

GYMNOSPERMS -GENERAL CHARACTERISTICS

- ❖ Some seeds are enclosed in a pod, some in a husk, some in a vessel, and some are completely naked- **Theophrastus**.
- ❖ **Goebel**- phanerogams without ovary.
- ❖ The term gymnosperm was given by **Theophrastus** in his book “**Enquiry into Plants**”(300 BC).
- ❖ It is derived from two Greek words, “**Gymnos**” means Naked and “**Sperma**” means **Seeds**.
- ❖ Gymnosperms and angiosperms are two groups of seed plants(Spermatophyta).
- ❖ Gymnosperms shows two distinct lines, namely ;



1. Cycadophytes

- Palm like tree habit.
- Unbranched stem.
- Long and large compound leaves.



2. Coniferophytes

- one shaped plant body.
- Tall and profusely branched stem.
- Acicular leaves.



- ❖ Of the living and fossil gymnosperms, Cycadales and Ginkgoales are very ancient.
- ❖ for this reason and with some other primitive characters, these members are called “**living fossils**”.
- ❖ Tallest tree known to plant kingdom belongs to gymnosperms- the Red wood plant or **Californian sequoia** (*Sequoia sempervirens*).
- ❖ Smallest gymnosperm is a cycad, *Zamia pygmaea* .
 - ❖ Longest living - *Pinus aristata*.



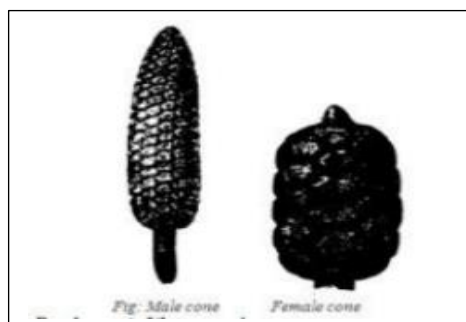
GENERAL CHARACTERISTIC

- ❖ Gymnosperms are middle sized trees (*Cycas*) to tall trees (*Pinus*) and shrubs (*Ephedra*).
- ❖ They are rarely woody climbers (*Gnetum montanum*).
- ❖ Herbs are not present in the gymnosperms.
- ❖ The most massive (thick) and among the oldest, is *Sequoiadendron giganteum* popularly known as **Redwood tree** or **Father of forest**.
- ❖ Usually tap root system is present but in some forms **symbiotic relationship** is found between roots and algae in **coralloid roots** of *Cycas* and between roots and fungi in **mycorrhizal roots** of *Pinus*.
- ❖ The stems are aerial, erect, branched (unbranched in *Cycas* and *Zamia*) and woody.
- ❖ In *Pinus* branches are of two types i.e. **dimorphism**

1. Long shoots or branches of unlimited growth.
 2. Dwarf shoots or branches of limited growth.
- ❖ Plants may possess one kind of leaves i.e. **monomorphic** or two kinds of leaves i.e. **dimorphic**.
 - a. Foliage leaves (evergreen simple or compound).
 - b. Scale leaves (minute and deciduous).
 - ❖ Internal features of roots are like to dicotyledons.
 - ❖ Vascular cylinder in roots is **diarch** to **polyarch**.
 - ❖ Xylem is **exarch** and roots show secondary growth.
 - ❖ Vascular bundles of stems are **collateral, endarch, open** and are arranged in a ring.
 - ❖ Secondary growth is also present.
 - ❖ Secondary wood may be **manoxylic** (well developed pith and cortex) or **pycnoxylic** (much reduced pith and cortex).
 - ❖ In cycads (*Cycas*) manoxylic wood is present while in others (*Pinus, Taxus*) it is pycnoxylic.
 - ❖ Xylem lacks vessels and phloem lacks companion cells.
 - ❖ Secondary vasculature may be monoxylic (single layer of cambium) or polyxylic (several successive layers of cambium).
 - ❖ **Stomata are present in deep cavities.**
 - ❖ **Mesarch xylem** and **transfusion tissues** are present.

REPRODUCTION

- ❖ Vegetative reproduction is altogether absent in gymnosperms except in *Cycas*.
- ❖ *Cycas* do propagate through **bulbils**.
- ❖ Sexual reproduction is advanced- **oogamous type**.
- ❖ Plants are heterosporous- **microspores** and **megaspores**.
- ❖ Both **monoecious** and **dioecious** types of plants are found in gymnosperms.
- ❖ In most of the gymnosperms, reproductive organs are arranged in the form of compact cones called as **strobili**.
- ❖ Male cones are **microsporangiate** and female cones are called as **megasporangiate**.
- ❖ Male cones are short lived and smaller than female cones (except in *Cycas*).
- ❖ Female cones are long lived.



❖ **Microsporangia**

- are borne on the lower surface of microsporophylls.

ENTRI

- They may be numerous and grouped in **sori** (*Cycas*) or reduced to two (*Pinus*).

❖ **Megasporangia**

- or ovules.
- are **naked** and are borne on the upper surface of megasporophylls.

❖ **Ovules**

- are covered by a **single integument**.
- which is differentiated into **fleshy outer sarcotesta**, **stony middle sclerotesta** and **fleshy inner sarcotesta**.

❖ **Embryo** gets differentiated into **suspensor**, **radical**, **hypocotyl**, **plumule** and **cotyledons**.

❖ **Polyembryony** (development of several embryos in one seed, out of which only one survives) is of common occurrence in *Pinus*.

❖ The zygote is **meroblastic** i.e. only basal part develops into an embryo, whereas upper and middle parts do not participate in embryo formation.

❖ **Endosperm** develops before fertilization and is **haploid**.

❖ The number of cotyledons may be one or two or whorl of many.

❖ Seeds of all gymnosperms except those of *Cycas* and *Ginkgo* undergo a **resting period**.

❖ The germination of the seed is **epigeal** (cotyledons come above ground).

❖ The **alternation of generation is heterologous**.

❖ Gametophytic generation (n) is reduced and dependent upon the sporophytic generation.

❖ Sporophytic generation (2n) is dominant and independent.

LIFE CYCLE OF GYMNOSPERMS

