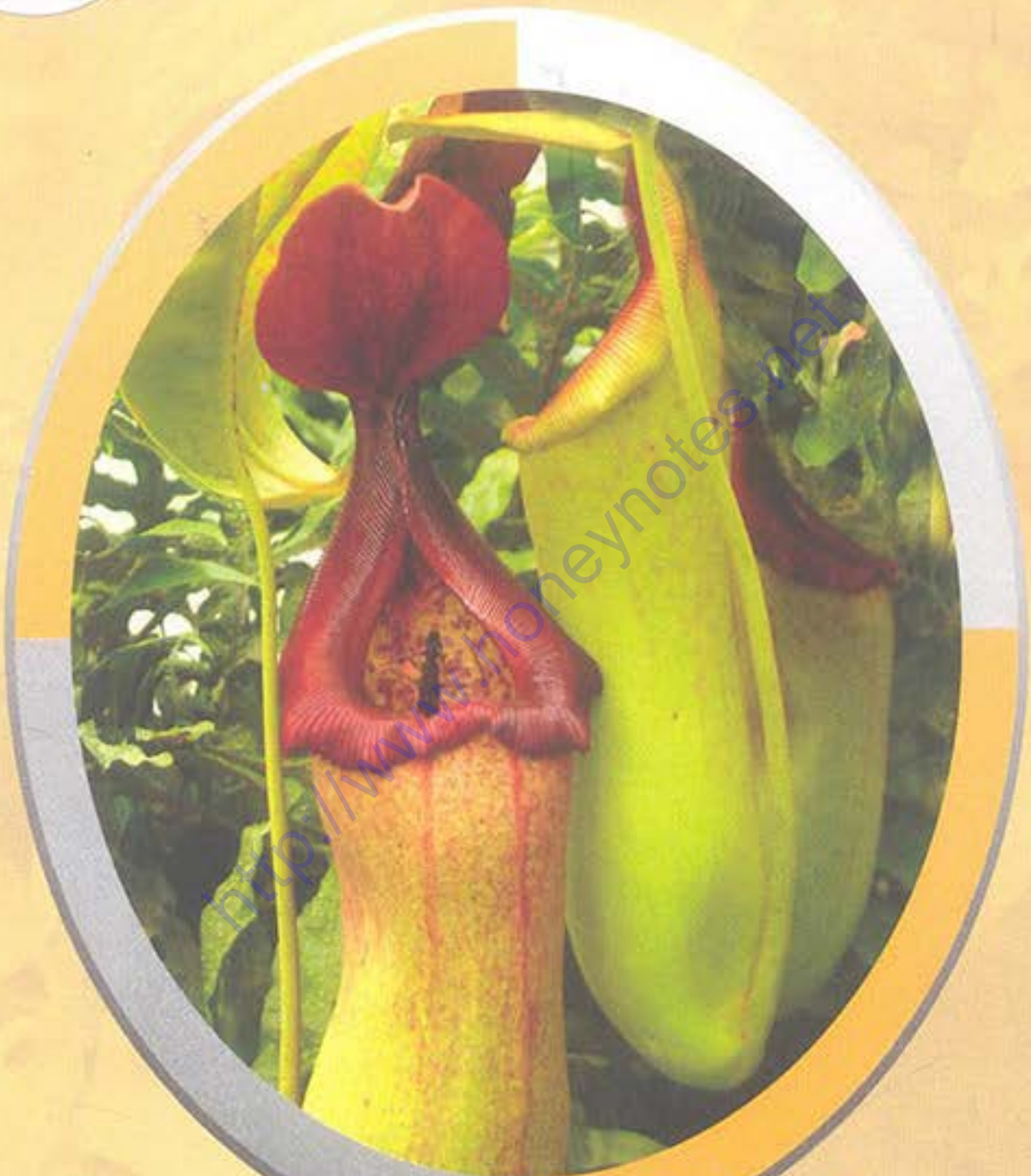
BIOLOGY

11



Chapter -9
Kingdom Plantae

INTRODUCTION

- Includes all eukaryotic multicellular and chlorophyllous living organisms, which have cell wall made up of true cellulose.
- Majority of members are autotrophic but few are parasite e.g.: "Cuscuta"
- They have localized growth, regions of growth lying primarily at the extremities that is root and stem apices.

CLASSIFICATION OF KINGDOM PLANTAE

Kingdom planatae is divided into tow sub-kingdom on the basis of presence or absence of vascular tissue (xylem and phloem).

A – SUB-DIVISION – BRYOPHYTES (NON-VASCULAR)

- Class Hepatica (Liverworts)
- Class Musci (Mosses)
- Class Anthroccrota (Hornworts)

B- SUB-DIVISION – TRACHEOPHYTES

- Class Psilopsida (Psilopsids)
- Class Lycopsida (Club Mosses)
- Class Sphenopsida (Horse Tails)
- Class Pteropsida (Ferns)
- ClassSpermopsida (Seed Plants)

SUB –DIVISION BRYOPHYTA (AMPHIBIAN PLANTS) OR (NON-VASCULAR PLANTS)

- Absence of lignin-fortified tissue to support tall plants on land.
- Members of this sub-division usually sprawl horizontally as mats over a large surface.
- Always have a low profile (1-2cm-20cm tall).

Regular heteromorphic alternation of generation is present w/t gametophytes dominancy (Gametophytes large and long lived).

- Sporophyte stage of bryophytes is generally smaller and shorter lived, and it depends on gametophyte for water and nutrients.
- The diploid sporophyte produces haploid spores via meiosis in a structure called “sporangium”
- The tiny, spores, protected by sporopollenim, disperse and give rise to new gametophytes.
- All members of bryophytes need water to reproduce.
- Gametes produce within reproductive structures “Gametangia” (Male-Antheridia and Female-Archer-gonium)
- Antheridium produces flagellated sperm while female archegonium contains one egg (ovum).
- Fertilization occurs w/t in the archegonium
- Zygote develops into an embryo within the protective jacket of Archegonium.
- Windblown spores disperse the speies.
- All bryophytes belong to Silurian/Devonian period (345-395Million yrs. Ago.)

ADAPTATION OF BRYOPHYTES TO LAND HABITAT

All Bryophytes show amphibious form of land plants.

Following are main adaptations exhibited by them.

a. Rhizoid for water absorption
b. Conservation of water
c. Absorption of CO 2
d. Heterogamy
e. Protection of reproductive cells
f. Formation of embryos

CLASSES OF BRYOPHYTES

1-MUSCI (MOSSES)

- Plants grow in a tight pack, in the form of mat, in order to hold one another up.
- Mat of moss possess spongy quality and enables it to absorb and retain water.

- Rhizoids are elongated cells or cellular filaments of mats which grip the substratum.
- Photosynthesis occurs in upper part of the plant w/c has many small stem like and leaf like appendages. E.g Funaria.

2-HEPATICAE (LIVERWORTS)

- Usually present in tropical areas
- Plant body is divided into lobes somewhat of the lobed liver, of an animal.
- These plants are less fimiliar than Mosses.

E.g Marchantia

3- ANTHROCERATAE:- (HORNWORTS)

- These plants resemble w/t liverworts, but are differentiated by their sporophytes plants.
- Sporophyte are elongated capsules that grow like horn from mat like gametophyte.
- Sporophyte has stomata and chloroplast, performs photosynthesis
- Sporophyte plant can survive even often the death of gametophyte due to presence of Meristem.
- Meristem is a specialized tissue, which keeps on adding new cells in sporophyte plant.
- Hornworts are the most advanced members of bryophytes.

E.g Arthroceros

SUB-DIVISION TRACHEOPHYTA (VASCULAR PLANTS)

Main characters are as follow,

- Conducting vessels Xylem and Phloem are present in plant body.
- A protective layer of sterile “Jacket” cells around reproductive organs are present.
- Multicellular embryos retained within the archegonia.
- On aerial parts protective covering “Cuticles” is present w/c prevents excessive loss of water during hot climate.
- In life cycle Sporophyte stage is dominant.

CLASSES OF TRACHEOPHYTES

1-PSILOPSIDA

- These are the fossil representatives of the vascular plants, belonging to "Silurain period" and "Devonian Period"
- Sporophytes are simple dichotomously branching plants.
- True leaves and true roots absent.
- Underground stems that contain unicellular rhizoid similar to root hairs.
- The aerial stems are green and carry out photosynthesis.
- Lacking secondary growth due to absence of "Cambium"
- Reproductive structure "Sporangia" develop at the tips of some of the aerial branches.
- Meiosis produces haploid spores, within the sporangia.

E.g. Rhynia, Psilotum Temesipteris

A) RHYNIA (FIRST VASCULAR PLANT)

- One of the most primitive vascular plant
- It is an extinct genus, was named often the village "Rhynia of Scotland where the first fossils of Rhynia were discovered.
- It belongs to Devonian period, which started about 400 million years ago.
- The fossils of this plant are so well preserved that the stomata are still intact.

STRUCTURE

- The plant body (Sporophyte) was simple.
- It consisted of slender, dichotomously branched creeping rhizome, bearing erect, dichotomously branched aerial stem.
- Instead of roots, rhizoids were given out from rhizome.
- The aerial branches were leaf-less having terminal fusiform naked sporangia.

MICROSCOPIC STRUCTURE

- The internal structure of branches show a solid central core of vascular tissues surrounded by Cortex.
- The outer most layer is Epidermis having stomata.
- The vascular tissue is differentiated into centrally placed xylem and surrounded phloem

(FIGURE 9.06(a) Reconstruction of Rhunia) TEXT BOOK BIO-XI Pg# 170

B) PSILOTUM AND TEMESIPTERIS (LIVING SPECIES OF PSILOPSIDA)

- Sporophyte plant produce spores, which give rise to minute subterranean gametophytes.
- Each gametophyte bears both female reproductive organ Archegonia and male reproductive organ Antheridia w/c produce both egg and sperm respectively.
- As a result of fertilization a diploid zygote is formed which develops into sporophyte plant.
- Sporophyte stage of life cycle is dominant, but haploid gametoplyte stage is still relatively large.

EVOLUTION OF LEAF

The leaf is the most important organ of a green plant because of its photosynthetic activity. Leaves are of tow types

1. Single veined leaves- Contain only one vein
2. Poly veined leaves- Contain two or more veins

1- EVOLUTION OF SINGLE-VEINED LEAF

- It is assuming that a thorn like out growth emerged on the surface of the naked stem.
- With an increase in size of the leaf, the vascular tissues were also formed for the supply of water and support to the leaf.
- Another possibility is that a single veined leaf originated by a reduction in size of a part of the leafless branching system of the primitive vascular plants.

2-EVOLUTION OF POLY-VEINED LEAF

- These are the evolutionary modifications of the forked branching in the primitive plants.
- The first step in the evolution of this leaf was the restriction of forked branches to a single plane.
- The branching system become flat.
- The next step in the evolution was filling the space b/w the branching and the vascular tissues.
- The leaf so formed looked like the webfoot of a duck.

(Fig#9.7-9.8From Text. Book)

2-LYCOPSIDA(THE CLUB MOSSES)

- These plants belong to middle Devonian and carboniferous periods.
- They were very large trees that formed the earth's first forests.
- Only five living genera of this group are present.
- Two members, selaginella and lycopodium are common in many areas of Pakistan
- These plants have true branched underground roots.
- True leaves also present w/c have arisen as simple scale like outgrowth (emergence) from the outer tissues of the stem.
- Specialized reproductive leaves bearing sporangia on their surfaces, are present, such type of leaves are known as "Sporophylls".
- In some members, the sporophylls are collected on a short length of stem and form cone like structure "Strobilus".
- The cone is rather club-shaped; hence name "Club-Mosses" for the lycopsids.
- Gametophytes plant may be homosporous or heterosporous .

A) HOMOSPOROUS GAMETOPHYTES

- Spores produced by sporophyte plant are all alike, and each give rise to a gametophytes that bear both

archegonia (female reproductive structure) and antheridia (male reproductive structure)

Example Lycopodium (Running pine or ground pine)

B) HETEROSPOROUS GAMETOPHYTES

- Sporophyte (2n) plant produces two types of sporangia, which produced different kinds of spores.
- One type of sporangium produces very large spores called "Megaspores," which develop in female gametophytes bearing archegonia.
- Other type of sporangium produces small spores called "Microspores, which develop into male gametophytes bearing antheridia.
- That's mean sexes are separate in the gametophytes generation (Heterosporous).

Example: Selaginella.

EVOLUTION OF SEED

Seeds are evolved from primitive spores.

STEPS OF EVOLUTION

1. PRIMITIVE SPORES

All spores of specie are nearly identical in size, structure and function.

2. HETEROSPORES

- There are many vascular plants that form two kinds of spores, these plants are said to be "Heterosporous" and spores are called "Heterospores."
- These spores on germination give rise to two different types of plants.

A) MALE SPORE: It produces sperm forming gametophyte plant.

B) FEMALE SPORE: It grows into egg forming gametophyte.

3. PROTECTION OF HETEROSPORES

- The two different kinds of spores are formed in two different kinds of sporangia.
- Various enveloping structures develop in order to protect these spores.

- Certain fern like plants first developed seed like structures, each of their sporangia, containing one or more female spores, was surrounded by little branch like out growth structure forming "Integument."

4. PERSISTANCE OF FEMALE SPORES

- Instead of being shed from the sporangium, the female spores are retained and protected inside the integument.
- The female spore develops into a tiny female gametophyte protected by the integuments.

5. FORMATION AND STRUCTURE OF SEED

- Seed is formed as the result of fertilization of male spore with this protected female spore.
- Immature seed is called "Ovule."
- Ovule is protected by integuments and it contains great quantities of food.
- Ovule not only protects the female gametophyte from the environment but also provides food for the new off springs that is produced when the seed matures and germinate. The development of seed has given the vascular plants better adaptations to their environment.

3. SPHENOPSIDA (THE HORSE TAILS)

- These plants belong to late Devonian and Carboniferous period.
- Only one living member "Equisetum" commonly called "Horse-tail" exists today.
- Ancient sphenopsids were large trees but now most of these are small (Less than one meter).
- Coal deposits of today was formed from the dead bodies of those plants.
- These plants possess true roots, stems and leaves.
- Stems are hollow and are jointed, whorls of leaves occur at each joint.
- Secondary growth absent, because modern species do not possess cambium.

- Spore are born in terminal cones (Strobili) and all are alike (i.e. plants are homosporous) and give rise to small gametophytes that bear both archegonia and antheridia (i.e. the sexes are not separate).

4. PTEROPSIDA (THE FERNS)

- These plants belong to Devonian and Carboneferous Period and then decline in Paleozoid Period.
- They are very well developed plants having vascular system with true roots, stem and leaves.
- Leaves are probably arisen from flattened web branched stems. They are large and provide much greater surface area for photosynthesis.
- Leaves of Ferns are sometimes simple, but more often they are compound, being divided into numerous leaflets.
- In most modern ferns of temperate regions, the stems are prostrate on or in the soil, and the large leaves are only part normally seen.

SPOROPHYTIC STAGE

- The large leafy plant (fern) is diploid sporophytic phase.
- Spores are produced in sporangia (Reproductive structure) located in clusters on the underside of some modified leaves "Sporophyll."
- Most modern ferns are homosporous i.e. all these spores are alike.
- Vascular sporophytes can live in drier places and grow bigger.

GAMETOPHYTE STAGE

- After germination, the spores develop into gametophytes that bear both archegonia and antheridia.
- These gametophytes are tiny (less than one centimeter wide), thin and often more or less heart-shaped.
- Free-living, non-vascularized gametophytes can survive only in moist places, their sperms are flagellated and water is required for fertilization.Young sporophyte

develops directly from the zygote without passing through any protected seed like stage.

(LIFE CYCLE OF FERN-TEXT BOOK PAGE # 166 NEW ADDITION)

ALTERNATION OF GENERATION

- In Kingdom Plantae, life cycle of many plants is completed in two stages or generations known as Gametophyte and Sporophyte.
- The two generations normally differ from each other in morphology, reproduction and number of chromosomes.
- The gametophyte is haploid and reproduces sexually by forming the gametes, while the sporophyte is diploid and reproduces a-sexually by forming the spores.
- The two generations regularly alternate with each other and therefore, the phenomenon is called "Alternation of generation" (Heteromorphic).
- In Bryophytes, the main plant itself is the Gametophyte while the sporophyte is reduced.
- In Tracheophytes, the main plant is "Sporophyte" and the "Gametophyte" is reduced.

5. SPERMOSIDA (THE SEED PLANTS)

- First appeared in late Devonian and became dominant in Carboniferous Period.
- Gametophyte stage is even more reduced than in the ferns, and non-photosynthetic or free-living.
- The sperms of most modern species are not independent free-swimming flagellated cells.
- Young embryo, is enclosed within a seed coat and can remain dormant for long periods.
- Spermosida can be divided into two main sub-groups, which are as follows:

i) Gymnosperms
ii) Angiosperms

I) GYMNOSPERM

These plants have naked seed because ovules are not

covered by ovary i.e. fruit is absent.
Sub-divisions of Gymnosperms are
a) Cycads
b) Gnetae
c) Ginkgo
d) Conifers

A) CYCADS'

- They have arisen from the seed ferns.
- These plants appeared in "Permian Period" and Mesozoic Period and declined in Cretaceous Period.
- They possessed large palm like leaves with short height stems.
- Living species commonly found in tropical regions and also known as "Sago Palms."
- Nine living genera with over a hundred species exist today.
- Cycads and its relatives.

B) GINKGOAE

- Mostly contains extinct species, only one living specie, "the Ginkgo" which is also known as "Maiden Hair Tree."
- Ginkgo often planted as lawn tree.

E.g: Ginkgo Biloba.

C) CONIFERS

- Most familiar and best-known group of gymnosperms.
- Leaves are small evergreen needles or scales with an internal arrangement of tissues.
- Reproductive organs are cone like modified leaves.

E.g: Pinus.

PINUS

This plant belongs to Gymnosperms. It includes about 90 species.

HABIT AND HABITAT

- It is distributed world-wide mostly in northern hemisphere. 30 species are found in the Himalayas. Some are reported in the planes of Punjab.

MORPHOLOGY

- The pinus plant belongs to the "Sporophytic Phase."
- It is a tall tree, pyramidal in form and gives a conical appearance and therefore commonly grouped under "Conifers."
- It is well differentiated into stem, root and leaves.

STEM

It is erect, cylindrical, solid and covered with thick, rough and brownish bark. The branches are dimorphic,

- Branches of unlimited growth or long shoot.
- Branches of limited growth or dwarf shoot.

ROOTS

Underground root system is formed by "Tap Roots" which disappear early and only lateral roots persist later on.

LEAVES

It bears two types of leaves (dimorphic condition)

a) Scale leaves

b) Foliage leaves

A) SCALE LEAVES

- Thin, membranous small scale like structures.
- Provide protection and do not help in photosynthesis.

B) FOLIAGE LEAVES

- Only develop on dwarf shoots.
- Number of foliage leaves is fixed for particular specie.
- Each leave is needle shaped, simple green therefore also known as "Needles."
- They have smooth surface and are evergreen and persistent.

LIFE CYCLE OF PINUS

The adult plant of Pinus represents the "Sporophytic Phase" of life cycle.

The sporophytic plant body of pinus reproduces asexually by means of spores and after passing through "Gametophytic Phase" of the life cycle again produce Sporophytic plant, showing distinct Alternation of Generation.

1. SPOROPHYTIC PHASE

- The sporophytic plants of Pinus are mostly monoecious i.e. male and female cones are found on same plant.
- Special reproductive organs called "Cones," developed on it.

A) MALE CONE OR O-STROBILUS

- The male cones occur in clusters near the end of long branches at the place of dwarf shoot. (Dwarf shoots are replaced by male cone).
- Each male cone is simple ovoid structure 3-4 cm in length.
- It has got single centrally located cone axis around which are arranged spirally, many scaly microsporophylls (60-135).
- Each microsporophyll has an expanded triangular central part and a stalk like base.
- Each microsporangium, which is born on the lower side bears numerous "Pollen grain mother cells."
- When the microsporangium matures, on its lower side a horizontal slit is formed through which numerous Pollen grains are liberated and dispersed by wind.
- Each pollen grain is winged structure and yellow in colour.

B) FEMALE CONE OR O-STROBILUS

- The female cones are developed laterally in the axis of scale leaves.
- The female cones are much bigger, woody, dry and hard structure.
- The young female cone is reddish green structure. Each female cone consists of a central axis to which are attached the "Megasporophyll."
- Each megasporophyll on its surface has two ovules.
- Each ovule is orthosporous and consists of a central mass of tissue, surrounded by a single integument, made up of 3 layers.

- The integument bears a wide gap, the microphyle.
- Within the megasporangium, megaspore mother cells are present, which undergoes reduction division to produce a "Megaspore."
- Only one megaspore is functional, however the other three degenerate.

2. GAMETOPHYTE PHASE

- The spores are the units of gametophytic phase of life cycle.
- In case of Pinus the spores are of two types, microspores and megaspores.

A) MALE GAMETOPHYTES

- Microspore is a unit of male gametophyte.
- Each microspore or pollen grain is a unicellular body, covered with an outer layer, "Exine," thick and heavily culticularized, while the inner layer, the "Intine" is very thin.
- The Exine forms the balloon shaped wings on either side, which help in pollination.
- The microspore is at this, four celled stage (consisting of one generative cell and two prothalial cells and a tube cell).

B) FEMALE GAMETOPHYTE

- The Megaspore is the first cell of female gametophyte.
- The functional megaspore increases in size and forms a complete cellular female gametophyte, also known as "Endosperm."
- The "Archegonia" are formed towards micropylar side.
- The cells of the endosperm or Archegonia initial cell divides and forms the central cell.
- The central cell forms the venter canal cell and a large egg cell.

POLLINATION

In case of Pinus, Pollination is effected by wind (Anemophyllous).

FERTILIZATION

1. The pollen grains reach the apex of the Archegonium.
2. The pollen tube carrying the two male gametes and the tube nuclei comes in contact with the archegonium.
3. The tip ruptures, discharging its contents into the egg.
4. One of the male gamete fuses with the egg nucleus and unites forming the oospore or zygote.
5. The second male gamete along with the tube and tube nuclei disintegrate.

PINUS SEED

- Fertilized ovules get transformed into seeds.
- Seeds are small elongated and winged.

GERMINATION OF SEED

The seed undergoes into a condition of dormancy when the conditions are favourable, the seed absorbs moisture and the embryo resume growth.

STRUCTURE OF OVULE

- Ovules are female part of flower, form seed after fertilization.
- Microscopic study of an ovule reveals following structural features of an ovule.

1. FUNICLE

It is slender stalk of ovule through which it attaches to the placenta.

2. HILUM

It is the point of attachment of the body of the ovule to its funicle.

3. RAPHE

In the inverted ovule, the funicle continues beyond the hilum along side of the body of the ovule forming a sort of ridge, which is called the “Raphe.”

4. CHALAZA

The distal end of the raphe, which is the junction of integuments and the nucellus is called the “Chalaza.”

5. NUCELLUS

It is the main body of ovule.

6. INTEGUMENTS

Nucellus is surrounded by two coats called the "Integuments."

7. MICROPYLE

It is the small opening at the apex of integuments.

8. EMBRYO-SAC

It is a large, oval cell lying embedded in the nucellus towards the micropyle end. It is the most important part of the ovule as it bears the embryo. It is further developed, and in the mature embryo sac following cells can be seen:

A) EGG APPARATUS

- It is the group of three cells lying towads the micropyle.
- One cell of the group is the female gamete, the ovum/egg, and the other two are called "Synergids."
- The ovum or egg-cell on fertilization gives the embryo, synergids get disorganized soon after fertilization.

B) ANTIPODAL CELLS

This is the group of three cells lying at the opposite end of egg apparatus. These have no definite function.

C) DEFINITIVE NUCLEUS

In the middle of the embryo-sac there is a distinct nucleus known as a definitive nucleus, which is the fused product of the two polar nuclei.

STRUCTURE OF POLLEN GRAIN

- Pollen grains are male part of flowers, and are contained in the "Pollen-Sac."
- They are very small in size, usually varying from 10 to 200 µm.
- Microscopic study of a pollen grain shows following features:

1. EXINE

- It is the outer coat of the pollen grain.

- It is tough, cutinized layer, which is often provided with spinous out growths or markings of different patterns, sometimes smooth.
- It has one or more weak slits or pores called "Germopores."

2. INTINE

- It is the inner coat of the pollen grain.
- It is thin, delicate, cellulose layer lying internal to the exine.
- During fertilization in time grows to form pollen-tube.

3. INTERNAL STRUCTURE

- Each pollen grain contains a bit of cytoplasm on a nucleus.
- During germination of pollen grain nucleus further divides to form a "Tube Nucleus," and a smaller one the "Generative Nucleus."
- The generative nucleus soon divides into two male gametes.

Plant Families

1- CAESAL PINIOIDEAE/CASIA FAMILY

CLASSIFICATION

- DIVISION : ANGIOSPERMS
- CLASS : DICOTYLEDON
- SUBCLASS : POLYPETALAE
- SERIES : CALCIFLORAE
- ORDER : ROSALES
- FAMILY : LEGUMINOSAE
- SUB-FAMILY : CAESALPINIOIDEAE OR CAESALPINIACEAE.

GENERAL CHARACTERS

Majority of these plants are trees or shrubs, about 135 genera and 5800 species are known .

VEGETATIVE CHARACTERS

ROOT

Usually, Taproot with nodules and primary, secondary and tertiary divisions.

STEM

Usually, Climbing stem or erect herbaceous or woody, Some plants show xerophytic character.

LEAVES

Usually, Compound leaves bipinnate, stipulate.

INFLORESCENCE

Usually, Racemose.

FLORAL CHARACTER

Usually, Complete, bisexual, perigynous, zygomorphic, pentamerous.

CALYX

5 sepals, polysepalous, imbricate or valvate, Green in colour.

COROLLA

5 petals, poly petalous, imbricate aestivation.

ANDROECIUM

Usually, 10 stamens, polyanderous, exerted, extrose.

GYNOECIUM

Usually Monocarpillary, perigynous, placentational marginal, unilocular with many ovules.

FLORAL FORMULA

+ , Q , K(5) , C(5) , A10 , G1/

POLLINATION

Usually, Cross pollination by insects (entomophilly)

SEEDS

Usually, Both endospermic and non-endospermic.

FRUIT

Legume pod.

ECONOMICAL IMPORTANCE

MEDICINAL PLANS

- Amaltas
- Kachnar

- Tamarindus Indica
- Panwar. e.t.c.

ORNAMENTALS

- Parkinsonia
- Gul-e-mohar
- Cacia sophera

DYES AND STAINING

Haemotoxylin is obtained from haemotoxylon campechianom.

EDIBLE FRUIT

Lomentum (Imli)

FIBER

Suitable fiber for paper making is obtained from parkinsonia Aculeata.

FAMILIAR PLANTS

Botanical name……Common Name……Local Names

1-Tamarindus indica……Tamarind……Imli

2-Cassia fistula……Amaltus.

3-Bauninia verigata……Camel's foot……Kachnar

4-Poinciana regia……Flame of Forest ……Gul-e-Mohar

5-Parkinosia roxburgai……VilayatiKikar

FLORAL DIAGRAM

(From Book)

2 MIMOSACEAE

ALTERNATE NAME

It is also known as "Acacia family".

CLASSIFICATION

- DIVISION : ANGIOSPERMS
- CLASS : DICOTYLEDON
- SUBCLASS: POLYPETALAE
- SERIES : CALCIFLORAE
- ORDER : ROSALES
- FAMILY : LEGUMINOSAE

- SUBFAMILY : MIMOSACEAE / ACACIA

GENERAL CHARACTERS

It is the smallest group among the 3 groups of family legume. It contains about 40 genera and 1450 species.

HABITAT

Mostly plants are distributed in tropical and subtropical regions. Great variation inhabit, usually these trees are perinial or binnial shrubs, some are herbs and climbing.

VEGETATIVE CHARACTERS

1. ROOT

Usually, Tap root with side branches, nodules are present.

2. STEM

Usually, Erect and woody stem, rarely herbacious, tannin and gums may also present.

3. LEAVES

Usually, Compound, bipinnate, stipule are modified into spines. In many plants leaves show sleeping movement or after having a shock.

INFLORESCENCE

Mostly, racemose.

FLORAL CHARACTERS

Usually, Complete, bisexual actinomorphic, perigynous, pentamerous.

1. CALYX

Usually, 5 sepals, gamosepalous, valvate.

2. COROLLA

Usually, 5 petals, polypetalous, valvate aestivation, small size.

3. ANDROCEIUM

Usually, numerous stamens, exerted, extrose, basifixed anther.

4. GYNOECIUM

Usually, Monocarpillary, perigynous, unilocular, placentation marginal, many ovules in locule.

POLLINATION

Usually, cross pollination by insects (entomophilly).

SEEDS

Usually, Non-endospermic or with very little endosperm.

FRUIT

Usually, It is called legume.

FLORAL FORMULA

+ ,Q , K(5) , C(5) , Aα , G1/

ECONOMICAL IMPORTANCE

1.WOOD YIELDING PLANTS

e.g-prosopis

- Acacia species
- Albizzia
- Xyliaet

2. ORNAMENTALS

e.g-Mimosa pudica (chuimoi)

- Austratian Acacia
- Neptunia

3. FOODER

From leaves of prosopis,

- Acacia
- Dicrostachys e.t.c.

4. SOAP POPS

Acacia concinna pods have (soponim), a substance can be used as Soap.

5. CATECHU (KATHA)

Piece of hard wood

6. MEDICINAL USE

- Katha
- Siah Kanta
- Entada
- Acacia senegal

7. GUMS & DYES

- Katha
- Safed Babul

- Sada Babul

IMPORTANT FAMILY MEMBERS

BOTANICAL NAME……COMMON NAME……LOCAL NAME

1-Acacia nilotica……Gum tree……Bauble, Kikar

2-Albizzia lebbek……Siris

3-Mimosa pudica……Touch-me-not……Chhui mui

4-Prosopis glandulosa……Prosopis……Devi

5-Acacia catechu……Katha plant

FLORAL DIAGRAM

(FROM BOOK)

3- ROSACEAE

CLASSIFICATION

- Division
- Class
- Subclass
- Series
- Order
- Family: Rosaceae / Rose family.

GENERAL CHARACTERS

It has about 100 genera and 2000 species.

HABITAT

These plants are found growing all over the world 213 species of about 29 genera are reported from Pakistan.

VEGETATIVE CHARACTERS

1. ROOT

Usually, Tap root with its usual branching.

2. STEM

Usually, Green herbaceous, cylindrical, small spines are also present.

3. LEAVES

Usually, Simple leaves with or without petiole, Opposite or alternate.

INFLORSCENCE

Usually Racemose

FLORAL CHARACTERS

Usually, Complete, bisexual, actinomorphic, perigynous, pentamerous.

1. CALYX

Usually, Sometime epicalyx may also be present, of variable number, 5 sepals are present, Gamosepalous, green, pubescent.

2. COROLLA

Usually, 5 petals or multiple of 5 petals, polypetalous, aestivation, imbricate, shape-rosaceous, full of colour.

3. ANDROCEIUM

Usually, Nomerous stamen,ditheous, anther, enerted, extrose, dorsi fixed.

4. GYNOECIUM

Usually, Monocarpillary or multiple capillary with formation of a single compound pistil. Ovary perigynous, unilocular two or more ovules are present, placentation axile when the carpels are many and syncarpous

FLORAL FORMULA

+ , Q , K(5) , C(α) , Ax , G1/ (2-5) or x

ECONOMICAL IMPORTANCE

FRUIT

Economical importance of this family is great in providing the pleasure and welfare of mankind. Plants of many famous fruits belong to this family for e.g. Apple, pear, peach, e.t.c. Perhaps they rank 3rd in commercial importance in the temperate, zone among the families of flowering plants.

ORNAMENTALS

A large no. of ornamental plants of this family are grown in parks and gardens the most widely cultivated plant for this purpose is Rosa. Many others genera are also grown for their beautiful flowers in homes and gardens.

OTHERS

Branches of crataegus and cotoneaster provide excellent walking stick and wood. The wood of pyruspastia is used for making tobacco pipes. In Asian countries rose petals are used in making Gul Khand and are also used in extraction of an essential oil, Rose oil, used as perfume or may be used as eye cleaner in certain diseases.

FAMILIAR PLANTS

BOTANICAL NAME……COMMON NAME……LOCAL NAME

Malva silvestis……Apple……Seb

Pyrus pyrifolia……Pear……Nashpati

Prunus amygdalus……Almond……..Badam

Rosa indica……Rose……Gulab

Prunus persica……Peach……Aru

FLORAL DIAGRAM

(FROM BOOK)

4-SOLANACEAE

ALTERNATE NAME

Night shade or Potato family

HABIT AND HABITAT

- It is widely distributed in temperate region and very abundant in tropical countries.
- The plants are usually herbs or climbing vines but may be shrub.

VEGETATIVE CHARACTERS

1-ROOT

Tap root and branched

2-STEM

Herbacious, erect or underground(Potato)

3-LEAF

Alternate in vegetative and opposite in floral region

FLORAL CHARACTERS

INFLORESCENCE

Cyme sometimes helicoids

1-FLOWER

Pentamerous, Bisexual, Regular, Actinomorphic, Hypogynous.

2-CALYX

Five, united sepals

3-COROLLA

Five petals, united, valvate aestivation

4-ANDROCIEUM

Five stamens, Inserted on Corolla

5-GYNOECIUM

Bicarpellary, Syncarpous (Carpels fused), Placentaion axile.

6-FRUIT

Capsule Berry or Xanthium.

7-SEED

Minute with abundant endosperm.

FLORAL FORMULA

+ , O , K(5) , A5, C(5) ,

ECONOMIC IMPORTANCE

Members of this family provide drugs and food. Some plants are poisonous and other are ornamental. This family is of great economic importance as it provides food, fodder, drugs and ornamentals.

1-FOODER

- Solanum tuberosum (Potato)
- Lycopersicum esculentum (Tomato)
- Solanum melongena (Brinjal)

2-CONDIMENTS

- Fruit of capsicum
- Capsicum frutenscens

3-EDIBLE FRUIT

- Physalis (Cherry or Rasbhari)

4-DRUG YIELDING

- Atropa belladonna (atropine)
- Dotura (Daturine)
- Used in severe cold and in eye diseases.
- Sap of hanbane is used in dilating the pupils, white cherry is used an nerve tonic.

5-ORNAMENTAL

- Cultivated in gardens
- Petunaia
- Nicotiana
- Cestrum Schizanthus
- Brunfelsia solanum

6-CIGARETTE MAKING

- Nicotiania tobacum (Tobacco)

IMPORTANT FAMILY MEMBERS

BOT-NAME……COMMON NAME……LOC-NAME

1-Solanum Tuberosum……
Potato……Aaloo

2-Solanum Melongena……
Bringal……Bengan

3-Lycoperscum Escalentum……Tomato……Temater

4-Capsicum Annum……Red-Pepper……Lal-mirch

5-Petunia Alba……Petunia

6-Solanum Nigrum……Black Night shade

7-Datura Alba……Thorn apple

8-Nicotiana Tobaccum……Tobacco……Tamba ko

9-Atropa Belladonna……Deadly night shade

10-Cestrum nocturnum……Lady of night……Raat ki Rani

FLORAL DIAGRAM

FROM TEXT BOOK (BIO-XI FAMILY SOLANACEAE)

5-FABACEAE

ALTERNATE NAME

Papilionaceae or Pea family

HABIT AND HABITAT

Plants are herbs, shrubs or trees. Climbers, aquatic plants or xerophytes. World wide distributed.

VEGETATIVE CHARACTERS

1-ROOTS

Tap root, branched bearing tubercle containing nitrogen fixing bacteria.

2- STEM

Herbecious or woodi, erect or climber.

3-LEAF

Simple or commonly compound alternate, stipulate

FLORAL CHARACTERS

1- INFLORESCENCE

Racemose, rarely solitary.

2- FLOWER

Bisexual, irregular, zygomorphic, hypogynous.

3- CALYX

Five sepals, united

4- COROLLA

- Five petals, usually free.
- Corolla is papilionaceous (Butterfly shaped). In this form the petals are 5, one of them is usually large and clawed. This petal is called standard or “Vexillum” The two lateral ones, which are free are called as “Wings” and two anterior inner most fuse to form a boat shaped structure called the “Keel” or “Carina”.

5- ANDROCIEUM

Stamens (9) +1 i.e 9 fuse to form a round sheath around the pistil while tenth is free.

6-GYNOECIUM

Monocarpellary, ovary unilocular, ovule numerous on marginal placenta.

7-FRUIT

Legume or pod.

8-SEED

EX-albuminous.

FLORAL FORMULA

+ , Q , K(5) , C 1+2+(2) , A(9)+1 , G1

ECONOMIC IMPORTANCE

The family is of considerable importance, as a source of high protein food, oil and forage as well as for ornamental purposes. Chief importance lies in the pulses, belonging to this family. All types of pulses (Dalls) are actually the seeds of this family which are rich in protein.

1- FOOD & FORAGE

- Cicer arietinum (Gram)
- Pisum sativum (Pea)
- Lens esculanta (Masure)
- Phaseolus aureus (Mung)
- Phaseolus mung (Urad/Mash)
- Phaseolus vulgaris (kidney bean/Lobia)
- Medicago sativa alfalfa (Lusan)
- Vicia
- Melilotus & Trifolium

2- FURNITURE & BUILDING PURPOSE

- Butea
- Dilburgia

3- OIL EXTRACTION

Arachis hypogea (Peanut/Moongphali)

4- DYES

- Indigofera tinctoria (Neel)
- Butea monosperma (Yellow dye)

5-MEDICINAL PURPOSE

- Glycyrrhiza glabra (Cough & cold treatment)

- Clitoria termatea (Snake bite treatment)

6- ORNAMENTAL PLANTS

- Lathyrus
- Lupinus
- Clitoria
- Butea
- Abrus precatorious, used by jewellars as weights called "Ratti".

IMPORTANT FAMILY MEMBERS

BOT-NAME……COMMON NAME……LOCAL-NAME

1- Lathyrus Odoratus……Sweet pea……Matter

2- Arachis Hypogea……Peanut……Moongphali

3- Cicer Arietinum……Gram…… Channa

4- Dalbergia Sisso……Red-wood……..Shesham

5- Pisum Sativum……Edible pea

6- Sesbania aegyptica……Sesbania

FLORAL DIAGRAM

FROM TEXT BOOK BIOLOGY-XI Pg # 191

6-POACEAE

ALTERNATE NAME

GRAMINAE/ GRASS FAMILY

HABIT AND HABITAT

- The species are most numerous in the tropics but they are also abundant in temperate region.
- This family is monocot (one cotyledon in seed)
- Mostly annual or perennial herbs or shrubs.

VEGETATIVE CHARACTERS

1- ROOTS

Adventitious, fibrous or fascicled.

2- STEM

Cylindrical, Conspicuous nodes and hollow, although solid stems are also found as sugar cane.

3- LEAF

Legulate, alternate leaf sheath mostly open sessile, lamina narrow and ribbon shaped.

FLORAL CHARACTERS

1- INFLORESCENCE

Compound spikes.

2- FLOWER

Sessile, bracteate, incomplete, bisexual or unisexual and zygomorphic.

3- PERIANTH

It is combined structure instead of calyx and corolla. Number 2 or 3 membranous scales called " Lodicules"

4- ANDROECIUM

Usually 3 stamens, filaments long, free anther versatile.

5- GYNOECIUM

Tricarpellary, syncarpous though only one is functional, unilocular, single ovule, style short 2-3, stigma feather like.

6- FRUIT

Grain or coryposis.

7- SEED

Endospermic, monocotyledonous.

FLORAL FORMULA

+ or O , O or O or O , P2 (lodicules) , A3 or 0 , G1 or 0

ECONOMIC IMPORTANCE

The family poaceae has great importance than any other family of flowering plants.

1- FODDER AND FOOD STUFF

- Triticum indicum
- Avena sativa
- Zea mays
- Oryza sativa
- Hordeum vulgare

- Pennisetum typhoideum

2- SUGAR MAKING

- Saccharum officinarum (sugar cane)

3-PAPER MANUFACTURING

- Certain species of Grasses

4- VEGETABLES & SOUP DISH

- Sugar cane
- Bamboo-shoots

IMPORTANT FAMILY MEMBERS

BOT-NAME……COM-NAME……LOC-NAME

Triticum Indicum……Wheat……Gandum

Avena Sativa……Oats

Zea Mays……Indian corn……Makai

Oryza Sativa……Rice……Chawal

Saccharum Officinarum……Sugar cane……Ganna

Hordeum Vulgare……Barly……Joo

Pennisetum Typhoideum……Bajra

Bambusa Arundinacea……Bamboo……

Banns Cymbopogon Jawarancuza……Lemon Grass

Cynodon dactylon……Lawn Grass

FLORAL DIAGRAM

FROM TEXT BOOK BIOLOGY-XI Pg#196)

DOUBLE FERTILIZATION

- After pollination, the tube nucleus of the pollen grain forms pollen tube, while generative nucleus divides into two male (sperm) gametes.
- When pollen tube reaches the embryo sac through micropyle, one of the male gametes fuses w/t egg cell and forms "oospore (zygote)",it develops into seed. Another male gamete fuses with definitive nucleus and forms "Endospermic nucleus", w/c develop into endosperm of seed or food storage tissue of seed.
- Because two times fertilization occurs so it is called "Double fertilization".

THE FLOWERS

The flower is a modified shoot and meant for sexual reproduction. It is collection of four different kinds of floral members, arranged in four separate whorls. The upper two whorls are essential or reproductive whorls whereas lower two are helping or accessory whorls. The flower is born on an axis which consists of two parts the pedicel or stalk of flower and the thalamus is swollen end of the axis on which the floral leaves are inserted. The floral whorls are arranged on the thalamus in a particular order one just above the other. These four whorls are as follows.

CALYX

It is the first or lower most whorl of the flower, the calyx is generally green is colour. Each member of calyx is known as sepal. Sometimes sepals become coloured called petaloid. Such as in gold mohur. The calyx is non essential or accessory part of flower.

FUNCTIONS

1- Protection of floral bud
2- Assimilation when green in colour
3- Attraction when coloured and showy
4- Modified into papus which helps in dispersal

COROLLA

It is the second non essential floral whorl of flower. It is brightly colored. Each member of its known as petal. However there is no differentiation of calyx and corolla in some flowers. It is called perianth.

FUNCTIONS

1- The corolla attracts insects and hence help in pollination.
2- It encloses stamens and carpels.
3- It protect the stamens and carpels from external heat rain and insects attack.

ANDROCIEUM

It is the third essential floral whorl and each member of it is known as stamen. The stamen is a male reproductive body and consists of filament, anther and connective. The anther bears four chambers of pollen sacs, each chamber is filled with granular mass of small cells called pollen grains. Each pollen grain consists of two walls, the outer exine and inner intine.

FUNCTIONS

It is the male reproductive body and hence possess male gametes which take part in reproduction.

GYNOECIUM

It is the fourth essential floral whorl and its component parts are called carpals. The carpel is a female reproductive body, it may be one or more than one, and may be united or free. Each carpel consists of stigma, style and ovary. The stigma is terminal end which receives the pollen grain. It may be smooth or hairy and becomes sticky on maturity, The style is slender projection of ovary, It helps in pollination and later on dries up. The ovary is swollen basal portion, which encloses minute egg like bodies called ovules. The ovule possess egg cells.

FUNCTIONS

The gynoecium is a female reproductive body. It possess the egg cells which take parts in reproduction.

AESTIVATION

It is the arrangement of floral whorls i.e. the sepals or petals in a floral bud, it is of following types:

(A) VALVATE

The members of a whorl lie close to each other and do not overlap e .g Calatropis.

(B) TWISTED

One margin of a floral whorl overlaps that of the next one. It may be clockwise or anti clockwise e.g. China rose.

(C)VEXILLARY

When petals are five, two internal are overlaped on both margins by two petals, these two are overlaped by a single largest posterior petal e.g. Pea bean etc.

(D)IMBRICATE

When one of the sepal or petal is internal and other external and each or remaining one is overlaped on one margin and it overlaps the next one on other margin e.g Gold mohur .

A. Velvate.
B Twisted
C. Vexillary
D. Imtricate.

INSERTION OF FLORAL LEAVES ON THE THALAMUS

The floral leaves are inserted on the thalamus in a particular order, it is of following types:

(A) HYPOGYNOUS

In some flowers the thalamus is convex or conical and ovary occupies the highest position on it. However other floral whorls are inserted below the ovary, such flower is known as hypogynous and ovary as superior. E.g. Mustard.

(B) PERIGYNOUS

In certain flowers thalamus forms a flattened circular disc due to the fact that sises of thalamus grows up to the same level. The apex of thalamus is in the middle of the disc at which gynoecium develops, whereas at the rim or margin sepals, petals and androecium are inserted. They are round about it and hence are called perigynous, such as in pea.

Sometimes the apex of thalamus grows up in conical shape as in raspberry. Whereas in some cases the calyx forms a cup shaped structure called calyx tube such as in wild rose.

(C) EPIGYNOUS

In some flowers the concave receptacle surrounds the ovary and is fused with it. The sepals, petals and stamens apparently arise from the tip of the ovary such ovary is said to be inferior. E.g. Sunflower, apple, guava, pear etc.

IMPORTANT TERMS TO DESCRIBE A FLOWER

COMPLETE: When all the four floral whorls are present.
INCOMPLETE: When any of the whorl is absents.
BISEXUAL: The stamen and carpel both are present.
UNISEXUAL: The flower possess either stamen or carpel.
STAMINATE: Only stamens are present (male).
PISTILATE: When flower possess only carpels (female).
NEUTER: The stamens and carpels both are absent.

SYMMETRY

+ACTINOMORPHIC

When a flower can be divided into two equal halves by any vertical section passing through centre.

+ ZYGOMORPHIC

When it can be divided into two similar halves by only one vertical section.

+ IRREGULAR

The flower can not be divided into two similar halves by any vertical plane.

COHESION OF STAMEN

+ MONOADELPHOUS

When filaments are united in a bundle and anthers are free e.g. China rose.

+ DIADELPHOUS

The filaments are united into two bundles and anthers are free e.g. Pea.

+ *POLYADELPHOUS*
The filaments are united into more than two bundles and anthers are free.
+ *SYNGENECIOUS*
The anthers are united together and filaments are free e.g. Sunflower.
ADHESION OF STAMENS
+ *EPIPETALOUS*
The stamens adhere to corolla, wholly or partially by their filaments.
+ *GYNANDROUS*
When stamens adhere to carpels e.g. Calatropis.
LENGTH OF STAMENS
+*DIDYNAMOUS*
The stamens are four, two of them short and two long e.g. Nerium.
+*TETRADYNAMOUS*
The stamens are six but two short and four long e.g. mustard.
GYNOECIUM
+ *MONOCARPELLARY*
The pistil consists of only one carpel, it is also known as simple pistil e.g. Pea, Bean
+ *POLYCARPELLARY*
The pistil consists of two or more carpels, it is also known as compound pistil e.g. Rose.
+ *SYNCARPOUS*
The carpels are united into one ovary e.g. Mustard.
STIGMA
+ *CAPITATE*
When stigma is rounded and knob like. Bi, tri or Multified: when stigma is branched into two , three or many.
+ *FEATHERY*
When stigma is feather like.

+ *FLATTENED*
When sitgma is flat.
+ *POINTED*
When stigma is pointed.
+ *LINEAR*
When it is long and narrow.
STYLE
+ *TERMINAL*
When style arise from top of ovary; such as in Mustard.
+ *GYNOBASIC*
When it arise between the lobes of the ovary from its base;such as in Salvia.
+ *PEDICILLATE*
When flower is born on a stalk or pedicel. (STALKED)
+ *SESSILE*
When stalk is absent
+ *BRACTEATE*
When flower is developed in the axil of a bract
+ *EBRACTEATE*
When bract is absent.
+ *DIMEROUS*
When each floral whorl has two floral leaves (Dicot)
+ *TRIMEROUS*
When floral whorl has three floral leaves (Monocot)
+ *TETRAMEROUS*
When each floral whorl has four floral leaves; and so the pentamerous Dicots)
CALYX
+ *PETALOID*
The calyx having other then green colour.
+ *CAMPANULATE*
Sepals fused to form bell shaped structure.
+ *POLYSEPALOUS*
When sepals are free from one another.

+ GAMOSEPALOUS
When sepals are fused or united with one another.
PETALS
+SEPALOID
The petals are green in colour.
+CRUCIFORM
Petals are arranged in form of a cross.
+POLYPETALOUS
When petals are free from one another.
+GAMOPETALOUS
When petals are united with one another.
+PERIANTH
When calyx and corolla can not be distinguished with one other due to similar shape and colour.
PERIANTH
+SEPALOID
When perianth leaves are green.
+POLYPHYLLOUS
When perianth leaves are free from one another.
+GAMOPHYLLOUS
When perianth leaves are fused.
FLORAL FORMULA
The floral formula is represented by various symlols. The symbols used in floral formula are as follows.
SYMMETRY OF THE FLOWER
Zygomorphic = +
Actinomorphic = O
SEXUALITY

- Bisexual = Q+
- Unisexual (male)
- Unisexual (female)
- Neuter =

PERIANTH

- Perianth = P
- Polyphyllous = Pn n=number of perianth leaves.

- Gamophyllous = (n) " " "

CALYX

- Epicalyx = Epi K
- Petals = C
- Calyx = K
- Polypetalous = Cn,
- Polysepalous = Kn, n= number
- Gamopetalous = C(n)
- Gamosepalous = K (n) of sepals

ANDROECIUM

- Androecium = A
- Androecium free = An n= number of stamens
- Androecium United = A (n)
- Epipetalous = C-A

GYNOECIUM

- Gynoecium = G
- Apocarpous = Gn
- Syncarpous = G (n)
- Ovary inferior = G
- n= number of carpels
- Ovary Superior = G

FLORAL DIAGRAM

The features of flower in flora formula are represented by symbols, while in floral diagram by the diagram of its various floral leaves alongwith actual number and position.

MOTHER AXIS: It is represented by a Dot above the floral diagram. It actually shows the position how a flower is born. The position of it can be seen from upperside. It may be between two adjacent sepals or a single sepal.

PLACENTATION

It is the arrangement of placenta which are cushion like ridges in the ovary, The placenta bear ovules. In simple ovary placentaion is marginal, whereas in compound ovary it may be parietal, axile, free central, basal and superficial.

(A) MARGINAL

In a simple ovary or monocarpellary pistil, the ovules are arranged along the fused margins, these margins forms a cushion like tissue called placenta along the ventral suture on the inner surface of ovary wall e.g. Pea, Gram, Bean, etc.

(B) PARIETAL

In a compound syncarpous and unilocular ovary, the fused margins of the carpals swells up to form placentas, to which ovules are attached. The placentas lie along the wall of ovary and their number indicates the number of carpels forming ovary e.g. cucumber, Melon; etc.

(C) AXILE

In a polycarpellary syncarpous pistil and multilocular ovary, each carpel is folded along its mid-rib and meets in the centre of the ovary. The ovules are attached to this central axis e.g. Tomato, China rose, etc.

(D) FREE CENTRAL

In a compound and unilocular ovary the ovules are situated all around the central axis, which arise from the thalamus and not fused with the margins of the carpels. However in some plants the axile placentation becomes free central due to breaking down of septa e.g. Pink (Diantus)

(E) BASAL

In a unilocular ovary the placentas develops directly on the thalamus and bears single ovule at the base of ovary e.g. Sunflower, Cosmos etc.

(F) SUPERFICIAL

In a multilocular ovary, the ovules are not on the margins of the carpels; but over the whole inner surface of the partition walls e.g. Waterlily.

TYPES OF PLACENTATION

1.FOR SIMPLE OVARY

Only one type, MARGINAL.

2.FOR COMPOUND OVARY

I- Exile

II- Central
III- Parietal
IV- Basal
V- Superficial.

1. MARGINAL PLACENTATION

In marginal placentation, the ovary is one chambered and the placenta develops along the junction of the two margins of the carpel, called the ventral suture.

EXAMPLES

Pea, wild pea, gram, gold mohr, and cassia are common examples.

2. AXILE PLACENTATION

In the axile placentation the ovary is two to many chambered and the placenta bearing the ovules develop from the central axis e.g. Potato, Tomato, Petunia, China rose etc.

3. CENTRAL PLACENTATION

In this case the septa in the young ovary soon break down so that the ovary becomes one-chambered and the placenta develops all round the central axis e.g. Dianthus, Saponaria etc.

4. PARIETAL PLACENTATION

The ovary is one chambered and placenta develops on the inner wall of the ovary e.g. papaw, orchids etc.

5. BASAL PLACENTATION

The ovary is unilocular and placenta develops directly on the thalamus e.g. sunflower, cosmos etc.

6. SUPERFICIAL PLACENTATION

The ovary is multilocular, carpels are numerous and placenta develops all round the inner surface of the partition walls as in waterlily.

INFLORESCENCE

The branch system of the floral region bearing a group of flowers is called INFLORESCENCE. The term inflorescence refers to the arrangement of flowers on plant.

TYPES OF INFLORESCENCE

The flowers may be solitary or grouped into clusters, Such clusters vary in shape and arrangement. On the basis of arrangement of flowers, inflorescence is classified into

1-RECEMOSE

1- In this case, the main axis of inflorescence does not end in a flower.
2- Main axis continues to grow and gives off flowers laterally.
3- The lower or outer flowers are always older and open earlier than the upper or inner ones.
4- Order of opening of flowers is called centripetal.

EXAMPLES

Mustard, Gold mohr, Mulberry, birch etc.

KINDS OF RECEMOSE INFLORESCENCE

Recemose inflorescence has following main types on the basis of nature and shape of the peduncle:

I- PEDUNCLE ELONGATED

It is further subdivided into following types;

1. RECEME

The main axis in this case is elongated and it bears laterally a number of flowers which are all stalk e.g. radish, mustard, dwarf gold mohur etc.

2. SPIKE

In this case the flowers are sessile e.g. Adhatoda, Achyrnthes etc.

3. CATKIN

This is a spike with a long and pendulous axis which bears unisexual flowers e.g. Musberry, Acalypha, Birch and Oak etc.

4. SPADIX

This is also a spike with a fleshy axis which is enclosed by one or more large bracts called spathes e.g. Banana, Palms etc.

II- PEDUNCLE SHORTENED

It is further divided into following types;

1. CORYMB

Here the main axis is comparatively short, and the lower flowers have much longer stalk than the upper ones. Hence all the flowers are brought more or less to the same level e.g. candytuft, wall flowers etc.

2. UMBEL

Here the primary axis is short and it bears at its tips a group of flowers which have pedicles of more or less equal length so that the flowers are seen to spread out from a common point. In the umbel there is always a whorl of bracts forming an involucre, and each flower develops from the axil of a bract, e.g. Carrycumin, Coriander etc.

III- PEDUNCLE FLATTENED

The best example is seen in sunflower family, here the inflorescence is called the head as the capitulum.

HEAD OR CAPITULUM

1. A dense cluster of sessile or sub-sessile flowers, on a compound receptacle is called capitulum.
2. Main axis is almost flat, bearing sessile flowers.
3. Outer flowers are older and open earlier.
4. The florets are commonly of two types

I- RAY FLORETS
II- DESC FLORETS

EXAMPLES

Capitulum is characteristic feature of sunflower family e.g. sunflower, marigold; zinnia, cosmos etc.

IV- SPIKELET INFLORESCENCE

It is a kind of racemose inflorescence. There are three bracts at its base called glumes. The lower two without flowers are called empty glumes. The third glume has flower in its axil and called Lemma. Just opposite to lemma, there is small bractcole called Palea. Flowers are covered by their respective lemma and palea. This type of inflorescence is characteristic feature of family Poaceae (Grass Family).

2-CYMOSE

1- Here the main axis ends in a flower and similarly the lateral axis also ends in a flower.
2- The growth of each axis is checked due to presence of flower on its tip.
3- The terminal flowers are always older and open earlier than the lateral ones.
4- The order of opening of flowers is centrifugal.

EXAMPLES

Jasmine, Teak, Night Jasmine, Ixora.

KIND OF CYMOSE INFLORESCENCE

I- UNIPAROUS (MONOCHASIAL) CYME

Main axis soon ends into a flower and produces only one lateral branch at a time ending in a flower. The succeeding lateral branches again follow the same mode of producing flowers. If the succeeding branches are produced on alternate side, it is called Scorpiold cyme (cotton, forget-me-not). Whereas, if the succeeding branches are produced on same side, it is called Helicoid (sundew).

II- BIPAROUS (DICHASIAL) CYME

Main axis soon terminate into a flower and produces two flowers. This mode is followed by each succeeding flowers (Pink, Night- Jasmine).

POLLINATION

It is the process of transference of pollen grains to the stigma of the flower.

TYPES OF POLLINATION

Pollination is of two types.
1- Self pollination or Autogamy.
2- Cross Pollination or Allogamy.

(A)SELF POLLINATION

It is the transfer of pollen grains from the anther of a flower to the stigma of the same flower.

METHODS OF SELF POLLINATION

In self pollination, only one flower is concerned to produce

the offspring. Irrespective whether the flower is unisexual or bisexual self pollination can take place by two methods

I-HOMOGAMY

In homogamy the anther and the stigma of a unisexual flower mature at the same time. In rare cases it may takes place by insects or wind.

II- CLEISTOGAMY

In cleistogamy the flower never open. They remain closed and the pollination takes place in the closed flower such as in pansy (viola), balsam (impatiens), oxalis, etc.

B)CROSS POLLINATION

It is transfer of pollen grain from the flower of one plant to the stigma of flower of another plant of the same species.

METHODS OF CROSS POLLINATION

It takes place by external agencies. These agents are insects, animals, birds, wind and water.

I- ENTOMYPHILY

The pollination takes place by insects. It is of general occurrence in plants.

II ANEMOPHILY

The pollination is brought about by wind.

III HYDROPHILY

The pollination takes place in aquatic plants particularly the submerged ones, through the medium of water e.g. Hydrilla and vallisneria

IV ZOOPHILY

The pollination is carried out by birds, squirrels, snails etc. Examples are Bombax and Erythrina.