PUC I YEAR SEMESTER-II

UNIT–V. PLANT SYSTEMATICS

Module 25: TAXONOMY OF ANGIOSPERMS: SYSTEMS, TYPES OF CLASSIFICATION

Taxonomy is the science of naming, describing and classifying organisms. This is a term coined by A.P.deCandolle in 1813. Classification of plants refers to grouping plants based on their structural similarities and inter relationships. Classifications are orderly ways to present information. Depending upon their objectives, classification can be artificial, natural, or phylogenetic.

Artificial and natural classifications

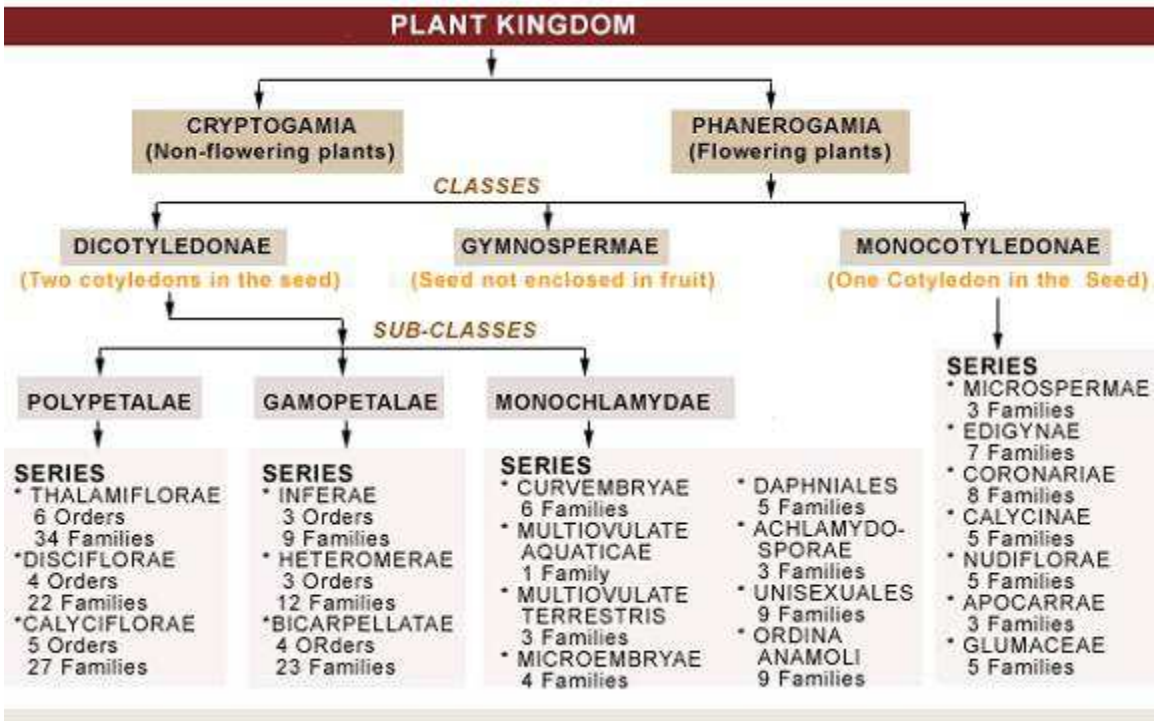
Classifications that use single or at most only a few characteristics to group plants usually are **artificial** classifications—that is, all the plants in a single group share the same characteristics, but they are not closely related to one another genetically. Popular floras(books to identify plants of a certain area) sometimes group plants using color of their flowers, or their growth form (trees, shrubs, herbs, and so on). Although such books are useful in finding the names of taxa, they provide few clues about relationships among the taxa and hence are not predictive, which means that you can deduce nothing more about the plant other than that it exhibits the characteristics used to classify it.

Some of the artificial systems of classification - **Theophrastus** (370 to 285 BC) in his book '**Historia Plantarum'** classified plants into three groups based on their habit as herbs, shrubs and trees. **Linnaeus** (1754) in his book '**Species Plantarum'** classified plants into 24 groups based on the number, length and union of stamens and of carpels (sexual characters).

Natural classifications group together plants with many of the same characteristics and are highly predictive. All the important mostly morphological characters are taken into consideration. That is, by enumerating the characteristics of a plant, one can predict the natural group to which it belongs. Plants were first classified into few big groups. These were further divided and subdivided into smaller and smaller groups until the smallest division/taxon

(species) is reached. Usually the floral characters are given importance. However characters of evolutionary importance were not considered. Inspite of this, Natural system still provides an easy means for identification of plants.

Bentham and Hooker's (1862-1893) system of classification proposed in their book '**Genera Plantarum'** is a Natural system of classification.



Phylogenetic (phyletic) classifications:

Phyletic classifications are natural classifications that try to identify the evolutionary history of natural groups. When botanists accepted Darwin's theory of evolution near the end of the last century, the reasons why some groups of plants looked alike became clear: They were related to one another by a common ancestry. The mission of taxonomy since Darwin has become a quest for evolutionary relationships, not just at the lower levels of the hierarchy, but at the upper levels as well.

The evolutionary history of a taxon is called its **phylogeny**. To establish phylogenies, decisions must be made concerning which characteristics are "primitive" and which "advanced"—that is, which taxon is the ancestor of the

others. Early phylogenetic classifications were based primarily upon plant morphology and anatomy with great emphasis upon reproductive morphology, which is more stable and less influenced by the environment than is vegetative morphology. Today, taxonomists additionally use the techniques of biochemistry and molecular biology to add details of internal organization and mechanisms to the classifications. A phylogenetic classification is a **hypothesis**, a scientific explanation of the data and, like any hypothesis, is subject to further testing.

The system proposed by **Engler and Prantl** in their book **'Die Naturlichen Pflanzenfamilien**'(1887-1893) and by **J.Hutchinson** (1954) in his book **'families of flowering plants**' are examples of phylogenetic system. The latest phylogenetic system is "**APG**" system (Angiospermic Phylogenetic Group).

Numerical taxonomy (phenetics): Systematists have tried many ways to make phyletic classifications more subjective. When computers became readily accessible in the 1960s, **numerical taxonomy** or **phenetics** became a popular approach. In practice, measurements were made of a large number of characters of a taxon. No special importance was attributed to any one of the characters. After the measurements were complete on hundreds of individuals, the data were analyzed statistically with computer programs and cluster analysis or other methods to show natural groupings of plants with overall similarities.

Description of a typical angiospermic plant

The description of an angiospermic plant has to be brief, in a simple and scientific language, and to be presented in a definite sequence. The description should help in identifying and assigning a plant to its appropriate taxonomic position.

The plant is described beginning with its habit, habitat, vegetative characters (roots, stem and leaves) and then floral characters (inflorescence, flower and its parts) followed by fruit. After describing various parts of a plant floral diagram and floral formula are presented.

To describe a flower, some specific botanical terms are used. They are as follows:

a. Bracts (Br)

Br Bracteate.

Ebr Ebracteate.

b. Bracteoles (Brl)

Brl Bracteolate.

Ebrl Ebracteolate.

c. Symmetry of the flower

⊕ Actinomorphic

◯ Or % Zygomorphic

d. Sex

 Staminate (male)

 Pistillate (Female)

 Hermaphrodite (Bisexual)

e. Calyx (K)

K_4 4 sepals, polysepalous.

$K_{(4)}$ 4 sepals, gamosepalous.

K_{2+2} 4 sepals in 2 whorls of 2 each.

f. Corolla (C)

C_4 4 petals, polypetalous.

$C_{(4)}$ 4 petals, gamopetalous.

C_{2+2} 4 petals in 2 whorls of 2 each.

g. Perianth (P)

P_6 6 tepals, polypetalous.

P_{3+3} 6 petals, in 2 whorls of 3 each (free)

$P_{(3)+(3)}$ 6 tepals, gamotepalous in 2 whorls of 3 each.

h. Androecium (A)

A_6 6 stamens, polyandrous.

A_{2+4} 6 stamens in 2 whorls of 2 and 4 each (tetradynamous).

A_{2+2} 4 stamens (didynamous).

A_0 Stamen is absent.

A_α Stamens are indefinite.

$A_{(n)}$ Monoadelphous.

$A_{1+(9)}$ Diadelphous.

$A_{(5)}$ five stamens, fused.

$\overset{\frown}{C\ A}$ Epipetalous.

i. Gynoecium (G)

G_0 Gynoecium is absent.

G_2 2 carpels, apocarpous.

$\underline{G_{(2)}}$ Bicarpellary, syncarpous, superior.

$G_{(2)}^{-}$ Bicarpellary, syncarpous, semi-inferior.

$\overline{G_{(2)}}$ Bicarpellary, syncarpous, inferior.

A **floral diagram** provides information about the number of parts of a flower, their general structure, arrangement, and the relation they have with one another, cohesion and adhesion, position of the flower with respect to the mother axis. It is a ground plan of a flower. The calyx lies outermost, corolla next

to calyx, Androecium next to corolla and gynoecium in the centre. The cohesion and adhesion in the parts, such as sepals, petals, stamens and carpels of different Whorls including Placentation is also represented diagrammatically.

A dot on the top of the floral diagram represents the position of the mother axis. The axis or part of shoot on which the flower is borne is described as the mother axis. The part of flower towards the mother axis is posterior part and the one opposite to it is the anterior part.

The **floral formula** represents the organization of different whorls of the flower, their number, cohesion and adhesion, and mutual relationship, if any.

Check points

- Classification of plants refers to grouping plants based on their structural similarities and inter relationships
- Classification can be artificial, natural, or phylogenetic.
- Classifications that use single or at most only a few characteristics to group plants usually are **artificial** classifications
- Some of the artificial systems of classification were proposed by **Theophrastus** and **Linnaeus**
- **Natural** classifications group together plants with many of the same characteristics and are highly predictive
- Bentham and Hooker's system of classification proposed in their book 'Genera Plantarum' is a Natural system of classification.
- **Phylogenetic or Phyletic** classifications are natural classifications that try to identify the evolutionary history of natural groups.
- The system proposed by **Engler and Prantl** and **Hutchinson** are examples of phylogenetic system of classification

Short answer questions

1. Define classification?
2. Give an account of artificial system of classification
3. Write about natural system of classification
4. Give salient features of phylogenetic system of classification

Long answer questions

1. What is classification? Describe different systems of classification proposed to classify plants?

MCQS

1. Linnaeus presented his classification of plants in the book
   a. Species Plantarum
   b. Genera Plantarum
   c. Historia Plantarum
   d. None of the above
2. Natural system of classification was proposed by
   a. Theophrastus
   b. Linnaeus
   c. Bentham and Hooker
   d. Aristotle
3. Evolutionary history is taken into consideration in which of the following classifications
   a. Artificial
   b. Natural
   c. Phylogenetic
   d. Both a and b
4. Which of the following scientists has taken into consideration evolutionary history while classifying plants
   a. Bentham and Hooker
   b. Linnaeus
   c. Engler and Prantl
   d. Theophrastus
5. _____ is called the ground plan of a flower
   a. Floral diagram
   b. Floral formula
   c. Description of a flower

d. All the parts of a flower

6.  This symbol in a floral diagram represents that the flower is

a. Unisexual

b. Bisexual

c. Pistillate

d. Staminate