mouth disease, Diarrhea, arthritis, mastitis, greasy pig disease, anaemia etc.

Sick pigs generally have the following signs

- Loss of appetite.
- Rapid breathing which is an indication of a fever.
- In white skin-colored pigs, the skin may become reddish.
- Diarrhea which may sometimes be bloody or blood stained.
- Droopy ears or ears pointing downwards.
- Dull eyes.
- Dull skin and hair.
- Its tail will become limp.
- Separates itself from the rest.

35.0 Bee Keeping/Apiculture

Apis is a Latin word for bees. The honey bee is Apis mellifera.

Terms used in bee keeping

Apiary/Bee yard; a place where a number of bee colonies are kept.

Apiculture; the keeping of bees.

Bee keeping; the art and science of managing bees for the production of honey, bee wax, propolis, bee pollen, royal jelly, bee venom.

Importance of bees

- Production of nutritious food like honey, pollen and royal jelly.
- Income generation from sale of different bee products and services.
- Pollination of food crops.
- Contribution to biodiversity; bees sustain natural habitats through pollination and aid reproduction of plants in these habitats.
- Bee keeping contributes to agro-tourism.
- Entomological research e.g. in toxicology studies of agricultural and veterinary drugs.
- Bee keeping provides employment.
- Bee products are used for treatment of human diseases (Apitherapy).
- Bee keeping creates a relaxing atmosphere (leisure).
- Bees are being used in modern warfare in detection of explosives and narcotics.

Justification for engaging in bee keeping/ Reasons for increasing popularity of bee keeping

- Bees pollinate crops hence boosting crop yields and house hold incomes.
- Bee products generate high income levels.
- Bee keeping requires limited capital to start since bees are got from the wild and equipment are made locally.
- Bee keeping does not use land needed for crops but can be done on waste land areas.
- Bees do not compete for food with other livestock or people.
- Local traders benefit from bee keeping industry bee making bee hives, equipment and selling products.
- Bee keepers have a financial reason to conserve the environment, ensuring that bees are protected.
- Bee keeping can be done by people of all ages since they do not need daily care.
- Bee keeping is an enterprise that generates income without necessarily destroying the habitat.
- Presence of favourable environmental conditions for bee keeping.
- Bee keeping creates an opportunity for diversification by the farmers.

SYSTEMS OF BEE KEEPING

Bee killing/honey hunting; hunters invade nests, kill bees for honey.

Disadvantages of honey hunting

- Nests and bees are destroyed or bees abscond.
- Bees may become aggressive.
- Access to the colony can be far, difficult and dangerous.
- Combs get mixed during harvesting and this can produce bad quality honey.
- The environment is damaged since trees are cut and fires are set.

Bee hiving

This conserves bees and allows regular harvesting of honey and wax. Honey bees are encouraged to settle into simple hives.

Advantages

- The fixed combs are cheap and require limited labour costs.
- Less risky than honey hunting.
- Hives can be placed close to home.

Disadvantages

- Combs are fixed and must be broken during harvesting hence cannot be re-used.
- Honey yields are modest.

Bee keeping

The keeping of bees in specially designed hives, such as the top bar hive in which combs are movable without disturbing neighbouring combs.

TAXONOMY AND COLONY CYCLE OF HONEY BEES

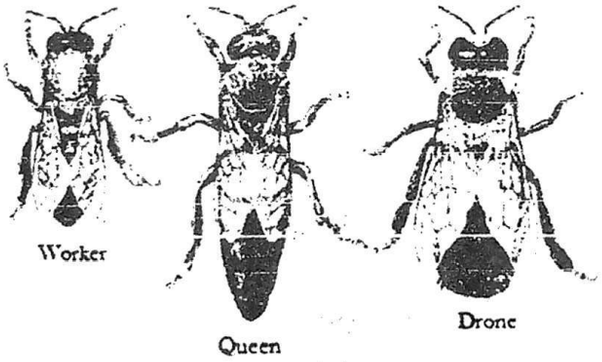
Kingdom	:	Animalia
Phylum	:	: Arthropoda
Class	:	Insecta
Order	:	Hymenoptera
Family	:	Apoidea (social bees)
Genera	:	Apis (Honey bees)
Species	:	Mellifera (Ugandan honey bee- Apis mellifera scutellata)

HONEY BEE RACES

Distinguishing factors for honey bees include;

- Body size; Apis mellifera scutellata is smaller than Apis mellifera linguistica.
- Colour; the first dorsal segment of the abdomen varies in colour between light yellow and entirely dark.
- Length of tongue; 1.7 mm difference between tongues of bees.
- Hair coverage; some races have wide and dense tomenta.
- Veins of the wings; Wing veins join and enclose some cells, shape of cells.
- Number of hooks on the wings;
- Width of the metatarsus.
- Shape and size of wax glands.
- Shape of the chitinous plates of male sexual organs.

MEMBERS OF THE COLONY



The queen

- Fully fertile female.
- Largest in size.
- Mainly lays eggs. Workers' eggs (fertilized) or drone eggs (unfertilized).

The drones

- Male bees in the colony.
- Larger and heavier than workers.
- Have no stings.
- Main function is to mate with the queen.

The workers

- Females that lack fully developed reproductive organs of the queen.
- Smaller in size.

Functions of young workers in a hive

- Cleaning cells for re- use.
- Nursing the grubs, by feeding them royal jelly.
- Secretion of bees wax.
- Receiving nectar which the foragers bring and converting it into honey by evaporating water from the nectar and digesting the sucrose into glucose and fructose.
- Cooling the hive if it gets too hot, by receiving water from foragers and spreading it on the surface of the combs, evaporating it by fanning it with her wings.
- Keeping the hive clean by removing any debris.
- Guarding in front of the hives, ready to sting any intruders.

General duties of workers

- Cell cleaning: Nurse bees remove debris, faecal matter from the hives.
- Brood, queen and drone feeding.
- Building the comb using wax secreted by wax glands of worker bees.
- Food transmission and processing; nectar is transmitted from worker to worker, worker to queen or worker to drone.
- Colony defence against strangers.
- Undertaking dead bees 30M away from the hive.
- Regulating temperatures in the hives (thermo regulation).

- Foraging: collecting pollen as a protein source, nectar as an energy source, water to dilute honey or cool hives.

Social Behaviors of Bees

1. **Swarming:** The movement of bees from one place to another looking for a new bee hive.

Causes of swarming

- Change in the ratio between the number of young workers and the brood. As honey occupies many cells, the foragers have to vacate and find a new hive.
- Overcrowding in the hive due to rapid population buildup.
- Emergency of a new queen in the colony makes the workers to vacate.
- Overheating in the hives encourages buildup of new queen cups and queen cells hence swarming.
- Outbreak of pests like mites and ants and diseases in the hives.
- Sick or infertile queen that makes worker bees to vacate the hive.
- Damage of brood combs during honey harvesting or by pests and parasite in the hives.
- Strong bad odour/ smell in the surrounding environment that makes the bees uncomfortable.

Prevention of swarming

- Adding honey supers on time to increase hive volume.
- Removing artificial swarms from the colony.
- Good ventilation of the hive to reduce temperature rise.
- Controlling pests and disease in and around the hives to make the bees comfortable and reduce damage of the brood.

2. **Migration:** The process of bees leaving the hives they had colonized over sometime.

Causes of migration

- Pests and predators.
- Unfovourable weather e.g. overheating.
- Dampness.
- Disturbances by man.
- Shortage of forage.
- Disease attack.

Supercedure: A means by which an old queen may be replaced. This is when a colony realizes that the queen is no longer productive ' producing more drones than workers'

Absconding: Sudden departure of bees from their hive.

Aggressiveness: tendency of some bees being prone to attacking and defending than others.

Reproduction and Mating in Honey Bees

1. **Mating of the queen**

- On a mating day, a virgin queen comes out of the hive and flies while locating landmarks (trees, houses) so that she can recognize her home on return.
- During her nuptial flight (usually in the afternoon of a bright and clear day, the queen is pursued at sped by many drones whom she has attracted using a characteristic pheromone.
- Mating takes place in air and may be done by more than one drone.

- During mating, the sperm mass in the drone's penis bulb is discharged by eversion of the penis into the queen's vagina pouch.
- When the mating queen separates herself from the drone, the penis bulb remains in her genital tract, the male organ having been torn apart at its weakest point between the bulb and the penis neck.
- The drone bleeds to death and its carcass falls off, giving way for other drones to have a lifetime chance to mate.
- The spermatozoa discharged by the drone are first stored in the distended lateral oviducts.
- As soon as the remains of the male organ and the mucus are removed from the vagina by muscular contractions, the female forces the spermatozoa into the vagina.
- The spermatozoa are directed into the spermatheca where they retain their viability throughout the reproductive life of the queen (2-5 years).

Life cycle of bees

(i) **Egg laying**

- When an egg is ready to be laid, the lower end of its follicle opens and the egg passes down the oviduct into the vagina. Eggs that produce females are laid in worker comb cells, and because these are small, the queen's abdomen is squeezed together with the spermatheca, hence sperm is released to fertilise them.
- Eggs that produce males are not fertilized since they are laid in large cells.
- The queen lays all the eggs in hexagonal bees wax cells built by workers. Depending on the feeding of the larva, the fertilized egg becomes a queen or worker.
- Drones develop from unfertilized eggs by a process of parthenogenesis called **arrhenotoky.**

Metamorphosis

The brood (developing young honey bees) go through four (4) stages;

- **Egg stage.**
- **Larva**; the larva feeds on royal jelly during the first three days after hatching. The royal jelly is produced by **hypopharyngeal** glands in the head of the worker bee. The drone to be and worker to be larvae feed on nectar and pollen; the queen larvae feed on royal jelly.
- **The pupa;** the antennae, legs and wings are formed, compound eyes and adult mouth parts are present. The pupa sheds its cuticle and does not change further externally.
- **The adult:** emerge from splits of pupal shells. Workers emerge after 16 days, (30 days life span), Drones after 21 days (survive as long as they don't mate), Queen after 24 days (Up to 5years lifespan).

Anatomy of honey bees

- **The head:** the center of information gathering.

  The visual, gustatory and olfactory inputs are received and processed by the head.
  - Compound eyes; for motion and mosaic imaging.

- Simple eyes/ocelli; provide information about light intensity.
- Mouth parts; chewing and sucking.
- Endocrine glands; produce juvenile hormone for queen- worker differentiation.
- Exocrine glands; the mandibular gland produces queen pheromones.

- **Thorax**: divided into prothorax, mesothorax, metathorax and propodeum.
- **Abdomen**: has 9- segments, possess wax glands, the scent glands, the sting, the alimentary canal.

Communication and physiology of bees

- **Honey bee dances**
- **The circular or round dance:** performed when food is 150 meters around the hive.
- **Waggle dance:** performed when food is 150 meters and more away from the hive.
- **The sickle dance.**

PHEROMONES

Worker pheromones

- **Nasanov gland:** produces geraniole, citral 2, citral E, Nerol, Nerolic acid, Geronic acid and Farnesd. These help bees to easily find entrance to the hive during swarming.
- **Koschevnikov gland**: secretes the alarm pheromone that attracts other bees after a bee stings your body.
- **Dufour glands**: indicate families, colony kinship or nest ownership.
- **Mandibular glands**: secrete heptan-2-one for designating an object or attack.

Queen pheromones

- **Mandibular glands:** secretes the queen substance 'queen mandibular pheromone' containing:
  - 9-oxodes-trans-2-onoic acid that inhibits workers from constructing emergency queen cells, inhibits ovary development in workers.
  - Attracting drones during mating flight.
  - Attracting workers to the queen in the hive.
- **Koschevnikov glands:** formation of the clusters of court bees that surround the queen.
- **Drone pheromones:** the mandibular glands secrete a hormone that causes drones to gather together.

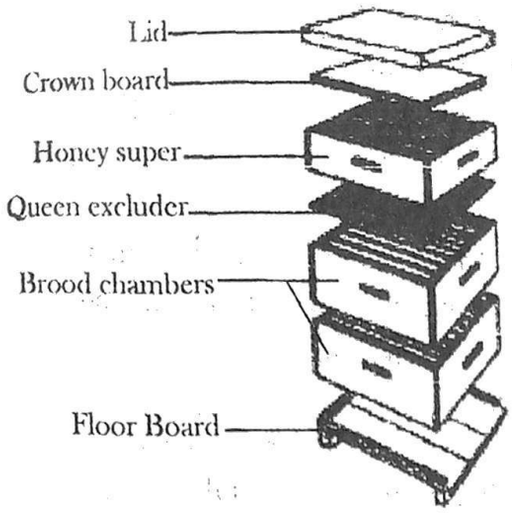
BEE KEEPING EQUIPMENT

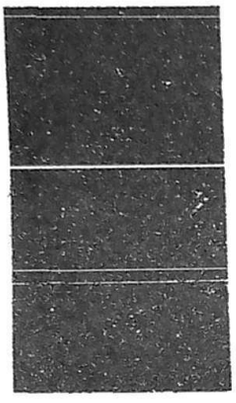
- **Hives:** house for bees.

1. **Traditional hives:** these include the following;
   - **Log hive:** A tree is felled and cut into cylindrical or truncated conical shape.
   - **Basket hive:** woven flexible sticks in a cylindrical or truncated conical shape.
   - **Grass hive:** woven dry grass in a cylindrical form.
   - **Clay-pot hives.**
   - **Gourd hive.**

2. **Improved hives**

(a) **Langstroth hive:** made up of the following:





- **Bottom board:** a wooden stand on which the hive rests.
- **Frames and foundation:** wooden frames hold sheets of bees wax.
- **Hive body/brood chamber:** a large wooden body for bees to rear brood and store honey for their own use.
- **Queen excluder:** placed between the brood nest and the honey supers, keeps the queen confined in the brood nest.

Advantages of using a queen excluder

- The queen bee only lays eggs in the brood chamber.
- The honey chamber contains clean honey.
- Wax from the honey chamber is clean and white.
- When honey is removed, bees are calm as there are fewer disturbances.
- Bee population increases steadily and therefore more honey is produced since there is no disturbance to the queen and the brood.
  - **Honey supers**: bees store surplus honey that is harvested.
  - **Inner cover**: insulates the hive against temperature changes.
  - **Over cover**: provides weather protection.
  - **Feeders**: hold sugar syrup that is fed to bees in prolonged dry seasons.

Advantages of the langstroth hive

- The comb is firmly fixed to four sides of the frame hence easy to harvest without damaging the comb.
- The strength of the built- in- comb also allows easy transportation.
- Honey is extracted using the centrifugal extractor making it possible to remove the honey without damaging the comb.
- Very few bees are crushed during hive manipulation.
- The queen and brood are undisturbed during honey harvesting.
- It is easy to hive a swarm of bees since the bees easily pass through the spaces between the frames.
- Hive boxes can easily be stacked for storage.
- It is difficult to be stolen

Disadvantages of the langstroth hive

- It is expensive to purchase.
- A high degree of craftsmanship is required to build the hive.
- The wood for constructing the langstroth frames needs to be

seasoned for at least a year, which is hard for local carpenters.
- It requires many equipment to harvest the honey e.g. extractors, de-capping, knives, trays.
- They are heavy and difficult to carry.

(b) The top- bar hive

Advantages of top- bar hive
- The size of the hive can vary to suit local conditions.
- Every comb is accessible without removing the others.
- The brood can easily be inspected for disease, giving the bee keepers control over the hive.
- The bee keeper can judge the exact time when the combs are ready for harvesting.
- The farmer gathers good quality bee wax which is marketable.
- No lifting is required other than that of the comb.
- There are better management techniques promoted by these hives hence preserving and improving bee populations.

Smokers

Produce smoke which calms bees and reduces stinging.

Adaptations of the smoker to its functions;
- Possess a bellow for pumping/ puffing smoke in the hive.
- Possess ignition chamber where dry material is put with fire to produce smoke.
- Narrow outlet/vent for smoke to enter the hive inlets.
- Handle for grip during the operation.

How to use a smoker
- Put burning materials or substances with smoke in the ignition chamber.
- Press the bellow to generate pressure to release smoke out.
- Apply smoke coming out through the vent onto the hive to suffocate the bees and make them docile.

➢ **Hive tool**
  - Sharp at one end and is used for cutting honey combs during harvesting.
  - Used to separate the top bars.

➢ **Container**; used for placing honey after harvesting.

➢ **Bee suites, veils, gloves;** protect the bee keeper's body, head and arms from stings.

➢ **Honey tank;** storage of honey.

➢ **Honey extractor;** extracting honey from the combs.

➢ **Solar wax extractor;** melts the combs after honey extraction to recover the wax for further industrial use.

APIARY

An apiary is a place where a number of bee hives are kept.

Factors considered when siting an apiary
- Nearness to water source; place hives besides a river or stream and incase of no flowing water, provide water in the apiary.
- Proximity to flowering trees and plants; place bee hives within a bushy area rich in flora where different trees bloom at different times.

- Wind direction; the hive should be sheltered from strong winds with hedgers.
- Overhead sun; place the hives in a shady place since too much sunshine causes overheating in the hives.
- Noise and pollution; site the apiary away from noisy places like roads. Public places etc. and away from sources of smoke.
- Distance from homesteads and the grazing area; the apiary should be at least 100M away from the home dwellings.

Features of a good apiary site

- Should be at least 100- 200 meters away from human dwellings.
- Should be quiet and away from areas where children play or any other source of continual noise.
- Water should be available at least a mile away.
- Proximity to flowering trees and shrubs and crops that need pollination.
- The hives should be sheltered from strong winds.
- The hive should be sheltered from strong sunshine.
- Dryness of the environment; away from marshy areas since this encourages fungal growth and prevents honey from maturing.
- Should be a way from cattle and other livestock.
- The path to the apiary should not face the entrance to the hives to avoid frightening the bees.

Sources of starter bee colonies

- Buying and moving colonies.
- Catching swarms clustered on accessible places such as low tree branches.
- Installing packed bees.

Procedure of stocking a bee hive

- Smear a hive with an aromatic old comb or sheep sorrel to attract bees.
- Transfer a swarm cluster to a new hive using a catcher net. Ensure the queen is in the swarm cluster. Catching of bees is best done in the morning when the bees are less active.
- Use a catcher box- a small box placed near a bee cluster, when bees collect in it, transfer the box close to the hive and position it conveniently. The bees then move into the hive.
- Place the hive in a convenient site, this increases the chances of a swarm
- Occupying it.

Factors that encourage colonization of bee hives

- Cool environment.
- Availability of water.
- Availability of flowers.
- Placing hives in a quiet and isolated place.
- Place hives in a north- south direction to avoid the sun.
- Placing hives in a cool sheltered place.
- Putting a small bee swarm or queen in a hive.

Routine apiary management activities

- **Hive inspection**; ensure that the hive does not become dirty or a residence for mice and wasps that keep of the swarm.

- **Colony division and unification**; splitting the colonies already in the apiary, transfer the brood with the queen into the new hive.
- **Annual re-queening**; kill and discard the old queen, leave the colony queen less for 24hours and introduce the new queen in the hive.
- **Supplementary feeding**; during prolonged dry seasons, provide sugar syrup.
- **Apiary cleaning**; cut the grass around the hives, remove tree branches touching the hives, remove insects from hives.
- **Record keeping;** makes hive inspection easy.

Seasonal management in bee keeping

Due to climatic variations in the tropics, the following seasonal variations affect bee forage and water availability;

- Dearth period
- Buildup period
- Honey flow period
- Harvesting period

(i) **Dearth period** is a time of the year when nectar and pollen are not available to the bees. Egg laying activities stop due limited food supply for feeding the brood.

Causes of the dearth period

- Prolonged dry season which will not permit flowering.
- Very heavy rains which prevent bees from foraging.
- The combination of prolonged dry season followed by very heavy rains.
- Very cold weather which prevents bees from going out to forage, instead they cluster to produce heat.

Management of the dearth period

- In hot weather, put the hive under shade so that bees have time to search for their food source instead of wasting time trying to cool the hive.
- Shelter hives to keep them dry where rains are heavy and provide proper ventilation.
- Enhance pest control measures since the colonies are most vulnerable at this time.
- Provide water if there is scarcity and feed the colony if necessary.
- Provide supplementary feding in form of a sugar syrup.

(ii) **Build-up period**

This is a time when bee plants start flowering and bees start to bring in pollen and nectar.

During this period, all the combs are used for comb building, egg laying and brood rearing instead of keeping honey.

Management of build-up period

- Remove all combs which are wrongly built.
- Check that the brood are in compact blocks on th combs.
- Look for for hiding places for small hive beetles and wax moth larvae, which the bees cannot remove.
- Merge queenless and small colonies to medium sized ones.
- Help to bees to expand their brood nest by putting an empty top bar in between the brood bar and the top bar containing honey and pollen.

(iii) Honey flow period

This is a period when plants are in full bloom, bees bring in nectar and pollen in greater quantities for their daily requirements and therefore utilize the period for storing instead of collecting excess nectar and pollen.

Management of the honey flow period

- Use a queen excluder to restrict the queen to the brood area to leave the other combs to be used for storage.
- Incase of a langstroth hive, give extra honey supers for proper distribution of the colony population, to control swarming and to store excess food.
- In case of a Top bar hive, harvest the honey to create space for honey storage.

(iv) Harvest period

This is the period when the honey is ripe and ready for harvesting. It starts after 10 days after blooming.

Signs that honey is ready for harvesting

- Bees become more aggressive in gurding the hive.
- Presence of worker bees outside the hive in large numbers.

Precautions taken during honey harvesting

- Harvest when the honey is ready; i.e. smells of honey, when bees are more aggressive than usual.
- Harvest in the cool of dusk.
- Do not harvest during rainy weather as water dilutes the honey.
- Use a suitable smoker.
- Harvest combs that are 2/3 full of honey.
- Leave light coloured combs for the bees to use re-build a new honey comb.
- Place the honey combs into a pot or bucket that can be closed to avoid robbing.
- Always carry two clean and dry containers with sealed lids.
- Remove dirt from then honey.
- Avoid propolis and too much pollen in honey.

Steps of harvesting honey

- Wear protective clothing and assemble all the necessary tools at the apiary.
- Place a few embers in a smoker.
- Using a smoker, puff all around the sides on the hive then introduce smoke inside the hive gradually. On sensing danger, the bees inside the hive suck a lot of honey and thus become docile and will not sting a lot.
- Remove the hive's top cover.
- Systematically remove the top bars each in turn and check for comb formation.
- Scrape off the bees from the combs with use of a hive tool. If the comb is bright in colour, then it contains honey, but if it is dark colored, then it has brood.
- If the comb has honey, cut it using a hive tool and leave a small length (2.5 cm) still attached to the bar and place it back. This will serve as an orientation line for a new comb.
- Place the cut comb in a clean container.
- After checking all the combs, replace the top cover.
- Carry the containers out of reach of bees still buzzing around.

Honey bee products

Compostition of honey

- Honey sugars; 95-99% of honey dry matter.
- Water content;
- Acids.
- Minerals e.g. chlorine, sodium, calcium, magnesium, potassium.
- Honey enzymes.
- Hydroxymethylfural.
- Water insoluble solids-suspended wax particles, insects, vegetable debris and pollen grains.

Uses of honey

- Food to humans as a sweetener or eaten directly.
- Health benefits are derived from feeding on honey e.g. For respiratory diseases, gastric ulcers, skin and wound healing.
- Honey helps with recovering from alcohol intoxication.
- Raw material in baked products, confectionary, milk products.
- Honey is used in tobacco, meat, cosmetic industry.

Factors affecting quality of honey

- The method of extraction; direct heating of the honey combs discolors the combs lowering its quality.
- Type of flowers from which the nectar was collected.
- Season of the year; honey formed over dry season tends to be of a lower quality.
- Stage of honey maturity; mature honey is of good quality.

Processing of honey

- **Sieving method:** the honey combs are crushed, placed in a muslin cloth put on a container and left for several hours. The honey drips through the muslin cloth into the container leaving the combs with wax on the cloth. The honey is then collected and any scum scooped out.
- **Heat method:** the honey combs are put in a container which is then immersed inside another container with water being heated. The combs are heated causing honey to melt. The honey is placed in a clean container and left to cool. After cooling, any wax found floating on the honey is removed.
- **Honey extractor:** used in large scale honey extraction. Crushed honey combs are placed in a centrifugal extractor which is operated either manually or mechanically. The high centrifugal force extracts honey from the combs.

Uses of bee venom

Bee venom is a defensive agent against predators. It is water soluble and not fat soluble.

It is used in bee venom therapy against diseases.

Predators and pest control

Common bee predators include:

- **Honey badgers:** strong animals that enter unsecured hives and cause a lot of destruction.

  Control
  - Suspend hive on wires to guard off honey badgers.
  - Seal off cracks and crevices on the hives.
  - Spread wood ash around hive wire poles.

- Fence the apiary to exclude predators.

- **Ants**

  Control

  - Cut off any vegetation touching the hives.
  - Band wires or suspension wires with chemicals like creosote and grease.

- **Wax moth:** they make tunnels in the honey combs destroying broods, contaminate honey with their excreta.

  Control

  - Dispose of any infected combs.
  - Remove and melt old combs or wax left after harvesting.

- **Predatory birds:** they eat bees or honey.

  Control

  - Place meshed wire netting near the entrance to the hive.
  - By use scarecrows.
  - Capture and kill the predators.

- **Bees louse:** Bee louse lays eggs on the combs with hatch into larvae. The larvae damage the combs.

  Control

  - Place creosote into the smoker and puff into the hive.

The following records are kept by a bee keeper;

- Date/time of last inspection,
- forage and weather conditions
- Date of occupation/colonization
- honey yield per harvest
- Age of queen
- cash flow analysis.
- Date of last harvest
- colony strength and growth
- Amount of honey in store
- hive characteristics
- Swarming record
- pest incidence and their control.

Importance of records to a bee keeper

- They are used in selection of the queen for use in breeding.
- Used during evaluation of the economic viability of the colonies and the apiary.
- They are used during inspection and monitoring of the progress of the colonies in the apiary.
- They are used to time the progress of the hives to ensure timely harvesting of honey.
- Used during control of pests in the colony.

Revision questions

(a) Describe the procedure of harvesting fish in a fish pond.
(b) Explain the management practices conducted for proper growth of fish in the fish pond.
(c) Explain the factors that affect the stocking rate of a pond.
(d) What are causes of mortality in a fish pond?
(e) Give the methods of preserving fish after harvesting.
(f) Describe the procedure of harvesting honey from a bee hive.
(g) What factors affect the quality of honey?
(h) Describe the procedure of dividing a bee colony.
(i) Describe the methods of controlling predators in a bee hive.
(j) Explain how to raise piglets from birth upto weaning.
(k) What are the signs of ill health in pigs?