

## **MODULE 1: BEE BIOLOGY AND BEHAVIOUR**

### **Introduction**

There are various types of bees which include the stingless bees, solitary bees, honey bees. But we are focusing on honey bees.

Honey Bees belong to the animal kingdom, Phylum Arthropoda, Order Hymenoptera, class Insecta, Superfamily Apoidea, family Apidae, genus *Apis*. The genus *Apis* is divided into several species and sub species/races but the 5 main species are: *Apis dorsata* (the giant honeybee), *Apis laboriosa* (the darker giant honeybee), *Apis florea* (the dwarf honeybee), *Apis cerana* and *Apis mellifera*. Research needs to be done to ascertain the major species available in Uganda.

Honey bees are social insects that live in colonies of 10,000 to 60,000 bees. A colony consists of a queen (fertile female), a few hundred drones (males) and thousands of workers (sterile females). They pollinate flowering plants and crops. They also produce honey, beeswax and other bee products of very high economic value.

### **Learning objectives**

By the end of the session, participants will be able to:-

- 1) Identify the different castes of honey bee colony.
- 2) State the roles played by the different castes in a honey bee colony.
- 3) Explain the life cycle of the different bee castes.

**Target Participants:** -Beekeepers, extension service providers, individuals and organizations/Institutions.

**Suggested Number of Participants:** A maximum of 30 persons

**Duration:** 2 hours.

### **Materials**

- Flip chart, masking tape, chalkboard, marker pens or chalk, notebooks and pens, bees and/or pictures of bees, TVs, Projectors, generators, films about bees and hand outs.

### **Methods**

- Lecture
- Brainstorming
- Group discussion
- Field exercise to identify the different castes in a bee colony

### **Steps:**

### **Step 1**

Write the title “Bee biology and behavior” on the chalkboard or flip chart

### **Step 2**

Engage the participants to brainstorm on the meaning of bee biology and behavior.

### **Step 3**

Explain bee biology and behavior to the participants

### **Step 4**

Allocate the participants in 3 groups and assign them the following tasks:

- Group 1      Discuss the roles played by the different castes in a bee colony
- Group 2      Describe the life cycle of different honey bee castes
- Group 3      Discuss the behavior of the bee in different seasons of the year

### **Step 5**

In plenary, participants present findings, the trainer clarifies, summarizes and gives out the hand outs.

## HAND OUT: BEE BIOLOGY AND BEHAVIOUR

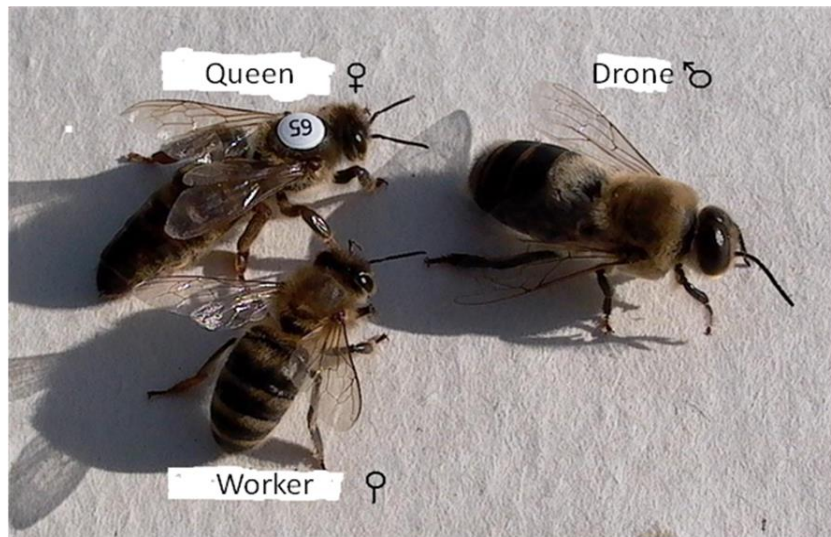
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### 1. Castes in a bee colony

Honey Bees are social insects that live in colonies of about 10,000 to 60,000 bees. A colony consists of a queen (fertile female), a few hundred drones (males) and thousands of workers (sterile females). They pollinate flowering plants and crops.

**Bees:**



*Fig.1: The honeybee castes in a colony*

**The queen bee** is a reproductive female. There is only one queen in the hive and her job is to lay eggs and produce queen substance (pheromones). When a new queen starts life, she mates only once with drones outside the hive. A good queen lays between 1,500-2,000 eggs per day but after two years she lays fewer eggs. She lives three to five years. It is very difficult to find the queen but she can be recognized by her long and slender body and short wings. She is fed by the young workers and is bigger than the other occupants due to massive feeding especially with royal jelly. She has a sting that is only used against rival queens. Her pheromones or scents serve to control the other bees and harmonize the colony's behaviour.

The Queen bee can be marked on the dorsal surface of the abdomen for easy identification and to avoid being crushed accidentally during hive manipulations

**The Drones** are males and are bigger than the workers. They develop from unfertilized eggs and their major task is to mate with the queen. They are stingless, very large eyes which are used to spot the Queen during mating. Drones look large and square and make a loud buzzing noise when they fly. Drones are dependent on the workers for food because their proboscis is short and cannot collect food for them. There can be about 200 to 500 drones in a hive but in time of food shortage the workers chase the drones out of the hive to die. Their lifespan is usually not more than 2 months.

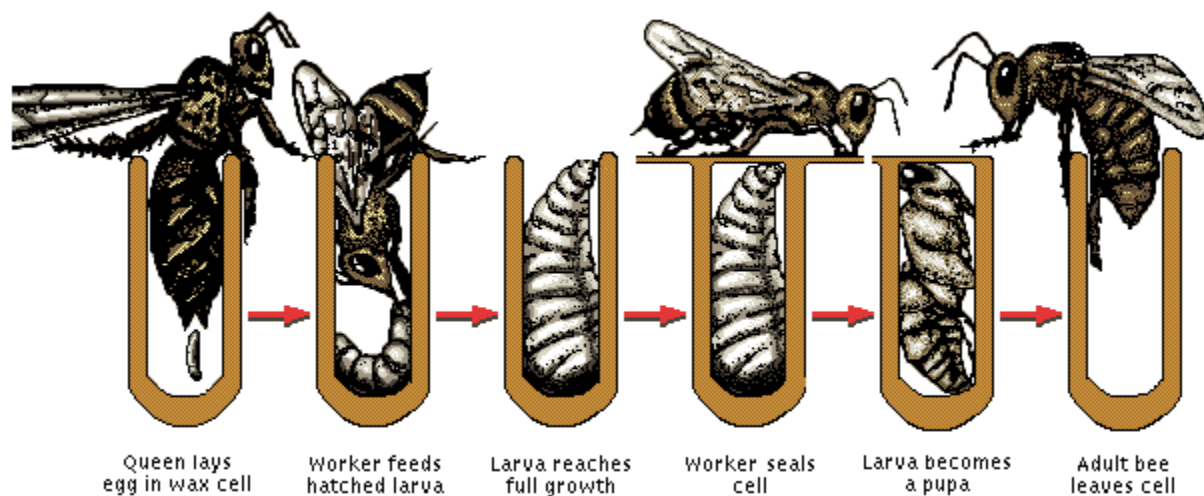
**The Workers:** Most of the bees in the hive are workers- they are all sterile females. The worker bees' change tasks according to age. Young worker bees clean the hive, feed both young and the Queen and make the beeswax combs. They control the temperature of the hive by flapping their wings and also guard the hive. Older workers scout for food and collect the pollen, nectar, water and propolis. They have a sting plus special glands and organs to help them to defend the colony against enemies. The workers are also responsible for the honey formation process.

The lifespan of a worker bee is 7-8 weeks during the main flowering season when they work hard. They can live longer during dormant periods.

## 2. Life cycle of a bee

Each bee in the course of its life passes through 4 stage metamorphosis: Egg→ Larva→ Pupa→Adult. During the development stages, the eggs, larvae and pupae are known as brood.

*Fig.2: Diagram of the life cycle of the honeybee*



The egg laid by the queen looks like a small grain of rice or hair nit. Whether an egg will develop into a queen, drone or worker depends on the type of cell it is laid in (it is very important to learn the difference between capped brood and capped honey – capped brood is usually dark brown and capped honey is usually white or creamy in colour).

The egg develops into larva, which looks like a white maggot. All larvae are fed on royal jelly for the first three days after which larvae for workers and drones are fed on pollen (bee bread) and honey put into the cell by the nurse bees (younger worker bees). The queen feeds on royal jelly throughout the life.



Peanut-shaped queen cell



*Fig.4: Queen cells*



Pebbly textured drone cells

*Fig.5: Pebbly textured drone cells*

The larvae are sealed with a wax capping in the comb after six days where they turn into pupae and later emerge as adult bees as shown in the table below.

**Table 1: Life span of bees**

<b>Caste</b>	<b>Egg</b>	<b>Larvae</b>	<b>Pupae</b>	<b>Total days</b>
Worker	3	6	11-12	21
Queen	3	6	6-7	16
Drone	3	8-9	12-13	24

### **3. Communication in bees**

Bees communicate with one another in a number of ways such as drumming feet, flapping wings like a ‘dance’ and use of pheromones. The dance performed by the scout bees is one way the bees inform each other of the location of food and how far away it is. There are several types of dances performed by the bees, but the main ones are the round dance and the waggle dance. The round dance is performed by bees that forage less than approximately 100 metres from the hive. Waggle dance is performed to locate food source beyond 100 metres from the hive. The scout bees also perform a characteristic dance to locate the new found home to which bees intend to swarm.

The queen releases a substance called a “pheromone” (sometimes called queen substance) which serves different functions. The pheromone enables her to identify members of the colony, to inhibit ovary development in worker bees, to prevent the workers from building queen cells, to help a swarm or colony to move as a cohesive unit, and to attract drones during mating flights. The absence of the queen substance (e.g. when the queen dies) produces opposite responses, i.e. worker bees begin to develop ovaries and to build queen cells, and a swarm searching for accommodation will not cluster but will divide into smaller groups that cannot support the normal life of a bee colony.

Colony decisions are taken by the collective behaviour of bees within one colony sharing the same odour, allowing guard bees to detect intruders.