Quadrant II – Transcript and Related Materials

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Unit: 4

Module Name: Adaptation in xerophytes

(Ecological Adaptations)

Module No: 31

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Notes:

Plant communities have been classified by Warming (1909) on the basis of dependence and relation of plants to water as hydrophytes, Xerophytes, Mesophytes, Epiphytes, Saprophytes and Halophytes.

Plants growing under different conditions become adapted anatomically and ecologically to habitats in order to maintain a balance for their better growth.

Xerophytes are plants growing in dry habitats or in areas of physical dryness. They adapt themselves to dry, sandy or rocky soils having poor water content and extreme atmospheric conditions. They are able to live in these environments because they contain special features that prevent water loss.

There are two types of structural xerophytic adaptations. They are xeromorphic and xeroplastic characters.

(i) Xeromorphic characters:
Xerophytic characters that are genetically fixed and inherited are referred to as xeromorphic. They will appear in the xerophytes irrespective of conditions whether they are growing in deserts or in humid regions. Halophytic mangroves and many other evergreen trees, although growing in moist conditions always develop xeromorphic characters.

(ii) Xeroplastic characters:
These features are induced by drought and are always associated with dry conditions. They are never inherited. These characters may disappear from plants if all the favourable conditions are made available to them.

Xerophytic features are summarized under morphological (external) adaptations and anatomical (internal) adaptations.

Morphological (external) adaptations:

Xerophytes have well developed root systems which may be profusely branched. It is extensive and more elaborate than shoot system. Many desert plants develop superficial root system where the supply of water is restricted to surface layer of the earth. The roots of perennial xerophytes grow very deep in the earth and reach the layers where water is available in plenty. Root hairs are densely developed near the growing tips of the rootlets. These enable the roots to absorb sufficient quantity of water.

Stems are hard and woody. Some stems are covered with dense hairs (*Calotropis*), coated with wax (*Opuntia*) or silica (*Equisetum*). Stems in some xerophytes are modified to thorns (*Duranta*). Succulents have their stems modified into structures like phylloclades (*Opuntia*.); cladodes (*Asparagus*) or leaf like structure (*Ruscus*). All such structures are usually meant for water storage.

Usually leaves of xerophytes are reduced or modified to various kinds of structures to minimise transpiration. The following types of condition are seen: Microphyllous when the leaves are small scaly (*Casuarina, Asparagus*) or needle like (*Pinus)*, Trichophyllous when the leaves are covered with hairs (*Nerium, Calotropis*), Macrophyllous when the leaves are soft and fleshy (*Begonia)*, Sclerophyllous when the leaves are stiff and hard. (*Banksia*), Many xerophytes have no leaves (*Capparis*) or they fall very early (caducous) as in Euphorbia. Rolling of leaves is observed in some xerophytes like *Ammophile* where the stomata are directed inwards.

Anatomical (internal) adaptations

Some xerophytes have multiple epidermises (*Nerium*). Epidermis is with thick cuticle and deposition of waxes, resins etc. There are epidermal hairs especially in grooves (furrows) that protect the sunken stomata which are sunken in

nature and in pits. Stomatal frequency is normally low. Leaves may have specialised cells called bulliform cells that have the capacity to roll.

Hypodermal layers of xerophytes are thick and well developed. In *Casuarina* stems, there is abundant mechanical tissue in the form of sclerenchyma and leaves are reduced, the stems usually have chlorenchyma. In succulent plants, cortex is filled with water, mucilage, latex etc. In plants that have leaves, palisade parenchyma is well developed. *Pinus* mesophyll cells are modified. Intercellular spaces are greatly reduced. Vascular tissue (xylem and phloem) is very well developed in xerophytes.