# 6. MELIPONICULTURE OF STINGLESS BEES

## MELIPONINAE

Stingless bees are closely related to the honeybees, bumblebees and orchid bees. Work with stingless bees is called meliponiculture. Stingless bees are amongst the longest evolved bees, and have been found preserved inside pieces of amber 80 million years old. Stingless bees developed before the continents drifted apart from each other. Therefore, they are present in all tropical parts of the world. It is estimated that 400 to 500 different species of stingless bees are known, but new species are identified every year.

Approximate numbers of species so far identified are 50 in Africa, 300 species in the Americas, 60 in Asia, 10 in Australia. Four species occur in Madagascar.

The different species are diverse: their size ranges from two millimetres (e.g. the tiny sweet bees) to stingless bees slightly bigger than the European honeybee. The number of bees a colony can contain ranges from some few hundred to more than a hundred thousand bees. This differs from species to species.

The stingless bees have evolved a wide range of nesting and feeding behaviours that allow them to share habitats and to occur in high densities. Some species of stingless bees are nest parasites. This means that their queens are laying eggs in other bee's nests. All stingless bees build their nest in a closed structure. The *Melipona* species of stingless bees and most of the species *Trigona* usually build their nests in hollow tree trunks or branches, and some in cavities in the ground or empty mice or parrot nests. Other species live in ants or termites' nests. Nests can sometimes be found in cavities in buildings. The various species prefer different cavity dimensions and most species have characteristic nesting sites. For example, the nests of *Trigona fulviventris* most often are found at the foot of a tree. In other species, the selection of nest sites is more variable. The entrance of the nest is most often very small, so that it can be protected against other bees, phorid flies and ants. The entrance can be a tubular structure, extending into the open air. Some have the opening pointing up – other openings are pointing downwards.

In *Tetragonisca,* the entrance can be closed at night by a network of fine threads. The entrance tube can be so small, that only one bee can guard it, or it can be so wide that a whole group of soldier bees are necessary for its protection. Outside the entrance of *Tetragonisca angustula* there will even be a group of guard bees hovering around and able to catch intruders in flight.

The shapes of the nests of stingless bees are quite different from the nests of honeybees. Honeybees always build vertical hanging wax combs. The typical stingless bee nest is made with horizontal brood combs, often consisting of one type of cell with the openings upward, from which workers, queens and drones emerge. The queen cells being a little larger and situated on the end of the brood nest. Some few species build brood cells in piles in a special brood chamber, and one African stingless bee, *Dactylurina staudingeri*, builds vertical double-sided combs. The brood chamber is surrounded by a protective wall made with wax and propolis - the involucrum. Outside the involucrum, the bees build soft wax pots for pollen and honey. These pots can be from five to 40 millimetres high. In some species the honey pots and pollen pots are segregated, in others they are intermixed. In a few species, the honey pots are oval and the pollen pots appear like stalactites hanging over the brood cells. The whole nest, or the ends (if placed in a hollow trunk) is enclosed in the batumen, a special material made by a mixture of resin, wax and various amounts of other materials like mud, oil, paint, and sometimes, animal faeces. It is like dark, hard propolis. The batumen can be very strong and thick and protects the colony against water and enemies. Stingless bees are often seen visiting trees that are secreting resin from recent wounds, because they need a lot of resin for building. The bees transport it home in their pollen baskets for construction work in the nest. Some species keeps stores of wax and propolis, ready for use.

The life cycle of the stingless bees is different from that of the honeybees. In stingless bees, there can be two or more queens laying eggs in the same nest. New queens are produced regularly, but most of them are killed and never allowed to produce eggs. Some queens may remain imprisoned in special cells as reserves. Replacement of the egg-laying queen does not happen every year, and some queens may live for 3-7 years.

The queen lays eggs in a special way. First, a completed cell is half filled with honey and pollen by the workers. Then one or more workers lays an egg in the cell and the queen is encouraged to come near. Then the queen eats the worker egg from the cell and lays her own egg instead, and then proceeds to another cell. One or more workers closes the cell by bending the upper collar of the cell against the centre. The cell is closed until the adult bee emerges. This is called the mass provisioning system and differs from the situation in honeybees where the honeybee larvae are fed continuously as they develop. Stingless bee queens can provide 10-100 cells with eggs a day, depending on the species. When the fully developed bee leaves the brood cell, the cell is torn down, and the material is reused for building new cells. Fertile eggs from the queens develop into worker bees and queens. Drones come from unfertilised eggs from the queen, or from egg laying workers. It sometimes happens that an egg laying worker bee lays an egg into a cell already containing a queen's egg. The male egg develops into a larva more rapidly than the female egg. The male larva then punctures the queen's egg before it hatches, and is able to eat all the food in the cell. After 10 to 15 days, the drones leave their parent colony forever. Where they go is not known.

Stingless bees multiply themselves by swarming. When a colony has reached a certain size and a usable new nest place is found, some worker bees will start transporting building materials to the new place. More and more bees will fly to the new nest over the next few days, and in the end, a queen from the old nest will transfer to the new nest and begin producing eggs there. Now a new colony has been established, and little by little, the flying between the two colonies will stop. In most species, mating between a new queen and drones takes place outside the nest.

Stingless bees are connected with tropical and subtropical forest areas. Here navigation by means of the sun, as used by honeybees, is not as easy as in open habitats. Stingless bees use different ways of communicating to each other the way to food sources. There are three main methods, depending on the different species. One method is that the scout bee returns and makes a special sound in the nest that gets other bees to fly out and search for the flowers at random. Another method is that the scout bee lays out an odour trail by marking stones and plants on the route with a special scent. Inside the colony, she makes a sound and a zigzag dance. When leaving the nest again, she leads a group of recruits to the source by following the trail. The third method is like the second, but instead of the odour trail, the scout bee guides a group of recruits by means of a pheromone emitted during her flight back to the flowers.

The communication systems of the stingless bees are three dimensional, and indicate how high in the forest the nectar and pollen sources are. In this way, stingless bees are well adapted for tropical forests.

## KEEPING STINGLESS BEES

Meliponiculture developed in Central and South America long before the European settlers arrived. During this period, the Indians obtained honey and wax from stingless bees. Subsequently honeybees were brought from Europe and, during the 20th century, from Africa. Elsewhere in the tropics, where stingless bees and honeybees are present, people have not developed management of stingless bees in hives, but simply harvested from wild colonies. The amount of honey from the stingless bees could not compete with the amount of honey from the honeybee, but honey from stingless bees is usually valued more highly.

Today meliponiculture is mainly found Central and South American countries, especially in Mexico as a heritage of the Mayas, and in NE Brazil. The most commonly used species are *Melipona beecheii*, *M. scutellaris*, *M. compressipes* and the tiny bee *Tetragonisca angustula*. This last named bee produces very little honey, but is kept because its honey is used as a medicine against eye cataracts.

Among the food resources used are pollen, nectar and fruits. The necrophagous species of *Trigona* also live from fluids from dead animals. There is a great diversity in preferred flowering plants and different niches are used by different species. This results in a great variation in the type of honey produced.

The yearly honey harvest from a stingless bee colony is most often between 200 grams to five kilograms. It depends on the species of bees, vegetation and handling. Today, there are farmers in Tanzania keeping stingless bees in log hives as they keep honeybees, and it is impossible to tell how long back this tradition goes. In Australia honeybees were not present before colonisation by Europeans, and as in the Americas, stingless bees were harvested for their honey.

Meliponiculture has developed from bringing log hives with bees' nests inside to the home, or to special shelters. This practise is still most widely used in Central America. Eventually a nest is placed in a simple box of wood. Many local beekeepers do not know how to divide a colony even though it is quite simple. New methods have developed in Brazil, and this is named the *Rational Hive.* It is a hive made of wood, in a way so that it easily can be divided in two parts, each with half the brood and honey and pollen cups. The one hive part with bees inside is equipped with a new top, the other with a new bottom. If the two boxes are not equally strong, the weakest, or that without a queen is left in the old site and the other box is placed in a new place. Nest boxes can also be equipped with inspection "doors" so that it is possible to watch for new queen cells, if the colony is of the type that places the queen cells at the edge of the brood area. From a wooden box hive the honey pots can easily be inspected, and if ripe, placed on a strainer upside down or they can be harvested by a small vacuum pump or syringe. It is very important when using log hives or box hives, that every crack or opening except for the main entrance is carefully closed after opening of the hive. This can be done with clay or a mixture of clay and cow dung. If not, the bees can be attacked by other bees or enemies.

The ripe honey from stingless bees has higher water content than honeybee honey. Therefore, it may also have a higher antibiotic activity to prevent fermentation. In laboratory tests, *Melipona* honey had a higher bacteria inhibiting effect than honey from honeybees.