

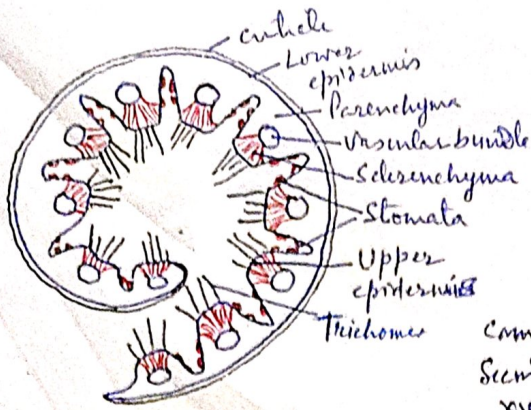
Anatomical adaptations in xerophytes

Roots

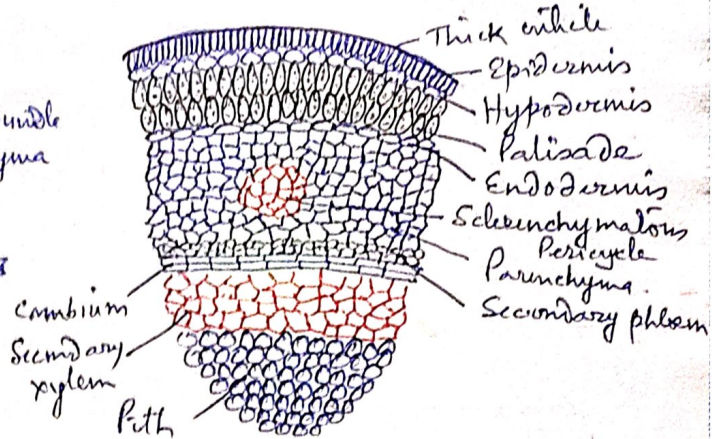
1. In succulents like Opuntia, root hairs and root caps are well developed. In Opuntia root hairs develop even at the root tips.
2. In drought resistant like Calotropis and Pinus edulis, roots possess thick^{-ened} and rigid walls.
3. In succulents development of water storing parenchymatous tissues may occur in roots as found in Asparagus and Ceiba parvifolia. Such roots contain mucilage also.

Stems

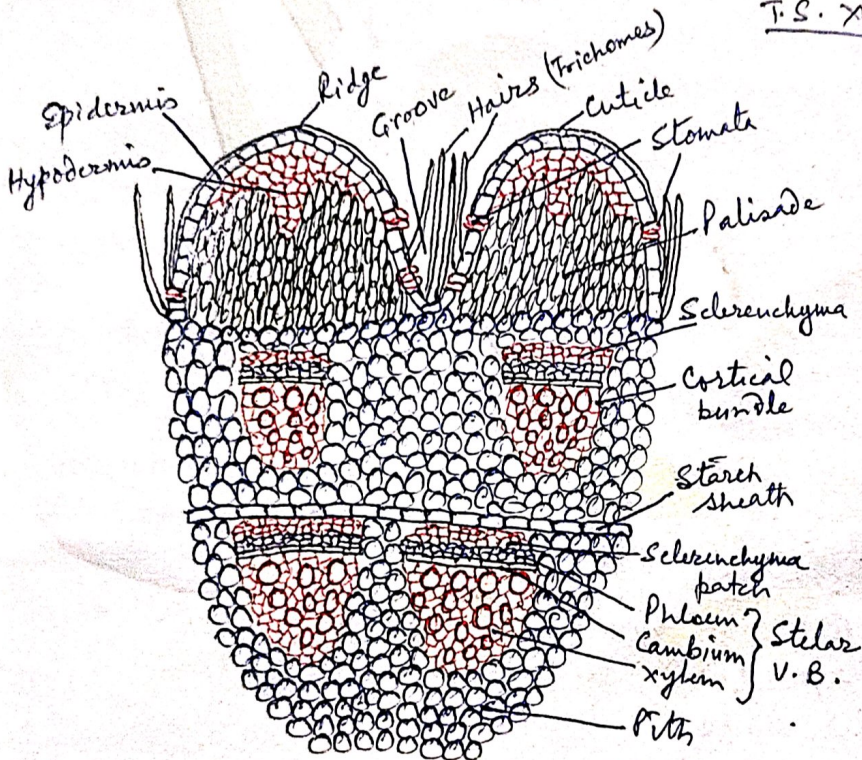
1. In general the xerophytic stems have thick cuticle and vascular system is ill-developed (in succulents) ^{or} well developed (in non-succulents).
2. Hypodermis is cutinised to lignified in most of the cases. In many plants mucilage, gum, tannins are commonly found in hypodermis. Laticiferous canals are present in Calotropis, Euphorbia etc.
3. In Capparis decidua palisade tissue is present in stem.
4. In woody xerophytes, there is prominent bark development.
5. The conducting tracts are prominent, the vessels being larger and longer. Lignification is also prominent. Bast fibres and other mechanical elements reach their highest development in xerophytes.
6. In succulents like Opuntia the stem has : -
 - a/ Thick epidermis with thick cuticle over it.
 - b/ Below epidermis is a 2-3 layered collenchymatous hypodermis
 - c/ Next to this is chlorenchymatous cortex
 - d/ Next to this is water storage tissue which consists of thin walled cells with few small intercellular spaces.
 - e/ Cells of this layer are highly vacuolated and contain mucilage.



Rolling leaf of Ammophila



T.S. Xerophytic stem of Capparis decidua



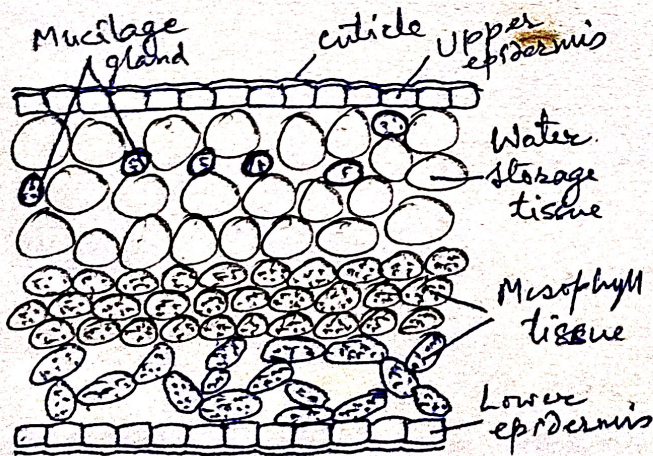
T.S. stem (a sector) of Casuarina

7. Stems of most of the non-succulents such as in Casuarina have :-
- Thick cuticle.
 - Stems are ridged and grooved. Grooves have sunken stomata and trichomes.
 - Epidermis with heavily thickened walls.
 - Hypodermis is sclerenchymatous & there is thick layer below ridges.
 - Below the hypodermis, palisade layer is found
 - The cortex has vascular bundles with sclerenchymatous patch over the phloem

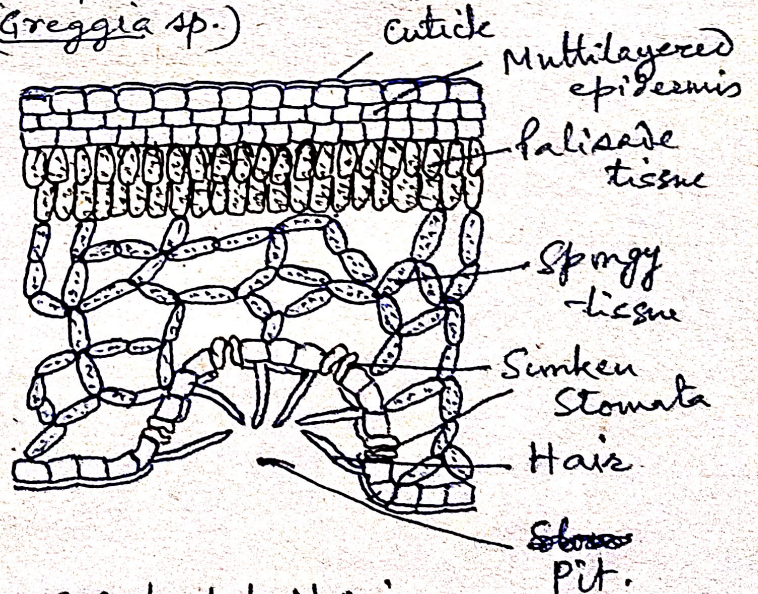
- g) Stellar vascular bundles are also of same nature. vascular bundles are well developed with much lignification.
- h) Mechanical tissues are well developed. Well developed bark is also formed.
- i) oils and resins are often present.

Leaves

1. In general the xerophytic leaves have thick cuticle, sclerenchymatous hypodermis, but sometimes epidermis is also lignified (Banksia & other grasses) or the lignification may go even to palisade (cycas).
2. In succulents the important adaptation is presence of water storage tissue.
3. Example of succulents are Agave, Yucca, Bryophyllum, Aloe, Peperomia Sabota sp. etc. While non-succulents are many times more to succulents. The important ones are Pinus, Casuarina, Calotropis, Nerium, ~~Hakea~~ Banksia etc.
4. Thick layer of wax is found in Salix glaucophylla.
5. In Ficus elastica and Nerium, the epidermis is multilayered.
6. Stomata are found either in pits (Nerium) or it may be sunken (Pinus, Agave, Hakea) or their number is reduced.
7. Several layer thick sclerenchymatous hypodermis is found in Pinus.
8. Mesophyll well differentiated into palisade and spongy tissue. Sometime palisade is more developed (Greggia sp.)



c.s. Leaf of Peperomia



c.s. Leaf of Nerium