TOPIC: SYSTEMATICS AND BINOMIAL SYSTEM OF NOMENCLATURE

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SPECIES CONCEPT

John Ray:- Proposed the term and concept of species.
To explain the species different concepts were proposed, which are as follows:

(A) Biological concept of species:-

- Mayr proposed the biological concept of species.
- Mayr defined the "species" in the form of biological concept.
- According to Mayr "All the members that can interbreed among themselves and can produce fertile off springs are the members of same species" But this definition of Mayr was incomplete because this definition is applicable to sexually reproducing living beings because there are many organisms that have only asexual mode of reproduction.
  Example - Bacteria, Mycoplasma, BGA
- The main character in determination of any species is interbreeding. But this character is not used in taxonomy. In taxonomy, the determination of species is based on other characters.
  Example - Mainly morphological character

- In higher plants, the determination of species is mainly based on the morphology of flower (floral morphology). Because floral (reproductive) characters are more conservative as compared to vegetative (Root, Stem, Leaf) characters i.e. they do not show major changes.
- When the species is determined on the basis of interbreeding then it is called as biological species.
  Example - All the humans in this world can interbreed among themselves.
  So all the humans are the members of one biological species.
- When the determination of species is based on other characters then it is called as taxonomic species.
  Example - These 3 have same morphological characters. Therefore they belong to same taxonomic species i.e. one taxonomic species. But these three can not interbreed among themselves. Therefore on the basis of inter-breeding these are three biological species.

(B) Static concept of species :-

- The static concept of species was proposed by Linnaeus. According to Linnaeus "species is un-changeable" i.e. there is no change in the character of species. The species of present day are same as they were in past and they will remain same in future.
- Linnaeus believed in the "Theory of Special creation"
  Father Suarez - gave the principle of special creation. According to this theory "All the living organisms are created by God (Every life is created by God) and God gave the basic size and shape of all living organisms, they are still present in their actual former form. But Lamarck rejected this hypothesis.

(C) Dynamic concept of species:-

- It was proposed by "Lamarck".

- According to this concept "Species is always changeable". Changes always occur in the characters of species from one generation to next generation. And these changes are known as "evolution".

(D) Typological concept:-

- It was proposed by "Aristotle" and "Plato".
- According to this concept "There is a definite type or pattern of characters in the each species of every living organisms and all the members of species show maximum resemblance with this pattern. (Typological concept is based on single individual of species) The species in which a fixed pattern of characters is present are called as monotypic species.
  Example - Bacteria, BGA
- In many species, more than one type or pattern of characters are present. These are called "Polytypic species" or "Macrospecies".
  Example - Brassica oleracea → Cauliflower, Cabbage, Knol - khol.

<u>Polytypic Species are of three types</u>

1. Biotype – Members of same species inhabiting similar environment and having some genetic variations are known as biotypes. Variations found in these members are permanent. These members can not interbreed among themselves.
Example - Cauliflower , Cabbage, Knol –Khol are three biotypes of one species.

2. Ecotypes – Members of same species inhabiting different environment and having some genetic variations are know as ecotypes. Variations are permanent. These members can interbreed among them selves but due to geographical barrier they can not interbreed.
Example - Crow (Corvus splendens) found in different regions are ecotype of one species
Corvus splendens splendens – Indian crow
Corvus splendens insolens – Myanmar crow
Corvus splendense protegatus – Srilankan crow

3. Ecads or Ecophenes – Members of same species having some non genetic variations due to change in environment. These variations are temporary.
Example –Every living being
Note:- This hypothesis is believed to be most acceptable.

SOME DEFINITION RELATED TO SPECIES

1. Linneon species:- Those taxonomic species whose determination is based on morphology. They are called as linneon species. They are also called morpho-species or taxonomic species.
Example - Most of species in taxonomy are linneon species

2. Microspecies or Joardan's species:- Those species in which variations are very less. They reproduce asexually so they have very less variations.

3. Sibling species or Cryptic species:- Members of species which are morphologically similar but reproductively isolated are known as sibling species i.e. they can not interbreed among themselves. Sibling species is one taxonomic species (because these members have similar morphology) but they are different biological species. [Because they can not interbreed]
Example - Brassica oleracea

4. Allopatric species:- The species found in different geographical regions and have geographical barriers between them are known as allopatric species. Geographical barriors like hills, oceans, Himalyan mountains.
5. Sympatric species:- The species found in similar geographical regions.

6. Allochronic species:- The species found in different time periods or era.
Example - Man and Dinosaurs

7. Synchronic species:-Those species that are found in same era.
Example- Dinosaurs and Archaeopteryx

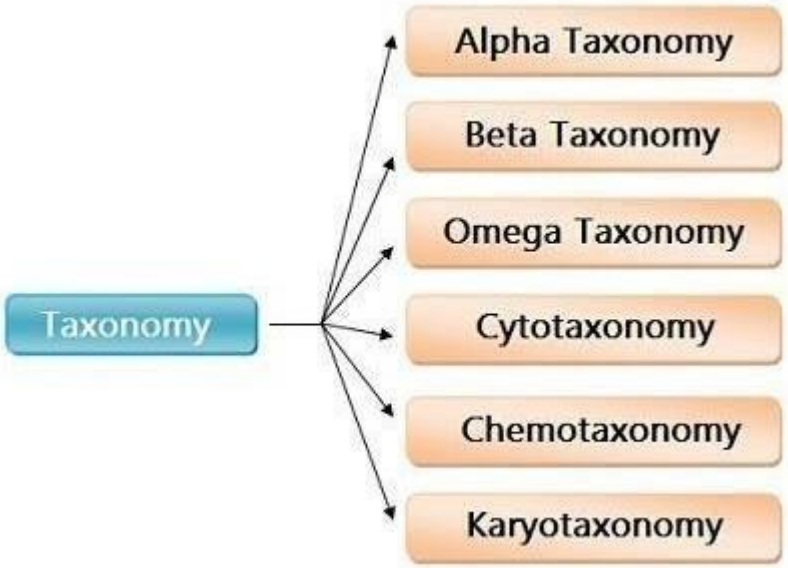
Fig: Archaeopteryx

8. Palaeo species:- Those species that are extinct now and are found in the form of fossils.

Example - Dinosaurs

9. Neontological species:- Those species which are living presently.

TYPE OF TAXONOMY



1. Alpha taxonomy or classical taxonomy: It is based on external morphology characters of plants.

2. Beta taxonomy: Besides external morphology, it also includes internal characters like embryological, cytological, anatomical characters etc.

3. Omega taxonomy: Omega taxonomy has widest scope. It is based on all the informations or data available about plants.

4. Cytotaxonomy: The use of cytological characters of plants in classification or in solving taxonomic problems is called cytotaxonomy. Cytological characters constitute an important aid to plant taxonomy, especially in determining affinities at the generic and infrageneric levels.

5. Chemotaxonomy: The uses of chemical characters of plants in classification or in solving taxonomic problems is called chemotaxonomy or chemical taxonomy. It is based on the chemical constitution of plants. The fragrance and taste vary from species to species.
The basic chemical compounds used in chemotaxonomy are alkaloids, carotenoids, tannins, polysaccharide, nucleic acids, fatty acids, amino acids, aromatic compounds etc.

6. Karyotaxonomy: Based on the characters of the nucleus and chromosomes. Pattern of chromosomal bands (dark bands and light bands) is most specific characters.

HISTORY OF TAXONOMY

(1) Aristotle (382 B.C.):- Father of biology & father of zoology

- Time - 370 - 285 B.C.
- He is known as father of ancient plant taxonomy and father of botany.
- Both Theophrastus & Aristotle are Greek political philosophers.

(3) Carolus Linnaeus [1707 - 1778]

- His real name was - Carl Von Linne

- On the basis of work in Latin language, he changed his name to Carolus Linnaeus. He was the Swedish scientist
- He is known as the father of taxonomy, father of plant taxonomy and father of animal taxonomy.
- Linnaeus gave the two kingdom system classification. He grouped plants and animals into kingdom Plantae and kingdom Animalia respectively.
- Linnaeus wrote many books. Some important books are:-
  (i) Hortus uplandicus - First book
  (ii) Flora lapponica
  (iii) Philosophia botanica
  (iv) Critica botanica
  (v) Systema naturae (1737)
  (vi) Genera plantarum
  (vii) Species plantarum - last book (1753)

(4) A.P. De Candolle

- He wrote the book "Theories Elementaire de la botanique" (B) He was the first to propose the significance of vascular tissue in taxonomy.
- On this basis of vascular tissue he classified plants into two groups
  (i) Cellular plants (Non-vascular plants) - this group includes Thallophyta and Bryophyta
  (ii) Vascular plants - This group includes Pteridophyta, Gymnosperm and Angiosperms.

(5) George Bentham (1800 - 1884) and Joseph Dalton Hooker (1817 - 1911)

- Both Bentham and Hooker were related to Royal botanical garden.
- Scientists working in botanical garden are known as curator.

- They wrote the book "Genera plantarum" (1862 - 1883). In this book, Bentham and Hooker gave the biggest and natural classification of spermatophyta i.e. plants with seeds.
- In Genera plantarum, there is description of 202 families. In it, basically the description of seeded plants is present.

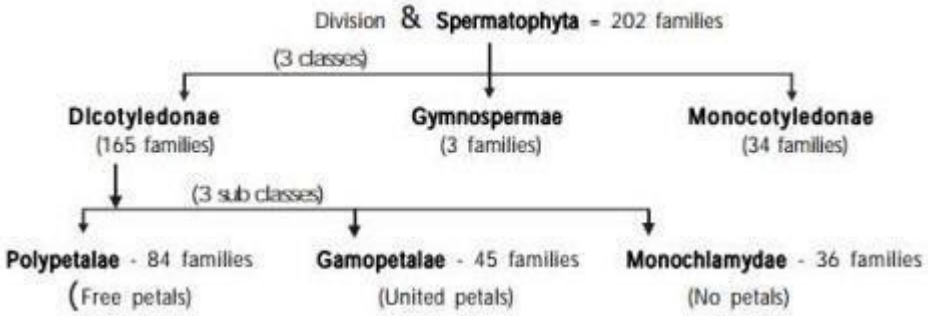


Fig: Spermatophyta classification

Merits of Bentham and Hooker classification:

- The classification of Bentham and Hooker was natural formal.
- The classification of Bentham and Hooker was mainly based on the floral characters. This was very appreciable because floral characters are more stable than vegetative (root, stem, leaves) characters.
- It is the simplest classification. Therefore the arrangement of all plants in the botanical gardens and herbarium of the world is based on it. Although it is not the best classification but yet the arrangement of plants in botanical gardens and herbariums is based on it, because it is the simpler one. The main reason for its simplicity is that this classification is based on actual observations.

Demerits of Bentham and Hooker:

- In this classification the phylogeny of plants is not considered, because in it, gymnosperms are placed in between dicots and

monocots. The sequence of evolution is as follows:- Phylogeny = Gymnosperm → Dicots → Monocots

(6) A.W. Eichler

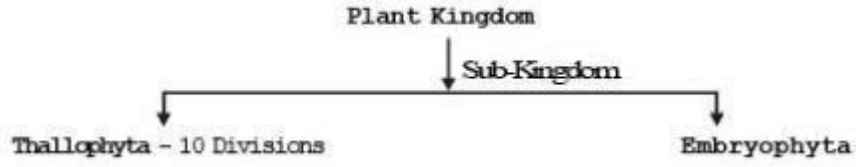
- Syllabus de vorlesungen uber phanerogamen kunde - Book written by Eichler.
- In this book, Eichler gave the first phylogenetic classification of plant kingdom.
- The classification of Eichler is very little phylogenetic.
- Eichler classified plant kingdom into five divisions and arranged them in the order of evolution (Phylogeny). Thallophyta → Bryophyta → Pteridophyta → Gymnosperm → Angiosperm

(7) Engler (1844 - 1930) & Prantl (1849 - 1893):-

- Book - "Die Naturlichen Pflanzen Familien"
- He gave the phylogenetic classification of plant kingdom. This classification was more phylogenetic as compared to Eichler's classification.

(8) Oswald Tippo:-

- Proposed the biggest phylogenetic classification of plant kingdom.
- This classification is the complete classification of plant kingdom.
- This is the most acceptable classification for books and study.



(1) Cyanophyta – B.G. Algae
(2) Euglenophyta – Euglenoids
(3) Chlorophyta – Green algae

(4) Chrysophyta – Yellow - Green - algae
(5) Pyrrophyta – Dinoflagellates & Diatoms
(6) Phaeophyta – Brown algae
(7) Rhodophyta – Red algae
(8) Schizomycophyta – Bacteria
(9) Myxomycophyta – Slime molds (false fungi)
(10) Eumycophyta – True fungi

These ten divisions include three types of organisms:
(1) Algae = 7 - division
(2) Bacteria = 1 - division
(3) Fungi = 2 - division

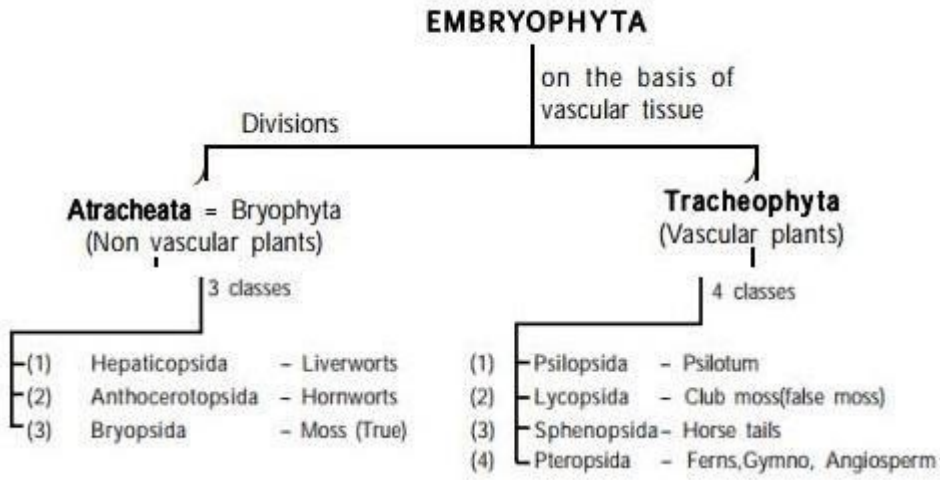


Fig: Embryophyta division

Note : Tippo did not use the word pteridophyta.

(9) Karl Menz:

- He showed the importance of serology in taxonomy.
- Similarities and dissimilarities in the structure of proteins help to know the phylogenetic relationship of living beings. Living organisms which are phylogenetically close relatives have more similarities in their proteins. Organisms which are distantly

related have different proteins.
Note: Phylogenetic relationship of plants and animals can be established by animal serum. Serology indicates that chimpanzee is the closest relative of man.

(10) Haeckel:-

- Haeckel gave the three kingdoms (Protista, Plantae, Animalia) system of classification.
- Haeckel established the kingdom Protista.
- The term 'Protista' was given by C. Cuvier.
- Haeckel grouped those living organisms in Protista which did not have tissues.
- Kingdom Protista → Prokaryotes, Protozoa, Porifera, Algae & fungi
- First tissue was originated in animal kingdom in → Coelenterata
- First tissues was originated in plant kingdom in → Bryophyta
- **(11) Copeland:-**

- He gave the Four kingdom system of classification.
- **Mychota:-** Dougherty & Allen gave the name "Monera" to Mychota of Copeland. All the prokaryotes are grouped in Monera Protista or
- **Protoctista:-** Copeland grouped those eukaryotes in protista, which are visually different than normal plants and animals. eg. Brown algae, Red algae, Fungi, Protozoa
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- **Plantae or Metaphyta:-** Remaining all eukaryotic plants are grouped.
- **Animalia or Metazoa:-** Remaining all eukaryotic animals are grouped.

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