticides are some of the most critical factors affecting the health of Meliponini bees.

Using terms such as "training, strengthening, and law" has indicated the need for institutional and technical support for producers, according to [9] training programs are fundamental for optimizing management practices and ensuring the viability of the productive system. Additionally, incorporating terms such as "law and license" indicates a concern for the regulation and formalization of the activity. This issue has become critical in nations where beekeeping is beginning to be recognized as an important economic activity. The emphasis on words such as "future, increase and strengthening" reflects an optimistic but cautious view of the development of the activity. According to [10] who highlights the potential of beekeeping to contribute to sustainable development in tropical regions, adequate support policies are implemented. In conclusion, the word cloud emphasizes a mixture of fundamental issues in meliponiculture: production, the challenges faced, the demand for institutional support, and the future outlook for the activity. These findings align with the existing literature, highlighting the relevance of addressing technical and environmental challenges while promoting sustainable development through training and defined policies. [18,19,20]



Figure 1. Word cloud on the production of meliponini bees

Sankey diagrams

Producers face considerable challenges during the early stages of meliponiculture, particularly in the technical management of the colonies. According to [10] in their study conducted in Mexico, "the proper management of native bee colonies requires a thorough knowledge of the biology of the species and particular breeding techniques." This is consistent with the technical guidance and management challenges presented in the graph; the constant progress in beekeeping production is closely linked to the training and strengthening of producer communities.

In this sense [11] found that systematic training programs increase productivity by 40 % among traditional Brazilian meliponiculture producers. Legality and the regulatory framework also play a crucial role, as demonstrated by [7] when analyzing the impact of licenses and regulations on the development of sustainable meliponiculture.

Working with local bees poses specific challenges that require a particular approach. Recent studies by [12] have shown that the success of reproduction in these species is directly linked to the producers' training level and the implementation of locally adapted methods. This is manifested in the need to implement programs of constant technical guidance.[20,21,22,23,24]

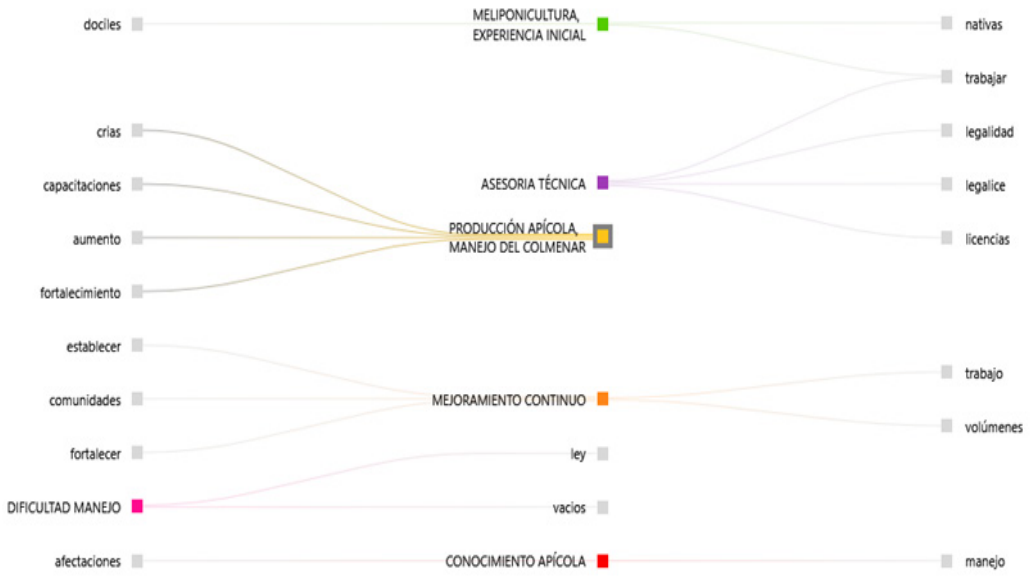


Figure 2. Conceptual map of beekeeping production and apiary management

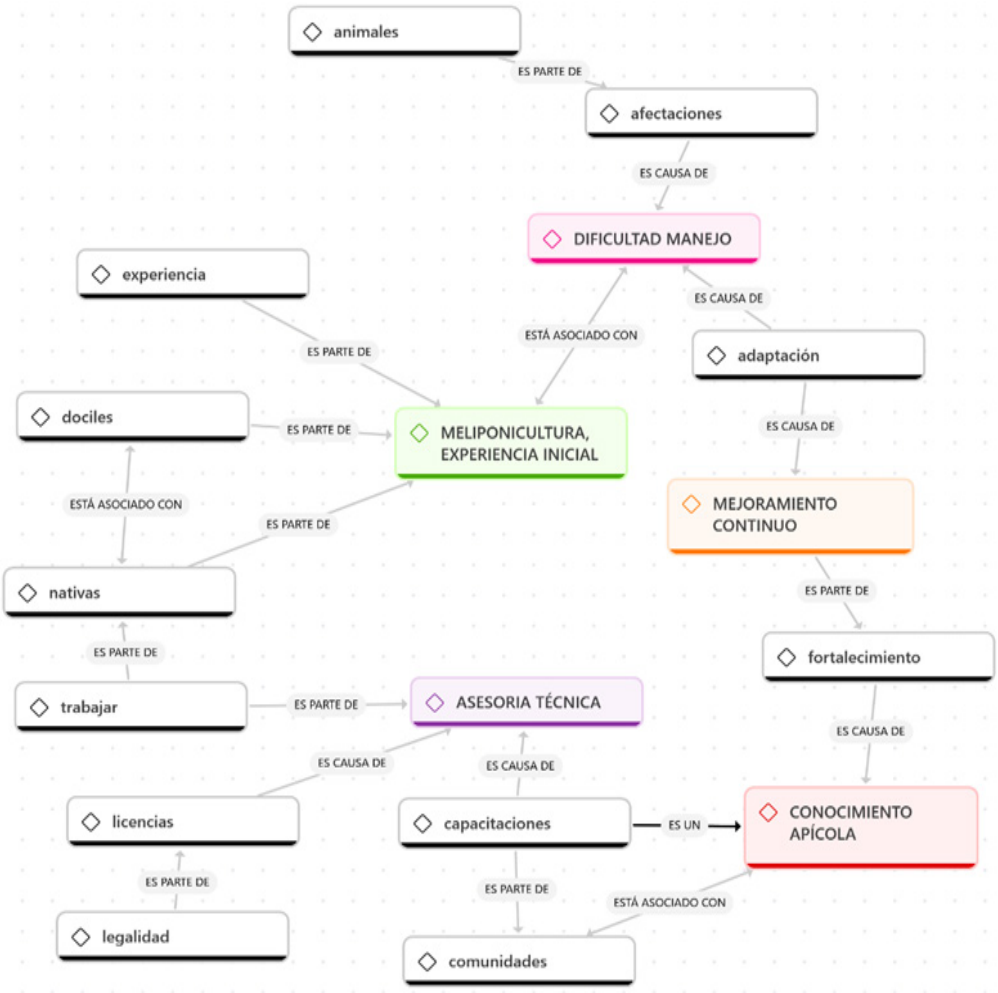


Figure 3. Concept map of meliponiculture and its components in the initial experience

Codes (networks)

When examining meliponiculture in its initial phase, the importance of understanding the connections between various elements becomes clear. Studies by [13] indicate that working with native bees poses unique challenges in management, mainly due to the biological characteristics of these species and the need to adapt traditional methods. The complexity of management is directly related to the diseases these animals can suffer. According to [12] a lack of initial experience can cause significant problems for the

colony, highlighting the importance of training and technical guidance in the early stages of the process.

The extent of beekeeping knowledge and its link to communities has been extensively analyzed. According to the study by [11] strengthening melipona farming communities is directly related to participation in structured training programs and constant technical monitoring. Within the legal and licensing context, these emerge as essential components for the sustainable progress of meliponiculture. According to [14,15,16,17] an appropriate regulatory framework enables the formalization of the activity and promotes access to resources and programs for continuous improvement.

CONCLUSIONS

Initial meliponiculture represents a complex system in which the interaction between technical knowledge and practical experience is fundamental to the activity's success. Far from being insurmountable obstacles, management difficulties act as catalysts for developing adaptive capacities and strengthening beekeeping knowledge.

The role of communities stands out as a crucial component of this process, in which the imparting of knowledge and constant improvement merge to generate a beneficial cycle for learning. Technical guidance, rather than merely transmitting knowledge, is shown to be an essential link between tradition and innovation, facilitating the transformation of ancient practices into more effective and sustainable techniques. Ultimately, for meliponiculture communities, success in meliponiculture is not based solely on technical knowledge. It lies in the ability to harmoniously combine social, economic, and environmental elements in sustainable development that benefits producers and the native species they protect.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

CONTRIBUTION OF AUTHORSHIP

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