

Ecological Adaptations in Xerophytes

We have discussed above three different types of xerophytic plants, and their chief characteristic features. These three major groups of xerophytes may differ in several ways from each other but at the same time they all possess certain features in common. On the basis of these similarities, they are grouped into the same ecological group – the xerophytes. These features, which are more or less common to all, and which enable them to survive under the prevailing xeric conditions, are as follows:

Morphological features

1. **Roots.** In contrast with hydrophytes which develop in conditions with plenty of water, xerophytes develop under water-deficient conditions. Thus, in order to secure water, which is present in less amount and, moreover, in deeper layers of soil, roots in xerophytes become the principal organs of primary importance. The root system is thus very well developed, with the following characteristics:

(i) It is very extensive, which in some cases is several times longer than the shoot. Roots are long, tap roots, with extensive branching spread over wide areas.

(ii) Root hairs and root caps are very well developed.

2. **Stems.** (i) Mostly they are stunted, woody, dry, hard, ridged and covered with thick bark.

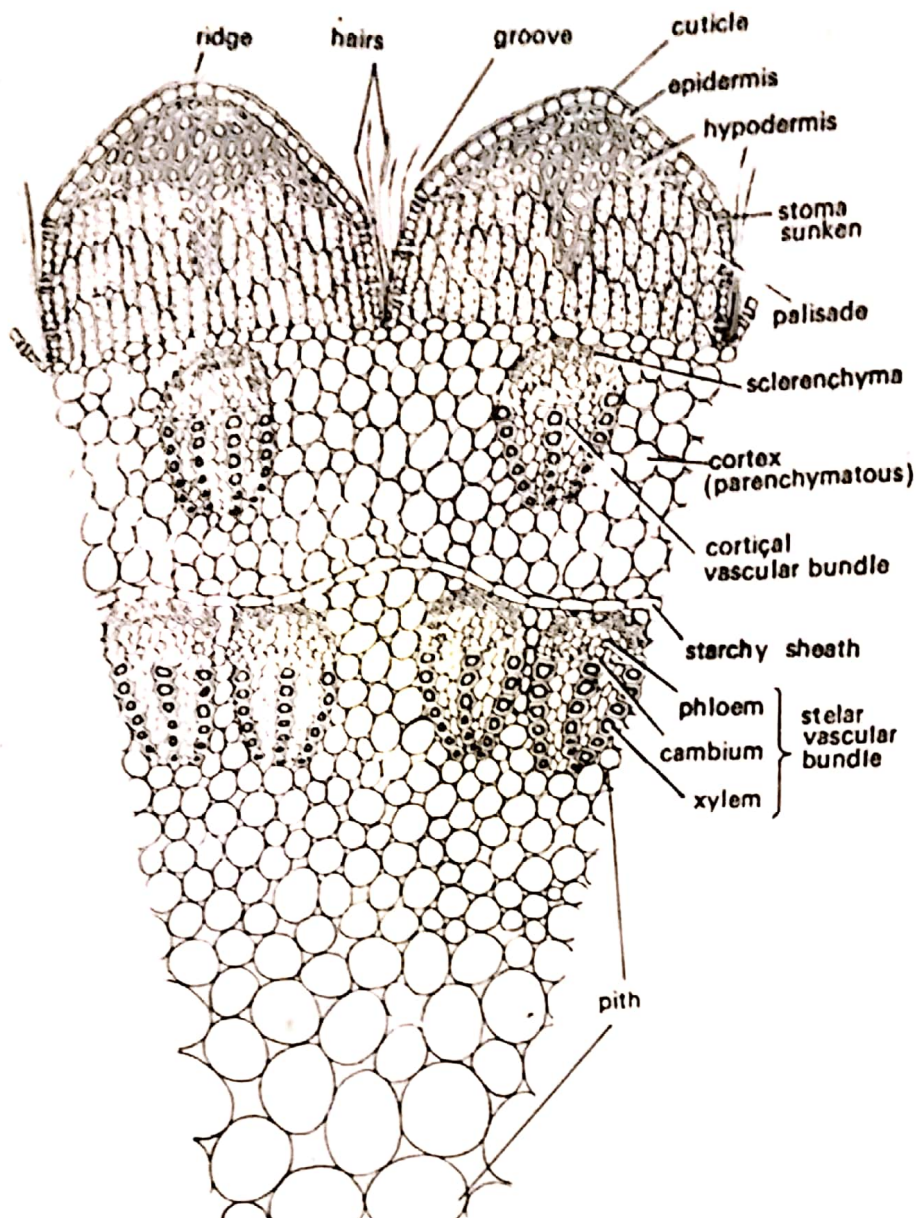


Fig. 16. T.S. stem (a part) of *Casuarina*. Note, the thick cuticle; sunken stomata, confined only to grooves; presence of hairs in grooves; sclerenchymatous hypodermis; green palisade region of subhypodermal cortex; well-developed vascular and mechanical tissues.

(ii) In some as *Saccharum*, stem becomes underground, whereas in *Opuntia* (Fig. 14) it becomes fleshy, green, leaf-like (phylloclade) covered with spines. In *Euphorbia* also (Fig. 14) it becomes fleshy and green.

(iii) On stems and leaves there are generally hairs and/or waxy coatings.

3. Leaves. (i) Leaves are very much reduced, scale-like appearing only for a brief period, sometimes modified into spines. Lamina may be long, narrow or needle-like as in *Pinus* or divided into many leaflets as in *Acacia*.

(ii) Foliage leaves, wherever present, may become thick, fleshy and succulent, or tough and leathery in texture.

(iii) Leaf surfaces are generally shiny and glazed to reflect light and heat.

(iv) In some monocots as *Ammophila*, *Poa*, and *Agropyron* (Fig. 21A-C), leaves become folded and rolled in such a manner that the sunken stomata become hidden, and thus rate of transpiration is considerably minimised.

(B.C.—4)

(v) In some of them as *Euphorbia* (Fig. 14), *Acacia nelotica*, *Zizyphus jujuba* and *Capparis aphylla* (Fig. 15), stipules become modified into spines.

Anatomical features

1. **Roots.** (i) Roots hairs and root caps are well developed. In *Opuntia*, root hairs develop even at the root tips.

(ii) Roots may become fleshy to store water as in *Asparagus*.

(iii) In *Pinus edulis* and *Calotropis*, roots possess rigid and thickened walls.

2. **Stems.** (i) In succulent xerophytes, stems possess a water-storage region.

(ii) In stems of most of the non-succulent xerophytes, such as *Casuarina* (Fig. 16), there are present the following chief characteristics:

(a) Cuticle is very thick.

(b) Epidermis is well developed, with heavily thickened cell walls.

(c) Hypodermis is several-layered and sclerenchymatous.

(d) Stomata are of sunken type.

(e) Vascular tissues are very well developed, differentiated, heavily lignified. Vascular bundles have well developed several-layered bundle sheaths.

(f) Mechanical tissues are very well developed.

(iii) Bark is very well developed.

(iv) Oil and resins are often present.

3. **Leaves.** (i) In succulent leaves of malacophyllous xerophytes, such as *Peperomia* (Fig. 17), epidermal cells of leaves serve as water-storage organs.

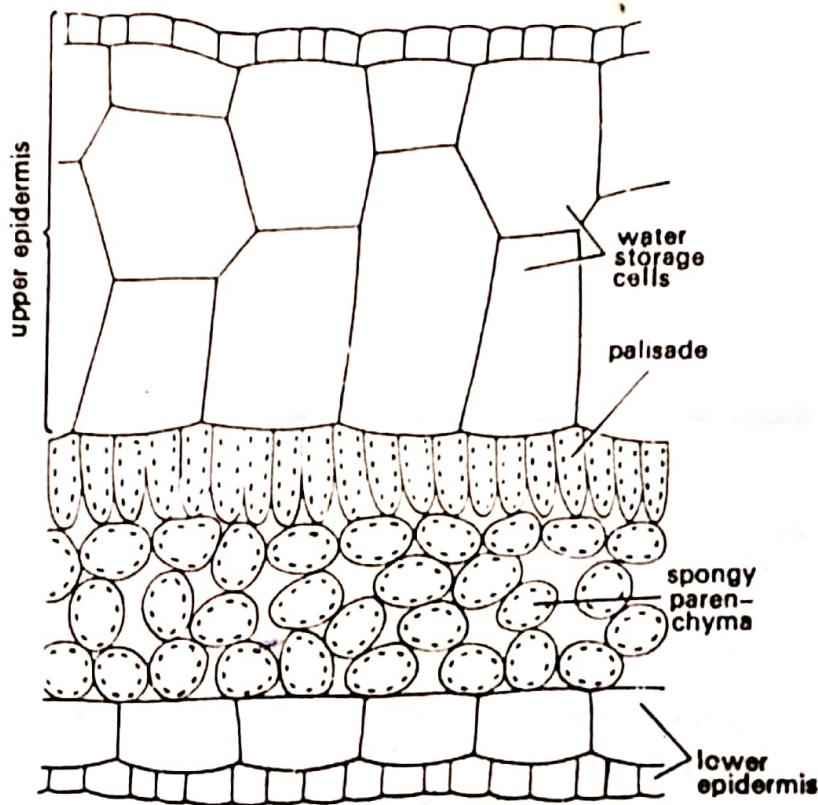


Fig. 17. T.S. leaf (lateral wing portion only) of *Peperomia* (a succulent) showing epidermal water storage tissues. Note, several-layered epidermis (particularly upper one) inner layers of which have quite large thin-walled cells acting as water-storage cells.