Vivekanand College, Kolhapur
(Autonomous)

DEPARTMENT OF BOTANY

B.Sc. I

TOPIC: TAXONOMY

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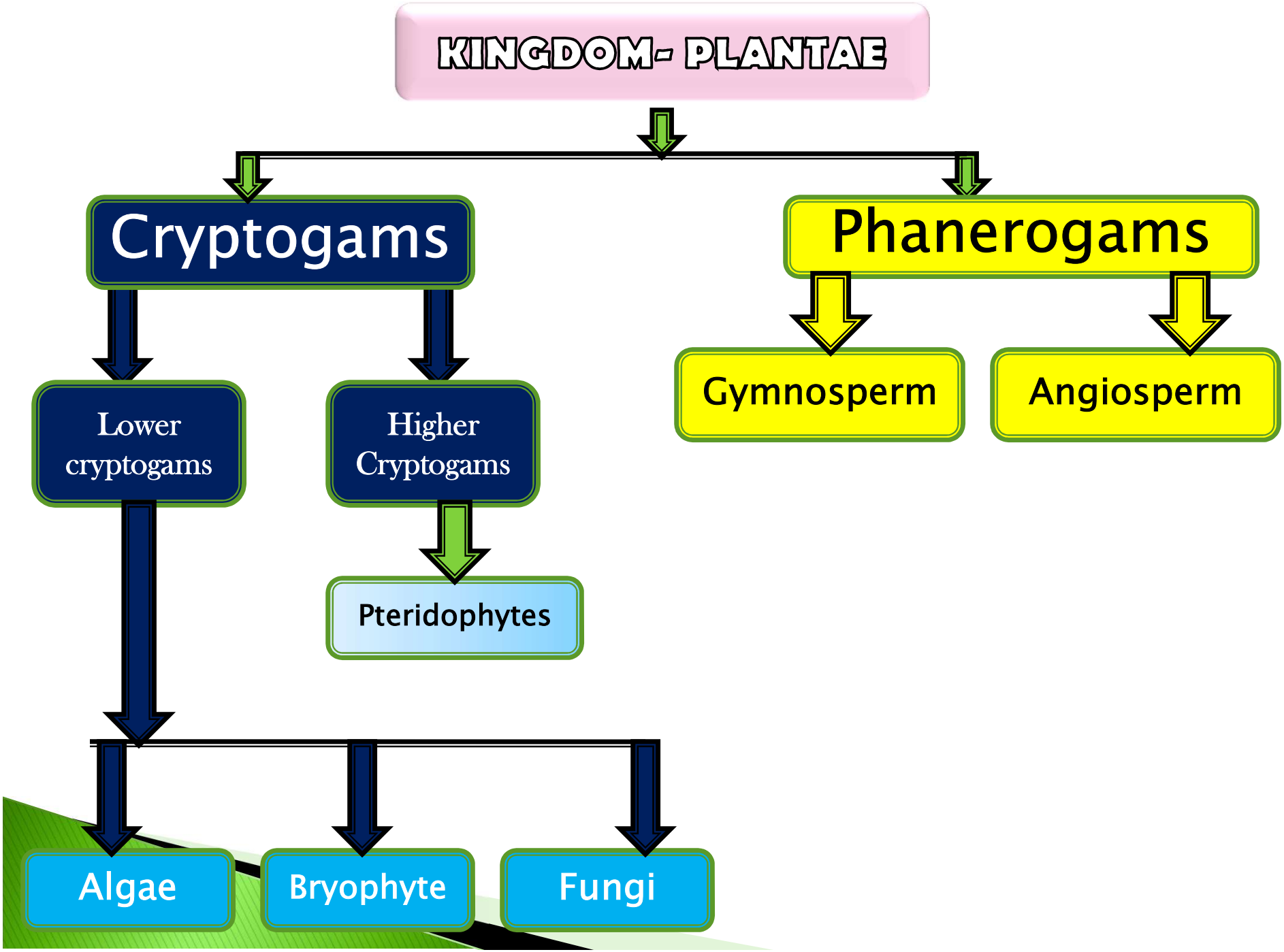
KINGDOM- PLANTAE
Cryptogams
Phanerogams
Lower cryptogams
Higher Cryptogams
Gymnosperm
Angiosperm
Pteridophytes
Algae
Bryophyte
Fungi

Sub-unit 4.1: General characters

The plant kingdom is divided into two sub-kingdom named as phanerogams and cryptogams, considering presence or absence of flower and seeds. All plants which bear seeds are included in phanerogams whereas the cryptogams covers all non-flowering plants such as algae, bryophyte, fungi, lichen and ferns. The phanerogams are also known as spermatophytes since they produce seeds. These seed bearing plants are further divided into two divisions viz., Gymnosperms and Angiosperms. The angiosperms include all flowering plants which produce seeds and have ovules enclosed in an ovary or fruit.

What is Taxonomy

• **Taxonomy:** The term 'Taxonomy' is first time recognized by A. P. de Candolle (1813) as a combination of Greek words *'taxis'* means arrangement and *'nomos'* means rules or laws.

• Thus the taxonomy can be defined as, 'it is a branch of botany deals with the study of identification, nomenclature and classification of plants'.

• The the important functions of taxonomy are Identification, Nomenclature and Classification of organisms (plants).

Identification: Identification or determination is recognizing an unknown specimen with an already known taxon and assigning a correct rank and position in an extant classification. In practice, it involves finding a name for an unknown specimen. This may be achieved:

•by visiting a herbarium and comparing unknown specimen with identified one

•the specimens may send to an expert and identification can be achieved

• Now a new method becoming popular which involves taking a photograph of a plant, uploading the picture in the website, who can see the photograph at the website and send their comments to the enquirer.

Classification: Classification is an arrangement of organisms into groups on the basis of similarities.

Nomenclature: Nomenclature deals with the determination of a correct name of a taxon. Nomenclature of plants is governed by the rules and recommendations. There are different code for the different groups of the plants like:

ICBN: International Code of Botanical Nomenclature (now it is ICN- International Code of Nomenclature for Algae, Fungi and Plants

ICNB: International Code for the Nomenclature of Bacteria (now its BC- Bacteriological code)

ICNCP: International Code of Nomenclature for Cultivated Plants

ICTV: International Committee for the Taxonomy of Viruses.

International Code of Botanical Nomenclature (ICBN)

Introduction / Principles of ICBN

• It was previously known as **'International Code of Botanical Nomenclature'** but the name has been changed as International code of Nomenclature for algae, fungi and plants (ICN) in International Botanical Congress held at Melbourne in July 2011.

• The foundations of this code are to be found in Linnaeus own book entitled '*Philosophia Botanica*', in which he has given main points of nomenclature. Some important rules are: '**260'**: size does not distinguish the species, **'284'**: A generic name must be applied to each plant species.

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• In the course of time, it has become necessary to specify the rules so as to make them precise. For the same purpose first International Botanical Congress was held at Paris in 1867 and very recently 19th International Botanical Congress was held at Shenzen in China in 2017.

•The present code is divided into three divisions and six principles.

The important principles of the ICBN are:

1. The nomenclature of algae, fungi and plants is independent of zoological and prokaryotic types.
2. The application of name of taxonomic group is determined by means of nomenclatural types.
3. The nomenclature of a taxonomic group is based upon priority of publication.
4. Each taxonomic group with a particular circumscription, position and rank can bear only one correct name, the earliest that is in accordance with the rules, except in specific case.
5. Scientific names of taxonomic groups are treated as Latin regardless of their derivation.
6. The rules of nomenclature are retroactive unless expressly limited.

IMPORTANCE OF TAXONOMY

1. **To provide a convenient method for identification and communication.**
2. To provide an inventory of the world's flora. Although a single world flora is difficult to compile, the regional floras can be made available.
3. To detect evaluation at work, to reconstruct the evolutionary history of the plant kingdom, determining the sequence of evolutionary change and character modification.
4. To provide a system of classification which depicts the evolution within the group.
5. To provide an integration of all available information, to gather information from all the fields of study.
6. To provide an information reference, supplying the methodology for information storage, exchange and utilization.
7. To provide significant information- covering endangered species, unique elements, genetic and ecological diversity.
8. To provide new plant concept, interpret the old and develop new producer for correct determination of taxonomic affinities, in terms of phylogeny and phenetics.
9. To provide integrated database including all species of plants across the globe.

SALIENT FEATURES OF ANGIOSPERMS

1. The angiosperms are seed bearing plants, well adopted to the terrestrial life.
2. Angiosperms occurs in diverse habitat like cold tundra, to hot tropical and evergreen desert areas, they also thrive well in aquatic habitats.
3. Angiosperms represented by tree, shrub and herbs.
4. The body is well differentiated into root, stem and leaves.
5. Angiosperms also posses well developed vessels in xylem and campanion cells in phloem.
6. In angiosperms male reproductive organ is represented by androecium and female by gynoecium.
7. The phenomenon of pollination i.e. transfer of pollen from stamens to carpels is an unique mechanism of angiosperms.
8. These are dominant green flowering plants of the present day vegetation.
9. Double fertilization and triple fusion is only reported from angiosperms.
10. All angiosperms are catagarized into two classes i.e. Dicotyledonae and Monocotyledonae.

Types of Classifications

What is classification ?

Is a general process related to categorization.

Why classification is needed?

To delimit the taxa or organism.

Historical concepts of relationships:

- ❖Natural classifications- Bentham and Hooker
- ❖Artificial classifications- Linnaceous
- ❖Phylogenetic classification- Takhtajan system

- **Natural system of classification:** During the construction of such type of classification system all possible characters are taken into consideration and also system indicated the natural relationships between the plants.

- Thus according to their similarities and differences, mostly in their important morphological characters, plants are first classified into a few big groups. These are further divided and sub-divided into smaller and smaller groups until the smallest group.

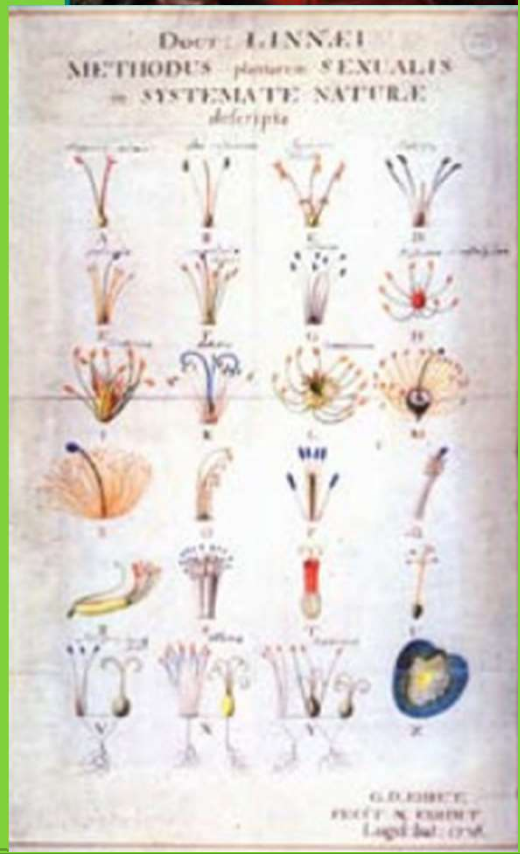
- The well known example of such type is Bentham and Hookers system of classification.

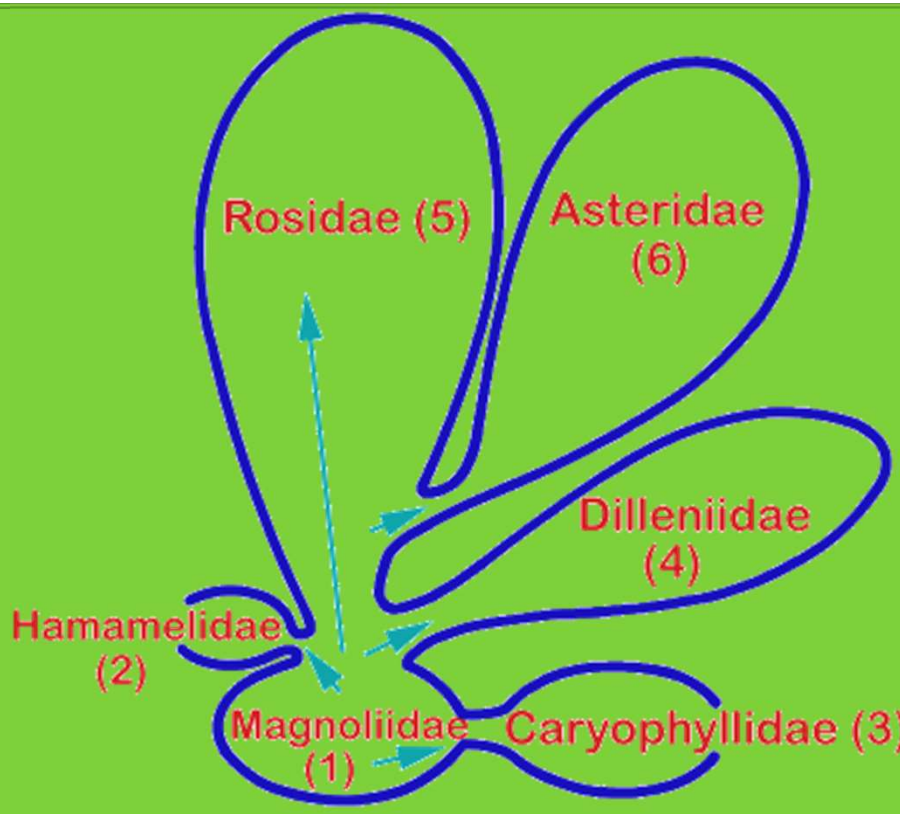
•**Artificial system of Classification**: The system which is based on single character is known as artificial system of classification.

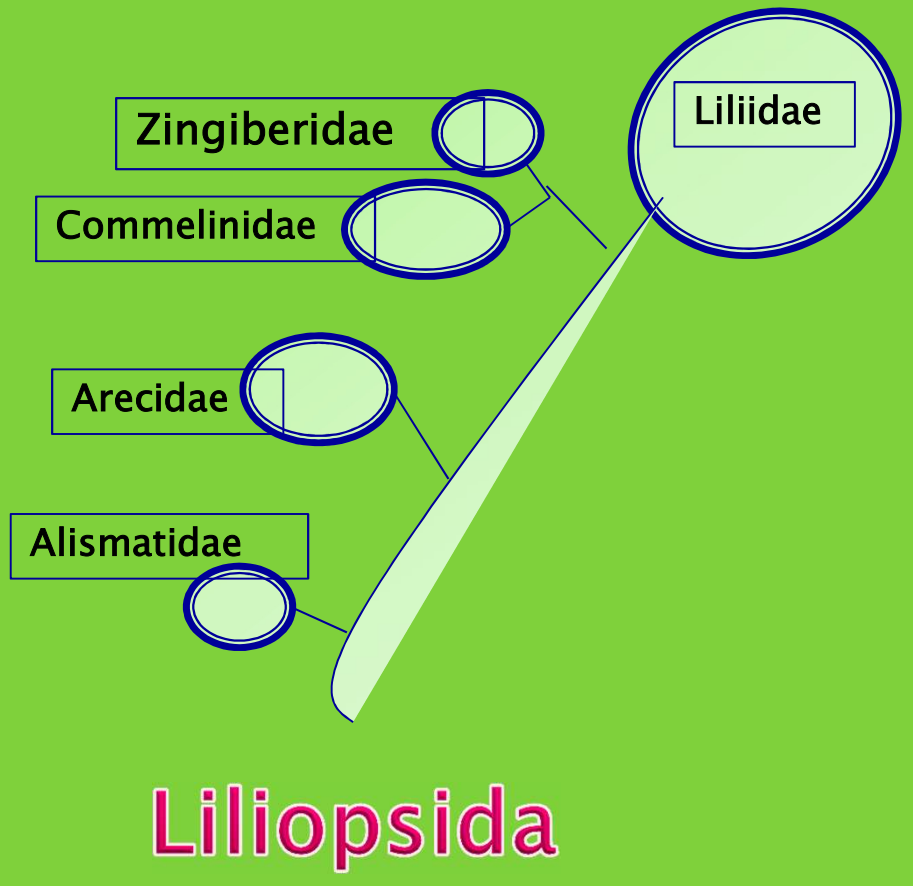
•In this type the closely related plants are often placed in different groups because of the presence or absence of a particular character.

•This system enables us to determine readily the names of plants but does not indicate the natural relationship that exists among the individuals forming a group.

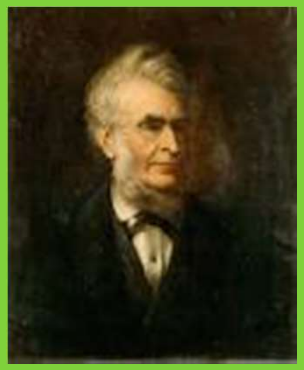
•It is like the manner of arrangement of words in a dictionary in which, except for the alphabetical order, adjacent words do not necessary have any agreement with one another. The well known example of this system is Carl Linnaeus system of classification.







Phylogenetic system of classification: Such systems are based on evolutionary trends among the plant kingdom. In such systems plants are classified basing on their phylogenetic relationships and thereby indicating the sequence of evolution among the plants. Common examples are Engler (1886), Hutchinson (1942), Takhtajan (1997) etc.



George Bentham

Bentham and Hookers system of Classification

Sir Dalton Hooker

- **Introduction**
- **Outline of the classification**
- **Merits and Demerits of the System**

Introduction:

George Bentham (1800-1884) and Sir Dalton Hooker (1817-1911), two English scientists presented their system for seed plants in a three volume work. Bentham was a well trained botanist and Hooker was Director of the Royal Botanical Garden at Kew.

The system highlights following silent features:

•The system is published in the book '***Genera Plantarum***' in between 1862 to 1883 and it was in Latin language.

•It is one of the ***natural systems of classification*** because in this system weightage has been given to all possible characters of the seed plants.

•System presents 3 classes, 3 sub-classes, 21 series, 25 cohort and 202 orders with 7569 genera and about 97,205 species of seed plants.

•The classification was ***a refinement of*** the systems proposed by ***A. P. de Candolle*** with some modifications.

•In this system ***more weightage*** has been given ***to flower characters***.

Outline of the system of Classification

Division : Phanerogams			
Class	Dicotyledons	Gymnospermae	Monocotyledons
Sub-class	3 Sub-class (Polypetalae, Gamopetalae and Apetalae)	3 Sub-class (Gnetales, Coniferales and Cycadales	----
Series	**3 series in polypetalae** (Thalamiflorae, Disciflorare & Calyciflorae), **3 series in Gamopetale** (Inferare, Superae and Bicarpellatae) and **7 series in Apetalae** (Curvembryae, Multiovulatae aquaticeae, Multiovulatae terrestriae, Microembryae, Dhaphnales, Achamydosporae and Unisexuals)	-----	**7 series in the Monocots** Microspermae, Epigynae, Coronarieae, Calycinae, Nodiflorae, Apocarpae, Glumaceae

Merits of the system:

•This system is based on actual examination of specimens and preserved herbarium sheets.

•Although this system represents a natural and not a phylogenetic approach, some aspects of the system does show affinity with modern concepts of evolution.

•The placement of monocots after dicots also appears to be in accordance with the evolutionary trends and most of the recent taxonomists are agreed with this trend.

•In this system all possible characters have been taken into consideration.

•This system still followed and used in a number of herbaria and botanical gardens all over the world.

•The large genera are divided into sections and sub-sections.

•The system has great practical value for identification of plants. It is very easy to follow for routine identification.

Demerits of the system

• The system does not incorporate phylogeny, although it was published after Darwin's publication on evolution theory.

• The position of gymnospermae in between dicots and monocots has not been acceptable.

•It is also weak on evolutionary basis of grouping of genera, families and orders, since some closely related families are placed apart.

• The placement of families like Asteraceae in the beginning of gamopetalae and Orchidaceae in microspermae (both having inferior ovary) do not justify the recent evolutionary approach.

•Some cohorts that could not be satisfactory placed by them in any cohort were treated as anomalous orders.