INTRODUCTION TO PLANT TAXONOMY

INTRODUCTION

Angiosperms form the largest group of plant kingdom. It includes about 300 families, 12,500 genera and 2,50,000 species. They are found almost in every possible habitat and climate. Angiosperm is comparatively a recent and highly successful group of plants. It has probably originated in permo-triassic period and became dominant in upper mesozoic or cretaceous period (30 million years back). The rapidity with which angiosperms became dominant during mesozoic era is one of the most drammatic phenomena in the geologic history of earth and has no parallel elsewhere in the plant kingdom. Angiosperms are dominating the vegetation of earth today therefore, angiosperms are **The Ruling Dynasty of the Plant World**".

Angiosperms (Gr. angeion = vessel / receptacle; **sperma = seed) form one** of the **highly** evolved sub-classes **of spermatophyta / seed** bearing plants. **Angiosperms are** therefore **defined as "those flowering plants, in which seeds are enclosed in the fruit".**

'Angiosperms, show great diversity in their size, occurence, habit and habitat, life forms and span of life. Some angiosperms are minute aquatic forms such as **Lemna and Wolffia** (about 1.5 mm) while others are gigantic trees, 300 ft., or more tall. Banyan tree **(Ficus benghalensis)** may spread over large area of land. Angiosperms have formed luxuriant forest of the tropics. They are primarily land plants but even present in aquatic and marine water bodies. The great Amazon-water - Lily **(Victoria amazonica)** has a giant 2 meter long disc like leaves which can bear the 5 kg weight of a baby. Another interesting angiospermbcalled double coconut palm tree **Lodoicea maldivica** which has world's largest and heaviest seeds measuring 12 inches in length and nearly 3 ft circumference and with a a weight of about 40 pounds which looks like two coconut fused together. Angiosperms occur from sea level to highest mountain peaks. They are autotrophic but some are parasitic **(Cuscuta)**, Saprophytic **(Monotrapa)**, Carnivores **(Drosera, Utricularia),** Epiphytes **(Vanda, Dendrobium)** also.

PLANT TAXONOMY: DEFINITION AND PRINCIPLES

Taxonomy, perhaps the oldest discipline of biological science, It is **"The theory and practice of classification".** Taxonomy is defined as **"The study of the principles and practice of classification". OR**

"Taxonomy is lawful arrangement or classification of plants by certain rules".

The word taxonomy comes from two Greek words **(Taxis + nomos) Taxis** - arrangement / classification; **nomos** -law. The term Taxonomy was coined by great French Botanist A.P. De Candolle (1813) in his book **"Theorie Elementaire de la botanique".** Taxonomy account for the laws governing the arrangement or classification of plants. Taxonomy contributes to the orderly study of plants and to the systematization of our knowledge about them. The branch of botany in which taxonomy is the principle interest is called **Systematic Botany.**

The major aspects of taxonomy are -

i) Exploration of plants,

ii) Description of plants in botanical terms,

iii) Identification of plants,

iv) Nomenclature of plants,

v) Classification of plants and study of evolutionary trends in plant.

Taxonomy is considered as **"Queen of all biological sciences**. "It is the study of the rules, principles and practice of classifying plants. Taxonomy is heart of botanical knowledge and has great scope.

As per Lawrence (1951) Plant taxonomy is “the science of identifying, naming and classifying plants”. While according to Davis and Heywwod (1963) “Taxonomy is science that deals with the study of classification including its bases, principles, rules and procedures”.

OBJECTIVES, SCOPE AND IMPORTANCE OF TAXONOMY

Plants have great diversity at all levels. It necessitates arrangement of plants according to some definite scheme or rules which is a basic objective of plant taxonomy. It is a "Queen" of all Botanical branches as it establishes some lawful arrangement of plants. It is also "servant" because it provides basic information about plants and the similarities and differences among different plant groups. It thus provides first hand information about plants. Taxonomy prepares foundation for all sciences concerning plants. Taxonomy / systematic botany has following objectives (= real values), scope (= opportunities) and importance as below:-

A) Objectives of Plant Taxonomy

Taxonomy has following main objectives -

1) The main objective of taxonomy is to know variety of plants on the surface of the earth, in

addition to their names, affinities, geographical distribution, details of habit and economic importance.

2) The second objective of taxonomy is to have a reference system for plants, where the scientists can work with named entities such as species, genus and family.
3) The third objective of taxonomy is to demonstrate the manifold diversity found in plant kingdom and their relation to evolution of plants. The complete knowledge of plant can be made only after systematic studies about individual plant.
4) The fourth objective of taxonomy is to have organized nomenclature; according to International Code of Botanical Nomenclature". Every plant is given a binomial name e.g. Mango is named as **Mangifera indica** L. The first part of the name indicates **Genus** while the second part refers to **species.** It is followed by an authority i.e. the person who described first and named it is **Linnaeus** represented by L.
5) The fifth objective of taxonomy is **documentation.** The information gathered from various studies is properly documented in floras, manuals, monographs, checklists museums, herbaria etc.

B) Scope and Importance of taxonomy

The science of taxonomy takes into consideration description, relationships, names, distribution of plants which is foundation of entire plant kingdom. It has great scope as below -

1) Taxonomic studies have great scope in forestry. Every type of tree of the forest must be named, classified to understand its importance, distribution and abundance.

2) Taxonomic studies have scope in agriculture and horticulture. To carry out hybridization for development of new varieties, the details of all species of a genus is prerequisite. The foreign seeds and plant are introduced with sufficient knowledge of systematic botany.

3) The knowledge of taxonomic botany is highly essential to know plant ecology. Ecologist must know names of the plants, their relationship to habitat and environment to understand vegetation types.

4) The knowledge of systematic botany is highly essential for conservation of soil. Ecologists properly trained in systematic botany select proper species of plants for conservation of soil; to prevent soil erosion.

5) The sound knowledge of systematic botany is highly essential to trace the origin of plants.

6) Plants provide basic things for life. Systematic botany provides basic knowledge of plant life, all forms of species in a particular genus so that scientists have continuous thirst to know plant species over the world. A host of life saving medicines may be available through systematic studies on plant species which is finding great scope in modern world.

ASPECTS OF TAXONMY

The science of taxonomy has three main functions- identification, nomenclature and classification. Its main aim is to provide a convenient method of identification and communication about a taxa and provide a classification which is based on natural affinities of plants as far as possible. The word taxon (taxa) was first suggested by German biologist Adolf Meyer in 1926 (for animal group) and in 1948 it was used for the plant system by Herman J. Lam. It a taxonomic group of any rank e.g. family, genus, species, subspecies etc.

A) Identification

It is a basic prerequisite for any study. It is the determination of taxon based on overall similarities and differences with other taxa. Identification is carried out by comparing representative specimens of given taxon with the help of key descriptions, illustrations etc. Many times, the specimen may not agree or compare with the existing predetermined specimens. In such a case, it is taken to be new to science.

Identification is thus 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.

For correct identification of plant specimen, the specimen may be send to the expert in the field. It may be achieved by using various types of literature like floras, manuals and by using identification keys it may be confirmed.

B) Nomenclature

Nomenclature deals with the determination of a correct name for a taxon. It is a second step after identification of plant specimen that correct scientific name (as per ICBN rules) which is called binomial system of nomenclature. It is a precise and universal system of rules used by all botanist of the world for naming newly discovered plants.

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. A new specimen is named as new taxon as per ICBN rules regulations and recommendations.

C) Classification

Plants are classified as per similarities and differences. They are placed into small or large group and then arranged in a sequential manner into categories according to their levels. Each category given a name following the rules of nomenclature.

Thus similar looking plant specimens are classified into a single species and similar species under a genus and several genera into a family and so on. Classification is the arrangement of groups of plants with particular characteristics by rank or position according to certain criteria and placing them into a taxonomic hierarchy or level. It includes the determination of position or rank for new taxa as well as old taxa. In all there are three systems of classification are not mutually exclusive but often overlap in practice:-

1) Artificial system- System is based on one or few characteristics that are easily observable e.g. habit, color, number of stamens etc. Linnaeus system is of artificial type.
2) Natural system-This system takes into account all gross morphological characters e.g. Bentham and Hooker's system
3) Phylogenetic system- This system is based on overall process of evolution and simplicity to complexity of the of the characters present in the plant specimen. e.g. Engler and Prantl's system or Hutinsons system.

CONCEPT OF SYSTEMATICS

The term Systematics has been derived from the Latin word Systema (organized whole) and first used in the title of publication by Linnaeus in 1735 called "**Systema naturae**". The term **Systematics** also first appears in his publication "**Genera Plantarum**" in 1737. According to Simpsons (1961) Systematics has been defined as-

"Scientific study of the kinds and diversity of organisms and of any all relationships between them".

Stace (1980) defined Systematics as "The study and description of variation in organisms, the investigation of causes and the manipulation of the data obtained to produce a system of classification".

Systematics is thus scientific study of the kinds and diversity of plants and the relationship among them any. It not only includes traditional activities of taxonomy but it includes

investigation of evolution, speciation, natural variation, reproductive biology and a variety of biological phenomenon.

Radford (1986) defined Systematics as "Systematics is the study of phonetic, genetic and phylogenetic relationship among taxa".

The science of Taxonomy and Systematics passes through-

1) **The pioneer or exploratory phase** - It is collection and discovery of different members of taxon by exploration in different parts of the world.
2) **The cosolidation phase**- this phase is based on morphology of plant specimen called synthetic phase of systematics. Plant material is studied on field level and herbarium specimen level. Thus all new investigation about plant taxon, it is described that helps for monographic studies.
3) **The experimental or biosystematic phase**- It is concerned with collection of vast knowledge about plant specimen or a taxon. The analysis of taxon is carried out on the basis of geographical location, variation, chemical studies, cytogenetic studies, physiological features, fertility relationships, evolutionary patterns and other population studies.
4) **The encylpadic or hootaxonomic phase-** This is coordination of all types of studies of a taxon. It involves analysis of data to develop correct classification systems based on phylogenetic relationships.

Thus modern systematics is the more advanced called molecular systematics, numerical taxonomy, chemotaxonomy, biosystematics based on breeding behavior, chromosomes and variation in plants, computer use in analyzing systematics data.