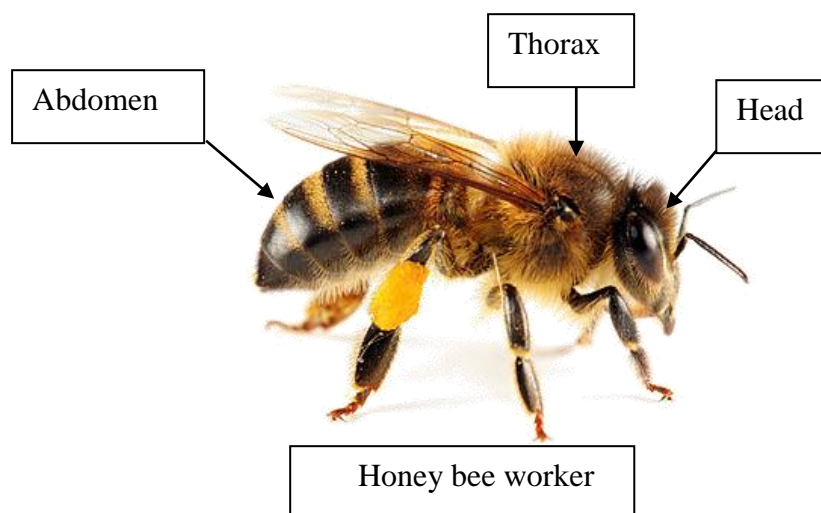


Lecture-2-

The external and internal anatomy of honey bees:-

The body of the honey bees is divided into 3 regions, the head, thorax and abdomen.



I. The head: The head is triangular in shape, larger or wider on the upper side and it contains:-

A- Eyes: The bees possess 2 types of eyes:-

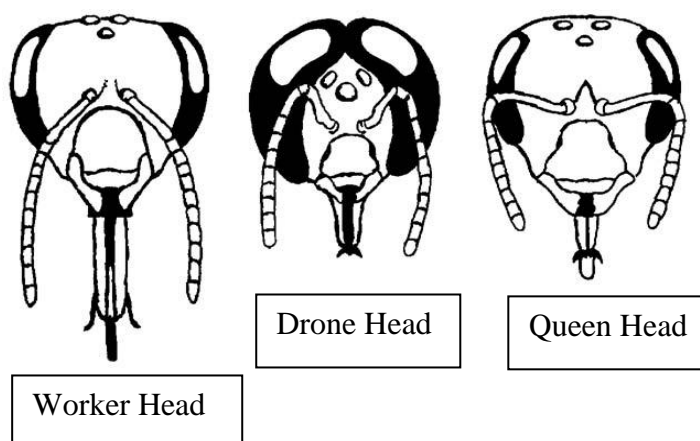
1-Ocelli also called (simple eyes) because each eye has just one lens, but with many sensory cells. Three in number and located on the vertex in the queen and worker, but in front side in the drones. These eyes are sensitive to light and used by bees for orientation according to the position of the sun.

2-Compound eyes are two in number and placed on each side of the head. They are largest in drone and smallest in the worker are made up of many hexagonal facets united together they can easily see all around them (above, below, side to side and forwards).

B-Antennae: The head also bears 1 pair of antennae, geniculate type consist of three parts scape, pedicel and flagellum. Flagellum consists of ten segments and contains over 300 taste sensors on the tips of it. It can be moved to any direction and it use especially to stimuli of touch and oder.

C- Mouth parts: Are chewing-lapping type.

Consist of labrum, mandible, maxilla, labial palp and glossa (Proboscis).

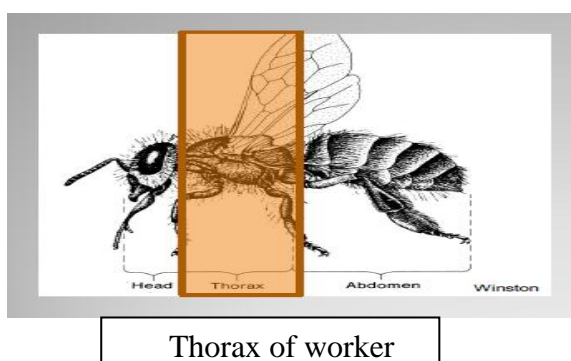


II. Thorax: It is the second part of the body of the honey bee and divided into three segments:-

1-Prothorax: it carries the first pair of legs.

2-Mesothorax: it carries the second pair of legs and the first pair of wings.

3-Metathorax: it carries the third pair of legs and second pair of wings and it has the first segment of abdomen also fused with it called as propodeum. The thorax is fully covered with hair in the worker and thin in the drone while in the queen little or hairless.



Thorax of worker

The thorax appendages:-

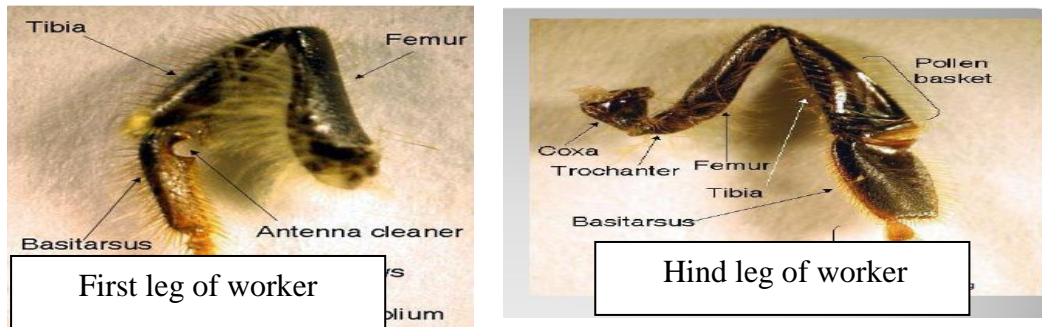
1-The Legs: There are 3 pairs of legs, one pair in each thoracic segment. Each legs is divided into six principal parts or segments (Coxa, Trochanter, Femur, Tibia, Tarsus and Pretarsus). The tarsus however is subdivided into several small parts or tarsomeres. The pretarsus is a very small but it carries a pair of lateral claws and a median lobe termed as arolium.

The modification of legs:-

a-The first legs carry the antennae cleaner.

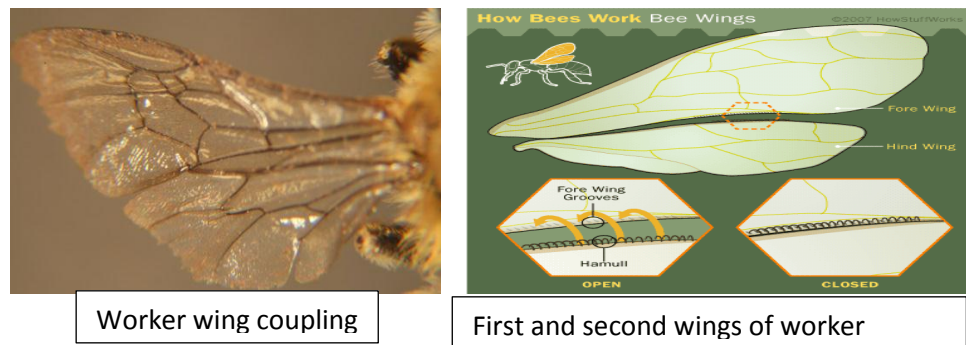
b-The medium legs have no modified, except a long spur helps the hind legs to get rid of the pollen from pollen basket in to the cells.

c-The hind legs are highly modified for the pollen and propolis transporting functions. The most prominent structure is the pollen basket or corbiculum which are very essential for collecting pollen from the flowers. All these legs are fully covered with hairs which are useful in collecting and brushing the pollen.



2- The Wings: Type of it is Membranous. There are 2 pairs of wings in a honey bee:-

The first pair (anterior pair) is located on the mesothorax and bigger than the second pair are called posterior wings and located on the metathorax. The posterior pair has a number of wing hooks or hamuli, when the bee takes a flight, the fore wings are drawn over the hind wings and the hooks are automatically catch in the marginal folds of the fore wings. This called wing coupling (Hamulate type).



III. The Abdomen: This is the last part of bee body. Many important organs are located inside it.

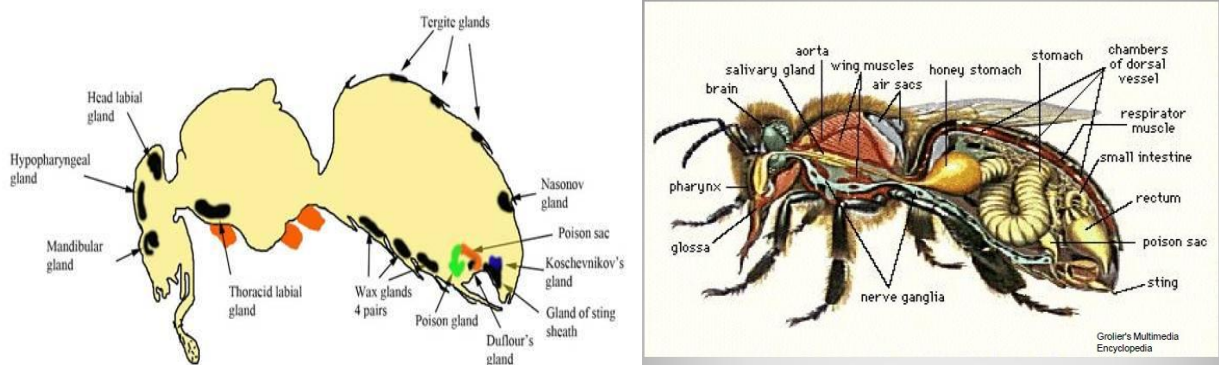
-It is made of chitin and joined with the thorax by a short tube.

-The abdomen is enclosed by ten round segments, inserted into one another, each of them is made of 2 plates, on the back are called as dorsal plates or tergal plates and on the lower side or beneath the abdomen are ventral or sternal plates.

-The first segment is omitted or deleted in the thorax and the last 3 segments are also omitted and they are so inserted in the sixth segment. Thus only 6 segments remain visible to us in the queen and worker and 7 in the drone.

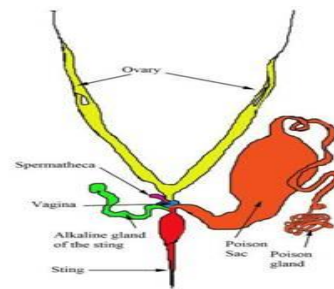
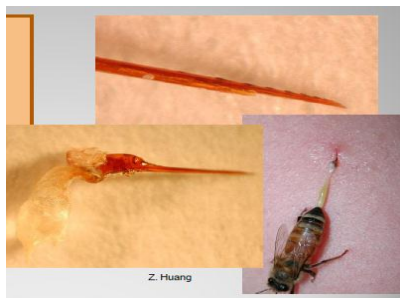
Internally the abdomen contains most of the organ systems and some glands:

- 1- Digestive system
- 2- Reproductive system (queen and drone).
- 3- Circulatory system
- 4- Respiratory system.
- 5- Nervous System
- 6- Sting organs. The sting organs are an elaborated ovipositor modified as an instrument of defense, when supplies with venom become a sting.



Sting organ: The sting organs are an elaborated ovipositor modified as an instrument of defense, when supplies with venom become a sting. The stinger has two components or parts, the poison gland and the alkaline gland together with the stinger. Each sting contains 150mg of venom.

Note. Bees die after using the stinger as the organ is left in the victim.

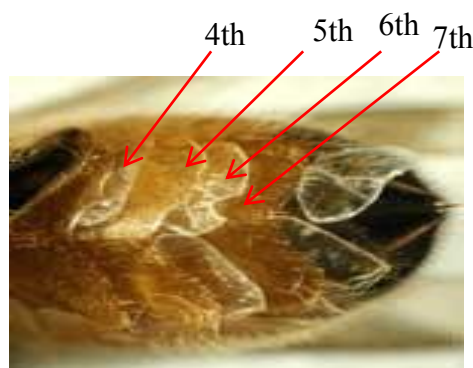


Sting organ

Glands: Honey bee worker contains several glands.

- **Wax gland:** This produce or secretion the wax from 4, 5, 6 and 7 sternal segments in the workers.

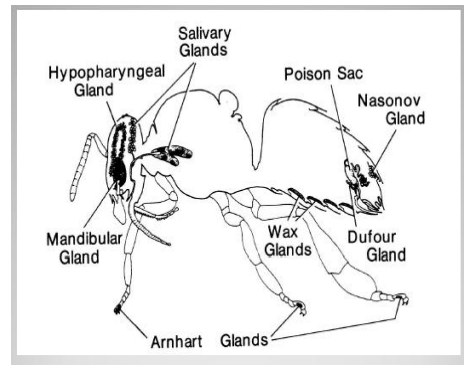
Honey bee wax gland



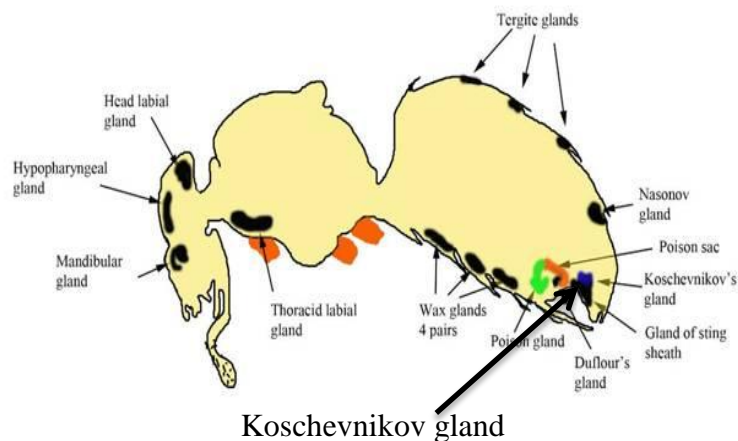
Nasanov gland: This produces a variety of chemicals which the bee uses to assist identification of the entrance of the hive.



Nasanov gland



Koschevnikov gland: This releases alarm pheromone – attracts other bees to attack and sting the same part of the body of the offending or attacker animal. In the queen this gland products are responsible for the formation of the clusters of court bees that surround the queen.



Koschevnikov gland

Honey Bee Hives.

Hive: It is the house or shelter in which the members of honeybees live inside and also in which the workers build the combs, where the queen lay eggs also the workers store the honey and pollen grains as food for the brood and the casts.

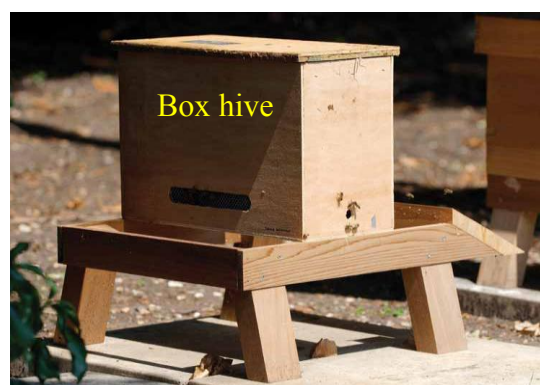
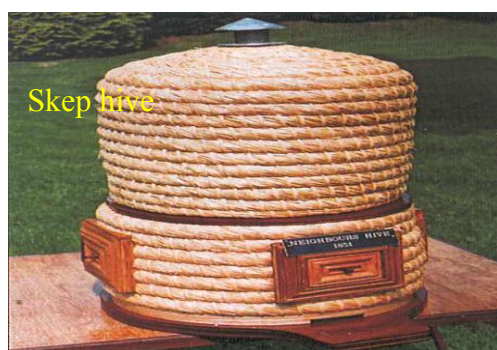
Types of hive:

A- Local hives such as:-

- 1- Clay or mud hive: It made from clay mixed with hay (straw).
- 2-Forest hive: it made by make hollows in the stem of big trees.
- 3- Log hive: it made from fallen trees.
- 4- Skep hive: it is named also wicker hive and its shape like basket.

5- Box hive: it is a wooded box.

6-Twig hives: Twig hives are cylindrical in shape and are made by joining together twigs. The cylindrical structure is then covered with cow dung on the outside.



The local hives disadvantages:-

In spite of its low costs and easy to build and transfer, but it have many disadvantages such as:-

- 1-It is not possible to inspection it and to test its activity and also it is impossible to see the anterior and middle combs except some of the posterior combs.
- 2-It is not easy to know in case the colony is infected by pests or not.
- 3- The beekeeper unable to breeding (rearing) queen or replace it.
- 4-It is impossible to increasing (dividing) or uniting colonies.
- 5-Beekeeper cannot control or prevent swarming.

6-Its honey production is very little because the workers consumed it during combs building.

7-During honey extraction the combs may contain brood and Pollen grain and this affect the taste and color of the honey and affect its value. Thus we cannot return combs back to the hive.

B-Modern hives: There are several types of it with different size, but the langstroth hive is the most common in the world. In 1852, Lorenzo Lorraine Langstroth patented a design for a moveable-frame honey bee hive after he discovered bee space.

Parts of Langstroth hive:

1-**Hive stand:** This is the bottom part of the hive that has an angled landing board for the bees. Hive stand functions to elevate the hive off of the ground and this keeps the bottom board dry and helps to insulate the hive. Different in styles wooden hive stand and stainless steel hive stand.

2-**Bottom board:** It forms the floor in a beehive and provides a single point for bees to enter and exit the hive by entrance (wooden or iron).

3-**Entrance reducer:** This is a piece of wood or iron which fits between bottom board and brood chamber. It is used for various reasons including protecting the colony from robbers, for weak hives starting out and sometimes as a mouse guard.

4-**Brood chamber (Deep super):** It is wooden boxes that serves as the living quarters for the colony and sit directly on top of the bottom board. Brood chamber hold either 8 or 10 frames where the queen lays her eggs and workers store pollen and honey for food. Each brood chamber has enough space to house between 50,000 and 60,000 workers.

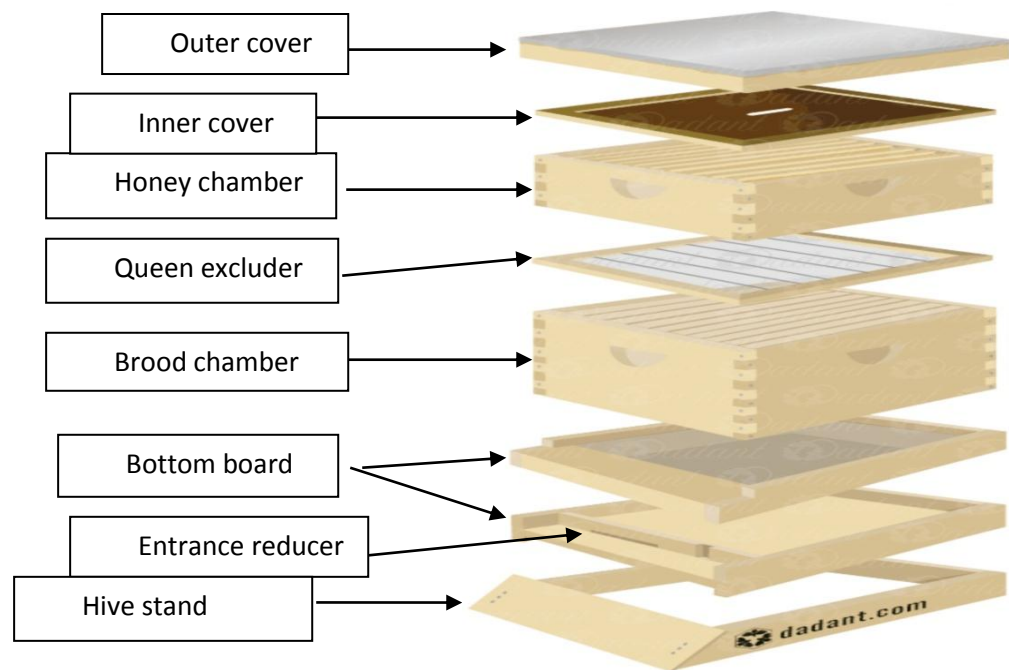
5-**Queen excluder:** The queen excluder consist of a wooden frame holding a grid of metal wire, it is placed between the brood chamber and honey chamber, the spacing of the grid help the worker bees can pass through to the honey chamber and prevents the queen from entering the honey chamber and laying eggs. Queen excluder use only when you placed honey chamber on the brood chamber or during the honey harvest.

6-**Honey chamber (Shallow super):** It has the same dimensions as the brood chamber or half size .it is for surplus honey production. The bees work hard to fill it with honey in active season and beekeeper can use it as ventilation in summer or during artificial feeding.

7-**Frames:** Consist of top bar 2side bars and bottom bar each chamber capacity 10 frames.

8-Inner cover: This is a wooden board to cover the brood or honey chamber. Has the same length and width as a chamber and fitted with a rim to allow ventilation and to prevent bees from building comb between the cover and top bars of the frames. Center hole may be fitted with a bee escape to removing bees from honey chamber before extraction honey and used during artificial feeding and we can use it as quick feeder.

9-Outer cover: It is a telescoping cover which telescopes well down over the sides of the top super and protects the hive from rain, snow and winds.



Langstroth hive

The modern hives advantages:-

1-It is possible and very easy to inspection it test it`s activity to see all the frames and the brood.

2-It is easy to provide it with wax foundation or comb and this lessen the honey consumed by the workers building.

3-The honey production is much, about 15 k or more /colony and pure dependence to season.

4-Easy to know in case the colony or broods are infected by diseases or pests and it is easy to control it.

5-The beekeeper able to rearing new queen and to replace the older or illness queen.

6-It is very easy to dividing and uniting colonies.

7-It is easy to prevent the swarming and to handling the weak colony.

8- Beekeeper able to lift or add frames or chamber to the colony depending to its activity.

Beekeeping equipments:

The operation of beekeeping needs much equipment's and tools which can never be ignored. Such as:-

I. Equipment's for bee breeding:

A- The hives (modern hives) as it is mentioned before.

B- Swarming (transporting) box: It is wooden box; it is size equal to the half of langstroth hive. It is capacity 5 frames .Used for:

1-Housing or catching swarm.

2-Transporting colonies.

3-During dividing colonies.

4-During queen breeding and mating.

C-Mating nucleolus: It is small wooden box with 2 or 3 small frames use for queen mating only.

D-Observation hives: It is small hives contain 1or 2 or 3 frames with 2 faces of glass showing inside it. Use for agricultural fair.

E-Package bee box: It used for transporting bee colony with or without queen and without frames (combs).



Swarming box



Package bee box



Observation hive



Mating nucleolus