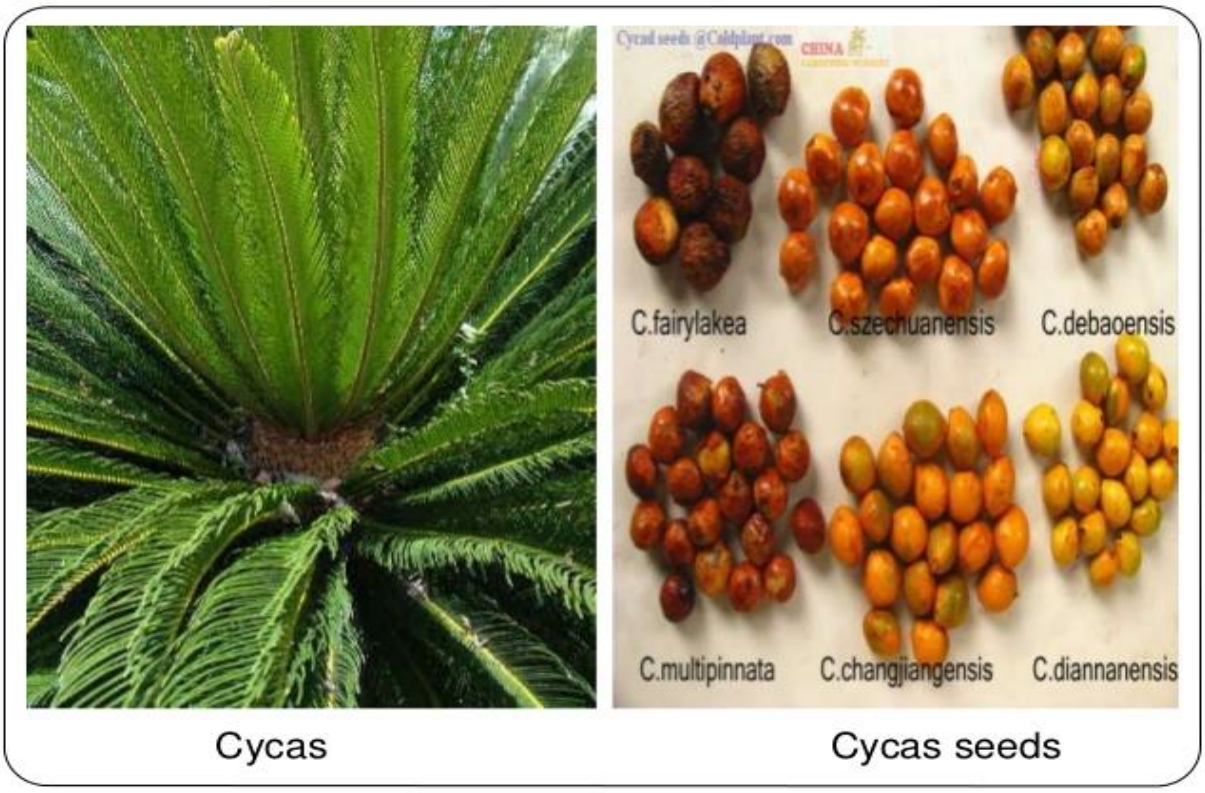
Gymnosperms

Gymnosperms are primitive seed producing plants of spermatophytes (Phanerogams). The term gymnosperms are derived from two Greek words, gymnos = naked; sperma = seed was introduced by Theophrastus in 300 BC to describe plants with unprotected seeds. According to Goebal, gymnosperms are phanerogams without ovary.

The phanerogams or Spermatophyta (sperm = seed; phyton = plant) or seed plants are those plants which reproduce by means of seeds, not spores. Gymnosperms are the vascular plants where seeds are not enclosed within an ovary (opposite to an angiosperm or flowering plants where seeds are enclosed by mature ovaries or fruits). The ovules of the gymnosperms are borne directly on the surface of the megasporophylls.

Naked Seeds of Gymnosperms



General Characteristics of Gymnosperms

Distribution:

- Gymnosperms are a small primitive group of seed plants consisting of 83 genera and 1080 species.
- Distribution-Temperate and Tropical regions
- Gymnosperms originated in the paleozoic era (541-252 million years ago)
- They were the dominant plants of Jurassic and Cretaceous periods of the Mesozoic era.
- Most of the primitive gymnosperms were extinct
- Extinct Gymnosperm examples are Cycadofilicales, Bennettitales, Cordaites

Fig. Fossils of Gymnosperms

- Some examples of gymnosperms are *Cycas*, *Pinus*, *Zamia*, *Podocarpus*, *Taxus*, *Gingkgo*, *Cedrus*, *Araucaria*, *Ephedra*, *Welwitscia*. etc.

Pinus

Cycas

Zamia

Thuja

Podocarpus

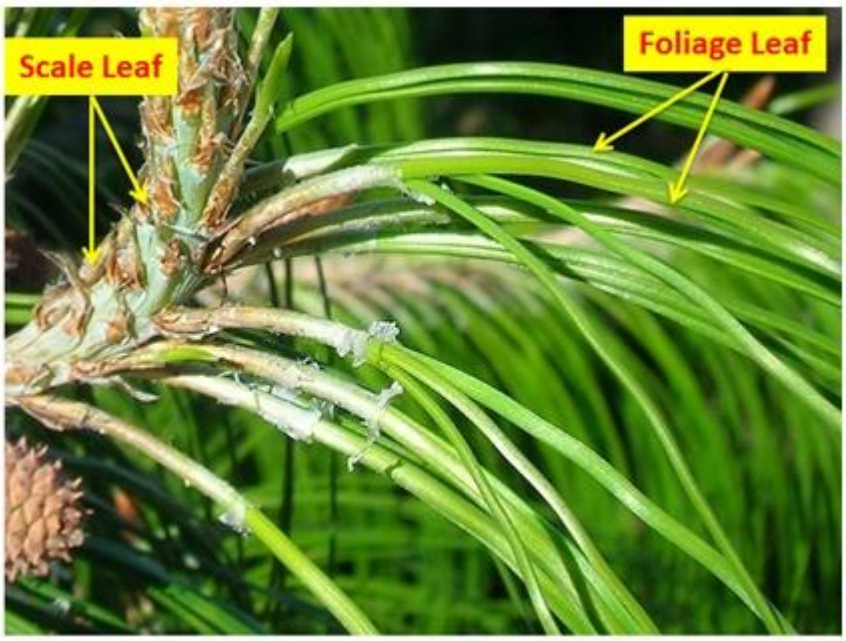
Ginkgo biloba

Araucaria

Pinus

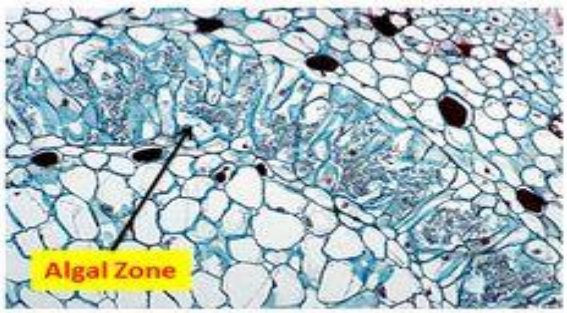
Morphological Characteristics:

- The plant body is sporophytic (diploid) in nature. It is represented by perennial, evergreen and woody plants. Most of them are trees, some of them are herbs and there is no herbs in Gymnosperms
- The plant is differentiated into roots, stem and leaves
- Leaves are usually dimorphic (two types of leaves in the same plant).
    - **i)** **Foliage leaves-** The foliage leaves are green, simple, needle shaped and pinnately compound
    - **ii)** **Scale leaves-** Scale leaves are minute and deciduous



Foliage Leaves and Scale Leaves in *Pinus*

- They produces cones, do not bear fruits.
- They shows xerophytic characters
- They have monopodial growth represented by one main axis. As the main axis grows taller, it increases in diameter due to secondary growth
- The stem is usually erect, branched and woody. Stem is usually unbranched in C*ycas* and it is underground in *Zamia*.
- The stem shows two types of branching-
    - i) Long shoots or branches of unlimited growth
    - ii) Dwarf shoots or branches of limited growth
- The root shows symbiotic association with fungi (Mycorrhizal association with *Pinus* root) or cyanobacteria
- Algae (Nostoc) inhabited in the coralloid roots of cycas helps in nitrogen fixation



Algal Zone in the Coralloid Roots of *Cycas*

- Cycas shows circinate vernation (Young leaves curved inwards). This is the strong evidence for the pteridophytic origin of gymnosperms. Cycas act as the connecting link between Pteridophyte and Gymnosperms.