

✓ 6. **Respiratory system:** It consists of paired lateral spiracles, tracheae and tracheoles. The spiracles are the external openings through which the air enters and leaves the body. They can be closed because they are provided with a closing mechanism. The ak grasshopper has 10 pairs of spiracles, two thoracic (one between the prothorax and mesothorax and the other between the mesothorax and metathorax-- Fig. 16B) and eight abdominal (one on each of the first eight abdominal segments -- Fig. 17A). The spiracles open into elastic internal tubes, the tracheae (sing. trachea). The tracheae from the adjoining spiracles unite to form longitudinal trunks. There are six longitudinal trunks: two dorsal, two ventral and two lateral. When the grasshopper is dorsally dissected and the two flaps are brought on sides and pinned, one dorsal trunk goes on each side as shown in Fig. 32. The two ovaries are united into a single body which lies on the alimentary canal in the abdominal segments 3-5. One lateral trunk is located on each side of this body, while the two ventral trunks are present below it. The tracheae from the spiracles also extend on the inner side, branch and dilate to form white air-sacs which unite with those of the opposite side on the ovaries in a beautiful fashion (Fig. 32). The tracheae or longitudinal trunks give numerous branches which divide and subdivide into finer branches known as tracheoles that enter the body tissues.

Types of respiration: According to different modes of life, the respiration in insects can be divided into the following three types:

1. **Respiration in terrestrial insects:** The air enters the spiracles and passes through the tracheae and ultimately reaches the tracheoles. The latter penetrate into the tissues and cells of the body and are filled with liquid. The air in the tracheoles contains more oxygen and less carbon dioxide, while that in the cells has more carbon dioxide and less oxygen. Now on the principle of differential diffusion of gases, oxygen enters the cells and carbon dioxide comes into the tracheoles and ultimately goes out of the spiracles. When the spiracles are closed or absent, the air enters the tracheae through the body wall.

2. **Respiration in aquatic insects:** These insects respire in water by the following mechanisms:

(a) **Extraction of oxygen by gills:** In this type all the spiracles are closed and non-functional. The molecular oxygen present in water is extracted by thin-walled gills, which are of three types.

The tracheal gills are outgrowths or evaginations of the tracheae, which are thread-like or leaf-like and richly supplied with tracheae and tracheoles. They are usually present on the sides or end of abdomen, e.g., nymphs of mayflies, stoneflies, dragonflies and damselflies and larvae of caddisflies, many true flies and some beetles.

In some larvae and pupae of true flies and beetles with closed and non-functional spiracles, the spiracular gills are used for respiration. These gills are the outgrowths of the spiracles that directly open into the tracheae.

(68)

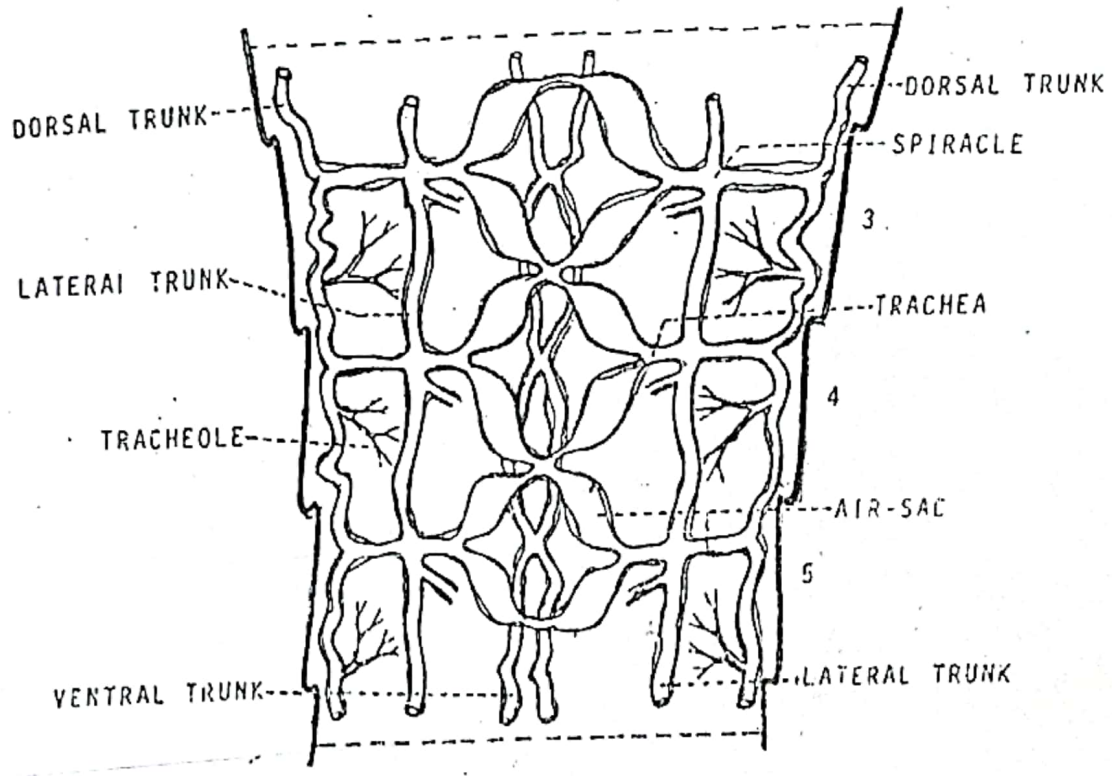


FIG.32. RESPIRATORY SYSTEM
(3-5 ABDOMINAL SEGMENTS) OF AK GRASSHOPPER