

MORPHOLOGY

Synopsis:–

- * Common Indian species of cockroach –Periplaneta americana
- * Wings in male P.americana – along and extended beyond the tip of abdomen.
- * Body tagmata of cockroach are– head, thorax, and abdomen.
- * Nature of exoskeleton– chitinous.
- * Body color of P.americana–brown.
- * The hardened chitinous plates are –Sclerites.
- * Dorsal sclerites are– Tergites.
- * Ventral sclerites are– Sternals.
- * The flexible articular membrane that joins the sclerites– Arthroidal membrane.
- * Arrangement of head to body axis is– Right angle to longitudinal axis.
- * Number of segments united to form head capsule are– 6.
- * Unpaired head sclerites are– 1.frons, 2.clypeus.
- * Biggest head sclerite is– frons
- * Last sclerites of head is – clypeus.
- * Paired sclerites are – epicranials and genae.
- * Arrangement of head–hypognathus.
- * Flexible neck is covered with–2 pairs of sclerites.
- * Nature of sockets of antenna –membraneous.
- * Type of mouth parts in cockroach –biting and chewing type.
- * Upper lip is called –labrum.
- * Function of upper lip– smelling and handling of the food.

- * Type of sensilla present on the antennae—olfactory and tactile sensilla.
- * Hard triangular structure of mouth parts that helps in biting and chewing of food are mandibles.
- * Tongue like flexible lobe among mouth parts is – hypopharynx.
- * Anterior chamber of preoral cavity is –cebarium.
- * Posterior chamber of preoral cavity is –salivarium.
- * Divisions of thorax are– pre, meso, meta thorax.
- * Number of legs in cockroach–6.
- * Number of podomers–5.
- * Arrangement of podomers are–coxa, trochanter, femer, tibia, and tarsus.
- * Structure that helps for cockroach to move on smooth surface–plantulae.
- * Structure that helps for cockroach to move on rough surface–arolium.
- * Number of pairs of wings in cockroach – 2pairs.
- * First pair of wing are called as – tegmina.
- * Tegmina are formed form–mesothorax.
- * Wings are internally supported by–veins (or) nervures.
- * Tegmina for –balance.
- * 2nd pair wings are for–flight.
- * 2nd pair of wings from–metathorax.

ABDOMEN

- * Number of segments in the abdomen of male and female cockroach–10.
- * Number of segments in abdomen of larval stages are–11.
- * Number of sclerites that cover each abdominal segment are–4.
- * In female cockroach boat shaped sternum number is –7.
- * In female cockroach the brood pouch is formed by the union of –7, 8, 9 sternae.
- * Gonopore, spermathecal pores and collateral gland openings are present at the –anterior part of genital pouch.
- * In male cockroach genital pouch is present in between –9th and 10th terga and 9th sterna.
- * In male cockroach the arrangement of anus, genital pore and gonapophysis is – dorsal–anus, middle–genital pore and ventral–gonapophysis.

SEXUAL DIMORPHISM

- * Appendages on posterior end of male cockroach are– anal cerci and anal style.
- * Anal cerci are –15 jointed appendages.
- * Reduced 11th segmental appendages are –anal cerci.
- * Anal cerci functions as– auditory sense organs.
- * Gynovalvular plates are found in– female cockroach.
- * Gynovalvular plates are formed from– 7th sternum.
- * Roof of brood pouch is– 9th sternum
- * Female genital pore is present on– 8th sternum.
- * Epiprocts are– tergums of 11th seg.
- * Paraprocts are – sternums of 11th seg.

DIGESTIVE SYSTEM

- * Alimentary canal and digestive glands unite to form– digestive glands.
- * The long coiled tube like structure of digestive system is – alimentary canal.
- * Divisions of alimentary canal are– fore gut, mid gut, hind gut.
- * Ectodermal originated divisions of alimentary canal are– fore gut and hind gut.
- * Fore gut and hind gut are internally lined with –cuticle.
- * Mid gut derived from–endoderm.
- * Grinding mill of alimentary canal–gizzard.
- * Number of chitinous teeth in gizzard–6.
- * Gizzard is also called as–proventriculus.
- * Number of hepatic caecae–6 to 8.
- * Hepatic caeca functions are–digestion and partial absorption.
- * Hepatic caeca derived from–endoderm.
- * Midgut contain–mesentron.
- * Mesentron helps in–digestion and absorption.
- * The wall of mesentron is protected from hard particles in food by– peritrophic membrane.
- * Nature of peritrophic membrane–chitinous.
- * Peritrophic membrane is secreted by – stomodial valve of foregut.
- * Most of digestion occurs in– crop.
- * Even though crop is ectodermal in origin and chitin lined, the process of digestion occurs in it because– regurgitation of digesting enzymes from mesentron.
- * Absorption occurs in – posterior part of mesentron.
- * Cellulose digestion occurs in– colon
- * Cellulose producing bacteria are present in– colon.

- * Carbohydrates are digested in to– disaccharides.
- * Some **disaccharides** are– sucrose, maltose, and lactose.
- * Sucrose $\xrightarrow{\text{Sucrase}} \text{Glucose} + \text{Galactose}$
- * Maltose $\xrightarrow{\text{Maltase}} \text{Glucose} + \text{Glucose}$
- * On digestion of 300 sucrose molecules, 300 molecules of glucose and 300 molecules of galactose are produced.
- * Proteins are digested in to – amino acids.
- * Fats are digested in to – fatty acids, and glycerol.
- * Digested nutrients are absorbed in to– haemolymph.
- * Digestive glands associated with the alimentary canal of cockroach are–salivary glands, hepatic caecae, and glandular cells of mesentron.
- * Number of salivary glands–1 pair.
- * Number of lobes in each salivary gland–2.
- * Flow of saliva from acini to salivarium– acini (zymogen cells) → ductules →common salivary duct → median salivary duct → salivary receptacle.

EXCRETORY SYSTEM

- * Yellow color thin filamentous structures present at the base of mesentron are– [malpighian tubules](#).
- * Number of malpighian tubules –100–150 in 6 bundles
- * Excretory organs in cockroach are–malpighian tubules.
- * Malpighian tubules collect the excretory materials from– heamolymph.
- * Major excretory product in cockroach is– uric acid.
- * Based on nature of excretory product cockroach is – uricotelic organism.
- * Cells that help in excretion are– nephrocytes.

- *Glands that help in excretion are– uricose glands.
- * Wall of malpighian tubules contains – glandular and ciliated cells.
- * Excess of water in collected waste is reabsorbed by– rectal papillae.
- * Other structures that helps in excretion are– fat bodies, nephrocytes and uricose glands.
- * Number of rectal papillae are– 6.

CIRCULATORY SYSTEM

- * Type of vascular system in cockroach is – open vascular system.
- * Structure of heart – 13 chambered tubular heart.
- * Location of heart –mid dorsal region.
- * Heart is present in – pericardial sinus.
- * Heart is pulsatile because of– 13 pairs of alary muscles.
- * Blood enters in to heart chambers through– ostia.
- * Direction of blood flow in heart– from posterior to anterior.
- * Blood of cockroach is –color less.
- * Blood of cockroach is colorless because of – absence of respiratory pigment.
- * Blood of cockroach helps in – circulation of nutrients and waste material.
- * Blood composition is – colorless plasma and haemocytes.
- * Blood filled principle body cavity in cockroach is called as– haemocoel.
- * Along with blood the finger like structures in haemocoel are– fat bodies.
- * Cells in fat bodies are– trophocytes, mycetocytes, oenocytes, urate cells.
- * Trophocytes meant for – storage of nutrients.

- * Function of bacteria in mycetocytes is– synthesis of amino acids.
- * Function of oenocytes– lipid synthesis.
- * Urate cells for– the storage of uric acid.

RESPIRATORY SYSTEM

- *Respiratory organs in cockroach– trachea.
- * Composition of respiratory system –spiracles, trachea, tracheoles
- * Number of spiracles–10 pairs.
- * Distribution of spiracles– 2 pairs in last two thoracic segments and 8 pairs in first 8 abdominal segments.
- * Spiracle openings are covered by– peritrichs.
- * Chamber behind the spiracle is – atrium.
- * Covering layer of trachea– 3(basement membrane, epithelium and intima).
- * Ctenidial ridges are formed by– intima.
- * Ctenidial ridges are periodically shed off during moultings, because these are made by– sclerotised chitin.
- * Trachea is subdivided in to – trachioles.
- * Trachioles contain– trachiolar fluid.
- * Trachiolar fluid is regulated by– trachioblast cell.
- * Trachioles are directly innervated and connected to– mitochondria.
- * The amount of trachiolar fluid is high when– the insect is active.
- * Closing and opening of spiracles are controlled by– high PCO_2 in spiracles and low PO_2 in trachea.

NERVOUS SYSTEM

- * Nervous system is derived from – mesoderm.
- * Nervous system of cockroach consists of – a series of fused segmentally arranged ganglia.
- * Ganglia in cockroach are connected by– longitudinal connectives.
- * Number of ganglia in thorax–3.
- * Number of ganglia in abdomen– 6.
- * A bit of nervous system only hold by–head.
- * Brain of cockroach is – supra oesophageal ganglion.
- * Divisions of brain are– proto cerebrum, deuto cerebrum, trito cerebrum.
- * Sensory centre of body– brain.
- * Trito cerebrum is just on the wall of –oesophagus.
- * From compound eyes and antenna nerves are connected to– brain.
- * Motor centre of the body is – sub oesophageal ganglion.
- * Movement of mouth parts, legs and wings are controlled by – sub oesophageal ganglion.
- * Circum oesophageal connectives of nerve ring connects– trito cerebrum, and sub oesophageal ganglion.
- * Co ordination between sensory impulses and motor impulses is achieved by– circum oesophageal connectives.
- * Sense organs in cockroach are– antennae, labrum, maxillary palp, anal cerci, labial palp, compound eye and simple eye.
- * Photoreceptor organs are– compound eyes and simple eyes.
- * Olfactory organs are present in– antennae, maxillare palps and labial palps.
- * Johnsons organ meant for the – coordinated movement of flagellum with pedicle.
- * Thermoreceptors are present on –1, 2, 3, tarsomeres.

- * Number of ommatidium in each compound eye are– 2000.
- * Facet shape of ommatidium– hexagonal.
- * Dioptrical region of ommatidium contain– cornea and crystalline cone.
- * Receptor region of ommatidium contain – rhabdom and retinulae.
- * Type of image formed in compound eye of cockroach– mosaic type.
- * Nocturnal vision characters are – more sensitive but less resolution.

REPRODUCTIVE SYSTEM

- * Sexually cockroaches are – dioecious
- * Having different external characters by two different sexes is called– sexual dimorphism.
- * In male cockroaches sexual dimorphic characters are– 1) presence of both anal style and anal cerci. 2) Visible 8th and 9th and sternums.
- * Female cockroach sexual dimorphic characters are – 1) presence of only anal styles and 2) At 7th sternum a pair of gynovalvular plates.
- * Location of testes – lateral side in the 4th and 5th abdominal segments.
- * Vas Deferens arises from- Testes.
- * Vas deferens opens in to – ejaculatory duct.
- * Vas deferens is connected to ejaculatory duct through – seminal vesicle.
- * Male gonopore situated – ventral to anus.
- * Accessory reproductive glands in male reproductive system is –mushroom glands and phallic glands.
- * Mushroom glands located in –6th and 7th abdominal segments.
- * Function of mushroom glands – nourishment of sperms.
- * The long club shaped gland is called – phallic gland.

- * External genitalia of male cockroach – phallomeres.
- * The location of phallomeres is – right left and ventral.
- * Pseudopenis is present on– left phallomere.
- * Bundle of sperms is called – spermatophores.
- * Ovaries are located in– 2nd and 3rd abdominal segments.
- * Each ovary is formed of a group of – 8 ovarioles.
- * Both oviducts are united to form –vagina.
- * Number and location of spermatheca– 1 pair in 6th abdominal segment.
- * Spermatheca opens in to – genital chamber.
- * Fertilized eggs are encased in a capsule called– ootheca.
- * Ootheca color is –dark reddish to blackish brown.
- * On an average the number of ootheca produced by one female – 9 to 10.
- * Number of eggs in each ootheca –14 to 16.
- * Type of development in p.americana – paurometabolus type.
- * Young cockroach hatched out from ootheca is called– nymph.
- * Nymph differs with adult by– size, color, sexual maturity and absence of wings.
- *Shedding of exoskeleton is called– moulting (or) ecdysis.
- * Moulting helps in – growth.
- * Number of moulting occurs in cockroach life cycle–13.

ECONOMIC IMPORTANCE

- * Cockroaches are household pest because– they destroy food and contaminate the food.
- * During spreading of diseases cockroaches acts as– mechanical vectors.