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Stingless Bees and Their Importance in Crop Pollination

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Introduction

Stingless bees are a group of small to medium-sized bees, with vestigial stings, found in tropical and many subtropical parts of the world. They are the major visitors of many flowering plants in the tropics. They show a level of social organization comparable to that of honey bees. Colonies are perennial and usually consist of hundreds or thousands of workers. The estimated several hundred species of stingless bees are arranged into 21 genera. The most important genera are *Melipona*and *Tetragonula*. *Melipona*consists of more than 50 species, is confined to the neotropics, has more complex communication systems, and are capable of buzz pollination (*i.e.* ejecting pollen grains by vibration of the pollen-bearing anthers of flowers that dehisce pollen through pores). *Tetragonula* is the largest and most widely distributed genus, with more than 130 species including the neotropical*Tetragonula sensustricto* and most of the Asian Meliponini.

Nature of Comb Construction

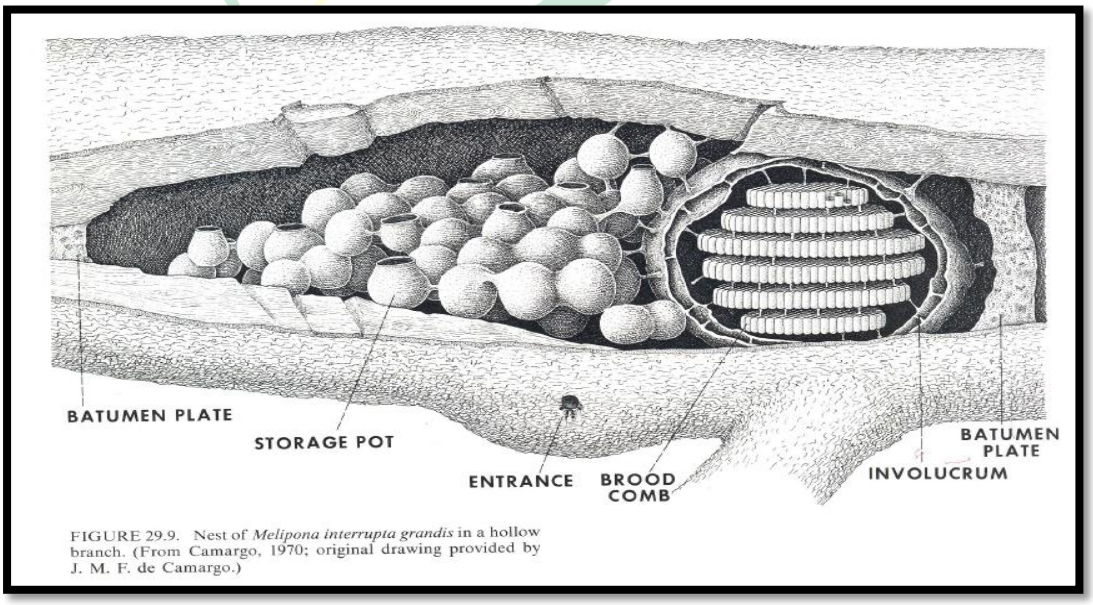

FIGURE 29.9. Nest of *Melipona interrupta grandis* in a hollow branch. (From Camargo, 1970; original drawing provided by J. M. F. de Camargo.)

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Common nesting sites of stingless bees are tree cavities, cracks and crevices in old walls or stone walls. Nest consists of external tube, internal tunnel, resin dumps, waste dumps, food pots for storing pollen and honey, brood pots. Entrance tube has made out of cerumen. The brood area comprises a dense aggregation of brood cells that is usually surrounded by a covering of multi-layered wax and resin called involucrum whose function is to protect the brood nest and insulate it. Outside the involucrum, there is an large waxen storage pots where the bees store pollen and honey. The nest is often sealed off from the rest of the cavity by one or more plates of resin called batumen plate which resists water percolation into the colony and protects the colony from natural enemies

Why Stingless Bees?

It is often stated that stingless bees are important pollinators of crops in tropical and subtropical parts of the world. The use and management of non-*Apis* bees and other insects for crop pollination is important because of the almost total reliance of world agriculture on honey bees. In many locations and for many crops, the ability of honey bees to pollinate is threatened or limited because of factors such as africanization, diseases and parasites, low efficiency on some crop species, climatic limitations and economic pressures.

Recently, numbers of both managed and wild bees are declining rapidly, causing global concern for pollination services. Threats include habitat destruction or alteration, over use of pesticides, parasites and diseases and the introduction of alien species (Kremen*et al.*, 2002). Management of honeybee hives is handicapped worldwide by infectious diseases and parasites such as *Varroa* mites (*Varroadestructor*), American Foul Brood (*Bacilluslarvae),* and Chalk brood *(Ascosphaeraapis).* Diversification of crop pollinators would help to achieve pollination services when the commonly used pollinator (specifically honeybees for most crops nowadays) is not available in sufficient numbers. In addition, honeybees are not always the most efficient pollinators due to various factors, e.g. a miss-match in body size and flower size, low nectar production and specialized pollen release mechanisms in some plants, including those with poridical anthers. When honeybees do not efficiently pollinate a given crop, it is probably economically beneficial to search for a better pollinator-plant match.

Stingless bees comprise a highly diverse and abundant group of eusocial bees that inhabit the tropical and subtropical parts of the world. Stingless bees form perennial colonies from which they forage year-round. Worldwide several hundred species exist, which differ

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significantly in colony size (from a few dozen to tens of thousands of individuals), body size (from 2to 14 mm; compare to 12 mm for honeybees).

Many characteristics of stingless bees resemble those of honey bees. Some of the characteristics that influence their ability as efficient pollinators are;

- **Polylecty and adaptability**: This enables them to pollinate multiple plant species and adapt to new ones.
- **Floral constancy**: A worker on a trip usually visits only one plant species.
- **Domestication**: Colonies can be placed in hives, inspected, propagated, fed, re-queened, controlled for enemies, transported, and otherwise managed easily.
- **Perennial colonies**: This allows workers to forage continuously within climatic constraints and obviate the need to develop colonies each year.
- **Large food reserves are stored in nests:** This has the obvious benefit of allowing colonies to survive long periods of low food availability. Additionally, it means that workers will collect floral resources beyond immediate needs, resulting in intensive visitation of preferred flowers.
- **Possibility of in-hive pollen transfer**: This decreases the need for bee movement between plants of self-incompatible species. It has been found for honey bees and is equally likely for stingless bees.
- **Forager recruitment:** Workers recruit nest mates to rewarding floral resources and provide information on the position of those floral resources, which allows the rapid deployment of large numbers of foragers relative to other bees and insects in which each individual has to find the resource.

Table 14: Crops for which stingless bees make an important contribution to pollination

Scientific Name	Common Name	Stingless Bee
Bixaorellana	Annato	*Meliponamelanoventer*
Myrciariadubia	Camu-camu	*Meliponafuliginosa*
Sechiumedule	Chayote	*Trigona corvina,*
Cocosnucifera	Coconut	*Partamonacupira*
Averrhoacarambola	Carambola	*Trigona thoracica*
Macadamia intergrifolia	Macadamia	*Trigona spp.*
Mangifera indica	Mango	*Trigona spp.*

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Coffeaarabica	Coffee	*Trigona terminata*
Coffeacanephora	Coffee	*Trigona terminata*
Perseaamericana	Avocado	*Trigona nigra,*
Fragaria×ananassa	Strawberry	*Plebeiatobagoensis*
Capsicum annuum	Sweet pepper	*Meliponafavosa*
Lycopersiconesculentum	Tomato	*Meliponaquadrifasciata*
Cucumissativus	Cucumber	*Scaptotrigonaaff. depilis*

Advantages of Using Stingless Bees as a Pollinator:

Unlike honey bees, stingless bees have the following advantages: They are generally less harmful to humans and domesticated animals; they are able to forage effectively in glasshouses; propagation of colonies contributes to preservation of biodiversity by conserving populations of species that may otherwise decline owing to human disruption of ecosystems; colonies are rarely able to abscond, as the old queen is flightless; and they are resistant to the diseases and parasites of honey bees. Thus a honey bee epizootic that disrupted pollination would not affect the stingless bees in that system.

Disadvantages

Disadvantages of stingless bees for crop pollination include the following:There is a poor level of domestication technology for most species; there is a lack of availability of large numbers of hives; colony growth rates are low compared with honey bees; some species are unable to be domesticated because of specific nesting requirements; some species damage leaves in search of resin and some species are territorial and fight when placed in close proximity.

Threats to Meliponi culture

- Insecticides
- Fungicides, Herbicides and Fertilizers
- Transgenic crops
- Deforestation
- Diseases and pests
- Competition for resources
- Climate change

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Future Thrust

- Species identification
- Identification of effective pollinating species
- Documentation of crops benefitted
- Multiplication technology
- Management for pollination

Conclusion

Stingless bees play an important ecological role as pollinators of many wild plant species and seem good candidates for future alternatives in commercial pollination. These bees are especially suitable to provide pollination services in greenhouses as they forage effectively under enclosed conditions and possess several biological characteristics favourable in applied pollination indicating they are strong candidates in the search for alternative pollinators for our crops.

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