

Course: B.Sc. Part II (Botany Honours)

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Systems of Plant Classification

Systems of classification of plants are categorised under three types which have been proposed by different taxonomists. Those were based on different criteria, such as on the basis of habit, floral characters and evolutionary sequence, adopted to classify them. Following are three systems of classification:-

1. Artificial systems
2. Natural systems
3. Phylogenetic systems

Artificial system -

This was given by ancient herbalists, who used the simplest criteria such as habit and the number and arrangement of sexual units as the basis for classifying plants. It is the earliest system which dominated from 300 BC period till the natural system of classification came into existence in the eighteenth century. This system was given simply for convenience, generally by means of one or few characters which may help in identification. This system may be compared to the alphabetical arrangement of the letters, which have no connection with each other. Artificial system is associated with the history of plants study. History of plants classification dates back the time of **Theophrastus (370-287BC)**, when the first attempt to classify plants was done by him. He was a Greek naturalist and was the disciple of the great philosopher **Plato** and **Aristotle**. He classified plants to four major groups on the basis of their habit (morphological structure) as **Herbs, Under shrubs, Shrubs** and **Trees**. He described 500 plants in his **Historia plantarum**, which is the oldest plant description. Dicotyledons and Monocotyledons as well as conditions of floral appendages were first time brought in to consideration to classify plants.

Further works on plants classification were taken by many scientists such as **P.Dioscorides** (62-128 AD), **A. Caesalpino** (1519-1603 AD), **G.Bauhin** (1560-1624 AD), **John Ray** (1628-1705) and **Carolus Linnaeus** (1707-1778).

Carolus Linnaeus (1707-1778) was the Swedish naturalist. He was a physician as well as a botanist. He gave the most important concept in nomenclature of plants, which is known as Binomial nomenclature. He published a lot of books of which some are **Hortus Uplandicus** (1730), **Genera Plantarum** (1737) and **Classes Plantarum** (1738). His revised publication was **Philosophia Botanica** (1751) and **Species Plantarum** (1753). **Linnaeus** proposed the system which is also known as *sexual system of classification*.

C. Linnaeus' made the characters of flowers such as number, size and union, arrangement of sexual units (stamens) as the basis of his classification. He classified plants into 24 classes as given below:-

Class

1. Monandria –Stamen one
2. Diandria -- Stamens two
3. Triandria --- Stamens three
4. Tetrandria—Stamens four
5. Pentandria—Stamens five
6. Hexandria –Stamens six
7. Heptandria—Stamens seven
8. Octandria –Stamens eight
9. Enneandria—Stamens nine
10. Decandria—Stamens ten
11. Dodecandria—Stamens eleven –nineteen
12. Icosandria -- Stamens 20 or more attached to the calyx
13. Polyandria—Stamens 20 / more, attached to the receptacle
14. Didynamia—Stamens didynamous
15. Tetradynamia—Stamens tetradynamous
16. Monadelphia—Stamens monadelphous
17. Diadelphia—Stamens diadelphous
18. Polyadelphia –Stamens polyadephus
19. Syngenesia—Stamens syngenesious
20. Gynandria -- -- Stamens adnate to gynoecium
21. Monoecia --- Plants monoecious
22. Dioecia -----Plants dioecious
23. Polygamia --- Plants polygamous

24. Cryptogamia – Flowerless plants/concealed flowers. Ex. Algae, fungi, mosses .ferns.

Binomial system of nomenclature of plants was given by **Carolus Linnaeus** (1753) ,which has been described in his book *Species Plantarum*. According to this, the plants are given two names. The first is generic name (i.e.genus) and second is specific epithet. Thus every individual has generic and specific name together. One genus has many similar individuals with slight differences have been categorized as species of that genus.

Natural systems (Systems based on form relationship)

As the science of taxonomy evolved, it was realized in about 1800 that there existed greater natural affinities between plants than as indicated in the sexual system of classification proposed by *Linnaeus*. There came many new classifications, which were based on form relationships and evolutionary basis. The first transition in this was Natural system of plants classification. Natural systems involved the floral characters and number of cotyledons. The beginning was with the French scientist **A.L.de Jussieu** (1748-1836) who published this in the book *Genera Plantarum* (1789) which was the modified version of classification proposed by his uncle **Bernard de Jussieu** (1699-1771). Their system was based on *Linnaeus'* system. In Jussieu's classification position of stamens in relation to ovary was considered as one basis and plants were divided into 15 classes. These classes were further divided into 100 natural orders (present day families) .

A.P.de Candolle (1778-1841),another French botanist published his system of classification in *Theorie elementaire de la botanique* (1813) which gave more impetus on the natural system similar to Jussieu's one in many respects but with improvements. He divided Dicotyledons in to two groups on the basis of presence or absence of petals, free or fused petals and position of ovary.

Bentham and Hooker's system of classification

The two British botanists **George Bentham** (1800-1884) and **Joseph Dalton Hooker** (1817-1911) gave their system of classification in their book *Genera Plantarum* (1862-1883).Their system was proved a great taxonomic work. *G.Bentham* and *J.D.Hooker* were associated with Royal Botanic Garden, Kew (England) who studied large number of plant species in their work and gave their work in shape of their publication *Genera Plantarum*. The first part was published in 1862 and the final part in 1883. It was published in three volumes in Latin. About 2/3 of it was written by *Bentham*. This system is not perfectly natural but it is easily workable and describes 97,205 species of plants grouped into 202 orders (present day family)

Following is the summary of *Bentham and Hooker's* system of classification:--

Seed Plants (Spermatophyta) were divided in to **Dicotyledones, Gymnospermae and Monocotyledones**

A. Dicotyledons were divided into three groups **Polypetalae, Gamopetalae and Monochlamydeae.**

Polypetalae (Petals free) was divided in to three series – **Thalamiflorae, Disciflorae and Calyciflorae**

Each of the three series was divided in to cohorts (present day orders)

Each cohort was divided into families.

1. Polypetalae –Flowers with two distinct whorls of perianth (calyx and corolla) with petals free

Series A- Thalamiflorae- Calyx with free sepals, flower hypogynous

Cohort (Orders)	Number of families
1. Ranales	8
2. Parietales	9
3. Polygalinae	4
4. Caryophyllinae	4
5. Guttiferales	6
6. Malvales	3

Series B- Disciflorae- Calyx may be free or adnate to ovary. A cushion shaped disc usually present below the ovary. Sometimes it is in the form of glands.

7. Geraniales	11
8. Olacales	3
9. Celastrales	4
10. Sapindales	5

Series C- Calyciflorae Calyx consists of united sepals, rarely free and adnate to ovary. Petals one or two seriate, perigynous or epigynous. Ovary often inferior.

11. Rosales	9
12. Myrtales	5

13. Passiflorales	7
14. Ficoidales	2
15. Umbellales	3

2. Gamopetalae (Petals united)- was divided in to three series namely-

Series A. Inferae (Ovary inferior) with three cohorts-

Cohorts	Number of families
1. Rubiales	2
2. Asterales	4
3. Campanales	3

Series B. Heteromerae (ovary superior, stamens as many or twice as many as corolla lobes, carpels more than two).

4. Ericales	6
5. Primulales	3
6. Ebenales	3

Series C. Bicarpellatae (Ovary superior, stamens as many as the corolla lobes or lesser, carpels usually two).

7. Gentianales	6
8. Polemoniales	5
9. Personales	8
10. Lamiales	4+1(Anomalous family)

3. Monochlamydeae- Only one whorl of perianth which is usually sepaloid, sometimes perianth may be absent.

Series	Number of families
1. Curvembryae-	7
2. Multiovulatae aquaticae-	1
3. Multiovulatae terretres	3
4. Micrembryae	4

5. Daphnales	5
6. Achlamydoxyporeae	3
7. Unisexuales	9
8. Ordines anomali	4 (Unisexual families with doubtful affinities)

Gymnospermae

3 families 1. Gnetaceae 2. Coniferae 3. Cycadaceae

Monocotyledones - Plants with one cotyledon

Series	Number of families
I. Microspermae	3
II. Epigynae	7
III. Coronarieae	8
IV. Calycinae	3
V. Nudiflorae	5
VI. Apocarpae	3
VII. Glumaceae	5

Important features:-

1. This is the first most elaborated natural system of classification in the history of plant taxonomy.
2. The classification is based on elaborate studies of large number of plant species (97,205 species) belonging to 202 orders (present day families)
3. The *Genera plantarum* was well accepted in England, United States and European countries.
4. The cohort Ranales (family Ranunculaceae, dicotyledonous family) has been placed in the beginning as primitive family and Gramineae (monocot family) is placed in the last as advanced one.
5. The basis of classification is floral characters such as free or united petals, position of ovary, apocarpous and syncarpous condition.
6. Dicots are divided into three groups Polypetalae, Gamopetalae and Monochlamydeae.

7. A separate intermediate group *Disciflorae* is created for the plants which are difficult to be assigned under other groups *Thalamiflorae* and *Calyciflorae*.
8. The system includes most of the *de Candolean system*, only renaming *Corolliflorae* as *Gamopetalae* and keeping *Monochlamydeae* with the same name.
9. There is separate series *Ordines anomali* in the *Monochlamydeae* of Dicots for unisexual families of doubtful or unknown affinities.
10. Monocots are divided into seven series beginning with the most complex epigynous orders *Orchidaceae* and *Scitamineae*, passing through petaloid hypogynous order *Liliaceae*, to orders where the perianth has lost its petaloid character as in *Pandanaceae* and *Aroidae*. The family with simplest flower and grass like habit has been placed in the last, as series *Glumaceae*.

Demerits:-

1. Since, this system was given before the publication of *Darwin's* theory of origin and *Wallace's* theory of evolution, so it is not based on phylogenetic principles.
2. *Gymnosperms* are primitive than angiosperms, but it has been placed between Dicots and Monocots, i.e. before Monocots.

Although *Polypetalae* and *Monochlamydeae*, both are apetalous, both are kept far apart from each other.

3. *Chenopodiaceae* and *Caryophyllaceae* should be kept together, since both have curved embryo and are apetalous, but it is not so.
4. Placing of advanced families, *Orchidaceae* and *Scitamineae* at the beginning of monocots is a drawback.
5. Creation of anomalous orders for plants of uncertain affinities is not advisable for a perfect system. No member should be in oscillating position.