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I PHYLUM : PROTOZOA

1) *Amoeba proteus*

PHYLUM : PROTOZOA

CLASS : SARCODINA

ORDER : LOBOSA

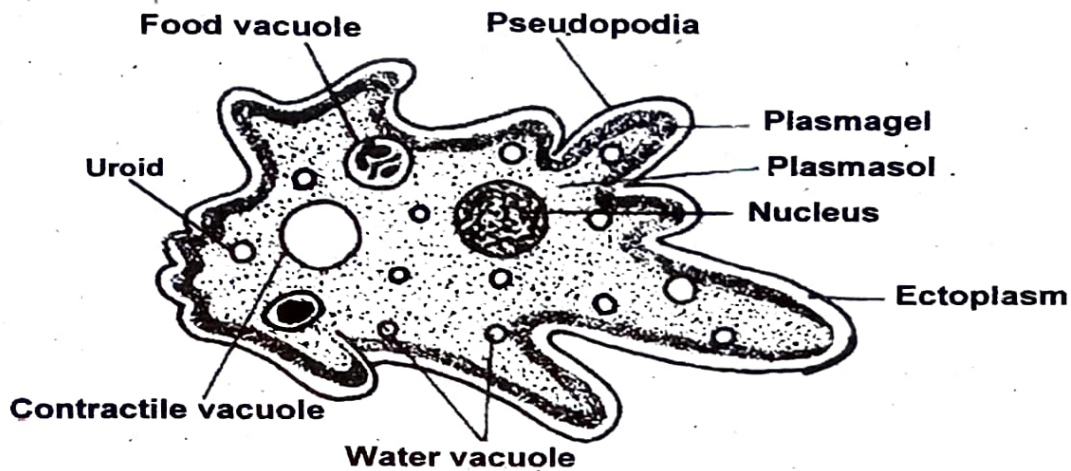


Fig : *Amoeba proteus*

IMPORTANT FEATURES :

- ❑ Amoeba is a freshwater living eukaryote organism seen in freshwater habitats.
- ❑ It is minute unicellular and microscopic measuring about 800m microns in size. Amoebae occur not only among the other protoans but also amongst fungi, algae and other microscopic animals.
- ❑ It is discovered in 1755 by August Johann Rösel von Rosenhof.
- ❑ It is universal in distribution and has no definite shape.
- ❑ It is commonly called as the proteus animal cule as it resembles the Greek God who has no shape.
- ❑ Body is covered by a thin plasma membrane enclosing a fluidy cytoplasm and nucleus.
- ❑ Outer surface is drawn into a number of temporary locomotory tubular structures called Pseudopodia of varying lengths.
- ❑ Cytoplasm is differentiated into an interchangeable outer gel like cytogel and inner fluidy cytosol.

- A number of fine granules of inorganic and organic substances are seen showing Brownian movement in the cytosol.
- Besides a vesicular nucleus, cytoplasmic inclusions commonly seen are the contractile vacuoles for osmoregulation and food vacuoles having food articles.
- The organism reproduces binary fission during favourable conditions and multiple fission or encystation during unfavourable conditions.
- An **amoeba**, often called amoeboid, is a type of cell or organism which has the ability to alter its shape, primarily by extending and retracting pseudopods.

(2) *Paramecium caudatum*

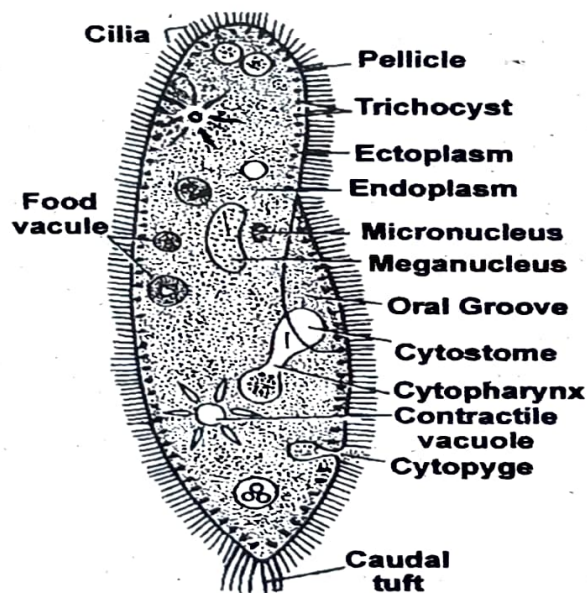


Fig : *Paramecium*-whole mount

PHYLUM : PROTOZOA
SUB.PHY : CILIOPHORA
CLASS : CILIATA
ORDER : HOLOTRICHA

IMPORTANT FEATURES:

- The organism resembles the sole of a slipper and hence is called slipper animalcule.
- This cigar/spindle shaped organism mostly inhabits fresh water ponds, ditches, streams, rivers, pools and lakes.
- Measures about 75 to 300 μ in length with a blunt anterior and a pointed posterior end bearing long tufted cilia.

- Body is encircled by a thick pellicle having serially arranged hexagonal plates.
- Cilia covering the body are almost uniform except the posterior tuft and they help in bringing out locomotion.
- Cytoplasm is distinguished into an outer jelly like ectoplasm and an inner granular, colloidal endoplasm.
- Cytoplasm also possess a kidney shaped macronucleus, a small micronucleus, contractile vacuoles surrounded by radiating feeder vacuoles.
- Oral groove on the ventral side of the organism is prominent ending in a vestibule.
- Vestibule extends posteriorly into the cytoplasm and ends in a cytopharynx.
- The organism leads a free swimming life feeding on bacteria and other microorganisms.

Identification :

Slipper shaped body, two contractile vacuoles surrounded by radiating vacuoles, two distinguishable nuclei

(3) *Paramecium*-binary fission

PHYLUM: PROTOZOA
 CLASS: CILIOPHORA
 ORDER: CILIATA

IMPORTANT FEATURES :

- Paramecium is a cigar/spindle shaped organism mostly inhabits fresh water ponds, ditches, streams, rivers, pools and lakes.
- During favourable conditions, it reproduces by simple binary fission.
- The organism elongates slightly than its normal size during breeding season.
- It becomes inactive and the endoplasm becomes more fluidy.
- Macronucleus undergoes amitosis and divides into two nuclei of either unequal or equal size.
- Micronucleus undergoes mitotic division to give two equal daughter nuclei.
- Karyokinesis is followed by cytokinesis, identified by the appearance of a horizontal groove over the body near the cytopharyngeal region.
- The furrow deepens and ultimately cuts the organism into two daughter individuals.
- The anterior one is the protenor. It elongates and develops the missing structures like vestibule and cytopharynx, the posterior contractile vacuole etc.
- The posterior one is the opisthe. It also elongates to have a blunt anterior end, an anterior contractile vacuole and a cytostomal opening on the ventral side leading into the vestibule.
- Thus formed daughter paramecia swim freely in water and lead independent life as two daughter paramecia.

Identification points:

Presence of a horizontal furrow, two macro and two micro nuclei.

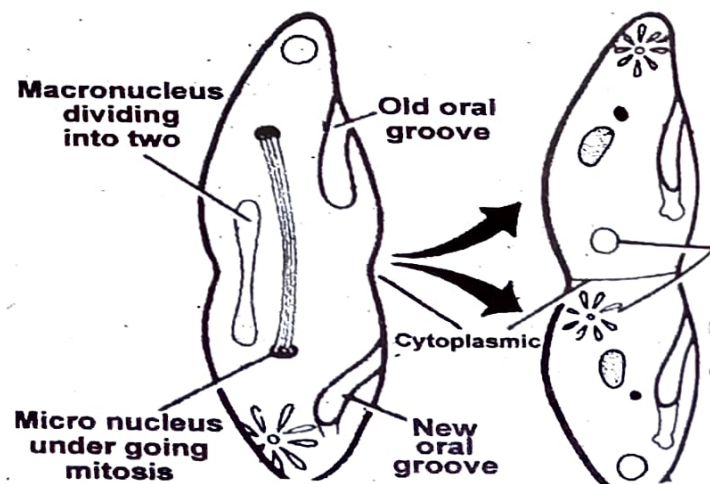


Fig : *Paramecium*- stage in binary fission

(4) *Paramecium* - Conjugation

PHYLUM: PROTOZOA
CLASS: CILIOPHORA
ORDER: CILIATA

IMPORTANT FEATURES :

- Conjugation is a primitive type of sexual reproduction because it involves exchange of nuclear material between conjugants, meiosis and formation of synkaryon.
- Conjugation occurs between two individuals of same **syngen** and of different mating types.
- During the process of conjugation, two *Paramecia* from two different clones come together on their ventral side at the oral groove regions. They are called **conjugants**.
- Both conjugants swim in water while in attachment.. Their pellicle dissolve at the place of fusion to form a cytoplasmic bridge.
- Macronucleus breaksup slowly and mixes with cytoplasm.
Micronucleus divides meiotically to form four haploid nuclei in each conjugant.
- Out of four nuclei, three disintegrate. The remaining nucleus divides unequally to form the two pronuclei.
- Smaller one is called male or **migratory nucleus** and larger one is called female or **stationary nucleus**.
- The male pronucleus of one conjugant fuses with the stationary or female pronucleus of other conjugant and form the zygote nucleus or **synkaryon**.
- At the end of the process both the conjugants separate and are called as **ex-conjugants**.
- Each ex-conjugant finally divides to form four daughter paramecia.
- This process occurs during sanile decay and unfavourable conditions.
- Conjugation leads to **rejuvenation, nuclear reorganization and variation** in *Paramecium*.

Identification points:

Slide is identified by the presence of two conjugants attached on their ventral sides, protoplasmic bridge, one nucleus in each conjugant.

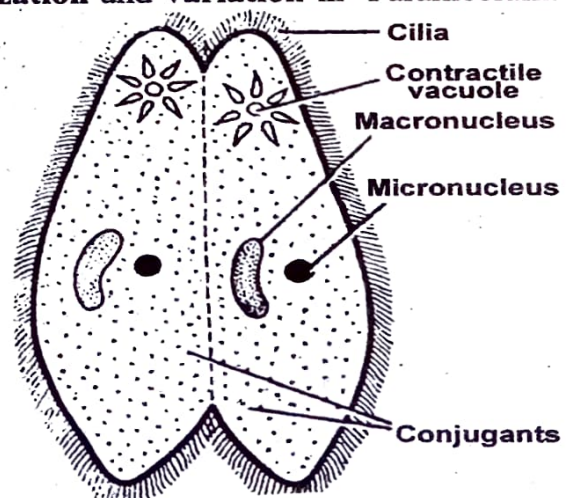


Fig: *Paramecium* - A stage in Conjugation

(5) *Vorticella companula* (Bell animal cule)

PHYLUM: PROTOZOA
 S.PHYLUM: CILIOPHORA
 CLASS: CILIATA
 ORDER: HETEROTRICHIA

IMPORTANT FEATURES :

- Unicellular, sedentary ciliate attached to the substratum with a long contractile peduncle having myonemes
- Measures about 100-4500 μ in length.
- Free end of the peduncle bears a disc or bell shaped body covered by pellicle.
- Cilia are arranged in two rows along the edge of the peristome i.e., the rim of the bell.
- The groove in between these two margins of the peristome is the oral groove.
- Peristome extends into the cytoplasm as a long funnel like vestibule
- A horseshoe shaped micronucleus and a circular macronucleus, food vacuoles, contractile vacuoles are seen in cytoplasm.
- Oral groove forms into cytopharynx. Food particles filtered by the cilia enter the food vacuole.
- Nutrition is holozoic and reproduction is by longitudinal binary fission and conjugation.

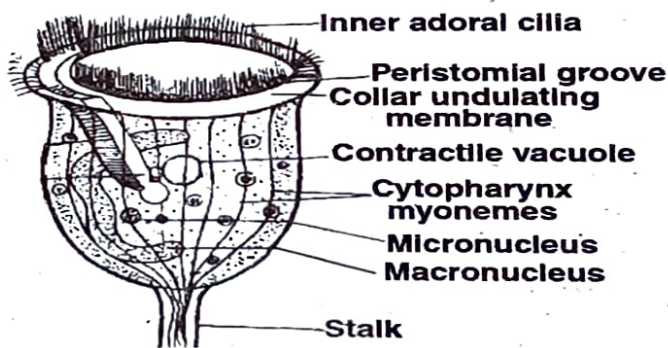


Fig : *Vorticella*

Identification points:

Bell shaped pedunculate body, spirally arranged cilia along the peristome, contractile peduncle, horseshoe shaped macronucleus.

(6) *Entamoeba histolytica*

PHYLUM : PROTOZOA
 SUB.PHY : SARCOMASTIGOPHORA
 CLASS : RHIZOPODA
 ORDER : LOBOSA

IMPORTANT FEATURES:

- Unicellular, pathogenic, dangerous intercellular parasite living in between the intestinal cells.
- Microscopic parasite measuring about 20-30 μ in size
- Body is surrounded by a thin plasma membrane and possess only one lobe like pseudopodium
- It occurs as precystic, cystic and trophozoite stages.
- Conducts all the metabolic activities and causes disease in trophozoite stage only
- Cytoplasm is differentiated into ectoplasm and endoplasm and helps in the formation of pseudopodium
- Ectoplasm is opaque and non granular while endoplasm is granular and transparent with a nucleus
- Chromatin granules are seen inside the nuclear membrane and a karyosome at the centre of the nucleus
- Nucleus resembles the wheel of the cycle
- Food vacuoles with RBC and chromatoid bodies of reserve food materials are seen in the cytoplasm
- Contractile vacuoles are absent
- Reproduces by asexual reproduction through binary and multiple fission.
- Infection is by contaminating water and food materials as there is no intermediate host in the lifecycle
- Causes amoebic dysentery identified by blood motions, stomachache, anemia, jaundice, fever etc.
- In chronic condition, it infects even liver, lungs, brain and causes ulcers etc.,

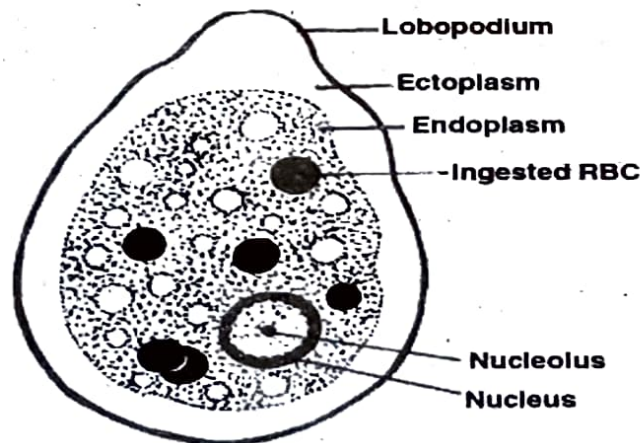


Fig : *Entamoeba histolytica*

Identification points:

Single pseudopodium, nucleus resembling the wheel of a cycle, RBC filled food vacuoles and chromatoid bodies in the cytoplasm.

(7) Plasmodium vivax

PHYLUM: PROTOZOA
SUB.PHY: SARCOMASTIGOPHORA
CLASS: SPOROZOA
ORDER: HAEMOSPORIDIA

IMPORTANT FEATURES :

- Unicellular, pathogenic, dangerous parasite living in the RBC of human being, leading intracellular life.
- Primary host is man and the secondary host is the blood sucking female anopheles mosquito. Hence the parasite is termed as a digenetic one.
- Infective stages to man are the sporozoites. Mode of infection is by inoculation. Sporozoites enter the blood of man along with saliva of the mosquito when it bites for its blood meal.
- Sporozoites reach liver, undergoes schizogony producing cryptomerozoites and metacryptomerozoites.
- Infective stages to the RBC are the micrometacryptomerozoites.
- Adult stage in the life cycle is the round trophozoite present inside the RBC.
- Trophozoites are identified by the nucleus and by the enlargement of the infected RBC. Erythrocytic schizogony results in the release of merozoites and a poisonous substance called haemozoin.
- Haemozoin is responsible for the expression of malaria.
- Sexual life Cycle or cycle of Ross occurs in the mosquito.
- The zygotes of the parasite undergoes sporogony, release spores. They enter the salivary glands and transform into the infective stages to man viz., sporozoites.
- Presence of the parasite causes malaria in man, which is identified by chilled fever, anemia, and weakness.

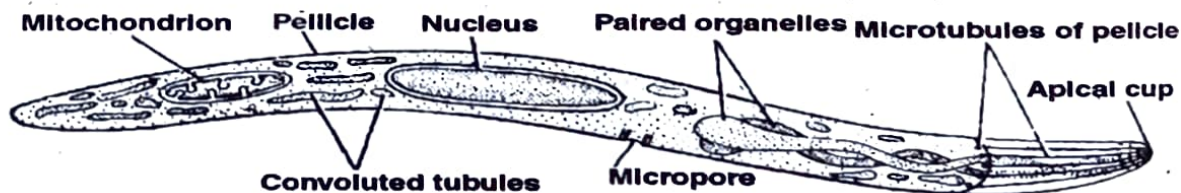


Fig : Plasmodium

Identification points:

Sickle shaped sporozoites, enlarged RBC and signet ring stages in RBC.

II

PHYLUM : PORIFERA

(8) *Sycon* (Urn sponge)

PHYLUM: PORIFERA
CLASS: CALCAREA
ORDER: HETEROCOELA

IMPORTANT FEATURES :

- Unicellular, pathogenic, dangerous parasite living in the RBC of human being, leading intracellular life.
- Leads sedentary life in sea water
- Cylindrical body with a large number of dermal ostia
- Osculum is the single large opening located at the terminal end of the sponge.
- Body wall with a number of canals is supported by a number of calcareous, triradiate spicules.
- Incurrent and radial canals of the body wall form sycon type of canal system.
- The external body surface and inner spongocoel are lined by pinacocytes.
- Radial canals are lined by collared cells called choanocytes
- Water enters through dermal ostia into the incurrent canals, prosopyles to radial canals, apopyles to spongocoel and leaves the body through osculum
- Sycon type of canal system present in the body helps in nutrition, respiration, excretion and reproduction.

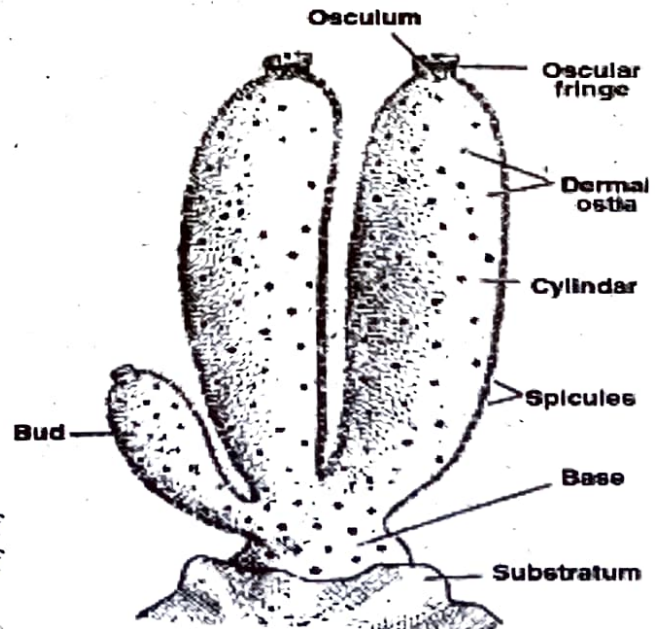


Fig : *Sycon* colony

Identification points:

Cylindrical vase like body with a number of dermal ostia, terminal osculum, sedentary mode of life and colonial existence.

(9) *Spongilla lacustris*

IMPORTANT FEATURES :

- Fresh water sponge leading sedentary life and growing beneath the water plants under shade.
- Colonial organisms with finger like projections over the body
- Body is coloured green because of the presence of symbiotic algae in the body wall
- Free end of the organism possesses a number of oscula.
- Body encloses a highly complex rhagon type of canal system
- Spongocoel lined by pinacocytes is reduced due to the presence of subdermal water spaces
- Choanocytes are limited to the flagellated chambers
- Skeleton is formed of silicious monoaxon spicules, mega scleres and micro scleres
- Asexual reproduction is by the formation of internal buds called gemmules besides regeneration.

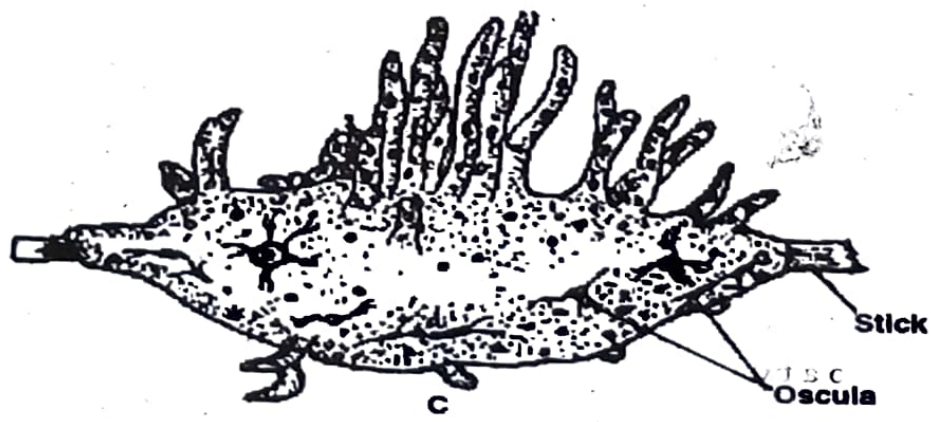


Fig : *Spongilla*

(10) *Euspongia Afficinalis* (Bath Sponge)

PHYLUM: PORIFERA
CLASS: DEMOSPONGIA
ORDER: KERATOSA

IMPORTANT FEATURES :

- Sedentary organism with a brown coloured cup like body leading marine life.
- Body wall is highly folded forming lucon type of canal system having incurrent canals, excurrent canals, flagellated chambers, water filled spaces etc.,
- Oscula are more in number at its anterior free end.
- Body wall is devoid of spicules and hence is supported by spongin fibres
- Reproduction is by sexual and asexual method besides regeneration.
- Sponge having commercial importance.

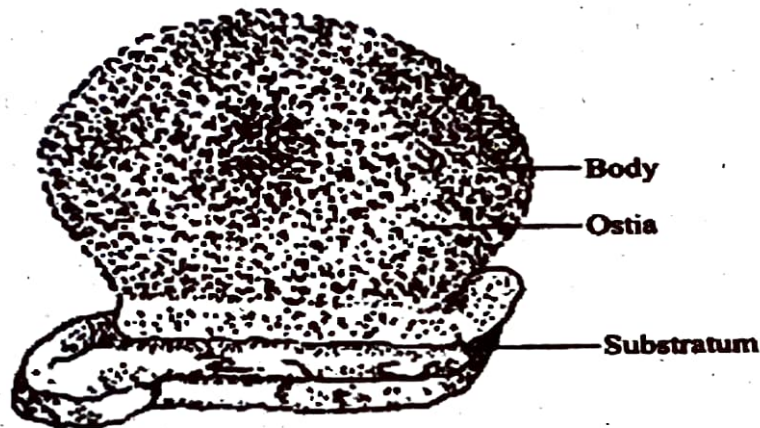


Fig. *Euspongia*

Identification points:

Cup like body attached to a twig, many oscula, tender body with out spicules.

(11) *Transverse section (TS) of Sycon*

IMPORTANT FEATURES :

- T.S. of sycon is circular in outline.
- Wide central space in the body is the spongocoel and is lined by pinacocytes.
- Body wall is innervated with alternatively arranged incurrent canals and radial canals
- Body wall is supported by a number of calcareous triradiate spicules.
- Dermal ostia present on the surface of the body lead into incurrent canals
- Incurrent canals lead into the radial canals through prosopyles.
- Radial canals in turn open into the spongocoel through apopyles and internal ostia.
- Mesenchyme in between outer and inner layer is very thick and gelatinous.
- Canal system in the body is of sycon type.
- Choanocytes lining the radial canals help in creating water current in the canal system.

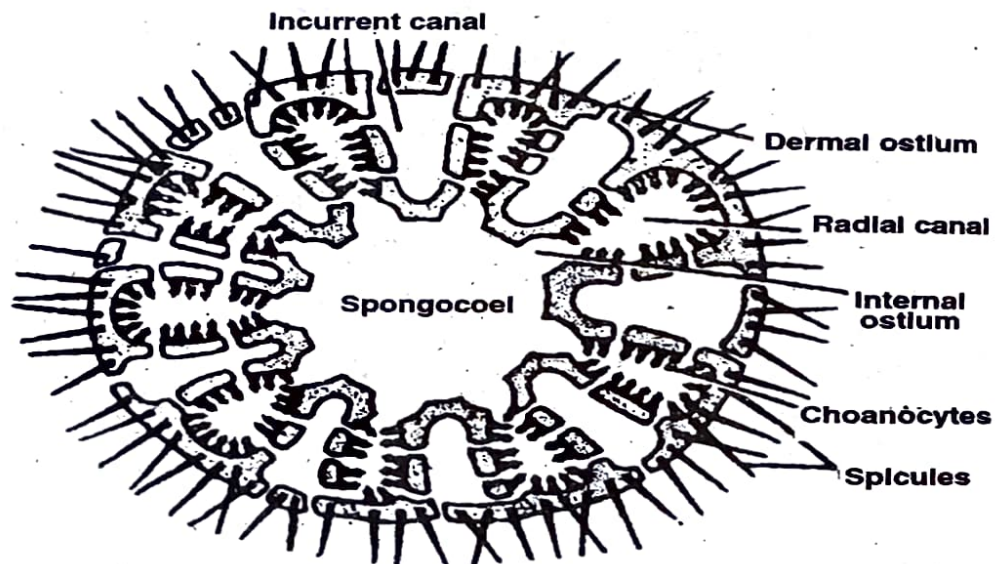


Fig : *Transverse section of Sycon*

(12) Longitudinal (LS) section of Sycon

IMPORTANT FEATURES :

- ❑ Sycon in its longitudinal section is elongated and oval in shape because of cylindrical shape.
- ❑ Body wall shows cellular grade of body construction.
- ❑ Outer and inner surfaces are lined by pinacocytes.
- ❑ Body wall is very thick due to mesenchyme and is supported by calcareous triradiate spicules.
- ❑ Body wall is innervated by incurrent and radial canals. Dermal ostia open into the incurrent canals
- ❑ Incurrent and radial canals are communicated with each other through prosopyles.
- ❑ Spongocoel is wide and posses a number of internal ostia through which radial canals open.
- ❑ Other cells associated with the body wall are the chromocytes, scleroblasts, archaeocytes, thesocytes, gland cells etc.,
- ❑ Spongocoel is communicated out through the terminal osculum
- ❑ Canal system is of sycon type and helps in conducting several important metabolic activities.

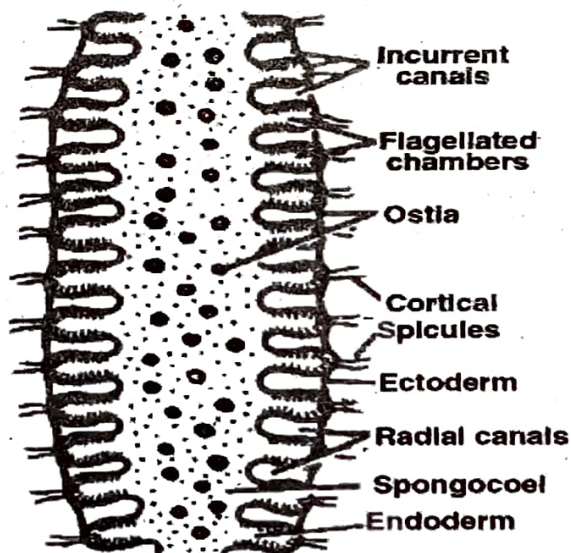


Fig : Sycon. L.S.

Identification points:

Body with branched finger like projections, large number of oscula, body wall with silicious monoaxon spicules.

(13) *Monoaxon spicules*

IMPORTANT FEATURES:

- Spicules constitute the main supporting skeleton of the body.
- Each monoaxon spicule has a central axis with one end pointed (monoaxon-monoactine) or both ends pointed (monoaxon-diactine).
- Mostly these spicules are formed either from silica or from calcium carbonate
- The cells involved in their production are the scleroblast cells and are embedded in either mesenchyme or in spongin fibres.
- These are seen in large numbers near the ostia and osculum
- Tetraradiate calcareous spicules are also seen in the body wall of sycon.

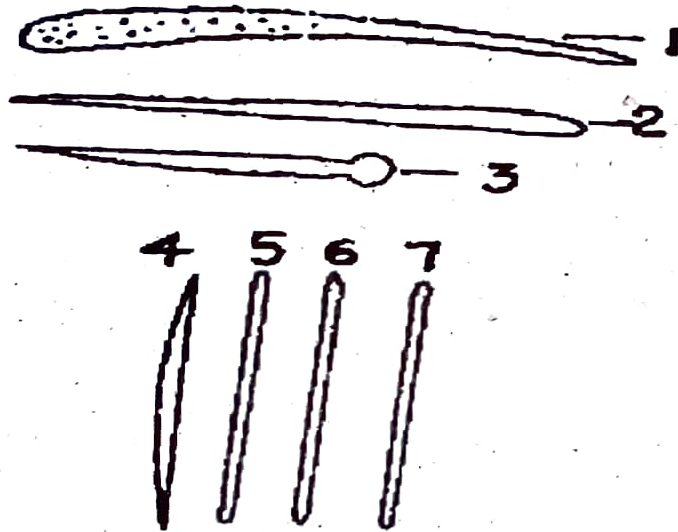


Fig. : *Sponge- monoaxon spicules*

- (1) Acanthostyle, (2) Style, (3) Tylostyle, (4) Oxea,
(5) Strongyle, (6) Tornote, (7) Tylote.

(14) Gemmules

- These are the small buds formed in the development of sponges.
- Sponges use these buds to reproduce asexually and to tide over the adverse conditions like freezing, drying and lack of oxygen.
- Gemmules are small masses of cells surrounded by protective membranes and reserve food granules.
- The protective membranes are often reinforced by spicules.
- These buds can transform into adult sponges after the restoration of the favourable conditions.
- The inner dormant cells of the gemmules come out through the micropyle located on the gemmule.
- The cells of the sponge become active after coming in touch with water.
- These cells are totipotent and can transform into any type of cells.
- Slowly these drained cells rearrange and grow into adult sponge.

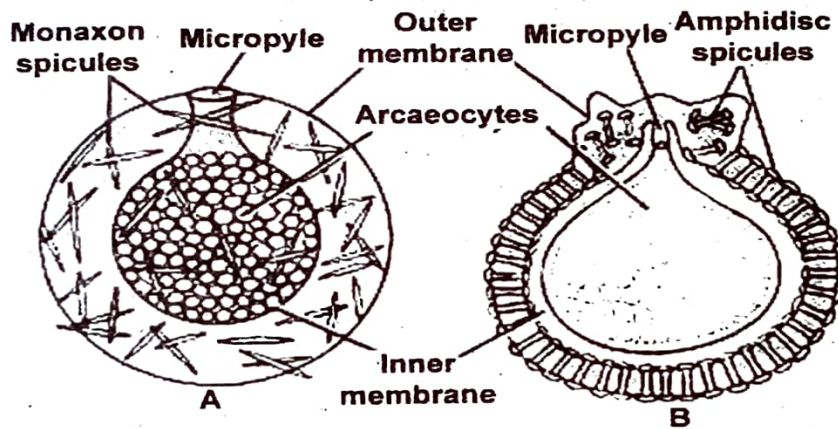


Fig : Gemmules in sponges

(A) Gemmule of Spongilla (B) Gemmule of Ephydatia

III PHYLUM : COELENTERATA

(15) *Obelia geniculata* (Sea fur)

PHYLUM: COELENTERATA
CLASS: HYDROZOA
ORDER: HYDROCOMEDUSA

IMPORTANT FEATURES:

- Sedentary and colonial organism leading marine life in shallow waters.
- Commonly grows over rocks, shells, seaweeds and on any hard surface.
- Body resembles a plant having root like hydrorhiza for fixation over the substratum and vertical branched stem like structures called hydrocauli.
- Main stems of Hydrocauli bear flower like zooids for nutritive function viz., hydranth or polyp.
- Side branches end in club shaped closed zooids for asexual reproduction viz., the gonangium blastostyle.
- Because of polyps and blastostyles, obelia is said to be dimorphic showing division of labour.
- Entire colony is surrounded by a protective non-cellular layer called perisarc.
- The inner cellular tubes connecting the polyps and gonangia constitute coenosarc.
- Polyp possesses a bulb like manubrium surrounded by tentacles and is protected by hydrotheca.
- Gonangium is blind and protected by gonotheca having a germ pore for releasing medusae.
- Blastostyle or gonangia produce free living umbrella like zooids called medusae for sexual reproduction.
- Life cycle includes alternation of generations or metagenesis.

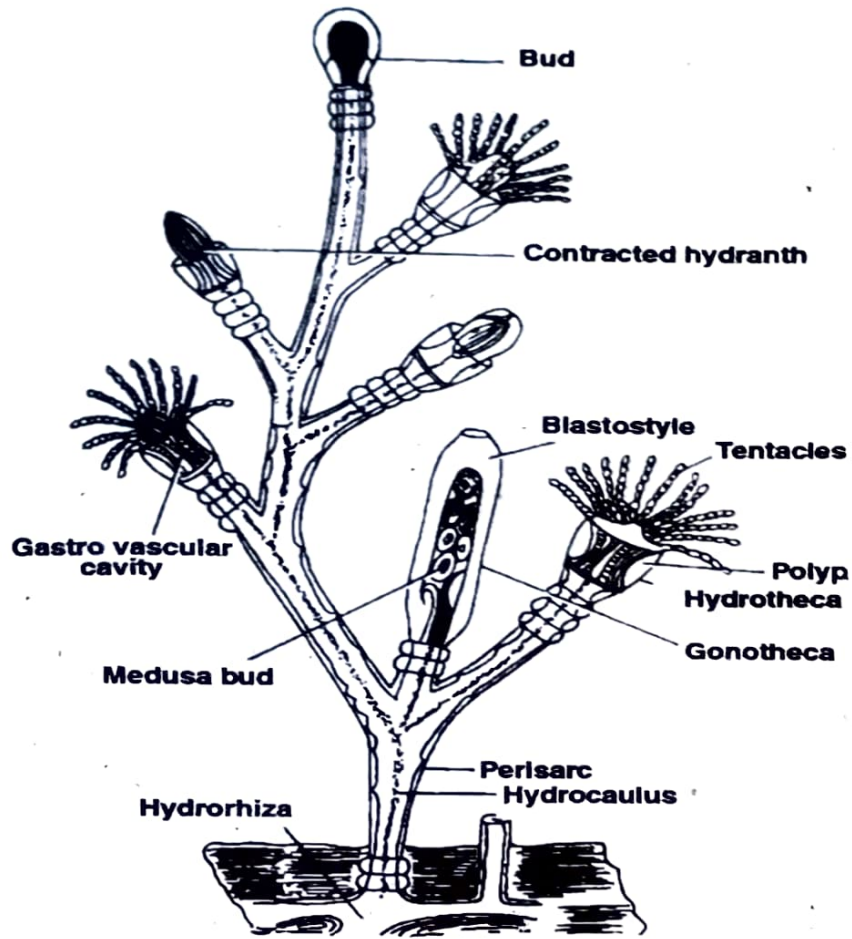


Fig : Obelia colony

Identification points:

Branched colony with polyps for nutrition and blastostyles for asexual reproduction by budding; hydrorhiza and hydrocauli giving plant like appearance, perisarc as protective covering.

(16) *Obelia medusa*

PHYLUM: COELENTERATA
 CLASS: HYDROZOA
 ORDER: HYDROIDEA

IMPORTANT FEATURES :

- Free swimming zooid for sexual reproduction produced from the blastostyle of obelia by budding.
- Released into water through germinal opening on the gonothecal covering.
- Body is umbrella shaped with convex exumbrellar and concave subumbrellar surfaces.
- Exumbrellar surface is smooth but the subumbrellar side bears a central four cornered stick like manubrium with tetra radiate mouth.
- Margin of the medusa is beset with 16-32 solid core tentacles meant for locomotion.
- Adradial tentacles bearing eight statocysts for establishing equilibrium in water.
- An inwardly directed ridge viz., the velum along the periphery (craspedate medusa).
- Gastrovascular cavity differentiated into a central wide stomach; four perradial canals radiating from the stomach; a circular canal connecting all the radial canals.
- Four gonads located over the perradial canals.
- Body wall is diploblastic. The zooid is lined externally by ectoderm, internally by endoderm. between these two, a thick layer of non-cellular mesoglea exists giving it a jelly like appearance.

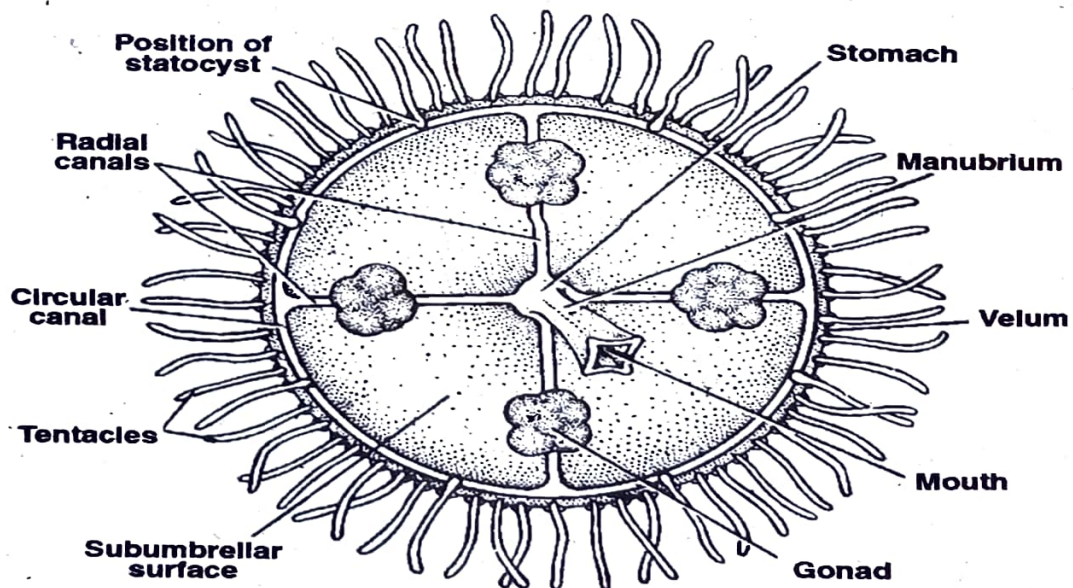


Fig.: *Obelia - Medusa*

Identification points:

Umbrella shaped macroscopic and transparent body, central four cornered mouth, four perradial canals with gonads, jelly fish like appearance and pelagic existence.

(17) *Aurelia aurita* (Jelly fish)

PHYLUM: COELENTERATA
 S. PHYLUM: CNIDARIA
 CLASS: SCYPHOZOA
 ORDER: SAEMOSTOMAE

IMPORTANT FEATURES :

- It is a solitary, free swimming, marine organism.
- Body has a convex exumbrellar surface and a flat subumbrellar surface
- Mesoglea present in between ectoderm and endoderm is very thick and contain 98% water
- Body is slender, tender and transparent with a four cornered mouth on its subumbrellar surface
- Thin leaf like undulating oral arms arising from the corners of mouth help in locomotion
- Mouth opens into a four chambered stomach extending to the periphery as perradial, interrarial and adradial canals. These are interconnected by a ring canal formed at the margin.
- Each gastric pouch bears a horseshoe shaped gonad producing germ cells for sexual reproduction.
- Life cycle includes a polypoid hydratuba and a eight armed ephyra larva
- Eight tentaculocysts present in the pits along the margin are the statocysts for equilibrium.

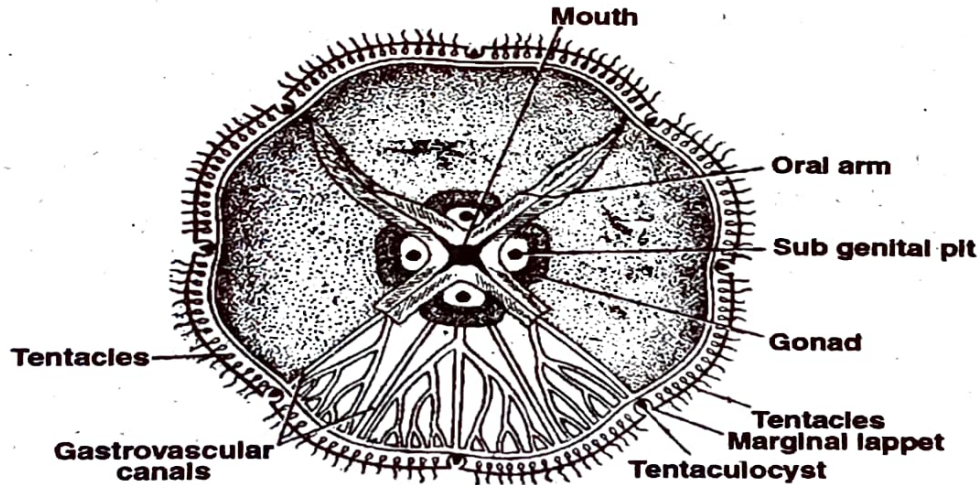


Fig : *Aurelia* - Oral view

Identification points:

Jelly like body; leaf like oral arms arising from the corners of mouth, horse shoe shaped gonads, and eight tentaculocysts along the margin for establishing equilibrium.

(18) *Physalia* (Portuguese man at war)

PHYLUM: COELENTERATA
 S. PHYLUM: CNIDARIA
 CLASS: HYDROZOA
 ORDER: SIPHONOPHORA

IMPORTANT FEATURES :

- Marine, pelagic and colonial organism
- Sky blue coloured medusoid body is flattened like a disc and helps in floatation
- A single nutritive gastrozoid is located at the center of the colony on the ventral side.
- Blastostyles for asexual reproduction are located around the mouth on the oral side.
- Dactylozooids are the long (10 m long) protective tentacles present along the margin of the disc.
- Nematocysts on the dactylozooids can inflict poisonous stings upon swimmers.
- The float consists of a number of gas filled air chambers opening out by small pores.
- The space between gastric cavity and float is filled with calcareous mass.

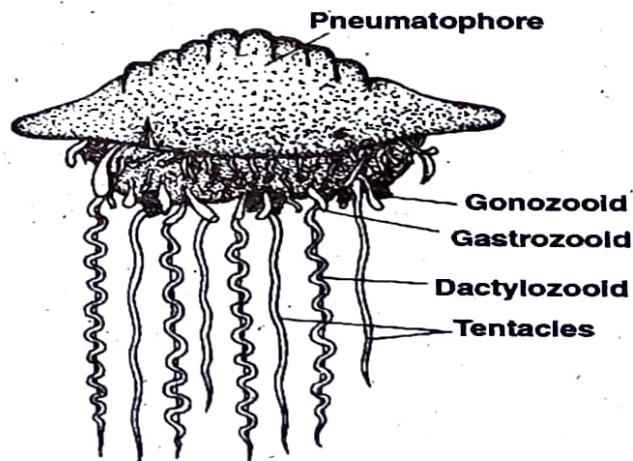


Fig : *Physalia*

Identification points:

Sky blue coloured float, gastrozoid surrounded by blastostyles; long protective dactylozooids along the margin.

19) *Verella* (Little sail)

PHYLUM: COELENTERATA
S.PHYLUM: CNIDARIA
CLASS: HYDROZOA
ORDER: SIPHONOPHORA

IMPORTANT FEATURES :

- Marine, pelagic and colonial organism
- Body has a light blue coloured gas filled float in the form of a sail.
- The float is divided internally into a number of air chambers opening out through small pores.
- The disc like float bears a gastrozoid surrounded by gonangia on its ventral side.
- Dactylozooids are present all along the periphery.
- Gonozoids produce medusae by budding which in turn produce gametes for sexual reproduction
- The float bears an obliquely arranged thin layered sail for locomotion
- The organism appears as an independent one though it is a colony.

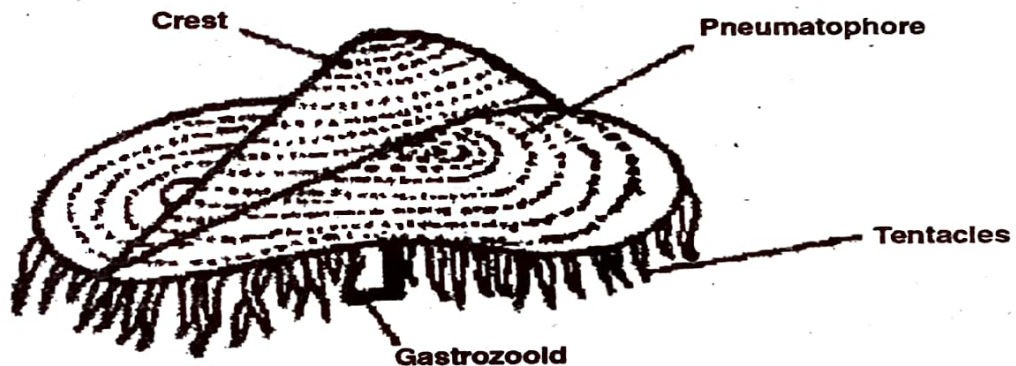


Fig : *Verella*

Identification points:

A thin sail on the dorsal side of the float, body looking like a hat, zooids arranged on the ventral side.

(20) *Corallium rubrum* (Red coral)

PHYLUM: COELENTERATA
 S. PHYLUM: CNIDARIA
 CLASS: ANTHOZOA
 ORDER: ALCYONARIA

IMPORTANT FEATURES :

- Colonial organism leading sedentary life on marine substratum.
- Erect and branched body is supported by calcareous rods formed by the fusion of spicules
- The calcareous skeleton is surrounded by cellular coenosarc embedded with spicules
- Body bears dimorphic zooids namely the polyps and siphonozooids
- The zooids help in nutrition and in pumping out water
- The skeleton is used as beads in the ornaments and hence has got commercial value.

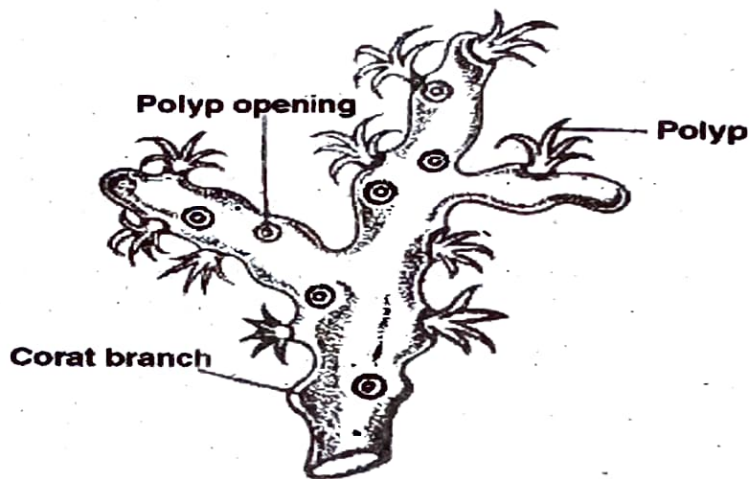


Fig : Corallium

Identification points:

Red coloured branched colony; body supported by calcareous skeleton; body bearing dimorphic zooid

21) *Gorgonia* (Sea fan)

PHYLUM: COELENTERATA
S. PHYLUM: CNIDARIA
CLASS: ANTHOZOA
ORDER: GORGONACEA

IMPORTANT FEATURES :

- ❑ Colonial organism leading sedentary life on marine substratum.
- ❑ Branched body with anastomosing branches forming into a net work .
- ❑ Body is coloured red or brown and appears as a fan and hence the name sea fan
- ❑ Body is supported by a special horny protein called gorgonin having iodine and bromine.
- ❑ Main axial filament of the body is branched and extends into all the branches
- ❑ Polyps present at the terminals of the branches possess eight branched tentacles, a mouth opening, a coelenteric/gastrovascular cavity, and gastric filaments.
- ❑ Unisexual organisms

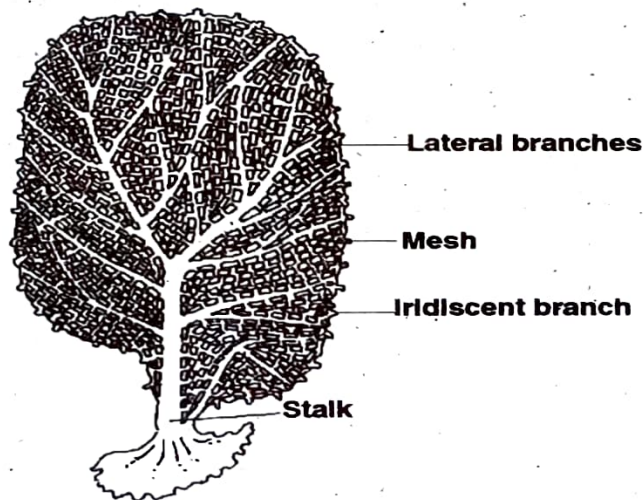


Fig : *Gorgonia*

Identification points:

Pedunculate feather like body moving like a fan in seawater, sieve like surface, a basal disc for attachment.

(22) *Pennatula* (sea pen)

PHYLUM: COELENTERATA
 S. PHYLUM: Cnidaria
 CLASS: Anthozoa
 ORDER: Pennatulacea

IMPORTANT FEATURES:

- Colonial organism leading sedentary life on marine substratum.
- Widely distributed along the sandy shores at a depth of 36-800m.
- The body is attached to the substratum with the help of a fleshy red peduncle.
- Main body has a central white rachis with a number of water pumping siphonozooids
- Tightly arranged branches arising from the rachis possess a number of tentacular zooids.
- The organism with its rachis and branches give the shape of a feather
- Anthocodia present over the branches are the nutritive zooids possessing eight pinnate tentacles
- Blastostyles are the blind zooids meant for asexual reproduction.
- Sexes are separate. Gametes are formed from gastrozooids.

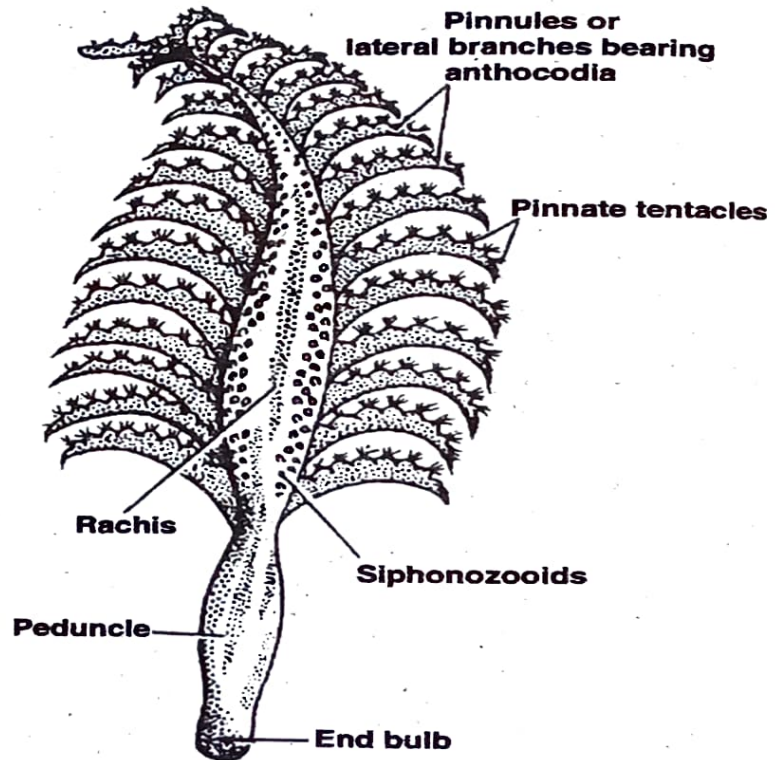


Fig : *Pennatula*

Identification points:

Feather like body, elongated fleshy peduncle, pinnated tentacles, tightly arranged lateral branches

IV

PHYLUM : PLATYHELMINTHES

(23) *Dugesia tigrina* (Planaria)

PHYLUM: PLATYHELMINTHES

CLASS: TURBELLARIA

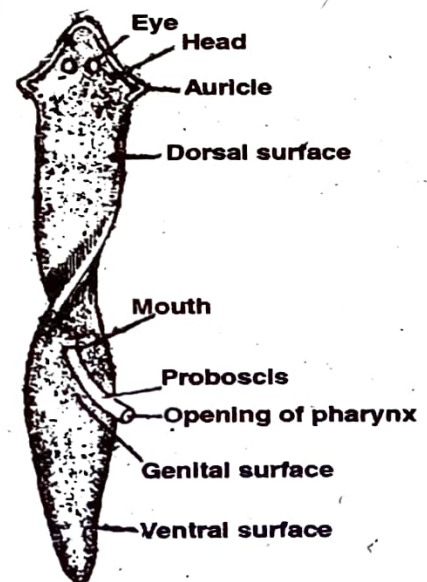
ORDER: TRICLADIDA

IMPORTANT FEATURES:

- Triploblastic, bilaterally symmetrical, organisms creeping over rocks and hard substrata of fresh water ponds, lakes, streams.
- Dorsoventrally compressed body measures about 1.5cm.
- Ciliated epithelium lines the outer surface of the transparent body and mucous forms a gelatinous covering over it.
- Ectodermal cells possess granular rhabdites in their cytoplasm.
- Anterior end of the body is formed into a triangular head with a pair of lappets bearing a pair of eyes.
- Head and body are separated by a constriction forming the neck. Trunk lies as an elongated band.
- Mouth opening is present on the middle of the ventral side leading into an alimentary canal having an eversible proboscis, oesophagus and intestine. It grows as one anterior and two posterior arms.
- Anus is absent. Matured organisms possess a genital opening behind the mouth.
- A number of nephridial openings are present on the dorsolateral surface of the body.
- Planaria can reproduce by asexual and sexual methods. It has great power of regeneration.

Identification points :

Elongated leaf like body, triangular head lobe with a pair of lateral eyes, ventral mouth having an everted pharynx.

Fig : *Dugesia*

(24) *Fasciola hepatica* (liver fluke)

PHYLUM: PLATYHELMINTH
 CLASS: TREMATODA
 ORDER: DIGENETEA

IMPORTANT FEATURES :

- Triploblastic, bilaterally symmetrical, acoelomate cone shaped parasite with organ system level organization.
- Lives in the liver, gall bladder and bile ducts of primary hosts like sheep, goat and man.
- Secondary host is the fresh water snail, *Lymnea truncatula*.
- Dorsoventrally compressed body possess excretory opening at its posterior pointed end.
- Leaf like body measuring about 1-3cm possesses an oral lobe having oral sucker at its wide anterior end.
- Mouth opening lies at the middle of the oral sucker. Trunk slowly tapers to a pointed posterior end.
- Another powerful ventral sucker called acetabulum lies in the anterior one third of the body.
- Genital opening lies anterior to the ventral sucker
- During maturity, Laurer's canal opens out on the middorsal side of the body.
- Digestive system is incomplete and has no anus. Intestine is highly branched and laterally extended.
- A thick tegument supported by a number of spines surround the body.
- Excretory system is formed of flame cells distributed on the lateral sides of the body.
- Parasites are bisexual and protandrous.
- Life cycle includes a number of larval forms like miracidium, redia and cercaria and hence is indirect.

Identification points:

Conical body with an anterior oral lobe having oral sucker and mouth opening; transparent body, excretory system composed of flame cells; spiny tegument, and a Ventral acetabulum, excretory opening at the post.end.

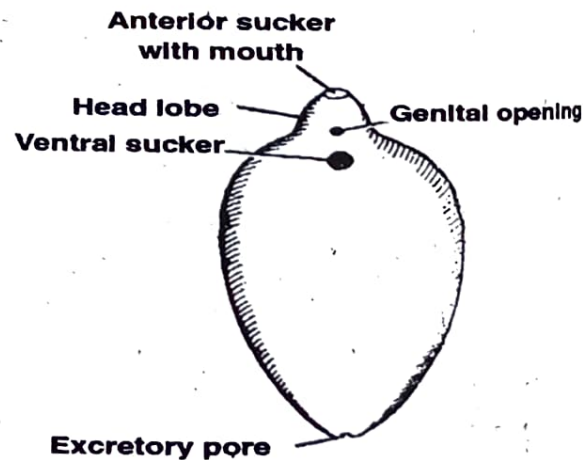


Fig : *Fasciola*

(25) Fasciola - Miracidium larva

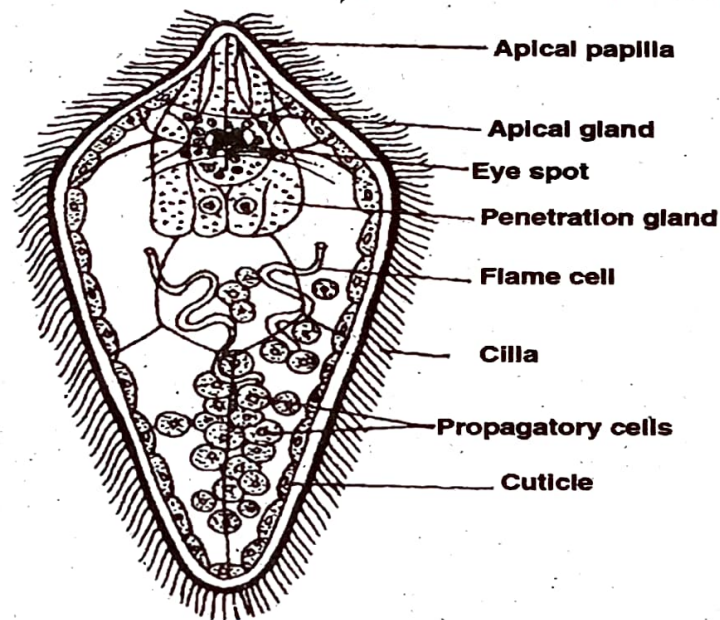
PHYLUM: PLATYHELMINTHES

CLASS: TREMATODA

ORDER: DIGENIA

IMPORTANT FEATURES :

- Free living first larva formed in the life cycle of the digenetic liverflukes.
- Body is transparent and measures about 0.07mm.
- Larva is covered by ciliated epithelium, muscle cells and a pair of eyes for photoreception
- Ciliated ectodermal cells are arranged in five rows at 6, 6, 3, 4, 2.
- Conical larva has an anterior terebratorium or oral cone with penetration glands.
- Penetration glands facilitate its entry into the secondary host, the snail.
- Body also possesses flame cells, primitive brain, two lateral eyes, and a pair of protonephridia.
- These larvae enter the hepatopancreas of the secondary host and develop into sporocysts.

Fig : *Fasciola-Miracidium Larva***Identification points:**

Cone like microscopic body, ciliated ectoderm, a pair of protonephridia, and a pair of eyes at the anterior end.

(26) *Fasciola - Redia larva*

PHYLUM: PLATYHELMINTH
 CLASS: TREMATODA
 ORDER: DIGENEA

IMPORTANT FEATURES:

- Larval forms formed parthenogenetically from the sporocyst in the life cycle of liverflukes.
- Sporocysts are present in the hepatopancreas of the secondary host, the snail.
- They also live in the hepatopancreas as parasitic larval forms.
- Larva has rounded ends and elongated body measuring about 1.5mm in length.
- Mouth at the anterior end opens in to the intestinal diverticula through a muscular pharynx.
- A transverse muscle band present behind the mouth is the collar region.
- A pair of lateral lappets is present on either side of the body at the posterior end.
- Pharynx is associated with pharyngeal glands.
- Body encloses blastocoel in which a pair of protonephridia are present
- Groups of germ cells present in the middle of the body develop parthenogenetically into second generation of redia.
- Cercaria is the free swimming larval form developed from the second generation of redia

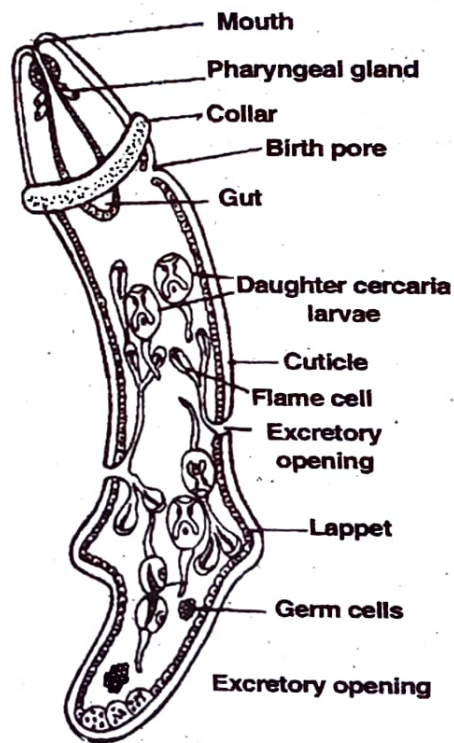


Fig : *Fasciola-Redia Larva*

Identification points:

Elongated oval body with a pair of marginal lappets at the posterior end, a transverse muscle band, protonephridia

(27) Fasciola - Cercaria larva

IMPORTANT FEATURES:

- Cercariae are the free living larval forms found in the life cycle of liverflukes.
- They develop parthenogenetically from the germ cells of second generation redia
- The larval forms are released into the water by the secondary host, the snail.
- The larva has a heart shaped body with a long tail at its wide posterior end for swimming.
- Narrow and round anterior end has an oral sucker and mouth opening.
- Mouth leads back in to the bifid intestine through a muscular pharynx.
- A pair of flame cells open into the urinary bladder located at the posterior wide end of the larva.
- Acetabulum is the ventral sucker present behind the oral sucker on the ventral side of cercaria
- Secretions of the cystogenic glands present in the body wall facilitate the formation of cyst.
- The cystic larva formed from the cercaria is the infective stage viz., the metacercaria

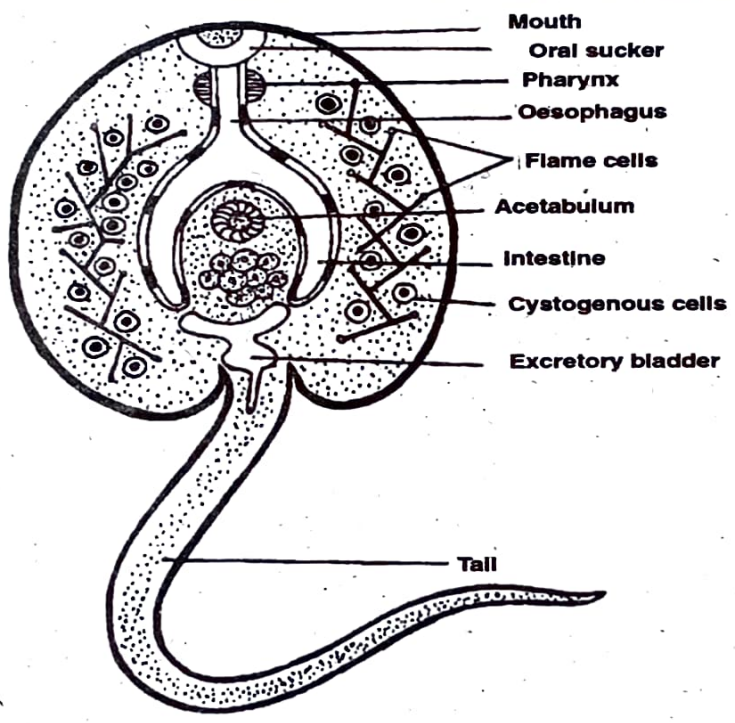


Fig : Fasciola-Cercaria Larva

Identification points:

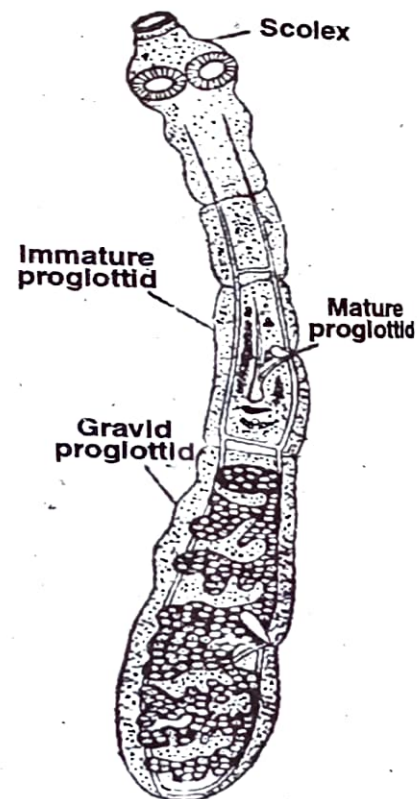
Transparent conical body with a long tail, oral sucker with mouth opening, urinary bladder and flame cells at the posterior end.

(28) *Echinococcus granulosus* (Hydatid worm or dog tape worm)

PHYLUM: PLATYHELMINTHA
 CLASS: CESTODA
 ORDER: CYCLOPHYLLIDA

IMPORTANT FEATURES:

- A common ribbon like parasite living in the intestine of dogs, wolves, foxes and cats.
- Digenetic parasite having pig, cattle and domesticated animals including man as secondary hosts.
- Parasite reaches man accidentally by contaminative mode and causes severe pathogenicity.
- Adult body has a scolex, a neck and a trisegmented strobila.
- Scolex has a rostrum with two circlets of hooks, four suckers for attachment in the intestine.
- Neck is undivided and produce new segments are by strobilization
- Strobila has an immature proglottid with testis lobes, a mature proglottid with male and female genital organs and a gravid proglottid with branched uterus loaded with eggs.
- In man, eggs hatch into oncospheres and develop in to hydatid cysts in liver, lungs, brain, and other organs.
- The genital epithelium of inner layer of hydatid cyst can produce internal and external buds.
- Upon eating the meat with hydatid cysts, primary hosts lodge this parasite.
- Hydatid cysts are highly dangerous than adult worm causing hydatid disease.
- The cysts are highly pathogenic causing inflammation of organs, allergy, diarrhea, and vomiting, abdominal pain in man.



Identification points:

Short parasite with a trisegmented body, barrel like gravid proglottid loaded with eggs, scolex with hooks and suckers.

Fig : *Echinococcus granulosus*

(29) *Taenia solium*

PHYLUM: PLATYHELMINTHES
 CLASS: CESTODA
 ORDER: TAENIOIDEA
 ORDER: DIGENIA

IMPORTANT FEATURES :

- ❑ It is commonly called as ribbon worm or pork tapeworm of man.
- ❑ Ribbon worm is also a digenetic and pathogenic macro parasite living in the small intestine of the infected human being.
- ❑ Its secondary host is the pig and gets into the primary host through the eating of pork.
- ❑ The body of the adult is divided into an anterior scolex, a short neck and a long segmented strobila.
- ❑ The scolex is the organ of attachment bearing 4 large suckers with a double row of hooks. The adult tape worm grows to about 6mm in width and 2-7 m in length.
- ❑ Strobila is generally divided into about 800 segments called proglottids.
- ❑ As the tapeworm grows in the intestine, mature or gravid proglottids carrying eggs are released into the intestine first and then sent out along with undigested waste materials.
- ❑ Gravid possess fertilized eggs with different stages of development.
- ❑ Infection to the secondary host is by eating the human feces by the pigs.
- ❑ In the secondary host, the eggs develop and pass through hexacanth or onchosphere stage and transform into a bladder worm in the striated muscles.
- ❑ Bladder worm(cysticercus) is the infective stage to man, it enters the human through the eating of improperly cooked pork.
- ❑ For the bladder to develop in to adult in human intestine, 5 to 12 weeks of incubation period is required.
- ❑ Presence of the parasite in large numbers produce symptoms like stomachache, vomiting, Diarrhea, constipation, indigestion.

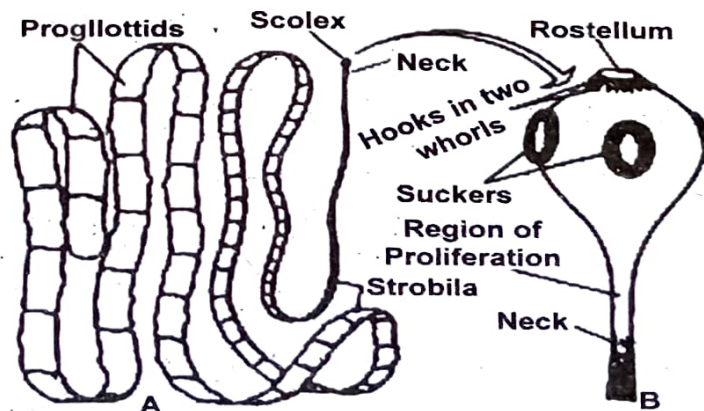


Fig : *Tenia* : A. whole; B. its scolex

(30) *Schistosoma haematobium* (Blood fluke)

PHYLUM: PLATYHELMINTH
 CLASS: TREMATODA
 ORDER: DIGENETEA

IMPORTANT FEATURES:

- Triploblastic, bilaterally symmetrical, acoelomate and digenetic parasite living in the blood of
- Primary host is man and the secondary host is a snail.
- Unisexual and sexually dimorphic form. Both male and female possess oral and ventral suckers.
- Females are long and slender possessing a bifid intestine and a single ovary.
- Males are short and stumpy with 4-5 testicular lobes and a dorsal viz., gynaecophoral canal.
- Eggs are oval and each egg possesses a spine.
- Neither redia nor metacercaria stage occur in the life cycle.
- Ciliated cercariae are the infective stages with an apical spine. Enters man by penetration.
- Highly pathogenic parasite causing schistosomiasis or bilharziasis identified by fever, abdominal pain, diarrhoea, bronchial cough and eosinophilia etc.,
- Cercariae cause swimmer's itch having symptoms like itch, skin rash and pain.

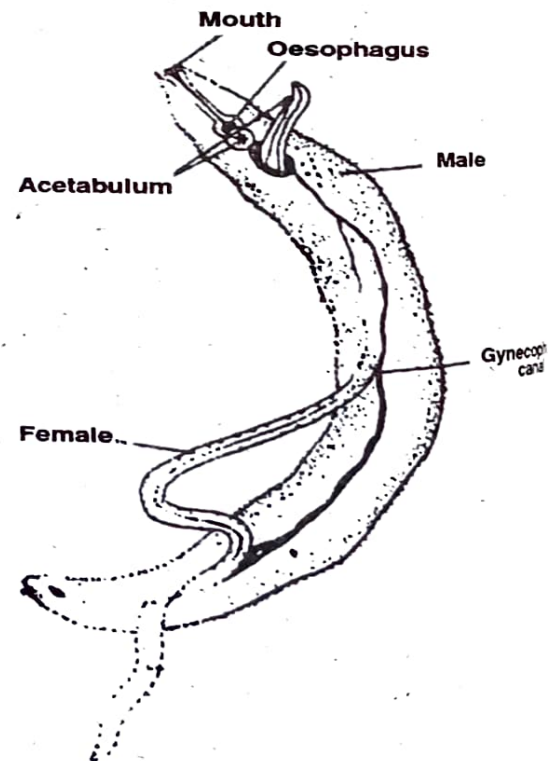


Fig : *Schistosoma haematobium*

Identification points:

Unisexual and sexually dimorphic parasite, female living in the gynaecophoral canal of male.

V

PHYLUM : NEMATHELMINTHES

(31) *Ascaris lumbricoides*

PHYLUM: NEMATYHELMINTHES

CLASS : ASCAROIDEA

ORDER : ASCAROIDEA

- Ascaris is a cream coloured worm like endoparasite living in the intestines of man.
- Males and females exhibit sexual dimorphism showing specific differentiating fexternal features.
- There is no secondary host in its life cycle. Infection is through contaminative method.
- The animal has an anterior mouth, a ventral excretory opening in the anterior 1/3 of the body.
- The body is covered by a nine layered cuticle which is resistant to the gastric juices of the intestine.
- Ascaris shows sexual dimorphism.
- The length of the males range between 15-30 cm. and females between 20-40 cm.
- Posterior end of the male is curved like a watch spring and it bears cloacal opening. One inch before the posterior extremity. Two penial spicules aiding in copulation are also present.
- Females have a slightly curved posterior end with anal opening behind the posterior extremity on the ventral side.
- Male genital opening opens into the cloaca while in female, the female genital opening opens on the ventral side at the anterior 1/3 of the body near excretory opening.
- Pre-anal and post anal papillae present in front and behind the cloacal aperture in male while they are not present in males.
- The parasite causes ascariasis identified by abdominal pain, vomiting, nausea, anaemia, and diarrhea.

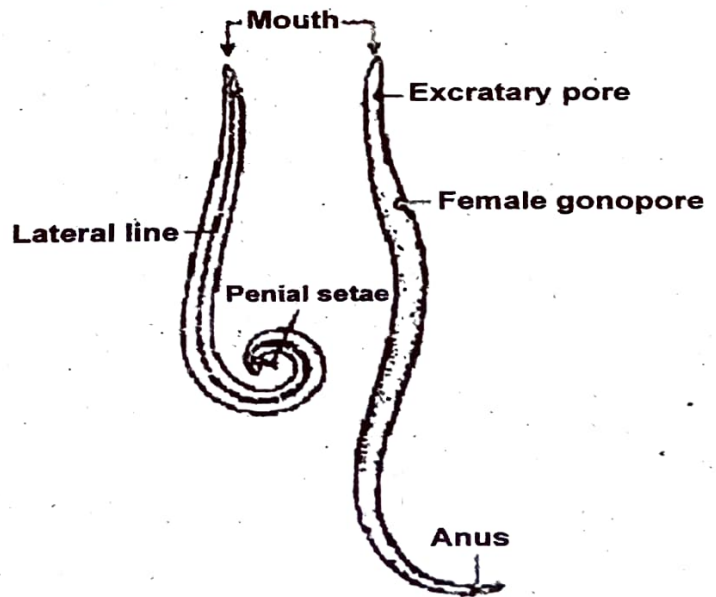


Fig : *Ascaris lumbricoides*

(32) *Dracunculus medinensis* (Guinea or Nara worm or Fiery serpent)

PHYLUM: NEMATYHELMINTH

CLASS: PHASMO

ORDER: STRONGYLO

IMPORTANT FEATURES :

- ❑ It is an endo parasite living in the subdermal cutaneous tissue of feet and legs.
- ❑ The parasite is a triploblastic, bilaterally symmetrical pseudocoelomate with a thick cuticle.
- ❑ Primary host is man and the secondary transmitting host is the crustacean copepod, viz., cyclopoid.
- ❑ Unisexual, sexually dimorphic and females are very long measuring to about 100-400cm.
- ❑ Males with their curved posterior end are small (10-15mm). They bear four pairs of preanal and four pairs of post anal papillae besides a pair of unequal copulatory spicules near the cloaca.
- ❑ Oesophagus at the anterior end is long and narrow ending in a glandular bulb.
- ❑ A blister is formed over the body through which females release fertilized eggs into water.
- ❑ Females continue to release embryonated eggs as long as the blister comes in contact with water.
- ❑ Larvae are swallowed by copepods that act as transmitting hosts.
- ❑ The parasite reaches primary host through drinking water contaminated with the infected copepods.
- ❑ The disease caused by the parasite is the NARA or dracontiasis producing symptoms like itching, diarrhoea, vomiting, asthma etc.

Identification points:

Very long thread like body in the subcutaneous tissue, unequal male and females.

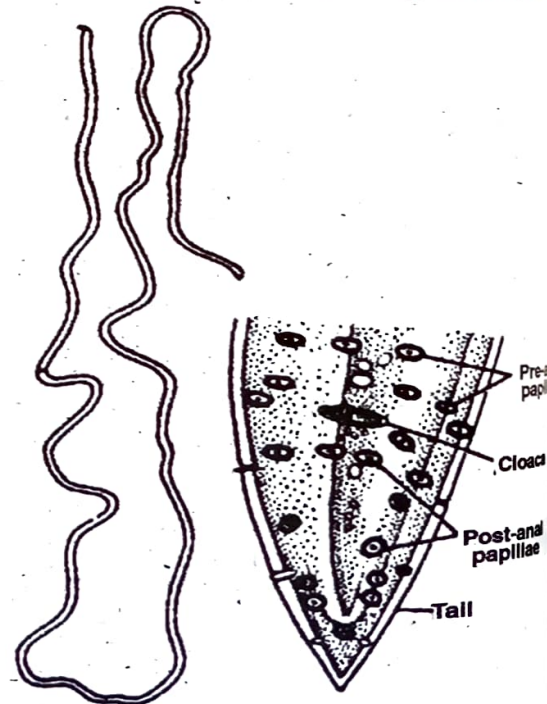


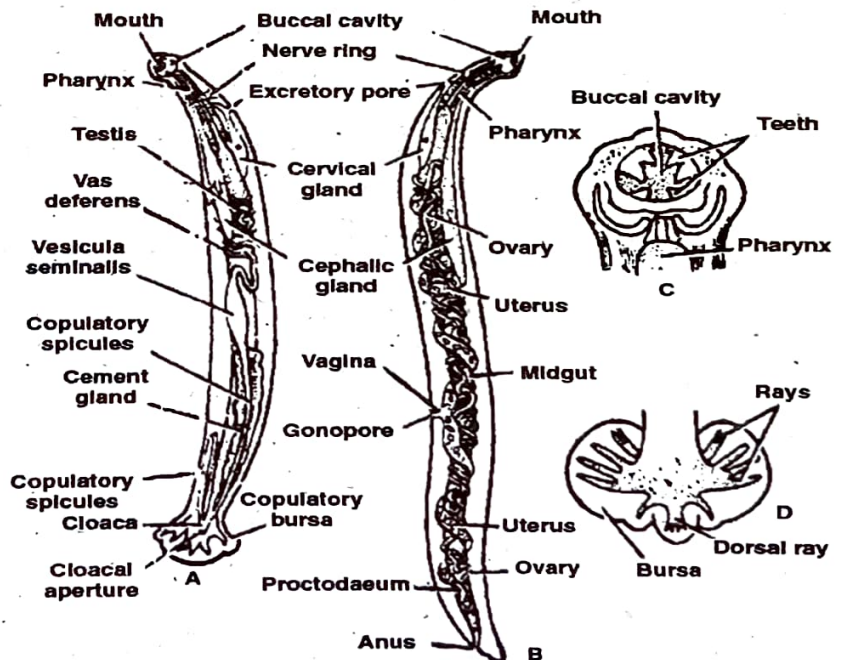
Fig : *Dracunculus medinensis*
(A) Female, (B) Tail end of male

(33) *Ancylostoma duodenale* (Hook worm)

PHYLUM: NEMATYHELMINTHES
 CLASS: PHASMIDIA
 ORDER: STRONGYLOIDEA

IMPORTANT FEATURES :

- Bilaterally symmetrical, triploblastic, pseudocoelomate parasite living in the intestine of man, dogs, cats etc.,
- It damages the intestinal wall and feeds on blood.
- Males measure about 8-10mm and females are about 10-15mm.
- Anterior end of both the animals is curved.
- Posterior end in the female is pointed and male has a widened bursa supported by muscular rods.
- Buccal capsule having cuticular plates and teeth help in attaching with the intestinal wall
- Digestive system has a buccal capsule, pharynx, intestine and rectum opening out through anus in female and cloaca in male organisms.
- Larvae enter the human being/ main host by penetrating through the skin.
- The parasite produces ancylostomiasis, a disease identified by dermatitis, pneumonia, haemorrhagea and anemia.



Identification points:

Buccal capsule with cuticular teeth and plates, males with wide bursa.

Fig : *Ancylostoma duodenale*
 (A) Adult Male (B) Adult female (C) Anterior end
 (D) Posterior end of male

(34) *Wuchereria bancrofti*:

PHYLUM: ASCHELMINTA
 CLASS: SPIRURIDA
 ORDER: FILARIDIA

- ❑ It is a common digenetic human parasite found in the lymphatic tissues of lower organs in man as scrotum, legs etc. Its secondary host is the female culex mosquito.
- ❑ This parasite exhibits sexual dimorphism. Male possess a curved posterior end.
- ❑ It is distributed in the coastal areas of the tropical regions in the world.
- ❑ Its distribution is influenced by the availability of the climate and the intermediate host.
- ❑ The primary host is man and the secondary or intermediate host is the female culex mosquito. Hence it is described as a digenetic organism.
- ❑ Adult worms live in the lymphatic vessels of the groin.
- ❑ Adults are translucent white worms with a smooth cuticle.
- ❑ The head is rounded and separated from the body by a neck-like constriction.
- ❑ In females the tail tapers gradually and is rounded at the tip, while in males the tail curves ventrally.
- ❑ Males and females live coiled together. Females vary in length from 30-100 mm with a diameter ranging from 100-300µm. Males are smaller, typically half the size of females.
- ❑ Juvenile larval forms are the microfilaria measuring about 290 µm by 6-7 µm in size. These are enclosed in a loose cuticular sheath. Anteriorly they have a spine and internally they possess granules of undifferentiated cells.
- ❑ The larvae circulate in the blood between 10pm to 4 am. Hence they are nocturnal.
- ❑ The larvae are ingested by mosquitoes during their blood meal from an infected human.
- ❑ In the mosquito the third stage infective juveniles migrate into the thoracic muscles and finally settle in the salivary glands of the mouthparts.
- ❑ They are transmitted in to a healthy human when the infected mosquito feeds on the blood.
- ❑ The parasite causes filariasis or elephantiasis in man. It is diagnosed by the abnormal swelling of the lymphatic tissue in lower regions of the body.
- ❑ Diagnosis is by the presence of the microfilaria larvae in the night blood of the patient.

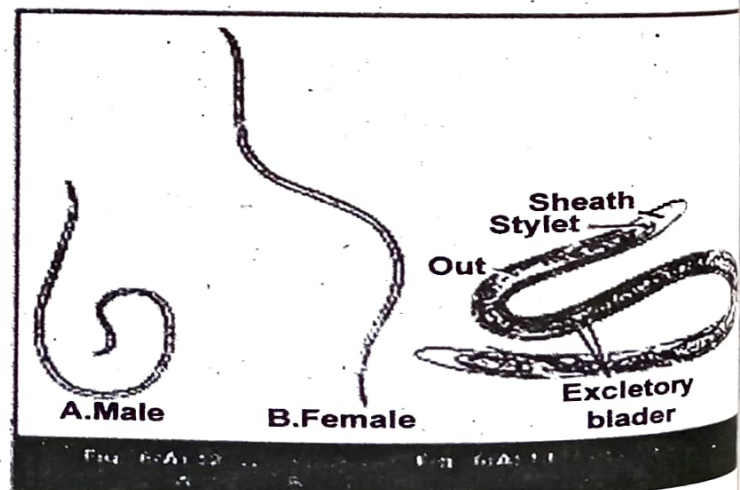


Fig : *Wuchereria Bancrofti*
 (a) Male (b) Female (c) Microfilaria Larva

VI

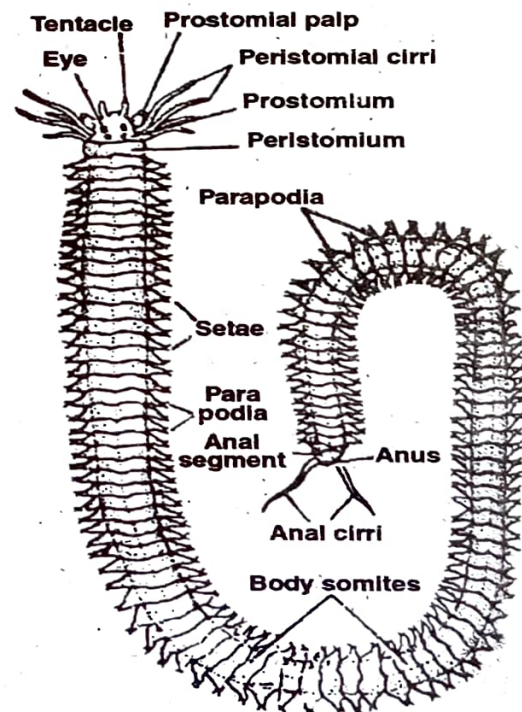
PHYLUM : ANNELIDA

(35) *Nereis virens* or *Neanthes* (Clam worm)

PHYLUM: ANNELIDA
 CLASS: CHAETOPODA
 ORDER: POLYCHAETA

IMPORTANT FEATURES :

- It is a triploblastic, bilaterally symmetrical, free living organism living in 'U' shaped burrows
- Body is divided into a distinct head, a short collar like neck and an elongated abdomen.
- Head bears a pair of eyes, a pair of tentacles, a pair of prostomial palps and two pairs of peristomial tentacles.
- Every segment has a pair of laterally arranged parapodia for locomotion.
- Anus lies at the posterior end and anal segment bears a pair of anal cerci.
- Pharynx comes out during feeding
- Organisms are unisexual and germ cells are released by heteroneries stage during breeding season.

Fig : *Nereis* - external features

Identification points:

Long worm like body with segmentation, distinct head, cephalic tentacles, eyes, abdominal segments with lateral parapodia, anal segment with anal cerci.

(36) *Aphrodite* (sea rat)

PHYLUM: ANNELIDA
 CLASS: CHAETOPODA
 ORDER: POLYCHAETA

IMPORTANT FEATURES:

- Commonly seen living in muddy shores.
- Body measures about 12-15cm in length possessing 30-35 segments.
- Dorsal surface of the body possesses a number of fine setae giving it an appearance of a cushion.
- Body wall helps in filtering the water and sending it in to the body.
- Oval shaped body is compressed dorsoventrally but in transverse section, dorsal side is convex.
- Head is indistinct possessing a pair of eyes, a pair of lateral papillae formed from peristomium and a median long tentacle. Anus lies on the dorsal side of the posterior end.
- Slender, hard and iridescent setae are seen in association with the dorsal lobe of parapodium.
- Ventral lobe of the parapodium bears only hard spicules.
- Ventral side is flat and help in creeping over hard surfaces.
- Proboscis can become eversible whenever needed during food collection.
- Pharynx bears a pair jaws. 18 pairs of lateral diverticula are seen on the lateral sides of intestine.
- Undulating membrane on the dorsal side also facilitates water filtration before it enters body.

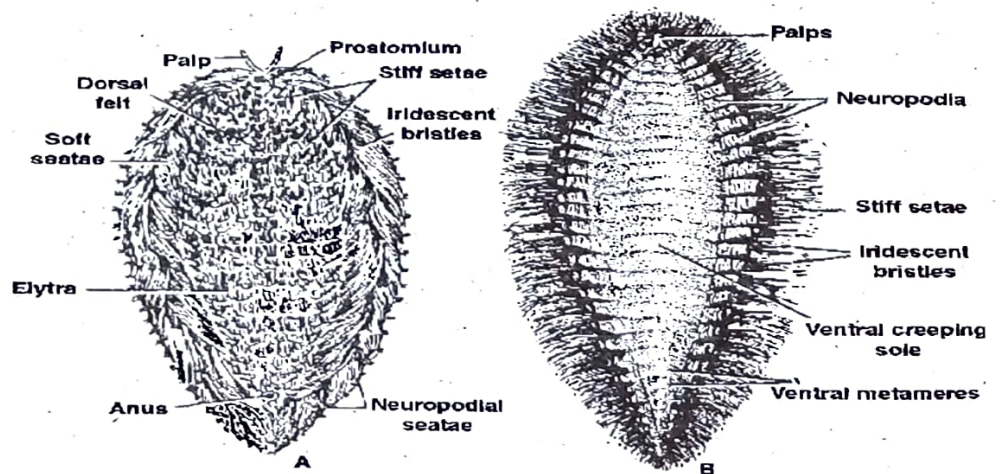


Fig : *Aphrodite* (A) Dorsal view (B) Ventral view

Identification points:

Differential setae, body with limited number of segments, capable of rolling in to a spiral when disturbed.

(37) Chaetopterus (Paddle worm or parchment worm)

PHYLUM:ANNELIDA
 CLASS:CHAETOPODA
 ORDER:POLYCHAETA

IMPORTANT FEATURES:

- Free living tubicolous organism living in a 'U' shaped burrows along the seashore.
- Triploblastic, bilaterally symmetrical, eucoelomate organism with true segmentation/metamerism.
- Body can be divided into an anterior region of 15-20 segments, a middle region of 3 segments and many-segmented posterior region.
- Preoral segment is small. A funnel like collar encircles the mouth, called peristomium having a pair of long peristomial tentacles.
- Succeeding nine segments possess cone like parapodia possessing tender setae. Rest of the anterior segments bears suckers for getting firm attachment in the burrow.
- Ciliated groove extends from mouth to the suckered segments and forms in to a food cup.
- The middle three segments bear biramous parapodia each having a small notopodium and a big neuropodium. Neuropodium of one side fuses with the neuropodium of the other side to form a fan like structure. This is used to draw water and filter food particles to feed.
- All the posterior segments bear biramous parapodia.
- Body is encircled by iridescent cuticle.
- Power of regeneration is more and even a single segment can develop into a new individual.

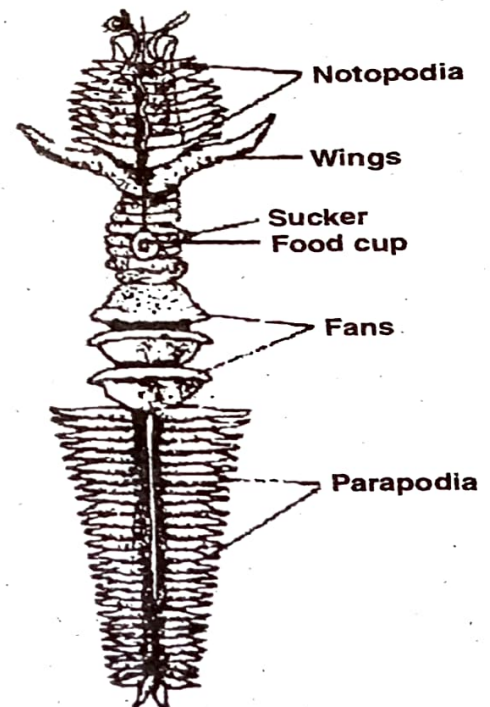


Fig : *Chaetopterus*

Identification points:

Shiny body divided into three parts, food funnel in the middle region, segments with parapodia.

(38) *Hirudinaria granulosa* (Common Cattle Leech)

PHYLUM: ANNELIDA
CLASS: HIRUDINARIA
ORDER: GNATHOSTOMATA

IMPORTANT FEATURES :

- Leech is a slightly flattened, triploblastic, bilaterally symmetrical, intermittent ectoparasite leading a sanguivorous life on cattle.
- Body has dermomuscular body wall and hence is highly distensible.
- Club shaped body is divided into 33 segments and 109 annuli
- Body measures about 10-15cm in length and is covered by a thin cuticle
- Anterior sucker is formed by the fusion of the ventral side of the first three segments.
- Sucker is muscular enclosing a preoral chamber having mouth and three toothed/denticulate jaws.
- Jaws help in making the wound on the host to suck the blood.
- Blood is prevented from coagulation by hirudin, an anticoagulant from pharyngeal glands.
- Sucked blood is stored in the crop having ten chambers with lateral blind and distensible caeca.
- All the segments bear segmental and annular receptors
- Anus is postero dorsal in 26 segments.
- Male and female genital openings are present on the mid ventral side of 10 and 11 segments
- Clitellum appears as a temporary band between 9-11 segments during breeding season.
- Seventeen pairs of nephridial openings are present on the ventrolateral sides of 6-22 segments.
- Posterior sucker is disc like and is formed by the fusion of the last seven segments.
- Body cavity is filled with hard and fibrous botryoidal tissue.

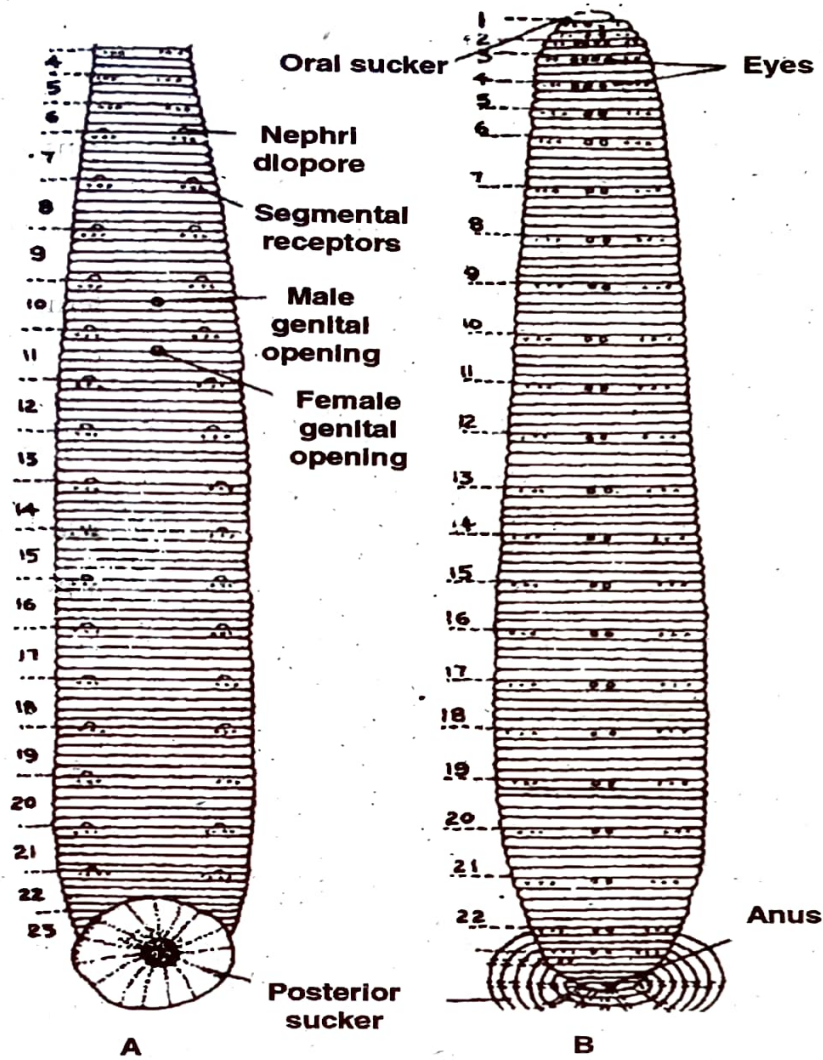


Fig : *Hirudinaria granulosa*

Identification points:

Club shaped body, disc like posterior sucker, 33 segments and 109 annuli, olive green body.

(39) Trochophore Larva

PHYLUM: ANNE
 CLASS: HIRUDIN
 ORDER: GNATHOSTOM

IMPORTANT FEATURES :

- It is a larva in the life cycle of many polychaete worms and certain molluscs.
- In Nereis, it hatches out from the fertilized egg after 24 hours.
- It is a marine, pelagic, minute, pear shaped transparent, unsegmented creature with oral and anal surfaces.
- Its body is composed of an outer ectoderm. Its epithelium is thickened at their ends and in the middle of the body while the remaining part is lined by thin epithelium.
- The anterior end has a apical plate bearing a tuft of cilia.
- Brain** or **ganglia** is present beneath the apical plate below which an **eye spot** is present.
- Digestive tract is **complete** in the form of **Coiled tube**. Mouth lies ventrally and opens into a small oesophagus.
- Oesophagus is ectodermal and called as **stomodaeum**.
- Stomach is a bag-like structure formed by endoderm.
- Hind gut is formed by the ectoderm which opens outside through anus.
- A characteristic feature of larva is the presence of a pre-oral ciliated girdle of the cell just above the equator called **prototroch**.
- A post-oral ciliated band or **metatroch** lies behind the mouth. In some animals, a **telotroch** is present just in front of the anus. All these bands help in feeding and locomotion.
- In between digestive tract and ectoderm, a **blastocoel** is present which is filled with mesodermal cells.
- A pair of **protonephridia** is present in blastocoel. It is ectodermal in origin. It undergoes metamorphosis to become an adult.

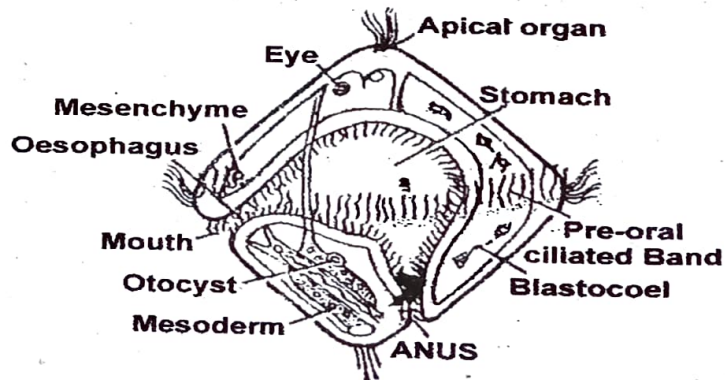


Fig : Trochophore Larva

VII

PHYLUM : ARTHROPODA

(40) *Cancer menas* (Crab)

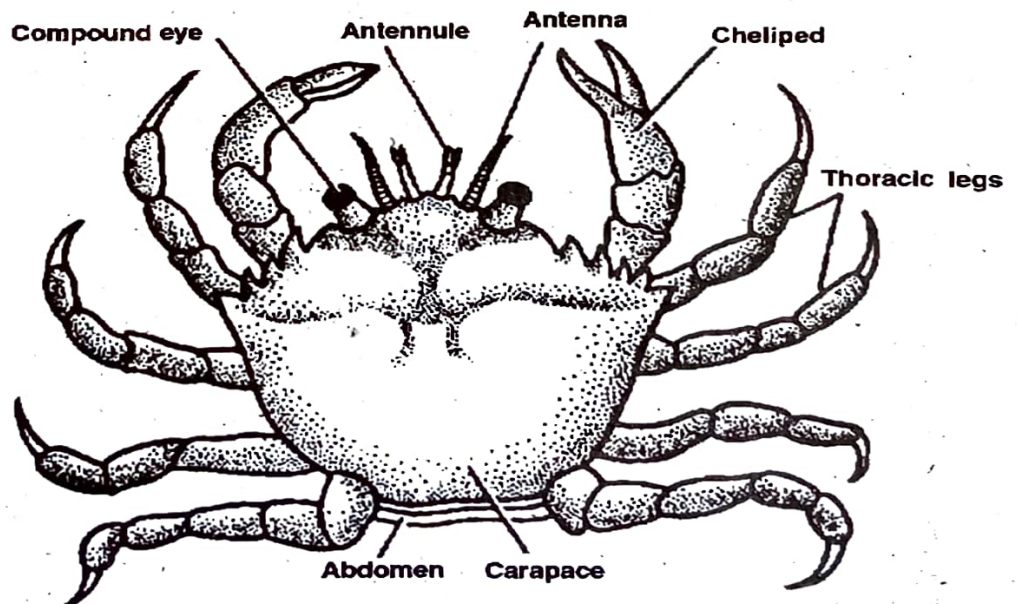
PHYLUM : ARTHROPODA
 CLASS : CRUSTACEA
 ORDER : DECAPODA

IMPORTANT FEATURES:

- Marine organism living along the shores having a wide cephalothorax and flattened abdomen
- Serrated anterior margin of the cephalothorax bear a pair of compound eyes, a pair of antennae and a pair of antennules.
- Among five pairs of thoracic appendages, first pair is large and strong pedipalps having terminal segments modified into pincers. They help in catching the food materials.
- All the other appendages end in a pointed claw.
- Pedunculate eyes are arranged along the margin in front of cephalothorax.
- Third pair of maxillipeds bears flattened terminal segments for protecting the mouthparts.
- Abdomen is soft and folded to fit into the ventral groove
- Pleopods in males help in copulation and in females for storing eggs
- Life cycle is indirect involving a number of larval stages.

Identification points:

Five pairs of thoracic appendages, wide, flattened and hard cephalothorax with serrated anterior margins, pedunculate eyes, first pair of appendages as forceps like pedipalps.

Fig : *Cancer menas*

(41) *Palaemon malcomsoni* (Fresh water prawn)

PHYLUM : ARTHROPODA
 CLASS : CRUSTACEA
 ORDER : DECAPODA

IMPORTANT FEATURES:

- A fresh water prawn living in streams, rivers, ponds and lakes.
- A nocturnal animal living in deep waters during day time
- Omnivorous animal feeding on microorganisms, algae and small insects.
- Body has an anterior cephalothorax formed of 5 cephalic and 8 thoracic segments.
- The posterior abdomen is formed of 6 segments.
- Cephalothorax has an anterior, elongated, serrated rostral spine
- A pair of pedunculate compound eyes is located just below the rostral spine.
- A pair of long antennules and a pair of antennae are present beneath the compound eyes.
- Thoracic appendages are the pleopods or walking legs for walking over the hard substratum.
- Six pairs of abdominal appendages are the periapods for swimming in water.
- Last abdominal segment bears a spine like telson and a pair of uropods for guiding the movement.
- All the appendages are biramous and the organisms are unisexual with direct life cycle.
- Prawns are economically important as they are exported, as they constitute important food.

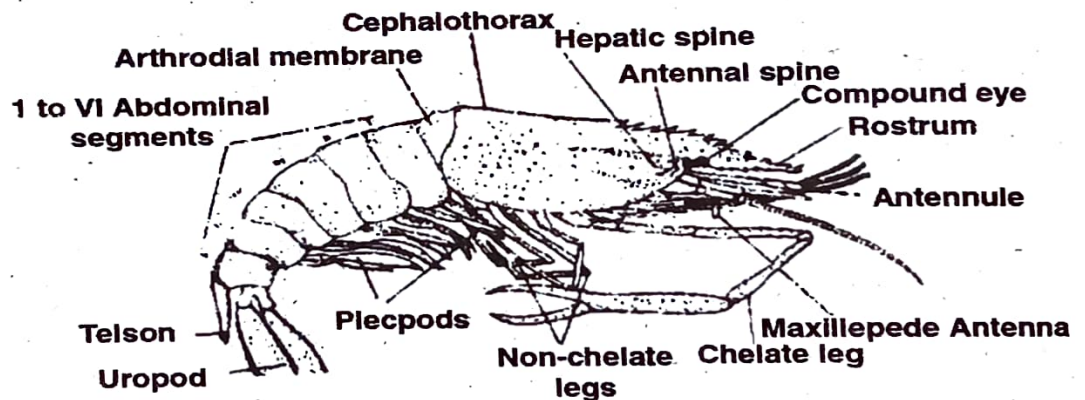


Fig : *Palaemon* - External Characters

Identification points:

Slightly curved body, segmented abdomen, forceps like chelicerae, long antennules and antennae

(42) *Buthus tamulus* (Scorpion)

PHYLUM: ARTHROPODA
 CLASS: ARACHNIDA
 ORDER: SCORPIONIDA

IMPORTANT FEATURES:

- ❑ Nocturnal, solitary organisms commonly living under stones, wooden logs and in crevices
- ❑ Carnivorous in habit feeding on insects, worms etc., and also are cannibalistic in nature.
- ❑ Body measuring about 8 cm appears black or light red or yellow in colour.
- ❑ Anterior unsegmented part of the oval body is the cephalothorax or prosoma and the posterior segmented part is the abdomen or opisthosoma.
- ❑ Last segment is the anal segment bearing a poisonous gland and a sting..
- ❑ Every segment has a dorsal tergum, a ventral sternum and a lateral pluron.
- ❑ Six-segmented prosoma has a dorsal carapace with a median ridge, a pair of simple eyes, and two to five pairs of lateral eyes. Ventrally, it has a pair of chelicerae, a pair of large and strong pedipalps and four pairs of walking legs.
- ❑ Wide region of the opisthosoma is the mesosoma having seven segments. The first mesosomal sternum is the bifid genital operculum. Second sternum is associated with comb like pectines.
- ❑ Four pairs of book lungs are present on ventrolateral sides of 3,4,5 and 6 mesosomal segments. They open out through transverse slits and help in respiration.
- ❑ Posterior narrow and long segmented part appearing as tail is the metasoma with five segments.
- ❑ Coxal glands for excretion are present in the coxal segment of third pair of walking legs.
- ❑ Unisexual organisms and are viviparous giving birth to the fully developed young ones.

Identification points:

Elongated oval shaped body with a long tail like metasoma, four pairs of walking legs, a pair of strong pedipalps, and a pair of chelicerae, and four pairs of book lung openings and mesosoma having seven segments.

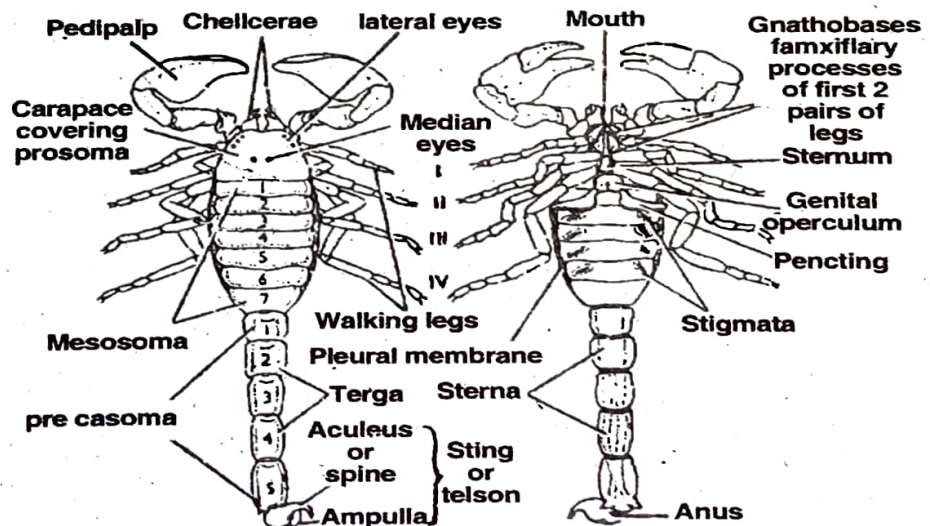


Fig : Scorpion - External Characters

(43) *Scolopendra* (Centiped)

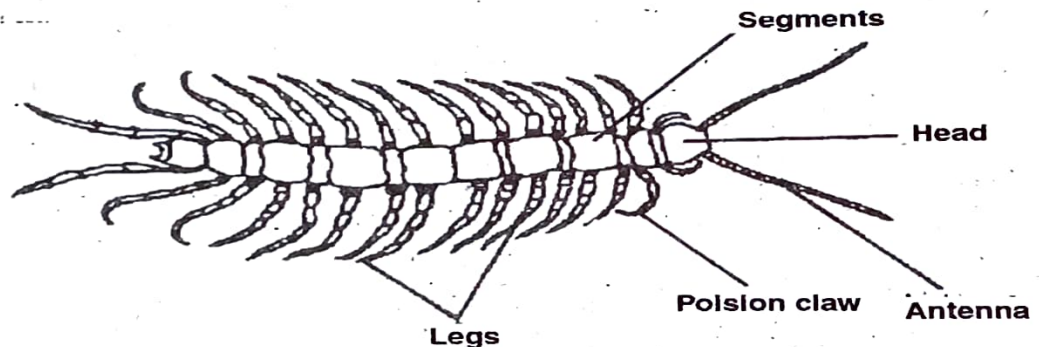
PHYLUM: ARTHROPOD

CLASS: CHEILOPOD

ORDER: SCOLOPENDROMORPH

IMPORTANT FEATURES:

- Active, nocturnal animals seen creeping under rocks, crevices, toilet tanks and wooden logs.
- Dorsoventrally compressed and segmented worm like body is divided into head and trunk.
- Head bears a pair of long antennae, a pair of mandibles, and two pairs of maxillae.
- First pair of maxillipeds possesses poisonous claws helping in killing their food materials.
- Each segment bears a pair of lateral legs formed of seven segments and end in claws.
- Carnivorous animals feeding on small insects and worms.
- Head bears a pair of eyespots for photoreception.
- Some segments possess respiratory stigmata in the pluron.
- Last segment bears anus and the penultimate segment possesses genital openings.
- A pair of anal tentacles is seen attached to the anal segment.
- Poison is harmful but not fatal to man.

Fig : *Centipede***Identification points:**

Dorsoventrally flattened segmented body, head with antennae and eyespots, first pair of maxillipeds with poisonous claws, each segment with a pair of lateral walking legs.

(44) *Sacculina* (Root headed barnacle)

PHYLUM: ARTHROPODA
CLASS: CRUSTACEA
ORDER: RHIZOCEPHALA

IMPORTANT FEATURES:

- Ectoparasitic crustacean living on the abdomen of a crab another free living crustacean.
- Sacculina* appears as a mass of degenerated tissue with out any external appendages.
- The parasite extends into the inner tissue of the host by sending a number of roots
- It is very difficult to consider *sacculina* as an organism by seeing its shape and appearance as the appendages, eyes, segmentation and mouth are lacking in the adult stage.
- Body has got only the well-developed reproductive system as an adaptation for parasitic life.
- Germ cells are released out by the parasite through cloaca at the posterior end.
- It was identified as a crustacean by observing its first larval form, nauplius seen in the life cycle.
- Nauplius undergoes metamorphosis and develops into *sacculina externa* with roots extending into all systems of the body of the host.
- Parasitic castration is the effect of the parasite on the host identified by non-functional ovaries in female crab and appearance of female features in male crabs.

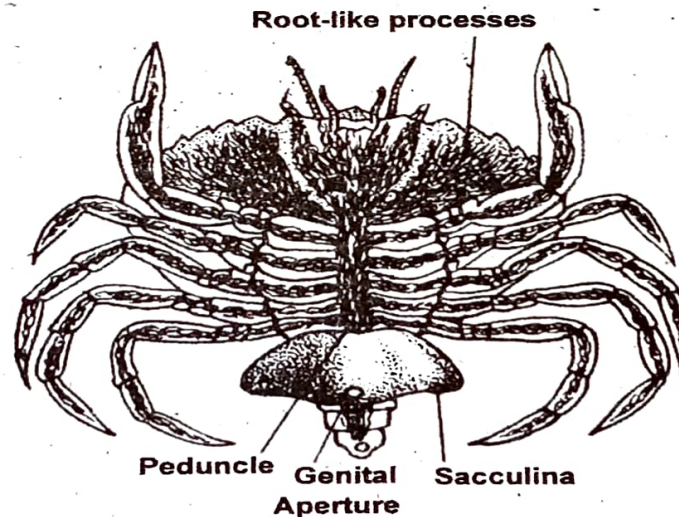


Fig : Sacculina on crab's abdomen

Identification points:

The parasite appearing like a mass of meat over the abdomen of crab, a number of branched roots extending into the body of the host.

(45) *Limulus polyphemus* (King crab)

PHYLUM: ARTHROPODA
 CLASS: ARACHNIDA
 ORDER: XIPHOURA

IMPORTANT FEATURES:

- ❑ Carnivorous and free living marine organisms living in muddy shores at a depth of 8-10m.
- ❑ Feeds on worms and insects living in sandy and muddy shores.
- ❑ Anterior wide horse shoe shaped part of the body is the six segmented prosoma, posterior narrow part is the nine segmented opisthosoma with which a long spine like telson is attached
- ❑ Opisthosoma is further divided into an anterior wide mesosoma and cone like posterior metasoma
- ❑ Carapace covering the prosoma is convex on dorsal side possessing a median ridge and a pair of lateral ridges. A pair of median eyes and a pair of lateral eyes are present close to the ridges.
- ❑ Prosoma has a pair of primitive chelicerae and five pairs of walking legs on its ventral side.
- ❑ Chelicerae are the three-segmented primitive forceps like structures.
- ❑ Mesosoma bears six pairs of spiny appendages while metasoma has no appendages.
- ❑ Males have modified first pair of appendages that help in holding female during copulation.
- ❑ First pair of mesosomal appendages has modified into operculum.
- ❑ All the appendages are biramous.
- ❑ Excretion is by coxal glands and respiration by book gills present on the ventral side of mesosoma
- ❑ A hinge joint is present at the junction of prosoma & opisthosoma and opisthosoma & telson.
- ❑ This is considered as a living fossil as it possesses primitive chelicerae as seen in early arthropods

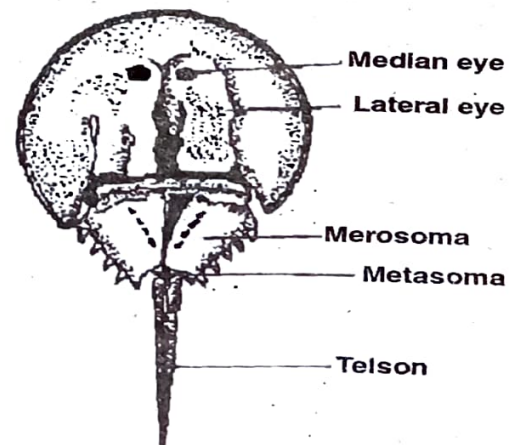


Fig : *Limulus*

Identification points:

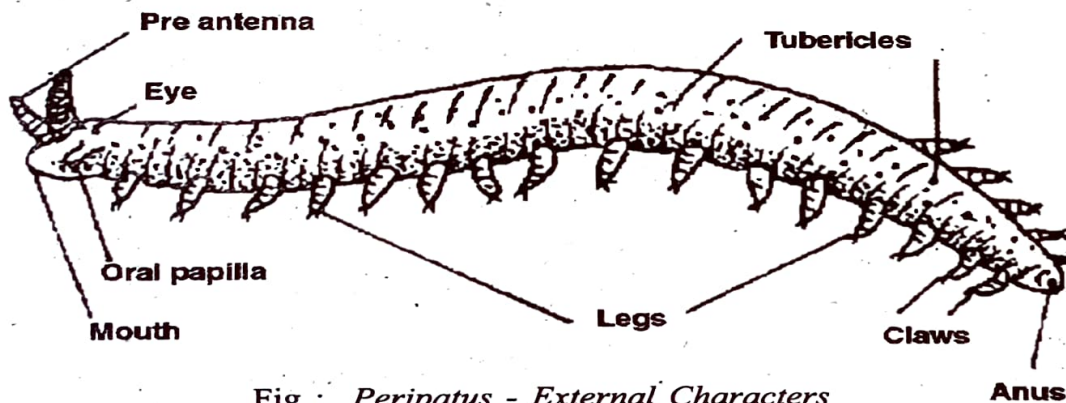
Horseshoe shaped body with a posterior spine, lateral spines in mesosoma, a long spine like telson.

(46) *Peripatus* (walking worm)

PHYLUM: ONYCHOPHORA

IMPORTANT FEATURES:

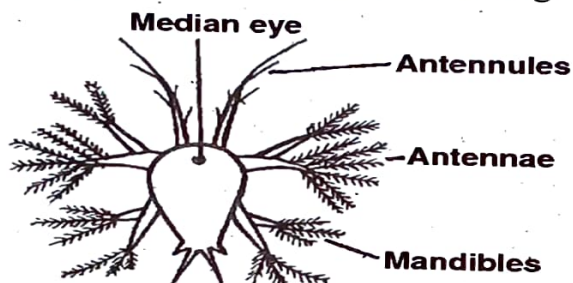
- Active, nocturnal animals seen creeping under rocks, in the crevices, in moist soils, beneath the bark and wooden logs.
- Carnivorous in habit feeding on insects, worms etc.,
- Triploblastic, bilaterally symmetrical, shiny, columnar body resembles the caterpillar of butterflies.
- Animal measures about 5-7 cm in length and possesses 14-43 pairs of unsegmented clawed legs.
- Body is surrounded by wrinkled, soft cuticle giving the appearance of segmentation.
- A number of conical papillae with spines are distributed over the body
- Head is indistinct but bears a pair of dorsal eyes, a pair of pre oral antennae, a pair of slime secreting papillae, mouth surrounded by a pair of toothed jaws formed from the papillae.
- Anus is located at the posterior end.
- Unisexual organisms exhibiting sexual dimorphism and viviparity.
- A good example for living fossil, connecting link and discontinuous distribution.
- Annelidan characters in peripatus are the dermomuscular body wall and nephridia for excretion. Arthropodan features in peripatus are the conical lobe like clawed legs and trachea for respiration. Hence peripatus is considered as a connecting link.

Fig : *Peripatus* - External Characters**Identification points:**

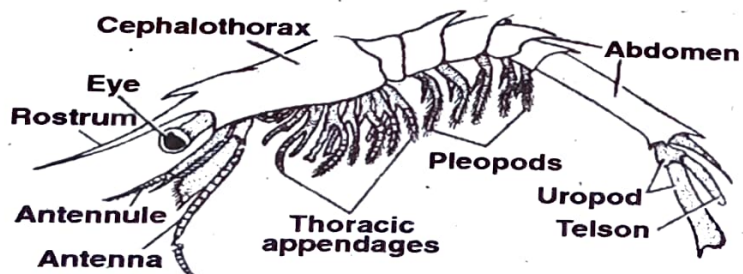
Caterpillar like body covered by a shiny wrinkled cuticle, dermomuscular soft and fleshy body wall, lateral clawed feet.

(47) Nauplius larva**IMPORTANT FEATURES :**

- Seen in the life cycle of marine crustaceans and malacostraceans as their first larval form
- Microscopic free swimming palagic form.
- A trisegmented oval body having broad anterior head, middle trunk and a bifid or forked posterior end.
- Has a simple median eye on the dorsal side of the body.
- Possess three pairs of appendages of which first pair are the uniramous antennules.
- Second and third pairs are the biramous antennae and mandibles surrounding mouth.
- Jaws help in food collection. Primitive gut and ganglion are seen.
- Nauplius undergoes moultings and changes to a series of larval stages in the life cycle.

**(48) Mysis larva****IMPORTANT FEATURES :**

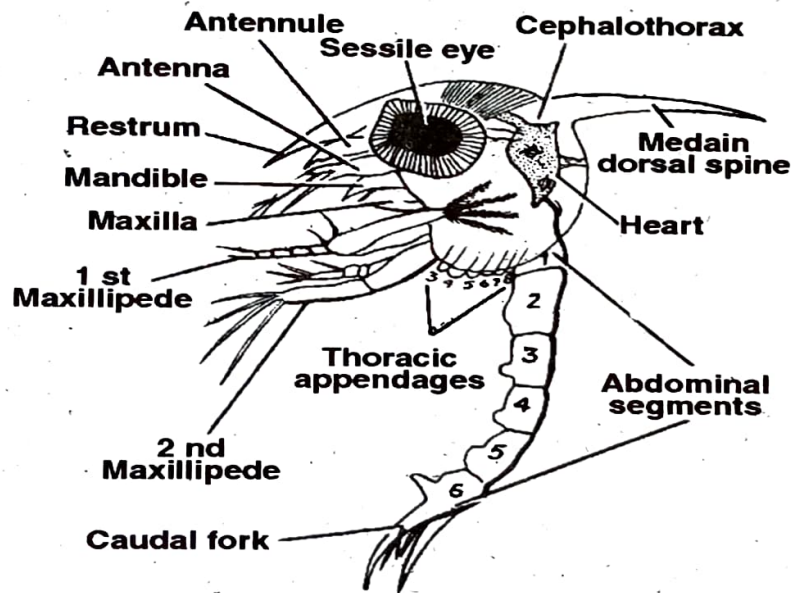
- Seen as a modified zoea in the life cycle of peneid crustaceans.
- Possess an elongated and laterally compressed transparent body.
- Cephalothorax is covered by carapace having a anterior median rostral spine.
- Cephalic, thoracic appendages are well developed while abdominal begin to appear.
- Abdomen ends in telson.
- A pair of stalked and compound eyes are seen attached to the cephalothorax.
- The larva resembles the adult mysis and hence the name.



(49) Zoea larva

IMPORTANT FEATURES :

- Seen in the life cycle of some marine crustaceans
- Microscopic free-swimming pelagic form.
- Body has a broad cephalothorax and a posterior curved abdomen.
- Carapace covering cephalothorax has two long spines viz., a median dorsal and a median rostrum.
- Cephalothorax also bears a pair of short lateral spines.
- Movable, stalked and paired compound eyes are located just beneath the rostrum.
- Cephalic appendages (5 pairs) are well developed.
- Among 8 pairs of thoracic ones, three pairs of biramous maxillipeds are slightly formed.
- Five pairs of walking legs are seen as buds. Caudal end is forked.
- Segmented abdomen ends in a forked telson and bears no appendages.



(50) Mouth parts of male Anopheles mosquito

IMPORTANT FEATURES:

- All the components such as labrum, maxillae, mandibles, labium and hypopharynx are present in the mouthparts of mosquito but they are variously modified to suck plant juices.

- Mouthparts are long and needle like.
- Long and club shaped maxillary palps
- Mandibles are absent.
- Sensory hair is dense at the antennary segments.
- Hypopharynx fuses with labrum to form the sucking tube.

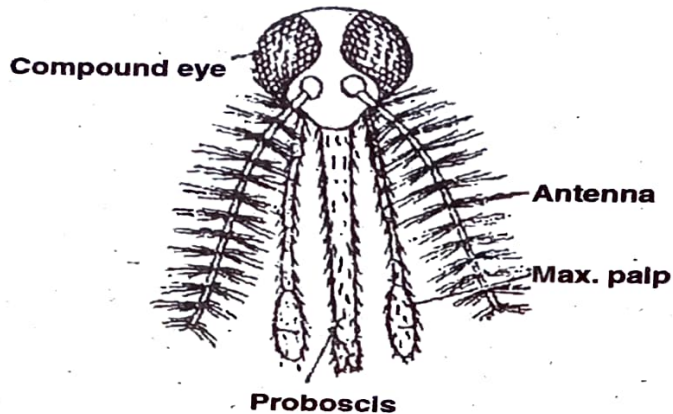


Fig : Head and mouth parts of male *Anopheles*.

Identification points:

Absence of mandibles, club shaped maxillary palps, dense hair at the antennary segments.

(51) Mouth parts of female *Anopheles* mosquito

IMPORTANT FEATURES :

- Piercing and sucking type of mouth parts suiting to the blood feeding habit
- All the components such as labrum, maxillae, mandibles, labium and hypopharynx are present in mouthparts of mosquito but they are variously modified to suit the sanguivorous mode of life.
- Labium is formed into a half moon shaped proboscis in which other parts rest during flight
- Free end of the labium possesses a pair of labellar lobes having sensory hair to recognize the host
- Labrum epipharynx and hypopharynx are modified into long needle like structures having groove. They arrange one above the other forming a food canal to suck blood from the host
- Salivary amylase preventing coagulation is released through salivary duct in hypopharynx.
- Mandibles and maxillae are long, needles ending in blades to make wound on the host
- Elongated maxillary palps arising from the base of the proboscis are equal to the length of labium
- Antennae are long, segmented with few hair at the antennary segments:

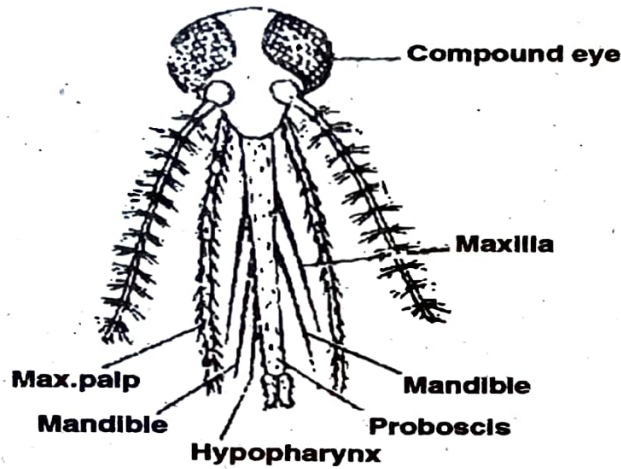


Fig : Head & Mouth parts of female *Anopheles*

Identification points:

Needle like mandibles and maxillae ending in blades, elongated. Maxillary palps equal to the length of labium, antennae with thin hair at the segments.

(52) Mouth parts of male *Culex* mosquito:

IMPORTANT FEATURES:

- Absence of mandibles
- Fused labium and hypopharynx.
- Maxillary palps longer than labium
- Spine like labrum epipharynx
- Antennae with less number of segments having dense sensory hair.

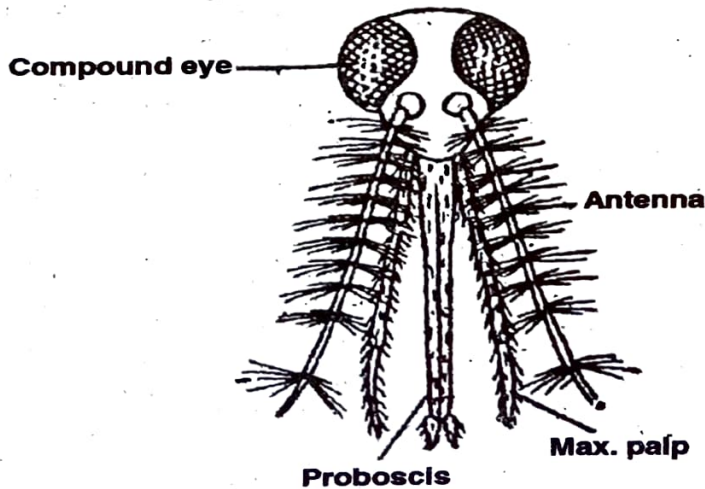


Fig : Head mouth parts of male *Culex*

(53) Mouth parts of female Culex mosquito

IMPORTANT FEATURES:

- Piercing and sucking type of mouth parts suiting to the blood feeding habit
- All the components such as labrum, maxillae, mandibles, labium and hypopharynx are present in mouthparts of mosquito but they are variously modified to suit the sanguivorous mode of life.
- Labium is formed into a half moon shaped proboscis in which other parts rest during flight
- Free end of the labium possesses a pair of labellar lobes having sensory hair to recognize the host
- Labrum epipharynx and hypopharynx are modified into long needle like structures having groove. They arrange one above the other forming a food canal to suck blood from the host
- Salivary amylase preventing coagulation is released through salivary duct in hypopharynx.
- Hypopharynx is strong and needle like with a ventral groove.
- Mandibles and maxillae are long, needles ending in blades to make wound on the host
- Trisegmented maxillary palps arising from the base of the proboscis are very short.
- Antennae are long, segmented with few hair at the antennary segments.
- Few sensory hair over maxillary palps and labium.

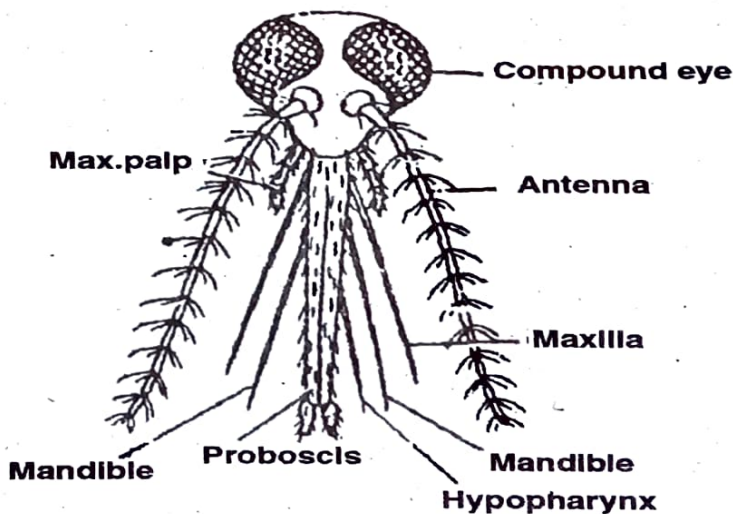


Fig : Head and mouth parts of female Culex

Identification points:

Short maxillary palps, spine like hypopharynx, little hair over antennae.

(54) Mouth parts of House fly - *Musca domestica***IMPORTANT FEATURES :**

- ❑ Houseflies are the common insects in housing areas. They are saprozoic. Hence they possess sponging/lapping type of mouthparts.
- ❑ All the components such as labrum, maxillae, mandibles, labium and hypopharynx are present in the mouth parts of housefly but they are variously modified to suit the saprozoic mode of life.
- ❑ Labium is modified into a proboscis with three divisions viz., rostellum, houstellum and labellum.
- ❑ Labrum epipharynx and hypopharynx form the sucking tube for liquid feed. They fit in the houstellum to form the food groove.
- ❑ Rostrellum is triangular possessing maxillary palps. A hinge joint present in between rostellum and houstellum and hence it can fold inwards during resting periods. Mandibles are absent.
- ❑ Labellum is a wide tongue shaped one formed of two lobes. The lobes bear a number of parallel air tubes like structures called pseudotracheae. They converge towards mouth and communicate with the food canal.

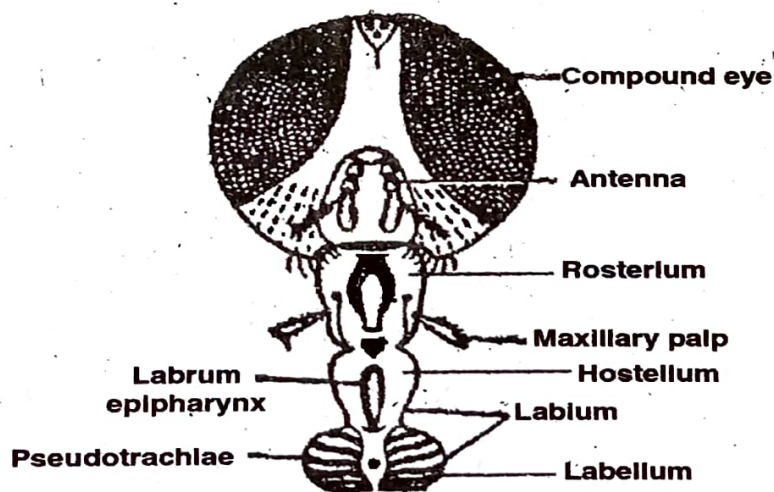


Fig : House-fly Head and mouth parts

Identification points:

Mouthparts having labellum with pseudotrachea, labellum formed of three segments.

(55) Mouth parts in Butterfly**IMPORTANT FEATURES :**

- The mouth parts resemble the basic pattern of insect mouth parts. Because of the food habit, mouth parts are transformed into siphoning type.
- The long and sucking proboscis is formed from the elongated galea of the maxillary palp.
- The proboscis consists of paired galea which, during feeding, fit together to form a tube or used to suck the nectar of the flowers.
- At rest, it becomes coiled and held close to the underside of the head.
- The labial palps have a sensory function.
- Rest of the mouth parts like labrum, epi and hypo pharynx, mandibles and maxillae are either reduced or disappeared since they have no specific function to conduct.

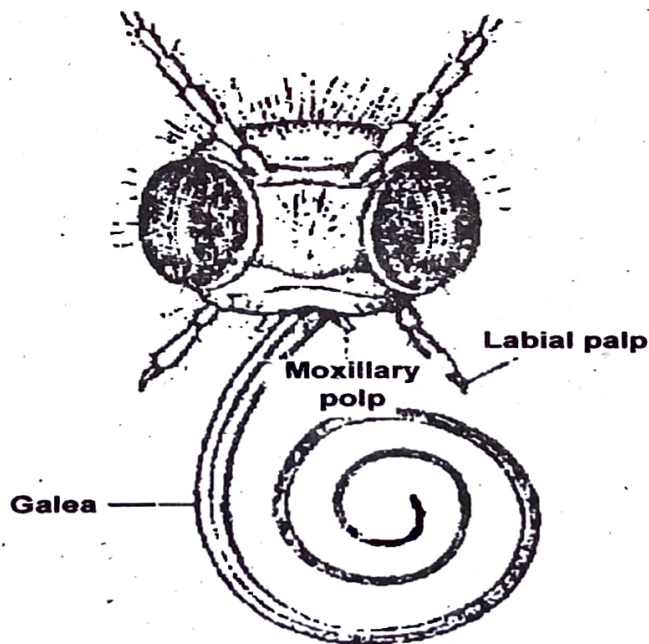


Fig : Mouth parts in Butterfly

Comparative study of mouth parts :

Component	Female anopheles mosquito	Female culex mosquito	Male anopheles	Male culex
Labium	Long, half moon shaped proboscis to lodge other components in rest	Same	Same	Same
Labellar lobes	Possess a pair of labellar lobes at the free end	Same	Same	Same
Labrum epipharynx	Long, flexible needle like one with a ventral half moon shaped food groove	Same	Same	Same
Hypopharynx	Another long needle like one with a salivary duct	Same	Same	Same
Maxillary palps	Elongated, long needle like one equal to the length of labium	Trisegmented and short maxillary palps	Long club shaped	Longer than labium
Mandibles	Long needle like one ending in blade to make wound	Same	Absent	Absent
Antennae	Long, segmented with thin hair at the segments	Long, segmented with thin hair at the segments	Sensory dense hair at the antennary segments	Long with less number of segments having dense hair

VIII

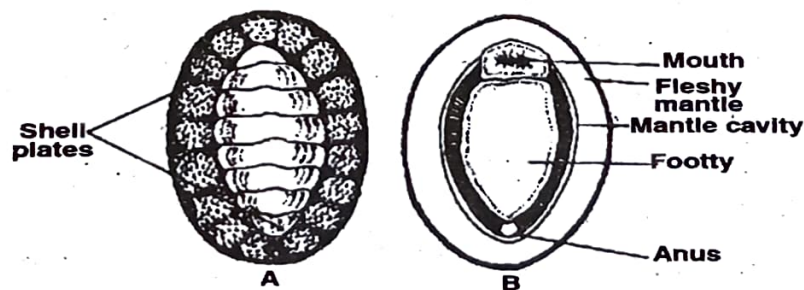
PHYLUM : MOLLUSCA

(56) *Chiton* (Sea mouse or Coat of mail shells)

PHYLUM : MOLLUSCA
 CLASS : AMPHINEUR
 ORDER : CHITONIDA

IMPORTANT FEATURES :

- Free living organism moving over a hard substratum in shallow waters.
- It is considered as a living fossil. Body is convex on the dorsal side and flat on the ventral side.
- Oval body measuring about 1-5 cm has no head but possess a powerful muscular oval foot attachment and creeping over the substratum.
- Eight overlapping shell plates are present on the dorsal side of the body. A band like mantle membrane encircles all the plates at their margin on the dorsal side. Mantle edge is supported by spicules.
- Mantle forms a deep groove on either side of the foot. Respiratory gills are present in this groove.
- Radula is the toothed rasping structure found behind the mouth in the buccal capsule.
- Ladder shaped nervous system formed from the mantle and pedal nerves got their ganglia concentrated in the head region only.
- Gills, muscles, shell plates, kidneys etc., show metameric arrangement and bilateral symmetry.
- The organism rolls over when disturbed.
- Feeds on diatoms and algal cells.

Fig. : *Chiton*

(A) Dorsal view, (B) Ventral view

Identification points:

Dorso - ventrally flattened oval body; eight overlapping shell plates on the dorsal side; mantle groove with gills, skin fold supported by spicules along the margins.

(57) *Pila globosa* (Apple snail)

PHYLUM: MOLLUSCA
CLASS: GASTROPODA
ORDER: PECTINIBRANCHIATA

IMPORTANT FEATURES :

- Triploblastic soft bodied organism living in fresh water ponds, lakes, tanks, paddy fields and rivers
- A calcareous shell protects body. It's mouth is closed by an operculum when the organism is retracted into the shell
- Body is divided into a head, foot, visceral hump and mantle.
- Head and foot are bilateral symmetrical and the rest of the body is asymmetrical because of spiral coiling
- Head grows over the foot in the form of a thick fold called rostrum-having mouth opening.
- A pair of labial palps, a pair of antennary tentacles and a pair of ommatophores bearing simple eyes are present on either side of the head fold or rostrum
- Foot is a triangular one with a wide anterior propodium and a posterior narrow metapodium. Operculum attaches with a posterior lobe.
- Rippling movements caused by the strong muscles of the foot and the mucilaginous secretions help in locomotion
- Visceral mass is in the form of a hump. All the organ systems inside the hump have undergone torsion during metamorphosis
- A loose and thin mantle membrane covers the body on its dorsal surface. This encloses a mantle cavity having gill, lung, genital structures, sense organs and rectum.
- Mantle and its surface release secretions to help in the formation and growth of the shell.
- Mantle form pseudopodia or nuchal lobes on either side of the head. They help in respiration.

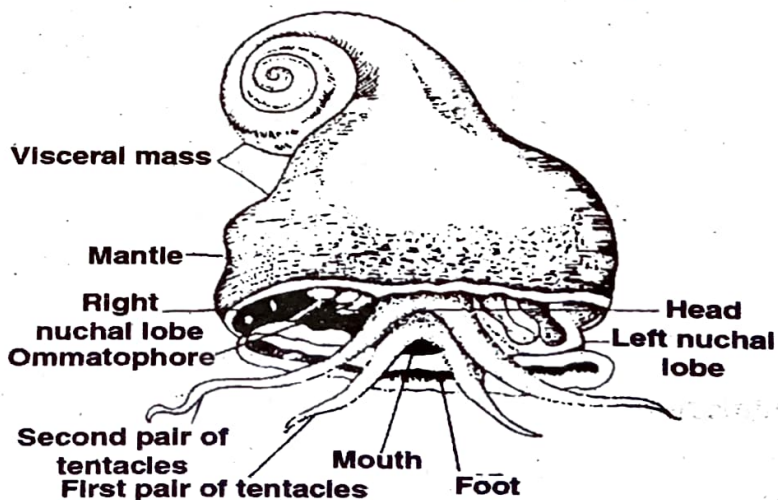


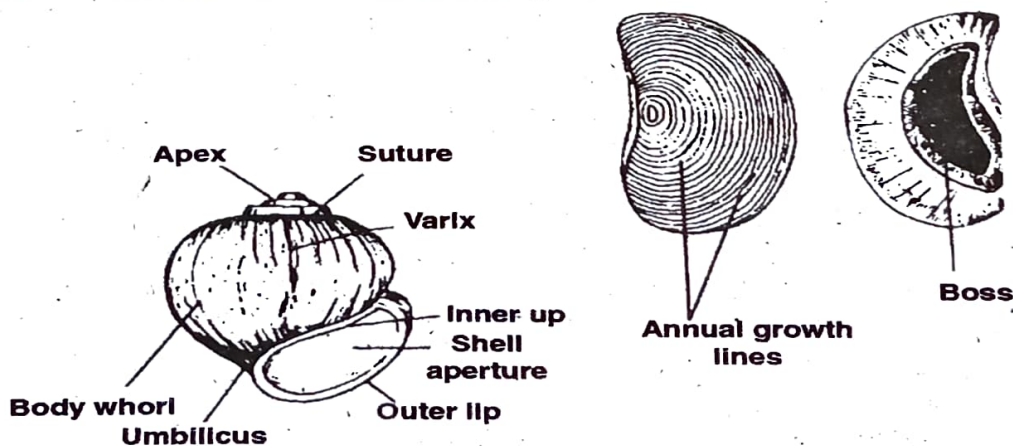
Fig : *Pila* - External structure after removing shell

Identification points:

Muscular triangular foot, spirally coiled visceral mass covered by a loose mantle, tentacles and eye bearing ommatophores on either side of the head, calcareous shell and mango shaped operculum having lines of growth.

(58) *Pila globosa* – shell**IMPORTANT FEATURES :**

- Pila* is a triploblastic soft-bodied organism living in fresh water ponds, lakes, tanks, paddy fields and rivers. Some people take it as food. It is protected by a shell.
- A calcareous, univalvular, conispiral and umbilicated shell protects body. It's mouth is closed by operculum when the organism is retracted into the shell
- It has a central columella around which the shell coils are formed. This opens out at its base and the side of the shell mouth through umbilicus. Hence the shell is an umbilicated one.
- Shell opens out through a wide opening called the mouth of the shell.
- First formed primary coil of the shell is the apex and is pointed.
- Shell is dextral as the mouth opening is towards the right side of the viewer when held with its apex up
- Outer most spiral of the shell is the body whorl and inner to it is the penultimate spiral.
- Major portion of the body lies in the body whorl. Visceral hump extends into the other whorls
- Thick ridges present over the shell surface are the varices indicating the cessation of growth
- Thin lines in between the successive varices on the surface of the shell are the lines of growth.
- Sutures are the lines separating the successive whorls of the shell
- Shell in its micro structure possess three layers viz.,
 - ⇒ the upper darkly colored thin layer of periostracum made of organic substance called conchiolin
 - ⇒ the middle ostracum formed of calcareous aragonite plates and
 - ⇒ the inner shiny hypostracum or nacreous layer or nacre formed of thin fibrous plates.
- Periostracum and ostracum are secreted from the shell glands of the mantle edge and the hypostracum from the secretions of the mantle epithelium

**Identification points:**

Spirally coiled conispiral and dextral shell, large body whorl, lines of growth over the surface, pointed apex, shiny nacreous or inner layer.

(59) *Unio* (Freshwater mussel)

PHYLUM: MOLLUSCA
 CLASS: BIVALVIA/PELECYPODA
 ORDER: EULAMELLIBRANCHIATA

IMPORTANT FEATURES:

- Unio* is an aquatic organism living in fresh water ponds, rivers, lakes and streams.
- Body and the shell valves are laterally compressed.
- Round and wide anterior body gradually tapers to a narrow and round posterior end.
- Foot is a axe shaped one coming out from the anterior end to make burrows into the sand
- Posterior end is always exposed to facilitate respiration
- The organism crawls over the substratum
- Nocturnal organism leading herbivorous life.
- First formed part of the shell is the UMBO which is surrounded by a number of growth lines
- Thick ridges formed on the shell in between the lines of growth are the varices.
- The two shell valves are united by a hinge at the umbo region
- A pair of respiratory siphons is located at the posterior end.
- Internally the body is covered on either side by mantle lobes.
- Shell is formed from the secretions of the mantle lobes.
- Shell is made of a horny outer layer of conchiolin; a calcareous middle prismatic layer of arragonite plates having conchiolin as cementing substance; an inner shining pearly layer called nacreous layer.

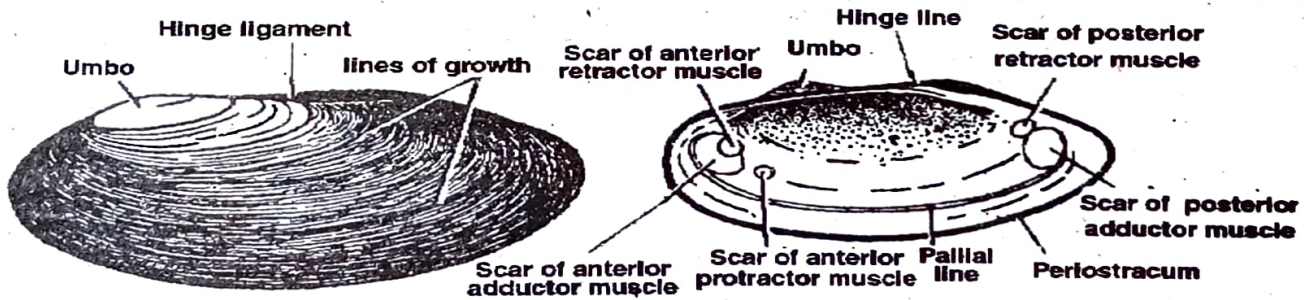


Fig : *Unio* the fresh water mussel

Fig : Inner view of Right Valve of Mussel

Identification points:

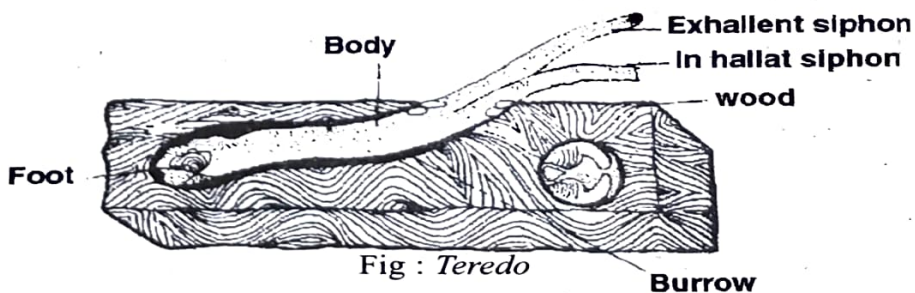
Bivalvular shell, axe like foot, lines of growth and varices over the shell valves.

(60) *Teredo* (Burrowing ship worm)

PHYLUM: MOLLUSCA
 CLASS: BIVALVIA/PELECYPODA
 ORDER: EULAMELLIBRANCHIA

IMPORTANT FEATURES:

- It is commonly called as a woodborer.
- It makes burrows into the submerged wooden boards and logs to settle in the burrows.
- Body is long and slender bearing a shell at its anterior end
- Shell plate is small and the body is covered by mantle
- Lamellar gills are present on either side of the body under the mantle.
- Reduced foot for attachment with substratum
- Posterior end of the body bears a pair of respiratory siphons which are anteriorly united
- The organisms feed on wood and plankton
- The body has well developed abductor muscles.



Identification points:

Elongated worm like body, anterior reduced shell plates, elongated respiratory siphons, cavity enclosing gonads and gills.

(61) *Murex tribulus* (Shell):

PHYLUM: MOLLUSCA
CLASS: GASTROPODA

- This is a macroscopic marine organism measuring about 80-110 mm in size.
- It has wide distribution and lives in soft bottoms.
- Its shell is a large protoconch with 7-8 convex whorls.
- Each whorl shows approximately four conspicuous varices, armed with very strong spines.
- Space between varices possess a sculpture of irregular spiral cords.
- The opening of the shell is ovate. It is drawn anteriorly by a very long, nearly closed siphonal canal, over which the varices and their spines are continued in a comb-like pattern.
- The shells are creamy white in colour intervened by brownish blotches. Interspaces between the spiral cords is darker.
- The animal has proto a protoconch.

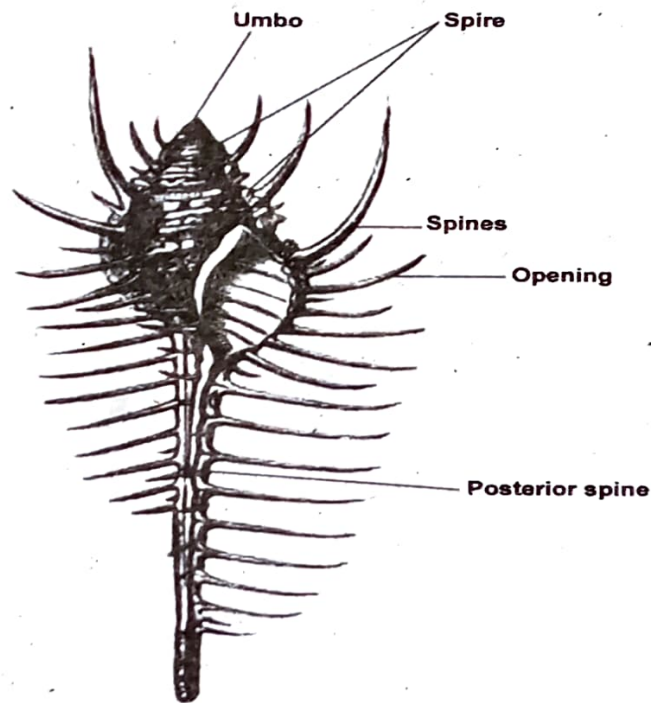


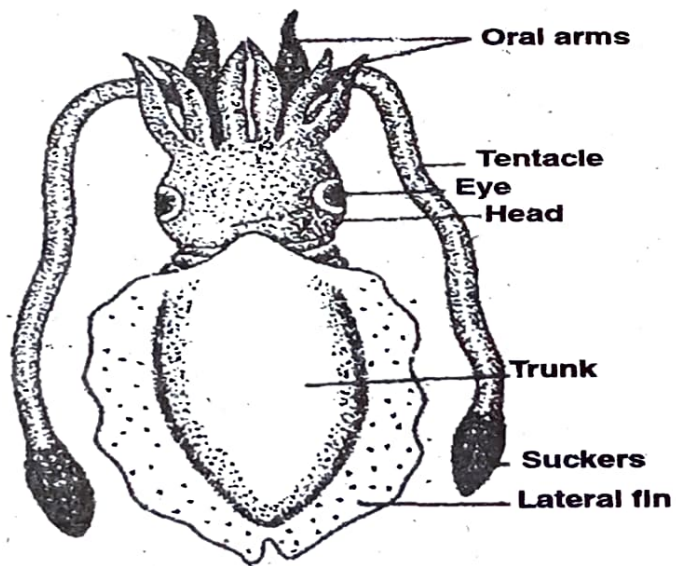
Fig : *Murex tribulus* (shell).

(62) *Sepia* (Cuttle fish)

PHYLUM: MOLLUSCA
 CLASS: CEPHALOPODA
 ORDER: DECAPODA

IMPORTANT FEATURES:

- Oval shaped marine organism swimming actively in shallow waters.
- Body has a definite head, a trunk formed of visceral hump.
- Dorso- ventrally compressed body has a pair of thin fins as parapodia on either side of the trunk.
- Mantle cavity opens out through a funnel like structure on the antero ventral side.
- Shell is internal and disc like. Visceral hump has seven gills.
- Head bears conspicuous eyes with sharp sight.
- Ten suckered arms helping in locomotion are present at the anterior end of the head.
- Males possess a pair of long suckered hectocotylized arms.
- Visceral hump possess an ink gland releasing ink at the time of danger to escape from the predator.
- Ink released from the gland forms a smoke screen in water facilitating the escape from the predator.
- Body has shiny surface.

Fig : *Sepia*

Identification points:

Oval body with ten suckered arms around the head, bulb like head with conspicuous eyes, funnel like mantle lobe, ink gland in side the body, internal disc like shell, lateral fins not fusing at the posterior end.

(63) *Loligo* (squid – sea arrow)

PHYLUM : MOLLUSCA
CLASS : CEPHALOPODA
ORDER : DECAPODA

IMPORTANT FEATURES:

- Active swimmers of the shallow waters of tropical seas having food value.
- Resembles sepia in shape but possess an elongated elliptical body having a distinct head and trunk
- Head bears a pair of conspicuous eyes and ten suckered arms. Two of them are the long hectocotylized arms helping in food collection.
- Lateral fins arise from middle of the body and unite posteriorly to form into a triangular parapodium.
- Shell is internal and pen like.
- Visceral hump has an ink gland. Its secretions form a smoke screen in water in times of dangers.
- Body is dorso-ventrally flattened.
- In males, one arm transforms to conduct the function of sperm transfer.
- Visceral mass has a pair of gills, a pair of kidneys, and a pair of auricles exhibiting bilateral symmetry.
- Unisexual organisms and females die after spawning.

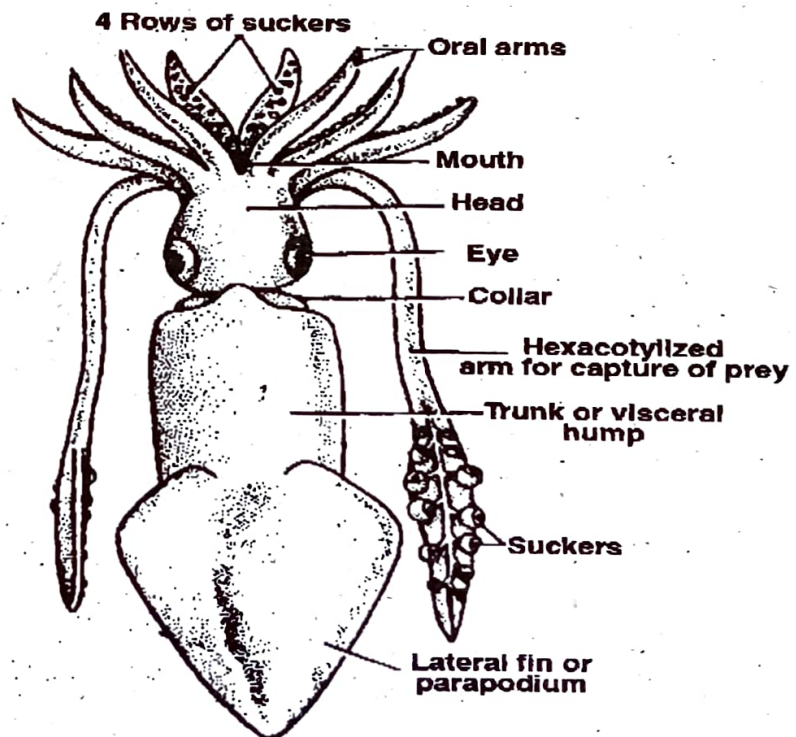


Fig : *Loligo*.

Identification points:

Elongate body with a triangular parapodium at the posterior end; internal pen like shell.

(64) *Octopus* (Devil fish)

PHYLUM: MOLLUSCA
 CLASS: CEPHALOPODA
 ORDER: OCTOPODA

IMPORTANT FEATURES:

- ❑ Nocturnal, carnivorous, creeping organism commonly seen among the corals of deep-water.
- ❑ Body is bulbous in shape with eight long suckered arms around the head. Suckers are arranged in two rows along the margins. Cephalic arms are webbed.
- ❑ Body bears a pair of conspicuous lateral eyes and mantle opening out through a funnel on the side. Water coming out through the funnel as a jet helps in locomotion.
- ❑ Visceral hump and mantle cavity is covered by mantle membrane.
- ❑ Shell is absent in the body but nervous system is well developed.
- ❑ Visceral hump has a pair of gills, a pair of auricles and a pair of kidneys.
- ❑ Octopus is capable of changing its body colour in relation to the environment.
- ❑ In males, the arm ending with a spoon like structure is the hectocotylyzed arm.

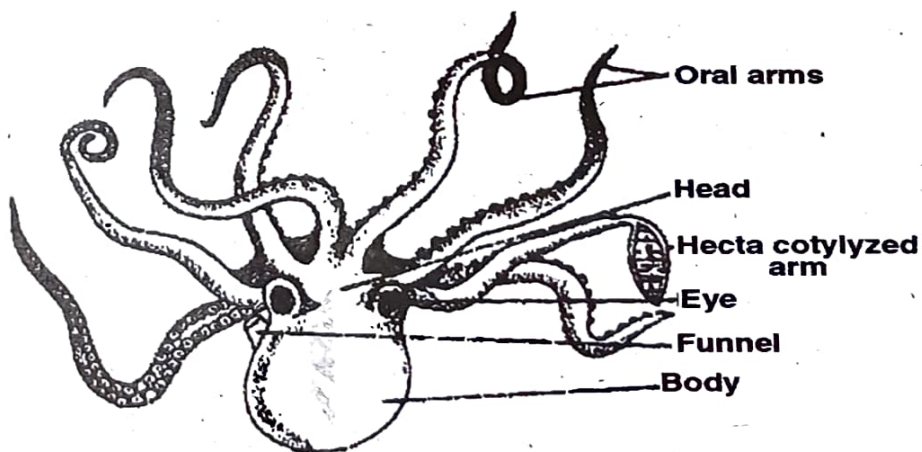


Fig : *Octopus*

Identification points:

Oval body, head and visceral hump covered by mantle membrane, eight long and suckered arms, conspicuous eyes, hectocotylyzed arm, ink gland inside the visceral mass.

(65) Nautilus (Pearly nautilus)

PHYLUM: MOLLUSCA
CLASS: CEPHALOPODA
ORDER: NAUTILAOIDEA

IMPORTANT FEATURES:

- Nocturnal, carnivorous organisms commonly seen in groups, among the corals of deep water seas.
- Body is seen inside the cup like body whorl of a planospiral, multi chambered shell
- Shell can grow to a size of 25cm. Outer surface of the shell is shiny with brown and white bands.
- Septa separating the chambers possess a narrow opening.
- Head in the body whorl bears about 90 tentacles
- Visceral mass in the body chamber extends to the first chamber as a long peduncle called sipuncle.
- Body has four gills, four kidneys and four auricles.
- Ink gland is absent.
- Organism release gas in to the chambers through sipuncle. This gas helps in flotation.
- Osphradia are the chief sensory structures in the body.
- Muscle contractions of the body create water current in the mantle for respiration.
- Cup like eyes are devoid of lens.

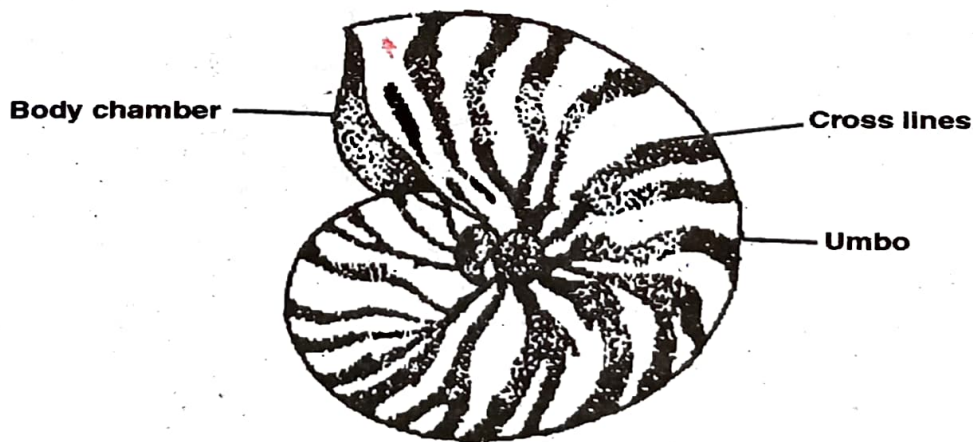


Fig : *Nautilus*

Identification points:

Planospiral shell with alternate white and brown bands, septa with a central opening, cup like eyes without lens, large number of tentacles in front of the head.

(66) *Glochidium larva*

IMPORTANT FEATURES:

- Seen in the life cycle of bivalvian molluscans
- Minute larva with two triangular dorsally united porous shell valves
- Leads an ectoparasitic life on the gills of fishes and feeds on the mucus
- Ventral free end of the shell valve bears a spiny or serrated hook
- Body covered by a pair of mantle lobes lies at the center of the shell
- Margin of the mantle lobes are beset with three or four groups of sensory cilia
- A single median abductor muscle help in keeping the valves together
- The glandular pouch at the mid ventral side of the body secretes a long sticky byssus thread
- Byssus helps in acquiring its host. Upon reaching the host, the larva becomes encysted
- Encystment is due to the overgrowth of the skin in the gills of fish

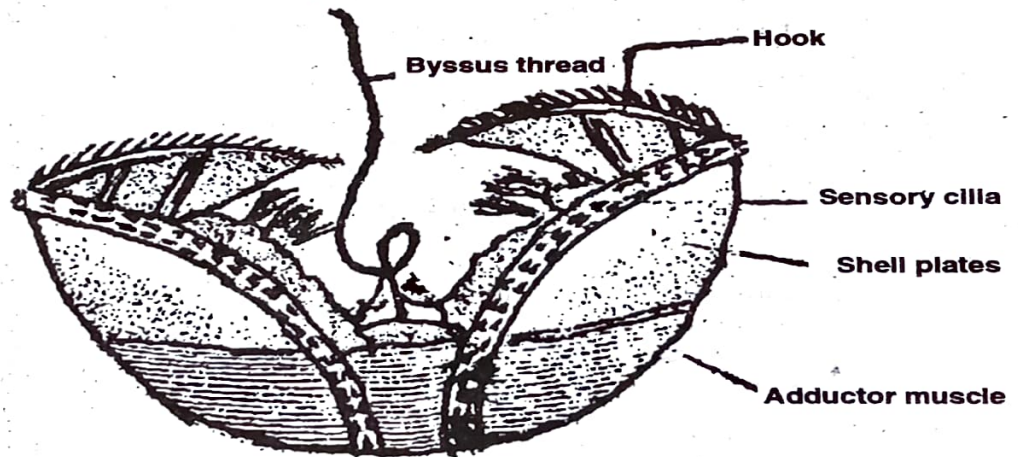


Fig: *Glochidium larva of bivalves*

Identification points:

Two shell valves connected by a hinge and adductor muscle, byssus thread, hooks at the free end of the shell valves.

IX

PHYLUM : ECHINODERMATA

(67) *Asterias* (Starfish or Sea star)

PHYLUM: ECHINODERMATA

CLASS: ASTEROIDEA

ORDER: FORCIPULATA

IMPORTANT FEATURES:

- Star shaped active swimmers of marine waters showing pentamerous radial symmetry
- Body is orally aborally compressed
- Body has a central disc and five radiating arms having wide base and tapering and round ends
- Calcareous plates at the margins of the body and arms are not conspicuous
- Anus is eccentric on the aboral side.
- Exactly opposite to this and near to the margin of the body, lies a porous plate called madreporite
- Water enters the water vascular system of the body through madreporite
- A number of branchial gills or respiratory papillae are present over the surface for respiration
- Surface of the body on the aboral side possess a number of tubercles having spines
- Pedunculate and suckered pedicellariae are present over the surface of the body to keep the body clean
- A pentagonal mouth is located at the centre of the disc on the oral surface.
- Each corner of the mouth extends as an ambulacral canal into the arm.
- The canal ends in a non contractile tentacle at the end of the arm
- A photo receptive ocellus is located at the base of the tentacle
- Margins of the arms are lined by inconspicuous calcareous plates
- The margins of the ambulacral canal are lined by four rows of tube feet.
- Tube feet are suckered and protected by ambulacral spines. They help in locomotion
- Pedicellariae are of straight type and possess a basal plate
- Two arms on either side of madreporite form bivium and the remaining three form trivium
- Organisms are unisexual with external fertilization and indirect development.
- Life cycle includes bipinnaria and brachiolaria as bilaterally symmetrical free-swimming larval forms.

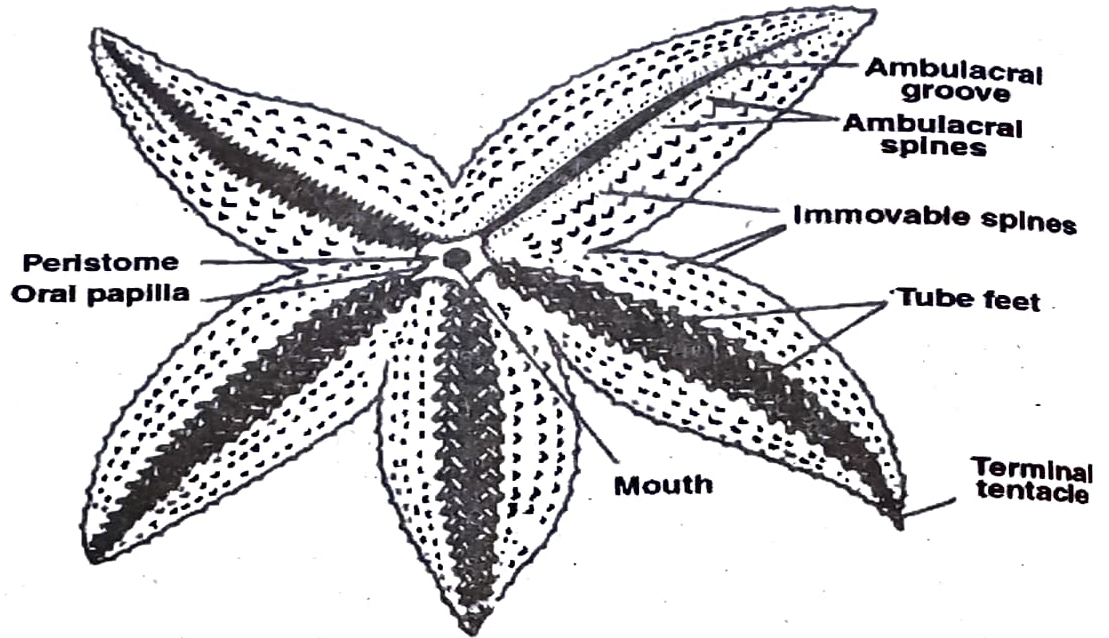


Fig.: Sea star - Oral view

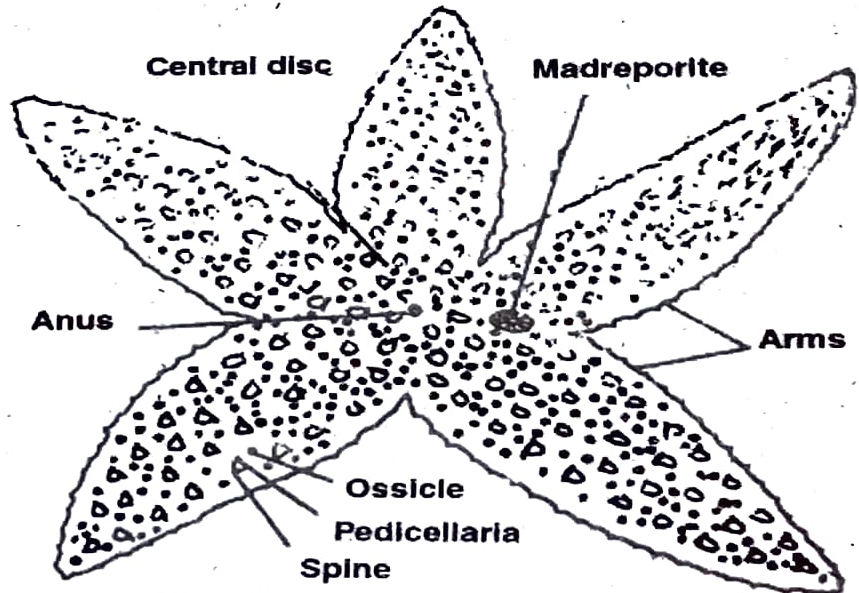


Fig.: Sea star.- Aboral view.

Identification points:

Five armed star shaped body, tuberculate surface, arms with ambulacral grooves, rows of tube feet and ambulacral spines, pentagonal mouth at the center of the oral disc on surface.

(68) *Ophiothrix* (Brittle star)

PHYLUM: ECHINODERMATA
 CLASS: OPHIUROIDEA
 ORDER: OPHIURAE

IMPORTANT FEATURES:

- Active swimmers of marine waters possessing spiny body and pentamerous radial symmetry
- Body is oroborally compressed and has a central disc with five radiating arms.
- Arms are tapering and appear as snake tails. They arise from the margin of the disc on the aboral side. They are surrounded on all sides by spiny plates.
- Pedicellaria, ambulacral grooves, dermal papillae and anus are absent.
- Mouth and madreporite are present on the oral side
- Five movable jaws present at the mouth opening constitute the jaw apparatus.
- Tube feet are without suckers and are present on the under surface of the arms.
- Germ cells are released through the bursal opening located at the base of the arms.
- Arms are brittle and hence the organism easily escapes from the predator .
- Possess high power of regeneration. Life cycle is indirect involving ophiopleuteus as larva.

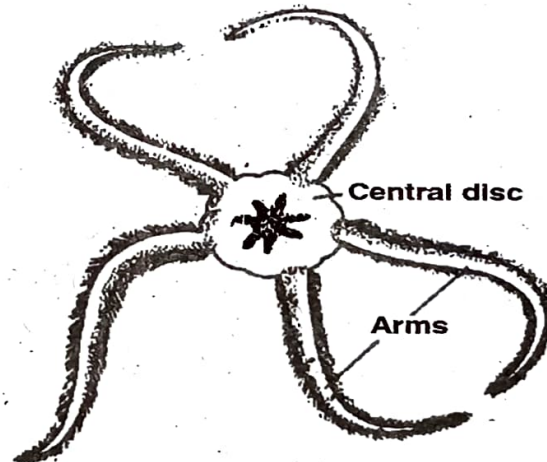


Fig : *Brittle Star*

Identification points:

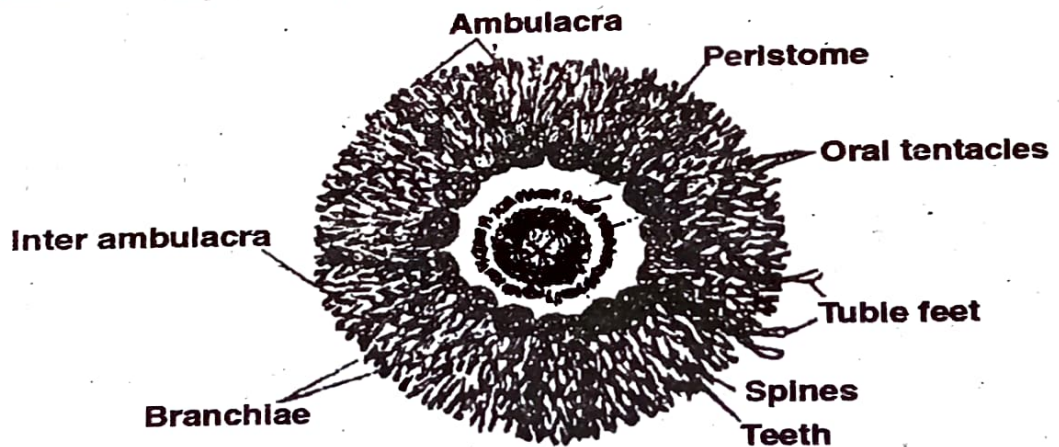
Long tapering arms with tapering ends; long posterolateral arms, ciliated short anterolateral arms.

(69) *Echinus* (seaurchin)

PHYLUM: ECHINODERMATA
 CLASS: ECHINODERMATA
 ORDER: DIDEMNATA

IMPORTANT FEATURES:

- Free living organism moving slowly over a hard substratum in shallow waters.
- Body is globe like with dark brown coloured movable spines.
- Oral side is flat while aboral side is in the form of a dome.
- Visceral mass is enclosed in a calcareous shell called corona.
- Corona is formed of endoskeletal plates and its surface has systematically arranged tubercles.
- Surface of the corona can be differentiated into ambulacral and inter ambulacral areas.
- Ambulacral areas possess spines and tube feet. About ten rows of tube feet are seen extending between oral and aboral sides.
- Mouth is surrounded by a fold of skin supported by jaws constituting aristotle's lantern for feeding.
- Pedicillate pedicellariae each of three jaws are present in between the ambulacral spines.
- Anus and madreporite are aboral in position.
- Water vascular system is well developed.
- Life cycle is indirect having echinopluteus as a free-swimming bilaterally symmetrical larva.

Fig: *Echinus*

Identification points:

Globe like brown body with movable spines, beautiful corona made of calcium carbonate, pedunculate pedicellariae each with three jaws, and aristotle's lantern as jaw apparatus.

(70) *Clypeaster* (cake urchin or sand dollar)

PHYLUM: ECHINODERMATA
 CLASS: ECHINOIDEA
 ORDER: CLYPEASTROIDEA

IMPORTANT FEATURES:

- Organisms live buried in sand along the sea shores.
- Body is enclosed in an orally flattened corona and shows bilateral symmetry.
- Corona is oval and possess strong and short spines. Pedicellaria are located in between the spines.
- Five ambulacral grooves arising from the corners of the mouth extend to the margin of the corona.
- Suckered tube feet are present on either side of the grooves
- Anus is also located on the oral side.
- Minute spines are dispersed along the convex aboral side
- Madreporite is at the centre of the aboral surface from which arise five leaf like ambulacral areas.
- The margin of each ambulacral area is lined by two rows of tube feet helping in respiration.
- Aristotle's lantern composed of five jaws is enclosed in prostomial fold and it helps in feeding.
- Genital plates with genital pores are present at the bases of ambulacral areas.

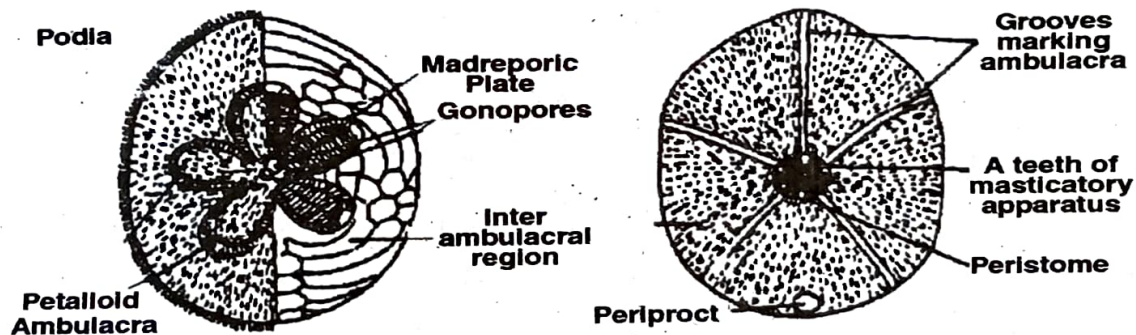


Fig : *Clypester*

Identification points:

Oroaborally flattened corona, five ambulacral areas on the aboral side, mouth and tube feet on the oral side.

(71) *Cucumaria* (sea cucumber)

PHYLUM: ECHINODERMATA
 CLASS: HOLOTHURIDA
 ORDER: DENDROCHORDATA

IMPORTANT FEATURES :

- It is commonly seen over the loose substrata of shallow waters in tropical seas.
- Body is cylindrical and elongated along the anteroposterior ends.
- Dark coloured body resembles the cucumber. Mouth lies at the oral end and anus at the posterior end.
- Body crawls over the substratum with its ventral side and feeds on the organic debris.
- Ventral side has three ambulacral areas (trivium) and dorsal side with two ambulacral areas (bivium).
- Tube feet are limited to the ambulacral areas on dorsal and ventral sides.
- Respiratory trees arising from the posterior cloacal end help in respiration.
- Mouth is surrounded by a number of branched tentacles.
- Only one polian vesicle is seen in the water vascular system.
- Unisexual organisms with indirect development having auricularia larva in the life cycle.
- Evisceration is observed when the organisms are disturbed.

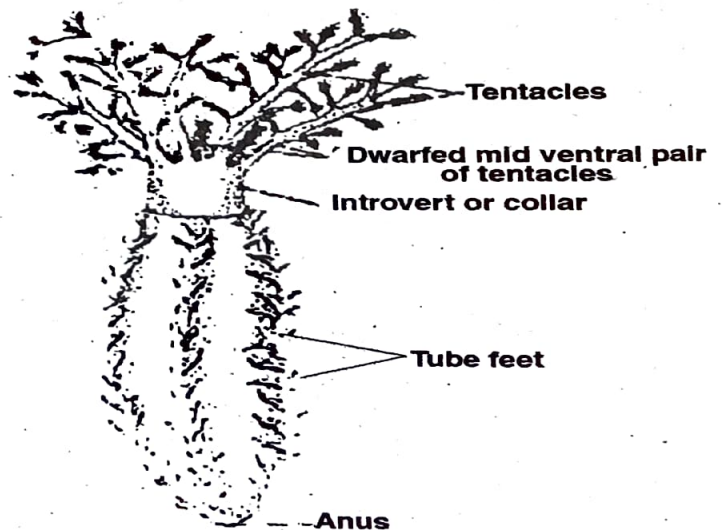


Fig: *Cucumaria*

Identification points:

Oroborally elongated cylindrical soft body, cloacal respiratory trees, branched tentacles at the mouth.

72) *Antedon* (Sea lilly or feather star)

PHYLUM: ECHINODERMATA

CLASS: CRINOIDEA

ORDER: ARTICULATA

IMPORTANT FEATURES :

- 1 It is a sedentary organism found attached to the rocks and sandy substrata.
- 1 Body is divided into a central disc like calyx and radiating arms
- 1 Five arms arising from the disc bifurcate to form ten in number
- 1 The free oral surface of the calyx is convex and basal aboral disc is flat bearing joined cirri for attachment with the substratum.
- 1 Oral surface is covered by a leathery skin called tegmen.
- 1 Mouth and anus are seen at the oral end but anus is located on papilla.
- 1 Arms are flexible bearing pinnules containing gonads. They give frilled margin to the arms.
- 1 Oral arms bear ambulacral grooves arising from the mouth to the terminus.
- 1 The sensory podia around the mouth are provided with suckers.
- 1 There is no madreporite leading into the water vascular system.
- 1 Organisms are unisexual. Life cycle includes a pentacrinoid larva.

Identification points:

Presence of five bifurcated radiating arms, central disc with cirri for attachment, pinnules over arms giving frilled appearance.

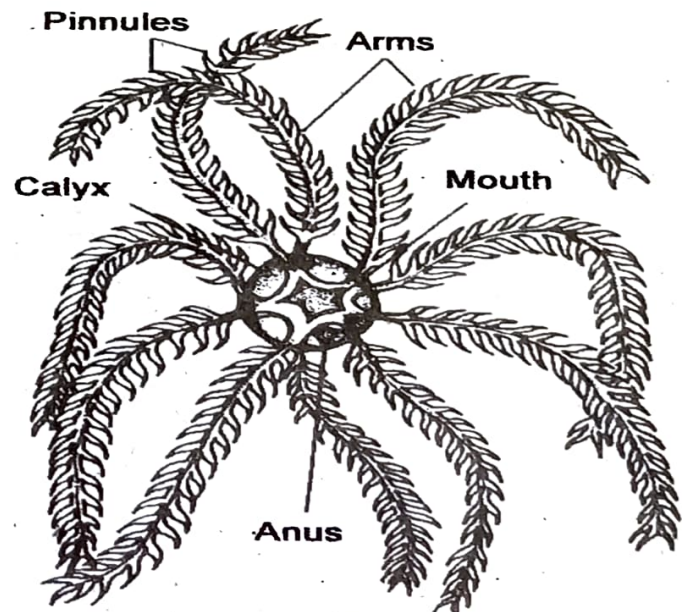
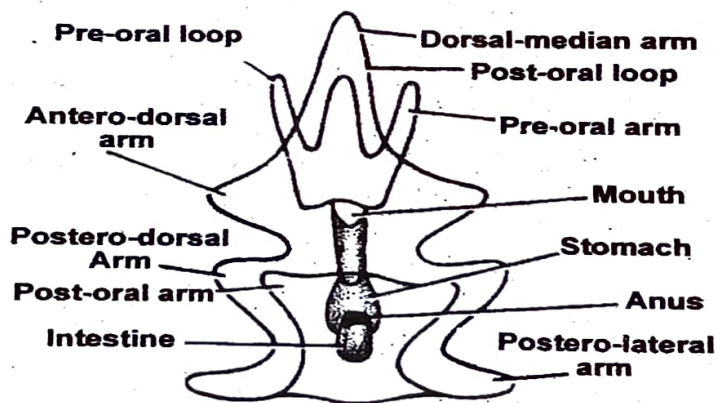


Fig : *Antedon*

(73) *Bipinnaria larva*

IMPORTANT FEATURES :

- Bipinnaria* larva is seen in the life history of starfish.
- During development, the gastrula develops into a ciliated, bilaterally symmetrical diplurula.
- It slowly swims in water for some time and transforms into a **bilaterally symmetrical *Bipinnaria* larva**.
- The larva is a free swimming marine planktonic organism.
- It feeds on microorganisms of the open waters.
- The larva has a **tri-branched preoral ciliated lobe**.
- 3 lateral lobes** on either side of the larva are bound by **pre and post oral ciliated bands**.
- The ciliated bands are the resultants of **perioral band**.
- A perianal loop encircles the anus at the posterior end of the larva.
- This larva with its characteristic appearance is the ***Bipinnaria* larva**.
- The larva is bilaterally symmetrical with waterfilled hydrocoel as body cavity.
- Internally the larva has a mouth, oesophagus stomach, intestine, hydropore and a dorsal somatocoels.
- After some weeks of free swimming life, changes into to a ***Branchiolaria* larva**.



Identification points:

Fig : *Bipinnaria* Larva

Presence of bilateral symmetry, preoral, lateral, post oral and perianal ciliated bands.

DISSECTIONS : PRAWN

1) Prawn-Appendages

- There are 19 pairs of appendages attached to the pleuron on the ventrolateral sides of prawn.
- Take a prawn and separate the appendages carefully.
- Keep them over the glass slide in the following order for further observation as shown in the diagrams Antennule, antenna, mandible, maxilla, maxillula, I, II, III maxillipeds, second and fourth walking legs, I, II, III abdominal appendages, uropod present on either side of the telson.

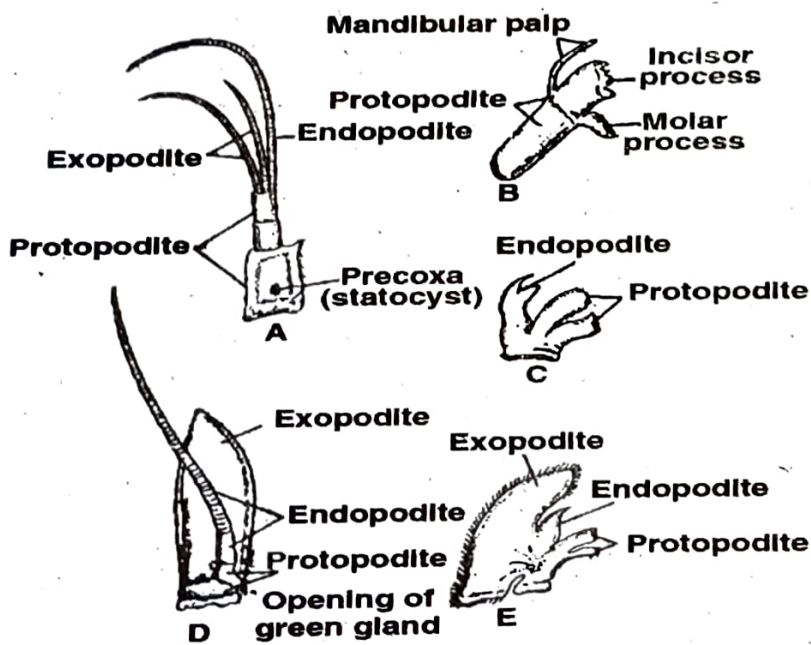


Fig :Prawn Cephalic appendages

(A) Antennule (B) Antenna (C) Mandible (D) I maxilla (E) II maxilla

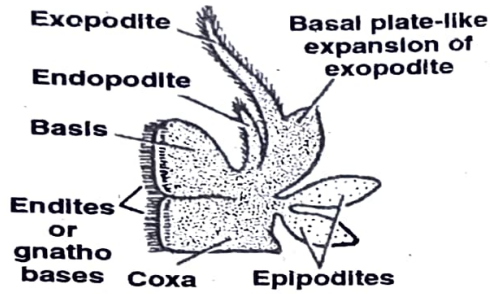


Fig: First Maxillipede of Prawn

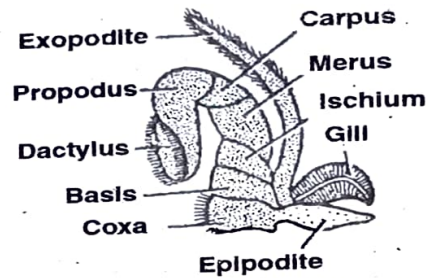


Fig: Second Maxillipede of Prawn

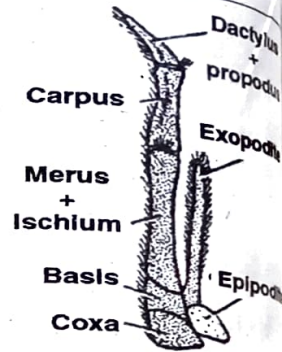


Fig: Third Maxillipede of Prawn

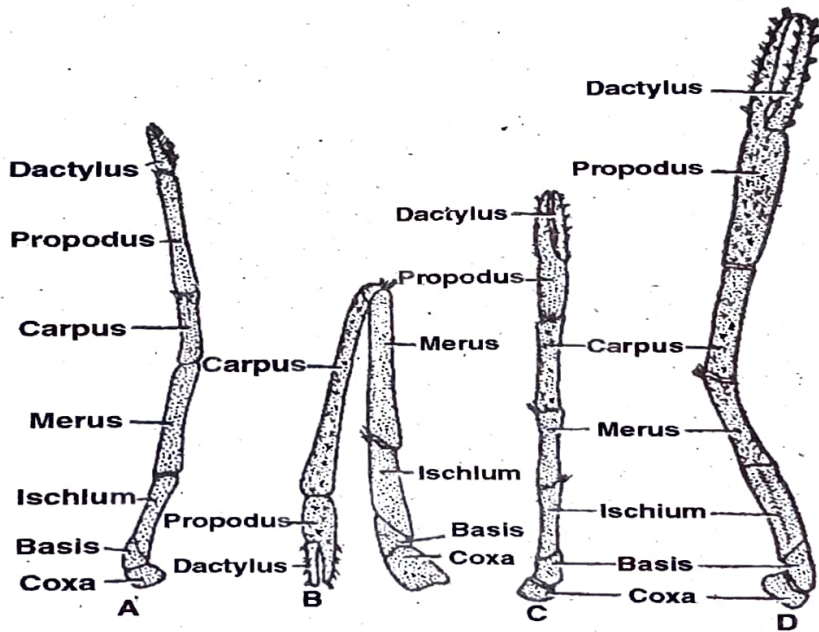


Fig: Thoracic appendages of Prawn

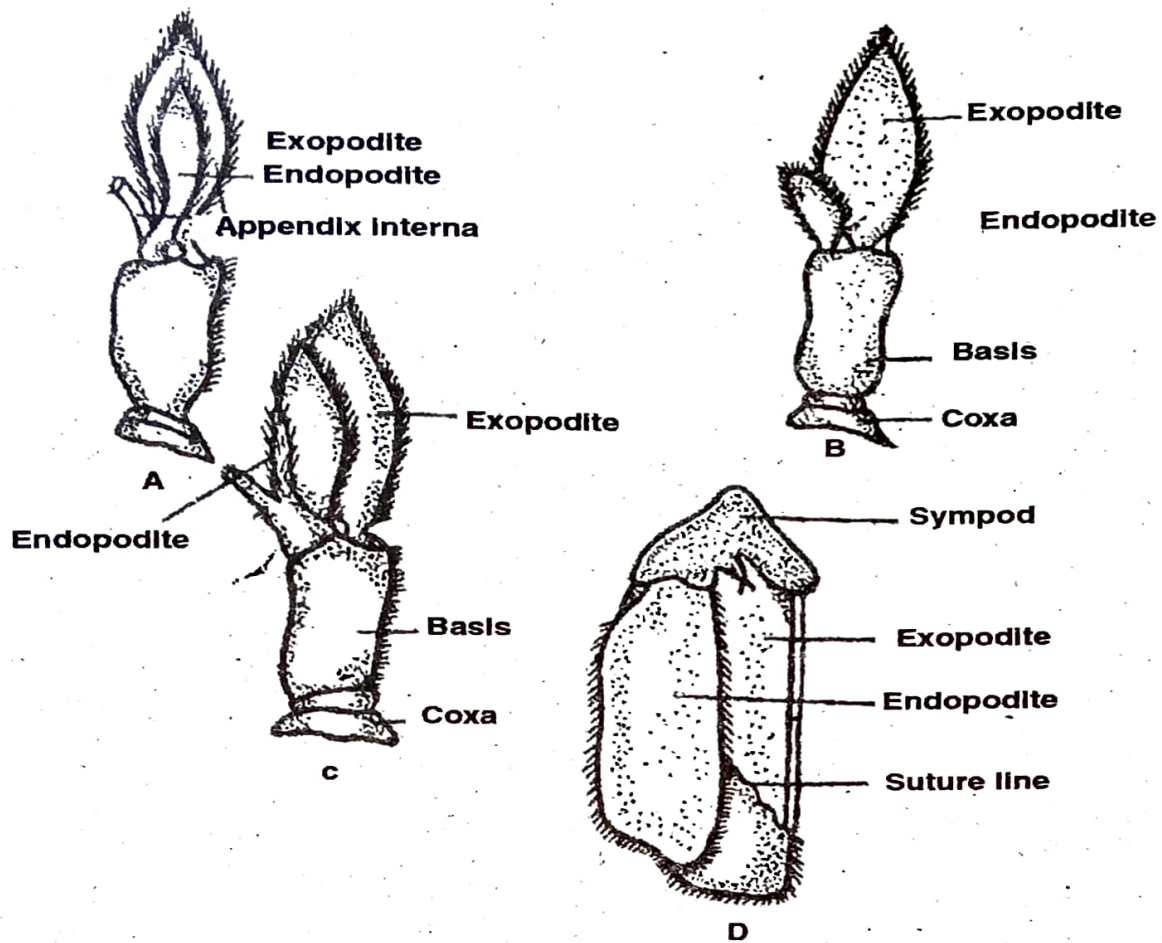
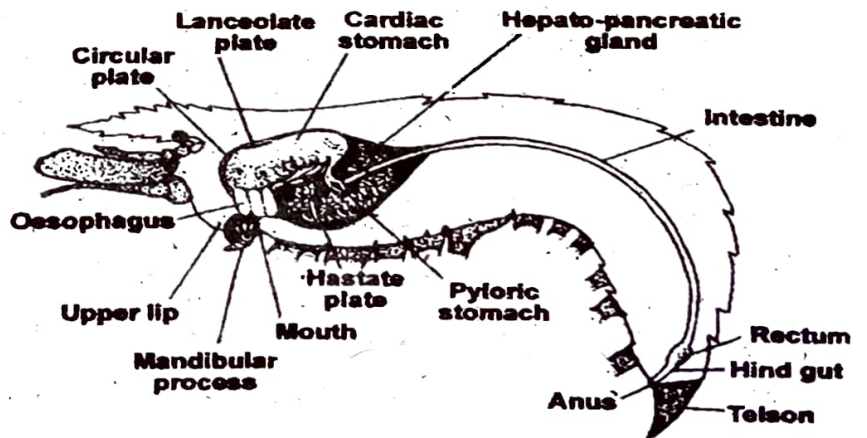


Fig. Abdominal appendages of Prawn

(A) Second Abdominal appendage (B) Abdominal appendage (General)
 (C) Third Abdominal in male (D) Uropod

(2) Prawn-Digestive system

- Fix the prawn in wax tray.
- Cut on the mid dorsal side and open slowly.
- See the thin membranous large stomach surrounded by digestive gland.
- Intestine extends back to the posterior end
- Mouth is seen in between cephalic appendages.



(3) *Prawn-Nervous System*

- Fix the prawn in the wax tray with its dorsal side upwards.
- Make a deep cut in the organism either with a blade or a scissors on the mid dorsal side, from posterior end to the anterior rostral spine.
- Make an incision into the ommatophores and trace the optic nerves entering the eyes.
- Separate the muscles in the body carefully with forceps and identify the ventral nerve cord.
- Nerve ring is located in the cephalothoracic region. Carefully separate the ring from the muscle mass.
- While removing the stomach, attention must be paid to the transverse commissure present in between the perioesophageal connectives as shown in the diagram.
- Insert small pieces of black paper in between the ganglia and underneath the nerve cords and the branches.
- Leave the dissection for evaluation after cleaning and filling the tray with clean water.

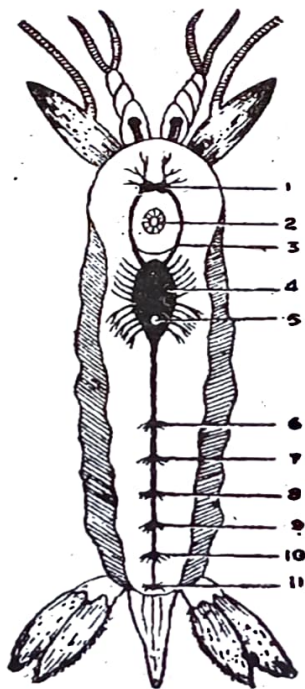


Fig : *Palaemon-Nervous system*

(1) Supora pharyngeal ganglea, (2) T.spharynx, (3) Peri connectives,
 (4) Thoracic gengleonic mass (5) Neural aperture (6-11) Abdominal ganglea

(4) Prawn - Glycerine Mount of Statocyst

- ❑ Statocyst is located in the precoxa segment of the first appendage i.e. the antennule.
- ❑ Take a prawn and separate the antennules at their basal segment. See for the statocyst in the precoxa.
- ❑ With the help of a needle and forceps, carefully remove the upper plate of precoxa.
- ❑ Separate the statocyst carefully and transfer it over to a glass slide.
- ❑ Place one or two drops of glycerine and then drop a coverslip to prevent drying.
- ❑ Observe under microscope for structural details as shown in the diagram.

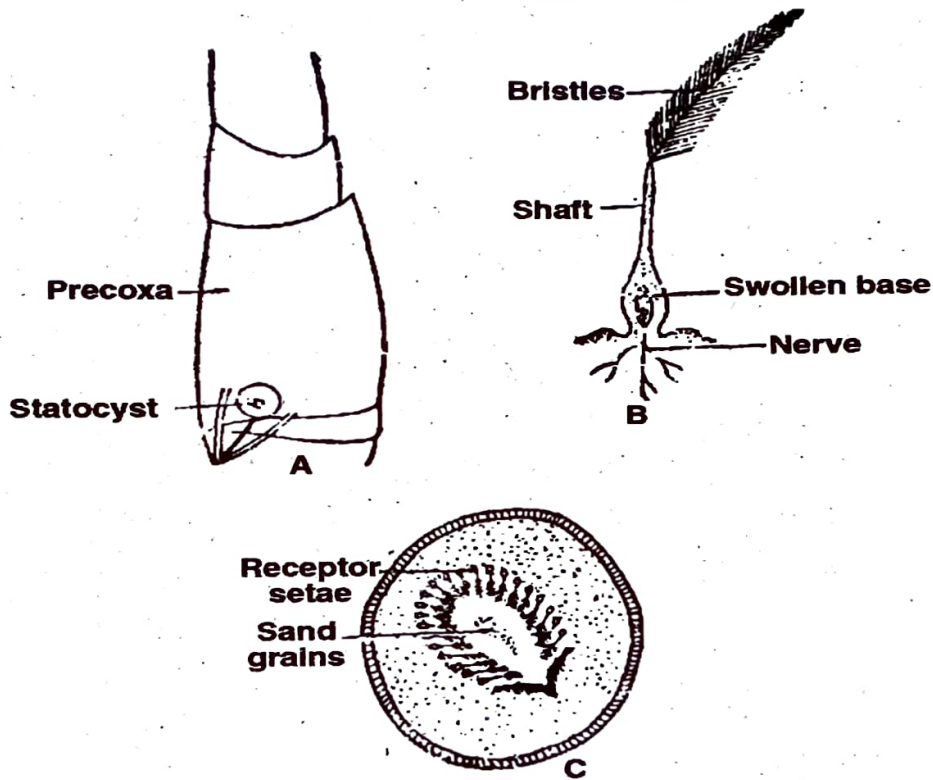


Fig : Palaemon sence organs

(A) Statocyst on antennule

(B) T. S. of statocyst

(C) A Single receptor seta, enlarged

(5) Mouth parts of Cockroach

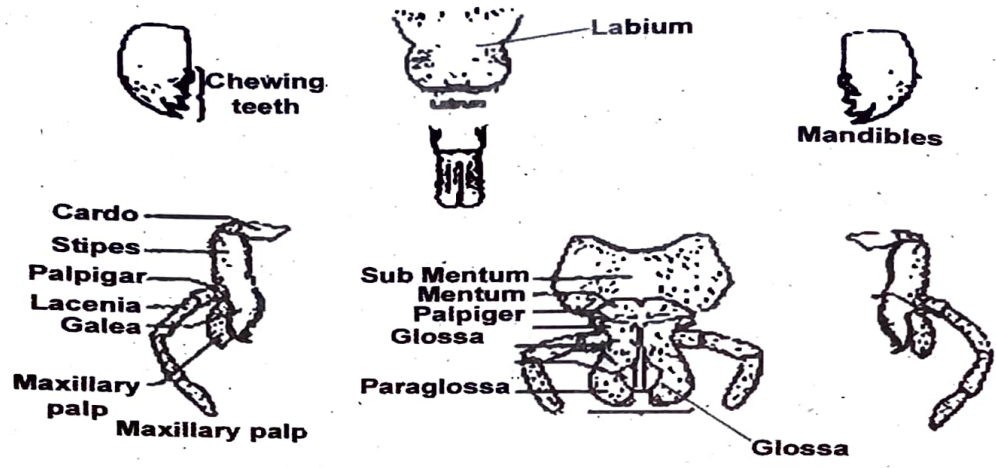


Fig :Cockroach - Mouth parts