

## **Introduction to plant taxonomy:**

### **6.1. Taxonomy and Systematics**

The word taxonomy derived from two Greek words- *taxis* (arrangement) and *nomos* (rules of laws). Plant taxonomy is a very rapidly growing branch of botany and also an invaluable tool for dealing with the problems of various branches. Taxonomy is as old as the language skill of mankind. It has always been essential to know the names of edible as well as poisonous plants in order to communicate acquired experiences to other members of the family and the tribe. Classifying plants in different categories has started since the advent of civilization, although taxonomy as a formal subject developed only after the famous work- *Theorie elementary de la botanique* by A. P. De Candolle in 1813.

The word '**taxon**' (taxa) was first used by a German Biologist Adolf Meyer in 1926 for animal groups. It was later proposed for the plant system in 1948 by Herman J. Lam. It is a taxonomic group of any rank, e.g. family, genus, species, subspecies, etc.

According to Lawrence (1951) taxonomy is the "science of identifying, naming and classifying plants". According to Davis and Heywood (1963), "taxonomy is the science dealing with the study of classification, including its bases, principles, rules and procedures". According to Heywood (1977), "one of the major roles of taxonomy is to produce a system of classification of organisms that best reflects the totality of their similarities and differences". So, taxonomy is the science that basically deals with the practise of naming and classifying organism (Davis and Heywood, 1963).

Another term systematics is commonly considered to be synonymous to taxonomy (Lawrence, 1951; Jones and Luschinger, 1979; Radford *et al.* 1986, etc.), although some authors do differ from them and prefer to draw a line of demarcation between them. According to recent and widely accepted views "systematics is the scientific study of the kinds and diversity of organisms, and of any or all possible relationships between them" (Simpson, 1961). It was recognized as a study which is concerned with the naming, classification and evolution among plants. According to Mason (1950), Camp (1951), Simpson (1961), etc. systematics mainly deals with the application and practise of taxonomy, while taxonomy is basically the theoretical and knowledge of classifying and identifying organisms. Blackwelder (1967) is of the opinion that systematic botany deals with the kinds of organismal diversity, their classification and evolution, while taxonomy is the practise dealing with the kinds of organism.

A more accepted definition of taxonomy proposed by Stace (1980) is "the study and description of variation in organisms, the investigation of causes and consequences of this variation, and the manipulation of the data obtained to produce a system of classification". This definition of taxonomy makes it to coincide with systematics. Although there are views which do not consider taxonomy and

systematics as synonymous, but most of the present day authors believe that the terms are synonymous. According to them it deals mostly with the diversity of organisms, their relationships and to provide a mean of classification to reflect their evolution.

## **6.2. Basic components of Taxonomy:**

Taxonomy is often defined as a science dealing with the study of classification, including its bases, principles, rules and procedures. The general purpose of taxonomy is to arrange elements, components, objects or taxa in a way so that it can make the most effective use of information and leads to the acquisition of data, information and knowledge.

The three fundamental components of taxonomy are identification, nomenclature and classification. Its main aim is to provide a convenient method of identification and communication about taxa and provide a classification which is based on natural affinities of plants as far as possible.

### **(a) Identification:**

Identification of a taxon is a prerequisite for any study based on it. It is the determination of a taxon based on overall similarities and differences with other taxa. Identification is generally done by comparing representative specimen of a given taxon with the help of key descriptions, illustrations, etc. The reason for the development of an identification system is to provide a means of easy, accurate, positive identification for each taxon.

The most widely used system of identification is mainly done with the help of herbarium specimens. Another important system is the use of keys (mainly dichotomous, sometimes polychotomous) present in different Floras (like Bengal Plants by David Prain) or e-Floras (like Flora of China). Polychotomous keys are mostly used in computer based systems or software. Some pictorial guide books are also available for the easy identification of some taxa of a particular region (like Trees of Delhi by P. Kishen).

Sometimes, the specimen may not match with the existing predetermined specimen and also can not be identified with the help of standard literature. In such a case it is taken to be new to science. Identification is thus also the assignment of additional unidentified plants to a correct rank once a classification has been established. It is the determination of a name for a specimen. This also implies its rank.

### **(b) Nomenclature:**

Once the taxon has been identified, it becomes necessary to give it a scientific name. Thus, nomenclature is the naming of a taxon correctly. It is a precise and universal system of rules used by all botanists of the world for naming the plants. Nomenclature of plants is governed by the Rules and Regulations of ICBN (International Code of Botanical Nomenclature), presently ICN (International

Code of Nomenclature for algae, fungi and plants). It is regularly updated (usually at an interval of six years) in International Botanical Congress organized by IAPT (International Association of Plant Taxonomy). To avoid disadvantageous nomenclatural changes of certain taxa, there is provision for conserved names (*nomina conservanda*). Nomenclature of cultivated plants is governed by International Code of Nomenclature for Cultivated Plants (ICNCP).

With the revolution of electronic media there is an attempt to communicate a common uniform code for all living organism – called Draft BioCode which was first proposed in 1995. The successive reviews were made in 1997 by Greuter *et al.* Another version of draft BioCode was proposed on January 1, 2000, but agreement to replace the existing *Codes* was not accepted unanimously. In 2011, a revised *BioCode* was proposed which instead of replacing the existing *Codes*, would provide a unified context for them, referring to them when necessary.

Some authors encountered problems in using the Linnean system in phylogenetic classification. So another *Code* was proposed in 1998, i.e. the *PhyloCode*, which would regulate phylogenetic nomenclature instead of the traditional Linnaean nomenclature. It omits all the ranks except species and “clades” and is based on the recognition of monophyletic groups.

### (c) Classification:

Classification is the arrangement of groups of plants with particular circumscription by rank and position according to artificial criteria, phenetic similarities or phylogenetic relationships. It includes the determination of position or rank for new as well as old taxa. Generally classification provides a system of named, circumscribed reference bases (taxa) for informational storage, retrieval and use.

The classification may be categorized into three basic types:

- a) **Artificial classification:** based on few arbitrary, easily available characters, such as habit, flower colour, number of stamen, etc.  
e.g.- Sexual system of Linnaeus (1753)
- b) **Natural classification:** uses characters from all possible sources and based upon overall resemblances and based upon overall resemblances, mostly gross morphology. It does not consider any evolution among group.  
e.g.- Bentahm and Hooker’s system of classification (1862-83).
- c) **Phylogenetic classification:** is based on the evolutionary descent of a group of organisms, the relationships depicted either through a phylogram, phylogenetic tree or Cladogram. The classification is constructed with the purpose that all the descent of a common ancestor should be placed in the same group, i.e. the group should be monophyletic.  
e. g.- Cronquist’s system of classification (1988).