Quadrant II – Transcript and Related Materials

Programme	**:** Bachelor of Science (First Year)
Subject	**:** Botany
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Paper Title	**:** Biodiversity II (vascular plants)
Module Name	**:** Artificial, Natural and Phylogenetic system of Classification.
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Notes

Taxonomy or (Systematics) is basically concerned with classification of organisms. All living organisms are placed in groups, based on similarities & differences at the organismic, cellular & molecular levels. The earlier plant records were written in Sanskrit, a language which was not easily understood by all. The historical development of classification has passed from simple classification based on **gross morphology** to the latest **phylogenetic systems** incorporating all types of **phenetic information**. These include the following types.

1. Artificial system of Classification – This system is based on only one or few characters seen morphologically.

2. Natural system of Classification – Here more than two characters are used for classification for example – the Morphology and Anatomy, Physiology, Embryology, Development, Phytochemistry, Reproduction etc.

3. Phylogenetic system of Classification – In this classification the evolutionary characters and Genetic relationship were taken into consideration.

The table explains the artificial system of classification proposed by different taxonomist in the past. The Vedas classified the plants based on religious importance, their medicinal values, flowering, fruiting etc.

Theophrastus, the father of taxonomy classified the plants based on the size and the life cycles of plants. He classified them as herbs, shrubs and trees. He also differentiated them into annuals, biennials or perennials. The herbalist classified the plants based on medicinal values. Tournefort classification was based on the nature of flowers, petaliferous (with petals) or apetalous that is without petals, whether they were free or fused. Linnaeus classified the plants based on their sexual behaviour that is the number, length and union of stamens and carpels.

Let us see some examples of artificial system of classification.

1. **Artificial system of Classification**

Theophrastus, the Father of Botany, classified plants based on form & texture. He has described his classification in ***Historia Plantarum.*** Here he has classified & described around 450 cultivated Plants as Herbs, Under Shrubs, Shrubs & Trees. According to him, trees were considered as highly evolved, while herbs as primitive. He distinguished between annual, biennial & perennial plants. He also recognized the difference between flowering & non flowering plants, Superior and inferior ovary, free and fused petals & fruit types. His classification was strictly artificial.

Linnaeus system of Classification

Carolus Linnaeus is called the Father of Taxonomy was also known as Carl Linnaeus. He published ***Species plantarum & Genera plantarum*** describing all the plant genera/species known to him. In his classification

there was a generic name & a polynomial descriptive phrase up-to twelve words. He established the binomial nomenclature & recognized 24 classes based on number, cohesion & length of stamens. Linnaeus further sub divided the classes based on carpel characteristics into orders. Such a system resulted in bringing together unrelated groups.

Merits and Demerits of Artificial system of Classification

Merits – Artificial system was simple and easy**;** less information and time was required. The poorly known plants could be placed easily and needed only few instruments.

Demerits – The simple morphological characters of plants can change with environment. So, we cannot rely on such characters for classification. This system cannot classify all plants perfectly. There was little predictive value and could not describe evolution of plants. The characters used here had more dissimilarities among groups rather than similarities.

2. **Natural system of Classification**

The natural system of classification was introduced by **Jean Bauhin**. Here the classification of taxonomic groups is arranged according to their natural relationships & characters of plants. It places the organisms together that have greatest number of shared features. In this system large number of criteria/characters are used – that included morphology, anatomy etc. All characters are used as tools for classification. The examples of natural system of classification are - Gaspard Bauhin, A.P Candolle, Bentham & Hooker's system.

Basis of Natural system of Classification

The table shows the list of taxonomists who have contributed to the natural system of classification.

A.L. de Jussieu classified the plants based on the number of cotyledons, the presence and absence of petals and the position of petals and stamens their fusion & ovary position. His famous work is published in **"*Genera Plantarum".***

Further **Robert Brown** classification is based on the tissue structure.

A.P Candolle classified on the characteristics of vascular tissue and the presence or absence of cotyledons. He classified on the basis of presence or absence of vascular structures. His famous work is **"*Theorie elementaire de la botanique".*** He declared certain principles that provided the base of origin of Bentham & Hooker's classification. The importance of anatomical features was highlighted & used.

Bentham and Hooker's system of Classification is the most well-developed natural system of classification. He has published his classification in three volume work - ***Genera plantarum.*** Bentham utilized the seed characteristics for his classification. He classified seed plants describing 202 Families & 7569 Genera.

Merits and Demerits of Natural system of Classification.

Merits - This classification is more satisfactory on placing of species and has high predictive value. It contains more information about species.

Demerits- It is complex than artificial system. It takes long time & more information is needed for classification. Those plants which are poorly known cannot be placed easily. The Gymnosperms were placed in between Monocotyledones and Dicotyledones.

Phylogenetic system of Classification

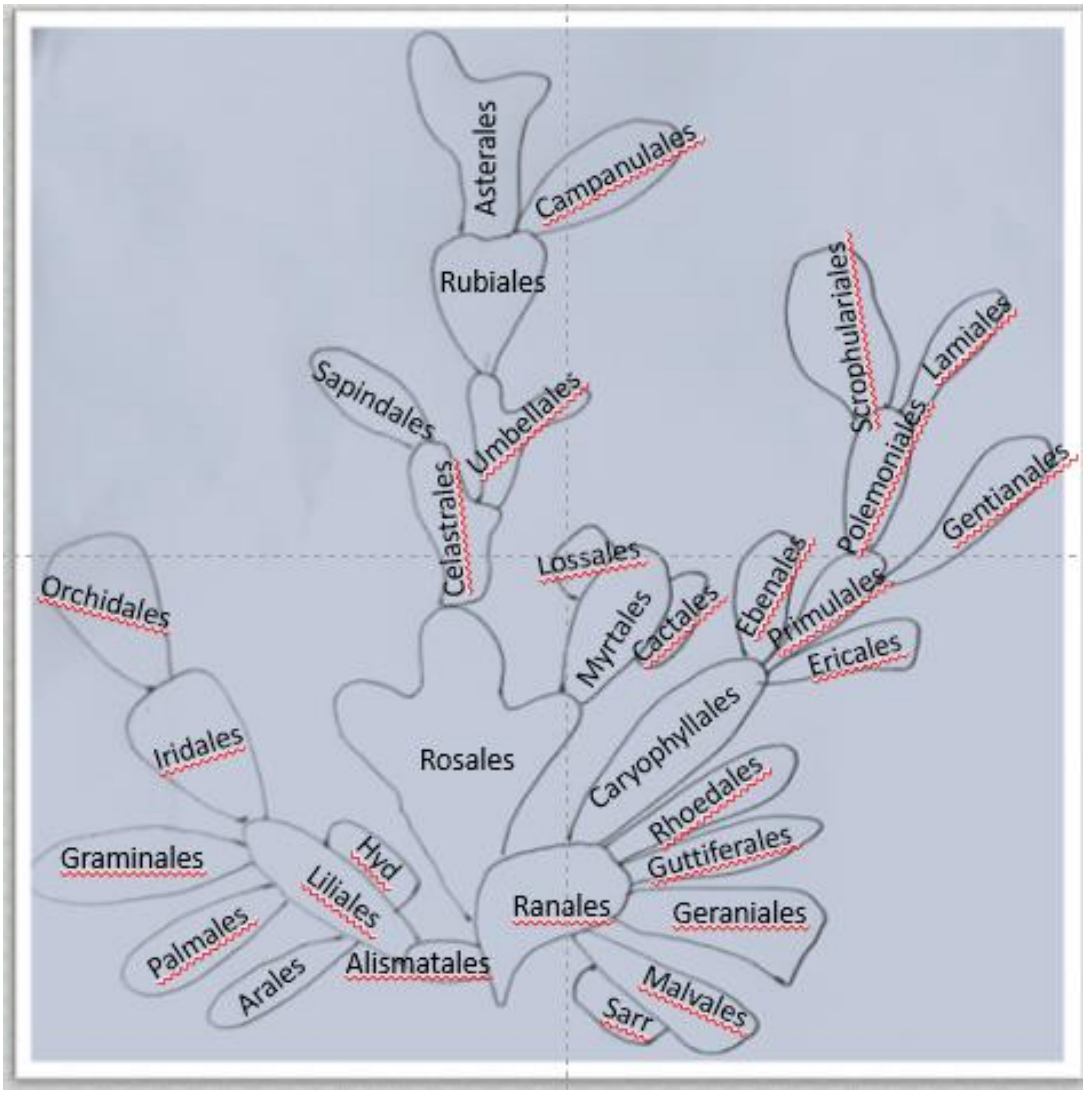
It is a recent classification. The taxa are arranged according to Evolutionary order and Genetic relationships. Here the Evolution and genes are considered. The classification is done on microscale level, that is cell level. The examples include Engler and Prantl, Charles Bessey, Hutchinson, Takhtajan and APG (Angiosperm phylogeny group system) systems of classification.

Engler and Prantl system of Classification.

It provides classification and description down to the Genus level. This is considered as the beginning of Phylogenetic system, but it is not strictly Phylogenetic. It was an arrangement of plants in a linear sequence starting with simplest groups & arranged in the order of progressing complexity.

Charles Bessey

He was an American Botanist who laid the foundation of modern Phylogenetic classifications. He considered Angiosperms to have evolved monophyletically from Cycadophyta belonging to Bennettitalean ancestry. Bessey Initiated the representation of evolutionary relationship through an evolutionary diagram/phylogram with primitive groups at base & advanced at the top branches. His diagram resembling a cactus plant is better known as Besseyan Cactus. This diagram is a phylogram or Besseyan cactus represented by Bessey showing the relationships between orders in monocots and dicots.



Besseyan Cactus or Opuntia Besseyi showing the relationship of orders recognized by Bessey

John Hutchinson

He was a British Botanist associated with the Royal Botanic gardens, Kew, England. He has given the latest information about Phylogenetic Classification. He proposed the classification of Angiosperms in ***The Families of Flowering Plants.*** He dealt only with flowering plants included under Phylum Angiospermae as distinct from Gymnospermae.

Principles of Hutchinson system

According to Hutchinson, Evolution is both upwards & downwards and does not involve all the organs of a plant at the same time. It has generally been consistent. In certain groups, trees & shrubs are more primitive than herbs. According to his views trees & shrubs are older than climbers and the perennials are older, than biennials & annuals. The aquatic phanerogams are more recent than terrestrial ones and the collateral vascular bundles arranged in cylinder (Dicots) are primitive than those with scattered bundles (Monocots).

Armen Takhtajan

A Russian Taxonomist has provided classification up-to Family level. He believed in Monophyletic origin of Angiosperms, having evolved from seed ferns - Lyginopteridophyta. Simple entire, pinnately veined leaves of primitive angiosperms represent the juvenile or young frond like leaves of the seed ferns. This system is more phylogenetic than Hutchinson. Here more weightage is given to Cladistic information as compared to Phenetic information.

Merits and Demerits

Merits – The unique name of each species in this classification helps to eliminate confusion. There is maximum predictive value and detail scientific study gives maximum information about species.

Demerits – It is a complex system and it needs long time and research. The Physical appearance (morphology) is neglected, so physically same species can be in different groups. The genome of all living organisms are not known.