DOWNLOAD PDF EXTREME ADAPTATIONS IN ANGIOSPERMOUS HYDROPHYTES

Chapter 1 : calendrierdelascience.com - Adaptation of Hydrophytes | Hydrophytes

They may be fresh water or marine water plants. Plants which grow in water systems like in ponds, lakes, streams, rivers, pools, etc are known as fresh water plants. The plants which grow in salt water are known as salt water plants or marine plants. Here the adaptations of hydrophytes are discussed under three headings: Morphological Adaptations Aquatic plants show various kinds of modification in the morphology of roots, stem and leaves to adapt to their aquatic life. In hydrophytes roots of the plants are not much important as the plants are partially or completely immersed in water. In plants like Utricularia, Slavinia roots are absent. In submerged plants like Vallisnersia roots are poorly developed. In floating plants like Pistia, in place of root caps, root pockets are found. Root hairs are poorly developed in hydrophytes. Stems are spongy, flexible, slender and long in submerged hydrophytes like Ilydrilla. In floating plants like Pistis, Azolla the stems are horizontal, spongy and floating. In hydrophytes which bear roots as in Cyperus, Potamogeton the stem is a rhizome or stolon. Some hydrophytic plants show special modifications in their petioles. Petioles of submerged plants, with free floating leaes are long, spongy and slender. In free floating plants like hydrophyte the petiole is swollen and helps in floating. Leaves of hydrophytes show a number of variations in the structure of their leaf lamina. In submerged hydrophytes like Utricularia the leaves are finely dissected and in plants like Vallisneria the leaves are long and narrow. In both, the adaptation is to offer little resistance to water current. The leaves of free floating hydrophytes are smooth and shining and coated with wax. The wax prevents water from clogging and also protects the leaf from physical and chemical injuries. Anatomical Adaptations in Hydrophytes Hydrophytes show the following adaptations in the anatomical features: Reduction in protecting structures: The submerged portions of the plants lack cuticle. The epidermis is used as an absorbing or photosynthesizing organs rather than a protecting organ. The hypodermis is poorly developed. Reduction of mechanical tissue: In the submerged portions of the plants the sclerenchyma is totally absent or poorly developed. In some hydrophytes special type of sclereids called asterosclereids provide mechanical support in the absence of sclerenchyma. Sclerenchyma is present in little or moderate quantities in the aerial portions of the plant. Reduction of vascular tissue: The vascular bundles in the plants are reduced to few or even to one and are located at the center. Xylem cells are very few. Phloem tissues are not well developed, there are a few exceptions. In the submerged parts of the plants the stomata are totally absent or vestigial. They are present only on the upper surface of the leaves of rooted and floating hydrophytes. In most of the hydrophytes plant the roots, stems and leaves have air chambers and they have CO_2 and O_2 gases that help them in respirations and photosynthesis. The air chambers also help in buoyancy and provide mechanical support. Aquatic plant - Wikipedia, the free encyclopedia Aquatic plants are plants that have adapted to living within aquatic environments. They are also referred to as hydrophytes or aquatic macrophytes. From Yahoo Answers Question: This is a topic of botany. Anyone who has knowledge on the topic "aquatic adaptations of hydrophytic plants", please share it with me. I have to submit the project at the very 1st of january So please hurry up! Here are some adaptations of aquatic plants: All aquatic plants however, flower out of the water. However the earliest ancestor of hydrophytes, the waterlily, is found to have characteristics of both monocots and dicots, which implies that the waterlily appeared early in the evolution of angiosperms. It is possible that hydrophytes developed concurrently with land plants. The roots in these plants are mainly for anchorage. There is some complicated chemistry involved with the carbon dioxide, pH, and carbonate hardness of the water that affects the environment these plants are in. Some plants, such as Elodea waterweed , have adapted to low levels of carbon dioxide by decalcifying the water. Storage of water succulent leaves eg. Water uptake deep root system eg. An example of a mesophytic habitat would be a rural temperate meadow, which might contain Goldenrod, Clover, Oxeye Daisy, and Rosa multiflora. Mesophytes generally require a more or less continuous water supply, and have only basic features for water conservation, such as a cuticle and stomata. They usually have larger, thinner leaves compared to xerophytes, sometimes with a greater number of stomata on the undersides of leaves. Because of their lack of particular xeromorphic adaptations, when they are exposed to extreme conditions they lose water rapidly, and are not tolerant of drought. Cuticles primarily prevent water loss, thus most hydrophytes have no need for cuticles. Stomata that are open most of time: This means that guard cells on the stomata are generally inactive. An increased number of stomata, that can be on either side of leaves. A less rigid structure: Air sacs for flotation. Specialized roots able to take in oxygen. Characteristics of aquatic plants: Excerpted entirely from link below: Cuticles primarily discourage water loss; thus most hydrophytes have no need for cuticles.

Chapter 2 : Handbook of Plant Anatomy

*Extreme adaptations in angiosperms hydrophytes (TraitÃ© d'anatomie vÃ©gÃ©tale) [Elias Landolt] on calendrierdelascience.com *FREE* shipping on qualifying offers.*

Advanced Search Abstract Podostemaceae have markedly specialized and diverse roots that are adapted to extreme habitats, such as seasonally submerged or exposed rocks in waterfalls and rapids. This results in a splitting into two meristems that separate the parental root and lateral root anisotomous dichotomy. In some extreme cases, due to meristem recovery, root lobing does not occur, so the margin is entire. The evolutionary reappearance of a protective tissue or root cap in Z. The plants grow submerged during the rainy season and are usually exposed to the air during the dry season. They flower shortly after exposure to air and set fruits whilst drying. The family has evolved specialized morphologies that appear to have adaptive significance. Within the family, considerable discontinuous morphological variation is reflected by the current classification in which approx. The extensively modified plant body of the Podostemaceae is difficult to interpret using the ordinary rootâ€"shoot concept. The morphological nature of the diversely structured roots is controversial, and they have been variously termed a thallus, rootâ€"thallus or crust, as well as a root Rutishauser and Huber, The pattern is as regular as that commonly seen in shoots of most angiosperms where shoots occur in the axil of each subtending leaf. The shoot emerges on the dorsal surface of the root near the lateral edge between the main axis and lateral root. This association between root branching and shoots is also seen in Cladopus, a species of Polypleurum and Asian members of Podostemoideae, whereas there is no such association in other related species of Polypleurum S. The foliose root is chlorophyllous, with extremely reduced vegetative and reproductive adventitious shoots scattered on the dorsal surface, and root hairs adhesive hairs on the ventral surface. Such roots are seemingly multifunctional. A molecular phylogeny shows that Asian Podostemoideae are monophyletic and divided into two clades, one consisting of Zeylanidium and Polypleurum, and the other consisting of Cladopus, Torrenticola, Hydrobryum and Synstylis Cook and Rutishauser, ; Kita and Kato, This suggests that the foliose roots of Z. This proposed parallel evolution is also supported by the developmental morphology of seedlings Suzuki et al. However, no attention has been paid to a possible association between root lobing and shoot formation in Z. This paper describes the developmental anatomy of roots of Z. Anatomical data are compared for the four species to clarify the evolution from subcylindrical to foliose roots and the evolution of the developmental relationships of root branching or lobing with such a regular association with shoots. Vouchers are housed in the herbarium of the University of Tokyo TI. For anatomical observation, materials were fixed with FAA formalin: It consists of an epidermis and a parenchymatous ground tissue that is roughly seven to nine cells thick in Z. The ground tissue is devoid of intercellular spaces and possesses only a rudimentary vascular bundle Fig. In both species, the vascular bundle is single and consists of elongated cells. There are no apparent tracheary elements with helical thickenings except in the endogenously developed shoot. Adhesive root hairs are borne densely on the ventral surface, mostly along the vascular bundles dark bands in Fig. The root has an apical meristem that is slightly flattened and consists of a single surface layer and small, densely stained inner cells Fig. Surface cells are approx. Surface cells are nucleated near the inner walls in both species Fig. The surface cells undergo anticlinal divisions exclusively, so the surface layer does not rupture even at root branching but continues to the epidermis in the proximal portion Fig. The root apex does not produce a root cap or any similar protective tissue. Since the shoots occur between main and lateral roots at every branching point, root branching is always associated with shoot formation Fig. The root apical meristem widens prior to branching Fig. Consequently, the meristem splits into two. In a section of Fig. The larger daughter meristem will become the apical meristem of a future main root axis, whereas the smaller meristem becomes that of a future lateral root. Since shoots occur alternately on either side of the root apex, the main root appears zigzagged with alternate lateral branches Fig. Zeylanidium olivaceum The roots of Z. The shoots are scattered over the dorsal surface of the root with no obvious pattern

Fig. Most shoots occur interior to shallow or deep incisions in the root margin Fig. The root is composed of a dorsal and ventral epidermis between which are sandwiched about six parenchymatous layers without intercellular spaces, and an anastomosing provascular strand Fig. The strand consists of elongated parenchymatous cells Fig. The unicellular root hairs are borne in patches on the ventral epidermis. Young shoots are supplied by one or two provascular strands from an anastomosing network of strands spreading in the root Fig. There is a meristem along the margin of the foliose root covered by protective tissue Fig. In this paper this meristem is referred to as a marginal meristem; its appearance is similar to that found in Hydrobryum japonicum Ota et al. The protective tissue is composed of large, lightly stained cells that are five to eight cells wide and four to five cells thick. It is produced from the meristem as shown by cell alignment: Pieces of protective tissues consisting of very old brown cells are often retained outside the outermost protective cells and are scattered along the margin Fig. This suggests that formation of a protective tissue from the marginal meristem is quite discontinuous. The shoot is initiated endogenously in the innermost zone of the meristem Fig. Growing shoots protrude from the root after rupturing the dorsal epidermis Fig. In contrast, the neighbouring meristem area, which is not associated with shoots, remains wide seven to eight cells; Fig. It seems probable that activity of the marginal meristem decreases under the influence of the initiating shoot. As the meristem gradually becomes less active, the derived root tissue exterior to a shoot becomes thinner, although it is only one cell layer thinner vertically than that in actively growing neighbouring parts Fig. Finally, the meristem area exterior to the shoot differentiates into parenchyma, completing the splitting of the meristem Fig. No marginal meristem or protective tissue remains although the parenchyma cells at the margin are slightly larger than the meristem cells Fig. In a small number of cases the root margin remains entire not incised , even exterior to a shoot Fig. The exterior part is very elongated and retains the marginal meristem, although this is as thin and stretched as that in incised parts Fig. This part also lacks a network of strands. There is also another extreme case: Serial longitudinal sections of the elongated area show that the proximal portion is thin and consists of fewer cell layers and stretched cells, while the distal portion is thicker and consists of more layers and small cells Fig. The distal portion is probably derived from a recovered marginal meristem, which is as vigorous as that in the neighbouring portion Fig. Zeylanidium maheshwarii The roots of Zeylanidium maheshwarii are foliose and irregularly lobed but the incisions are not associated with shoots Fig. The roots examined here are stacked up and grow on other roots with shoots, resulting in irregular lobing. The shoot is initiated in young parenchyma just proximal to, and probably derived from, the root marginal meristem Fig. The meristem distal to the shoot is as vigorous as that prior to shoot formation and in neighbouring parts. It continues to produce root tissues, so that the root is as thick as neighbouring parts Fig. Consequently, the margin of the foliose root exterior to the shoots is entire Fig. Endogenous root formation is common in other angiosperms Esau, , and many other species probably exhibit this pattern of formation. This proximity to the vascular bundle is reminiscent of the proximity to the pericycle of a parental root commonly seen in angiosperms in general. Zeylanidium subulatum, Polypleurum stylosum, P. Willis, ; Rutishauser, We have provided developmental anatomical evidence that root branching is initiated exogenously in Z. The meristem of a root branch or lobe arises from that of a parental root or root lobe, so that the root branches apically or becomes lobed marginally. Our observations show that the exogenous origin of root branches in Z. Surprisingly, a similar association is often found in the foliose root of Z. The root apical meristem widens prior to branching and is split into two daughter meristems because the meristem exterior to a shoot, which is initiated within the root meristem, becomes parenchyma Fig. Initiation of a shoot within a root meristem is highly unusual compared with the situation in other angiosperms in which new organs are initiated in the peripheral zone of, or at some distance from, the apical meristem of a shoot or root Esau, This branching pattern can be described as anisotomous dichotomy Gifford and Foster, , and is very unusual in angiosperm roots. Such meristem behaviour may be seen in other Asian Podostemoideae with a regular association of root branching and shoots. The divisional pattern of the marginal meristem associated with shoots in Z. However, shoots are initiated in the innermost zone of the meristem, in a more internal position than those in Z.

Consequently, the meristem behaves differently in Z. Phylogenetic relationships strongly suggest that the foliose roots of Z. To some extent the meristem is already flattened and widened in Z. We speculate that the effect of shoot formation on root meristem splitting was reduced by shifting the shoot initiation site from the extreme apex e. The foliose root of Hydrobryum and Synstylis is derived from the flattened subcylindrical root found in a group including Cladopus and Torrenticola independently of the evolution of that of Zeylanidium Kita and Kato, It is probable that the change of meristem development involved in evolution of the foliose root of Hydrobryum and Synstylis is different from that for Zeylanidium although the genera have similar marginal meristems. As a result, the meristem is split and the root is lobed. The combination of the exogenous origin of roots and meristem widening into a marginal meristem seems to be related to the derivation of flattened and widened roots and, eventually, foliose roots from subcylindrical roots Rutishauser, Kita and Kato implied that the evolution of exogenous roots from endogenous roots occurred at the base of the Asian Podostemoideae clade and that foliose roots evolved subsequently in some of Asian genera and species. By contrast, the root is subcylindrical not foliose in clades with endogenous roots, e. To determine whether the foliose roots of African species Engler, ; Taylor, ; Cusset, are exogenous will require developmental and anatomical studies. As described by Willis and Rutishauser , Z. In all the material at various stages of root development examined here, the surface layer at the root tip was part of the apical meristem that produces the epidermis and was never sloughed off. Seedlings and young plants of some species of Asian Podostemoideae, including Z.

Chapter 3 : Adaptation of Mesophytes | eHow

Physiological Adaptations: Petioles of floating- leaved hydrophytes have a great capacity for renewed growth, which is perhaps regulated by auxins (phytohormones). In lotus, the long petioles seem to adapt themselves the depth of water, thus keeping the leaf lamina on the surface of water.

Pathological and Regenerative Plant Anatomy. Handbuch der Pflanzenanatomie XII, pages, figures, plates, 22 color plates. However, it is only the stressed, injured, or diseased plant which exhibits the full range of possible structural and functional responses to challenges by harmful abiotic or biotic stimuli, consisting of highly variable forms of degeneration, adaptation, defense, or regeneration. In medicine, books on diseases are obviously much more numerous than books on healthy humans; in botany, by comparison, books on injured and diseased plants are much rarer. The present text tries to comprehend the current status of our knowledge of the possible structural changes in plants suffering from, e. With more than references it covers the most relevant literature, including many older publications which have nearly fallen into oblivion, though they contain valuable and still unsurpassed information. In order to present this vast amount of information from the diverse fields in a lucid form, special emphasis was placed on schematic classifications which are illustrated in comprehensive graphs. More than half of the illustrations are original drawings and photomicrographs, including in colour. Two smaller chapters finally cover aspects of the physiological background for the structural modifications, and the possible use of structural criteria for diagnostic purposes. Because proper knowledge of structural relations is the prerequisite for all further understanding of plant reactions, this monograph will not only be an important reference book for all scientists working in plant pathology and related field, but also for those involved in developmental, physiological, and molecular plant biology. Cutler and Ingrid Roth. Band II Teil 2: Fotomechanischer Nachdruck der 2. The Plant Cell Wall. Die mechanischen Elemente und das mechanische System. Cytology and Morphogenesis of Bacteria. Anatomie der Asco- und Basidiomyceten. Photomechanischer Nachdruck der 1. Comparative Anatomy of Vegetative Organs of the Pteridophytes. Entwicklungsgeschichtliche und topographische Anatomie des Angiospermenblattes. Structural Patterns of Tropical Barks. Edited by Muhammad Iqbal. Fruits of the Angiosperms. Meyer, Jean et H. Extreme adaptations in Angiospermous Hydrophytes. Leaf Structure of a Venezuelan Cloud Forest, in relation to the microclimate. Montane regions of Venezuela. Dendrology, tree structure and economic use. Pathological and regenerative plant anatomy. It has been almost 75 years since the last comprehensive treatment by Kuester was published and the author presents a new wholistic compilation in the field of plant pathological anatomy. More than up-to-date references and over illustrations make this a truly encyclopedic work. XII, pp, figs. Proceedings of the double symposium "Floral development: Edited by Peter Leins, Shirley C. A cytotaxonomical Atlas of the Balkan Flora. The classification of Leaf Venation Patterns. The Pathology of the Plant Cell, Part 1. Plant Galls and Gall Inducers. Translated by Suellen Cheskin. Physik und Chemie des Zellkerns. Schriftenverzeichnis zu Teil 1:

Chapter 4 : Morphological and Physiological Adaptations of Hydrophytes

Key to the african Podostemaceae Extreme Adaptations in angiospermous Hydrophytes. Pp. - plant anatomy: Extreme adaptations in angiospermous.

External Morphology of Xerophytes: 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. Some of the important characteristics of xerophytic stems are listed below: It may be either aerial or subterranean. Some may be covered with dense hairs as is Calotropis. In Ruscus plants, the branches developing in the axils of scaly leaves become metamorphosed into leaf-like structures, the phylloclades or cladophylls Fig. In Asparagus plant Fig. They are called cladodes. A number of species of Euphorbia also develop succulence and become green. In these plants, leaves are greatly reduced, so the main function of leaves, the photosynthesis, is taken up by these green phylloclades or cladodes which are modified stems. Plants with succulent leaves generally develop very reduced stems. Examples of leaf succulents are Sedum acre, Aloe spinossissima Gheekwar Fig. Sometimes they may be reduced to spines, as for example, in Ulex, Opuntia, Euphorbia splendens Fig. In Australian species of Acacia Babool the pinnae are shed from the rachis and the green petiole swells and becomes flattened taking the shape of leaf. This modified petiole is termed as phyllode Fig. The phyllode greatly reduces the water loss, stores excess amount of water and performs photosynthesis. In some xerophytes especially those growing well exposed to strong wind, the under surfaces of the leaves are covered with thick hairs which protect the stomatal guard cells and also check the transpiration. Those xerophytes which have hairy covering on the leaves and stems are known as trichophyllous plants. Leaves in some extreme xerophytic grasses have capacity for rolling or folding. In these cases stomata are scattered only on the upper or ventral surface and as the leaves roll upwardly, stomata are effectively shut away from the outside atmosphere. This is effective modification in these plants for reducing the water loss. Sun-dune grass is an important example for this Fig. D Flowers, fruits and seeds. Flowers usually develop in the favourable conditions. Fruits and seeds are protected by very hard shells or coatings. Anatomical Modifications in the Xeropliytes: A number of modifications develop internally in the xeric plants and all aim principally at water economy. The following are the anatomical peculiarities met within xerophytes: Some plants secrete wax in small quantity but some are regular source of commercial wax. Shining smooth surface of cuticle reflects the rays of light and does not allow them to go deep into the plant tissues. Thus, it checks the heavy loss of water. Cells are small and compact. It is single layered, but multiple epidermis is not uncommon. In Nerium leaf, epidermis is two or three layered Fig. In stems, the epidermal cells are radially elongated. Wax, tannin, resin, cellulose, etc. This further reduces the evaporation of water from the surface of plant body. Certain grasses with rolling leaves have specialized epidermis Figs. In these, some of the epidermal cells that are found in the depressions become more enlarged than those found in the ridges. These enlarged cells are thin walled and are called bulliform cells or motor cells or hinge cells. These are found usually on the upper surface of leaves between two parallel running vascular bundles. The highly specialized motor cells facilitate the rolling of leaves by becoming flaccid during dry periods. In moist conditions these cells regain their normal turgidity which causes unrolling of the leaf margins. Bulliform cells are of common occurrence in the leaf epidermis of sugarcane, bamboo, Typha and a number of other grasses. Hairs are epidermal in origin. They may be simple or compound, uni- or multicellular. Compound hairs are branched at the nodes. These hairs protect the stomata and prevent excessive water loss. In some plants, surfaces of stems and leaves develop characteristic ridges and furrows or pits. The furrows and pits in these plants are the common sites of stomata. Hairs found in these depressions protect the stomata from the direct strokes of strong wind Figs. In xerophytes, reduction of transpiration is of utmost importance. It is possible only if the stomatal number per unit area is reduced or if the stomata are elaborately modified in their structures. In xerophytes, number of stomata per unit area of leaf is greater than in mesophytes. They are generally of sunken type. In some cases, they may be found in the furrows or pits. Subsidiary cells of sunken stoma may be of such shapes and arrangement that they form an outer chamber that is connected by narrow opening or the stoma. Such type of specialized stomata are very common in conifers, Cycas, Equisetum, etc. Walls of the guard cells and subsidiary cells are heavily cutinized and lignified in many xeric plants. These devices have little value in directly reducing transpiration when stomata are open. When the plants are wilting and stomata are closed then only lignified or cuticularized walls of guard cells have protecting properties and under such circumstances only cuticular transpiration is possible which is of little significance. In dorsiventral leaves stomata are generally found on the lower surface, but m rolling leaves they are scattered mostly on the upper surface. In the rolled leaves, stomata are protected from the direct contact of outside wind. This is very important rather secured device for lowering the rate of transpiration in xerophytic grasses. In xerophytes, just below the epidermis, one or several layers of thick walled compactly grouped cells may develop that form the hypodermis. The cells may be much like those of epidermis and may either be derived from epidermis or from the cortex m case of stem or from the mesophyll in case of leaf. The hypodermal cells may sometimes be filled with tannin and mucilage. In those cases, where the leaves are either greatly reduced or they fall in the early season, the photosynthetic activity is taken up by outer chlorenchymatous cortex Fig. The chlorenchymatous tissue is connected with the outside atmosphere through stomata. The gaseous exchange takes place in regular manner in the green part of stem. This makes the stems swollen and fleshy Figs. Palisade tissue develops in several layers. There are some xerophytes in which mesophyll is surrounded by thick hypodermal sheath of sclerenchyma from all the sides except from below. This sheath forms a diaphragm against intense light. Such xerophytes in which sclerenchyma is extensively developed are called sclerophyllous plants. In succulent leaves, spongy parenchyma develops extensively which stores water Figs. In Pinus, the spongy cells of mesophylls are star shaped Fig. Cells in the body are generally very small, thick walled and compactly grouped. They may be spherical, rounded or cuboid m shape. Such cells are very common in xerophytes. It was long assumed that the structural adaptations in the body of xerophytes were useful in reducing the transpiration but now a number of experiments related with the physiology of these plants reveal some facts which are contrary to the early assumptions. Works of Maximov support that except succulents, true xerophytes show very high rate of transpiration. Under similar conditions, the rate of transpiration per unit area in xerophytes is much higher than that in mesophyte. Stomatal frequency per unit area of leaf surface in xerophytes is also greater than that in the mesophytic leaf. The structural modifications in these succulent xerophytes are directly governed by their physiology. How does the succulence develop? Metabolic reaction which induces development of succulence is the conversion of polysaccharides into pentosans. Pentosans have water binding property. These pentosans together with nitrogenous compounds of the cytoplasm cause accumulation of excess amount of water in the cells and consequently the succulence develops. This unusual feature is associated with metabolic activity of these plants. In dark, these plants respire and produce acids. The heavy accumulation of acids in the guard cells increases osmotic concentration which, m turn, causes inward flow of water in the guard cells. When guard cells become turgid the stomata open. In the sunlight, acids dissociate to produce carbon dioxide which is used up in the photosynthesis and as a result of this osmotic concentration of cell sap decreases which ultimately causes closure of stomata.

Chapter 5 : Plant Adaptations: Introduction and Ecological Classification of Plants

Here the adaptations of hydrophytes are discussed under three headings: Morphological Adaptations Aquatic plants show various kinds of modification in the morphology of roots, stem and leaves to adapt to their aquatic life.

Mesophytes are the largest ecological group of terrestrial plants that grow under moderate to hot and humid climatic conditions. These plants are exposed to such an environment which does not need any extreme adaptations as do not have a hardship of loosing water by evaporation from the aerial parts of the plant. The structural and physiological features of mesophytes allow them to cope to terrestrial habitats. The leaves of the mesophytes have a waxy cuticle which are important in the survival of the plants as they trap the moisture inside leaves and it also decreases water loss as it does not letting water diffuse easily. The cuticle works as a protective waxy covering on the epidermis of the leaf and is thicker on the top of the leaf. The stomata in the mesophytes are present on the lower epidermis of the leaf. The stoma closes in conditions of extreme heat or wind and prevents transpiration, the guard cells force the stomata to close and prevent water loss. The mesophytes are plants that grow under average conditions of temperature and moisture and these plants are intermediate between xerophytes and hydrophytes. The adaptations of mesophytes are: The root system is well developed in the mesophytes, the dicots have a taproot system and the monocots have a fibrous root system. The roots of the mesophytes are well developed and are provided with a root cap. The stem of the mesophytes are solid and are well branched. The stem is aerial, straight, thick, branched and hard. The leaves of these plants are well developed and are covered with cuticle. The stomata are present on the lower surface of the leaf. The leaves are thin, are broad in middle and dark green. The leaves of this group of plants are large and variously shaped. The mesophyll layer in the leaves are well differentiated with many inter cellular spaces. The vascular and mechanical tissues are well developed. Examples of mesophytes are: Maize corn , lilac, clover, oxeye daisy, goldenrod, privet, Rosa multiflora. Mesophytes do not have any specific morphological adaptations, however they usually have broad, flat and green leaves. Xerophyte A xerophyte or xerophytic organism xero meaning dry, phyte meaning plant is a plant which is able to survive in an environment with little available water or moisture, usually in environments where potential evapotranspiration exceeds precipitation for all or part of the growing season. Plants like the cacti and other succulents are typically found in deserts where low rainfall amounts are the norm, but xerophytes such as the bromeliad s 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. 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 as in epiphytic orchids , and succulence , or storage of water in swollen stems, leaves or root tissues. The typical morphological consequences of these adaptations are collectively called xeromorphisms. Mechanism table Importance of water conservation If the water potential inside the leaf is higher than outside the leaf, the water vapour will diffuse out of the leaf down this gradient. This loss of water vapour from the leaves is called transpiration , and the water vapour diffuses through open stomata in the leaf. Although this is a normal and important process in all plants, it is vital that plants living in dry conditions have adaptations that decrease this water potential gradient, and decrease the size of open stomata, in order to reduce water loss from the plant. It is important for a plant living in these conditions to conserve water because without enough water, plant cells lose turgor and the plant tissue wilts. If the plant loses too much water, it will pass its permanent wilting point , where the plant will die. Types of xerophytic plants are: Succulent plant s - typically store water in stems or leaves. They include the Cactaceae family 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. Bulb s - water is stored in their bulbs, at or below ground level. They may spend a period of dormancy during drought conditions underground, and are therefore known as drought evaders. Short-lived annuals can often germinate following rainfall. An example of this is the California poppy whose seeds lie dormant during drought and then, flower and form seeds within four weeks of rainfall. From Encyclopedia Deciduous Forests Deciduous Forests The temperate deciduous broadleaf forest TDBF is composed of broad-leaf angiosperm trees like the oaks, maples, and beeches familiar to many Americans and Europeans. The forests exist best in moderate climates that are neither too hot nor too cold and neither too wet nor too dry. While there are roughly thirty families and sixty-five genera in the TDBF, variation in the precise definition and defined area of the forest make absolute numbers impossible. With thousands of species, the TDBF is a highly diverse biome. Worldwide, there are five major groups of TDBFs. Within each group, botanists define TDBFs by the species that tend to occur in a given area. These collections of species, together with their environment, are called associations. At that time, land was opened for agriculture in the Mississippi valley, and many farms were abandoned. Pines grew well in the remaining grassy fields, but after a catastrophic hurricane in , the TDBF grew back. Today, there is much more TDBF in the United States than there was one hundred years ago though still less than before the arrival of European settlers. There are nine generally recognized associations in the United States TDBF, each defined by differences in vegetation see accompanying table. Though the species are representative of common dominants, many other species exist. TDBF associations are not completely separate. Many species, such as northern red oak and sugar maple, exist in more than one association. Nor are the boundaries between the associations sharp and easily identifiable. In particular, the Western Mesophytic association can be difficult to distinguish from its neighbors to the east Mixed Mesophytic and west Oak-Hickory. Associations can change with time too. The Oak-Chestnut association is now almost completely devoid of chestnut, but many people still use the association name even though it is now mostly oak and maple. Association names in North America and elsewhere are most useful for distinguishing broad differences in forest type often associated with variation in soils, topography, and climate. Forests in Europe have been extensively modified by humans for more than two thousand years and are some of the most manipulated forests in the world. In the northern European TDBF, birch species are common, while in the middle European latitudes, beech Fagus sylvatica is widely distributed and commercially valuable. Towards the south, various oak and maple species abound. The European TDBF is replaced by drought-resistant shrubs and evergreen broadleaf trees in the south and the boreal coniferous forest in the north. The last three TDBF areas are much smaller than the first two. Today, even though the species mix is still very diverse, much of the East Asian forest outside of Japan is currently under cultivation and most existing forest fragments are protected refuges or in areas unsuitable for agriculture. Acacia caven and seven Nothofagus species are also found there. In nearly all cases, the deciduous trees of South America occur in mixtures with evergreen broadleaf species. East Asia was glaciated less severely than America and Europe, so most species were able to survive with little difficulty. In North America, the north-to-south orientation of major mountain ranges allowed species to migrate, and species diversity here is only slightly lower than in East Asia. In Europe, on the other hand, the east-to-west mountains caused the TDBF to be trapped by advancing glaciers. Consequently, Europe has very low-species diversity. The length of the frost-free period ranges from to over days. Precipitation is year-round and averages between 80 and centimeters per year. Snowfall can range from nonexistent in the southeastern United States to extremely heavy in northern habitats. Climates that are wet and warm all year are occupied by tropical forest consisting of broadleaf evergreen trees. As climates become drier, as occurs at the western edge of the Oak-Hickory association, drought stresses are too extreme for TDBF and grasses become dominant. To the north of the major TDBF, extreme cold, short growing seasons and poor soils favor evergreen coniferous forests. TDBF soils tend to be deep and fertile and, unlike some soils in the northern coniferous forest, do not freeze year-round. For this reason, TDBFs have historically been popular for agricultural use. Deciduous leaves are the most distinctive feature of the TDBF. In the fall, spectacular reds, oranges, and yellows produce breathtaking displays across the TDBF. Why does this occur? During autumn, as temperatures cool and days shorten, trees send hormonal signals to their leaves causing them to turn colors and fall off the branch. First, leaves form a barrier between the leaf and the branch, known as the abscission layer. At the same time, chlorophyll, the compound that gathers light for photosynthesis, begins to degrade in the leaf. Chlorophyll is responsible for the usual green leaf color: Some of the sugar in the leaves of oaks and maples may be converted into red colors. Once the leaf is totally shut down and no longer conducting any photosynthesis, the abscission layer becomes very brittle. Any small breeze can snap the leaf off at this point. In the spring, using carbon from special storage cells in the trunk, trees grow a new batch of leaves. In an evolutionary adaptation designed to maximize the amount of light received, shrubs and small trees growing in the understory will begin growth before the overstory. The study of any recurring biological cycle and its connection to climate is called phenology. Patterns of bird migration and insect outbreaks are examples of phenological cycles. For centuries, scientists have been studying phenology in the TDBF. In the deciduous forest, phenology refers to the timing of spring leaf growth and fall leaf drop and their relationship to climatic variation. Observational evidence has shown that TDBF phenology is highly sensitive to variation in weather. Warm springs will cause leaves to grow earlier, sometimes by up to as much as one month. Conversely, plants respond to a cold fall by dropping th From Yahoo Answers Question: Storage of water succulent leaves eg.

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Chapter 7 : General Literature I-L

Distinctive features of different groups of hydrophytes are summarized in the following chart. Physiological adaptations in hydrophytes: The aquatic plants exhibit a low compensation point and low osmotic concentration of cell sap.

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