MORPHOLOGY OF FLOWERING PLANTS

ROOT

Roots are (+) vely geotropic, (+) vely hydrotropic, (-) vely phototropic.

TYPES OF ROOTS

- **Tap roots :-** In most of the dicot plants, the direct elongation of the radicle leads to the formation of primary root. It bears lateral roots of several orders that are referred to as secondary. tertiary roots. etc. The primary roots and its branches constitute the tap root system. Eg. :- mustard plant
- Adventitious roots :- In some plants, like grass, Monstera and the banyan tree, roots develop from parts of the plant other than the radicle and are known as adventitious roots.
- **Fibrous roots :-** In monocot plants, the primary root is short lived and is replaced by a large number of roots. These roots originate from the base of the stem and constitute the fibrous root system. Eg. :- wheat plant



Functions of the root system :- Absorption of water and minerals, provide a proper anchorage to the plant parts, storage of reserve food material (Carrot, radish, turnip, sweet potato and Asparagus) and synthesis of PGR (plant growth regulators).

MODIFIED ROOTS

1. Modified tap root for storage :

- (i) **Fusiform roots/Spindle roots -** These root are thicker in the middle and tapering on both ends. eg. :- Radish
- (ii) **Conical roots -** These roots are thicker at their upper side and tapering at lower side eg. Carrot
- (iii) Napiform roots These roots become swollen and spherical at upper end and tapering Oike a thread) at their lower end. Eg. Turnip, sugarbeet = beet root (Beta vulgaris)
- (iv) **Tuberous roots -** These roots do not have regular shape and any portion of roots become swollen & fleshy. Eg. Mirabilis.
- (v) Nodulated roots Nodules are formed on branches of roots by nitrogen fixing bacteria (Rhizobium). Eg. Plants of Papilionatae sub family of leguminosae family -Pea, gram, bean



2. Tap root modified for respiration: In marshy/swampy areas, scarcity of oxygen is found. Some branches of tap root of the plants which grow in this region, grow vertically upward and comes on the surface. These roots are called pneumatophores which have minute pores called pneumathodes or lenticels by which air enters in the plant and plant gets oxygen for respiration Pneumatophores are negatively geotropic

E.g. Rhizophora, Heritiera, (Mangrove plants)



Respiratory roots (Pneumatophores) of Rhizophora

Modification of adventitious roots :

(i) **Fasciculated roots -** These are adventitious roots occuring in clusters and all of them are swollen.

Eg. Asparagus, dahlia

(ii) **Beaded or moniliform roots -** Root swells up like a bead at different places after a regular interval.

Eg. Vitis(grapes), Momordica (bitter gourd), Portulaca.

- (iii) **Tuberous adventitious roots :** The food is stored in these roots, therefore they become swollen and irregular. These roots have no definite shape Eg. Sweet potato (Ipomoea batatus)
- (iv) Stilt roots or brace roots These roots arise from lower node and enter in the soil. These roots are supporting roots.

Eg. Maize, sugarcane, Pandanus (screwpine).



(v) **Prop roots or pillar roots -** These hanging roots arise from branches of plant and grow downward towards the soil. These roots support the tree.

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

Eg. Banyan (Ficus bengalensis)

- (vi) Climbing roots These roots arise from nodes and help in climbing
 - Eg. Money plant (Pothos), Monstera, betel (Piper betel}, black pepper.
- (vii) Foliar roots or Epiphyllous roots :- When roots arise from leaf then they are called foliar roots.

Eg. Bryophyllum, Begonia.

- (viii) Sucking roots or Haustorial roots or Parasitic roots :- In parasitic plants, roots enter in the host plant to absorb nutrition from the host. Eg. Dendrophthoe, Cuscuta, Viscum.
- (ix) Annulated roots: In these roots swelling occurs in a series of rings on the roots. Eg. Ipecac.



STEM

Stem develops from the plumule of the embryo of a germinating seed. The stem bears nodes and internodes. The region of the stem where leaves are borne are called nodes while the portions between two nodes are called internodes. Stem shows negatively geotropic growth. **The main function of the stem** is spreading out branches bearing leaves. flowers and fruits. It conducts water, minerals and photosynthates (food). Some stems perform the function of storage of food (potato, ginger, turmeric, zaminkand and Colocasia), support, protection and of vegetative propagation.

Forms of stem :-

(i) **Caudex/Columnar :-** It is unbranched, erect, cylindrical stem and marked with scars of fallen leaves.

eg :- Palm.

(ii) **Culm :-** Jointed stem with solid nodes & hollow internodes. eg :-Bamboo (Gramineae).

Modification of stems :-

A - sub-aerial modification of stem - These are creeping stems.

- (1) **Runner** In these stems roots develop at lower side and leaves at upper side from the nodes eg. Cynodon dactyl on (doob grass), Oxalis, Strawberry.
- (2) **Stolon -** In it branches develop from the lower part of the main stem and grow for some distance like arch and finally touch the ground to give rise to new shoot. Eg. Fragaria (Wild strawberry), jasmine, peppermint
- (3) **Sucker** In it the main stem grows in the soil out branches develop from basal and underground nodes and comes out from the soil. E.g. Mint, pineapple, Chrysanthemum, banana.

(4) **Offset** - Generally these occur in aquatic plants which have fragile stem. Internodes of offset are small & thicker and each node bears a rosette of leaves and a tuft of roots. It is also known as aquatic runner. E.g. Pistia, Eichhomia



B - Underground modification of stem

This type of modification occurs generally for food storage and vegetative propagation.

- (1) **Tuber** The tips of branches become swollen in the soil. Eyes are found on tuber which are axillary buds and axillary buds are covered with scaly leaves. Eg. Potato.
- (2) **Rhizome** It is fleshy stem which grows horizontally in the soil. Nodes and small internodes are found which are covered by scaly leaves. Eg. Ginger, turmeric, canna, water lily, banana.
- (3) **Corm-** It is condensed structure which grows vertically under the soil surface. Eg. Colocasia, Alocasia, zaminkand, saffron, Colchicum.
- Organ of perennation- Underground stems of potato, ginger, turmeric, Colocasia, zaminka, are modified to store food in them. They also act as organ of perennation to tide over conditions unfavourable for growth.



- (4) **Bulb** Stem is highly reduced and disc like and surrounded by numerous fleshy leaves. Many roots arise from its base. Eg. Onion, garlic. The fleshy leaves of onion and garlic store food.
- **Note:** Type of stem in banana is rhizome and modification is sucker. Banana propagates through rhizome. Aerial part of banana plant which looks like stem is pseudostem (leaf bases).

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

C- Aerial modification of stem

- (1) **Stem tendril-** In this type of modification axillary bud forms tendril in place of branches and helps in climbing of those plants which have weak stem. Eg. Grapes/Grapevines, Passiflora, gourds (cucumber, pumpkins, watermelon)
- (2) Stem thorn Thorn develops from axillary bud of the stem. It may bear leaves, flowers. Eg. Carissa (karonda), Bougainvillea, pomegranate, Citrus
 - Thorn protects plant from browsing animals. It is a woody pointed structure.
- (3) **Phylloclade** Stem is modified into a fleshy flat (Opuntia) or fleshy cylindrical (Euphorbia) and green leaf like structure and carries out photosynthesis like leaf. The leaves are modified into spines E.g. Opuntia, Euphorbia, cactus, Casuarina (cylindrical).



LEAF

The leaves develop from the nodes. Their main function is to carry out photosynthesis or food formation. axillary buds are found in the axil of leaves. The axillary bud may develop into a branch. Leaves originate from shoot apical meristems and are arranged in an acropetal order. Leaf is a lateral outgrowth of stem developed exogenously at the node.

Leaf (Phyllopodium) is divided into 3 main parts :-

- (1) Leaf base (Hypopodium) The part of leaf which is attached to stem is known as leaf base. Sheathing leaf base is found in monocots. In monocots. the leaf base expands into a sheath covering the stem partially or wholly. Pulvinus leaf bases are found in some legume plants. Swollen leaf base is known as pulvinus leaf base.
- (2) **Petiole** (Mesopodium) The part of leaf connecting the lamina with the branch or stem is known as petiole. Petiole or stalk containing leaves are known as petiolate leaves and when petiole or stalk is absent then leaves are called sessile. In Eichhornia petiole swells up and in Citrus it is winged. The petiole helps hold the blade to light. Long thin flexible petioles allow leaf blades to flutter in wind, thereby cooling the leaf and bringing fresh air to leaf surface.
- (3) **Lamina** (Leaf blade = Epipodium) It is a broad and green flattened part of leaf. Its main functions are photosynthesis and transpiration.

Stipules :-

Leaves of some plants have two lateral appendages on either side of leaf base, known as stipules. Leaf with stipule is known as stipulate leaf. eg. Fabaceae Leaf without stipule is called ex-stipulate leaf eg. Solanaceae. Liliaceae.

Stipules are of various types -

1. **Free lateral -** They are independently present on both sides of leaf base. Eg. Hibiscus rosasinensis (China rose).

 Power by: VISIONet Info Solution Pvt. Ltd

 Website : www.edubull.com
 Mob no. : +91-9350679141

2. Foliaceous - These type of stipules are leaf like. Eg. :- Pea



- **3. Spiny -** Stipules modified into spine like structures. Eg. Zizyphus (ber)
- 4. Ochreate When both stipules of a leaf combine together and form a tube like structure, then it is called ochreate. Eg. Polygonum
- 5. Tendrillar Stipules are modified into tendrils like structure. Eg. Smilax



Types of Leaves -

Bracts - These are leaf like structure which may present at base of pedicel of flower. **Bracteoles** - These are leaf like structures found on pedicel.

VENATION OF LAMINA

The arrangement of veins and veinlets in leaf lamina is known as venation. It is of 2 - types

- (1) Reticulate. It is found in dicots. Exception- Calophyllum (It has parallel venation)
- (2) Parallel. It is found in monocots. Exception- Smilax (It has reticulate venation)
- 1. **Reticulate venation -** In this type of venation lateral veins are divided into various branches (vein lets), and vein lets form a net like structure.

Reticulate venation is of 2 types -

- (a) Unicostate or pinnate- This type of venation is having only one principal vein or midrib that gives off many lateral veins which proceed towards margin and apex of lamina of the leaf and form a network.
- (b) Multicostate or palmate In this type of venation many principal veins arising from the tip of petiole and proceed upward, this is again of two types –





RETICULATE VENATION

2. **Parallel venation-** In this type of venation, all veins run parallel to each other and they donot form network.

They are of 2 types -

Power by: VISIONet Info Solution Pvt. Ltd

Website : www.edubull.com

- (a) Unicostate or pinnate : This type of pattern is having only one principal vein, that gives off many lateral veins, which proceed toward the margin of leaf blade in a parallel manner but they donot have veinlets.
- (b) Multicostate or palmate : This type of pattern is having many principal veins arising from the tip of the petiole and proceeding upwards.



PARALLEL VENATION

MODIFICATION OF LRAVES

When leaves are' modified into different structures then it is called modification of leaves.

- (1) Leaf tendril- In some plants whole leaf is modified into a wire like structure which is called leaf tendril. Tendril helps is climbing. Eg. Lathyrus aphaca (wild pea) \rightarrow Peas.
- (2) Leaf spine Leaves are modified into pointed spines. Eg. Opuntia, Cacti, Argemone.
- (3) Leaf pitcher Leaves of some plants are modified into pitcher shaped structure. Eg. Nepenthes (pitcher plant) (Only lamina is modified into pitcher). Water is stored in the pitcher of Dischidia (complete leaf is modified into pitcher). In Nepenthes insectivorous pitcher while in Dischidia- non insectivorous pitcher is formed.
- (4) Leaf bladder In some plants, leaves are modified into bladder like structure Eg. Utricularia (bladder wort)
- (5) **Phyllode** In some plants petiole becomes flat leaf like green. Synthesises food and functions as normal leaf. Eg.: Australian acacia. Parkinsonia.
- (6) Leaflet tendril When leaflet is modified into tendril like structure then it is called leaflet tendril. Eg. : Pisum sativum (garden pea), Lathyrus odoratus (sweet pea).
 Note : Dispace (ways flater) is insective over plant and it also has modified leaves.

Note : Dionaea (venus flytrap) is insectivorous plant and it also has modified leaves.

(7) Leaflet hook - eg. Cat's nail (Bignonia unguis cati)



SIMPLE AND COMPOUND LEAF

- (1) Simple Leaf : A leaf is said to be simple. when its lamina is entire or may be incised to any depth, but not up to the midrib or petiole. Eg. :- Peepal, mango, radish.
- (2) **Compound leaf :** A leaf in which the leaf blade (lamina) is incised up to the midrib or petiole. Thus dividing it into several small parts. i.e. leaflets.

It has two types :-

(A) **Pinnately compound leaf :** In this type of leaf. leaf blade (lamina) is incised upto the mid rib and mid rib is known as rachis. A number of leaflets are present on a common axis. the rachis. Eg. Neem



- (B) Palmately compound leaf: In this type incisions of leaf are directed from leaf margins to apex of the petiole and all leaflets are attached at a common point i.e. at the tip of the petiole. Rachis is absent in palmately compound leq.f. Eg. Silkcotton (Bombax).
- A bud is present in the axil of petiole in both simple and compound leaves. but not in the axil of leaflets of the compound leaf.

PHYLLOTAXY

Phyllotaxy is the pattern of arrangement of leaves on the stem or branch. This is usually of three types;

- (i) Alternate : In this type a single leaf arises at each node at alternate manner. Eg. Mustard. chinarose. sunflower.
- (ii) **Opposite :** In this type of phyllotaxy a pair of leaves arise at each node and lie opposite to each other. eg, Guava. Calotropis, Ocimum
- (iii) Whorled : If more than two leaves arise at each node and form a whorl, then it is called whorled phyllotaxy. Ex. Alstonia (devil tree), Nerium



(A) Alternate (B) Opposite (C) Whorled

INFLORESCENCE

The arrangement of flowers on the floral axis is termed as inflorescence.

RACEMOSE/INDEFINITE : In this we of inflorescence the main axis continues to grow and does not terminate in a flower and flowers are borne laterally in an acropetal order/acropetal succession (Where old flowers are arranged at lower side and young flowers are at upper side). This is of following types :



Racemose inflorescence

1. Raceme - In this type of inflorescence, peduncle (main axis or floral axis) is elongated and flowers are pedicellate.

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

- Eg. Radish, mustard
- When peduncle is branched and each branch bear pedicellated flowers like raceme and are arranged in acropetal manner then it is known as compound raceme or Raceme of racemes or panicle Eg. Gulmohar, Cassia.



- 2. Spike In this type of inflorescence peduncle is elongated but flowers are sessile (without pedicel). Eg. Achyranthes.
 - When peduncle is branched and each branch bears spike like infloresence then the small branch having flowers is called spikelet and this arrangement is called spike of spikelets. Eg. Grass family (Gramineae = Poaceae).



3. Catkin/Amentum - In this type of inflorescence peduncle is thin, long and weak, and flowers are sessile and unisexual unisexual flowers develop on separate catkin. Eg. Mulberry (Shahtoot).



- 4. Spadix In this type of inflorescence peduncle is thick, long and fleshy and it has small sessile and unisexual flowers covered with one or more large green or colourful bracts (spathe). Eg. Colocasia, maize, aroids. (palms- compound spadix)
 - Grain of maize is a fruit (caryopsis).
 - Long filamentous threads (Silky hairs) protruding at the end of a young cob of maize are styles.
 - Mixed spadix is found in banana .

Edubull



- 5. **Corymb** In this type of inflorescence peduncle is short and all flowers are present at same level because the lower flower has much longer pedicel than the upper ones.
 - eg. Candytuft (lberis amara) = chandani, Capsella.
 - If peduncle is branched and each branch has flower cluster, then this type of inflorescence is called compound corymbs or corymbs of corymbs. eg Cauliflower



- 6. Umbel An inflorescence in which the flower stalks (Pedicels) are of more or less equal in length, arise from the same point. At the base of flowers stalk, there is whorl of bracts forming the involucres.
 - eg. CenteUa(brahmi)
 - If peduncle is branched and each branch has flower cluster then this type of inflorescence is called compound umbel or umbel of umbels eg. Coriandrum (coriander or dhania), Foeniculum (fennel or saunph), Cuminum (cumin or jeera) (Umbelliferae or Apiaceae family).



7. Capitulum/Racemose head (Anthodium) - In this type of inflorescence tip of peduncle becomes broad, flattened concave or convex (receptacle). On it small sessile flowers are found. These flowers are called florets. The florets which are present in centre are small & called disc

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

florets and florets which are present at periphery are large & called ray florets, florets A are arranged in centripetal order.



In this type of inflorescence florets may be unisexual, bisexual and sterile. This inflorescence is surrounded by one or more involucre. It is most advanced type of inflorescence, because a single insect can easily pollinate innumerable florets within a very short time without having to fly from one flower to another. The ultimate advantage is that this mass pollination helps the setting of seeds in most heads for reproduction, multiplication in number and continuity of species. Eg. Composite/Asteraceae family [Sunflower, zinnia, marigold (Tagetes)].

CYMOAE/DEFINITE

In this type of inflorescence, the main axis/peduncle terminates in a flower hence is limited in growth. In it the older flowers are present at upper side and young flowers are arranged towards the base. This type of arrangement is called basipetal succession/basipetal order.

It is of following types -



Cymose inflorescence

- 1. **Uniparous cyme/Monochasial cyme -** The peduncle ending in a flower producing one lateral branch at a time which also ending in a flower. It is of two types -
 - (a) Helicoid cyme When all lateral branches develop on the same side on peduncle forming a sort of helix, then it is called helicoid cyme. Eg. Heliotropium.
 - (b) **Scorpioid cyme -** In this type one lateral branch develops on one side and the other branch develops opposite to first one, i.e. they lie alternate to each other. Eg. Begonia



2. **Biparous cyme I Dichasial cyme -** In this type of inflorescence peduncle ends in a flower and from the basal part of peduncle two lateral branches arise which also end in a flower, now this same arrangement occurs on these lateral branches.

Eg. Bougainvillea, jasmine

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141



3. Multifarious cyme/Polychasial cyme - In this type of inflorescence peduncle ends in a flower and from the base of it many lateral branches arise, which also terminate in flower, this arrangement now also occurs on these lateral branches eg. Calotropis (madar)

SPECIAL TYPE OF INFLORESCENCE

1. **Cyathium** - The bracts or the involucres become fused to form a cup shaped structure, on the margin of it secretory gland is found. In the central part of cup shaped structure a female flower is found, which matures earlier. Due to the growth of pedicel this flower comes out from the cup shaped structure. Achlamydeous female flower is surrounded by small achlamydeous male flowers. The male flowers, which lie towards the centre mature earlier than the flowers which lie towards the periphery. Male flowers are represented by stamens

This type of inflorescence is found in Euphorbiaceous family - Euphorbia, Poinsettia.

Ratio of female & male flowers \rightarrow One : many

- 2. Verticillaster This type of inflorescence is found in Labiates/Lamiaceae family. In this type of inflorescence leaves are arranged in opposite manner on stem. From the axil of each leaf inflorescence develops. From the main axis, lateral axis arises, on which flowers are found. Now from these branches lateral branches develop also which bear flowers. In this type of inflorescence each dichasial cyme changes into monochasial (scorpioid) cyme. Eg. LabiataejLamiaceae family-Salvia, Ocimum (tulsi).
- **3. Hypanthodium** In this type of inflorescence upper part of peduncle is modified into a pear shaped structure having cavity with a pore (ostiole). At the base of cavity female flowers develop while towards the pore male flowers develop. All three types of flowers (male, female, sterile female) are present in this inflorescence. Eg. Ficus species banyan, fig, peepal Note : Cyathium & hypanthodium inflorescence are similar in having unisexual flowers.



ROOTS TO INFLORESCENCE

1. In which of the following type of underground modification of stem, storage of food does not occur in stem?

(1) Bulb (2) Rhizome (3) Corm (4) Tuber

Power by: VISIONet Info Solution Pvt. Ltd		
Website : www.edubull.com	Mob no. : +91-9350679141	

2.	Fasciculated roots are	e found in :-		
	(1) Asparagus	(2) Colocasia	(3) Ginger	(4) Turmeric
3.	Lamina is also known	1 as :-		
	(1) Phyllopodium	(2) Epipodium	(3) Mesopodium	(4) Hypopodium
4.	Phyllode & cladode a	re		
	(1) Homologous	(2) Analogous	(3) Vestigial organs	(4) Homoanalogous organs
5.	Name the inflorescen	ce in which only unise	xual flowers are preser	nt.
	(1) Cyathium	(2) Capitulum	(3) Raceme	(4) Umbel

GOLDEN KEY POINTS

- Tap roots arise from radicle whereas adventitious roots arise from any other part of plant other than radicle.
- Root cap is thimble like structure;
- Gladiolus is an example of corm.
- Opuntia and Euphorbia are examples of phylloclade.
- In Nepenthes, only lamina is modified into pitcher like structure.
- In Achlamydeous flower, accessory whorls are absent.
- In Portulaca food storing adventitious root is present.

FLOWER

A flower is a modified shoot where in the shoot apical meristem changes to floral meristem. Internodes do not elongate and the axis gets condensed. When a shoot tip transforms into a flower, it is always solitary.

Generally flower has a short or long stalk which is called pedicel. The upper part of pedicel is swollen, which is called thalamus. Floral leaves are present on it. There are 4 types of floral leaves.

(1) Sepal (2) Petal (3) Stamen (4) Carpel

- A typical flower has four different kinds of whorls arranged successively on thalamus. These are calyx, corolla, androecium and gynoecium.
- Calyx and corolla are accessory organs or accessory whorls while androecium and gynoecium 'are reproductive organs or reproductive .whorls or essential whorls.
- **Complete flower :** All four whorls are present.
- **Incomplete flower :** Any whorl is absent e.g. Unisexual flower
- **Bisexual flower :** Perfect flower
- Unisexual flower : Imperfect flower
- A flower may be timorous, tetramerous or pentamerous when the floral appendages are in multiple of 3,4 or 5, respectively. In divots flowers are usually pentamerous while in monocots flowers are timorous.

Edubull

Parts of a flower

SYMMETRY OF FLOWER

- 1. Actinomorphic/Radial/Regular When a flower can be divided into two equal radial halves by any vertical plane or radial plane passing through the centre, then it is said to be actinomorphic flower eg. Mustard. Datura. chilli.
- 2. Zygomomhic/Bilateral When a flower can be divided into two equal (similar) halves only by on particular vertical plane, then it is said to be zygomorphic flower. eg. Pea. bean. gulmohur. Cassia.'
- **3.** Asymmetrical/Irregular When a flower cannot be divided into two equal (similar) halves from any vertical plane passing through the centre, then it is said to be asymmetrical flower. eg. Canna.
- The part of flower which lies near to the mother axis is posterior part while the part which is far from the mother axis is anterior part of flower. The position of the mother axis with respect to the flower is represented by a dot on the top of the floral diagram.

TYPES OF FLOWERS ON THE BASIS OF INSERTION OF FLORAL LEAVES

The relative position of gynoecium changes with respect to floral parts. Based on the position of calyx, corolla and androecium in respect of the ovary on thalamus, the flowers are divided into three types.

- (1) **Hypogenous flower -** When gynoecium occupies the highest position while the other parts like petals, sepals and stamens are situated below the ovary, then the flower is called hypogynous and in this condition ovary will be superior. eg. Mustard. china rose. brinjal, mango.
- (2) **Perigynous flower** In it thalamus grows upwardly and form a cup shaped structure. On the margin or rim of thalamus floral parts are attached except gynoecium, which lies at-the basal part or in the centre. So in this condition gynoecium is situated below the other floral parts. But ovary in this condition is said to be half inferior. Eg. Rose. plum. peach.

Power by: VISIONet Info Solution Pvt. Ltd

Website : www.edubull.com Mob no. : +91-9350679141	rower by: visionet into solution rvt. Ltu		
	Website : www.edubull.com	Mob no. : +91-9350679141	

(3) Epigenous flower - When the margin of thalamus grows upward enclosing the ovary completely and getting fused with it and other parts of flower like petals, sepals & stamens are situated above the ovary, then the ovary is said to be inferior and rest of the floral parts superior. Eg. Guava, apple, cucumber and the rayflorets of sunflower.

BRACT

Bract is a reduced leaf found at the base of the pedicel of flower.

Bracteate flower - The flower with bract is called bracteate flower.

Ebracteate flower - Flower without bract is known as ebracteate flower.

Involucre - The whorl of bracts is called involucre.

Spathe - When large bract completely encloses whole inflorescence, then it is called spathe. Eg. Banana, maize

Petaloid bract - When the size of bract is greater than the size of flower and it is of various coloured like petals, then it is called petaloid bract. Eg. Bougainvillea.

Glumes - Small, dry, scaly bracts are called glumes. Eg. Wheat, grass (Gramineae family).

CALYX -

The outermost whorl of flower is called calyx. Each member of this whorl is called sepal, when all the sepals are free from each other, then it is called polysepalous condition eg. Mustard, radish. When the sepals are fused (united) with each other then this condition is called gamosepalous condition. Eg. Cotton, Datura, brinjal.

- Sepals are green leaf like and protect the flower in the bud stage.
- In calyx of Mussaenda, one of the sepal enlarges and forms a leaf like structure. It may be brightly coloured. It attracts the insects and thus acts as advertisement flag/advertising flag.
- In Trapa, Calyx is modified into spines and helps in protection of fruits.
- In the family of sunflower (compositae) sepals are modified into hairy structure which is known as pappus. The pappus is modified calyx and helps in dispersal of fruit by parachute mechanism.
- If sepals do not fall and remain attached to fruit, then they are called persistent sepals. Eg. Tomato, chilli, brinjal, cotton, Datura

COROLLA -

The second whorl of flower is called corolla and each member of corolla is called petal. When all the petals are free, then it is called polypetalous condition and when petals are fused, then it is called gamopetalous condition.

• Petals are usually of brightly coloured to attract insects for pollination.

FORMS OF COROLLA -

(A) Actinomorphic Polypetalous Corolla

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

- (1) **Cruciform -** In cruciform corolla 4 petals are found. These petals are arranged crosswise. The lower narrow part of petal is called claw while the upper broad part is called limb. Eg. Radish, mustard (Cruciferae)
 - (B) Actionmorphic Gamopetalous Corolla
 - (i) **Campanulate/Bell shaped-** In this type of corolla 5 fused petals are present. It's shape is similar to bell. Eg. Tobacco, raspberry, Campanula.
 - (ii) **Tubular** In this type 5 fused petals form tubular (t1,1be like) or cylindrical structure. Eg. Disc florets of sunflower.
 - (iii) **Funnel shaped or infundibuliform -** In this type 5 fused petals are found. It's shape is similar to funnel. Eg. Datura, railway creeper, Petunia
 - (iv) Wheel shaped/Rotate In this type 5 gamopetalous petals are found and the fused parts form small tube and the petals are arranged in a whorl above the tube. Eg. Brinjal.

ZVGOMORPHIC POL YPET ALOUS COROLLA -

Papilionaceous (Butter fly shaped corolla)

In this type of corolla five petals are found. Posterior petal is largest and is known as standard or vexillum. Vexillum covers two lateral petals which are called wings or alae and the innermost anterior petals are united to form a keel or carina. Both lateral petals cover the keel. Eg. Pea, bean, gram, (Papilionatae).

ZVGOMORPHIC GAMOPETALOUS COROLLA

- (i) Bilabiate The petals of gamopetalous corolla are divided into two lips. The place between two lips is called corolla mouth Eg. Ocimum (holy basil = tulsi), Salvia (Labiatae family)
- (ii) Ligulate The upper part of corolla is long, flattened tongue like which is attached with short narrow tube. Eg. Ray florets of sunflower.

AESTIVATION

The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as aestivation. It is of following types :-

- (1) **Valvate** When the petal of a whorl lie adjacent to other petal and just touch one another at the margin without overlapping then it is known as valvate aestivation. Eg. Calotropis plant, Cruciferae, Solanaceae & Liliaceae family.
- (2) **Twisted** In this type one margin of a petal covers adjacent petal and the other margin is covered by another petal. One margin of the petal overlaps that of the next one and the other margin is overlapped by the another one. Eg. Cotton, ladyfinger, china rose (Malvaceae family).
- (3) **Imbricate** When both margins of the one petal are covered by the other two petals and both margin of another one, covers other. Rest are arranged in twisted manner OR If the margins of sepals or petals overlap one another but not in any particular direction, then it is known as imbricate aestivation.

Eg.: Cassia, gulmohur (Delonix regia).

- Ascending imbricate :- The posterior petal is innermost i.e., its both margins are overlapped. e.g. Caesalpinoidae sub-family of leguminosae.
- (4) Vexillary or Papilionaceous or Descending imbricate The posterior petal is outermost and largest and is known as standard or vexillum which overlaps the two lateral petals wings or alae. These two laterals petals overlaps two smallest anterior petals i.e. keel or carina. Vexillary arrangement is found in pea family. Eg. Pea. bean (Papilionatae sub-family of leguminosae family).
- (5) **Quincuncial :-** Out of the five petals, two are completely internal, two are completely external and in the remaining petal, one margin is internal and the other margin is external. e.g. Murraya.

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

ANDROECIUM

It is composed of stamens. When the stamens of an androecium are free from one another, then it is called polyandrous condition,

COHESION OF STAMENS:-

When the floral parts of similar whorl are fused, then it is called cohesion.

- (1) When stamens are united by their filaments only, then it is called Adelphi. It is of following types-
- (a) **Monoadelphous** In this type of cohesion all the filaments are united into a single bundle or one bunch but anthers remain free. In this type of cohesion a tube is formed around the gynoecium which is called stamina tube Eg. China rose (Malvaceae family).
- (b) **Diadelphous** In this type of cohesion filaments are united into two bundles but the anthers remain free Eg. Pea (Papilionatae). In these plants out of 10 stamens, 9 stamens are united into a bundle while 1 stamen remains free.
- (c) **Polyadelphous -** Filaments are united into more than two bundles. Eg. Citrus.
- (2) **Syngenesious -** Only anthers are united in bundle, but filaments remain free eg. Compositae family.
- (3) **Synandrous -** Anthers as well as filaments of stamens are united through their whole length. Eg. Colocasia, Alocasia, Cucurbitaceae family.

Monoadelphous

Polyadelphous

Synandrous

ADHESION OF STAMENS -

When the stamens are attached to other parts of flower, then it is called adhesion of stamens. I

(1) **Epipetalous -** Stamens are attached to the petals. Eg. Brinjal. (Solanaceae)

Diadelphous

- (2) **Epiphyllous or Epitepalous -** Stamens are attached to the tepals (perianth) . Eg. Lily. (Liliaceae)
- (3) **Gynandrous -** Complete stamens or only anthers are attached to the gynoecium. Eg. Calotropis, Aristolochia

LENGTH OF STAMENS -

There may be a variation in the length of filaments within a flower. as in Salvia and mustard.

Power by:	: VISIONet Info Solution Pvt.	Ltd
Website :	www.edubull.com	

(1) Didynamous - If four stamens are present and out of them two are long and two are short, then it is called didynamous condition. Eg. Lamiaceae/Labiatae family (Salvia)

Tetradynamous

Tetradynamous - When there are six stamens and they are arranged in two whorls. In outer (2) whorl, there are two short stamens while in inner whorl, there are four long stamens, this condition is called tetradynamous.

Eg. Cruciferae family (Mustard, radish, turnip).

GYNOECIUM

- Gynoecium is female reproductive organ of the flower and is made up of one or more carpels. •
- If only one carpel is present in gynoecium then this condition is called monocarpellary condition.
- If more than one carpel is present in gynoecium then this condition is called polycarpellary.
- When all the carpals in polycarpellary/multicar pillory condition are free, then this condition is called apocarpous, eg., lotus, rose, Michelin.
- When all the camels are fused, then this condition is called syncarpous, eg., Pap aver, Hibiscus. mustard, tomato.

PLACENTATION

The ovules are attached on ovary walls on one or more cushion like structure called placenta. The manner in which placenta or ovules are arranged on ovary wall is known as placentation or The arrangement of ovules within the ovary is known as placentation. It is of following types:

- Marginal : This type of placentation is found in monocarpellary gynoecium. In this type of (1) placentation placenta forms a ridge along the ventral suture of the ovary and the ovules are borne on this ridge forming two rows, as in pea. There is no true placenta. Eg. Pea (Leguminosae family).
- **Axile :** This type of placentation is found in multicarpellary, syncarpous gynoecium. Ovary is (2) multilocular and the ovules are borne on the central axis. Number of chambers are equal to the number of carpels fused. Eg. china rose, lemon. tomato.
- **Parietal**: This type of placentation is found in unilocular syncarpous ovary. The ovules (3) develop on the inner wall of the ovary or on peripheral part. Eg. Mustard and Argemone.
- In some plants, ovary is one chambered but it becomes two chambered due to formation of false septum or replum, Cruciferae family (Eg. Mustard. Capsella) and Argemone.
- Free central/Central : This type of placentation is found in syncarpous gynoecium. In it, the (4) ovary is unilocular (septa are absent) and the ovules are borne on the central axis. eg. Primrose. Dianthus
- Basal : The ovary is unilocular and the placenta develops at the base of ovary and a single (5) ovule is attached at the base of ovary. Eg. Marigold, sunflower (Asteraceae / Compositae family), Gramineae / Poaceae family.

Power by: VISIONELING Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

(6) **Superficial :** This type of placentation is found in multicarpellary, syncarpous, multilocular gynoecium. The ovules are attached on the entire inner surface or walls of loculii Eg. Nymphaea (water lily)

FRUIT

The fruit is the characteristic feature of the flowering plants. It is the mature of ripened ovary, developed after fertilization. If a fruit is formed without fertilization of ovary, it is called a parthenocarpic fruit. In some fruits like grapes, banana seeds are not found and such type of fruits are called parthenocarpic or seedless fruits. Parthenocarpy can be induced through the application of growth hormones.

PERICARP (Fruit wall) : After ripening, the ovary wall changes into pericarp. This pericarp may be thick and fleshy or thick and hard or thin and soft.

In fleshy fruits pericarp (fruit wall) is made up of 3 layers :-

(a) Outermost layer	=	Epicure
(b) Middle layer	=	Mesocarp

(c) Innermost layer = Endocarp

- (a) **Epicarp** It is the outermost layer, it may be thick or thin and hard or soft. It forms outermost layer of fruit which is also called rind
- (b) Mesocarp : It is the middle layer which is thick and fleshy in mango, peach and date palm. In coconut, this layer is made up of fibres which is also called coir
- (c) Endocarp : It forms the innermost layer, it may be thin membranous (eg. Orange, Datepalm) or thick and hard (eg: Mango, Coconut)

TRUE FRUIT OR EUCARP : When the fruit is developed only from the ovary then the fruit is called true fruit.

Eg. Mango, Coconut, Zizyphus

FALSE FRUIT OR PSEUDOCARP : In some fruits, in place of ovary, some other parts of flower like thalamus, calyx and inflorescence are modified into fruit or a part of fruit. Eg. Apple, Strawberry, Pear, Mulberry, Fig, Cashew nut

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

False fruits of apple and strawberry

In apple, strawberry, cashew, etc. the thalamus also contributes to fruit formation. Such fruits are called flase fruits.

CLASSIFICATION OF FRUITS :

Fruits are divided into 3 types :

- 1. **SIMPLE FRUITS** These fruits develop from ovary of monocarpellary gynoecium or multicarpellary, syncarpous gynoecium and only one fruit is formed by the gynoecium. Simple fruits are of two types :
 - (a) Fleshy fruits (b) Dry fruits

(a) **FLESHY FRUITS** - In fleshy fruits, fruit wall (pericarp) is differentiated into epicarp, mesocarp and endocarp, these fruits are indehiscent.

Fleshy fruits are of following types :

(1) **DRUPE FRUITS :** These fruits develop from monocarpellary, superior ovaries and are one seeded. In these fruits endocarp is hard and stony, so these fruits are also called stony fruits. Eg. Mango, coconut, almond, peach, walnut, plum. In mango the outermost cover or thin rind is called epicarp. Middle edible fleshy part is mesocarp and the inner stony hard endocarp. In plum (Ber), epicarp and mesocarp both are edible while endocarp is stony.

The hard covering of almond and walnut is endocarp and their edible part is seed. In coconut epicarp is hard and thin while mesocarp is thick and fibrous. The endocarp is hard and seed is proteced in it. The sweet water and edible part of coconut are liquid and solid endosperm respectively.

- (2) **BERRY :** These fruits develop from mono or multicarpellary, syncarpous ovary. Ovary may be superior or inferior. Placentation is axile. Generally epicarp is thin membrane like and seeds are embedded in fleshy part. Initially seeds are attached with placenta of fruit but after maturation these seeds are detached from placenta and are spread randomly in fleshy part. eg. Tomato, grapes, brinjal, guava, banana (date palm and betel nut are single seeded berry)
- (3) **PEPO :** These fruits develop from inferior ovaries. They have parietal placentation but looks like axile due to swelling of placenta. Eg. fruits of cucurbitaceae family like cucumber (khira), water melon (tarbooz), Cucurbita maxima (pumpkin), bitter gourd (karela), muskmelon (kharbuja).
- (4) **POME :** This fruit develops from inferior ovary and having enlarged thalamus Eg. Apple, pear. These are false fruits. Fleshy swollen thalamus of these fruits is edible part.

(5) **HESPERIDIUM :** They have axile placentation. This fruit is specially found in the plants of Rutaceae family. Eg. Orange, lemon.

Epicarp of these fruits is made up of thick rind which is having many oil glands. Mesocarp is the white fibrous structure which is attached with epicarp. Membranous endocarp projects inward and forms many chambers. Many glandular hairs are present on the inner side of endocarp. These glandular juicy hairs are edible.

(6) **BALAUSTA :** This fruit, develops from inferior ovary. Calyx is persistent which is arranged in the form of crown. Testa of seed is fleshy and juicy. Testa is the edible part. Eg. Pomegranate (Punica granatum) = anar.

Power by: VISIONet Info Solution Pvt. Ltd Website : www.edubull.com

Edubull

DRY-FRUITS

Pericarp (fruit wall) of simple dry fruits is not diffrentiated into epicarp, mesocarp and endocarp. In some dry fruits, pericarp dehisces/ruptures after ripening and seeds are dispersed, such fruits are called dehiscent fruits. In some fruits, pericarp breaks/splits into one or more seeded segments, such fruits are called schizocarpic fruits. In some fruits, pericarp does not dehisce even after maturing/ripening, such fruits are called indehiscent fruits.

Simple dry fruits can be divided into following three groups : (i) Indehiscent (ii) Dehiscent (iii) Schizocarpic

- i. **INDEHISCENT FRUITS** These fruits do not dehisce/rupture. These simple dry fruits are generally of small sized and single seeded.
- (1) **CYPSEIA:** This is a small, one seeded dry fruit which develops from bicarpellary, syncarpous, inferior ovary. In cypsela fruit pericarp (Fruit wall) and seed coat are free from each other and a bunch of hair is attached with the fruit which is known as pappus, Pappus helps in fruit dispersal. Pappus is modification of calyx. Eg. Compositae family (Sunflower, marigold).
- (2) **CARYOPSIS:** These are small, one seeded dry fruits, which develop from monocarpellary, superior ovary. In these fruits Pericarp is fused with the seed coat and form a joint surface. These fruits are present in family Gramineae. Eg. wheat, rice, maize etc.
- (3) ACHENE : In these fruits pericarp is free from the seed coat & pappus are absent. Eg. Clematis, Mirabilis, Boerhaavia.
- (4) **NUT :** This is a single seeded fruit, its pericarp is hard. Eg. Cashewnut, Trapa (water chestnut), litchi.

In litchi epicarp and mesocarp is fused and give leathery appearence. Endocarp is membrane like thin. An additional coat arround the seed is formed which is called aril. Actually it is a sort of third integument. In mature fruit, this aril is fleshy and is only edible part.

(5) **SAMARA:** These are dry indehiscent one seeded winged/feathery fruit. The main character of these fruits is that wing like structure develops from pericarp which helps in dispersal of fruits. Eg. Holoptelia (chil-bil), Dioscorea.

In Shorea robusta wing develops from calyx instead of pericarp and these fruits are called samaroid.

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

- ii. **DEHISCENT FRUITS** Pericarp of these fruits gets ruptured after ripening and seeds are dispersed outside. These fruits are mainly of 5 types:
- (1) **LEGUME ORPOD :** The fruits develop from monocarpellary, unilocular, superior ovary with marginal placentation. They are generally long and multiseeded fruits, Dehiscense of fruit occurs at both sutures i.e. dorsal and ventral suture. Dehiscence starts from apex/tip and reaches to basal part. Eg. Pea, beans, gram.
- (2) SILIQUA : This fruit develops from bicarpellary, syncarpous, superior ovary and ovary has parietal placentation. Dehiscence occurs from both dorsal and ventral suture, Dehiscence starts from lower part and proceeds upward (from base to the apex). Initially ovary is unilocular but due to formation of false septum/replum ovary becomes bilocular later on. On false septum seeds are attached. This type of fruit is found in Cruciferae family. Eg. Brassica (mustard).
- (3) SIUCUIA : Small, broad siliqua is known as silicula. It is reduced form of siliqua. Eg. Candytuft (!beris amara), Capsella
- (4) **CAPSULE** Dehiscence occurs by various methods. Poricidal (Porous), loculicidal, septifragal, septicidal.

Eg. Papaver (poppy = opium plant), Gossypium (cotton), Datura, Abelmoschus (lady finger), onion

iii. SCHIZOCARPIC FRUITS = SPLITTING FRUITS : After ripening, they break/split and divide into mericarps and after destruction of pericarp seed comes out. Each mericarp contains one or two seeds (Usually one seed).
 Schizocomic finite on of five times:

Schizocarpic fruits are of five types:-

- (1) **LOMENTUM:** These fruits are splitted in one seeded many mericarps, after maturity mericarps get separated with each other. Eg. Tamarind, Cassia fistula, Mimosa pudica, Arachis hypogea (ground nut/pea nut), Desmodium, Acacia (babool).
- (2) **CREMOCARP :** It is generally found in umbelliferae family. On maturation, it splits from apex to the base in such a way that two mericarps are formed and each mericarp contains one seed. These mericarp are attached with carpop.h ore. Carpophore is the extended part of thalamus. Eg. Coriander (dhania), Daucus (carrot), Cuminum (jeera = cumin), Foeniculum (saunph=fennel).
- (3) **REGMA :** In it 3 to 5 locules are present and it breaks/splits into 3 to 5 one seeded parts. Each part is known as coccus. At the outer side of pericarp, spines are found. Eg. Euphorbiaceae family (arand=castorfi?icinus) has three cocii and Geranium has 5 coccus.
- (4) **CARCERULUS :** It divides into four one seeded mericarps I locules & spines are absent. Eg. Ocimum (tulsi), Salvia.

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

AGGREGATE FRUITS

These fruits develop from multicarpellary, apocarpous gynoecium. In apocarpous condition each carpel is free from each other and it forms a fruitlet. Aggregate fruits are made up of a bunch of fruitlets which is known as etaerio.

(1) **Etaerio of achenes :** In this type of aggregate fruit, each fruitlet is an achene. Eg. Ranancu/us, strawberry, rose, lotus.

In lotus, thalamus becomes spongy and some achenes are embedded in it. In strawberry, thalamus is fleshy and small achenes are found on its surface. In rose, many achenes are present on a saucer (cup) like inner surface of fleshy thalamus.

- (2) **Etaerio of berries :** It is an aggregation of small berries. Eg. Polyalthia, Annona squamosa (custard apple = sitaphal). In etaerio of Anona all the berries are arranged densly on thalamus.
- (3) **Etaerio of drupes :** In this type of fruit, many small drupes develop from different carpels. Eg: Raspberry, blackberry.

COMPOSITE FRUITS = Multiple fruits

All composite fruits are false fruits.

In composite fruits, generally whole inflorescence is modify into fruit. These are of two types : **SOROSIS :** This fruit develops from spike, spadix or catkin inflorescence.

- (1) **SOROSIS :** This fruit develops from spike, spadix or catkin infloresc Eg. : Pineapple (annanas) jack fruit (kathal), mulberry (shahtoot).
- (2) **SYCONUS OR SYCONIUM :** This fruit develops from hypanthodium inflorescence. Many achenes develop from the pistillate flowers. Eg. Ficus species like Fig [anjeer (Ficus carica)], peepal (Focus religious)

Power by: VISIONet Info Solution Pvt. Ltd
Website : www.edubull.com

• Geocarpic fruits : Underground fruits are called geocarpic fruits. E.g. A rachis (groundnut)

Dispersal of fruits and seeds

We know that most of the plants do not move from one place to another. They grow, produce flower and fruits while remaining fixed at one and the same place. The seeds falling directly under the mother plant have to germinate and develop under limited food supply and space. To overcome this problem, the fruits and seeds have developed several special devices for wide dispersal. The natural agents like wind, water and animals and even mechanism of dehiscence in some fruits, help the seeds and .fruits to disperse from one place to another, and to long distances from the parent plant.

Wind-

In the species where the seeds are light in weight or have some accessory part to help dissemination, are dispersed by the air current. The seeds of Drum-stick and Cinchona, and fruits of yam, maple and sal tree, are provided with one or more appendages in the form of thin, flat and membranous wings, which help them to float in the air and be carried away to long distances. In the members of Asteraceae, the calyx is modified into hair-like structures called pappus. They persist in fruit and open out like umbrella, helping the seeds to float in the air. In poppy and prickly poppy (Argemone), the fruit dehisces and seeds are thrown out to a distances away from the parent plant. The seeds of Calotropis, Alstonia and cotton are provided with hair and cover sufficient distances alongwith the wind.' The seeds of orchids and some grasses are very small and light in weight and may be easily carrie'a away by wind to far off places.

Water-

The fruits and seeds with specialised devices which may be in the form of spongy and fibrous outer walls as in coconut and spongy thalamus as in lotus, and small seeds with airy aril as in water lily, float very easily in water and are carried away to long distances with the water current.

Animals-

The fruits and seeds with hooks, spines, bristles, stiff hair, etc., get attached to the body of hairy and woolly animals and are carried away by them to distant places. For instance fruits of Xanthium and Urena bear curved hooks, spear grass has a bunch of stiff hair, Tribulus has sharp and rigid spines Boerhaavia has sticky hair, which help their dispersal by animals. The edible fruits like guava, grape, fig and plum are dispersed by birds and even human beings, either by feeding on them and passing out undigested seeds with faeces or by carrying them to other places for later feeding.

Defense mechanism in plants

Plants have developed special organs or devices to repulse or avoid the attack of their enemies. Some plants like lemon, pomegranate and Duranta have thorns ; pineapple, datepalm, Agave and Yucca have sharppointed spines at the leaf ends ; silk cotton tree and rose have prickles ; Opuntia and other cacti have spines for their protection from animals. The stinging hair with

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

sharp and siliceous apex occur on all parts of the body in nettles (Laportea spp) and Urtica dioica. Glandular hair with sticky substances are present in Jatropha, Boerhaavia and tobacco. The dense coating of hair or stiff hair which are always repulsive to animals are found in cud-weed (Gnaphalium) and in many cucurbits.

There are other defense devices like the presence of poisonous and irritating substances in the plants. These are in the form of latex in Ficus, Nerium and Euphorbia; alkaloids in poppy, Datura and tobacco, and irritating substances in Colocasia and other aroids. The plants of neem and karela have a bitter taste. Production of tannin, resin, essential oils, etc., in some plants and the geophilous habit in others (e.g. zinger , turmeric, colocasia and onion) are protective measures. Some plants like guava, mango and litchi have a habit of harbouring ants (myrmicophily), which save the plant from damage by other animals. Mimicry is a habit of imitating the general appearance, colour, shape of other plants or animals, generally disliked by attackers. The aroids (Caladium) and Sansevieria resemble spotted snakes and are thus able to scare away plant-eating animals.

	EDIBLE PARTS OF SOME IMPORTANT FRUITS				
S.	PLANT	TYPE OF	EDIBLE PARTS		
No.		FRUIT			
1.	Abelmoschus esculent us / Lady's Finger /	Capsule	Whole fruit (vegetable)		
	Okra / Bhindi				
2.	Achrus sapota/Sapodilla/Cheeku	Berry	Mesocarp and endocarp		
3.	Anacardium occidentale/Cashewnut/kaju	Nut	Cotyledons and Peduncle		
4.	Ananas comosus = A. sativus / Pineapple	Sorosis	Fleshy axis, bracts fused		
			perianth &		
			Pericarp/Outer portion of		
			receptacle		
5.	Annona squamosa/Custard Apple/Sitaphal	Etaerio of	Mesocarp & Thalamus I		
		Berries	Pericarp		
6.	Arachis hypogea/Ground nut/Peanut	Lomentum	Seeds/Cotyledons		
7.	Areca catechu/Betel nut or Areca nut	Berry	Endosperm/seeds		
8.	Artocarpus integrifolia/Jack Fruit/Kathal	Sorosis	Bracts, Perianth and		
			seeds		
		2	(as vegetable and fruit)		
9.	Carica papaya/Papaya/Papita	Berry	Mesocarp and Endocarp		
10.	Cereals, Oryza, sativa (Rice), Hordeum	Caryopsis	Whole fruit		
	vulgare (Barley), Triticum aestivum (13read		(Endosperm and embryo)		
11	Citrus reticulate/Oran ac Citrus	Heanaridium	Inion alondulan hain		
11.	citrus feuculata/Orange, Citrus	Hesperialum	Juicy grandular hair		
	surentifolia/Lime				
12	Cocos nucifera/Coconut	Drupe	Fndosperm		
12.	Cucumis melo/Musk Melon/Kharbuja	Peno	Mesocarn Endocarn and		
13.	Cucumis meio/ wusk weion/ kharouja	Теро	seeds		
14.	Cucumis vulgaris/Water melon/Tarbooj	Реро	Mesocarp, Endocarp and		
15	Cuoumis sotivus/Cuoumbar/Vhaara	Pana	Magazam Endagam and		
13.	Cucums sativus/Cucumber/Kneera	repo	Young seeds		

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no

16.	Ficus carica/Fig/Anjeer	Syconus	Fleshy receptacle
17.	Fragaria vesca/Strawberry	Etaerio of	Fleshy thalamus
		achenes	
18.	Juglans regia/Walnut	Drupe	Lobed cotyledons of seed
19.	Litchi chinensis/Utchi	Nut	Aril
20.	Lycopersicom esculentum/fomato	Berry	Whole fruit (Pericarp and
			placenta)
21.	Pyrus malus (M. sylvestris)/ Apple	Pome	Fleshy thalamus
22.	Mangifera indica/Mango	Drupe	Mesocarp
23.	Morus alba, M. nigra/Mulberry	Sorosis	Whole fruit (Fleshy
			perianth,Fleshyaxis
24.	Phoenix dactylifera/Date/Khajoor	Berry	Pericarp
25.	Prunus amygdalus/ Almond	Drupe	Seed (Cotyledons and
			embryo)
26.	Musa paradisiaca/Banana	Berry	Less developed Mesocarp
			and well developed
			endocarp
27.	Psidium guajava/Crn.va	Beny	Whole fruit (Thalamus,
			pericarp and placenta)
28.	Pulses	Pod/Legume	Seed
29.	Punica granatum, Pomegranate/ Anar	Balausta	Fleshy testa of seeds
30.	Pyrus communis/Pear	Pome	Fleshy thalamus
31.	Solanum melongena/Brinjal	Berry	Whole fruit (Pericarp &
			Placenta)
32.	Tamarindus indica/famarind	Lomentum	Pericarp (Mesocarp)
33.	Trapa bispinosa/Water Chestnut/Singhara	Nut	Seed
34.	Vitis vinifera/Grapes	Berry	Pericap and placenta
			(whole fruit)
35.	Zizyphus	Drupe	Epicarp and mesocarp
	mauritiana/Zjujuba/Jujube/Chinease		
	Dates/Ber		

EXTRA POINTS

- 1. **Cladode :** In this modification branches of limited growth become green and flat like a leaf and perform photosynthesis. Eg. Asparagus (one internode long) Ruscus (2 internode long).
- **2. Bulbil :** It is modified vegetative bud with stored food, meant for vegetative reproduction E.g. Agave, oxalis, Dioscorea (Yam).
- **3. Cabbage** represents the largest bud.
- 4. **Pistillode :** Sterile pistil is known as pistillode eg. Some ray florets of compositae.
- 5. Staminode : Sterile stamen is called staminode. eg. Salvia, Caesalpinoidae (Cassia, gulmohur, tamarind)
- 6. **Isomerous flower :** When each whorl has an equal number of parts or its multiple, Just oppsite to isomerous is heteromerous.
- 7. **Polygamous :** A plant bearing bisexual, unisexual and even neutral flower is said to be polygamous. Eg. Polygonum, mango

8. **Position of style :**

- (a) **Terminal:** Arising from the tip of the ovary.
- (b) Lateral: Arising from the side of ovary. Eg. Mango,
- (c) **Gynobasic style :** Arising from the depressed centre of the four-lobed ovary or directly from the thalamus. Eg. Tulsi (Ocimum), Salvia
- 9. Clove (Syzygium aromaticum) = Unopened floral bud

10. Saffron (Crocus sativus) = Stigmas + Styles.

- 11. Attachment of filament to anther lobe
 - The attachment of filament to another lobe is of 4 types :
 - (a) Adnate Filament runs the whole length of the anther, from the base to the apex. Michelia (champa), Magnolia
 - (b) **Basifixed** Filament is attached to anther at its base. Eg. Datura, radish, mustard
 - (c) **Dorsifixed** The filament is attached at the centre to the back of the anther. Dorsifixed anther can not swing freely. Eg. Passion flower, Malvaceae family.
 - (d) Versatile Long filament is attached to the back of the anther at a point swing freely. Eg. Wheat, grass, maize (Gramineae family).

Versatile

Adnate

Basifixed

Dorsifixed

Power by: VISIONet Info Solution Pvt. Ltd Website : www.edubull.com

Edubull

FAMILIES OF ANGIOSPERMS			
Following symbols are used for floral f	formu	ıla :-	
Bracteate	=	Br Ebr	
	_		
Actinomorphic			
Zygomorphic	-	% or Φ or $+$ or \div	
Bisexual	=	∮ n ^{tr} tan t	
Unisexual male (staminate)	-	්	
Unisexual female (Pistillate)	=	Q	
Epicalyx	=	Epi or EpiK	
<u>Calyx</u>	='	K_{m}^{A} - Polysepalous condition K_{m}^{A} - Gamosepalous condition	
Corolla	=	C_{10}^{-1} - Polypetalous condition C \sim C_{10}^{-1} - Gamopetalous condition	
Perianth	-	$P_n - Polyphyllous or polytepalous condition P_{(n)} - Gamophyllous or gamotepalous condition$	
Androecium	=	A_{n}^{A} - Polyandrous condition A_{n}^{A} - Cohesion condition	
Gynoecium	-	G_n - Apocarpous condition $G_{(n)}$ - Syncarpous condition	
Superior ovary	=	Hypogynous flower = \underline{G}	
Inferior ovary	=	Epigynous flower = \overline{G}	
Ovary half inferior or half superior	-	Perigynous flower = G-	
Adhesion			
Epiphyllous condition	=	Ρ́À	
Epipetalous condition	=	ÉÀ	
Gynandrous condition	=	ÂG	

1 - CRUCIFERAE [= BRASSICACEAE] = Mustard family

1. Distinguishing Features of Cruciferae:-

(i) The plant organs have pungent odour. This odour is due to presence of sulphur containing glucosides compound.

Myrosin enzyme (present in secretory cells) hydrolyse them into glucose & different isothiocyanates (Various oils)

(ii) Inflorescence- Typical raceme.

Exceptions:-

- (i) lberis amara = Candytuft (chandani) has corymb type of inflorescence in which lower flower have much longer pedicels than the upper ones.
- (ii) The edible compound corymb inflorescence is present in cauliflower in which main axis (floral axis) is branched. Each branch is a corymb. It is a corymb of corymbs (compound inflorescence)

2. The common Characteristics of flower:-

(i) Flower - Ebracteate

Bisexual or hermaphrodite

Actinomorphic but sometimes zygomorphic e.g. lberis amara (Candytuft = Chandani) Flower- Hypogynous and tetramerous.

- (ii) Calyx Sepals 4, polysepalous, calyx arranged in two whorls 2 outer and 2 inner, imbricate aestivation.
- (iii) Corolla- Petals 4, polypetalous, valvate aestivation and cruciform/cross form.
- The each petal in cruciferae is divided into two parts -long claw and broader (spreading) lamina-limb. i.e clawed petals.
- Some petals are transformed into stamens in Capsella.
- (iv) Androecium :- Stamens 6, arranged in two whorls in which two outer stamens are small (antisepalous) and inner four stamens are long (antipetalous). This condition is known as tetradynamous.
- Polyandrous condition is found.
- Anthers are dithecous.
- (v) **Gynoecium:** Bicarpellary, syncarpous.
- The ovary is unilocular in the begining but it becomes bilocular later on due to the formation of a false septum (replum). Replum is developed from the thalamus inplace of wall of the ovary.
- Placentation is parietal.
- (vi) Fruit:- Usually siliqua (eg. Mustard)
 Silicula fruit is found in Capsella, Iberis (Chandani), Lepidium and Alyssum. The small, broad siliqua is known as silicula.
- (vii) Seeds :- Non endospermic
- (viii) Floral Formula:-

3. Economic importance :- The family includes a large number of plant species which are of immense importance to mankind as follows:-

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

[A]	Food Stuff		
(i)	Radish (Muli)	=	Raphanus sativus- Fusiform root.
(ii)	Turnip (Shaljam)	=	Brassica rapa - Napiform root
(iii)	Cauliflower (Phool gobhi)	=	Brassica oleracea var. botrytis, immature inflorescence is edible.
(iv)	Cabbage (Patta gob hi)	=	Brassica oleracea var. capitata, fleshy leaves of bud are edible.
(v)	Knol-Khol (Ganth gobhi)	=	Brassica oleracea var. caulorapa, thickened stem is edible.
(vi)	Mustard (Sarson)	=	Brassica campestris (yellow); B.napus (black)
(vii)	Rai	=	Brassica nigra (Black Rai), Brassica-alba (white
			Rai) ; Brassica juncea (Local Rai)
[B]	Ornamental plants:		
(i)	Chandani (Candy tuft)	=	Iberis amara
(ii)	Wall Flower	=	Cheiranthus cheiri
(iii)	Shepherd's purse	=	Capsella bursa -pestoris

2. MALVACEAE = Cotton family, Mallow family

[1] Diagnostic features of malvaceae:-

The mucilage is present in various plant organs like flower, fruit. Stellate (star shaped) hairs are present on the shoot.

Inflorescence:- Cymose or solitary- solitary axillary or solitary terminal.

• Most of the economically im.p ortant fibre yielding plants belong to family malvaceae .

[2] General characteristics of flower:-

- (i) **Flower :-** Bracteate- Bracts are big and green in colour because simple leaves function as bracts. Flowers are bisexual, actinomorphic, hypogynous and pentamerous.
- (ii) Epicalyx :- Epicalyx (Bracteoles) are 3-7; free and green in colour. They are the transformed bracteoles.

The structure of the bracteoles are like as bracts which is present on pedicel. Valvate aestivation.

- (iii) Calyx:- sepals 5, gamosepalous, valvate aestivation. In some of the plants persistant calyx are present, it means they are present on fruit eg. Abelmoschus (Bhindi) and Gossypium (Cotton).
- (iv) **Corolla:-** Petals 5, polypetalous, twisted aestivation, mucilagenous and attractive.
- (v) Androecium :- Stamens infinite, monoadelphous means filaments united together in one bundle and anthers remain free.
 - Anthers kidney shaped, Monothecous
- The filaments are united together to form a long staminal canal or staminal tube around style.
- Staminal tube is united with the petals at the base of the flower, so stamens are epipetalous.
- (vi) **Gynoecium:** Pentacarpellary or polycarpellary, syncarpous but stigma's are free, so gynoecium is incompletely syncarpous.

The number of locules are equal to the number of carpels, so ovary is pentalocular or multilocular.

The ovary and style are enclosed in stamina tube but stigma remains outside. Axile placentation

- (vii) Fruit:- Loculicidal capsule e.g. Lady finger, Cotton.
- (viii) Seeds:- Non endospermic
- (ix) Floral formula:-

- [3] **Economic importance :-** The family includes many plants of great economic importance e.g. food, fibres, oils, medicine and ornamentals:-
 - (a) **Food:-** (i) Okra/bhindi(Lady finger) = Abelmoschus esculentus or Hibiscus esculentus used as vegetable.
 - (b) Oils:- From Cotton seeds (Gossypium seeds). The seeds of Gossypium are used for obtaining oil which is hydrogenated to prepare vegetable ghee.Volatile oil known as Musk seed oil used in perfumary is obtained from Hibiscus abelmoschus seeds.
 - (c) **Fibres :-** Most of the economically important fibre yielding plants belong to the family malvaceae
 - (i) Surface fibres:- These fibres are obtained from the surface of the seeds.
 - Cotton = Gossypium.
 - (ii) Soft fibres or Bast fibres :-
 - (a) **Patua** = Hibiscus sabdariffa (Rosella hemp)
 - (b) **Patsan** [Deccan hemp] = Hibiscus cannabin us
 - (d) Tunber:
 - (i) Ochroma lagopus = Balsa wood, lightest wood
 - (ii) Malva sylvestris = Mallow wood
 - (e) Medicine :

Urena repanda - These roots are useful in hydrophobia.

- (f) **Ornamental**:
 - (i) **China rose [Shoeflower]** = Hibiscus rosasinensis- Red shoes polish is obtained from the petals of this flower.
 - (ii) Holly hock [Gul-e-khera] = Althaea rosea (Blue colour is obtained from its leaves)
- (g) Vitamins:- Gossypium seeds are rich in vitamin A, D, E, and B- complex.

3. SOLANACEAE = Potato family

[1] It is distributed in tropics. subtropics and even temperate zones. Many ovules are present in the ovary sci many seeds are formed as in tomato, brinjal etc.

- Most of plants of this family are herbs, some of them are shrubs, rarely small trees.
- Underground stem in potato.
- Stem herbaceous rarely woody, aerial, erect, cylindrical, branched, solid or hollow. hairy or glabrous (Smooth).
- The tap root system is present in these plants.
- Leaves are simple rarely pinnately compound and exstipulate, alternate, venation reticulate. Bicollateral vascular bundles are present in stem

Edubull

Solanum nigrum (makoi) plant : (a) Flowering twig (b) Flower (c) L.S. of flower (d) Stamens (e) Carpel (f) Floral diagram

- [2] Inflorescence:- Solitary axillary, or cymose inflorescence as in Solanum. Monochasical cyme is of two types:-
 - [A] Helicoid cyme:- sp. of Solanum.
 - [B] Scorpioid cyme :- species of Atropa plants.
 - Exception :- Solitary terminal inflorescence is found in Datura.
- [3] Flower :- Rowers are bracteate or ebracteate, bisexual, complete, hypogynous, pentamerous and actinomotphic.
- [4] **Calyx:-** Sepals 5, gamosepalous (united), valvate aestivation and persistent. (eg. tomato, brinjal)
- [5] **Corolla:-** Petals -5, gamopetalous (united), aestivation valvate.
- [6] Androecium: Stamens 5, polyandrous, epipetalous stamens, introrse.
- [7] **Gynoecium:-** Bicarpellary. syncar:pous and axile placentation, ovary superior, bilocular. Special features:- SwoHen placenta and oblique septum. Ovaries arranged obliquely on thalamus, carpels move at $\angle 45^{\circ}$ in clock wise direction, posterior carpel turns on right side and anterior carpel turns on left side.
 - Multilocular ovary is formed in tomatoes and Datura due to formation of false septum.
- [8] **Fruit:-** Fleshy fruit- (tomato, brinjal) sometimes capsule (Datura).
 - The fruit of the Datura is septifragal capsule.
- [9] Seeds:- Many and endospermic/endospermous.
- [10] Floral formula :

Br or Ebr $\bigoplus \oint K_{(5)} \stackrel{\frown}{C}_{(5)} \stackrel{\frown}{A}_5 \stackrel{\frown}{\underline{G}}_{(2)}$

[11] Economic Importance :-

- (A) Food:
- (i) Potato = Solanum tuberosum edible part under ground ~tern- tuber
- (ii) Tomato = Lycopersicum esculentum
- (iii) Brinjal (Egg plant) = Solanum melongena

Power by: VISIONet Info Solution Pvt. Ltd		
Website : www.edubull.com	Mob no. : +91-9350679141	

- (iv) Makoi =Solanum nigrum
- (v) Chilli = Capsicum annuum (used as spice)
- (vi) Shimala Mirch = Capsicum frutescence
- (vii) Rasbhary (Goose berry) = Physalis- peruvian a (fruits are eaten)
- (B) Medicines :-
- (i) Atropa belladonna (Deadly night shade) The roots are used in the manufacture of drug belladonna. Atropine alkaloids is obtained from the roots Atropine is used to dialate the pupil of the eye.
- (ii) Stramonium is obtained from the seeds of Datura (Thorn apple) in which Scopolamine alkaloid is present. It is pain reliever and sedative.
- (iii) Henbane medicine (containing hyoscyamine alkalloid) obtained from the leaves of Hyoscyamus niger. It is used in the treatmet of asthama and whooping cough.
- (iv) Nicotine & anabasin alkaloid obtained from the leaves of Nicotiana tabacum (Tobacco)& N. rustica. It is nerve stimulent and are also used as insecticide.
- (v) Solanum xanthocarpum = (Nelee Kanteli) the juice of its used in rheumatism and cough.
- (vi) Withania somnifem = Asvagandh/Ashwagandha- Its root used as nerve tonic, leaves used in fever.
- (vii) Solanum nigrum = (Makoi) The fruit are laxative.
- (C) **Ornamental Plants :-** Many plants of the family are cultivated for their beautiful flower and fragrance as follows:-
- (i) Petunia alba and Petunia hybrida.
- (ii) Cestrum noctumum = Rat- Ki- Rani (Night Jasmine)
- (iii) Cestrum diumum = Din Ka- Raja (Day Jasmine)
- (D) **Fumigatory :-** Tobacco (Nicotiana tabacum)

4. LEGUMINOSAE

Leguminosae family is devided into 3 - subfamilies

1. Papilionatae/Papilionoideae/Lotoideae 2. Caesalpinoideae 3. Mimosoideae

SUB - FAMILY → PAPIUONATAE = Pea family= Pulse family = FABACEAE FAMILY

IMPORTANT FEATURES

It is distributed all over the world.

Trees, shrubs, herbs are found in this family.

- [1] **Roots :-** Roots are branched and tap root system is present. Root nodules are present. In root nodules N-fixing bacteria Rhizobium leguminosarum are present.
- [2] **Stem -** Erect or climber
- [3] Leaves :- Stipulate, simple or pinnately compound. leaf base pulvinate/pulvinus, venation reticulate, alternate
- [4] **Inflorescence :-** Typical raceme (racemose).
- [5] Flower :- Bracteate, bisexual, hypogynous, pentamerous and zygomorphic symmetry. The zygomorphic symmetry is due to presence of different (odd) petals (dissimilar petals & androecium).
- [6] **Calyx :-** Sepals 5. gamosepalous, aestivation imbricate or valvate (mainly valvate)

Power by: VISIONet Info Solution Pvt. Ltd Website : www.edubull.com

- [7] **Corolla :-** This is the first main diagnostic character for the subfamilies of leguminosae. Petals 5, papilionaceous (Butterfly shaped), polypetalous, one petal is odd out of 5-petals, towards the mother axis- means posterior in position. It is the largest and outermost petal which is called standard or vexillum.
- Below the vexillum, two small free lateral petals present which are known as wings or alae. (lateral in position)
- Anterior two petals fused together to form a boat like structure called keel or carina which encloses the essential organs. i.e. stamens and pistil/carpel. Such type of aestivation is called vexillary or descending imbricate.

Pisum sativum (pea) plant : (a) Flowering twig (b) Flower (c) Petals (d) Reproductive parts (e) L.S. of carpel (f) Floral diagram

[8] ANDROECruM

*

This is the second main diagnostic character for the subfamilies of Leguminosae. Stamens - 10: diadelphous (9) + 1

9 stamens fused together to form a sheath around the pistil while the tenth posterior one is free **Anther dithecous**

- [9] **GYNOECIUM :-** Gynoecium is monocarpellary, unilocular with many ovules, superior ovary. Style single and marginal placentation.
- [10] **FRUIT :-** Legume or pod (dry, dehiscent, one chambered fruit). Sometimes lomentum is also found eg. Arachis (mungphali)
- [11] **SEED :-** Non-endospermic, one to many

[12] FLORAL FORMULA :-

Power by: VISIONet Info Solution Pvt. Ltd Website : www.edubull.com Br $\Phi \ \Cite{M} K_{(5)} \ C_{1+2+(2)} \ A_{1+(9)} \ \underline{G}_{1}$ or Br % $\Cite{M} K_{(5)} \ C_{1+2+(2)} \ A_{(9)+1} \ \underline{G}_{1}$

[13]	ECONOMIC IMPORTANCE		
[A]	FOOD PLANT		
[i]	Arhar (Pigeon pea) - Pulse	=	Cajanus cajan (indicus)
[ii]	Chana(Gram) - Pulse	=	Cicer arietinum
[iii]	Mattar (Pea)	=	Pisum sativum
[iv]	Urad (Biak gram) - Pulse	=	Phaseolus mungo or vigna mungo
[v]	Mung (green gram) - Pulse	=	Phaseolus radiatus (esculentus) or vigna radiatus
[vi]	Masoor - Pulse	=	Lens esculenta or L. culinaris or Ervum lens
[vii]	French bean or Kidnev bean (Raima)	=	Vigna/Phaseolus vulgaris
[viii]	Soyabean - Pulse	=	Glycine max (G. soja) - Soyabean contains more
L' J			protein than meat
ſixl	Gwar (cluster bean)	=	Cymopsis tetragonoloba
[x]	Methi	=	Trigonella foenum graecum
[xi]	Mungphali (Ground nut)	=	Arachis hypogea
[xii]	Sem- Pulse	=	Dolichos lablab
[xiii]	Cowpea (chowla)	=	Vigna sinensis
[]			
[B]	FODDER		
[i]	Berseem	=	Trifolium alexanddrium. Used as green mannure
[ii]	Dhaincha	=	Sesbania
[C]	FIBRES		
	Sunhemp	=	Crotalaria juncea (ternatea)
[D]	TIMBER		
	Shisham	=	Dalbergia sissoo (Indian Red wood)
[E]	DYES		
	Neel (Blue dye)	=	Indigofera tinctoria (dye is ibtained from leaves)
[F]	MEDICINAL PLANTS		
			Glycyrrhize glebre. Its roots are used in cough &
	Mulaithi (Liquorice)	=	Orycynnicza gradia. Its noois are used in cougin &
	Mulaithi (Liquorice)	=	cold.
[G]	ORNAMENTALS	=	cold.
(i)	ORNAMENTALS Indian telegraph plant	=	cold. Desmodium gyrans
(i) (ii)	ORNAMENTALS Indian telegraph plant Sweet pea (Phool matar)	= =	cold. Desmodium gyrans Lathyrus odoratus
(i) (ii) (iii) (iii)	ORNAMENTALS Indian telegraph plant Sweet pea (Phool matar) Lupic	= = =	Cold. Desmodium gyrans Lathyrus odoratus Lupinus albus
(i) (ii) (iii) (iii)	ORNAMENTALS Indian telegraph plant Sweet pea (Phool matar) Lupic	= = =	Cold. Desmodium gyrans Lathyrus odoratus Lupinus albus
(i) (ii) (iii) (iii) [H]	ORNAMENTALS Indian telegraph plant Sweet pea (Phool matar) Lupic EDIBLE OIL OTHER_USES :-	= = = →	Cold.Desmodium gyransLathyrus odoratusLupinus albusSoyabean, groundnut
(i) (ii) (iii) (iii) [H] [I]	Mulaithi (Liquorice) ORNAMENTALS Indian telegraph plant Sweet pea (Phool matar) Lupic EDIBLE OIL OTHER .USES :- Abrus precatorius	= = = →	 Cold. Desmodium gyrans Lathyrus odoratus Lupinus albus Soyabean, groundnut Crab's eve = Ratti = Iweller's weight - iwellers use

5. LILIACEAE = Lily family

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

(1) Liliaceae is a monocot family.

Perianth is present in this family, It means there is no difference in between calyx and corolla. If perianth is green in colour then it is called sepaloid as in onion.

If perianth is coloured other than green then it is known as petaloid as in Uly.

(2) **DIAGNOSTIC FEATURES**

(A) HABIT:-

- Perennial herbs with underground bulbs/corms/rhizomes
- (B) ROOT

Usually adventitious/fibrous. Fasciculated roots are found in Asparagus (satawar).

(C) STEM

The aerial stem is present in few plants. (Dracaena, Yucca, Smilax etc.) Majority of the plants have underground stem. It is of following types -

- [i] BULBS eg. Onion, Garlic.
- [ii] CORM eg. Colchicum.
- [iii] RHIZOME- eg. Aloe.
- MODIFICATION

Cladode - eg. Asparagus, Ruscus

- (3) LEAVES
- Mostly basal, linear, alternate, exstipulate with parallel venation.
- Exceptionally reticulate venation is found in Smilax
- The stipule of Smilax and leaf tip of Gloriosa are modified into tendrils.

Allium cepa (onion) plant : (a) Plant (b) Inflorescence (c) Flower (d) Floral diagram

(4) **INFLORESCENCE** :- Soli~ary I Cymose; Often umbellate clusters.

Scapigerous umbel or Cymose umbel or Umbellate clusters- e.g. Onion and Garlic In this type of inflorescence, a axis called scape arises from the underground stem and on its top cluster of flowers develop, this bunch (cluster) of flowers looks like an umbel. But, truely speaking it is not umbel. The flowers are arranged in compact monochasial scorpioid cyme order.

(5) FLOWER

Bracteate, bisexual, complete, actinomorphic, hypogynous and trimerous.

(6) **PERIANTH**

Tepals 6, arranged in two whorls 3 + 3, Often united into tube. valvate aestivation

(7) **ANDROECIUM**

6 stamens, epiphyllous(epitepalous), arranged in two whorls 3 + 3, polyandrous.

(8) GYNOECIUM

 Power by: VISIONet Info Solution Pvt. Ltd

 Website : www.edubull.com
 Mob no. : +91-9350679141

Tricamellary, syncarpous, trilocular with many ovules, axile placentation, superior ovary.

- (9) FRUIT
 - Capsule (Onion), rarely berry (Lily).
- (10) **SEEDS :-** Endospermic/Endospermous
- (12) FLORAL FORMULA

- (13) ECONOMIC IMPORTANCE
- (A) FOOD
- (i) **Onion Allium cepa** Foul odour is due to an oil like organic compound of sulphur allyl sulphide formed in Fleshy leaves of bulb.
- (ii) **Garlic = Allium sativum -** Antidiabetic property is due to sulphur containing M-S-Allyl-Cystine Sulphoxide (SACS) in Fleshy leaves of bulb.
- (iii) **Satawar** = Asparagus used as vegatable.

(B) ORNAMENTAL PLANTS :-

- (i) Lily = Lilium bulbiferum
- (ii) Tulip = Tulipa
- (iii) Gloriosa

(C) MEDICINAL USES :-

- (i) Gvar patha (Ghee quar) =Aloe vera- Aloin, a purgative is obtained. The juice of the leaves is used as skin tonic and it increases the eye sight.
- (ii) Garlic (Lahasun) =Allium sativum =It is very useful in heart disease, rheumatism &' diabetes.

(D) **OTHER USES :-**

Colchicum autumnale - Colchicine (mitotic poison) is obtained from corms of this plant, which is used to induce polyploidy plants.

6. ASTERACEAE OR COMPOSITAE = Sunflower family

It is largest family of angiosperms, having largest geographical distribution. The name of this family is based on its inflorescence.

Special characters : Inflorescence mostly racemose head or capitulum. Calyx is usually represented by hairy structure called pappus or represented by minute scales. It is persistant & attached on fruit & helps in dispersal of fruits. Petals 5, gamopetalous, valvate aestivation. Stamens-5, epipetalous, syngenesious, ovary bicarpellary, syncarpous, inferior ovary,

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

unilocular, basal placentation. Fruit is cypsela with hairy pappus i.e. important character of this family. In Dahlia fasciculated roots are present.

10. FLORAL FORMULA

- (A) Ray florets \rightarrow Br % Q K_p C₍₅₎ A₀ $\overline{G}_{(2)}$
- (B) Disc florets \rightarrow Br $\bigoplus \ O K_p \xrightarrow{C_{(5)}} A_{(5)} \overline{G}_{(2)}$
- (C) Sterile florets \rightarrow Br Φ K_P C₍₅₎ A₀ G₀
- (It is a type of ray florets)

ECONOMIC IMPORTANCE :

- [A] **Food**:
 - (1) **Helianthus tuberosus -** Their tubers are eaten which contain inulin crystals.
 - (2) **Helianthus annuus** = Sunflower (Suraj mukhi)- The seeds of this yields valuable oil which is used for cooking purposes.

[B] Medicinal plants :-

- (1) Eclipta alba (Bhring Raj) Juice is used as hair tonic.
- (2) **Chrysanthemum cinerariaefolium = Guldaudi- Py**rethrum named insecticide is obtained.
- (3) **Taraxacum officinale** 'Taraxacum' medicine is obtained which is purgative and diuretic.

[C] Ornamental :-

- (1) **Helianthus annuus** = Sunflower
- (2) **Chrysanthemum** = Gul-Daudi
- (3) **Tagetes** = Genda (Marigold)

[D] Other Values :-

Parthenium hysterophorus/P.argentatum = Carrot grass or Congress grass- skin allergy develops from its pollen grains.

7. POACEAE OR GRAMINEAE = Grass family

Special character : This is the largest family of the Indian flora. Poaceae is a monocot family. Inflorescence spike of spikelets. Flowers zygomorphic, bisexual, but in Zea and Coix flowers are unisexual. Flowers are hypogynous and trimerous. Tepals 2, polyphyllous, membranous and situated in anterio lateral position. They are called lodicules. Stamens 3, polyandrous, versatile (Long filamant is attached to the back of the anther at a point only and anther can swing freely). Monocarpellary or tricarpellary, syncarpous, superior, unilocular ovary, placentation is basal, stigma is feathery. Fruit is caryopsis. Culm stem is present.

FLORAL FORMULA :-

Power by: VISIONet Info Solution Pvt. Ltd					
Website : www.edubull.com					

		(meml	Lodicule Dranous tepsi)	AGRAM
ECO	NOMI	C IMPORTANCE:-		
[A]	Orna	amental Plants :		
[]	Cync	adon dactylon = Doob		
[B]	Cere	als :-		
	(1)	Avena sativa	=	Jai/oat
	(2)	Hordeum vulgare	= 1	Barley/jau – It is the oldest ancient crop
	(3)	Oryza sativa	=	Rice
	(4)	Pennisetum typhoides	=	Bajra
	(5)	Secale cereal	=	Rye
	(6)	Sorghum vulgare	=	Jawar
	(7)	Triticum aestivum	=	Wheat
	(8)	Zea mays	=	Maize
[C]	Suga	ır:-		
	Sacc	harum officinarum		
[D]	Fibr	e Yielding Plants :-		
	S. m	unja = Moonj - Fibres obtair	led from stem	is used for making ropes, mats and baskets etc.
\mathbf{E}	Timl	her Vielding Plants •-		

Bambusa balcooa =Bamboo

[F] Other Uses :-

- (1) Hordeum vulgare (Barley = Jau) is used for making beer.
- (2) Zea mays is used in alcohol industry.

8. CUCURBITACEAE = Gourds family

Special characters : Stem pentangular, branched, with bicollateral vascular bundles. They are arranged in two circles. Inflorescence-Solitary axillary. Most of the plants of this family are monoecious, it means male and female flowers are present on the same plant. Flowers are ebracteate, pedicellate, flowers are incomplete, unisexual, actinomorphic symmetry, flowers are pentamerous and epigynous. 5 Sepals, gamosepalous, valvate aestivation. Petals 5, gamopetalous, valvate or imbricate aestivation. Tricarpellary, syncarpous, inferior ovary, unilocular, parietal placentation but it looks like axile placentation due to swelling of placenta. 5 Stamens, usually cohesion in three groups 1 + (2) + (2). It means four stamens are present in two pairs and fifth one is free, synandrous condition, Fruit is pepo. The bitter taste of the fruit is due to presence of tetracyclic triterpenes.

Power by: VISIONet Info Solution Pvt. Ltd	
Website : www.edubull.com	Mob no. : +91-9350679141

FLORAL FORMULA

Male flower - Ebr $\bigoplus O K_{(5)} C_{(5)} A_{1+(2)+(2)} G_0$

Female flower - Ebr $\bigoplus \ Q \ K_{(5)} \ C_{(5)} \ A_0 \ \overline{G}_{(3)}$

=

=

=

=

=

=

=

=

ECONOMIC IMPORTANCE :

VEGETABLES AND FRUITS

- (i) Kadoo (Pumpkin)
- (ii) Lauki (Bottle gourd)(iii) Kharbooza (Muskmelon)
- (iv) Ghia tore
- (v) Kakari
- (vi) Tarj,ooj (Water melon)
- (vii) Kheera (Cucumber)
- (viii) Karela (Bitter gourd)
- (ix) Tinda =
 Most advanced dicot family =
 Most advanced monocot family
 Most primitive dicot family =
- Cucurbita pepo or Cucurbita maxima Lagenaria vulgaris
 Cucumis melo
 Luffa cylindrica
 Cucumis melo var. utilissimus
 Citrullus vulgaris
 Cucumis sativus
 Momordica charantia
 Citrullus vulgaris var. fistulosus
 Asteraceae (compositae)
 Poaceae (Gramineae)
 Either Magnoliaceae
 Or
 Ranunculaceae (Butter cup family) (mainly Magnoliaceae)

BEGINNER'S BOX-2

FLOWER TO FAMIUES

1.	A flower can be regarded as perfect flower when :						
	(1) Only one essentia	l whorl is present	(2) Both essential whorls are present				
	(3) Both accessory w	horls are present	(4) Both essential whorls are absent				
2.	Beauty of Bougainvil	lea is due to :-					
	(1) Sepal	(2) Petal	(3) Bract	(4) Stipule			
3.	Pappus is characteristic feature of :-						
	(1) Cotton	(2) Lady finger	(3) Sunflower	(4) Mustard			
4.	Select the correct statement?						

Power by: VISIONet Info Solution Pvt. Ltd Website : www.edubull.com

- (1) In syncarpous condition one carpel is present
- (2) The number of locules are always equal to number of carpels in gynoecium
- (3) Free central placentation is found in primrose
- (4) Arrangement of ovaries is called placentation
- 5. Select incorrect statement ?
 - (1) Berry fruits are generally single seeded
 - (2) Tetradynamous stamens are found in mustard
 - (3) Tricarpellary gynoecium is found in the members of family Liliaceae
 - (4) In family Cucurbitaceae, plants are generally monoecious

GOLDEN KEY POINTS

- Half inferior ovary is found in plum, peach, rose.
- In apocarpous condition carpels are free.
- Generally the fruit consists of pericarp and seeds.
- In fabaceae, flowers are zygomorphic.
- Solanaceae is commonly called 'potato family'

ANSWER KEY

					BE	EGINN	ER'S B	OX-1			
1.	(1)	2.	(1)	3.	(2)	4.	(2)	5.	(1)		
					BI	EGINN	ER'S B	OX-2			
1	(2)	2	(3)	3	(3)	1	(2)	5	(1)		