MORPHOLOGY OF FLOWERING PLANT

Syllabus

MORPHOLOGY OF FLOWERING PLANT

Roots, Stem, Leaf, Venation of Lamina, Inflorescence, Flower, Fruit, Semi-Technical Description of a Typical Flowering Plant

Name : _____ **Contact No.** _____

MORPHOLOGY OF FLOWERING PLANT

LEVEL - I

1. Lateral root arise from -
(A) Pericylce (B) Cortex
(C) Endodermis (D) Stele

2. Root hairs are found -
(A) Elongation zone (B) Root cop
(C) Xtataration zone (D) Apical meristem

3. Roots are absent in -
(A) Wolffia (B) Podostemon (C) Pistia (D) Lemua

4. Sucking root are present in the plant -
(A) Betel (B) Cuscuta (C) Mangifera (D) Solanum

5. Pneumata phores are present in -
(A) Mangroves (B) Xerophytes (C) Hydrophytes (D) Lithophytes

6. Calyptra related with -
(A) Root cop (B) Growing point (C) Elangalium zone (D) Root hoviv zone

7. Water absorbation in plant with the -
(A) Lateral root (B) Root cop (C) Loot hair (D) All of these

8. Top root present in -
(A) Pea (B) Gram (C) Ground nut (D) All of these

9. Fibrous root present in -
(A) Rice (B) Onion (C) Wheat (D) All of these

10. Carrot shown in which type root -
(A) Fusiform root (B) Tuberous root (C) Conical root (D) Napiform root

11. Offset present in -
(A) Jasmine (B) Oxalis (C) Cyandon (D) Pistia

12. Stem tendrils is -
(A) Rose (B) Curcurbita (C) Casurina (D) All of these

13. Reticulate venation absent in -
(A) Smilax (B) Dioscoren (C) Triticum (D) Castor

14. Alternate phyllotaxy of arrangment present in -
(A) Calotropis (B) China rose (C) Merium (D) Nepenture

15. Twisted aestivation present in -
(A) Mustard (B) Hibiscus (C) Eassia (D) Pea

16. Axile placentation absent in -

(A) Malvaceae (B) Fabaceae (C) Lilyaceae (D) All of these

17. Example of drape truit is -

(A) Apple (B) Mango (C) Coconut (D) All of these

18. Endospermic seed present in -

(A) Maize (B) Castor (C) Wheat (D) Maize

19. Part present between the point of attachment of cotyledone & radicle in seed -

(A) Hypocotyl (B) Epicotyle (C) Embryoaxis (D) Noe

20. Stem hook present in -

(A) Rose (B) Citrus (C) Passiflora (D) Opuntia

Answer Key (Level - I)

1.	C	**2.**	C	**3.**	C	**4.**	B	**5.**	A	**6.**	A
7.	?	**8.**	D	**9.**	D	**10.**	C	**11.**	D	**12.**	B
13.	C	**14.**	B	**15.**	D	**16.**	B	**17.**	B	**18.**	D
19.	A	**20.**	A								

LEVEL - II

1. At root tip, number of divisions to produce 100 cell is -
(A) 25 (B) 50 (C) 99 (D) 100

2. Modification of tap roots for storage -
(A) Canical root (B) Fusi form root (C) Napiform root (D) All of these

3. Prop root present in -
(A) Hea ways (B) Picus (C) Money plant (D) Orchid

4. Secondary root is -
(A) Root hair (B) Root cop (C) Primary root (D) secondart root

5. Bulbils present in -
(A) Agave (B) Limium (C) Oxalis (D) All of these

6. Leaf spine present in -
(A) Opuntia (B) Kingiber (C) Nepenthes (D) Acacia

7. Epipetalous condition present in -
(A) Bringel (B) Lily (C) Citrus (D) Salvia

8. Edible part of apple is -
(A) Masocorp (B) Eudocorp (C) Pericarp (D) Thalamus

9. Primrose show type of placentation -
(A) Axile (B) Parietal (C) Free central (D) Marginal

10. Hypantuodium inflorescance present in -
(A) Ocimum (B) Ficus (C) Eaphorbia (D) All of these

11. Aloe & Agave ceave why shore water -
(A) To protect light (B) To resist drought
(C) To store food (D) All of these

12. Fusiform roots present in -
(A) Carrot (B) Radish (C) Turnip (D) Mirabilis

13. Climbing root present in -
(A) Ficus (B) Oxalis (C) Orchid (D) Protuos (Money plant)

14. Berry fruit is -
(A) Tomato (B) Banana (C) Briayal (D) All of these

15. Endospermic seed is -
(A) Wheat (B) Rice (C) Rice (D) All of these

16. Coconut is -
(A) Dupe (B) Pepo (C) Sorosis (D) All of these

17. Types of tendril present in -

(A) Heaflet tendril (B) Stem tendril (C) Stem & leaf tendril (D) None of these

18. Plant used for reliewing pair & treating cough -

(A) Petania (B) Atropa bellodona

(C) Witnania somuitera (D) All

19. Periantn present in -

(A) Fabaceae (B) Liliaceae (C) Solanaceae (D) Malvaceae

20. 10, stamen present -

(A) Pisum salivum (B) Solanum nigrum (C) Alinum cepa (D) All

Answer Key (Level - II)

1.	B	**2.**	D	**3.**	B	**4.**	D	**5.**	D	**6.**	A
7.	A	**8.**	D	**9.**	C	**10.**	B	**11.**	B	**12.**	B
13.	D	**14.**	D	**15.**	D	**16.**	A	**17.**	D	**18.**	B
19.	B	**20.**	A								

LEVEL - III

1. Monocot family is -
(A) Fabaceae (B) Liliaceae
(C) Solanaceae (D) Malvaceae

2. Berry fruit present in -
(A) Liliaceae (B) Solanaceae (C) Fabaceae (D) None of these

3. Root pocket present in -
(A) Parasite plant (B) Hydrophyte plant (C) Terrestrial plant (D) All

4. Tap root absent in -
(A) Pea (B) Gram (C) Ground nut (D) Onion

5. Napiform root present in -
(A) Mirabilis (B) Zea mays (C) Beet root (D) Radish

6. A leaf having a single or undivided lamina is called -
(A) Simple leaf (B) Compound leaf (C) Both (D) None of these

7. Diadelphous stamen present in -
(A) China rose (B) Salvia (C) Bringel (D) Pea

8. Variation in the length of filament -
(A) Mustard (B) Onion (C) Chinarose (D) All of these

9. Pentamerous flower is -
(A) Mustard (B) Onion (C) Makoi (D) All of these

10. Non endospermous seeds is/are -
(A) Bean (B) Gram (C) Pea (D) All of these

11. The edible part of sweet potato is -
(A) Stem (B) Root (C) Leaf (D) flower

12. Cuticle is absent in -
(A) Mesophytes (B) living roots (C) Mature stem (D) Leaves

13. The type of leaf in daucus carola is -
(A) Simple (B) Bipinnate (C) Tripinnate (D) Delempound

14. Cyatnium inflorescence is found in -
(A) Morus (B) Dorstenia (C) Ficus (D) Euphorbia

15. In cauli flower, the inflorescence is -
(A) Carymbose (B) Cymose (C) Recerue (D) Capithlum

16. Edible part of cauli flowre is -
(A) Bled (B) inflorescence (C) Flower (D) Fruit

17. Umbef in inflorescence is formed in -

(A) Xqusa (B) Colocasia (C) Coriandrum (D) Heliantnay

18. Spadix is an inflorescence found only in -

(A) Monocot (B) Dicot (C) Both 1 & 2 (D) None of these

19. Perantoge (%) sign used for -

(A) Actinomorphic flower (B) Zygomorphic flower

(C) In complete flower (D) Epigynous flower

20. Vivipary is observed in -

(A) Banyan (B) Bryophyllum (C) Ipomoea (D) Rhizo-phora

Answer Key (Level - III)

1.	B	**2.**	B	**3.**	B	**4.**	D	**5.**	C	**6.**	A
7.	D	**8.**	A	**9.**	C	**10.**	D	**11.**	B	**12.**	B
13.	D	**14.**	D	**15.**	A	**16.**	B	**17.**	C	**18.**	A
19.	B	**20.**	D								

Roots

Radical comes out/arise from the seed coat in the form of soft structure and move toward the soil. It develop and form primary root.

Types of Root :--

Root are of two types :

1. Tap root 2. Adventitious root

1. Tap root :-

It develops from radicle which is made up of one main branch and other sub-branches.

2. Adventitious root :-

In some plants after sometime the growth of tap root which arises from radicle stops and then roots develops from other part of plant which are branched or unbranched, fibrous & storge and known as adventitious roots.

Modified Roots :-

Tap and adventtious roots are modified in different forms to perform special functions and called modified roots.

1. Tap root modified for storage :-

(i) **Fusiform root** - These root are thicker in the middle and tapering on both ends. In this type of roots both hypocotyl and root help in storage of food. E.g. **Raddish**

(ii) **Conical root** - These roots are thicker at their upper side and tapering at basal end e.g. **Carrot.**

(iii) **Napiform** - These roots becomes swollen and spherical at upper end and tapering at like a thread at their lower and Eg. Turnip, Sugarbeet

(iv) **Tuberous root** - Such roots do not have regular shape and get swollen & fleshy in any portion of plant. Eg. Mirabilis.

(v) **Nodulated root** - Nodules are formed on branches of roots by nitrogen fixing bacterias. Eg. Plants of leguminosae family - Pae

2. Tap root modified for respiration

The plants which grow in marshy areas, scarcity of oxygen is found. The plants which grow at this region some branches of tap root grow vertically upward and comes on surface of soil. These roots are called pneumatophores by which air entered in side the plant and get oxygen for respiration Eg. **Rhizopora**

Adventitious root modified for storage :

(i) **Tuberous adventitious root** : When food is stored in these roots, they become swollen and form a bunch.

(ii) **Fibrous** - Roots are very thin and filamentous.

(iii) **Nodulose** - In this type tips of roots swell up. Eg. Melilotus

(iv) **Beaded or moniliform** - When root swell up like a bead at different places after a regular interval. E.g, **Vitis, Momordica**

(v) **Stilt roots** - When root arises from nodes and enter in side the soil and form a rope like structure, known as still roots Eg. **Maize.**

(vi) **Climbing roots** - These root arises from nodes and helps the plant in climbing E.g. Money plant, Monstera

(vii) **Respiratory root** - When the quantity of oxygen is low in soil then some root comes out from the soil and helps in respiration. Eg., Avicennia, Jussica.

(viii) **Foliar root** - When roots arise from leaf call as foliar roots E.g. **Bryophyllum.**

(ix) **Sucking or haustorial roots** - In parasitic plants, roots enter the in the stem of host plant and absorbed nutrition from there. E.g. **Dendrophthoe.**

Stem

Stem is a part of plant which lies above from surface of soil i.e., it shows negative geotrophic growth. It has nodes and inter nodes. Branches, leaf, flower bud and bracts are develops from nodes. etc. are develops from nodes.

Modification of stem :

A - Sub - Aerial Modification

(1) **Runner** - When stem grows and spread on the surface of soil. Roots are developed at lowe side and leaves from upper side from node Eg. **Cynodon dactylon.**

(2) **Stolon** - In it branches are small stem condensed and grow in all direction. After sometime, of growing their apical region comes out from the soil. Eg. **Fragaria.**

(3) **Sucker** - In it the main stem grow in the soil but branches develop from nodes above the soil. Eg., **Mint**

(4) **Offset** - Generally these are aquatic plants which have and fragile stem. Eg., **Pistia**

B - Underground modification

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

(1) **Tuber** - The tips of branches become swell in the soil. Eyes are found on them which are axillary buds and covered with scaly leaves. Eg., **Potato.**

(2) **Rhizome** - It is freshy and horizontally found below in soil small nodes and intermodes are found which are covered by scaly leaves. Eg. **Ginger.**

(3) **Corn** - It is condensed structure which grow vertically under the soil surface. Eg., **Colocasia.**

(4) **Bulb** - This stem has disc like structure and surrounds with numerous fleshy scaly leaves. Many roots are arise from its base. Eg., **Onion.**

C - Aerial modification

(1) **Stem tendril** - In this type axillary bud forms tendril in place of branches and helps in climbing of those plants which have weak stem. Eg. **Grapes.**

(2) **Phylloclade** - The stem is modified into a flat, fleshy and green leaf like structure and carries out photosynthesis like leaf. The leaves are modified into spines Eg. **Opuntia.**

(3) **Stem thorn** - Axillary bud, modified in to branched or unbranched spinges Eg., **Carrisa.**

Thorns are of 3 types -

(i) **Prickle** - These develop only from cortex and epidermis and found at nodes or internodes Eg. **Rose.**

(ii) **Sping** - It is modification of stipule and found on node.

(iii) **Thorn** - It is modification of branch and are found in axil of leaf Eg. Carrisa, Acacia

Leaf

The leaves develop from the nodes. It's main function is Photosynthesis and food making Axillary buds are found in its axil.

Leaf is divided into 3 main parts :

(1) **Leaf base** - The part of leaf attached to stem.

(2) **Petiole** - The part of leaf connecting the lamina with the branch or stem. petiolated or staked leaves are known as petiolate and when petiole or stalk is absent then leaves are called sessile.

(3) **Lamina** - It is a broad and flattened aprt of leaf. Its main functions are photosynthesis and transpiration.

Stipules :-

Leaves of some plants have lateral appendages on either side of leaf base, known as stipules.

Stipules are of varous types -

1. **Free lateral** - When two independently present on both sides of leaf base. Eg. Hibiscus rosasinesis.
2. **Interpetiolar** - When two leaves are meet oppositely at the node then nearest stipules of each leaf joint with each other. In this way only two stipules of two leaves are found in place of four Eg. Ixora.
3. **Intrapetioler** - In this both stipules of a single leaf joint with each other to form a single stipule.
4. **Foliaceous** - These type of stipules form a leaf like structure Eg. Pea
5. **Scaly** - Stipules are dry, small and are paper like.
6. **Spiny** - Stipules modified into spiny. Eg. Zizyphus
7. **Ochreate** - When both stipules of leaf combine together and form a tube like structure, it is called orhreate. Eg **polygonum**
8. **Adnate** - Both stipules are joint with petiole. Eg. rose
9. **Tendrillar** - Stipules are modified into tendrils like structure. Eg. Smilax

Types of Leaves -

1. Foliage-**leaf** - They are usually green coloured and their main function is photosynthesis.
2. **Cotyledonary leaf** - This leaf comes out during germination and helps in nutrition until the first leaf is not formed.
3. **Scale leaf** - Such leaves are usually dry membrance like and they can not do photosynthesis.
4. **Bract** - Bract are the leaves which contain flower in their axil.
5. **Bracteole** - These are leaf like structure found on pedicle.
6. **Floral leaf** - Sepals, petals and tepal and stamen, carpel are found in flower which are included in this type of leaf.

Duration of leaf :-

1. **Persistent** - Leaves of such plants are found in all season and do not (fall) shed combinedly. Eg. Pinge, Sara indica, Date palm.
2. **Caducous** - Leaves are shed as the bud formation takes place.

Note :-

1. **Cauline leaves** - When the leafs are found on stem and branches and nodes, then these are called cauline leaves.
2. **Ramal leaves** - When leaves are found on branches, then called ramal leaves.
3. **Radical leaves** - During favourable season leaves develop from the nodes of under ground stem and that they are developing from roots. This type of leaves are known as radical leaves.

Venation of lamina :-

The arrangement of veins in leaves (Lamina) is known as venation. It is of 2 types

1. Reticulate 2. Parallel

1. **Reticulate venation** - In it many veins divided into various branches and form a net like structure.

Reticulate venation is of 2 - types ;-

(a) Unicostate or pinnate - In this type of venation having only one principal view or midrib that give off many lateral veins which proceed toward margin and apex of lamina of the leaf and form a network eg. Mango, Guava, Peepal.

(b) **Mullicostate or palmate** - In this type of venation many principal views arising from the tip of petiole and proceed upward this is again two types :-

(i) **Multicostate divergent** - Many principal veins arising from the tip of petiole diverge from the another toward the margin of leaf blade eg. Coton, Arhar

(ii) **Multicostate convergent** - Many principal veins arising from the tip of petiole. At the base of leaf they are closely arranged but diverge from are another in middle part and converge towards the apex of leaf. eg. Camphor, Ziziphus, Tejpat

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

They are of 2 types -

(i) **Unicostate or pinnate** : This type of pattern having only one principal vein, that gives off many lateral veins, which proceed toward the margin of leaf blade in a parallel manner but the donot have veinlets.

(ii) Multicostate or palmate : Having many principal veins arising from the tip of the petiole and proceeding upwards.

Modification of leaves :

When in place of leaf some other structure develop, than it is called modification of leaves.

(i) **Leaf Tendril** - In it whole leaf is modified into a wire like structure which is called leaf tendril Eg. Lathyrus aphaca. (Sweet pea)

(ii) **Leaf spine** - Leaves or any part of leaflet are modified into pointed spine. Eg. Opuntia, Aloe.

(iii) **Leaf scale** - In it leaves become thin, dry and form a membrane or paper like structure. Eg. Ruscus.

(iv) **Leaf Pitcher** - Leaves of some plants are modified to pitcher shape. Eg. Nepenthes, Dischidia

(v) **Leaf bladder** - In some plant, leaves are modified into bladder like structure eg., Utricularia

(vi) **Phyllode** - In it petiole becomes flat structure and function as normal Eg. Acacia

(vii) **Leaflet tendril** - When leafleat is modified into tendril like structure than it is called leafleat tendril Eg. Pisum sativum (Pea)

Simple and Compound Leaf

(i) **Simple Leaf** : A leaf which may be incised to any depth, but not down to the midrib or petiole then this type of leaf called simple leaf.

(ii) **Compound leaf** : A leaf in which the leaf blade is incised up to the midrib or petiole, this dividing it into several small parts, known as leaf lets.

(A) **Pinnately compound leaf** : In this type of leaf mid rib is known as rachis. Leaf lets are arranged on both side of rachis.

It is of two types :

(i) Unipinnate : In this type of leaf division occur only once and leaf lets are directly attached on both sides of rachis. It the number of leaflet is even, then leaf is known as peripinnate.

If the number of leaflet is odd, it is known as imperipinnate :

(ii) Bipinnate : A twice pinate compound leaf

(ii) Tripinnate : A thrice pinnate comound leaf

(iii) Decomound : A compound leaf which is more than thrice pinnate.

(B) **Plamate compound** : In this type incision of leaf is directed from leaf margin to apex and all leaflets are attached on the upper end of petiole.

It is of following types :

(i) Unifoliate : When single leaf let is found. Eg. Lemon

(ii) Bifoliate : When two leaf lets are present. Eg. Bauhinia. Regnelidium

(iii) Trifoliate : When three leaf lets are attached Eg. Oxalis, Aegle.

(iv) Tetrafoliate : When four lets are attached to the peliole. Eg. Marsilia.

(v) Multifoliate : When more than four leaflet are found, then leaf is called multifoliate palmate compound leaf.

Inflorescence

Arrangement of flower on (shoot or peduncle system) of a plant is called inflorescence.

Recemose - In this type of infloresence the main axis continues to grow and close not terminate in a flower and give off flowers lateraly in acropetal manner. Where old flowers are arranged lower side and young flowers are upper side.

This is of foll. diff. types :

1. **Receme** - When peduncle or (main axis) is elongated and flowers are pedicellate.

   Eg. **Mustard, Raddish.**

   When peduncle is branched and each branch bear pedicelated flowers like racemose and are arranged in acropetal manner known as compound raceme or panicle Eg. Gulmohar, Amaltas, Cassia simea.

2. **Spike** - In it peduncle is elongated but flowers are sessile. Eg. Achyranthes.

   When peduncle is branched and each branch bear spike, like infloresence then the small branch having flower is called spikelet and this arrangement is called as spike of spikelet.

3. **Catkin** - In it peduncle is thin, long and weak, and flowers are sessile and unisexual Eg. Mulbery.

4. **Spadix** - In it peduncle is thick, long and fleshy and have small sessile and unisexual flowers covered with one or more green or colourfull bracts. Eg. Colcasia, Musa, Maize

5. **Corymb** - In it peduncle is short and all flowers are present at same level because the lower flower have much long pedicle than the upper one. Eg. Candytuft (Iberis amara)

6. **Umbel** - An inflorescence in which the flower stalks of more or less equal length, arise from the same point. At the base of flower stalk, there is whorl of bracts forming the involucure. Eg. Cantella.

   When in this type of inflorescence, peduncle is branched then each branch have flower cluster at the apex this type of inflorescence is called compound umbel. Eg. Coriandum

7. **Capitullum** - In it the growth of peduncle is related and it become broad, flattened concave or convex. On it small flowers are found. These flowers are called floret.

   If the flower of all capitulum are same, then it is called homogamous. If the younger flower towards centre and other towards the periphery, than it is known centripetal order. The flowers which have present in centre called disc floret and flowers at periphery are called as ray floret and arrangement of this type is called heterogamous. In this type of infloresence florets may be unisexual, bisexual and sterite. This infloresence is surrounded by one or more involucre. Eg. Helianthus, Launaea.

Cymose

In this type of inflorescence, the peduncle terminate in a flower. In it the order flowers are present at upper poriton and young bud are arranged towards base. This arrangement is called basipetal succession. It is of following types -

1. **Uniparouscyme** - The peduncle ending in a flower producing lateral branch at a time ending in a flower. It is two types -
   (a) **Helicoid cyme** - When all lateral branched developed on the same side on peduncle than it is called helical cyme. Eg. Heliotropism
   (b) **Scorpiod cyme** - In it the lateral branch if develop on one side and the other branch will develop opposite to first one. i.e., they lie alternate to each other. Eg. Bigonia, Hamelia

2. **Dischasial or biparous cyme** - In it peduncle ends in a flower from the basal part of peduncle two lateral branches arise which also ends in a flower now this same arrangement occur in these lateral branches. Eg. Gypsophylla, Sponaria, Dianthus

3. **Multiparous cyme** - In it peduncle ends in a flower and from the base of it may lateral branches arise, which also terminated in flower, this arrangement now also occur on these lateral branches Eg. Calotropis.

Special Type of Inflorescence -

1. **Cyathium** - The bracts or the involucre become fuseed to form a cup shaped structure on the margin of it secretory glands are found. In the central part of cup shaped structure a female flowers is found which mature earlier. Due to the growth of pedicle this is come out from the cup shaped structure. Female flowers are surrounded by small male flowers. These are also found on pedicle. This male flower which lie toward centre mature earlier than the flowers which are towards periphery.

   This inflorescence is found in euphorbiacea famliy like euphorbia, poisetia, pedilanthus.

2. **Vesticillaster** - This type inflorescence is found in labitae family. In this type of infloresence leaves-are arranged in opposite manner on stem. From the axil of each leaf inflorescence these branches lateral branches developsed also. On these flowers are found also. In this inflorescence each dichasial chyma changes into monochasial chyme.

3. **Hypanthodium** - In it peduncle is modified in narrow cup like structure. At the base of cup, female flower develops while towards mouth male flower develops. Eg. Banyan, Peepal.

Flower

The part from where flower arise is called bract. Flower is short or long on flower stalk which is called pedicle. The upper part or pedicle is swollen, spherical shaped or conical which is called thalamus, Floral leaves are present on it.

In a flower there are 4 type floral leaves are found.

(i) Sepal

(ii) Petal

(iii) Stamen

(iv) Carpel

Symmetry of flower

If the floral leaves are cylic arranged in a flower, than it is called cyclic flower. It floral leaves are spirally arranged than it is called spiral or acyclic flower.

1. **Actinomorphic** - When flower is divided by any vertical plane into two equal halves, then it is called actinomorphic flower eg. mustard.

2. **Zygomorphic** - When the flower is divided into two equal halves only by one vertical plane, than it is called zygomorphic flower. eg. Pea.

   If from median plane, it is divided into two equal halves, than it is called medianly zygomorphic, Eg. Ocimum.

   But if by lateral plane it is divided into two equal halves, than it is called laterally zygomorphic.

3. **Asymmetrical** - When the flower cannot be divided into two equal halves from any plane. then it is called asymmetrical flower e.g. canna.

Note :-

(i) **Anthophore** - Internode between calyx and corolla is called anthopore Eg. Silene

(ii) **Androphore** - Internode between corolla and androceium is called androphore, Eg. pasieflora.

(iii) Gynophore - Internode between androcium and gynoecium is called gynophore.

(iv) Gynandphore or Androgynophore - When androceium and gynoceium both are present on node than it is called gynandophore or androgynophore Eg. Cleome gynandra/

Note :-

The part of flower which lies near to mother axis is posterior part while the part whichis far from mother axis is anterior part of flower.

Insertion of floral leaves

The relative position of gynoceium changes will respect to floral parts and on this basis it is divided into three parts.

1. **Hpogynous condition** - When petals, sepals and stamen are situated below the ovary, the flower is called hypogynous and in this condition ovary will be superior. eg. mustard.

2. **Perigynous condition** - In it thalamus grow upwardly and from a cup shaped structure. On the margin of thalamus floral parts are attched except gynoceium while lie at the basal part. So in this condition gynoceium situated below floral part. But ovary in this condition is said to be half superior. Eg. rose, Primrose.

3. **Epigynous condition** - When petal, sepals & stamen are situated above the ovary, than the ovary is said to be inferior and rest of the floral part are superior. Eg. sunflower, guava, Apple

Bract - The part of the leaf of main axis from the axil of which flower arise is called bract.

Bracteole- Sometimes on the internodes of pedicle, small leaves arises which are called as bracteole.

Bracteate - The flower which arise from the axil of bract is called bracteate flower.

Involucre - The whorl of bract surrounding peduncle is called involucre.

Involucel - The whorl of bract lying below pedicle is called involucel.

Petaloid bract - When the size of bract of flower is greater than size of flower and these are of various coloured than it is called petaloid bract.

Glumes - Small, dry, scaly bracts are called Glumes. Eg. Wheat Grass

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, than it is called poly-sepalous condition eg. Mustard, Raddish. When the sepals are fused each other than it is called gameosepalous condition. Eg. Cotton, Datura, Brinjal.

1. In calyx of mussaenda, one of the sepal enlarge and from a leaf like structure. It may be white or brightly coloured. It attract the insects and thus act as advertisement flag.
2. In trapa, calyx is modified into spines and helps in protection of fruit.
3. In aceoniteem In spines are present on the surface of sepal which protect the flower bud.
4. In larkspur and balsum, the posterior part of sepal is modified into a narrow tube. This structure is called sepal spur. For attraction of insects in it Nector is stored.
5. In the family of sunflower, sepals are modified into hairy structure. It is called pappus. These pappus is a modified calyx and helps in dispersal of fruit.

Duration of Sepals

1. Some plants in which sepals fall just at the time of opening of flower bud thse are called caducous sepals. Eg. Poppy.
2. In some plants, sepals fall after polination than these are called deciduous.
3. Upto fruit formation, if sepals do not fall and remain attached to fruit, than these are called persistent. Eg. Tomato, Capsicum, Brinjal, Cotton, Dhatura

Sometimes below calyx, a whorl similar to sepals is found which is called epicalyx. Eg. in malvacea family.

Corolla

The second whorl of flower is called corolla and each member of it is called petals. Corolla lie above calyx. When the shape and size of petals are similar than it is called symmetrical while when they ar not similar, then they are asymmetrical. When all the petal are free, then it is called polypetalous while when petals are fused, than called gamopetalous.

Forms of corolla -

A. Polypetalous

i. **Cruciform** - In it 4 petal are found. The lower part of petal which is narrow is called claw while the outer broad part is called limb. These petals are arranged crosswise. Eg. Raddish, Mustard.

ii. **Caryophyllaceous** - It consists of 5 petals the claw of petals are short and the limb of petals from right angle to the claw eg. Dianthus, Gypsophylla.

B. Gamopetalous

i. **Campanulate** - In this type of corolla 5 gamopetalous petals are present. It's shape is similar to bell. Eg. Tobacco, Rusbury, flowers of campanula.

ii. **Funnel shaped or infundibuliform** - In it 5 gamopetalous petals are found also. It's shape is similar to funnel. Eg. Datura, Railway crreper.

iii. **Tubular** - In it 5 gamopetalous petals are found which form tubular or cylindrical structure. Eg. Disc flosets of sunflower. Which are situated in centre.

iv. **Rotate** - In it 5 gamopetalous petals are found and the fused part form above small tube and the petals are arranged in a whorl above tube. Eg. Brinjal.

Zygomorphic polypetallous corolla -

Papilionaceous - In it five free petals are found. It's posterior part is largest and is known as standard or vexillum. Vexillum is covered with two lateral petals which are called as wings and the innermost basal parts are united to form a keel or carina. Both lateral part covered the keel Eg. Pea, gram Arhar

i. **Bilabiate** - The petal of gamopetalous corolla is divided into two lips. The place between two lips is called corolla mouth Eg. Ocimum

ii. **Personate** - In this case also the corolla is bilabiate but the two lips are near to each other. Eg. Antirrhinum

iii. **Ligulate** - The upper part of corolla is long, flattened which is attached with short narrow tube. Eg. ray florets of sunflower.

Aestivation - In calyx and corolla the arrangement of petals with other petals or the arrangement of sepal with other is called aestivation. It is of following types ;

1. **Valvate** - When the petal of a whorl lie adjacent to other petal and just touches. It Eg. Oak, Mustard, One margin of the petal overlaps that of the next one, and the other margin is overlapped by the third one.
2. **Twisted** - In it the petal of one part is covered by adjacent petal and the other part is covered automatically by posterior petal. Eg. cotton, ladyfinger.
3. **Imbricate** - When both margins of the one petal are covered by the others two petals and both margin of another one covers other and of the remaining of these petals one margin is overlapped and the rest are arranged in twisted manner Eg. Cassia, Caesalpina.
4. **Vexillary** - In it standard or vexiullum covers two lateral petals. These two laterals covers two anterior ones. This vessilary arrangement is present in pea family. Eg. Pea, gram

Attachement of filament to anther lobe

This attachement of filament to another lobe is of 4 type :

1. **Adnate** - Michelia (Champa), Tobaco, Filament runs the whole length of the anther from the base to the apex.
2. **Basifixed** - Filament is attached to anther by its base. Eg. Datura, Raddish, Mustard flower.
3. **Dorsifired** - The filament is attached at the centre to the back of the auther. Eg. passion flower.
4. **Versatile** - Filament attached to the back of the anther at a point only, so that the anther can swing freely, Eg. Wheat grass, maize.

Cohesion of stamens :

When the floral parts of similar species are fused, than its is called cohesion. When the stamens of an androcium are free from one another, it is called polyndrous condition.

1. **Monoadelphous** - When all the filaments are united into a single bundle but anthers are free from each other. In this type of cohesion a tube is formed a round the gynocium which is called staminal tube Eg. Cotton, Holyhock, ladyfinger.
2. **Diadelphous** - When the filaments are united in two bundles but the anther remain free Eg. gram, Pea, bean.

   In these plants from 10 stamens, 9 stamens are arranged in bundle while 1 remains free.
3. **Polyadelphous** - When filaments are united into more than two bundles. Eg. Castor, Lemon.
4. **Synandrous** - When anther as well as filaments of stamens are united through their whole length. Eg.colocasia, Alocasia, Momordcia.

5. **Syngenesious** - In it only anthers are united in bundle but filament remain free.

Aanesion of stamens

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

1. Epipetalous - When stamens are attached to petals. Eg. Datura, Tobacco, Sunflower, Potato.
2. Epiphyllous - When stamens are attached to tepals. Eg. Onion.
3. Gynandrous - When stamens are attached to gynoceium or by anthers only Eg. Calotropis. Aristolochia.

Length of Stamens -

1. **Didynamous** - When there four stamens are present out of them two are long and two are shor than it is called didynamous. Eg. ocimum.

2. **Tetradynamous** - When there are six stamens and they are arranged in two whorls. In outer whorl, there are two stamens while in inner whorl, these are four stamens, this condition is called tetradynamous. It is of 2 types -

i. **Inserted** - When the stamens are similar than corolla. Eg. Datura.

ii. **Exerted** - Stamens are larger than corolla and are radially outward. Eg. Gulmohar are found.

COHESION OF OVULE (CARPEL)

1. When many carpels are fused, then they form ovary. But in it, stigma and style are separated with each other, Eg. Dianthus, Plumbago.
2. In carpels ovary are fused with style, but stigma are not fused, eg. In Malvaceae family Hibiscus rosasienensis, cotton.
3. When stigma are fused but the carpel and style are free. eg. Calotropis, Casis, fistula, Nerium.
4. Carpels are completely fused. This condition is found in max flowers, eg., Mustard Raphanus sativis, Lycopersiscan.

In syncarpous gynoceium how many carpels are fused, can be detected thorugh-

(i). No of stigma (ii) No. of style (iii) No. of lobes of ovary (iv) No. of placenta

Placentation :-

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

1. **Axile** - it is found in multicarpellary synarpous gynoceium. The fusing margin of carpels grows inward and meet in the centre of the ovary. Thus an axis forms in the centre the ovary thus ovary become multichambered in each chamber. The ovules are born on the central axis. Number of these chambers is equal to the number of ovules. Eg. Potato, China rose, Onion.

2. **Free central** - This type of placentation is found in syncarpous gynoceium. In it, the ovary is unilocular and the ovules are borne on the axis in the centre of the ovary.

This placenation is of 2 types :

i. Placentation is axile is begining. After sometimes walls of chamber destroy and only ovulated central axis lef.

ii. Superficial - This type of placentation is found in multicarpellary syncarpous gynoceium.

The ovules are attached on the walls of loculii Eg. Nymphae (Water lilly).

iii. Basal - The ovary is unilocular and a single ovule is borne at the base of ovary Eg. Sunflower.

Fruit

The seeds are protected inside fruit. But in some fruits, seeds are not found like in grapes, banana and such type of fruits are called parthenocarpic or seedles fruit.

Pericarp : After repening, the ovarian wall changes into pericarp. This pericarp may be thick and fleshy or thick and hard or thin and soft.

Pericarp is made up of 3 layers :

a. Outermost layer = Epicarp

b. Middle layer = Mesocarp

c. Inner most layer = Endocarp

a. **Epicarp** - It is the outermost layer it is thin and hard or soft part. 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, 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 membrane (eg. Orange date) or thick and hard (eg. Mango, Coconut)

True fruit : When the fruit is developed only from the ovary, the fruit is called as true fruit. Eg. Mango, Coconut, Zizyphus.

Flase fruit : In some fruits, in place of ovary, some other parts of flower like thalamus, Inflorescence, Calyx are modified to form a part of fruit.

Classification of fruits : Whether fruit is true or false can be broadly divided on the basis of :

1. Carpels present in gynoceium are whether free on in fused state.
2. One or more flower takes part in formation of fruit.

On the above two basis, fruits are divided into :

1. Simple 2. Aggregate 3. Composite

1. **Simpe fruit** : These fruit develop from monocarpellary ovary or multicarpellary syncarpous ovary and only one fruit is formed by the gynocium. Simple fruits are of two types :

a. Fleshy fruit b. Dry fruit

a. **Flashy fruit** - These fruit develops from superior or inferior syncarpous gynocelium these may be unilocular or multiocular these fruits are indehiscent. Dispersal of fruit occur after pericarp is destroyed. In this fruit pericarp is distinguished into epicarp, mesocarp and endocarp.

False fruit are of following types ;

1. **Drupe fruit** : These fruit develops from mono or multicarpellary, syncarpous, superior ovary. In these fruits endocarp is hard and stony so that these fruits are also called stony fruits. Eg, Mango, Coconut, Almond, Walnut. In mango the outermost cover or rind is called epicarp. Edible fleshy part is mesocarp and the part where seed is protected is called as endocarp. In ber, epicarp and mesocarp both are edible part while endocarp is drupe.

The rind of almond and walnut are endocarp and their edible part is seed. In coconut epicarp is hard and end thin while mesocarp is thick and consists, of hard fibres. The endocarp is hard and seed is protected in it. The sweet water and of coconut are liquid and solid endosperm.

2. **Berry** : These fruit develops from mono or multicarpellary syncarpous ovary. Ovary may be superior or inferior. Placenation is axile or parieal. In these epicarp is thin like membrane and seeds are embedded in fleshy part initially seeds are attached with placenta of fruit but after maturation these seeds are detached with placenta and are spread randomly in fleshy part.

i. Plants with superior ovary = Tomato, Grapes, brinjal.

ii. Plants with inferior ovary = guava, banana.

Date palm is one seeded berry. In it pericarp is divided into epicarp, mesocarp and endocarp, Epicarp is thin and soft while mesocarp is thick and fleshy and endocarp is **Arecanut** is a one seeded fibrous fruit. When its thick fibrous layer is removed then seed comes out which is hard.

3. **Pepo** : These fruit develops from tricarpellary, syncarpous and inferior ovary. This fruit is unilocular and have parietal placentation. These fruits are fleshy and spongy. Eg. fruits of cucurbitaceae family like cucumber, melon, cucurbita maxima, bitter gourd, muskmelon.

4. **Pome** : This fruit develops from bi or multicarpellary syncarpous inferior ovary. The rind and sponge are made up of thalamus. The main part of ovary is like to cartilage. It means it is hard and dry remain inside the fruit seeds are present in it. Eg. Apple, Pear.

5. **Hesperidium** : This fruit develops from multicarpellary, syncarpous, superior ovary. This fruit is specially found in plants of rutaceae family. Eg. Orange, Lemon.

Epicarp of these is made up of thick rind which is deathery and many oil glands are found in it. Mesocarp is the white fibrous structure which is attached with epicarp. Membranous endocarp projects inward and & formed. many chambers. Many glandular hairs are present on the inner side of endocarp. These glandular hairs are only edible parts.

6. **Balausta** : It is a multiocular multiseeds fruit, which develops from inferior ovary. It's pericarp is hard. Calyx is persistent which is arranged in the form of crown. If is persistant Carpels are arranged systemetically. Seeds are irregularly arranged on placenta. Endocarp is hard. Testa is fleshy and juceious. This is the edible part of fruit. Eg. Pomegranate. Punica granatum.

7. **Amphisarca** : This is multicarpellary and multichambered which develops from superior ovary. Pericarp is hard and fleshy placenta is found in them. The inner part of pericarp and placenta is edible part of fruit. Eg. wood apple, Aegle mamelos, elephant apple, feronia limonia.

Pericarp of simple dry fruits is hard and dry. In some dry fruits, this pericarp is ruptured and seeds are dispersed. These fruits are called dehiscent fruits. In some fruits, pericarp is divided into one or more seeded segments. Such fruits are called shizo carpic fruits. In some fruits, pericarp after the rupturing. Such fruits are called indehiscent fruits.

Simple dry fruits can be divided into following three groups :

i. Indehiscent ii. Dehiscent iii. Shizocarpic

Semi-Technical Description of a Typical Flowering Plant

The description of a flowering plant should be brief, sequential and in scientific language. This is required to designate a plant in its appropriate taxonomic position.

The plant can be Described Briefly in the following Way

- Habit — Herb, shrub, treesm, climber, creeper, etc.
- Habitat — Mesophyte, xerophyte or hydrophyte, etc.

- **Vegetative Character**

Roots	-	Tap or adventitious root system.
Stem	-	Herbaceous or woody, smooth, hairy, prickly, cylindrical, angular or flattened, etc.
Leaves	-	Deciduous or persistent, phyllotaxy may be alternate, opposite or whorled, petiolate or sessile, reticulate or parallel, blade may be simple or compound.

- **Floral Characters**

Inflorescence — Cymose or racemose and their subtypes.

Flower Parts		Sessile or pedicellate, bracteate or ebracteate, unisexual or bisexual, zygomorphic or actinomorphic, hypogynous, pergynous or epigynous, complete or incomplete, isomerous or heteromerous, etc.
Calyx	-	Polysepalous or gamosepalous, deciduous or persistent.
Corolla	-	Polypetalous (free) or gamopetalous (united), aestivation and special appendages.
Androecium	-	Polyandrous or united. If united, adelphous, syngenesious or synandrous.
Gynoecium	-	Free or united carpels, ovary superior or inferior, etc.
Fruits	-	Simple, aggregate or multiple, true or false fruits.
Seeds	-	Monocot or dicot, endospermic or non-endospermic, etc.

Description of this formula is Ebracteate, actinomorphic, bisexual, bimerous, calyx-4, polysepalous, in two whorls of two each corolla-4, polypetalous, cruciform, androecium-6, polyandrous, tetradynamous in two whorls, one with two, gynoecium-bicarpellary syncarpous, superior.

Symbols used in Floral Formula

Br - Bracteate	G - Gynoecium and carpels
Brl - Bracteolate	$\overline{G}$ - Inferior ovary
	$\underline{G}$ - Superior ovary
⊕ - Actinomorphic	Ebr - Ebracteate
♂ - Hermarphrodite or bisexual	Ebrl - Ebractealate
♀ - Female or pistillate	% - Zygomorphic
♂ - Male or staminate	
Epi - Epicalyx	
C-Corolla and petals	N - Nectar
K - Calyx sepals	
P - Perianth and tepals	
A - Androecium and stamens	Std - Staminodes

Symbols for Number of Floral Parts

The number of floral parts are written at right foot of the symbol. It they are fused they are bracked.

Some examples are given below

Sepals 6 free	K_6
Sepals 6 fused	$K_{(6)}$
Petals 5 free	C_5
Petal 5 fused	$C_{(5)}$
Stamens 10 free	A_{10}
Stamens 10 in two whorls of 5 each.	A_{5+5}
Stamens indefinite	A_∞
Stamens 10, diadelphous (9 fused and 1 free)	$A_{(9)+1}$
Carpels two free	G_2
Bicarpellary syncarpous	$G_{(2)}$

Floral Characters

i. **Inflorescence** Solitary, axillary or cymose as in Solanum.

ii. **Flower** Bisexual, actinomorphic, ebracteate, pedicellate, pentamerous and hypogynous.

a. **Calyx** - Sepals 5, united valvate aestivation, usually persistent as in brinjal, tomato, chilly, etc.

b. **Androecium** - Stamens 5, epipetalous, alternating with petals, inserted in corolla tube, filaments usually of unequal length, anters bithecous.

c. **Gynoecium** - Bicarpellary, syncarpous, ovary superior, bilocular, placenta swollen with many ovules.

e. **Fruits** - Berry or capsule.

f. **Seeds** - Endospermic, embryo straight.

iii. Ebr $\oplus$ $K_{(5)}\,\widehat{C_{(5)}A_{(5)}}\,\underline{G}(2)$

Economic Importance with Examples

Plants belonging to the family-Solanaceae has their importance in the following fields.

i. **Food** The family-Solanaceae includes a number For example, *Solanum tubersoum* (potato), *esculentum* (tomato), *Physalis peruviana* (ground cherry), *Capscicum annuum* (chillies), etc.

ii. **Tobacco** - Nicotiana tabacum and N.rustica contain toxic alkaloid nicotine. It is used for chewing, smoking and snuff.

iii. **Medicines** - Atropa bellodona is used to obtain Bellodona and atropine. Bellodona is used for relieving pain and treating cough. Atropine is used dilating eye pupil. *Datura stramonium* is used in asthma. Other medicinal plants are *Solanum xanthocarpum, Withania somnifera, Hyoscymus niger*, etc.

iv. **Ornamentals** - The common ornamental plants are *Cestrum nocturnum* (Rat-ki-Rani), *Petunia hybrida*, *Physalis peruviana* (cape gooseberry), etc.

Family - Liliaceae

1. Systematic Position

Division	-	Spermatophyta
Sub-division	-	Angiospermae
Class	-	Monocotyledonae
Order	-	Liliflorae
Series	-	Coronarieae
Family	-	Liliaceae

2. Distribution

The family-Liliaceae (lily family) includes about 250 genera and 3700 species showing world wide distribution. About 200 species are available in India.

3. Habit

Usually perennial herbs, perenating by underground rhizomes, corms or bulbs, rarely shrubs or climbers (eg. *Smilax*, *Glorisa*, etc).

4. Vegetative Characters

i. **Root** Generally adventitious, fibrous or fleshy (eg. *Asparagus*).

ii. **Stem** Herbaceous or woody. In some species underground bulbs or rhizomes.

iii. **Leaves** Mostly basal, alternate, linear, exstipulate with parallel venation.

5. Floral Characters

i. **Inflorescence** Mostly racemose, sometimes cymose, rarely solitary.

ii. **Flower** Bracteate, pedicellate, actinomorphic, incomplete, bisexual, trimerous and hypogynous.

a. **Perianth** Tepal six (3+3), aften united into tube, valvate aestivation.

b. **Gynoecium** Tricarpellary, syncarpous, trilocular with many ovules, axile placentation, rarely unilocular with parietal placentation, ovary superior, style simple with three lobed stigma.

c. **Fruit** A loculated capsule, rarely a berry.

d. **Seed** Endospermic, embryo curved or straight.

iii. Floral Formula $Br \oplus \varphi \; P_{(3+3)}A_{(3+3)}\underline{G}_{(3)}$

Economic Importance with Examples

Plants beloging to this family has their importance in the following fields.

i. **Food** *Allium cepa* (onion), *Allium sativum* (garlic) young shoots and fleshy roots of *Asparagus* (shatavar) are used as vegetables.

ii. **Medicines** *Aloe* leaves are used to cure piles, liver problems. Roots of *Smilax* are used as blood purifier. Raw onion is useful in constipation, diarrhoea and cholera. Dried corms of *Colchicum autumnale* (meadow saffron) are used against rheumastism and gout.

iii. **Ornamentals** The common ornamentals are *Ruscus, Yucca, Aloe, Asparagus, Gloriosa, Smilax, tulips, lilies*, etc.

iv. **Fibres** The fibre yielding plants of lily family are *Yucca filamentosa, Sansevieria roxburghiana*, etc.

Floral Diagram

A floral diagram provides information about the number of parts of a flower, their arrangement and the relation, they have with one another.

The floral diagram of flower tell us about the following characters of the flower.

i. Presence or absence of bract and bracteoles.

ii. The position of odd sepal.

iii. The number and arrangement of floral leaves in relation to one another.

iv. The cohesion and adhesion of floral leaves.

v. Aestivation of sepals and petals.

vi. Symmetry of the flower.

vii. Monothecous and bithecous nature of anther.

viii. Number of locules in the ovary.

ix. Types of placentation.

In the floral diagram, the position of the mother axis with respect to the flower is represented by a dot on the top of the floral diagram. Calyx, corolla, androecium and gynoecium are drawn in successive whorls, calyx being the outermost and the gynoecium in the centre.

Description of Some Important Families

I. Family-Fabaceae

This family was earlier called Papilionoideae, a sub-family of family-Leguminosae. It is distributed all over the world.

1. Systematic Position

Division	-	Embryophyta
Sub-division	-	Angiospermae
Class	-	Dicotyledonae
Sub-class	-	Polypetalae
Series	-	Calyciflorae
Order	-	Rosales
Family	-	Fabaceae

2. Distribution The family includes 600 genera and 13000 species. It is distributed all over the world except the Arctic regions.

3. Habit The plants are mostly herbs, however shrubs, trees and climbers are also common.

4. Vegetative Characters

i. **Root** Tap root with lateral branches. The lateral branches mostly contain bacterial nodules (with *Rhizobium* bacteria which fix atmospheric nitrogen).

ii. **Stem** Herbaceous or woody, erect or climbing.

iii. **Leaf** Alternate, pinnately compound or simple, leaf base, pulvinate, stipulate, venation-reticulate.

5. Floral Characters

i. **Inflorescence** Simple recema, axillary cyme or solitary.

ii. **Flower** Bracteate, pedicellate, subsessile, bisexual, mostly, irregular, zygomorphic, sometimes regular, pentamerous, hypogynous or slightly perigynous.

a. **Calyx Sepals** 5, gamosepalous, imbricate aestivation.

b. **Androecium** Stamens 10, usually diadelphous [(9) + 1] or monadelphous, sometimes free, polyandrous, another dithecous, basifixed (attached by its base).

c. **Gynoecium** Monocarpallary, ovary superior, unilocular with marginal placentation, style bent, stigma simple and hairy.

d. **Fruit** Leguma (pod).

e. **Seed** One to many non-endospermic.

Economic Importance with Examples

Plants belonging to this family has their importance in the following fields

i. **Pulses and Vegetables** The family is an important source of pulses and vegetables. The pulses are rich in proteins like gram (chana), pea (matar), field bean (bankla), cluster bean (gwar), lima bean (lobia), lentil (masoor), bean (sem), soy (soyabean), etc.

ii. **Oil** Edible oils are obtained from the seeds of *Arachis hypogaea* (groundnut) and *Glycine max* (soyabean). Vegetable ghee is prepared by using the oils after hydrogenation.

iii. **Timber** *Dalbergia sissoo* (indian redwood),*Dalbergia latifolia* (indian rose wood), are important timber yielding trees of the family.

iv. **Dye** *indigofera tinctoria* (indigo), *Butea monosperma* (flame of the forest) is used to produced red dye used as an astringent.

v. **Fodder** Plants like *Trifolium alexandrium* (barseem), *Medicago sativa*, *Cyamopsis tetragonoloba* etc. yield fodder for the cattle.

vi. Fibres Crotalaria juncea (sunhemp) is used to produce fibres.

vii. Ornamentals Some common ornamental plants are Lathyrus odoratus (sweet pea), Clitoria (butterfly pea), Lupinus, etc. are common ornamental plants.

viii. Jeweller's Weight The seeds of Abrus precatorius (ratti) are used weight by jewellars.

ix. Medicinal Plants The flowers of Trifolium pratense are used in whooping cough. The gum of Butea monosperma (dhak) is useful for treating dysentery and diarrhoea. There are several other examples in this family that are used as medicines.

II. Family - Solanaceae

It is a large family, commonly called as the 'potato family' it is widely distributed in tropics, sub-tropics and even temperature zones.

1. Systematic Position

Division	-	Spermatophyta
Sub-division	-	Angiospermae
Class	-	Dicotyledonae
Sub-class	-	Gamopetalae
Series	-	Bicarpellatae
Order	-	Polymoniales
Family	-	Solanaceae

2. Distribution

The family is represented by 90 genera and 2800 species distributed in both tropical and temperature regions.

3. Habit

Annual or perennial herbs, shrubs or rarely soft wooded trees.

4. Vegetative Characters

i. **Root** Usually tap roots.

ii. **Stem** Herbaceous or woody, hair or prickels often present, sometimes underground tubers (Solanum tuberosum).

iii. **Leaf** In vegetative parts alternate and floral regions opposite, exstipulate, simple, rarely pinnately compound as in potato and tomato.