FAMILIES OF ANGIOSPERMS

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*** The symbols used for Angiosperms for floral formula :-**

Bracteate	=	Br
Ebracteate	=	Ebr
Actinomorphic	=	⊕
Zygomorphic	=	% or ◐
Bisexual	=	⚥
Unisexual male (staminate)	=	♂
Unisexual female (Pistillate)	=	♀
Epicalyx	=	Epi
Calyx	=	K or if joined = $K_{(}$
Corolla	=	C or if joined = $C_{(}$
Perianth	=	P or if joined = $P_{(}$
Androecium	=	A or if joined = $A_{(}$
Gynoecium	=	G or if joined = $G_{(}$
Superior ovary	=	Hypogynous flowe = $\underline{G}$
Inferior ovary	=	Epigynous flower = $\overline{G}$
Ovary half inferior or half superior	=	Perigynous flower = G-

Adhesion

Epiphyllous	=	P A
Epipetalous	=	C A

CRUCIFERAE [= BRASSICACEAE]

1. Systematic Position:-

Class	=	Dicotyledonae	
Sub-Class	=	Polypetalae	
Series	=	Thalamiflorae	Flower - Hypogynous
Order	=	Parietales	Placentation – Parietal

2. Distinguishing Features of Cruciferae:-

(i) The plant organ have pungent odour. This odour is due to presence of sulphur containing glucosides compound. Myrosin enzyme (present in secretory cells) hudrolyse them into glucose & different isothiocyanates (Various oils)

(ii) Inflorescence- typical raceme. This is a type of racemose inflorescence.

***Characteristics of Racemose :-**

(a) The peduncle continues to grow forming a new bract because it never bears flowers flower.

(b) Flowers are produced in acropetal succession i.e. the older being near the base and the youngest near the growing point.

* **Characteristic of typical racemose :-** Flowers are pedicellate and pedicel is small.

Exceptions :-

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

3. **The common Characteristic of flower :-**

(i) Flower- Ebracteate
(ii) Bisexual or hermaphrodite
(iii) Actino morphic but some times zygomorphic e.g. **Iberis amara**
Out of their four sepals, two lower sepals are small and upper two are big in size.
(iv) Flower- Hypogynous and tetramerous,
(v) Calyx- Sepals 4, polysepalous, calyx arranged in two whorls 2 outer and 2 inner, and imbricate or valvate or quincuncial aestivation.
(vi) Corolla- Petals 4, polypetalous, valvate aestivation and cruciform.
- The each petals in Cruciferae is divided into two parts-long **claw** and broader (Spreading) lamina-**limb.** i.e clawed
- The corolla is absent in **Lepidium** and **Coronopus.**
- The corolla is transformed into stamens in **Capsella.**

(vii) Androecium :- Stamens 6 (2+4), arranged in two whorls-in which two outer small stamens antisepalous and inner four stamens are long and anti petalous. This conditions is known as **Tetradynamous.** Nectaries are present at the base of the anthers
- Polyandrous condition is found.
  Anther is dithecous.
- Stamens introrse i.e. stamens bending towards the gynoecium.

***Type of Adnation :-** Stamens are basifixed, it means filament attached to the base of the anther.
***Exception :-** 2 Stamens in Coronopus, 4 stamens in Lepidium and Cardamine, and 16 stamens in Megacarpea.
(viii) Gynoecium :- Bicarpellary, syncarpous i.e. both of the carpels fused together
- The ovary is unilocular in the beginning but it becomes bilocular due to the formation of a false septum (replum), because it is developed from the thalamus in place of wall of ovary.

* Placentation is parietal.
* Both the carpels arranged transversely.
* Ovule is campylotropous.
** Gynoecium is tricarpellary in Lepidium, and tetracarpellary gynoecium in Nasturtium.

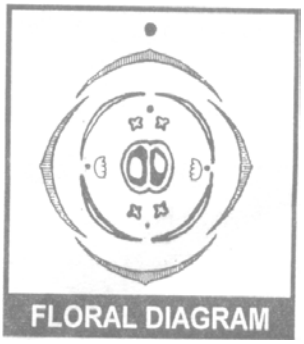
(ix) Fruit :- Usually Siliqua which is solitary dry and dehiscent.
It is pod like in appearance but dehiscence start from the base to the apex while dehiscent in pod from apex to the base. Silicula fruit is found in **Capsella, Iberis, Lepidium** and **Alyssum.** The small Siliqua is known as Silicula. The Schizocarpic fruit Lomentum is found in **Raphanus sativus.**

(x) Seed :- Non endospermic

(xi) Floral Formula :-

$$\mathbf{Ebr} \quad \oplus \quad K_{2+2}\ C_{4,}\ A_{2,4}\ \underline{G}_{(2)}$$

(xi) Floral diagram :- fig.



(4) **Economic Importance :-** The family includes a large number of plant species which are of immense importance to mankind as follows :-

(A) Food stuff

(i) Radish = **Raphanus sativus –** fusi form root.
(ii) Turnip = **Brassica rapa –** Napiform root
(iii) Cauliflower = **Brassica oleracea** var. botrytis inflorescence
(iv) Cabbage = **Brassica oleracea** var. capitata – Fleshy leaves.
(v) Knol-Knol = **Brassica oleracea** var. caulorapa/gongilodes - thickened stem.
(vi) Mustard = **Brassica campestris** (yellow); **B. napus** (black)
(vii) Brassica nigra = (Black Rai), **Brassica-alba** (white Rai); **Brassica juncea** (Local Rai)
(viii) Taramira = **Eruca sativa –** obtain oil
(ix) Armoracia lapathifolia – obtains sweet materials from roots.

[B] Medicinal uses :-

(i) Halima = **Lepidium sativum –** garden cress- Its seeds are used in liver diseases, astand bleeding piles.
(ii) Khoob Kalan = **Sisymbrium irio –** Its leaves are used in scurvy disease
(iii) Wall flower = **Cheiranthus cheiri –** Its seeds are used in fever cough, paralysis, bronchitis.
(iv) Tarha = **Nasturtium indica –** Its seed are very useful in asthma disease.
(v) Chandani (Candy tuft) = **Iberis amara**- It is used in rheumatism disease.

[C] Ornamental :- Some of the plants are cultivated as ornamental plants in garden such as

(i) Chandani (Candy tuft) = **Iberis amara**
(ii) Wall Flowe = **Cheiranthus cheiri**
(iii) Shepherd's purse = **Capsella bursa - pestoris**
(iv) Basket of gold = **Alyssum sexatile**
(v) Honesty = **Luneria annue**
(vi) Stock = **Mathiola incana**

2.MALVACEAE

[1] Systematic position :-

Class - Dicotyledonae
Sub class - Polypetalae
Series - Thalamiflorae
Order - Malvaceae

[2] Diagnostic feature of Malvaceae :-

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

Inflorescence :- Cymose or solitary axillary or solitary terminal.

It means single flower developes in the axis of leaves on the vegetative branches. Separate floral axis is absent.

Exception :- The racemose inflorescence is present in **Althaes** (holly hock) and solitary terminal in **Abutilon.** The single flower present on the terminal end of the branches in solitary terminal inflorescence.

[3] General characteristic 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 are 3-7; free and green in colour. They are the transformed of bracteoles. The structure of the bracteoles are like as bracts which is present on pedicel.
Epicalyx is not considered as a part of flower because they do not originate from the thalamus. Valvate aestivation.
Epicalyx is absent in some genera of the Malvaceae such as Abutilon, sida, and Bombax.

(iii) Calyx- Calyx-5, gamosepalous valvate aestivation but in some of the plants **persistant** calyx are present, it means present on fruit also as in **Abelmoschus** and **Gossypium.**

- The odd sepal is posterior in Malvaceae.

(iv) Corolla- Petals 5, polypetalous twisted aestivation mucilaginous and attractive.

(v) Androecium :- Stamens indefinite, Monoadelphous means filaments united together and anthers remain free.

- The Stamens are monothecous, kidney shaped, anther Dorsifixed.
- The filament are united together to form a long **staminal** canal or tube around styles.
- Staminal tube united with the petals at the base of the flower so stamens **epipetalous.**
- The stamens are **extrorse.**

Exception : Julostylis contains 10 stamens in which 5 stamens are sterile and remaining 5 are normal.

(vi) Gynoecium :- Penta carpellary or poly carpellary syncarpous, but stigma are free so gynoecium is incompletely syncarpous.
The number of locules are equal to the number of carpels so ovary is penta locular or multilocular.
The ovary and style are enclosed by staminal tube but stigma remains out side.
Axile placentation
Exception :- Three carpels are present in the flower of **kydia.**

(vii) Fruit :- Loculicidal capsule, which is solitary, dry, dehiscent multilocular and multi seeded fruit each locules breaks from the wall of the locule during the dehiscence. e.g. Lady's finger, cotton
***Exception :-** The Carcerulus fruit is found in holly hock = Althaea, Abutilon, sida. This is a typeof Schizocarpic fruit. The fruit divided into pieces after dehiscent and each piece is called mericarp. seed enclosed inside the mericarp, e.g. **Malva, sida.,** Hooked-schizocarpic in urena & pavonia Some times berry is present e.g. **Malva viscus.**

(viii) Seed :- Non endospermic, a dense hairy seed coat is present on cotton seed [**Gossypium**]

(ix) Floral Formula :-

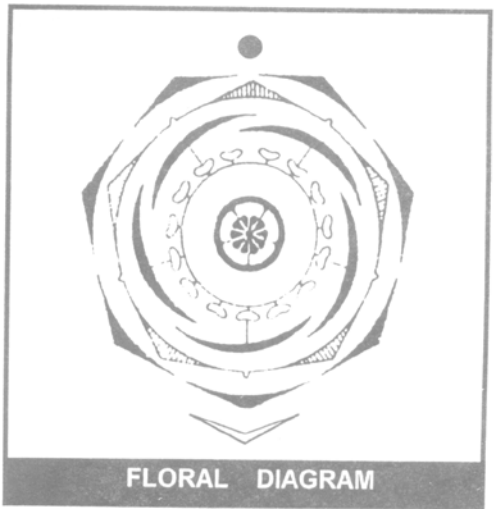
$$Br \oplus \varnothing\ Epi_{3-7}\ K_{(5)}\ \overset{\frown}{C_5}\ A_{(\infty)}\ \underline{G}_{(5-\infty)}$$

(x) Floral diagram :- (fig)

[4] Economic Importance :- The family includes many plants of great economic importance e.g. food, fibres, oil, medicine and ornamentals :-

(a) Food :- (i) Okra (Lady's finger) = Hibiscus **esculentus** or **Abelmoschus esculentus** used as vegetable.

(b) Oils :- Cotton seeds = **Gossypium** genera. The seed of **Gossypium** are used for obtaining oils which is hydrogenated to prepare vegetable ghee. Volatile oil known as Musk seed oil used perfumery is obtained from **Hibiscus abelmoschus** seeds.


FLORAL DIAGRAM

(c) Fibres :- (1) Surface fibres ;- Fibres obtained from the surface of seeds.

(a) Cotton = Gossypium.
The seeds of **Gossypium** are used for obtaining cotton fibres- the king of fibers in textile industries, The species commonly grown are-

Gossypium hirsutum – Upland cotton
G. arboretum = Egyptian cotton
G. herbaceum = Asiatic cotton
G. barbadense = Long fibre
(b) Red Silk cotton = **Salmalia malabaricum**
(c) White Silk cotton = **Eriodendron** or Ceiba [Kapok]

[ii] Soft fibre or Bast fibres :-
(a) Patua = **Hibiscus sabdariffa** (Rosella hemp)
(b) Queen's land hemp = **Sida rhombifolia**
(c) China Jute = **Abutilon asiaticum**
(d) Patsan [Deccan hemp] = **Hidiscus cannabinus**
(e) Cuba bast = **Hibiscus elatus**
(d) Vilayati Sunn = **Urena lobata**

[D] Timber ;-

(i) Ochroma lagopus = Balsa wood, lightest wood
(ii) Malva sylvestris = Mallow wood
(iii) Hibiscus elatus

[E] Medicine :-
[i] Urena repanda – These roots are useful in hydrophobia
[ii] Adansonia digitata = Monkey bread tree – Quinine like medicine is obtained from its **roots.**
[iii] Abelmoschus moschatus = Musk mallow – Its root is used for abdominal pain.
[iv] Abutilon indicum = Laxative seed – Their seeds are used for constipation and root are used for fever.
[v] Thespesia populnea :- It is used as purgative.
[vi] Sida acuta – Its roots are used in neural and urinal diseases.
[vii] Sida rhombifolia = It is used in rheumatism diseases.

[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)
[iii] Pula = **Kydia calycina**
[iv] Cotton rose = **Hibiscus mutabilis** (Changeable rose)
[v] Mallow [Khatmi] = **Malva sylvestris**
[vi] Umbrella tree = **Thespesia populnea**
[vii] Pavonia odorata – from roots hina perfume is manufactured.

[G] Vitamins :- Gossypium seeds are rich in vitamin A, D, E, and B- complex.

3.SOLANACEAE

1. Systematic position :-

Class - Dicotyledonae
Subclass - Gamopetalae
Series - Bicarpellatae
Order - Polymoniales
Family - Solanaceae

Many ovules are present in the ovary so many seed are formed as in tomato, Brinjal etc.
- Most of olants of this family are herbs, some of them are shrubs , rarely trees.
- The tap root system is present in these plants.
- Leaves are simple and exstipulate. Bicollateral vascular bundles are present in stem

[2] Inflorescence :- Solitary axillary or cymose inflorescence.
Monochasical cyme is of two types :-
[A] Helicoid cyme :- In which the lateral branches arise on the same side so inflorescence becomes helicoid, such as in sp. of **Solanum.**
[B] Scorpioid Cyme :- In which the lateral branches arise alternately on right and left so that inflorescence becomes zig-zag such as in species of **Atropa** plants.
Exception :- Solitary terminal inflorescence is found in **Datura,** means flowers arise at the apex of the vegetative branches.

[3] Flower :- Flowers are bracteate , bisexual, complete, Hypogynous, pentamerous and actinomorphic but in few of them is zygomorphic such as in Henbane
Hyoscyamus and salpiglossis, schizanthus.

[4] Calyx :- Seplas 5, gamosepalous, valvate aestivation and persistent. (Accrescent)
The sepals in some of the plants chanfed into membranous balloon like structure which help in dispersal of fruits. e.g. **Physalis** (Rasbhari). The sepal grows with the growth of the fruit and becomes thickened and elongated. They are known as **accrescent** such as in Brinjal.
The odd sepal in Solanaceae is in posterior condition.

[5] Corolla :- Petals -5 gamopetalous aestivation valvate or imbricate with various shapes of corolla.

[6] Androecium :- Stamens -5, polyandrous means no cohesion, epipetalous means shows adhesion, introrse, filaments basifixed and anthers dithecous.
-The dehiscence of anther is longitudinal but in Solanum dehiscence through the apical pores.
Exceptions :- 4 – Stamens are present in **Salpiglossis** in which two are elongated means Didynamous in condition. 2 – Stamens are present in **Schizanthus.**

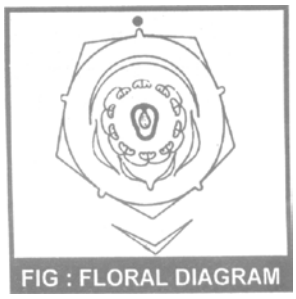
[7] Gynoecium :- Bicarpellary, syncarpous, bilocular and axile placentation, superior.
Special features :- Swollen placenta is present. Ovaries arranged obliquely on thalamus carpels move at $\angle 45^{o}$ in clock wish direction. posterior carpel turns on left side.
- Multilocular ovary is formed in tomatoes and Datura due to formation of false septum.
* Unilocular is present in Henoonia.
* The ovary is bilocular at the base and unilocular on the upper side in Capsicum (chilli)

[8] Fruit :- Fleshy fruits – berry sometimes capsule which is simple fleshy and indehiscent such as Tomato Brinjal, chilli, Physalis etc.
The seeds release by the degeneration of pericarp. All the parts of the fruit are edible.
The fruit of the Datura is septifragal capsule in which dehiscence takes place through the septa.

[9] Seed :- Endospermic

[10] Floral formula :

Br or Ebr ⊕ ♀ $K_{(5)}$ $\overset{\frown}{C_{(5)}}$ A_5 $\underline{G}_{(2)}$


FIG : FLORAL DIAGRAM

[10] Floral diagram :

[11] Economic Importance :-

[A] Food : (a) Vegetable :-

(i) Potato = **Solanum tuberosum** - edible part = under ground stem - **tuber**
(ii) Tomato = **Lycopersicon esculentum/Solanum lycoperscium**
(iii) Brinjal (Egg plant) = **Solanum melongena**
(iv) Makoi = **Solanum nigrum**
(v) Chilli = **Capsicum annullm**
(vi) Shimala Mirch = **Capsicum frutescence**
(vii) Rasbhary (Goose berry) = **Physalis- peruviana** (fruit are eaten)
(viii) **Physalis ixocarpa**
(ix) **Cyphomandra betacea** [tree tomato]

[B] Medicines :-

(i) **Atropa belladonna** (Deadly night shade) The roots are used in the manufacture of belladonna. Alropine alkaloids is obtained from the roots Atropine is used to dialate the pupil of the eye.
(ii) **Stramonium** is obtained from the seeds of Dature (Thorn apple) in which **Scopolamine alkaloid** is present. It is pain reliver 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 obtain from the leaves of **Nicotiana tabacum** & **N. rustica** It is nerve timulant and are also used as insecticide.
(v) **Solanum xanthocarpum** = (Nelee Kanteli) the juice of its used in rheumatism and cough.
(vi) **Withania somnifera** = 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 nocturnum** = Rat – Ki - Rani
(iii) **Cestrum diurnum** = Din – Ka - Raja
(iv) **Schizanthus** = Poor man's orchids
(v) **Brunfelsia hopeana** = Kal – Aaj - Kal
(vi) **Salpiglossia sinvata**
(vii) **Solanum dulcamara**
(viii) **Solanum grandiflorm**
(ix) **Nicandra physaloides**