B.Sc. BBZ

Semester 3

Flowering Plant Identification and Aesthetic Characteristics

UNIT 2: Part 1

II	**Types of classification & Evidences** Artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series) angiosperm phylogeny group (APG IV) classification. Introduction to taxonomic evidences from palynology, cytology, phytochemistry & Molecular biology data (Protein and Nucleic acid homology).

Comparative Account of Various System of Classification

Based on different criteria, many systems of classification of plants have been proposed by various philosophers, herbalists and botanists

Artificial System of Classification

- Oldest and first approach of classification of plants
- Cannot describe all plants
- Classification based on one or few characters of plants selected by author like,
  - –Reproductive behavior
  - –Physical appearance
  - –Habitat
  - –Phenology
  - –Cotyledon
  - –No. of stamens etc..

Some Examples of Artificial System of Classification

- Vedas (ar.200 BC)
- Theophrastus (370-285 BC)
- Secundus (23-79 AD)
- Dioscorides (62-128 AD)
- Mangus (1200-1280 AD)
- Brunfles (1464 – 1553 AD)
- Bock (1489- 1554 AD)
- Fuchs (1501-1556 AD)
- Tournefort (1656-1708 AD)
- Linnaeus (1707- 1778 AD)

Basis of Some Artificial Classification Systems

Sr. No	Name	Characters
1	Vedas (ar.200 BC)	Religious importance, medicine, flowering, fruiting etc...
2	Theophrastus (370-285 BC)	Size and life time (herb, shrub and trees)
3	Herbalists (1470-1670 AD)	Medicinal value
4	Tournefort (1656-1708 AD)	Flower and fruit giving rise
5	Linnaeus (1707- 1778 AD)	Sexual behaviour of plant (number, length and union of stamens and carpels)

Advantages and Disadvantages of Artificial Classification

- Advantages
  - –Simple and easy
  - –Need less information and time
  - –Poorly known plants can be placed easily
  - –Need few instruments
  - –Focus on properties of interest
- Disadvantages
  - –Cannot classify all plants perfectly
  - –Little predictive value
  - –Artificially selected properties do not correlate well with each other
  - –Cannot describe evolution

Natural System of Classification

- Introduced by Jen Bauhin in 1623
- Based on natural affinities and characters of plants
- It place together organisms that greatest number of shared features
- Instead of single feature all features are tools of classification

Some Examples of Natural System of Classification

- Gaspard Bauhin (1550-1640AD)
- Ray (1627-1705 AD)
- Adanson (1727- 1806 AD)
- A.L.de. Jussieu (1748-1836 AD)
- Robert Brown (1773-1858 AD)
- A. P. Candole (1778- 1884 AD)
- Alphonse (1806- 1893 AD)
- Bentham (1800 -1884 AD) and Hooker (1817-1911 AD)

Basis of Some Natural Systems of Classification

Sr. No.	Name	Classification parameter
01	A.L.de. Jussieu (1748-1836 AD)	•No. of Cotyledon •Presence and absence of petals •Position of petals and stamens
02	Robert Brown (1773-1858 AD)	Tissue structure
03	A. P. Candole (1778-1884 AD)	Characteristics of vascular tissue
04	Bentham (1800 - 1884 AD) and Hooker (1817-1911 AD)	Seed characteristics of plants

Advantages and Disadvantages of Natural Classification

- Advantages
  - More satisfactory on placing of species
  - More predictive value
  - Contain more information about species
- Disadvantages
  - Complex then artificial system
  - Need long time and more information
  - Poorly known plant can not be placed easily
  - Can not focus specifically on properties of interest

Phylogenetic System of Classification

- Latest system
- Done on micro scale i.e. cell level
- Based on Darwin's "Origin of Species (1859)"
- First introduced by August Wilhelm Eichler in 1883
- Based on evolutionary descent of its members
- According to this system it is believed that every species come from evolutionary change

Some examples of Phylogenetic system of classification

- Eichler (1839-1889)
- Engler (1844-1930) & Prantl (1849-1893)
- Bessey (1845-1915)
- Hutchinson (1884-1972)
- Takhtajan (1980)
- Cronquist (1981)
- Thorne (1981)
- APG (Angiosperm Phylogeny Group system) (1998,03,09)

Advantages And Disadvantages of Phylogenetic system of Classification

- Advantages
  - –Unique name for each species help to eliminate confusion
  - –Maximum predictive value and detail scientific study as provide maximum information about species
- Disadvantages
  - –Complex then system
  - –Need long time and research
  - –Physical appearance neglected so physically same species can be in different groups.

Most widely accepted systems

Arificial classification

- Theophrastus ca. 300 B.C.
- Linnaeus (1707-1778 AD.)

Natural classification

- Benthum (1800-1884)

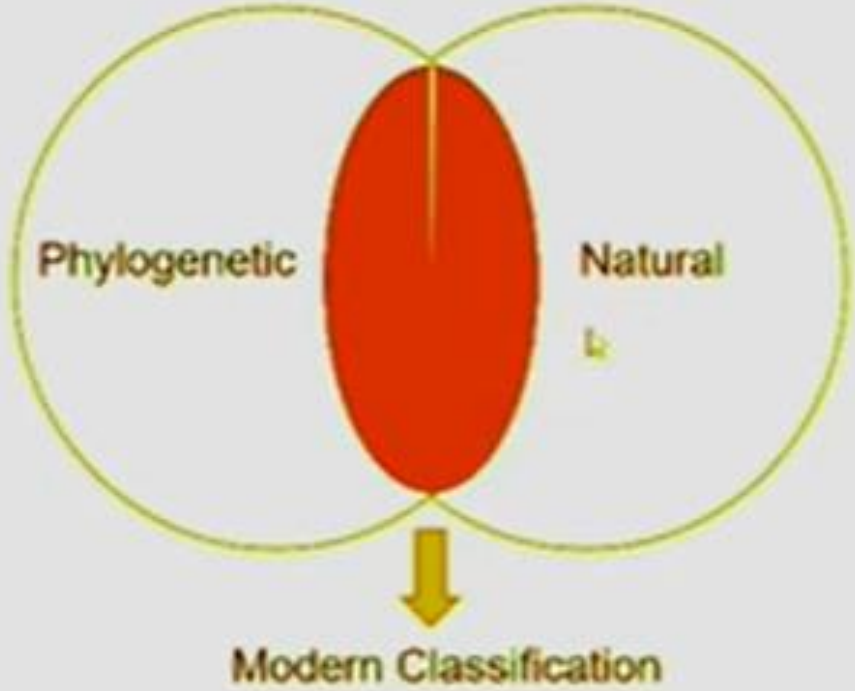
  and Hooker (1817-1911)

Phylogenetic classification

- Hutchinson (1884-1972)
- Takhtajan (1980)
- APG (Angiosperm Phylogeny Group system) (1998,03,09)

Modern Classification System

Now phylogenetic and natural systems of classification are combined for classification of plants



(i) **Artificial systems:** These systems of classification were based on one or few morphological characters e.g. classification proposed by **Carolus Linnaeus.**

(ii) **Natural Systems:** In these systems the organisms are classified on the basis of their natural affinities (i.e. the basic similarities in the morphology) rather than on a single character for determining the affinities e.g. **Bentham and Hooker's Classification.**

2.1.2. Artificial System of Classification

From 300 B.C. to around 1830, artificial systems of classification predominated. It was based on the presence or absence of few morphological or vegetative characteristics of plants that were used for grouping of organisms or differentiating one group of an organism from another. Characteristics like number and position of stamens, style, etc. were considered.

Examples of Artificial Systems of Classification

1) **Theophrastus** gave the first artificial system of classification based on plant habitat. He grouped plants into four categories, namely herbs, under, shrubs, and trees.
2) **John Ray** gave another artificial system of classification of plants.
3) **Carolus Linnaeus** introduced an artificial system of classification of plants based on the presence or absence of some sexual characters (total number of stamens and carpels). He grouped plants into 24 classes, of which 23 belonged to phanerogamia (visible sex organs) and 1 belonged to cryptogamia (hidden sex organs).

2.1.2.1. Theophrastus System of Classification

Theophrastus was a Greek naturalist and an Aristotle and Plato student. He divided the plants into 4 types based on their habit, i.e., **herbs**, **under shrubs**, **shrubs**, and **trees**. He published his work in Historia Plantarum, regarded as the first botanical treatise ever written, and documented and identified roughly 480 different species.

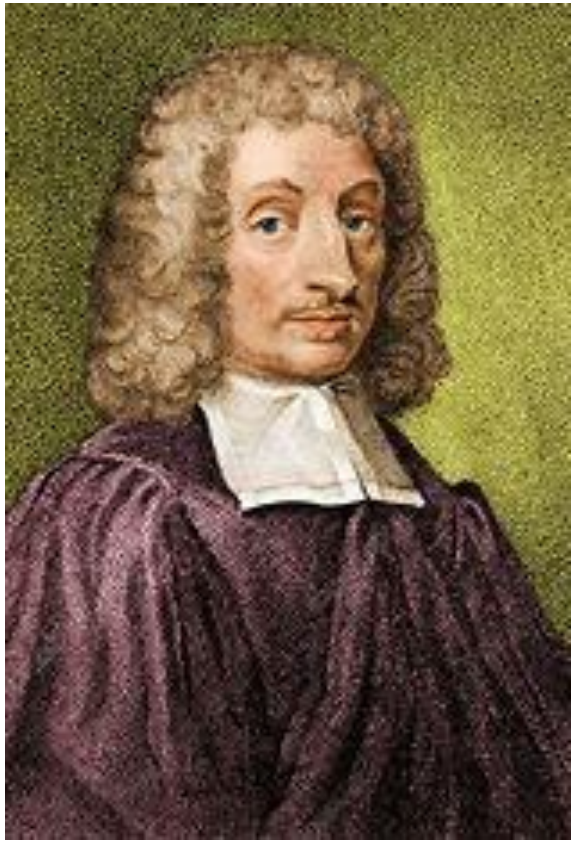
Important Contributions of Theophrastus

1) The fundamental distinction between dicotyledons and monocotyledons.
2) The distinction between inflorescences of the racemose and cymose types.
3) The distinction between polypetalous and gamopetalous corolla.
4) The distinction between superior and inferior ovary, etc.

Aspharagos (***Asparagus***), ***Daukan*** (***Daucas***), and other of his names have gained widespread popularity and are also employed as generic names in current categorisation. **Theophrastus** is known as the **Father of Botany** due to his enormous contributions listed above.

2.1.2.2. John Ray System of Classification

John Ray was a botanist from Britain. His classification system was initially put forward in Methodus Plantarum Nova (1682). Later, he provided his taxonomy in three volumes in Historia Plantarum (1686-1704). He divided plants into **herbs** and **trees**, then into **dicotyledons** and **monocotyledons**, much like other antiquated classification systems. In comparison to past classifications, his system was far more sophisticated and came close to the natural system.



His system of classification is organised as follows:

1) **Herbae (Herbs):**
   - i) Imperfectae (non-flowering plants, i.e., cryptogams).
   - ii) Perfectae (flowering plants).
   - iii) Dicotyledons.
   - iv) Monocotyledons.

2) **Arborae (Trees and Shrubs):**
   - i) Dicotyledons.
   - ii) Monocotyledons.

2.1.2.3. Carolus Linnaeus System of Classification

Carolus Linnaeus was a Swedish naturalist. He is called the **Father of Modern Botany** owing to his outstanding contribution.

Publications of Carolus Linnaeus

1) **1730:** Hortus Uplandicus (contains the plants of Uppsala Botanic Garden at that time).
2) **1735:** Systema Naturae.
3) **1737:** Hortus Cliffortianus (contains the plants in the Garden of George Clifford at Hartecamp).
4) **1737:** Genera Plantarum.
5) **1738:** Classes Plantarum.
6) **1751:** Philosophia Botanica (contains the revised revision of his earlier publications Systema Naturae and Classes Plantarum.
7) **1753:** Species Plantarum (contains 7300 species described and arranged according to his classification system). In this book, Linnaeus constantly used the binomial system in plant names, consisting of two names of a specimen, i.e., the generic epithet and the specific epithet.

Carolus Linnaeus Classification System : -

Carl Linnaeus (23.05.1707–10.01.1778), also known as **Carl von Linné** was a **Swedish botanist, zoologist and physician** who **formalised binomial system of nomenclature**. He is **known as** the **"father of modern taxonomy"**.

Linnaeus was **born in Rashult, Stenbrohult, Paris of southern Sweden**. He received most of his **higher education** at **Uppsala University** and **began** giving **lectures in botany** there **in 1730**. He **lived abroad** from **1735 to 1738, where** he **studied** and also **published** the **first edition** of his *Systema Naturae* in the **Netherlands**. He then **returned to Sweden** where he **became professor of medicine and botany at Uppsala.** In the **1740s, 1750s and 1760s** he was sent on **several journeys** through Sweden **to collect and classify animals.**

Carolus Linnaeus Classification System : -

plants, and minerals, while publishing several volumes. **He was one of the most acclaimed scientists in Europe at the time of his death.**

Philosopher Jean-Jacques Rousseau sent him the **message**: "Tell him I know no greater man on earth." **Johann Wolfgang von Goethe** wrote: **"**With the exception of Shakespeare and **Spinoza ,** I know no one among the no longer living who has influenced me more strongly." **Swedish author August Strindberg wrote:** "Linnaeus was in reality a poet who happened to become a naturalist**." Linnaeus has been called *Princeps botanicorum* (Prince of Botanists) and "The Pliny of the North".**

The Taxonomy Linnaeus :-

In his *Imperium Naturae*, Linnaeus established **three kingdoms**,namely *Regnum* ***Animale***, *Regnum* ***Vegetabile*** and *Regnu m* ***Lapideum***. This approach, the Animal, Vegetable and Mineral Kingdoms, survives today in the mind, and arise question: "Is it animal, vegetable or mineral?" . The **work of Linnaeus had** a huge **impact on science**; it was indispensable as a **foundation for biological nomenclature , now regulated by the nomenclature codes . Among his works,** the **first edition** of the *Species Plantarum* **(1753) for plants**

and the **tenth edition** of the *Systema Naturae* **(1758),** are **accepted as part of the starting points of nomenclature.**

Basis of Carolus Linnaeus System of Classification

The classification system of Linnaeus is artificial. He recognised the significance of flower and fruit structures. He emphasised the basic numerical characteristics of sexual parts, i.e., the number of stamens and carpels. Thus, the Linnaeus system is also known as **sexual system**, which groups plants into 24 classes based on the number of stamens has become one of the most well-known artificial systems of classification.

According to Linnaeus, his classification system is based on the following:

1) Number of Stamens (I-XII classes)
2) Size of Stamen (XIV –XV classes)
3) Cohesion of filaments into bundles (XVI – XVIII classes)
4) Cohesion of anthers (XIX class)
5) Stamens adnate to ovary (XX class)
6) Distribution of sex in plants (XXI-XXIII classes)
7) Plant without flower (XXIV class)

Outline of the Carolus Linnaeus System of Classification

In his renowned works **Genera Plantarum** (1737) and **Species Plantarum** (1753), Linnaeus divided the plant kingdom into 24 groups. He identified about 6000 species under 1000 genera in species Plantarum. Linnaeus introduced binomial nomenclature in this book, which is why modern botanists have selected species Plantarum and the date 1st May, 1753 as the beginning point of the current botanical nomenclature.

Classification of Plants Or Sexual System:-

The classification was first of all **proposed in** *Hortus Uplandicus* then **elaborated in** *Genera Plantarum* **and finally in** *Species Plantarum*. This was **based on the number of stamens**, **pistils with in a flower**, bisexual or unisexual flowers **etc**. The **plants** were **divided in** to **24 classes**, among these from **1 to 23 classes** are **of flowered plants** and **last 24** class has plants who **have not flowers** known as **Cryptogamia.** Within each class were several orders.The Linnaean classes for plants, in the Sexual System, are as follows:

1. Monandria: 1 stamen
2. Diandria: 2 stamens
3. Triandria: 3 stamens
4. Tetrandria: 4 stamens

1. Monandria: 1 stamen
2. Diandria: 2 stamens
3. Triandria: 3 stamens
4. Tetrandria: 4 stamens
5. Pentandria: 5 stamens
6. Hexandria: 6 stamens
7. Heptandria: 7 stamens
8. Octandria: 8 stamens
9. Enneandria: 9 stamens
10. Decandria: 10 stamens
11. Dodecandria: 11-19 stamens
12. Icosandria: 20 (or more) stamens, perigynous
13. Polyandria: Many free stamens, inserted on the recptacle
14. Didynamia: 4 stamens, 2 long and 2 short
15. Tetradynamia: 6 stamens, 4 long and 2 short i.e. Brasica
16. Monadelphia:The anthers free, but filaments fused at base
17. Diadelphia; The stamens fused in two separate groups

18. Polyadelphia:The stamens fused in many separate groups

19. Syngenesia:Stamens fused by their anthers in Asteraceae

20. Gynandria:The stamens fused to the pistils in Calotropis

21. Monoecia: On a single plant male and female flowers +nt

22. Dioecia: On different plant male and female flowers +nt

23.Polygamia:Onsingle plant unisexual,bisexual,neuterfls +nt

24.Cryptogamia:The"flowerless"plants,Thalophyta,Bryophyta

Merits of Carolus Linnaeus System of Classification

The ability to quickly and easily identify plants using just a few traits is the only benefit of this classification system.

Demerits of Carolus Linnaeus System of Classification

1) The system is not at all sexual, but is only based on numerical relationship of sex organs. Thus, this system was developed on differences of sex organs instead of similarities.

2) The closely related members differ and distantly related members become very close to each other for the numerical relation of sex organs.

3) Gymnosperms were placed in class XIV Didynamia, along with Labiatae (an angiosperm family).

4) Monocotyledons, Dicotyledons, and Gymnosperms, i.e., phanerogamic, plants are not considered distinctly. Thus, Dicotyledons and Monocotyledons members become very close; **for example**,
   i) **In class I** – Monandria (flower having 1 stamen) – Globba (Zingiberaceae of Monocotyledons) and Mangifera (Anacardiaceae of Dicotyledons).
   ii) **In class VI** – Hexandria (flowers having 6 stamens) – Alisma (Alismaceae of Monocotyledons) and Rumex (Polygonaceae of Dicotyledons) come very close.

5) This classification system is like a dictionary where the words are arranged alphabetically without any relationship.

Natural System of Classification

Natural system of classification is based on overall resemblances, mostly in gross morphology, thus, using as many taxonomic characters as possible, to group taxa. Based on common natural characteristics, the plants are grouped and placed into different taxa, like classes, orders, families, and genera.

Many botanists published their natural system of classification:

Michel Adanson: He was a French botanist who rejected all the artificial classification systems and proposed his classification in favour of natural system. He published his work in Families de Plantes (1763) in two volumes. His grouping of plants is equivalent to orders and families of modern system.

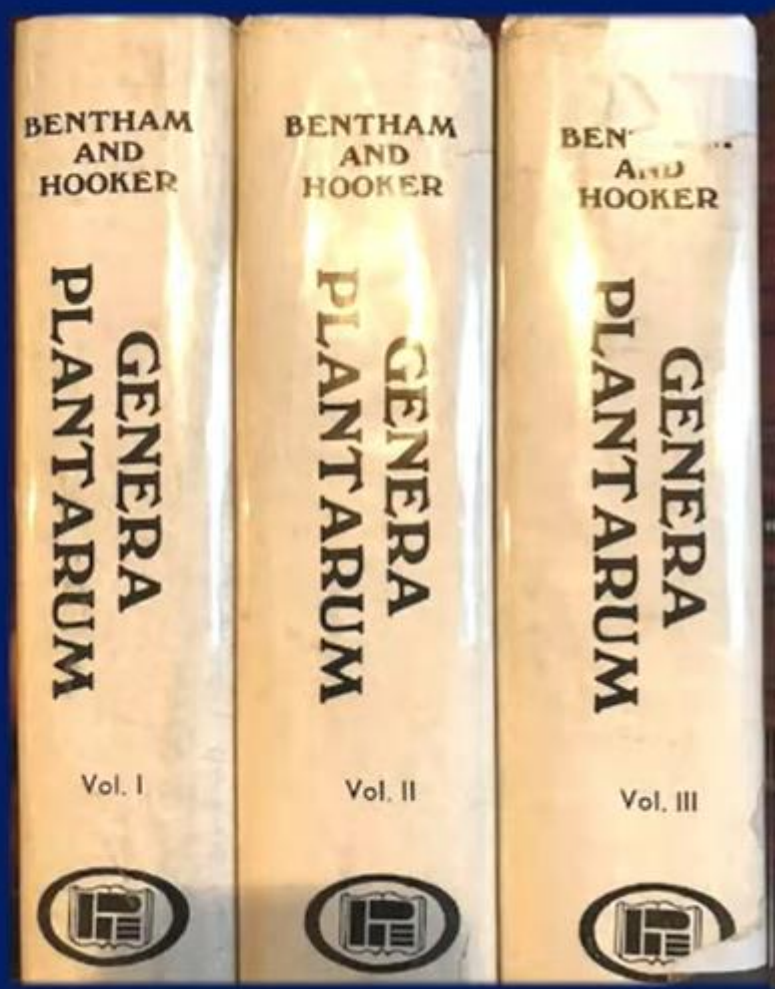
Bentham and Hooker: They gave the natural classification system based on the natural characters, like seed plants, and explained in the book Genera Plantarum. They learnt about the leaves of plants, like whether they are simple, compound, alternate, stipulate, petiole, and wavy margins.

Robert Hooke: He discovered the cell theory, stating that cell is the fundamental unit of life. He studied the cork cell under a microscope and suggested that cells come from pre-existing cells.

Bentham and Hooker's System of Classification

Bentham and Hooker's System of Classification

- Proposed by two English botanists George Bentham (1800-1884) and Sir Joseph Dalton Hooker (1817-1911).
- It is a natural system of classification.
- Even today this system is being followed in many countries.
- Their system of classification was published in 'Genera Plantarum' in **three volumes**.



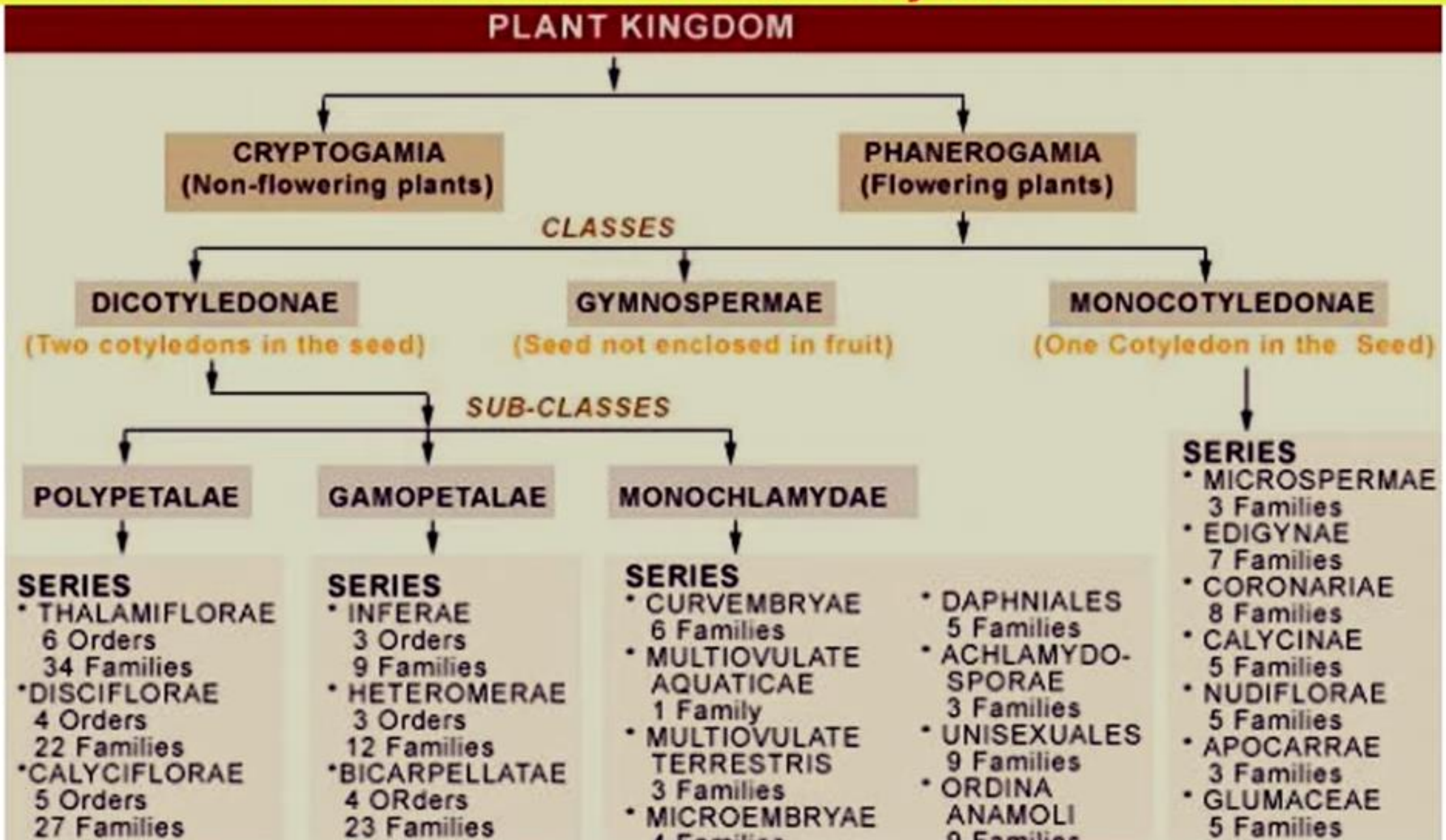
Silent Features of Bentham and Hooker's System of Classification

1. It is a classification of only the "seed plants" or phanerogams.
2. Described **97,205 species** of seed plants belonging to **7,569 genera of 202 families.**
3. Classified all the seed plants into 3 groups or classes i.e. Dicotyledons (165 families), **gymnosperms** (3 families) and **monocotyledons** (34 families).
4. Dicotyledons were divided into 3 subclasses (**Polypetalae, Gamopetalae** and **Monochlamydeae**) and 14 series. Each series again divided into cohorts (modern orders) and cohorts into orders (modern families).
5. In Bentham and Hooker's classification of plants, the present day **'orders'** were referred to as **'cohorts'** and **'families'** as **'orders'.**

Silent Features of Bentham and Hooker's System of Classification

6. Polypetalae carries **82 families, 2610 genera & 31,874 species.**
7. Gamopetalae carries **45 families 2619 genera & 34,556 species**.
8. Monochlamydae includes **36 families, 801 genera & 11,784 species**.
9. Among the Monochlamydeae, major taxa, like the **series,** were divided based **on terrestrial and aquatic habits.**
10. Monocotyledons consist **34 families, 1495 genera and 18,576 species**.

Outline of Bentham and Hooker's System of Classification



Class I Dicotyledonae:

- Seeds of dicotyledonous plants contain two cotyledons.
- Leaves show reticulate venation.
- Flowers are tetramerous or pentamerous.

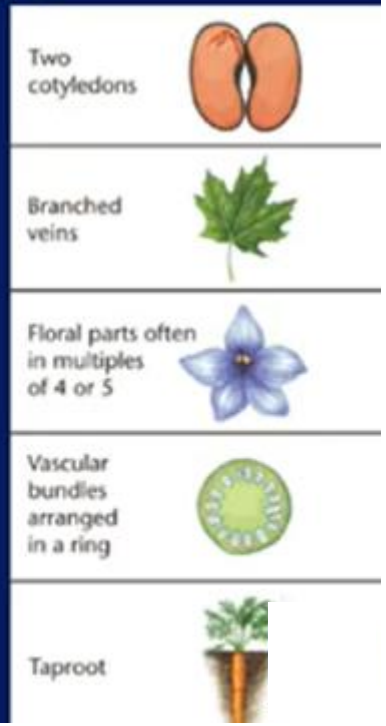
It includes three sub-classes – Polypetalae, Gamopetalae and Monochlamydeae.

Sub-class I Polypetalae:

- Plants having flowers with free petals.
- The flowers are with distinct calyx and corolla.

It is further divided into three series –

1. Thalamiflorae,
2. Disciflorae and
3. Calyciflorae.



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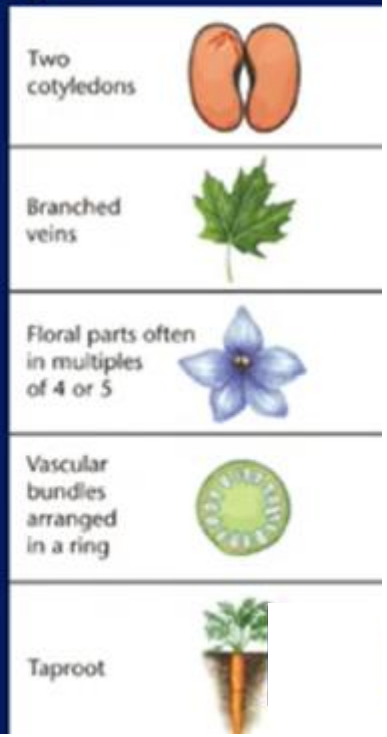


POLYPETALAE

Series (i) Thalamiflorae

- Flowers with dome or conical thalamus.
- Ovary is superior.
- Includes 6 orders and 34 families.

Series (ii) Disciflorae

- Flowers with disc shaped thalamus below the ovary.
- Ovary is superior.
- Includes 4 orders and 23 families.

Series (iii) Calyciflorae

- Flowers with cup shaped thalamus.
- Ovary is superior or inferior sometimes half inferior.
- Includes 5 orders and 27 families.

Sub-class 2. Gamopetalae

- Plants having flowers with petals, which are either partially or completely fused to one another.
- The sepals and petals are distinct.
- Gamopetalae is further divided into three series-
    1. Inferae,
    2. Heteromerae
    3. Bicarpellatae.

GAMOPETALAE

Series (i) Inferae

- Flowers are epigynous and ovary is inferior.
- Includes 3 orders and 9 families.

Series (ii) Heteromerae

- Flowers are hypogynous and ovary is superior with more than two carpels.
- Includes 3 orders and 12 families.

Series (iii) Bicarpellatae

- Flowers are hypogynous and ovary is superior with two carpels only.
- Includes 4 orders and 24 families.

Sub-class 3. Monochlamydeae

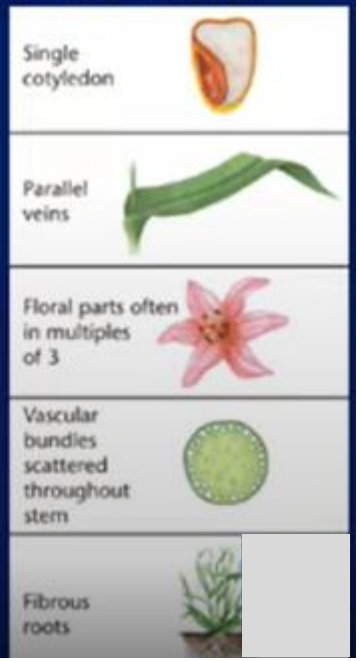
- Flowers with single whorl of perianth.
- Flowers are incomplete.
- Sepals and petals are not distinguished and are called perianth.
- Tepals are present in two whorls.
- Sometimes both the whorls are absent.
- Monochlamydeae includes 8 series and 36 families.

MONOCHLAMYDEAE

- **Series I Curvembryeae:** Embryo curved round the endosperm, ovule usually one.
- **Series II Multiovulatae Aquaticae:** Aquatics with numerous ovules.
- **Series III Multiovulatae Terrestris:** Terrestrial plants with numerous ovules.
- **Series IV Microembryeae**: Embryo very small.
- **Series V Daphnales:** Ovary usually with one carpel.
- **Series VI Achlamydosporeae:** Ovary usually inferior, unilocular and one to three ovules.
- **Series VII Unisexuales:** Flowers unisexual. It includes 9 orders.
- **Series VIII Ordines anomaly**: Uncertain relationship.

Class III Monocotyledonae

- Seeds of monocotyledonous plants contain only one cotyledon.
- Leaves show parallel venation.
- Flowers are trimerous having three members in various floral whorls.
- The plants have fibrous root system.
- The Monocotyledonae has 7 series and 34 families



MONOCITYLEDONAE

- **Series I Microspermae**: Ovary inferior, seeds very small.
- **Series II Epigynae:** Perianth usually inferior, seeds large.
- **Series III Coronarieae:** Perianth petaloids, ovary superior.
- **Series IV Calyciane:** Perianth sepaloid, ovary superior.
- **Series V Nudiflorae:** Perianth mostly lacking, ovary superior.
- **Series VI Apocarpeae:** Carpels free.
- **Series VII Glumaceae:** Perianth small, scale-like or chaff.

Merits of Bentham and Hooker System of Classification

1) It is a good system of natural classification.
2) It is crucial and very appropriate for practical applications.
3) Dicotyledonous give rise to monocotyledons.
4) In monocotyledon class, emphasis is being placed on the features of ovary and perianth's relative location.
5) From research and dissection of specific plants, a full and thorough description of each plant was created.
6) Each genus was split into sections and sub-genera for convenience, and each was given a name, a diagnosis, and assignment of significant species that belonged to it.
7) The system is helpful in identifying seed plants.
8) The inclusion of disciflorae and the grouping of certain groups based on aquatic and terrestrial characteristics are unique features of this system.

Demerits of Bentham and Hooker System of Classification

1) The position of gymnosperms between dicotyledons and monocotyledons is irregular.
2) The angiosperms' origin is unknown.
3) In monocots, emphasis is placed on the perianth character and ovary location, which is unwarranted in case of some orders.
4) Placement of Scitamineae and Orchidaceae at the start of the monocots is unsatisfactory.
5) Monchlamydeae family is thought to be the most advanced among the cotyledons, and the polypetalae family to be the most archaic. Gamopetalae have been positioned between the two, although this placement defies evolutionary logic.
6) A random choice of characters is causing some of the linked orders (families) to be far apart.
7) Monochlamydeae is thought to be a synthetic group. There are many orders (families) in it that have affinities to biseriate perianth.
8) Iridaceae and Amaryllidaceae of Liliaceae family should not be distinguished from one another based on the characteristics of their inferior ovary.

Phylogenetic System of Classification

Phylogenetic systems of classification categorise the plants based on their evolutionary tendencies. The phylogenetic classification is typically created using natural classification as a guide. As a result, there is overlap in practise. Some good **examples** of phylogenetic classification systems are those introduced by Engler and Prantl (1887-1915), Hutchinson (1926-34), (1959 and 1973), and Takhtajan (1964,1969,1973 and 1980).

Adolf Engler

(25 Mar. 1844 - 10 Oct. 1930)

Karl Anton Eugen Prantl

(10 Sept. 1849 - 24 Feb. 1893)

3. Engler and Prantl System of Classification

- Adolf Engler (1844-1930) Karl Pranltl (1849- 1893) - Classification in **"Die Naturlichen Pflanzen familien"** between 1887-1915.
- The plant kingdom is divided into 13 divisions. The 13th division was **Embryophyta Siphonogama.**

In this system of classification the plant kingdom was divided into 13 divisions.

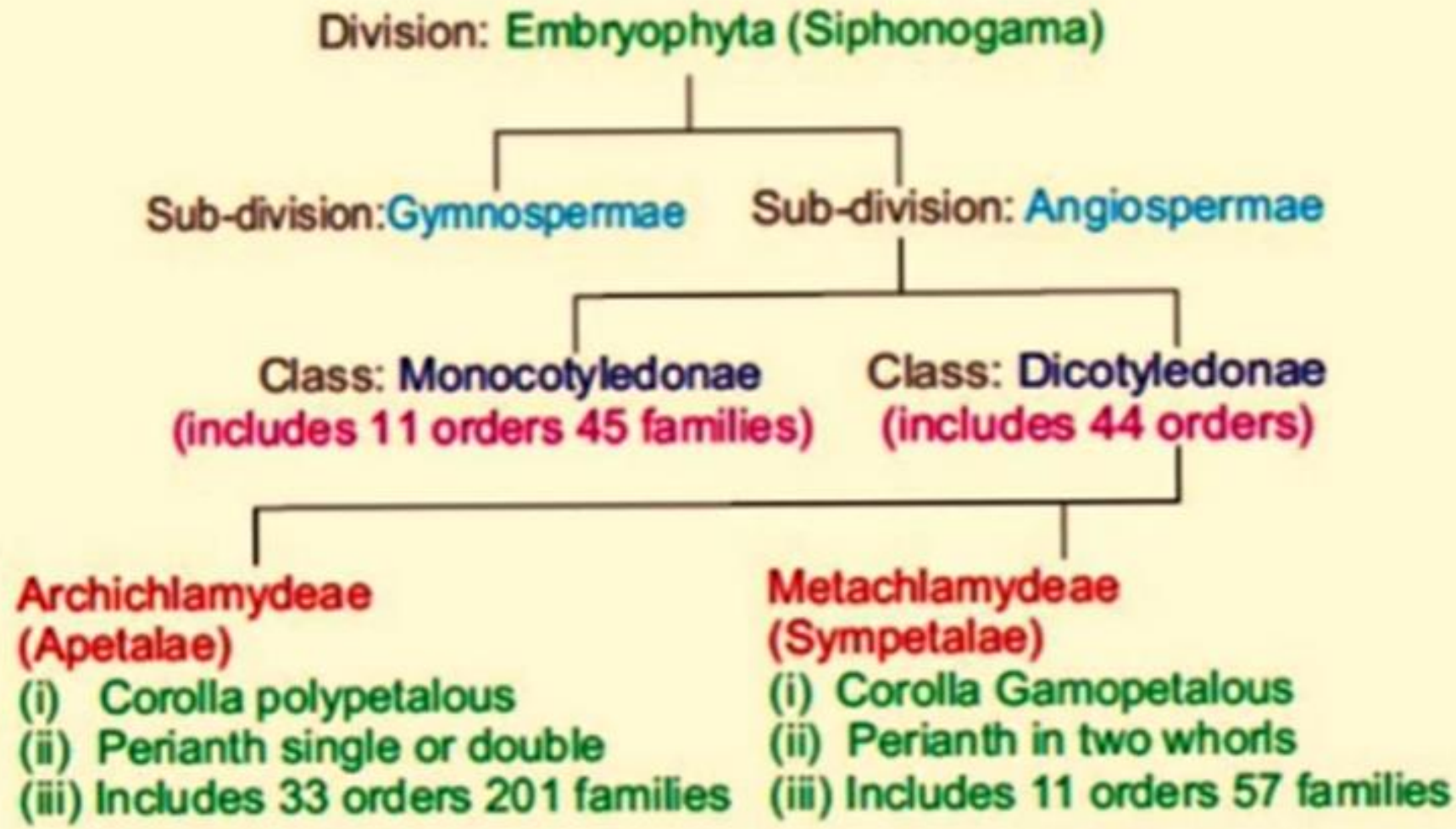
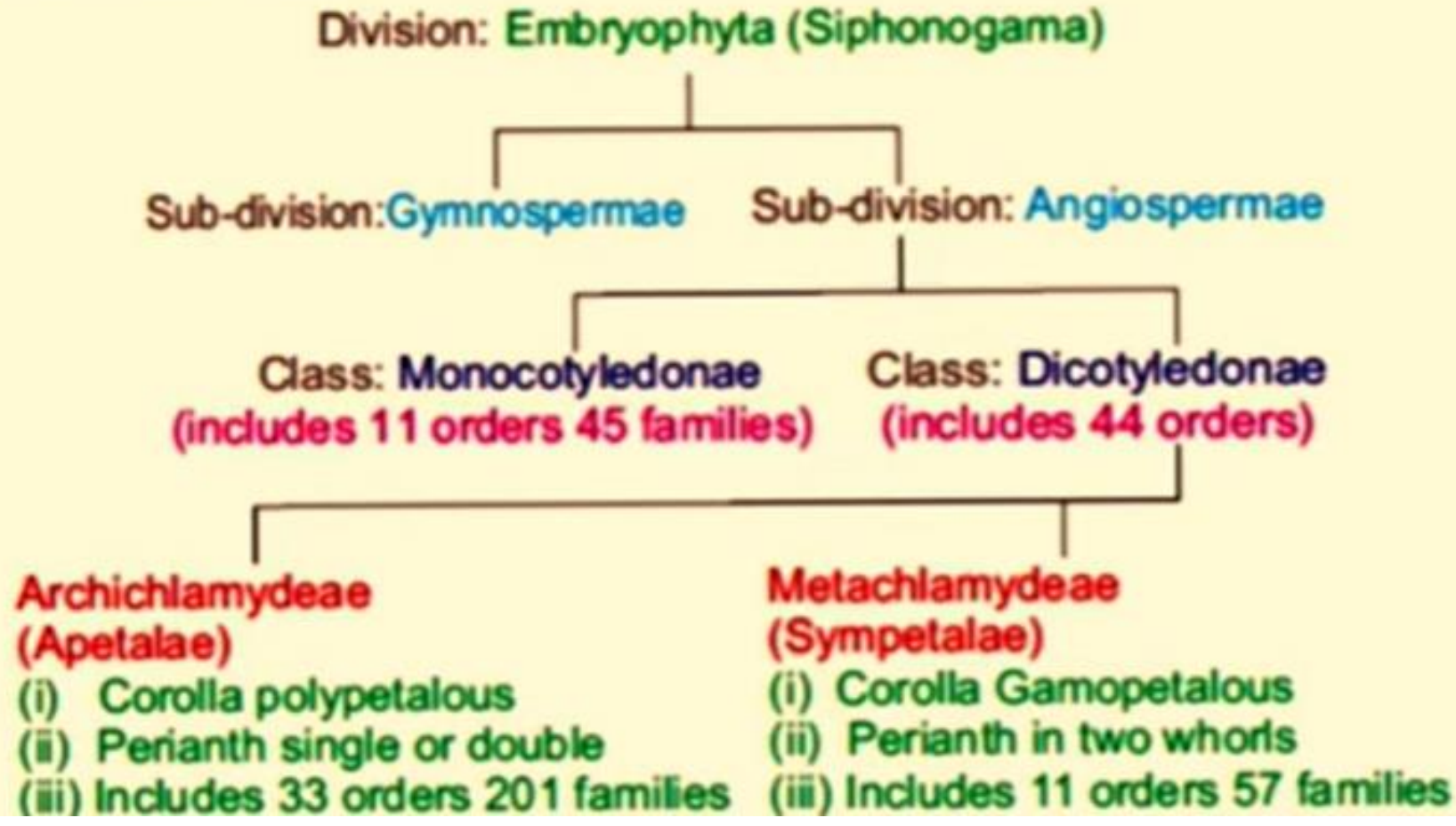


Figure 5.7: Outline of Engler and Prantl classification

The first 11 divisions are Thallophytes, twelfth division is **Embryophyta Asiphonogama** (plants with embryos but no pollen tubes; Bryophytes and Pteridophytes) and the thirteenth division is **Embryophyta Siphonogama** (plants with embryos and pollen tubes) which includes seed plants.

The thirteenth (13) Division is the Embryophyta Siphonogama (the seed-bearing plants i.e., Spermatophyta). It is divided into two Subdivisions, Gymnospermae and Angiospermae. The Angiospermae is divided into two Classes — Monocotyledonae and Dicotyledonae. The Class Monocotyledonae is divided directly into 11 Orders.



Salient features of E and P system of classification

- The class Dicotyledoneae was divided into two subclasses namely, **Archichlamydeae** and **Metachlamydeae** or **Sympetalae**.
- The Polypetalae and Monochlamydeae were unified under the single group **Archichlamydeae**, while **Metachlamydeae** include those families with sympetalous corollas.
- Monochlamydeae is completely abolished as such and families are distributed in the large group called **Archichlamydeae.**
- Flowers without perianth (achlamydeous), or those with one whorl of perianth (monochlamydeous) were **primitive**.
- Flowers with two-whorled perianth, distinguished into sepals and petals, as **advanced.**

Salient features of E and P system of classification

- **Gamopetalous** condition considered more **advanced** than the **polypetalous** condition and the **monocotyledons** are **primitive** and placed before the dicotyledons.
- **Indefinite number of stamens and carpels** are **primitive** to a **definite number of stamens and carpels.**
- The most **primitive plants are wind pollinated** and most **advanced plants are insect pollinated.**

Salient features of E and P system of classification

- **Unisexual plants are more primitive** and with the passage of time, no of sepals and petals are increased.
- **Bisexual flowers are highly advanced** flower ie bisexual flower is originated from the unisexual flower.
- **Free sepals, free petals, free stamen,** and **carpels** are the signs of **primitive** plants; where **United is the sign of advanced** plants.
- **Epigynous** condition is more **advanced** than hypogynous condition.
- **Apocarpy** is regarded as a **primitive feature** and **syncarpy** as an **advanced** feature.

Merits of Engler and Prantl System

1) The entire Plant Kingdom was broadly treated with excellent illustrations, and phylogenetic arrangement of many groups of plants was made.
2) The amalgamation of Polypetalae and Monochlamydeae into Archichlamydeae is justified.
3) In this system the Gymnosperms are treated separately.
4) Consideration and placing of Orchidaceae at the end of Monocotyledons and Compositae at the end of Dicotyledons are justified — since they are most highly evolved.
5) Juncaceae, Amaryllidaceae and Iridaceae are placed judiciously nearer to Liliaceae.

Demerits of Engler and Prantl System of Classification

1) The idea of a primordial flower (unisexual, naked, catkin) goes against the theory of evolution as it is currently understood.
2) The present theory of evolution does not support the idea that monocots are thought to be more primitive than dicots.
3) It is not advisable to combine Apetalous and Polypetalous families to construct the Archichlamydeae because this created 33 orders and 206 families, which is an unmanageable number.
4) The system is not very useful in real life.

THANK YOU