

# **Subject- Botany**

**Credit – II**

**Chap 4- Gymnosperms**

**Paper I- Plant Life and Utilization II**

**Term II, Sem – II**

**A Y 2020-21**

**By**

**Dr Shilpa M Jagtap**

# Chap 4- Gymnosperms

## Learning Objectives

- .4.1 Introduction
- .4.2 General Characters
- .4.3 Classification of Gymnosperms
- .4.4 Life cycle of Cycas
  - . 4.4.1 Root
  - . 4.4.2 Stem
  - . 4.4.3 Leaf
  - . 4.4.4 Reproduction
- .4.5 Economic Importance

## 4.1 Introduction

•Gymnosperms (gymnos = naked; spermos = seed) represent a primitive group of seed-bearing plants (spermatophytes) in which the seeds are naked (i.e., without the covering of a fruit wall) . This is because in gymnosperms, a closed carpel (ovary) is not formed. The ovules are directly borne on open carpellary leaves (megasporophylls) and hence they are "naked". These develop into naked seeds after fertilization. The term 'gymnosperms' was first used by Theophrastus in 300 B.C. in his book, Enquiry into Plants.

•Gymnosperms were most abundant and widely distributed during the mesozoic era. However, they form only a small part of the present day vegetation. There are about 70 genera and 725 species of gymnosperms distributed in tropical and temperate regions. Most of these are the conifers, which are comparatively better-represented today. Others include the cycads and the Ginkgo tree. On the Indian sub-continent, these are found in the form of the coniferous forests in the Himalayas.

## 4.2 General Characters

- The life cycle shows heteromorphic alternation of generations.
- Gymnosperm plants are more advanced than pteridophytes but are more primitive than angiosperms.
- A diploid plant body (sporophyte) is mostly a tree with well developed roots, stem and leaves.
- Two types of reproductive leaves are present: microsporophylls that produce microspores and megasporophylls that produce megaspores.
- The gametophytes are greatly reduced, microscopic and dependent on sporophyte plant body.
- The ovules as well as the seeds are naked.
- The reproductive organs are usually grouped into compact cones or strobili (exception-female reproductive organs in *Cycas*).
- Pollination is mostly anemophilous (by wind).
- The endosperm (representing the female gametophyte) is a pre-fertilization tissue and is haploid.
- Archeogonia are highly reduced and simple.
- Vessels are absent from xylem.

## 4.3 Classification of Gymnosperms

•Sporne classified gymnosperms into 3 classes, 9 orders and 31 families. The classes include i) Cycadopsida ii) Coniferopsida iii) Gnetopsida.

<b>GYMNOSPERMS</b>		
<b>Class-I</b>	<b>Class-II</b>	<b>Class-III</b>
<b>Cycadopsida</b>	<b>Coniferopsida</b>	<b>Gnetopsida</b>
<b>Orders:</b> 1. Pteridosper- males 2. Bennettiales 3. Pentoxylales 4. Cycadales	<b>Orders:</b> 1. Cordaitales 2. Coniferales 3. Taxales 4. Ginkgoales	<b>Order:</b> 1. Gnetales

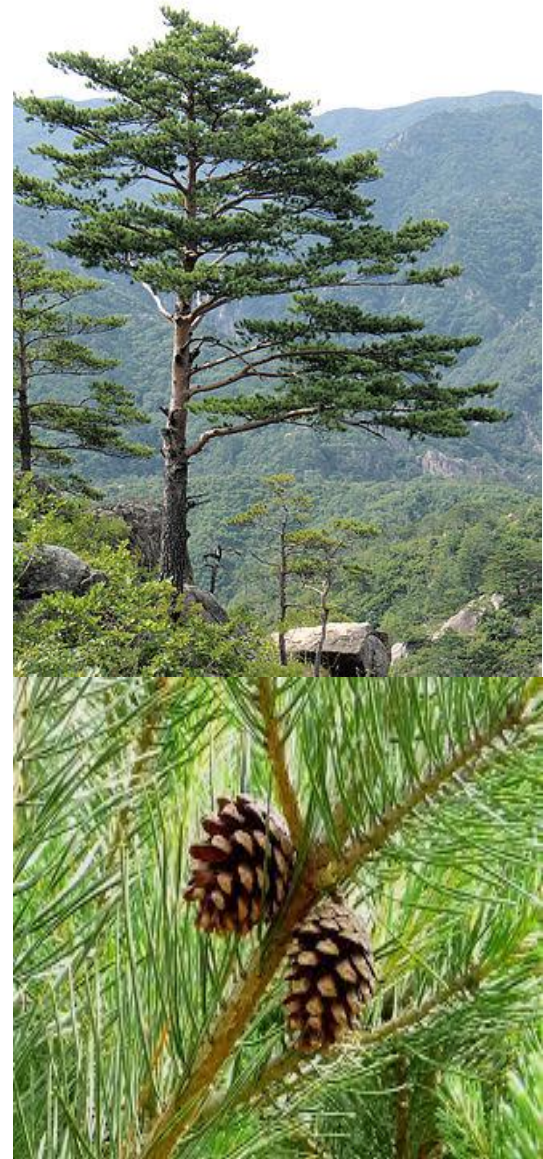
# General Characters of Main classes:

- Class I – Cycadopsida
- Plants are palm-like or fern-like.
- Compound, frond-like pinnate leaves.
- Manoxylic wood.
- Sperms are motile.
- Flower like structures are absent.
- Strobili are simple.
- Example: Cycas, Zamia.



## .Class II – Coniferopsida

- . Tall trees with simple leaves of varied shape.
- . Wood is pycnoxylic.
- . Cone like strobili are present.
- . Motile sperms are absent (except *Ginkgo biloba*).
- . Example: *Pinus*.



### .Class III – Gnetopsida

- . Shrubs, trees and lianas.
- . Leaves are elliptical or strap-shaped, simple, opposite or whorled.
- . Motile sperms are absent.
- . Wood contains vessels.
- . Strobili is called as inflorescence.
- . Flower like structure with perianth is present.
- . Example: Gnetum, Ephedra.





## 4.4 Life cycle of Cycas

.Cycas is among the simplest of living gymnosperms. There are about twenty species of Cycas in the world. *Cycas revoluta* and *Cycas circinalis* are two of them.

.Habit: Cycas is a slow growing small tree, about 3-6 meters in height. It grows under xerophytic conditions.

.Habitat:

.Distribution:

## External morphology

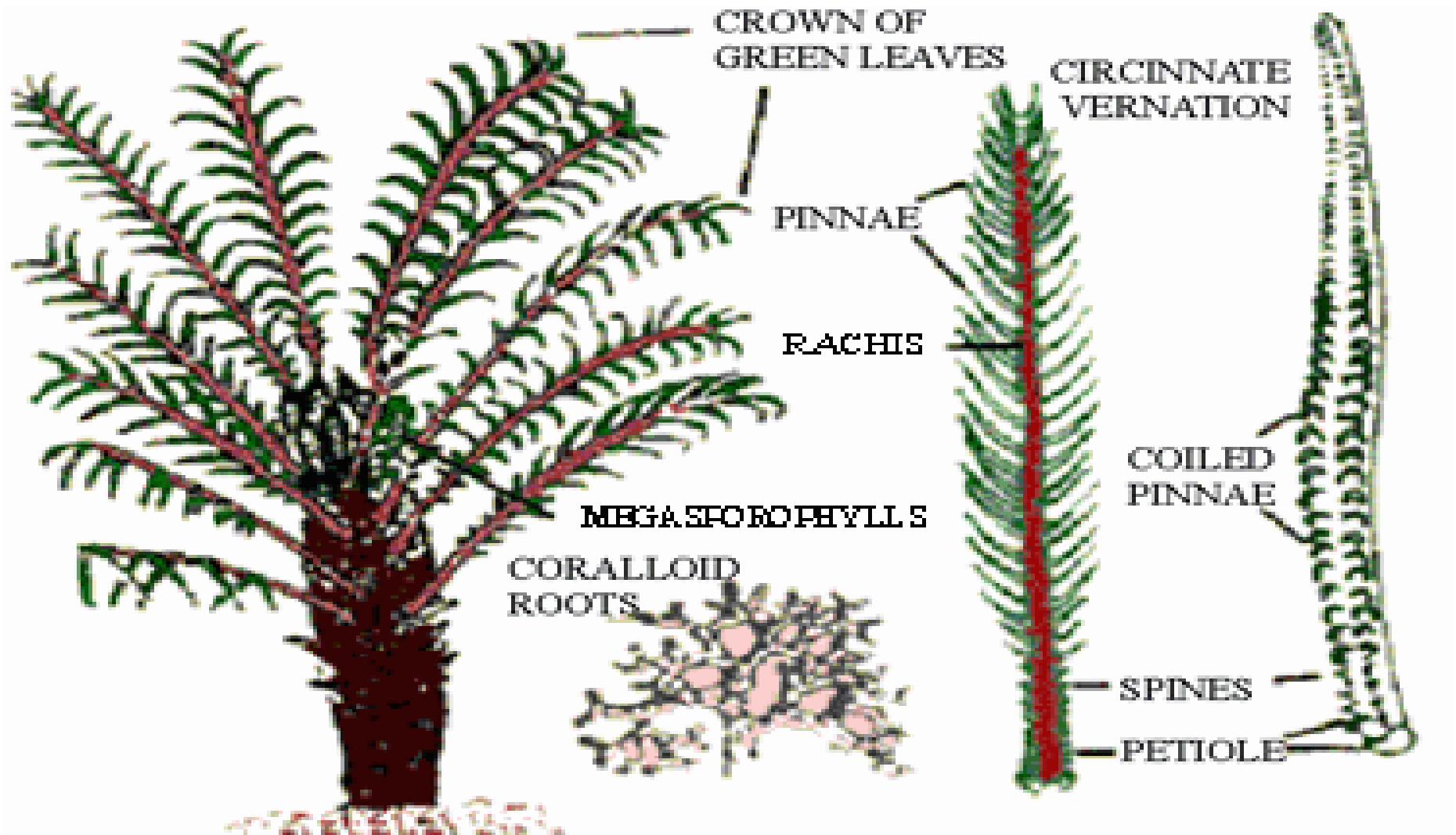
•Cycas is a slow growing small tree, about 3-6 meters in height. It grows under xerophytic conditions. The plant body is a diploid sporophyte and resembles a small palm tree. It has a tap root system, columnar stem and a dense crown of green leaves.

•The stem is thick, cylindrical and column-like. It is usually unbranched and has a growing apex (apical bud). The stem surface is covered with a thick, protective armor of the bases of fallen leaves.

•Cycas has dimorphic leaves, (i.e., two types of leaves): scale leaves and green leaves. Both develop spirally around the stem apex. The spirals of scale leaves alternate with those of green leaves. The scale leaves are small and non-green.

•The green photosynthetic leaves are between 1-3 meters long and unipinnately compound . They form a crown around the stem apex. Young leaves show circinnate venation (similar to ferns). Each green leaf has a strong petiole and a main rachis with two rows of numerous leaflets (pinnae). Each pinna is long, linear and lanceolate with an entire margin. It has a distinct midrib but lateral veins are absent. Some of the basal leaflets are reduced to spines.

(A) Habit (B) Coralloid roots (C) Green leaf (D) Young Green leaf



•The tap root (primary root) is very thick and bears secondary roots. Some of the secondary roots are negatively geotropic. These grow upwards to the soil surface and form a special type of root called coralloid roots. These roots form clusters due to repeated irregular branching.

•Coralloid roots (also called root tubercles) are enlarged, roughly cylindrical and without root-hairs. They have an algal zone in the region of the middle cortex. Nitrogen-fixing blue-green alga (*Anabaena*) is present in the intercellular spaces of the algal zone. The alga provides nitrogen compounds to *Cycas* and in return, it gets space, shelter, water and nutrients from *Cycas*. Thus, the association is symbiotic.



Figure 2.39: *Cycas* Habit

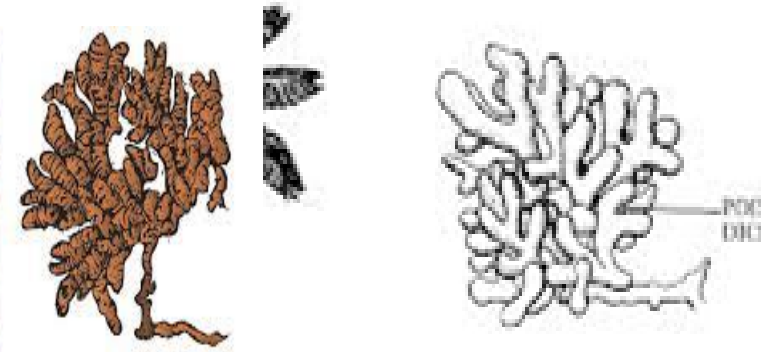
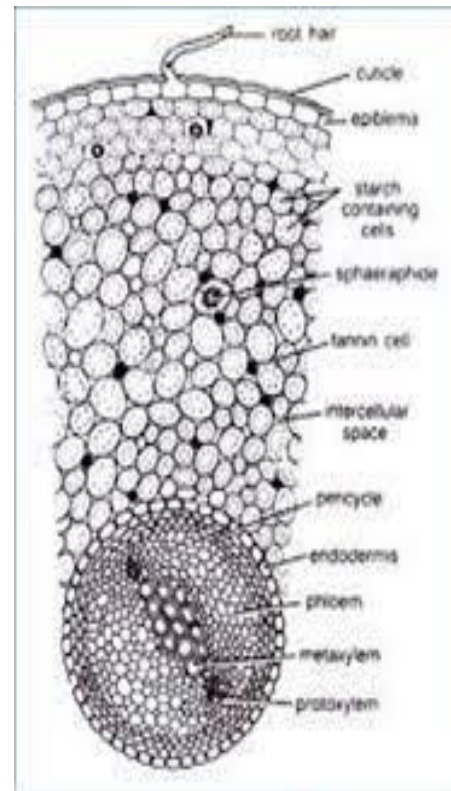


Figure 2.40: Coralloid root



T.S. Normal Root

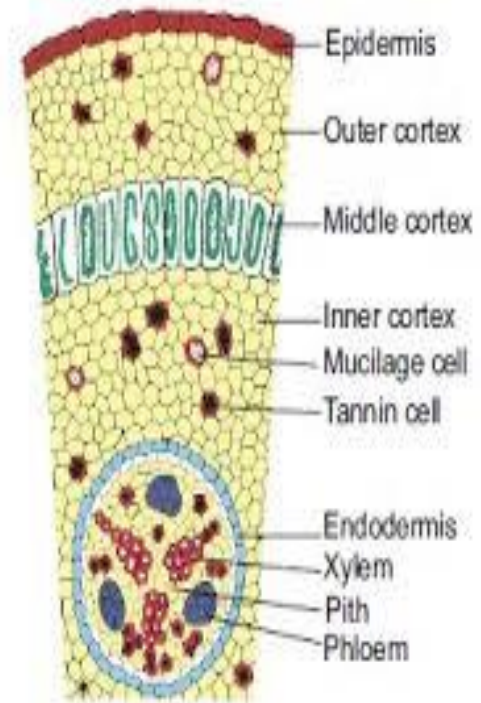


Figure 2.41: T.S. of Coralloid root

## Reference

• [https://www.brainkart.com/article/Classification-of-Gymnosperms\\_32885/](https://www.brainkart.com/article/Classification-of-Gymnosperms_32885/)

• <http://pinkmonkey.com/studyguides/subjects/biology-edited/chap15/b1515202.asp>