



Modern Bee Farmers

PROMOTING MODERN BEE
APICULTURE IN KENYA

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APICULTURE TRAINING, BEE KEEPING EQUIPMENT & NATURAL HONEY

Introduction to Beekeeping in Kenya

Beekeeping has been practiced in Kenya for centuries, with the indigenous honeybee, *Apis mellifera scutellata*, being the most commonly kept bee species. Beekeeping in Kenya has grown significantly over the years, providing a valuable source of income and improving food security for many families. This handbook will provide an in-depth look at the history of beekeeping in Kenya, the types of beehives available, setting up a hive, beekeeping equipment, honey harvesting, and processing, as well as plant species that are a great source of pollen. Additionally, it will explore some of the behavioral aspects of bees that affect their management.

History of Beekeeping in Kenya

Beekeeping in Kenya dates back to the pre-colonial era, where it was practiced mainly for medicinal and cultural purposes. The introduction of European honeybees by colonialists in the early 20th century led to the commercialization of beekeeping in Kenya. Today, beekeeping is an important economic activity in Kenya, providing employment and income to many families.

Honey Bee Biology

Honeybees are social insects that live in colonies. The colony is made up of a queen bee, worker bees, and drones. The queen bee is responsible for laying eggs, while worker bees perform various tasks such as collecting nectar and pollen, caring for the brood, and defending the colony. Drones are male bees whose sole purpose is to mate with the queen. A single colony may have up to 60,000 bees.

In a typical honeybee colony, there are three types of bees: queen bees, worker bees, and drones. Each type of bee has a specific role in the colony, and their differences in morphology and behavior contribute to the efficient functioning of the colony.

QUEEN BEE



Queen bees are the largest bees in the colony and have a distinctive elongated abdomen. Their primary function is to lay eggs and maintain the colony's population. A queen bee can lay up to 2000 eggs per day, and her pheromones regulate the behavior and productivity of the entire colony. If a queen bee dies or becomes less productive, the worker bees will select a new queen to replace her. Queen bees can live for several years.

THE DRONE BEE



This is a male bee, which is hatched from an unfertilized egg. Drones are the only male bees in the colony, and they have a larger and more robust body than the worker bees. Drones are generally inactive and do not contribute to the day-to-day activities of the colony. Their primary function is to mate with the queen bee, and they do not have a stinger or the ability to gather food or produce wax. Drones are usually expelled from the hive during the winter months when resources are scarce.

THE WORKER BEE



Worker bees are the most numerous bees in the colony, and they are responsible for a wide range of tasks. They are all female (with undeveloped female organs. Worker bees do not have reproductive functions), and their duties change as they age. When they first emerge from their cells, they clean and care for the brood. As they mature, they become involved in other tasks such as building comb, foraging for food, guarding the colony, and caring for the queen. Worker bees are also responsible for regulating the temperature and humidity inside the hive, and they produce and store honey and pollen for the colony's survival. Worker bees have a lifespan of around six weeks.

Hive Components

Beekeeping has been practiced since about 15000 BC. Initially, people would take honeycombs from wild bees in caves, tree-holes, and rocks. Over time, people began to domesticate wild honeybees by providing them with homes made of hollow logs, woven cones, gourds, clay pots, and calabashes. However, it wasn't until L. L. Langstroth invented modern beekeeping technology in 1851 that significant advancements were made. Langstroth claimed that he received divine inspiration on how to make a hive with movable frames and foundation wax, which revolutionized beekeeping practices.

There are various types of beehives available in Kenya, but the Kenya top bar hive (KTBH) and Langstroth hive are the most commonly used.

The KTBH is a traditional African hive that has been used for centuries. It is a long, horizontal hive with a sloping roof and removable bars that rest on top of the hive. The bars serve as a foundation for the bees to build their comb, and the hive can accommodate up to 40 bars. The KTBH is popular in Kenya due to its simplicity, low cost, and ease of management.

The Langstroth hive, on the other hand, is a vertical hive that consists of several boxes stacked on top of each other. The boxes are designed to accommodate removable frames that serve as a foundation for the bees to build their comb. The Langstroth hive is popular among commercial beekeepers in Kenya due to its high honey production and ease of management.



- **TOP COVER (ROOF)**

This is a sheet of hard board covered by a sheet of metal. The hard board acts as an insulator.

- **SUPER BOX**

The honey supers are where the bees store their excess honey. They are smaller than the brood boxes and are usually located on top of the brood boxes. When the honey is ready, the beekeeper can remove the honey supers and extract the honey.

- **QUEEN EXCLUDER**

The queen excluder is a mesh screen that is placed between the brood boxes and the honey supers. Its purpose is to prevent the queen from laying eggs in the honey supers, ensuring that the honey remains pure and free from any brood.

- **BROOD BOX**

The brood boxes are where the queen bee lays her eggs, and the worker bees raise the brood. They are usually the largest boxes in the hive and are located at the bottom of the hive. This is where bees store pollen and honey for themselves.

- **BOTTOM BOARD**

This is the bottom part of the hive. It provides a flat surface for the hive to sit on which rests on the hive stand. It also serves as an entrance for the bees & prevents cold by regulating the temperature and humidity levels in the hive and stops bees from extending the combs downwards.

- **HIVE STAND**

The hive stand elevates the hive off the ground, keeping it away from moisture, insects, and other potential threats. It also helps to provide a stable base for the hive, making it less likely to tip over or become unstable.

- **FRAMES**

Beehive frames are rectangular structures made of wood or plastic that are used to hold beeswax foundation sheets in place inside a beehive. They provide structure and support for the bees to build their honeycomb, which is where they store honey, pollen, and raise their young.

- **BEE ESCAPE/CLEARER BOARD**

A mechanical trapping device with arrangement in such a way that bee can go one way but not another.

Setting Up a Hive

One of the most critical factors in beekeeping is selecting the right location for your apiary. Here are some factors to consider when setting up your apiary:

Areas to Avoid Setting Up:

- Busy or high-traffic areas, such as near a road or footpath
- Areas with high levels of pesticide or chemical use
- Areas with insufficient sunlight or airflow

Factors to Consider:

- **Accessibility:** Choose a location that is easily accessible for you to work on and manage the hives. Hive stands are also vital for easier access compared to hanging beehives as was done traditionally.
- **Space:** Make sure that you have enough space for the number of hives you plan to keep, and that there is room for expansion if needed. A distance of 10-15 feet between hive stands is ideal.
- **Water Source:** Bees need a reliable source of water to survive, so choose a location near a natural water source such as a pond or stream or provide a shallow dish of water in the apiary.
- **Windbreaks:** Consider providing a windbreak such as a fence or trees to protect the hives from strong winds.
- **Sun Exposure:** Bees need access to sunlight to regulate the temperature inside the hive, so choose a location with sufficient exposure to the sun.





A simple beehive

Environmental Factors to Consider:

- Flora: Bees need a diverse range of nectar and pollen sources to thrive, so choose a location with a variety of flowering plants in the area.
- Pesticide Use: Avoid areas with high levels of pesticide or chemical use, as these can be harmful to bees and may contaminate their honey.
- Noise Pollution
- Areas prone to flooding

PUTTING UP STANDS

It is well known that bees encounter great trouble with pests and other predators such as ants, lizards, honey badgers etc. We need to put our hives where all the above-mentioned enemies will not get access to the hive



Beehive stands are essential components of a beehive setup, providing a stable base for the hive and raising it off the ground. These stands can be made from various materials such as wood, metal or plastic and come in different shapes and sizes. Beehive stands serve several important functions, including:

1. Protection against moisture:

Elevating the beehive off the ground helps to protect it from moisture, which can cause rotting and mold growth. The stand also allows for adequate ventilation underneath the hive, which prevents the buildup of humidity.

2. Protection against pests:

Beehive stands help to keep the hive out of the reach of ground-dwelling pests such as ants, mice, and honey badgers. This helps to prevent these pests from accessing the hive and stealing honey or damaging the hive.

3. Easy access for beekeepers:

Raising the beehive off the ground makes it easier for beekeepers to access the hive during inspections, maintenance, and harvesting. It also prevents back strain and other injuries that can occur when working on a low-

lying hive. Moving hives from the top of trees to the ground and climbing them back again is cumbersome compared to using hive stands.

4. Increased airflow:

By elevating the beehive, the stand provides increased airflow, which is essential for regulating the hive's temperature and reducing moisture buildup. This helps to maintain a healthy hive environment for the bees.

5. Aesthetic value:

A well-designed beehive stand can add to the overall aesthetic appeal of the apiary. It can also serve as a functional piece of equipment that complements the hive's design.

GETTING A COLONY

Acquiring bee swarms is an exciting part of starting a new hive as a beekeeper. Bee swarms are groups of bees that have left their old hive to establish a new one. There are several ways that a new beekeeper can acquire bee swarms for a new hive, each with its own steps, equipment, and functions.

1. *Swarm Traps:*

Swarm traps are an effective way to capture and relocate bee swarms. These traps are designed to mimic the conditions of a natural beehive, making them attractive to passing swarms. You need to have nucleus or catcher box to be able to catch a swarm of bees and transfer them to the hive. Nucleus is a small hive composed of 3 to 5 frames.

To set up a swarm trap, follow these steps:

Choose a location for the trap that is shaded and sheltered from the wind.

Set up the catcher box in an elevated area accessible to swarming bees.

Use a lure such as lemon grass oil or beeswax to attract bees to the catcher box.

Check the trap regularly and relocate any swarms that are captured to a new hive.

2. *Buying colonies:*

Colonies can now be purchased from local beekeepers. This can be either in a ready catcher box or a full beehive.

Steps

Find a reputable beekeeper:

When purchasing a bee colony, it's important to find a reputable beekeeper who has experience and knowledge in beekeeping. Look for beekeepers in your local area and ask for recommendations from other beekeepers or gardening clubs.

Inspect the colony:

Before purchasing a bee colony, inspect it thoroughly to ensure that it is healthy and thriving.

Ask questions:

When purchasing a bee colony, don't be afraid to ask the beekeeper questions about the colony's history, care, and health. A reputable beekeeper should be willing to answer your questions and provide information about the colony.

Transport the colony safely:

Once you have purchased a bee colony, it's important to transport it safely to its new location. Make sure that the bees are secure and well-ventilated during transport and avoid exposing them to extreme temperatures.

This is done after **two weeks** of colonization. Close the entrance after smoking it.

Use foam sponge or a piece of cloth; do not use any plastic or anything that can hinder air. You can use bee screen meshed roof for better ventilation.

3. *Cut-Outs:*

A cut-out is a process of removing bees and their hive from a location such as a tree, wall, or roof and relocating them to a new hive. This method requires more equipment and expertise than swarm traps or bait hives.

To perform a cut-out, follow these steps:

Wear protective gear such as a bee suit, gloves, and a veil.

Use a smoker to calm the bees and make them easier to handle.

Use a bee vac or a catcher box to collect the bees and transfer them to a new hive.

Cut out the hive using a de-capping knife, being careful not to harm the bees or the queen. Transferring as much of the brood combs

BEEHIVE MANAGEMENT

Before inspecting and managing your bees its necessary to have the following tools

Beesuit with veil, good beekeeping gloves and working boots

A bee suit and gloves are essential for protecting the beekeeper from bee stings.



Bee Smoker

The smoker is used to calm the bees and make them easier to handle during inspections.



Smoker fuel

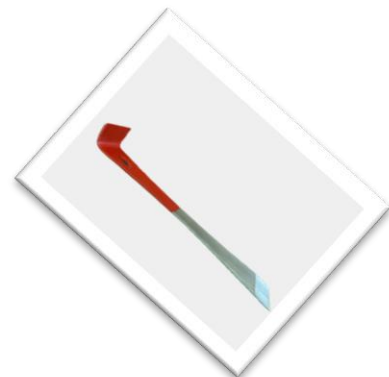
Wood Shavings are voted the best fuel in a smoker, but not every part of the country you can find them. For that matter it is possible to use the following fuels as supplement.

- Saw dust
- Cow dung
- Grass
- Rotten wood
- Elephant dung

Do not use chemical fuel.

Hive tool

The hive tool is used to pry apart hive components and remove frames



Bee Brush

Bees can be brushed away from the comb using the brush.



INSPECTION

Inspection is meant to monitor the progress of your colony. It should be done once every week.

Reasons:

- (i) To check for wax moth on small colonies.
- (ii) Destroy queen cells to avoid swarming (should be done when you are sure there is a queen present).
- (iii) Clean the hive.
- (iv) Confirm whether colony is ready for supering.

INSPECTION GUIDELINES

- Make sure you light your smoker before putting on your bee suit.
- Dress and make sure you are fully protected.
- It is advisable always to work in two's.
- Start by smoking the entrance, and then open the roof using your hive tool, and give a few puffs of smoke and put back the roof for a short time.
- Open the hive and inspect by removing one frame at a time. Do not hold the frames away from the hive.
- Do not stand in the flight path of the bees (entrance).
- Make sure grass and branches do not get too close to the hive. All dry grass should be taken away from the apiary in case of any fire accident.

SUPERING

Supering is an important process in beekeeping that involves adding extra boxes or supers on top of a Langstroth beehive. This is done to provide the bees with more space for storing honey, pollen, and brood. Supering is necessary to ensure that the bees have adequate space and to prevent overcrowding, which can lead to swarming.

Preparing for Supering

Before supering your Langstroth beehive, it is important to ensure that the hive is healthy and free from any diseases. This can be achieved by regularly inspecting the hive and treating any diseases that may be present. It is also important to have enough frames and boxes on hand to accommodate the bees during the supering process.

Tools and Equipment

The following tools and equipment are necessary for supering a Langstroth beehive:

- Bee suit and gloves
- Hive tool
- Smoker
- Bee brush
- Supers
- Frames

Steps Involved in Supering a Langstroth Beehive

The following are the steps involved in supering a Langstroth beehive:

Step 1: Put on your bee suit and gloves to protect yourself from bee stings.

Step 2: Light your smoker and gently smoke the hive to calm the bees.

Step 3: Start by smoking the entrance, and then open the roof using your hive tool, and give a few puffs of smoke and put back the roof for a short time.

Step 4: Carefully inspect each frame in the brood box to determine if the bees have filled it with honey or brood. If the frames are full, it is time to add a super.

Step 5: Take a new super and add frames to it. Ensure that the frames are evenly spaced and that the foundation is securely in place.

Step 6: Lift the top brood box and place the new super on top. Ensure that the frames are properly aligned with the frames in the brood box. **With the Queen excluder securely in place**

Step 8: Inspect the hive again after a few weeks to determine if the bees have filled the new super. If the frames are full, it is time to add another super or replace the filled frames

HONEY HARVESTING

The best time to harvest honey is when the frames are full and capped with wax. The honey can be extracted using a manual or electric honey extractor. The honey should be filtered and stored in clean, dry containers. In Kenya, honey is often sold in local markets, but there is also a growing market for organic honey exports.

Harvesting honey from a Langstroth beehive is an exciting and rewarding experience for beekeepers. However, it requires proper preparation, equipment, and steps to ensure the process is safe for both the beekeeper and the bees.

Harvesting Process:

1. Preparation of the Hive: Start by lighting the smoker and puffing smoke into the hive entrance to calm the bees. Next, remove lift the roof cover, smoke inside and close the lid cover.
2. Remove the Honey Supers: After removing the covers, gently remove the honey supers from the beehive. Use a bee brush to remove any bees on the frames.
3. Clearing the Bees: Once you have removed the honey supers, shake the frames to remove any remaining bees. Alternatively, you can use a bee blower to remove the bees.
4. Uncapping the Honeycomb: Using a hive tool or an uncapping knife, uncap the honeycomb cappings to release the honey. Make sure to keep the wax cappings as they can be used for other purposes.



5. Extracting the Honey: Place the frames in the honey extractor and spin the extractor. The extractor uses centrifugal force to separate honey from the comb.



6. Filtering the Honey: Once the honey is extracted, filter it to remove any wax or debris. Pour the honey through a double sieve or cheesecloth into a container.



7. Bottling and Storing the Honey: Pour the filtered honey into storage settling tanks or jars and store them in a cool, dry place.

NOTE

- Do not over smoke on honey.
- Do not harvest when it is raining.
- Do not hold the combs with your fingers.
- Do not harvest combs, which are not $\frac{3}{4}$ capped.

BEES PLANTS: NECTAR AND POLLEN SOURCES

Bee botany: This is the study of plants herbs and shrubs that are of economic use to beekeeping industry.

IMPORTANCE OF BEE BOTANY

- It is important for the farmer to have some knowledge about the food sources of the bees
- Plants determine the geographical region of honey source
- To identify toxic plants that contaminate pollen
- Problems of beekeeping in relation to insects sprays and how to solve them
- To know blooming period so as to time honey low periods/seasons
- To identify attractant plant species such as *Oscium sp.* And *Teclea Simplicifolia* (Maasai of Laikipia)
- Knowledge about sugarcane areas where sucrose/sugar are produced which are of little economic importance to beekeeping
- Understand some plants which are repellents i.e. *Targetes Minuta*, puff ball *Walburgia longimanii* and plant species which give hone with nasty characteristics, not fit for human consumption. Some of these plants

include Castor Oil Plant *Ricinus communis* poison arrow tree *Acokanthera schimperii*, avoid harvesting when such plants are in flower

- Understand some of the plants with beautiful flowers yet bees do not reach their nectaries because of their large corolla/long style i.e. Nandi Flame *Spathodea cumpanulata* , *Tecoma Stan* and *Markhamia Lutea* all belonging to the family of Bignonia.
- Understand some of the plants that are carnivorous i.e. trap and digest flesh of insects and small birds. Such plants secrete false nectar which lure foragers and finally entangle them. In India 70% of such plants are found there. There are about 300sp. of this nature world wide. *Mimosa Puntica* touch me not is one of the rear species found in Kenya. It is important that if a farmer discovers such unique behaviours, he should remove the plant or avoid or avoid siting apiary within the area.

CULTIVATED CROPS

SCIENTIFIC NAME	COMMON NAME	VERNACULAR NAME	VALUE
<i>Coffee Arabica</i>	Coffee	Mkahawa - Kiswahili	Nectar and pollen
<i>Psidium guayava</i>	Guava	Mpera - Kiswahili	Nectar and pollen
<i>Cajanus cajan</i>	Pigeon pea	Njugu - Kikuyu - Nzoo- Kikamaba	Nectar and pollen
<i>Anacardium occidantale</i>	Cashew nut	Mkanju - Kiswahili	Nectar
<i>Hellianthus annus</i>	Sunflower	Alizeti - Kiswahili	Nectar and pollen
<i>Citrus sinesis</i>	Orange	Mchungwa - Kiswahili	Nectar and pollen
<i>C. grape</i>	Grape fruit	Mndazi - Kiswahili	Nectar and pollen
<i>C. lemon</i>	Lemon	Mlimau - Kiswahili	Nectar and pollen
<i>Magnifera indica</i>	Mango	Muembe - Kiswahili	Nectar and pollen
<i>Persea Americana</i>	Avocado		Nectar and pollen
<i>Vignia sinesis</i>	Cowpea	Kunde - Kiswahili	Nectar and pollen
<i>Prunus africana</i>	Red stink wood	Omoiri - Kisii	Nectar and pollen
<i>Ipomea batatus</i>	Sweet potatoes	Viazi vya kinyamwezi- Kiswahili	Nectar and pollen
<i>Musa (sp) Cavendish</i>	Sweet bananas	Mkomba - Kiswahili	Nectar and pollen
<i>Zea mays</i>	maize	Mhinhi - Kiswahili	Pollen

INDIGENOUS AND EXOTIC PLANTS

SCIENTIFIC NAME	COMMON NAME	VERNACULAR NAME	VALUE
<i>Acacia abysinica</i>	Umbrella thorn	Mugaa - Kikuyu	Nectar and pollen
<i>Acacia mearnsii</i>	Black wattle	Omotandegé - Kisii	Pollen
<i>Acacia mellifera</i>	Hook thorn	Muthiia - Kikamaba	Nectar and pollen
<i>Acacia Nilotica</i>	Egyptian thorn	Mgunga - Kiswahili, Musemei - Kikamaba	Nectar and pollen
<i>Acacia xanthoploea</i>	Naivasha thorn	Ochmnyaliliet - Kalenjin	Nectar and pollen
<i>Adansonia digitata</i>	Baobab	Mbuyu - Kiswahili	Nectar and pollen
<i>Albizia gummifera</i>	Peacock flower	Omongonjoro - Kisii	Nectar and pollen
<i>Azadirachta indica</i>	Neem tree	Mwarubaini - Kiswahili	Nectar and pollen
<i>Calliandra calothyrsus</i>	Calliandra	-	Nectar and pollen
<i>Grevillia robusta</i>	Silk oak tree	Mukima - Kikuyu	Nectar and pollen
<i>Leucaena leucocephala</i>	Luecaena	Lusina - Kiswahili	Nectar and pollen
<i>Dovyalis caffra</i>	Kei apple	Kaiyaba - Kikuyu	Nectar and pollen
<i>Sesbania sesban</i>	-	Mwethya - Kikuyu	Nectar and pollen
<i>Schinus molle</i>	Pepper tree	Mugeita - Kikuyu	Nectar and pollen
<i>Callistemon speciosus</i>	Bottle brush (red flowers)		Nectar and pollen
<i>Ceiba pentandra</i>	Kapok tree	Msufi - Kiswahili	Nectar and pollen
<i>Eucalyptus sp.</i>	Blue gum		Nectar and pollen
<i>Teclea simplicifolia</i>	-	Mti - chuma - Kiswahili Kidimu - Digo	Nectar and pollen attractant plant among the Maasai of Dol- Dol

SOME OF THE BEHAVIOURAL ASPECTS OF BEES THAT AFFECT THEIR MANAGEMENT

SWARMING

Swarming is the process where a group of bees, led by the queen bee, leave the hive to form a new colony. This usually happens when the hive becomes overcrowded or when the queen bee is not laying eggs as she used to. Swarming can be prevented by taking measures such as adding more space to the hive, splitting the hive, or removing queen cells.

SIGNS OF SWARMING

- a) Increased number of bees at the hive entrance
- b) Increased number of drones
- c) Presence of swarm cells along the edge of the combs
- d) Increased defensiveness

Control:

- Provide ample space in the hive by either dividing the colony and/or harvesting some of the combs
- Decrease overheating by providing some shade
- Destroy the swarm cells so as to stop the merging of new queens

ABSCONDING

Absconding, on the other hand, is when the entire colony leaves the hive and never returns. This can happen when the colony is under stress, such as when there is not enough food or water or when the hive is infested with pests. To prevent absconding, ensure that the hive is well-maintained, has adequate food and water, and is free from pests and diseases.

Causes:

- a) Physical disturbance of the hive e.g. poor harvesting methods, attack by honey badgers e.t.c
- b) Presences of pests e.g. safari ants
- c) Bad odour
- d) Starvation

The colony does not take time to prepare; hence there are remnants of food, brood, eggs e.t.c.

Control:

Proper management e.g. proper harvesting, handling of bees, proper hanging of hives, clearing of apiary and greasing of the wires.

MIGRATION

This is a natural phenomenon whereby a colony moves from one habitat to another mainly due to unfavourable weather conditions. Nothing is left behind in terms of brood or food reserves. Migrating bees seasonally follow well-established routes.

Control:

Feed bees in times of food shortage

SUPERSEDURE

Supersedure is the process where the bees replace the queen bee with a new one. This can happen when the queen bee is old or when the colony is not satisfied with her performance. Signs of supersedure include the presence of queen cells in the hive. To prevent supersedure, ensure that the hive has a healthy queen bee and that the colony is well-fed and maintained.

Signs

- a) Irregular egg laying pattern

- b) Weak colony
- c) Supercedure cells on the comb surface
- d) Increased number in drones

COMMUNICATION IN HONEY BEES

Bee communication is an intricate and fascinating process that takes place within a beehive. Bees use a variety of methods to communicate with each other, including pheromones, dances, and physical contact.

Pheromone is a chemical substance secreted from a gland and discharged or emitted externally. They convey information and illicit responses or definite reactions by other individuals of the same species. In other words, they influence or direct behaviour of other bees.

PHEROMONE	FUNCTION	SOURCE
1. Sex attractant	Sex attractant	Mandibular glands
2. Aphrodisiac	Sexual stimulation of drones	Mandibular glands
3. Swarn orientation substance	Orientation pf flying swarm	Mandibular glands
4. Swarm stabilization substance	Stabilization of landed swarm	Mandibular glands
5. Queen substance	Inhibit queen replacement and worker ovary development	Mandibular glands
6. Alarm odour	Defence alarm	Vicinity of worker sting
7. Alarm tag odour	Mark site of attack	Vicinity of sting chamber
8. Alarm substance	Provokes attack	Mandible gland of worker
9. Scent gland secretion	Orientation of position and direction	Nasanov gland of worker

ELEMENTARY FORMS OF COMMUNICATION

1) PATROLLING

Some bees spend about 2/3 of their time either resting or wondering through the anterior of the nest, the activity is referred to as patrolling. For [patrolling to be a form of communication, the bees should:

- a) Show a social behavior among them
- b) Have a high ability of performing several duties
- c) Have the urge to perform extra duties
- d) Always be alert.

2) MUTUAL BEGGING

Liquid food sharing or: tropholaix” is the exchange of liquid food among the members of the same colony. This plays a key role in the social organization of most species of the social insects.

In a honeybee colony food is passed from:

- ❖ Worker to worker
- ❖ Worker to drone
- ❖ Worker to queen

Food sharing serves as a means of communication concerning the quality of food and water. It also serves as a media of transmission of queen substance.

DANCES AS A FORM OF COMMUNICATION

They perform dances inside the hive on the surface of the comb depending on the distance of food from the hive. Bees make two types of dances.

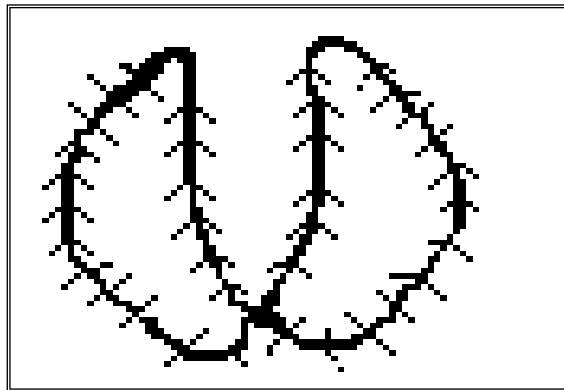
- a) Round dance
- b) Tail waggle dance

ROUND DANCE

- a) Performed when food source is less than 100m from the hive.
- b) Foragers tend to follow the dancing bee putting the antennae in the abdomen
- c) The dance is determined by the amount of food or distance
- d) A drop of nectar from the dancing bee can determine food taste
- e) Search of specific odour of the nectar when they come back perform the same dance.

In the round dance the bees run in small circles that covers a single cell; she runs approximately over six adjacent cells, suddenly reversing direction and then turning again to her original course. And so on. Between two reversals there are often one or two complete circles, frequently only $\frac{3}{4}$ or $\frac{1}{2}$ of a circle.

Round dance



Dance may be completed after one or two reversals or may go on 20 or more times after which it stops abruptly often to be resumed once or twice by the same bee at the same place or elsewhere in the nest. Consequently, the recruits get excited; they leave the dance, clean themselves, feed on honey in preparation for the foraging trip ahead and then within a minute leave the hive.

TAIL WAGGLE DANCE

- a) Performed when source of food is more than 100m away from the hive.
- b) Announces the food potentiality
- c) Distance to the food source or direction
- d) Direction which is determined by: - straight tail waggle dance - orients the direction between the sun and the food sources.

The bee runs straight on the comb and turns round, waggles her abdomen and repeats the dancing and runs another semi-circle to complete the circle in the opposite direction. Thus it roughly circular dance consisting of two halves - the figure of eight; the straight run is emphasized by vigorous shaking of the abdomen from side to side and usually by a buzzing sound made by the flight muscle and the skeleton but without noticeable wing beating.

The waggle dance differs with different species.

HONEY

Honey is a natural food product, which must be maintained to meet its delicate flavours and aroma associated with freshly extracted honey from the hive.

IMPORTANT FACTORS IN QUALITY CONTROL OF HONEY

1. Moisture content

It is the major factor that determines the keeping of honey.

- Honey is highly hygroscopic due to its high concentration of sugars
- Moisture content should be maintained between 17% - 20%
- Moisture content above 20% causes honey fermentation
- A hand refractometer may be used to check the moisture content of honey.

Other field methods of detecting quality honey are the dipstick method and the tilting method

2. other additives in honey

Natural honey should not have other additives such as water, sugar fruits e.t.c

Unscrupulous farmers and dealers are tempted to add water, sugars fruits e.t.c. hence lowering the quality of honey and when this happens, moisture level goes beyond 20% while addition of sugar pushes sucrose above 5%.

3. effect on heat

Heating should be controlled between 45-50 degrees centigrade during processing. Excess heat denatures all the proteins, destroys the vitamins and the sugars are converted to a chemical called HMF.

AVERAGE COMPOSITION OF HONEY

1. water/moisture content	17.7%
2. Glucose	32.29%
3. Fructose	39.28%
4. Maltose	7.11%
5. Sucrose	1.62%
6. Others	1.03%

PROPERTIES OF HONEY

Colour - depends on the floral source

These includes light amber, amber, dark amber, golden, water white

Density - 1.39 - 1.44 at 20° C

Poor conductor of heat

Viscosity - has high viscosity compared to water. A honey sample with high water content flows readily at room temperature. Prior to straining, honey might need to be warmed to reduce viscosity of honey thus facilitating rapid straining.

Crystallization/ Granulation - honey crystallizes naturally either on storage of even in the combs. This should not be viewed as bad honey. In the event of the above you can liquefy by warming it gently in a water bath.

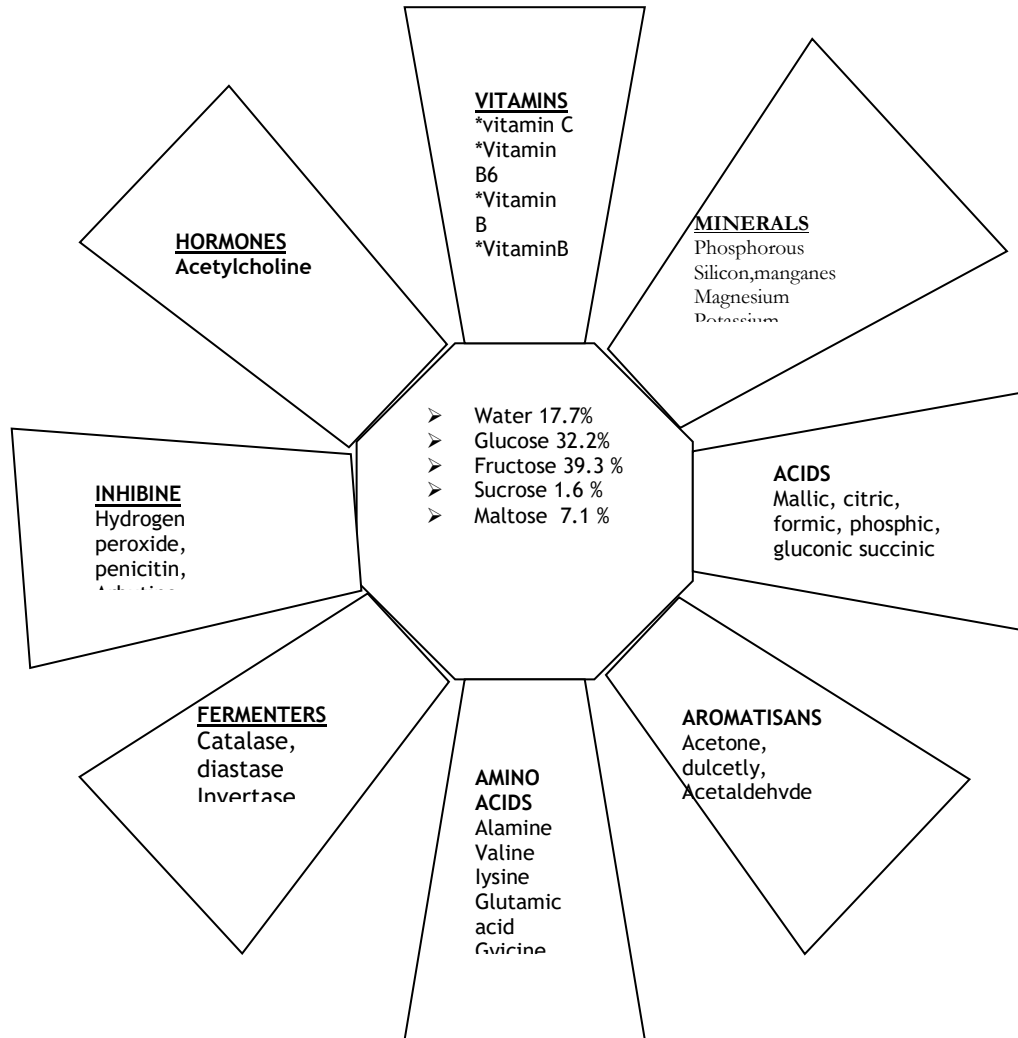
GRADING

This is done according to the moisture content using a hand refractometer.

LABORATORY HONEY ANALYSIS PARAMETERS

CHARACTERISTICS	REQUIREMENT
Moisture level	Maximum 20%
Total reducing sugar (glucose and fructose)	Maximum 65%
Sucrose	Maximum 5%
Acidity	Maximum 40mg/kg
HMF	Maximum 40mg/kg

THIS IS WHAT COMMON SUGAR OFFERS US SUCROSE 90 -100%



Conclusion

Beekeeping is an important practice in Kenya that provides a valuable source of income and improves food security. By following the basic principles of beekeeping outlined in this handbook, beekeepers can ensure the health of their colonies and produce high-quality honey for local and international markets.

Hope that it has been of much help and a source of information.