Characteristics of Angiosperms:

Angiosperms are vascular plants with stems, roots, and leaves. The seeds of the angiosperm are found in a flower. These make up the majority of all plants on earth. The seeds develop inside the plant organs and form fruit. Hence, they are also known as flowering plants.

Angiosperms are the most advanced and beneficial group of plants. They can grow in various habitats as trees, herbs, shrubs, and bushes.

Angiosperms have diverse characteristics. The important characteristics of angiosperms are mentioned below:

- All plants have flowers at some stage in their life. The flowers are the reproductive organs for the plant, providing them with a means of exchanging genetic information.
- The sporophyte is differentiated into stems, roots, and leaves.
- The vascular system has true vessels in the xylem and companion cells in the phloem.
- The stamens (microsporophyll) and the carpels (megasporophyll) are organized into a structure called the flower.
- Each microsporophyll has four microsporangia.
- The ovules are enclosed in the ovary at the base of the megasporophyll.
- Angiosperms are heterosporous, i.e., produce two kinds of spores, microspore (pollen grains) and megaspores.
- A single functional megaspore is permanently retained within the nucellus.
- The pollen grains transfer from the anther to stigma and reproduction takes place by pollination. They are responsible for the transfer of genetic information from one flower to the other. The pollen grains are much smaller than the gametophytes or reproductive cells present in the non-flowering plants.
- The sporophytes are diploid.
- The root system is very complex and consists of cortex, xylem, phloem, and epidermis.
- The flowers undergo double and triple fusion which leads to the formation of a diploid zygote and triploid endosperm.
- Angiosperms can survive in a variety of habitats, including marine habitats.
- The process of fertilization is quicker in angiosperms. The seeds are also produced quickly due to the smaller female reproductive parts.
- Presence of well developed flowers with specialized floral whorls like calyx, corolla, androecium and gynoecium.
- All angiosperms are comprised of stamens which are the reproductive structures of the flowers. They produce the pollen grains that carry the hereditary information.

- The carpels enclose developing seeds that may turn into a fruit.
- The production of the endosperm is one of the greatest advantages of angiosperms. The endosperm is formed after fertilization and is a source of food for the developing seed and seedling.
- Classified into two classes- Dicotyledon and Monocotyledon
- Pollination by wind, water, birds, insect animals, etc.

Taxonomy

The term **"taxonomy"** originates from two words, ***"taxis"*** meaning arrangement and ***"nomos"*** meaning laws. **Plant taxonomy** deals with the classification of plants according to certain set of rules. The term taxonomy was coined by the Swiss botanist **A. P. de Candolle (**1813) in his book **"Théorie élémentaire de la botanique".**

Plant taxonomy can be defined as the branch of botany which deals with characterisation, identification, classification and nomenclature of plants based on their similarities and differences.

Principles of Plant Taxonomy:

Taxonomy is a functional science. The direction and character of its functions are governed by principles. The principles developed with the increase in knowledge of plants themselves.

The principles are as follows:

- **Descriptive taxonomy**: It developed in the nineteenth century, mainly concerned with the observation of similarities and differences in the gross morphological characters of plants known at that time. This began with the works of Tournefort, de Jussieu and Linnaeus. In this principle the plants were described and classified on the basis of morphological characters.
- **Experimental taxonomy**: This principle was introduced in the 20^{th} century. Primary importance was given to morphological distinctness and affinity, but it was influenced appreciably by findings of cytologist, geneticist, physiologist and embryologist.
- **Phylogeny:** Modern taxonomists of the 20^{th} century used the phylogeny as the main principle of plant taxonomy. It is the evolutionary history of a taxon. By this principle attempt is made to account for the origin and development of species. To determine the origin of species a taxonomist has to depend on the science of palaeobotany.

The goals of plant taxonomy are:

Identification:

Identification or determination is recognizing an unknown specimen based on its characteristics and with an already known taxon and assigning a correct rank and position in a classification. It can be achieved by visiting herbarium, using various type of literature such as floras, monograph and identification keys.

Characterisation:

To describe all the characteristics of the newly identified species. Listing of the features by recording the appropriate characters (diagnostic characters).

Classification:

Placing and arranging the known species into different groups or taxa according to similarities and dissimilarities. The process of classification includes assigning appropriate position and rank to new taxa. Rank system of classification is popularly known as the Linnaean system.

Nomenclature:

Giving the scientific name according to the convention. It deals with the determination of correct name for a taxon. Nomenclature of plant is governed by International Code of Nomenclature (ICN).

SYSTEMATICS

The term systematics is derived from the Latinised Greek word and 'systema' means 'together'. The systematics partly overlaps with taxonomy and originally used to describe the system of classification prescribed by early biologists. Linnaeus applied the word "Systematics" in the system of classification in his famous book 'Systema Naturae' published in 1735.

Scientific study of the kinds and diversity of organisms and all relationships between them (Simpson 1961). Radford (1986) defined systematics as "the study of phenotypic, genetic and phylogenetic relationship among taxa"

But often, both taxonomy and systematics are considered synonymous (Lang 1959, Turrill 1964).

In Greek, Taxonomy is "arrangement by rules" and Systematics is "to put together"

Objectives

- To prepare a scheme of classification that provides phonetic, natural or phylogenetic relationships among plants.
- To establish a suitable a suitable method for identification, nomenclature and description of plant taxa.
- To provide an inventory of plant taxa that suits local, regional and continental needs.
- To create an understanding of the evolutionary processes.
- To train the students of plant sciences in regard to the diversity of organisms and their relationship with other biological branches.

Goals

- To acquire the fundamental values of plants systematic.
- To know about the basic concepts and principles of plant systematic.
- To develop the knowledge of applicability of plant studies.

The systematics includes both taxonomy and evolution. Taxonomy includes classification and nomenclature but inclines heavily on systematics for its concepts. So study of systematics includes a much broader aspect that includes not only morphology and anatomy but also genetics, molecular biology, behavioural aspects and evolutionary biology.

The recent approach to the science of biology has added a new dimension to the science of classification and the new systematics has emerged as a synthesis of progress in all the major disciplines of Biology.

Branches of Systematics:

The new systematics may be divided into following branches:

- **Numerical systematics:**
  This type of systematics is based on bio-statistical method in identification and classification of plants. This branch is called biometry.

- **Biochemical systematics:**
  This branch of systematics deals with classification of animals on the basis of biochemical analysis of protoplasm.
- **Experimental systematics:** This branch of systematics deals with identification of various evolutionary units within a species and their role in the process of evolution. Here mutation is considered as evolutionary unit.

Application of systematic in biology

- Systematics is the study of diversity of organisms including past and present and relationships among living things. Relationships are established by making cladograms, phylogenetic trees and phylogenies.

  The phylogeny is the evolutionary history of an animal or plant, for a taxonomic group. Phylogenies include two parts—the first part shows the group relationships and the second part indicates the amount of evolution. Phylogenetic trees of species and higher taxa are established by morphological, physiological and molecular characteristics, and the distribution of animals and their ancestors are related to geography. In this way the systematics is used to understand the evolutionary history of organisms.

- The field of systematics provides scientific names of the organisms, description of the species, ordering the organisms into higher taxa, classification of the organisms and evolutionary histories.

- Systematics is also important in implementing the conservation issues because it attempts to explain the biodiversity which is related to different kinds of species and could be used in preservation and protect the endangered animals and plants. The loss

of biodiversity is related to the extreme harmful of the existence of mankind. The unchecked human population destroy different kinds of plants and animals for food and other factors.

- The destruction or suppression of harmful pests or animals by the introduction and increase of their natural enemies is called biological control.