Semester - 2 : Plant Taxanomy:

Unit - 1

Botanical Exploration and contribution with special Reference to India by william Roxburgh

* Botanical exploration are scientific voyages designed to explore the flora of a particular region, either as a specific design or part of a large expedition.
* A naturalist or botanist would be responsible for identification, description and collection of specimens.
* Among them some of the most illustrious pioneers are listed below.
  - william Roxburgh
  - J. D. Hooker
  - Robert wright
  - Nathanial wallich ←
  - Gramble

Dr. William Roxburgh: (1751-1815)

→ Abbreviated as 'Roxb' was a scottish physician and one of the pioneer botanists of India subcontinent.

→ He is Regarded as "The Father of Indian Botany"

→ He lived in India during 1776 to 1806

→ He served as a superintendent of the east Indian company's Botanic garden at cullutta from 1793.

→ He was actively engaged in the floristic studies ~~studies~~ of the eastern coast of the Peninsular India.

1776
1806
-10
1710
1806
1776
0|30

→ While studying as a medical student in the university of Edinburgh.

→ He learned the rudiments of Botany and linnean taxonomy from famous British botanist professor John hope (1725-86)

→ He was transferred presidency as a surgeon of British East India company.

→ That time he started working experimentally with plants in an experimental garden.

→ He established in ramalkot 200miles North of Madras.

→ Roxburgh was made the superintendent, calcutta Botanic garden in November 1793.

→ He drawings and description of as many as 2583 illustrations of Indian plants.

→ He published a book named Hortus benghalensis (1814) where he mentioned 5877 species out of which 4149 species.

→ Another contributions of India plants he described 6480 species.

→ One of them is Justicia Hincboria Roxb

Sir Joseph Dalton Hooker (1817–1911)

→ One of the most respected scientists and important botanists of the 19th century.

→ The second son of william Jackson Hookes and Maria Hookes

→ He was born on the 30th June 1817.

→ His Father William was appointed Regius Professor of Botany at Glasgow university 1820

→ Hookes started attending his father's lectures when he was a young as seven

→ But there is no doubt that it was through a life time of dedicated study pioneering travel botanical discovery and taxonomic innovation.

→ He built his own towering reputation as a man of science and as the leading botanist of his age.

→ Hooker began his career as a surgeon in the navy.

→ Unable to travel as a gentleman naturalist like Darwin.

→ So he used his medical qualification to secure an appointment as Assistant surgeon on Antarctic.

→ He used this opportunity to do much botanising in the southern ocean nations especially Newzealand.

→ Hooker gained a government grant to travel in India and the Himalayas (1847–51)

→ He was the first westerner to set foot in the more remote northern areas of the Himalayas

→ In India he collected around 7000 plant species including 25 new species of Rhododendron that helped create a craze among British Gardeners.

→ Hooker was more than just a plant collector

→ He was an interrogator of the natural world.

→ Hooker's own publications were numerous

→ The best one is beautifully illustrated. Rhododendrons of Sikkim Himalaya.

→ The genera plantarum prepared with Co-author George Bentham over more than 25 years.

Robert Wight (1796 - 1872)

→ He was born on 6 July 1760 east of Edinburgh

→ He is a scottish Surgeon working for the East India company.

→ Wight was the most prolific taxonomist in South India in the first half of the 19 century.

→ Together with george walker Arnott his collaborator in scottland.

→ He described 1261 new species and 104 new genera.

→ This book documents their names and the type specimens in the herberium of the Royal botanical garden Edinburgh.

→ He employed Indian botanical artists to illustrated many plants collected by himself and Indian collectors he trained.

→ 1838 he published a series of illustrated works in madras including the uncolored six volumes icones plantarum Indiae Orientalis and two-hand coloured. two-volumes work the illustration of Indian Botany (1838-50) and Spicilegium Neilgherrense (1845-51).

Dr. Nathanial Wallich (1786-1854)

* Nathanial wallich was born at Denmark.
* In 1806 wallich obtained the diploma of the Royal Academy of surgeons at copenhagen January 28, 17
* Wallich was held as a prisoner of war but later in 1809 he was released from his parole on the merit of his scholarship.

* On his release wallich was appointed assistant to william Roxburgh the east Indian company botanist in calcutta.
* Wallich kee interest in the Native flora and fauna of India
* His scholarly work with collecting and cataloging was making impressions both locally and abroad.
* He was one of the most significant superintendants of the calcutta Botanic garden. (1817 – 1846).
* His indirect predecessor william Roxburgh largely on account of the ~~and~~ Insect pests had not ~~kept~~ dried plant materials in calcutta.
* Other similar collections had been received by the EIC following the foundation of the Museum in 1800.
* Wallich started to Amass large amonts of dried Specimens at the Gearden.
* Wallich himself collected assiduously on various sick leaves.
* Wallich also received specimens from company officials based in all four presidencies.
* He stored 7963 collections of plant specimens in his Names as "Wallich's catalogue"
* He collected plant specimens with Buchanon Hamilton De. silva M.R. Smith and W. Gomez

Natural classification

Benthem & Hooker's system of classification.

→ The system of classification of seed plants was proposed by Benthem and Hooker.

→ It's the most well developed natural system, it was published in 3 volume work genera plantarum (1862-83).

→ They described 97,203 species of seed plants belonging to 7,569 genera of 202 families starting from Ranunculaceae up to Gramineae.

→ Benthem and Hooker have grouped advanced seed bearing plants into a major division called phanerogamia.

The division has been divided into three classes namely.

(i) Dicotyledonae

(ii) Gymnospermae and

(iii) Monocotyledoneae.



Ordinaanamoli

classes.

Dicotyledonae
(Two cotyledons in the seed)

Sub-classes.

Polypetalae
Series
- Thalamiflorae
  - 6 orders
  - 34 families
- Disciflorae
  - 4 orders
  - 22 families
- calyciflorae
  - 5 orders
  - 27 families

Gamopetalae
Series
- Inferae
  - 3 orders
  - 9 Families
- Heteromerae
  - 3 orders
  - 12 Families
- Bicarpellatae
  - 4 orders
  - 23 Families

Monochlamydae
Series
- Curembryae
  - 6 Families
- Multiovulate Aquaticae
  - 1 Family
- Multiovulate Terrestris
  - 3 Families
- Microembryae
  - 4 Families
- Daphniales
  - 5 Families
- Achlamydosporae
  - 8 Families
- Unisexuales
  - 9 Families
- Ordinaanamoli
  - 9 Families

Gymnospermae
(seed not closed in fruit)
- 3 Families
  1. Gnetaceae
  2. coniferae
  3. Cycadaceae

Monocotyledonae
(one cotyledon in the seed).

Series
- Microspermae
  - 8 Families
- Epigynae
  - 7 Families
- Coronariae
  - 8 Families
- Calycinae
  - 5 Families
- Nudiflorae
  - 5 Families
- Apocarpae
  - 3 Families
- Glumaceae
  - 5 Families.

Principles of classification as proposed artificial - Linnaeus.

The arrangement of plants into groups or subgroups on the basis of similarities is called classification.

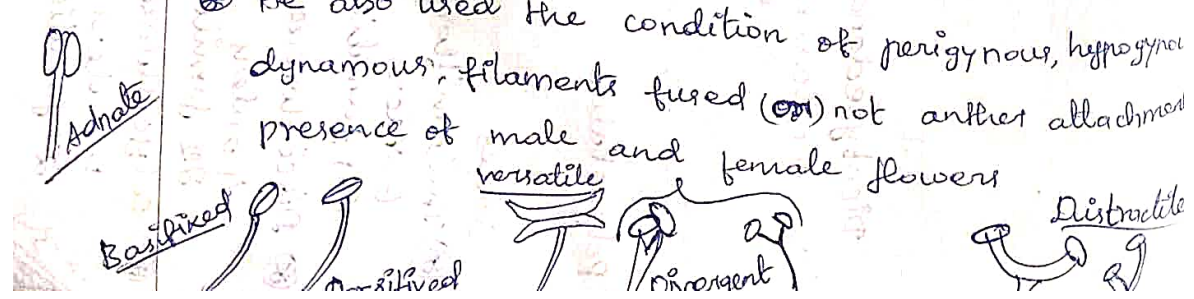
The characters which are uses as basis classification are called criteria of classification.

Types:

(i) Artificial system of classification
(ii) Natural system of classification
(iii) Phylogenic system of classification.

(i) Artificial system of classification:

- The classification system based only one (or) two morphological characters for the identification of plants is called artificial system of classificati
- Theophrastus divided the plants on the basis of form and texture, herbs, shrubs under shrubs and trees.
- Carolus Linneaus: regarded as the father of systematic botany published artificial system based exclusively on floral characters.
- It is also known as sexual classification system
- He has published system of classification as a two volume work in famous books.
  1. Species plantarum
  2. Genera plantarum
- He formed 24 classes of plants on the basis characters of stamens, he placed many unrelated plants in a single group due to common character of stamens.
- He also used the condition of perigynous, hypogynou dynamous, filaments fused (or) not anther attachment presence of male and female flowers



Outline of classification:

1. Monandria (flowers with 1 stamen)
2. Diandria (flowers with 2 stamens).
3. Triandria (flowers with 3 stamens),
4. Tetrandria (flowers with 4 stamens)
5. Pentandria (flowers with 5 stamens)
6. Hexandria (flowers " 6 ")
7. Heptandria (" " 7 ")
8. Octandria (" " 8 ")
9. Enneandria (" " 9 ")
10. Decandria (" " 10 ")
11. Dodecandria (" " 12 ")

- The system of Linneaus recognized 24 classes mostly on the basis of stamens.
- These classes were further subdivided on the basis of carpel characteristics into orders such as monogynia, Digynia etc.
- Such as classification based on stamens and carpels resulted in the artificial grouping of unrelated taxa and separations of relatives.
- He used hiarchical classification each kingdom was sub-divided into classes, orders, genera and species.

1. Life
2. Domain
3. Kingdom
4. phylum
5. classes
6. order
7. Family
8. Genus
9. species.

Phylogenetic System of classification – John (1884-

→ John Hutchinson was a British botanist associ with Royal Botanic Gardens, Kew. England.

→ He developed and proposed his system based o Bentham and Hooker and also on Bessey.

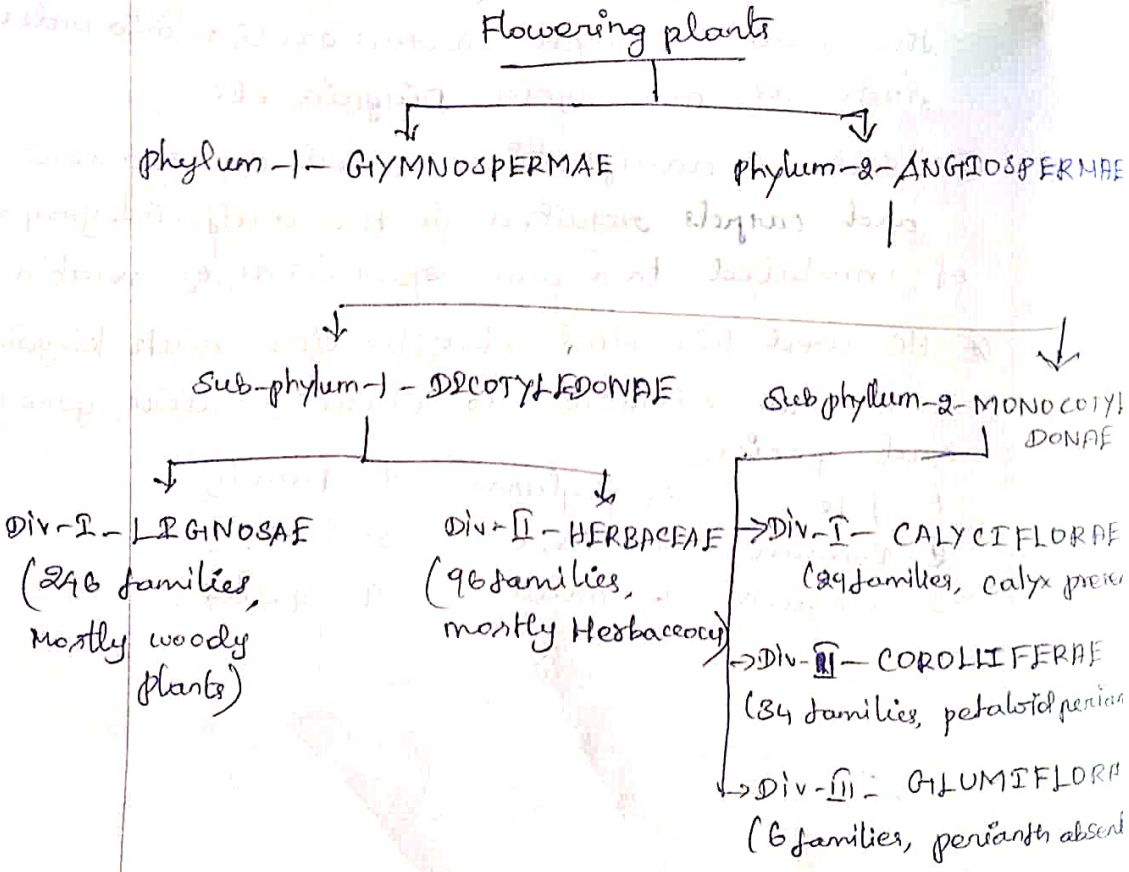
→ His phylogenetic system appeared as "The famili of flowering plants" in two volumes.

→ The first volumes contains Dicotyledons (1926) a Second volume contains Monocotyledons (1934).

→ He made several revisions in different years.

→ The final revisions of "The families of flowering plants" was made just before his death on 2nd September 1972.

→ 3rd ~~xxx~~ edition was published in 1973.



The following principles were adopted by Hutchinso to classify the flowering plants.

→ Evolution take place in both upward and downwa direction.

→ During evolution all organs do not evolve at the same time.

→ Generally evolution has been constant.
→ Trees and shrubs are more primitive than herbs in a group like genus or families.
→ Trees and shrubs are primitive than climbers.
→ Terrestrial angiosperms are primitive than aqueatic angiosperms.
→ Normally simple leaves are more primitive than compound leaf.
→ Solitary flowers are primitive than flowers on inflorescence.
→ Single fruits are primitive than aggregate fruits.

Merits:

* Hutchinson's system is a phylogenetic one based on evolutionary trends which deals with trends of evolution in all parts of the plants.
* Hutchinson proposed the monophyletic origin of angiosperms from some hypothetical pro angiosperms having Bennettitalean characteristics.
* He made a valuable contribution in phylogenetic classification by his careful and critical studies.
* Monocots have been derived from dicots.
* According to him, the definitions of orders and families are mostly precise, particularly in case of subphylum Monocotyledons.

Demerits:

* There is undue fragmentation of families.
* Too much emphasis is laid on habit and habitat. Thus, creation of Lignosae and Herbaceae is thought to be a defect reflecting the Aristolean view.
* The origin of angiosperms from Bennettitalean-like ancestor is criticised by many, because the anatomical structures of the early dicotyledons are not tenable with such ancestry.

Modern classification Takhtajan's system of classification:

→ Present day Armenian-born botanist & systematist.
Armen leonovich Takhtajan (1910-2009).

→ He was one of the most influential botanist and systematists of 20th century.

→ In 1942 he developed a classification which published in his "Die evolution der Angiosperm" i.e the origin of Angiosperm plants in Russian language.

→ The classification was published in Flowering plants origin and dispersal 1969 in English.

Later on in 1980, a new revision of his of system was published.

→ He classified angiosperms as division magnoliophyta and sub divided them into the dicotyledons [class: Magnoliopsida) and Monocotyledons (class: Liliopsida).

Armen Leonovich Takhtajan

Outlion of classification:

Division	class	Sub-classes	order
Magnolio-phyta [Angiosperms]	Magnolio-psida (Dicotyledons)	Magnoliidae	7
		Hamamelidiae	8
		Ranunculidae	3
		caryophyllidae	3
		Dillendae	12
		Rosidae	16
	Liliopsida (Monocotyledons)	Ausmalidae	3
		Lilidae	3
		Arecidae	5
		Commelinidae	6

Characters	Primitive	Advanced.
Growth habit	Woody habit Small Evergreen	Herbaceous large Deciduous.
Leaves	Simple leaves Reticulate venation Alternate leaves	Compound leaves parallel venation opposite leaves
Stomata	Mesogenous type with subsidiary cells	Perigenous type lack subsidiary
Nodal structure	Tri to pentalacunar	unilacunar
Inflorescence	cymose	Racemose
Pollen grains	Monocolpate	Tricolpate
pollination	Entomophily	Anemophily
Fruit	Many seeded follicular fruit	coenocarpus fruit.

Merits:

→ It is more phylogenetic than that of earlier systems.

→ The classification is in general agreement with the major contemporary system of Thorn and others

→ The treatment of magnoliidae as a primitive group and the placement of Dicots before monocots is in agreement with the other contemporary system.

→ The Nomenclature of various groups is in accordance with ICBN.

Demerits:

→ This system provides classification only up to family level

→ Takhtajan considers Degeneriaceae as the most primitive angiosperm but many

present day taxonomists considers Ranales to be most primitive family in Angiosperm

Natural classification:

Merits:

1. The description of families and genera is very accurate.
2. The system is very handy for identification purposes.
3. Each family had a synopsis at the begin which is very useful in identification.
4. The system starts from Ranales, which are now universally considered to be most primitive living angiosperms.
5. Larger genera subdivided into subgenera and sections.
6. Creation of Monochlamydeae at the end of Dicots.
7. The gamopetalae placed after polypetale is justified since union of petals is considered to be an advanced feature.

Demerits:

1. The system does not give any idea as to the evolutionary history of any genera, family or order.
2. The group "Monochlamydeae" is entirely artificial.
3. Gymnospermae is placed between the dicotyledones and monocotyledones, which is extremely anomalous.
4. Advanced families like orchidaceae and scitamineae are treated in the beginning of monocots.
5. Liliaceae and Amaryllidaceae were kept apart though they are very closely related.

J.S. Gamble:

- James sykes Gambles (1846–1925) was born in London on 1846.
- He graduated with honours in mathematics from oxford in 1816.
- He studied forestry at Nancy from 1869 to 1871.
- As a student he displayed keen interest in systematic botany and collecting plant specimens
- In 1871 he arrived in India and his first assignment in the India forest service was in Burma.
- He complied a list of the trees and shrubs found in the Darjeeling District in 1878.
- After 1879 he was posted as conservation of forest in Bengal for three years, later in madras presidency.
- In 1882 when he was in madras presidency he was responsible for the foundation and future policy of the forest Department particularly for the extension of Eucalyptus plantations in the Nilgiris.
- In 1890 he become the director of the forest school in Dehradun and retired in 1899 from the Indian forest service.
- He preserved a large number of collections from India.
- In 1915 he commenced the work on the Flora of the presidency of madras.
- Gamble made intensive collections in Gumsoor tract of Ganjam District (now in orissa).
- He has also made a few collections from Wynaad, Trichur (Kerala), Anamali, Killai in south Arcot etc.

- All these enable to [illegible] a good idea of the varied flora of the madras presidency.
- Gamble prepared in accounts form Rutaceae & Euphorbiaceae and a few genera in ulmaceae.

Botanical Gardens and herbaria of world:

Oil yielding:

(i) Groundnut:
Family: Fabaceae
Bot. Nam: Arachis hypogaea
Verna. Name: Groundnut (or) peanut

(ii) Sunflower:
Family: Asteraceae
B.N: Helianthus annuus
Ver name: Sunflower, sooriyakanthi

Sugar yielding:

(i) Sugarcane:
F: Saccharum officinarum
B.N: Poaceae
V.N: Karumbu
Origin: tropical region
Distri: cuba, Brazil, India, Pakistan

(ii) Beetroot:
F: Chenopodiaceae
B.N: Beta vulgaris
Distri: USA, Germany, Denmark

Chemotaxonomy:

- This science of chemical taxonomy is based on the classification of plants on the basis of their chemical constituents.
- Investigation of the distribution of chemical compound (or) groups of biosynthetically related compounds in series of related plants.
- Different plants sometimes contain substances belong to different chemical compounds appe to be biosynthetically analogous.
- Such plants may contain similar enzyme system and the compounds produced by su enzymes infer that relationships exist between related plants.
- The investigations of the patterns of the compounds existing in plants and in all individual parts of the plants such as bark, wood, leaves, roots, etc.
- The chemical constituents usually differ mud in different organs
- Real evidence for alliance and non-allian of plants.
- According to Turril the physiological aspe to some extent lead the taxonomist to the determination of the phyllogeny.
- The presence (or) absence of essential oil, resi latex, glucosides etc.
- Alston and Turner (1963) in their work Biochemical systematics.
- Hegnauer (1965) in chemotaxonomic dat of plan
- Leone (1964) - Taxonomic Biochemistry and Serology
- Swain (1963) - chemical plant taxonomy
- [illegible] based on the impor