

Assignment. no. 1

1. Define Entomology. Describe in detail history of Entomology.
→ Entomology is a branch of zoology that deals with the scientific study of insects including their classification, morphology, physiology, ecology, behaviour, life cycle and their economic importance.

History of Entomology -

1. Ancient period (before 1500 AD)

In this period, knowledge about insects was based on observation and experience.

→ Important contributions:

- Ancient Egyptians used honey bees for honey and wax.
- Chinese people practiced silk production from silkworms.
- Indian Vedas and scriptures mentioned insects and pests affecting crops.
- Aristotle (384 - 322 BC)
 - He described many insects in his book *Historia Animalium*.
 - He classified insects based on wings and habitats.

Middle Ages (1500 - 1700 AD)

- Scientific progress was very slow.
- People believed insects were produced by spontaneous generation.
- No proper classification system existed.

Modern period (1700 - 1900 AD)

This period is called the Golden Age of Entomology.

Carolus Linnaeus (1707 - 1778)

Known as Father of Taxonomy.

Classified insects in his book *Systema Naturae*.

He grouped insects based on wings and structure.

- b) Johan Christian Fabricius (1745 - 1808)
- Known as the Father of Insect Classification
 - Classified insects based on mouthparts, which is still important today
- c) Reaumur and Swammerdam
- Studied insect anatomy and physiology.
 - Swammerdam discovered metamorphosis in insects.
 - Reaumur studied insect behaviour and development.
- d) Charles Darwin (1809 - 1882)
- Proposed Theory of Evolution.
 - Explained how insects evolved and adapted to the environment.
4. Economic Entomology period (1900 - present)
- Entomology became important in agriculture, medicine, etc.
 - Scientists studied crop pests, beneficial insects, insect-borne disease, pest control methods, etc.

Assignment . no. 2

2 Write short note on Indian history of Entomology.

Ancient period -

Ancient Indians had practical knowledge of insects through sericulture, honey collection and lac production. Epics like Ramayana and Mahabharata mention insects (eg: Madhumakshika for honey bees, pipilika for ants, pathanga for grasshopper and umbakapalika for termite queens).

→ 18th - 19th Century -

Beginnings of scientific study

- 1758 : Carl Linnaeus's Systema Naturae recorded the first ~12 Indian insect species.
- 1767 - 1779 : Dr. I. G. Koenig initiated systematic collection and published on termites.
- 1782 : Dr. Kerr described the lac insect.
- 1785 : Asiatic Society of Bengal founded, promoting insect studies.
- 1883 : Bombay Natural History Society established.
- 1892 onward : Fauna of British India series began.
- 1897 : Sir Ronald Ross discovered the malaria parasite in Anopheles mosquitoes in Secunderabad.

→ Early 20th Century -

Institutional growth and Applied focus

- 1901 : Lionel de Nicéville appointed first government Entomologist of India.
- 1903 - 1905 : Harold Maxwell Lefroy - Established entomology at the Imperial Agricultural Research Institute (IARI) in Pusa (later New Delhi) and published key books like Indian Insect Pest (1906) and Indian Insect Life (1909).
- 1914 - T. B. Fletcher published some South Indian insects.

- 1916 - Zoological survey of India formed.
- 1925 - Indian Lac Institute started
- 1938 - Entomological Society of India (ESI) founded.
- 1939 - Indian Journal of Entomology launched ; locust warning organization established.

→ Post Independence to Present -

- Entomology expanded into integrated pest management , vector control biotechnology and biodiversity.
- Key works includes H.S. Pruthi's textbook (1963) , M.S. Mani's General Entomology (1968) and S. Pradhan's contribution.
- Institution like IARI , ESI and the Directorate of plant protection (DPP) remain central , supporting agriculture , public health and global research on pest and pollinators.

Assignment no. 3

Describe in detail reasons of dominance of insects.

→ The reasons of dominance of insects are :

1. Capacity for flight
2. More adaptability or universality smaller size -
 - Majority of insects are smaller in their size conferring the following physiological and ecological advantages.
3. Presence of exoskeleton -
 - Insect body is covered with an outer cuticle called exoskeleton which is made up of a cuticular protein called Chitin.
 - This is light in weight and gives strength, rigidity and flexibility to the insect body.
4. Resistance to desiccation -
 - Insects minimize the water loss from their body surface through prevention of water loss.
5. Tracheal system of respiration -
 - This ensures direct transfer of adequate oxygen to actively breathing tissues. Spiracles through their closing mechanism admit air and restrict water loss.
6. Higher reproductive potential -
 - Reproductive potential of insect is high. For example, egg laying capacity of queen termite is 6000 - 7000 eggs per day.
 - Presence of special types of reproduction other than oviparity and viviparity like polyembryony, parthenogenesis and paedogenesis.
7. Presence of complete metamorphosis -
 - More than 82 % of insects undergo complete metamorphosis with four stages.

8. Presence of defense mechanisms -

- By different defense mechanisms, insects escape from the enemies to increase their survival rate

9. Hexapod locomotion -

- Insects use 3 legs at a time during locomotion, while the remaining 3 legs are static, which gives greater stability

Assignment no. 4

Give the taxonomic position of insects in Animal Kingdom.

→ Taxonomic position of insects is given below:

Invertebrates



Kingdom - Animalia



Phylum - Arthropoda



Sub-phylum - Uniramia



Class - Insecta / Hexapoda



Sub class - Pterygota / Apterygota



Order



Suborder



Super family

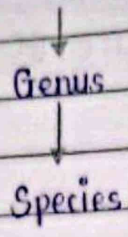


Family



Sub family





Assignment no. 5

Differentiate between class Insecta and class Arachnida.

| Basis of difference | Class Insecta | Class Arachnida |
|---------------------|--|---|
| Phylum | Arthropoda | Arthropoda |
| Body division | Body divided into Head, Thorax and Abdomen (3 parts) | Body divided into Cephalothorax and Abdomen (2 parts) |
| No. of legs | 3 pairs (6 legs) | 4 pairs (8 legs) |
| Antennae | One pair of antennae present | Antennae absent |
| Wings | Usually 1 or 2 pairs of wings present | Wings absent |
| Eyes | Compound eyes usually present | Simple eyes (ocelli) present |
| Respiration | Through tracheae | Through book lungs or tracheae |
| Examples | Cockroach, butterfly, housefly, etc. | Spider, scorpion, tick, etc. |

Assignment. no. 6

Differentiate between class Insecta and class Crustacea.

| | Class Insecta | Class Crustacea |
|---------------|--|---|
| Basis | | Arthropoda |
| Phylum | Arthropoda | |
| Habitat | mostly terrestrial (land) | mostly aquatic (freshwater and marine) |
| Body division | Body divided into Head, Thorax and Abdomen | Body divided into Cephalothorax and Abdomen |
| No. of legs | 3 pairs (6 legs) | Usually 5 or more pairs of legs |
| Antennae | One pair of antennae | Two pairs of antennae |
| Wings | usually present | wings absent |
| Respiration | Through tracheae | Through gills |
| Eyes | Compound eyes | Compound eyes (often stalked) |
| Examples | Cockroach, butterfly, housefly, etc. | Prawn, crab, lobster, etc. |

Assignment no. 7

Enlist characteristics of phylum Arthropoda.

→ Characteristics of phylum Arthropoda are :

1. Segmented body.
2. Segments grouped into 2 or 3 regions (tagma) known as Tagmosis.
3. Renewable chitinous exoskeleton.
4. Grow by molting.
5. Bilateral symmetry of body.
6. Body cavity filled with blood and called as haemocoel.
7. Tubular alimentary canal with mouth and anus at anterior and posterior ends.
8. Dorsal heart with valve like ostia.
9. Dorsal brain with ventral nerve cord.
10. Striated muscles (with dark and light bands).
11. No cilia (hair like vibratile structure on the surface of the cell).
12. Paired, segmented appendages.

Assignment. no. 8

Enlist characteristics of Hexapoda or Insecta.

→ Characteristics of Hexapoda or Insecta are :

1. The body is divided into distinct regions i.e., Head, Thorax and Abdomen.
2. Single pair of antennae on head.
3. Three pairs of legs on thorax.
4. Two pairs of wings on thorax.
5. The genital opening are situated on 8th and 9th abdominal segments.
6. Respiration by means of tracheae.
7. Undergo metamorphosis.
8. Excretion is mainly by malpighian tubules which help in maintaining ionic balance.

Assignment. no. 9

Draw well-labelled diagram of insect body wall or cuticle along with its functions

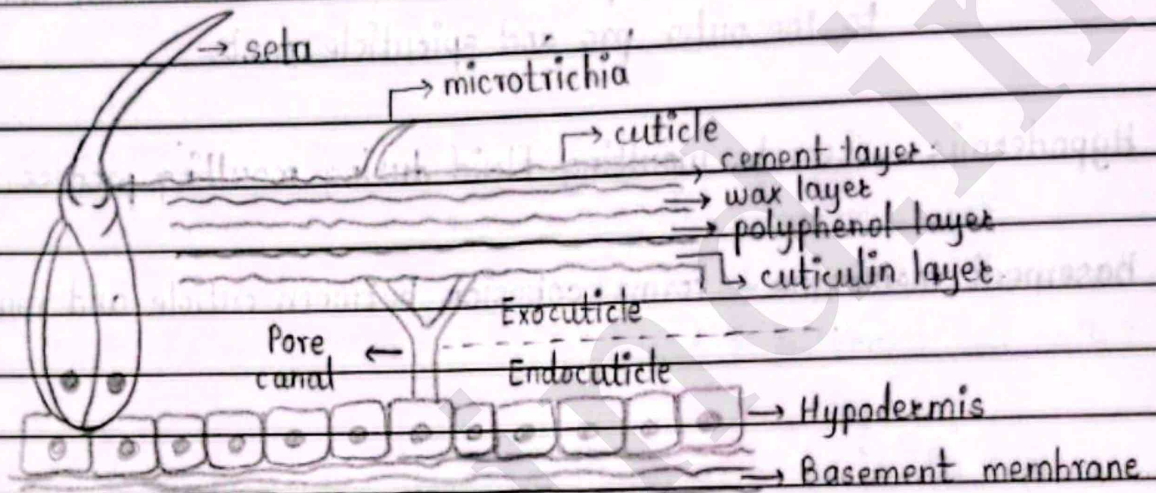


Fig: Body wall of Insect

Functions :

1. Seta - have role of taxonomic importance.
2. Cuticle - protection, prevents water loss, provides shape and support, muscle attachment, movement, sensory function, coloration.
3. Cement layer - protects body from external damage.
4. Wax layer - prevents water loss from the body.

5. Polyphenol layer - formation of the proteins.
6. Cuticulin layer - serves the purpose of permeability and also acts as growth barrier.
7. Exocuticle - gives hardness and protection.
8. Endocuticle - provides flexibility and movement.
9. Pore canal - useful in transportation of cuticular material and enzymes to the outer pro and epicuticle parts.
10. Hypodermis - secretes moulting fluid during moulting process.
11. Basement membrane - forms cohesion between cuticle and muscles.

Assignment. no. 10

Write short note on processes or appendages of cuticle.

→ I. Cuticular appendages - These are the outgrowths of the cuticle/integument connected with it by means of membranous joint. They arise from modified epidermal cells.

These are classified into setae and spurs.

A) Setae / Macrotrichia -

- Commonly known as hairs and arise from a cup like alveolus or pit.
- They are produced by a single enlarged hypodermal cell called 'trichogen cell'.
- Articular membrane is usually produced by a second hypodermal cell called 'tormogen cell'.
- Setae have role in taxonomic importance and vary with species to species.

B) Spurs -

- Occur on the legs of many insects and differ from setae in being multi-cellular in origin.

II. Cuticular processes -

- They have no membranous articulation.

A) Microtrichia / fixed hairs / aculei - These are minute hair like structures found on wings of Mecoptera and certain Diptera.

B) Spines - outgrowths of the cuticle which are more or less thorn like in form.

Assignment no. 11

Describe in detail with well-labelled diagram insect head, area, sulcus and sutures along with insect head position.

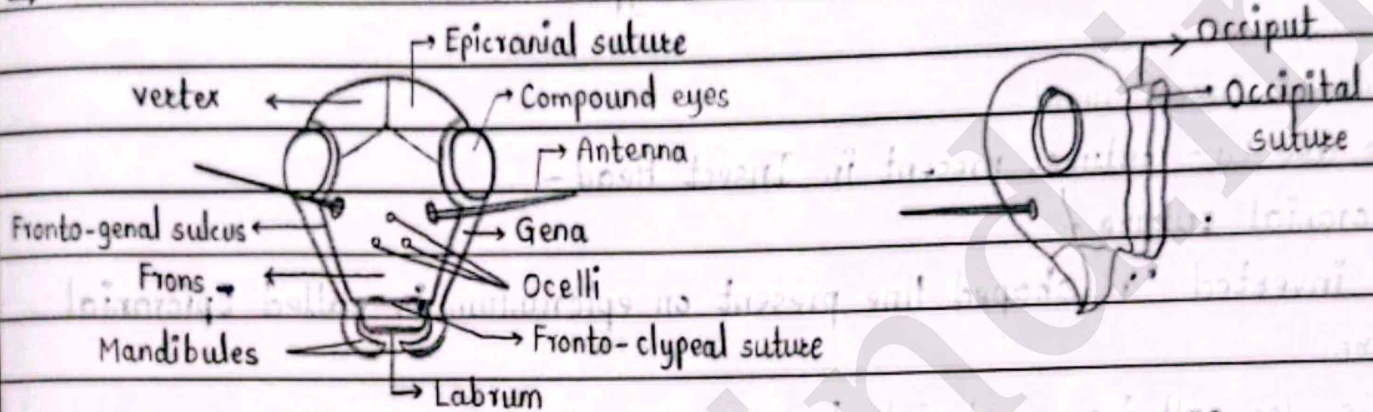


Fig: Front view of Insect Head

Fig: Lateral view of Insect Head

Areas of Insect Head -

1. Epicranial suture -

1. Epicranium - It forms the upper part of the head extending from frons to the neck.

2. Vertex - It is the portion beyond the compound eyes.

3. Frons - It is the facial part present between two compound eyes.

4. Gena - It is the lateral portion present below the compound eyes.

5. Clypeus - It is a plate like structure present beyond the frons.

6. Labrum - The upper lip is called as labrum.

7. Mandibles - The teeth like portion present below labrum is called Mandibles.

Sulcus of Insect Head -

1. Circumantennal sulcus - The sulcus present around the antenna is called circumantennal sulcus.
2. Circumocular sulcus - The sulcus present around the compound eyes is called circumocular sulcus.
3. Frontogenal sulcus - The sulcus which joins frons and gena or present between frons and gena is called frontogenal sulcus.
4. Frontoclypeal sulcus - The sulcus present between frons and clypeus is called frontoclypeal sulcus.

Sutures of Insect Head -

There are two sutures present in Insect Head -

1. Epicranial suture -

- The inverted 'Y' shaped line present on epicranium is called Epicranial suture.
- It is also called as ecdysial cleavage.
- Ecdysial cleavage is starting point of moulting process.

2. Occipital suture -

- It is 'U' shaped or horseshoe shaped suture.
- It is present between epicranium and occiput.
- It joins head and neck.

Insect head positions -

1. Hypognathous (Hypo - below ; Gnathous - jaw)

- Mouth parts are present downwards towards horizontal axis of body.
- eg: Grasshopper, Cockroach

2. Prognathus (Pro-infront ; Gnathus -jaw)

- Mouth parts are present parallel to the horizontal axis of body.
- eg: beetles, termites.

3. Opisthognathous (Opistho-behind ; Gnathous -jaw)

- Mouth parts are present between four legs and going towards the abdomen.
- eg: Red cotton bug

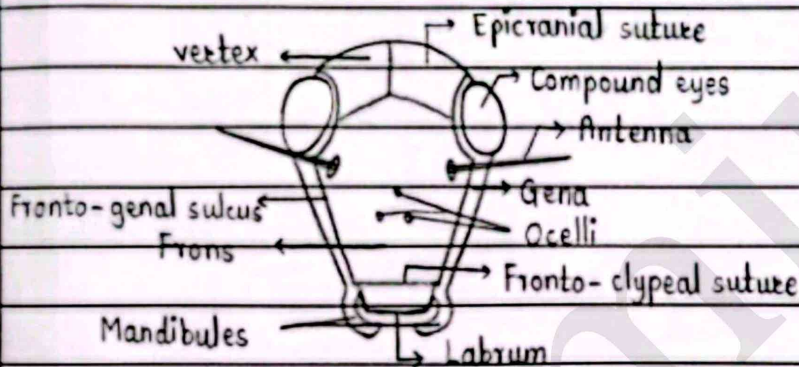


Fig: Front view of Insect Head

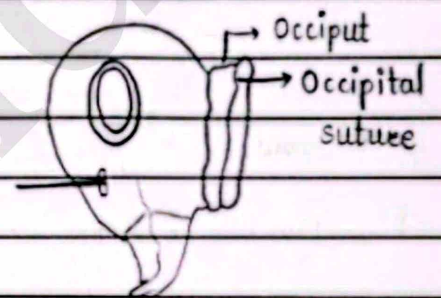


Fig: Lateral view of Insect Head

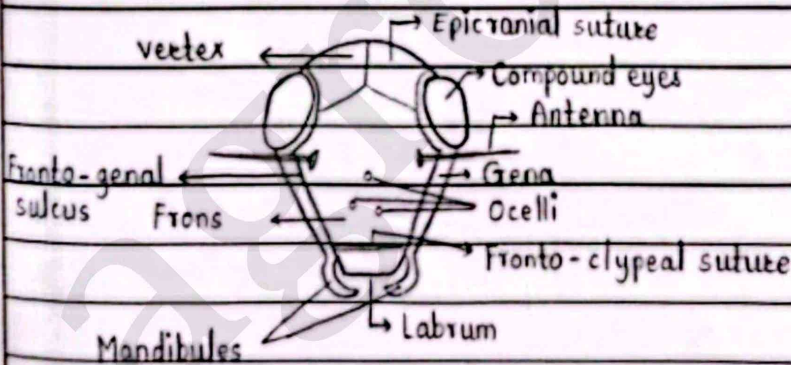


Fig: Front view of Insect Head

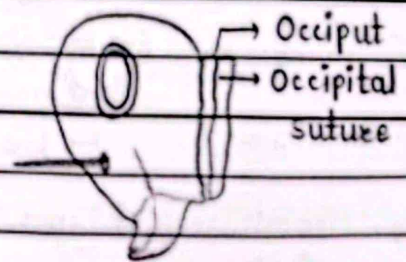


Fig: Lateral view of Insect Head

Assignment . no. 12

Give the typical structure of insect antenna and describe in detail modifications of antenna with example and function.

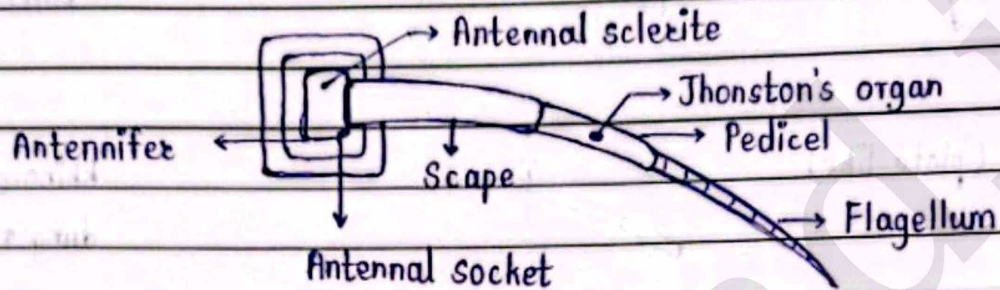
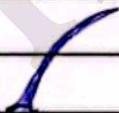

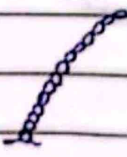
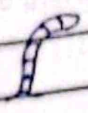



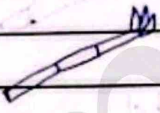

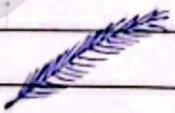




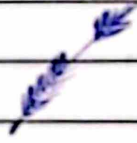
Fig: Insect Antenna

• Modifications of Antenna -

| Sr. no. | Type of antennae | Structure | Function | Example |
|---------|-----------------------------------|---|------------------------------------|---------------------|
| 1. | Setaceous (hair like) |  | sensory function, smell, awareness | Cockroach |
| 2. | Filiform (thread like) |  | smell, touch, sensory organ | Grass hopper |
| 3. | Moniliform (like string of beads) |  | | Termites and thrips |

| | | | |
|-----|--------------------------------|---|------------------------------------|
| 4. | Clavate (clubbed like) |  | Skipper moths, butterflies |
| 5. | Geniculate (elbow like) |  | Ant, honey bees, wasps. |
| 6. | Capitate (clubbed with knob) |  | Bettles |
| 7. | Serrate (saw like) |  | Mango stem borer. |
| 8. | Lamellate (plate like) |  | Rhinoceros beetle, dung rollers |
| 9. | Pectinate (comb like) |  | Female mulberry silk moth |
| 10. | Bipectinate (double comb) |  | Male mulberry silk moth. |
| 11. | Aristate (antenna with arista) |  | House fly |
| 12. | Plumose (feather like) |  | Male culex mosquito |

13. Pilose (brush like hairs)



Female culex mosquito

14. Stylate (antennae with style)



Jassids, Robber fly

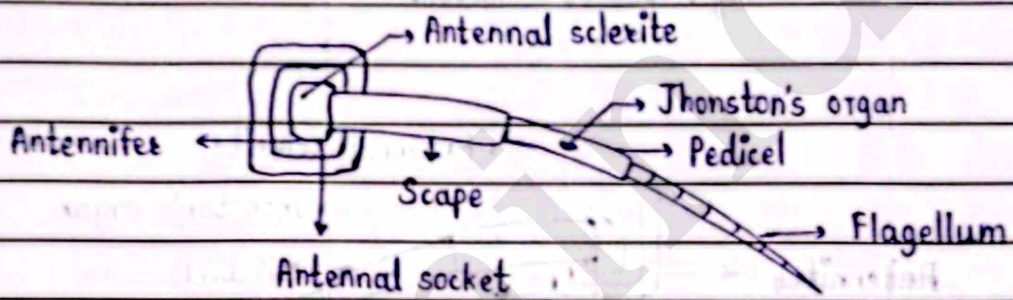


Fig: Insect Antenna

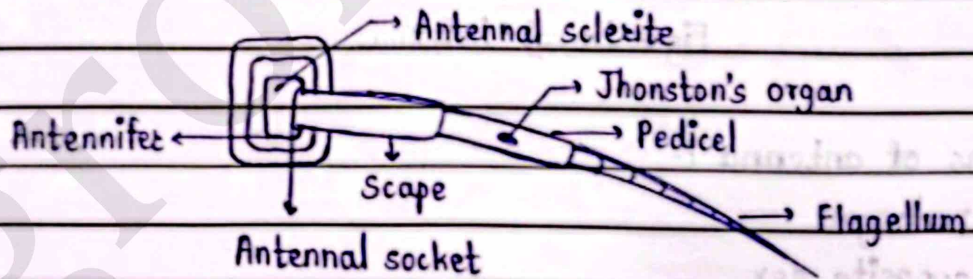


Fig: Insect Antenna

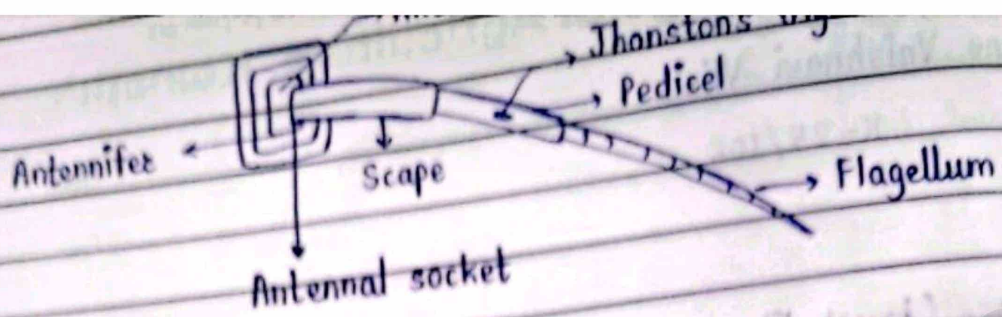


Fig: Insect Antenna

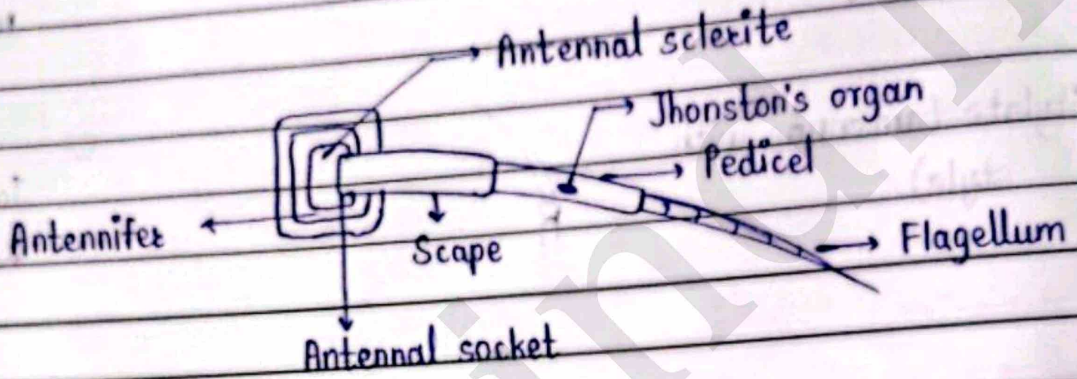


Fig: Insect Antenna

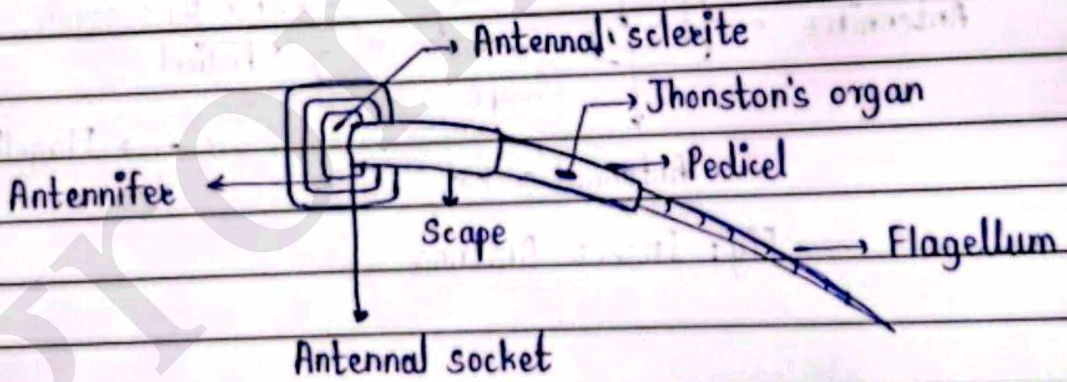


Fig: Insect Antenna

• Functions of antenna :-

- To detect danger.
- To find opposite sex
- To communicate with each other.
- It acts as sense organ.
- It helps in environmental awareness.

Assignment no. 13

Enlist different type of mouth parts present in insect with examples

→ Different types of mouth parts in insects are -

1. Chewing and biting type -

eg: Grasshopper, cockroach, beetles, etc.

2. Piercing and sucking type -

eg: Plant bugs and mosquitoes.

3. Rasping and sucking type -

eg: thrips

4. Sponging type -

eg: adult houseflies

5. Chewing and lapping type -

eg: honey bees

6. Siphoning type -

eg: Butterflies and moths.

Describe in detail chewing and biting type of mouth parts.
 → Chewing and biting type of mouth parts -

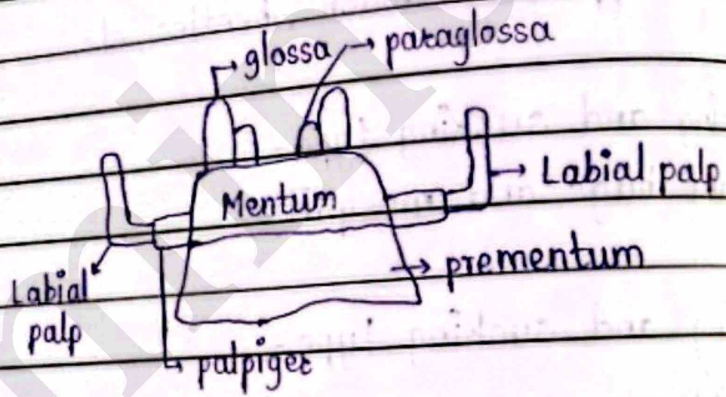
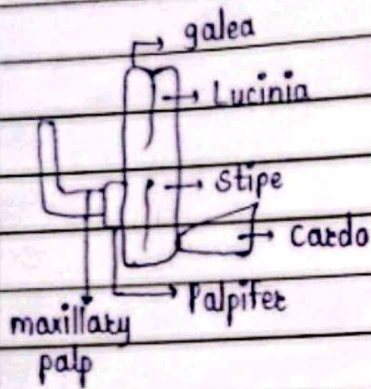
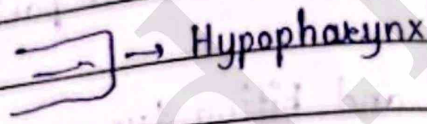
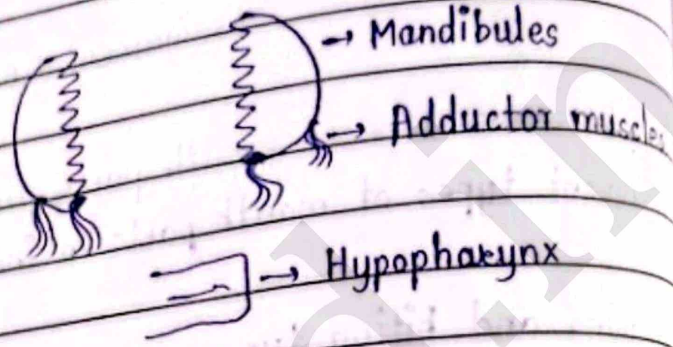
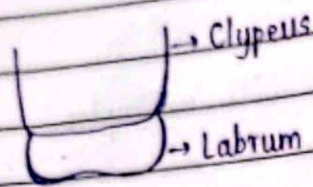


Fig: Mandibule

Fig: Labium

1. Labrum -

- It acts as upper lip.
- It is attached with clypeus.
- It has 'V' shaped notch which help to hold food at the time of feeding.
- Sometimes labrum acts as taste organ.
- Labrum hangs down from clypeus through clypeo-labral suture.

2. Mandibles - (upper jaw)

- Used for cutting food material.
- Two muscles are present abductor and adductor muscles which helps in moving.

3. Maxillae (lower jaw) -

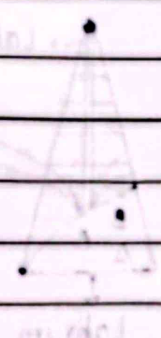
- These are homologous structures with basal triangular 'cardo' middle rectangular 'stipes'.
- Most of the maxillae made up of stipe.
- Lacinia and galea fuse together and form mala.
- Sclerite on which maxillae part present is called palpifer.
- It is sensory in nature.

4. Hypopharynx -

- It is tongue like organ present in mouth cavity.
- Act as a taste organ.
- Function is to mix saliva with the food material.

5. Labium -

- It act as lower lip.
- It is divided into prementum and mentum.
- Prementum is articulated with head.
- On mentum four lobes are present, outer lobe is glossa and inner lobe is paraglossa.
- Sclerite on which labial palps are present is called palpiger.
- They are sensory in nature.



Enlist different types of mouth parts with examples. Describe in detail piercing and sucking type along with feeding mechanism

→ Different types of mouth parts -

1. Chewing and biting type -

eg: Grasshopper, cockroach, etc.

2. Piercing and sucking type -

eg: Plant bugs, mosquitoes

3. Rasping and sucking type -

eg: thrips

4. Sponging type -

eg: adult houseflies

5. Chewing and lapping type -

eg: honey bees

6. Siphoning type -

eg: Butterflies and moths

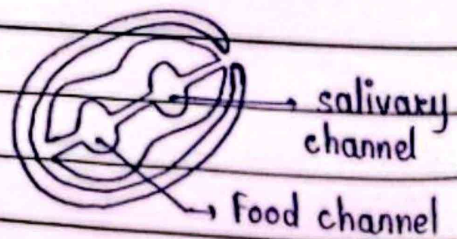
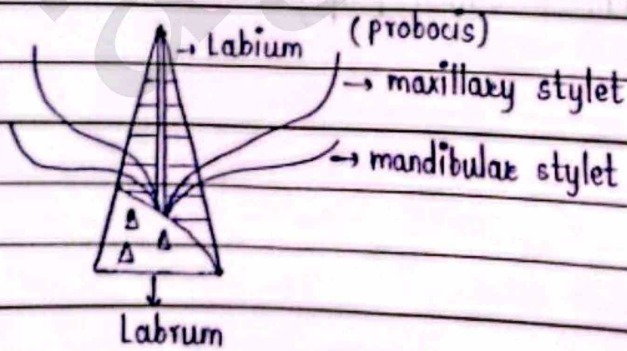


Fig: Piercing and sucking type of mouth parts

1. Labrum -

- It acts as roof over proboscis.

2. Mandibles -

- These are modified into stylet form which have internal groove.

3. Maxillae -

- It is also modified into stylet form having internal groove.

4. Hypopharynx

5. Labium -

- It is highly modified beak like structure called proboscis which have internal groove in which all four stylets placed together.

→ Feeding mechanism -

- First mandibular stylet starts piercing, alternately maxillary stylet start at rapid rate till the cell sap comes out.
- Then all four stylets council together and form tube like structure, from the salivary channel saliva is secreted by action of Sibatian sucking pump from food channel, food is taken through mouth.

Assignment. no. 15

Describe in detail mouth parts present in honey bees.

→ Honey bees have chewing and lapping type of mouth parts

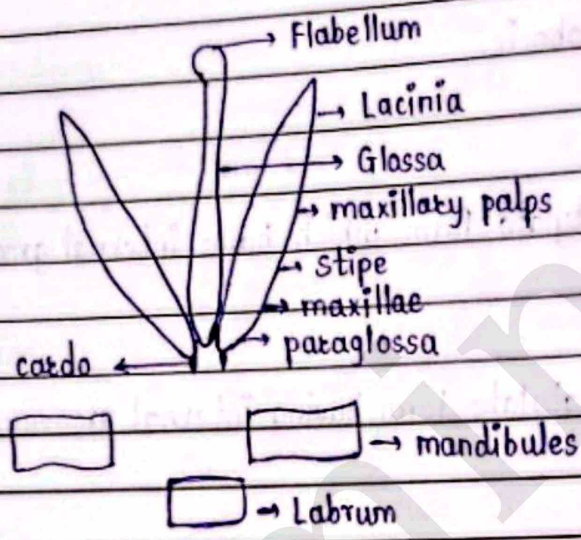


Fig: Chewing and lapping type of mouth parts (honey bees)

1. Labrum -
 - It is a narrow, plate-like structure.
2. Mandibles -
 - It is a dumbbell shaped structure.
 - They are not used for cutting food but for molding wax and cleaning comb.
3. Maxillae -
 - Cardo - it is narrow and inserted into head.
 - Stipes - they are elongated.
 - Galla - it is also elongated structure.
 - The maxillary palp is reduced to one segment.

4. Labium -

- It is also elongated.
- Glossa and paraglossa - elongated
- Flabellum is spoon like at the end of glossa.

5. Hypopharynx -

- It is highly modified part called maxo-labial complex.

Assignment no. 16

Enlist different types of mouth parts and explain sponging type of mouth parts with feeding mechanism.

→ Different types of mouth parts -

1. Chewing and biting type

eg: Cockroach, Grasshopper

2. Piercing and Sucking type

eg: Plant bugs and mosquitoes

3. Rasping and Sucking type

eg: Thrips

4. Chewing and Lapping type

eg: Honey bees

5. Sponging type

eg: Houseflies

6. Siphoning type

eg: Butterflies and moths

→ Sponging type of mouth parts -

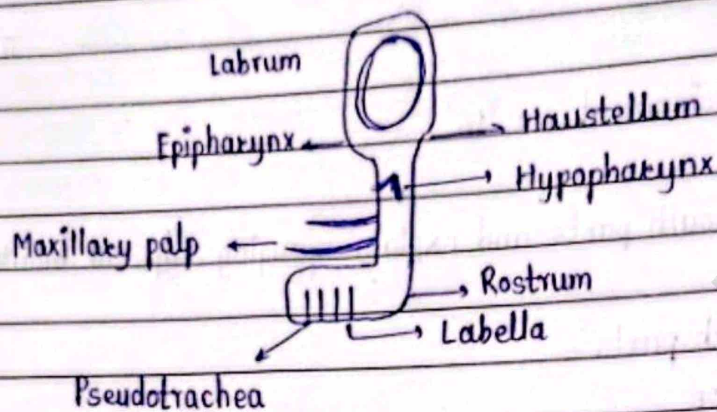


Fig : Sponging type of mouth parts

1. Labrum -

- Reduced in stylet form.
- Labrum epipharynx is present.

2. Mandibles -

- They are absent or vestigial.

3. Maxillae -

- Only maxillary palps are present and are reduced.

4. Labium -

- It is highly modified.
- Basal portion is called rostrum and posterior portion is called haustellum.
- The sponge like portion is called labella in which pseudotrachea is present.

→ Feeding mechanism -

- The houseflies feed on sugar (solid food).
- When they press labella, they secrete saliva and enzymes.
- They dilute food material by capillary movement and then liquid material is taken into the mouth.

Assignment. no. 17

Write short note on :

1. Rasping and sucking type of mouth parts

- • Rasping and sucking type of mouth parts are found in Thrips.
- All parts are same as piercing and sucking type but right mandibles are absent.
- So, they are called as asymmetric mouth parts.
- Labium is reduced and maxillae are present in stylet form.
- Labium is also reduced, and hypopharynx is vestigial.

2. Siphoning type of mouth parts

→

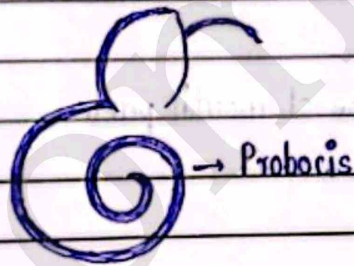


Fig: Siphoning type of mouth parts

- Labium and mandibles are reduced.
- Maxillae are highly modified.
- Galea is elongated and inter-locked in each other forming coil like structure called proboscis.

Assignment no. 18

Write short note on Thorax.

- • The part of insect body present between head and abdomen is Thorax.
- It is divided into 3 segments - Prothorax, Mesothorax and Metathorax.

1. Prothorax -

- It never beats wings.
- Pro-legs are present (frontal legs).

2. Mesothorax -

- First pair of wings (forewings) and middle legs are present.

3. Metathorax -

- Hindwings and hind legs are present.

- Sometimes, prothorax and mesothorax fuse together called pterothorax.
metathorax

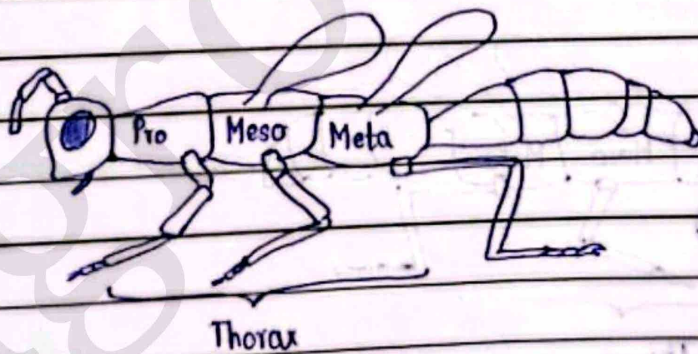


Fig : Thorax

4. Media (M) -

- It is divided into 2 main branches - anterior and posterior.
- Anterior media is divided into MA_1 and MA_2 .
- Posterior media is divided into MP_1 , MP_2 , MP_3 , MP_4 .

5. Cubitus -

- It is concave and denoted by 'Cu'.
- It is divided into Cu_1 and Cu_2 .

6. Anal veins -

- They are denoted as 'A' and are convex.
- They are 3 in number - A_1 , A_2 and A_3 .

→ Modification of wings:

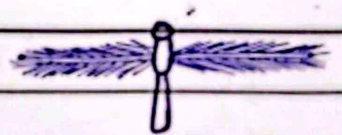
1. Membranous wings -

- They are membranous and used for fly.
- eg: dragon fly, honey bees



2. Fringed wings -

- Wings are narrow and have projections at both ends.
- eg: Thrips



3. Hemelytra wings -

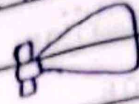
- The basal portion of wing is hard and thick.
- eg: Red cotton bug



4. Elytra wings -

- These wings are hard and highly sclerotized but not used for fly

eg: forewings of beetle



5. Tegmina wings -

- Forewings are leathery and tough.
- They are protective in function.

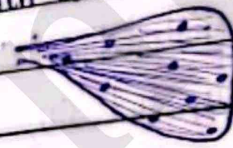
eg: forewings of grasshopper, cockroach



6. Scaly wings -

- Wings are thin, membranous but covered with unicellular scales all over the surface.

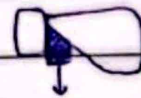
eg: butterflies, moths



7. Halteres -

- Hindwings are modified into halteres.
- Halteres act as balancers at the ~~top~~ time of flying

eg: housefly, mosquito.



Halteres

Assignment. no. 19

Give the typical structure of insect legs and describe in detail modification of legs with examples

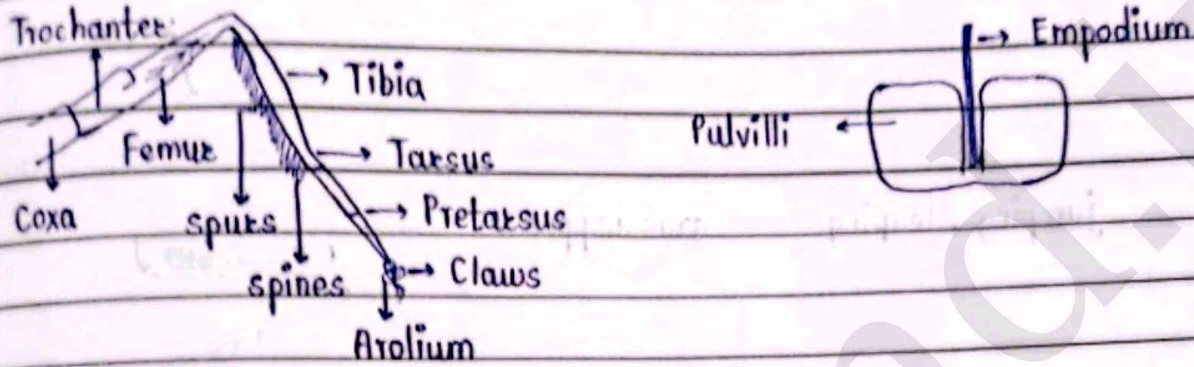
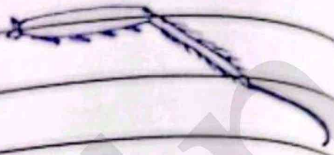
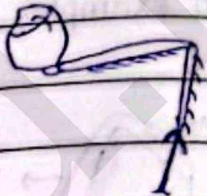
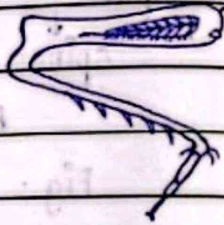

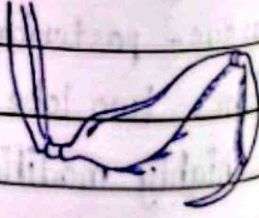


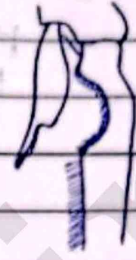
Fig: Insect leg.

1. Coxa - first segment articulated with thorax is called coxa.
2. Trochanter - second segment, small and attached to coxa is Trochanter.
3. Femur - largest, strongest and highly modified in jumping type of insects (eg: grasshopper).
4. Tibia - it is the fourth segment posterior to femur on which spurs and spines are present.
5. Tarsus - posterior, flexible and divided into segment.
6. Pretarsus - posterior part to tarsus is pretarsus.
7. Arolium - two lobe like structure present posterior to tarsus is arolium.
 - It is highly modified in houseflies and present in pad like structure called pulvilli.
 - In between two pulvilli, empodium is present.

| Modification of legs - | | | Structure |
|------------------------|------------------|---------------------------|---|
| Type | Function | Example | |
| 1. Cursorial | walking | cockroach, beetle |  |
| 2. Ambulatorial | running | ants |  |
| 3. Saltatorial | jumping, leaping | grasshopper |  |
| 4. Fossorial | digging | mole crickets (fore legs) |  |
| 5. Raptorial | grasping | mantids |  |

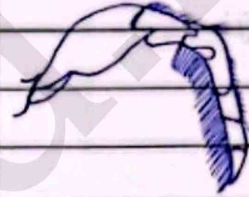
1. Scansorial

clinging

head louse, sucking
lice

2. Natatorial

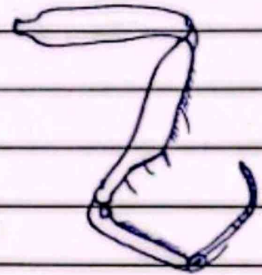
swimming

water beetle,
water bugs

3. Prehensile

basket forming type

dragon flies



4. Antennal

cleaning antennae

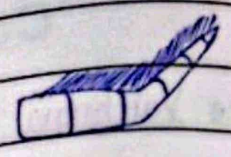
honey bees

cleaning legs



10. Sticking type

honey bees



11. Pollen collecting and pollen brushes

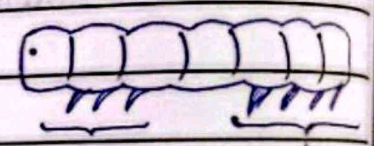
for collecting pollen and cleaning the body

honey bees



12. Pseudolegs

caterpillars



true legs

pseudo or abdominal legs

Assignment, no. 20

Define wing venation. Describe in detail arrangement of veins along with modifications of wings.

→ "The arrangement of veins on the wings is called as wing venation."

→ Arrangement of veins :

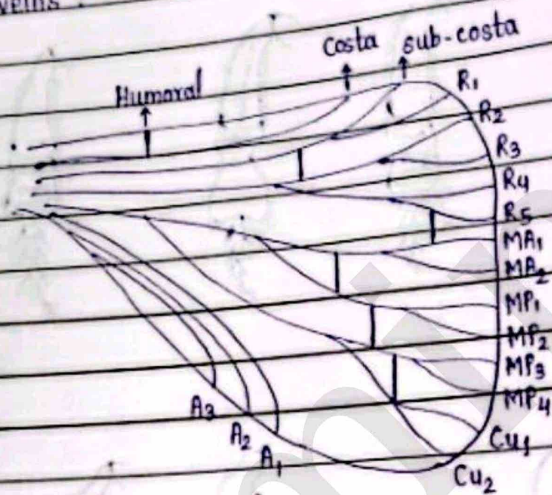


Fig: Wing venation

1. Costa -

- It is denoted by 'C'
- It forms anterior margin of the wing
- It is unbranched and convex.

2. Sub-costa -

- It is denoted by 'Sc'
- Present below the costa.
- It is concave.

3. Radial vein -

- It is denoted by 'R' and it is strongly convex.
- It is divided into five branches - R_1, R_2, R_3, R_4, R_5 .

Assignment, no. 21

Write a short note on :

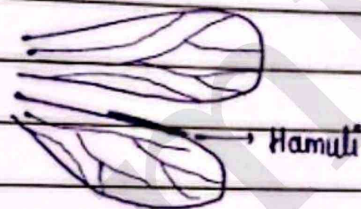
a. Wing coupling apparatus.

→ "The structures in the form of lobes, bristles, hairs or spines that help the wing to be together are known as wing coupling apparatus."

i. Hamuli / Hamulate -

• The small curved hook like or spine like structure present on costal end of hind wing is known as hamuli.

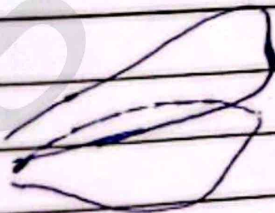
eg: wasps and honey bees.



ii. Amplexiform -

• The coupling observed by folding costal margin of hind wing and anal margin of forewing is known as amplexiform.

eg: butterfly



3. Frenate -
• At the base of costal margin bristle like structure is present called frenulum,
which is attached to retigum.
eg: Fruit sucking moth

4. Jugate / Jugum -
• Forewing is lobe like attached to costal margin of hindwing.
eg: moths.

h. Angles and margins of wings.

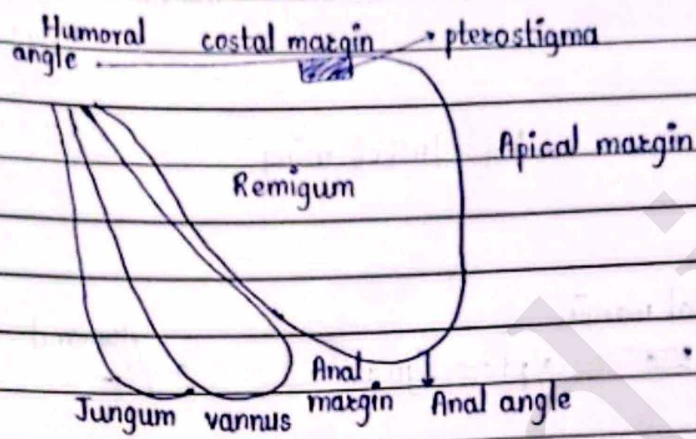


Fig: Insect wing

→ Angles of wing :

1. Humeral angle - The angle by which wings are attached to thorax is called Humeral angle.
2. Apical angle - The angle between costal margin and apical margin is called apical angle.
3. Anal angle - The angle between apical margin and anal margin is called anal angle.

→ Margins of wing :

1. Costal margin - The anterior margin of wing is called costal margin.
2. Apical margin - The outer margin of wing is called apical margin.
3. Anal margin - The posterior margin of wing is called anal margin.

Assignment . no. 22

Describe in detail digestive system of insect along with how digestion takes place

→ Digestive system of insect consist of Alimentary canal and salivary gland.

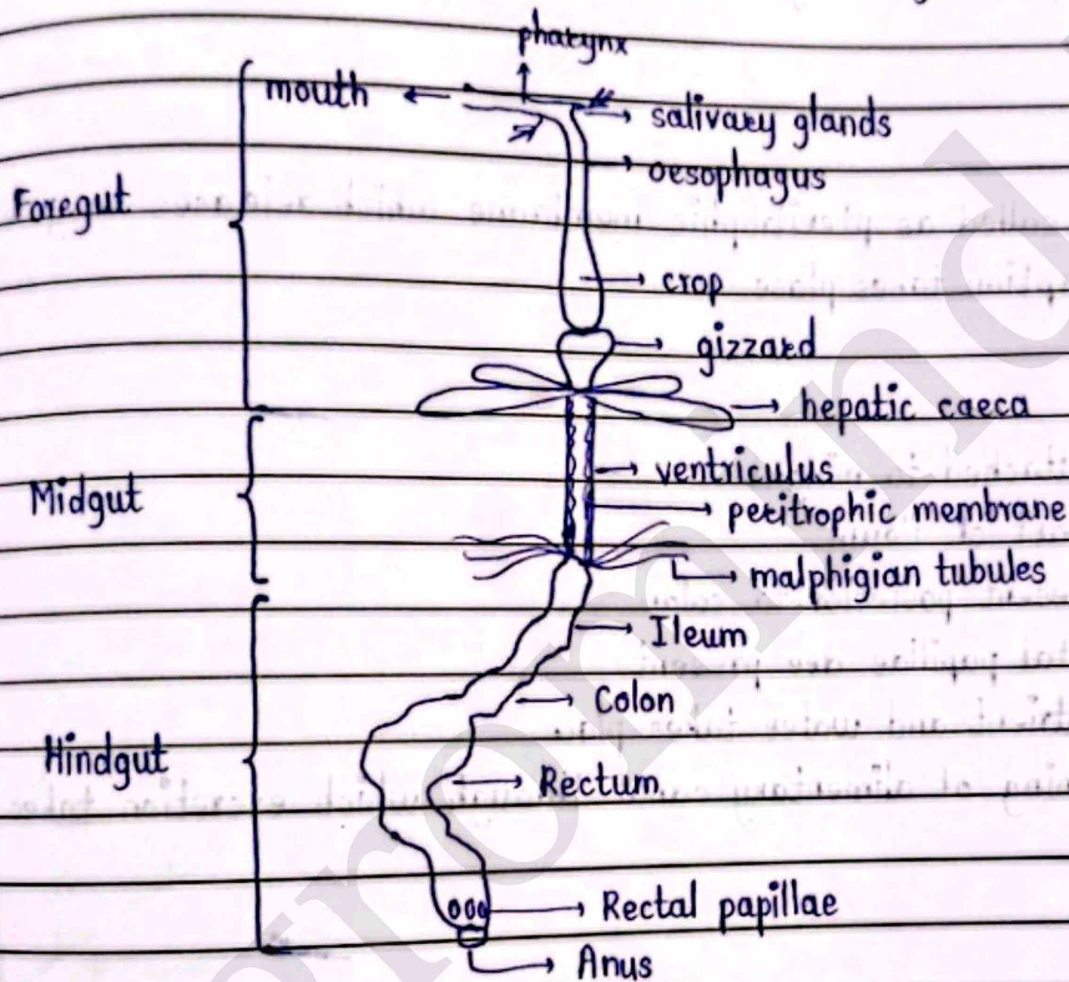


Fig: Alimentary canal

- Alimentary canal is extending tube like structure from mouth to anus.
- It is divided into 3 parts - Foregut, Midgut and Hindgut.

1. Foregut / stomodaeum -

- Ectodermal in origin, internal cuticular lining is present.
- Terminal mouth parts lead to preoral cavity.
- Preoral cavity betⁿ epipharynx and hypopharynx is called cibarium.
- Preoral cavity betⁿ hypopharynx and salivary duct is salivarium.
- Pharynx act as sucking pump in sap feeders.
- Oesophagus is narrow tube which conduct food into crop.
- Crop acts as food reservoir.
- Gizzard also called proventriculus and act as grinding mill.
- Hepatic caeca is present at the junction of foregut and midgut and increases area of absorption.

2. Midgut -

- Have inner lining called as peritrophic membrane which releases enzymes.
- Digestion and absorption takes place.

3. Hindgut -

- Ileum - portion attached to midgut.
- Colon - posterior part of ileum.
- Rectum - it is present posterior to colon.
- In rectum, 6 rectal papillae are present.
- Reabsorption of nutrient and water takes place.
- Anus - natural opening of alimentary canal through which excretion takes place.

Assignment, no. 23

Write a short note on Excretory system.

- Removal of waste products such as salts is called Excretion.
- Excretory system helps to maintain balance of water and salts.
- Organs present are Malpighian tubules and Nephrocytes.
- Malpighian tubules -
 - Discovered by Malpighi.
 - They are absent in aphids.
 - They ~~are~~ vary in number from insect to insects.
eg: 2 in scaly insects, 4 in bugs and 6 in moths.
 - It regulates salt concentration as well as sugar levels.
- Nephrocytes -
 - It helps to remove unwanted materials from haemocoel.
 - They are excretory in function.
- Alimentary canal plays role in excretion of salts through malpighian tubules.

Short note on Circulatory system.

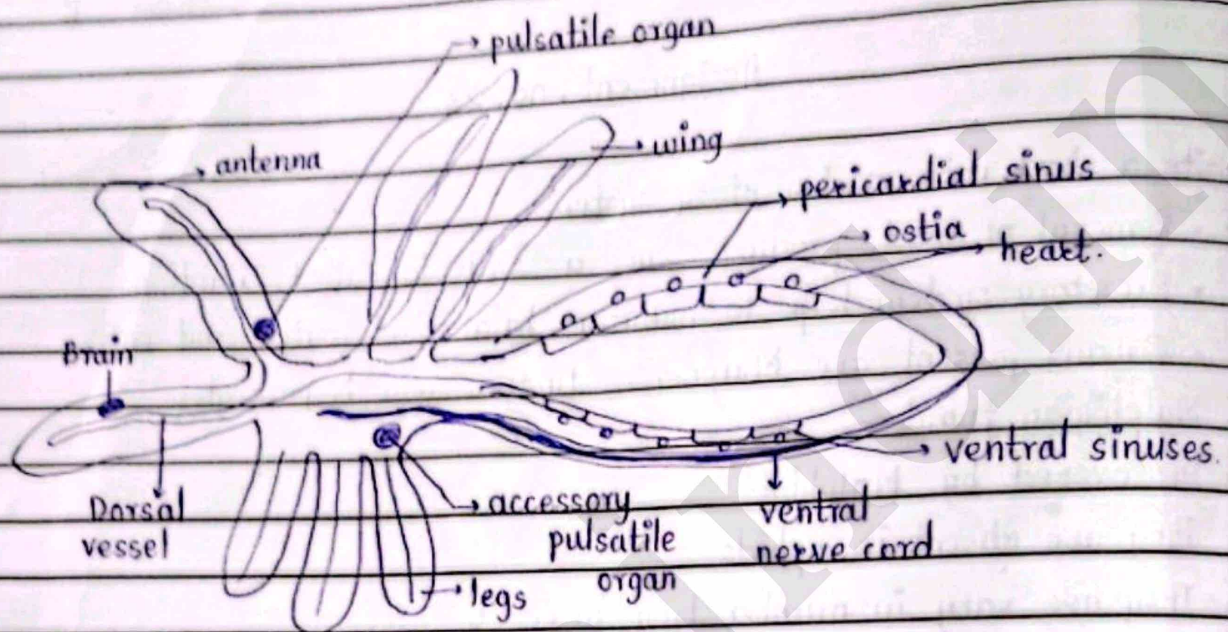


Fig: Circulatory system

- Open type of circulatory system present in insects
- One closed organ present called dorsal vessel which contain aorta and heart.
- Dorsal vessel -
 - Anterior part is called aorta.
 - Posterior part is called heart.

Write a short note on Respiratory system.

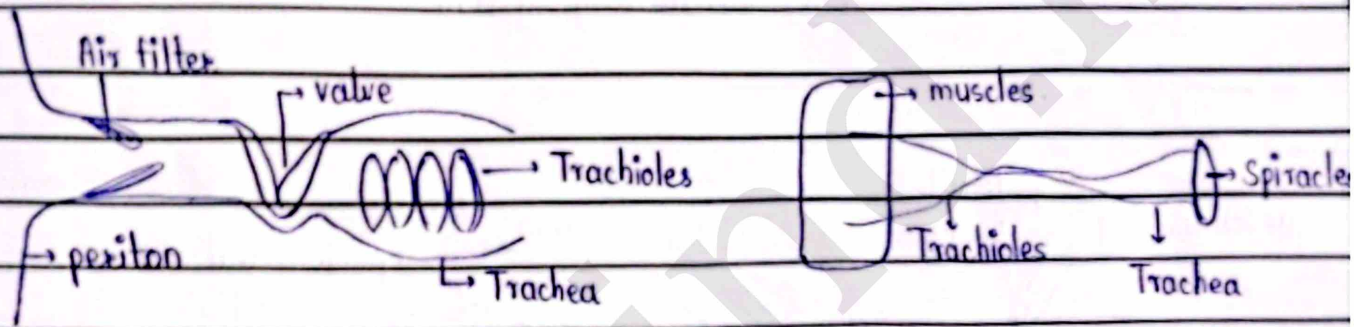


Fig: Respiratory system.

- Respiration is process of intake of oxygen and release of CO_2 .
- In insects, spiracles on body are responsible for respiration.
- Closing and opening of spiracles is done by plate like structure called atrial valve.
- Spiracles are absent in prothorax except *Diplura*.
- There are 10 pairs, 2 pairs on thorax and 8 pairs on abdomen.
- Trachea - wing like structure present in trachea called as Taenidia.
- Trachioles - small tube like, attached to trachea and extended towards organs.
- In trachioles, taenidia is absent, only valves and air is present which act as reservoir for exchange of gases.
- In aquatic insects, gills are present for respiration.