

# Entomology practical

**ENTOMOLOGY:-** is a part from biology it deals with a type of organisms which is insects studying morphology ,physiology, taxonomy, ecology and life cycle .

## What is an Insect?

An insect is a small [arthropod](#) organism in the class of insecta. It is a small living [invertebrate](#) that has a body divided in to three parts (head, thorax, and abdomen), six legs, and usually two pairs of wings. Insect examples are bees, ants, butterflies, grasshoppers, moths, crickets, flies, termites, etc

## GENERAL CHARACTERISTICS OF CLASS INSECTA:-

1. Body divided in to head, thorax and abdomen
2. Possess three pairs of legs, hence the name Hexapoda
3. Presence of one or two pairs of wings
4. A pair of antennae
5. Respiration through either body surface or gills in aquatic forms and trachea & spiracles in terrestrial forms
6. The sexes nearly always separate.
7. Circulatory system is open, where the only blood vessel usually being a tubular structure
8. Possess exoskeleton made up of hard cuticle which plays important role for survival.
9. Excretion is mainly by malpighian tubules which help in maintaining ionic balance.

## Insect Collecting Equipments

1- Collecting nets:-

Nets may easily be made at home. The necessary parts are a handle, a loop or ring to be attached to it, and a cloth bag to be hung from the loop,

a- Aerial net

used for flying insect the bag of a butterfly net is generally constructed from a light weight mesh to minimize damage to delicate butterfly wings



b-Sweeping net

used to sweep through vegetation to collect random insects not easily seen



c-Water net

used for aquatic insect

2- The traps :-

a-the light traps



b-the baits traps



3- the sieves:-

4-seperater funnel:-

5-the aspirator:-



## Killing insects

### A- Freezing

This is a simple and efficient method that does not require any chemicals.

### B- chemicals

Of all the products available, ethyl acetate is the best. It is a colorless liquid poison that is considered quite safe for humans.

### C- Alcohol

insect that will be displayed in alcohol may also be killed with alcohol. Larvae, soft-bodied adults and tiny beetles should be placed directly in 70% or 75% isopropyl alcohol.

## **Spreading insects:-**

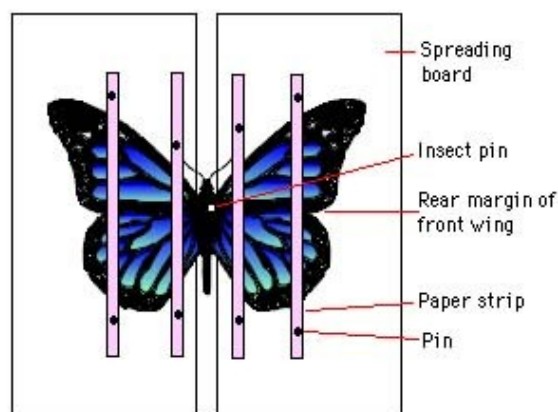
Entomologists depend heavily on patterns of wing venation to identify insects in the orders Odonata (dragonflies and damselflies) and Lepidoptera (butterflies and moths). The wings of these insects must be "spread" in order to ensure that the venation is visible.

**The following steps will guide you through the process of mounting an insect so its wings will be spread.**

1. Pin the insect through the center of its thorax, leaving exactly 10 mm of the pin above the specimen.
2. Adjust your spreading board so its central groove is just slightly wider than the body of the insect.
3. Push the pin down into the spreading board's central groove until the wings are just even with the top surface.

4. Prick one of the front wings lightly with an insect pin (just behind the strong vein on the wing's leading edge) and pull the wing forward until its hind margin is perpendicular to the insect's body. Use the pin to hold the wing in place temporarily.
5. Using another insect pin, repeat step 4 with the other front wing.
6. Using a third insect pin, prick one of the hind wings behind a strong vein. Move the wing forward until it just begins to slide under the hind margin of the front wing. Use the pin to hold the wing in place temporarily.
7. Using a fourth pin, repeat step 6 with the other hind wing.
8. Cut an index card into two narrow strips long enough to extend beyond the front and hind wings. Lay one of these strips over the wings on the left side and another over the wings on the right side. Secure the strips with more pins placed just beyond the wing margins.
9. Once the paper strips are holding the wings in place, remove the four temporary pins from behind the wing veins.
10. If necessary, use additional pins to hold the antennae in a natural position and provide support under a droopy abdomen.
11. After allowing the insect to dry for several days, remove the extra pins and paper strips. Carefully pull the pinned insect out of the spreading board's groove. Handle with care -- your specimen will be very brittle.

**Spreading board:-** are useful for laying the wings of insects out flat and holding them in place while the specimen dries.

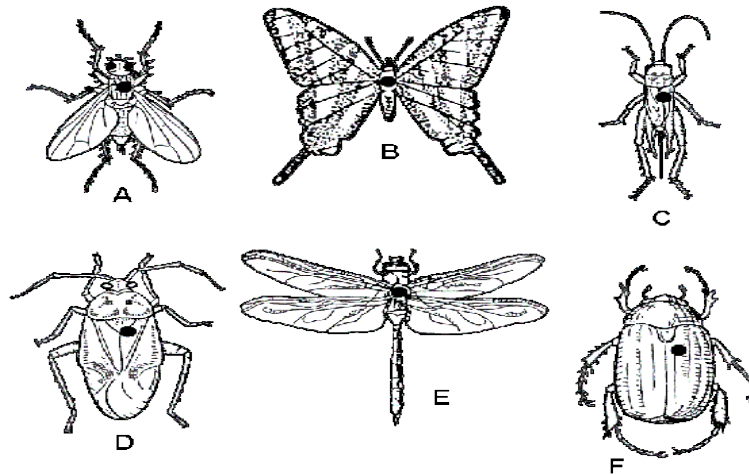


**FIGURE 1:** Properly pinned butterfly

## **Mounting insects**

### **Large Insects**

Pin the insect, dorsal side up, so that precisely 10 mm of the shaft is free above the specimen. Generally, the pin should pass through the insect's mesothorax, slightly to the right of center (see Diagram of Pinning Locations for different body types).



### **Small Insects**

Small insect glued on their right sides to tiny paper triangles. Pick up the small insect carefully with forceps and mount it by touching it on its thorax (right side) to the drop of glue., then allow the glue to dry. You can also use nail polish instead.

Pins are placed as follows:

Most insects: pin through thorax to slightly to right of midline

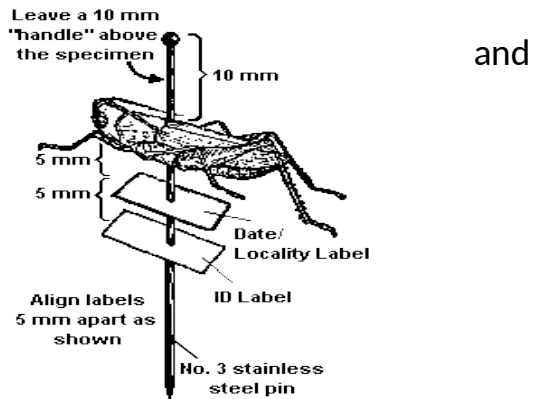
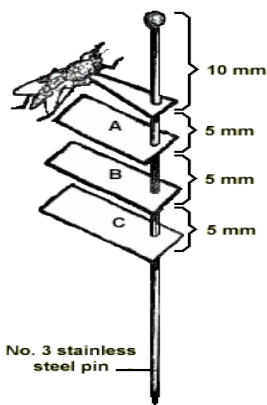
True bugs: pin through scutellum slightly to right of midline

Beetles: pin through base of right wing cover (exit between mid and hind legs)

Butterflies, dragonflies, and damselflies: pin through middle of thorax

### **Data Labels**

1. Top level -- **Date/locality label** (general to specific)
  - Lines 1 & 2: Country, State, County, City
  - Line 3: Date collected (day, month year in full as 1-1-2014)
  - Line 4: Collector's name (initials and last name)
2. Second level -- **Identification label**
  - Give family name for pinned insects; order family for insects in alcohol
3. Third level (optional) -- **Ecological label**



## Preserving Insects in Alcohol

Not all insects can be successfully mounted on a pin or a paper point. Some are just too small (like thrips and lice); others are too delicate or fragile (mayflies and silverfish, for example). Soft-bodied insects, such as aphids, and many immature stages (like maggots, white grubs, and caterpillars) will shrivel up and discolor or decompose if left to dry out on a pin.

For the purposes of this course, all immature stages, all soft-bodied adults, and small insects should be preserved in 70% ethyl alcohol (ethanol).

## Insect storage :-

Always put naphthalene (moth balls) in your box of pinned insects to prevent contamination by ants or dermestid beetles

## Body regions

### 1-HEAD

#### External view of the head

The head have 5 segments united in one part called **Cranium** these segments or sclerites are:-

1-frons 2-vertex 3- clypeus 4- gena 5- sub gena

**1-Frons:** - It is the largest sclerite in the face lies between vertex in the top and clypeus in the bottom

**2-Vertex:** - It is very small sclerite in the top of head between the compound eyes

**3-Clypeus:** - It is the medium size lies between frons in the top and mouth part in the bottom

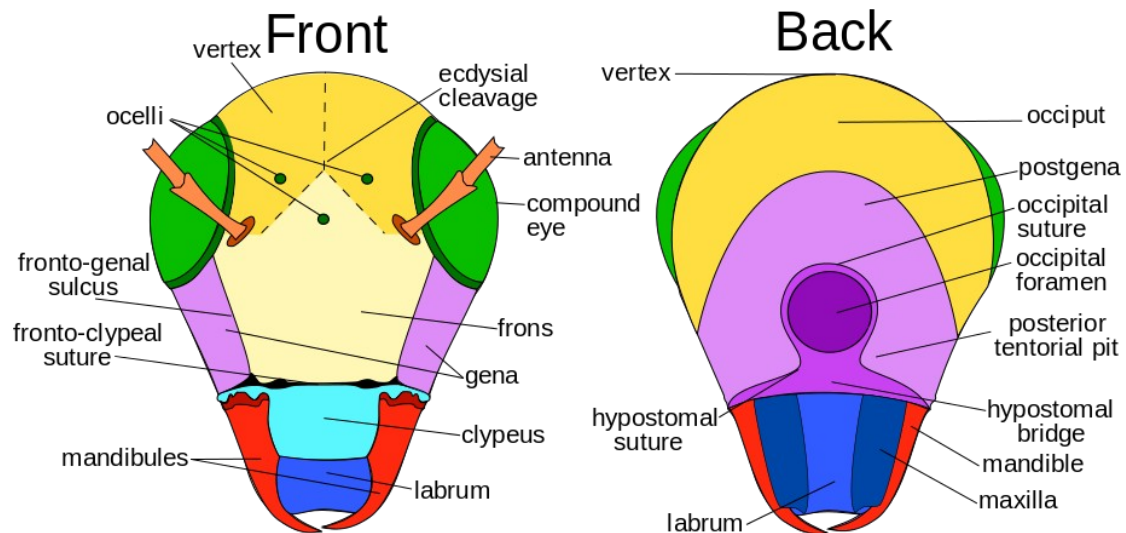
**4-Gena and sub gena:-**small sclerites lying in the lateral side of clypeus and frons

#### Posterior view of head

**-Occiput :** It is an inverted “U” shaped structure representing the area between the epicranium and post occiput .

**-Post occiput :** It is the extreme posterior part of the insect head that remains before the neck region.

**-Ocular sclerites :** These are cuticular ring like structures present around each compound eye



## Sutures

The common sutures present in head are:-

1) **Clypeolabral suture** : It is the suture present between clypeus and labrum..

2) **frontoclypal suture or epistomal suture**: The suture present between clypeus and frons

3) **Epicranial suture**: It is an inverted 'Y' shaped suture distributed above the facial region extending up to the epicranial part of the head. It consists of two arms called **frontal suture** occupying the frons and stem called as **coronal suture**.

This epicranial suture is also known as **line of weakness** or **ecdysial suture**

because the exuvial membrane splits along this suture during the process of ecdysis.

4) **Occipital suture**: It is 'U' shaped or horseshoe shaped suture between epicranium and occiput.

5) **Post occipital suture**: It is the **only real suture** in insect head. Posterior end of the head is marked by the post occipital suture to which the sclerites are attached.

As this suture separates the head from the neck, hence named as real suture.

6) **Genal suture**: It is the sutures present on the lateral side of the head i.e. gena.

7) **Ocular suture:** It is circular suture present around each compound eye.

8) **Antennal suture:** It is a marginal depressed ring around the antennal socket.

**-The head of insect are oriented in One Three Ways**

1- **Hypognathous:** The long axis of the head is vertical . at right angle to the long axis of the body. The mouthparts point downwards e.g. grasshopper, cockroach.

2- **Prognathous:** The long axis of the head is horizontal and in line with the long axis of the insects body. The mouthparts are directed forwards e.g. beetle.

3- **Opisthognathos** The head is reflexed ventrally so that the mouth parts are directed backwards between the coxa of the front legs e.g. Red cotton bug.



## Head appendages

There are 2 appendages in the head

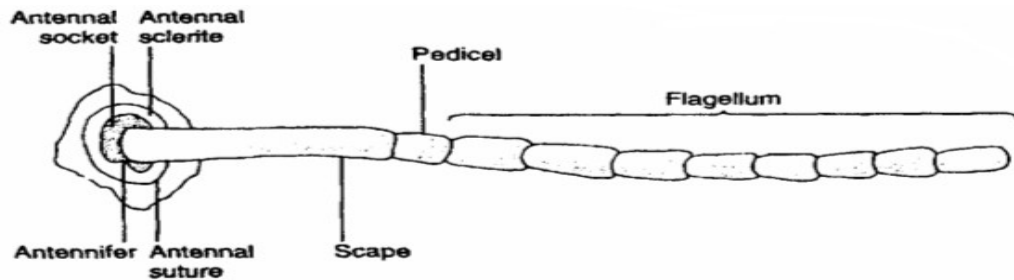
- 1- Antennae
- 2- Mouth parts

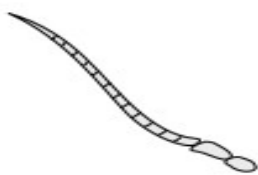

### 1- Antennae





The **antennae** are a pair of sense organs located near the front of an insect's head capsule. Although commonly called "feelers", the antennae are much more than just tactile **المسية** receptors. They are usually covered with olfactory **الشم** receptors that can detect odor **رائحة** molecules in the air (the sense **حاسة** of smell). Many insects also use their antennae as humidity sensors, to detect changes in the concentration **تركيز** of water vapor.



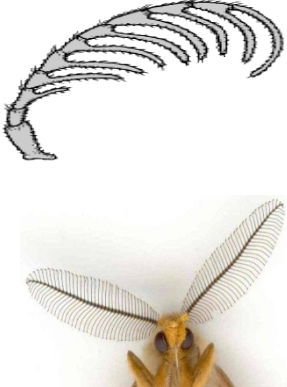

Although antennae vary widely in shape and function, all of them can be divided into three basic parts:

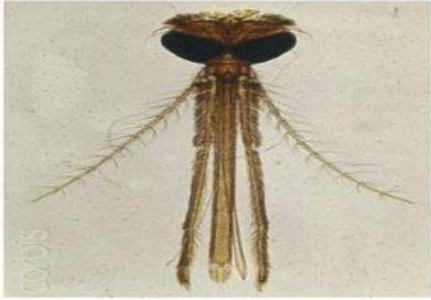



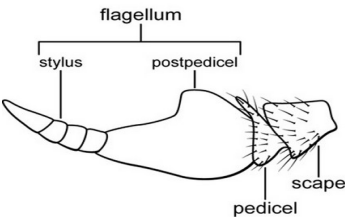
1. **scape** --the basal segment that articulates with the head capsule
2. **pedicel** -- the second antennal segment
3. **flagellum** -- all the remaining "segments"



Name		Example
<b>Setaceous</b> – Segments gradually decrease in size from base to apex	 	Cockroach

<p><b>Filiform</b> -- thread-like each segment of flagellum similar in shape and size to the others</p>		<p>Grasshopper</p>
<p><b>Moniliform</b> -- bead-like segment in the flagellum is circular in shape</p>		<p>Termit</p>
<p><b>Serrate</b> – sawtoothed the segments are angled on one side giving the appearance of a saw edge</p>		<p>Stem borer beetles</p>
<p><b>Clavate</b> -- gradually clubbed the segments become wider towards the tip of the antenna</p>		<p>Butterfly</p>

<p><b>Capitate</b> -- abruptly clubbed having the terminal joint forming a club, or knob</p>		<p>Flour beetles</p>
<p><b>Lamellate</b> -- nested plates the segments towards the end are flattened and plate-like. This gives the appearance of a fan</p>		<p>Scarab beetles</p>
<p><b>Pectinate</b> -- comb-like The segments are longer on one side. This gives the appearance of a comb</p> <p><b>Bipectinate</b> The segments are longer on two side .</p>		<p>Female Silk worm butterfly</p> <p>Male Silk worm butterfly</p>
<p><b>Plumose</b> – whorls of hairs arise from each joint of the segment each whorl contains number of hairs</p> <p>Pilose:-looks like a plumose but each whorl contains less number of hairs</p>		<p>Male Mosquitoe</p> <p>Female Mosquitoe</p>

		
<p><b>Geniculate</b> – the first segment (scape) is greatly elongated and flagellum always makes an angle with it</p>		<p>Wasp and Ants</p>
<p><b>Aristate</b> Antennae are small, microscopic 3 segmented. 3rd segment enlarged and bears a bristle called <b>arista</b> on its dorsal side.</p>		<p>House flies</p>
<p><b>Stylate</b> Antennae small 3-4 segmented. Terminal segment elongate into a bristle like structure called <b>style</b>.</p>	 	<p>Horse fly</p>

## 2-Mouth parts of insects

Mouthpart of an insect consists of the following parts.

1- Labrum (upper lip) 2- A pair of mandibles 3- A pair of maxillae 4-Labium (lower lip) 5- Hypopharynx (tongue)

### TYPES INSECT MOUTH PARTS.

#### 1- Chewing & Biting Type:

##### A-Labrum:-

It is small sclerite that forms the upper lip of the mouth cavity.

##### B- mandibles :-

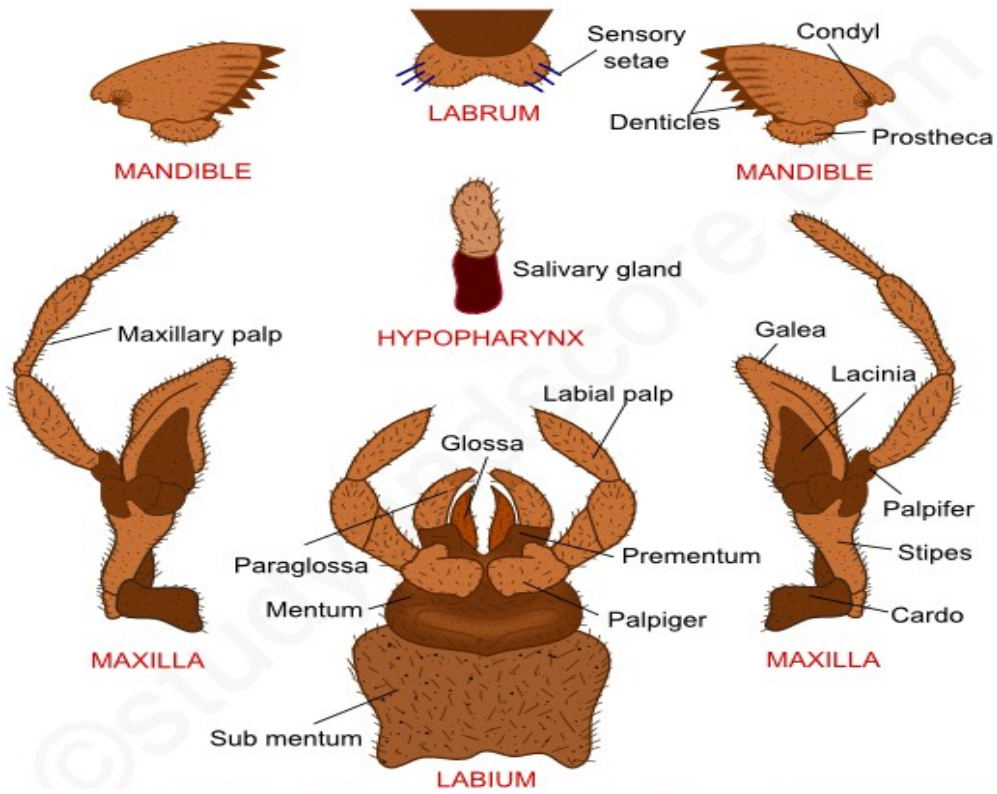
one pair it have different shape and size

##### C-maxillae.- composed of 5 parts

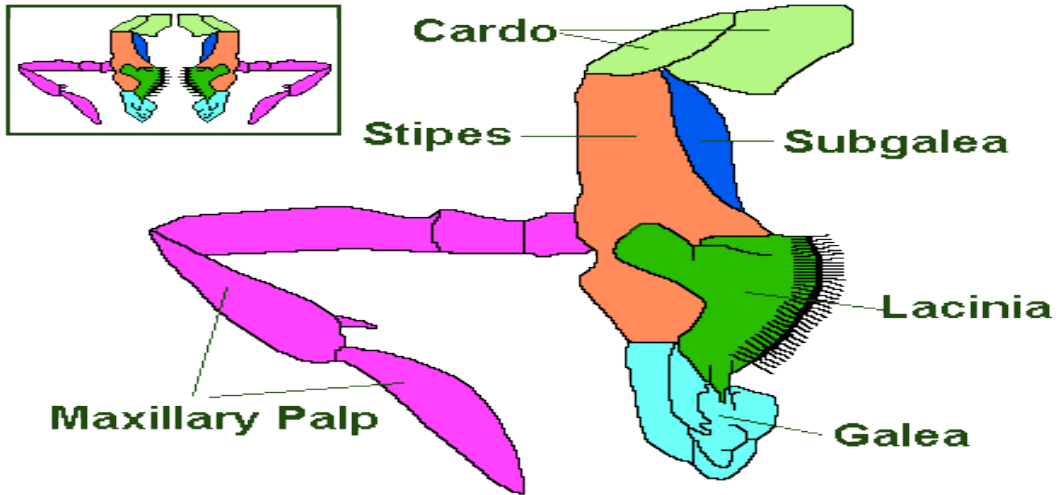
1-Cardo 2-stipes 3-galea 4- lacinia 5- maxillary palp

##### D-Labium:-composed of 5 parts

1-mentum 2-submentum 3-glossa 4- para glossa 5-labial palp



### The Insect Maxillae (one side only)



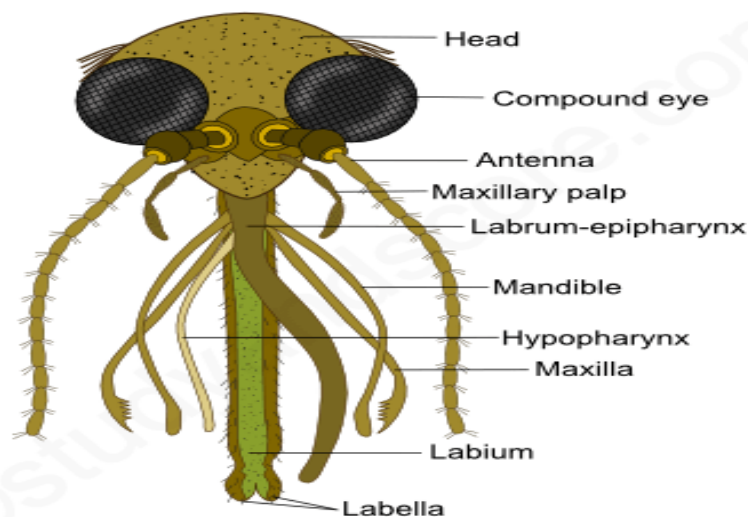
## 2-piercing-sucking:-

The labium is elongated and acts as a sheath. This encloses the mandibles and maxillae which are modified in to sharp needle like stylets for piercing. The maxillae have two tubes running along their length on the inside surface. 'Saliva' may be pumped down one of the tubes. This saliva makes the food into a liquid. The liquified food is sucked up the other tube.

The mandibular stylelets form the outer pair and possess serrated margins at their tip.

The maxillary stylelets forms the inner pair having smooth curved tips and combine together enclosing a **food channel**.

ex:- hemiptera



MOUHPARTS OF MOSQUITO - PIERCING & CHEWING TYPE



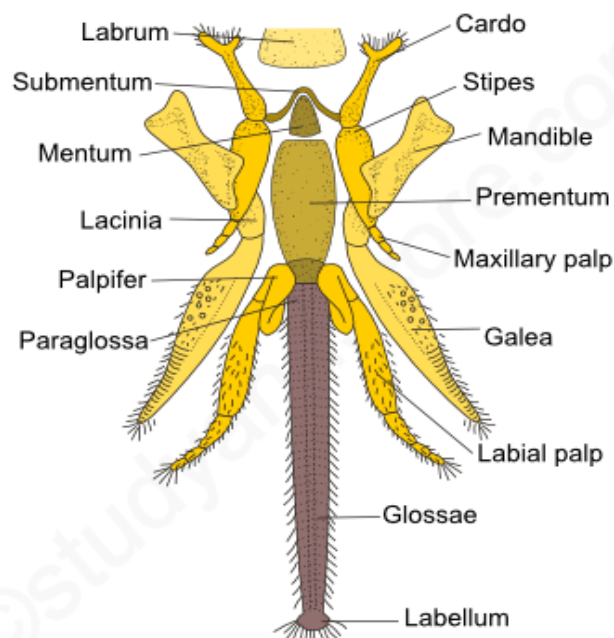
### 3-Chewing and lapping type:

Ex:- honey bee this insect feeding on different types of food solid (pollen) and liquid (flower juice) so this type of mouth parts have 2 processes chewing the pollen (solid material) and lapping the liquid (flower juice)

Mandibles used for chewing and mixing the food with salivary gland secretions

Labrum used for pushing the pollen to the mouth part

Maxilla used for lapping the flower juice labium used for sucking the liquid which is ended with flabellum is spongy part used for sucking the liquid



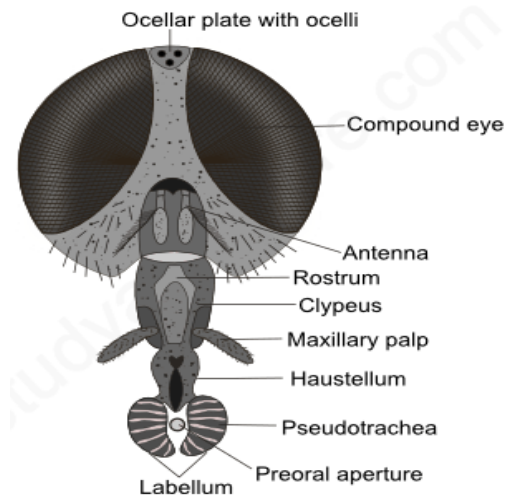
MOUHPARTS OF HONEY BEE - CHEWING & LAPPING TYPE  
©studyandscore.com

#### 4-Sponging type:

The sponging mouthparts are found in the housefly and some other flies to suck up the liquefied food. These flies lack the cutting weapons of the insects that chew the food. The mandibles are absent, while the maxillae are represented only by two maxillary palps, each made of a single piece. These mouthparts are represented by **proboscis** formed from the **labium**.

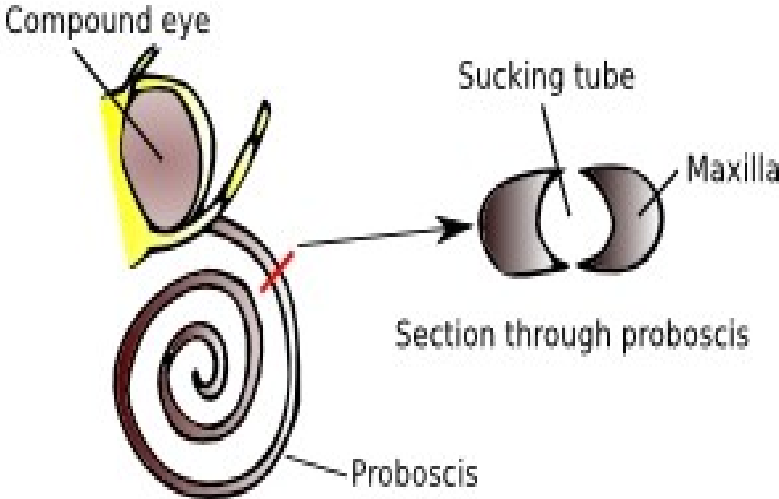
The proboscis is divided into a basal **rostrum**, middle **haustellum** and a distal **labellum**.

The labellum is a sponge like structure. It is traversed by a number of narrow transverse channels called **pseudotrachea**



#### 5-Siphoning type:

Butterflies and moths are adapted for feeding on nectar like the bees, but in their mouthparts the maxillae form the main proboscis and not the labium. The mandibles and labium are much reduced. The labium forms a triangular plate forming a labial palps. The galeae are much elongated and coiled. When not in use the proboscis is coiled into position beneath the head and when the insect wants to feed, it becomes uncoiled to reach the nectary.



## Thorax

The insect thorax is divided into three parts: the prothorax (pro=first), mesothorax (meso=middle), and metathorax (meta=last). Each segment consists of hardened plates, or sclerites. Dorsal sclerites are called nota (sing. notum) (pronotum, mesonotum, and metanotum), lateral sclerites are called pleura (sing. pleuron), and ventral sclerites are called sterna (sing. sternum) (prosternum, mesosternum, and metasternum)..

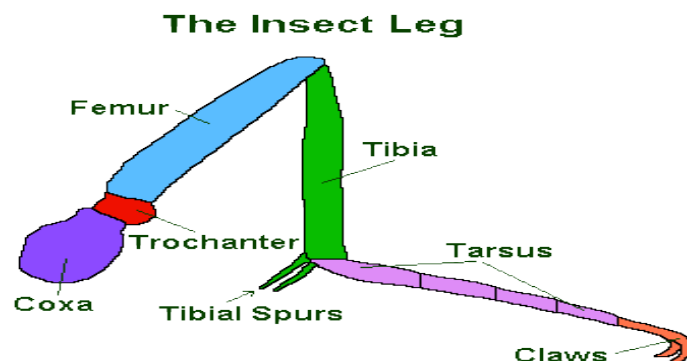
Each of the three thoracic segments contains one pair of legs. Wings are found only on the meso- and metathoracic segments.

### The Thoracic Appendages

#### 1-Legs

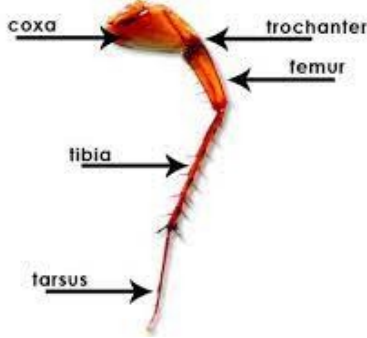

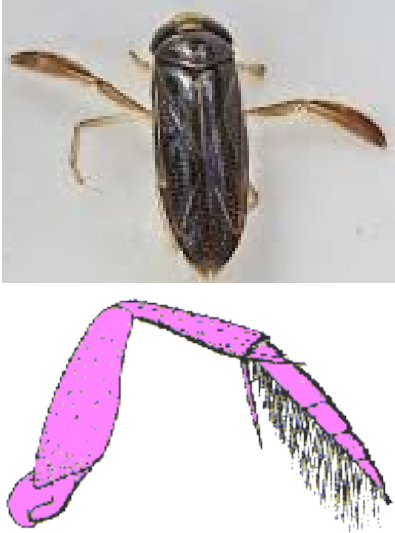

Most insects have three pairs of walking legs - one pair on each thoracic segment. Each leg contains five structural components (segments) that articulate with one another by means of hinge joints:

1- Coxa 2- Trochanter 3- Femur 4- Tibia 5- Tarsus



The term **pretarsus** refers to the terminal segment of the tarsus

### **Leg Adaptations and Modifications:**

Characteristic	Appearance	Example(s)
<p><b>Walking legs</b>-- adapted for walking</p>		<p>All legs Cockroaches</p>
<p><b>Raptorial</b>(grasping)femur spinose and possess a central longitudinal groove. Tibia narrow, blade like spinose and fits into the groove of femur adapted for catching and holding prey</p>		<p>Front legs Praying mantis</p>
<p><b>swimming legs</b> -- Hind legs pad like. Tibia and tarsus short and broad having dense long marginal hairs. adapted for swimming</p>		<p>Hind legs Water beetles</p>
<p><b>digging legs</b> -- Tibia and tarsus short and broad with teeth adapted for digging in soil</p>		<p>Mole crickets</p>



**jumping legs** :- Femur and tibia elongated adapted for jumping



Grasshopper

**Clinging legs**:- Tibia possess tibial thumb. Tarsus single segmented and pretarsus with a single long curved claw



Head louse

**Cleaning legs:-** Tibia possess a movable spine, and the first tarsal segment with a semicircular notch



Front leg  
honey bee

**Collecting legs:-** first tarsal segment enlarged and possess short stiff hairs called pollen basket



Hind legs  
honey bee



Lab 6

## 2-Wings

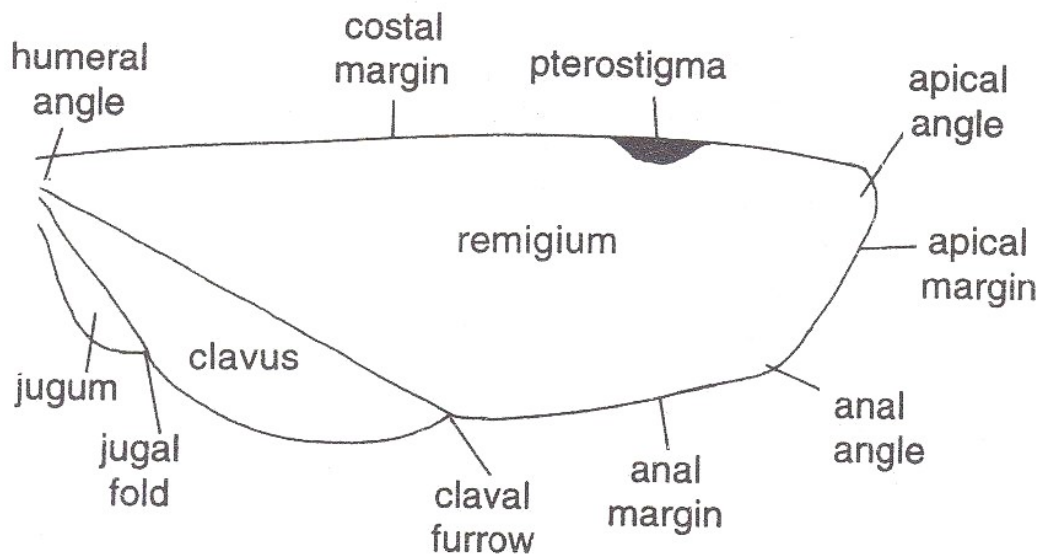
A typical insect wing is triangular with **three margins** and **three angles**.

Three margins are:-


- 1-**costal** or anterior,
- 2-**Apical** or outer and
- 3-**Anal** or inner

Three angles are

- 1-**Humeral** angle :between body wall and costal margin
- 2-**Apical or outer** angle : between costal and apical margin
- 3-**Anal** angle or **tornus** : between apical and anal margin



**Wing adaptations and modifications:**

Characteristic	Appearance	Order(s)
<p><b>Elytra</b> -- hard, sclerotized front wings that serve as protective covers for membranous hind wings</p>		<p>Coleoptera beetles</p>

**Hemelytra** The base of the wing is thick like elytra and the remaining half is membranous. This thickened portion is divided in to corium, clavus cuneus and embolium. They are useful of protection and flight



Hemiptera:

**Tegmina** -- front wings that are completely leathery or parchment-like in texture






Orthoptera,  
Blattodea,

**Halteres** -- small, club-like hind wings



Diptera

<p><b>hairy wings</b> -- slender front and hind wings with long fringes of hair</p>		<p>Thrips</p>
<p><b>Membranous :</b> -wing having membranous texture &amp; clear veins</p>		<p>Dragonflies wasp</p>
<p><b>Scaly wings:</b> covered with flattened setae (scales)</p>		<p>butterfly</p>

**Wing Venation:**

Costa (C) the leading edge of the wing

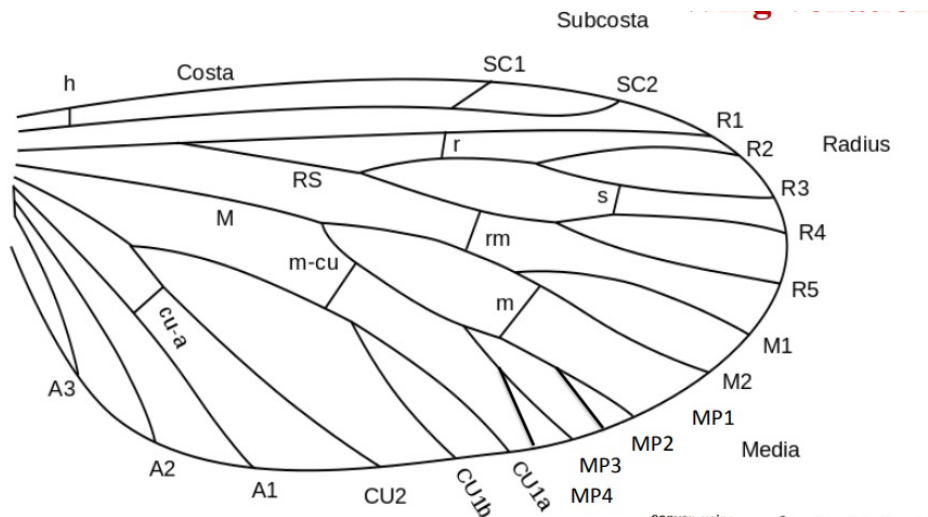
Subcosta (Sc) – second longitudinal vein (behind the costa), typically unbranched

Radius (R) -- third longitudinal vein, one to five branches reach the wing margin

Media (M) fourth longitudinal vein, one to four branches reach the wing margin

Cubitus (Cu) fifth longitudinal vein, one to three branches reach the wing margin

Anal veins (A1, A2, A3) -- unbranched veins behind the cubitus



**Names of crossveins are based on their position relative to longitudinal veins:**

- c-sc** crossveins run between the costa and subcosta
- r** crossveins run between adjacent branches of the radius
- r-m** crossveins run between the radius and media
- m-cu** crossveins run between the media and cubitus

**Wing coupling apparatus/Organs/Mechanisms:**

For taking flight, insect need to keep both the fore and hind wings together as a single unit. The structures in the form of lobes, bristles, hairs or spines that help the wings to be together are known as wing coupling organs

**1. Jugate type or jugum type :**

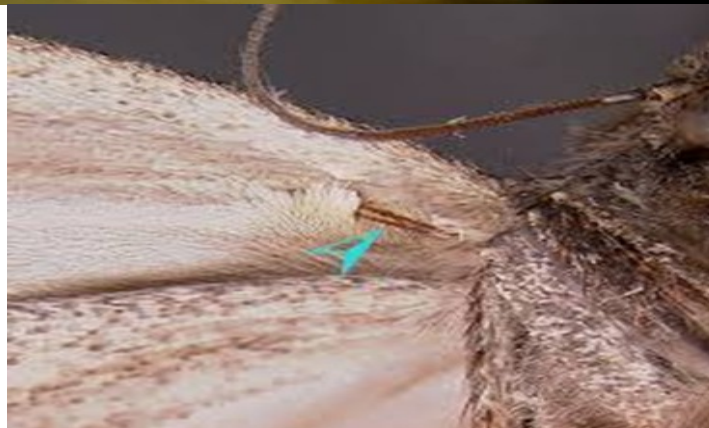
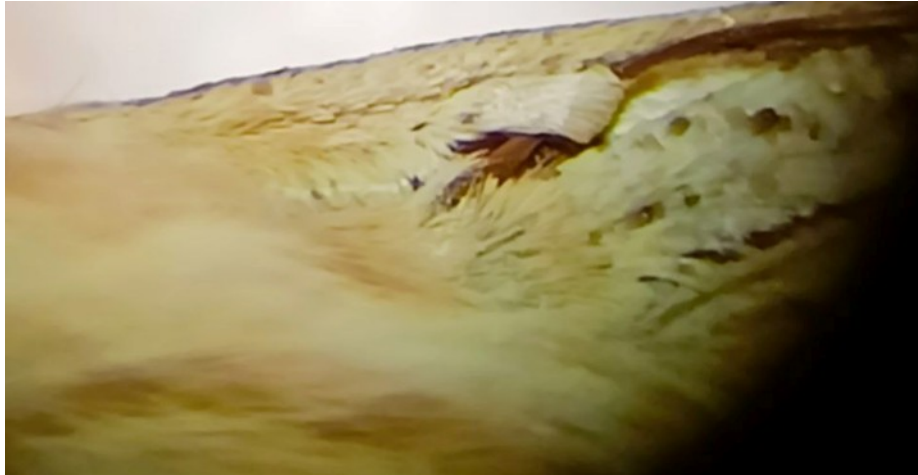
The costal margin of the front wing possess a small lobe at its base called **fibula**

Which rest on the surface of the hind wing or sometimes engages with spines

present on the upper surface of hind wings .

e.g.: primitive lepidopterans of the family Hepialidae

**2. Frenulum and retinaculum type:-** The hind wings possess bristle or spine like structure or group of hairs known as **frenulum**. The forewings possess hook like **retinaculum** on anal side. During flight the frenulum passes beneath the retinaculum and thus the both the wings are kept together.. e.g.: moths



**3. Hamuli :** Small curved hook like structures present on the costal margin of the hind wing known as **Hamuli** that fit into the upward fold of the anal margin of the forewing . e.g.: hymenopterans(wasps and bees)

