

WJPR

World Journal of Pharmaceutical Research

GYMNOSPERMS: A AMAZING WORLD

Dr. Teena Agrawal



Published By
Editor in Chief
WJPR

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2018

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PREFACE

Gymnosperms are the amazing group of the natures, they are the best plants of the evolution, they are intermediate in the fossil group between the angiosperms as well as the other lower plants, they have the great empire in the upper Jurassic as well as whole of the Mesozoic era, later on these group degrades due to development of angiosperms, the era of the Mesozoic was called as the golden ages of the gymnosperms, now they are presented by only 85 genera and some endemic species in the world in India they are present in the Himalayas as well as the Nilgiri area, but geographical distribution is degrading due to the fragmentation of the habitat and the other factors. These are the typical reservoirs of the genes and they need to be conserved for the metabolites as well as the genes for the future uses. They are the best gift of nature and evolution prospective. My book **GYMNOSPERMS A AMAZING GROUP** is a compilation of the several genera as well as some of the main features of the gymnosperms so that persons who are unaware of the gymnosperm knowledge can read them and can know this world better.

Dr. Teena Agrawal

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CHAPTER-1 INTRODUCTION

INTRODUCTION

The Gymnosperms are a group of seed-producing plants that includes *conifers*, *cycads*, *Ginkgo*, and *Gnetales* (Coulter and Chamberlain 1910). The term "Gymnosperm" comes from the Greek composite word *γυμνόσπερμος* (*γυμνός* *gymnos*, "naked" and *σπέρμα* *sperm*, "seed"), meaning "Naked seeds", after the unenclosed condition of their seeds (called ovules in their unfertilized state) (Engler and Prantl 1926). Their naked condition stands in contrast to the seeds and ovules of flowering plants (angiosperms), which are enclosed within an ovary.

Gymnosperm seeds develop either on the surface of scales or leave, often modified to form cones, or at the end of short stalks as in *Ginkgo* (Engler 1986). The gymnosperms and angiosperms together compose the spermatophytes or seed plants. By far the largest group of living gymnosperms are the conifers (pines, cypresses, and relatives), followed by cycads, *Gnetophytes* (*Gnetum*, *Ephedra* and *Welwitschia*), and *Ginkgo* (a single living species) (Sporne 1965).



Figure 1: General feature of Gymnosperm.

Definition of Gymnosperms

Gymnosperms are the plants have the remarkable history, since they are the best product of the evolution. They have many features of the combination of the character's. The morphology of the plants shows all the features' of the evolutionary

significance(Harris T.M., 1964) The anatomy of the plants of stems and the roots have the combination of the many features which shows the evolution from the aquatic to the land adaptations. However the adaptation pattern of the gymnosperms' are low from the angiosperms' since they are the much evolved plants in the evolution of the plant groups(Eames A.J.,1961).

Gymnosperms were flourishing in the Mesozoic era; this was the era of the reptiles and the other gignatious organism. Well at that era cycads were abundant in the distribution in all over the globe, in this series many extinct plants exist which have a tremendous evolutionary significance, now palaeobotanical evidences of these plants can be seen in all over the world like in india Rajmahal hills are the point of distribution of many gymnosperms'. A very significant aspects of the plants(progressive evolution) can be seen in that era (Harris T.M.,1964).

Seed habit was once observed in the pteridophytes but complete seeds can be seen in the gymnosperms, first time in the evolution seeds appeared in gymnosperms, from cycadles to the gnetales seeds have been seen from giganteious cycadales to the miniatures gnetales(Stevenson D,W,1990).

However the fruit habit has been observed only in some extinct gymnosperms like the calamitales and the some extinct ferns. but the complete seed with fruit has been observed only in the fossil angiosperms and the living angiosperms.

One crucial step in the evolutionary history of all plants was the development of seeds. **Seeds** provide a viable means for dispersal of offspring without the need for water. They are more efficient of dispersal and allow plants to exist away from direct sources of water (Van Tieghem 1898).

Gymnosperms were the first plants to have seeds. They are often referred to as having naked seeds because they do not have flowers, and their seeds develop on the surface of the reproductive structures of the plants that has been considered as the cones having the sporangia of the many kind the distributional pattern rather than being contained in a specialized ovary. These seeds are often found on the surfaces of cones and short stalks.

Gymnosperm, any vascular plant that reproduces by means of an exposed seed, or ovule—unlike angiosperms, or flowering plants, whose seeds are enclosed by mature ovaries, or fruits. The seeds of many gymnosperms (literally “naked seeds”) are borne in cones and are not visible until maturity. Taxonomists recognize four distinct divisions of extant (no extinct) Gymnospermous plants—, *Cycadophyta*, *coniferophyta*, *Ginkgophyta*, and *Gnetophyta*—with 88 genera and more than 1,000 species distributed throughout the world.

Characteristics of Gymnosperms

- Gymnosperms are a group of plants with the following some unique characteristics:
- They do not have an outer covering or shell around their seeds. (naked seed plants).
- They do not produce flowers.(the sporangia are distributed on the cones).
- They do not produce fruits. (these are the features of the angiosperms’).
- They are pollinated by the wind. (much higher step in the evolution, in comparison to the other kinds of the pollination pattern).
- Most plants are perennial and woody. (however fossils gymnosperms were have many kind of the distribution pattern in water as well as in xeric conditions) (A. Farjon, M.F. Gardner, R.R. Mill, and M.W. Chase (2011)).
- They are xerophytic, with sunken stomata and thick cuticle.(adaptations to the land conditions).
- The xylem is without vessels and phloem lacks companion cells. (a prominent feature of the angiosperms).
- Reproductive organs are usually in the form of cones or strobilus. The male cones are made up of microsporophyll’s and female cones are made up of megasporophylls. (huge cones are the diagnostic feature of the gymnosperms)
- Microsporophyll’s bear microsporangia (900-1000 microsporangia in sori in *Cycas* and two microsporangia in *Pinus* spp) (distribution pattern of the sporangia is the featured of the Taxonomic significance).
- Large number of microspores (pollen grains) is produced in microsporangia after reduction division which later forms male gametophytes (this again the step of the progressive evolution).

- Male gametophytes of all gymnosperms produce pollen tubes.(the evolutionary reduction of the pollen tubes can be seen from cycadales to the gnetales).
- In the nucellus of megasporangia (ovules) one of the cells forms megaspore mother cell which after reduction division forms a linear tetrad of megaspores of which only one is functional.(megasprogenesis).
- Functional megaspore forms female gametophyte (also called endosperm). Thus the endosperm is a pre-fertilization tissue in gymnosperm(s).(endosperm of the gymnosperm is the feature of the taxonomic significance and have many economic importance).
- On the micropylar end of female gametophyte are differentiated two or more archegonia.(evolutionary reduction of the archegonia can be seen from the cycadales to the gnetales).
- All gymnosperms are wind pollinated.
- Usually polyembryony is found in seed although ultimately only one embryo survives.(it is the adaptations for the survival of the species in the extreme conditions).
- Archegonia lack neck canal cells.
- Embryo bears two as in Cycas or more (10-11 in Pinus) cotyledons.

Conservation aspects of the gymnosperms

Gymnosperms have a great evolutionary history. palaeobotanical aspects of the gymnosperms shows a tremendous history of these group of the plants which were very fascinating and have a long history. pteridospermales shows the a large assemblage of the plants which have so many features' of the combination of the characters

However due to the geological changes and the other factors these remarkable group of plants now at the line of the relicts.

From the last century due to the over exploitation of the natural resources in India and the other part of the world, these group of the plants have very limited distribution. The gymnosperms can be indentified only be some genera among them Cycadales have only 10 genera's and the conifers' have assemblages of the genera's which shows the gymnosperms.

Some of the factors which are responsible for the degradation of that group can be elucidated as.

- Overcutting of the forest for the different purposes.
- Degradation of the forest ecosystem
- Habitat destructions due to many anthropogenic factors.
- Some of the diseases' are the main factors for the degradation of the many genera.
- These plants have long evolutionary history but changes in the climate and the other evolutionary reasons these plants cannot be acclimatize with the environment.
- Unplanned uses of the gymnosperms' by the tribal communities and other peoples is also the main reasons for the degradation of the gymnosperms'.

CONCLUSION

In the long history of the evolution of the plants many natural geological events occurs which were the reasons for the disappearances of the plant kingdom from the earth. These feature we can seen in the evolutionary history from palaeozoic to the recent Cenozoic era but these kinds of the succession pattern were very fruitful for the another kinds of the vegetations. (natural reasons for the establishment of the plants.

But in the last century and the few decades the rapid industrialization and urbanization is the main factor for the degradation of the plants form the earth. The anthropogenic factors have very negative consequences on the succession biology of the plants. Now the estibilishment rate of the plants is very low in comparsions to the other time era's.

Well gymnosperms have a very important evolutionary, economic and the ecological significance. From economic point of view they have tremendous importance. All the plant parts are the reservoirs of the many kinds of the complex metabolites which have very important economic as well as ecological significance. Conifers have been used from centauries for many purposes. Similarly cycadales and the gnetlaes also have very important role in the economics' utilization of the plants.

A sustainable uses of the plants is an essential features for the conservation of this remarkable group of the plants. Since in that era humans have many kinds of the

diseases', so by planned uses of these plants one can trace out the solutions of all diseases' on the planet (changes habitat).

In addition a number of the environmental problems also exist, due to rapid industrialization, so they can be used for solution of the many environmental problems.

Overall human need to be saved these groups of the plants for the saving of the vegetation and the other species on the planet.

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CHAPTER-2

CLASSIFICATION OF GYMNOSPERMS

In the early classification schemes of the gymnosperms (Gymnospermae) were regarded as a "natural" group, they were classified on the basis of the morphological features and some of the assemblage of the combinations of the characters. There is conflicting evidence from the fossil sciences that this lines of the evolution diverge in the different directions and they leads to the development of the angiosperms. They are relicts, they are presented only by the their living classes, these are the cycadopsida, coniferopsida genetopsida. The question of whether the living gymnosperms form a clade.^{[3][4]} The fossil record of gymnosperms includes many distinctive taxa that do not belong to the four modern groups, including seed-bearing trees that have a somewhat fern-like vegetative morphology (the so-called "seed ferns" or pteridosperms.)^[5] When fossil gymnosperms such as Bennettitales, *Caytonia* and the glossopterids are considered, it is clear that angiosperms are nested within a larger gymnosperm clades, although which group of gymnosperms is their closest relative remains unclear. There were several classification of the gymnosperms were represented but one of the accepted classification are presenting over here.

For the most recent classification on extant gymnosperms see Christenhusz *et al.* (2011).^[6] There are 12 families, 83 known genera with a total of ca 1080 known species (Christenhusz & Byng 2016 ^[7]).

Subclass **Cycadidae**

- Order **Cycadales**
 - Family **Cycadaceae**: *Cycas*
 - Family **Zamiaceae**: *Dioon*, *Bowenia*, *Macrozamia*, *Lepidozamia*, *n*

Subclass **Ginkgoidae**

- Order **Ginkgoales**
 - Family **Ginkgoaceae**: *Ginkgo*

Subclass **Gnetidae**

- Order **Welwitschiales**
 - Family **Welwitschiaceae**: *Welwitschia*

Classification of Gymnosperms

- Order **Gnetales**
 - Family **Gnetaceae**: *Gnetum*
- Order **Ephedrales**
 - Family **Ephedraceae**: *Ephedra*

Subclass **Pinidae**

- Order **Pinales**
 - Family **Pinaceae**: *Cedrus*, *Pinus*, *Cathaya*, *Picea*, *Pseudotsuga*, *Larix*, *Pseudolarix*, *Tsuga*, *Nothotsuga*, *Keteleeria*, *Abies*
- Order **Araucariales**
 - Family **Araucariaceae**: *Araucaria*, *Wollemia*, *Agathis*.
 - Family **Podocarpaceae**: *Phyllocladus*, *Lepidothamnus*, *Prumnopitys*, *Sundacarpus*, *Halocarpus*, *Parasitaxus*, *Lagarostrobos*, *Manoao*, *Saxegothaea*, *Microcachrys*, *Pherosphaera*, *Acmopyle*, *Dacrycarpus*, *Dacrydium*, *Falcatifolium*, *Retrophyllum*, *Nageia*, *Afrocarpus*, *Podocarpus*
- Order **Cupressales**
 - Family **Sciadopityaceae**: *Sciadopitys*
 - Family **Cupressaceae**: *Cunninghamia*, *Taiwania*, *Athrotaxis*, *Metasequoia*, *Sequoia*, *Sequoiadendron*, *Cryptomeria*, *Glyptostrobus*, *Taxodium*, *Papuacedrus*, *Austrocedrus*, *Libocedrus*, *Pilgerodendron*, *Widdringtonia*, *Diselma*, *Fitzroya*, *Callitris* (incl. *Actinostrobus* and *Neocallitropsis*), *Thujopsis*, *Thuja*, *Fokienia*, *Chamaecyparis*, *Callitropsis*, *Cupressus*, *Juniperus*, *Xanthocyparis*, *Calocedrus*, *Tetraclinis*, *Platycladus*, *Microbiota*
 - Family **Taxaceae**: *Austrotaxus*, *Pseudotaxus*, *Taxus*, *Cephalotaxus*, *Amentotaxus*, *Torrey*.

CHAPTER-3
FOSSIL GYMNOSPERMS

Gymnosperms are the plants which have fully exposed ovules not enclosed in the fruit, they have the long evolutionary history. The palaeobotany of the gymnosperms goes from the early Triassic to the late Cretaceous. Gymnosperms are the most ancient seed plants, that originated during the late Palaeozoic era and flourish well in the Mesozoic era. The long pathway of the evolution has a number of the lines of the cladistics and the diverge lines of the evolution. At that time a number of the plants of that lineage evolved and other plants group extinct in the lines of the evolution. There are a large group of the gymnosperms who have along lineage of the fossil gymnosperms, in this series, pteridophytes, having Lygiopteridaceae, Medullaceae, Glospteridaceae, Calamopityaceae, Bennettitales are the group having a very long and diverse kind of the evolutionary history. However in that era majority the gymnosperms' are extinct, they are presented by only the Cycadales and Coniferales, Gnetales.

Evolution of the plants is a very important aspects in the development of the life or biota in the biosphere. In the early Proterozoic era a number of the unicellular and the multicellular algae like organism start evolved in the oceans, this was the first step in the evolution of the plants on the earth. Later on as the evolution proceeds out the plants start adapting on the lands, in this case different kinds of the adaptation as well as evolution of the many organs starts in the life. Bryophytes, pteridophytes, gymnosperms and angiosperms are the plants of the evolution, which shows the clear pathway of the development of the organs according to the adaptation of the plants on the lands.

However each series of the plants like algae, fungi, pteridophytes, gymnosperms and angiosperms also have a fossil history. In that review articles we are trying to analyse the fossil history of the gymnosperms.'

Gymnosperms are the most ancient seed plants, originated during the late Palaeozoic era during the upper Devonian time scale, it was the first evolutionary time for the origin of the gymnosperm in the time scale of the plants development. However they flourish well in the Mesozoic time era. During that era gymnosperm spread all over the planet, they can be found on the land, on the air and as well as in the water,

Fossil Gymnosperms

however long evolutionary history of the gymnosperm is full of a number of the examples' of the living and the extant gymnosperms. In that era we can observe a number of the gymnosperms who were abundant in that era but as the climate changes a rapid decline can be seen in that organism. one of these plants includes the organisms of the ferns like in evolution, they have been termed as the pteridospermales, they have been resemblance from the early ferns as well as some advances features' of the cycades, so that time has been termed as the ages of the cycades.

This was the very large group having the assemblage of the, many kind of the plants having intermediate feature from may kinds' of the plants, here are included a number of the families like the **lyginopterodaceae**, **medulalceae**, **caytoniaceae**, **calamopitacese**, **beenntiitles**, **pentoxyleses**.

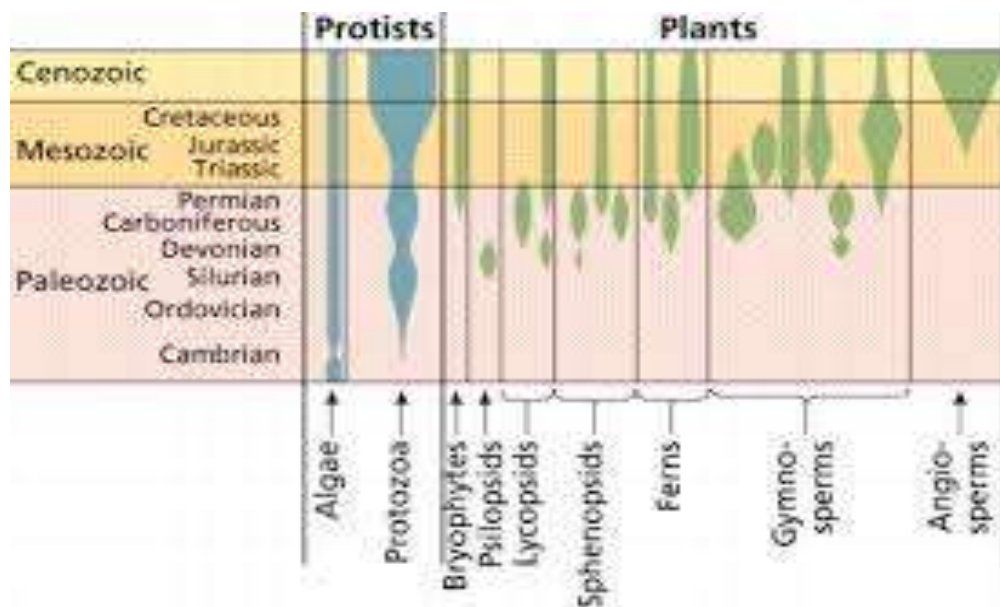
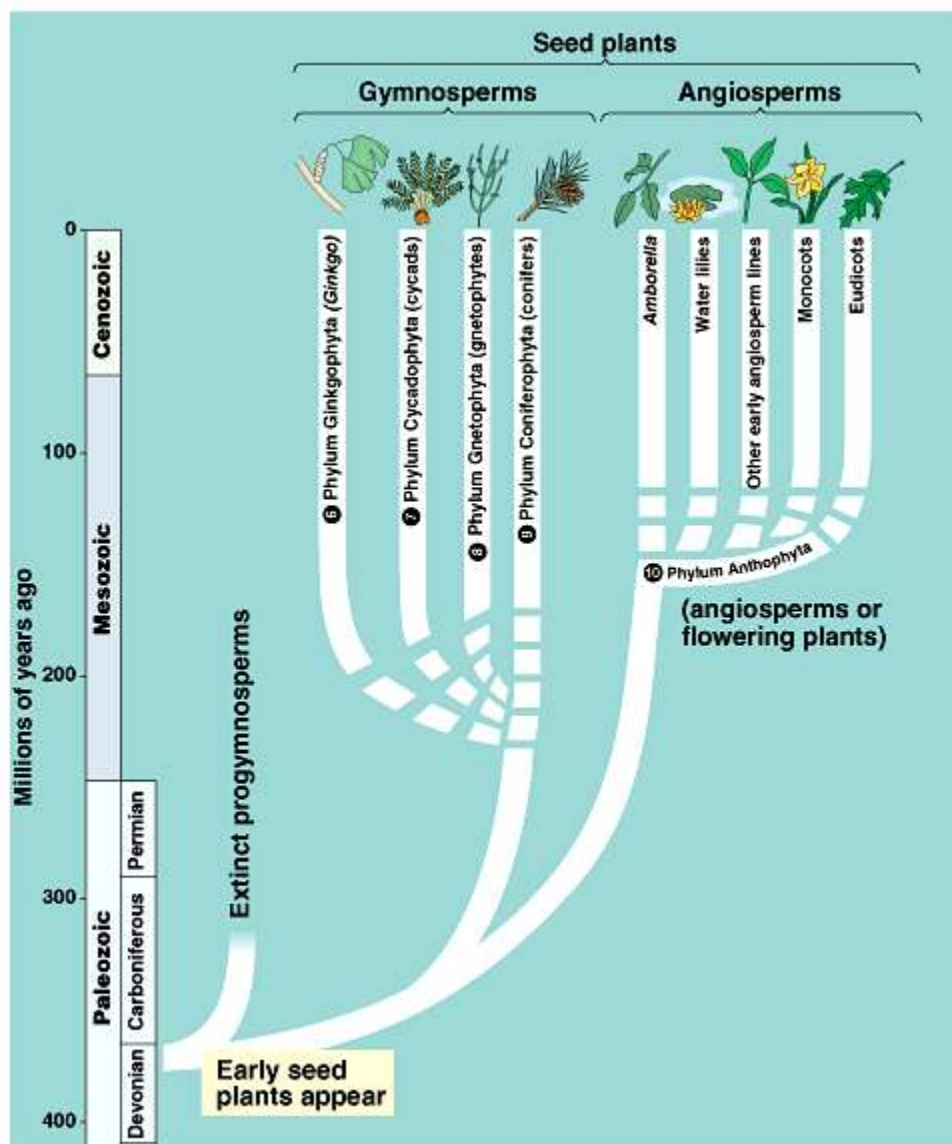


Fig 1: Evolution of the plants.



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Fig 2: Evolution of the land plants.

Table 1: Extinct gymnosperms.

S. No.	Extinct group	Period of existence	Life span of millions of years
01	Palaeozoic pteridopaelmales	Lower carboniferous to permian	115 millions of years
02	Mesozoic pteridopsermasles	Upper Triassic to lower cretaceous	90 millions years
03	Pentoxylaes	Lower Jurassic to Triassic	25 millions years
04	Benettiltaes	Triassic to upper creaceous	155 millions years
05	Cordialtes	Lower carboniferous	115 millions years
06	Extinct cycaldes	Upper creatous	120 millions years

The modern and the living gymnosperm are place in the following categories like the cycadophyta, coniferophyta, ginkgophyta, gentophyta. The Cycades and the

ginkgoales includes the long fossil history, among the ginkgoales all the plants are extinct now only one of the existing genus termed as *Ginkgo* IS LIVING. In cycadales also most of the members in the lines of the degradation, however only 11 genera can be elicited as the living representative of the group. These orders have been termed as the living fossils in the group.

In recent era representative of the gymnosperms are presented by only the coniferales, some of the genera of the conifers are representatives of the gymnosperm, however their distribution is also very restricted, they are distributed only in some part of the world like the northern hemisphere of the globe.

In India the conifers are distributed in the Uttarakhand area as well as Nilgiri hills of the India, however in India also the habitat for the gymnosperms are degrading, so they are represented by only a very small group.

The Gnetales are presented by the three genera like the **Gnetum, Ephedra, and Welwitschia**. Gnetum and the Ephedra are distributed in the Asia as well as tropical part of the world. Gnetales is presented by the different lines of the evolution, however they are very close to the angiosperms in distribution as well as they have been considered as the progenitor of the angiosperms. A line of the evolution of the Gnetales is also very different from the other lines of the gymnosperms.

Some of the features of the fossil gymnosperms' is presented by the following orders.

1. Pteridospermales
2. Bennettitales
3. Pentoxylales.

Pteridospermales: features

- ❖ Pteridospermales are the fern-like plants having the fern-like appearance but they have the seeds on their leaves in place of sporangia on the leaves. The seeds are unprotected.
- ❖ This plant group contains the large assemblages of the many tree-like ferns in the group, which were flourish well during the upper carboniferous periods.
- ❖ This fascinating group was discovered by the grand eury in 1877.

- ❖ This group is represented by the number of the genera's like the Ganagompteris, Glossopteris, Godwandium, Indotheca, Pecopteris and other similar genera's.
- ❖ In India and among the other part of the world this group has been analused by the number of the palaeobotanist.
- ❖ This plant group had some of the resemblance from the pteridophytes and the gymnosperms.
- ❖ Pteridospermales is represented by the following families.
- ❖ A) lyginopteridacear, B) medullloceae, C) calamipytaeae, D) corystopsermaceae, E) caytoniaceae.
- ❖ Among these families, the three are presented in the Palaeozoic era and the other are represented in the late Mesozoic era,

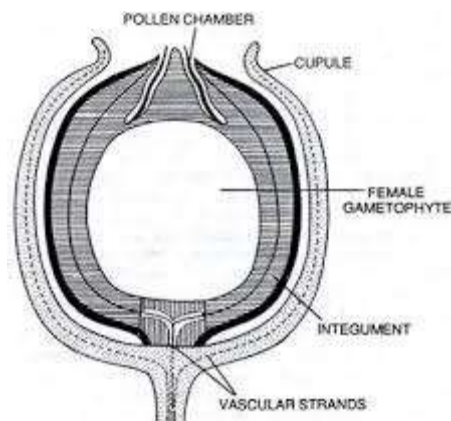


Fig. 2.11. *Legenostoma lomaxi*. Longitudinal section of the ovule with the investing cupule.

Fig 3: Pteridospermales ovules (From the Eames).



Fig 4: Tree ferns: Pteridospermales.

Some of the genera of the pteridopsemales are represented by the following genera, *Lyginopteris*, *Medullosa*, *crosotheca*, *Telangium*, *Neruopteris*, *whittleyasia*, *caalmopitys*, *Glossopteridacea*.

Bennettitales is the fossil group that has been discovered in the great Britain by the paleobotanist in 1825, the genus was the BUCKLANDIA, these group of the plants has been found in the form of the petrification and compression form of the fossil. well the discovery of that group has trace out the pathway of the evolution of the many kind of the gymnosperm and the angiosperms, since this group has a many features of the combinations in characters. this group was well flourished in late Triassic and the early Jurassic period, that age has been termed as the **ages of the cycades**.

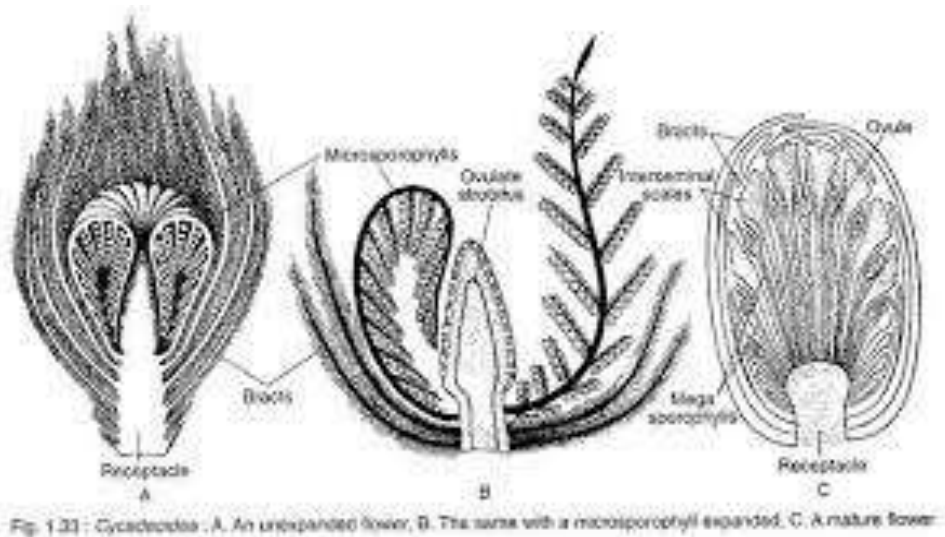


Fig 5: Flowers of the Bennettitales.

Some of the feature of the Benntitales are enlisted as.

1. The leaves are large and pinnate, they resemble with the ferns in appearances’.
2. The stomata are syndetocheilic.
3. The stem have large pith surrounds’ by the vascular bundles,.
4. The reproductive organs are bisexual.. These organs have been termed as the flower like in organization.
5. The bennittitales have two families.
 - a) Williamsoniaceae.
 - b) Cycadodiaceae.

The third order is represented by the **Pentoxylales**.

This fossil group has been discovered by the prof Birbal Sahani. It was discovered from the Rajamahar hills of the India from the Jurassic flora of the India. However in the Spornae classification, this order has been represented in a different Taxa.

This order was discovered in the different from like separated stem, leaves. Flower, pollen.



Fig. 7.1. *Pentoxylon sahani*. T.S. stele. (after Sahni)

Fig 6: Pentoxylales.

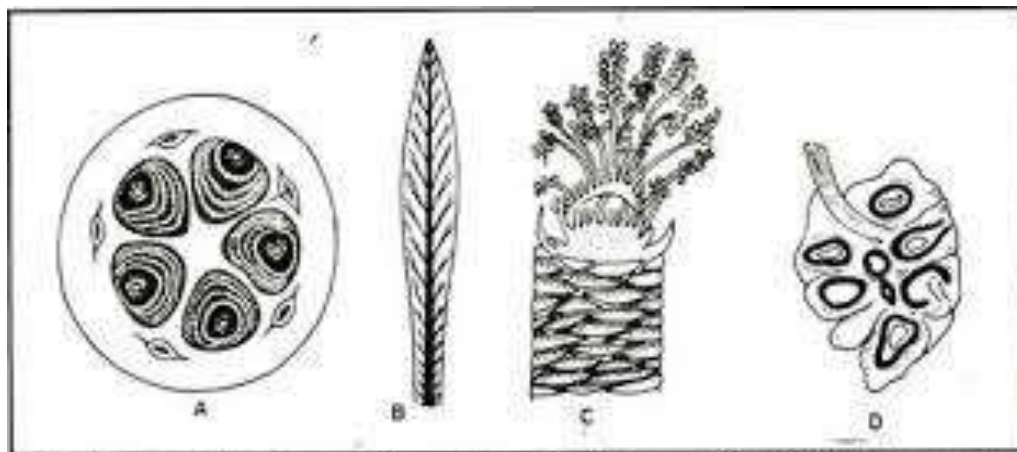


Fig 8.19: A - T.S. through stem of *Pentoxylon* Sp., B - Whole mount of leaf, C - Microsporophyll, D - V.S. through ovules.

Fig 7: Pentoxylon structures.

Similarly a number of the fossils plants can be seen in the cycadales, however there is a long fossil history of the gymnosperms' which can be discussed in detail overall this plant group is very fascinating, and we have to conserve these lines of the evolutions, since due to changes in the habitat and rapid degradation of the habitat, these group are extinction with the great speed, by the biotechnological conservations methods these group needs more protection and establishment.

CHAPTER-4 CYCADALES

Cycadales are the very important class of the gymnosperms; they are the living fossils among the all other gymnosperms, they in the upper Jurassic best in the upper Jurassic periods, and they extends well in the whole of the Mesozoic era, however there was the rapid decline in this line of the evolution in the late cretaceous periods. Cycadales are charter raised by the following features theses features are follows as:

In many of the species the stem is unbranched and they are typical woody, ooccsiaonly adventitious branches can be seen on the stem. The woods are the manoxylic, mucilage canal are found in the pith and cortex. Leaves are the large and pinnaetly divided. Leaf trace are diploxylic, dioecious, reproductive organs in cones, cones are terminal and lateral. Megsaporophyls are sterile at the tips and many of the orthotropus ovules are found laterally.

Microsporophylls are peltate and the microsporangiums are present in the form of the synangia.

Sperms with the spiral invagination of the flagella.

The order cycadales are divided in to the four the classes, these are the

- 1) Nilssoniaceae
- 2) Cycadaceae.
- 3) Stangeriaceae
- 4) Zamiaceae.

Among them the Nilsoniaceae is the assemblage of the fossil Cycadales. Rest of the living family are divided on the basis of the distribution of the central veins as well as the lateral veins on the leaves. The family cycadaceae are featured with the central veins as well as the absence of the lateral veins, whereas the other families are featured with the presence and the diversification of the lateral veins.

Cycadaceae are featured with the *Cycas and many more species* which are distributed in the many genera's. The family zamiaceae is featured with the following genra, theses are as follows.

Cycadales

- 1) Zamia,
- 2) Encephalartos
- 3) Macrozamia
- 4) Lepidozamia
- 5) Ceratozamia
- 6) Microcycas,
- 7) Chigua.
- 8) Dioon

The stangeriaceae is featured with the two genera's, these are enlisted as

- 10) Stangeria
- 11) Bowenia

Cycades fossils goes back dates to the Permian periods, 280 million years ago, there are some controversy regarding the exact dates of the ages of the cycadales, these goes back to the date carboniferous periods, the year was the 250myago. They were the first colonizers and they dates back to the diversification during the early clades, the region of the cycadales goes in to the early Pangea and later on theses Pangea diversify in to the two lands, these are the gondwana as well as the Laurasia.

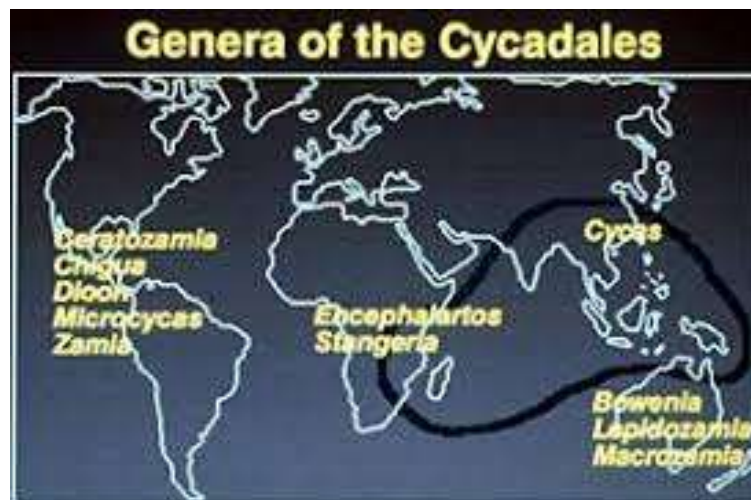


Figure 1: Distribution of the cycadales (sources: Montgomery botanical garden).

The life cycle of the Cycadales are the typical examples of the alternation between the gametophytes as well as the sporophytes. The live cycle of the cycadales are the diplohaplontic, it is the alternation between the two heteromorphic generations, these are the typical sporophytes and the small gametophytes life cycle pattern.

The reproduction occurs by the male cones as well as with the female cones, the male cone is in the form of the microsporophylls and the sporangia are present in the forms of the groups with the sterile hairs, the size and the shape of the microsporophyll varies according to the genera's.

The size and the other features of the megasporophylls are also varies and they are the typical taxonomic features of importance's. The ovules are present laterally on the megasporophylls.

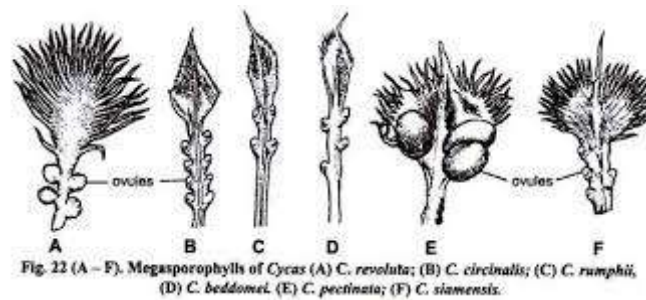


Figure 2: Variations in the megasporophylls of the cycads (sources: biology discussion).

The development of the male gametophytes and the female gametophytes development follow the typical gymnospermous features.

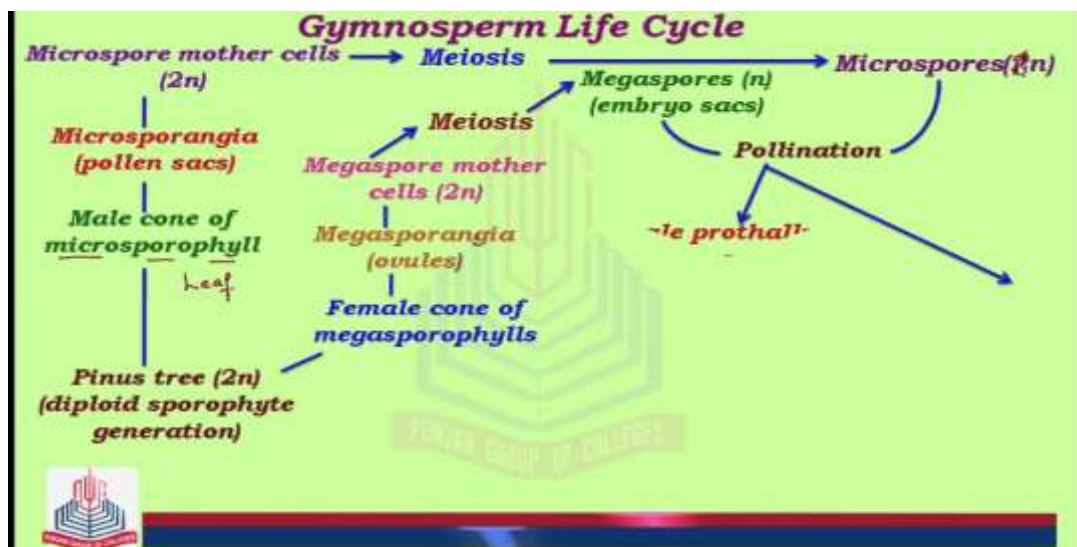


Figure 2: Gymnosperms life cycle (sources: gymnosperm life cycles).

The family includes the genus cycadales which is characterised by the 88 species, *Cycas* are generally recognised by the leaflets, the stem is single large and they are

subterranean and the stout are the swollen, they have the bunch of the leaves on the heads, the leaves are pinnaetly compounds with the several kinds of the leaflets, the shape of the leaflets and the venation is the features of the taxonomic values.

Male Sporophylls are arranged in the form of cones. The female cones are arranged in the form of the looses megasporophylls and they are found in the form of the loose crown bearing the ovules on them. These are the species of the **Cycas** which are enlisted over here.

<i>C. aculeata</i>	<i>C. circinalis</i>	<i>C. inermis</i>	<i>C. pranburiensis</i>
<i>C. angulata</i>	<i>C. clivicola</i>	<i>C. javana</i>	<i>C. pruinosa</i>
<i>C. apoa</i>	<i>C. collina</i>	<i>C. lane-poolei</i>	<i>C. revoluta</i>
<i>C. arenicola</i>	<i>C. condaoensis</i>	<i>C. lindstromii</i>	<i>C. riuminiana</i>
<i>C. armstrongii</i>	<i>C. conferta</i>	<i>C. litoralis</i>	<i>C. rumphii</i>
<i>C. arnhemica</i>	<i>C. couttsiana</i>	<i>C. maconochiei</i>	<i>C. schumanniana</i>
<i>C. badensis</i>	<i>C. curranii</i>	<i>C. macrocarpa</i>	<i>C. scratchleyana</i>
<i>C. balansae</i> Warb.	<i>C. debaoensis</i>	<i>C. media</i>	<i>C. seemannii</i>
<i>C. basaltica</i>	<i>C. desolata</i>	<i>C. megacarpa</i>	<i>C. siamensis</i>
<i>C. beddomei</i>	<i>C. diannanensis</i>	<i>C. micholitzii</i>	<i>C. silvestris</i>
<i>C. bifida</i>	<i>C. dolichophylla</i>	<i>C. micronesica</i>	<i>C. simplicipinna</i>
<i>C. bougainvilleana</i>	<i>C. edentata</i>	<i>C. multipinnata</i>	<i>C. sphaerica</i>
<i>C. brachycantha</i>	<i>C. elephantipes</i>	<i>C. nathorstii</i>	<i>C. taitungensis</i>
<i>C. brunnea</i>	<i>C. elongata</i>	<i>C. nongnoochiae</i>	<i>C. taiwaniana</i>
<i>C. cairnsiana</i>	<i>C. falcata</i>	<i>C. ophiolitica</i>	<i>C. tanqingii</i>
<i>C. calcicola</i>	<i>C. ferruginea</i>	<i>C. orientis</i>	<i>C. tansachana</i>
<i>C. campestris</i>	<i>C. fugax</i>	<i>C. pachypoda</i>	<i>C. thouarsii</i>
<i>C. canalis</i>	<i>C. furfuracea</i>	<i>C. panzhihuaensis</i>	<i>C. tropophylla</i>
<i>C. chamaoensis</i>	<i>C. guizhouensis</i>	<i>C. papuana</i>	<i>C. tuckeri</i>
<i>C. chamberlainii</i>	<i>C. hainanensis</i>	<i>C. pectinata</i>	<i>C. wadei</i>
<i>C. changjiangensis</i>	<i>C. hoabinhensis</i>	<i>C. petraea</i>	<i>C. xipholepis</i>
<i>C. chevalieri</i>	<i>C. hongheensis</i>	<i>C. platyphylla</i>	<i>C. yorkiana</i>

The females cones have the laterally arranged ovules in

A) **Microcycas: an Endangered genus**

Gymnosperms are the plants of always of the great values, they are characterised by the naked seeds without fruits, they have the great evolutionary values, whole gymnosperms are presented by the three lines of the evolution among them cycadales liens of the evolution are the living fossils, whole this liens contains the 11 genera with the very narrow and the restricted kinds of the distribution, they are at the junction of the extinction, among the 11 genera many have the very endemic population in some restricted part of the world, initially they were consumed by the local population for the variety of the purposes but now whole of the order needs the conservation and the protection, according to the IUCN norms and the other means. In this review article we are working on the one of the cycadales entitled as the **MICROCYCAS**, this is the monotypic genus with the one species termed as the **Microcycas calocoma, southern cuba** is the endemic point of the **Microcycas** and now by the IUCN version the species has been declared as the **critically endangered**.

Introduction: Gymnosperms are the naked seed plants, they have the arborescent habits as well as the typical cones pattern for the reproduction, among them the cycadales are plant which have attract the human attraction form the thousands of years due to their ornamental natures and the many kinds of the uses by the civilization for the different kinds of the purposes. Cycadales is the order which includes the all extant cycadales, these genera have the long and the stout trunk, mostly unbranched stem with crown of the leaves on the top of the trunk, the leaves are generally pinnate, sexes are generally separate, the growth pattern is generally slow and they grow for the thousands of years, in the superficial resembles the cycadales resemblance with the palms, there are generally three families' of the cycadales, these are termed as the Zamiaceae, stangeraceae, cycadeaeae. Evolutionary this plant group is very valuable; this group was very famous n the Jurassic period and till now there in this liens the evolution very little change occurs.^[5]

Microcycas is the genus which has the very narrow and the restricted kinds of the distribution, this genus was discovered in the western Cuba, in the Cuba there is place named as the **pinar dal rio proviances**, this region has the abundant distribution of

the **Microcycas**, well the genus is monotypic and contains the one species termed as **the Microcycas calocoma**, this **genus concerned with the family Zamiaceae**.^[1]

The height of the plant is about the 10-15m, and it is upright, the diameter of the trunk is about the 40-60 cm, the leaves are dark green, and they are about the 1 to 1.5 meter long, they pinnately divided, the unique characters of the leaves that they are truncated, males cones are cylindrical and they have the height of the 30 -40 cm, the sporophylls have the round two projections.^[5] Other feature of genera contains the features which are similar with the other cycadales.^[1]



Figure 1: Microcycas calocoma (sources forestry images).



Figure 2: Micorcycas calocoma (source forestry images).



Figure 3: Microcycas calocoma (sources forestry images).

History: originally in 1851 the genus was described as the one of the specie of the Zamia and the species of the zamia described as **the zamia calocoma**. and a small section was coined it was the **Microcycas**, By the F A w Mitchell in 1857.1868 the genus was grouped under the genus **Microcycas** by the A P de condaollae.^{[1][5]}

IUCN CONSIDERATIONS: Genus was described as the critically endangered in 1998, since on the basis of the area of the occupancy it was found that total number of the trees of the genus are the only 600.^{[1][5]} However after the rediscovery of the plant it was proposed that that there are many other area of the **Microcycas** which have the other populations of the **Microcycas**, it was considered as the endangered, however due to the continues decline of the population and the degradation of the habitat the genus is nearly at the junction of the critically endangered,since it is used as the ornamental and the wild peoples of the cuba utilizes the plant for the variety of the purposes.^{[1][5]}

CONCLUSION

Well the review represents the small account of **the Microcycas** genus. Here we presented the some of the aspects of the plant as well as their threatend state. IUCN data represents the degrading position of the genus in the habitat so efforts are needed for the conservation of the plants. Gymnosperm are at the edge of the extinction and we need to conserve this beautiful line of nature for the tracing out the evolution and the metabolites.

Zamiaceae

Zamiaceae are also known as the sago palm family. The Zamiaceae are divided in to the two subfamily, theses subfamily are also termed as the Encepherlotoidae and the

zamioidae. The subclass includes the following genera's *Encephlartos*, *Macrozamia*, *Lepidozamia*, *Dioon*, *Ceratozamia*, *chigua*, *Microcycas*, *zamia*. Plants are perennial and they are evergreen, these plants are dioecious, the stems are subterranean and they are underground, the stems are fleshy, stout and their perennials, roots are with many kinds of secondary roots, leaves are pinnae compounds, leaves are spirally arranged and they are clumped on the apex of the stem, pollen are present in the form of cones and they are more than the seed cones. Microsporophylls are meant and they have many pollen cones present, they are found in the form of synangia. On their megasporophylls many kinds of ovules are found and they are present axially. The seed cones are typical features and the arrangement of the veins is another feature by which the taxa's are enumerated and they are taxonomically arranged.

B) Ceratozamia

Ceratozamia is the genus of the new world, this is new world Cycades, the genus belongs to the zamiaceae family. The name *ceratozamia* belongs to the terminology of the ceratoas meaning the horns, these are the horns which are present in the microsporophyll as we also on the megasporophylls of the cycads tree or the cycads genus, the genus contains about 27 species, most of the species are endemic to the mountainous region of Mexico, some of the species are migrated to other mountain regions like Guatemala, Honduras and Belize.

Most of the species of the *Ceratozamia* has very limited kinds of distribution and they are very endemic. Almost all species are endemic and they are rare, endangered, some of the species are critically endangered. However CITES has declared some of the species as banned and they are not utilised for commercial purposes. The illegal poaching of the *Ceratozamia* is also stopped and it is banned for several purposes for commercial utilization.

The palms are dioecious, the stems are cylindrical and they are unbranched, in some cases the stems are globose. Rarely the stems are dichotomously n. The stem may be underground or it may be unbranched.

Several species of the *Ceratozamia* produce basal shoots or suckers.

The leaves are presently compounds, and spirally and they are straight. The petioles and rachis has the spines. The number of their spines may be very few to the very high.

Male cones are upright and straight, hard and they are stalked.

Female cones are stalked or it may be sessile.

Most of the species of the *Ceratozamia* are the distributed in the mountain region.

The forest where the *Ceratozamia* are distributed are the typical rain forest and they are the typical oak pine forest, the sizes of the leaflets vireos from the minute to the large which depends on the weather conditions. The winter favours the large leaflets and the summer favors the small leaflets.

Almost all the species of the **Ceratozamia** are endangered and rare and they are critically endangered, IUCN has declared the genus on the basis of the AOO and the EOO and the version 3.1 and there are several other parameters on which the majority of the species has been declared as the endangered or it has been declared as the critically endangered.

Since these are the very primitive plants and they were abundant in the Jurassic and in the late cretaceous, now only very little or very rare kinds of the distribution of these species has been seen, now the endemic species are also deterring due to various kinds of the ill activity and the habitat fragmentation, so the species are needed to be conserved and they needs to be protected fro the proper utilization of the species for the several purposes.

C) Stangeria: an endangered cycades

Gymnosperms are the plants of the conservation of the evolution in there all plant parts; they have the good reservoirs of the metabolites and the other conserved sequences of the evolutionary values. These groups have the very fantascting ecosystems in the Mesozoic era. The appropriate reconstruction of the Mesozoic era gives the appearances of that evolutionary past. Cycadales are the living fossils and they are at the edge of the degradation, all of them totally 11 genera are existing, which have very narrow distribution in some of the area of the world. In this review

articles we are trying to work on the one of the Cycadales entitles as the **Stangeria**. This is well distributed n the some of the area of the South Africa and the some islands of the West Indies. Now this cycadales is at the junction of the disappearances due to the habitat destruction and the other anthropogenic activity. (IUCN endangered).

Gymnosperms are the plants of the naked seeds with some anatomical differences form the angiosperms; they developed the large and the gigantism ecosystem in the Mesozoic era; however one can seen the declines in the fascinating line during the modern era. Gymnosperms dominate the earth for many millions of year, they have two liens of the evolution one of them is the cycadophytes and the another one is the coniferophytes liens of the evolution the anatomy and cycadales and the conifers are very different in the morphology as well as in the anatomy as well as in the orientation of the reproductive cones and the ovuliferous scales. The conifers are still very dominated in the northern parts of the world while the cycadales are only represented by the some of the 11 geners's in the earth. cycadales are generally unbranched stem and with the pinnate leaves with gigantic pattern of the arrangement, they have the (dioecious and Monoecious) male and female cones with the sometimes Megasporophylls and the microsporangia on the Microsporophylls. Here in this review article we are presenting some of the aspects of the cycadales known as the **Stangeria, this is the endangered cycadales with some of peculiar features.**

Stangeria is the one of the surviving gymnosperm of the order Cycadales, although the plant was reported till 18th centaury, but appropriate nomenclature was possible only after the 20th centaury. The plant has the fern like appearances, so previously it was assumed to be the fern or the pteridophyta, later on after findings of the cones on the plants it was regarded as the gymnosperms.^{[1][2][5]} It was identified as the fern and it was named as the **Lomaeria coriacea. It was described by the German botanist otto kunzae as a new species of the fern. It was *Lomaria coriopus*.** In 1829 it was identified as the cycades, when the pant started producing the cones.^{[1][2][5]} These observations was made by the Dr Stanger in chelsa, physic garden in London, it was described By the T.moore, however the exact nature of the cones and there gymnosermous Nature was identified by the Ballion.^{[1][2][5]}



Figure 1: Stangeria cones (sources IUCN RED LIST).



Figure 2: Stangeria in wild (sources cycades pages).

Stangeria is the slow growing plant, it is the perennial in nature, the body of the plant consist of the large tuberous roots, they are carrot shaped, containing the reserve food material in the form of the starch and the other carbohydrates. This is the main part of the Cycadales due to which the tribal community utilises the plants for the various purposes.^{[1][2][5]}

The upper portions of the branches of the plants is modified in to the branches. The leaves have the typical fern appearances, they are coloured at the early ontogeny of the plants later on the leaves convert in to the green colour. The leaves have the typical circinate vernation at the time of the early ontogeny. Later on they opened like the coil turned.^[5]

The stem has the many growing points, on each growing point there is one cones. The plant produces the cones throughout the year, the number of the cones are 100 -250 on the stem.^{[5][2]} The plant is dioeciously, and the male and female cones are on the separate plants. The male cones are cylindrical and they have long male

microsporophyll on the them arranging in the spiral fashion. The tip of the microsporophyll is also the taxonomic values, on them the micorsporangia are arranged in the form of the groups and the sterile hairs can be founds. (Typical cycadales nature.)^[5]

The female cones are egg shaped. They have the long megasporophylls of taxonomic values, they have the arrangement of the eggs or the ovules on the adaxial sides of the megasprophylls.^{[2][5]}

The structures of the gymnosperm are typical cycadales types.^{[1][2][5]}

Distribution: *Stangeria* grows in to the open and the dry soil the vegetation is the grassland types, in light soils, under threat. The plant is well distributed near the South Africa and the mozambae of the South Africa. This is the place where endemism of **the Stangeria** has been reported.^{[2][5]}

Conservation: **although stangeria** has the long evolutionary history and it was widely distributed in the 200 years ago, in the different part of the world. But now around 150 years ago the aboriginal peoples are utilising the plant for their own beneficiations.^{[2][5]} So now around 54 percent of the habitat is destroying, now the species grow there are also disappearing, IUCN red data, list declared the **Stangeria** as the threaded species.^{[5][2]}

During the two decades ago under the IUCN version A² and A⁴ **Stangeria** has been regarded as the vulnerable genus.^{[1][2][5]}

Well in the south African and in the America the forest ecosystem of the **stangeria** are degrading with the great speed due to the various reasons for the various purposes, one of them is the constructions of the buildings and the other constructions.so in the near future the genus is supposed to be the threatened.^[5]

In 1998 IUCN reported the genus as the vulnerable, later on the 2003 it was considered as the near to threatened (Iucn red data list 2010).

The data of the IUCN shows that during them any decades **the stangeria** is disappearing form then natural vegetation.^{[1][2][5]} The main reasons of the disappearances of the vegetation is the habitat destructions and the construction work,

in the Durban the heavy constructions leads to the disappeared in the Durban the heavy constructions leads to the disappeared of the may habitat of the **stangeria**, the vegetation of the **stangeria** is utilised for the formation of the grasslands of the sugarcane and the other green plantations. Due to these reasons in South Africa very little vegetation exists. (IUCN red data list description 2010).

These are the few threats due to which the **stangeria** is the edge of the disappearances.

The future road constrictions of the coastal highway through the Eastern Cape have threatened the many populations in the area.^[5]

In addition the increasing urban pressure in the cape area will also lead the disappearance of the **Stangeria** from the place or the habitat.^{[1][2][5]}

In that area around 34 places are which are the clump of the **stangeria**, **some of the threats of these clumps are enlisted as.**

1) 14 clumps are at the edge of the degradation, these are the populations of the stangeria, which are near to disintegration due to the heavy road constructions.

2) 14 other populations of the **stangeria** are near to threat due to the agriculture of the different other crops of the human values. (IUCN RED DATA LIST 2010).

In addition to that there are many other reason for the disintegration of the **Stangeria** populations from the places. (IUCN red data list 2010).

Uses of the stangeria: The plant has the several medicinal uses, due to which any tribes of the South Africa utilizes the plant for various purposes.

After the Second World War many of the scientist transport the plants for their botanical garden investigation, they transport the plants heavily.^{[1][2][5]} This was the main reason for the disappearances of the plants from the habitat. The tribes of the Xhosa and the Zulu peoples utilises the plants for their own beneficitions.^{[1][2][5]}

They utilises the plant for the headaches and the other purposes. However one of the significant uses of the **stangeria** is that they are ornamental.^{[2][5]}

This is the remarkable plant of the cycadales and it needs the proper conservation.

Significance: **Stangeria** is the one of the great cycades in the gymnosperms, the plants was very highly distributed in the 18 century in the Africa and the other part of the world. The plants has its values for the ornamentation as well as the medicinal aspects, these lines of the cycadophytes are very important since they have the great reservoirs of the gens as well as the metabolites, as the cycades are near to the extinction, so these plants needs the conservation and propagation for the maintenance of the lien of the evolution.

REFERENCES

1. Cycad Society of South Africa: *Stangeria eriopus*.

CHAPTER-5 CONIFERALES

The many of the trees of the conifers are the evergreen and they have the needles in them, the needles are the scaly leaves, they are the dominant forest maker in the northern hemispheres of the world. They are the chief forest makers in USA and the Mexico. The stem has the two kinds of the shoots; these are the long shoots as well also the short shoot. The shoots has the needles on the top of the stem. The needles are the adapted for the xerophytes habitat. The reproduction occurs in the forms of the cones, the cones are the male cones and the female's cones, the female cones have the many kinds of the megasporophylls.

Many of the species are the dioecious and some of the many of the species are monoecious, the male and the female cones are present on the same branches or the same trees. They are cosmopolitan in distribution and they are widely present in the Polar Regions.

The order is divided in to the following families:

- | | |
|---|--|
| <p>Araucariales Gorozh. 1904</p> | <p>Araucariaceae
Podocarpaceae
Sciadopityaceae</p> |
| <p>Cupressales Link 1829</p> | <p>Cupressaceae
Taxaceae
Pinaceae</p> |

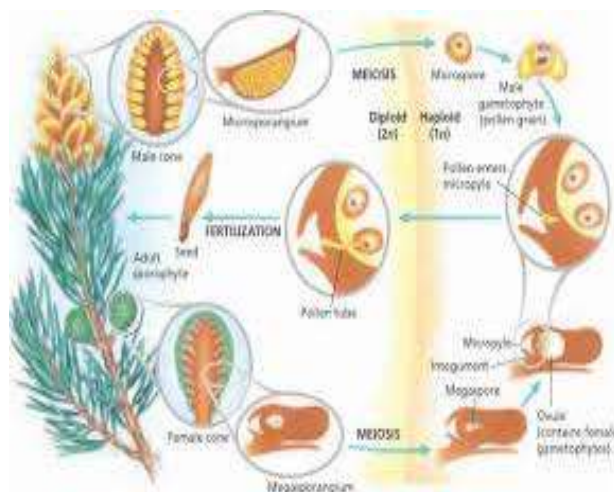


Figure 1: The lifecycle of an conifers (sources: ALPF medical research).



Figure 2: Cones of conifers.



Figure 3: Types of Cones of conifers.

A) Araucariaceae

The family include the three genera's, these three genera's are featured by the 40 species. Evergreen trees are with the arborescet tree habit, in addition the spirally arranged leaves, with the short and the long shoots, with the spurs. The trees are the dioecious and the monoecious. Male cones are relatively long and they have the spirally arranged microsporophyll's leaves, in them the male organs or the pollen can be seen. The female cones are the long and they are the woody cones, the ovuliferous scales are woody and they bear the ovules on them. Cotyledons are four and the two cotyledons are two.

Many of the genus species are used for the timber purposes and they are also used for the logging purposes. The cones and the other parts of the trees are of the several uses. The descriptions of the some of the genera's are as follows.

A) Agathis

Agathis are commonly known as the kauri or the dammal, the trees of the *Agathis* are the evergreen trees, the genus is the mixture of the 22 species, the genus is the mixture of the many kinds of the ancient and the advanced features of the evolutionary

significances. The genus was widely distributed in the Jurassic and the Mesozoic time period. In India and in the other part of the globe the genus is widely distributed in the southern hemispheres.

The mature kauri tree has the large trunk with the conical shapes and the canopy of the tree is highly unbranched up to the crown of the leaves. The leaves are the needle shaped and they are acute and the margins of the leaves are serrate and they are oval, the tree is the conical in shape. The bark of the tree is large and gray in colour. The bark peel in the forms of the flasks or in the form of the sticks. The branches of the tree spread out in the form of the horizontal direction.

The cones are of the two types, these are the male and the females cones, the male cones are the round shaped and the females cones appears late in the seasons.

The timber of the tree is very valuable. They are of the commercial importance. The timber is of the fine quality, the wood is used for the variety of the functions, and these are the guitar and the other musical instrumentations. The bark is smooth and gray and they on the maturity turn in the form of the brown colours. The branches are of the ascending types and they forms the conical shapes and they appears in the form of the crown.

The leaves are leathery and they are arranged in the form of the opposite's direction, they are acute and they are leathery. They have the anatomy typical of the dicot natures. The resin ducts and the resin canal can be seen in these wood. Seed of the some of the species are spread and they are disseminated by the moth, these are the Agnothomorpha. The kauri tree is very valuable form the timber purposes, they are utilises for the purposes for the formation of the many kinds of the instrumentation of the musical and the other purposes. A number of the species of *the Agathis* known, these 22 species are summarises as:

1. *Agathis atropurpurea*—black kauri, blue kauri (Queensland, Australia)
2. *Agathis australis*—kauri, New Zealand kauri (North Island, New Zealand)
3. *Agathis borneensis* (western Malesia, Borneo)
4. *Agathis corbassonii*—red kauri (New Caledonia)
5. *Agathis dammara* (syn. *A. alba*, *A. celebica*, *A. loranthifolia*)—Bindang (eastern Malesia)

6. *Agathis endertii* (Borneo)
7. *Agathis flavescens* (Peninsular Malaysia)
8. *Agathis kinabaluensis* (Borneo)
9. *Agathis labillardieri* (New Guinea)
10. *Agathis lanceolata* (New Caledonia)
11. *Agathis lenticula* (Borneo)
12. *Agathis macrophylla* (syn. *A. vitiensis*)—Pacific kauri, dakua (Fiji, Vanuatu, Solomon Islands)
13. *Agathis microstachya*—bull kauri (Queensland, Australia)
14. *Agathis montana* (New Caledonia)
15. *Agathis moorei*—white kauri (New Caledonia)
16. *Agathis orbicula* (Borneo)
17. *Agathis ovata* (New Caledonia)
18. *Agathis philippinensis* (Philippines, Sulawesi)
19. *Agathis robusta*—Queensland kauri (Queensland, Australia; New Guinea)
20. *Agathis silbae* (Vanuatu)
21. *Agathis spathulata*—New Guinea kauri (Papua New Guinea)
22. *Agathis zamunerai*—Patagonia, South America (Argentina).

Several species of the *Agathis* has been worked out by the many workers, however the work of the P.Thomas is very significant in the field of the *Agathis* biology. They have worked on the several status such as the conservation strategies of the *Agathis* species, he worked on the AOO, and AOE, the several species of the *Agathis* has been declared as the near threatened or near the extinction. The estimated area of the Occurrence of the *Agathis atrocarpurea*(AOO) is near the threatened species or near the threatened lines. The EOO is also very low and it is also very poor. So it is supposed that in the near future this line of the evolution may becomes the endangered and they become of the near of the extinction.

The main reason for the degradation of the belt of the *Agathis atrocarpea* are the continuous logging and the deforestation as well as the some of the infection by the pathogens like the *Phytophthora cinnmonai*, the invasion of the alien spec another reason for the debarkation of this belt of the evolution.

The timer of the species is very significant and they are utilises for the Varity of the purposes, for the formation of the Many kinds of the valuable furniture and the other goods.

Agathis orbicula: The species has been consider as the endangered according to the version of the IUCN as the endangered 3.1. The species is highly distributed in the different islands of the borneo, how ewer the main problem of the wood degradation is the logging of the wood discontinuously without the proper means of the propagation of the trees in the islands.

In the 1996 the tree has been declared as the vulnerable however later on the basis of the AOO and on the basis of the AOE the genus has been decry as the endangered.

Agathis flavescences ridi: The genus is known from the mountain of the capeninsular malasiya, the total number of the individual of the genus are the 1000 in the area. Theses number is restricted to the small area. However due to the small number the genus and the [species of the area can be very reduced and they can be extinct in the near future. the IUCN estimation on the basis of the AOO and the AOE the exact calculation has not been done.



Figure 1: *Agathis* sp. Forest (sources: wildscreen.com).

Agathis lentiula: the species is vulnerable

Due to continue logging the species has been considered as the vulnerable, the AOO and the EOO the species has been declared as the vulnerable.

The description and the IUCN categorization of the other species of the *Agathis* genus are more or less similar and many of the species of the genus are endangered and they need the protection and the conservation, the basic threat are the continues logging and the decline of the forest woods for the Varity of the purposes, so the genus needs the conservation.

B) Araucaria

Araucaria is the evergreen tree of the coniferous family, the genus belong to the arucaricaeae family, there are about the 20 extant genera's, many of the species of the Araucaria are endemic of the New Caledonia.

A number of the endemism can be seen in these islands groups. The tree is mostly dioeciously, male and the female cones both are separated. The stem of the tree is massive, the height of the tree is very massive, the trunk of the stem varies from the 5-80 meters. The horizontal branches appears spreading from the right angles of the tree upwards, the branches are covered by the needled like leaves, they are overlaping types, the leaves covers the branches completely. the leaves are narrow, needle shaped ad they are awe shaped, females cones are generally, appears on the top of the tree rather than on the same length, the male and female cones are on the differ length. The sizes of the cones range from the 7-25 cm. The seeds have the winged shaped structures and they are the edible.

Members of the Caledonia are founds in the Argentina, chilae, brazil and new Caledonia. In the New Caledonia many of the species are endemic. They are the living fossils; they go back to the Mesozoic era. The genus is covers from the northern hemisphere. They flourish the world during the cretaceous period and they were decline at the end of the Mesozoic era. The rocks of the New Caledonia islands are made-up of the pure supply of the nickel and the other composition. The New Caledonia islands are at the junction of the threats due to the mining of the nickel and the other ores. The Araucaria and the other related species are at the junction of the extinction, it is suppose that *Araucaria* and the other related species were there extreme development at the time of the sauropods, it is suppose that the long neck of the sauropods are used for the long Araucarians.



Figure 1: *Araucaria* species (figure:Wikipedia).

There are four extant sections and the two extinct sections of the Araucarians.

The living genera are divide in to the clades. These are the *Araucaria*, *bunya* and the *intermedia*, the another is the monophyletic genus which is termed as the *Eutacta*.

Some of the chracyers of the genus are as follows:

1) Arucaria: the leaves are borard, cones are more than 12 cm, seed germination are hypogeal. the species are genus are as follows:

Theses geerna are as follows, *Aruacaria angustifoliia*, *A. nipponenesis*, *A. aracana*.

2) Bunya: it consists of the one living species, seeds are recalcitrant and they have the hypogeal kinds of the germination of the seeds, there are four following species of the Bunya, the genus consists of the following species, *A.bidwilli*, *A.brown*, *A mirabilis*.



Figure 2: Araucaria in the natural places (sources: Gardening express).

A. spheracarpa

- 3) Intermedia: contains only one living species, the seeds are the recalcitrant's, there are the two species which are enlisted as:

A.hunsteinni

A.hassthi

- 4) Eutacta: leaves are narrow, awl like, the height of the cones ranges from thr 12cm to the high. Seed germination epigeal. There are following species are included in this section.

- *Araucaria bernieri* – New Caledonia
- *Araucaria biramulata* – New Caledonia
- *Araucaria columnaris* – Cook pine; New Caledonia
- *Araucaria cunninghamii* – Moreton Bay pine, hoop pine; Eastern Australia, New Guinea
- *Araucaria goroensis* – New Caledonia
- *Araucaria heterophylla* – Norfolk Island pine; Norfolk Island
- *Araucaria humboldtensis* – New Caledonia
- *Araucaria laubenfelsii* – New Caledonia
- *Araucaria luxurians* – New Caledonia
- *Araucaria montana* – New Caledonia

- *Araucaria muelleri* – New Caledonia
- *Araucaria nemorosa* – New Caledonia
- *Araucaria rulei* – New Caledonia
- *Araucaria schmidii* – New Caledonia
- *Araucaria scopulorum* – New Caledonia
- *Araucaria subulata* – New Caledonia
- †*Araucaria lignitici* – (Paleogene) Yallourn, Victoria

Some of the extinct genera of the *Araucaria* lines of the evolution are as follows.

Section: *Yezonia*, it contains only one species, these are the *Araucaria vulgaris*.

Section: *Perpendicula*

A. desmondii.

Some of the applications of the genus are as follows:

These uses are as follows:

- 1) Some of the species of the genus are utilised as the ornamental purposes.
- 2) Some of the seeds of the species are eaten as the nuts, like the *A. angustifolia* and the *A. bidwillii* are eaten as the American nuts.
- 3) In some of the cases the woods of the *Araucaria* are used as the woods.
- 4) Some of the pharmacological work of the araucarians shows the following uses of the woods as well as the leaves, these are as follows. antiulcer, antidepressant, antiviral, neuroprotective, anticoagulants.

Many of the species of the ***Araucaria*** are at the junction of the extinction, this line of the evolution is very primitive and they need the conservation, there are many species are investigated and many of the species are declared as the endangered on the basis of the AOO and the EOO. They were vulnerable at the time of the 1990, after the exploitation of the woods and from them any other purposeless tree or the genus has been declared as the endangered and the near to extinction. The genus has the endemism in the new Caledonia as well as some of the places of the Argentina as well as the new America. The *Araucaria* lines of the evolution were very primitive and they have the many characters in the intermediate series from the gymnosperms lines of evolution to the angiosperms, they coevolved with the large and giant dinosaurs of the time of Jurassic and the Cretaceous. So careful conservation is required for the proper propagation of the genus.

C) *Wollemia nobilis*

Araucariaceae family consists of the basically of the three genera's, one of them is the *Agathis*, *Araucaria* and the *Wollemia*, all are the typical kinds of the primitive genera and they have the relict kinds of the distribution.

The *Wollemia* is the genus which is presented by the only one species this is the *Wollemia nobilis*, the genus has the very narrow distribution and they are confined of the very limited places of the western australias, this is the Sydney. The genus is the monotypic and it is presented by the one of the species called as the *wollemia nobilis*. The discovery of the genus is also very interesting, the genus was discovered by the one of the English person Nobel, the genus is presented in the form of the patch of the 40 individuals one of the places. On the basis of the AOO and on the basis of the EOO the genus is declared the very restricted and they have been categories as the critically endangered.



Figure 1: *Wollemia nobilis* (sources: Wikipedia).



Figure 2: *Wollemia nobilis* cones (sources :Wikipedia).

The architectures of the genus is typical of the arucarians, the long stem and the leaves and types and kinds of the foliage are the typical of the gymnosperms conifers, the leaves are in the form of the needles and they are present on the long and the short shoots in the two rows. The DNA analysis of the genus shows that the evolution of the species occurs in the same lines and they are of the clones. The DNA phylogenetic studies of the *Araucaria* and the *Agathis* and the *Wollemia* shows the closest phylogenetic relationships and they are close in the lines of the evolution. The analysis of the chloroplast DNA is another significant way for the tracing out the evolution. The area where the gymnosperm *wollemia* grows it is the place which is also the assemblage of the many kinds of the pteridophytes and the ferns. The area of the AOO and the EOO is need to be conserved and they needs to be propagated, so that these lines of the evolution can proceed and can be propagated.

B) PODOCARPACEAE

Podocarpaceae is a large family of mainly Southern Hemisphere conifers, comprising about 156 species of evergreen trees and shrubs.^[1] It contains 19 genera if *Phyllocladus* is included and if *Manoao* and *Sundacarpus* are recognized.

The family is a classic member of the Antarctic flora, with its main centres of diversity in Australasia, particularly New Caledonia, Tasmania, and New Zealand, and to a slightly lesser extent Malesia and South America (primarily in the Andes mountains). Several genera extend north of the equator into Indochina and the Philippines. *Podocarpus* reaches as far north as southern Japan and southern China in Asia, and Mexico in the Americas, and *Nageia* into southern China and southern India. Two genera also occur in sub-Saharan Africa, the widespread *Podocarpus* and the endemic *Afrocarpus*.

Parasitaxus usta is unique as the only known parasitic gymnosperm. It occurs on New Caledonia, where it is parasitic on another member of the Podocarpaceae, *Falcatifolium taxoides*.^[2]

The genus *Phyllocladus* is sister to Podocarpaceae *sensu stricto*.^[2] It is treated by some botanists in its own family, These are the following genre of the podocarpaceae and they are enlisted as:

- *Microstrobos*

- *Nageia*
- *Parasitaxus*
- *Phyllocladus*
- *Afrocarpus*
- *Dacrycarpus*
- *Dacrydium*
- *Falcatifolium*
- *Halocarpus*
- *Lagarostrobos*
- *Lepidothamnus*
- *Manoao*
- *Microcachrys*
- *Podocarpus*
- *Prumnopitys*
- *Retrophyllum*
- *Saxegothea*
- *Sundacarpus*
- *Acmopyle*

A) **Saxogothia**

Saxogothia is the monotypic genus, the genus consist of the single species termed as the *Saxogothia conspicua*. It is the only conifer genus of the podocarpaceae family. The genus is native of the southern Chiloe as well as of the Argentina. Naturally the tree grows at the height of the 800 -1000meters. The species are of the 15-20 meters, the width of the tree is of the 3-4 meters Leaves are the liner as well as the lance late and they are minute, they are of the 2-3 mm in length and 1-3 mm in width. The cones are of the height of the 2-3 mm. The cones contain the 15-30 ovuliferous scales. *Saxogothia* are only genus of the Argentina as well as of the Chiloe. The genus has been declared as the near threatened according to the version 3.1.



Figure 1: *Saxogothoeaea* in the natural habitat (sources Wikipedia).

B) Prumnopitys: vulnerable Taxa

Abstract: Gymnosperms are plant of the great values, they have the very rich evolutionary background and the composition of the metabolites is of great economic and the medicinal values. Among the gymnosperms there are three major lines of the evolution, these are the Cycadales, coniferales and the genatales lines of emergences. coniferal are the most abundant gymnosperms, they have all together three families, one of them is Pinaceae, podocarpaceae, cuppresaceae. Podocarpan are the assemblages of the plant which have the tree architectures, they are evergreen and have the longitudinal branches, leaves are arranged spirally as well as in the whorl and they are needled and in some species they are as microphylls. In this review article we are presenting some of the aspects of the genera of podocarpaceae family entitled as the **Prumnopitys**, this genera is well distributed in the Alps mountain series. overall the genera contains the 11 species as whole, the genera is valuable from the commercial point of view with respect to the wood and the medicinal values of the bark. IUCN categories the genera as the valuable and vulnerable and it needs protection and conservation for the genera and great line of evolution.

Keywords: Gymnosperm, conifers, IUCN, vulnerable, needles, conservation.

Introduction: Gymnosperms are the naked seed plants; they have the seeds which are strictly attached with the ovuliferous scales, gymnosperms have the dominant flora in the late and the upper Mesozoic era. Now majority of the gymnosperms are at the junction of the extinction and totally they are presented by the three lines of the

cladistics, these are the cycadales, coniferales, gnetales. overall the conifers are the valuable and the important flora. About 55 genera of the coniferales are existed on the earth and about 500 species of the conifers are distributed whole globe, they forms the belt in the upper hemisphere and dominant ecosystem and the vegetation also have been the significant point of the classification of the vegetations. they are generally monoecious and the male and the female sex cones are presents on the same or the different plants.^[2] Female cones presents the ovuliferous scales of different taxonomic position.^[2] Different peoples classify the conifers with their own classification pattern. However they have three or four families, these are the Pinaceae, cupressaceae, Podocarpaceae.^[7]

Podocarpaceae are the evergreen trees with stout trunk and the broad bases, the trunk contains the horizontal branches with the armour of leaves. leaves are the evergreen as well as in some of the species the leaf are found to be shreds.^[2] Usually they are opposite and the spirally arranged with the long needles. Members are Monoecious as well as dioeciously. Pollen are arranged in the group and they are catkin like.^{[7][2]}

All members of the podocarpaceae have the arbuscular and vesicular mycorrhizae.^{[7][2]} Majority of the members of the podocarpaceae are distributed in the south East Asia as well as the New Zealand and the Australia. Some of the genera of the podocarpaceae are enlisted as.^[2]

Acropyle, Dacrycarpus, Lepidothamnus, Manoa, Microcachrys, Microstrobilus, Nageia, Parasitaxus, Phyllocladus, podocarpus, Retrophyllum, Saxegothea, Sundacarpus, Prumnopitys.

1. Prumnopitys

Prumnopitys is the members of the podocarpaceae, **it is the evergreen member of the family**, generally the plant is in the form of the giant tree and the height of the tree is about the 40 to 50 meters. prumno is the Greek word and the meaning of the prumno is the presence of the resin canal in the side of the tissues.^{[7][2]}

The leaves of the tree are similar to the yew plants and they are 1-4 cm in long and the 2-3 mm in width. the plant have the both of the sexes in the form of the cones, male cones and the female cones on the separate branches.^{[7][2]}

The plant is distributed in the New Zealand and the New Caledonia and the Australia.

These are some of the species of **the Prumnopitys**.^{[7][2]}

- © *Prumnopitys andina*
- © *Prumnopitys exigua*
- © *Prumnopitys ferruginea*
- © *Prumnopitys ferruginoides*
- © *Prumnopitys harmsiana*
- © *Prumnopitys ladei*
- © *Prumnopitys montana*
- © *Prumnopitys standleyi*
- © *Prumnopitys taxifolia*.



Figure 1: Prumnopitysgenus (sources chilae flora.com).



Figure 2: Prumnopitysmegacones(chilae flora.com).



Figure 3: Prumnopitys female cones (chilae flora.com).

2. IUCN data considered the tree as the vulnerable in the 2003 on the basis of the area of the occupancy(AOO) and the area of extent (AOE). There are about the 8 location and the 8 subpopulations' of the **Prumnopitys** genera.^{[7][2]} Each population contains about the 20 to 2000 subpopulations or the mature individuals.^{[7][2]} so IUCN has categorised the genera as the vulnerable according to the version E-2.^{[8][9][10]}
3. **Threats:** There are several reasons for the decline of the species or the genera of the **Prumnopitys**. The species is valuable for the wood and the other constructions. The forest fire are the another reasons for the degradation of the genus. Sometimes the bark of the species also contains many kinds of the metabolites of the medicinal importance. Fleshy coating of the seeds are the another reasons for the degradation of the species. Hydroelectric projects' f the area of the occurrences of the trees are another reasons for the degradation or the demolition of the Species'.^{[7][2]} Sometimes plantation of the exotic species form the another laces are also the reason for the degradation or declining of the spcesis.^[2]

Volcanic activity and their lava are also the reasons for the degradation of the ecosystem of the **Prumnopitys**.^[7]

4. **Conclusion:** well this is the short account of the genus **Prumnopitys**, this genus has the about 11 species all over the world, and they are endemic in distribution, in this decades and in the other past decades the species are degrading due to the several reasons.so this genus needs the protection and the conservation.

C) *Retrophyllum*

Retrophyllum is the only conifers of the podocarpaceae family; the genus has the five species which are world wide distributed. The genus has them any centre of the distribution however many of the species are located to the tropical rain forest. Native places are the Indonesia as well as the pupae New Guinea, as well as some of the places of the South America are also the centre of origin. *Retrophyllum* is the only conifer of the family. They show the relict kinds of the distribution. The five species of the genus shows the restricted kinds of the distribution as well as they have the very narrow kinds of the distribution in many places of the world (retrogressive evolution). The leaves of the genus are the small, and they are evergreen, they are present on the short and the long shoots. The bark of the stem and the shoots are small and they are scaly, the leaf blades are flat, in the leaves and on the cones resin canal are present. The cones are of the various sizes, they have the long kinds of the microsporophylls with the two pollen sacs, and the pollen is winged.



Figure: 1 *Retrophyllum* in natural places (sources wild screen archives).

These are five species of the *Retrophyllum*, these species are enlisted as

- 1) *Retrophyllum comptonii*
- 2) *Retrophyllum minus*
- 3) *Retrophyllum pierssi*
- 4) *Retrophyllum rospigliosii*
- 5) *Retrophyllum vitiense*

D) *Saxogothea*

Saxogothea is the monotypic genus, the genus consist of the single species termed as the *Saxogothea conspicua*. It is the only conifer genus of the podocarpaceae family.

The genus is native of the southern Chiloe as well as of the Argentina. Naturally the tree grows at the height of the 800 -1000meters. The species are of the 15-20 meters, the width of the tree is of the 3-4 meters Leaves are the liner as well as the lance late and they are minute, they are of the 2-3 mm in length and 1-3 mm in width. The cones are of the height of the 2-3 mm. The cones contain the 15-30 ovuliferous scales. *Saxogtheaea* are only genus of the Argentina as well as of the Chiloe. The genus has been declared as the near threaded according to the version 3.1.



Figure 1: *Saxogtheaea* in the natural habitat (sources: Wikipedia).

E) Dacrycarpus: a small podocarpean genus

Abstract: Gymnosperms are the plants of the great values, they have the assemblage of the metabolites and the evolutionary features. Seed without fruit is the prominent features of the gymnosperms, generally conifers are dominant form of the gymnosperms. Since cycadales are represented by the only 11 genera's of the relict and rare distribution. Conifers are presented by the families, these are the Podocarpaceae, Pinaceae, and the cupreseceae. Podocarpaceae are the giant tree with the arborescent habits, they have the height of the 50-60 meters and the bark of the tree is of the various shape and it appears in the form of the plates and the sheets. They have the long male and the female cone with the catkin like appearances and the seed are in the cupules which are fleshy in structure. Here in this review article we are presenting some of the aspects of genus entitled as the **Dacrycarpus** of the podocarpaceae family. This genus is giant tree with the scales on the bark and they represent the whole of the charters of the podocarpaceae. Australia, New Zealand and

New Caledonia are the endemic point of their distribution. IUCN categories the tree as the endangered since continuous habitat destruction is the threats of the species.

Keywords: Gymnosperms, evolution, habitat destructions, arborescence, IUCN.

Introduction: Gymnosperms are the assemblage of the trees which have the combination of the characters. This line of evolution flourishes well in the upper Jurassic period, later on continues decline as can be seen in the vegetation.^[5] They have the great fossil history. In this era the gymnosperms are presented by the three lines of the evolution, these are the Cycloclades, coniferales and the Gnetales lines of the evolution.^[4] Coniferales are the most dominant form of the gymnosperms, about 56 genera of the coniferales dominate the earth now and they are presented by the 500 species. Coniferales have the three families overall these are the Pinaceae, Podocarpaceae, Cupressaceae.^{[4][5]}

Podocarpaceae are the evergreen trees, with the large and the huge trunk, the leaves are in the whorl and they are evergreen.^{[4][5]} Some times in some of the genera's they are presented by the needles and Microphylls.^[4]

Generally the members are Dioecious as well as the Monoecious. Male cones and the female cones are catkin in appearance. After the reproduction the ovuliferous scales turned in to the cupules like structures. In some of the genera they are fleshy and in some of them they have the huge gap, sometime this features of the podocarpaceae have been taken in to the consideration for the taxonomic placement of the genera.^[5]

Dacrydium is the evergreen genus of the podocarpaceae family. The genus is characterised by the Nine species. The height of the plant is about the 50 -60 meters.^{[4][5]}

Native place of the genus are the New Caledonia, Indonesia, Malaysia, Philippines and some place of the Australia.^[5]

Initially the genus was placed under the genus **Podocarpus**. The genus was described by the De laubenfels in 1969.^[4]



Fig 1: Dacrycarpus species (sources Alchetron).



Fig 2: Dacrycarpus species (sources Alchetron).

Some of the species of the Podocarpaceae are enlisted as.

- 1) **D.cinctus**
- 2) **D.compactus**
- 3) **D.cumingii**
- 4) **D.dacrycoides**
- 5) **D.expensus**
- 6) **D imbricatus**
- 7) **D.viellardii**
- 8) **D stevii.**

This tree is valuable for the timber and the other features. The wood is used for the variety of the purposes. Habitat destruction and the logging is the major threats of the species.^{[4][5]}

All the features of the **Dacrycarpus** resembles to the podocarpaceae. IUCN veriosn 3.1 states the genus as the vulnerable.so proper conservation and cultivation of the genus are required.

NOTE:

- 1) Dear sir there is not any conflict of interest
- 2) We have written a review article, so there is not any ethical consideration.
- 3) There is not any funding agency.

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F) *Lepidothamnus*

Lepidothamnus is the genus of the podocarpean family; the genus is present in the form of the trees shrubs and herbs. The genus has the three species, *Lepidothamnus laxifolium*, *L.foenkii*, *L.intermidium*. *L.foenkii* is the least concern genus, the genus is native of the Argentina and the Chiloe, the genus has the threats due to the fire as well

as the continuous cuttings. The IUCN declares the genus as the least concern according to version 3.1.

Lepidothamnus intermedium, the genus is the least concern according to the version 3.1.



Figure 1: *Lepidothamnus* species (sources: Chiloé flora).

The genus is endemic of the New -zealands. In the past the genus was used as the formation of the railway creepers, boat building and the other goods. No specific threat of the genus has been identified till yet.

Lepidothamnus laxifolium, according to the version 3.1 the genus is the least concern. The genus is common in the alpine as well as in the other subalpine region of the New Zealand's. No specific threat as well as the no uses of the woods of the genus has been identified till yet.

G) Lagerostrobus

Lagerostrobus is the genus which is the native of the south Tasmania. The genus has the one recognised species that has been termed as the Lagerostrobus *frankinnln*, the genus is known as the huson pines. Sometimes the morphological similarity of the genus is quite similar with the rest of the taxa's that they have been included formerly in the other podocaprean genus. Sometimes the genus found similar with the *parataxus*. The wood of the genus is very valuable and it is used commercially for the production of the many kinds of the fuernitures. The fragrances of the timber is also very fines and they utilised for that purposes. Some of the woods of *the Lagerostobus* are too olds and they are of the 2000 years old. The leaves are small and they are in the form of the microsporophyll's and the leaves are spiral arranges in the shoots. The

height of the shoots is about the 10m to the 50 meters. The tree is the dioecious and the male and the female cones are different from the branches and they are present on the different shoots. Male cones are of the height of the 4-5 mm long and they have the ovuliferous scales on them the pollens are found. The females' cones have the megasporophylls of them the ovule are presents. Overall the genus has the typical kinds of the podocarpeun features. The IUCN declares the genus as the endangered due to the continuous logging and the regular cutting of the wood of the different type of the Commercial purposes. The destruction of the habitat is the reason for the disesapperces of the woods.



Figure 1: *Lagerostrobus* genus (sources: findmepalnts).

H) Sundacarpas

Sundacarpas is the evergreen genus, it is the dioecious tree, the tree is the evergreen and they are present together with the other forest of the conifers like the genus of the podocarpaceae family as well as the genus of the cupressaceae family. The genus was designated as the genus by the C.N. Page in 1989. Previously it was classified as the podocarpeun genus or the *prumnopitys*. The genus is the least concern. The genus is about the 10-60m. The trunk of the genus is about the 12-140 cm. The leaves are about the 5-15cm.long and narrow. The genus is native of the Australasia as well as the Malaysia. The genus has been declared as the least concern according to the version 3.1 as the least concern. The continuous logging of the forest is main problem that why the genus has some threat but still there is not any specific threat to genus, so it is widely distributed.



Figure 1: *Sundacarpous* genus (sources IUCN categories).

I) *Phyllocladus gymnosperm*

This is the only conifer genus of the podocarpaceae family; the genus is native of the Indonesia as well as the New Zealand's and the Japan. The genus is very different from the rest of the genus of the podocarpaceae family; the genus is in the form of the flat phylloclade which are adaptation towards the hard conditions. Sometime the morphologically the genus is so differ that some of the taxonomists involves the genus in the separate family. The height of the genus is about 10-40 meters; the main shoots as well as the dwarf shoots are also present. The leaves are present in the form of needles and they are microphylls, the reproduction occurs in the form of the male cones as well as the female cones. Overall the evolution is differ from the rest of the members. The genus include the five species. These species are enlisted a



Figure 1: *Phyllocladus* genus (sources: wildscreen archives).

- *P.alpinus*
- *P.asplenifolium.*
- *P.hy;pophllyus*
- *P.toaoa*
- *P.trichonodies*
- *Lagerostrobus*

Lagerostrobus is the genus which is the native of the south Tasmania. The genus has the one recognised species that has been termed as the *Lagerostrobus frankinnln*, the genus is known as the huson pines. Sometimes the morphological similarity of the genus is quite similar with the rest of the taxa's that they have been included formerly in the other podoacapean genus. Sometimes the genus found similar with the *parataxus*. The wood of the genus is very valuable and it is used commercially for the production of the many kinds of the fuernitures. The fragrances of the timber is also very fines and they utilised for that purposes. Some of the woods of *the Lagerostobus* are too olds and they are of the 2000 years old. The leaves are small and they are in the form of the microsporophyll's and the leaves are spiral arranges in the shoots. The height of the shoots is about the 10m to the 50 meters. The tree is the dioecious and the male and the female cones are different from the branches and they are present on the different shoots. Male cones are of the height of the 4-5 mm long and they have the ovuliferous scales on them the pollens are found. The females' cones have the megasporophyls of them the ovule are presents. Overall the genus has the typical kinds of the podocarpeun features. The IUCN declares the genus as the endangered due to the continuous logging and the regular cutting of the wood of the different type of the Commercial purposes. The destruction of the habitat is the reason for the disesapperces of the woods.



Figure 1: *Lagerostrobus* genus (sources: findmepalnts).

J) Afrocarpous: a vulnerable genus

Abstract: Gymnosperms are the plants of the great evolutionary values. They have the reserves of the metabolites and the many kinds of the genes of the evolution clock, they represent the whole of the giant ecosystem in the Mesozoic era; however during the Dawn of the Mesozoic era one can see the tremendous decline in the vegetation of the gymnosperms. Now in this era they are presented by only some of the specie

and the genera which can be counted on the fingers generally 85-86 and some 700 species all over the world. Among the conifers. Conifers are the most abundant and the widely distributed plants of the gymnosperms, in this review articles we are presenting some of the aspects of the genus **Afrocarpous** of the family podocarpaceae. Podocarpaceae are the trees which have the giant trees with the 40-50 meters in height. The plants of the Afrocarpous are the evergreen in the texture and they have the long needled and the male the female ovuliferous scales on them. The genus is endemic of the many palces of the Africa continent.

Keywords: Gymnosperms, conifers, endemic, evergreen, ovuliferous scales.

Introduction: gymnosperms is the word which is used for the naked seed plants, these plants are characterised by the lack of the vessels and the sieve tube elements in the vascular bundles. The formation of the fruits is lacking in whole of the group, which is the another evolutionary step in the angiosperms.^[8] whole of the gymnosperms are generally evergreen and whole conifers contains about the 55 genera's and the 700 species all together.^[11] coniferales order contains the three families these are the pinaceae, podocarpaceae, cupprssceaeae.^[8]

Podocarpaceae are the evergreen trees with the height of the 40-60 meters. They have the long foliage **and** the separate male and the female sexes with the catkin like of the appearances. The ovuliferous scales after the fertilization fused in to the cupules' like structure and they are the features of the taxonomic significance.^{[8][11]}

Afrocarpous is the genus with the Africa origin and the seeds with the peculiarities. Overall the genus has the six species in common. **Afrocarpos** the name was coined in 1989.^{[8][11]}



Fig 1: Afrocarpous species (sources African fern pines).



Fig 2: Afrocarpus species (sources African fern pines).

Initially the genus was placed in the group podocarpos but later on the basis of the separation of the ovuliferous scales the scales were separated and they never fused and forms the cupules as in the podocarpos, so it was placed separately.^{[8][11]} Page (1989) separated the genus on the basis of the absence of the cupules. Later on basis of the morphological and the molecular data the Beffins et al., (2001), Sinclair et al., (2002) described the genus separately and placed the genus related to the **Nageia**, by the **baseyan molecular clock analysis it was declared that Nageia, podocarpos, Afrocarpus and the Retrophyllum shares the common ancestors that separated around the 40 millions years ago of the evolution.**^{[8][11]}

The tree is the evergreen and the bark of the tree appears in the form of the thin plates.^[8] The leaves are simple and the phyllotaxy of the leaves is spiral.^[11] The plant is typically dioecious.^[11] Male and the female cone appear on the separate plants. Other features of the plant resemble with the podocarpaceae. Some of the species of the **Afrocarpus** follows as.^[8]

A.dawei, A.gausseii, A.mannii, A.falcatum, A. graciliana

Conclusion: The plant is valuable for the timber and the other constructions, the genus has the threats for the many reasons, so IUCN declared the genus as the vulnerable and needs the conservation.

C) Pinaceae

The **pine family** are trees or shrubs, including many of the well-known conifers of commercial importance such as cedars, firs, hemlocks, larches, pines and spruces. The family is included in the order Pinales, formerly known as Coniferales. Pinaceae are

supported as monophyletic by their protein-type sieve cell plastids, pattern of proembryogeny, and lack of bioflavonoids. They are the largest extant conifer family in species diversity, with between 220 and 250 species (depending on taxonomic opinion) in 11 genera,^[1] and the second-largest (after Cupressaceae) in geographical range, found in most of the Northern Hemisphere, with the majority of the species in temperate climates, but ranging from subarctic to tropical. The family often forms the dominant component of boreal, coastal, and montane forests. One species, *Pinus merkusii*, grows just south of the equator in Southeast Asia.^[2] Major centres of diversity are found in the mountains of southwest China, Mexico, central Japan, and California.

K) *Abies*: a Threatened genus

Gymnosperms are the plant of the **always** with great concerns, they have the fruitless seed, they represent the great evolution. In that recent era cycadales (one lines of the evolution) are the living fossils of the gymnosperms, this is the relict lines of the evolution, only few member are present here and they show the all feature of the pathways of the conservative evolution of the gymnosperms. Coniferales lines of the evolution is the main cladistces which have a combinations of the characters, they have all the characters of development and evolution of the gymnosperms, in this review we are analysing some of the aspects of the one of the confier entitled as the **Abies**. This is the dominant genus only after the **Pinus**, in the belt of the conifers forest in different mountains. Some of the main aspects of the **Abies** have been regarding to their occurrence and the conservation has been presented in this paper.

Introduction: Gymnosperm have the great evolutionary history, this lines of the evolution was abundant in the Mesozoic time period, however rapid decline can be observe during the end of the cretaceous periods, coniferales are the dominant & most abundant and distributed form of the gymnosperms, they have all the features of the maximum development of the Gymnosperms.^{[1][2][3]}

Fossil conifers have been reported from the early Jurassic period, they have the highest complexity of the tissue at that era, however the complexity of the tissues has not been observed like the angiosperms anatomy.^{[2][3][5]}

Conifers are the evergreen trees with the long bushes and the shrubs, they have the long needles with the two kinds of the shoots, these shoots are the dimorphic, one of them is the long shoots and the another one is the spur with the whorls of the leaves or the Microphylls.^[2] reproduction occurs by the cones, these are the male and the females cones with the woody textures and the appearances, ovuliferous scales are the point of the taxonomic significances.^[3] Commercially the conifers are utilised as the timber and the other wooden purposes. **Abies** is the genus of the family pinaceae and the order is the coniferales.^[5]

Abies is the important genus of the coniferales, commonly the plant has been termed as the **FIRS**. some of the species of the firs has been termed as the silver firs. **Abies** names has been proposed by the Nirgil (70-19 BC) for the wood of the plant, the name has been used for the scandivian fir, silver fir usually found in the high mountainous area (500-2000m^{[1][2][5]} The moist, humid condition are required for the cultivation of the firs, the rainfall for the cultivation of the firs should be between the 800-2000 mm, it is distributed in whole of the northern part of the world, they are distributed in the central Europe, v south and eastern Germany.^{[1][5][6][7]}

The plant is erect, pyramidal typical cone shaped, the plant has the very marvellous appearances, likes the typical ornaments.^[9] Leaves of the **Abies** are like the other coniferales needles, in some of the species dimorphism can be observed.^{[3][5][7]}

The genus **Abies** like the other conifers **Picea, cedrus, larix, Pesudosuga**, grows in to the northern hemisphere, to the arctic circles.^[3]



Fig. 1: Abies species, (source: Vnden berk nurseries).

In the genus **Abies** around 45 species of the **Abies** has been reported in all over the world and in India around 30 species has been reported from the Himalayas and the uttrakahnd region.

In the northern hemisphere of the world there is long belt of the conifers, among them **pinus** and the **Abies** form the dominant vegetation of the forest ecosystem. Arnold arboretum is the place in the haward university of the USA which has the unique collection of the various kinds of the **Abies** species naturally.^{[3][5][6]}

Leaves

Are the short and linear, lanceolate, very less stomata, resin canals can be seen on the leaves. They are limited by the resin secreting ducts from all sides.^[2] The position of the resin ducts with respect to the other tissues is always the matter of the great taxonomic significance. Many species of **the Abies** can be indentified on the basis of the position of the resin ducts with respect to the other tissues.^{[5][6]}

Cones of the plant are barrel shaped. The ovuliferus scales' of the cones are woody, two wings on the adaxial sites, they bears the ovules on it.^[3]



**Fig : 2 Abies tree ,the
(sources gymnosperm
databases)**

Majority of the species of the genus are monoecious. The both sexes can be found on the same plant. Bract of the cones are more longer than the other cones e of the genera's.^{[2][5][7]}



Fig 3: Abies cones (source gymnosperm databases).



Fig : 4 Abies sp .microphylls (sources vascular palnt images library)

Some of the characters' of the species of the ABIES are enlisted as.

Abies alba: grows widely in the Europe, mostly in the hilly area, from the 38 north latitude to the 52 north latitude.

Habit: The height of the **A. alba** is around 70m, however variation in the height can be observed, the shape of the tree is pyramedical, later on branches diverge in to the different directions. leaves are needles shaped, form 2cm to the 2mm, linear, with ridges and the groves, there is proper angels in the diverges of the leaves from the branches.^{[5][6][7][8]}

Cones: are green, 11 cm to 4 cm, at the both end are the ouvluiferous scales with the tapering in to the end. Some of the species of the **Abies** like the **Abies nordamniana** are also very similar to the above species.^[3]

Abies anabilis: It grows in to the southern Alaska to the Oregon. They grows from lower elevation to the higher elevation of the mountain, this species of the fir can be found f in to the Olympic peninsula, of the Washington. In the armold arboretum of the harward university there is one specimen of the **Abies anabilis**.

The plant is paramedical, spiral like growing at the height of the 80-100 m, in its native habitat, foliage are from the 5cm to the 3 cm, flattened, linear, occasionally notched, curved slightly, margin entire. The stomata are deep sunken. Resin canal are in margin, cones are of the 10-15 cm and 5-6 cm in height. Some of the species of **the**

Abies are similar. with the **A.nordmaniana**, the variations can be seen in the position of the resin canal of the leaves.^{[2][3][5]}

Abies balseamia: Balsum fir, balsum fir is the native of the northern united states, and Canada, from Newfoundland to Alberta. The fragrances of the tree is like the balsam. The name balsum is also applied to the other species of the fir also. These species are enlisted as:

Abies lepidocarpa, **Abies concolor**, it is the cold climate tree, the height of the tree reaches up to the 30-40 meters.

The growth pattern of **the A.balsamina** is slow. The plant is symmetrical, conical, crown like, it is used for the purposes of the ornamentals.^[2]

Some of the species of the **Abies** are hybrid. They are the resultant of the fusion of the two species, among them **Abies borsiversis**, this is the hybrid between the **Abies cehalonica** and **Abies alba**, this plant species grows in to the Bulgaria.it is supposed that hybridization occur between the ice ages.

Abies religiosa: This is commonly known as the oyuanmer fir. According to the version of the IUCN 3.1 the species has been consider the least concerns. The native place of the species is the Mexico. The species is utilised for the timber and the other purposes. Continuous logging and the habitat destruction are the reasons for the degradation of the species in the places, so careful conservation of the genus are required for the propagation of the species for the Varity of the purposes.^{[1][2]}

Abies alba: commonly known as the silver fir. The IUCN version 3.1 says that the species is the least concerns. On the basis of the AOO (area of the occupancy) and the area of the extent (AOE) the species has been declared as the least concern, since the species of the genus is widely spreaded. This species of the **Abies** is commercially very valuable and significant.

Abies vejarii: This is commonly known as the vejour fir. the species has been declared as the near threatened, they are endemic to the north east Mexico, on the basis of the area of the occupancy and the extent it has been reported that the species members are

degrading due to the natural fires and the logging and the degradation of the habitat.^{[1][2][3]}

Abies numicida: this is known as the Algerian fir. The genus has been declared as the critically endangered. This species is threatened to the verity of the reasons these are the forest fires and the logging, another reasons is the degradation of the habitat.^{[1][2][5]}

Alba densa: this is commonly known as the Sikkim fir. Previously this species is placed in the species termed as the **Abies spectabilis**, later on it was found that on the basis of the morphological and the phylogenetic evidences there is marked difference in the **spectabilis**, so it should be placed in to the separate species **densa**.^{[1][3][7]}

Some of the species of the Abies also follows the same features with minor difference, so they can be included as.

A. Recurvata, A.anabilis,A squamata, A.sibirica, A grandis.A.gutalensis.

Uses of the ABIES

- 1) The **Abies balsemia** popularly known as the charismas tree.it is worshipped in the occasion of the chrismus day as a festival tree.
- 2) The resin is used to produces the Canada balsam.
- 3) It was traditionally used for the treatments of the cold and the other diseases.
- 4) The resin is used for the purposes of the glues.
- 5) It is used for the formation of the optical instrument compounds.
- 6) It is used for the preparation of the permanent slides of the tissues.
- 7) The resin is important medicinally, the Canada balsam has been used for the treatment of the scurvy.
- 8) The wood of the tree is used for gthe construction of the many products of the commercial values.
- 9) The pulp is uses for the manufacture of the paper.
The balsum is used for the air freshener.
- 10) The leaves of the abies are ayurvedis in nature; it is used for the treatment of the variety of the diseases.
- 11) The resin is bronchodilator.
- 12) In majority of the cases the resin is used for the treatment of the varitey of the respiratory disorders.

Conclusion: well the review shows the basic points of the **Abies** genus with some species, **Abies** is the major conifers in the conifers belt of the northern hemisphere as well in India in the Himalayas range. Majority of the species of the **Abies** are at the critically endangered due to the habitat destruction and the natural reason like the forest fires and the climate change so we need to conserve this lines of the evolution for the maintaince of the metabolites as well as the phylogenetic genes for the tracing out the evolution.

L) Pseudolarix: a endangered genus

Gymnosperms are the naked seed plants without fruits. They are generally evergreen trees with needles and beautiful woody cones on them. Seeds are present on the ovuliferous scales, the sizes and the shapes of the ovuliferous scales are of the taxonomic values for the several species of the genera. Coniferales order of the gymnosperms are evergreen trees with commercial values, they are lorches, cedars, pines, hemlocks. The plants has two kinds of the branches, these are the long branches and the short spurs. Short spurs are filled with the needles and bark. In this review article we are working on the some of the aspects of the, one of the genus entitled as the **Pseudolarix**, this genus is monotypic having one species entitled as the **Pseudolarix amabilis**. commonly it is known as the **Chinese golden lorches**. The plant is valuable commercially and wood is used for the variety of the purposes, IUCN version categories the genus as endangered on the basis of the area of the occupancy (AOO)and the area of the extents(AOE) in the china.The genus is valuable commercially as well as medicinally,so it requires the protection and the conservation.

Introduction: Gymnosperms are the plants group having the seed without the fruits. They were abundant in the Mesozoic era and construct the great ecosystem with the giant trees with the reptiles, fossil evidences of the Mesozoic era shows the history of this remarkable group.^{[1][3]} Now there are overall 85 -86 genera's in all over the world and they are confined to the very less places like the northern hemisphere and the Australia.^{[1][4]} living gymnosperms are presented by the three orders in details like the cycadales,coniferales and the gnetales.Cycadales are very narrow in their ecological niches, in general there are 11 genera's with few species' in the globe, some are monotypic and IUCN categories the genera as the endangered and some of them as the critically endangered.^{[1][4]} So they need the protection and the conservation.

Conifers are the most abundant gymnosperms on the globe, they have about 55 genera's in earth, conifers represent the major liens of the evolution and they are valuable commercially as well as the medicinally point of view. Conifers are the large and the giant trees and the herbs.^{[1][3][4]} They have the two kinds of the shoots, one of them is large shoot and another of them is spurring with the group of the needles on them.^{[1][3][4]} Reproduction occurs by the male and the female cones, the female's cones are generally woody, the sizes and the shapes of the ouvuliferous scales taken as the parameters of the identification of the species. IUCN categories the most of the genus of the conifers and found that majority of the genus are endangered and near to the extinction, so they requires the conservation and the propagation.^{[1][2][4]}

In this review article we are presenting some of the aspects of the conifer or the pine entitled as the **Pseudolarix amabilis**. This is a monotypic genus and the majority of the taxon are confined to the china. The genus is commonly known as the **chinesees golden lorch**.^{[1][3][4]} The genus is not the true lorch but it s near the **keetelaria, larix** and the **Abies and cedrus**. **Native** place is eastern china it occurs in the mountains of the zhejiang, Fujian, Jiangxi, Hunan.^{[1][2][4]}



Figure 1: Pseudolarix amabilis (sources camellia forest nursery).



Figure 2: Pseudolarix amabilis (sources camellia forest nursery).



Figure 3: Pseudolarix amabilis needles on spurs (sources camellia forest nursery).

Some of the features of the **Pseudolarix** are enlisted as

- A) The tree is deciduous evergreen trees.
- B) The height of the tree reaches about the 30 -40 meters.
- C) The crown of the tree is conical.
- D) The shoots are dimorphic; there are two kinds of the shoots, long shoots and the spur.
- E) The leaves are arranged spirally, the leaves are in the dense whorl.
- F) The cones are superficially resembled with the globe artichoke resembling with the flowers of the Asteraceae family.
- G) The way of the reproduction resembles with the typical conifers.
- H) **Pseudolarix** is useful form the medicines and the commercially point of view.

IUCN declared the genus as the endangered on the basis of the area of the occupancy and the area of the extents of the genus.^{[1][3][4]}

Threats: The genus has many threats for the destruction; one of them is the degradation of the ecosystem and the logging of the tree for the various reasons. However it was introduced in USA from five decades ago and it was the reason that the genus was overexploited.

Now the genus needs the conservation and propagation.

Conclusion: Pseudolarix are the surviving lines of the evolution of the gymnosperms, they are considered as the living fossils, from century ago these plants were abundant in the distribution, later on the degradation of the plants was very high due to the various kinds of the commercial exploitation of the tree, so the genus is need to be conserved. This mini review articles represents the some of the aspects of the **Pseudolarix**, since the gymnosperms are at the edge of the extinction and they need the propagation and the conservation for the maintenance of the line of the evolution.

68.

On the basis of the phylogeny it was concluded that first *Pseudotsuga* evolved in the North America, later on lines of the evolution diverge in the different directions,^[7] which leads to the establishment of the *Pseudotsuga* in the different geographic area's.

Tertiary fossils has been recorded form bey of the alsaka,^{[7][2]} pollen deposit of the *Pseudotsuga* has been found in the lower cretaceous times in eastern gobi,Mongolia (Alvaraz1994).

On the basis of the morphological, anatomical and cytological investigations two main hypothesis has been proposed for the evolution of the *Pseudotsuga.*, one hypothesis says that one lines of the evolution goes from the **pinus** to the **pseudotsuga**, it diverge in to the two lines one in the development of the **Larix** and the other cladistic lines of the evolution in the *Pseudotsuga.*^{[2][7]}

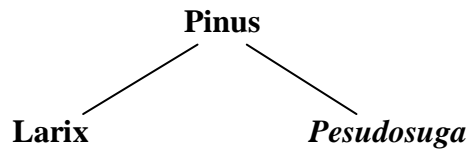


Figure 2: Divergence of the lines from the Pinus.

The another hypothesis says that another lines' of the evolution goes from the **larix** lines of the evolution, in that case **Larix** has produced the **pinus** liens of the evolution,from them *Pseudotsuga*like cladistic arises.^{[2][3][7]}

The close relationship between the **larix** and the *Pseudotsuga* has been observed by the chromosomal studies^[7] some morphological and the anatomical similarities has been observed in both of the genera's.^{[2][3][7]}

Pseudotsuga has been observed in the voyage of the one of the english person Archibald Menzies (1754-1842).^{[2][3][7]}



Fig : 3 Pseudotsuga in natural sites (source wild flower society,new england)

Introduction of the *Pseudotsuga* to the different part of the world occur by the different means.^{[2][3][6][7]}



Fig ; 4 cones of the Pseudotsuga (sources royal horticulture society)

Phytochemical aspects of the *Pseudotsuga* has been investigated by the^{[2][3][6][7]} in franco Romania. The composition of the needles and young shoots essential oils in Douglas fir needles from different part of the plants has been observed by the.^{[2][3][6][7][8]} The extraction of the essential oils has been done using the neocleavenger type apparatus. The analysis of the oil has been done by the GS –MS system. The major contribution of the oils follows as, sabiene, terpinolene, terpinenes, beta pinene, alpha terpene, alpha piene in various concentration due to different vegetative organs and the differ kinds of the climatic conditions ecotypes.^{[2][3][6][7]} Some of the oleorsins of the great complexity and the the glucosides has also been reported in the genus.^{[2][3][6][7]} Douglas fir great for the various purposes by the tribes of the North America people's who used the plants for the variety of the purposes.^{[3][6][7][8]}

Some of the uses of the **Pseudotsuga** have been enlisted as.

- 1) An antiseptic resin is obtained from the trunk.
- 2) The resin is used for the variety of the purposes; these uses are cuts, burns, wounds, and other skin ailments,

- 3) The resin is used for the treatments of the cough and can be used for the treatment of the throats.
- 4) Infusion of the green bark has been used in the treatment of the menstruation problem, bleeding bowels and stomach problems.
- 5) The leaves has been used for the treatment of the rheumatoid arthritis.
- 6) The young sprouts has been used for the treatment of the cold.
- 7) A decoction of the shoots has been used for the treatment of the urinary and the bladder problems.
- 8) A number of the other applications also can be written.

Threats and Conservation of the *Pseudotsuga*: These decades one can observe the *Pseudotsuga*'s rapid declines in the different part of the world. In India during the 1900 to 1950 there were long belt of the *Pseudotsuga* forest in the Himalayas mountain series and in the uttrakahnd, now a rapid degradation in the forest vegetation can be observed. The plant is valuable from the variety of the purposes from roots to the shoots (Indian ministry of the forest and environment should take the serious majors for the protection of the degrading **Pseudotsuga** vegetations. These efforts should be internationally, than only declining vegetation of the threatened *Pseudotsuga* can be saved.^{[6][7][3]} IUCN on the basis of the area of the occupancy and the area of the presence declared the species as the endangered and need conservation and protection.

M) Tsuga: an endangered genus

Abstract: Gymnosperms are the plants of the great values; they have the good economic ach have not the as well as the evolutionary values. They are characterizes by the naked seed plants which have not the fruit around them. Reproduction occurs by the male and the female cones with the ovuliferous scales. IUCN categorized majority of the gymnosperms as the critically- endangered since these groups are degrading due to the habitat destructions and the logging of the trees for the various purposes. Here we are describing some of the features of the conifers entitled as the **Tsuga** as an endangered genus with the 11 species all over the globe. The genus represents the all the features of the conifers and now by the IUCN categorization the genus has been declared as the endangered by the version 3.1, so the genus is need the conservation and the propagations.

Keywords: Gymnosperms, conservation, IUCN categorization, habitat destructions, conifers.

Introduction: Gymnosperms are the naked seed plants, they are the trees without the fruits and some of the elements in the vascular tissues are lacking. They are without the sieve tube elements and the vessel lack the tissues. Gymnosperms were abundant in the Mesozoic era. In this era they are at the margin of the extinction, many of the genera has been declared as the critically endangered by their various criteria and the measurements. Gymnosperms are presented by the three lines of the evolution, these are enlisted as the cycadales, coniferales, Gnetales. Coniferales are the most abundant kinds of the gymnosperms, about 55 genera's of the coniferales exist all over the world with about the 500-600 species overall. They all are large and giant trees with the evergreen leaves and the short and the long branches. Reproduction occurs by the cone, these are the male and **the** female cones with the ovuliferous scales of the various taxonomic positions, which is used for the encertain the position of the species in to the genera's. Various taxonomic peoples classify the Pinaceae family according to their suitability. Broadly they have the three families in common, these are the Pinaceae, cupressaceae, podocarpaceae.

Pinaceae are the evergreen and the long trees with the short and the long branches, the branches are the horizontal and leaves in the spiral and the sometimes tuft of leaves in groups.^[9] Pinaceae are the most abundant genera's after the cupressaceae, they form the long belt in the Northern hemisphere which is of the many commercial uses, for the formation of the furniture's and the other things.^[9] IUCN categorised the genus as the endangered by the various means of the measurements and the parameters, so the whole of the members of the family needs the conservation and protection for the species.^[9]

Here the main object of this review articles is the some of the aspects of the genus **Tsuga**, this word is taken from the Japanese language, commonly known as the hemlock from the word poisons smell from the crushed leaves but **Tsuga** are nontoxic.^{[3][4]} **Tsuga** have all the features of the typical pinaceae family. Overall the genus contains the 11 species in common. Among them four species in the North America and the four are in the south Asia.^{[6][7]}

They are generally evergreen, and medium sized, generally the height of tree is 20-60m, the canopy of tree is conical, in some of the species it is irregular.^{[6][7]} As in the other conifers they have two branches, one of them is long horizontal braches and small spur with leaves,^{[3][4]}

Male cones are small and they are catkin like appearances, they are woody in later stages in life cycle, they are generally solitary in numbers.^{[7][8]} The shape of the ovuliferous scales is also of the taxonomic values in the identification of the species of the genus.^{[3][4]}



Fig 1: Tsuga species (sources: the flowering garden.com).



Fig: 2 Tsuga heterophylla (sources: the flowering garden.com).



Fig 3: Tsuga species (sources: the flowering garden.com).

Some of the species of the **Tsuga** are described as

Tsuga canadensis: This species of the **Tsuga** are termed as the eastern hemlock some times as the Canada- hemlock.^{[3][4]} IUCN categories the genus as the Near Threatened according to the version 3.1.^{[6][7]} These features of the species are also shared by the another species of the **Tsuga**. these species of the **tsuga** are enlisted as:

- 1) **Tsuga caroliniana,**
- 2) **Tsuga chinensis.**
- 3) **Tsuga diversifolia.**
- 4) **Tsuga dumosa.**
- 5) **Tsuga foretrii**
- 6) **Tsuga heterophylla**
- 7) **Tsuga mertensiana**

These species are valuable commercially and the wood of the tree's are used for the formation of the furniture's and the other instruments of the commercial uses. The major threats of the species are follows as the continuous logging and the destruction of the habitat and the Dominant pests as hemlock woolly adelgid. This is the serious pests of the genus and it cause the serious threat to the all species, well the species of the genus needs the conservation for the propagation of the genes and the metabolites of medicinal values.

Cupressaceae

Is a conifer family, the cypress family, with worldwide distribution. The family includes 27–30 genera (17 monotypic), which include the junipers and redwoods, with about 130–140 species in total. They are monoecious, subdioecious or (rarely) dioecious trees and shrubs 1–116 m (3 ft 3 in–380 ft 7 in) tall. The bark of mature trees is commonly orange- to red- brown and of stringy texture, often flaking or peeling in vertical strips, but smooth, scaly or hard and square-cracked in some species.

A) *Microbiota*

The genus is the monotypic, the genus is the evergreen conifers of the **cupressaceae family, the genus is represented by the only one species known** as the *Microbiota decussate*, the genus is known as the carpet cypress. The genus is famous in distribution in the some of the mountain region of the Russian provinces. the genus was discovered in the 1923, but due to the political pressure the knowledge of the genus couldn't grow outside the country, the genus is the prostrate shrubs and the length of the shrubs are the 20-50 cm, and the height of the shrubs varies from the 2-5 meters, the leaves are in the form of the foliages and the length of the foliage are of the 2-4 mm, the cones are of the height of the 2-3 mm, the leaves are in the opposite decussate manners, the tree are grown in the places as the ornamental and in some of the places the trees are used a the ornamentals.

IUCN declares that the major threats of the species are the continued declines due to the logging of the tree. So it has been declared as the least concern.

B) *Platycladus*

This is the evergreen conifer trees, the genus has the only one specie it has-been termed a *Platycladus orientalis*, the genus is known as the Chinese's thuja. The genus is native of the china, Korea, as well as the Russia. The genus is the slow growing, 15-20 meter tall, 5 meter thickness, the bark are very smooth and they spilt in the form of peels or the stripes. The genus is the slow growing conifers. The foliage are scales likes and they are minutes. The cones are 15-20mm cones, each cones has the 15-20 scales in them. The typical podocarpian features can be seen in the genus.

The tree is very valuable and they are used and utilised as the ornamentals in the Japan as well as the Korea. The wood of the tree is also very beneficial and they are used for the formation of the furniture and the purposes of the other needs of the life.

The IUCN categorization declares the tree as the near threatened on the basis of the AOO and the EOO. The major threats of the tree area as the continuous declines of the tree by the cutting of the wood for the various means and the utilization of the wood for the various purposes.

C) *Thujopsis*

Thujopsis is the conifer of the cupressaceae family; the sole species of the genus is the *Thujopsis dolabrata*.

The genus is endemic off the Japan, commonly the genus is known as the asunaro, the genus is closely related to the Thuja.

The leaves are thick and linear and the cones are small and they have the short height and length. The genus *Thujopsis* is the evergreen tree. The height of the *Thujopsis* about the 40-50 meters, the diameter of the *Thujopsis* is about the 1-5 meters. The bark are the red brown and they generally peel off in the form of the streaks. The leaves are arranged in the decussate form in the opposite form pairs. The leaves are 3-10 mm in length. The leaves are of the green colour and they are pinnaately compounds. The texture of the leaves is the smooth.

The tree is very valuable in the Japan, they are used in the Japan as the ornamentals, they are used in the formation of the building as well as the houses are also formed with the genus.



Figure 1: *Thujopsis* in nature (sources: Japan sites).

IUCN category shows that these species has not the treat of the genus, so the genus has been declare as the least concern. The version 3.1 shows that the genus is the least concern and the species is in these decades are widely distributed in the whole of the Japan.

Overall this is the wide distributed genus of the *Thojopsis*.

CHAPTER-6
GINKGOALES

Ginkgoales are the order which were termed as **the living fossils, these are the marvellous gifts of the natures**. They were very abundant in the Mesozoic era; the whole of the era was very much fascinating with the deep growth of the forest in the hemisphere associated with the giant kinds of the reptiles. *Now only the one genus is present and it has been termed as the living fossils, only monotypic species is the Ginkgo biloba*, these plant assemblage has been termed as the *living evolutionary records of the genes* and they are now have the very limited (Endemism) kind of the distribution, in whole of **the world they are found only in the china and some of the northern hemispheres**. *These lines of the evolution has the very good collection of the genes which were dominated during the Jurassic and later on the diversion of the liens of the evolution occurs and they diverge in the separate lines, among them some of the lines were extinct and some of the lines of the evolution leads to the formation of the angiosperms lines of the evolution.*

Ginkgo biloba is the genus which is concern with the order Ginkgoales and the class is termed as the Ginkgopsida. The order has the single family termed as the Gingoaceae. The first ginkgo leaves are found of the Jurassic era, they were found in the form of the compression and petrifications. These lines of the evolution flourish well in the jurrasic era, but the starting of the cenozoic era angiosperms and this cladistics lines of the evolution become extinct.

Ginkgo tree is the dioecious and the male and the female tree is different, the male cones, pollen organ are very similar to the catkin like appearances, they comes from the axils of the bud scales, ovules of the ginkgo tree comes from the axils of the female tree and they bears the one or three ovules together. The pollen of the ginkgo tree is multi-flagellated and they are big and large(primitive features). The reproduction of the ginkgo tree is the typical of the gymnosperm kinds.

There one can observe the evolutionary degradation of the archegonia as well as the retrogressive kinds of the degradation of the length of the archegonia is also the very usual features of the gymnosperm reproductive organs.

Ginkgo was first identifying in the china dynasty and they were very abundant in that era, in some of the literature they were declared as the national trees in that era. The tree reaches the height of the 30 meters. The leaves are the fan shaped and they have the two lobes. Ginkgo tree has the long and the short shoots together the growth of the long shoots are the definite and the growth of the short shoots are the restricted.

Medically the tree is very valuable and they are used for the formation of the various kinds of the drugs of the medicinal values. The leaves of the ginkgo contain the various kinds of the terpenoids as well as the flavonoids, in addition to that they contains the several rich antioxidants in them, so they are the poetical drugs for the several medicines in the china as well as the other parts of the world. In some of the cases they have been seen for the memory enhancement as well as in the dementia and the other nervous system disorders.



Figure 1: Ginkgo leaves in nature (sources: biology discussion).

Evolutionary position

Morphologically there are several features which make the gymnosperm very interesting plants in the evolution, there are several features of the value which shows that how they flourish well in the Mesozoic era and later on the whole of the empire become extinct and now they are present only in the forms of the relicts. There are several morphological features in the Ginkgo which makes the genus evolutionary very valuable and examples of the progressive as well as the retrogressive evolution. The collar of the ginkgo is regarded as the vestigial organ. These lines of the evolution have originated from the corytospermales as well as the allied branches of liens. In 1949 florin gives the hypothesis that the ginkgo originates from the trichophytes lines of the evolution and there was gradual reduction in the number of

the ovules, of the megalasporophylls, so this cladistic line of the evolution leads to the ginkgoales line of the evolution. In 1984 Meyen proposed that the ginkgoales line of the evolution was proposed by the peltaspermales line of the evolution. The collar has the two ovules and the swollen base is the example of the reduced pedicel, sometimes the collar was supposed to be the reduced kind of the megasporophyll. Some people consider them as the fertile bracts. However the morphological nature of the collar of the ginkgo is also the matter of concern, they have been considered as the *organ sui-generis*. However overall the gymnosperm ginkgoales line of the are of the phylogenetically valuable.

CHAPTER-7
GNETALES LINES OF EVOLUTION

Gnetales are the lines of the evolution which are morphologically so different from the each other as well as the other classes of the gymnosperms that some time by the phylogeneticists, it was supposed that these genera's should be treated like the separate orders. There are some combination of the characters due to which these genera's are needed to be places in the one order, these are the *Ephedra*, *Gnetum*, *Welwitschia*. these order are characterised by the several combination of the characters, these are the compound cones with the unisexual kinds of the inflorescences, these are characterised by the unisexual flower, these are characterised by the unisexual as well as the typical dioecious natures of the flower. These flower are surrounded by the several kinds of the tuft of the bracts, which are covered and they are with the rounds of the bracts around the inflorescences.

Here in this order the ovules are surrounded by the one or two envelopes with the long micropylar tubes with the extended tips, they carry the pollination droplets. These combinations of the trait are rare in the other fossil forms.

The 92 streptophytes were reported and the transcriptome were analysed, they were analysed by the 11 plant genome and it was found that they are the diverge line of the cladicstces from the early coniferales and they diverge differently which leads to the evolution of the early angiosperm lines of the evolution, They resemble with the early one of the family of the coniferales these are the members of the Pinaceae and the some of the members of the Araucariceae. On the basis of the gene analogy it was found that gene diversion takes places in the early cretaceous and they have the resemblance with the early angiosperms.

The gene alignment was found to reduce in that lines and they are found in the form of the artefacts of the gene family. These observation is based on the gene heterogeneity model.

In their morphology as well as in there ecological distribution these Gnetales found to be the enigmatic in the evolution. The gnetales consist of the three monogeneric cladicstces liens of the evolution. *Gnetum* and the *Ephedra* are monographed in the

last century, and the *Welwithchia* are found in the Namib desert. *Ephedra* is the sister of the two other genera, the *Ephedra* consist of the 54 species, these species are distributed in the old world as well as in the new world. *Gnetum* has the 120 species in the south America as well as 2-4 species in the tropical south Africa, 25 in the tropical Asia. Multilocus DNA analysis of the nuclear as well as the plastid DNA of the species lead to the conclusion that the **Ephedra** and the **Gnetum** are the sister lines of the evolutions and they share the common cladistics.

The species of the **Ephedra** occurs in the old world as well as in the new world desert. Semi desert, desert steppes, or in the seasonal dry habitat, they occur in the form of the deciduous woodlands, or sometimes they occur in the form of the thorny vegetations.

The genus occurs in the several levels these levels may be from the sea levels to the highest of the Himalayas of the India, in addition they can be found in any kinds of the habitats.

The branching pattern of the **Ephedra** are like the brooms like, the branches reach to the parallel of each others.

Ephedraceae: All Ephedraceae are the perennial and the dioecious and most of the species are the shrubs. Some of the species are the climber and they are of the 4m in height. Some of the morphological forms are of the tree of the height of the 2meters. The tree stem are divided into the nodes and in the internodes. The nodes bear the narrow lanceolate kinds of the leaves which are present in the whorl. The leaves are present in the form of the decussate form, the leaves are the 2-15 cm long and they become non functional, then whole of the stem turns into the photosynthetic stem, the apical portion of the each of the blade are free from the tips however they are fused from the base and they form the joint kind of the sheath, which covers the stem and they protect it.

The wood anatomy of the stem have the vessels in them, which help in the more effective type of the conducting tissue, whereas these vessels are totally absent in the other coniferlike orders. The abundance of the vessels is greater in the lianoid species as well as in the scrambling species, whereas they are absent in the alpine

species. Narrow vessels are the features of the dry habitat; they are the result of the reduced kind of the metabolism in the dry conditions. The female cones are made up of the decussate bracts,

Each female cones are surrounded by the one or more two integuments, the bracts are the decussate and each of the bract contains the one three ovules, in the axils, the seed are surrounded by the seed envelopes. The male cones consists of the two lateral cones, among them the 2-3 are the sterile bracts at the base and the remaining are the 4-6 Fertile bracts are found on the tips.

Narrow vessels are the features of the dry habitats, by reducing the sizes, they reduce the metabolism of the body hence they secure the reduction of the metabolites. In the tracheids one can see the fibre banding as well as the storage starch, the fibre thickening in the form of the spiral banding is the another features form the adaptations. The female cones are made up of the decussate as well as the ternate phyllotaxy, the distal pairs of the envelope surrounds the one to three seeds, the anatomical as well as the vascular bundles structures of *Ephedra* within the 45 species of the shows that the three vascular bundles in the envelopes are the primitive contends and the two of the vascular bundles arise by the fusion of the three vascular bundle, so the in the evolution the diversion as well as the fusion of the vascular bundles occurs, it leads to the addition towards the vascular bundles phylogeny. The seed envelopes are smooth and they bears the transverse ridges' as well as the furrows the male cones consists of the lateral strobilus, The 2-3 lateral strobili are present at the base, followed by the 2-8 fertile bracts, among them two or three bracts enclosed the stalked antherophores. Each antherophores consists of the two microsporophyll they bears the 2-8 stalked synangia, on this bases they have the homology with the other kinds of the *welwitschia* and the *Gnetum*. The pollen of the 45 species of the *Ephedra* has been reported by the SEM as well as the TEM.

The pollen are they ellipsoidal as well as they are large, Molecular phylogeny of the *Ephedra* with the 54 species' have been reported and analysed by the Huaange et al., in the 2005.

A wide variety of the metabolites have been isolated by the several species of the *Ephedra*. They are obtained by the stem of the *Ephedra*, these include the

ephedrine, pseudoephedrine as well as the, they are the alkaloids as well as the alkaloid components. They are the sources of the stimulants as well as the thermogenic activity.

They have been used for the different types of the cardiovascular effects as well as the brain stimulants, these alkaloids are also used for the several kinds of the respiratory symptoms.

Welwitschia mirabilis: This is the monotypic genus of the Order gnetales. The genus is characterised by the only single species these are the mirabilis. The genus is famous and widely distributed in the Africa, south Africa the dessert is the Namibia, the genus was first described by the fredirick Welwitsch in 1862, later in the 1863 the genus was described by the hooker as the gymnosperm.

Welwitschia is the one of the member of the order Gnetales, like the *Ephedra* and the *gnetum*. all the feature they have resemble with the gymnosperm, however they closely resemble with the angiosperm in some of the chractassr like the presence of the vessels in the xylem as well as the male reproductive organ that is also very much resembles with the angiosperm flowers. Ontogenetically as well as the phylogeneitcalaly the genus is very interesting and they have the many features of the gymnosperms evolution as well as their degrading due to change habitat in addition to the change climate. however as far as the morphology of theses genus are concerned theses genera's are totally different, among them the *Ephedra* are the typical xerophytes and they have the shrubby appercences, the *Gnetum* are the typical climbers and they have the dichotomously branched veins, the *Welwitschia* are the typical xerophytes they have the two leaves like the seedlings leaves and the stem is stunt and small. The plant consist of the stunt stem that is unbranched and the leaves are the vast as well as the very long, they have the crater like depression in the centre of the stem, that is surrounded by the photosynthetic tissues around them. The rim has the single pairs of the leaves along them.

The tap roots are elongated and they are deeply inserted. The plants are the dioecious and they arise from the meristematic region of the stem from where the other growth parts arise. The leave is the most conspicuous and the anomalous features of the stem, the leaves are the longest live and they are the best ontogeny in the plant kingdom.

The anatomy and the physiology of the *Welwitschia* is very well adapted to the adverse conditions. The physiology is adjusted to the CAM anatomy as well as the formation of the malic acid and the citric acid is another significant features of the *welwitshica* anatomy as well as the physiology. In the USA lab one work was carried out and it was found that the anatomy of the phloem is also very significant. The plastid genome of the *Welwitshia* is very smallest among the all other non parasitic vascular plants. The roots system is the shallows and they are in the need of the search of the water from the water table. Overall the *Welwtchia* are in the search of the coastal fog of the development and the search of the water and the other elements. IUCN has not described the genus as the **endangered** since in the Namib desert the genus is very widely distributed and the chance for the threatened stages are very rare, in addition the small growth as well as the low rainfall and the other factors make the genus as the threatened stages in the coming years.



Figure 1: *Welwitschia mirabilis* in natural habitat (sources: Kruger national park).

Gnetum

The name *Gentum gnemon* was given to the gymnosperms which were the very much similar like the angiosperms in the appearances. They were first described by the Carolus llineous as the *Gnetum* in 1767. They have the very much approximation with the angiosperms so they were initially concluded as the progenitors of the angiosperms and the ancestors of the angiosperm liens of the evolution. There are the

some the features among them the *Gnetum* are very much like the angiosperms, these features are the followings:

- 1) The reticulate venation of the leaves
- 2) The presences of the vessels in the xylem of the stem is the another significant features of the *Gnetum* approximation.
- 3) The dorsiventral anatomy of the leaves are also the another reasons for the approximation with the angiosperms.

Glossary

The following glossary contains botanical terms that occur in the *Key to the Gymnosperms of the Southeastern U.S.* <<http://www.ibiblio.org/pic/GymnospKey/>> along with certain other basic terms that the reader may find helpful for understanding the definitions. A number of the definitions given here apply specifically to the features of the taxa in the key, and are thus more narrow than the range of meanings used more broadly in botanical literature.

The principal source used for each definition is listed in brackets at the end of the entry. Definitions with no source listed were written by the editor.

A B C D E F G I K L M N O P R S T U V W

A

Acute – Tapering to a pointed apex with more or less straight sides, the sides coming together at an angle of less than 90°. (Compare with obtuse.) [modified from H&H, p. 153].

Alternate – Positioned singly at different heights on the stem; one leaf occurring at each node. (Compare with opposite and whorled.) [modified from L, p. 738].

Angiosperm – Plants that bear their seeds enclosed in an ovary; the flowering plants. (Compare with gymnosperm.).

Anther – The pollen-producing portion of the stamen, typically borne at the tip of a stalk or filament. [modified from Z, p. 358].

Apex – The portion of a plant structure (such as a leaf, bud, stem, etc.) farthest from its point of attachment or uppermost; the tip. (Compare with base.) [modified from H&H, p. 10].

Appressed – Pressed upwardly, close or flat against the bearing structure, thus more or less parallel to it. (Compare with ascending, reflexed and spreading.) [modified from K&P, p. 16].

Armature – Any kind of sharp defense such as thorns, spines, or prickles. [modified from L, p. 739]

Armed – Bearing a hook, prickle or other sharply pointed structure on the end of the cone scale. (Compare with unarmed.).

Ascending – Spreading at the base and then curving upward to an angle of 45° or less relative to the bearing structure. (Compare with appressed, reflexed and spreading.) [modified from K&P, p. 18].

Asymmetric – Not divisible into essentially equal halves along any plane. (Compare with nearly symmetric and symmetric.) [modified from K&P, p. 18].

Awl-shaped – Narrowly triangular and sharply pointed, like an awl. (Compare with linear.) [modified from H&H, p. 150].

Axis – Any relatively long, continuous, supporting structure that typically bears other organs laterally, and represents the main line of growth and/or symmetry; as a stem that bears leaves or branches. [modified from K&P, p. 19 & H&H, p. 13].

B

Bark – The outermost layer of a woody stem, usually with one or more corky layers that prevent water loss and protect the inner living tissues from mechanical damage. [modified from W&K, p. 587].

Bark plate – A more or less flat section of bark, often separated by furrows or grooves, as in bark of mature loblolly pine (*Pinus taeda*).

Base – The portion of a plant structure (such as a leaf, bud, stem, etc.) nearest the point of attachment or lowermost; the bottom. (Compare with apex.).

Bisexual – Having functional reproductive structures of both sexes (i.e. male and female) in the same flower or cone. (Compare with unisexual.) [modified from K&P, p. 21].

Blade – The flat, expanded portion of a leaf, petal, sepal, etc. [modified from RDMB, p. 93].

Bract – A modified, usually reduced leaf, often occurring at the base of a flower or cone; in some conifers, such as firs (*Abies*), bracts are interspersed between the cone scales. [modified from H&H, p. 18].

Branchlet – An ultimate branch, i.e. one located at the end of a system of branches; a small branch. (Compare with twig.) [modified from K&P, p. 22].

Broad-leaved – With leaves that are not needle-like or scale-like, but having relatively broad, flat surfaces, as in most deciduous trees such as maples (*Acer*) and hickories (*Carya*). (Compare with needle-like and scale-like.).

Bud – An immature shoot, either vegetative, floral (or cone producing), or both, and often covered by protective scales. [modified from RDMB, p. 88].

Bush – A short shrub that branches from ground level. (Compare with shrub.) [modified from K&P, p. 23].

C

Calyx – The collective term for all of the sepals of a flower; the outer perianth whorl. (Compare with corolla.) [modified from H&H, p. 20].

Clustered – Leaves grouped closely together at the point of attachment and tending to diverge from one another, as the leaves on short shoots in ginkgo (*Ginkgo biloba*) or the needles on short shoots in larches (*Larix*). (Compare with fascicled and solitary.) [modified from K&P, p. 29].

Compound – Divided into two or more equivalent parts, as a leaf that consists of multiple, distinct leaflets; not simple. (Compare with simple.) [modified from K&P, p. 31].

Cone – The reproductive structure in conifers comprised of scales and/or other types of modified leaves densely arranged on a central stalk; female, or seed cones, bear ovules on the surface of their scales; male cones produce pollen. (Compare with flower.).

Cone scale – The structure in seed cones, derived from a modified leaf, that bears an ovule on its surface. Cone scales are typically flattened, dry and woody, as the scales of pine (*Pinus*) cones. However, they may be soft and fleshy, as in junipers (*Juniperus*), or leathery as in eastern arborvitae (*Thuja occidentalis*).

Conifer – Cone-bearing plants, such as pines (*Pinus*).

Corolla – The collective term for all of the petals of a flower; the inner perianth whorl. (Compare with calyx.) [modified from H&H, p. 31].

Crown – The uppermost portion of a tree.

D

Deciduous – Falling at the end of one growing season, as the leaves of non-evergreen trees; not evergreen. (Compare with evergreen.) [modified from L, p. 748].

Decurrent – With the leaf base extending downward along the stem. [modified from RDMB, p. 134].

Dentate – Toothed along the margin, with pointed teeth that are directed outward rather than forward. (Compare with entire and serrate.) [modified from H&H, p. 157].

Dioecious – Having functionally unisexual (i.e. separate male and female) flowers or cones, which are borne on different plants within the species; thus some plants are male and others are female. (Compare with monoecious and synoecious.) [modified from K&P p. 39].

E

Entire – With relatively smooth margins that lack teeth, spines or other projections (the margins may be lobed); with a continuous margin. [modified from H&H, p. 157].

Evergreen – Bearing green leaves through the winter and into the next growing season; persisting two or more growing seasons; not deciduous. (Compare with deciduous.) [modified from RDMB, pp. 146 & 154].

F

Fan-shaped – Shaped like a fan, as a ginkgo (*Ginkgo biloba*) leaf.

Fascicled – In a tight bundle, several leaves appearing to arise from a common point and diverging little if at all, as the needles of many pines (*Pinus*). (Compare with clustered and solitary). [modified from RDMB, p. 119].

Filament – The stalk of a stamen, which supports an anther at its tip. [modified from K&P, p. 46].

Fleshy – Fairly firm and dense, juicy or at least moist, and easily cut. (Compare with leathery and woody.) [modified from K&P, p. 47].

Floral – upon, within, or associated with the flowers. [K&P, p. 48].

Flower – The reproductive structure in flowering plants (angiosperms), consisting of stamens and/or pistils, and usually including a perianth of sepals and/or petals. (Compare with cone.) [modified from H&H, p. 48].

Four-sided – More or less diamond-shaped in cross section.

G

Glabrous – Lacking plant hairs (trichomes). (Compare with pubescent.) [modified from W&K, p. 39].

Gland – A distinct structure that produces and secretes a substance such as oil or nectar, or resembles those that do. [modified from K&P, p. 52].

Glaucous – Covered with a whitish or bluish waxy coating (bloom) that can sometimes be rubbed off. [modified from W&K, p. 594].

Globose – Circular in cross section and in outline when viewed from any angle; like a globe or sphere. [modified from K&P, p. 52].

Gymnosperm – A seed plant that produces seeds which are not enclosed inside an ovary, as the conifers. (Compare with angiosperm.) [modified from REE, p. 898].

I

Internode – The portion of a stem between two nodes, i.e. the part where leaves and/or branches do not arise. (Compare with node.) [H&H, p. 60].

Involute – With margins rolled inward, toward the upper side. (Compare with plane and revolute.) [modified from H&H, p. 157].

K

Keel – A longitudinal ridge, more or less triangular in cross section, like the keel of a boat. [modified from K&P, p. 61].

L

Leaf – A lateral outgrowth of a stem, usually green and photosynthetic, and often consisting of a stalk (petiole) and an expanded portion (blade); leaves may also be needle-like or scale-like in form. (Compare with leaflet.) [modified from H&K, p.24].

Leaflet – One of the separate, leaf-like segments of a compound leaf. [modified from K&P, p. 64].

Leathery – Moderately thick, tough and pliable. (Compare with fleshy and woody.) [modified from K&P, p. 64].

Linear – Long and narrow, with the sides more or less straight and parallel. (Compare with awl-shaped.) [modified from K&P, p. 66].

Lobe – A more or less major protrusion or segment of a leaf or leaflet delimited by concavities (sinuses) in the leaf margin. [modified from K&P, p. 66].

Long shoot – A typically formed stem or branch, without compressed internodes. (Compare with short shoot.).

M

Margin – The edge, as in the edge of a leaf blade. [H&H, p. 67].

Midrib – A main or primary vein running lengthwise down the center of a leaf or leaf-like structure; a continuation of the leaf stalk (petiole); the midvein. [modified from W&K, p. 598, & K&P, p. 70].

Monoecious – Having functionally unisexual (i.e. separate male and female) flowers or cones, which are borne on the same plant; each plant thus possessing both male and female reproductive structures. (Compare with dioecious and synoecious.) [modified from K&P, p. 70].

N

Nearly sessile – With a very short, somewhat indistinct stalk. (Compare with sessile and stalked.) [modified from K&P, p. 106].

Nearly symmetric – Not fully symmetric, but divisible into nearly equal halves along one or more planes. (Compare with asymmetric and symmetric.).

Needle – A leaf that is long and thin (more or less needle-shaped) and usually evergreen; it may be flattened as in hemlocks (*Tsuga*) or more rounded as in pines (*Pinus*).

Needle-like – With leaves that are more or less needle-shaped, and usually evergreen; they may be flattened as in hemlocks (*Tsuga*) or more rounded as in pines (*Pinus*). (Compare with broad-leaved and scale-like.).

Node – The portion of a stem where leaves and/or branches arise; often recognizable by the presence of one or more buds. (Compare with internode.) [modified from H&H, p. 73].

O

Obtuse – More or less blunt at the apex, with the sides coming together at an angle of greater than 90°. (Compare with acute.) [modified from H&H, p. 153].

Opposite – Positioned in pairs along the stem, the members of each pair at the same level across from one another; two leaves occurring at each node. (Compare with alternate and whorled.) [modified from K&P, p. 75].

Oval – Elliptic in cross section.

Ovary – The lower portion of a pistil where ovules are borne; often distinguishable from the rest of the pistil by its larger circumference. [modified from K&P, p. 75].

Ovoid – Rounded in cross section, broadest near a bluntly rounded base and convexly tapering to a narrower rounded tip; egg-shaped. [modified from K&P, p. 75].

Ovule – The structure in flowering plants and gymnosperms which when fertilized develops into a seed. [modified from H&K, p. 29].

P

Palmate – With three or more leaflets, lobes or other structures arising from a common point and diverging from one another; arranged or structured in a hand-like pattern. (Compare with pinnate.) [modified from K&P, p. 76 & RDMB, p. 139].

Perennial – Normally living more than two years, with no definite limit to its life span. [K&P, p. 79].

Perianth – The collective term for the outer sterile parts of a flower, comprising the calyx (sepals) and the corolla (petals) when both whorls are present. [modified from W&K, p. 600].

Petal – A unit or segment of the inner floral envelope or corolla of a flower; often colored and more or less showy. (Compare with sepal.) [modified from L, p. 764].

Petiole – The stalk of a leaf. [modified from W&K, p. 600].

Pinnate – With several leaflets, lobes or other structures positioned along and on either side of a central axis; arranged or structured in a feather-like pattern. (Compare with palmate.) [modified from K&P, p. 81].

Pistil – The female or ovule-bearing organ of a flower, typically composed of an ovary, style and stigma. [modified from Z, p. 379].

Plane – With midrib and margin all in one plane, or nearly so; flat. (Compare with involute and revolute.) [modified from W&K, p. 39].

Plated – Bark with relatively large, more or less flat plates, as in mature loblolly pine (*Pinus taeda*) or mature white oak (*Quercus alba*).

Pollen – The small, often powdery, grains which contain the male reproductive cells of flowering plants and gymnosperms. [modified from H&K, p. 33].

Pollen cone – A male or pollen-producing cone; typically smaller and of shorter duration than seed cones.

Prickle – A small, sharp structure developed from outgrowth of the surface of bark or epidermis. (Compare with spine and thorn.) [modified from W&K, p. 39].

Pubescent – Bearing plant hairs (trichomes). (Compare with glabrous.) [modified from W&K, p. 39].

R

Reflexed – Bent backward or downward. (Compare with appressed, ascending and spreading.) [modified from H&H, p. 98].

Resin pocket – A small indentation in the surface of the bark of some conifer species where resin or pitch accumulates; a pitch pocket.

Resinous – Bearing resin and often, therefore, sticky. [H&H, p. 98].

Revolute – With margins rolled backward, toward the underside. (Compare with involute and plane.) [modified from H&H, p. 158].

Root – The portions of a plant that are anatomically distinct from the shoot and that lack nodes and internodes; roots serve for anchorage, absorption and/or storage, and usually grow below ground. (Compare with shoot.) [modified from K&P, pp. 87-88 (see radix)].

S

Scale (1) – Small, flattened structures that are usually thin, dry and membranous in texture.

Scale (2) – Small, often triangular shaped, leaves that are appressed to the branchlets as in juniper (*Juniperus*).

Scale-like – With small, typically triangular-shaped leaves that are often appressed to the branchlets, as in juniper (*Juniperus*). (Compare with broad-leaved and needle-like.) [modified from W&K, p. 603].

Seed – A mature or ripened ovule. [modified from K&P, p. 95].

Seed cone – A female or ovule-producing cone; typically larger and persisting longer than pollen cones.

Sepal – A unit or segment of the outermost floral envelope or calyx of a flower; usually green and leaf-like. (Compare with petal.) [modified from L, p. 769].

Serotinous – Having cones that remain closed long after the seeds are ripe. [modified from D, p. 1143].

Serrate – Toothed along the margin, the sharp teeth pointing forward; sawtoothed. (Compare with dentate and entire.) [modified from H&H, p. 158 & K&P, p. 97].

Sessile – Without a stalk, positioned directly against the bearing structure. (Compare with nearly sessile and stalked.) [modified from W&K, p. 604].

Shoot (1) – The portions of a plant that are anatomically distinct from the root and differentiated into nodes, where leaves and branches originate, and the spaces in between (internodes); shoots consist of stems, leaves and any other structures borne from the stem. (Compare with root.) [modified from K&P, p. 98].

Shoot (2) – A young stem or branch. [H&H, p. 107].

Short shoot – A stumpy, slow growing, lateral branch with very short internodes, often bearing flowers; a dwarf shoot. (Compare with long shoot.) [modified from W&K, p. 604].

Shrub – A relatively short, woody, perennial plant, usually without a single stem or trunk, and often with many crowded branches. (Compare with bush and tree.) [modified from RDMB, p. 88].

Simple – Undivided, as a leaf blade that is not separated into distinct leaflets; not compound. (Compare with compound.) [modified from H&H, p. 156].

Sinus – The space or recess between two divisions or lobes of an organ such as a leaf or petal. [modified from L, p. 770].

Smooth – Bark having a more or less continuous, even surface, with relatively few fissures or protrusions, as in American beech (*Fagus grandifolia*). [modified from H, p. xx].

Solitary – Occurring singly and not borne in a cluster or group. (Compare with clustered and fascicled.) [modified from H&H, p. 175].

Spine – A woody, sharp-pointed, modified leaf or leaf part. (Compare with prickle and thorn.) [modified from W&K, p. 39].

Spiral – Arranged along the stem in such a way that a line connecting the points of attachment would form a spiral; a form of alternate arrangement. [modified from H&K, p. 39].

Spreading – Extending outward horizontally, or upward at an angle between 90° to 45° relative to the bearing structure. (Compare with appressed, ascending and reflexed.) [modified from K&P, p. 102].

Stalk – A supporting axis or column that bears a structure at its apex and is usually narrower than the structure being borne, as the stalk of a flower or leaf. [modified from K&P, p. 102].

Stalked – With a stalk. (Compare with nearly sessile and sessile.).

Stamen – The male reproductive organ in a flower that produces and releases pollen, composed of an anther usually borne on a stalk (filament). [modified from Z, pp. 384-85].

Stem – The axis of a shoot, bearing leaves, bracts and/or flowers, and usually growing above ground, but sometimes specialized and growing underground or on the surface of the ground; stems are differentiated into regions called nodes, where leaves and branches originate, and internodes. [modified from K&P, p. 103].

Sterigma – A persistent leaf base that remains on the twig after the leaf falls, appearing as peg-like projection.

Stigma – The pollen-receptive region at the tip of a pistil. [modified from Z, p. 385].

Stomate – A microscopic pore on the surface of a leaf, stem or other surface, that controls moisture loss and exchange of gases.

Stout – With armature that is relatively thick and sturdy; not breaking easily. (Compare with weak.).

Style – The more or less elongated portion of a pistil between the ovary and the stigma. [modified from L, p. 772].

Symmetric – Divisible into essentially equal halves along one or more planes. (Compare with asymmetric and nearly symmetric.) [modified from K&P, p. 108].

Synoeious – With all flowers or cones bisexual, i.e. bearing functional reproductive structures of both sexes. (Compare with dioecious and monoecious.) [modified from K&P, p. 109].

T

Thorn – A woody, sharp-pointed, modified stem. (Compare with prickle and spine.) [modified from W&K, p. 39].

Three-sided – More or less triangular-shaped in cross section.

Tree – A relatively tall, woody, perennial plant usually with a single stem (trunk) that bears branches. (Compare with shrub.) [modified from RDMB, p. 88].

Trichome – Any type of plant hair (except for root hairs). [W&K, p. 607].

Trunk – The aboveground, relatively stout, main stem of a tree; the bole. [modified from K&P, p. 133].

Twig – The relatively small end portion of a woody branchlet; a small branchlet. (Compare with branchlet.) [modified from K&P, p. 114].

Two-sided – More or less flat in cross section, with an upper and lower surface.

Two-ranked – Arising from the bearing axis in two rows, usually on opposite sides. [modified from H&H, p. 128].

U

Unarmed – Without a hook, prickle or other sharply pointed structure on the end of the cone scale. (Compare with armed.).

Unisexual – Having functional reproductive structures of only one sex in the flower or cone. (Compare with bisexual.) [modified from K&P, p. 115].

V

Vegetative – Of, or relating to, the non-reproductive parts of a plant.

W

Weak – With armature that is slender and tends to break easily. (Compare with stout.)

Whorled – With three or more leaves positioned on the stem at the same level; three or more leaves occurring at each node. (Compare with alternate and opposite.) [modified from K&P, p. 119].

Woody (1) – With an aboveground shoot composed of relatively hard tissue that persists from one growing season to the next.

Woody (2) – Of or resembling wood, and thus relatively hard and dry. (Compare with fleshy and leathery.) [modified from K&P, p. 119].

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