

1.1A Taxonomy and Systematics :

In contrast the term *systematics* was treated by classical botanists as related to the classification of plants within a particular nomenclatural system with emphasis on their evolutionary relationships. However, taxonomy and systematic botany are considered by many botanists to denote the same thing and are used interchangeably. According to H. J. Lam (1959) and W. B. Turrill (1964) these two terms are synonymous.

H. L. Mason (1950) have treated taxonomy as a broad field of biological science which includes four main subjects of discussion such as : (i) comparative study of organisms i.e. systematics, (ii) taxonomic systems, (iii) nomenclature and (iv) documentation. On the other hand G. G. Simpson (1961), V. H. Heywood (1967), E. Mayor (1969) and H. H. Ross (1974) consider taxonomy as a part of systematics. According to O. T. Solbrig (1966), taxonomy and systematics have different concerns, the taxonomy includes classification and nomenclature, but mainly dependent in systematics for its concept.

1.2 Aims and Objects of Systematic Botany i.e. Plant Taxonomy :

Plant taxonomy i.e. systematic botany has the following purposes : (i) to classify all kinds of plants under plant kingdom, (ii) to identify, name and arrange the plants in a recognised system of classification showing phylogeny and relationship among groups of plants,—this may be done either on gross morphological characters or cytological, embryological evidences of plants ; former method is known as *classical-* or *alpha taxonomy* and latter *experimental-* or *omega taxonomy*, and also *biosystematics*, (iii) study of distribution and habitat-characters of different kinds of plants and their information to the scientific knowledge of the inventory of world's plant resources and (iv) organised reconstruction of the plant kingdom including changes in nomenclature.

Plant taxonomy is a very important branch of botanical science and fact-finding field and needs besides the study of gross morphology other sections of botany such as anatomy, embryology, cytology etc.

Taxonomists of present age put considerable value on the importance of cytogenetic factors in delimiting species and its elements ; data on these characters have been found to be of great value.

Vegetative and floral anatomy at present have proved of great significance in the inter-relationship of taxa and their consequent primitiveness, e.g. some members of the Amentiferae (Casuarinales, Juglandales etc.) are not very primitive in respect of phylogeny but more or less advanced. Particularly the wood anatomy reveals, in addition to morphological data, many facts in determining inter-relationship of those taxa and their consequent taxonomic position.

Taxonomy is also indirectly concerned with the distribution of plants ; knowledge of plant distribution is pertinent to the determination of geographic areas of origin of species, genera and often families—all such factors are valuable in determining matters of general relationship. The study of distribution and geography of plants i.e. ecological plant geography brings taxonomy in the field of phytogeography.

Embryology is no less important in solving the problems of controversies regarding taxonomic position of families, e.g. Cactaceae which is doubtless near to Ranales and bears affinity with centrospermean members (Chenopodiaceae etc).

The science of plant taxonomy i.e. systematic botany has been proved as a synthesis of four interrelated fields as given below :—

I. *Systematic botany i.e. plant taxonomy*, the fact-finding-field includes cytological, anatomical, embryological studies as well as any other sectional studies applicable to the problem.

II. The *taxonomic system*, based on the facts that have been observed and it includes (i) taxonomic concepts of plant-groups or taxa, (ii) concepts of evolutionary sequence of characters ; as at present arrangement of taxa is done according to the priority of evolution which forms the fundamentals of phylogenetic classification and (iii) description of taxa.

III. *Nomenclature*, the method of naming plants, is based on the rules of international code of botanical nomenclature. This permits only a single valid name for each kind of plant, it disapproved other synonyms.

IV. *Preservation of specimens*—This includes keeping of living or fossil plant specimens in a museum or dry specimens on cartridge paper sheets (herbarium sheets) including type specimens (the specimens on which names and concepts of species and taxa below species are originally based—holotypes) and drawings and figures which may sometimes be used in lieu of type specimens in a particular herbarium.

By using all the above four fields of taxonomy, a mass of information regarding plant populations and their units, their means of perpetuation, dispersal, their affinities and evolutionary tendencies may be known.

1.3 Units of Classification i.e. Major and minor categories in classification : Each unit of classification is termed as *taxon* (plural : *taxa*). These units of classification are established by the international code of botanical nomenclature. The plant kingdom forms the largest unit i.e. taxon and which is successively subdivided into smaller units (taxa) as follows :—

¹Kingdom—*Plant Kingdom*

Sub-kingdom—*Embryophyta* (the embryo plants)

Division (=Phylum)—*Tracheophyta* (the vascular plants)

Subdivision (=Subphylum)—*Pteropsida* (the ferns and seed plants)

Class—*Angiospermae* (flowering plants)

Subclass—*Dicotyledoneae* (flowering plants with 2 cotyledons in embryo)

Order—*Rosales*

²Family—*Rosaceae* (Rose family)

³Genus—*Rosa*

species—*Rosa setigera*

varieties—

forma—

clone—

SPECIES—It is the basic unit i.e. taxon of classification, subordinate to *genus*. In most cases species denotes group of closely similar individuals breeding among themselves but not with others. In other words, species may be defined as “the perennial succession of similar individuals perpetuated by generations.” Therefore a species is composed of similar individuals which resemble one another closely in morphological characters and which have descended from a common ancestor. Specific epithet i.e. taxon is now-a-

¹ For example, Tippo's system of classification (*Chronica Botanica*, 7, (5) : 203-206, 1942) is taken into consideration.

² Family is divided further into subfamily, tribe etc.

³ Genus is also divided into subgenus, section, subsection, and series to establish affinities of the species—those divisions of genus are not given in the above table.

days always spelled with a small initial letter. This epithet may be (a) an adjective with the generic name in gender (e.g. *Rosa alba*) or referring to a locality from where the species was discovered (e.g. *Ulmus americana*); (b) a noun in apposition but not always agreeing with the gender of generic name, e.g. *Pyrus malus*; (c) a noun in the genitive singular which occurs when the species is named in honour of a person and it may be of either masculine or feminine gender e.g. *Intsia hookerii*, named after Sir J. D. Hooker and (d) a general name in genitive plural, generally indicating something about the habitat of the species e.g. *Carex paludosum*—paludosum means of the swampy area. The name of a species is a binary combination consisting of the name of the genus followed by a single specific epithet. If an epithet consists of two or more words, these must be united or hyphenated.

GENUS—It is the next higher taxon above the species, composed of one or more species. A *genus* is the grouping or assemblage of related species which resemble one another in more characters in common than they resemble one another species. Generally, the genus is recognisable by one or more important characters of gross morphology. Generic name is always a noun and is spelled with a capital initial letter. The names of genera may be masculine, feminine or neuter in gender. The name of a genus is a substantive in the singular number, or a word treated as such.

FAMILY—It is the largest and readily recognisable taxon composed of one or more related genera—the similarities among the genera in a family are much greater than their differences. Sometimes a family is only characterised by the characters of reproductive structures (e.g. Leguminosae, Cucurbitaceae etc.) or the inflorescence (e.g. Umbelliferae, Gramineae, Compositae, Araceae etc) or by combination of several other characters in addition to those characters. The name of almost all the families ends in *-aceae* e.g. Solanaceae, Apocynaceae, Scrophulariaceae, Cucurbitaceae etc.; however there are eight families whose names end in *-ae*; such families together with their suggested alternative names (according to Art. 18.5 of International code of Botanical Nomenclature) are: Palmae (Arecaceae), Gramineae (Poaceae), Cruciferae (Brassicaceae), Leguminosae (Fabaceae), Guttiferae (Clusiaceae), Umbelliferae (Apiaceae), Labiatae (Lamiaceae) and Compositae (Asteraceae).

Botanists are authorised to use as alternatives the appropriate names when the Papilionaceae are regarded as a family distinct from the remainder of the Leguminosae, the name Papilionaceae is conserved against Leguminosae. The alternative name is Fabaceae. This is a unique exception.

The name of a family is a plural adjective used as a substantive. For example, Asteraceae is a highly advanced family; the correct way is to say "Asteraceae are a highly advanced family".

Subfamily is the major subdivision of the family. This taxon is used specially when a family is large, consisting of many genera. The division of such a large family into subfamilies is based on the common character or characters of the component genera. The name of a subfamily is a plural adjective used as a substantive; it is formed by adding the suffix *-oideae* e.g. subfamilies Festucoideae (from the genus *Festuca*) and Panicoideae (from the genus *Panicum*) of the family Gramineae; Phyllanthoideae (from the genus *Phyllanthus*) and Crotonoideae (from the genus *Croton*) of the family Euphorbiaceae; Mimosoideae (from the genus *Mimosa*), Caesalpinioideae (from the genus *Caesalpinia*) of the family Leguminosae etc. The subfamily Papilionatae of the family Leguminosae is the exception to the above rule because the name of that subfamily is not based on any genus.

ORDER—Order is the major taxon, it stands above the family but below class and subclass. Generally an order is composed of one or several families related to each other in one or more phyletically important characters. The names of orders end in *-ales*, e.g. orders Ranales, Rosales, Magnoliales etc. Names of few orders, still in use by some botanists, are exceptions to this general rule e.g. order Liliiflorae, Guttiferne, Campanulatae etc.

SUBCLASS, CLASS, DIVISION, SUBDIVISION ETC.—Orders are grouped into subclasses, subclasses into classes, classes into subdivisions, subdivision into divisions and so on until plants are placed in the final taxon—the plant kingdom. The endings of divisions should be *-phyta*, of subdivisions or subphyla *-phytina* and of classes and subclasses of vascular plants *-opsida* and *-idae* respectively.

INTRA- OR INFRAGENERIC UNITS i.e. TAXA—*Subgenus* (abbreviated *subg.*), *section* (abbreviated *sect.*), *subsection* or *series* etc. Sometimes the taxon *subgenus* is used between the genus and the section, this taxon is used generally when the genus is *naturally divisible* into a few major groups. Subgenera may be further divided into *sections*. Each section again may be divided into *subsection* or *series* if the section is large containing many species.

The name of a subgenus is a combination of a generic name and a subgeneric epithet connected by a term denoting the rank; for example subgenus *Drabella* under the genus *Draba*. But the subgenus containing the *type genus* i.e. the type of a generic name, *must bear* the name of the subgenus *unaltered*—for example subgenus *Croton* under the genus *Croton* (here *Croton* is the type genus), subgenus *Astragalus* under the genus *Astragalus* etc. Names of sections are given in the same manner as names of subgenera. In case of subsections or series, the names in plural adjectives agreeing with generic name in gender are preferred and the names are spelled with capital initial letter.

INTRA- OR INFRASPECIFIC UNITS i.e. TAXA—Intraspecific taxa, in descending order of magnitude, are *subspecies* (abbreviated *ssp.* or *subsp.*), *variety* (abbreviated *var.*), *forma* (abbreviated *f.*), and *clone* (abbreviated *cl.*). The rank of these intraspecific taxa is below that of species. Subspecies has been defined variously—according to some authors subspecies is defined as “*incipient species* whose evolutionary development has not progressed to the extent of its being markedly and consistently distinct from its parent species”. According to others, subspecies is a subdivision of a species which has its own distribution and which is not sufficiently morphologically or genetically distinct so that it may be given the rank of a species.

Variety is another taxon subordinate to subspecies, of course where subspecies used; otherwise variety is subordinate to species. Sometimes clear distinction between subspecies and variety is not possible, hence the taxon ‘variety’ of some authors is treated as subspecies by others or vice versa.

A *forma* is a minor variant of a species which is caused due to simple character variation. The *clone* is subordinate to variety, this term is generally restricted for horticultural types e.g. the so-called garden ‘varieties’ of rose, gladiolus etc. Scientific names of these intraspecific taxa are given in the same way as those of species. The name of an intraspecific taxon is a combination of the name of a species and an intraspecific epithet connected by a term denoting its rank. For examples, *Andropogon ternatus* subsp. *macrorhrix*; *Viola tricolor* var. *hirta* etc.