Gymnosperms

Gymnosperms:-

Spermatophytes
seed plant

→ commonly known as phanerogams.
→ flowering plants.
→ seeded plant / ovulated plants.
→ complete land plants.
→ siphonogamous - no need of water for fertilization.
→ it is of 2 groups:-
★ naked ovule - gymnosperm
★ closed ovule - angiosperm
(plant anatomy + morphology + taxonomy + embryology)

Gymnosperms:- (Gymnos :- naked, sperma - seed)
→ naked seeded plants.
→ ovules or seeds aren't enclosed inside the fruit wall (ovary)
→ termed by Theophrastus.
→ also defined as phanerogams without ovary.
→ most primitive seed plant
→ age of gymnosperm :- Mesozoic era.
→ gymnosperm are placed in tracheophyta, archegoniate and embryophyta.
↓
having archegonium as female gametophyte
Eg: Bryophytes - largest archegonium in plant kingdom.
Pteridophytes (Funaria)
Gymnosperm - smallest archegonium in plant kingdom.

Habitat:-

→ worldwide in habitat
→ more abundantly found in temperate region. ION
→ so, also known as dominant flora of temperate region.
→ plants are generally perennial woody trees, shrubs.

Tallest trees
↓
Sequoia ← Sequoia sempervirens → world's tallest tree. 366 ft
Sequoia gigantea. 342 ft
↳ world's trees of maximum age.

★ Father of trees is Sequoia gigantea bcoz age is maximum i.e. 5000 – 6000 years.

Note:- smallest gymnosperm - Zymia pigmea (25cm). Zasma
→ Herbs are absent in gymnosperm.

Sporophyte :-
→ root, stem, leaf present called cormophyte → root, stem, leaf, floral parts
→ sporophyte is independent.
→ gametophyte is parasitic.

Root:- 2 types:-
★ normal root :- Dicot
★ Symbiotic root → BGA/nostoc - coralloid roots. Eg Cycas.
Fungi - Mycorrhizal roots. Eg Pinus.
Basidiomycetes.
Ascomycetes.

→ Coralloid roots helps in N_2 fixation and for aeration.
Mycorrhizal roots helps in phosphate metabolism.

Stem :- 2 types

a) Unbranched - monopodial
- caudex. Eg) cycas.

b) Branched - sympodial
- excurrent Eg) pinus.

On the basis of growth,

a) long shoot - branch of unlimited growth
- absent of foliage leaf.
- bears scaly leaf and cones.

b) short / dwarf shoot
- branch of limited growth
- presence of foliage leaf and scaly leaf

Anatomy of Stem
- resembles with dicot - eustele, conjoint, collateral, open.

→ Xylem :- lacks vessels so soft / non-porous wood.
except Gnetales @ GEW
Gnetum, Ephedra, welwitschia.

→ Cambium - present so secondary growth occurs.

wood :- dual nature ↔ monoxylic / pycnoxylic. Eg) pinus
manoxylic / polyxylic Eg cycas

@ ~~Cyclo Han le Poison khaiyo~~

Vascular tissue

→ Phloem – lacks companion cells and sieve tube cells. (replaced by sieve cells).
In pinus, ~~secondary growth~~ sieve cell is replaced by albuminous cell.

Leaf:- dimorphic
a) Scaly leaf – Cataphyll present
– protection.
b) Foliage leaf – photosynthesis & transpiration.
Eg) Pinus, cycas.
→ Young – circinate ptyxis.
→ mature – unipinnate and sessile.
→ ramenta is present on petiole.
→ vascular tissue – Dictyostele, mesistele.

These characters resembles with fern. So, cycas is connecting link between pteridophyte and gymnosperm.
→ living fossil (Gingko > cycas)

Pinus is needle like in a group (1, 2, 3 or 5 leaflet ko group present on dwarf shoot)

Leaf of Pinus
a) ▭ – Eg) pinus monophylla. (1 needle)
b) ▭ – Eg) pinus sylvestris
c) ▭ Eg) Pinus roxburghii / chir pine – Khotesalla.
Pinus gerardiana – seed edible – chilgoza.
d) ▭ Eg) Pinus wallichiana / blue pine / Rani salla.

→ Anatomically, leaf of pinus show xerophytic character.
a) thick cuticle
b) reduce surface area
c) sunken stomata
d) Palisade tissue
e) Presence of transfusion tissue → tracheids present for transfusion tissue
→ Nucilage canal Eg) cycas
→ Resin canal Eg) Pinus.

Classification of Gymnosperm :- 2 types.

a) class cycadophyta
- small plants, unbranched, manoxylic wood
- foliage leaf :- compound and large.

order:- cycadofilicales.
cycadeoidales
cycadales.

b) class coniferophyta
- large trees, branched stem, pycnoxylic wood.
- foliage leaf :- simple.

order:- cordaitales
Ginkgoales
Coniferales
Gnetales

★ Order cycadofilicales
→ all are fossils.
→ connecting link between pteridophytes and gymnosperm.

★ Order cycadales
- living cycads.
- Eg) cycas, Zamia pygmae. (smallest gymnosperm)

☆ Order Ginkgoales

→ mainly fossils except one single living genera called Ginkgo biloba.
→ living fossil → @GINC Ginkgo, Nehseqpoia, cycas
→ also known as maiden hair tree.

☆ Order Coniferales :-

→ largest order of gymnosperm.
Eg. Pinus, sequoia (red wood tree), araucaria (christmas tree/ monkey pozzle)

☆ Gnetales

→ highest order of gymnosperm
→ connecting link bet gymnosperm and angiosperm.
→ vessels are present
Eg. Gnetom, Ephedra, welwitschia, etc. GEW

Reproduction in Gymnosperm.

→ vegetative method absent except in cycas by Bulbil formation.

☆ Sexual method

→ usual
→ with the help of sexual structure.
→ cone/flower :- unisexual / bisexual.
→ Heterosporous.

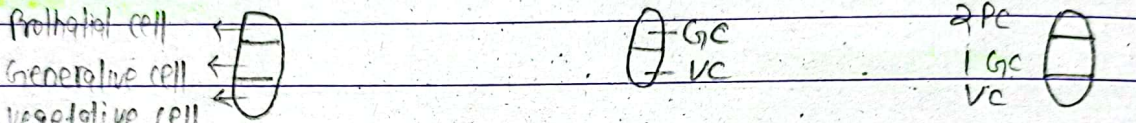
☆ cone < in a plant - monoecious - Pinus
in 2 plant - Diocious - cycas

Marchantia, cycas - dioecious @NCD
Pinus, Funaria - monoecious

Male cone / staminate cone.

→ winged pollen grain is present in pinus.

→ MMC (2n) meiosis → ⊗ → 0000
tetrad (n) microspore (n)
| mitosis
2 times | 1 times | 3 times



pollen grain germinated at 3 celled stage.
Eg: cycas

4 celled stage me pollen germ.
Eg: Pinus.

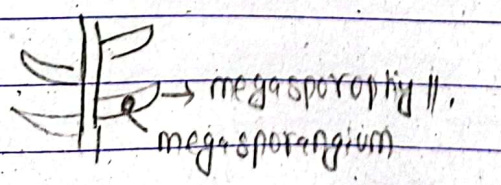
Yellow color ~~shower~~ Shower present in pinus called sulphur shower / golden dust shower by exine of pinus.. due to winged pollen.

→ microspore equivalent to pollen grain.

Female cone / pistillate cone

Cycas:-
female cone - loose one
male cone - compact

Pinus
female cone
male cone. > compact one.

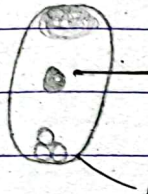


~~female cone.~~

Most common.

Pinus - unitegmic, anatropous ovule
Cycas - unitegmic, orthotropous ovule.
↳ most primitive & simple

Ovule of gymnosperm



secondary cell (2n) + ♂ → triple fusion → primary endosperm nucleus (3n).

egg cell (n) + ♂ → syngamy → zygote (2n) → embryo.

angiospermic fertilization and triple fusion.

→ In Gymnosperm, endosperm is haploid because it is formed before fertilization.

♂ + egg → zygote → embryo (2n) } polyembryony
♂ + egg → zygote → embryo (2n) }
↳ naked seed.

→ Polyembryony commonly seen in gymnosperm and 8t reported in Citrus.

naked seed
- ↳ seed coat - testa only present → represent sporophyte (♀)
- ↳ Kernel - made of endosperm (n) and embryo.
  - endosperm (n) → represent ♀ gametophyte
  - embryo → give future sporophyte.
    - ↳ Tigellum (main axis)
    - ↳ cotyledon.

cotyledon → Polycotyledon Eg> Pinus (3-18)
→ Dicotyledon Eg> Cycas (2)

☆ naked seed undergo germination :-
a) Epigeal : Dicot Eg> Pinus
b) Hypogeal : Monocot Eg> Cycas.

Note:
Pine nut is obt from pinus and seed is chilgoza.
→ sago palm obtained from cycas revoluta.

Lifecycle of Pinus and Cycas

→ Cycas revoluta is commonly known as sago palm, coco palm.
→ coralloid root of cycas is negatively geotropic, apogeotropic.
→ Cycas has biggest antherozoids, biggest megaspore, biggest ovule } in the whole Plant Kingdom.
→ antherozoids of cycas :- Spirally arranged, ciliated, multiflagellated.
→ megasporophyll of pinus has i) bract scale
ii) ovuliferous scale.
→ megasporophyll is arranged as loose female cone in cycas.
→ winged pollen grain is found in pinus from exointine part of exine.

→ Male cycas is top shaped multiciliated or multiflagellated & largest among plant kingdom. Tape & Nula

characters	Cycas	pinus
plant body	dioecious	monoecious
root	dimorphic root ⇒ coralloid root	dimorphic root ⇒ mycorrhizal root
wood	manoxylic and polyoxylic	monoxylic and pycnoxylic. non porous
foliage leaf	Unipinnately compound → circinate ptyxis, ramenta	→ needle like, simple → lack vernation and ramenta
microsporangium	In both, microsporangium is found on dorsal surface of microsporophyll.	
compact male cone	present	present
compact female cone	absent loose	present
dehisence of pollen grains	pollen drop mechanism	Sulphur shower mechanism
pollination occurs at	3 celled stage by wind (anemo)	4 celled stage. note:- Ephedra 5 celled @CPE 345
No. of ovules in megasporophyll	(1-6) pairs	2 owle.
ovules	orthotropous → zooidogamous	anatropous → siphonogamous by pollen tube
seed germination	Hypogeal	Epigeal.
no. of cotyledon in seed	2 Dicotyledon	3-18 polycotyledon.

Economic importance:

→ ornamental plants
→ food products
→ cycas revoluta bata sago palm is obtained.
→ medicine value
★ Taxol :- obt. from bark of taxus.
- medicine of cancer
Name ★ Ephedrine :- alkaloid obtained from Ephedra.
used in treatment of cough, cold and respiratory disease.

→ industrial purpose.
→ wood, timber, cedar, Deodar obt from cedrus.
→ Pencil obt from Juniperus.
→ Tannin is obt from bark.
Name → Resin oil / turpentine oil obt from resin of pinus.
→ paint industry
→ wood gas, wood tar, wood alcohol obt. from pinus.
Note Turpentine (canada balsam) obt from Abies balsamea.
→ mounting agent during slide preparation.

→ generally Pteridophyte and gymnosperm doesn't have vessel except. Vessel ∄ SEMI GNEW XQ.

Selaginella	Gnetum
Equisetum	Ephedra
Marsilea	Welwitschia

Characters

Examples

→ smallest angiospeamic plant and flower - wolffia microscopia.
→ tallest tree / tallest gymnosperm - sequioa sempervirens.
→ Tallest angiospeamic plant - Eucalyptus regnens.
→ smallest seed - orchids.
→ biggest seed - lodoicea maldavica, double coconut
→ largest leaves - victoria regia
→ longest leaves - Raphia
→ biggest egg cell (antherozoid), ovule present in cycas.
→ largest archegonium - bryophytes
→ largest flower - Rafflesia.

Polyembryony - Gymnosperm
Polyspory - Cuscuta & Citrus.

→ Transfusion tissue is present in cycas and pinus (needle, leaflet)
→ winged seeds found in Pinus.