Adaptation in Pteridophyta for Xerophytic Climate

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Abstract: **Plant classifications such as mesophyte, hydrophyte or xerophytes hint at the species ability to adapt and survive. xerophytes are a group of plants that are uniquely suited to areas with limited rainfall. Adaptations of xerophyte garden plants vary but may include lack of leaves, waxy skin, storage organs or stems, shallow spreading roots or even spines.**

I. INTRODUCTION

The morphology and physiology of xerophytes are variously adapted to conserve water, and commonly also to store large quantities of water, during dry periods. Other species may be adapted to survive long periods of desiccation of their tissues, during which their metabolic activity may effectively shut down. Plants with such morphological and physiological adaptations are xeromorphic.

Cacti and other succulents are commonly found in deserts, where there is little rainfall. Other xerophytes, such as certain bromeliads, can survive through both extremely wet and extremely dry periods and can be found in seasonally moist habitats such as tropical forests, exploiting niches where water supplies are too intermittent for mesophytic plants to survive. Likewise, chaparral plants are adapted to Mediterranean climates, which have wet winters and dry summers. Plants that live under arctic conditions also have a need for xerophytic adaptations, since water is unavailable for uptake when the ground is frozen.

A general definition of succulents is that they are drought resistant plants in which the leaves, stem or roots have become more than usually fleshy by the development of water-storing tissue.[Other sources exclude roots as in the definition "a plant with thick, fleshy and swollen stems and/or leaves, adapted to dry environments". This difference affects the relationship between succulents and "geophytes" – plants that survive unfavorable seasons as a resting bud on an underground organ.These underground organs, such as bulbs, corms and tubers, are often fleshy with water-storing tissues. Thus if roots are included in the definition, many geophytes would be classed as succulents. Plants adapted to living in dry environments such as succulents are termed xerophytes. However, not all xerophytes are succulents, since there are other ways of adapting to a shortage of water, e.g., by developing small leaves which may roll up or having leathery rather than succulent leaves. Nor are all succulents xerophytes, since plants like Crassula helmsii are both succulent and aquatic.

The Bromeliaceae (the bromeliads) are a family of monocot flowering plants of around 3,170 species native mainly to the tropical Americas, with a few species found in the American subtropics and one in tropical west Africa, Pitcairnia feliciana.

They are among the basal families within the Poales and are unique because they are the only family within the order that has septal nectaries and inferior ovaries. These inferior ovaries characterize the Bromelioideae, a subfamily of the Bromeliaceae. The family includes both epiphytes, such as Spanish moss (Tillandsia usneoides), and terrestrial species, such as the pineapple (Ananas comosus). Many bromeliads are able to store water in a structure formed by their tightly-overlapping leaf bases. However, the family is diverse enough to include the tank bromeliads, grey-leaved epiphyte Tillandsia species that gather water only from leaf structures called trichomes, and a large number of desert-dwelling succulents.

These are the most well represented of the seedless plants. Most ferns have fronds, compound leaves divided into several leaflets. As the frond develops it uncoils from a structure called a fiddle head. Ferns are homosporus with the leafy plant the sporophyte. The sporangia are located on the under surface of the fronds in areas called sori. The gametophyte is a free-living, small, fragile structure. Water is necessary for fertilization since the sperm must swim to the archogonium, where fertilization takes place.

II. ADAPTATION IN PTERIDOPHYTA

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, or change the allocation of the products of photosynthesis from growing new leaves to the roots.

Seeds may be modified to require an excessive amount of water before germinating, so as to ensure a sufficient water supply for the seedling's survival. An example of this is the California poppy, whose seeds lie dormant during drought and then germinate, grow, flower, and form seeds within four weeks of rainfall.

Xerophytic plants may have similar shapes, forms, and structures and look very similar, even if the plants are not very closely related, through a process called convergent evolution. For example, some species of cacti (members of the family Cactaceae), which evolved only in the Americas, may appear similar to Euphorbias, which are distributed worldwide. An unrelated species of caudiciforms, plants with swollen bases that are used to store water, may also display such similarities.

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