

CONCEPT MAP

COCKROACH

Cockroaches are brown or black bodied animals included in **Class Insecta** of **Phylum Arthropoda**. They are nocturnal omnivores, that live in damp places and the most common insects usually found in the houses. They are serious pests and vectors of diseases. The common species is *Periplaneta americana*.

MORPHOLOGY

Body is narrow, elongated, bilaterally symmetrical and dorso-ventrally flattened. Body is covered by chitinous brown coloured **exoskeleton** that provides support and rigidity and has hardened plates called **sclerites** formed by cuticle (tergites dorsally and sternites ventrally). They are joined to each other by **articular membrane** (arthrodial membrane) which allows movement of body and appendages. Adults are 24-35 mm long with their body segmented into three regions – **head, thorax** and **abdomen**. Head is triangular, formed by fusion of 6 segments and shows great mobility due to flexible neck. Head capsule bears a pair of **compound eyes** and a pair of **antennae** which have **sensory receptors**. **Mouthparts** are of chewing and biting type and consists of: **labrum, labium**, a pair each of **maxillae** and **mandibles** and a **hypopharynx**. A broad rectangular **clypeus** forms lower part of face. Thorax consists of 3 parts – **prothorax** (neck), **mesothorax** and **metathorax**. Each thoracic segment bears a pair of walking legs. Each leg consists of a series of segments or **podomeres**. There are two pairs of wings arising from meso and metathorax: **forewings** and **hindwings**. Abdomen is 10 segmented and contains a pair of **anal cerci**, in both females and males. The differences between male and female abdomen are: Abdomen of females is broader than males and males bear anal styles in 9th sternum which are absent in females.

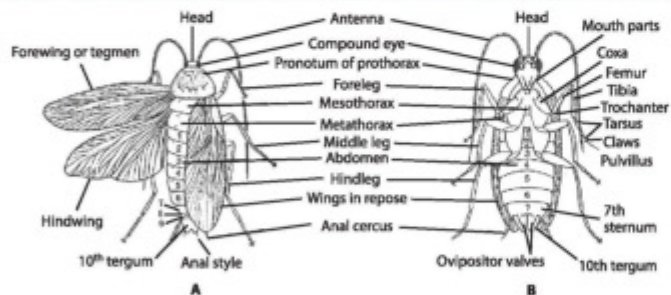
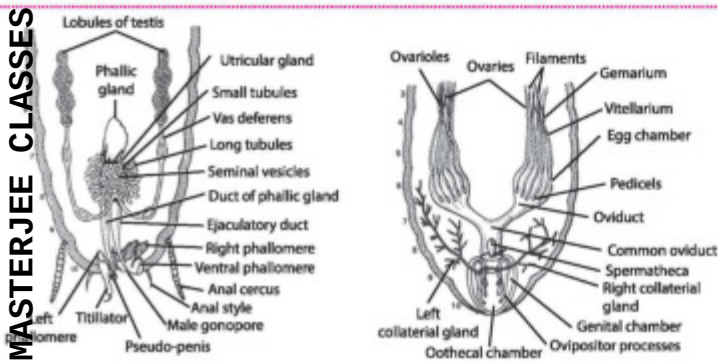


Fig.: *Periplaneta* external features. A-Male in dorsal view, B-Female in ventral view



ANATOMY

Circulatory System

- Heart of cockroach is **neurogenic**.
- It is enclosed by dorsal pericardial sinus and consists of elongated muscular tube differentiated into 13-funnel shaped chambers with **ostia** on either side. These allow flow of blood from pericardial sinus into heart only and not reverse.
- Blood vascular system is of open type and vessels open into **haemocoel**.
- Visceral organs located in haemocoel are bathed in blood (**haemolymph**) which consists of colourless plasma and haemocytes. Haemolymph is devoid of respiratory pigment and hence does not assist in respiration but in transfer of food material and metabolic wastes.

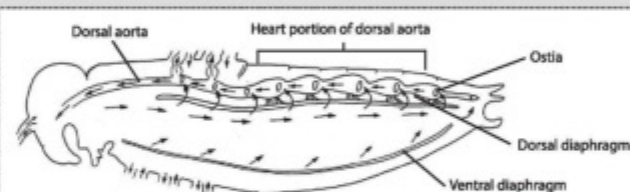


Fig.: Open type blood vascular system

Reproductive System

- Cockroaches are **dioecious** i.e., sexes are separate.
- Male**: It has a pair of testes in 4th-6th abdominal segments which is 3-lobed and consists of numerous whitish transparent follicles. **Vas deferens** arise from testes and opens into **ejaculatory duct** through **seminal vesicles**.
- Ejaculatory duct opens into **male gonopore**. Sperms are stored in seminal vesicles in the form of bundles called **spermatophores** which are discharged during copulation.
- An accessory **mushroom shaped gland** is located in 6th-7th abdominal segments.
- External genitalia** are represented by male gonapophyses or phallomeres.
- Female**: Ovaries are located in 2nd-6th abdominal segments and are formed of a group of ovarian tubules (**ovarioles**) which contain a chain of developing **ova**.
- Oviducts** from each ovary unite into single median oviduct which opens into genital chamber. A pair of **spermatheca** present in 6th segment also opens into genital chambers.
- Paired **collateral glands** lie behind ovaries. Their secretion forms **egg-case** or **ootheca**.

Fertilisation and development

- Sperms are transferred in form of spermatophores. Fertilised eggs are encased in **ootheca**, which are reddish brown capsules and are dropped or glued to a humid surface. On average, females produce 9-10 oothecae, each containing 14-16 eggs.
- The development is **paurometabolous** i.e., through nymphal stage.
- As nymphal development proceeds, wing pads arise, body increases in size, colouration becomes darker and ultimately after about 6-7 successive moults

Digestive System

- Alimentary canal is divided into 3 regions: foregut, midgut and hindgut.
- Foregut** and **hindgut** are ectodermal and lined by cuticle whereas, midgut is endodermal and lacks cuticle.
- Foregut**: Mouth opens into pharynx and leads to narrow oesophagus which in turn opens into a sac like **crop** used for storing food. This is followed by **gizzard** (proventriculus) which has 6 highly chitinous plates called teeth, used for grinding food particles.
- Midgut**: It is short and narrow. At the junction of foregut and midgut, 6-8 blind tubules called **hepatic caecae** are present which secrete digestive juice. At the junction of midgut and hindgut, thin filamentous 100-150 **Malpighian tubules** are present which remove excretory products from haemolymph.
- Hindgut**: It is differentiated into ileum, colon and rectum. Rectum has 6 **rectal glands**. It opens out through anus. Hindgut is more pervious to water than foregut.

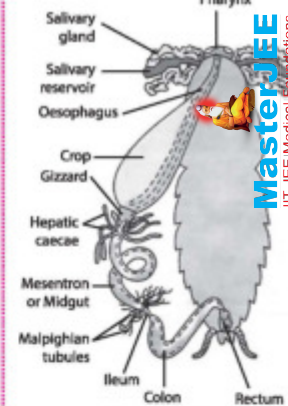


Fig.: Alimentary canal and associated structures

Respiratory System

- It consists of network of **tracheae** that opens through **10 pairs of spiracles** present on lateral side of body guarded by bristles or hair to keep out dirt.
- Thin branching tubes (**tracheal tubes**) carry oxygen from air to all the parts. They are subdivided into **tracheoles** where **exchange of gases** takes place by **diffusion**. Very little CO₂ leaves through spiracles; majority of it leaves through cuticular covering of the body.

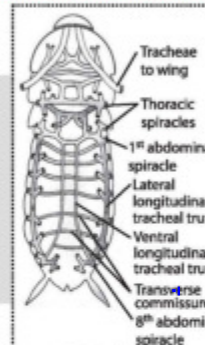


Fig.: Tracheal system

Nervous System

- Nervous system comprises of central peripheral and sympathetic or somatogastric system.
- It comprises of fused, segmentally arranged ganglia joined by paired connectives on the ventral side. It bears **9 ganglia**; 3 ganglia lie in thorax and 6 in the abdomen.
- Brain** is represented by bilobed supra-oesophageal ganglion which supplies nerves to antennae and compound eyes.
- Compound eyes**, located dorsally, consists of **2000 hexagonal ommatidia** which make up **mosaic vision** of cockroach. This type of vision is common during night (**nocturnal vision**), with more sensitivity and less resolution.
- Other sense organs include **antennae, maxillary palps, labial palps, anal cerci**, etc.

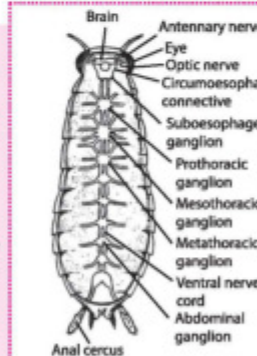


Fig.: Central and Peripheral nervous system

Excretory System

- Excretion is performed by **Malpighian tubules** which are lined by glandular and ciliated cells. They absorb nitrogenous waste products and convert them into **uric acid** therefore insects are called **uricotelic**. They also reabsorb certain salts and water.
- Fat body, nephrocytes** and **uricose glands** also help in excretion.

