

Semester II

Fundamental of Entomology

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DIGESTIVE SYSTEM

The alimentary canal in insects extends from mouth to anus which is divided into

- (i) Stomodaeum (foregut)
- (ii) Mesentron (midgut) and
- (iii) Proctodaum (hindgut)

Alimentary canal is divided in three parts:

1. Foregut

It is the anterior part of the alimentary canal which starts **from mouth cavity to gizzard**. Foregut is divided into **pharynx, oesophagus, crop** and **gizzard**.

Pharynx: It is the region between the mouth and oesophagus

Oesophagus: It is narrow part of foregut through which the food transported from the pharynx to the crop.

Crop: It is sac like structure and main purpose is to storage of food.

Gizzard: It is small part of the alimentary canal which consists of cuticular **Intima layer** modified into teeth like structure for grinding the food material

2. Midgut

It is also known as **mesentron** or **stomach**. Foregut opens into midgut through **stomodial/ cardiac valve**.

Midgut consists of an inner delicate layer called **peritrophic membrane** secreted by the epithelial cells.

The epithelial layer of midgut consists of three types of cells:

- (i) **Columnar cell:** Columnar in shape, release enzymes
- (ii) **Regenerative cells:** These cells are involved in the production or formation of new cells
- (iii) **Goblet cells:** Mainly serve for storage and excretion

3. Hindgut

Anterior end of hindgut can be marked by the presence of a set of **malpighian tubules** and a **pyloric valve**. Hindgut is divided into 3 regions namely **ileum, colon and rectum**. Ileum is a small intestine, tube like structure. Colon leads to rectum. The epithelial cells of the rectum may sometime get differentiated into rectal papillae and they are involved in **reabsorption of water, salts** from the faecal matter.

Salivary glands: These are a pair of glands involved in the secretion of salivary juice. These glands open at the base of **hypopharynx**. The enzymes secreted by these glands are amylase, lipase, proteases etc.

Process of digestion:

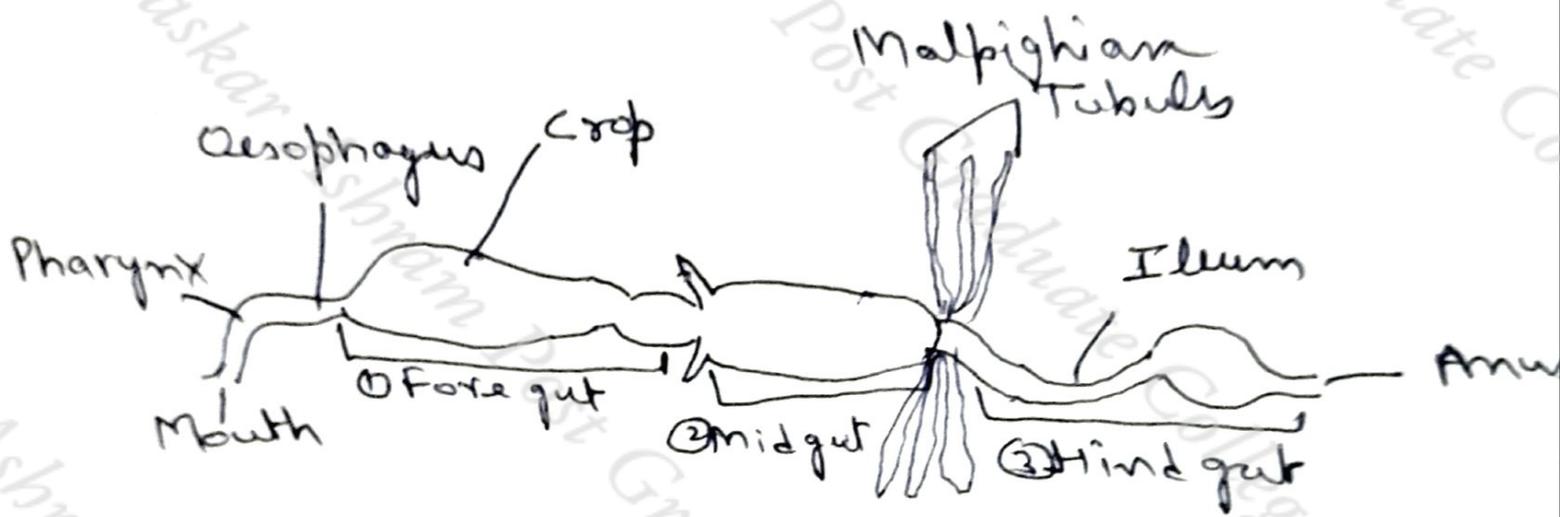
The food ingested by the insects through the mouth cavity enters into the alimentary canal, gets digested and the undigested waste material is excreted through anus.

Digestion mainly takes place in 5 steps:

- (i) **Ingestion:** Food is partially digested in the oral cavity with the help of salivary enzymes. In insects like fluid feeders, carnivorous Hemiptera etc. digestion occurs outside the intestine by a process called **extra intestinal or extra oral digestion**
- (ii) **Transportation:** The food material entered into the oesophagus is transported into the crop by **peristaltic movements**. Food moves from oesophagus into the crop where it is stored. From the crop, food enters into the gizzard where it is still broken into very minute particles with the help of denticles or the cuticular teeth.
- (iii) **Digestion:** From the gizzard through the stomodeal valve, food passes into the midgut where actually the digestion takes place. The epithelial cells produce enzyme i.e., **protease** which breaks **protein into amino acids**, **carbohydrases** breaks **carbohydrates into mono and disaccharides**, **lipase breaks lipids into fatty acids and glycerol**. In termites **cellulase enzyme break the cellulose**
- (iv) **Absorption:** Midgut epithelial cells absorb the nutrients from the digested food and pass on the faecal matter and undigested food into the hindgut.

The **Malpighian tubules** maintain **ionic balance** by **absorbing Na and K salts from the food**. The cells of hindgut are also involved in the reabsorption of water, salts and other metabolites from the faecal matter.

- (v) The waste food material is discharged through the anus.



St. of Alimentary canal