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PEDAGOGICAL DIDACTIC MELIPONARY

MELIPONÁRIO DIDÁTICO PEDAGÓGICO

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Abstract: Currently, several studies have reported the decline of numerous pollinators, especially bees, which are responsible for pollinating approximately 85% of floral species in the environment. In this way, the Meliponário project of UNIMONTES was created with the function of subsidizing the optional discipline of the Zootechnics course - "Creation of Meliponines", complementing the practices of the Beekeeping discipline and conserving and preserving native bees, encouraging the product to the producers and high school and elementary school students as Environmental Education work. The project was developed at the State University of Montes Claros in 2015, taking shape over the years, currently it has 15 (fifteen) boxes, of which 15 (fifteen) species of Jatais, 3 (three) Irais and 2 (two) Tubunas, and a hotel for solitary bees and several hollow cavities (trunks and hollow bamboos) for nesting solitary species. Visitors and students, when visiting the site, are able to identify and compare common species in the region, in addition to having information about the benefits they play in the ecosystem and information about their nesting habits. The exhibition focused on aspects of nesting, therapeutic products, nutrition, honey extraction and bee management.

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Keywords: Students, Stingless bees, Conservation, Extension.

Resumo: Atualmente diversos estudos tem relatado o declínio dos inúmeros polinizadores, principalmente o das abelhas, que são responsáveis pela polinização de aproximadamente 85% das espécies florais existentes no meio ambiente. Dessa forma, o projeto do Meliponário da UNIMONTES foi criado com a função de subsidiar a disciplina optativa do curso de Zootecnia – "Criação de Meliponíneos", complementar as práticas da disciplina de Apicultura e conservar e preservar as abelhas nativas, incentivando o produto os produtores e alunos o ensino médio e fundamental como trabalho de Educação Ambiental. O projeto foi desenvolvido na Universidade Estadual de Montes Claros em 2015, tomando forma com o decorrer dos anos, atualmente o mesmo conta com 15 (quinze) caixas, sendo que destas, 15 (quinze) espécies de Jatais, 3 (três) Irais e 2 (duas) Tubunas, e um hotel para abelhas solitárias e várias cavidades ocas (troncos e bambus furados) para a nidificação de espécies solitárias. Os visitantes e alunos ao visitarem o local, conseguem identificar e comparar espécies comuns da região, além de terem informações sobre os benefícios que as mesmas desempenham no ecossistema e informações sobre os seus hábitos de nidificação. A exposição enfocou aspectos da nidificação, produtos terapêuticos, nutricional, extração de mel e manejo das abelhas.

Palavras-chave: Alunos, Abelhas "sem ferrão", Conservação, Extensão.

Resumen: Actualmente, diversos estudios han reportado el declive de los numerosos polinizadores, principalmente el de las abejas, que son responsables de la polinización de aproximadamente el 85% de las especies florales existentes en el medio ambiente. De esta forma, el proyecto del Meliponario de la UNIMONTES fue creado con la función de subsidiar la disciplina optativa del curso de Zootecnia – "Creación de Meliponíneos", complementar las prácticas de la disciplina de Apicultura y conservar y preservar las abejas nativas, incentivando a los productores y alumnos de la enseñanza media y fundamental como trabajo de Educación Ambiental. El proyecto fue desarrollado en la Universidad Estatal de Montes Claros en 2015, tomando forma con el transcurso de los años, actualmente el mismo cuenta con 15 (quince) cajas, siendo que de estas, 15 (quince) especies de Jatais, 3 (tres) Irais y 2 (dos) Tubunas, y un hotel para abejas solitarias y varias cavidades huecas (troncos y bambúes perforados) para la nidificación de especies

solitarias. Los visitantes y alumnos al visitar el local, consiguen identificar y comparar especies comunes de la región, además de tener información sobre los beneficios que las mismas desempeñan en el ecosistema e información sobre sus hábitos de nidificación. La exposición enfocó aspectos de la nidificación, productos terapéuticos, nutricionales, extracción de miel y manejo de las abejas.

Palabras clave: Alumnos, Abejas "sin aguijón", Conservación, Extensión.

INTRODUCTION

Bees are insects that belong to the order Hymenoptera, superfamily Apoidea, and subgroup Anthophila (SILVA et al. 2014). Among their main beneficial characteristics, one can cite the production of honey and the pollination of floral species (SANTOS, 2010). Among the numerous tribes belonging to the order Hymenoptera, one draws attention, which is the tribe Meliponini, as it is characterized by the presence of an atrophied stinger (defense mechanism). Another point that draws attention is the large number of species that can be found widely distributed across all continents, encompassing tropical, subtropical, and temperate regions, with the largest proportions in Latin America. It is divided into 31 genera, with five of them based on fossils (*Creptotrigona Engel, Kelneriapis Sakagami, Liotrigonopsis Engel, Meliponorytes Tosi*, and *Proplebeia Michener* (MICHENER, 2007; SOUZA, MENEZES, and FLACH, 2021).

Stingless bees, since the dawn of humanity, have played an important sociocultural role. The rational rearing of these bees has always had as its main attraction the use of meliponine products and their economic valuation. However, these bees play an even more important role in ecosystems, that of pollinating most angiosperms (ROUBIK, 1989). Stingless bees, in addition to having species that can be reared by humans, have the advantage over other pollinators of sociability (they have an atrophied stinger), facilitating their handling.

The foraging carried out by many individuals (2,000 to 3,000) from the same swarm, and generally on similar plants (FREE, 1980), allows for more efficient pollination. Among bees, it is estimated that meliponines are the main responsible for pollination in natural conditions. The rearing of stingless bees in rational hives, in addition

to preserving these swarms from increasing anthropogenic threats, facilitates their study, allowing the monitoring of family development.

Due to their dependence on floral resources, bees have many adaptations to location and collection, and in visiting flowers, they inadvertently promote pollination. Therefore, their conservation and preservation function as bioindicators of environmental quality. The efficiency of this group of bees in pollination is related to the dependence on floral resources from the larval to the adult stage, with pollen being the protein source and nectar the energy source (KIATOKO et al. 2014).

The importance of meliponines interferes not only in social and economic aspects but mainly in ecological ecosystem processes. Given this problem, urgent awareness measures are necessary, with a key point being intervention with society through Environmental Education in schools and organizations. The ecological service performed by stingless bees, including other bee groups, is essential for the maintenance of plant diversity and native flora, and indirectly, the fauna that benefits from it. The greater availability of nesting sites for stingless bees directly contributes to the conservation of fauna and flora, which, together with other living beings, maintain our planet in balance (SILVA; PAZ, 2012).

According to Carvalho (2021), one of the main concerns with these bees is their commercialization over the internet, without control of where they are being taken, risking not finding food or a suitable environment for their development.

The UNIMONTES Meliponary project was created with the function of subsidizing the optional discipline of the Zootechnics course – "Rearing of Meliponines", complementing the practices of the Apiculture discipline and conserving and preserving native bees, encouraging producers and students of middle and elementary school as a work of Environmental Education.

MATERIALS AND METHODS

The meliponary was established at the State University of Montes Claros, Campus - Janaúba, MG, in 2015, presenting the following geographical coordinates (latitude 15º 48’09” S; longitude: 43º 18’32” W), with an average altitude of 533 m, an average annual rainfall of 800 mm, and an average annual temperature of 27°C. The region's climate can

be classified as type Aw (rainy period in summer and dry in winter). The area is surrounded by a forest characterized as Dry Forest (deciduous seasonal forest).

The meliponary features: 15 (fifteen) hives of Jataí bees (Tetragonisca angustula), 3 (three) Iraí bees (*Nannotrigona testaceicornis*) and 2 (two) Tubuna bees (*Scaptotrigona bipunctata*) (figure 1 A and 1B).



Figure 1A. Meliponary Entrance.



Figure 1B. Hives of Jataí, Iraí, and Tubuna bees.

Also, in the same area there is a solitary bee hotel and several nesting sites for these bees, such as hollow cavities (trunks and bamboos) that facilitate the nesting of solitary bees. It is worth noting that all species are properly identified with their scientific and common names, and are on individual wooden easels. The area was reforested with

fruit and ornamental trees, part of it was grassed, and it is irrigated, and efforts were made to keep the area free of debris (Figures 2 A and B).



Figures 2 A and B. Area designated for the meliponary and solitary bee nests.

The environment has become pleasant, with birds, hummingbirds, iguanas, and marmosets being observed in the surroundings, feeding on the fruits and flowers present in the area, as well as drinking water from the bird feeders, an activity that was not seen before the meliponary was set up (Figure 3 A and B).



Figures 3 A and B. Water feeders and fruit tree in the meliponary.

Thinking about increasing the number of species and conserving species in at-risk areas, a project took place on the campus of the State University of Montes Claros with the main objective of making bait boxes. The bait boxes were made with recycled material composed of PET bottles and cardboard (Figure 4A, 4B, 4C and 4D).



Figures 4 A to D. Capture method using the bait box (Bait preparation). A-Materials to be used; B- Covering the bottle with cardboard; C- Covering with plastic and adding the polyethylene spout; D- Solution application.

After being made, they were randomly distributed around the campus and in the native vegetation, which is classified as "Dry Forest" or deciduous seasonal vegetation, losing all its leaves during the dry period of the year (Figure 5A and 5B). The nests were periodically inspected to verify whether or not they were occupied by bees. Of the 20 nests installed, two captured swarms..



Figures 5 A and B. Bait boxes installed in the native vegetation.

RESULTS AND DISCUSSION

The exhibition was planned to make it possible for visitors to learn about, identify, and compare the most common species of Meliponines (native stingless bees) from the North of Minas region, as well as understand the importance of these social insects as pollinating agents and their role in maintaining biodiversity. The exhibition also focused on aspects of nesting, products for therapeutic and nutritional use, honey extraction, and bee management.

An interactive exhibition space was created where activities are held for visitor groups. In alternating shifts, participants can experiment with instruments used in the rational rearing of stingless bees, products made by these insects, honey from different species of native bees, an entomological collection, trunks of tree species used as nesting sites, and the rescue of at-risk stingless bee (ASF) colonies, which enabled the realization of a course for producers and academics.

The visitation of municipal, state, and private schools has provided (or will provide) students with awareness of the importance of stingless bees for the conservation of plant species in the region and also their importance as pollinating agents of cultivated plants, and therefore, their relationship with food production. The type of hive used was according to the characteristics of the species. The boxes were made of wood and the individual easels with roofs to protect the wood from sun and rain, fixed to the trees. All swarms were donated and captured through bait boxes and swarms migrated to inappropriate locations or were at risk due to the precariousness of their nests (Figures 6 A, B, C, and D).



Figures 6 A to D. School visits and course instruction.

From the moment the first swarm was acquired, efforts were made to maintain adequate feeding conditions (floral resources in quantity and quality, populous and healthy hives), with six water feeders distributed throughout the meliponary area and always kept with clean water. During periods of floral resource scarcity, pollen is provided to the swarms. Thinking about the feeding of native bees throughout the year, floral species have been planted around the meliponary to provide pollen and nectar.

The conservation of native bee species is of fundamental importance, as they tend to suffer from climatic adversities, as well as human actions. It is known that extractive practices have caused intense environmental degradation, which has made it impossible for these insects to adapt in nature, compromising their economic and ecological potential (SILVA et al., 2014).

However, one of the key points to conserve native bees, as well as the environment in general, is through environmental education, involving children, adolescents, and adults, showing how beneficial and harmful actions can affect families and the environment directly and indirectly. Due to non-conservationist practices, many bee species may disappear in the coming years, before being identified (BROWN; OLIVEIRA, 2014).

Thus, the extension project "Didactic Pedagogical Meliponary" is characterized as a conservation strategy for native species, in addition to the main objective of raising

awareness among its visitors about the importance of conserving regional and/or endangered native species. Environmental Education projects are a method of transforming secondary thoughts into priorities that concern sustainable development (BÖLTER; NOGUEIRA, 2018).

CONCLUSION

The construction of the Meliponary has enabled the realization of numerous practical activities in the disciplines of Apiculture and Meliponine Rearing, having been of great value in the learning of students in the Zootechnics course, in addition to receiving children from various schools with the aim of building knowledge about the benefits of the sustainability of native bee species, as well as the numerous pollinators that are essential for the maintenance of the ecosystem. Secondly, it allowed the development of research and the preservation of swarms that, by remaining in inadequate locations, were preserved.

However, activities are still being carried out to improve and develop the meliponary, with the aim of making the environment more wooded, getting as close as possible to the nesting sites of the bees.

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