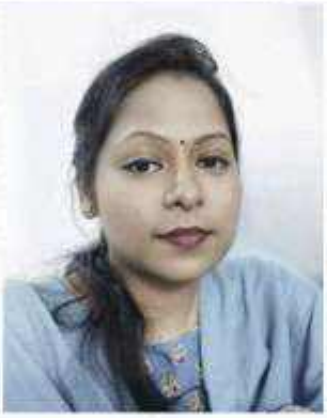
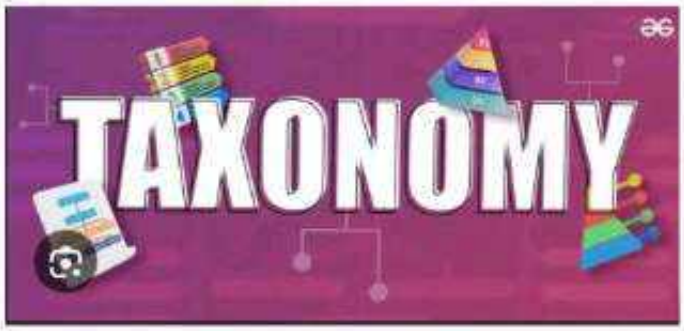


TAXONOMY: INTRODUCTION, IDENTIFICATION, CLASSIFICATION AND NOMENCLATURE

BOTANY (MINOR) SEM-3 ,UNIT-2



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Taxonomy

Taxonomy is defined as the 'science dealing with the study of classification, including its bases, principles, rules and procedures'. - Simpson (1961)

In simple word, "the science of identifying, naming, and classifying plants, animal or other organisms'

Taxonomy is a Greek words taxis (arrangement) and nomos (rules or laws)

The term 'taxonomy' was coined by A. P. de Candolle (1813) in his famous work Theorie elementaire de la botanique.

PLANT TAXONOMY

Definition and Background

Taxonomy or systematic is the study or description on variations among organisms in order to come out with a classification system.

Organisms that are arranged into groups enable a large population to be categorized and understood.

Taxonomy began about 300 years before christ by Theophratus (370-285 BC)

Carolus Linneaus (1707-1778) is regarded as the founder of taxonomy (father of taxonomy) till today.

Systematics

Systematics is the study of diversification and relationships of life forms

Simpson (1961) defines systematic as "The scientific study which deals with kinds and diversity of organisms and any or all relationships among them'

The word systematics is derived from the Greek word 'systema' applied to the system of classification developed by Linnaeus in the 4th edition of his historical book ***Systema Nature*** in 1735.

Relationship in sytematics and taxonomy

Taxonomy includes classification and nomenclature but systematics includes both taxonomy and evolution.
There are two parts of systematic.
(1) The first part, taxonomy, is concerned with describing and naming the different kinds of organisms
(2) The second part of systematics, evolution, is concerned with understanding just how all these kinds of animals arose and how they correlate to each other.

Basic Components of taxonomy and Systematics

Principles (Component) of Taxonomy

1. Description
2. Identification
3. Nomenclature
4. Classification

Principles (Component) of Systematics

1. Description
2. Identification
3. Nomenclature
4. Phylogeny
5. Classification

Description

The description of a specimen involves listing its features by recording the appropriate character states. A shortened description consisting of only those taxonomic characters which help in separating a taxon from other closely related taxa

The description is recorded in a set pattern (habit, stem, leaves, flower, sepals, petals, stamens, carpels, fruit, etc.).

Description = assign features

Character = a feature (e.g., "petal color")

Character states = (e.g., "red," "white").

The description is recorded for a proper documentation of data.

Identification

Identification or determination is recognizing an unknown specimen with an already known taxon, and assigning a correct rank and position in an extant classification.

This may be achieved by visiting a herbarium and comparing unknown specimen with duly identified specimens stored in the herbarium.

Alternately, the specimen may also be sent to an expert in the field who can help in the identification.

Identification can also be achieved using various types of literature such as Floras, Monographs or Manuals

A method that is becoming popular over the recent years involves taking a photograph of the plant and its parts, uploading this picture on the website and informing the members of appropriate electronic Lists or Newsgroups, who can see the photograph at the website and send their comments to the enquirer.

Identification = associate an unknown with a known

Taxonomic Key, e.g.,

Tree

Leaves simple ..... Species *A*

Leaves pinnate ..... Species *B*

Herb

Flowers red ..... Species *C*

Flowers white ..... Species *D*

Nomenclature

Nomenclature deals with the determination of a correct name for a taxon.

There are different sets of rules for different groups of living organisms. Nomenclature is govern by different codes through its rules and recommendations

Plant, fungi and algae - International Code of Botanical Nomenclature (**ICBN**) now changed as "The International Code of Nomenclature for algae, fungi, and plants (**ICN**)

Animal - International Code of Zoological Nomenclature (**ICZN)**

Bacteria – International Code for the Nomenclature of Bacteria (**ICNB),** now called Bacteriological Code **(BC)**

Viruses - International Code of Virus Classification and Nomenclature (**ICVCN).**

Classification

Classification is an arrangement of organisms into groups on the basis of similarities. The groups are, in turn, assembled into more inclusive groups, until all the organisms have been assembled into a single most inclusive group. In sequence of increasing inclusiveness, the groups are assigned to a fixed hierarchy of categories such as species, genus, family, order, class and division, the final arrangement constituting a system of classification.

The process of classification includes assigning appropriate **position and rank to a new taxon**

Taxon = a taxonomic group (plural = taxa).

How to classify life

Phenetic classification

Based on overall similarity from all available sources such as morphology, anatomy, embryology, phytochemistry, ultrastructure and, in fact, all other fields of study
Those organisms most similar are classified more "closely" together.

Phylogenetic classification

Based on known evolutionary history.
Classification reflects pattern of evolution
Classification not ambiguous

ICBN now ICN

International Code of Botanical Nomenclature (ICBN) is now changed as "The International Code of Nomenclature for algae, fungi, and plants (ICN)" at the International Botanical Congress in Melbourne in July 2011 as part of the Melbourne Code. ICN is and plants. Other than plants (bryophytes, pteridophytes, gymnosperm and angiosperm), ICN is now dealing the recommendations for formal botanical names of algae, fungi and taxonomically related non-photosynthetic groups.

Importance of Plant Taxonomy

1. To arrange elements or taxa of plants into a more systematic manner so that they can be better understood and could be used easily and more effectively.

2. To arrange data or information and knowledge about plants.

3. To indicate the source and genetic relationship (phylogenetic), ancestry and origin of plants.

4. To indicate the distribution and habitat of plants on earth and their benefits.

Introduction to plant Taxonomy (Identification, Classification and Nomenclature) :Various systematic activities are directed towards the singular goal of constructing an ideal system of classification that necessitates the procedures of identification, description, nomenclature and constructing affinities. This enables a better management of information to be utilized by different workers, investigating different aspects structure and functioning of different species of plant. The different components of systematics are as follows:-

Identification :- Identification or determination is recognizing an unknown specimen with an already known taxon, and assigning a correct rank and position in an extant classification. In practice, it involves finding a name for an unknown specimen. This may be achieved by visiting a herbarium and comparing unknown specimen with duly identified specimens stored in the herbarium. Alternately, the specimen may also be sent to an expert in the field who can help in the identification.

Identification can also be achieved using various types of literature such as floras, monograph or manuals and making use of identification keys provided in these sources of literature.

Description :- The description of a taxon involves listing its features by recording the appropriate character states. A shortened description consisting of only those taxonomic characters which help in separating a taxon from other closely related taxa, forms the diagnosis, and the characters are termed as diagnostic characters. The diagnostic characters for a taxon determine its circumscription. The description is recorded in a set pattern. For each character, an appropriate character state is listed. Flower colour (character) may thus be red, yellow, white, etc. (states). The description is recorded in semi-technical language using specific terms for each character state to enable proper documentation of data.

Nomenclature: - Nomenclature deals with the determination of a correct name for a taxon. Nomenclature of plants is governed by the International Code of Botanical Nomenclature (ICBN) through its rules and recommendation. Updated every six years or so, the Botanical Code helps in picking up a single correct name out of numerous scientific names available for a taxon, with a particular circumscription, position and rank. To avoid inconvenient name changes for certain taxa, a list of conserved names is provided in the code. Cultivated plants are governed by the International Code of Nomenclature for Cultivated Plants (ICNCP) slightly modified form and largely based on the Botanical Code.

With the onset of electronic revolution and the need to have a common database for living organisms for global communication a common uniform code is being attempted. The Draft BioCode is 1stpublic expression of these objectives. The first draft is prepared in 1995. After successive reviews the fourth draft, named Draft BioCode (1997) prepared by the International Committee for Bionomenclature was published by Greuter et. al. (1998) and is now available on the web. The last decade of the twentieth century also saw the development of rankles phylocode based on the concept of phylogenetic systematics. It omits all ranks except species and clades based on the concept of recognition of monophyletic groups.

Classification: - Classification is an arrangement of organisms into groups on the basis of similarities. The groups are in turn assembled into more inclusive groups , until all the organisms have been assembled into a single most inclusive group. The process of classification includes assigning appropriate position and rank to a new taxon, dividing a toxon into smaller units, uniting two or more taxa into one, transferring its position from one group to another and altering its rank. Taxonomic entities are classified in different fashion:-

- **Artificial classification** is utilitarian, based on arbitrary, easily observable characters such as habit, colour, number, form of similar features. The sexual system of classification of Linnaeus fits in this category.
- **Natural classification** uses overall similarity in grouping taxa, a concept initiated by M. Adanson and culminating in the extensively used classification of Bentham and Hooker. Overall similarity in this system is judged on the basis of features derived from all the available fields of taxonomic information (Phenetic relationship).
- **Phenetic classification** makes the use of overall similarity in terms of a phonetic relationship based on data from all available sources such as morphology, anatomy, embryology, phytochemistry, ultrastructure and, in fact, all other fields of study. This classification is strongly advocated by Sneath and Sokal (1973).
- **Phylogenetic classification** is based on the evolutionary descent of a group of organisms, the relationship depicted either through a phylogram, phylogenetic tree or a cladogram. Classification is constructed with this premise in mind, that all the descendants of a common ancestor should be placed in the same group (i.e. the group should be monophyletic). If some descendents have been left out, rendering the group paraphyletic, these are brought back into the group to make it monophyletic. Similarly, if the group is polyphyletic with members from more than one phyletic lines, it is split to create monophyletic taxa. This approach , known as **cladistics**, is practiced by **cladists**.
- **Evolutionary taxonomic classification :-** It differs from phylogenetic classification in that the gaps in the variation pattern of phylogenetically adjacent groups are regarded as more important in recognizing groups. It accepts leaving out certain descendants of a common ancestor if the gap are not significant, thus failing to provide a true picture of the genealogical history. The characters considered to be of significant in evolution are dependent on expertise, authority and intuition of

systematists. Such classification has been advocated by Simpson (1961) Mayr and Ashlock (1991). The approach, known as **eclecticism**, is practiced by **eclecticists.**

Classification not only helps in the placement of an entity in a logically organized scheme of relationships, it also has a great predictive value. The presence of a valuable chemical component in one species of a particular genus may prompt its search in other related species. The more a classification reflects phylogenetic relationships, the more predictive it is supposed to be.