Unit 6: Introduction to plant taxonomy
Topic - Identification, Classification, Nomenclature.

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Taxonomy is often defined as the ‘science dealing with the study of classification, including its bases, principles, rules and procedures’ (Davis and Heywood, 1963).

Simpson (1961) defined **systematics** as a ‘**scientific study of the kinds and diversity of organisms, and of any and all relationships between them**’. Taxonomy is a sub discipline of Systematics which is the study of those relationships.

Taxonomy began about 300 years b.c. by Theophrastus.

Refer to the figure provided to you in class/social media group.
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Basic Components (Principles) of Systematics

**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:

1- Visiting a herbarium and comparing unknown specimen with duly identified specimens stored in the herbarium.

2- The specimen may also be sent to an expert in the field who can help in the identification.

3- Using various types of literature such as Floras, Monographs or Manuals and making use of identification keys provided in these sources of literature. And further confirmed by comparison with the detailed description of the taxon provided in the literature source.

4- Taking plant photograph, uploading on some peer reviewed website, social media groups, as newsletter in mail-groups, etc. where someone can identify. Members of the fraternity could thus help each other in identification in a much efficient manner.

**Description:** It involves listing the features of a taxon by listing and recording the appropriate character states. An initial primary description also termed as ‘diagnosis’ differentiates a particular taxon from other closely related taxa. 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 (habit, stem, leaves, flower, sepals, petals, stamens, carpels, fruit, etc.). 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 a proper documentation of data. Whereas the fresh specimens can be described conveniently, the dry specimens need to be softened in boiling water or in a **wetting agent** before these could be described. Softening is often essential for dissection of flowers in order to study their details.
Nomenclature:

- Nomenclature is a formal system of names used to label taxonomic groups.

- It involves the determination of a correct name for a taxon by following different sets of rules for different groups of living organisms.

- Nomenclature of plants (including fungi) is governed by the rules and recommendations of the International Code of Botanical Nomenclature (ICBN) with regular updating every six years.

- The Botanical Code assigns a particular circumscription, position and rank that helps in differentiating a single correct name out of numerous scientific names available for a taxon.

- It also has a list of conserved names for certain group of taxa which prevents inconvenient name changes and confusions. Cultivated plants are governed by the International Code of Nomenclature for Cultivated Plants (ICNCP), slightly modified from and largely based on the Botanical Code.

- Names of animals are governed by the International Code of Zoological Nomenclature (ICZN); those of bacteria by International Code for the Nomenclature of Bacteria (ICNB), now called Bacteriological Code (BC).

- A separate Code exists for viruses, named the International Code of Virus Classification and Nomenclature (ICVCN). The International Committee on Taxonomy of Viruses (ICTV) authorizes and organizes the taxonomic classification of and the nomenclatures for viruses.
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 the first public expression of these objectives. The first draft was 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 twentieth century also saw the development of rankless **PhyloCode** based on the concepts of phylogenetic systematics. It omits all ranks except species and ‘clades’ based on the concept of recognition of monophyletic groups. The latest version of PhyloCode (PhyloCode4b, 2007) is also available on the web.

**Classification**

Classification is concerned with an arrangement of organisms into groups according to a lawful pattern on the basis of similarities.

The groups are, in turn, assembled from less inclusive to more inclusive group unless a single most inclusive group is attained. This gives a final sequence of arrangement of hierarchical categories from species to division.

Once established, a classification provides an important mechanism of information storage, retrieval and usage. This ranked system of classification is popularly known as the **Linnaean system**. Taxonomic entities are classified in different fashions:
Various systems of classification of plants, based upon varying characteristics, were proposed by the botanists. These systems of classifications are grouped into the following four categories:

1. **Artificial System for Plant Classification**
   - This system is used when plants are classified for the sake of convenience, using some arbitrary or easily observable characters, often irrespective of their affinity. The classification is called Artificial and the system of classification is termed as Artificial System. Early systems of classification were mostly artificial; for example, Linnaeus used only one character, the Cannaceae, which are similar in one respect only. Similarly, unlike plants such as Cacti and Cherries were placed together.

2. **Natural Systems for Kingdom Plantae**
   - By the end of the 1700s, most botanists realized that there were natural affinities among plants. The theory of evolution by Charles Darwin proposed that present-day plants have descended from those existing in ancient past through a series of modifications due to changing environmental conditions. This also suggests that all plants existing today are related to each other. Therefore, closely related plants should naturally be grouped together. A system of classification that reflects this is called Natural System. Such a system helps in identification of plants. This system superseded artificial systems, and most of the pre-Darwinian systems of classification are natural systems including that of Bentham & Hooker's system of classification. These systems were based upon morphological and reproductive characters.

3. **Phylogenetic System of Classification of Plants**
   - Systems of classification that try to reflect evolution are said to be Phylogenetic. As the impact of evolutionary theory became apparent, taxonomists started using evolutionary concepts into their classification. However, there was no abrupt departure from previous systems. The taxonomists tried to arrange the natural groups of plants in an evolutionary sequence from simple to the most complex. One of the advantages of phylogenetic systems is that it is a rich source of information as the identity of a plant is based upon its affinities and evolutionary relationships. Most of the post-Darwinian systems are phylogenetic, including that of Engler and Prantl's system of classification.

4. **Modern Systems of Botanical Classification of Plants**
   - At present, the classification of the plant kingdom continues to be modified as new information becomes available. These systems of classification are called Modern Systems. In these systems, modern information from the fields of paleobotany, biochemistry, anatomy, karyology, etc., have been used in classifying the flowering plants. Electron microscopy also helped in formulating modern systems. Systems of classification proposed by Robert Thorne (1968), Armen Takhtajan (1980), Arthur Cronquist (1981), and Rolf Dahlgren (1981) are modern systems.

Refer to the figure/text provided to you by mail/whatsapp. For explaining the complete hierarchical details for types of plant taxonomic classification, follow the instructions given to you in the orange box.

Next class we will start with unit 2.