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NAAC ACCREDITED 'A' GRADE



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DIAGNOSTIC CHARACTERS OF DIFFERENT DIVISIONS OF GYMNOSPERMS

Characteristics of Cycadophyta

The Cycads are an ancient phylum, surviving through the age of the dinosaurs to modern times. Today, the cycads are divided into 3 families, 11 genera and 250 species. There is a great deal of variation within the phylum, but a few unique characteristics hold them together and differentiate them from other seed-bearing plants.

- All cycads are **typical xerophytes** grow on tropical and subtropical habitats
- The plants are low and palm-like in habit.
- They have **pachycaul stem** .It is short, un-branched, columnar and **covered with dense persistent leaf bases.**
- The **leaves** are pinnately compound and **arranged in a terminal crown.**
- **Coralloid roots:** These secondary roots are found on all Cycads. They form masses of lightly colored, club shaped structures, at or near the surface of the soil. Usually containing cyanobacteria, they are **important in nitrogen fixation.**
- They **lack axillary buds.**
- The plants grow very slowly but they live for ages.

- **Girdling Leaf Traces** : Also found in some ferns, these leaf traces arise from the stele at a point opposite the point of leaf attachment and encircle the stem.
- Comparatively the pith is large and cortex is broad.
- There is a **narrow zone of conducting tissue** whereas in conifers the case is reverse. The conducting strand is represented by **conjoint, collateral, endarch and open vascular bundles** around the pith separated from each other by medullary rays.
- The cycads are **strictly dioecious**, i.e., **micro and megasporophylls** develop **on separate plants**. Except the female strobilus of *Cycas* the sporophylls are arranged in definite cones.
- Male cones can be singular, but more often there are two or more per plant. The microsporophylls are bladelike and the microsporangia are borne on their lower surfaces. The **microsporangia are arranged radially in sori**.
- **Male gametes are motile**.
- Female cones are usually singular, only one per plant, though there are a few exceptions.
- There are typically **two ovules per megasporophyll** which are attached to the inner part of the sporophyll end, or shield. The ovules are straight and usually sessile.

- The **pollen chamber is found** for receiving the pollen.
- Wind was previously thought to be the major pollination mechanism for cycads. That idea has now been replaced with **insect pollination, typically weevils and other small insects.**
- A mature cone splits open and dehisces its seeds.

Examples of some genera belonging to this division are as follows: Zamia, Microcycas, Dioon, Ceratozamia, Cycas, Macrozamia, Bowenia, Encephalartos

Characteristics of Coniferophyta

1. Mostly evergreen with branched stems, rarely shrubs.
2. The **leaves are needle or scale-like**, sometimes flattened, rarely falling in autumn, spirally arranged or whorled, entirely. The leaves possess xerophytic characters, ie. **sunken stomata** .
3. **Wood without vessels** consisting of long tracheids which show bordered pits. **Resin canals present frequently.**
4. **The flowers are monoecious or dioecious**, e.g., *Juniperus*, *Podocarpus*, Taxaceae, etc. The **female flowers** are terminal or lateral and then **surrounded by** supporting **bracts**.

5. The **male flowers consist of** a number of **stamens** arranged in strobili. The stamens are usually many, each with **2 to 20 pollen sacs**, connective often produced as an appendage. Pollen are small structures that contain male gametes.

6. **Pollen grains may be winged**, e.g., *Pinus*.

7. The **female flowers are arranged in cones or catkins** with the exception of Taxaceae, Cephalotaxaceae and Podocarpaceae.

8. Each **female flower consists of a bract (sterile) and a scale** (fertile). The scale is found above the bract. The ovules develop on the upper surface of **ovuliferous scales**. **Ovules contain female gametes** and develop into a seed after fertilization has occurred.

9. The female cone ripens in 1-3 years and is usually dry on ripening.

10. The seeds are often winged, nut-like and with a leathery or woody testa.

11. The cotyledons are epigeal and 2-16 in number.

12. **Polyembryony is quite common.**

13. They **produce non-motile sperms at the time of fertilization.**

Examples of some genera belonging to this division are as follows: Pinus, Taxus, Cordaites etc.

Characteristics of Gnetophyta:

This subdivision consists of 3 living genera and approximately 70 species, some quite unusual and still very apparent today.

1. These are **woody plants**, of which some species are trees (*Gnetum gnemon*), many are lianes or shrubs and a few. are stumpy turnip-like (e.g. *Welwitschia mirabilis*).
2. Leaves are simple elliptical or strap-shaped or sometimes reduced to minute scales. They are generally opposite or whorled.
3. **Tracheids and Vessels** both are present in the secondary wood. Most flowering plants contain vessel elements, too, providing

evidence to some botanists that the Gnetophyta **might have been ancestral to angiosperms.**

4. 'Flowers' are unisexual, usually dioecious and only rarely monoecious as in some species of *Gnetum*.

5. 'Flowers' are **arranged in compound strobili or 'inflorescences'**.

6. The **male flowers are surrounded by a perianth.** Each **male flower contains an antherophore with one to eight synangia.**

7. **A single erect orthotropous ovule is present in each female flower.**

8. The nucellus of the ovule remains surrounded by two or three envelopes.

9. **The micropyle of each ovule remains projected in the form of a long bristle-like tube.** Gnetophyta's unique fertilization feature is that a tube grows from the eggs to unite with the pollen tubes in order for fertilization to take place between the gametophytes., like we see in the cycads and Ginkgo.

10. At the time of fertilization the pollen tube contains two male nuclei. The **sperm themselves are not motile.**

11. This is the only type of gymnosperm that undergoes **double fertilization**, however **no endosperm forms** and the 2nd egg fertilized disintegrates. Also like the angiosperms, some of the species produce nectar and are visited by insects.

12.. A unicellular primary suspensor is present in the embryo.

13. **Two cotyledons are present in the embryo.**

Examples of some genera belonging to this division are as follows: Gnetum, Ephedra, Welwitschia etc.