**Classification**

Sahni (1920) has divided the gymnosperms into two groups, viz.

1. Phyllospermae (plants with leaf-borne seeds)-It includes 3 orders e.g. pteridospermae (Cycadofilicales), Cycadales and Bennettitales (Cycadeoidsles),
2. Stachyospermae (plants with stem borne seeds) – it includes 4 orders e.g. Cordaitales, Ginkgoales, Coniferales and Gnetales.

Pilger and Melchior in the 1954 edition of of Engler’s *Syllabus der Pflanzen familien* have classified Gymnosperms as follows



K. R. Sporne (1965) has also followed the classification of Pilger and Melchior

Cronquist, Takhtajan and Zimmermann (1966) have proposed a classification system in this system the subkingdom Embryophyta (embryo bearing plant) has been divided into eight divisions. All gymnospermous plants are grouped in the division *Pinophyta*.

Sub-kingdom Embryophyta

Division- Pinophyta (=Gymnospermae)

Subdivision A. Cycadicae (=Cycadophyta)

 Class1. Lyginopteridatae (=Cycadofilicales)

 ,, 2. Cycadatae (=Cycadales)

 ,, 2. Bennettittae (=Bennittitales)

Subdivision B. Pinicae (=Coniferophyta)

 Class1. Ginkgoatae (=Ginkgoales)

 ,, 2. Pinatae

Sub ,, i) Cordaitidae

Sub ,, ii) Pinidae (Coniferales)

Subdivision C. Gneticae (=Gnetales)

 Sub Class1. Ephedridae

 ,, 2. Welwitsciidae

 ,, 2. Gnetidae

C.J. chamberlain (1935), based on morphological and anatomical characters, classified gymnosperms into two main groups, such as-

I. Cycadophyta, II. Coniferophyta

I. Cycadophyta- Plants are comparatively smaller in size. Stem is unbranched , leaves are large and pinnate compound . stem in transverse section shows i) a large pith, ii) scanty and soft wood and iii) a thick cortex. Sporophylls are in simple cones.

Cycadophyta are again divided into three orders, viz.-

1. Cycadofilicales- All are extinct
2. Bennettitales- includes extinct members
3. Cycadales- Includes both extinct and living members, e.g. *Cycas*, *Zamia* etc.

II Coniferophyta- Plants are comparatively larger in size, stem is branched, leaves are simple. Stem in transverse section shows i) a small pith, ii) dense and massive wood and iii) a thin cortex. Microsporophylls are in simple cones while megasporophylls are in compound cones.

Coniferophyta includes 4 orders-

1. Cordaitales- All are extinct
2. Ginkgoales- Except one species all are extinct, the living one is *Ginkgo biloba*
3. Coniferales- This great order contains many extinct and living members e.g. *pinus, Thuja, Taxus* etc.
4. Gnetales- It includes mainly living genera such as *Gnetum* etc.

**Ecological importance of gymnosperm**

The gymnosperms are a group of plants that includes the conifers, cycads, gnetophytes, and ginkgo. Each one of them contributed to the economical and ecological values.Of the four gymnosperm groups, the conifers are by far the predominant group, dominating forest ecosystems over most of the temperate and boreal zones of the Earth as well as widespread within tropical mountains. Conifers differ from angiosperms in a variety of ways that have implications for their ecological roles; for instance, conifers rely on aromatic hydrocarbons to deter herbivory and disease, are wind pollinated, grow relatively slowly, and live to relatively great ages. Conifer wood is light and easily worked, so humans have exploited the group from the earliest times, and it remains economically important across a spectrum of economic systems and cultures; thus applied conifer ecology is broad field of study. Nonetheless, the conifers are also an emotionally significant group of plants, and people of many cultures seek to protect and restore these plants and their habitats.

The **Conifers**are the most familiar gymnosperms which include pines, spruces, firs, cedars, hemlocks, yews laches, cypresses, and others. The pine have tough and needlelike leaves. The leaves which have a thick cuticle and recessed stomata, represent a evolutionary adaptation for retarding water loss. They are important because many of trees grow in areas where the topsoil is frozen part of the year, making it hard for the roots to obtain water. And since conifers are almost trees, they create forests that provide habitat for wildlife. They are important economically because they provide wood and used it in making buildings, furniture and paper. And for ecological values the leaves of the conifers give them an advantage over broad-leafed tree in cold environment. Since the leaves of most conifers are evergreen, they can carry on photosynthesis on sunny winter days when most broad-leafed trees are leafless. They also have the advantage of not having to use the extra energy every year to produce a new crop of leaves in Spring.

The **Cycads**are slow-growing gymnosperms of tropical and subtropical regions. But even though they lived in that particular region they can cope up with dryness since their thick leaves lose little water. And when the leaves die, their stiff leaf bases remains. The **Gnetophytes**are the only gymnosperms with vessels in their xylem. They are use as folk medicines.

These plants are very useful in making furniture’s and for other construction purposes. They are the sources of food to animals and human. The strong roots of gymnosperm prevent from soil erosion. Gymnosperm plants are also scientifically important because they provide lots of evidence about the past. Beside these points, gymnosperm is also used as lumber.
They are also used to make perfume, oil, nail polish and many more. Foliage leaves rich in organic acids. Decomposition makes soil acidic and relativley low in nutrients. Strongly affects plant species that can grow. Acidity hinders bacteria but favour fungi. Foliage and wood high in secondary compounds that inhibit grazing animals