

# Systematic Botany for IFS officers

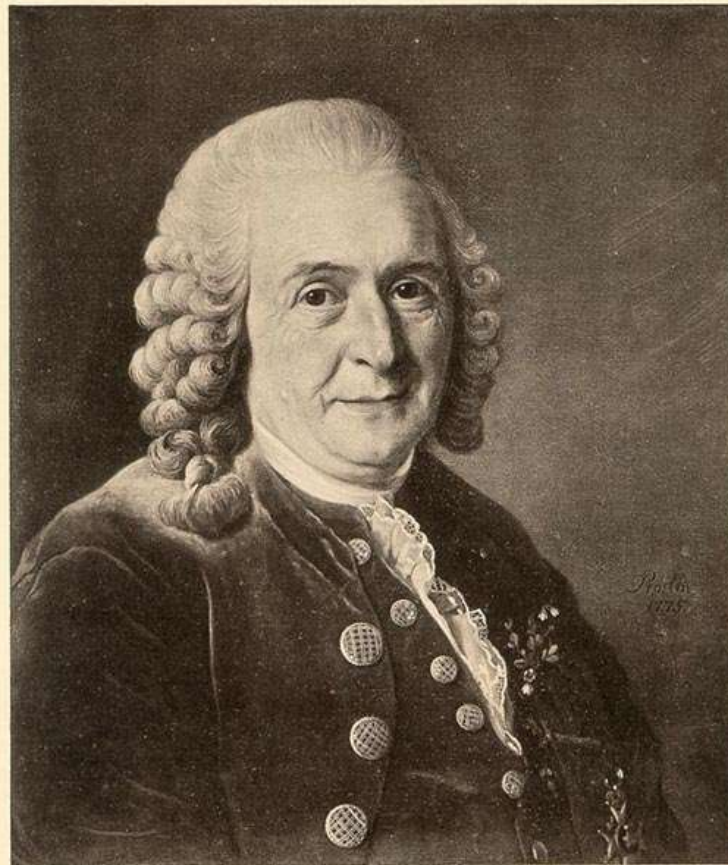
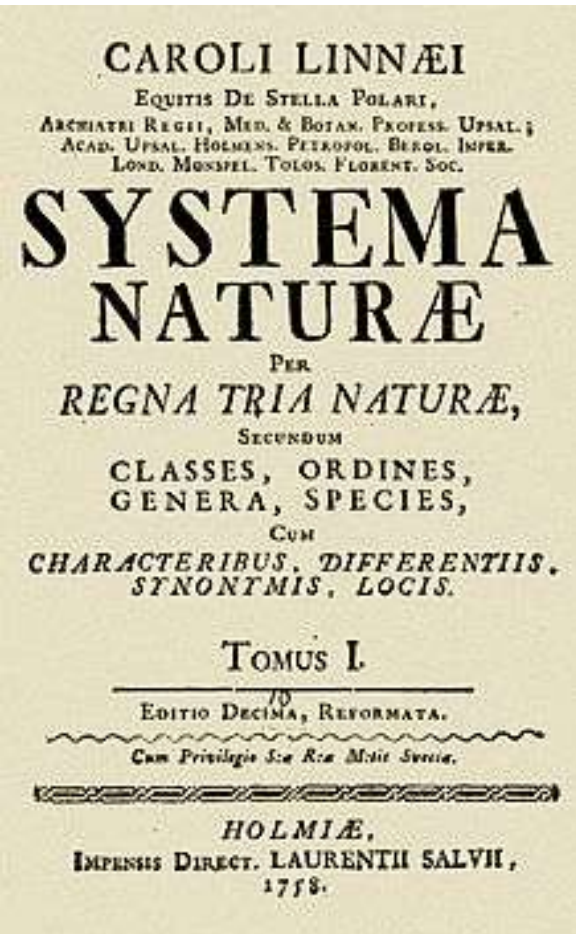
By MANOJ CHANDRAN IFS

Day 1

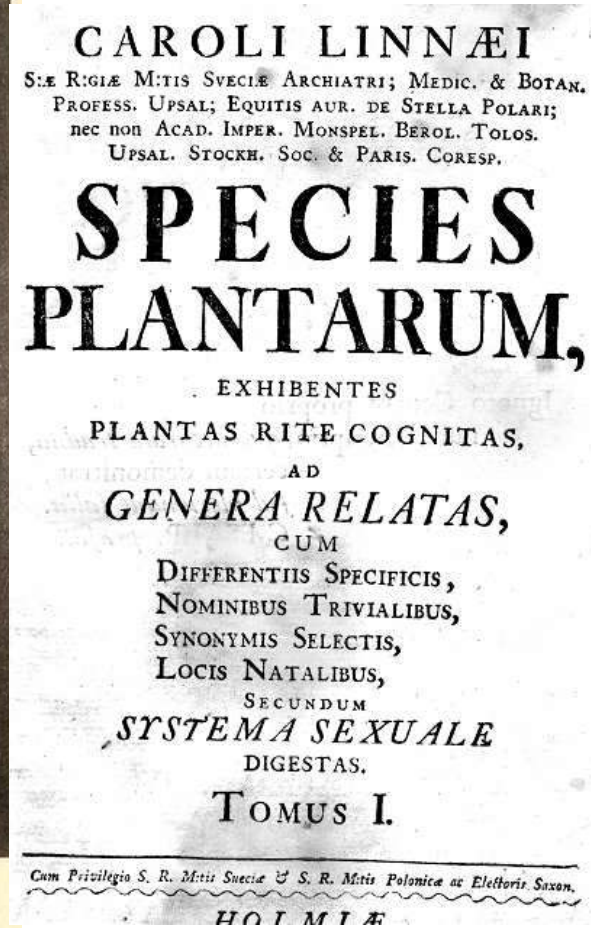
# Caterpillar mushroom- 'Yartsa Gambu'



# Father of Plant Taxonomy



Carl von Linné  
Painting by A. Roslin, 1775



# CARL LINNÆUS

# Classification/TAXONOMY

- TAXA

- Kingdom, Phylum, Class, Order, Family, Genus, Species
- Subclass, superfamily, subfamily, tribes, sub species, cultivar, variety,, etc.

## Plant classification

Kingdom – Plantae  
Unranked – Phanerogams  
Unranked - Angiosperms  
Class – Monocots  
Order – Poales  
Family – Poaceae  
Genus – Oryza  
Species - sativa

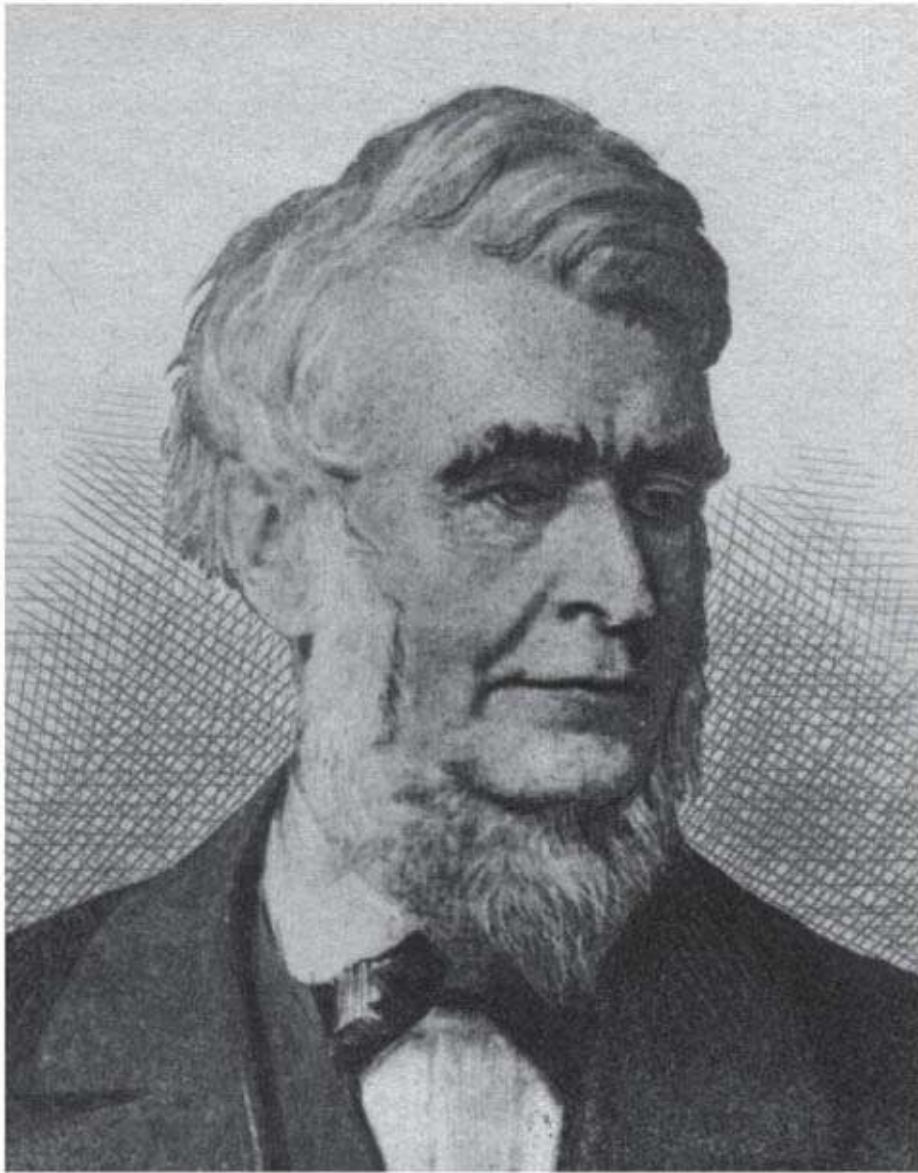
## Animal classification

Kingdom – Animalia  
Phylum – Chordata  
Class –Mammalia  
Order - Primata  
Family – Hominidae  
Genus – Homo  
Species - sapiens

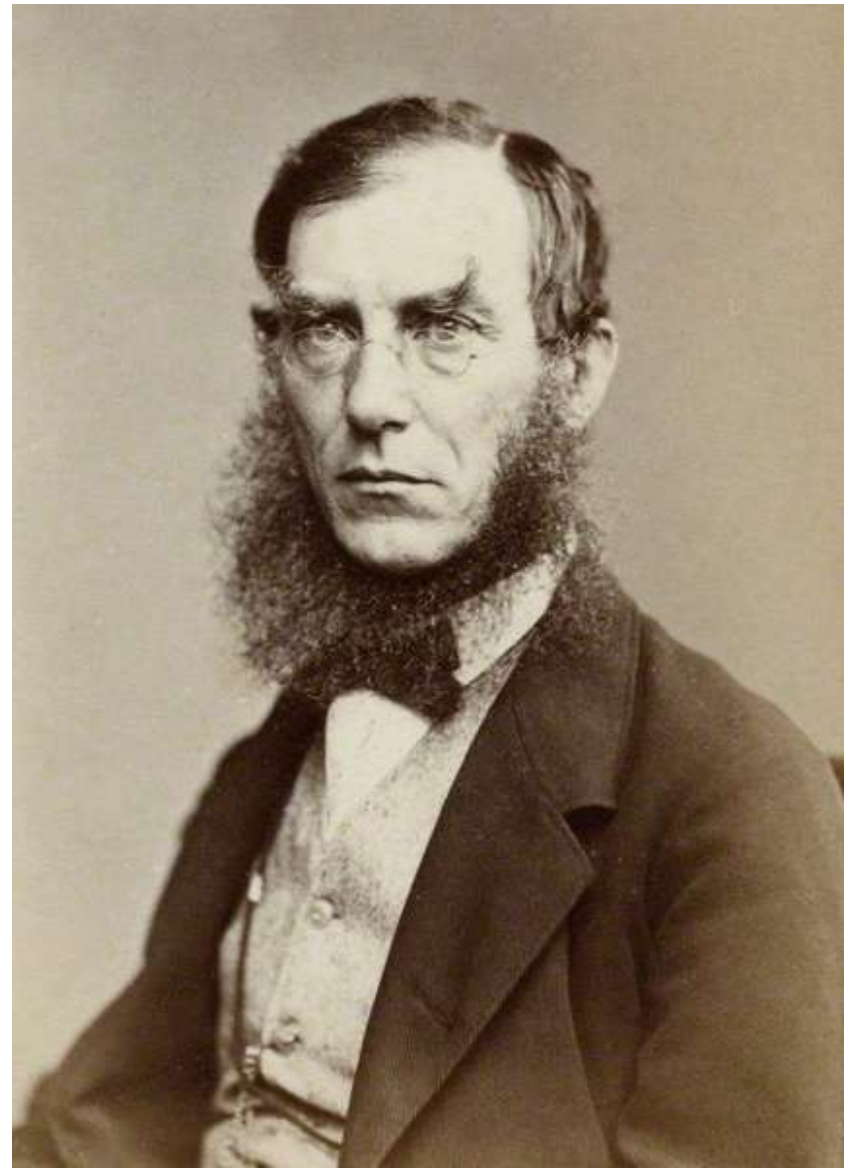
# Binomial nomenclature

- International Code of Botanical Nomenclature
  - Current version is International Code of Nomenclature of Algae, Fungi and Plants – Melbourne Code
  - Latest version is the Shenzhen Code 2017 (yet to be released) decided at the 19<sup>th</sup> International Botanical Congress, Shenzhen (Next is at Rio in 2023)
  - <http://www.leep.ufv.br/en-US/noticia/xx-ibc-in-rio-de-janeiro-july-23th-29th-2023>

- Genus and Species
  - *Quercus leucotrichophora* A.Camus
    - Aimee Antoinette Camus
  - *Shorea robusta* C.F.Gaertn.
    - Carl Fredrich von Gaertner
  - *Mangifera indica* L.
  - *Pinus roxburghii* Sarg.
  - *Pinus roxburghii* (Roxb.) Sarg. = *Pinus longifolia* Roxb.
- <http://www.theplantlist.org/>
- <http://www.ipni.org/>
- [www.kew.org](http://www.kew.org)



GEORGE BENTHAM  
1800-1884



JOSEPH HOOKER  
1817-1911

# Bentham and Hooker classification

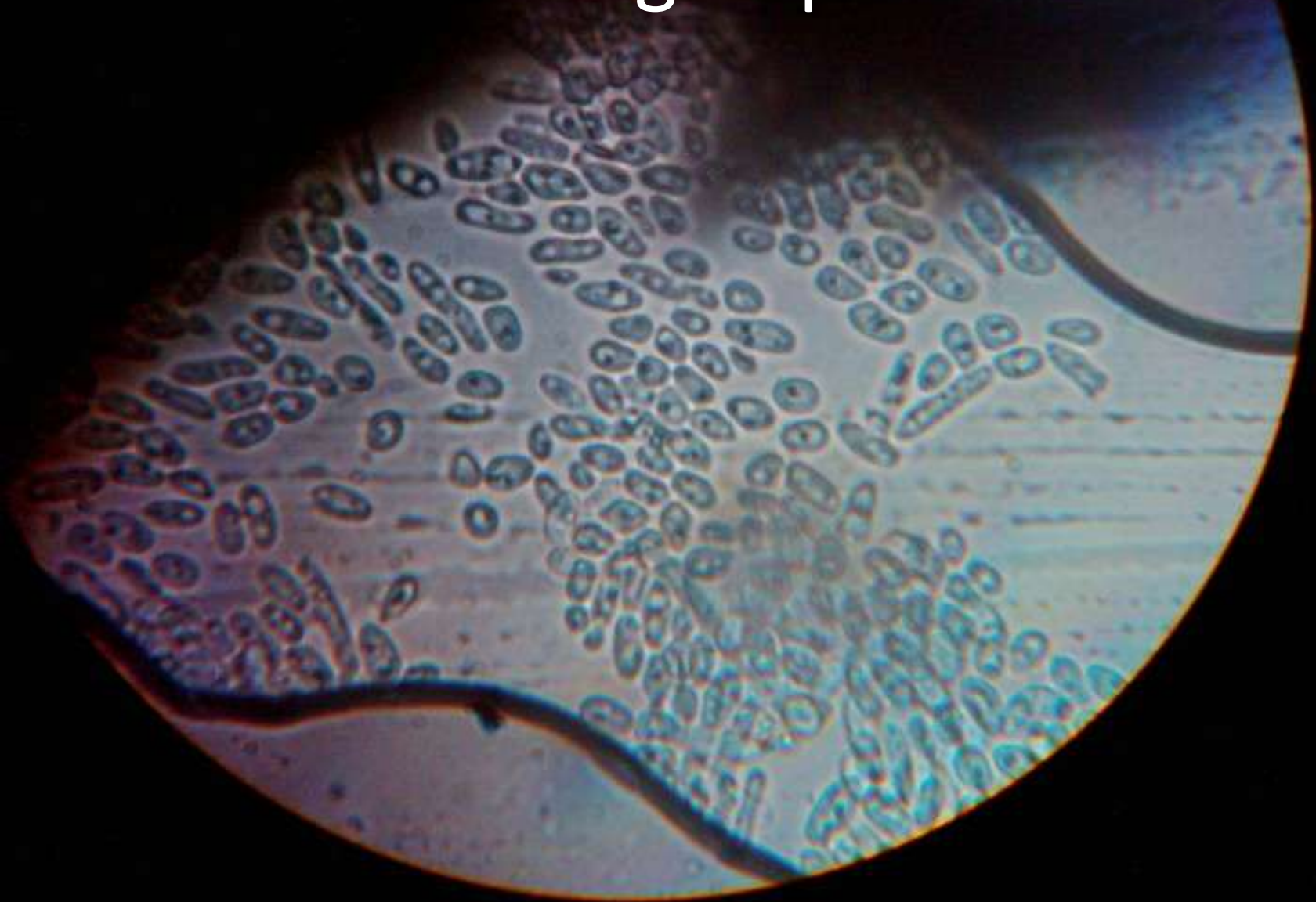
- Phanerogams
  - seed bearing plants with reproductive parts exposed
    - Angiosperms – covered seeded plants (flowering plants)
      - Monocots
      - Dicots
    - Gymnosperms – naked seeded plants (cone bearing)
- Cryptogams
  - spore bearing plants with hidden reproduction
    - Fungi
    - Algae
    - Bryophyta
      - mosses and liverworts
    - Pteridophyta
      - Ferns and fern allies



# Lichen



# Fungal spores



# Mushroom



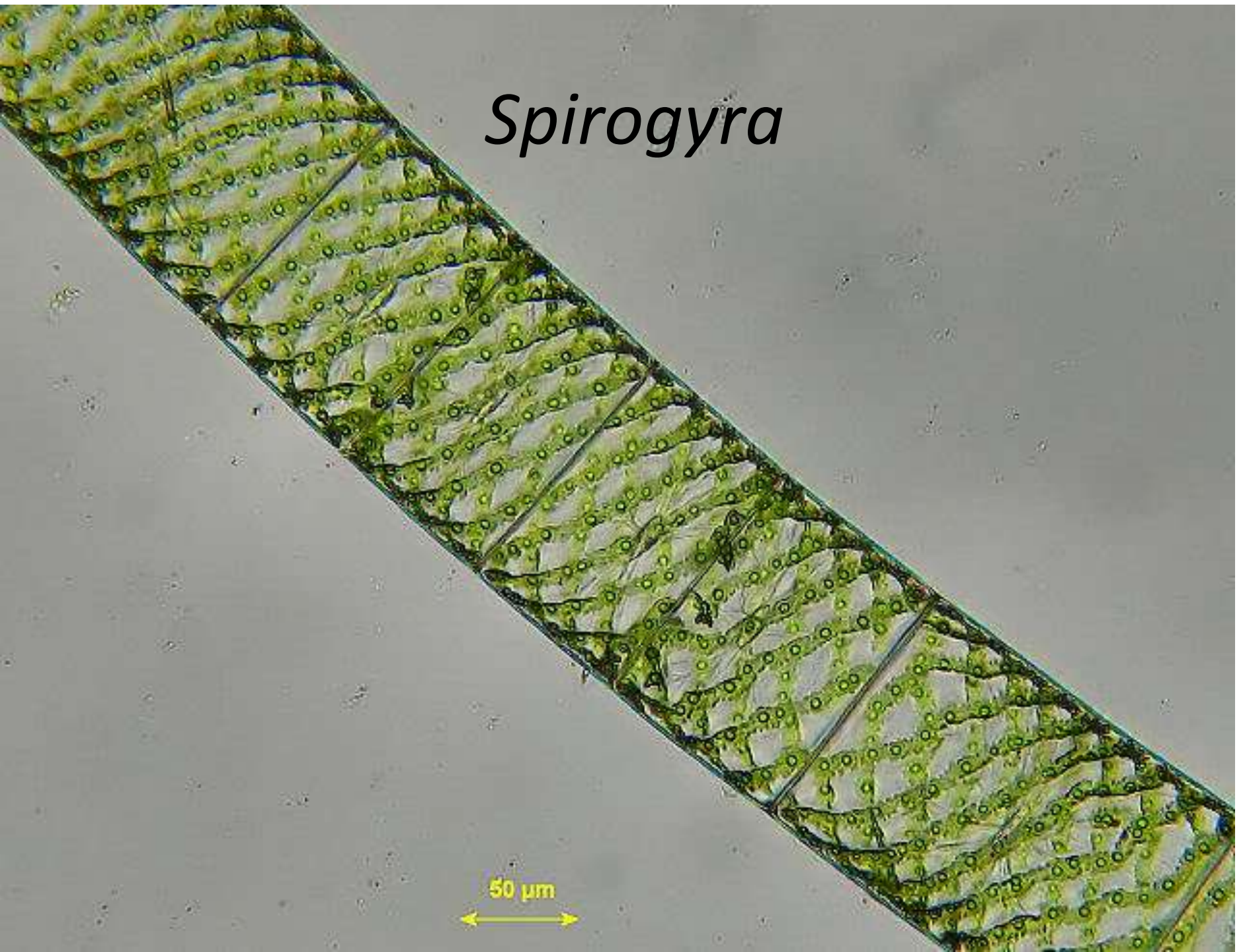
# Moss



Algae



# *Spirogyra*



50  $\mu\text{m}$

# Fern spores



Tree fern – *Cyathea spinulosa*





# Gymnosperms - FIR (*Abies spectabilis*)



# Flowering plants - Angiosperms

- *Rhododendron arboreum*



# Syllabus

- Magnoliaceae
- Dipterocarpaceae\*
- Rosaceae\*
- Sterculiaceae (now under Malvaceae)\*
- Lythraceae\*
- Myrtaceae
- Rhizophoraceae\*
- Lauraceae\*
- Anacardiaceae\*
- Leguminosae
  - Fabaceae/Papilionidae
  - Mimosaceae
- Caesalpiniaceae
- Asteraceae (Compositae)
- Rubiaceae
- Meliaceae\*
- Fagaceae (Cupuliferae)
- Euphorbiaceae
- Verbenaceae
- Poaceae
- Orchidaceae
- Coniferae
  - Pinaceae
  - Cupressaceae
- ETHNOBOTANY

# Systematic Botany for IFS officers

By MANOJ CHANDRAN IFS

Day 2

# Major identification features

- Stem

- Cross section

- Round (Terete)
- Square
- Triangular
- Irregular
- Planoconvex

- Growth

- Climbers - prostrate, rambler, tendrils, twiner
- Erect

- Stem base

- Buttress, stilts, props

- Bark – smooth, fissured, crocodile, decorative

- Blaze colour



# Major identification features

- Leaves

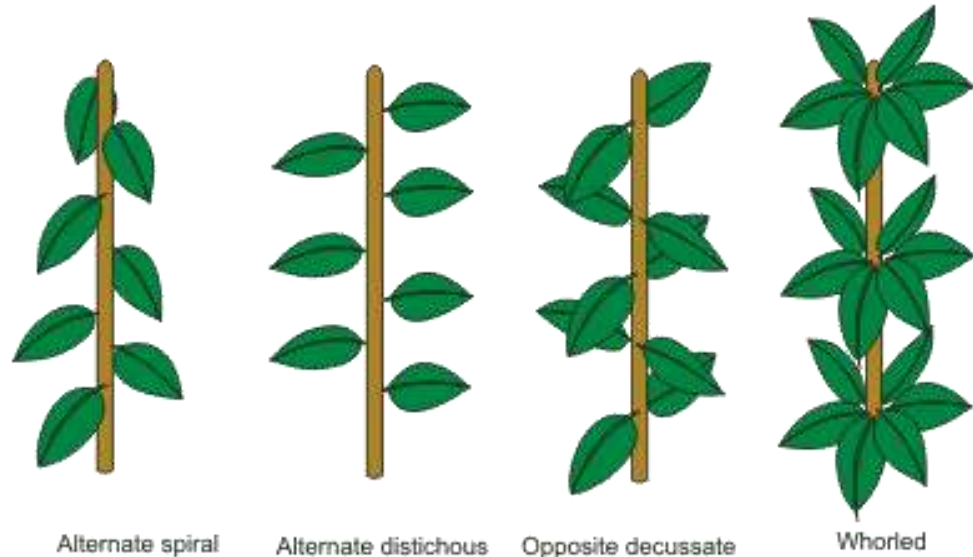
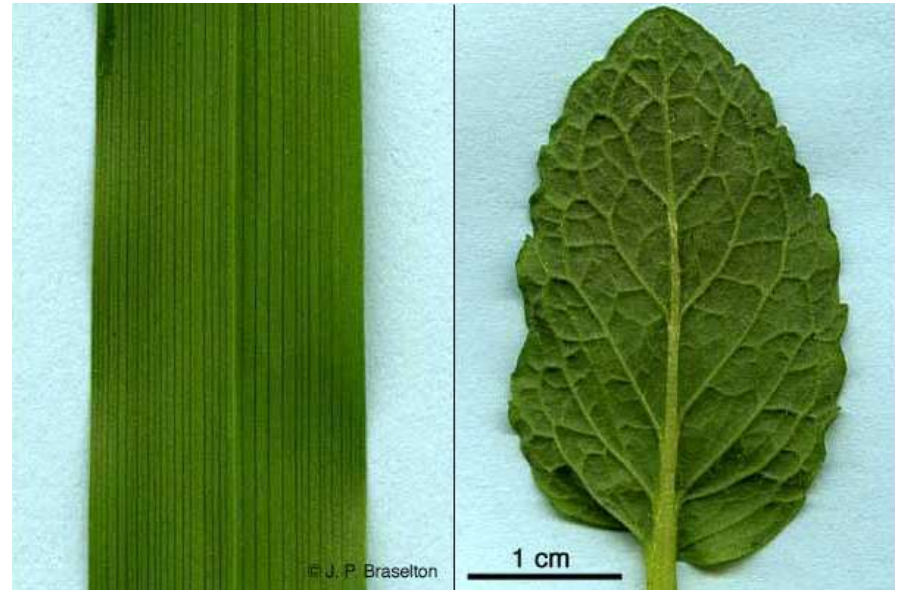
- Venation

- Parallel
    - Reticulate

- Phyllotaxy

- Alternate
    - Opposite
    - whorled

- Shape variations



Alternate spiral

Alternate distichous

Opposite decussate

Whorled

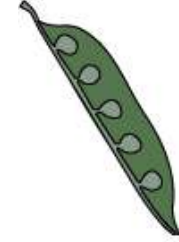
# Major identification features

- Flowers

(Sepals, Petals, Stamens, Stigma)

- Number of floral parts
- Symmetry
- Aestivation
- Polypetaly
- Arrangement of floral parts
- Placentation





**Marginal placentation**



**Axile placentation**



**Parietal placentation**



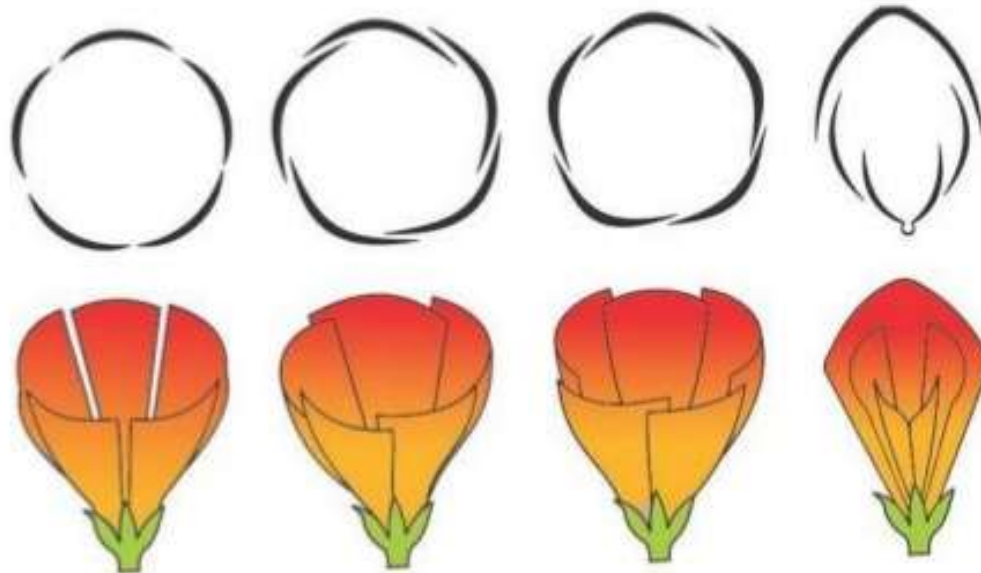
**Free central placentation**



**Basal placentation**







**Types of aestivation in corolla : (a)  
Valvate (b) Twisted (c) Imbricate  
(d) Vexillary**

# Bentham and Hooker classification

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    - Algae
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      - mosses and liverworts
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      - Ferns and fern allies

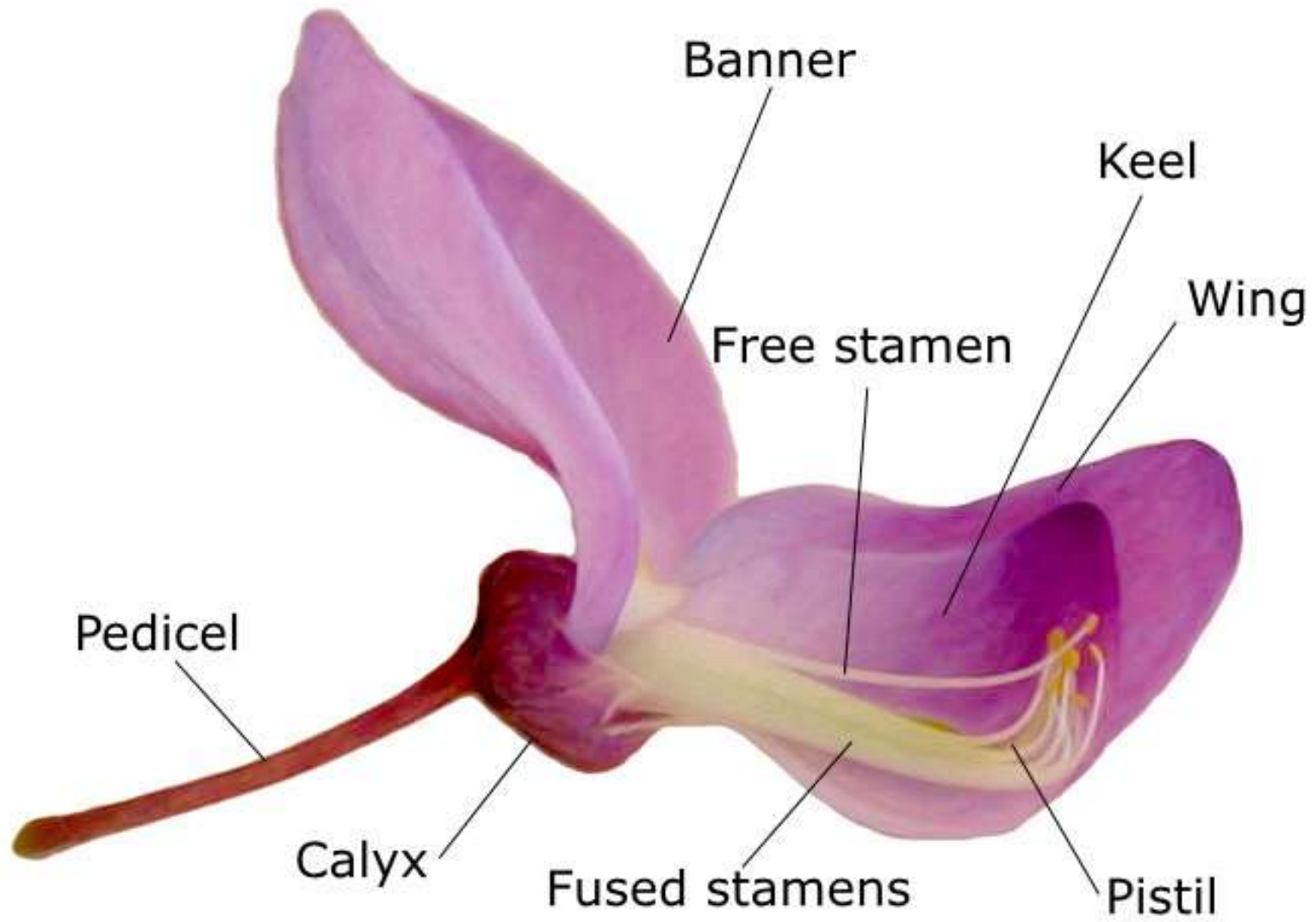
# Monocots vs Dicots

Character	Monocots	Dicots
LEAF VENATION	PARALLEL	RETICULATE
FLORAL PARTS	x3 - 2,3,6	x5 - 2,4,5,10, many
STAMENS	2,3,6	2,4,5,10, several
OVARY CHAMBERS	1,3	1 to many
COTYLEDONS	1	2

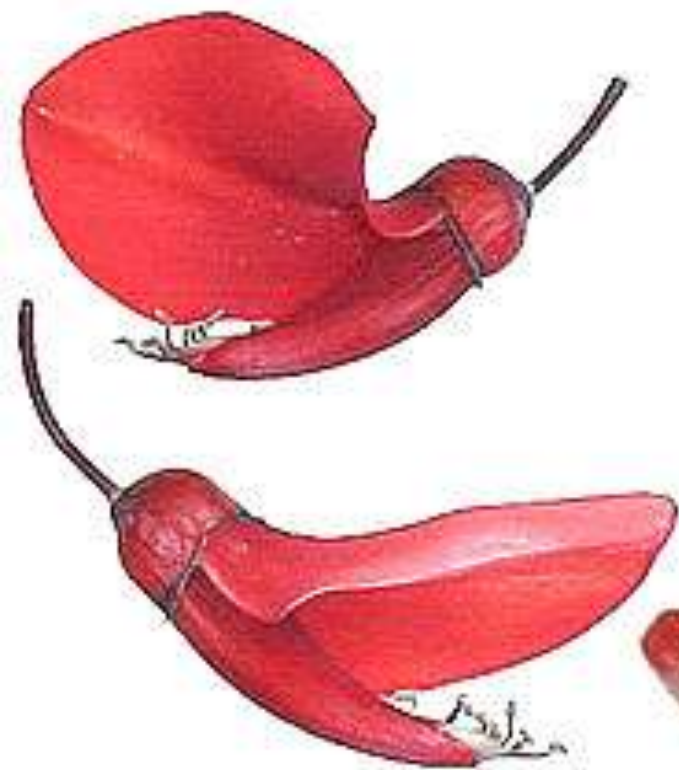
# LEGUMINOSAE – The Legume Family

- Has one chambered pods splitting from one edge
  - Marginal placentation
  - Pulvinus
  - Root nodules
  - Simple, two lobed, trifoliate or Pinnate leaves
  - Zygomorphic flower (symmetry only in one plane)
- 
- FABACEAE (PAPILIONACEAE)
    - All pulses
  - CAESALPINIACEAE
  - MIMOSACEAE





© W.P. Armstrong 2002

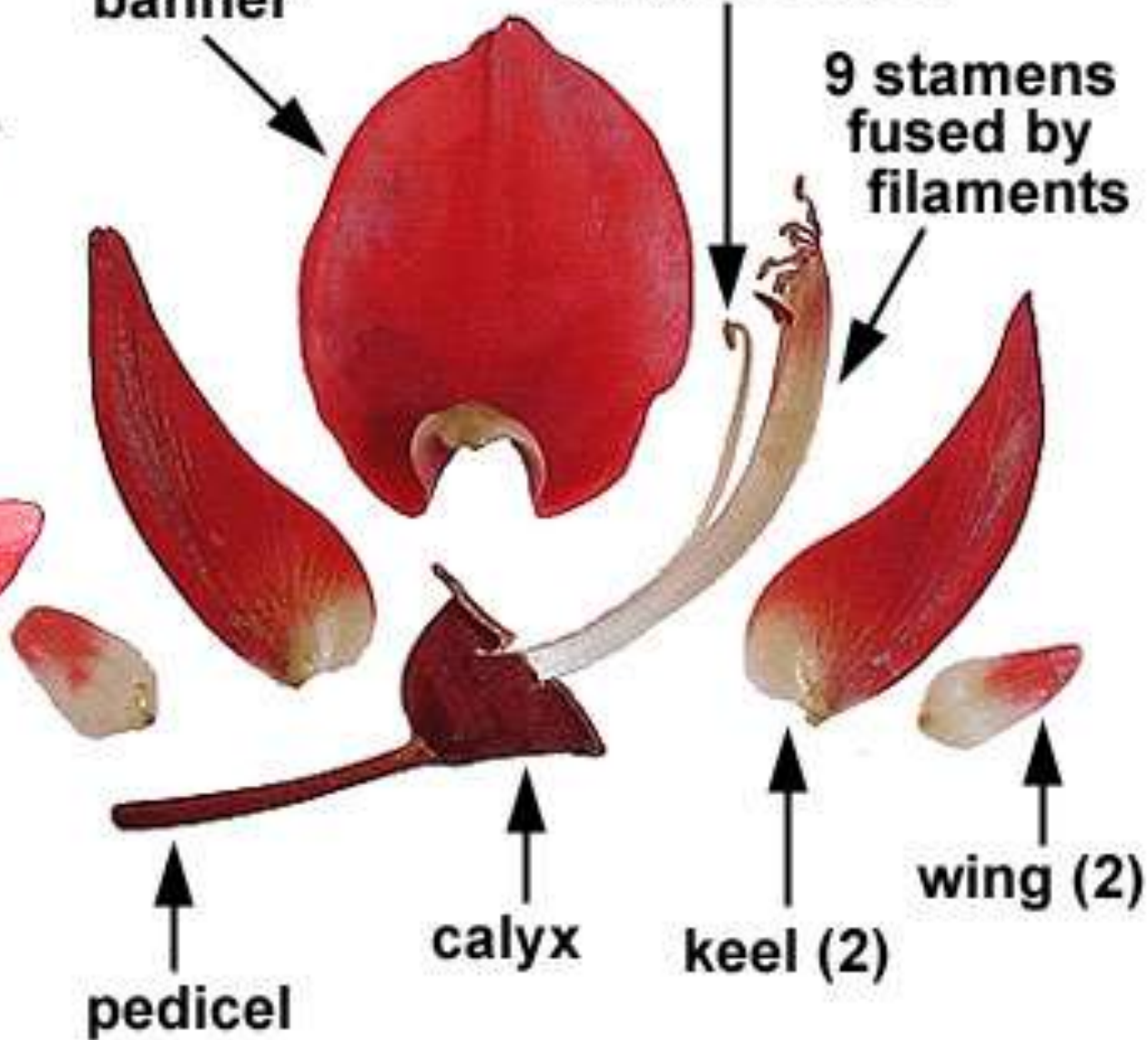


**papilionaceous  
blossoms of  
*Erythrina crista-galli***

**banner**

**single stamen**

**9 stamens  
fused by  
filaments**



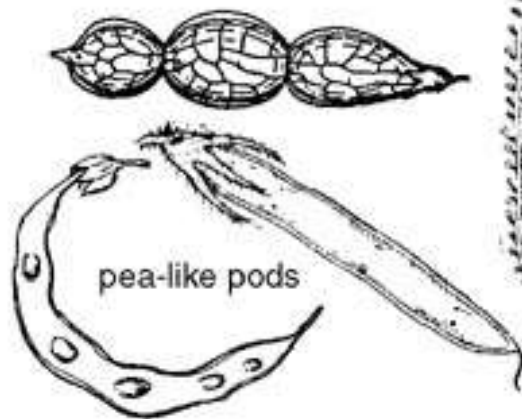
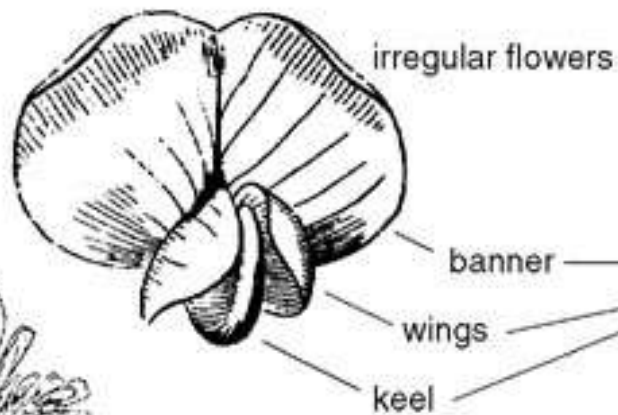
**pedicel**

**calyx**

**keel (2)**

**wing (2)**

# Patterns of the Pea Family (Pea Subfamily)





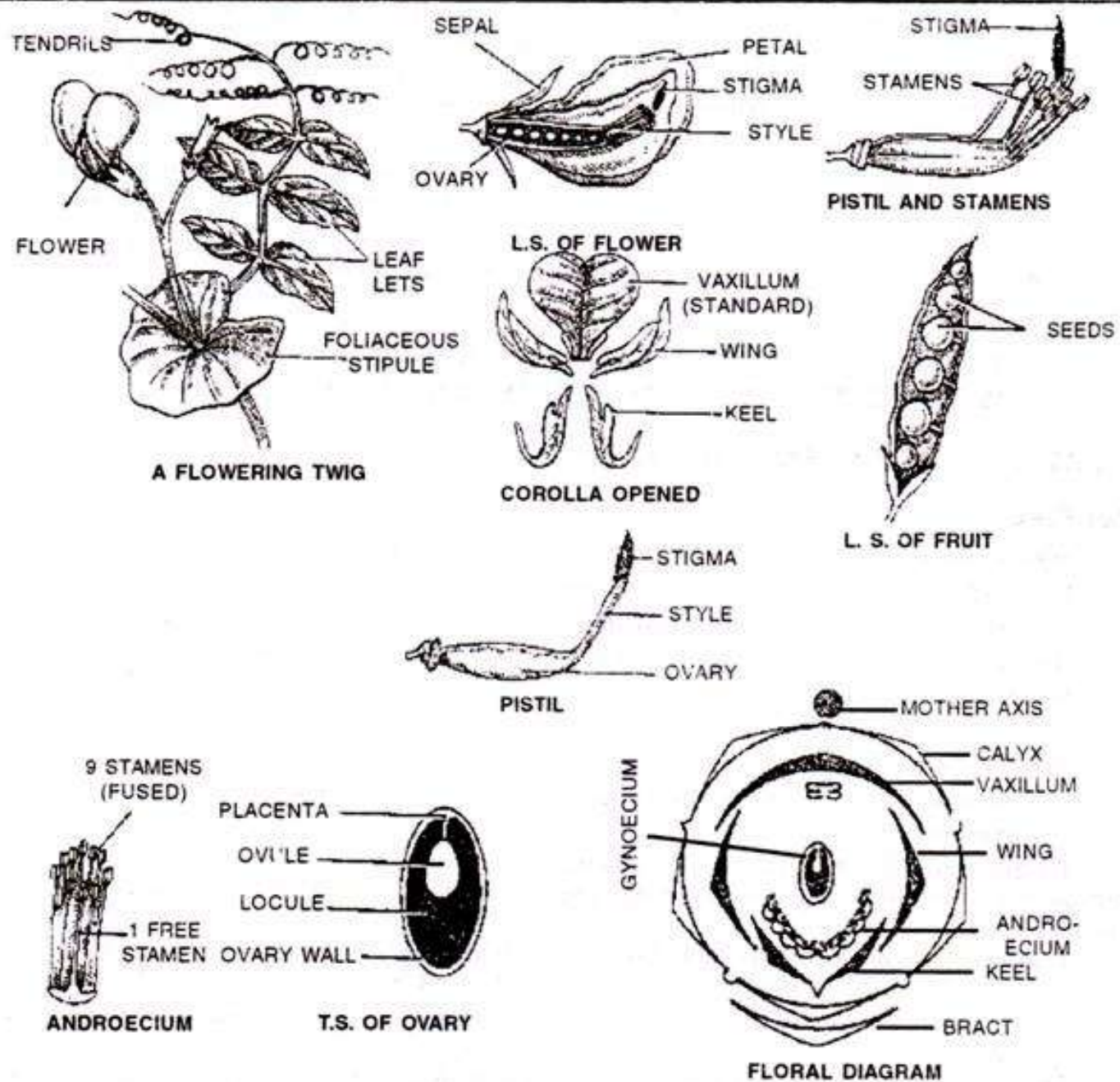
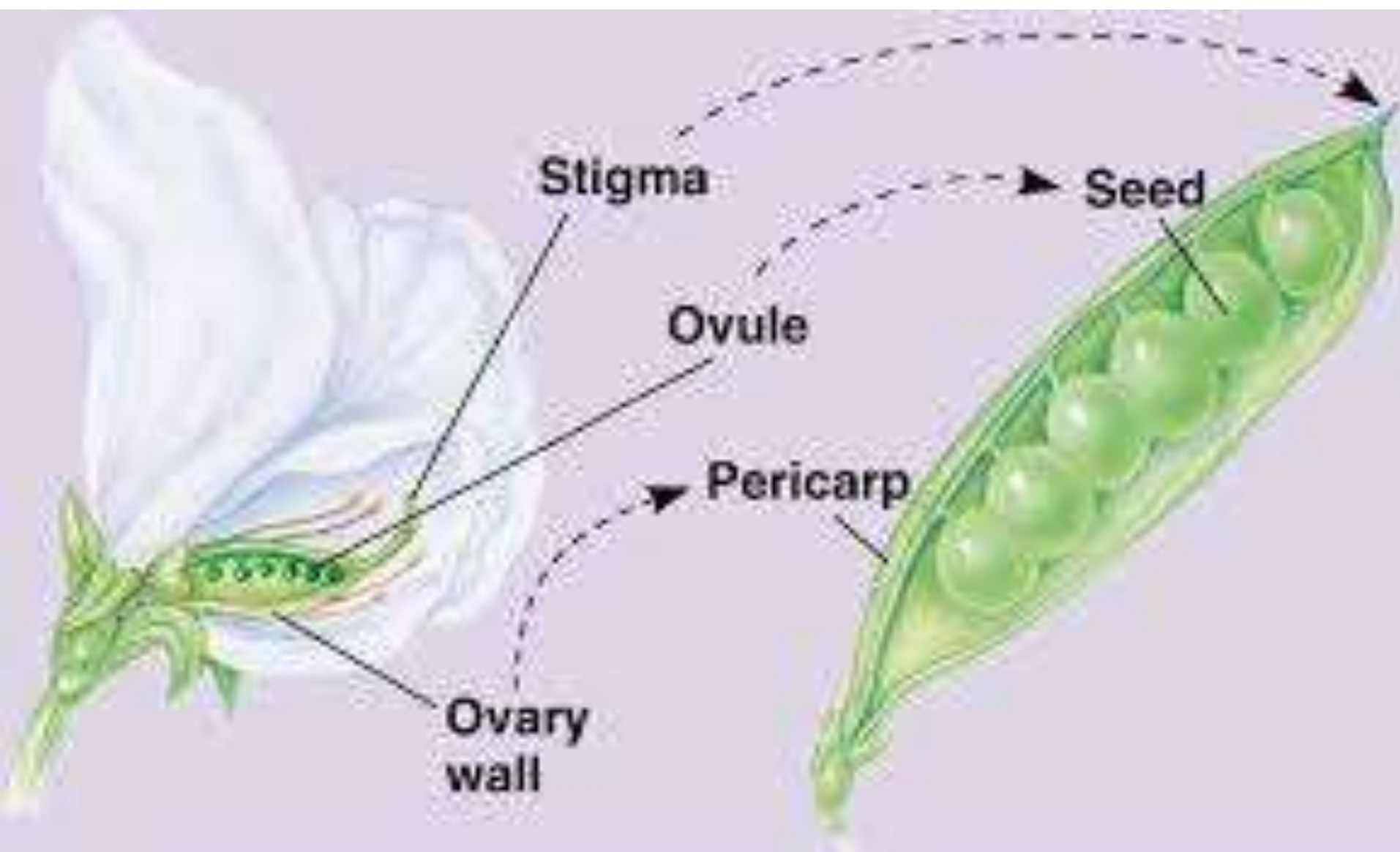


Figure 11.5. Floral structures and floral diagram of family Fabaceae (*Lathyrus odoratus*).



# FABACEAE

- Key features
  - Papilionaceous corolla (butterfly petals)
    - Standard, two wing and two fused keel petals
  - Superior, unilocular ovary with marginal placentation
  - Pods with seeds on one margin and splitting open on the other
  - Pulvinus at the base of petiole
  - Stamens in a bundle of 10 or 9+1
  - Root nodules

# FABACEAE

- Trees
  - Rosewood – *Dalbergia latifolia*
  - Shisham – *Dalbergia sissoo*
  - Indian Coral tree – *Erythrina indica*
  - Flame of the Forest – *Butea monosperma*
- Shrubs
  - *Desmodium elegans, Indigofera tinctoria*
- Herbs
  - *Pisum sativum, Trifolium alexandricum, Phaseolus vulgaris, Vigna mungo, Vigna radiata, Cajanus cajan*



# CAESALPINIACEAE

- Key features
  - Standard petal transformed into a decorative labellum
    - Standard, wing and free keel petals
  - Superior, unilocular ovary with marginal placentation
  - Pods with seeds on one margin and splitting open on the other
  - Pulvinus at the base of petiole
  - Stamens 10 free
  - Root nodules

# CAESALPINIACEAE

- Trees
  - Indian Laburnum – *Cassia fistula*
  - Gulmohar – *Delonix regia*
- Shrubs
  - *Caesalpinia pulcherrima*, *Caesalpinia bonduc*
- Herbs
  - *Cassia mimosoides*





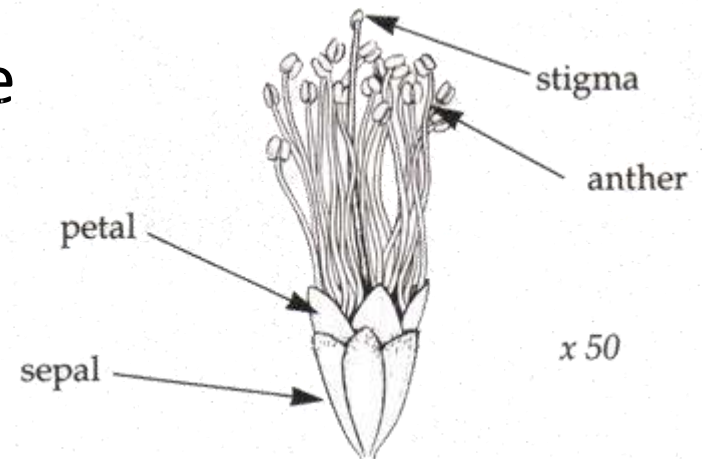


- *Cassia fistula*



# MIMOSACEAE

- Key features
  - Flowers in clusters (heads/raceme)
  - Superior, unilocular ovary with marginal placentation
  - Pods with seeds on one margin and splitting open on the other
  - Pulvinus at the base of petiole
  - Stamens several, free
  - Root nodules



# MIMOSACEAE

- Trees
  - Katha - *Acacia catechu* -
  - Siris - *Albizia lebek*, *Albizia odorattisima*
- Shrubs
  - *Mimosa himalayana*, *Calliandra* (Powder puff)
- Herbs
  - *Mimosa pudica*



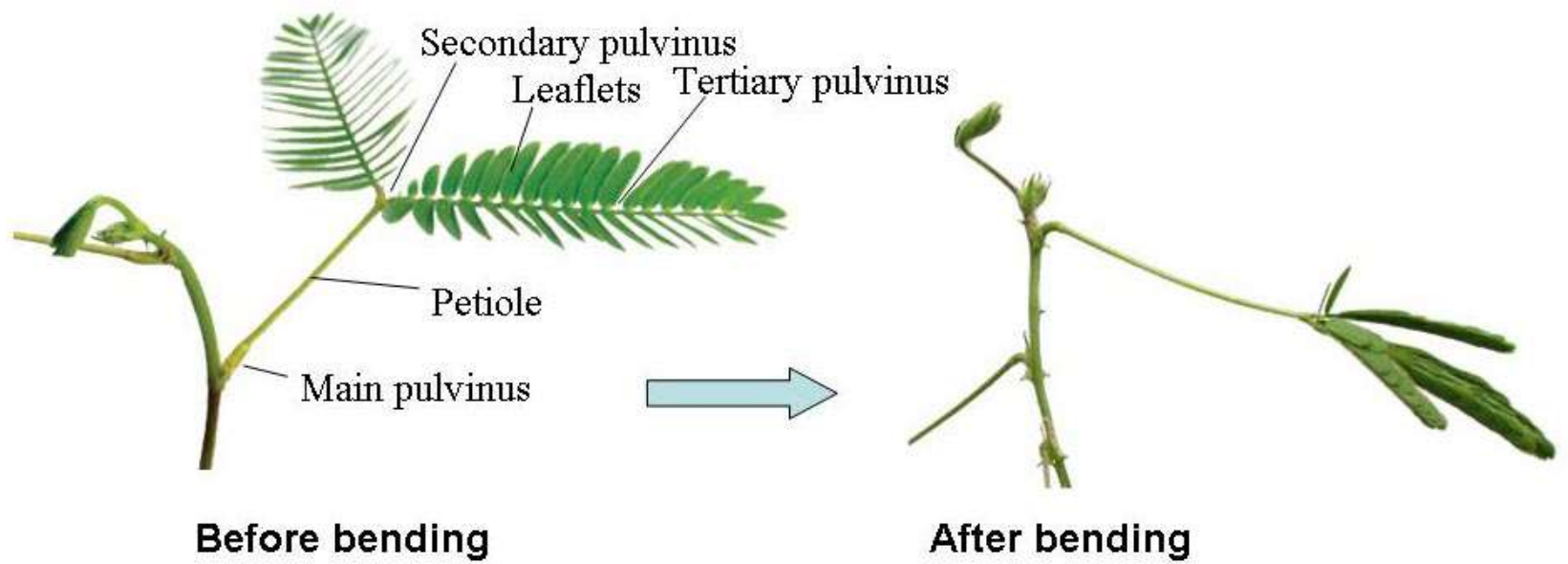




*Dichrostachys cineria*







- Indian Telegraphic Plant
  - *Desmodium motorium*

<https://www.youtube.com/watch?v=J-fIKlCbSU#t=21>

# Systematic Botany for IFS officers

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Day 3

# Bentham and Hooker classification

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      - Ferns and fern allies

# The World of Grasses

— *Sensitization on the*

- *Characteristics*
- *Identification*
- *Ecology*
- *Utilisation*

*Of Grasses*

by

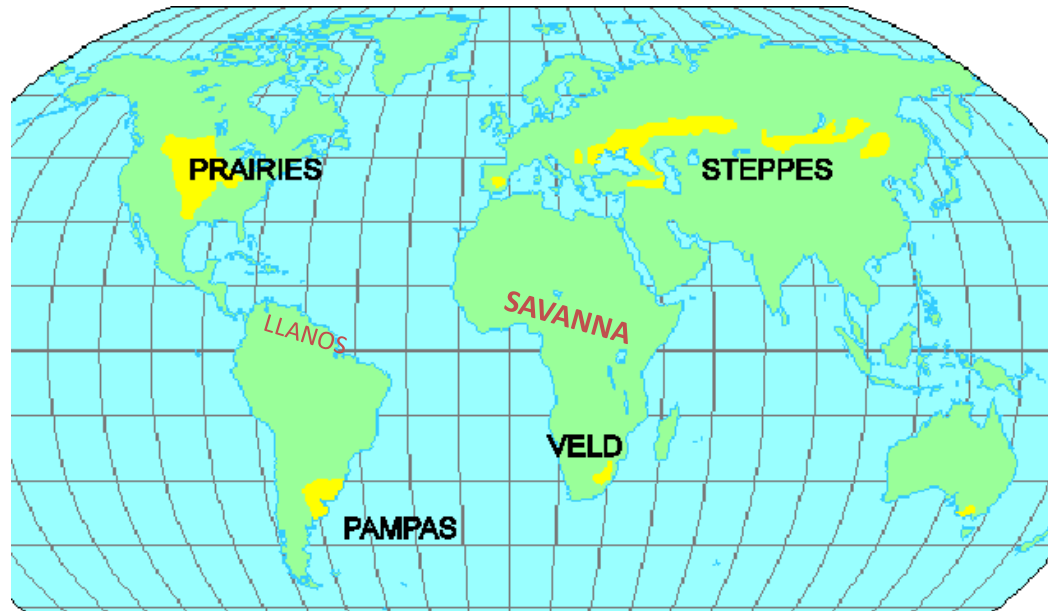
MANOJ CHANDRAN IFS  
Conservator of Forests  
Govt. of Uttarakhand

# Grass and Grassland

- Grass
  - A member of Family Poaceae
- Cyperaceae- Sedges
- Juncaceae - Rushes
- Grassland
  - A vegetation community predominated by herbs and other grass or grass like plants.

# Temperate and Tropical Grasslands

- Prairies
- Pampas
- Steppes
- Veldt



## Alpine meadows





# The Grass Family

- PLANTAE
  - Phanerogams>Angiosperms >> Monocots
    - Glumiflorae
    - Cyperales
      - **POACEAE** (Gramineae)
      - Type genus: *Poa*
      - Type species: *annua*
      - *660 genera*
        - » *10000 species*

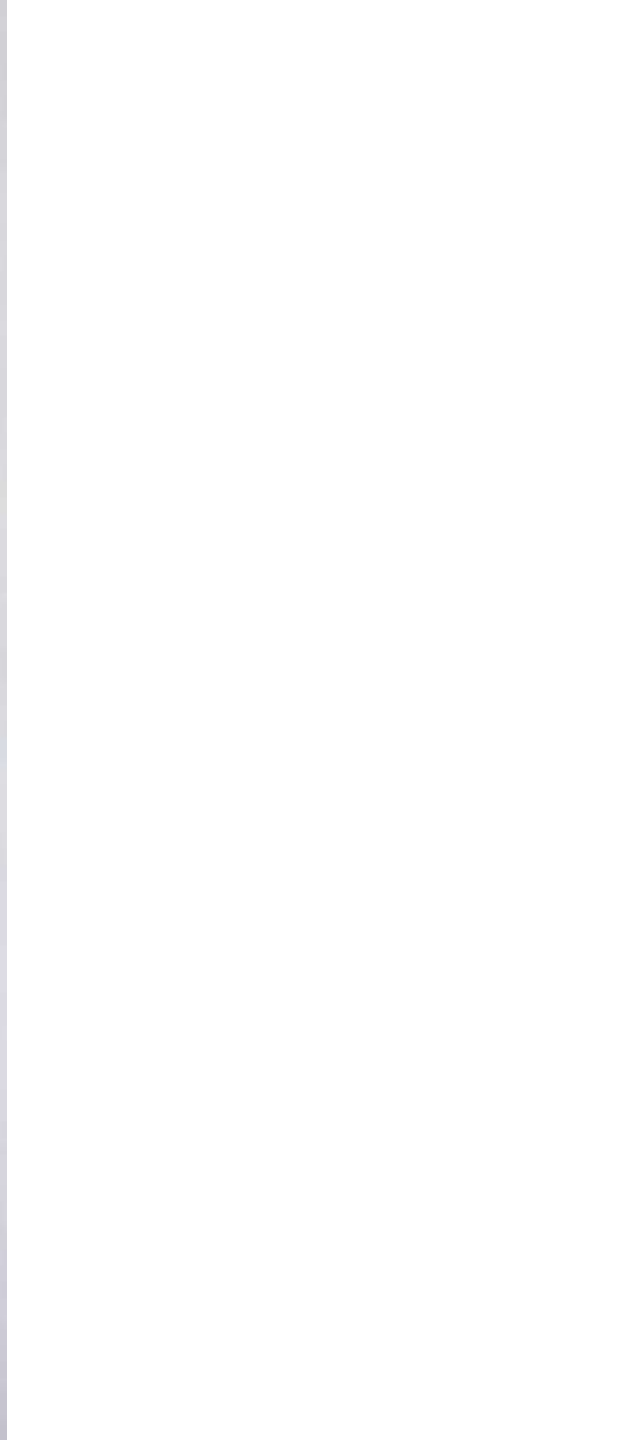
# TAXONOMY

- ***POACEAE- Subfamilies***
  - **Bambusoideae**
    - ***Bamboos***
      - *Monopodial - eg. Melocanna baccifera*
      - *Sympodial – eg. Bambusa bambos*
  - **Panicoideae – Tribes:**
    - ***Maydeae***
      - *Maize, Coix*
    - ***Paniceae***
      - *Usually awnless*
    - ***Andropogoneae***
      - *Usually awned*
  - **Pooideae**
    - ***Poa***
  - ***Study of Grasses - AGROSTOLOGY***

# Uses

- Food
  - Cereals and millets
    - Rice- *Oryza sativa*
    - Wheat- *Triticum aestivum*
    - Ragi – *Eleusine coracana*
- Fodder
  - Napier grass- *Pennisetum purpureum*
  - Guinea grass- *Panicum maximum*
- Essential oils
  - Lemon grass- *Cymbopogon flexuosus*
  - Palmarosa- *Cymbopogon martinii*
  - Vetiver- *Vetiveria zizanioides*





# Uses...

- **Soil Binders**
  - *Lasiurus hirsutus* – for sand dune stabilisation
- **Ornamental**
  - *Phragmites* and *Arundo*
- **Lawns**
  - *Zoysia tenuifolia*
- **Medicinal**
  - *Cynodon dactylon* – Doob
- **Brooms**
  - *Thysanolaena maxima*
- **Sugar**
  - *Saccharum officinarum*
- **Thatching**
  - *Chrysopogon gryllus*
- **Stuffing**
  - *Imperata cylindrica*

# Habits

- Arboreal
  - Eg. *Arthraxon jubatus*
- Terrestrial
  - Eg. *Poa annua*
- On walls
  - Eg. *Tripogon filiformis*
- Aquatic
  - Eg. *Hygrorhiza aristata*
- Sea shore
  - Eg. *Spinifex littoreus*

Kikuyu grass



# *Lasiurus* grasslands





*S. littoreus* (Male)



*S. littoreus* (Female)

# Oryzeae

## 110. *HYGRORYZA* Nees

Nees in Edinb. New Phil. J. 15; 380.  
1883; Bor, Grass. Bur. Cey. Ind. Pak.  
597. 1960.

Monotypic genus of South East Asia.

(*Hygroryza* is derived from *hygro*  
means water loving *rhyza* means root  
alluding to the its aquatic habit of the  
plant).

*Genus Distribution:* Bangladesh, Burma,  
Malaya and Sri Lanka.

*Hygroryza aristata* (Retz.) Nees ex Wt.  
& Arn.



*Hygroryza aristata*

# Andropogoneae

## 35. SACCHARUM Linn.

Linn. Sp. Pl. 54. 1753; Bor, Grass.  
Bur. Cey. Ind. Pak. 208. 1960.

(From the Latin *saccharum* means  
sugar).

Species about 30-40, of which 13  
occurs in India and 2 occurs in  
Maharashtra.

*Genus distribution:* Africa, America,  
Asia, Europe, Malaysian Islands,  
Philippine, Pacific and West Indies.

*S. spontaneum*

*S. officinarum*

*S. ravannae*



Saccharum spontaneum

*Arundo donax*





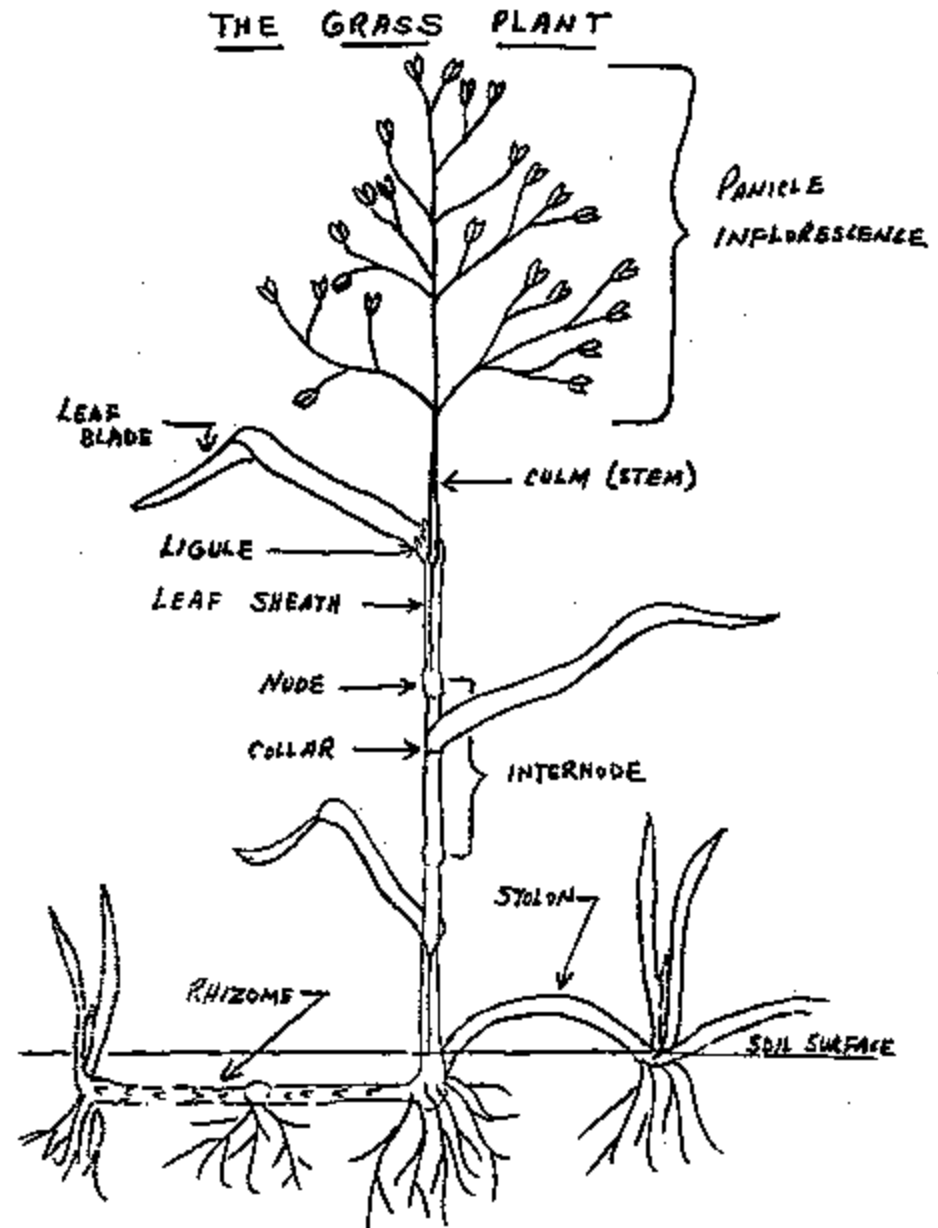
*Hierochloa laxa*

*Melica persica*



# Description

- Parallel veins
- Leaf sheath
- Ligules and auricles
- Cylindrical culm
- Fibrous roots
- Nodes



# Difference between Cyperaceae and Poaceae

- Triangular culm
- Three leaves at base of peduncle
- Palea absent
- Leaves from base



- **Leaves**
  - **Leaf sheath**
  - **Ligule**
    - **Hairy rim**
    - **Membraneous**
  - **Auricles**
  - **Lamina**
    - **Leaf tip**
      - *Acute, acuminate, blunt, etc.*
    - **Leaf base**
      - *Cordate, petiolate, cuneate, etc.*
    - **Leaf shape**
      - *Lanceolate, linear, oblong, etc.*

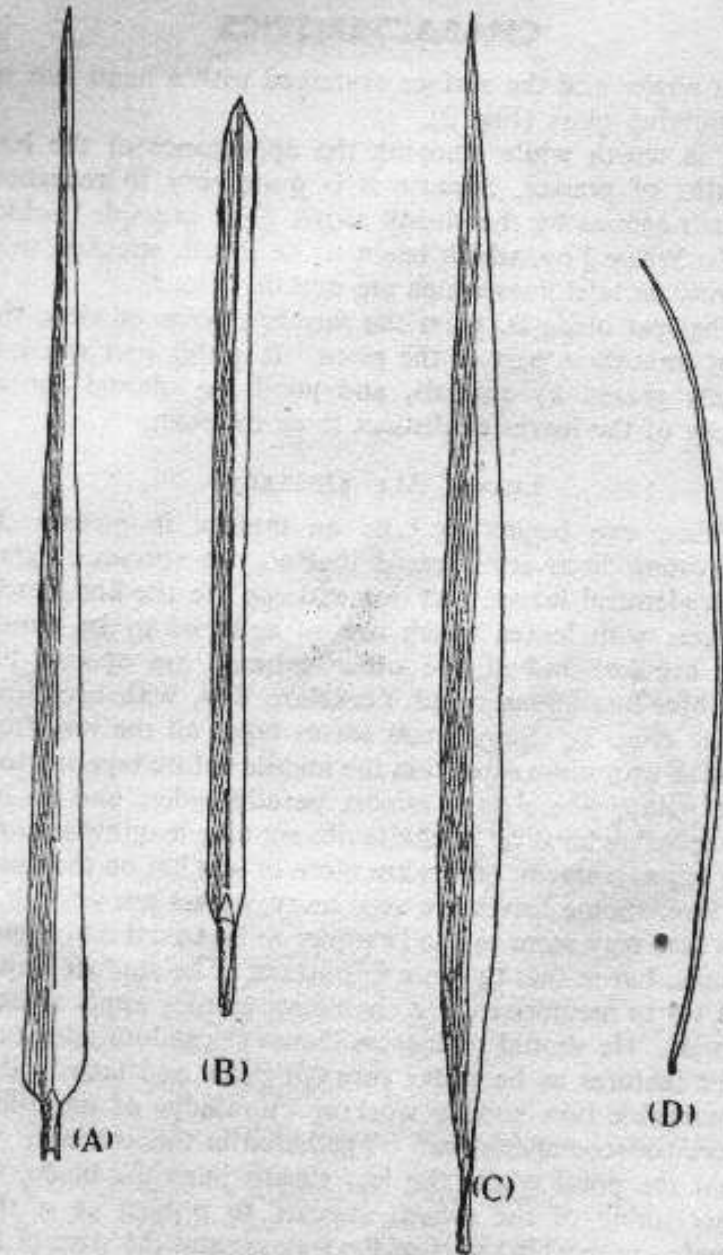


FIG. 3. Leaf Outlines.  
 A. Tapering to the tip (Cocksfoot and Agrostis).  
 B. Parallel-sided (Smooth-stalked Meadow Grass).  
 C. Tapering both ends (Brachypodium).  
 D. Needle-like (Small Fescue).



*Poa*



*Cocksfoot*



*Yorkshire Fog*



*Barley*



*Italian Ryegrass*



*Couch Grass*



*Sweet Vernal*

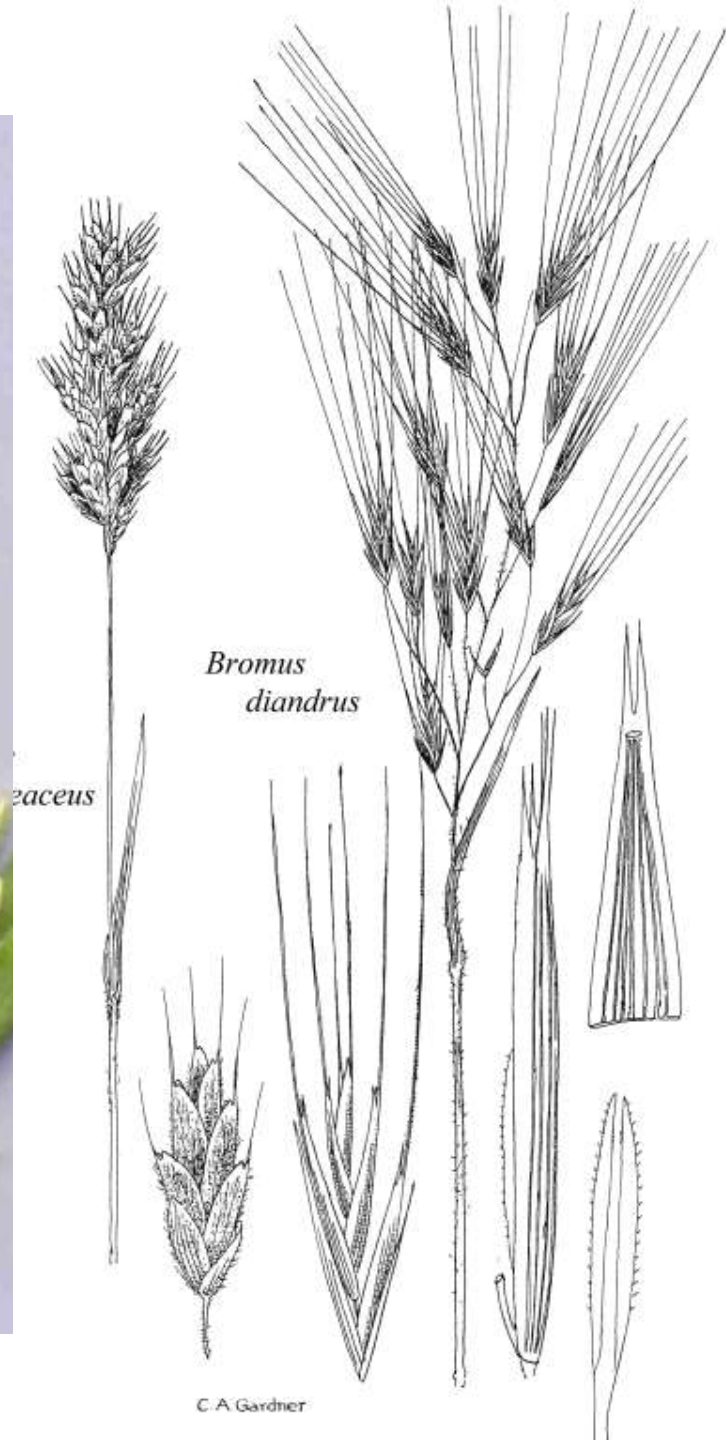


*Sheep's Fescue*

FIG. 4. Ligules and Auricles.

# ***Inflorescence***

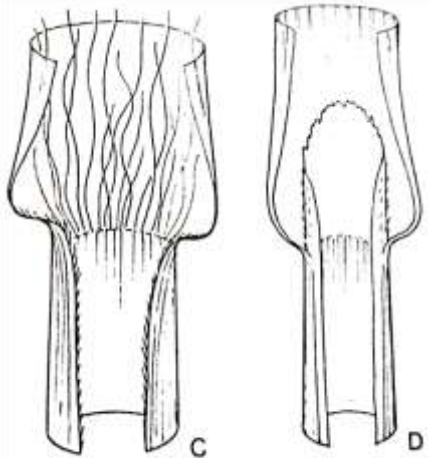
- ***Types of inflorescence***
  - ***Paniculate***
  - ***Racemes***
  - ***Spicate***
  - ***Branched racemes***
  - ***Digitate***
  - ***Sheath/Bracts***
  - ***Solitary***
    - ***eg. Lygaeum spartum***
  - ***Verticillate***
- ***Unit of inflorescence = spikelet***



# *Spikelets*

- *Spikelet >> Florets*
  - *Unisexual*
    - *Monoecious- eg.Maize*
    - *Dioecious-eg.Spinifex*
  - *Bisexual-*
    - *Wheat*
- *Awned/Unawned*
- *No. of florets*
- *Shape of spikelet*
- *Modifications*
  - *Eg.Coix, Thuarea*
- *Parts*
  - *Pedicel*
  - *Callus*
  - *Glumes*
  - *Florets*
  - *Rachilla*

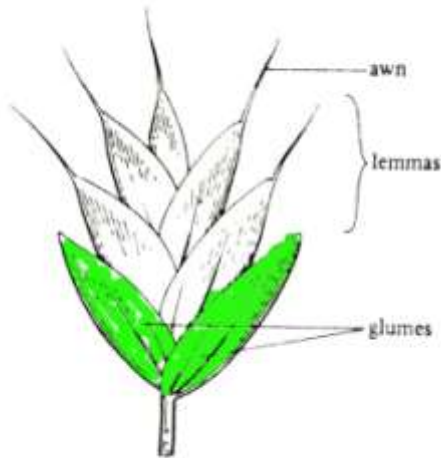
Ligule



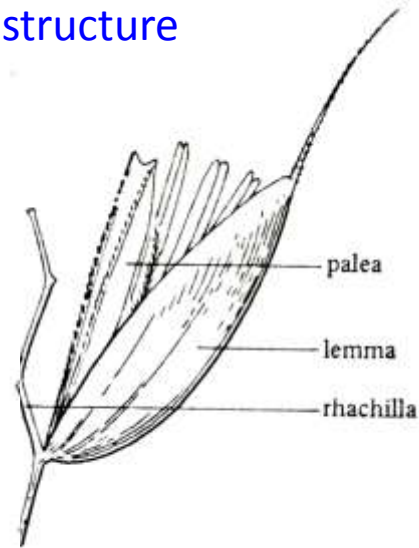
Hairy

Membranous

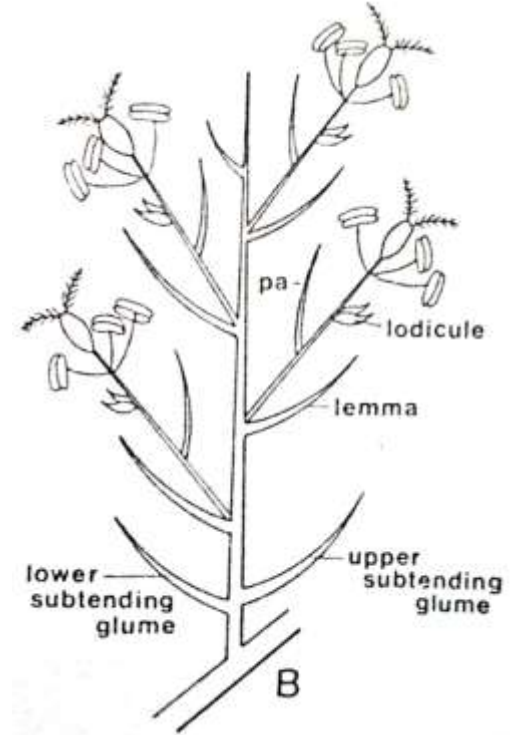
Grass spikelet structure



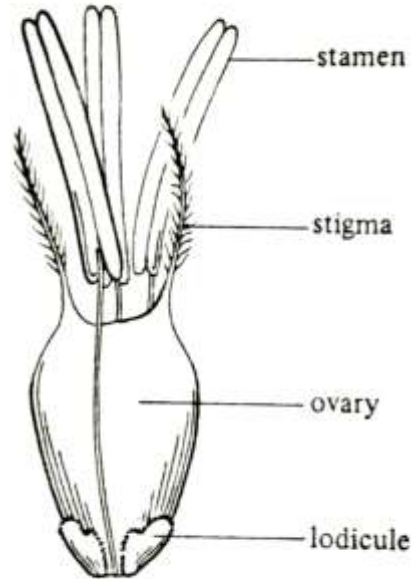
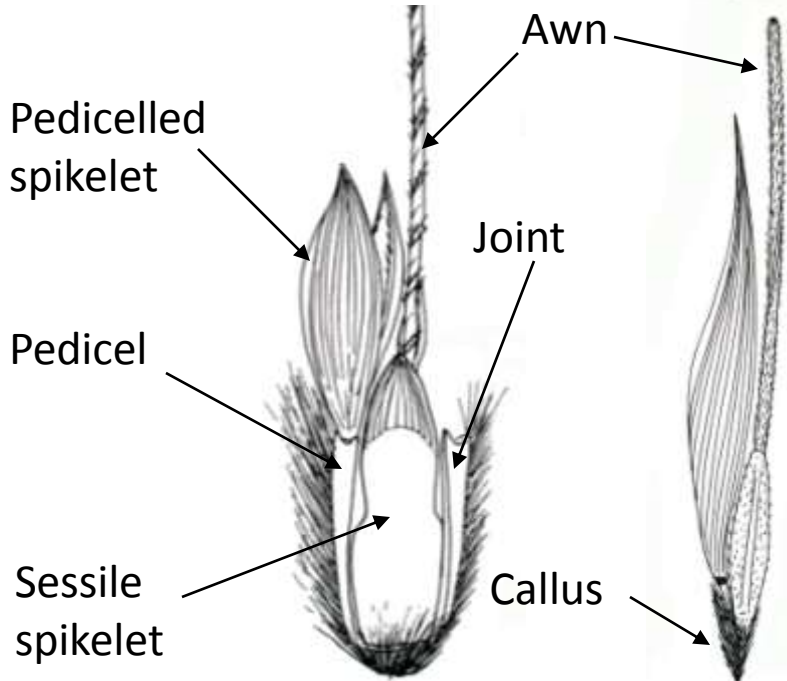
SPIKELET



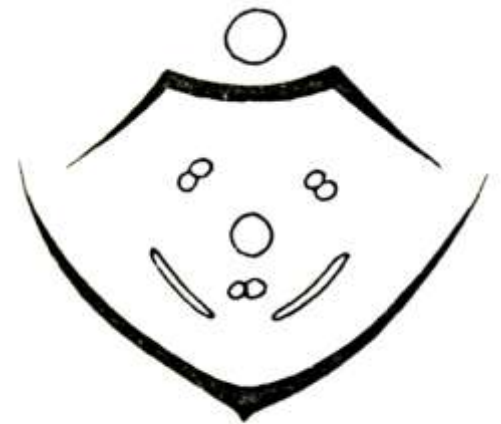
FLORET



Spikelet- Diagrammatic



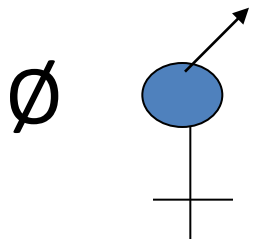
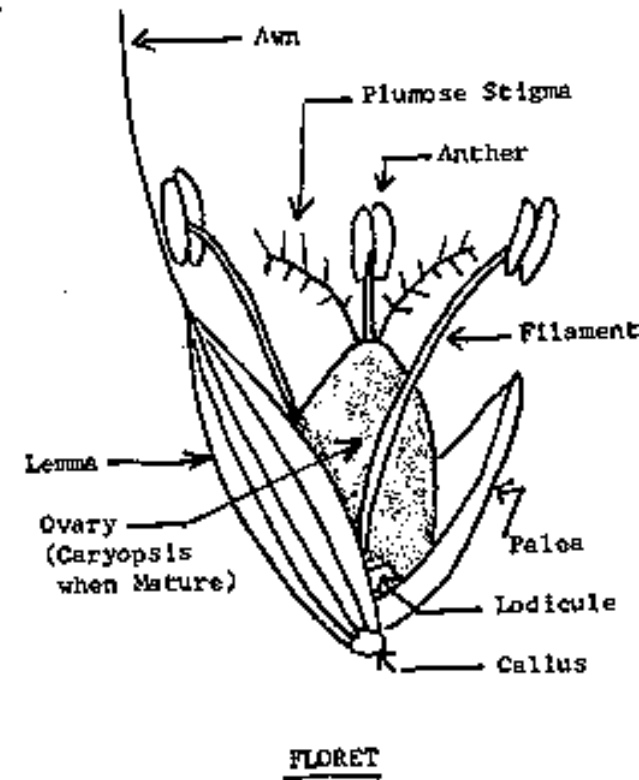
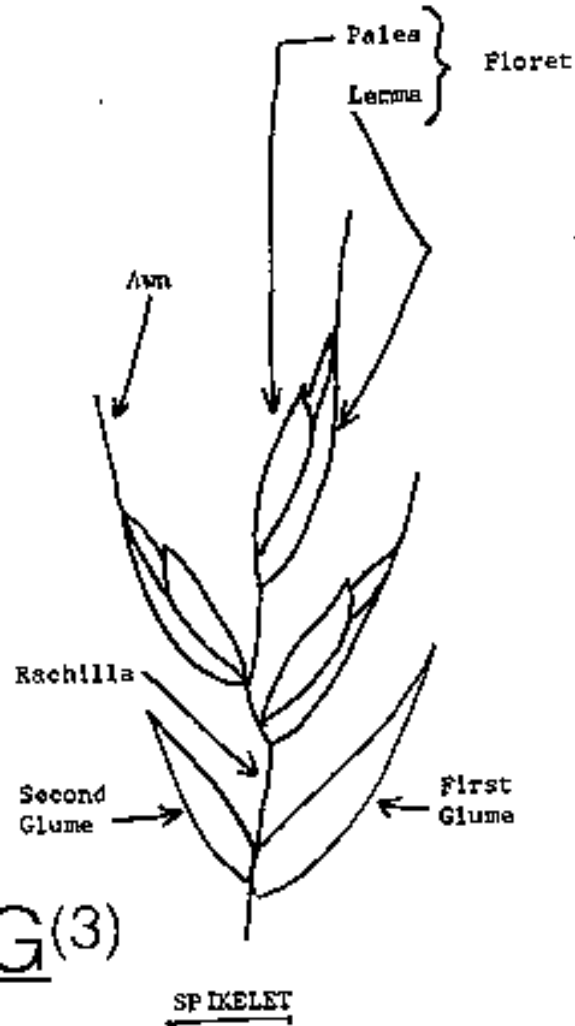
FLOWER



FLORAL DIAGRAM

# Florets

- Lemma and palea
- Lodicules
- Three stamens
- Fruit caryopsis



$K^0 C^0 A^3 \underline{G(3)}$



*Lopholepis ornithocephala*



Zoysieae

118. *Lopholepis*

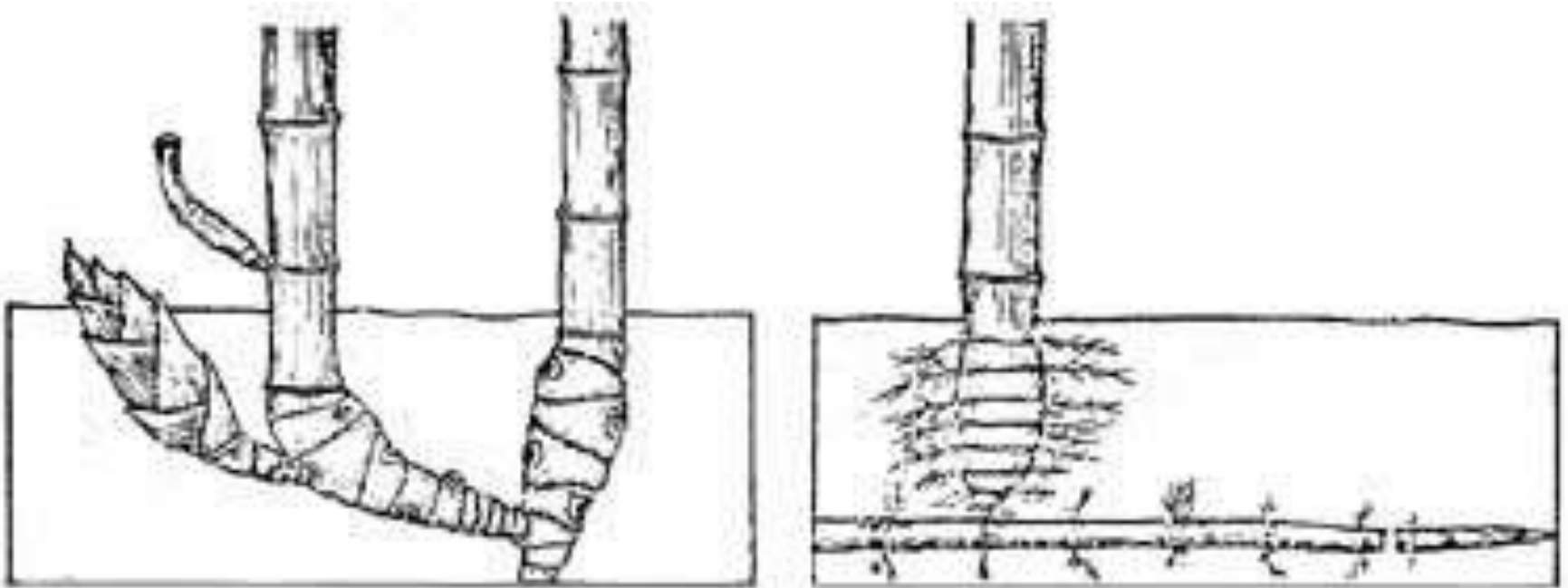


# ***Bamboos***

- ***Woody, perennial grass***
- ***Six stamens***
- ***Hard leaf sheath (culm sheath)***
- ***Gregarious flowering***
- ***Cross veins***
- ***Uses***
  - ***Poles, paper and pulp, baskets and wicker, irrigation, local uses***



# Sympodial and monopodial



## Bambuseae

### 123. DENDROCALAMUS Nees.

Nees. in *Linnaea* 9: 476. 1835;  
Hook. f., *Fl. Brit. Ind.* 403. 1896.

(*Dendrocalamus* Dendro-tree like  
calamus-reed like or cane like  
alluding to its tree like habit and  
cane like stem).

Species about 35, of which about  
10 occurs in India and 1 in  
Maharashtra.

*Genus distribution:* India, Sri Lanka,  
to China and the Philippines and  
few other warm countries.

*Dendrocalamus strictus* (Roxb.)  
Nees



*Dendrocalamus strictus*



*Yushania anceps* (*Arundinaria jaunsarensis*)



# Maydeae

## 4. ZEA Linn.

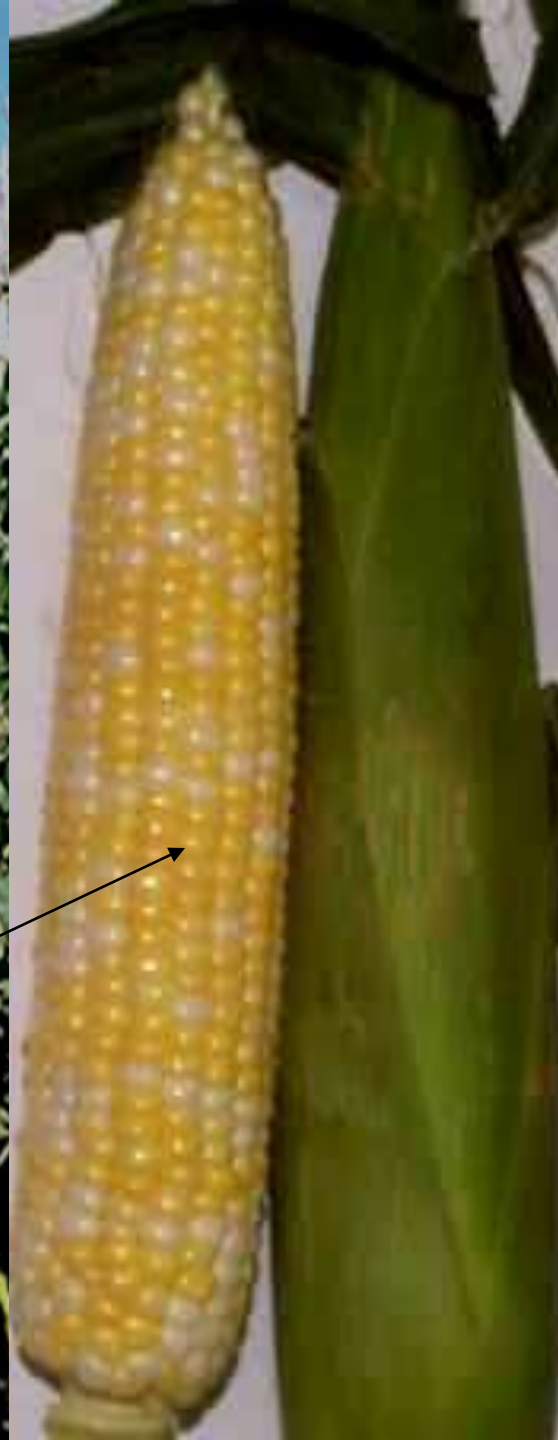
(*Zea* is the old Greek name for Cereal mentioned by Homer.)  
Species four one is cultivated in India.

*Genus distribution:* Cultivated in Warm countries of the world.

### Diagnostic characters:

Male and female spikelets in different inflorescence. The male spikelets are in terminal racemes, while the solitary female inflorescence consists of numerous female spikelets seated on a spongy axis.

Field note: Widely cultivated for its grains and used as fodder.



# Paniceae

## 58. PASPALUM Linn.

(*Paspalum* from the Greek term for a millet.)

Linn. Syst. Nat. ed. 10, 2:855. 1759; Hook. f., Fl. Brit. Ind. 7 :10. 1896; Bor, Grass. Bur. Cey. Ind. Pak. 334. 1960.

Species about 250, distributed in the tropical regions, of which about 12 species occur in India and 3 in this region.

*Genus Distribution:* Asia, Europe, Malaya, Pacific Islands and U. S. S. R.



*Paspalum canare* var. *canare*



*P. canare* var. *canare*



*P. scrobiculatum*



*Paspalum distichum*



*P. purpureum*

*P. pedicellatum*



*Pennisetum purpureum*

## Paniceae

### 59. PENNISETUM L.C.Rich.

L. C. Rich in Pers. Syn. Pl. 1 : 72.  
1805; Hook. f., Fl. Brit. Ind. 7 : 82.  
1896, p. p.; Bor, Grass. Bur. Cey.  
Ind. Pak. 341. 1960.

(*Pennisetum* is derived from Penna, a  
feather, and seta, a bristle)

Species about 75, distributed in the  
tropical and subtropical parts of the  
world, of which 15 occur in India  
and 6 in this region.

*Genus distribution:* Africa, America,  
Asia, Australia, Europe, Malaysian  
Islands, Philippine Islands and West  
Indies.

# Paniceae


## 47. CENCHRUS L.

Gen. Pl. ed. 5: 470. 1754; Sp.  
Pl. ed. 1: 1049. 1753; Bor,  
Grass. Bur. Cey. Ind. Pak. 287.  
1960.

(*Cenchrus*-is the Greek  
Kenchros, a kind of millet.)

Species about 25, 7 occurs in  
India and about 4 in  
Maharashtra

*Genus Distribution:* Africa,  
America, Australia, Europe,  
Mediterranean regions and  
other Warm countries.



Cenchrus biflorus



## Andropogoneae

### 43. VETIVERIA Lem.-Lisanc.

Lem.-Lisanc. In Bull. Soc. Philom, Paris 1822: 43. 1822; Bor, Grass. Bur. Cey. Ind. Pak. 258. 1960.

(*Vetiveria* comes from *Vetiver*, the Tamil vernacular name of the plant).

Species about 10, distributed in the tropics of the world, of which 2 occur in India and also in Maharashtra.

*Genus distribution:* America, Africa and many parts of Asia and Java.

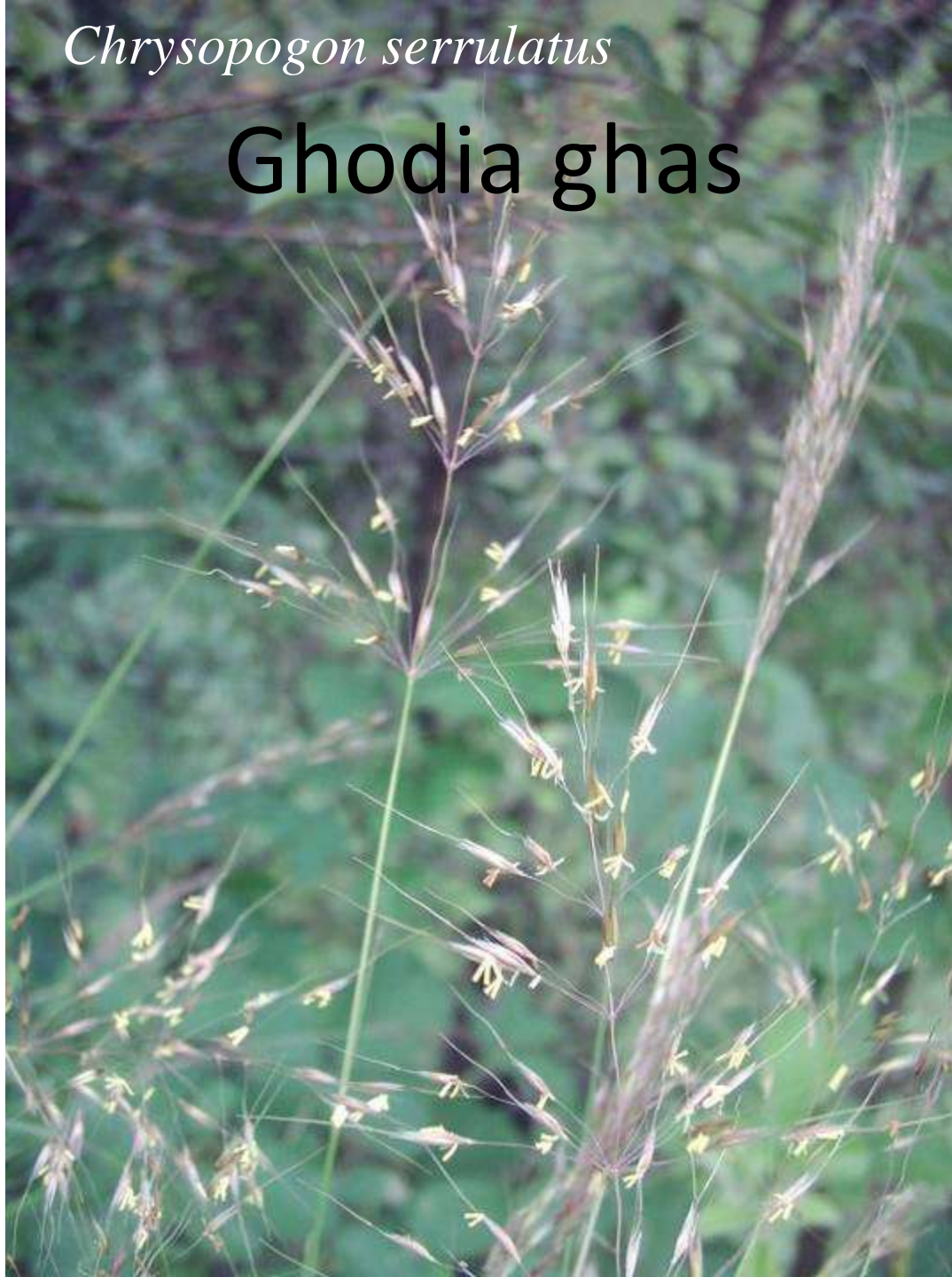
*V. zizanioides*

*V. lawsonii*



*Chrysopogon serrulatus*

Ghodia ghas



## Andropogoneae

### 41. THEMEDA Forssk

Forss. Fl. Aegypt.-Arb. 178. 1775;  
Bor, Grass. Bur. Cey. Ind. Pak. 248.  
1960.

(*Themeda* was formed from the  
Arabic name of the plant  
Thaemed).

Species about 20, of which 19  
occur in India and 6 in  
Maharashtra.

*Genus distribution:* Warm regions of  
the World.



## Andropogoneae

### 15. DIMERIA R. Br.

Prodr. Fl. Nov. Holl. 204. 1810;  
Hook. f., Fl. Brit. Ind. 7 : 103.  
1896; Bor, Grass. Bur. Cey. Ind.  
Pak. 136. 1960.

(*Dimeria* means having two parts,  
very likely in allusion to the  
bifarious arrangement of the  
spikelets.)

Species about 45, distributed in  
tropics and subtropics, of which **28**  
occur in India and 7 in this region.

*Genus distribution:* Eastern Asia,  
North America, Burma, Europe,  
Malaysian Islands, Malaya, Pacific  
Islands, Peninsula, Philippine  
Islands and Sri Lanka.



*Dimeria gracilis*



*D. woodrowii*



*Dimeria blaterii*

Andropogoneae: **Chrysopogon**



*C. velutinous*



*C. aciculatus*



*C. castaneus*



*C. gryllus*



*C. hackelii*



*C. lancearis*



*C. polyphyllus*



*C. fulvus*

*J. griffithiana*



## Arundinelleae

77. JANSENELLA Bor.

Bor, in Kew Bull. 1955:  
96. 1955; Bor, Grass.  
Bur. Cey. Ind. Pak. 426.  
1960.

A monotypic genus  
distributed in Burma,  
Ceylon and India also  
occurs in Maharashtra.

*Genus distribution:*  
Burma, India and  
Srilanka



*Avena ludoviciana*  
*ssp. sterilis*

*Avena sativa*

# Aveneae

78. *Avena*



**Centotheca lappacea**

## Centotheceae

### 80. CENTOTHECA Desv.

Desv. In Nouv. Bull. Soc. Philom. 2: 189.  
1810; Bor. Grass. Bur. Cey. Ind. Pak. 457.  
1960.

(*Centotheca* is derived from *Kentein* to prick,  
and *theca*, a receptacle, alluding to the  
restore spines on the flowering glumes.)

A genus of about 3 species distributed in  
the tropics and subtropics of the world,  
of which one species occurs in India and  
Maharashtra.

*Genus distribution:* North America,  
Australia, Burma, Bangladesh, Malaya,  
Malaysian Islands, Philippine Islands and  
Sri Lanka.



# Chlorideae

## 81. CHLORIS Sw.

Sw. Prod. Veg. Ind.  
Occ. 25. 1788; Bor.  
Grass. Bur. Cey. Ind.  
Pak. 464. 1960.

(*Chloris* is derived from  
Chloros, green)

Species about 60 , of  
which 10 occurs in  
India

*Genus Distribution:*  
Distributed in warmer  
regions of the world.

*Chloris barbata*



# Chlorideae

## 84. MELANOCENCHRIS Nees

Nees in Proc. Linn. Soc. 1: 94. 1841; Bor, Grass. Bur. Cey. Ind. Pak. 472. 1960.

Species 3, distributed in tropical Asia and India, of which 2 occurs in Maharashtra.

*Genus distribution:* Chad to India and Sri Lanka.

*M. jacquemontii*

*M. abyssinica.*



Manisuris jacquemontii

# Eragrostieae

## 92. DACTYLOCTENIUM Willd.

Enum. Hort. Berol. 1029. 1809; Bor,  
Grass. Bur. Cey. Ind. Pak. 488. 1960.

(*Dactyloctenium* is derived from  
dactylos means finger like).

Species about 13, distributed in  
tropical, subtropical and warm  
temperate regions of the world, 4  
occur in India and also in  
Maharashtra.

*Genus Distribution:* Distributed in  
warmer countries Africa, America,  
Australia, Bangladesh, Burma,  
Europe, Malaysia, Malaya Peninsula,  
Nepal, New Zealand and New  
Guinea.



Dactyloctenium aegyptium

# Eragrostieae

## 93. DESMOSTACHYA Stapf.

Stapf. in Dyer, Fl. Cap. 7: 632. 1900;  
Bor, Grass. Bur. Cey. Ind. Pak. 491.  
1960.

(From the Greek *desmos* binding material and *stachys* a plant with a narrow inflorescence, perhaps alluding to sand binding habit).

Species one which also occurs in India and Maharashtra.

*Genus Distribution:* Northern Africa, through the Middle East to India and Indo China

*Desmostachya bipinnata* (L.) Stapf



*Desmostachya bipinnata*



Elytrophorus spicatus

## Eragrostieae

### 97. ELYTROPHORUS P. Beauv.

Ess. Agrost. 67, t. 14. f. 2. 1812; Bor,  
Grass. Bur. Cey. Ind. Pak. 493. 1960.

(*Elytrophorus* derived from *elytron*, a  
cover, and *phorein*, to bear, perhaps  
alluding to the palea.)

Species 2, of which 1 occurs in India  
in Maharashtra.

*Genus distribution:* Australia, Burma,  
Bangladesh, Malaya, New Zealand, Sri  
Lanka and Tropical Africa.

*Elytrophorus spicatus* (Willd.) A.  
Camus

# Eragrostieae

## 98. ERAGROSTIELLA Bor.

Bor. in Ind. For. 66: 269.  
1940; Bor, Grass. Bur. Cey.  
Ind. Pak. 493. 1960.

(*Eragrostiella* a diminutive of  
*Eragrostis* a related genus).

Species 7 distributed in  
Burma and Ceylon, of which  
5 occur in India and 1 in this  
region.

*Genus distribution:* Eastern  
Africa to Burma and  
Northern Australia.

*E. bifaria*

*E. brachyphylla*



*Eragrostiella bifaria*

# Eragrostieae

## 99. ERAGROSTIS Wolf

Wolf. Gen. Pl. Vocab. Char. def. 23.  
1776; Bor, Grass. Bur. Cey. Ind.  
Pak. 495. 1960.

(*Eragrostis* is derived from the Greek eros, love and agrostis, grass in allusion to the loose dancing spikelets).

Species about 300, distributed in tropics and subtropics, of which 35 occur in India and 20 in this region.

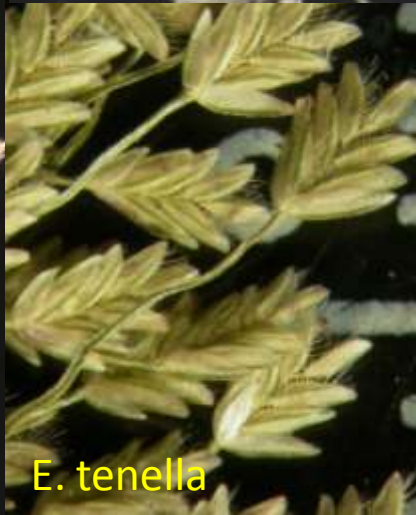
*Genus distribution:* Africa Asia, Australia New Zealand, Philippine, Sri-Lanka and U. S. S. R.



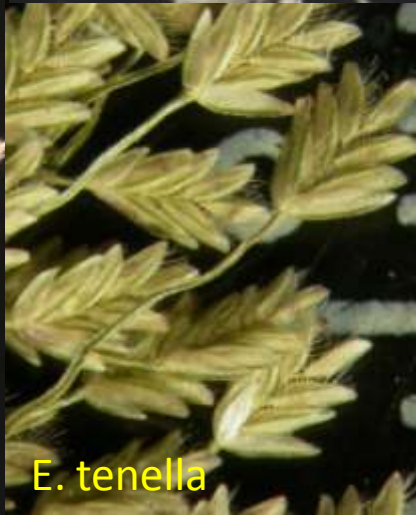
Eragrostis uniolooides



E. japonica



E. cilianensis



E. tenella



## 112. *ORYZA* Linn.

Linn. in Sp. Pl. 333. 1753 et.  
Gen. Pl. ed. 5. 155. 1754; Hook.  
f., Fl. Brit. Ind. 7 : 92. 1896; Bor,  
Grass. Bur. Cey. Ind. Pak. 601.  
1960.

(*Oryza* is Greek name for rice).

Species about 23, of which  
about 10 species and many  
varieties occur in India and 3 in  
this region.

*Genus distribution:* Tropical parts  
of the world.

*O. latifolia*

*O. rufipogon*

*O. sativa*



# Thysanolaeneae

## 117. THYSANOLAENA Nees

Nees in Edinb. New Phil. J. 18.  
180. 1835; Bor, Grass. Bur. Cey.  
Ind. Pak. 650. 1960.

(*Thysanolaena* is derived from  
thysanoi, fringe, tassels and laena, a  
garment or cloak, alluding to the  
very compound panicle).

A monotypic Grass genera.

*Genus distribution:* Tropical Asia and  
throughout India.



Thysanolaena maxima

# Zoysieae

119. TRAGUS Hall.

Hall., Hist. Stirp. Helv. 2, 203  
1768; Bor, Grass. Bur. Cey.  
Ind. Pak. 682. 1960.

Species about 7, widely  
distributed in tropics and  
subtropics of the world, of  
which 1 occurs in India and  
also in Maharashtra.

*Genus distribution:* Throughout  
the tropics, occurs chiefly in  
Asia, Europe, Africa, North  
and South America.

*Tragus roxburghii* Panigrahi



Tragus roxburghii

# Zoysieae

Zoysia

Zoysia matrella



120. ZOYSIA Willd. (*nom. cons.*)

Willd. In Neul. Schr. Ges. Naturf. Fr. Berlin 3: 440. 1801; Bor, Grass. Bur. Cey. Ind. Pak. 684. 1960.

Species about 10, of which 3 species occurs in India and 1 in Maharashtra.

*Genus distribution:* Tropics and subtropics of the world.

*Zoysia matrella* (L.) Merr. in Philipp. J. Sci. Bot

# References

- **Bor,N.L. (1960)**
  - *The Grasses of Burma, Ceylon, India and Pakistan*
- **DELTA Software**
  - [www.rbgkew.org](http://www.rbgkew.org)
- **Cope,T.A**
  - *Flora of Pakistan Vol 53*
- **Yadav,S.R**
  - **Know Your Grass Genera Through Hand Lens**
- *Flora of Tamilnadu – Grasses*
- *Grass Flora of Kerala*
- *Bombay Grasses*

THANK  
YOU

[chandranmanoj@hotmail.com](mailto:chandranmanoj@hotmail.com)



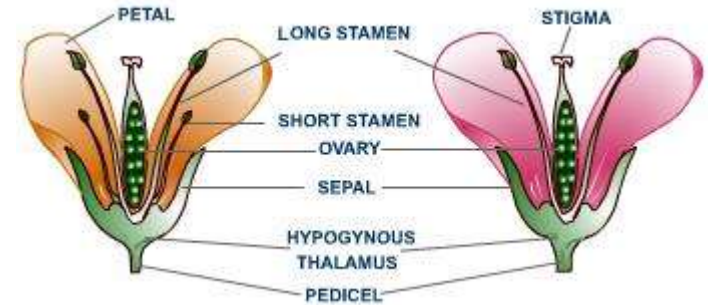
# Systematic Botany for IFS officers

By MANOJ CHANDRAN IFS

Day 4

# DICOTS

- POLYPETALAE
  - Thalamiflorae
  - Disciflorae
  - Calyciflorae
- GAMOPETALAE
  - Inferae
  - Heteromerae
  - Bicarpellatae
- MONOCHLAMYDEAE

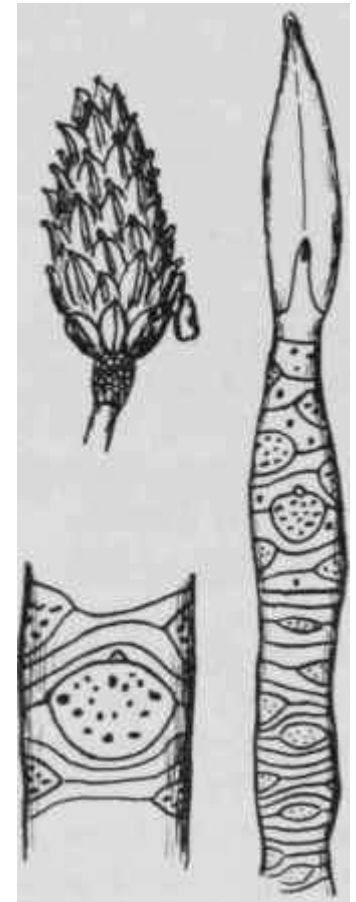


[http://en.wikipedia.org/wiki/Bentham\\_%26\\_Hooker\\_system](http://en.wikipedia.org/wiki/Bentham_%26_Hooker_system)

<http://www.docstoc.com/docs/90177584/Download-this-file-Dr-Maninder-Kaurppt---cmmsgc11org#>

# MAGNOLIACEAE

- Dicot → Polypetalae → Thalamiflorae → Ranales
- 7 genera, 219 species
- Key features
  - Trees
  - Stem scars
  - Solitary, showy flowers
  - Apocarpous pistil
    - (Carpels of ovary are separate and many in number)
    - Spirally arranged on elongated receptacle
  - Petals several and separate
  - Aggregate fruit
    - Etario of follicles

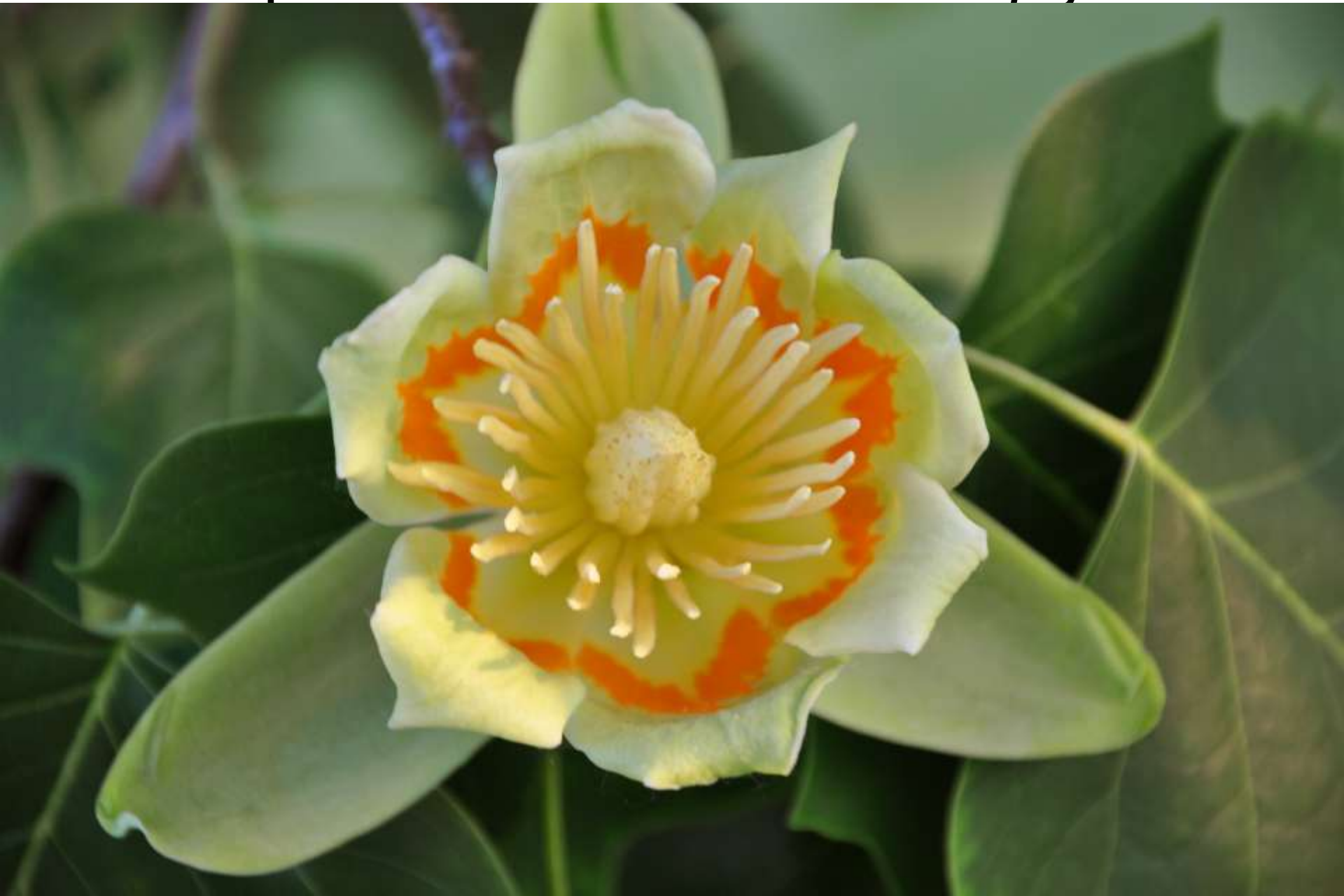


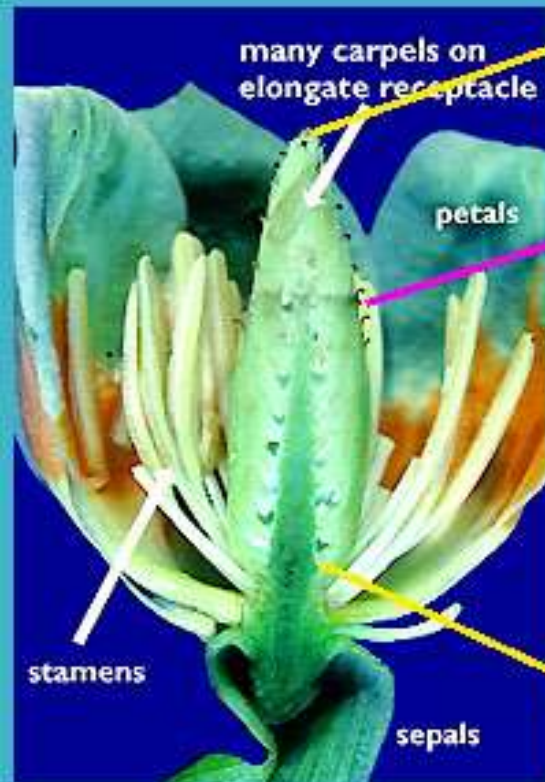
# MAGNOLIACEAE

- Trees
  - *Magnolia grandiflora*
  - *Michelia champaca*
  - *Michelia kissopa*
  - *Liriodendron tulipifera*

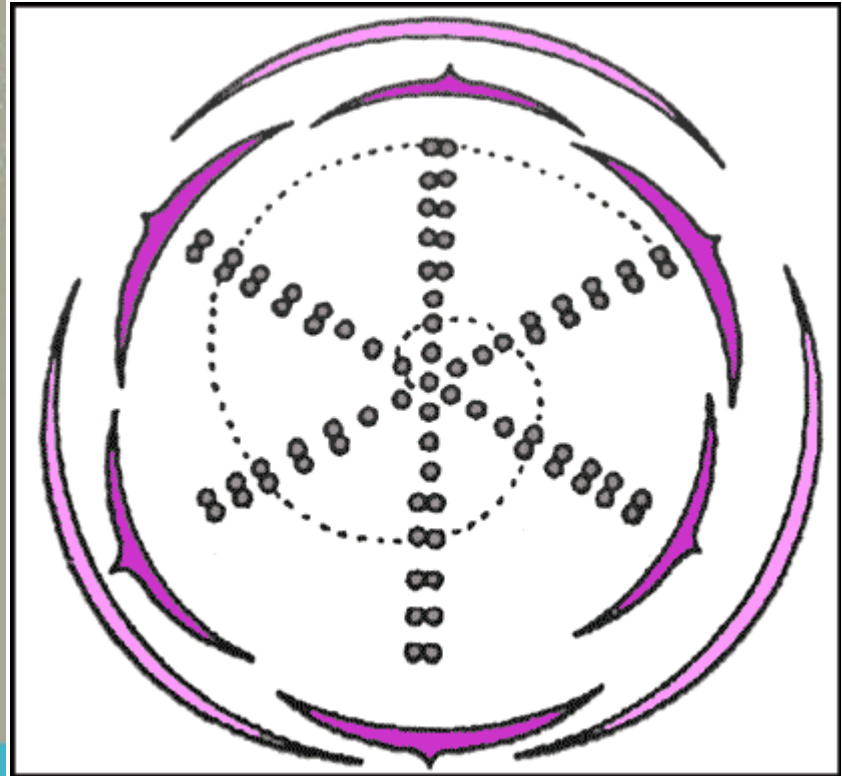
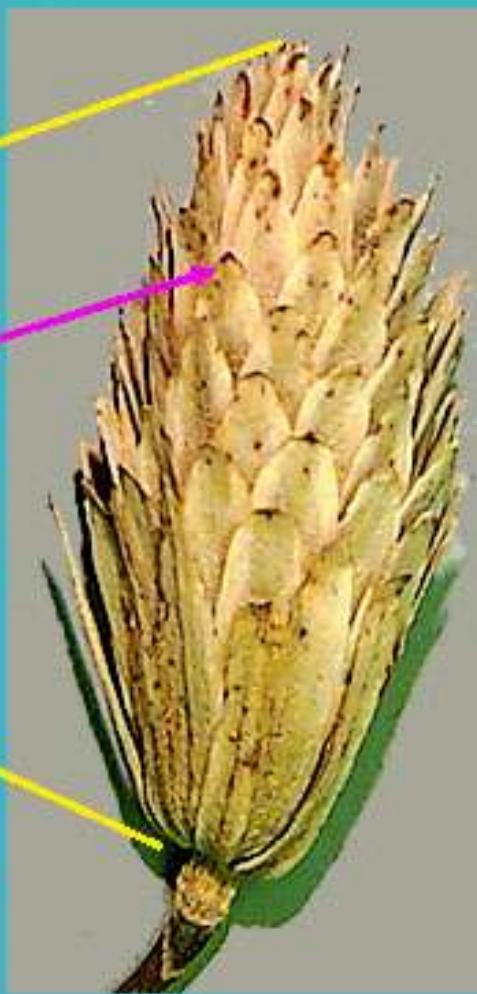


Tulip tree – *Liriodendron tulipifera*





© K. R. Robertson  
Illinois Natural History Survey



♀ CA<sup>3</sup> CO<sup>6-∞</sup> A<sup>∞</sup> G<sup>∞</sup>











- *Magnolia grandiflora*





# MYRTACEAE

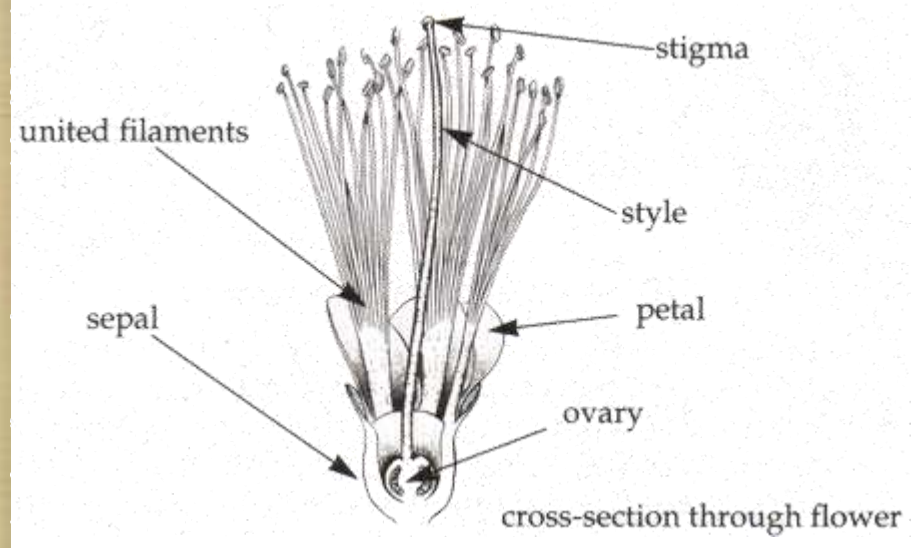
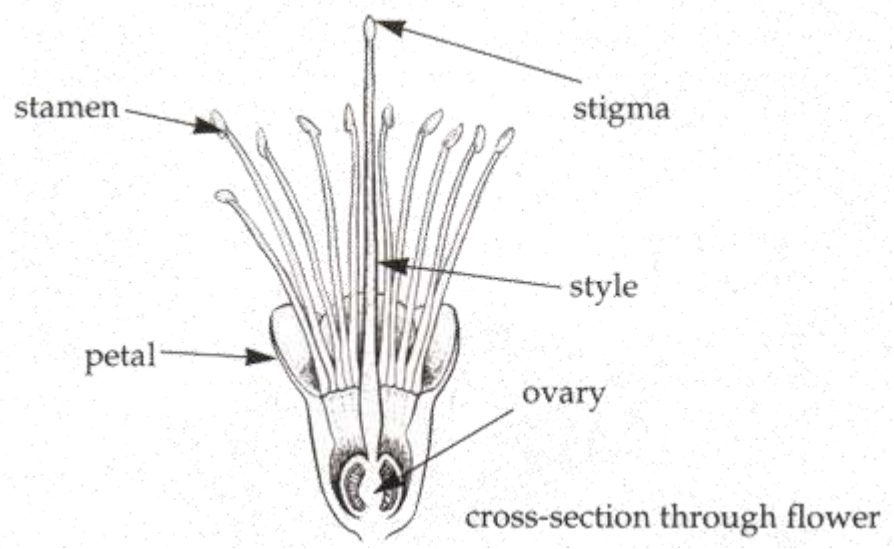
- Dicot → Polypetalae → Calyciflorae → Myrtales
- 130-150 genera, 5650 species
- Key features
  - Woody plants with leaves having essential oils
  - Showy and numerous stamens
  - Simple leaves (unlike Mimosaceae)
  - Bark peeling on maturity
  - Woody fruits

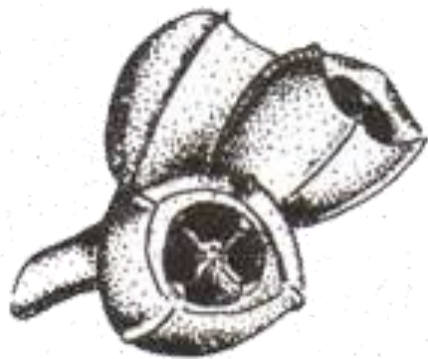
# MYRTACEAE (Myrtle family)

- Trees
  - *Eucalyptus regnans* – tallest flowering plant
  - *Eucalyptus tereticornis*, *E.grandis*, *E.camaldulensis*
  - *Eucalyptus globulus* – Mysore gum
  - *Psidium gujava* (Guava)
  - *Callistemon lanceolatus* (Bottle brush)
  - *Syzygium cumini* (Jamun)
- Shrubs
  - *Myrtus communis*



*Myrtus communis*



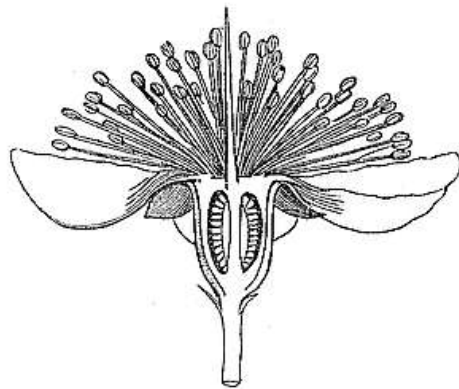


Fruits of various eucalypt species

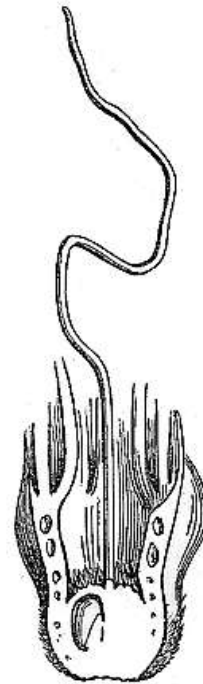




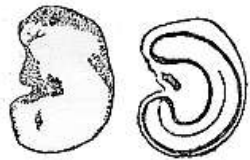
Myrtle. (*Myrtus communis*.)



Myrtle.  
Vertical section of flower (mag.).



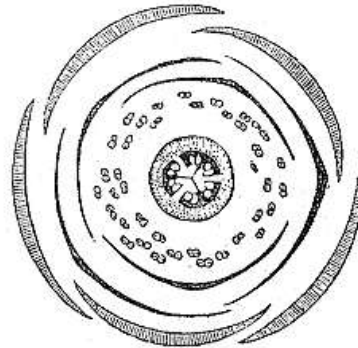
*Beaufortia*.  
Vertical section of pistil  
(mag.).



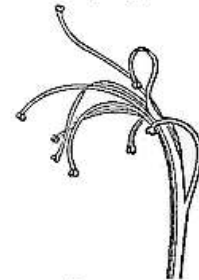
Myrtle.  
Seed, entire and cut  
vertically (mag.).



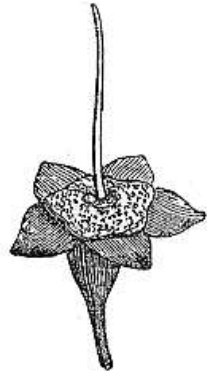
Myrtle.  
Ovary cut transversely  
(mag.).



Myrtle.  
Diagram.



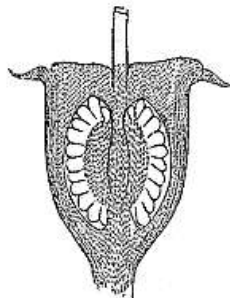
*Beaufortia*.  
Bundle of stamens.



Myrtle.  
Pistil, disk and  
calyx (mag.).



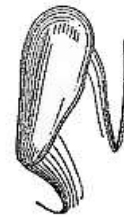
Myrtle.  
Stamen  
(mag.).



Myrtle.  
Ovary cut  
vertically (mag.).



*Beaufortia*.  
Flower without anthers  
or stigma.



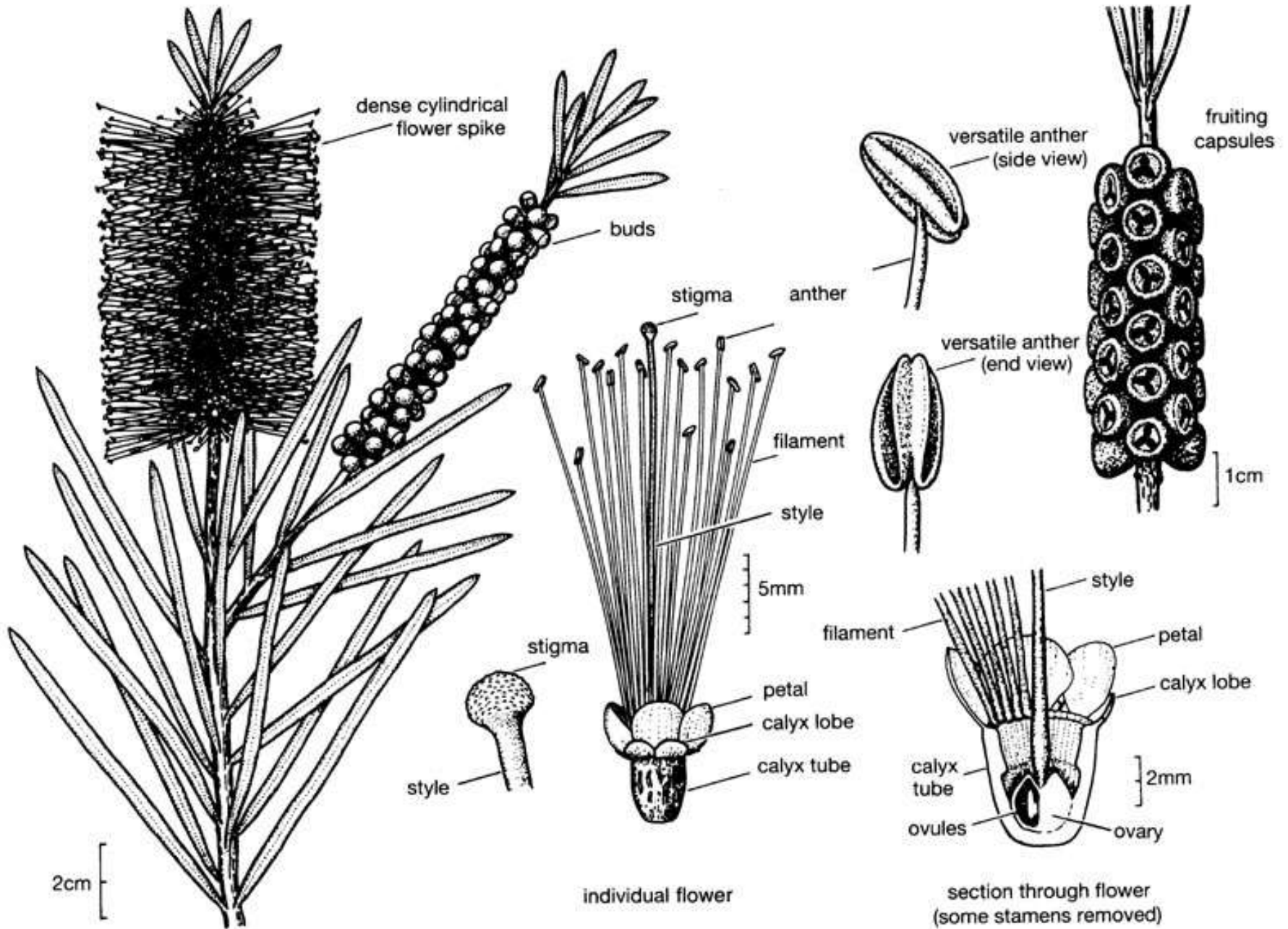
*Beaufortia*.  
Ovule  
(mag.).

# Peeling bark









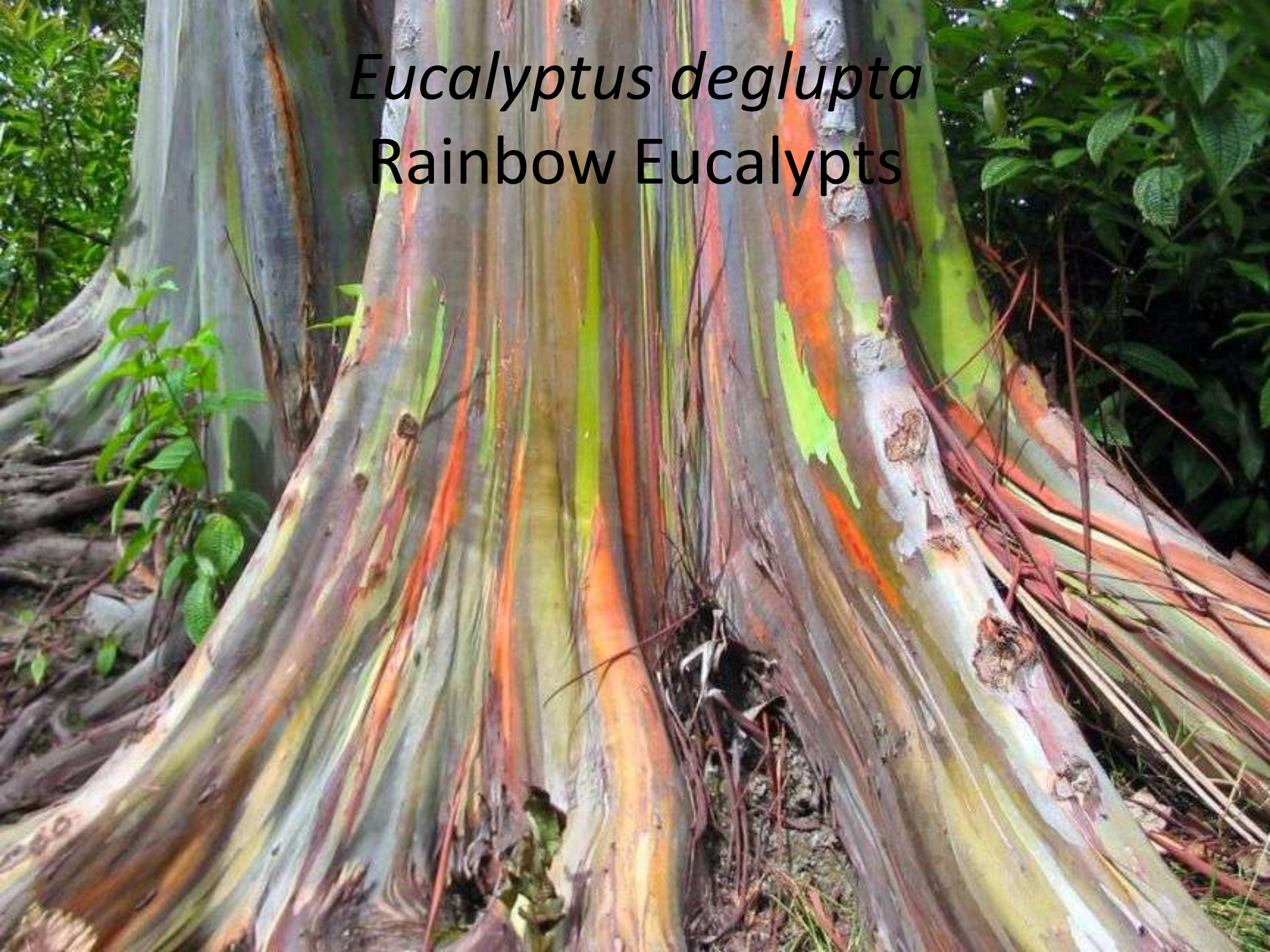




# *Eucalyptus*



*Eucalyptus deglupta*  
Rainbow Eucalypts





# Systematic Botany for IFS officers

By MANOJ CHANDRAN IFS

Day 5



# ORCHIDACEAE

- Monocot → Micrembryae → Orchidales
- 880 genera, around 22000-26000 species
- Second largest family in the world after Asteraceae
- *Bulbophyllum* – 2000 species
- *Dendrobium* – 1400 species
- Type species is *Orchis latifolia*



Cattleya



*Orphys  
apifera*

# ORCHIDACEAE

- Key features
  - Herbs – Terrestrial, Epiphytic, Lithophytic
  - Velamen roots
  - Fleshy or thick leaves
  - Resupinate (twisted 180 deg) peduncle
  - Showy flowers with ornamental labellum
  - Pollen sacs
  - Fruit dehiscent capsule
  - Microscopic seeds
  - Pseudobulbs
  - Orchis – two tubers present





# ORCHIDACEAE

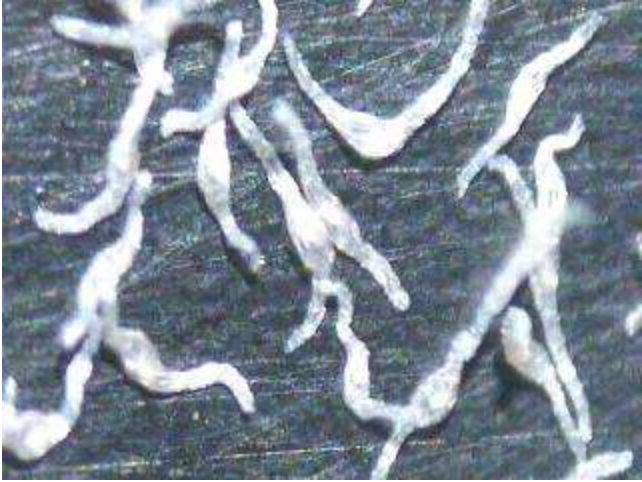
- Main species
  - Vanilla – *Vanilla planifolia*
    - (*has reticulate veins too*)
  - *Pholidota reticulata* – Harjojan
  - *Dactylorhiza hatagirea* – Hathajadi/ Salampanja
  - *Gymnadenia*
  - *Paphiopedilum* spp. Ladies slipper orchids
    - Schedule VI plant
  - *Habenaria*







## Photomicrographs of seeds of *Phaius tankervillae*



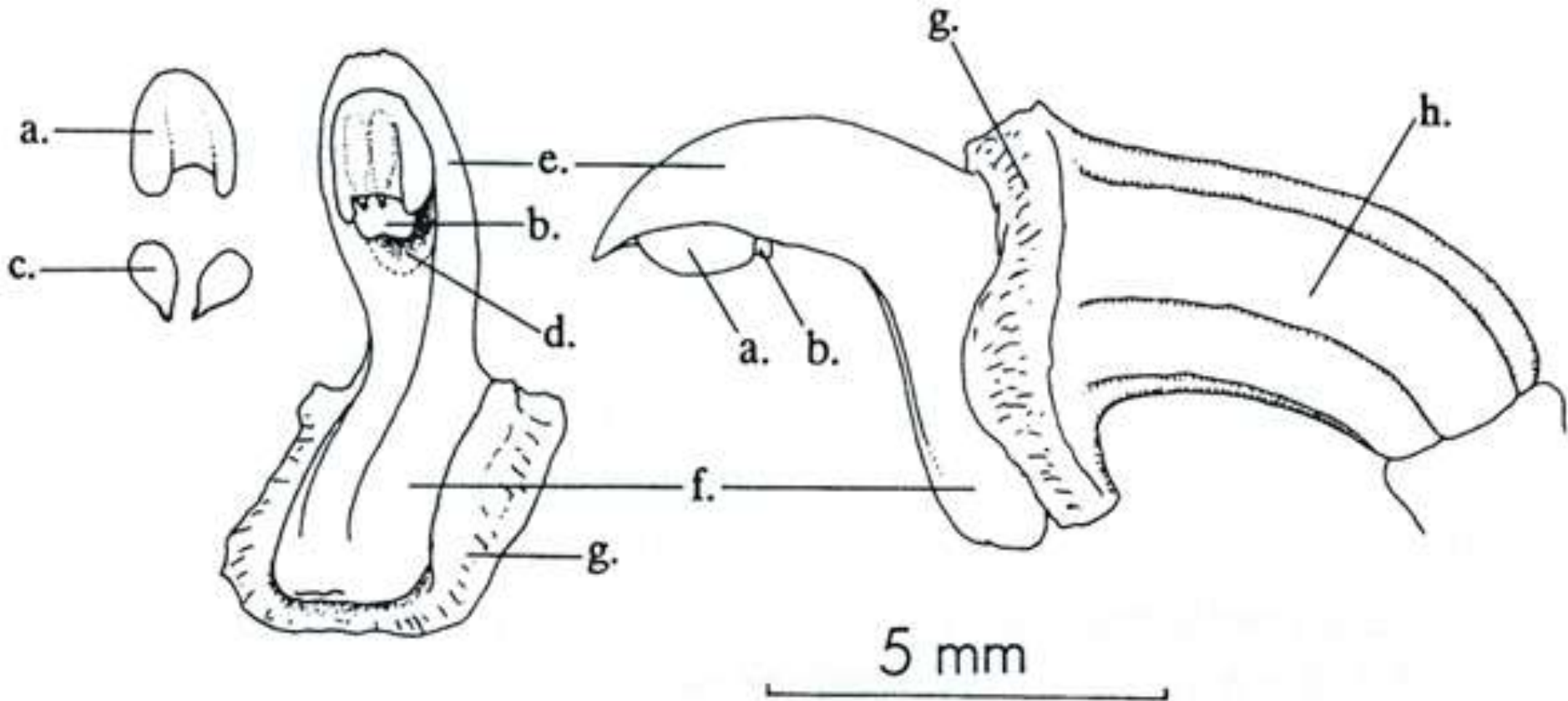


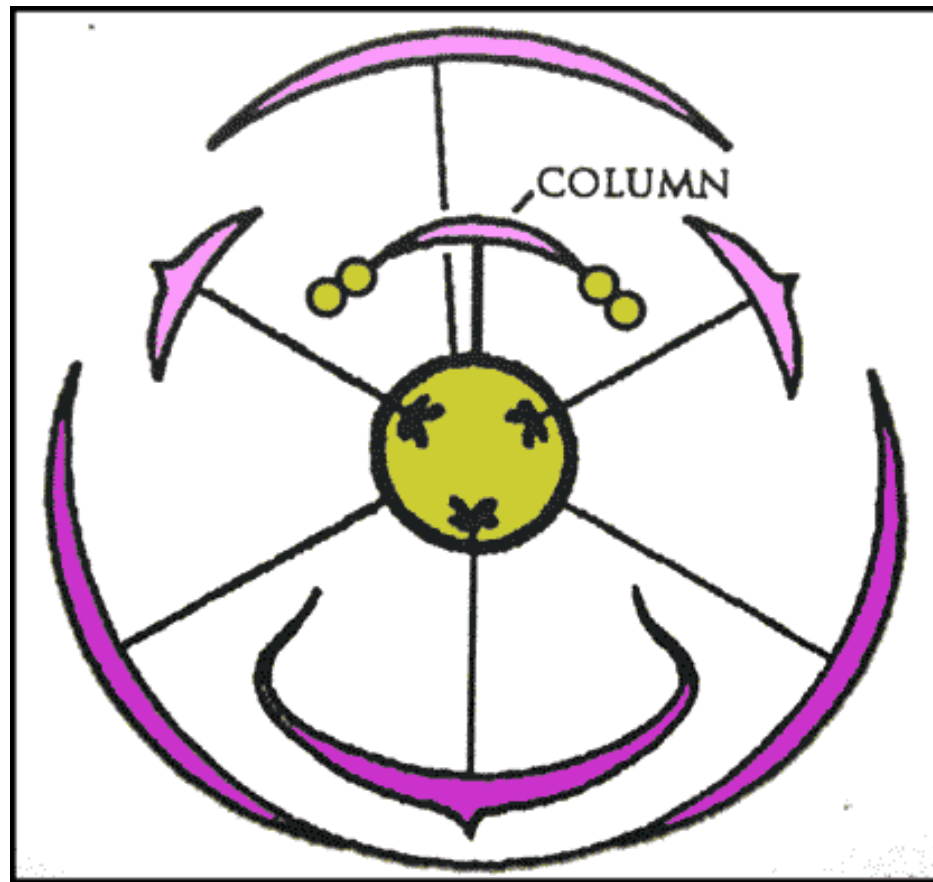
Figure 4. Column and a non-crested ovary (*Dracula verticulosa*).

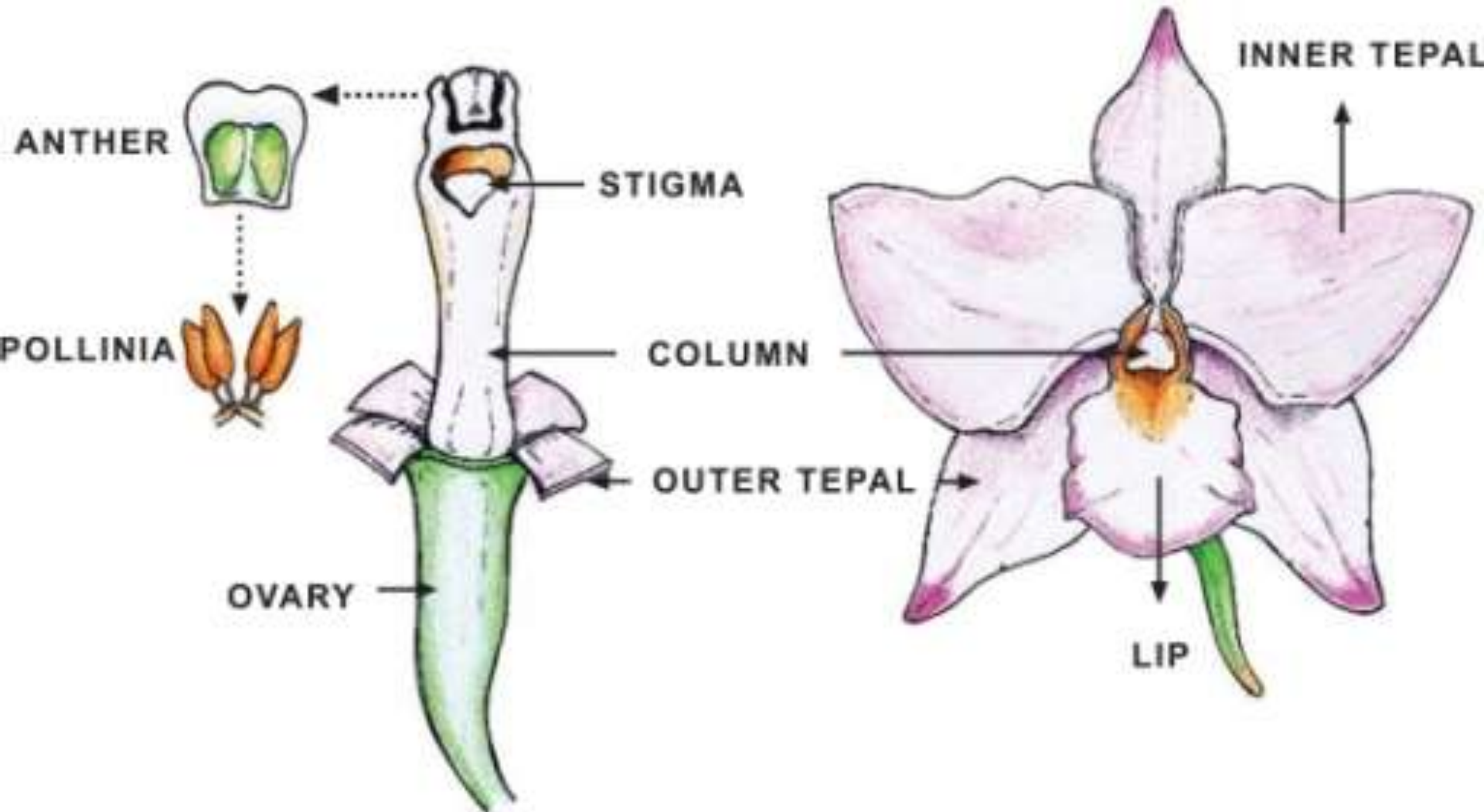
a. anther cap  
 b. rostellar flap  
 c. pollinium  
 d. stigma

e. column  
 f. column-foot  
 g. base of sepals cut away  
 h. ovary

# Orchidaceae Orchid Family

♂  
♀ CaZ<sup>3</sup> CoZ<sup>3</sup> A<sup>1 or (2) (3)</sup>  
G<sup>(3)</sup>





# Ghost orchid



- *Dendrophylax lindenii*





# Schedule VI orchids

- 3 out of 6 plants in schedule VI of WPA 1972
  - Ladies slipper orchids – *Paphiopedilum* spp.
  - Red Vanda – *Renanthera imschootiana*
  - Blue vanda – *Vanda coerulea*



Paphiopedilum  
insigne  
– Ladies slipper





*Vanda coerulea*

*Renanthera imschootiana*



# Orchids in Uttarakhand

- ~237 species
- ~121 in Gori valley alone
- 2 Orchidaria by UKFD – at Nainital and Munsyari
  - ~60 species
  - Collection of orchids fallen from trees. Hence not ‘consuming’
    - Habitat improvement –
      - by ANR, eradication of IAS, soil and moisture conservation
- Works done so far-
  - Somdeva and Naithani (1986) (NW Himalayas)
  - YPS Pangtey, S.S.Samant, Rawat G.S(1991) (Uttarakhand)
  - Samant, S.S, Rawal,R.S and U.Dhar (1995) (Kumaon)
  - Jalal,J.S, Rawat,G.S and Pankaj Kumar (2007) (Askot WLS)
  - Malhotra, Balodi, Kalakoti, Chaudhary and many others



*Habenaria commelinifolia*

*Habenaria commelinifolia*



*Phaius tankervillae*







*Vanda testacea*



*Eulophia spectabilis*



# Luisia trichorhiza



*Nervilia aragona*



Nervilia aragona



***Peristylus  
constrictus***



*Aerides multiflora*



*Rhycostylis retusa*







- *Satyrium* pollination

*Pholidota articulata*



*Coelogyne cristata*



# Himalayan Botanic Gardens

Nainital



# Fernatum and orchidarium



# Orchidarium and Fernatum at Nainital



*Luisia and Coelogyne ovalis*



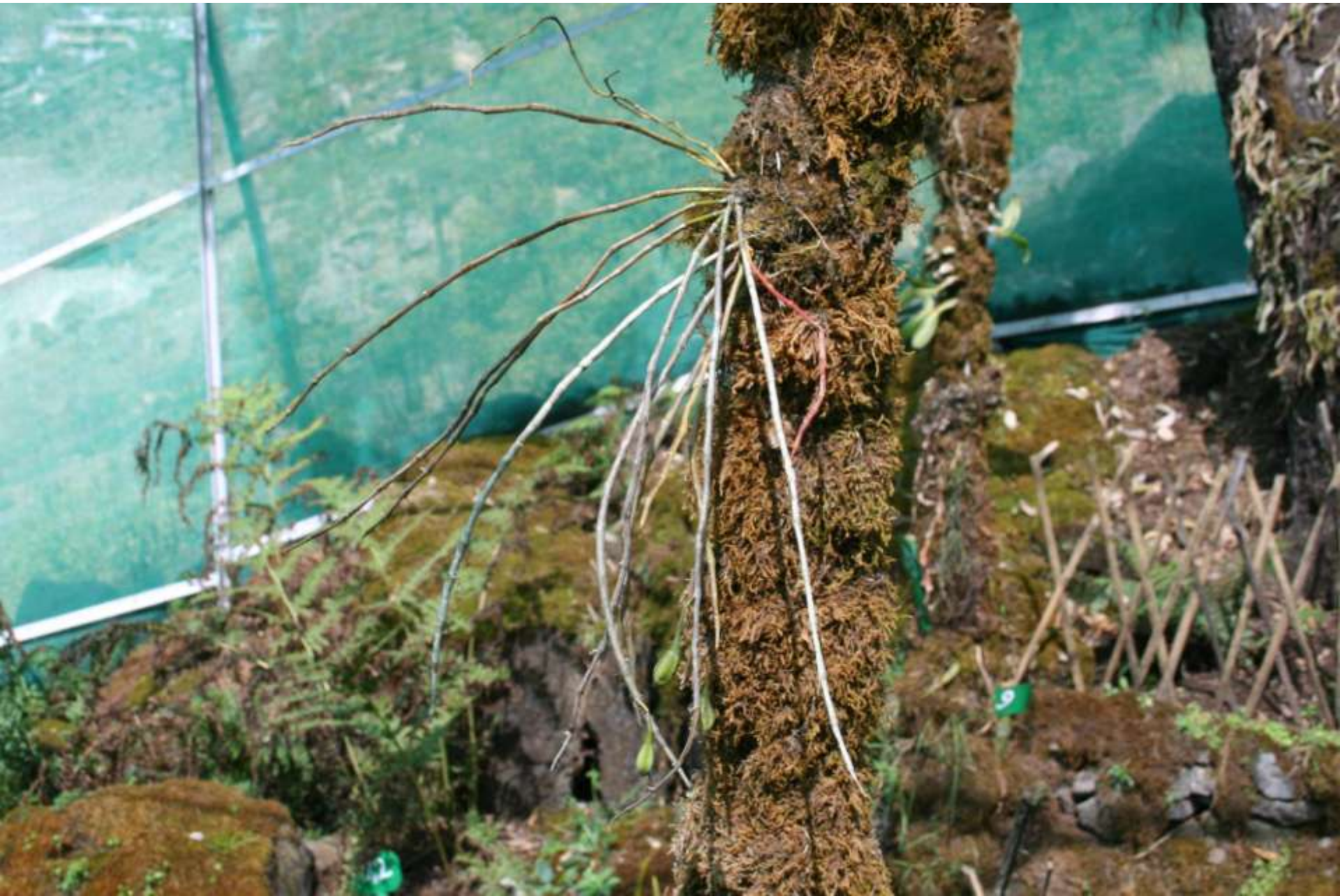




*Vanda cristata*



*Dendrobium amoenum*



*Dendrobium amoenum*



***Oberonia pachyrachis***



*Liparis viridiflora*



*Pholidata articulata*



*Goodyera repens*



- *Habenaria edgeworthii*



*Aerides odorata* and *A. multiflora*



*Malaxis acuminata*



- K.S.Rawat, Range Officer, Himalayan Botanic Gardens





*Spiranthes sinensis*



Liparis paradoxa



*Calanthe tricarinata*



*Dendrobium monticola*



## *Orchids in lower Goriganga valley*



***Dactylorhiza hatageria*** (melting snow-cold treatment?)





- *Gymnadenia orchidis* and *Dactylorhiza*



*Dactylorhiza hatageria*  
Salampanja हथाजडी





# Fertilization in plants

- <https://www.youtube.com/watch?v=dgFY7WUTASQ>
- [https://youtu.be/0UEpq1W9C\\_E](https://youtu.be/0UEpq1W9C_E)

# USING FLORA KEYS

## Rosaceae (rose family) dichotomous key

---

Leaves compound.

Leaflets small <1 inch, toothed. Stems lack prickles (thorns) - *Potentilla*.

Leaflets >1 inch. Stems with prickles (thorns) - *Rosa*.

Leaves simple.

Leaves lobed

Branches with thorns, fruit a pome - *Crataegus*

Branches without thorns, fruit a follicle

Plants a prostrate shrub under 4 feet tall - *Stephanandra*

Plants an upright shrub over 4 feet tall - *Physocarpus*

Leaves mostly without lobes.

Leaves entire, plants are mostly prostrate shrubs - *Cotoneaster*.

Leaves with marginal teeth.

Fruit is a drupe, achene or follicle.

Fruit is a drupe.

Fruit a shiny black drupe, petioles lack glands - *Rhodotypos*

Fruit a black or red drupe, petioles with glands - *Prunus*

Fruit an achene or follicle.

Fruit an achene, stems green - *Kerria*

Fruit a follicle, stems brown - *Spiraea*

Fruit a pome or berry-like pome.

Leaves with black glands on the leaf mid-vein - *Aronia*.

Leaves without black glands on the leaf mid-vein.

Plants multi-stemmed large shrub or small tree, leaves sharply serrate, - *Amelanchier*.

Plants a single-stemmed small or large tree.

Leaves with a shiny wax coating with a wavy margin, leaves twice as long as wide - *Pyrus*.

Leaves dull without a waxy coating, leaves less than twice as long as wide - *Malus*.

- **Rosaceae** – Agneshwar -Monday 10:00-10:30 – and practicals
- Sterculiaceae/Malvaceae –
- Euphorbiaceae – Wednesday 10:00-10:20 – Poornima
- Coniferae – Kunal – Wednesday 10:30-10:40
- Lythraceae – Shivkumar – Thursday 10-10:30
- Dipterocarpaceae – Vidya – Wednesday 10:40-11:00
- Rhizophoraceae – Abhinav – Thursday 10:30-10:55
- Meliaceae
- Lauraceae
- Anacardiaceae - Piyusha
- Rubiaceae
- **Asteraceae - MC**
- Fagaceae – MC
- **KANJILAL FLORA TO BE ISSUED**

# Systematic Botany for IFS officers

By MANOJ CHANDRAN IFS

Day 8

# ASTERACEAE

- COMPOSITAE - Sunflower family
- > 19000 species in > 1100 genera
- Aster
- Sunflower – *Helianthus annuus*
- Daisy, Zinnia, Cosmos, Chrysanthemum
- Anaphalis, Helichrysum (Everlasting)
  
- Usually herbs, some shrubs and rarely trees
- Tree – *Leucomeris spectabilis*

- Head/ Capitulate inflorescence
- Bracts and phyllaries (Involucre)
- Ray florets – Female/sterile
- Disc florets
- Ligulate florets – Cichory, Dahlia
- Nectaries present (as external outgrowths of ovary)



**inflorescence  
a head  
(capitulum)**

**actinomorphic  
tube florets**



**two  
stigma  
lobes**

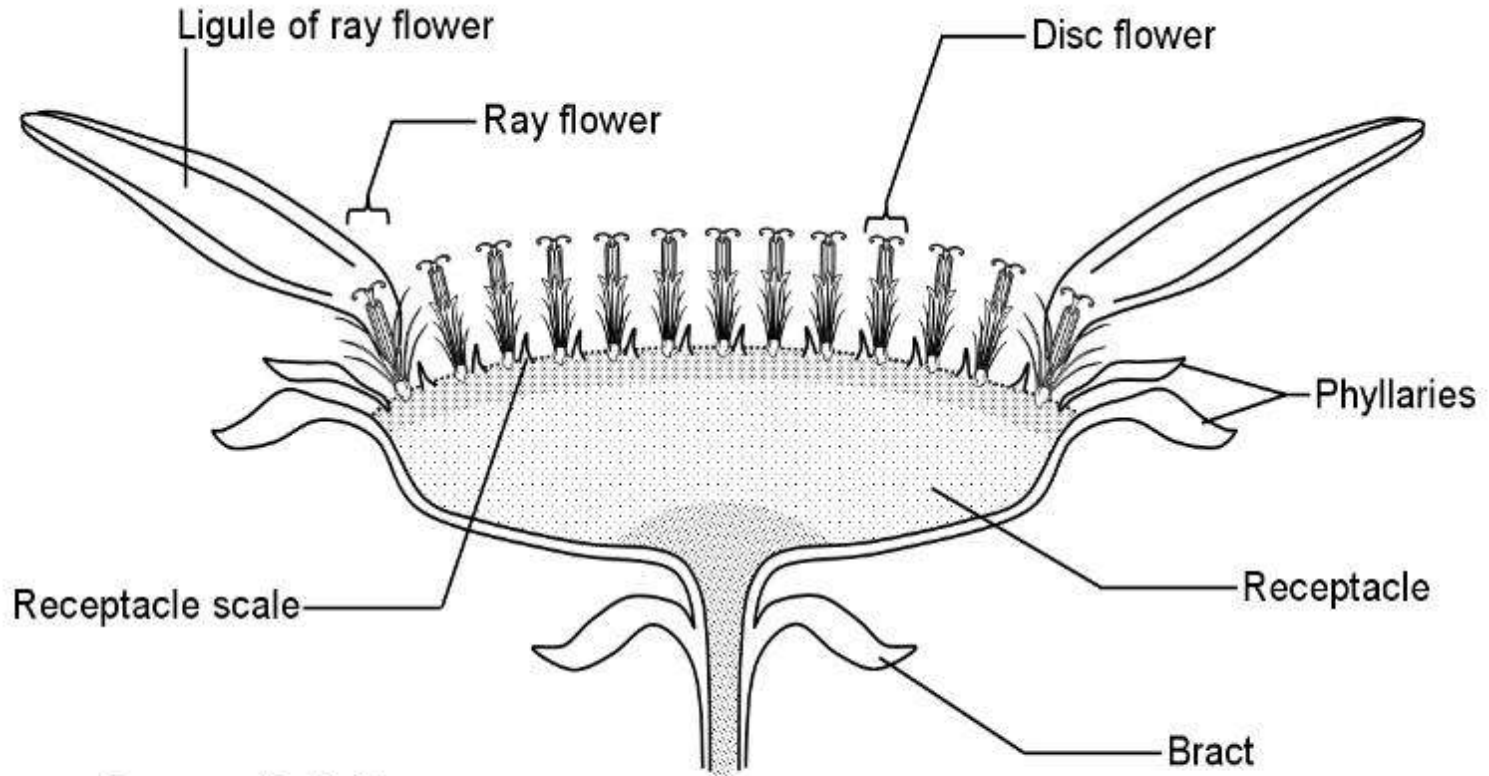
**zygomorphic  
ray florets**

# Moon Daisy – *Leucathemum vulgare*

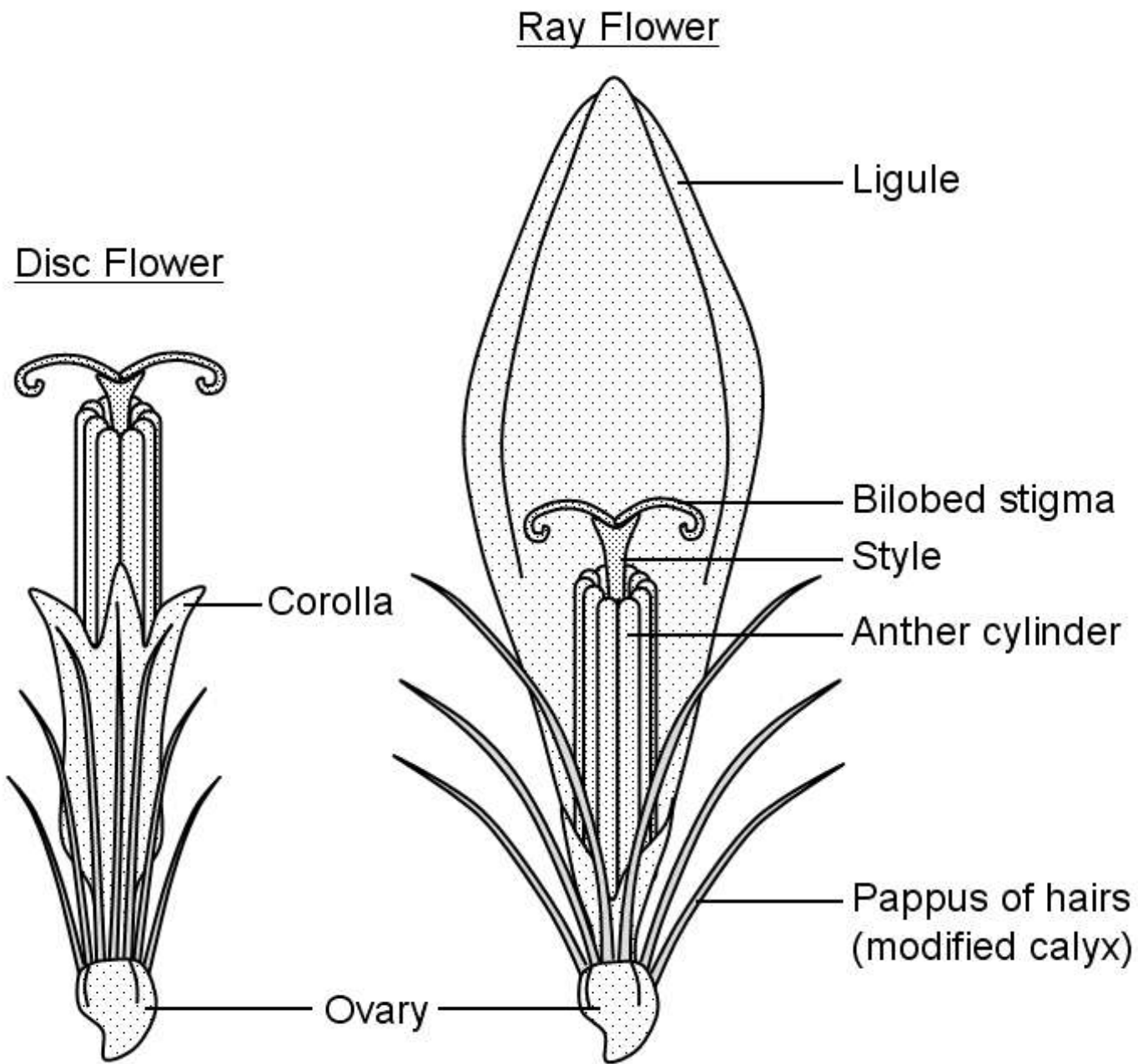


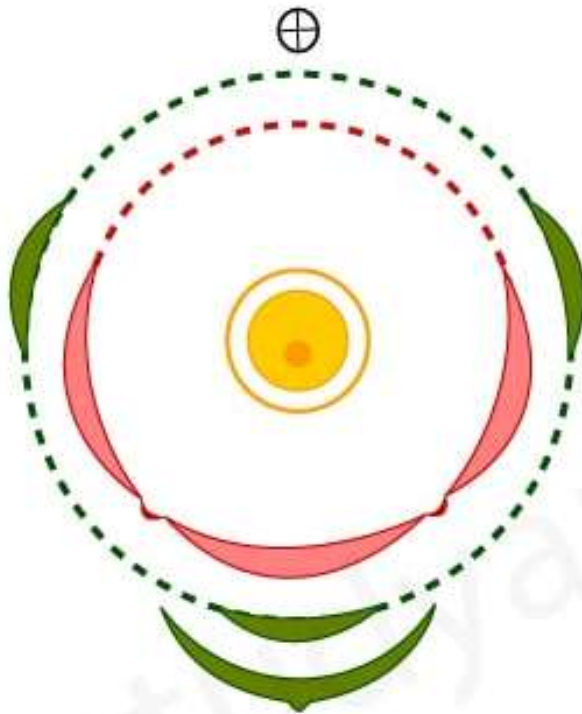
- <https://www.youtube.com/watch?v=zst08tm9s6M&t=43s>
- <https://youtu.be/kOABCH51KnQ>

# ASTERACEAE



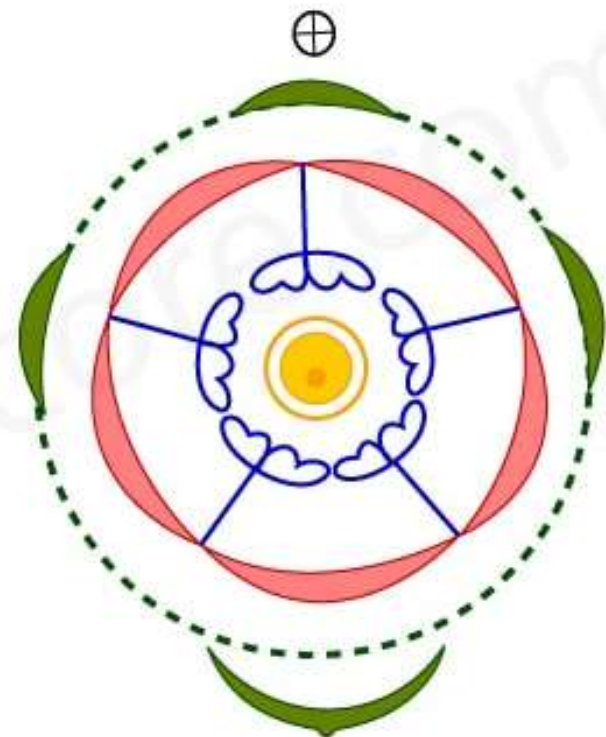
Composite Inflorescence  
e.g. *Chrysanthemum*





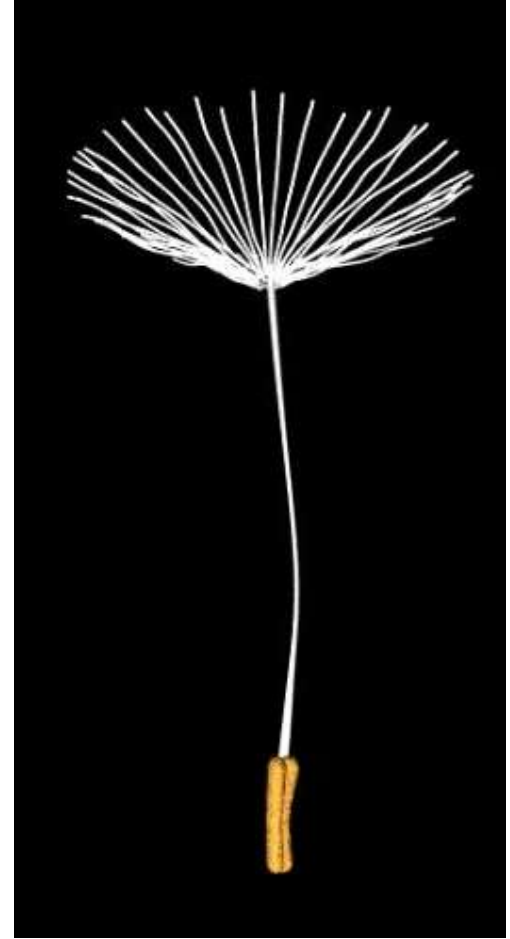
Floral Diagram of Ray floret

Floral formula:  $Br \ \% \ \text{♀} \ K_{(2-3)} \text{ (pappus)} \ \overset{\curvearrowright}{C}_{(3-5)} \ A_0 \ \bar{G}_{(2)}$



Floral Diagram of Disc floret

Floral formula:  $Br \ \oplus \ \text{♂} \ K_{2-3} \text{ (pappus)} \ \overset{\curvearrowright}{C}_{(5)} \ A_5 \ \bar{G}_{(2)}$



# Asteraceae

- Calyx rudimentary or absent/ pappus
- Corolla 5 united into tube in disc florets and united as ligule in ligulate/ray florets
- Androecium – stamens united by their anthers, filaments free – synandrous
- Gynoecium – inferior ovary, 2 carpels united, single ovule in basal placentation
- Fruit – achene/cypsela (with calyx attached)

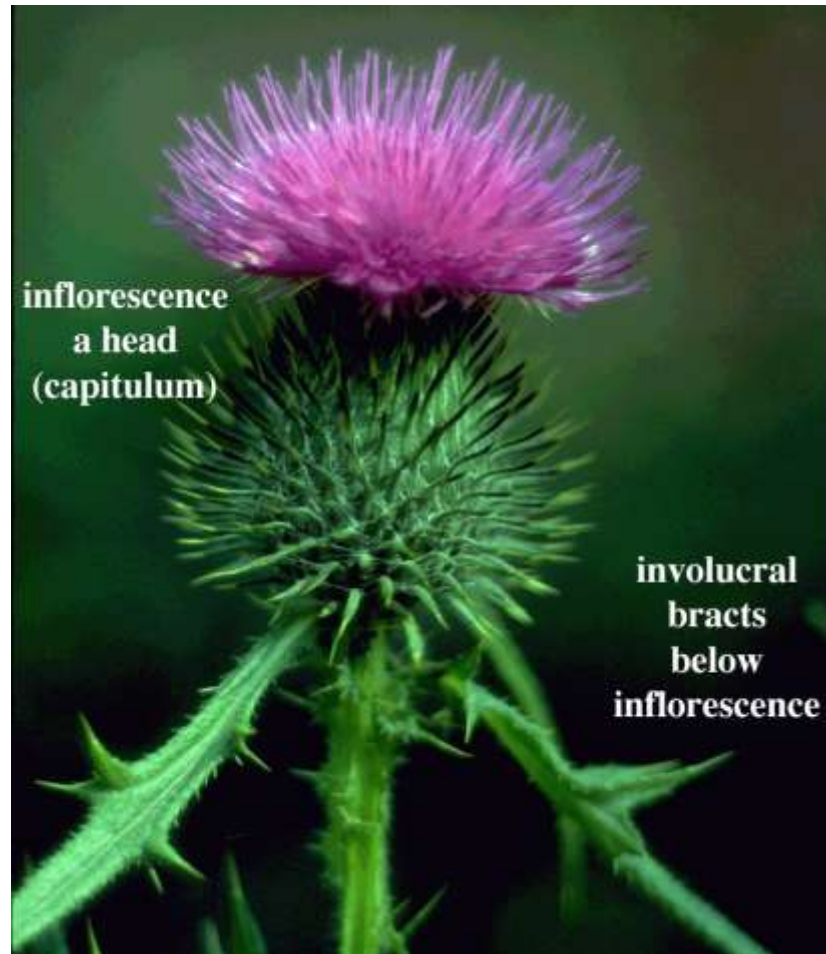


- *Tithonia diversifolia* – invasive weed
- *Parthenium hysterophorus* – invasive weed
- *Carthamus tinctorius* – Safflower
- *Helianthus annuus* – Sunflower
- *Cichorium intybus* – Cichory
- *Chrysanthemum* spp – ornamental
- *Cirsium arvense* – Thistle
- *Lactuca sativa* – Lettuce
- *Xanthium strumarium* – Cocklebur
- *Bellis perennis* – Daisy
- *Taraxacum officinale* - Dandelion
- *Saussurea costus* – Schedule VI of WPA 1972

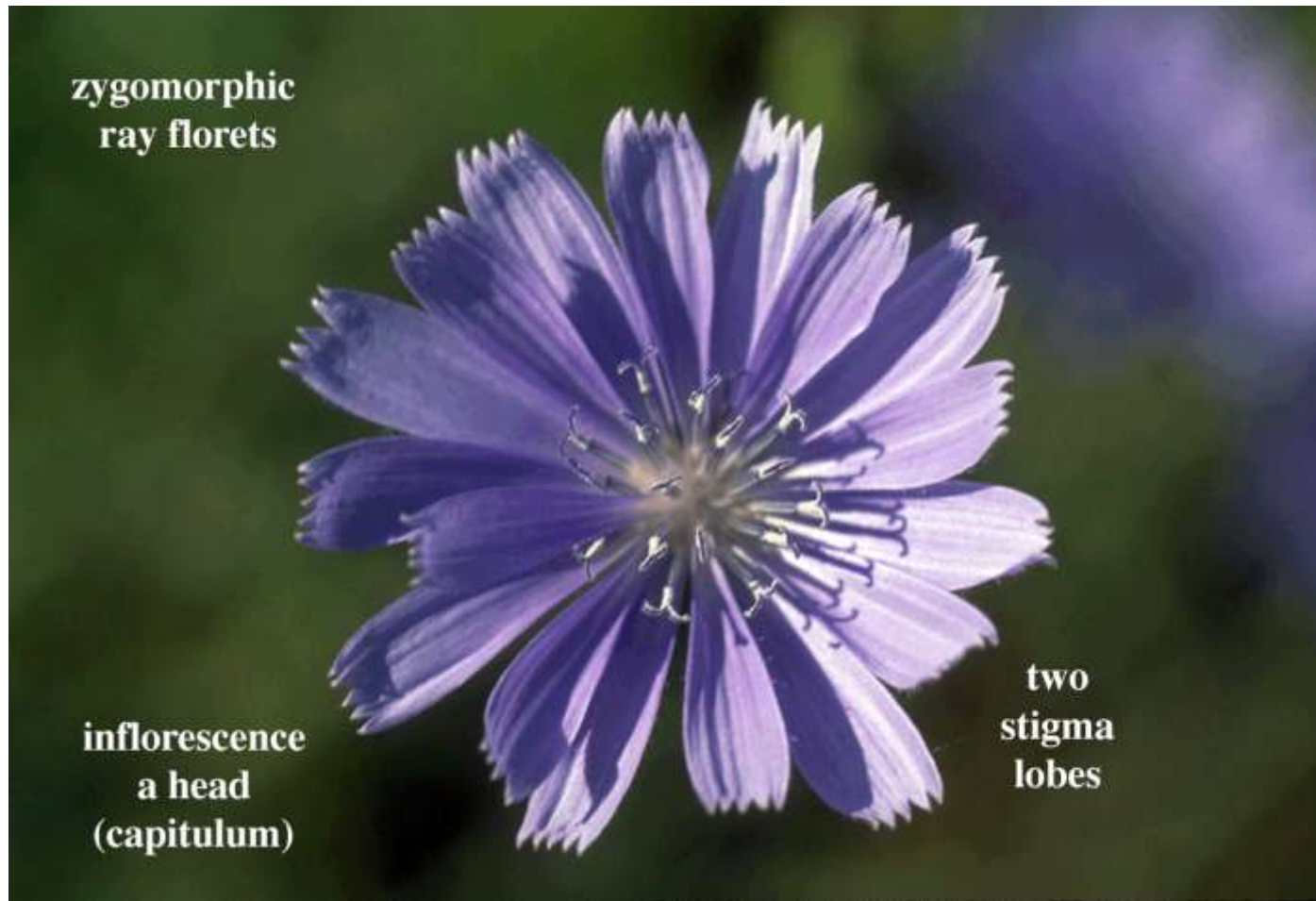
# Taraxacum officinale



# Cirsium arvense



# Cichory



zygomorphic  
ray florets

inflorescence  
a head  
(capitulum)

two  
stigma  
lobes

# Helichrysum (Everlasting)



# Anaphalis (Everlasting)



# Edelweiss

(*Leontopodium nivale*)

<https://www.youtube.com/watch?v=4g84dejrl>

XI

Sound of Music



# RUBIACEAE

- Trees
  - Pavetta indica
  - Coffea arabica
  - Cinchona officinalis
  - Adina cordifolia
  - Anthocephalus cadamba
- Shrubs
  - Ixora coccinea
  - Hamelia patens
  - Gardenia indica
- Herbs
  - Oldenlandia umbellata
  - Rubia cordifolia (climber)



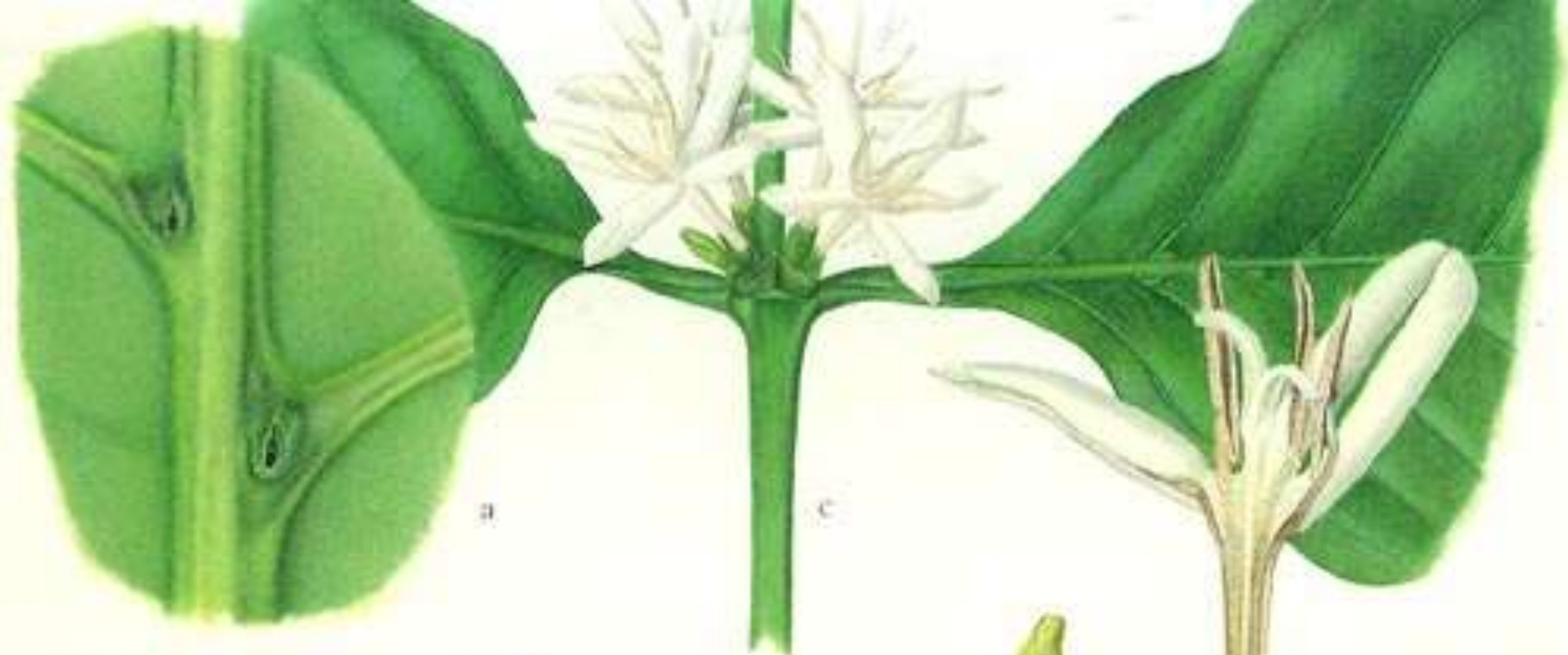
# *Ixora*

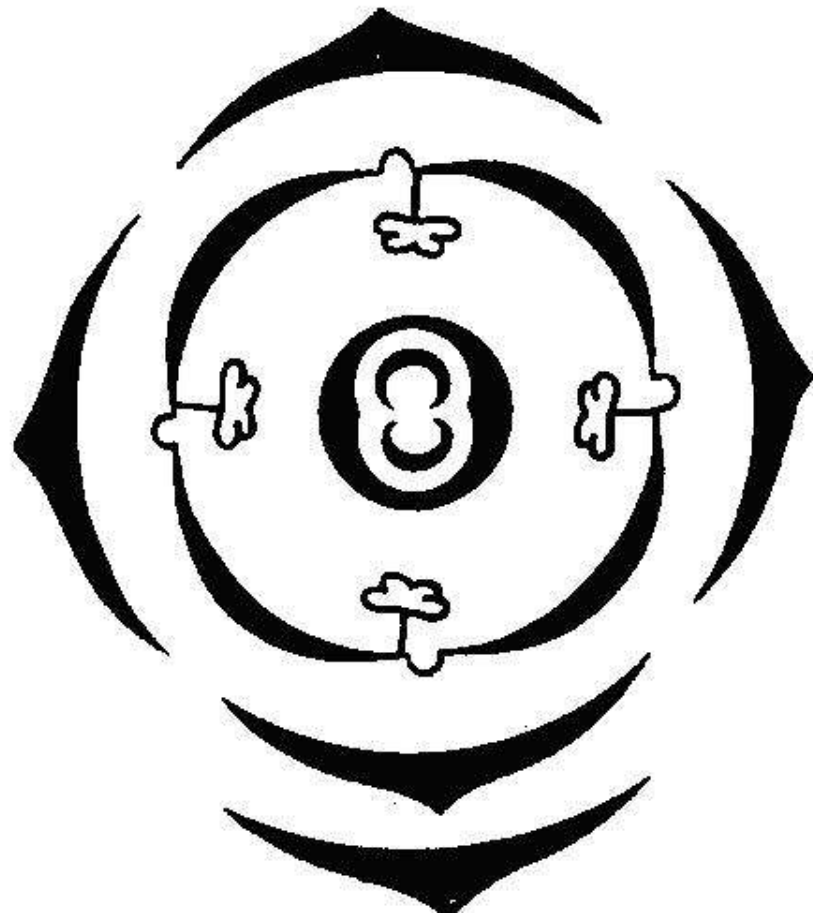


# RUBIACEAE

- Opposite or whorled leaves
- Interpetiolar stipules
- Tubular corolla
- Epipetalous stamens
- Bicarpellary ovary
- Ovary inferior







*Adina cordifolia*





Pavetta indica





# Psychotria elata



# MANGROVES

- Aerial/breathing roots (Pneumatophores)
  - Vertical roots – *Avicennia officinalis*
  - Stilt roots – *Rhizophora mucronata*
  - Kneel roots – *Bruguiera gymnorhyza*
  - Buttressed roots – *Heritiera littoralis*
- Viviparous germination
- Salt secretion by leaves
- Inter-tidal zones
- Biodiversity





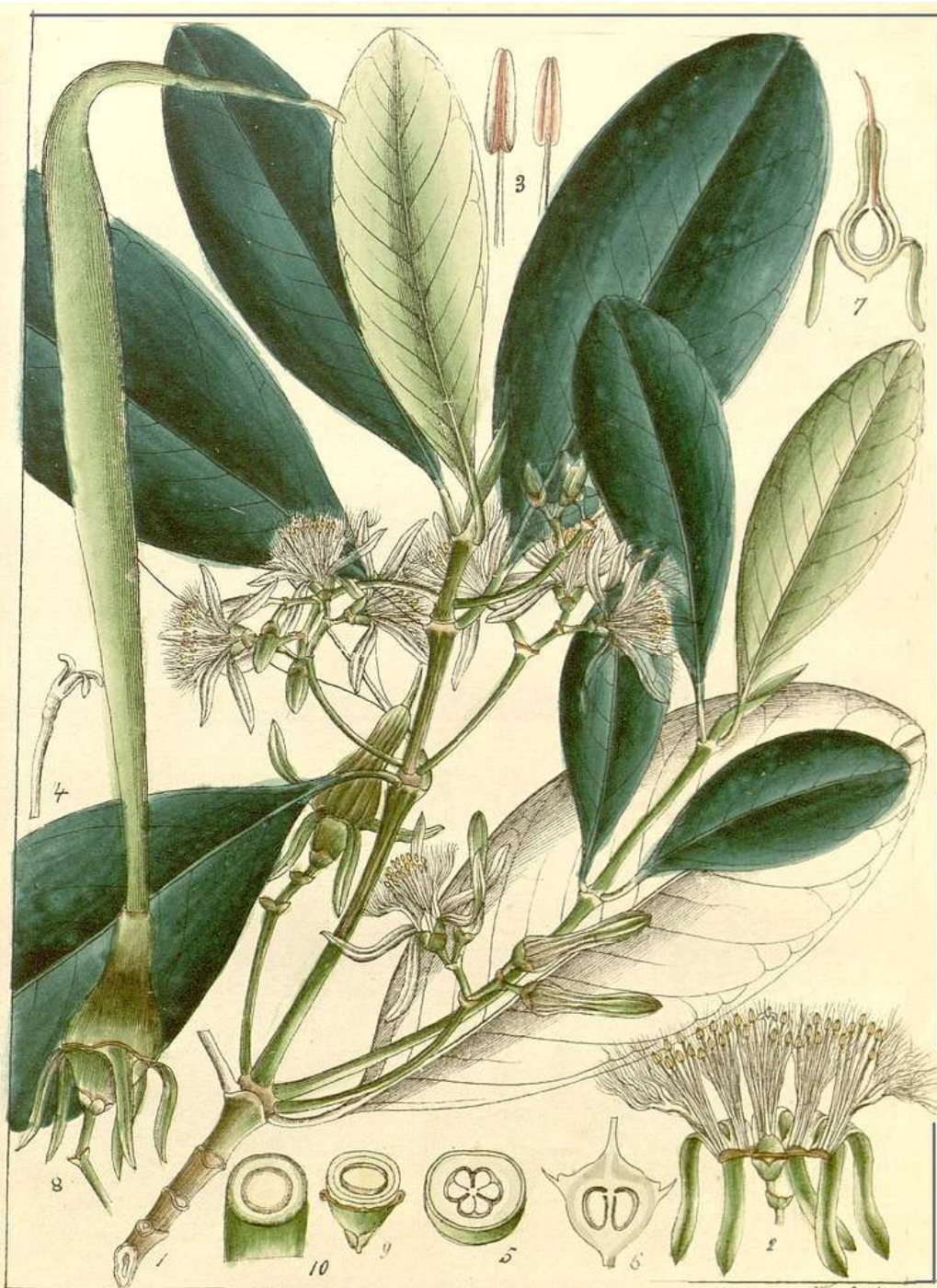


UGA5176065

*Rhizophora mangle*  
Rhizophoraceae  
G. Daida







Rungtsh. del.

KANDELIA RHEEDEI (W. & A.?)

Winchester. S. M.















# RHIZOPHORACEAE

- Major family of Mangroves
- Opposite or whorled leaves (not decussate)
- Nectary disc
- 3-32 free petals and sepals
- Stamens 8-40
- Ovary – 2 to 20 carpels (unilocular due to failure to partition)

- *Rhizophora mucronata*
- *Ceriops tagal*
- *Kandelia kandel*
- *Bruguiera gymnorhiza*
- *Carallia brachiata* – Inland mangrove
  - *Dysphania militaris* – Blue Tiger moth







# Other mangrove flora

- Acanthaceae – *Acanthus ilicifolius*
- Arecaceae – *Nypa fruticans*
- Poaceae – *Myriostachya wightiana*
- Poaceae – *Zoysia matrella*
- Lythraceae – *Sonneratia alba*
- Primulaceae – *Aegiceras corniculatum*
- Sterculiaceae – *Heritiera fomes* – Sundari tree
- Pteridophyte(Fern) – *Acrostichum aureum*



*Aegiceras corniculatum* - Primulaceae



# Aegiceras fruits



# *Avicennia* – Acanthaceae - flowers



# *Avicennia marina*





# Avicennia



# Bruguiera gymnorhiza



# Knee roots of *Bruguiera*



# Bruguiera flowers



# *Ceriops tagal*



# *Ceriops tagal*



# *Heritiera littoralis* - Andamans



# *Heritiera fomes* - Sundari





# *Nypa fruticans*



# Sonneratia alba





# Sundari flowers



# Mangrove videos

- <https://www.youtube.com/watch?v=cwTZhyA57mA>
- <https://www.youtube.com/watch?v=s3KecHP5zQ>
- <https://www.delta-intkey.com/angio/www/rhizopho.htm>

- <https://www.delta-intkey.com>
- [www.apps.kew.org/herbcat/gotoHomePage.d  
o](http://www.apps.kew.org/herbcat/gotoHomePage.do)

# FAGACEAE (Cupuliferae)

- Trees

- Oaks –

- *Quercus leucotrichophora* – Banj oak
    - *Quercus dilatata* – Moru oak/ Tilonj
    - *Quercus semecarpifolia* – Khursu oak
    - *Quercus lanata* – Latbanj
    - *Quercus glauca* – Falyat
    - *Quercus baloot*, *Q.suber* (Cork)

- Chestnut

- *Castanea sativa*

- Beech

- *Fagus sylvatica*

- Chinkapins

- *Castanopsis tribuloides*

# FAGACEAE

- UNISEXUAL FLOWERS
  - Male catkins
  - Female flowers in a cup shaped involucre
- Fruit is an Acorn
- Petals absent
  - Only stamens in male flower
  - Only ovary and stigmas in female flower
- Tricarpellary ovary

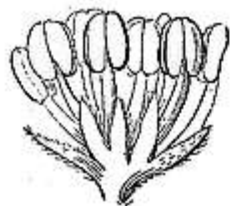


# *Quercus leucotrichophora*



# Oak male catkins

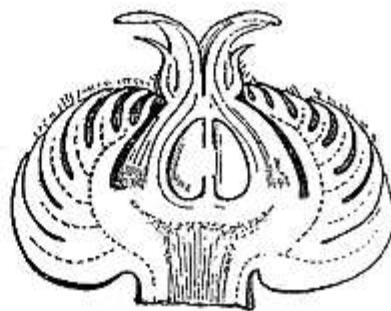




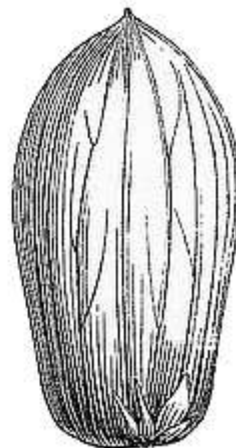
Oak.  
♂ flower (mag.).



Oak.  
♀ flower (mag.).



Oak.  
♀ flower cut vertically (mag.).



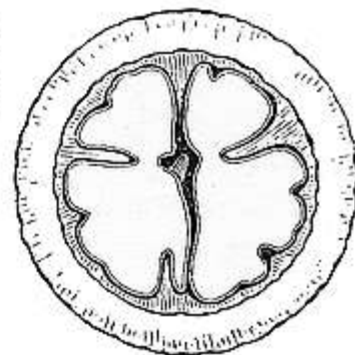
*Q. Egilops.* Abortive  
ovules at the base of  
the seed.



*Q. coccifera.*  
Ovule with outer flexuous  
membrane and large  
exostome (mag.).



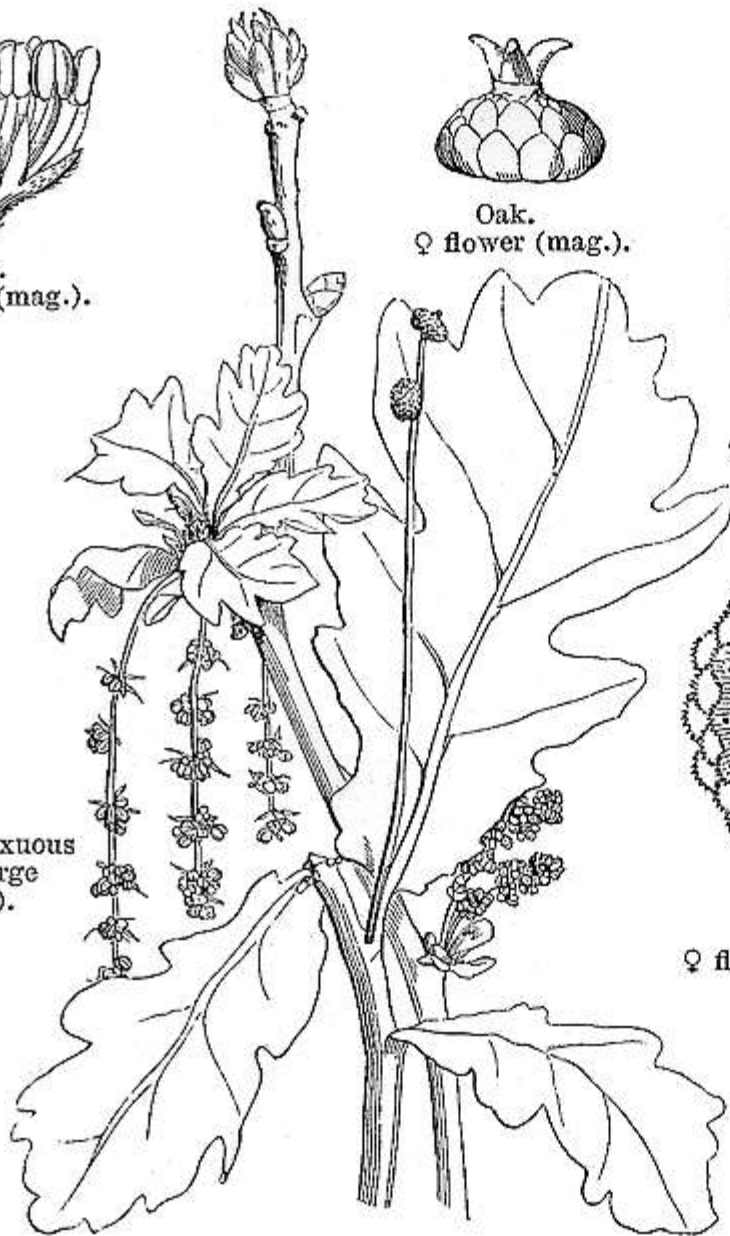
*Q. Cerris.*  
♀ flower cut transversely  
(mag.).



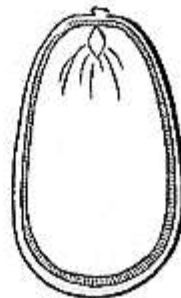
*Q. costata.*  
Transverse section of  
fruit.



Oak.  
Fruit



Oak. (*Quercus Robur.*)  
♂ and ♀ branches, with the gland.

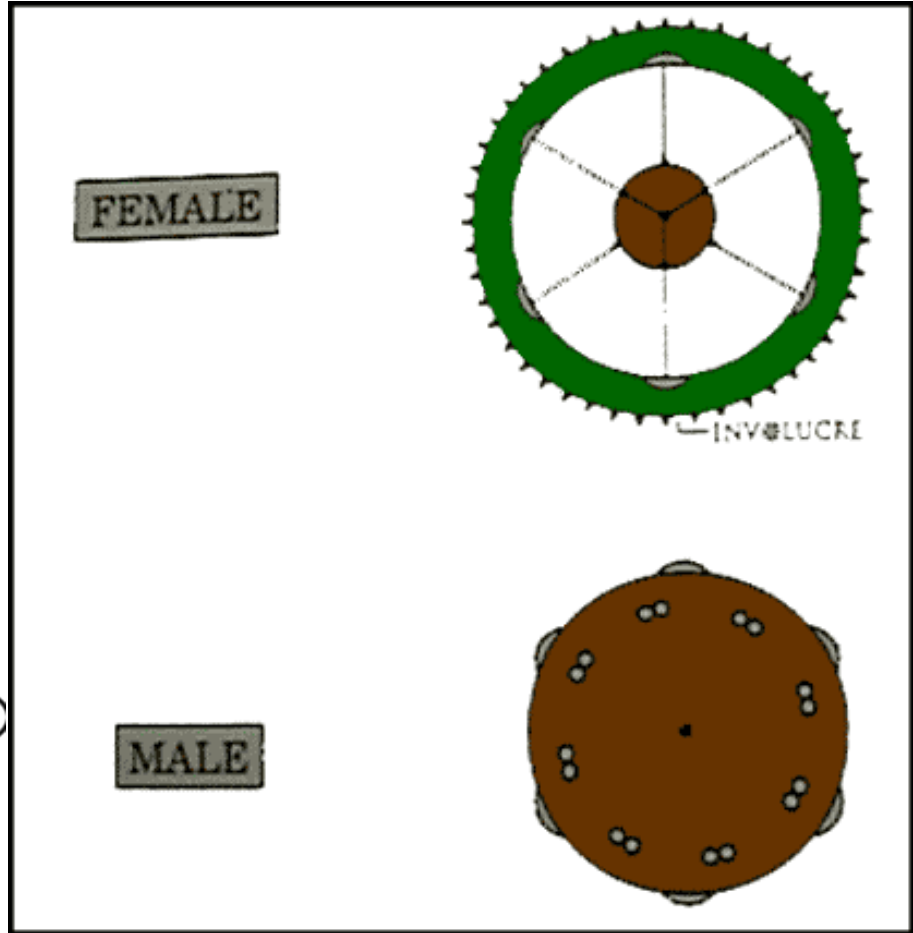


Oak.  
Fruit cut vertically.

*Fagus  
grandifolia*







♀ CA<sup>4-6</sup> CO<sup>0</sup> A<sup>0</sup> G<sup>2-3</sup>

♂ CA<sup>4-7</sup> CO<sup>0</sup> A<sup>4-40</sup> G<sup>0</sup>

# Systematic Botany for IFS officers

By MANOJ CHANDRAN IFS

Day 9

# VERBENACEAE

- Trees
  - *Tectona grandis* – Teak
  - *Gmelina arborea* – Gamhar
  - *Wendlandia excelsa* - Tirchuniya
  - *Premna latifolia* - Parijat
- Shrubs
  - *Lantana camara*
  - *Callicarpa macrophylla*
  - *Duranta repens*
- Herbs
  - *Clerodendron viscosum*
  - *Pentas lanceolata*
  - *Verbena bonnariensis*
  - *Stachytarpheta indica*
- Climbers
  - *Petraea volubilis* – Purple wreath
  - *Clerodendron thomsonae* – Bleeding heart

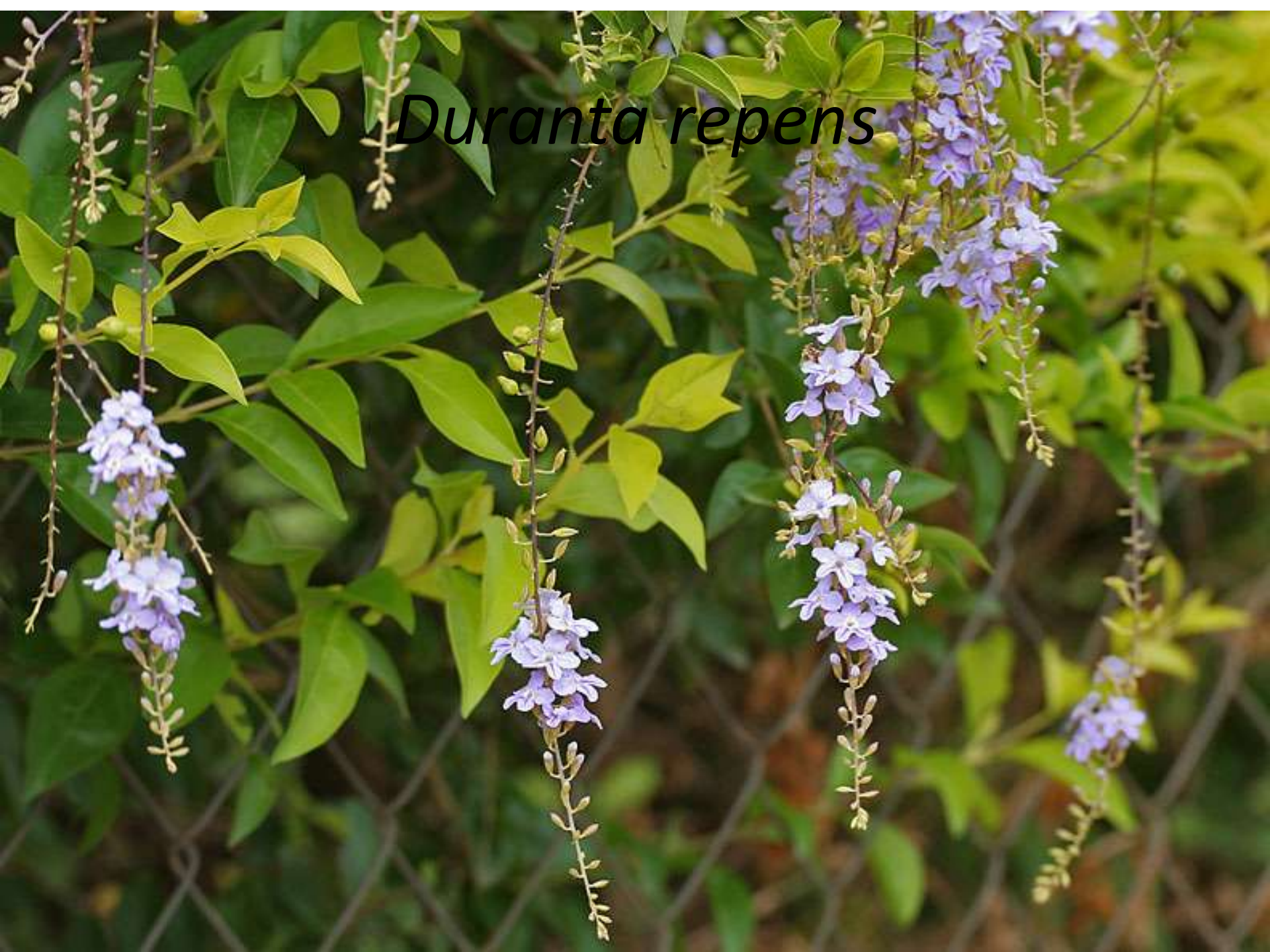


# VERBENACAE

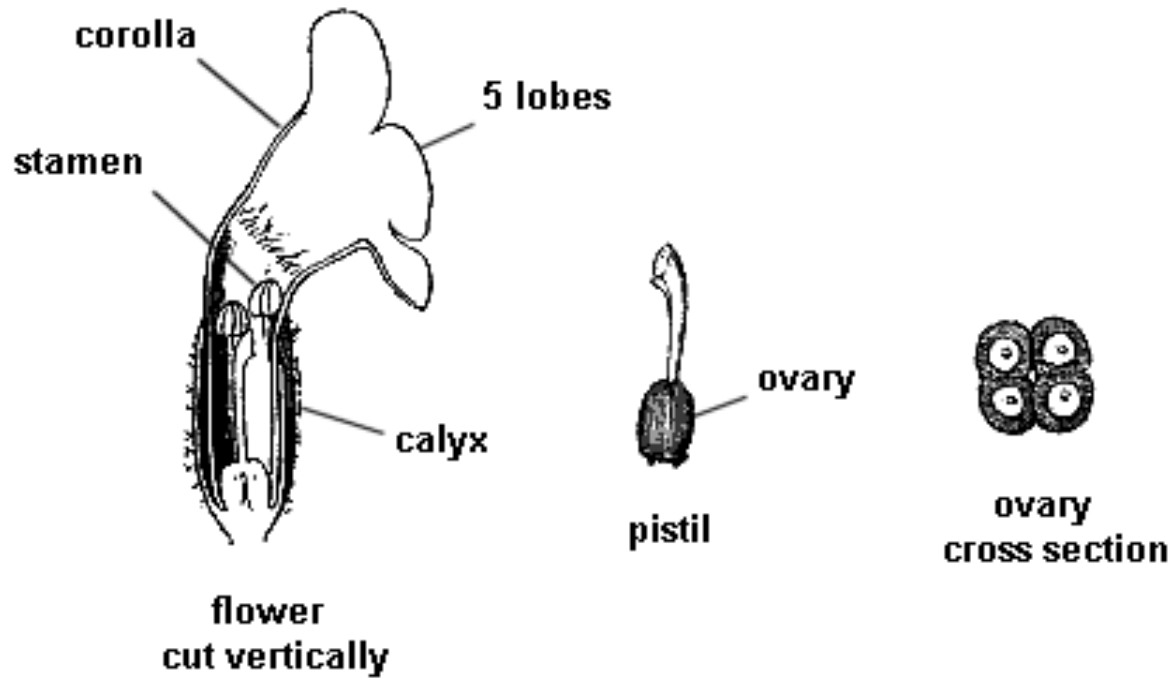
- Key features
  - Angular stem
  - Tubular corolla
  - 5 united sepals and 5 united petals
  - 4 unequal stamens
  - Bicarpellary ovary with 4 locules (false partitions)
  - 4 valved capsular fruit
  - Aromatic leaves (essential oils present)
  - Opposite/whorled leaves



*Duranta repens*



## VERBENA FLOWER PARTS



*Verbena bonnariensis*



Bleeding heart – *Clerodendron thomsonae*



# Teak flowers







Purple wreath – *Petrea volubilis*



# Lythraceae

- *Lythrum* spp.
- *Lagerstroemia speciosa* – Pride of India
- *L.indica*
- *L.parviflora*
- *Lawsonia inermis* – Henna
- *Rotala aquatica*
- *Punica granatum* (Pomegranate) - Punicaceae
- *Trapa bicornis* (Trapaceae) - Singhada

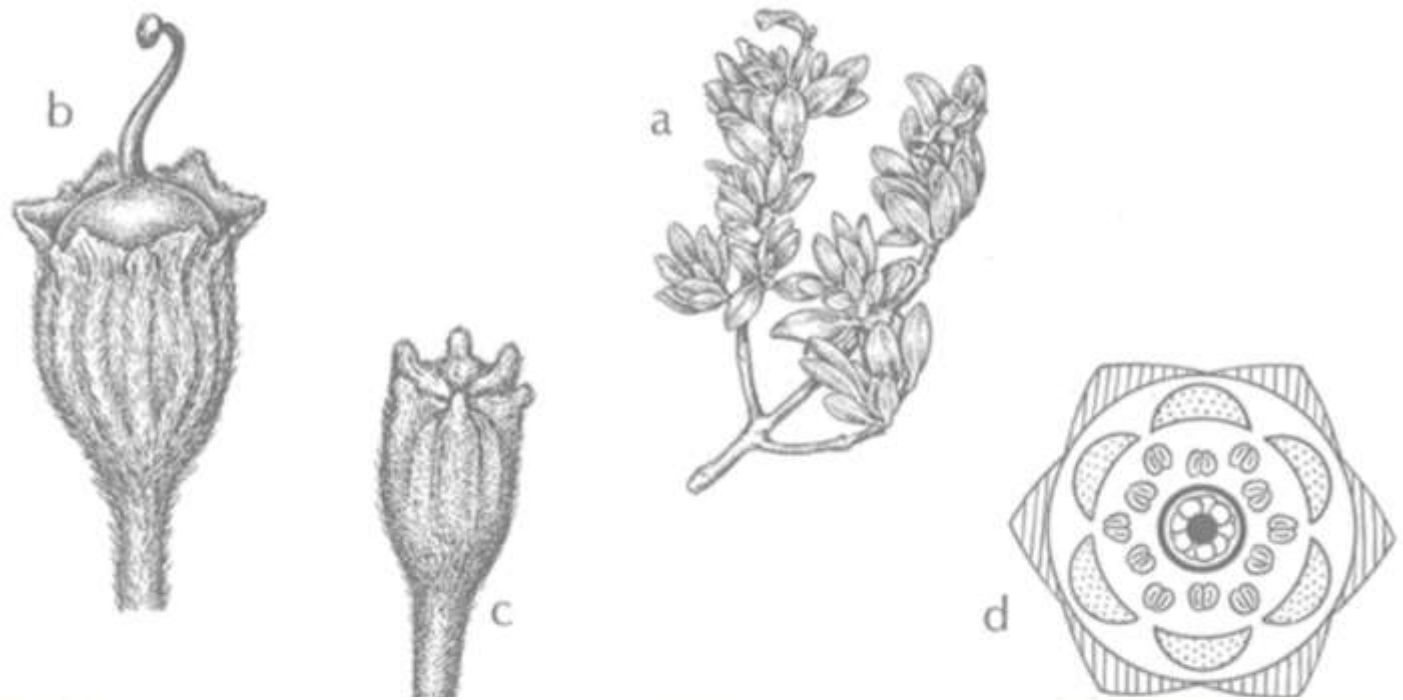
# Lythraceae

- Key features
  - Petals crumpled in bud and wrinkled on maturity
  - Hypanthium present
  - Sepals and Petals 4,6 or 8
  - Stamens double the number of petals or more
- Other features
  - Leaves opposite/whorled
  - Sepals free/connate at base
  - Free petals
  - Ovary inferior/half-inferior, 2-6 carpels

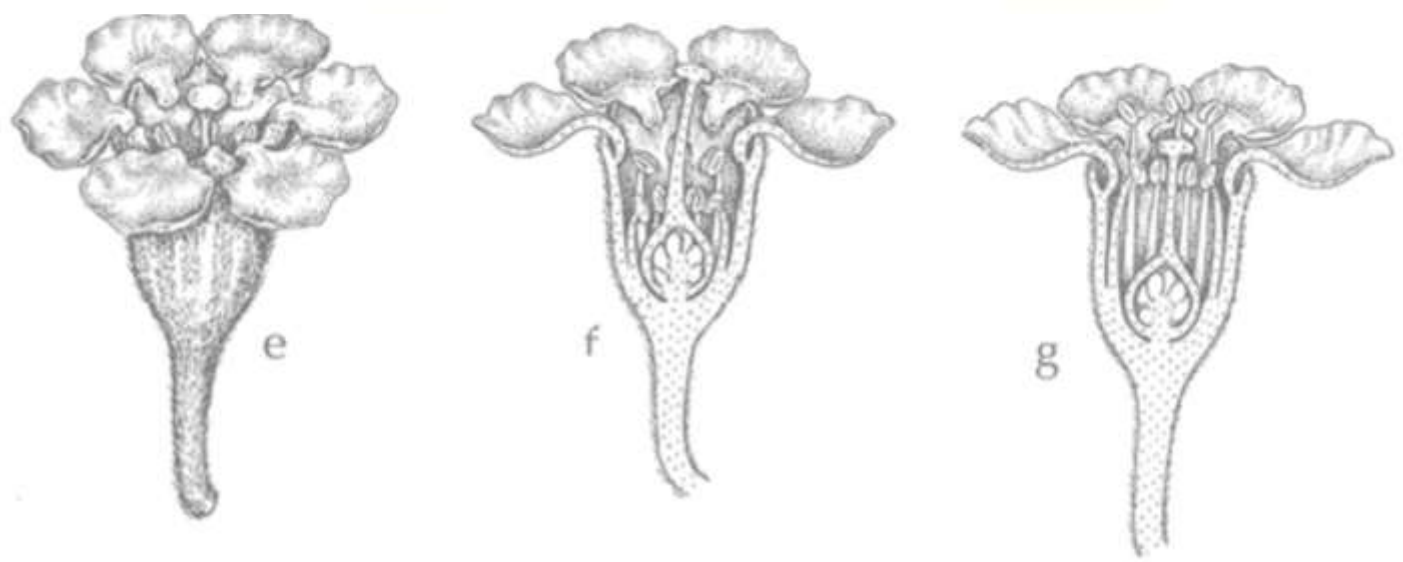
# Crepe myrtle – Lagerstroemia







**Br, ⊕, ♂,  $K_{4-6-8}$ ,  $C_{4-5-8}$   $A_{4-8-12}$  or more or 1,  $G_{(2-6)}$ .**



# Lawsonia inermis



# *Punica granatum*





# Trapa natans





# Ethnobotany

- How human communities of a particular region uses indigenous plants of the region for food, shelter, clothing, medicine, fibres, dyes, animal medicine, fodder, worship, etc.
- Traditional knowledge passed over generations
- Long term management of resources without destroying the habitat

# Uses of ethnobotanic studies

- Discover new plant resources
- Development of new drugs
- Study history of plant through linguistics
- Propagate for conservation – ex situ/in situ
- Locating new germplasm
- Identifying specific features – pest resistance, etc.
- Hybridisation/Genetic engineering

# Ethnobotany

- Species
- Part used
- Uses
  - Medicine, food, fodder, fibre, implements
- Harvest time & method
- Stress requirements
- Processing
- Dosage

# Biodiversity Act 2002

- BMC – Biodiversity Management Committee
- Village Biodiversity Register
- ABS – Access and Benefit Sharing



Ghingaroo *Pyracantha crenulata*



## Mushrooms



Cladonia



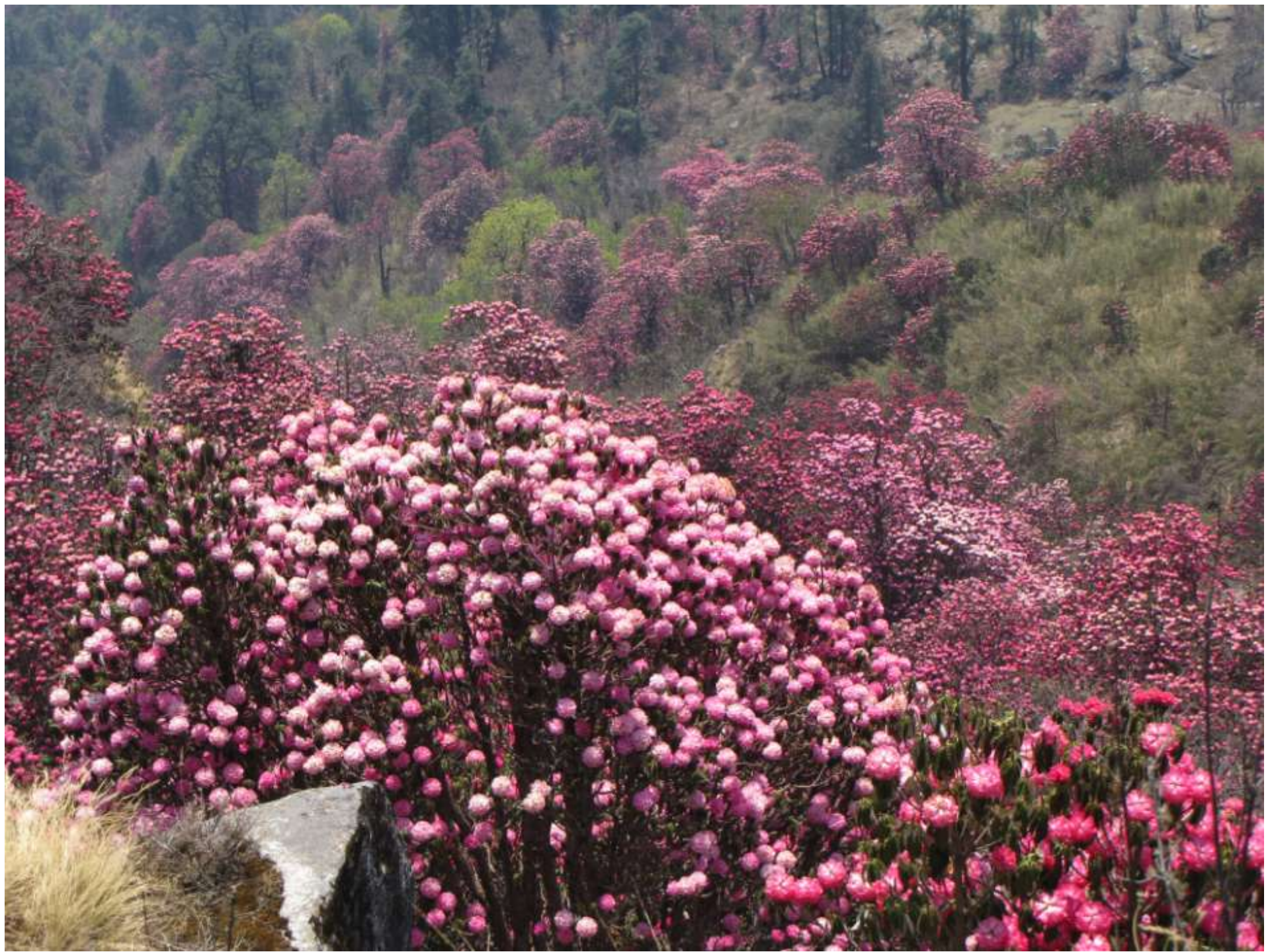


# Blue pine and Fir



*Taxus baccata*





# Mamla/Ficchi – *Danthonia cachemyriana*





*Aconitum ferox*

*Rhododendron anthopogon*



*Dactylorhiza hatageria*  
Salampanja



*Cordyceps sinensis* – Yar-tsa Gam-bu



*Saussurea lappa* (Kut)





*Podophyllum hexandrum*



# *Ephedra gerardiana*



*Picrorhiza kurooa*



# *Juniperus macropoda*



# Fen kamal

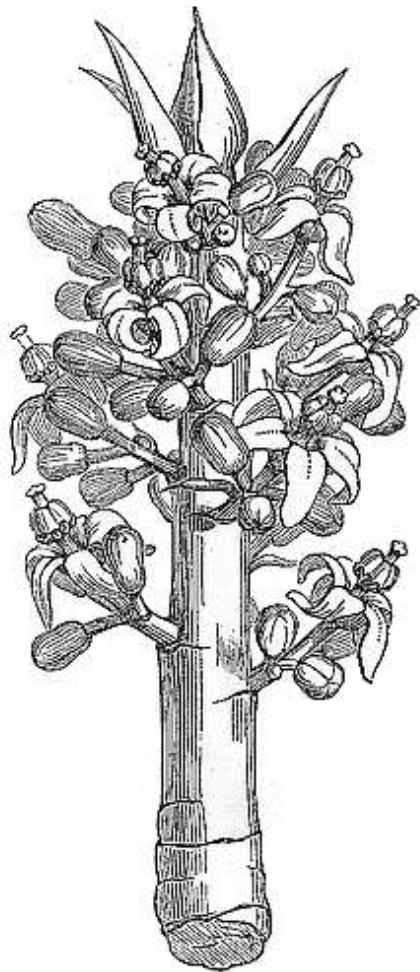


# STERCULIACEAE

- Trees
  - *Sterculia alata*
  - *Theobroma cacao*
  - *Pterospermum acerifolium*
- Shrubs
  - *Helicteres isora*
- Herbs
  - *Melochia corchorifolia*

# STERCULIACEAE

- Key features
  - Androgynophore
  - Fleshy calyx
  - Apocarpous pistil



*Sterculia Mexicana.*



*Sterculia platanifolia.*  
Diagram.



*Sterculia.*  
Flower, entire.



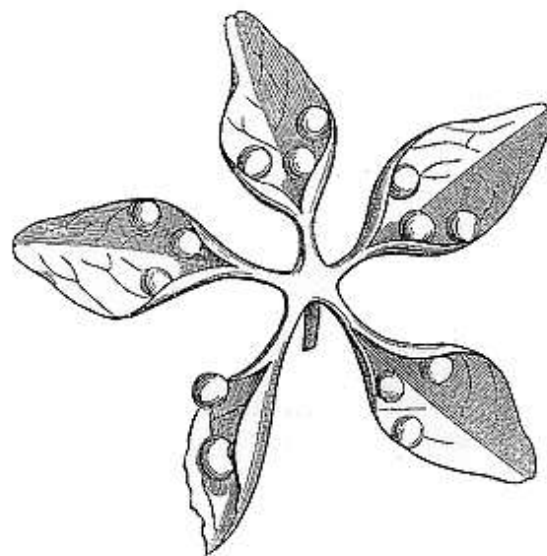
Chinese *Sterculia.*  
Entire seed (natural size).



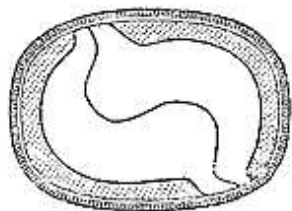
*Sterculia.*  
Flower cut  
vertically (mag.).



*Sterculia.*  
Young fruit.



*Sterculia.*  
Flower-bud.



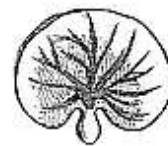
*Sterculia.*  
Seed cut transversely.



*Sterculia.*  
Pollen-grains (mag.).



*S. platanifolia.*  
Seed cut vertically.



*Sterculia.*  
Embryo.



# COCOA



*Butneria gracilipes.*



*Theobroma Cacao.*  
Fruit, one-third natural size.



*Hermansia.*  
Diagram, showing the stamens enveloped by the base of the petals.



*Hermansia.*  
Petal (mag.).



*Hermansia.*  
Styles joined at the top.



*Theobroma.*  
Seed, entire and cut vertically (mag.).



*Hermansia.*  
Diagram of corolla twisted to the right.



*Hermansia.*  
Diagram of corolla twisted to the left.



*Hermansia.*  
Ornate (mag.).



*Hermansia.*  
Stamen, outer face (mag.).



*Hermansia.*  
Stamen, inner face (mag.).



- *Helicteres isora*

*Sterculia rubiginosa*



*Pterospermum acerifolium* –  
Kanak Champa



# LAURACEAE

- *Cinnamomum zeylanicum*
- *C. tamala*
- *C. camphora*
- *Machilus odoratissima*
- *Litsea umbrosa*



# DIPTEROCARPACEAE

- SAL – *Shorea robusta*
- HOPEA – *Hopea parviflora*
- DIPTEROCARPUS – *Dipteracarpus turbinatus*



*Hopea parviflora*



# MELIACEAE

- MELIA
- AZADIRACHTA



# ROSACEAE

- Trees

