**Unit 5: Gymnosperms** **(18 lectures)**

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* , *Ginkgo* and *Gnetum* (Developmental details not to be included); Ecological andeconomic importance.

**Gymnosperms**

Gymnosperms (gymnos= naked, sperma=seed), with over 63 genera and about 722 living species. Gymnosperms includes all autophytic green plants having their exposed seeds on megasporophylls i.e. carpels. The systematic position lies in between pteridophyta and angiospermae.

**General characteristics features of Gymnosperms**

1. Plants are sporophytes, majority are tall woody, perennial and evergreen trees, rarely shrubs. Sporophytes are larger in size and independent, true roots, stems and leaves present. Plants are heterosporous producing male and female gametophyte.
2. Two types of leaves are present- one brown small scale leaves called microsporophylls and other green foliage leaves called megasporophylls.
3. At the time of pollination, pollen grains (microspores) are directly carried by wind to the micropyle of the ovule.
4. Gametophytes are much smaller but more conspicuous than those of angiosperms. The male gametophyte i.e. microgametophyte mostly consists of one or two prothalial cells, a tube nucleus, a stalk cell (except *Gnetum*) and two male gamete. The male gametophyte is a multicellular structure bearing one or more archegonia (except *Gnetum*).
5. Male gametes are either ciliated and motile as in *Cycas, Ginkgo* etc. or nonciliated and nonmotile as in *Pinus, Gnetum* etc.
6. Number of cotyledons varies from one to many.
7. True seeds are always present. Seeds are borne uncovered or naked.
8. Endosperm formation takes place within female gametophyte before fertilization.
9. Flowers are unisexual, simple, reduced and naked i.e. without perianth. Male and female flowers are represented by mico and mega sporophyll respectively. Mico and mega sporophylls are aggregated forming male and female cone or strobili respectively. Megasporophylls are simply leaf like structure.

**Comparative account of gymnosperms and pteridophytes**

|  |  |  |
| --- | --- | --- |
| Sl. no | Gymnosperms | Pteridophyte |
| 1 | True Roots | Advetitious root |
| 2 | Stems aerial | Stems are underground rhizome |
| 3 | Heterosporous producing micro and megaspores | Usually homosporous but in some cases heterosporous |
| 4 | Seeds are naked | No seeds |
| 5 | Secondary growth takes place | Secondary growth does not takes place |
| 6 | Pollen tube produced due to germination of pollen grains. | No formation of pollen tube due to germination of spores. |
| 7 | Megasporangium is protected by integument | Megasporangium is not protected by integument |
| 8 | Nack canal and neck canal cells are absent in archegonia except *Gnetum*. | Nack canal and neck canal cells are present in archegonia |

**Characters resembling gymnosperm and pteridophytes**

1. Plant body is differentiated into root stem and leaves, they exhibit heterosporous life cycle.
2. In vascular elements i.e. xylem and phloem- xylem is without trachae (except *Gnetum*, some species of *Selaginella* *Pteridium*) phloem is without companion cell.
3. Gametophytes are very reduced and developed within the spore wall, female gametophyte contain archegonia (except *Gnetum*)
4. Embryo development starts with free nuclear division of zygote-nucleus (except *Gnetum*)
5. In the life history, sporophytic and gametophytic generations alternate regularly with each other.
6. In some heterosporous pteridophytes one megaspore is present within the megasporangium, like gymnosperms
7. Have ciliated sperms (*Cycas* and *Ginkgo*).