

Characteristics of Xerophytic Plants in Desert Regions

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ABSTRACT: A xerophyte (xero meaning dry, phyte meaning plant) is a plant which is able to survive in an environment with little availability of water or moisture. Plants like the cacti and other succulents are typically found in deserts where low rainfall is the normal phenomenon, but few xerophytes can also be found in moist habitats such as tropical forests, exploiting niches where water supplies are limited or too intermittent for mesophytic plants.

Plants that live under arctic conditions may also have a need for xerophytic adaptations, as water is unavailable for uptake when the ground is frozen. Their leaves are covered with silvery hairs.

Adaptations of xerophytes include reduced permeability of the epidermal layer, stomata and cuticle to maintain optimal amounts of water in the tissues by reducing transpiration, adaptations of the root system to acquire water from deep underground sources or directly from humid atmospheres and succulence, or storage of water in swollen stems, leaves or root tissues. The typical morphological consequences of these adaptations are collectively called xeromorphisms.

KEYWORDS- xerophytes, deserts, hairs, stomata, cacti, succulents

I.INTRODUCTION

These are plants adapted to grow in dry habitats.

They are classified into four categories on the basis of their morphology and life cycle pattern:

a. Ephemeral Annuals:

These plants are also called as drought evaders or drought escapers. They are annuals and complete their life cycle within a very short period. They do not withstand dry seasons but actually avoid them. *Argemone mexicana*, *Solanum xanthocarpum*. [1,2,3]

b. Succulent:

These plants grow in habitats with less or no water. They store water whenever it is available. They have succulent and fleshy organs like stems, leaves and roots which serve as water storage organs and accumulate large amounts of water during the brief rainy seasons. *Euphorbia* and *Opuntia*.

c. Non-Succulent Perennials:

These are drought resistant and called as true xerophytes. They possess a number of morphological, anatomical and physiological characteristics which enable them to withstand critical dry conditions. *Calotropis*, *Acacia*, *Casuarina* and *Nerium*

d. Succulent Plants:

Succulent plants typically store water in stems or leaves. They include the Cactaceae families which typically have stems that are round and store a lot of water. Often, as in cacti where the leaves are reduced to spines, their leaves are vestigial, or they do not have leaves.

3. Characteristics of Xerophytes:

(i) Reduction in Air Flow:

Some xerophytes have tiny hairs on their surface to provide a wind break and reduce air flow, thereby reducing the rate of evaporation. When a plant surface is covered with tiny hairs, it is called tomentose. In a still environment, the areas under the leaves/spines where transpiration is taking place form a small localized environment that is more saturated than normal with water vapour. [4,5,6]

II.DISCUSSION

If this is not blown away by wind, the water vapour potential gradient is reduced and so is transpiration. Thus, in a windier situation, this localization is not held and so the gradient remains high, which aids the loss of water vapour. Spines trap a layer of moisture and also slow air movement over tissues.



(ii) Reflectivity:

The color of a plant, or of the waxes or hairs on its surface, may serve to reflect sunlight and reduce evaporation. An example is the white chalky wax (epicuticular wax) coating of *Dudleya brittonii*, which has the highest ultraviolet light (UV) reflectivity of any known naturally occurring biological substance.

(iii) Physiological:

Some plants can store water in root structures, trunk structures, stems, and leaves. Water storage in swollen parts of the plant is known as succulence. A swollen trunk or root at the ground level of a plant is called a caudex and plants with swollen bases are called caudiciforms. Tiny pores on the surface of a xerophytic plant called stomata may open only at night, so as to reduce evaporation.

Plants may secrete resins and waxes (epicuticular wax) on their surfaces, which reduce evaporation. Examples are the heavily scented and flammable resins (volatile organic compounds) of some chaparral plants, such as *Malosma laurina*, or the chalky wax of *Dudleya pulverulenta*.

Plants may drop their leaves in times of dryness (drought deciduous), or modify the leaves produced so that they are smaller.

During dry times, xerophytic plants may stop growing and go dormant, change the kind of photosynthesis or change the allocation of the products of photosynthesis from growing new leaves to the roots.[7,8,9]

III.RESULTS

4. Ecological Adoption in Xerophytes:

1. Plants growing in habitats where water supply is absent or physiologically dry are called Xerophytes.
2. Xerophytes classified based on their (a) Morphology (b) Physiology (c) Life cycle pattern
3. Plants growing in dry or arid zones are called Ephemerals or Drought evaders or drought escapers. Eg; Tribulus
4. Ephemerals are Annuals and complete their life cycles in 6-8 weeks.
5. Xerophytic plants absorbing more water during rainy season and storing them in different body parts are called Succulents or drought avoiding plants.
6. Succulents store water in the form of mucilage.
7. Leaf succulents: Bryophyllum, Aloe, Agave.
8. Root succulents: Asparagus[10,11,12]
9. Perennial plants which can withstand prolonged period of drought are called Non-succulents or true xerophytes Eg: Casurina, Nerium, Ziziphus, Calotropis etc.
10. Ecological adaptations of Xerophytes.
11. The all three major groups of xerophytes have some common adaptations to survive in very dry conditions.

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In this article we will discuss about:- 1. Meaning of Xerophyte 2. Types of Xerophytic Plants 3. Characteristics of Xerophytes 4. Ecological Adoption 5. Anatomical features.

Contents:

1. Meaning of Xerophyte
2. Types of Xerophytic Plants
3. Characteristics of Xerophytes
4. Ecological Adoption in Xerophytes
5. Anatomical features of Xerophyte[13,14,15]

1. Meaning of Xerophyte:

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a. Roots:

1. Root system is very well developed with extensive branching and often longer than shoot system.
2. Root hairs and root caps are very well developed.

b. Stems:

1. Mostly they are stunted, woody hard and covered with thick bark.
2. In some xerophytes stem becomes underground.
3. In some plants stem becomes fleshy, green, leaf-like phylloclades covered with spines, Eg: Opuntia.
4. Stems are usually covered by hairs and or waxy coatings.

c. Leaves:

1. Leaves are very much reduced small scale like and sometimes modified in to spines to reduce the rate of transpiration. Lamina may be long narrow needle-like or divided in to many leaflets as Eg: Acacia.
2. Foliage leaves become thick fleshy and succulent or tough and leathery in texture. Eg: Aloe.
3. Leaf surfaces are shiny glazed to reflect light and heat. Eg. Calotropis.[17,18,19]

IV.CONCLUSION

Anatomical features of Xerophyte:

1. Epidermis is covered thick cuticle to reduce the rate of transpiration.
2. Epidermal cells may have silica crystals.
3. Epidermis is multilayered Eg: Nerium.
4. Waxy coating is present on leaves and stem Eg: Calotropis.[20,21,22,23]
5. Stomata are generally confined to lower epidermis of leaves called hypostomatous.
6. Stomata are present in pits called sunken stomata. They are lined with hairs Eg: Nerium.
7. Mesophyll is differentiated in to palisade and spongy parenchyma.
8. Mechanical & vascular tissues are well developed.[24]

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