3.4 Transpiration

Transpiration is the loss of water from aerial parts of plants (especially leaves) in the form of water vapour. The driving force for transpiration is the difference in water vapour pressure between the leaf air spaces and the external air. Higher vapour pressure difference between leaf air spaces and the external air increase the transpiration. Transpiration may occur through the stomata, cuticle or lenticels of plants. Accordingly it is termed as stomatal, cuticular or lenticular transpiration.

Cuticular transpiration

Cuticle is a layer of wax-like covering on the epidermis of leaves and herbaceous stems. It is mainly composed of wax and cutin. *Cutin* is a principal constituent of the cuticle. It is a polymer consists of long-chain hydroxy or epoxy fatty acids that are attached to each other by ester linkages. Cuticle is meant to check transpiration. However, some water may be lost through it. The loss of water in the form of water vapour through the cuticle is known as cuticular transpiration, which accounts for 5 to 10% of the total transpiration by plants.

Lenticular transpiration

A *lenticel* is an opening in the bark of stems and roots that allows gases to be exchanged between atmosphere and the inner living cells of a plant. Loss of water in the form of water vapour through the lenticels is called lenticular transpiration. It accounts for only 1-5% of the total water loss by the plant.

Stomatal transpiration

Stomata (sing. stoma) are specialized epidermal structures that are responsible for modulating the exchange of gases between the plant and the environment. They act as a *turgor-operated valves*. The primary function of stomata is to allow gas exchange between the plant's internal tissues and the atmosphere. Loss of water in the form of water vapour through the stomata is called stomatal transpiration. It accounts for ~90% of the total transpiration by the plant.

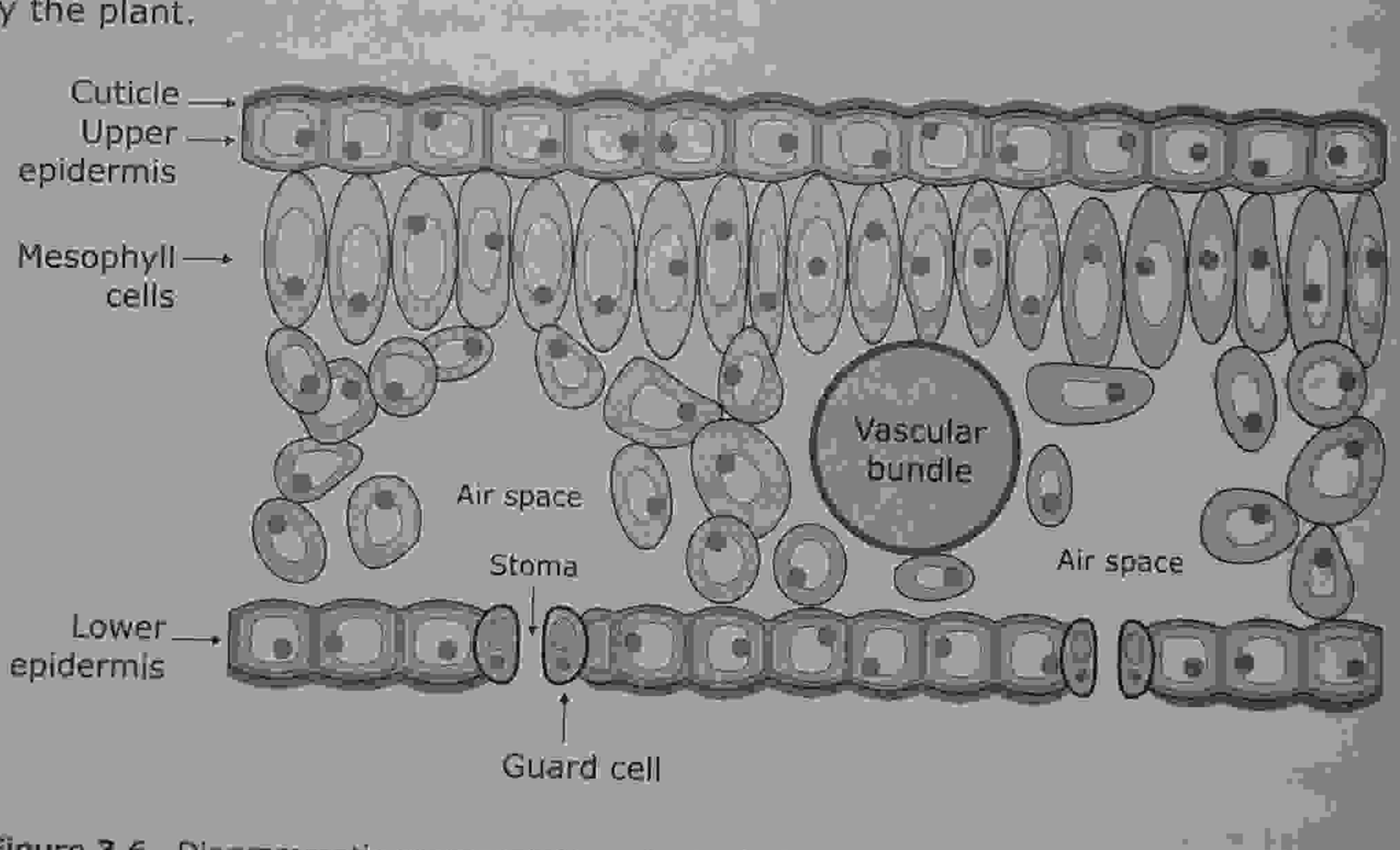

Figure 3.6 Diagrammatic representation of a typical dorsiventral leaf shown in cross-section.

Stoma consists of a small pore which is surrounded by a pair of kidney-shaped or dumbbell-shaped *guard cells* and two to four *subsidiary cells*. In dicot plants and nongrass monocots, kidney-shaped guard cells occur. Dumbbell-shaped guard cells occur characteristically in grasses. The guard cells, subsidiary cells and pore (stoma) are collectively called the *stomatal complex*. The guard cells have characteristic structures that include:

- Thickened inner walls (the inner walls are thick and the outer walls thin);
- Radial micellation (the cellulose microfibrils radiate out around the circumference of the pore);
- Bear chloroplasts (only epidermal cells with chloroplasts); and
- Connected end-to-end.