

## 2.1. Characteristics of Gymnosperms

Following are the important characteristics of gymnosperms:

1. They do not produce flowers.
2. Seeds are not formed inside a fruit. They are naked.
3. They are found in colder regions where snowfall occurs.
4. They develop needle-like leaves.
5. They are perennial or woody, forming trees or bushes.
6. They are not differentiated into ovary, style and stigma.
7. Since stigma is absent, they are pollinated directly by the wind.
8. Two gametes are produced by the male gametophytes but only one of them is functional.
9. They form cones with reproductive structures.
10. The seeds contain endosperm that stores food for the growth and development of the plant.
11. These plants have vascular tissues which help in transportation of nutrients and water.
12. Xylem does not have vessels, and the phloem has no companion cells and sieve tubes.

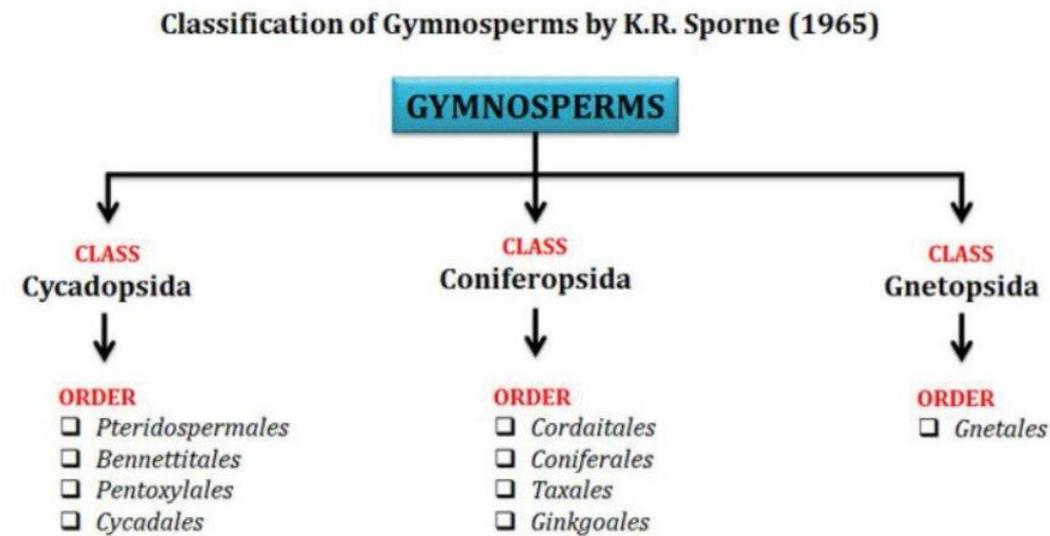
### General Characteristics *Pinus*

#### Salient Features

- They are evergreen, perennial lofty trees with spirally growing branches which give pyramidal or conical appearance.
- The body is divided into stem, roots and needle-like leaves.
- The stem is erect and cylindrical and is covered with bark.
- There are two types of branches: the long shoot of unlimited growth and dwarf shoot of limited growth.
- The long shoot bears apical bud and grows indefinitely with many scaly leaves.
- Dwarf shoot does not contain any apical bud and they arise on the long shoot in the axil of scaly leaves.
- Each dwarf shoot bear two scaly leaves which is also known as prophylls.
- Leaves are dimorphic: the long green needle shaped foliage leaves and small, brown, membranous scale leaves.

- Scale leaves are thin and brownish in color which is developed only on long as well as dwarf shoots while the foliage leaves are large, needle-like and found only at the apex of the dwarf shoots.
- The pine bears tap root system with insufficient hairs but it disappears soon. Many lateral roots also develop which play an important role to absorb the mineral containing water.
- The branch roots are infested with mycorrhizal fungus and hence it is called the mycorrhizal root.
- They have endarch vascular bundles. Individual vascular bundles are separated by means of medullary rays.
- The anatomy of leaves shows xerophytic structure: thick cuticularised epidermis with sunken stomata and sclerenchymatous hypodermis.
- Resin ducts are present in the mesophyll tissue and the cells of the mesophyll have ridges on the walls which project inside the cell cavities.
- Microsporophylls are arranged spirally on the central axis and forms male cone.
- Megasporophyll of the female cone is composed of large ovuliferous scale and lower smaller bract scale, which are the free from each other.
- Each ovuliferous scale bears two anatropous ovules or megasporangia.
- The pollen grains are winged.
- During the development of male gametophyte, two prothelial cells are formed which later on degenerates. Besides these, 2-3 archaegonia are formed with a neck of eight cells.

## 2.2. Classification (Sporne)



K.R. Sporne in 1962 classified the whole gymnosperms into three classes and they are again divided into orders.

### i. Cycadopsida

- Orders: Pteridospermales, Bennettiales, Pentoxylales, Cycadales Primitive group, represented by small plants.
- Wood is manoxylic Male cones are large with compactly arranged microsporophylls
- Megasporophylls are loosely arranged does not form a cone.
- Seeds are radially symmetrical
- Examples: *Cycas*, *Zamia*



## ii. Coniferopsida

- Orders: Cordaitales, Coniferales, Ginkgoales and Taxales
- Includes larger dominant gymnosperms.
- Wood is pycnoxylic
- Sporophylls form cones.
- Seeds are bilaterally symmetrical.
- Examples: *Pinus*, *Taxus*, *Ginko*



## iii. Gnetopsida

- Orders: Gnetales
- Includes advanced gymnosperms.
- Secondary xylem shows vessels.
- Ovules are orthotropous with long tubular micropyle.
- Examples: *Gnetum*, *Ephedra*, *Welwitschia*



*Lavish*