



**FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES**

**INTRODUCTORY BIOLOGY UGR-121**

## LECTURE- 09

### LEGUMINOSAE OR FABACEAE

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#### SYSTEMATIC POSITION

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*Class - Dicotyledonae*

*Sub class - Polypetalae*

*Series - Calyciflorae (Flower perigynous or Epigynous)*

*Order - Rosales - Gynoecium - monocarpellary or polycarpellary and carpels are free. (Apocarpous)*

*Family - Leguminosae (Fabaceae)*

#### Main characteristics

*Flower - Perigynous G- /Hypogynous G*

*Gynoecium - Monocarpellary*

*Ovary - Unilocular*

*Placentation - Marginal*

The ovary is superior and long in which two sutures are present - ventral suture and dorsal suture. The ovules are present in one row on the ventral suture.

Dis-similarities are found in the remaining characters. On the basis of these dissimilarities (inflorescence and floral characters), Leguminosae family is divided into 3 subfamilies –

1. **Papilionatae**
2. **Caesalpinioideae**
3. **Mimosoideae**

#### I. SUB - FAMILY – PAPILIONATAE / LOTOIDEAE

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Sleeping movements commonly occur in this family.

#### ROOTS

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Roots are branched and tap root system is present. Root nodules are present in which N<sub>2</sub>-fixing bacterium, *Rhizobium leguminosarum* is present.

## LEAVES

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- Stipulate, unipinnate, imparipinnate means lamina is divided into many leaflets and leaflets are in odd number.
- Many modifications are found in leaves as follows –
- Some of the leaflets of compound leaves of Pea are modified into tendrils for climbing.
- All the leaflets of *Lathyrus odoratus* are transformed into tendrils.
- The stipules of leaves in both Pea and *Lathyrus odoratus* become foliaceous (which help in photosynthesis).
- Inflorescence : Typical raceme or sometimes solitary axillary as *Lathyrus aphaca*.

## GENERAL FEATURES OF FLOWER

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Bracteate, bisexual, Perigynous/hypogynous, pentamerous and zygomorphic symmetry. The zygomorphic symmetry is due to presence of different (odd) petals (dissimilar petals & androecium).

### CALYX

Sepals 5, gamosepalous, aestivation valvate or imbricate and anterior sepal is odd.

### COROLLA

Petals 5, papilionaceous (main feature) polypetalous, one petal is odd out of 5-petals, towards the mother axis (posterior in position). It is the largest and outermost petal which is called standard or vexillum. Below the vexillum, two small free petals present are known as wing or alae (lateral in position)

The innermost two petals are fused together to form a boat like structure called keel or carina which encloses the essential organs.

Therefore, such type of aestivation is called vexillary or descending imbricate.

*Exception* : Petals are absent in *Lespedeza*.

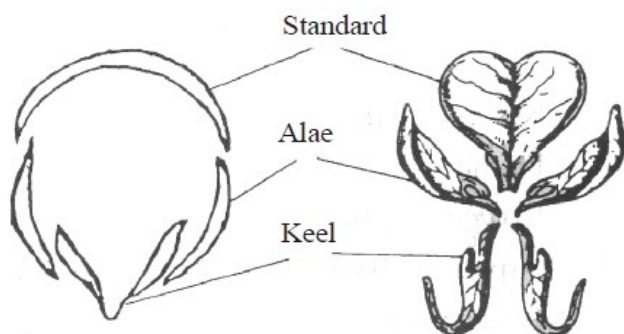


Fig. : Corolla

## ANDROECIUM

This is the second main diagnostic character for the subfamilies of Leguminosae.

Stamens - 10; diadelphous - 1 + (9) ;

9 stamens fused together to form a sheath around the pistil while the tenth (posterior one) is free

*Exception* : 10 - stamens are free in Sophora.

10 stamens are monadelphous in Pongamia, Crotalaria, Lupinus cymopsis (10).

The posterior stamen is absent in Arachis, Dalbergia and Abrus. 9 stamens are present in them in monadelphous condition (9).

## GYNOECIUM

Gynoecium is monocarpellary, unilocular, half inferior/ superior with marginal placentation.

## FRUIT

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Legume or pod, dry, dehiscent, one chambered fruit. It has two sutures and opens along both (dorsal and ventral) sutures.

Sometimes, lomentum is also found as in Arachis (mungphali)

## SEED

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Non-endospermic.

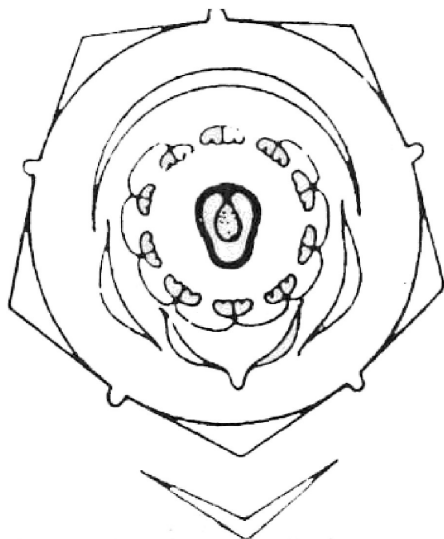
## FLORAL FORMULA

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Br  $K_{(5)}$   $C_{1+2+(2)}$   $A_{1+(9)}$   $G_1$

## FLORAL DIAGRAM

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## ECONOMIC IMPORTANCE

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### FOOD PLANT

- Arhar (Pigeon pea) = *Cajanus cajan* (Indicus)
- Chana (Gram) = *Cicer arietinum*
- Mattar (Pea) = *Pisum sativum*
- Urad (Black gram) = *Phaseolus mungo* or *Vigna mungo*
- Mung (green gram) = *Phaseolus radiatus* (esculentus) or *Vigna radiatus*
- Masoor = *Lens esculenta* or *L. culinaris* or *Ervum lens*
- French bean or Kidney bean (Rajma) = *Vigna/Phaseolus vulgaris*
- Soyabean = *Glycine max* (G. soja)
- Gwar (cluster bean) = *Cymopsis tetragonoloba*
- Methi = *Trigonella foenum graecum*
- Mungphali (Ground nut) = *Arachis hypogea*.
- Sem = *Dolichos lablab*
- Horse gram = *Dolichos bifloras*
- Agast tree = *Sesbania grandiflora*. Its flowers are edible
- Kasoori Methi = *Medicago flacata*
- Mothh = *Phaseolus aconitifolia* or *vigna aconitifolia*
- Cowpea (chowla) = *Vigna sinensis*
- Asparagus bean = *Vigna catiang*
- Khaseri dal = *Lathyrus sativus* (The lathyrism disease is produced by the use of this dal.)
- Lima bean (Lobia) = *Phaseolus lunatus*

### FODDER

- Alfalfa = *Medicago sativa*
- Van Methi (Sweet clover) = *Melilotus indicus*
- Sejni (Indian clover) = *Melilotus alba*
- Berseem = *Trifolium alexandrinum*
- Bankla = *Vicia faba*

### FIBERS

- Sunnhemp = *Crotalaria juncia* - bast fibres
- Dhanicha = *Sesbania cannabinus* - Hard fibres
- Ratthi = *Arbus precatorius* - Hard fibres
- *Ougenia delbegiodes*
- *Erythrina suberosa*

## **TIMBER**

- Shisham = *Dalbergia sissoo* [Indian Red wood]
- Kala shisham = *Dalbergia latifolia*
- African black wood = *Dalbergia melanoxylon*
- Red sandalwood = *Pterocarpus santalinus*
- Indian kino tree = *Pterocarpus marsupium*
- Hard sola = *Aeschynomene aspera*

## **DYES**

- Red colour is obtained from red sandal = *Pterocarpus santalinus*
- Neel (Blue dye) = *Indigofera tinctoria* (dye is obtained from leaves).
- Fire of forest = *Butea monosperma* - orange, yellow dye is obtained from the flower.
- *Crotalaria striata* = Black dye
- *Psoralea plicata* = Yellow dye

## **MEDICAL PLANTS**

- Muliathi (Liquoric) = *Glycyrrhiza glabra* - Its roots are used in coughs and cold.
- *Krameria triandra* - The medicine is used for diarrhoea.
- *Inacna prurita* (rainch) - Antihelminthic.
- *Pongamia pinnata* - Oil of seed is used for rheumatism.

## **ORNAMENTAL**

- Butterfly pea = *Clitoria ternatea*
- Sword bean = *Cannavalia gladiata*
- Indian Coral tree = *Erythrina indica*
- Indian telegraph plant = *Desmodium gyrans*
- Glory pea = *Clanthus*
- Phool matar (Sweet pea) = *Lathyrus odoratus*
- Japanese pagoda tree *Sophora japonica*
- *Lupinus albus*
- *Pongamia pinnata*

## **INSECTICIDES**

- *Deris elliptica* = Rotenone insecticide - rotenone is obtained.

## **GUM**

- Bengal kino - It is obtained from the butea (dhak)
- Balsam of perue = Myroxylon balsemum
- Gwar gum = Edible gum is obtained from the Gwar.

## **OTHER USES**

- *Arbus precatorius* = Crab's eye = Ratti = Jeweller's weight- Jewellers use it's seeds as weight.
- *Aeschynomene indica* - Omfosm pith plant - Its wood is spongy, toys are made from this.
- *Dalbergia latifolia* - (Indian Rose wood) - Its bark is used in tanning.
- *Aeschynomene aspara* = Indian cork plant - It is used as cork.
- Silk worm lives on the stem of Butea.
- *Alhagi pseudoalhagi* = Camel's fodder. From twigs screens (chiks) are manufactured.

## II. SUB-FAMILY - CAESALPINOIDEAE

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### **ROOT**

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Tap root system.

### **LEAVES**

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Usually compound, unipinnate, paripinnate. But, bipinnate in *Delonix*.

Phyllode is found in *Parkinsonia* – means lamina falls and petiole is transformed into a leaf like structure. Such type of modification is meant for reducing of transpiration.

Inflorescence : Panicle or raceme of racemes or compound raceme. “Raceme of racemes.”

### **GENERAL CHARACTER OF FLOWER**

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Bracteate, bisexual, perigynous/hypogynous, pentamerous and zygomorphic symmetry of the flower is due to the presence of sterile stamens.

### **CALYX**

Sepals 5, polysepalous, imbricate aestivation, odd sepal is anterior one.

## **COROLLA**

Petals 5, polypetalous, ascending imbricate aestivation (posterior petal is the innermost.)

Exception : Petals are absent in Ashok (Saraca), only 3 - petals are present in Imli (Tamaritidus)

## **ANDROECIUM**

Stamens 10, free, arranged in two whorls/(Circles) 5 + 5, some of them are sterile called staminodes.

Most of the genera have 3 staminodes.

7 Stamens are present in Tamarindus, monadelphous, out of them 4 are staminodes.

5 - 8 normal stamens are present in Saraca (Ashok)

5-normal stamens are found in Bauhinia variegata (Kachnar)

## **GYNOECIUM**

Monocarpellary, ovary half inferior/superior, unilocular, style long, stigma is simple and marginal placentation.

## **FRUIT**

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Legume or pod is present. Lomentum is present in Tamarindus.

## **SEED**

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Non-endospermic or endospermic

## **FLORAL FORMULA**

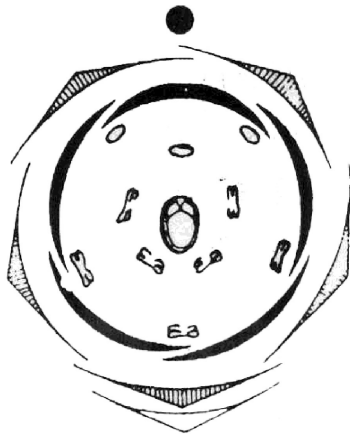
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Br  $K_5 C_5 A_{5+5}$  or  $A_{7+3}$  (Staminodes)  $G_1$



## FLORAL DIAGRAM

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## ECONOMIC IMPORTANCE

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### FOOD

- Imli = *Tamarindus indica*
- Kachnar = *Bauhinia variegata*
- Rawal = *Bauhinia purpurea*
- *Ceratonia siliqua* = Seeds are rich in protein

### ORNAMENTAL

- Amaltas = *Cassia fistula*
- Gulmohar = *Delonix regia*
- Nagput (Snake climber) = *Bauhinia anguinia*
- Ashok = *Saraca indica*
- Peacock flower = *Caesalpinia pulcherima*
- Kachnar = *Bauhinia variegata*
- Vilayati kikar (Jerusalem Thorn) = *Parkinsonia aculeata*
- *Amberstia nobilis*

### TIMBER

- Log wood = *Haematoxylon campachianum* - It yields a dye, haematoxylin.
- Purple heart wood = *Copaifera pubiflora*
- West Indian locust wood = *Hymaenia carbaryl*
- Hardest and heaviest wood = *Hardwickia binata*
- Used in agricultural implements = *Kingodendron pinnatum*

## MEDICINES

- The raw fruits of amaltas (*Cassia fistula*) are used as a laxative.
- Ashokarist is obtained from the bark of ashoka tree (ayurvedic medicine).
- The leaves and seeds of *Cassia occidentalis* and *Cassia obtusifolia* are used in skin diseases.
- The bark and leaves of *Cassia glauca* are used in diabetes and gonorrhoea.
- A tonic is prepared from the bark of *Bauhinia variegata*.

## OTHER USES

- *Phanera vahlii* - It yields a commercial gum and bark fibres are used for making ropes and baskets.
- *Caesalpinia sappan* - 'Gulal' is obtained from its heart wood.
- *Bauhinia purpurea* and *Ceratonia siliqua* are used as fodder.
- The oil of *Kingiodendron pinnatum* is used for making soaps and paints.

## III. SUB-FAMILY - MIMOSOIDEAE

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### ROOT

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Tap root system and branched.

### LEAVES

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Usually bipinnate. The stipule is modified into thorn as in *Acacia*. Phyllode is found in Australian *Acacia*. Most of the plants are xerophytes.

### INFLORESCENCE

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Two types of inflorescences are found in Mimosoideae family –

- **Capitate or cymose capitulum** : The apical region of floral axis, becomes suppressed and swells up and bears sessile flowers, e.g., *Acacia*.
- **Spike** : This is a type of raceme inflorescence, but in which flowers are sessile.

### GENERAL FLORAL CHARACTER

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Bracteate, bisexual, actinomorphic symmetry, perigynous/hypogynous, tetramerous or pentamerous.

### CALYX

Sepals 4 or 5 , gamosepalous, valvate aestivation.

### COROLLA

Petals 4 or 5, polypetalous or gamopetalous, valvate aestivation.

## ANDROECIUM

Many stamens, free, polyandrous.

Monadelphous stamens are present in Albizia.

4 stamens which are free - found in Mimosa.

In Prosopis, 10 stamens are free

## GYNOECIUM

Monocarpellary, unilocular, half inferior/superior, marginal placentation.

## FRUIT

Lomentum which is a type of schizocarpic fruit, pericarp contract in between the seeds. It is divided into single seeded pieces during dehiscence. Each piece is known as mericarp. Single piece or unit is indehiscent.

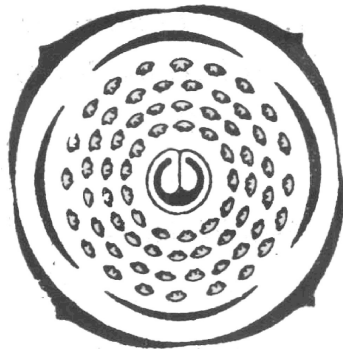
## SEED

Non endospermic

## FLORAL FORMULA

$Br \oplus \overset{\text{♂}}{\underset{\text{♀}}{+}} K_{(4-5)} C_{4-5} A_{\infty} G_1$

## FLORAL DIAGRAM



## ECONOMIC IMPORTANCE

### TIMBER AND FUEL

- *Acacia arabica* = Desi Babool. (Black wood)
- *Prosopis juliflora* = Australian babool.
- *Xylia dolbhiiformis* = Iron wood (Jamboo)
- *Prosopis cineraria* -Khejari (state tree of Rajasthan)
- *Albizzia lebbek* = Siris

- Acacia sundra = Heaviest wood in India
- Acacia julibrissin = Mimosa tree

### **FOOD & FODDER**

- Pithecolobium dulce - Jungle Jalebi (Aril)
- Albizzia lebbek- Siris-Pods are edible and used as fodder.
- Neptunia oleracea = Lajalu – Fruits are edible.
- Parkia roxburghii = Khurail
- Entada phaseliodes

### **ORNAMENTAL**

- Mimosa pudica = Sensitive plant – Touch me not.
- Neptunia oleracea = Lajwanti "Kiss me quick"
- Pithecolobium dulce - Hedge plant
- Leucaena leucophloea

### **OTHER USES**

- Adanathera pavonia = Seed – "Goldsmith's weight"
- Acacia farnesiana - Cassie perfume is obtained from the flowers.
- Acacia catechu = Kathha is obtained from its heart wood
- Acacia concinna = Shikakai - Its pods are used for head bath.
- Prosopis spicigera - It is grown in Rajasthan as wind breaker.
- Many species of Acacia yield gum.
- Albizzia (Siris) produces a special type of gum called "Sresh".
- The pods of shikakai are also used as insecticides.
- Gum arabic is obtained from Acacia senegal.