UNIT TWO

THE DEVELOPMENT OF TAXONOMY

The history of taxonomy dates back to the origin of human language.

a) Non–human taxonomists.

Animals prove by their relations that they classify objects of their environment as:

- food or non–food
- competitors or potential mates; and
- enemies (predators) or prey.

Animals also recognise plants as:

- food or
- non–food.

b) Human taxonomists

The development of taxonomy was started at Greek by Greek philosophers.

The development of taxonomy is gradual.

- Modern taxonomy has arisen from a number of diverse origin which are not easily treated as a **linear** sequence.
- In any era dominated by one particular outlook there have always been other activities carried out in parallel or left over from a previous era.

- The development of taxonomy has different **phases** with different people

i. Ancient classification and
ii. The herbalists–based on their value to human
iii. The early taxonomists
iv. Linnaeus and his apostles– Artificial
v. Post Darwinian phylogenetic system
vi. Post Linnaeus natural system
vii. Phenetic methods (taxometrics)
viii. Modern phylogenetic methods (cladistics)

Ancient Classifications

Phase I. Ancient classification

Ancient man classify organisms that are significant to them. they have had systems of plant classification, for their needed to convey to others.

- The names, and
- Properties of plants that were of significance to him.
- They give a vernacular name /common name/local name for their purpose and understanding

- They have developed a folk taxonomy

θ **Folk- taxonomies**–Classifications which grow up in communities, both primitive and civilised through need and without the influence of science.

- Classification by man of organisms

The Taxonomic Practices by Early Greek (and Roman) Philosophers

- Several early Greek and Roman philosophers enumerated organisms. They are:

1. Aristotle (370-322BC)- He was the first to classify all living organisms in to plant and animal.

2. Theophrastus (370-285 BC)

- He was a pupil of Aristotle. **Theophrastus** was a keen observer of **plants**
- **Theophrastus** was the first to write

- **Theophrastus** classified **480 kinds of plants** based **primarily on habit**
- In his book, **De Historia Plantarum**, he divided plants into:
  - trees;
  - shrubs;
  - under shrubs; and
  - herbs
- These are subdivided into:
  - cultivated; and
  - wild

- **Theophrastus** was a good morphologist and recognised the differences between:
  - polypetalous and sympetalous corollas;
  - superior and inferior ovaries;
  - determinate and indeterminate inflorescences
  - Fruit types
- Several of the names used by **Theophrastus** were later taken up by **Linnaeus** in Genera Plantarum and thus still used in the same sense today.

3. Dioscorides (1st Century AD)

- He was a Greek **physician** in the Roman army. He was interested in the **medicinal properties of plants**.
- His book **De Matera Medica-** described **600 taxa** largely from first-hand observations and detailed their useful applications. De Matera Medica dealt with **600 species** of:
  - Perfumes;
  - Oils;
  - Spices;
  - Cereals;
  - Condiments – powder or liquid used for giving a

PHASE II-THE HERBALS (15-16TH CENTURIES)

- During the15th and 16th Centuries, a period known as the Age of the Herbals,
  - many new plants were described and illustrated.
- There were the invention of printing machine & this enable new books to be produced in large numbers
- This was the time of the different harbals written by herbalists like:
  - O. Brunfels (1530),
  - J. Bock (1539),
  - L. Fuch (1542),
  - P. Mettioli (1544),
  - W. Tourner (1551), etc

- **Herbalism** dominated the 16th century botanical world.
- During this period the first field of science were herbals
- **Herbalism** is the study of plants in relation to their value to man, particularly as:
  - Food and
  - Medicines
- **Herbalists** are people who studied plants in relation to their use to man, particularly as food and medicines.

- However, herbals remained popular well after the 16th century, for they marked an important stage of development in:
  - Botany
  - Taxonomy
  - Medicine, and
  - Pharmacognosy

Phase III-Early Taxonomists

- Towards the end of the 16th century plants began to be the focus of attention of a number of naturalists for **their intrinsic interest** rather than for **their nutritive value or medicinal value.**
- The **books** that these botanists produced marked an important step forward in plant

1. A. Caesalpinus (1519-1603)

- He was a Professor of botany at Univ. of Pisa, Italy.
- He published his book on the classification of plants, **de Plantis (1583)**
- His book is the first **methodical classification of plants** based on definite morphological criteria.
- In his book de Plantis,
- Caesalpinus classified about **1500 species** of plants, mainly on the basis of:
  - habit
  - fruit and
  - seed forms
- He recognized the usefulness of fruits and

J. Bauhin (1554-1631) and G Bauhin (1560-1624)

- They were brothers and Swiss botanists who worked separately but along rather similar lines.
- **G. Bauhin** produced the most important book of its time **Pinax Theatri Botanici** (1623)
  Pinax = Register
- He listed in his book 6000 or so species
- He was notable for his:
  - Recognition of genera and species as major taxonomic levels
  - Using a **binary nomenclature** composed of the genus name followed by a single specific epithet to recognise many of the species.
    - 1623 – first use of binomial names

J. P. de Tournfort (1656-1708)

- He was a Frenchman who carried out further **Bauhin's** promotion of the rank of genus.
- He had a clear idea of the genus.
- **De Tournfort** wrote a book called "Institutiones Rei Herbariae" (1700) and many of his genera were later adopted by Linnaeus and are still in use today.
- **His system classified about 9000 species into 698** genera **and** 22 Classes (Orders)**.**

J. Ray (1627-1705)

- An English naturalist who produced several important books on plant classification.
- The most important books written by Ray were:
- **Methodus Plantarum Nova** (1682, 2nd ed. 1703)
- **Historia Plantarum** (3 volumes, 1686, 1688, 1704)

- The 2nd edition of Ray's Methodus dealt with nearly **18,000 species** in a complicated system of classification, using a very large number of characters of:
  - Flower and
  - Vegetative parts, he believed that all parts of a plant should be used in taxonomy.
- **Ray did not develop the idea of binary nomenclature** commenced by G. Bauhin.
- His **species** were characterised by **phrase-names.**

Phase IV-Linnaeus (& his students/Apostles)

- Carl von Linné, usually Latinized as Carolus Linnaeus (1707-1778), a Swede Taxonomist and Physician,
- He was the founder of **modern taxonomy** both for a
  - plants and
  - animals.
- The system of nomenclature that we employ today is essentially **Linnaeus**'.
- Linnaeus' main contribution was to bring order to the bewildering array of
  - literature
  - systems of classification
  - plants and animals which confronted the 18th

- Linnaeus produced many books and other literatures.
- His system was first published in **1735** in **Systema Naturae,** a work that classified all known:
  - animals
  - plants and
  - minerals
- For plant taxonomists the two most important works are
  - Genera Plantarum (1737, with later editions) and
  - Species Plantarum (1753, with later editions

- The Genera Plantarum listed and briefly described the plant genera recognised by Linnaeus, and hence carried forward the work of G. Bauhin and Tournfort in giving prominence to the rank of genus.
- Genera Plantarum and Species Plantarum, which were published in Stockholm together, cover **7700 species in 1105 genera.**
- Linnaeus classification continued to dominate taxonomic works until well into the 19th c.

Phase V. Post - Linnaean Natural System

- **Linnaeus'** system was called the Sexual System, because it was based on the use of characters of:
- The stamens (Number, Fusion and, Relative length) and
- The pistil/carpel
- Linnaeus' sexual system was popular largely because of its simplicity.
  - **His sexual system was very artificial.**

- **The foundation of modern families** comes mainly from the works of **French taxonomists** in the latter part of the 19th century, notably
  - **M. Adanson (1727-1806)**,
  - **A.A. de Jussieu (1748-1836)**, and
  - **J. de Lamarck** (1744-1829),
- who never followed the sexual system of Linnaeus.

1. M. Adanson (1727-1806)

- He produced his book "Familles Des Plantes in 1763.
- Today, Adanson is most remembered for championing the idea that
- In classification:
  - One should use a great range of characters covering all aspects of the plant and without placing greater emphasis on some than on others.
- This is called an **empirical approach.**
- **Adanson was a severe critic of Linnaeus' works.**
- Adanson recognised **58 families of**

2. A.L. de Jussieu (1748-1836)

- His most significant work was genera Plantarum (1789), in which he divided plants into three groups:
  - **Acotyledones** – Cryptogams + a few misunderstood monocotyledons
  - **Monocotyledones** – Monocotyledons
  - **Dicotyledones** – Dicotyledons plus gymnosperms
- Within group three, he used **many of the familiar modern characters** like:
  - Superior versus inferior ovaries;
  - Stamens fused versus stamens attached to the corolla;
  - Petals free versus petals fused, etc.
- He classified plants as whole into **15 classes** and **100 natural orders (families).**
- **A good number of his families** are still found similarly delimited in modern

3. J. de Lamarck (1744-1829)

- Lamarck is best known for his theory of evolution, Lamarckism whereby characters acquired during life become inherited.
- Lamarck wrote **Flore Francoise** (1778).
- He also wrote **Encyclopedie Methodique** (1783-1798)
- Lamarck's fame rests on his realisation that a natural system of classification was not the best for **rapid identification. (Used artificial keys)**

A. P. de Candolle (1778-1841).

- A Swiss botanist who contributed much to the development of higher plant classification and to other fields of plant science.
- His book **Theorie Elementaire de la Botanique (1813),** first introduced the word taxonomy in the French form **Taxonomie**.
- De Candolle divided plants into two major groups:
  - Cellulares - the non-vascular plants
  - Vasculares - the vascular plants

G. Bentham (1800-1884) and J.D. Hooker (1817-1911)

- They produced the last major classification in their book **Genera Plantarum** (1862-1883), which dealt with only seed plants, described **200 families** and **7569 genera**.
- It became a standard reference.
- **Dicotyledons** were divided into **three groups**:
  - **Polypetalae** (with free petals)
  - **Gamopetalae** (with fused petals)
  - **Monochlamydeae** (without petals)
- **Bentham** was an extremely accomplished self-trained classical taxonomist who wrote many important **monographs**.

Phyletic/Evolutionary System of Classification (post Darwinian system)

- Darwin's the Theory of Evolution by Means of Natural Selection (1859), had little immediate impact on plant classification.
- The aim of phyletic classification is:
- To construct a sequence starting with the most primitive or least specialised and ending with the most advanced or derived, and
- To ensure that each taxon recognised is **monophyletic** i.e. has arisen by the diversification of the single ancestor as

A.W. Eichler (1839–1887)

- The earliest **phyletic system** is generally reckoned to be that of **Eichler**.
- He obtained the division of plants into two:
  - Cryptogamae
    - Thallophyta
    - Bryophyta
    - Pteridophyta
  - Phanerogamae
    - Gymnospermae
    - Angiospermae
      - Dicotyledons
        - » Choripetalae (with free petals)
        - » Sympetalae (with fused petals)
      - Monocotyledons

B. G. A. Engler (1844-1930)

- Engler's classification scheme first appeared in 1892. His three major books (Magna Opera) are:
  - Die Naturalichen Pflanzenfamilien (1884-1915), with K.A. Prantl
  - Syllabus der Pflanzenfamilien (1892, 1st ed.)
  - Das Pflanzenreich (1900-1953)
- Engler's system was very widely adopted and in the latest form was today still perhaps the most frequently followed.

C.E. Bessey (1845-1915)

- The first American to make a major contribution to plant classification.
- Bessese's System – Outline of Plant Phyla, resembled Engler’s in the lower groups but differed in many ways.

H. Hallier (1868-1932)

- Independently produced (1905) a scheme for flowering plants, which resembled Bessey's in several respects, but differed in that the **Monocotyledons followed the**

Darwin and the Impact of his book, The Origin of Species (1859) on Taxonomy

- The evolutionary theory of Darwin**, The Origin of Species by Means of Natural Selection (1859)** had little immediate impact on classifications of organisms.
- Even if the impact came later, the process of classification remained the same, but **evolutionary thinking** was incorporated into classification.