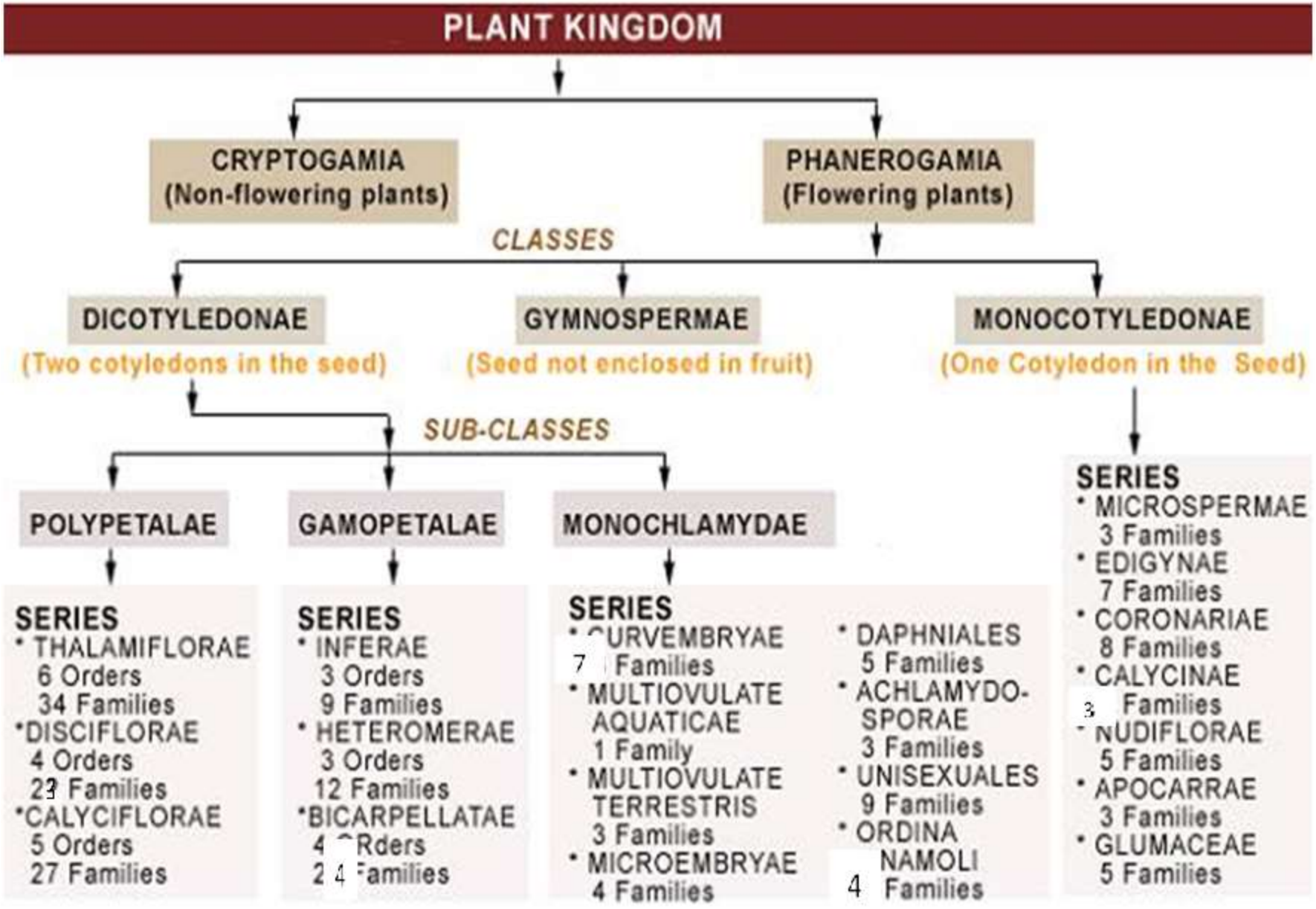
Bentham and Hooker's classification (1862 – ’83)

George Bentham and Joseph Dalton Hooker - Two English taxonomists who were closely associated with the Royal Botanical Garden at Kew, England have given a detailed classification of plant kingdom, particularly the angiosperms.

They gave an outstanding system of classification of phanerogams in their ***Genera Plantarum*** which was published in three volumes between the years **1862 to 1883.** It is a natural system of classification. However, it does not show the evolutionary relationship between different groups of plants, in the strict sense. Nevertheless, it is the most popular system of classification particularly for angiosperms. The popularity comes from the face that very clear key characters have been listed for each of the families. These key characters enable the students of taxonomy to easily identify and assign any angiosperm plant to its family.

Bentham and Hooker have grouped advanced, seed bearing plants into a major division called Phanerogamia. This division has been divided into three classes namely:

1. Dicotyledonae
2. Gymnospermae and
3. Monocotyledoneae


PLANT KINGDOM
CRYPTOGAMIA
(Non-flowering plants)
PHANEROGAMIA
(Flowering plants)
CLASSES
DICOTYLEDONAE
(Two cotyledons in the seed)
GYMNOSPERMAE
(Seed not enclosed in fruit)
MONOCOTYLEDONAE
(One Cotyledon in the Seed)
SUB-CLASSES
POLYPETALAE
GAMOPETALAE
MONOCHLAMYDAE
SERIES
• THALAMIFLORAE
6 Orders
34 Families
•DISCIFLORAE
4 Orders
23 Families
•CALYCIFLORAE
5 Orders
27 Families
SERIES
• INFERAE
3 Orders
9 Families
• HETEROMERAE
3 Orders
12 Families
•BICARPELLATAE
4 Orders
24 Families
SERIES
• CURVEMBRYAE
7 Families
• MULTIOVULATE AQUATICAE
1 Family
• MULTIOVULATE TERRESTRIS
3 Families
• MICROEMBRYAE
4 Families
• DAPHNIALES
5 Families
• ACHLAMYDO-SPORAE
3 Families
• UNISEXUALES
9 Families
• ORDINA NAMOLI
4 Families
SERIES
• MICROSPERMAE
3 Families
• EDIGYNAE
7 Families
• CORONARIAE
8 Families
• CALYCINAE
3 Families
• NUDIFLORAE
5 Families
• APOCARRAE
3 Families
• GLUMACEAE
5 Families

84 45 36 3 34

Summary of Bentham and Hooker's classification (1862 – 83)

Phanerogams or spermatophyta are divided into three classes - Dicotyledonae , Gymnospermae and Monocotyledonae

Class - Dicotyledonae– two cotyledons, open vascular bundles, reticulate venation

I. **Sub-Class Polypetalae** - The flowers are usually with two distinct whorls of perianth; the segments of the inner whorl or "corolla" are free.

A. **Series-Thalamiflorae** -(The calyx consists of usually distinct sepals, which are free from the ovary; doom shaped thalamus).
6 Orders/Cohort; 34 Families or Natural orders -R

B. **Series – Disciflorae -** The calyx consists of either distinct or united sepals, which may be free or adnate to the ovary; a prominent ring of cushion shaped disc is usually present below the ovary, sometimes broken up into glands; the stamens are usually definite in number, inserted upon, or at the outer or inner base of the disc; the ovary is superior.
4 Orders/Cohorts; 23 Families or Natural orders

C. **Series – Calyciflorae -** (Cup shaped thalamus; calyx consists of united sepals, rarely free and adnate to the ovary; the petals are uni-or bi-seriate, and peri-or epi-gynous; the ovary is often inferior).
5 Orders/Cohorts; 27 Families or Natural orders –F,

II. **Sub-Class Gamopetalae** - (The flowers-are usually with two distinct whorls of perianth; the segments of the inner whorl or '.corolla' are fused).

A. **Series – Inferae -** (The ovary is inferior; the stamens are usually equal in number to the corolla lobes).
3 Orders/Cohorts; 9 Families or Natural orders-Ast

B. **Series – Heteromerae -** (The ovary is usually superior; stamens are epipetalous or free from the corolla, either equal to or double the number of petals, or indefinite; carpels are more than two in number).
3 Orders/Cohorts; 12 Families or Natural orders

C. **Series - Bicarpellatae -** (The ovary is usually superior; stamens are as many as or fewer than the corolla lobes, and alternating with them; carpels are two, rarely lesser or more).
4 Orders/Cohorts; 24 Families or Natural orders S, Ve, La

III. Sub-class Monochlamydae - The flowers are with only one non-essential whorl (perianth) or absence of non-essential whorls. It includes 8 series.

A. Curvembryae: Usually single ovule, embryo coiled around the endosperm.

6 Families or Natural orders

B. **Multiovulate Aquaticae**: Aquatic plants with syncarpous ovary and many ovules.

1 Familie or Natural order

C. **Multiovulate Terrestris**: Terrestrial plants with syncarpous ovary and many ovules.

3 Families or Natural orders

D. **Microembryae:** Only one ovule, small, tiny embryo endospermic seed.

4 Families or Natural orders

E. **Daphnales:** Only one carpel and single ovule.

5 Families or Natural orders

F. **Achlamydosporae:** Ovary inferior, 1 to 3 ovules - unilocular.

3 Families or Natural orders

G. **Unisexuales:** Flower unisexual, perianth usually absent.

9 Families or Natural orders

H. **Ordines Anomali**: (Anomolous families) Plants with uncertain systematic position but closer to unisexuales.

9 Families or Natural orders

Class - Gymonspermae

3 Families or Natural Orders: (Gnetaceae , Coni ferae, and Cycadaceae)

Class -Monocotyledonae - One cotyledon, closed vascular bundles, parallel venation, trimerous flowers

A. Series -Microspermae - (The ovary is inferior; seeds are minute).
3 Families or Natural orders - Or

B. Series - Epigynae - (With very few exceptions, the ovary is inferior; seeds are large and with a copious endosperm).
7 Families or Natural orders

C. Series - Coronarieae - (The perianth, at least the inner whorl, is petaloid; the ovary is superior).
8 Families or Natural orders L

D. Series -Calycinae - (The perianth is sepaloid; the ovary is superior).
3 Families or Natural orders

E. Series - Nudiforae - (The perianth is usually absent or reduced to minute scales; seeds are albuminous).
5 Families or Natural orders

F. Series -Apocarpeae - (The perianth is absent or uni- or bi-seriate; the ovary is superior with one or more than one free carpels; seeds are exalbuminous).
3 Families or Natural orders

G. Series -Glumaceae - (The perianth is scaly or glumaceous or absent; the ovary is usually one-ovuled; seeds are albuminous).
5 Families or Natural orders - Poa

Merits

- The obvious advantage of the system of Bentham and Hooker's classification is that, it provides one with easy means and ways for identifying a plant.
- The description of families and genera is very accurate
- Each family has a synopsis in the beginning which is very useful in identification
- This classification is a great natural system of its own kind and to a great extent forms an ancestor of every recent system.
- Another importance of this system lies in the extempore study of the actual specimens by the authors and thus the classification of Bentham and Hooker represents the result of a careful comparative examination of known genera of all flowering plants.

Demerits

- The classification is based on the assumption of constancy of species. It establishes no phylogenetic relationship in different taxa of plants; hence many important evolutionary characters were neglected. So, closely related families were kept apart and many distant families of plants were put together e.g., in dicotyledons, Euphorbiaceae was placed in Monochlamydeae though related to Malvaceae; the retention of some natural orders *e:g.* Nyctaginaceae, Polygonaceae, Amaranthaceae, Chenopodiaceae etc. in the subclass Monochlamydeae is also unnatural because those orders are related to the orders having differentiated perianth. Similarly in monocotyledons Hydrocharitaceae and highly evolved Orchidaceae were put together under Microspermae due to their small seeds. Related families like Liliaceae and Amaryllidaceae were kept apart.
- The origin of angiosperms was not established.
- The position of gymnosperms is also anomalous i.e. in between dicotyledons and monocotyledons.
- The group Monochlamydeae is entirely artificial

Hutchinson's system of Classification

Hutchinson a British Botanist from England, associated with Royal Botanic Garden, Kew (1926,34) proposed a phylogenetic system of classification, its principles parallel to that of Bessey.

He mainly concerned with the classification of angiosperms. His work first appeared in a 2-volume work **"The Families of Flowering Plants" (1926, 1934).** This had undergone several revisions.

He published "Genera of Flowering Plants" (1964-1967).

He published "Evolution and Phylogeny of Flowering Plants" (1969).

According to him, angiosperms were considered monophyletic in origin, from hypothetical Proangiosperms. Initially , the angiosperms were regarded to have evolved along the two separate evolutionary lines, Herbaceae derived from Rannales and the Lignosae derived from Magnoliales.

Hutchinson's Classification was based on principles

1. Evolution is both (1) upwards and (2) downwards. The latter involving degradation and degeneration; examples: (1) towards the sympetalous condition; epigyny; (2) towards the. apetalous state of many flowers ; unisexuality in flowering plants.
2. Evolution does not necessarily involve all organs of the plant at the same time; and one organ or set of organ may be advancing while another set is stationary or retrograding. For example in the family Crassulaceae the carpels have remained free, while some genera aresympetalous.
3. Evolution has generally been consistent, and when a particular progression or retrogression has set in, it is persisted into the end of the' phylum; examples: the strong tendency to zygomorphy of the corolla coupled with the reduction in the number of stamens in Engler's hypogynous *Metachlamydeae:* the great tendency to perigyny and epigyny in the *Archichlamydeae* and *Metachlamydeae* as exhibited in the families *Apiaceae* and *Rubiaceae* respectively.
4. In certain groups, trees and shrubs are probably more primitive than herbs; examples: Mimosaceae and Caesalpiniaceae (trees and shrubs) as compared with the derived family Fabaceae (papiJionaceae) (becoming herbaceous).

5. Trees and shrubs are older than climbers, the latter habit having been acquired through particular environment.
6. Perennials are older than biennials, and from them annuals bave been derived; note the extraordinarily few annuals in the primitive family Ranunculaceae and in Rosaceae; the great number in the more advanced and natural family Brassicaceae.
7. Aquatic phanerogams are as a rule more recent than terrestrial (at any rate in the members of the same family or genus), and the same may be said of epiphytes and parasites.
8 Plants with collateral vascular bundles arranged *in* a cyclic manner (Dicotyledons) are more primitive in origin than those with scattered bundles (Monocotyledons), though It does not necessarily follow that the latter have been directly derived from the former.
9. The spiral arrangement of leaves on the stem and of the floral leaves precedes that of the opposite and whorled type.
10. As a rule simple leaves precede compound leaves.
11. Bisexual (hermaphrodite) precede unisexual flowers, and the dioecious is probably more recent than the monoecious condition.
12. The solitary flower is more primitive than the inflorescence, the highest forms of the latter being the umbel and capitulum ; examples of the latter: Apiaceae and Asteraceae respectively.

13. Spirally imbricate floral parts are more primitive than whorled and valvate ; examples: *Magnolia* and *Clematis.*
14. Many-parted flowers (polymerous) precede, and the type with few parts (oligomerous) follows from it, being accompanied by a progressive sterilisation of reproductive parts (sporophylls); examples: *Magnolia* and *Cherianthus.*
15. Petaliferous flowers precede apetalous ones, the latter being the result of reduction.
16. Free petals (polypetaly) are more primitive than connate petals (sympetaly).
17. Actinomorphy (regularity) of the flower is an earlier type than zygomorphy (irregularity) ; examples: *Caltha* and *Delphinium.*
18. Hypogyny is the primitive structure, and from it perigyny and epigyny were derived later.
19 Free carpels (apocarpy) are more primitive and from them connate carpels resulted; sometimes however, when the carpels have remained loosely united during evolution they may again become quite free, especially in fruit; example: Asclepiadaceae.
20. Many carpels (polycarpy) precede few carpels (oligocarpy); examples: *Ranuncu/us* and *Nigela.*
21. The endospermic seed with small embryo is primitive and the non-endospermic seed more recent; examples: Ranunculaceae and Rosaceae.

22. In primitive flowers there are many stamens, in more advanced flowers few stamens; examples: *Ranunculus* and *Cherianthus.* This condition may, however, be reversed within the confined of a single family like Papaveraceae, where bees feed on the pollen .
23. Separate stamens precede connate stamens; examples: Tiliaceae and Malvaceae ; Campanulaceae and Lobeliaceae
24. Aggregate fruits (fruits formed from several separate flowers) are more recent than single fruits, and as a rule the capsule precedes the drupe or berry

Summary of Hutchinson's classification (1926, 34) and (1959-60)

Introduction:

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Hutchinson, in his earlier classification **(1926, 34)**, classified the entire group of **Flowering plants** into two phyla, namely, **Gymnospermae** and **Angiospemae**.

I. **Gymnospermae** was nearly considered as a linear monophyletic series in an ascending order from the **Cycadaceae → Ginkgoaceae → Taxaceae → Pinaceae → Cupressaceae**

- He agreed that the **Araucarieae** "may have been formed independently.“

II. **Hypothetical Pro-angiosperms →** phylum **Angiospermae**.

- **Angiospermae** was divided into two sub-phyla, the **Dicotyledones** and the **Monocotyledones**.
- In his earlier edition of 'The Families of Flowering Plants," (1926,34), Hutchinson divided the Dicotyledones into two divisions, namely, **Archichlamydeae** and **Metachlamydeae**, on the basis of the polypetalous and gamopetalous conditions of flowers respectively.
- On the other hand, the sub-phylum the Monocotyledones was divided into three divisions, namely, **Calyciferae ,Corolliferae** and **Glumiflorae**.

Hutchinson in his revised classification (1959- 60) divided **Angiospemae as follows:**

II. Hypothetical Pro-angiosperms → phylum **Angiospermae. (last revision 1973)**

- Hypothetical Proangiosperms (Bennettitales-like ancestors) gave rise to **Dicotyledon**s. Initially, the angiosperms were regarded to have evolved along two separate evolutionary lines, **Lignosae**and **Herbaceae,** later the **Monocotyledons** originated from early herbaceous dicots like Ranales – so a monophyletic origin of angiosperms is suggested in this classification.
- **Dicotyledonae** was divided into two distinct subgroups *viz.* subgroup **'Lignosae**′ and subgroup ′**Herbaceae'** *,* according to priority of evolution.
- The **'Lignosae**′ includes families whose members are fundamentally and predominantly woody trees, -54 orders, beginning with Magnoliales and ending with Verbenales, 246 fam
- ***Herbaceae*** includes families whose members are fundamentally and predominantly herbaceous. 28 orders, beginning with Ranales and ending with Lamiales, 97 fam
- the sub-phylum the **Monocotyledonae**derived from Ranales, was divided into three divisions, namely, **Calyciferae ,Corolliferae** and **Glumiflorae** depending on the nature of parianth. These have evolved from herbaceae. 29 orders, 69 fam

Merits

- The origin of angiosperms is considered monophyletically from hypothetical Proangiosperms which had Bennettitalean characters.
- It is a phylogenetic system in which he has contributed a real work by his careful and critical estimate in the limitations of families and orders.
- The principles upon which the classification is based provide an indication of current trend in phyletic thinking. In the phylogenetic tree, Hutchinson did not derive one order directly from the other but from its ancestral stock.
- The arrangement of families within the-monocotyledons has been particularly appreciated the world over.
- It has provided a sound basis for the later phylogenetic system by Oswald, Tippo, Cronquist, Takhtajan and others. His long association with the flowering plants and his critical observations in the field as well as in the herbarium are very well projected in his sound judgements which were primarily based on external morphological features but later supported by investigators in other related fields

Demerits

- The main disadvantage of the classification lies in the undue fragmentation of families.
- In his revised classification, creation of two phyletic lines e.g. *Lignosae* (woody arboreal) and *Herbaceae* (herbaceous) is thought by many botanists to be a defect reflecting the old Aristotalean view. Overall resemblances and critical anatomical studies of Bailey, Sinnott, and others lead to assume that herbaceous habit has been derived from woody habit again and again and the reverse has also occurred occasionally. The two evolutionary lines therefore, cannot be considered distinct. Further, this primary division has resulted into wide separation of some families which resemble one another rather closely on the basis of floral structure. Various herbaceous families in the Ranales are clearly related to woody members of Magnoliales; herbaceous Umbelliferae are more closely related to and probably derived from the woody Cornaceae and Araliaceae; herbaceous Cruciferae are clearly derived from the predominantly woody Capparidaceae most probably via Cleomaceae; several other herbaceous families like Lythraceae, Onagraceae~ his Gentianales, Primulales, Saxifragales, Personales and Lamiales are more closely related to the woody Myrtales, his Apocynales, Myrsinales, Rosales and Verbenales respectively rather than among themselves. In spite of severe criticism from many parts of the world.

- The origin of angiosperms from Bennettitalean-like ancestry is criticised by some workers (Bailey), as the anatomical structures of the early dicots are not tenable with such ancestry.
- In the establishment of new taxa, Hutchinson however did not put any adequate remarks, as a result relative groups are shown to be distantly related and small taxa are delimited on resemblances only.

Ranunculaceae

Around 50 genera , 1800 species

- Economic importance

  Medicininal : *Aconitum heterophyllum*- aconitina- relieve pain and palpitation

  Thalictrum foliosum – drug for opthalmia and other eye problems

  Anemone pulsatilla – pulsatilla - tonic for nerves problem

  Ornamental: *Ranunculus, Clematis, Delphinium*

  Spices: *Nigella sativa* (black cumin) seeds are used as condiment and spice

- Affinity

  Affinity and relationship with families Berberidaceae, Magnoliaceae etc of dicots and Alismaceae, Hydrocharitaceae of monocots

- Primitive characters of the family

• systematic position

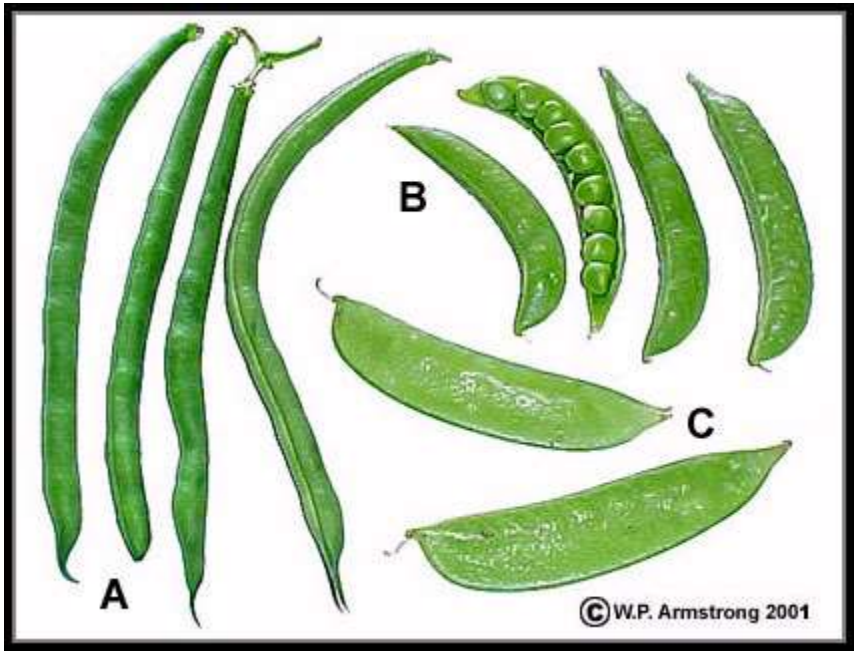
Bentham and Hooker's

Class – Dicotyledonae
Sub-Class Polypetalae
Series-Thalamiflorae
Order- Ranales
Natural Order (Family)-Ranunculaceae

Hutchinson's

Sub-phylum– Dicotyledonae
Sub-group- Herbaceae
Order- Ranales
Family- Ranunculaceae

Fabaceae



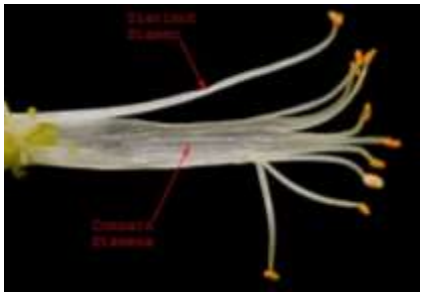
750 genera, 17000 species

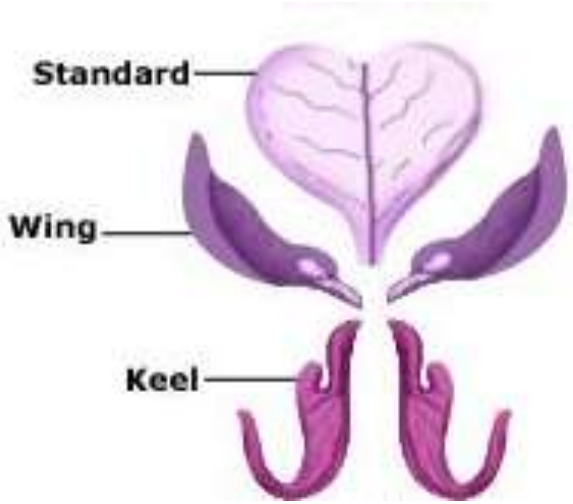

Unipinnate
(Paripinnate)


Unipinnate
(Imparipinnate)

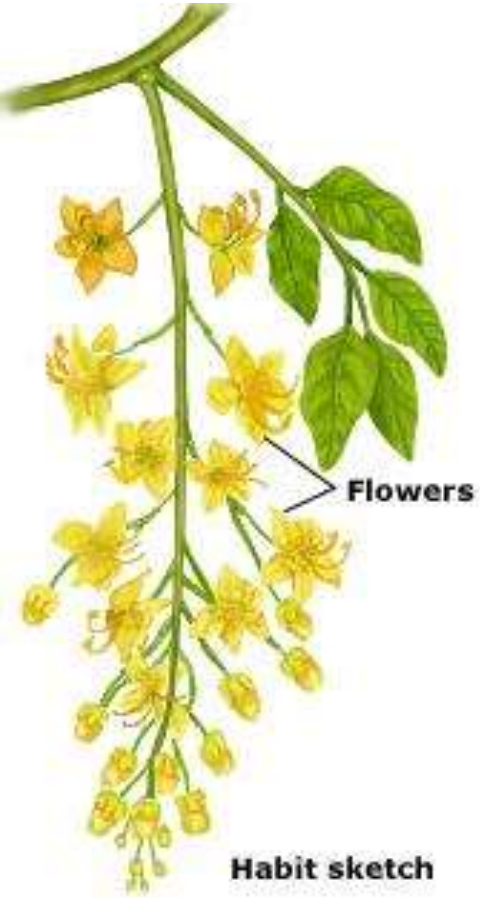

Bipinnate

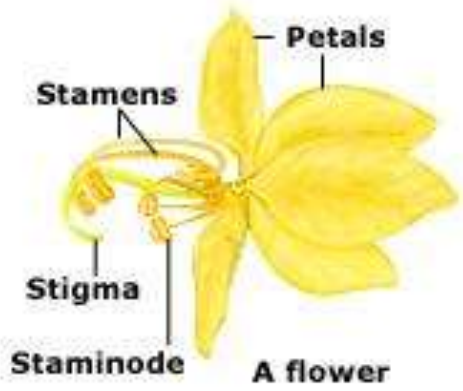

Tripinnate

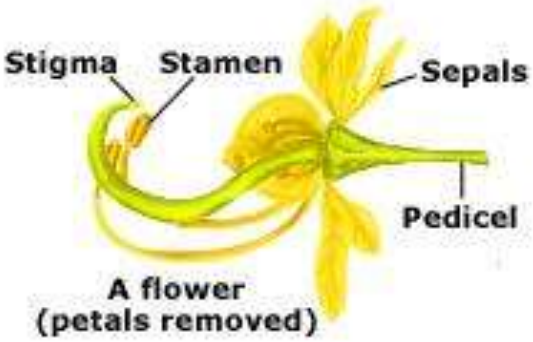




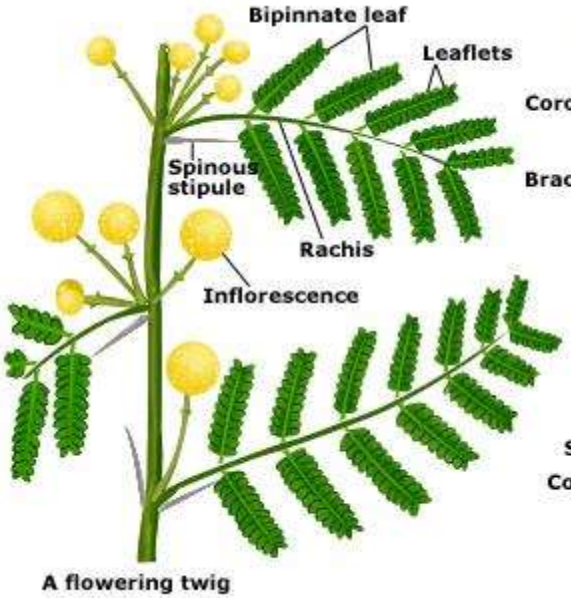
482 genera
7200 species



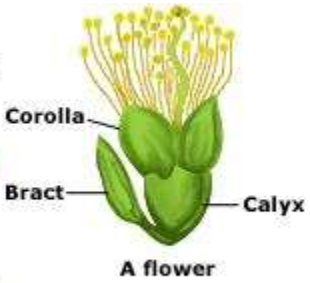




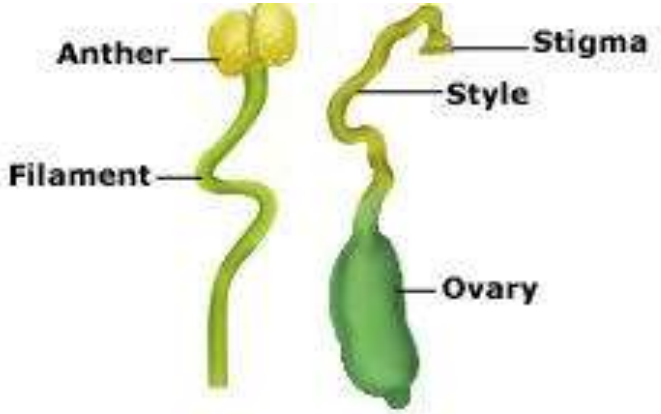
180 genera
2800 species

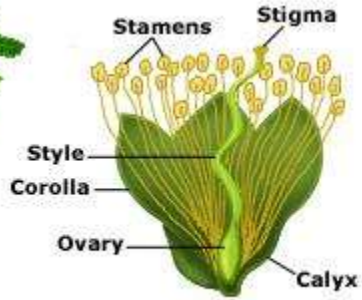


A flowering twig

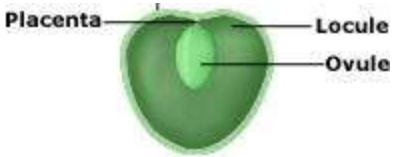


A flower

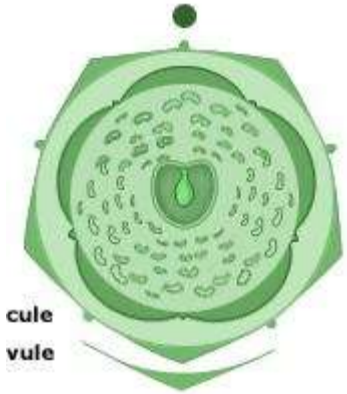




L.S. of flower

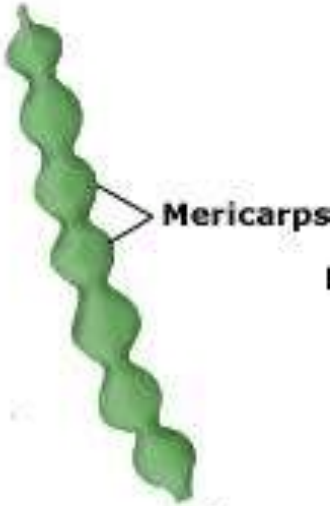


T.S. of ovary



Floral diagram

56 genera
2800 species



Fruit

lomentum

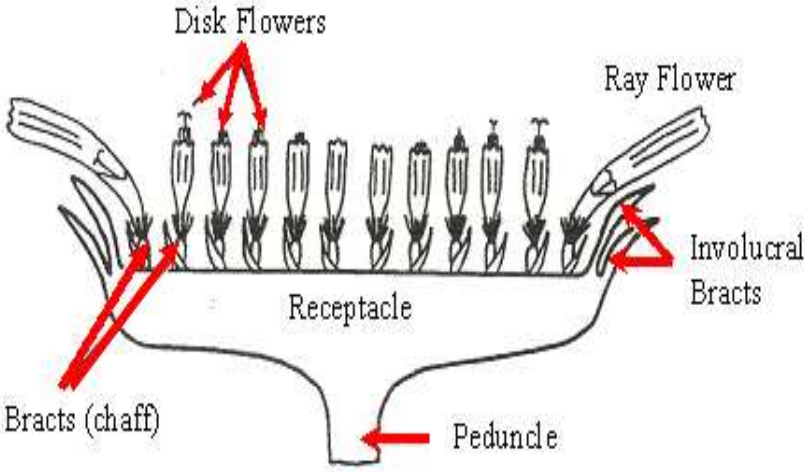
- Economic importance- *Albezia lebbeck*-timber, *Pisum sativum*, *Phaseolus* spp, *Cicer* spp, *Indigofera tinctoria* yield indigo

•Affinity related to family Rosaceae

•systematic position

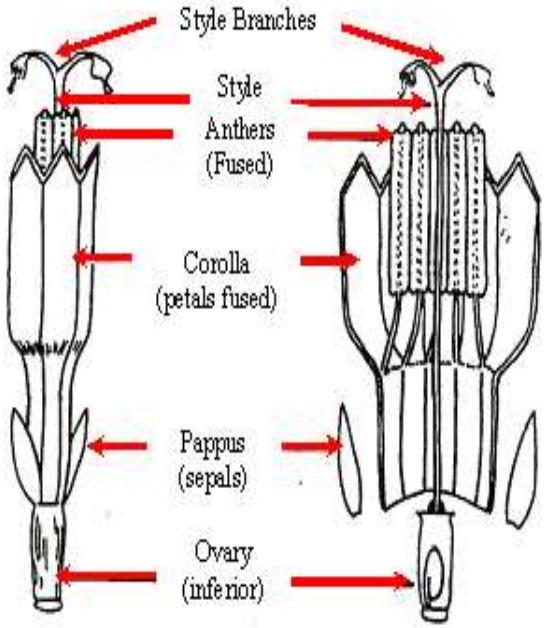
Class – Dicotyledonae
Sub-Class Polypetalae
Series-Calyciflorae
Order- Rosales
Family- Fabaceae/Leguminosae

Asteraceae



SECTION THROUGH HEAD OR CAPITULUM (INFLOURESCENCE) OF THE ASTERACEAE.

This whole structure mimics an individual flower with the ray flowers looking like petals.



DISK OR TUBE FLOWER

Asteraceae

1100 genera, 25000 species

Economic importance

- Medicininal : Artemissia absinthium , A. maritima – santonine (drug)
  Arnica montana – arnica medicine
- Ornamental:
- Edible:

Affinity and systematic position

The family has got affinity with the members of the order Rubiales.

Class – Dicotyledonae

Sub-Class Gamopetalae

Series-Inferae

Order- Asterales

Family- Asteraceae/Compositae

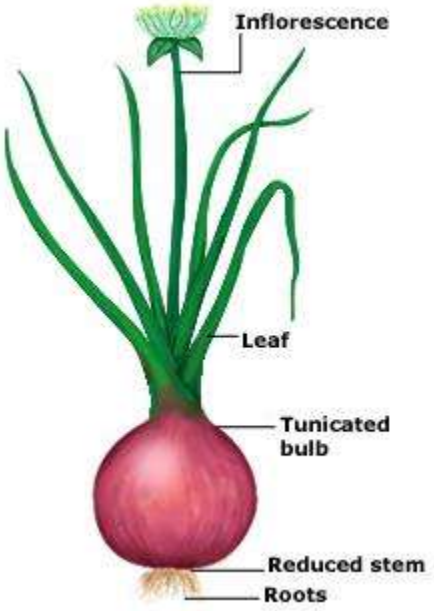
- Advanced characters of the family

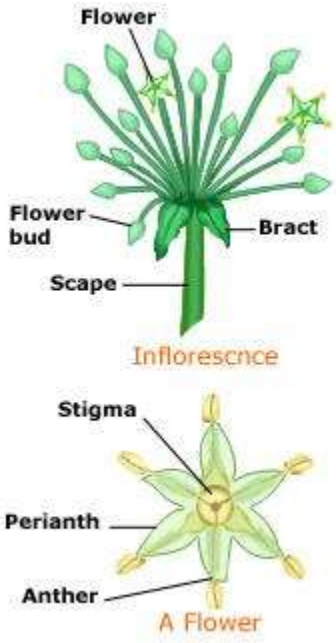
  largest number, herbaceous, pappus, syngenecious stamens, epigyny, fruit possess pappus parachute

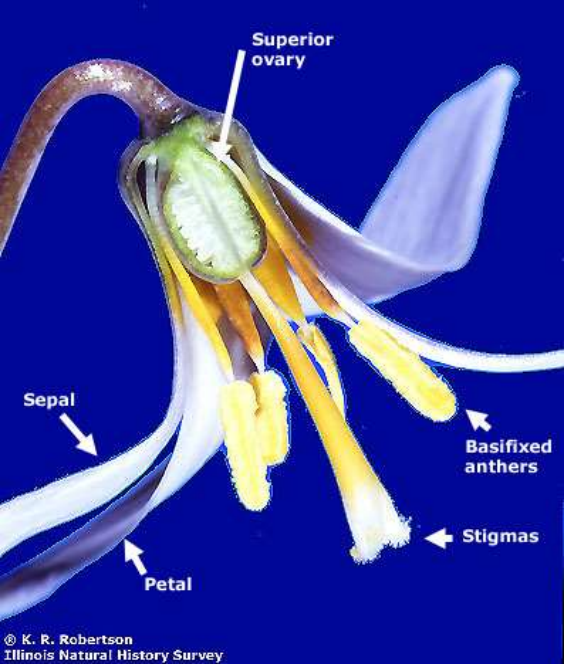
240 genera, 4,000 spp

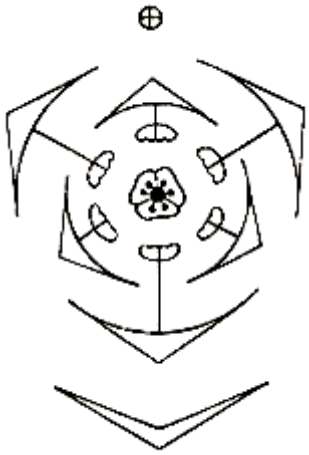
Liliaceae

Lilium lancifolium









Floral formula of Liliaceae

Economic importance

- Medicininal uses: *Aloe barbadensis, Alium sativum, are used* as medicine.
- Ornamental : *Lilium lancifolium, Yucca s, Tuli*
- Vegetables, condiments and Spices: *Alium sativum, Alium cepa, Alium hookerii etc.*

Affinity and systematic position

The family is closely related to Amaryllidaceae, Juncaceae, Pontederiaceae and Commelinaceae

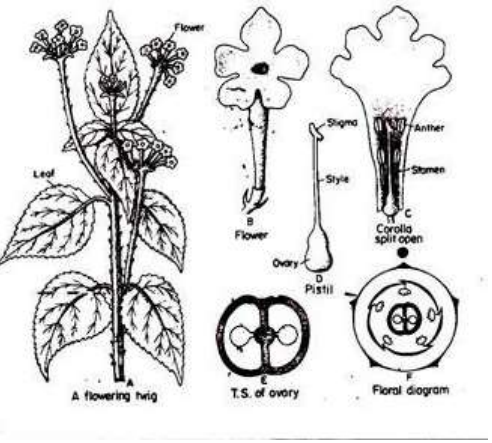
Class – Monocotyledonae
Series- Coronarieae
Family- Liliaceae

Verbenaceae

Clerodendrum colebrokianum

80 genera, 800 species

Clerodendrum thomsoniae


Flower
Leaf
A
A flowering twig
B
Flower
Stigma
Style
Ovary
D
Pistil
C
Anther
Stamen
Corolla split open
E
T.S. of ovary
F
Floral diagram

Economic importance

- Timber : *Tectona grandis, Gmelina arborea*
- Medicinal: young leaves and shoots of *Clerodendrum colebrokianum* are boiled and used as medicine to reduce blood pressure.
- Ornamental: *Duranta repens, Clerodendrum indicum, Clerodendrum thomsoniae*

- Edible: young leaves of *Clerodendrum colebrokianum* are used as vegetables

Affinity and systematic position

The family closely resembles Labiatae

Class – Dicotyledonae
Sub-Class Gamopetalae
Series-Bicarpellatae
Order- Lamiales
Family- Verbenaceae

Lamiaceae

200 genera, 3200 species


Lamiaceae

Verlagsbuchhandlung Paul Parey in Berlin SW., Hedemannstr. 10.

1, 2.
Salvia Sclarea L.
Muskateller-Salbei.
Blüten im Längsschnitt, von innen gesehen.
Pollenübertragung durch ein Insekt.

1.

2.

4, 5.
Lamium maculatum L.
Gefleckte Taubnessel.

4.
Blumenkrone, durch die Mitte der Unterlippe gespaltet, von innen gesehen.

5.
Ganze Blüte von der Seite gesehen.

3.
Salvia glutinosa L.
Klebriger Salbei.
Staubblätter mit der Unterlippe der Blüte.

Labiatae.

Economic importance

- Medicininal : leaves and flowering tops of *Rosemarinus offiicinalis* yields oil of rosemary, used in perfumery and medicine. It also ha antibacterial property
  Mentha piperata is the source of peppermint oil used in pharmacy, confectionery and for flavouring.
  Ocimum sanctum yields essential oil which is used in medicine and perfumery.
- Ornamental: *S. Splendens, Coleus sp Meriandra bengalensis* etc are grown as ornamental plants.
- Edible: *Mentha piperata*

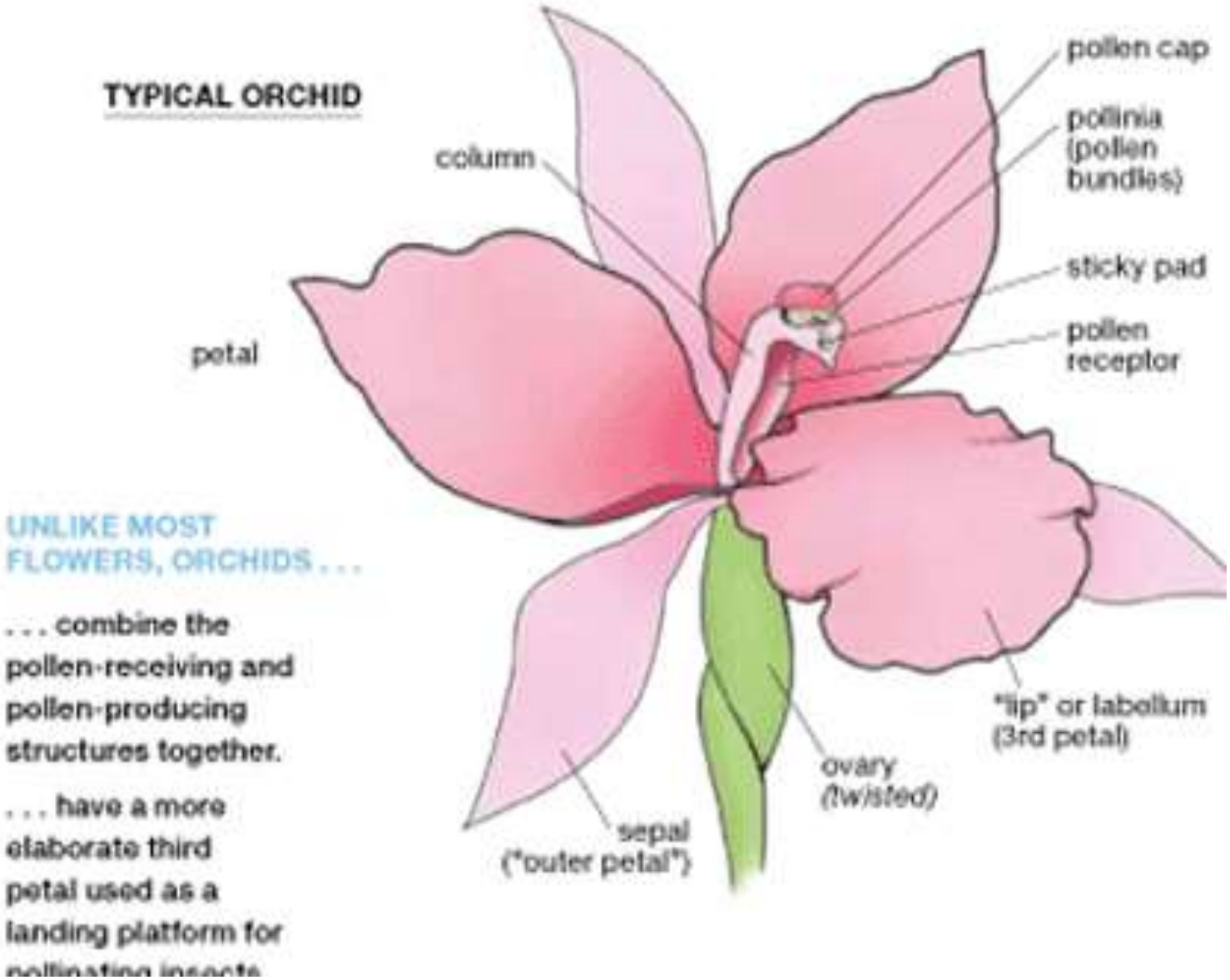
Affinity and systematic position

The family is closely related to Verbenaceae and Boraginaceae

Class – Dicotyledonae
Sub-Class Gamopetalae
Series-Bicarpellatae
Order- Lamiales
Family- Labiatae/Lamiaceae

Orchidaceae

750, genera, 18000 spp



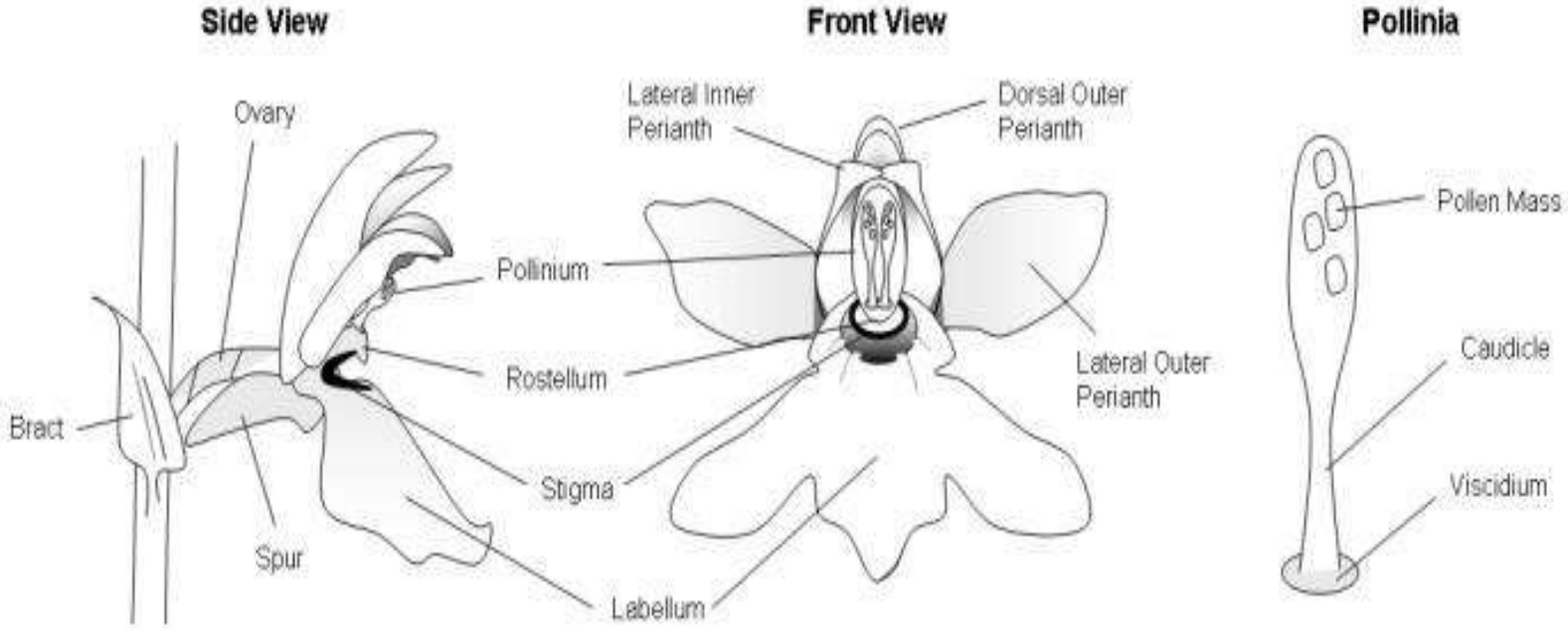
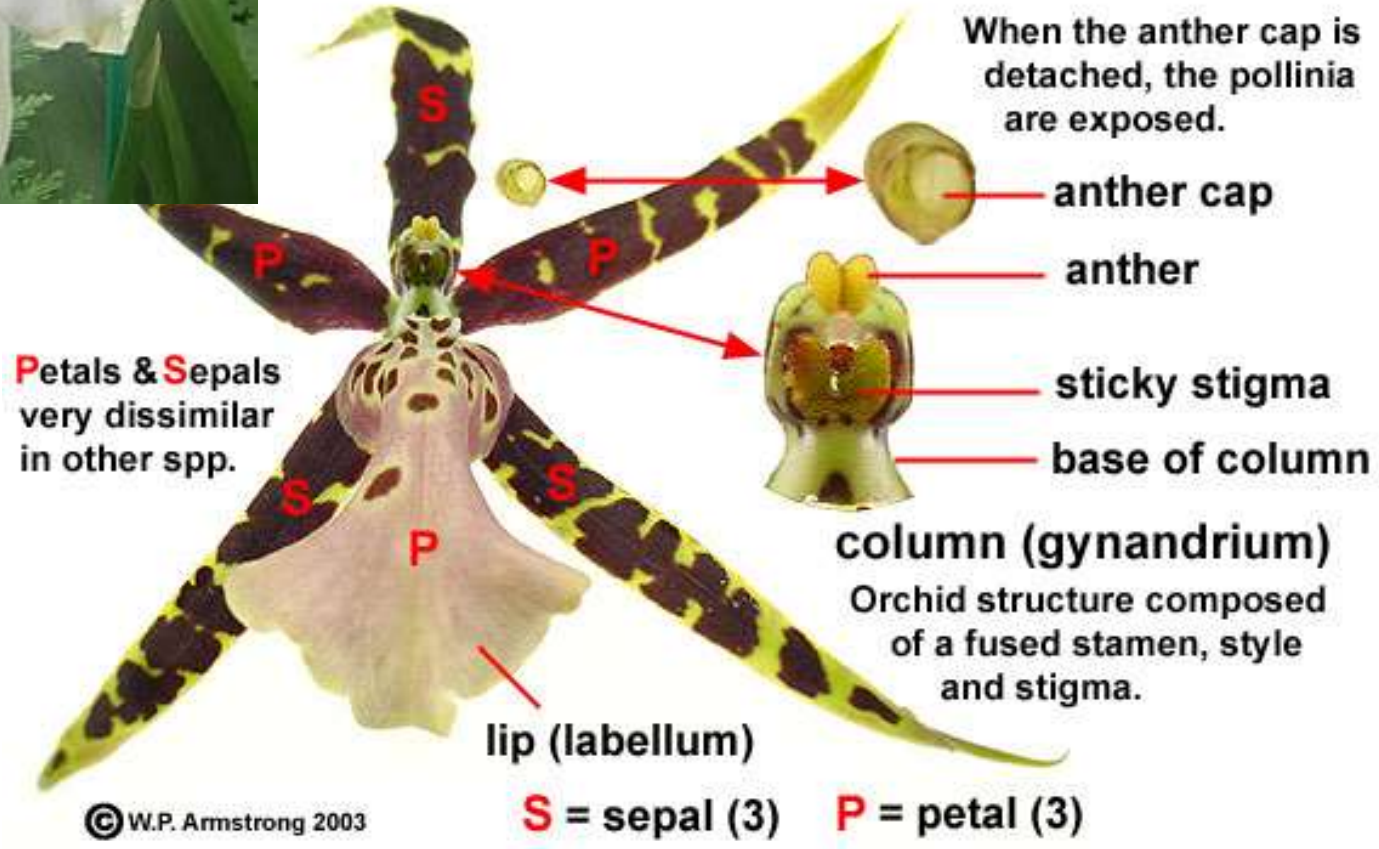


Figure 1.1. Generalised structure of Orchid Flowers. Diagrams adapted from Lang, 1980.

Details of an Orchid Flower (*Brassia* hybrid)



Economic importance

- Medicininal : *Vanda roxburghii* – roots are used for rheumatism and scorpion sting
- Ornamental: *Dendrobium s*pp, *Cymbidium* spp etc
- Edible: *Vanila planifolia*, - dried pulpy fruits yield vanilla – a scent for flavouring chocolate and confectionary.
- A blue dye is obtained from the leaves of *Calanthe veratriflora*.

Affinity and systematic position

The family is closely related to Musaceae, Zingiberaceae and Liliaceae

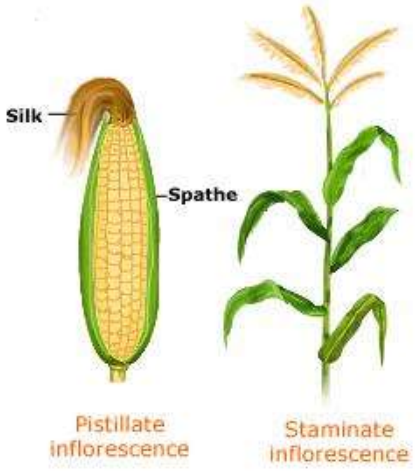
Class – Monocotyledonae
Series- Microspermae
Family- Orchidaceae

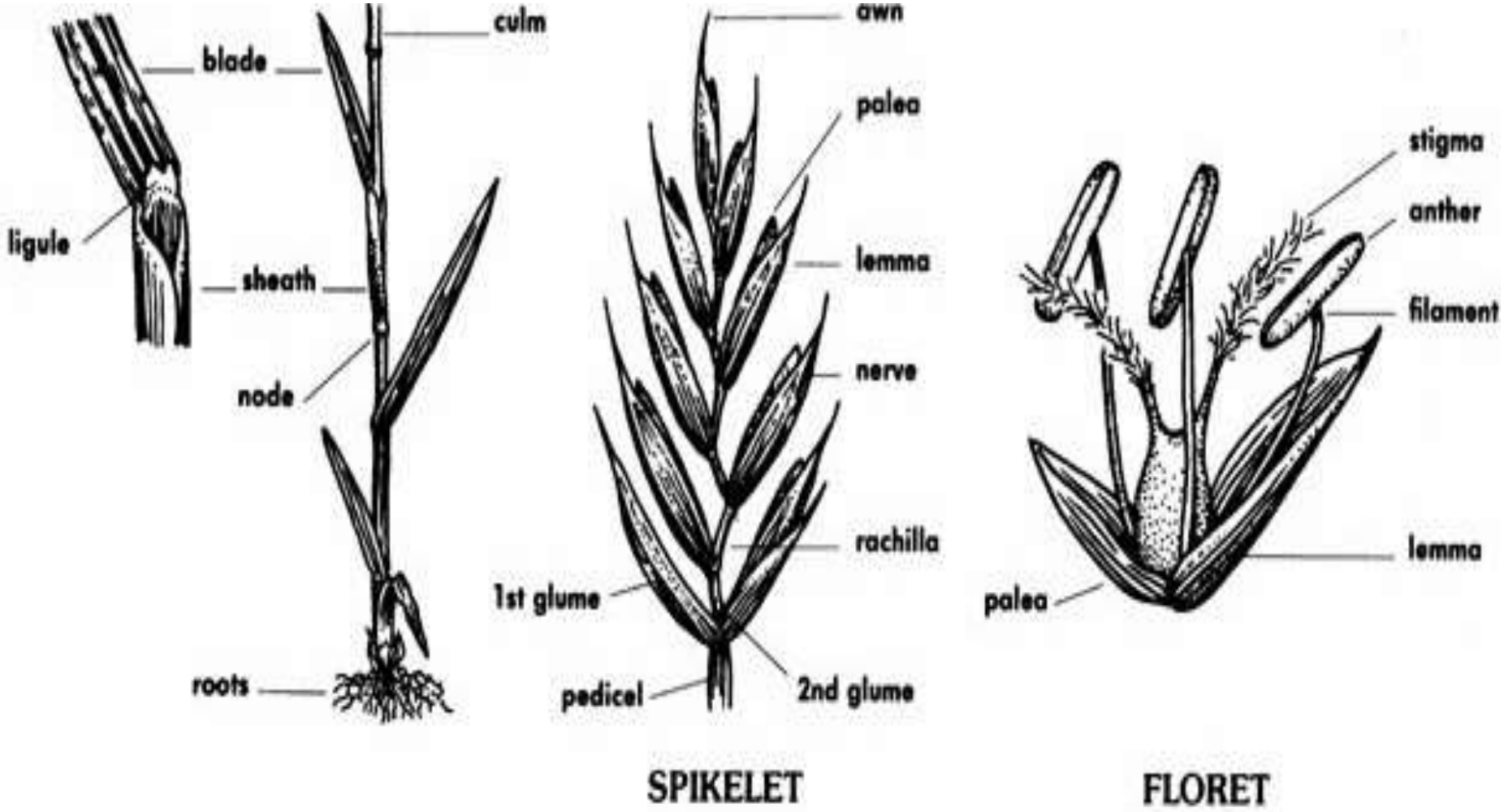
The most advanced family among monocots

1. Zygomorphic with modifications – labellum, for insect pollination
2. Epiphytic habit
3. Aerial roots
4. Pseudobulbs
5. Epigyny
6. Gynostegium
7. Rostellum ensures cross pollination
8. Pollination mechanism has reached the highest specialisation in the development of pollinia.

poaceae

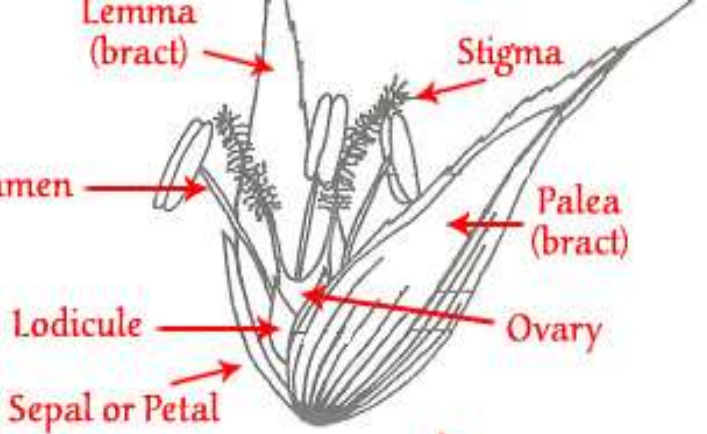
650, genera, 9000 spp



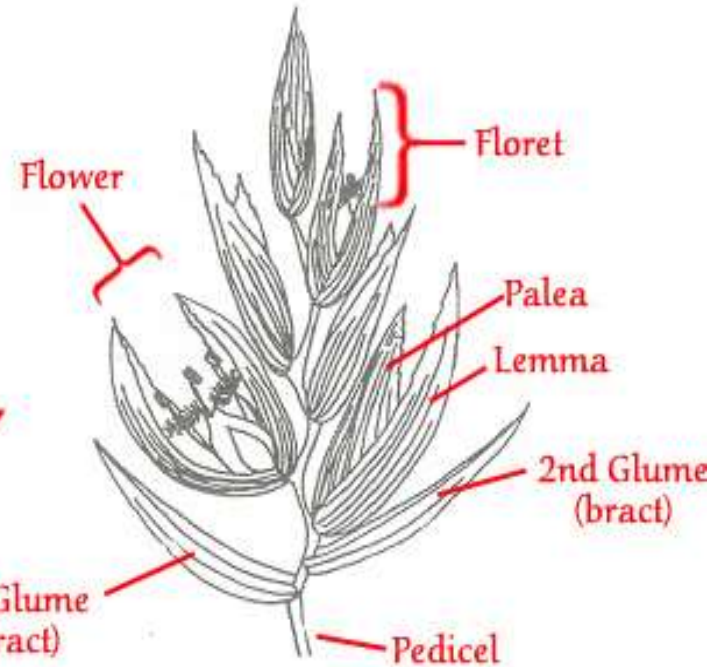


SPIKELET

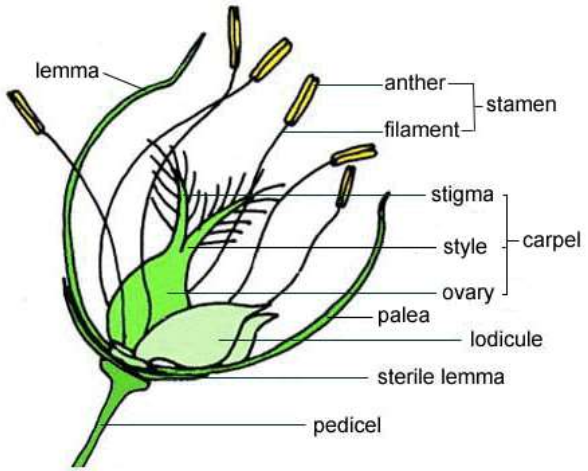
FLORET



Aggregation of grass flowers
into structure called spikelet



wers of the Poaceae
(Grasses)



Economic importance

- Medicininal grasses: *Phragmites karka* Trin is used in medicine
- Cereals and millets: *Triticum sativum, Zea mays, Oryza sativa* etc.
- Fodder grasses
- Sugar yielding: *Saccharum oficinarum*.
- Building materials: *Bambusa s*p, *Dendro-calamus s*pp.
- Aromatic grasses: *Citronella s*p (lemon grass), C*ymbopogon* spp

Affinity and systematic position

The family is closely related to Cyperaceae and Juncaceae

Class – Monocotyledonae
Series- Glumaceae
Family- Gramineae/Poaceae

47 genera, 1150 spp

Zingiberaceae

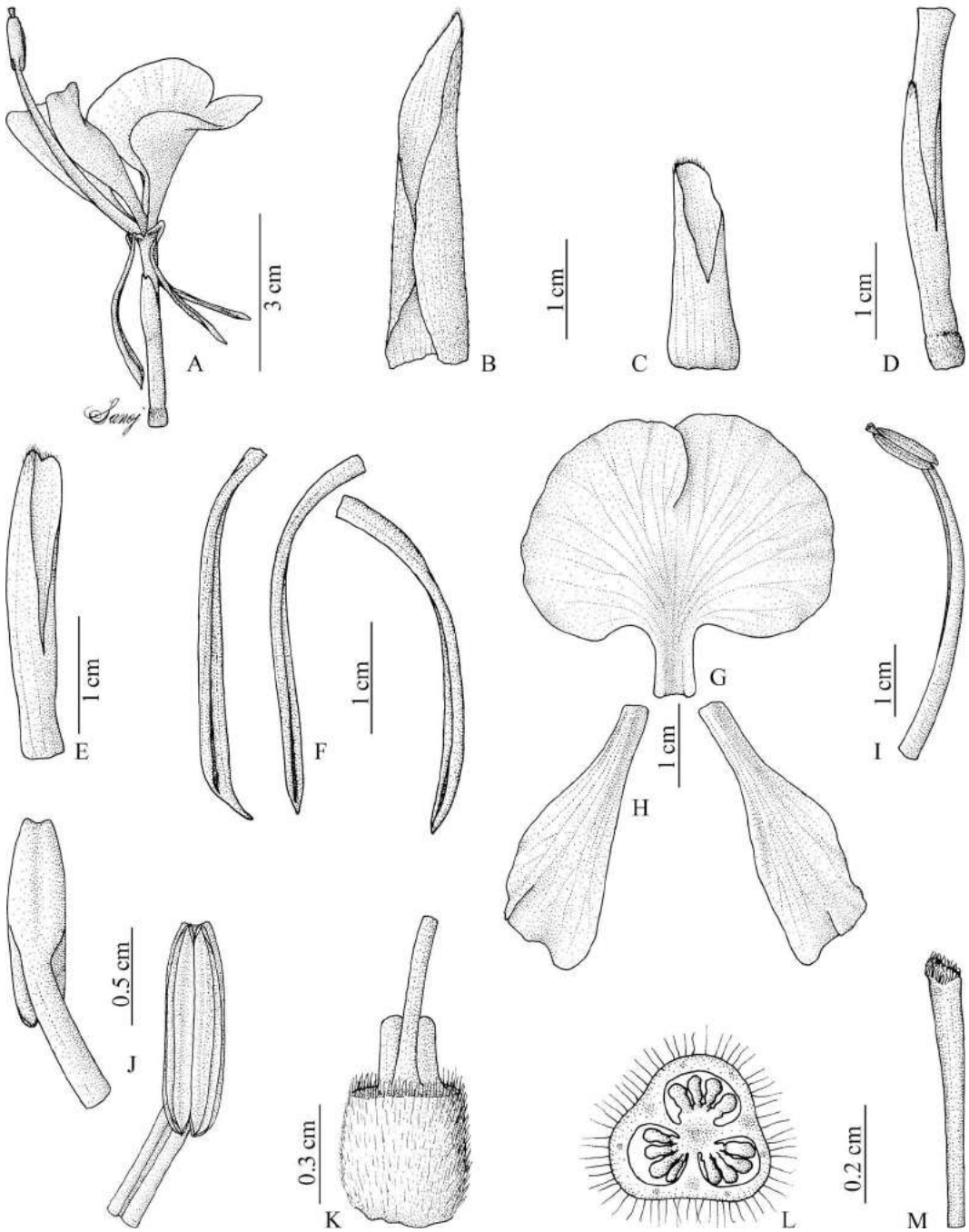


Figure 1. Hedychium deceptum N. E. Br.

A. Intact single flower.
B. Bract.
C. Bracteole.
D. Corolla tube with calyx and ovary.
E. Dissected calyx.
F. Dorsal and lateral corolla lobes.
G. Labellum.
H. Lateral staminodes.
I. Stamen.
J. Anther, ventral and dorsal views.
K. Ovary with epigynous glands and basal portion of style.
L. Ovary in cross section.
M. Upper portion of style with stigma.

Carpels with stylodial glands

Economic importance

- Medicininal uses: *Curcuma zedoaria* is used in medicine, rhizome of Costus speciosus is uses as medicine.
- Ornamental : *Hedychium coronarium*.
- Spices: *Zingiber officinalis, Curcuma longa*

Affinity and systematic position (Hutchinson's classification)

The family is closely related to Musaceae

Sub phyllum – Monocotyledones
Division - Caliciferae
Order – Zingiberales
Family - Zingiberaceae

Solanaceae

Solanum lycopersicum var. cerasiforme

Lycopersicon esculentum var. cerasiforme

Cyphomandra betacea/ Solanum bataceum

90 genera, 2200 spp

Petunia axillaris

Capsicum baccatum

Economic importance

Medicininal : *Atropa belladona* for atropin, which is used in tinctures and plasters, it is also antidote for poisoning by opium.

Datura atrsmonium – dried leaves are the sources of drug stramonium, used in spasm of broncioles in asthma and treatment in parkinsonism.

- Ornamental: *Petunia axillaris*
- Edible:

Affinity and systematic position

The family has got affinity with the members of Convolvulaceae and Scrophulariaceae.

Class – Dicotyledonae
Sub-Class Gamopetalae
Series-Bicarpellatae
Order- Polemoniales
Family- Solanaceae