

1. **Digestive system** (Fig. 27): It consists of the alimentary canal (gut) and the associated glands which help in digestion. The alimentary canal extends from the mouth to the anus. It is differentiated into the following three main regions:

- (a) Foregut (stomodaeum)
- (b) Midgut (mesenteron, ventriculus or stomach)
- (c) Hindgut (proctodaeum or intestine)

(a) **Foregut**: The foregut consists of the mouth or oral cavity, pharynx, oesophagus, crop and gizzard (proventriculus). The foregut starts from the mouth cavity into which open the salivary glands. The glands are grape-like clusters of circular acini (sing. acinus) which give their secretion into two salivary ducts, one on each side of the alimentary canal in the thorax. Two salivary ducts unite to form a common salivary duct which opens below the hypopharynx. The mouth cavity leads into a short thicker anterior portion of the foregut, the pharynx (throat). The pharynx forms posteriorly a narrow and curved tube, the oesophagus. The oesophagus gradually widens behind to form the large crop which acts as a food reservoir. The crop opens into the gizzard (proventriculus) which narrows posteriorly and is not clearly differentiated externally from the former. The gizzard is surrounded by the anterior lobes of the gastric caeca (sing. caecum). The junction of foregut and midgut is provided internally with a cardiac (oesophageal) valve which regulates the passage of food.

(b) **Midgut**: The midgut is comparatively a short, cylindrical and straight tube. At its anterior end arise six large, elongated sacs, the gastric caeca which are the evaginations (outgrowths) of its anterior end. Each gastric caecum consists of a longer anterior lobe and a shorter posterior lobe. The posterior lobes are filled with food where as the anterior lobes have only the secretory function. The midgut on its inner side has a very thin peritrophic membrane for the protection of its secretory cells from the friction of the food particles. This permeable membrane also extends into the hindgut. The posterior end of the midgut is marked by the presence of malpighian tubules. At the junction of the midgut and hindgut is a pyloric valve.

(c) **Hindgut**: The hindgut is further differentiated into an ileum, colon and rectum. The ileum (small intestine) is a thick and straight tube which narrows posteriorly. The colon (large intestine) is a short, narrower tube (very rarely coiled) which dilates posteriorly to merge into the rectum. The rectum is a wider tube which is externally provided with six bands of longitudinal muscles alternating with six long rectal pads (papillae). The rectum ends in an anal opening.

2. **Excretory system** (Fig. 27): It consists of malpighian tubules and fat bodies. The malpighian tubules are long, very slender, blind tubes which

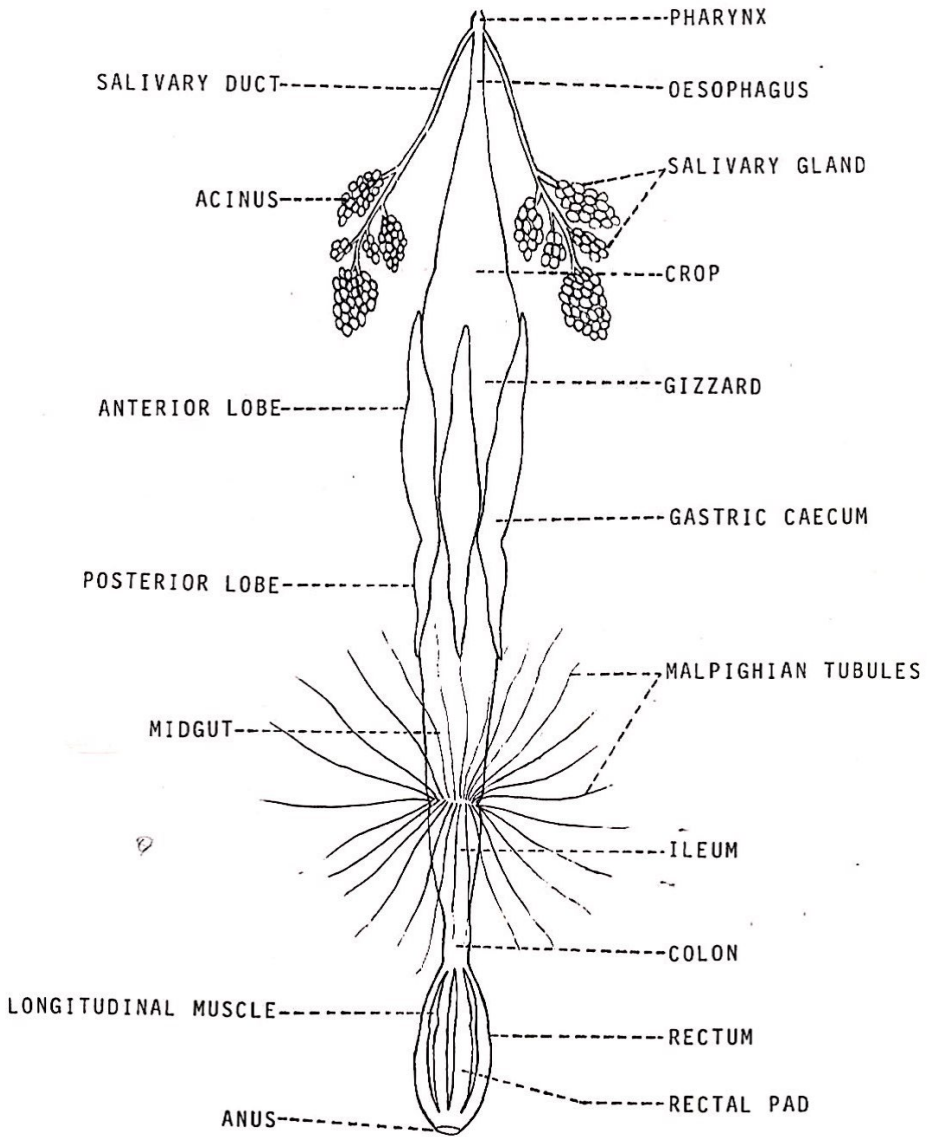


FIG.27. DIGESTIVE SYSTEM OF AK GRASSHOPPER

arise as evaginations from the anterior end of the hindgut. They extend anteriorly and posteriorly around the gut. The fat bodies are yellow or white masses of cells surrounding the gut. The principal function of the fat bodies is to store the food reserves like fat, glycogen and protein but they also carry out the excretory function.

**3. Reproductive system:** It should be studied separately in male and female sexes.

The male reproductive system (Fig. 28) consists of a pair of testes (sing. testis). These testes are closely associated into a single yellow structure which generally lies on the midgut of the alimentary canal. (Give a longitudinal cut with a blade along its mid-dorsal line to separate it into two parts.) Each testis is composed of a large number of tubular testicular follicles. Each follicle opens by means of a short, slender duct, the vas efferens (pl. vasa efferentia) into the long genital duct or vas deferens (pl. vasa deferentia). The follicles are attached to the body wall by a suspensory ligament. The vasa deferentia run posteriorly to open into a wider tube, the ejaculatory duct, below the ventral nerve cord. Just anterior to the points of opening of vasa deferentia, two groups of long tubular accessory glands also open into the ejaculatory duct. A medial pair of these glands becomes fairly dilated to serve as seminal vesicles (vesiculae seminales) for storing the sperms. The ejaculatory duct opens posteriorly into a large pouch-like structure, the ejaculatory sac which opens into the aedeagus (part of external genitalia).

The female reproductive system (Fig. 29) consists of a pair of ovaries. These ovaries are closely associated into a single body which lies on the midgut and a part of the hindgut. (Also separate it into two component parts by giving a longitudinal cut along its mid-dorsal line.) Each ovary is composed of a large number of tubular ovarioles which arise from the side of the oviduct. The ovarioles end in thread-like filaments which unite to form a suspensory ligament by which they are attached to the body wall. The oviducts also extend anteriorly to form two accessory glands. Then the oviducts run posteriorly and after making a short bend unite into a fairly dilated common oviduct (vagina) below the ventral nerve cord. The vagina terminates in the genital chamber. The spermatheca is a sac-like oval body which receives and stores the sperms. It opens by means of a coiled spermathecal duct into the genital chamber. The latter ends into an egg-guide which is situated between the ventral valves of the ovipositor (part of external genitalia).

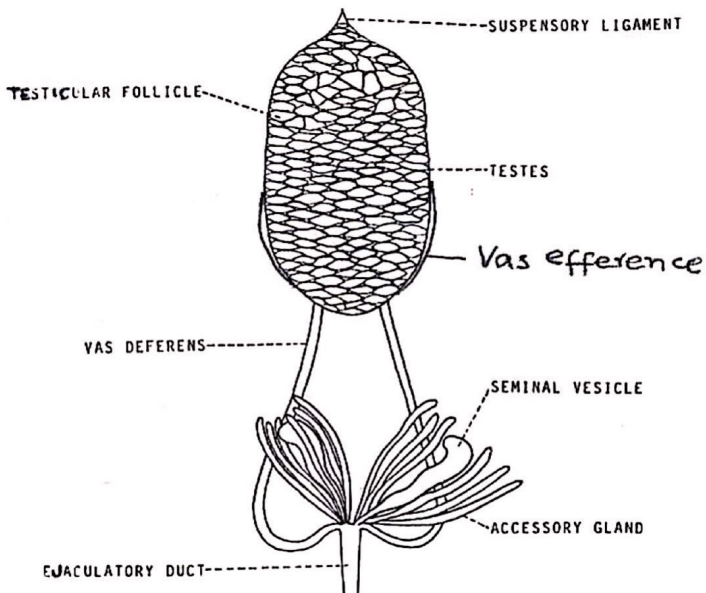


FIG. 28. REPRODUCTIVE SYSTEM OF MALE AK GRASSHOPPER

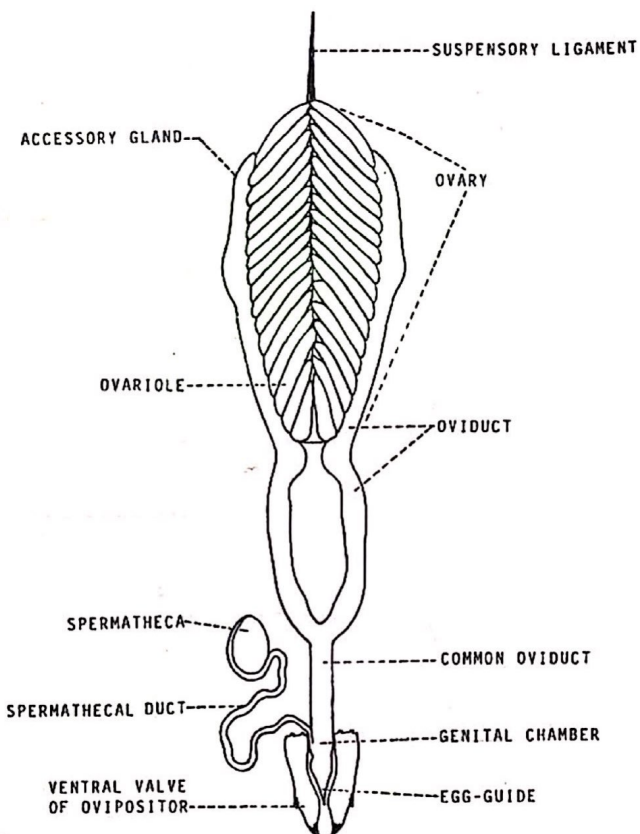


FIG. 29. REPRODUCTIVE SYSTEM OF FEMALE AK GRASSHOPPER