

Sri Dharmasthala Manjunatheshwara College (Autonomous), Ujire-574 240, Dakshina Kannada, Karnataka State (Re-accredited by NAAC at "A" grade with CGPA 3.61 out of 4)

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LAB MANUAL DEPT OF BOTANY (UG)

BOTANY PRACTICAL MANUAL

BSc. – III Semester

Name:..... Roll no.....



Dept. of Botany SDM College Ujire

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STUDY OF PSILOTUM

Psilotum:

Habit:

- Psilotum is a Pteridophyte.
- It is a member of the order Psilotales.
- The plant is a diploid sporophyte.
- The plant body consists of a rhizome, aerial branches and leaves.
- The rhizome is cylindrical and dichotomously branched. It is in the soil.
- The rhizome bears many rhizoids for anchorage and absorption.
- Aerial branches arise from the upper surface of the rhizome and grow erect.
- The aerial branch is ribbed and dichotomously branched. It is green in colour.
- The leaves are small and spirally arranged on the stem. The leaf has a midrib that does not reach the tip.
- The leaves of the upper portion are fertile and they have a sporangium in their axis, which is tri-lobed structure containing haploid spores.

T.S of Stem

- The T.S. of the stem shows an epidermis, cortex, endodermis and **actinostele**.
- The epidermis is the outer layer. It is made up of thin walled cells. It is interrupted by stomata. It is covered with cuticle.
- The cortex is differentiated into three zones. The outer cortex is chlorenchymatous, the middle cortex is sclerenchymatous and the inner cortex is parenchymatous.
- The endodermis is single layered and lies below the cortex.
- The pericycle is single layered and it surrounded the xylem and phloem.
- The steel is an **antinostelic siphanostele**. It consists of a star shaped xylem surrounded by phloem. There is a small pith in the centre of the stele.
- The xylem is exarch. The protoxylem lies at the projection of the stellate xylem.



T.S of Synangium:

- The T.S of sporangium is tri-lobed in outline, and shows sporangial wall and spores.
- It is an asexual reproductive structure.
- It is produced in the axil of fertile leaves on the sporophytic plant.
- The sporangial wall is three or four layered. The outer layer is made up of large thin walled cells.
- The cells of the inner wall layers are small and thin walled.
- The sporangium is homosporous.
- Each sporogenous tissue produces spore mother cells.
- The spore mother cells undergo meiosis to form haploid spores in tetrad.
- The haploid spores germinate and gives rise to haploid gametophytes.



STUDY OF LYCOPODIUM

Habit:

- The mature plant body of a *Lycopodium* is sporophyte.
- It can be differentiated into root and rhizoids and aerial stem.
- The stems possess numerous spirally arranged leaves. It is slender and prostrate.
- At the apical regions strobilii are situated and are the reproductive structure.
- The exhibit homosporous condition.

T.S. of stem

- The T.S. of the stem shows an epidermis, cortex, endodermis and a mixed stele.
- The epidermis is the outer layer. It is composed of a single layer of thin walled cells. It is covered with cuticle.
- The cortex is differentiated into three zones. The outer and inner cortexes are parenchymatous. The middle cortex is sclerenchymatous.
- Endodermis is a single layered.
- The pericyle consists of a single layer of thin walled cells.
- The stele is a **mixed protostele**. Here xylem elements are uniformely distributed in the phloem. The phloem serves as the ground tissue.
- The xylem consists of tracheids. The phloem consists of sieve cells and phloem parechyma.
- Pith is absent.

T.S. of the strobilus:

- In *L.cernuum* the strobilus are present at the apical regions of the stem.
- In L.S. it shows following characteristic features.
 - 1. There is a central sterile axis which is surrounded by fertile sporophylls.
 - 2. Sporophylls are arranged completely in spiral manner.
 - 3. They show acropetalous succession.
 - 4. Each sporophyll contains sporangia on its adaxial surface (upper surface). Each sporangia is stalk.
 - 5. In individual sporangia numerous spores which shows homosporous condition.





STUDY OF SELAGINELLA

Selaginella

Habit:

- The plant body is a diploid sporophyte, plant body consists of stem, leaves and roots.
- The leaves are microphyllus, sessile, ligulate and spirally arranged on the stem.
- The leaves are dimorphic i.e. the leaves are two kinds, small and large.
- The protostate branch bears elongated downwardly growing structure called rhizophores. The rhizophores are leafless and positively geotropic.
- The roots are adventitious and dichotomously branched. They have root caps and root hairs.
- The apex of the branches bears reproductive structures called strobili or cones or spikes. The strobilus contains sporangia with spores.

T.S. of Stem

- The cross section of the stem shows an epidermis, a cortex, a pericylce and a central stele.
- The epidermis is the outer layer. It is made up of a single layer of thin walled cells. It is covered by a cuticle.
- The cortex is lies below the epidermis. It is made up of an outer sclerenchymatous hypoderimis and an endodermis and air space.
- In the air space, trabeculae are present. They are the modified endodermal cells with casparian strips.
- The pericycle encloses the xylem and phloem.
- Stele is present in the centre and it consists of xylem and phloem. The stele is protostele with exarch xylem.
- The xylem consists of metaxylem and protoxylem.
- Pith is absent.

T.S. of Rhizophore:

- The cross section of selaginella rhizophore shows an epidermis, cortex, pericycle and stele.
- The rhizophores are produced from prostate branches and they are leafless and positively geotropic.



- The epidermis is the outer layer and it consists of a single row of thin walled cells.
- The cortex is distinguished into an outer sclerenchymatous and an inner parechymatous cortex. The endodermis is single layered.
- The pericycle consists few layers of thin walled cells.
- The stele is made up of xylem and phloem. The stele is protostele i.e., a central core of xylem is surrounded by phloem. The xylem is exarch.
- Xylem vessels are absent. In phloem, companion cells are absent.

V.S. of Cone:

- The L.S. of cone shows the sporangia and spores.
- Cones or strobili are the asexual reproductive structures.
- Selaginella plant is a diploid sporophyte. It reproductive asexually by spores.
- Selanginella is heterosporous and it produces two kinds of spores namely microspores and megaspores.
- Each cone consists of a cone axis and a number of sporophylls.
- The sporophylls are of two types, microsporophylls and megasporophylls.
- The microsporophylls bean microsporangia and megasporophylls bear megasporangia.
- Each sporangium is produced on the upper side of the sporophyte.
- In between the sporangium and sporophyll there is a ligule, in both micro and megasporophylls.
- A single megesporophyllis found at the base of the cone and the microsporophylls are produced in large numbers.
- Each sporangium has a multicellular stalk.
- The megasporangium produces four megaspores after reduction division in the megaspore mothe cell. The megaspores are haploid.
- Inner to the sporocarp there is a ring of parenchymatous tissue. On maturation it becomes a gelatinous ring around the sori, there are two sori on the lateral side of the sporocarp.
- The megasporangia produce megaspores while the microsporangia produce microspores.



STUDY OF EQUISETUM

Equiserum:

Habit:

- Equisetum is a pteridophyte which belongs to the family equisetaceae.
- The plant consists of much branched shoot system and underground rhizome.
- Rhizome is long, slender, horizontal and subterranian in nature.
- Aerial shoot arises from the rhizome.
- Each aerial shoot is simple and branched and provided with nodes and internodes.
- The branched shoots are usually sterile and vegetative in function.
- Unbranched shoots produced cones at their tip.
- The leaves are minute and scaly and they fall a whorl at each node.
- The lateral branches are alternating with the leaves and are photosynthetic in nature.

T.S. of stem:

Transverse section at the intermodal region shows following details.

- **Epidermis:** This is a wavy single outer layer of cells with prominent ridges and furrows. The cells are deposited with silica in their outer lateral walls. It is discontinuous at the furrows due to the presence of stomata.
- **Cortex:** It is a distinct at the regions of ridges and furrows.

At the ridges: There is a patch of sclerenchyma below the epidermis. Next to that there is a layer of few cells which are of chlorenchymatous nature and are photosynthetic in nature, inside to this region, there is a general cortex.

At the furrows: There is a stomal chamber made up of aerenchymatous tissue. Below that general cortex is present. General cortex is ruptured and is resulted into the formation of a hallow structure, which are called as 'vallecular canal'. Endodermis is innermost, wavy in outline which is made up of barrel shaped cells.

- Stele: Stele is composed of
- **Pericycle:** It is single layered.
- Vascular bundles: There are closed, collateral, they are opposite to ridges. And they near adjacent to a water filled cavity called 'carinal canal'. It is siphanostele.
- **Pith:** Major portion of pith is hallow.



Cone:

Structure of strobilus or cone:

- Equisetum sporophyll is somewhat specialised structure. It is flattened, hexagonal, disc like structure, supported by a short stalk. They are aggregated together in whorls, at the apex to form a strobilus. In T.S. we can observe many sporophylls which are attached to the central sterile axis at the both side of stalk, sporangia are present.
- Inside the sporangia numerous spores are present and they exihibit homosporus condition.

L.S. of cone:

- In longitudinal section of cone the arrangement of differently aged sporophylls can be studied.
- All the sporophylls are attached through the central sterile axis.
- At the base of axis, we can see older sporophylls and at the tip younger ones.
- In each sporangia we can observe homosporous condition.

Spores:

- Spores are single called, spherical structures equipped with elaters.
- Elaters are ribbon like structures which are sensitive to moisture.
- During dry condition elaters are coiled around the spores.
- At the time of dehiscences or splitting of sporangia moisture will enter inside the sporangia and these elaters absorb the moisture and stars uncoiling.
- This helps in dispersal spores to a greater distance.



STUDY OF OPHIOGLOSSUM

Habit:

- The matured plant body of ophioglossum is a sporophyte, which possess a short, erect, subterrenion rhizome.
- Rhizome produces an aerial leaf along with the reproductive structure called as spike.
- The name ophioglossum means snakes hood which is the appearance of the leaf and spike.
- The spike contains homosporous sporangia within it.

T.S. of Spike:

- The reproductive structure of ophioglossum is called as spike.
- In transverse section it shows two sporangia which are attached to central sterile region.
- The central sterile is called as Axis and it is two three layers in thikness.
- Sporangial walls are one-two layers in thickness within which they contain numerous spores.
- The spores are homosporous in nature.

V.S. of Spike:

- The reproductive structure of ophioglossum is termed as spike.
- In vertical section it appears like spindle, shape, elliptical shape.
- At the basal region it is attached to the petiole of the leaf, by the stalk.
- There is a central axis which is sterile, runs throughout the spike.
- In the both sides of axis sporangia are embedded within the sporangial walls.
- Usually sporangia which are in centre will be fertile and matured and in other region still growing.
- The spores are homosporous in nature.



STUDY OF HYMENOPHYLLUM

Habit:

- Hymenophyllum plant body is a sporophyte.
- It is commonly called as 'filmy ferm'due to the nature leaves which are translucent.
- The leaves will horizontally grow on the substratum producing the reproductive structure at the apices.
- The reproductive structure of Hymenophyllum is called as sorus.

V.S. of Spike:

- The reproductive structure of hymenophyllum is called sorus.
- The V.S. of sours exhibits the following features.
 - 1. The basal stalk of the source is attached to the leaves and it extends throughout the length of the sours in the form of central axis.
 - 2. It also possesses 'indisium' which covers the sporangia partially.
 - 3. Sporangia are attached to the central axis.
 - 4. The spores are homosporous in nature.



STUDY OF PTERIS

Habit:

- The pteris plant body is sporophyte.
- It can be differentiated into Roots, rhizoids and leaves.
- The rhizome is underground. In the aerial portion we can seen leaf or frond.
- The leaves are compound type, which contains numerous leaf lets or pinna.
- In the young condition they show 'circinate vernation'(it is a the coil of leaf, as it grows it become looses).
- The reproductive structure is 'sorus'(sori)are seen in the back sides of the leaves.

T.S. of the let through sorus:

- The reproductive structure is sorus are seen in the back sides of the leaves.
- The spore bearing leaf let is called as 'sporophyll'.
- The sporangia are born in groups called sori on the lower surface.
- The sori are not separated with each other hence they are called as 'coenosorus'.
- The margin of leaf let curves and covers the sorous forming 'false inducium'.
- The spores are of homosporous condition.



STUDY OF MARSILEA

Marsilea Habit:

- The plant is a diploid sporophyte.
- Plant body is differentiated into root, stem and leaves.
- Stem is long, slender, creeping with nodes and internodes.
- Single leaves arise from the upper surface at the node.
- It has long petiole and four leaflets at its tip.
- Young leaf shows circinate vernation.
- Roots are adventitious and arise from lower surface of stem node.
- Bean shaped reproductive bodies called sporocarp are found attached with base of petiole.

T.S. of Rhizome:

- T.S. of stem shows epidermis, cortex, endodermis and an amphiphloic siphonostele.
- Epidermis is the outer single layer of cells. Cortex has three zones. The outer and inner cortex are parenchymatous outer layer of inner cortex is sclerenchymatous.
- The middle of the cortex is aerenchymatous. It has rows of air chambers.
- Endodermis and pericycle are single layered.
- Metaxylem form a ring, protoxylem occur as definite patches on the outer surface of xylem ring. The xylem is exarch.
- Xylem consists of tracheids, vessels and xylem parenchyma. The phloem consists of sieve cells and phloem parenchyma.
- The pith lies in the centre of stele. Ti is sclerenchyma.



HLS of sporocarp:

- The reproductive organ is called as 'sporocarp'.
- It is bean shaped or kidney shaped structure.
- It has a body and stalk is attached to the basal region of petiole.
- The horizontal section of sporocarp passing through pedicel shows an epidermis, hypodermis gelatinuous tissue.
- There are two rows of sori. Each row has nearly eight-ten sori.
- Each sorces is covered with a two layered inducium.
- Within the inducium is fertile axis called as receptacle. Receptacle at its tip bears the megasporangia.
- Microsporangia are seen on both on both sides of the megasporangia.
- The pedicel portion shows stalk bundle.



STUDY OF CYCAS

Habit:

- Cycas is Gymnosperm; it is a slow growing plant.
- Cycas is a palm like plant. It is an evergreen plant.
- The plant is a diploid sporophyte. The plant body consists of root, stem and leaves.
- The roots are of two types the normal tap root forming a tap-root system and coralloid root.
- The tap roots are positively geotropic and they have root hairs.
- These roots fix the plant in the soil and absorb water and minerals.
- From the normal roots develop some lateral branches that bear vertical, negative geotropic roots. These are roots are repeatedly dichotomously branched and coral like. So they are called corolloid roots.
- These roots get infected with blue green algae like Nostoc and Anabaena.
- The stem is thick, woody and unbranched. The young stem is tuberous while mature stem is columnar, erect and stout. It is covered with persistent leaf bases. The stem bears a terminal group of leaves.
- The leaves are dimorphic i.e., the leaves are of two types, foliage and scale leaves.
- The foliage leaves are green large pinnately compound with a spiny petiole.
- The leaves a spirally arranged. Each leaf consists of a rachis and leaflets.
- The young leaves show circinate vernation.
- Scale leaves are also known as cataphylls. These are dry, small, brown coloured triangular leaves and covered with hairs.
- Cycas is diecious i.e., there are separate male and female plants. The female plants are common but male plants are rare. The reproductive structure are produced as 'cones'.

T.S. of leaflet:

- The T.S. of leaflet shows epidermis, hypodermis, mesophyll tissue, transfusion tissue and vascular tissue.
- Upper epidermis is a single layered and is thickly cuticularized. Hypodermis is present below the epidermis. It is sclerenchymatous.
- Mesophyll lies below the hypodermis. It is differentiated into upper palisade and lower spongy parenchyma.
- The lower epidermis is single layered. Stomata are sunken type.



In the midrib region lies a single vascular bundle. It is surrounded by parenchymatous tissue with calcium oxalate crystals.

T.S. of Corolloid root:

- The T.S. of coralloid root is differentiated into epiblema, cortex. Pericycle, vascular stele and pith.
- The epiblema is the outermost layer. It is single layered.
- Cortex is multilayered and parenchymatous. The cortex is divided into an outer cortex, a middle cortex with algal zone and inner cortex.
- Algal zone has radially elongated cells in the middle of the cortex. The cells contain blue green alga, Anabena, Nostoc etc.
- Endoderimis is the innermost layer of cortex and it is followed by many layered pericycle.
- Vascular stele consists of radial, vascular bundles.
- Xylem is triarch and exarch.
- In the centre, small pith is present.

Microsporophyll:

- The male cone is the male reproductive organ.
- It consists of central cone axis and numerous microsporophylls.
- The microsporophylls are leaf, like, woody, wedge shaped brown coloured structures with narrow base and expanded upper portion.
- The microsporophylls are spirally arranged around the cone axis.
- The upper portion is painted and sterile and it is called apophysis.
- Each microsporophyll on the lower surface bears thousands of microsporongia in 3-5 groups. Each group is called a sorus.
- Numerous microspores are present in the microsporangium.

Megasporophyll:

- The female reproductive organs are called megasporophylls.
- The megasporophylls are arranged spirally and each megasporophyll is leaf like and densely covered with brown hairs.
- Each megasporophyll consists a lower petiole or stalk, a middle ovale bearing portion and an upper leafy lamina.
- The middle portions f the megasporophylls bears ovules, they are produced in two rows, one on either sides, may be opposite or alternate.



L.S. of ovule:

- Cycas ovule are orthotropous, consists of stalk, an integument, a micropyle and a nucellus.
- The stalk is short, the integument of three layers namely an outer fleshy green or orange layer called sarcotesta, a middle yellow, stony layer sclerotesta and an inner fleshy layer.
- The outer and fleshy layers are supplied with vascular strands.
- The nucellus lies just below the integument and forms a nuclear beak in the region of the micropyle. The nucellus encloses an embryo (megaspore).
- The megaspore nucleus undergoes repeated divisions to form endosperm.



STUDY OF PINUS

Pinus

Habit:

- Pinus is a tall, evergreen, perennial xerophytic tree. It is conical in appearance it is conifer.
- The plant consists of stem, root and leaves.
- The stem is woody and branched. It is erect. The main stem is covered by scaly bark. The growth of the main stem is by an apical bud.
- The stem bears branches, formed on the lower part are longer than those formed on the lower part are longer than those formed on the upper part. Branching is monopodial.
- The branches are of two types (dimorphic) namely long shoots and dwarf shoots. The long shoots grow indefinitely and they are also called as branches of unlimited growth. They bear scale leaves. In the axis of scale leaves dwarf shoots are produced and they lack apical buds and the growth is restricted and they are called as branches of limited growth.
- There are two types of leaves they are scale leaves (cataphylls) and foliage leave.
- The plant has tap root system, the tap root bears numerous lateral leave younger leaves covered with an electrophic fungus Micorrhiza.
- Pinus is monoeoious plant and unisexual.

T.S. of leaflet (Needle)

- The T.S. of Needle shows epidermis, hypodermis, mesophyll tissue, endodermis, pericycle, vascular tissue or stele.
- The epidermis is single layered, covered with thick cuticle. Stomata are found on all sides. So the needle is amphistomatic. The stamata are sunken.
- Epidermis is followed by hypodermis and it consists of one or two layers of sclerenchymatous.
- Resin canals are present in the mesophyll tissue. Each canal surrounded by a epithelial layer.
- Endodermis consists of single layered pericycle, it is made up of three types of cells albuminous cells, tracheidal cells and transfusion tissue. And vascular bundle embedded in the transfusion tissue.
- The vascular bundle consists of xylem and phloem. The bundle is collateral and open.


T.S. of old stem:

- The T.S. pinus old stem shows secondary growth.
- The cells in the outer cortex become meristematic and form phellogen or cork cambium. The phellogen produces to cork tissue above and secondary cortex below.
- A continuous cambial ring is formed by the union of inter and intra fascicular cambia. The cambial ring produces secondary xylem towards the inside and secondary phloem towards outside.
- The primary medullary ray is seen from the pith to the cortex.
- Secondary medullary rays are formed from the cambium and they occur in secondary xylem and secondary phloem.
- Rasin canals are found in secondary xylem. Secondary xylem (wood) shows a number of annual rings. Each ring consists of spring and autumn wood.
- Primary xylem group are end arch and lie near the pith. Pith is small parenchymatous and they are filled with tannin.

Male cone:

- In pinus, male cone is the asexual reproductive organ.
- Pinus reproduces asexually by spores. Spores produced inside the cones.
- Male cone is also known as staminate stobilus, they are spirally arranged on long shoot.
- Each male cone is ovoid in shape. It consists of central axis and numerous microsporophylls, it bears microsporangia, microsporangia produce the spores, which develop into male gametophytes.

L.S. of male cone:

- In L.S. of each male cone it consists of a central axis and numerous microsporophylls.
- Each microsporophylls has a short stalk with a terminal leafy expansion.
- The tip is sterile and is called apophysis.
- Each microsporophyll bears two microsporangia on its lower side.
- The microsporangium consists of microspore mother cells. It undergo meiosis to form haploid winged microspores.



Female cone:

- In pinus, female cone is the female reproductive organ. It is also known as ovulate strobilus.
- Female cone develop laterally in the axil of scale leaves.
- They are produced in clusters in place of long shoots.
- A single shoot bear one or four female cones. They are reddish brown in colour.
- They are mature in three years.
- In the first year, cones are compact and sporophylls are closely arranged. In the second year the cones are larger and woody. The sporophylls are compactly arranged. In the third year, the cones become loose. The sporophylls separate fromone another.

L.S. of female cone:

- The female cone consists of a central axis and many megasporophylls.
- The megasprophylls are spirally arranged on the central axis.
- The megasporophylls bear megaspores which develop into female gametophyte.
- The megasporophylls consists of two kinds of paired scales namely the bract scale (cone scale) and ovuliferous scale.
- The terminal board sterile portion of the ovuliferous scale is called apophysis.
- Each ovuliferous scale bears on its upper surface two naked sessile ovules.

L.S. of ovule:

- The ovules are atropous.
- A young ovule consists of a single integument, enclosing the nucells.
- The integument is three layers. The integument leaves an opening at the top called micropyle. Just below the micropyle the pollen chamber is present as a very small depression.
- Near the apex of the nucellus a large cells becomes differentiated. This cell is called the megaspore mother cell. It is diploid. It undergoes meiosis to form a linear tetrad of megaspores.



STUDY OF GNETUM

Habit:

- Most of the species of Gnetum are woody climbers. Some of they are scandent shrubs and few of them are small trees.
- Gnetum is a sporophytic plant. It looks like an angiospermic plant.
- It consists of stem, leaves and a tap root system.
- The stem is woody and branched in different directions.
- It has two types of branches. They are, long branches or branches of unlimited growth and dwarf shoots or branches of limited growth.
- The long branches bear scale like leaves at the nodes.
- There are two leaves at each node.
- The leaf arrangement is decussate. The petiole very short. The margin is entire and distal end is acute. The leaves show reticulate venation.

Secondary Growth:

- The secondary growth begins in a normal manner but after a short time an extra fascicular cambium develops and it produces a normally oriented ring of vascular bundles.
- There is a anomalous type of secondary growth. Several successive rings of cambia develop one after the other in different parts of cortical region.
- These rings gradually become incorporated into a continuous xylem cylinder possessing wedge shaped vascular bundles.
- The growth of the first ring ceases and three after the growth of second ring begins and hence the rings formed successively one after another.
- Some of the rings remain incomplete and become in eccentric position with regard to pith.
- Secondary phloem is composed of sieve cells and parenchyma cells.
- The vessels of secondary xylem have simple pits on their radial walls. These vessels are more advanced in Gnetum.
- Sometime the cortex and the pith both possess laticiferous elements.
- Periderm is generally thin; it develops from the hypodermal region. It also possess lenticels.



Male cone:

- Male cone is also called as 'male strobilus'.
- It has long slender axis which bears numerous decussating pairs of bracts.
- These bracts are practically fused along their margins, so round the axis at short interval. They are cup shaped structures (collars) formed by the fusion of these bracts.
- In the axis of these are whorls of staminate flower found. Three –five in each whorl.

L.S. of Male cone:

- It shows a central axis and many male flowers.
- The axis consists of several swollen nodes and internodes.
- The node has a boat shaped structure at the node.
- 3-6 rings of male flower and arranged above the collar.
- The male flower consists of an outer covering called perianth and a bilocular microsporangium with a short stalk.
- The sporangium consists of a sporangial wall and sporogenous tissue.
- The sporogenous tissue gives rise to microspore mother cell.
- The microspore mother cell undergoes meiosis and forms four haploid microspore in the form of tetrad.
- The microspore gives rise to a male gametophyte.

Female cone:

- It is also called 'female strobilus'.
- It possesses an axis which bears collars arranged one above the other.
- Above each collar about 4-10 ovules are found and they are arranged in ring.
- The ovules are dimorphic. The smaller ovules ultimately degenerate.
- Each female flower is represented by a single ovule.

L.S. of Female cone:

- It consists of an axis with nodes and internodes and ovules.
- The axis has swollen nodes and slender internodes.
- The nodes bears a boat shaped structure called collar or cupule.
- Four rings of female flowers are arranged on the collar.
- The female flower represents a ovule or a megasporangium.



Ovule:

- An ovule is Orthotropous.
- The L.S. of ovule shows a spherical nucellus and three envelops called integuments.
- The integuments are called outer integument, middle integument and inner integument.
- The outer and inner integuments are soft, but the middle one is stony.
- The inner integument grows beyond the others and form a tube called micropylar tube. The opening of the tube is called micropyle.
- A pollen chamber lies below the micropylar tube.
- The nucellus consists of a mass of thin walled cells. It is a nutritive tissue.
- A female gametophyte remains embedded in the nucellus.
- The female gametophyte consists of a sac-like structure consisting of celluar tissue at the chalazal end and free nuclei at the micropylar end.
- It has one or two large nuclei which act as female nuclei.
- The female nucleus fuses with the male gamete to form a diploid zygote.



STUCTURE OF ANTHER

T.S. of Anther:

- The cross-section of a very young anther consists of a homogeneous mass of meristamatic cells surrounded by an epidermal layer. Further growth of the anther makes it four lobed.
- In each lobe a few cells in the hypodermal region become differentiated by their large, radial growth, dense cytoplasm and conspicuous nuclei. The makes the Archesporium.
- There is much variation in the number of cells of archesporium.
- Generally the archesporium consists of a 2-3 cells wide plate running along the entire length of the lobe.
- The Archesporial cells (microsporial initials) divided periclinally farming a primary parietal layer and a primary sporogenous layer, form the wall of the sporangium. These cells may be greatly lignified or cutinised.
- The layer next to epidermis is the endothecium (fiber layer). By the development of fibrous bands of thickening the endothecium become hygroscopic and is responsible for the dehiscence of mature anther.
- The intermost layer develops into tapetum, having dense cytoplasm and conspicuous nuclei, has great physiological significance since all the food materials entering the sporogenous tissue diffuse through this layer thus it is nutritive layer for development of microspore.
- The Archesporial cells or microsporangial cells divides to form primary sporogenous layer. This layer acts as pollen mother cell which later form pollen. The opening through which the pollen grains are released from the pollen sac arc called stomium.



PLACENTATION

Placentation:

- The manner in which the placentae are distributed in the cavity of the ovary is known as 'placentation'.
- The origin of an ovule or a group of ovules determines the position of the placenta.

Types of Placentation:

- 1. Axile placentation: In this type of placenation the ovary is many chambered, usually as many as the number of carpels. In axile placentation, the placentae bearing the ovules develop from the central axis. Here the carpels fold inwards, and their margins meet and fuse together in the centre of ovary and gives rise to a column or axis, and at the same time the ovary divides into as many chambers (loculi) as there carpels. The important examples of this type are lemon, orange, tomato, China rose, potato etc.
- 2. Basal placentation: Here the ovary is one chambered (unilocular) and the placenta develops directly on the thalamus, and bears a single ovule at the base of the ovary. For example, the members of Asteraceae.
- **3. Parietal placentation:** In such type of placentation the ovary is one chambered and the placentae that bear the ovule develop on the inner wall of the ovary. Their position remains corresponding to the confluent margins of the carpels and their number remains corresponding to the number of carpels. Eg: Mustard, cucubits, poppy, papaw, orchids etc.
- 4. Free central placentation: In this type septa or position walls in the young ovary soon break down and thus ovary becomes one chambered and the placentae bearing the ovules develop all round the central axis. Eg: stellaria, spergula, dianthus, saponaria etc.



TYPES OF OVULES

The Megasporangium or Ovule:

- An ovule or megasporangium develops from the base or the inner surface of the ovary.
- It is small, generally oval structure and consists chiefly of a central body of tissue, the nucellus and one or two integuments.
- Each ovule is attached in the placenta by a small stalk called the funiculus.
- The upper junction of the integument and the nucellus is called the chalaza.
- The small opening is left at the apex of the integument, which surrounded the nucellus, opposite to chalazal end the micropyle is present.
- The large oval cell lying embedded in the nucellus towards the micropylar end is the embryo sac, this make the most important part of the mature ovule, which bears embryo later on.

Forms of ovule:

1. Orthotropous Ovule:

• In this type the ovule is erect or straight so that the funide, chalaza and micropyle lie in one and the same vertical line, as in members of polygonaceae (eg: polygonum, Rumex etc) and piperaceae (eg: piper nigrum, piper betle).

2. Anatropous ovule or Inverted ovule:

• In this type the ovule bends along the funicle so that the micropyle lies close to the hilum. The chalaza lies at the other end. This is commonest type of ovule found both in dicots and monocots.

3. Campylotropous ovule or Curved ovule:

• In this type the transverse ovule is bent round like a horse shoe. So that the micropyle and chalaza do not lie in the same straight line, as capparis, gram, Mirabilis jalapa etc.



EMBRYO

Dicotyledonous Embryo:

- The oospore divides into two cells-an upper and a lower cell.
- The lower one lying towards the micropyle divides further in one direction into a row of cells, called suspensor. The suspensor, as it elongates, pushes the developing embryo deep into the embryo-sac and also acts as a feeding organ for the embryo during the formation of the latter. For this purpose, the basal cell of the suspensor often enlarges and acts as an absorbing organ. The suspensor becomes disorganised as the radical is formed.
- The terminal cell of the suspensor lying next to the embryonal mass is called the hypophysis cell. The upper lying away from the micropyle is called the embryonal cell. It enlargers and divides by three wall at right angles into eight cells (octants or compartments).
- The cell of the embryonal mass divides repeatedly and differentiated into plumule and the two cotyledons (from anterior octants) and main part of radicle and hypocotyls (posterior).

Monocotyledonous Embryo:

- Follows the development same as dicotyledonous embryo.
- In same monocotyledons the cotyledon is terminal and the stem apex is lateral, although in others the reverse is the case (as dicot).
- The oospore divides into two cells. The upper (towards micropyle) enlarges considerably and forms a massive suspensor.
- The terminal cell of these two, by repeated divisions on different planes, gives rise to the single cotyledon. The other cell also divides in the same way and gives rise to the stem apex, the hypocotyls and the root tip.



BOTANY PRACTICAL MANUAL

BSc. – **IV** Semester

2016 - 2017

Name:

Roll no :



Dept. of Botany SDM College Ujire.

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STUDY OF FAMILY-MAGNOLIACEAE

Family-Magnoliaceae:

Eg:Michaelia	champaka	
Divsion	-Spermatophyta	-Seed bearing plants.
Sub-division	-Angiospermae	-Seeds are enclosed within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons. Roots with taproot system.
		Stem with concentric vascular bundles. Leaf with
		reticulate venation. Flower with tetra /penta merous.
Sub-class	-Polypetalae	-petals are free.
Series	-Thalamiflorae	-Ovary is superior and prominent ovary.
Order	-Magnoliales	
Family	-Magnoliaceae	
Identification	1:	
Habit	-Tree	
Stem	-Erect, Branched, Woo	ody
Leaves	-Simple, Along with a	cuminate tip, Alternate phyllotaxy
Inflorescence	-Solitary cyme	
Flower	-Bracteate, Actinomorphic, Bisexual, Hypogynous	
Perianath	-Perianath lobes are pr	resent. Tepals are 14-16arranged spirally in 3 whorls.
Androecium	-Numerous stamens sp	birally arranged.
Gynoecium	-Numerous ovaries	(polycarpellary), Apocarpous (ovules are separate),
	Unilocular, Superior	ovary, Ovules with basal placentation. Style and stigma
	are simple.	
Fruit	-Etario of follicles.	



STUDY OF FAMILY-MALVACEAE

Family-Malvaceae:

Eg: Hibiscus rosa-sinesis

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledon	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Polypetalae	-petals are free.
Series	-Thalamiflorae	-ovary is superior, prominent ovary.
Order	-Malvales	
Family	-Malvaceae	
Identification	n:	
Habit	-Shrub	
Stem	-Erect, Branched, Woody, With stellate hairs, Mucilage.	
Leaf	-Simple leaf, Stipulate, Petiolate, Alternate phyllotaxy, Serrate margin.	
Inflorescence	e -Solitary cyme, Both axillary and terminal position.	
Flower	-Bracteate, Bracteolate, Bracteoles in the form of epicalyx, Actinomorphic,	
	Bisexual, Complete.	
Calyx	-Five, Gamosepalous,	Valvate aestivation.
Corolla	-Five, Polypetalous, Twisted aestivation, The base of the petals is connate	
	(fused) with stamina t	ube (made up of stamen.)
Androecium	-Numerous stamens,	Monadelphous (anthers are free), Connate with the
	corolla at the base.	
Gynoecium	-Pentacarpellary, Pe	entalocular, Syncarpous, Superior ovary, Axile
	placenatation, Simple	style, Stigma-five, Capitates.
Fruit	-Capsule	



STUDY OF FAMILY-ANACARDIACEAE

Family-Anacardiaceae

Eg: Anacardium occidantale

Division	-Spermatophyta -Seed bearing plants
Sub-division	-Angiospermae -Seeds are encloses within the ovary, flower bearing
	plants.
Class	-Dicotyledonae -Seeds with two cotyledons, Roots with tap root system.
	Stem with concentric vascular bundles. Leaf with
	reticulate venation. Flower with tetra/ pentamerous.
Sub-class	-Polypetalae -petals are free.
Series	-Disciflorae -A prominent disc is seen around the Gynoecium
Order	-Sapindales
Family	-Anacardiaceae
Identification	n:
Habit	-Tree
Stem	-Branched, Woody, Characteristic caustic juice.
Leaf	-Simple, Alternate phyllotaxy.
Inflorescence	-Cluster of panicles, Terminal and axillary position
Flower	-Bracteate, Polygamy, Actinomorphic, Hypogynous.
Calyx	-Five sepals, Polysepalous, Valvate aestivation.
Corolla	-Five petals, Polypetalous, Valvate aestivation.
Androecium	-Ten stamens out of which 2 are sterile.
Gynoecium	-Monocarpellary, Syncarpous, Superior ovary with ovules on axile
	placenatation, Simple style.
Fruit	-Nut, Pseudo fruit is seen as a result of enlargement of thalamus.



STUDY OF FAMILY-PAPILIONACEAE

Family-Papilionaceae

Eg: Crotolaria sp.

Divsion	-Spermatophyta -Seed bearing plants.	
Sub-division	Angiospermae -Seeds are enclosed within	the ovary, flower bearing
	plants.	
Class	-Dicotyledonae -Seeds with two cotyledons.	Roots with taproot system.
	Stem with concentric vas	cular bundles. Leaf with
	reticulate venation. Flower v	vith tetra /penta merous.
Sub-class	-Polypetalae -petals are free.	
Series	-Calyciflorae	
Order	-Rosales	
Family	-Fabaceae	
Sub-family	-Papillionaceae	
Identification	on:	
Habit	-Shrub	
Stem	-Erect, Branched.	
Leaves	-Trifoliate palmately compound leaf, Petiole with pu	ılvinous leaf base.
Inflorescence	e -Simple raceme, Acropetalous succession, Both	axillary and terminal in
	position.	
Flower	-Bracteate, Zygomorphic condition of symme	try (bilateral), Bisexual,
	Hypogynous, Complete.	
Calyx	-Five sepals, Gamosepalous, Valvate aestivation.	
Corolla	-Five petals, Three are free and two fused, Papillona	iceous corolla, Polypetalae,
	Vexillary or descendingly imbricate aestivation.	
Androecium	-Ten stamens, Monadelphous, Covered within the k	eel petals.
Gynoecium	-Monocarpellary, Unilocular, Superior ovary w	vith ovules on marginal
	placentation, Simple style and stigma is sickle shape	ed.
Fruit	-Legume	



STUDY OF FAMILY-CAESALPINEACEAE

Family-Caesalpineaceae

Eg: Caesalpinea pulcherima

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledon	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Polypetalae	-petals are free.
Series	-Rosales	
Order	-Fabaceae	
Family	-Caesalpineaceae	
Identification	n:	
Habit	-Shrub	
Stem	-Erect, Branched.	
Leaf	-Pinnately compound	leaves, Paripinnate.
Inflorescence	-Corymb inflorescence	e, Both axillary and terminal in position.
Flower	-Bracteate, Zygomorp	hic, Bisexual, Hypogynous, Complete.
Calyx	-Five sepals, Free, Valvate aestivation.	
Corolla	-Five petals (4-large	r and 1-smaller), Posterior petal is small, Imbricate
	aestivation	
Androecium	-Ten stamens, Free, In	two whorls of five each prominent, Filamentous long.
Gynoecium	-Monocarpellary, Un	ilocular, superior ovary with ovules on marginal
	placentation, Simple s	tyle and stigma
Fruit	-Legume.	



STUDY OF FAMILY-MIMOSACEAE

Family-Mimosaceae

Eg: Mimosa pudica

Division	-Spermatophyta	-Seed bearing plants.	
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing	
		plants.	
Class	-Dicotyledon	-Seeds with two cotyledons, Roots with tap root	
		system. Stem with concentric vascular bundles. Leaf	
		with reticulate venation. Flower with tetra/	
		pentamerous.	
Sub-class	-Polypetalae	-petals are free.	
Series	-Calyciflorae		
Order	-Rosales		
Family	-Mimosaceae		
Identification:			
Habit	-Herb		
Stem	-Erect, With pricks, Pr	ocumbent Nastic Movements	
Leaves	-Pinnate, Nastic Move	ments	
Inflorescence -Globose head			
Flower	-Bracteate, Actinomorphic, Bisexual, Tetramerous, Complete.		
Calyx	-Four sepals, Gamosepalous, Valvate aestivation.		
Corolla	-Four petals, Polypetal	lous, Valvate aestivation.	
Androecium	-Four stamens, Free, A	Alternating with petals.	
Gynoecium	-Monocarpellary, Unilocular, Superior ovary with ovules on axile placentation		
Fruit	-Lomentum (type of co	urves constricted legume).	



STUDY OF FAMILY-MYRTACEAE

Family- Myrtaceae

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Polypetalae	-petals are free.
Series	-Calyciflorae	
Order	-Myrtales	
Family	-Myrtaceae	
Identification:		
Habit	-Tree	
Stem	-Erect, Branched, Pee	ling of bark
Leaves	-Simple, Opposite dec	cussate, Intra marginal venation, Gland dotted.
Inflorescence -Cymose		
Flower	-Bracteate, Actinomorphic, Bisexual, Epigynous, Complete, Regular	
Calyx	-Five sepals, Gamosepalous, Valvate aestivation, Persistent calyx.	
Corolla	-Five petals, Polypeta	lous, Imbricate aestivation.
Androecium	-Numerous stamens, H	Free, Conspicuous.
Gynoecium	-Bicarpellary, Bilocul	ar, Syncarpous, Inferior ovary with two ovules on axile
	placentation, Style sin	nple, Stigma capitate.
Fruit	-Berry with persistent	calyx.


STUDY OF FAMILY-CUCURBITACEAE

Family-Cucurbitaceae

Eg: Cucurbita sp.

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Polypetalae	-petals are free.
Series	-Calyciflorae	
Order	-Passiflorales	
Family	-Cucurbitaceae	
Identification	n:	
Habit	-Herbaceous, Tendril b	pearing, Climbers or prostrate runners.
Stem	-Angular, Prostrate, Tr	richome, Watery juice
Leaves	-Simple, Alternate, Lo	obes, Some of the leaves are modified into spring like
	structure called tendril	s, Palmately compound
Inflorescence	-Racemose	
Flower	-Unisexual, Plant m	ay be either monoecious or diecious, Epigynous,
	Incomplete.	
Calyx	-Five sepals, Gamosep	alous, Valvate aestivation
Corolla	-Five petals, Gamopet	alous, Imbricate aestivation.
Androecium	-Three stamens found	d inserted at the mouth. 'Staminode' is sterile male
	reproductive structure	
Gynoecium	-Found in female fl	ower, Tricarpellary, Unilocular, Inferior ovary with
	numerous ovules on p	arietal placentation.
Fruit	-Pepo	



STUDY OF FAMILY-APIACEAE

Family-Apiaceae (umbelliferae)

Eg: Coriandrum sativum

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Polypetalae	-petals are free.
Series	-Calyciflorae	
Order	-Umbellales	
Family	-Apiaceae	
Identification	n:	
Habit	-Aromatic herb	
Stem	-Erect, Branched with	watery sap
Leaf	-Decompound leaf	
Inflorescence	-Umbel, Compound u	mbel, Terminal in position
Flower	-Bracteate, Actinomor	phic, Bisexual, Epigynous
Calyx	-Five sepals, Gamosep	balous, Valvate aestivation, Persistent
Corolla	-Five petals, Polypetal	lous, Imbricate aestivation.
Androecium	-Five stamens, Alterna	ate with petals
Gynoecium	-Bicarpellary, Syncar	pous, Inferior ovary with ovules arranged in two lobes
	with anterior-posterio	r arrangement. An epigynous disc namely stylopodium is
	present from which	two free styles will arise. Two ovules on basal
	placentation	
Fruit	-Creamocarp, it cons	ists of two indehiscent carpels which are compressed
	breaking up into two	parts called mericarp, which are attached to a slender
	axis, carpophores. Ea	ch mericarp shows five longitudinal ridges and oil canal
	(vittae) and furrows.	



STUDY OF FAMILY-RUBIACEAE

Family-Rubiaceae

Eg: Ixora coccinia

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused
Series	-Inferae	
Order	-Rubiales	
Family	-Rubiaceae	
Identification	n:	
Habit	-Shrub	
Stem	-Erect, Branched	
Leaves	-Simple leaves, Oppos	site decussate phyllotaxy, Interpetiolar stipule
Inflorescence	-Globose cyme	
Flower	-Bracteate, Actinomor	phic, Bisexual, Epigynous
Calyx	-Four sepals, Polysepa	lous, Valvate aestivation
Corolla	-Four petals, Gamopet	alous, Salvar shaped corolla, Twisted aestivation
Androecium	-Four stamens, Epipet	alous, Alternate with petals
Gynoecium	-Bicarpellary, Bilocu	lar, Syncarpous, Inferior ovary with ovules on axile
	placentation, Style-sir	nple, Stigma-bifid
Fruit	-Drupe	



STUDY OF FAMILY-ASTERACEAE

Family-Asteraceae (compositae)

Eg: Tridax procumbens

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused.
Series	-Bicarpellate	
Order	-Asterales	
Family	-Asteraceae	
Identification	n:	
Habit	-Shrub	
Stem	-Slender, Procumbent	with watery sap
Leaves	-Simple, Digitate	
Inflorescence	-Head or capitulum.	It consists of many bracts, bracteoles forming a cup
	shaped structure her	nce it is called as Involucre of Bracts. Since this is a
	heterogeneous head	we come across two types of flowers namely,
	1. Ray florets-Periphe	eral
	2. Disc florets-Centra	1.
	Ray florets: Bracteate,	, Zygomorphic, Unisexual (pistillate), Epigynous
Calyx	-It is modified into hai	ir like structures called as pappus.
Corolla	-Five petals, Tubular f	form of corolla
Androecium	-Five stamens, Fused,	Syngenecious
Gynoecium	-Monocarpellary, Syn	carpous, Inferior ovary, Basal placentation. Single style,
	Stigma-bifit	
	Disc florets: Bracteate	e, Actinomorphic, Bisexual, Epigynous flower.
Fruit	-Cypsela	



STUDY OF FAMILY-APOCYANACEAE

Family-Apocyanaceae

Eg: Vinca rosea or Catharanthus roseus

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/ penta
		merous.
Sub-class	-Gamopetalae	-Petals are fused
Series	-Bicarpellatae	
Order	-Gentianales	
Family	-Apocyanaceae	
Identification	1:	
Habit	-Shrub, Milky latex	
Stem	-Erect, Soild, With late	ex
Leaves	-Simple, Opposite dec	ussate phyllotaxy, Elliptical in shape.
Inflorescence	-Simple cyme, Axillar	y and terminal in position
Flower	-Bracteate, Actinomor	phic, Bisexual, Hypogynous
Calyx	-Five sepals, Polysepa	lous, Valvate aestivation
Corolla	-Five petals, Gamopeta	alous. Twisted aestivation, Corollary corona
Androecium	-Five stamens, Epipeta	alous, Situated at the bulged tip of corollary tube
Gynoecium	-Bicarpellary, Apocarp	pous, Bilocular, Superior ovary with ovules on marginal
	placentation, Style-fus	sed, Stigma-Hour glass shape
Fruit	-A pair of follicles	



STUDY OF FAMILY-SOLANACEAE

Family-Solanaceae

Eg: Solanum torvum

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused.
Series	-Bicarpellatae	
Order	-Polymoniales	
Family	-Solanaceae	
Identification	1:	
Habit	-Shrub	
Stem	-Erect, Branched, Tho	orny, Hairy or pubiscent
Leaves	-Simple, Alternate or	opposite phyllotaxy can be seen
Inflorescence	-Cymose clusters, Ext	ra axillary, both terminal and axiallary in position
Flower	-Bracteate, Actinomor	rphic, Bisexual, Hypogynous
Calyx	-Five sepals, Polysepa	lous, Valvate aestivation, Persistent calyx.
Corolla	-Five petals, Gamopet	alous, Rotate form of corolla, Twisted aestivation.
Androecium	-Five stamens, Epipet	alous stamens.
Gynoecium	-Bicarpellary, Oblique	ely placed ovary, Style-simple, Stigma-Bifid
Fruit	-Berry	



STUDY OF FAMILY-ACANTHACEAE

Family-Acanthaceae

Eg: Adhathoda vasica

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation. Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused.
Series	-Bicarpellatae	
Order	-Lamiales	
Family	-Acanthaceae	
Identification	n:	
Habit	-Shrub	
Stem	-Erect, Branched with	characteristic odour.
Leaves	-Simple, Opposite-dec	sussate phyllotaxy, Cystolits are present in the leaf
Inflorescence	-Spike inflorescence,	Many bracteoles are surrounded to the flower, Terminal
	and axillary in positio	n.
Flower	-Zygomorphic, Bisexu	al, Hypogynous with conspicuous bracts and bracteoles
Calyx	-Five sepals, Gamose	palous, Imbricate aestivation, Bilabiate corolla, Valvate
	aestivation	
Corolla	-Five petals, Bilabiat	e corolla (upper-2, lower-3), Gamopetalous, Imbricate
	aestivation.	
Androecium	-Two stamens.	
Gynoecium	-Bicarpellary, Syncar	pous, Bilocular, Superior ovary with ovules on axile
	placentation, Style-sin	nple, Stigma-single
Fruit	-Capsule	

STUDY OF FAMILY-ACANTHACEAE



STUDY OF FAMILY-VERBANACEAE

Family-Verbanaceae

Eg: Lantana camara

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation, Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are free.
Series	-Bicarpellatae	
Order	-Laminales	
Family	-Verbanaceae	
Identification	n:	
Habit	-Shrubs, Prickly and s	trongly smelling
Stem	-Erect, Branched and	Angular
Leaves	-Simple, Opposite dec	sussate phyllotaxy
Inflorescence	-Panicle inflorescence	
Flower	- Zygomorphic, Bisex	ual, Hypogynous, Bracts in the form of involucre.
Calyx	-Five sepals, Gamosep	palous, Valvate aestivation, Persistent calyx.
Corolla	-Five petals, Gamo	petalous, Five lobed, Limb is oblique, Imbricate
	aestivation.	
Androecium	-Four stamens, Didyna	amous, Epipetalous.
Gynoecium	-Bicarpellary, Bilocula	ar, Superior ovary with ovules on axile placentation.
Fruit	-Drupe	



STUDY OF FAMILY-LAMIACEAE

Family-Lamiaceae or Labiatae

Eg: Leucas aspera

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused.
Series	-Bicarpellalae	
Order	-Lamiales	
Family	-Lamiaceae	
Identification	1:	
Habit	- Herb	
Stem	-Erect, Branched, Qua	drangular, Aromatic.
Leaves	-Simple, Lanceolate, I	Dentate
Inflorescence	-Verticellaster	
Flower	-Bracteate, Zygomorp	hic, Bisexual, Hypogynous, Complete, Regular.
Calyx	-Seven sepals, Gamos	epalous, Valvate aestivation, Persistent calyx.
Corolla	-Five petals Gamopeta	lous, Bilabiate corolla, Valvate aestivation.
Androecium	-Four stamens, Epipet	alous, Dydinamous.
Gynoecium	-Bicarpellary, Tetraloo	cular, Axile placentation, Gynobasic-style, Stigma-Bifid
Fruit	-Nutlet.	



STUDY OF FAMILY-AMARANTHACEAE

Family-Amaranthaceae

Eg: Amaranthus tricolor

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused
Series	-Curvembryae	
Order	-Unisexual	
Family	-Amaranthaceae	
Identification	n:	
Habit	- Herb.	
Stem	-Erect, Branched, Cyli	indrical, Glabrous.
Leaves	-Simple, Fragile, Alter	mate phyllotaxy, Reticulate venation.
Inflorescence	-Catkin.	
Flower	-Bracteate, Unisexual,	Epigynous, Incomplete.
Male Flower		
Perianth	-Six tepals in two row	s, Valvate aestivation.
Androecium	-3 stamens, Free, Alter	rnating with inner whorls of tepals.
Gynoecium	- Absent.	
Female flowe	or	
Perianth	-Six tepals in two row	s, Valvate aestivation.
Androecium	-Absent	
Gynoecium	-Monocarpellary, Mo	onolocular, Superior ovary with ovules on basal
	placentation, Styleand	stigma are simple.
Fruit	-Urticle	

STUDY OF FAMILY-AMARANTHACEAE



STUDY OF FAMILY-EUPHORBIACEAE

Family-Euphorbiaceae

Eg: Euphorbia hirta

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Dicotyledonae	-Seeds with two cotyledons, Roots with tap root
		system. Stem with concentric vascular bundles. Leaf
		with reticulate venation Flower with tetra/
		pentamerous.
Sub-class	-Gamopetalae	-petals are fused
Series	-Curvembryae	
Order	-Unisexual	
Family	-Euphorbiaceae	
Identification	n:	
Habit	- Herb.	
Stem	-Erect, Hairy, Cylindr	ical, Solid with latex.
Leaves	-Simple, Serrate, Opp	osite phyllotaxy, Reticulate venation.
Inflorescence	-Compound cyathium	
Flower	-Bracteate, Actinomor	phic, Unisexual, Hypogynous, Incomplete.
Perianth	-Five tepals, Gamotep	alous, Valvate aestivation.
Male flower	-It is represented by	asingle stamen. Each stamen is having an elongated
	filament with dithecom	as anther lobes.
Female flowe	er-It is represented l	by Gynoecium, which is tricarpellary, Apocarpous,
	Trilocular with superi	or ovary.
Fruit	-Berry	



STUDY OF FAMILY-MUSACEAE

Family-Musaceae

Eg: Musa paradisiaca

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Monocotyledonae	-Seeds with only one cotyledon, Roots with fibrous
		root system. Leaf with parallel venation. Flower with
		trimerous
Sub-class	-Gamopetalae	-petals are fused
Order	-Scitaminae	
Family	-Musaceae	
Identification	1:	
Habit	- Herb with tree like a	opearance
Stem	-Underground modifie	cation is called as sucker or Rhizome which produces
	fibrous root system	
Leaves	-Simple, Along with s	heathing leaf bases which gives an appearance of stem,
	hence called as pseudo	stem, Parallel venation, Spiral phyllotaxy.
Inflorescence	-Spadix with prominer	nt spathe, Terminal in position.
Flower	-Bracteate, Zygomorph	hic, Bisexual, Epigynous.
Perianth	-Six tepals in 2 whorls	of 3 each, 5 fused and 1 free, Valvate aestivation.
Androecium	-Six stamens, Free, 5 f	ertile and 1 staminode
Gynoecium	-Tricarpellary, Trilocu	lar, Inferior ovary with ovules on axile placenatation,
	Style-simple, Stigma-	Flat or discoid
Fruit	-Berry	



STUDY OF FAMILY-ARECECEAE

Family-Aracaceae or Palmaceae

Eg: Areca catechu

Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Monocotyledonae	-Seeds with only one cotyledons, Roots with fibrous
		root system. Leaf with parallel venation Flower with
		trimerous.
Order	-Calycineae	
Family	-Aracaceae	
Identification	1:	
Habit	- Tree	
Stem	-Unbranched, Leaves	are restricted to the apical region forming a crown.
Leaves	-Sheathing leaf base, I	Pinnately compound leaf.
Inflorescence	-Compound spadix wi	th prominent spathe.
Flower	-Bracteate, Actinomor	phic, Unisexual, Epigynous.
Male flower		
Perianth	- Six tepals in two who	orls of three each, Polypetalous, Imbricate aestivation.
Androecium	-Three stamens, Free.	
Gynoecium	-Absent.	
Female flowe	r	
Perianth	-Six tepals in two who	orls of three each, Polypetalous, Imbricate aestivation.
Androecium	-Absent.	
Gynoecium	-Tricarpellary, Syncar	rpous, Trilocular, Inferior ovary with three ovules on
	axile placentation, Sty	ele-simple, Stigma-capitates
Fruit	-Drupe	



STUDY OF FAMILY-POACEAE

Family-Poac	eae	
Division	-Spermatophyta	-Seed bearing plants.
Subdivision	-Angiospermae	-Seeds are encloses within the ovary, flower bearing
		plants.
Class	-Monocotyledonae	-Seeds with only one cotyledons, Roots with fibrous
		root system. Leaf with parallel venation Flower with
		trimerous.
Sub-class	-Gamopetalae	-Petals are fused.
Order	-Glumales	
Family	-Poaceae	
Identification	n:	
Habit	- Herb.	
Stem	-Culm and tufted, Cyl	indrical.
Leaf	-Narrow, Flat, Pointe	d tip, Deposition of silica, Parallel venation, Sheathing
	leaf base.	
Inflorescence	-Racemose of panicle	of spike.
Flower	-Zygomorphic, Bisexu	ual, Hypogynous, Complete.
	At the base of the	flower hair like structure is found is called glumes.
	Trinerved bracts are	found and are called lemma. Two bracteoles are found
	and are called palaea.	
Perianth	-Two lodicules-perian	th lobes.
Androecium	-Three stamens are pro-	esent
Gynoecium	-Monocarpellary, unil	ocular, superior ovary
Fruit	-Caryopsis	



ECONOMIC BOTANY OIL YIELDING PLANTS

Ground nut		
Common name	-Ground nut	
Scientific name	-Arachis hypogea	
Family	-Leguminosae	
Parts used	-Seeds	
Uses	-The filtered refined oil is used for cooking and in making margine.	
	-Inferior grades are used for soap making, lubricants and illuminates.	
	-The oil cake is used as cattle feed.	
	-Oil, obtained from the kernels, is predominantly used for culinary	
	purposes; considerable proportion of hydrogenated fats, used as vanaspathi,	
	consists of ground nut oil.	
	Some new commercial products are ground nut milk, peanut ice cream and	
	massage oil for infantile paralysis.	
Coconut		
Common name	-Coconut	
Scientific name	-Cocos nucifera	
Family	-Aracaceae	
Parts used	-Fruit	
Uses	-Refined coconut oil is edible and is extensively used food products.	
	-Unrefined coconut oil is commonly used for cooking.	
	-Used for making confectionery and candy bars.	
	-Coconut oil has long been used for the best soaps, cosmetics, shaving	
	creams, shampoos and other toilet preparation.	
	-It is only oil in marine soaps.	

-It is also used as an illuminate. The oil cake is used fodder and as manure.

MEDICINAL PLANTS

Kasaraka

IXasal aka		
Common name	-Kasaraka	
Scientific name	-Strychnos nux-vomica	
Family	-Loganiaceae	
Parts used	-Seed	
Uses	-The dried ripe seeds are the source of a drug nux vomica which is used as a tonic stimulant and in the treatment of paralysis and nervous disorders.	
	-The powdered seeds are also given in general debility, chronic,	
	rheumatism, dyspepsia, intermittent fever, diarrhoea, hysteria, general	
	constipation, hydrophobia, impotence, cholera and epilepsy.	
Peiwinkle		
Common name	-Periwinkle	
Scientific name	-Vinca rosea	
Family	-Apocyanaceae	
Parts used	-whole plant	
Uses	-The plant has been used as a folk remedy for diabetes.	
	-It is reported to be toxic to cattle.	
	-The juice of the leaves is used as an application for wasp strigs.	
	-An infusion of the leaves is given in the treatment of menorohagia.	
-The root is considered tonic and stomachic. -The Alkaloid inhibits the growth of <i>Vibro choleare</i> and <i>Micrococ</i>		
	-Leaf extract form a useful anti-bacterial agent for the treatment of	
	staphylococcal and streptococcal infection.	

BEVERAGES

Coffee

Common name	-Coffee
Scientific name	-Coffea arabica
Family	-Rubiaceae
Parts used	-Beans/Seeds
Uses	-Coffee is the most important beverage plant from a commercial view point.
	-It is used to produce caffeine.
	-It is widely used in the preparation of chocolates.
	-The waste products, pulp and parchment, are used as a fertilizer, fuel and
	in the manufacture of cafelite, a plastic material with good insulating
	properties.
Теа	
Common name	-Tea
Scientific name	-Tea sinensis
Family	-Teaceae
Parts used	-Leaves
Uses	-Tea is the most important beverage plant from a commercial view point.
	-It is a good tranquilliser and at the same time acts as a mild stimulant.

FIBRE YIELDING PLANTS

Jute

Common name	-Jute
Scientific name	-Corchorus capsularis
Family	-Malvaceae
Parts used	-Fibre
Uses	-It is widely used for rope and cordages.
	-Considerable quantities are used in making finishing nets and strings for
	tying rafters.
	-It is also used for coarse canvas, sacks and gunny bags, floor mating, rug
	backing, chair baking etc.
	-Fibre of poor quality and cutting is used in the manufacture of paper.
	-the leaves are used as pot herb, tender twigs as cattle fodder, seeds are used
	as cattle feed, yield of fatty oil used for manufacture of soap, linoleum,
	paints and varnishes and refining for edible purposes.
Coir	
Common name	-Coconut (Coir)
Scientific name	-Cocos nucifera
Family	-Aracaceae
Parts used	-Fibre
Uses	-Coir is a natural fibre extracted from the husk of the coconut. It is a
	wonder fibre, rot proof, sound proof, water damp and pest resistant, a good
	insolent that stays cool in hot weather and warm in cold weather, tough-
	hard wearing and economical.
	-Items like fibre, yarn, mats, matting rugs; carpets, rope, and rubberised coir
	are exported.
	-A waste product in the coir industry. It can be used as manure or soil
	much.
	-It is an excellent surface soil much.
	-It can also be used for building slabs, or for hard boards.

TIMBER YIELDING PLANTS

Raktha chandana

Common name	-Raktha chandana	
Scientific name	-Pterocarpus marsupium	
Family	-Leguminosae	
Parts used	-Wood	
Uses	-The wood is used chiefly for building purpose, such as door, window	
	frames, rafter, beams and posts.	
	-It is also used in railway carriages, wagons, carts, boats, ship, electric	
	poles, and pit-props in mines, agricultural implements, drums, tool handles,	
	camp furniture, mathematical instruments, picture frames, combs and parts	
	of textile looms.	
	-It is a very important timber in Peninsular India.	

RUBBER YIELDING PLANTS

Rubber

Common name	-Rubber	
Scientific name	-Heavea brazilliens	
Family	-Euphorbiaceae	
Parts used	-Latex	
Uses	-The raw rubber as such has few important applications. Its chief uses are in	
	making insulation tapes, shoe soles, adhesives and erasers.	
	-Rubber is used for the production of wide variety of products utilized in	
	industries and services, and for domestic purposes, in tyres and tubes for	
	automobile and cycle, footwear, wire and cable insulations.	
	-Metals are coated with rubber to protect them from wear and corrosion.	
	-Sponge rubber from foamed latex uses in cushioning, seating and bedding.	
	Elastic fabrics are made from latex.	
	-It is also employed in the fabrication of battery boxes, fountatin pen	
	barrels, tobacco pipe stems, telephones and combs.	

CEREALS

Wheat

wheat		
Common name	-Wheat	
Scientific name	-Triticum aestivum	
Family	-Poaceae	
Parts used	-Fruit	
Uses	-The Flour is used chiefly for making bread and chapattis, biscuits, cak	
	pastry and similar articles. Wheat flakes are used as breakfast food.	
	-Wheat is also used in the manufacture of beer and other alcoholic	
	beverages.	
	-Wheat straw is used for seating chairs, stuffing mattresses etc. Wheat straw	
	is also used as fodder bedding for cattle, pudding etc.	
	-Also used for the production of furfuryl alcohol.	
	-Non feed industrial uses of wheat include the manufacture of starch,	
	industrial alcohol, malted wheat, and core-binder flour.	
Rice		
Common name	-Rice	
Scientific name	-Oryza sativa	
Family	-Poaceae	
Parts used	-Fruit	
Uses	-The chief use of rice is a food, and more people use it than any other	
	cereal.	
	-The rice is generally eaten with pulses (legumes) or some other food rich	
	in proteins.	
	The rice straw is used for making straw boards, paper and mats.	
	-Rice bran oil is used for making soaps and cosmetics.	
	-In several tropical countries intoxicating beverages and from rice. Sake is	
	prepared by fermenting rice.	
	-Broken grains obtained during milling, used as human and cattle food.	
	-Paddy husk is used as fuel; the bran is also used as cattle feed.	
	-The fatty oil obtained from bran is used for edible purposes.	

Raagi	
Common name	-Raagi (Finger millet)
Scientific name	-Elusine corocana
Family	-Poaceae
Parts used	-Fruit
Uses	-Its grain can be made into cakes, porridge and sweetmeats.
	-A beer is brewed from the grains by the hill tribes.
	-The flour is used for budding.
	-It is a grain of great nutritive valve, and is considered more sustaining for
	people doing hard physical work than any other grain.
	-the straw is considered a valuable food for the milk animals.
	-The grains are tonic and astringent, useful in biliousness, specially
	recommended for diabetics as a wholesome food.
SPICES AND CONDIMENTS

Pepper

repper	
Common name	-Pepper
Scientific name	-Piper nigrum
Family	-Piperaceae
Parts used	-Fruit
Uses	-The unripe dried berries are the black pepper of commerce; and the ripe
	fruit with the outer covering removed is the white pepper of commerce.
	-The berries contain alkaloid piperine.
	-The fruits are aromatic, stimulant, carminative, digestive, stomachic,
	nervinetonic, diuretic emmenagogue and antiperiodic.
	-It is given in dyspepsia, flatulence, diarrhoea, cholera, pipes, disorders of
	the urinary system, cough, coma, gonorrhoea and malarial fever.
	-It is given either as an infusion or powder.
	-White pepper is more aromatic and less pungent than black pepper. It is
	given in dyspepsia and constipation.
Clove	
Common name	-Clove
Scientific name	-Syzigium aromaticum
Family	-Myrtaceae
Parts used	-Immature flower bud.
Uses	-Clove is a very aromatic and fine flavoured and imparts warming qualities.
	-It is used as a culinary spice as the flavour blends well with both sweet and savoury dishes.
	-It is highly valued in medicine as a carminative, aromatic and stimulant.
	Clove has stimulating properties and is one of the ingredients of betel
	chewing.
	-Clove is used in preparation of a special brand of cigarette.
	-The essential oil which is obtained by distilling clove with water or steam
	has even more uses.
	-It is used medicinally in several ways. The chief constituent of the soil
	eugenol is extracted and used as an imitation carnation in perfumes.

Dhaniya	
Common name	-Dhaniya (Kottambari)
Scientific name	-Coriandrum sativum
Family	-Apiaceae
Parts used	-Leaves
Uses	-The fruits and leaves are aromatic and used as flavouring materials. Fruit is
	used as both spice and condiments.
	-The fruits are used extensively in the preparation of curry powder, pickles,
	sauces, soups etc.
	-They also employed for flavouring pastries, cookies, buns and cakes and
	tobacco products.
	-It is also used for flavouring liquors, particularly gin.
	-The fruits are also used as stimulant, carminative, stomachic, diuretic,
	antibilous, refrigerant, aphrodisiac and tonic.
	-Oil of Coriander is used in medicine and for flavouring beverages.
	-Leaves are one of the richest sources of vitamin C and vitamin A.
Onion	
Common name	-Onion
Scientific name	-Alium cepa
Family	-Liliaceae
Parts used	-Leaves
Uses	-The bulbs are used as food and as flavouring substances.
	-Bulbs as well as fresh herb yield an essential oil.
	-Onions are considered as stimulant, diuretic and expectorant, used against
	flatulence and dysentery.
	-The onion juice is prescribed for piles.
	-Its decoction is given in cough, cooked with vinegar the bulbs are given in
	jaundice, dyspepsia.
	-Taken with salt it is a common remedy for colic and scurvy.

Ginger

Common name	-Ginger
Scientific name	-Zingiber officinale
Family	-Zingiberaceae
Parts used	-Stem (Rhizome)
Uses	-Ginger is used more as a condiment than as a spice.
	-Aroma of ginger is due to essential oil, whereas the pungent taste is due to
	the presence of carminative and digestive stimulant.
	-The essential oil, obtained from the rhizomes, is used for flavouring food
	stuffs.
	-It is exceedingly popular for flavouring beverages, such as giger bear and
	ginger malt.
	-It makes a valuable drug for disorders of the digestive system, piles, and
	pulmonary diseases.
	-The paste of ginger is a local stimulant and rubefacient in headache and
	toothache.