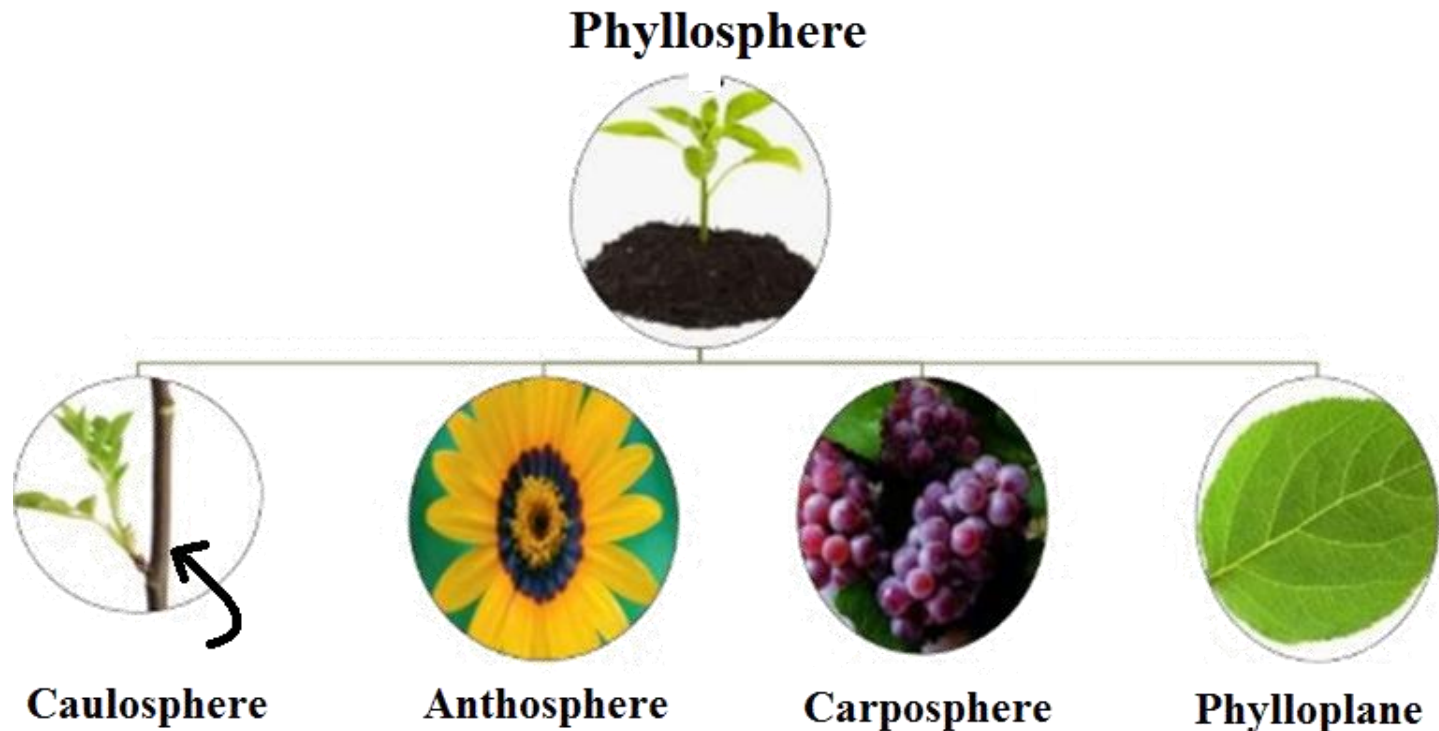


Phyllosphere

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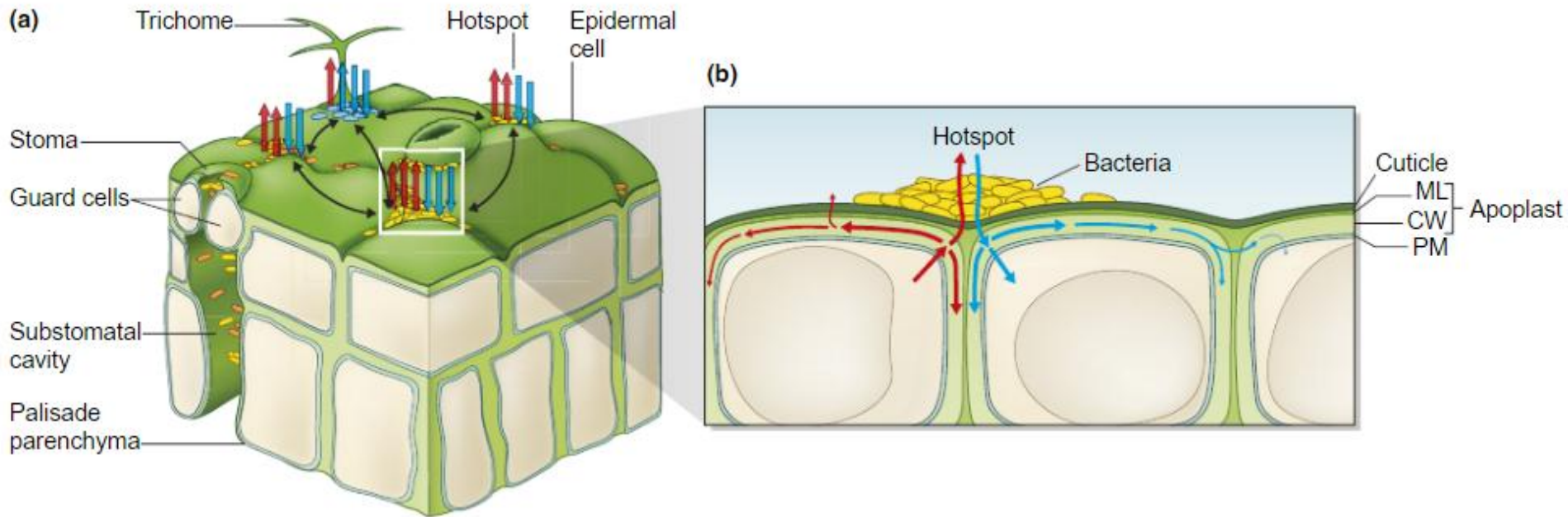
Phyllosphere

- The term phyllosphere was coined by 'Ruinen' in 1956.
- The phyllosphere is the aerial region of the plant colonized by microbes; its colonists are often called epiphytes.



Microbial communities of phyllosphere

- Fungi, algae, protozoa, and nematodes inhabit the leaf and stem surfaces, but the most abundant epiphytes are bacteria (averaging 10^6 – 10^7 cells cm^{-2}).
- The phyllosphere is considered to be a hostile environment due to rapid changes in temperature and humidity, limited nutrients, and solar irradiation.
- Yet, phyllosphere commensals have adapted to cope with these conditions:
 - [epiphytic bacteria](#) are pigmented to prevent ultraviolet (UV) damage
 - Specific DNA repair mechanism present
 - Up regulation of stress response proteins (eg. Pha A)
 - Production of extracellular polysaccharides.
 - [microbial communities](#) preferentially develop along veins, and around trichomes and stomata, where nutrients leak from the plant surface.



(a) Interaction hotspots on the leaf surface.

(b) Model of diffusion pathways and formation of interaction hotspots.

ML = middle lamella; CW = cell wall; PM = plasma membrane.

... Microbial communities of phyllosphere

- Leaf exudates contains amino acids, glucose, fructose and sucrose that provides nutrition for growth of phyllospheric microorganisms.
- Moisture released during transpiration provides water for growth of microorganisms on leaf.
- Plants usually support growth and activities of phyllospheric microorganisms. However sometimes plant produce phytoalexins that kills many phyllospheric microorganisms.
- Epiphytic bacterial populations differ sharply in size among and within plants of the same species, as well as in close proximity, and over short time scales as well as over the growing season.
- The surface of leaf contains large number of bacteria, fungi, actinomycetes and algae as given below;
 - **Bacteria:** *Beijerinckia, Erwinia, Azotobacter, pseudomonas, Pseudobacterium, Phytomonas, Serratia etc*
 - **Blue green algae:** *Anabaena, Calothrix, Nostoc, Scytonema, Tolypothrix*
 - **Fungi:** *Alternaria, Cladosporium, Cercospora, Penicillium, Saccharomyces,*
 - **Actinomycetes:** *Streptomyces*

Role of phyllospheric microorganisms

- Some phyllospheric microorganisms such as **Cyanobacteria** and ***Azotobacter*** fix atmospheric Nitrogen and provide it to plant growth.
- Phyllospheric microorganisms produce various plant growth hormones such as indole acetic acid (IAA), which is used by plant for their growth.
- Phyllospheric microorganisms provide stimulus for production of phytoalexin by plants. Phytoalexin is the defensive chemical produced by plants that kill pathogenic as well as other microbes.
- Phyllospheric microorganisms decompose leaf and help in formation of humus after falling of leaves from plant.
- Some phyllospheric organisms have antagonistic effects against fungal pathogen and hence protect the plants from fungal diseases.
- The phyllospheric microorganisms colonize the surface of leaf forming a layer. Therefore these organisms compete with pathogenic microorganisms for habitat and nutrients.
- Some phyllospheric microorganisms degrade wax and cuticle of leaf and damage it.

Questions

- What is phyllosphere? Discuss in detail the microbial composition and functions in phyllosphere.
- Write short note on:
 - Phyllosphere
 - Role of phyllosphere microorganisms