

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	: Bentham and Hooker (up to series) Engler & Prantl (up to series)
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Notes

Classification of Bentham and Hooker

This classification represents the most well-developed natural system. Bentham published this classification in three volumes in *Genera plantarum* from (1862-83). He also published the Hand book of British Flora, Flora Australiensis & Flora of British India.

Sir J.D. Hooker co-authored *Genera plantarum* along with George Bentham. He was also the Director of Royal Botanical Gardens, Kew.

Let us begin with the classification of Bentham and Hooker. They classified phanerogams or seed-bearing plants into three classes that is Class 1 – Dicotyledones, Class 2 – Gymnospermae and Class 3 as Monocotyledones. In Dicotyledones, the flowers were pentamerous or tetramerous and had two cotyledons, tap root system and reticulate venation. In Gymnospermae the ovules were naked that is they were not enclosed in an ovary. In Monocotyledones the flowers were trimerous, having a single cotyledon, fibrous root system and parallel venation. The class dicotyledons were further divided into three subclasses that is sub

class 1 is Polypetalae, sub class 2 is Gamopetalae and sub class 3 is Monochlamydeae. In Polypetalae the sepals and the petals are distinct and the petals are free. In Gamopetalae the petals are united that is fused. In Monochlamydeae the flowers are apetalous there are no petals. The flowers have simple perianth which is usually sepaloid and sometimes altogether absent.

The sub class polypetalae is further divided into three series that include series 1 -Thalimiflorae, series 2 - Disciflorae and series 3 -Calyciflorae.

The sub class Gamopetalae is also divided into three series that is Inferae, Heteromerae and Bicarpellatae.

The sub class Monochlamydeae is divided into eight series which include Curvembryeae, Multivulatae aquaticae, Multivulatae terrestres, Microembryeae, Daphnales, Achlamydosporeae, Unisexuales and Ordines anomali.

In Series one Thalimiflorae the flowers are hypogynous with many stamens and pistils and disc is absent. Under this series there are six orders included that is Ranales, Perietales, Polygalineae, Caryophyllineae, Guttiferales & Malvales.

The series two Disciflorae are also hypogynous. There is a prominent cushion shaped disc present below the ovary. The ovary is free or embedded in the receptacular disc. Stamens usually definite in number. There are four orders included in this series that is Geraniales, Olacales, Celastrales & Sapindales.

Under series three Calyciflorae, the calyx consists of united sepals rarely free and adnate to ovary. They are perigynous or epigynous. Here there are five orders included - Rosales, Myrtales, Passiflorales, Ficoidales & Umbellales.

The sub class gamopetale has three series. In series inferae the sepals and petals are distinct and the petals united. The ovary is inferior. In the 2nd series heteromerae the stamens are in one or two whorls and the carpels are more than two and the ovary is superior. Under the 3rd series Bicarpellatae the stamens are on one whorl, the carpels are two and the ovary is superior.

There are two orders included in Inferae viz. Rubiales and Asterales, 3 orders in Heteromerae (Ericales, Primulales and Ebenales). There are four orders in Bicarpellatae which include Gentianales, Polemoniales, Personales and Lamiales.

Sub class three is Monochlamydeae includes eight series. Series 1 is Curvembryeae in which the embryo is coiled and the ovule is usually one in number. The series two is Multivulate aquaticae in which all the plants are aquatic with many ovules. Series three is multivulate terrestres that includes all terrestrial plants with many ovules. The embryo is minute in series four that is Microembryeae, and the fifth series is Daphnales having one carpel and ovule. Under series 6 we have Achlamydosporeae having inferior ovary, unilocular and one to three ovules. The series seven is Unisexuales having unisexual flowers and series eight is Ordines anomali having plants whose relationship is uncertain and they cannot be classified.

Class 2 is Gymnospermae in which the ovules are naked and divided into three families that is Gnetaceae, Coniferae and Cycadaceae.

Class 3 is Monocotyledones having seven series that is Microspermae, Epigynae, Coronarieae, Calycinae, Nudiflorae, Apocarpae and Glumaceae.

In Microspermae the ovary is superior and the seeds are minute, many. The ovary is inferior and seeds are large in Epigynae. In series three

Coronarieae the ovary is superior, the carpels are united and the perianth is coloured. The series four is Calycinae with superior ovary, carpels united and perianth is green. In Nudiflorae the ovary is superior and the perianth is absent. In series Apocarpae the ovary is superior with carpels more than one and free. The last series Glumaceae the ovary is superior, the perianth is reduced and the flowers are enclosed in glumes.

The *Genera plantarum* of Bentham and Hooker classified seed plants describing 202 Families, 7569 Genera & estimated 97,205 Species. The descriptions were made on personal studies from specimens & not a mere compilation of known facts. Many important herbaria of the world have specimens arranged according to this system. There were no orders recognized within Monochlamydeae & Monocotyledones.

Merits

It is widely used for arrangement of specimens in the herbaria. The Gymnosperms were not placed among Dicots, but as an independent group. The Dicotyledones were placed before Monocotyledones. The description of Families & Genera is precise and the Keys for the identification are very useful. The larger Genera have been divided into smaller Subgenera. Taxa arrangement is on overall natural affinities based on morphology and the grouping is based on combination of characters than a single character.

Demerits

Bentham and Hooker system does not incorporate Phylogeny. The Gymnosperms are placed between Dicotyledones & Monocotyledones. The creation of Monochlamydeae resulted in separation of closely related families. Families Amaryllidaceae and Liliaceae in Monocots are closely related, but placed under different series that is Epigynae & Coronarieae.

The affinities of Families under Ordines anomali were tentatively grouped together. Orchidaceae is advanced family & placed at the beginning of Monocotyledones.

Engler and Prantl system of Classification

Adolf Engler & Karl Prantl are two German Botanists who published their classification in *Die natürlichen pflanzenfamilien* in 23 volumes. They provided classification & description upto Genus level, with information on Morphology, Anatomy & Geography. This was the beginning of Phylogenetic schemes. It was an arrangement of linear sequence starting with simplest groups to complex ones. This classification had significant improvements over Bentham & Hooker. The Gymnosperms were placed before Angiosperms and Monochlamydeae abolished & members distributed with Polypetalous relatives. Many unnatural families were split into smaller natural families. The Monocots placed before Dicots.

Outline of Engler and Prantl system of classification

Engler and Prantl have divided the plant kingdom into 13 divisions. Division one to twelve dealt with Bacteria, Algae, Fungi, Bryophyta and Pteridophyta. The 13th division is Embryophyta also called as Siphonogama or seed plants. It is further divided into two sub divisions that is Gymnospermae and Angiospermae. The Gymnospermae is divided into seven orders that include Cycadofilicales, Cycadales, Bennetitales, Ginkgoales, Coniferales, Cordaitales and Gnetales.

The sub division Angiospermae is divided into two classes that is Monocotyledoneae and Dicotyledoneae. 11 orders and 45 families are included under Monocotyledoneae and 44 orders and 258 families are included under Dicotyledoneae. The class Dicotyledoneae is further divided into two subclasses which include Archichlamydeae also called as

Apetalae having polypetalous corolla and perianth in single or double whorls. The subclass Metachlamydeae also called as sympetalae has gamopetalous corolla and perianth in two whorls.

Merits

This was the first system to put the idea of Organic Evolution & Phylogenetic system. It covers the entire Plant kingdom, description & identification keys are down to the level of Family, Genus & Species. Valuable illustrations & information on Anatomy & Geography are provided. Gymnosperms are separated & placed before Angiosperms. Many large unnatural families of Bentham & Hooker have been split into smaller natural families. Urticaceae is divided into Urticaceae, Ulmaceae & Moraceae. The abolition of Monochlamydeae has brought several related families together. The advanced families Compositae & Orchidaceae are placed at the end. Gamopetalous condition is considered as advanced than Polypetalous. The terms "Cohort & Natural order" have been replaced by Order & Family. The closely related families Liliaceae and Amaryllidaceae are placed in same order Liliiflorae.

Demerits

The System is not Phylogenetic one in the modern sense. Many ideas are outdated. Monocotyledoneae are placed before Dicotyledoneae. Now Paleoherbs & sometimes Magnolids are placed before Monocotyledons. The family Amentiferae is considered primitive & now it is placed in an advanced group based on studies of wood Anatomy, palynology & floral anatomy. The dichlamydeous (distinct calyx and corolla) forms were considered to have evolved from monochlamydeous (single whorl of perianth) forms. The Angiosperms were considered as a Polyphyletic groups. Recent advances point towards Monophyletic origin.

