

GINKGOALES

- Today Ginkgoales represented by only one living member, i.e. *Ginkgo biloba*.
- Ginkgo is called a “**living fossil**”
- Abundantly represented in the world by several species of about 16 genera during the Triassic period of Mesozoic age.
- All the genera, except *Ginkgo biloba*, are extinct.

General Characteristics of Ginkgoales:

- Tall, well-branched trees with short and long shoots. However, some earliest fossil members were without short and long shoots.
- Wood is pycnoxylic.
- Leaves are large, leathery and fan-shaped or strap-shaped. They are often deeply divided.
- Dichotomous venation is usually present in the leaves.
- Un-branched, catkin-like male organs are axillary in position.
- Male organs bear micro-sporangiophores.
- Each micro-sporangiophore possesses 2-12 pendulous microsporangia.
- Spermatozoids are motile and contain spiral bands of flagella.
- Ovules are terminal in position on branched or un-branched axillary axes. They are 2-10 in number.
- Seeds are large-sized.
- Each seed contains a fleshy outer layer and a middle stony layer.

Sporne (1965) divided Ginkgoales into following two families

- 1) Trichopityaceae, represented by an extinct genus Trichopitys.

- 2) Ginkgoaceae, represented by one living genus (Ginkgo) and six extinct genera (Arctobaiera, Baiera, Eretmophyllum, Ginkgoites, Sphenobaiera and Windwardia).

Resemblances with Cordaitales

- i. Presence of double leaf trace.
- ii. Endospermic beak in the mature ovule, and
- iii. The probable motility of the spermatozoids of the members of both Ginkgoales and Cordaitales are some of the resemblances between these two groups.

Resemblances with Pteridospermales:

- i. Presence of leaf gap in the stem.
- ii. Dichotomous open venation in the wedge-shaped leaves of Ginkgo and pinnules of some seed ferns (Pteridospermales).
- iii. A distinct pollen chamber,

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- iv. A massive fleshy layer in the ovules.
- v. Collar at the base of the ovules in Ginkgo and cupule in ovules of some Pteridospermales.

Resemblances with Filicales:

- i. The similarities between the primary xylem structure, secondary xylem structure and periderm of Ginkgo and some ferns (*Ophioglossum* and *Botrychium*),
- ii. Dichotomous open venation in their leaves,
- iii. Multi-flagellated and motile spermatozoids, and
- iv. Presence of ventral canal cell in the archegonia in some of their members.

Resemblances with Cycadales:

- i. Presence of multi-flagellated spermatozoids.
- ii. Well-developed nucellar beak and pollen chamber.
- iii. Haustorial nature of pollen tube.
- iv. Presence of large egg, massive female gametophyte and well-developed venter.
- v. Endoscopic embryo with two cotyledons.
- vi. Seed with thick and well-developed integument
- vii. Hypogeal type of seed germination.

Resemblances with Coniferales:

- i. Cone like appearance.
- ii. Extensively branched stem with two types of branches, i.e. long shoots and dwarf shoots,
- iii. Leaves are simple with sunken stomata.
- iv. Cortex and pith are narrow and wood is pycnoxylic.
- v. Secondary wood is well-developed.
- vi. Medullary rays are uniseriate.
- vii. Circular bordered pits arranged uniseriately along the radial walls of the tracheids.
- viii. Microsporangia show longitudinal dehiscence.
- ix. Sessile ovule.

Ginkgo biloba

- *Ginkgo biloba* is a tall tree.
- It is cultivated for its edible seeds in some parts of China and Japan.
- Ginkgo is known to have occurred in rocks as old as Triassic or even much earlier.

Morphological Features of Ginkgo:

- Sporophytic.
 - Attain a height up to 30 metres.
 - very irregular pattern of branching.
 - The branches are dimorphic .
 - The foliage leaves, present on the long shoots.
 - Leaves are deeply lobed while those on the dwarf shoots are not so deeply lobed and sometimes more or less entire
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- Possesses a long tap root system.
 - The foliage leaves are simple, large, petiolate and wedge-shaped or fan-shaped with expanded apex and narrow base.
 - Dichotomous type of venation.
 - Amphistomatic.
 - Stomata remain surrounded by 4-6 subsidiary cells with finger-like outgrowths overarchng the guard cells.

ANATOMY OF ROOT:

- Mature roots are surrounded by phellogen or suberized cells of cortex.
- A large portion of the young root is occupied by multilayered, thin-walled cortex which contains several tannin- filled cells and calcium oxalate crystals.
- Mucilage canals are also prominently visible
- young roots with a layer of endodermis and uni-layered pericycle
- Mature roots, however lack such a distinction.
- Diarch condition in the young roots.

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- Xylem is exarch. It remains separated by the phloem strands.

ANATOMY OF STEM

- The young stem (long shoot) remains surrounded by a single-layered, thickly circularized epidermis and made of brick-shaped cells.
- Epidermis is replaced by periderm in the older stems.

- Inner to the epidermal layer there present parenchymatous cortex.
- It contains mucilaginous canals, sphaeraphides and many tannin-filled cells.
- Endodermis and pericycle are not well-marked in long shoot.
- Conjoint, collateral, open and endarch vascular bundles are arranged as a ring in very young stem.
- Two leaf traces.
- After the secondary growth, the vascular cylinder of the stem becomes an endarch siphonostele with no parenchyma in the wood except that of uniseriate medullary rays.
- Protoxylem has spiral thickenings
- Sieve tubes and phloem parenchyma constitute the phloem.
- A narrow pith, containing mucilage canals and sphaeraphides, is present in the centre of long shoot.
- While in dwarf shoot the pith is comparatively more extensive.

ANATOMY OF LEAF

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- A layer of epidermis is present on upper as well as lower sides of leaf.
- The epidermis is thickly cuticularised and consists of rectangular to polygonal cells.
- Haplocheilic type of stomata, restricted to lower epidermis.

