Section B and C

Volume-16

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9. DIVERSITY OF LIFE FORMS

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A. PRINCIPLES AND METHODS OF TAXONOMY

SPECIES CONCEPT

The basic unit of taxonomy is the species. The definition of species is a controversial and much discussed topic. The idea of a species has long history dating back to Aristotelean logic and philosophy and according to Linnaeus species were divinely created which are discrete and true breeding. Species are made up of groups of individuals, i.e., populations. The whole controversy of the definition of a species lies in attempting to define what the species "really is" in all contexts, according to Mayr (1957).

Classification of Species

According to Mayr (1957), Beaudry, (1960), two main classes of species are recognized:

1. Taxonomic Species. This type of species is the orthodox, classical typological, morphological, morphogeographical concept adopted until recently, i.e. upto 1930's.

2. Biological Species. This type of species is the most modern concept of species, including the biosystematic, genetical, cytogenetical, non-dimensional, and multidimensional etc.

Taxonomic Species Concept

By the use of correlated morphological discontinuities in a number of features groups of individuals can be clearly distinguished as taxonomic species. According to Du Rietz (1930) the species is "*the smallest natural populations permanently separated from each other by a distinct discontinuity*". This definition embraces natural variation among individuals which is a Darwinian concept of species unlike Linnaeus' typological sense of species definition. According to Linnaeus one individual can be taken as the species which is morphologically misleading.

It is intended as a generally applicable concept and takes into account all available evidence, morphological, geographical, cytogenetic, etc. but insists that the species so. recognized must be delimited by morphological characters. Taxonomic species are recognized by type method or type concept.

Demerits of Taxonomic Species

1. It is highly subjective and incapable of precise definition. It has to be learned by experience. The subjectivity or the arbitrariness of the delimitation of taxonomic species can be minimized by employing as many numbers of correlated characters based on discontinuous variation and by using biometrical techniques for population analysis.

2. Taxonomic species is often criticized by biosystematists that it is less important biologically than species defined in terms of gene pools and sterility barriers. Despite its apparent subjectivity, the morphological-geographical manner of delimiting species has been widely successful.

Biological Species Concept: According to Grant (1957) it is defined as "a community of cross-fertilizing individuals linked together by bonds of mating and isolated reproductively from

other species by barriers to mating". According to the modem taxonomists there are certain objective discontinuities which are caused by restriction of gene flow between actually or potentially interbreeding populations.

Simpson (1961) distinguishes between the definition of the species in genetical terms and its recognition in morphological terms. In otherwords, morphology provides the evidence for putting the genetical definition into practice. But difficulties arise: morphologically distinct populations may be interfertile and conversely morphologically uniform populations may contain more than one reproductive isolation. Hence, the morphological-geographical sense for orthodox classification of species is inevitable since the biological species concept is largely unrealistic and impractical.

Demerits

1. Much of the definitions of biological species are deceptive and elusive. Reproductive isolation may be interpreted in a strict sense as meaning internal genetic or genetic-physiological mechanisms. But genetic differentiation and sterility changes do not necessarily go hand in hand.

2. The fertility-sterility test is not an all-or-nothing criterion. Every degree of interfertility can occur between populations, and even between different levels of polyploidy, the barriers are not absolute. This test can be applied only to a very small sample of populations which is a drawback.

3. In allopatric populations the fertility-sterility test becomes largely of theoretical value. The fertility-sterility test has no meaning in predominantly interbreeding or apomictic populations.

4. Reproductive isolations evolve and function at different intensities and two populations may be effectively isolated yet exchange genes through the intermediary of a third population.

5. The necessary cytogenetical and experimental knowledge is only available for a minute fraction of the world's flora.

HIERARCHIAL TAXA

According to Grant (1963) natural subordination on hierarchy is the result of evolutionary divergence. When an ancestral form gets split up into subgroups, which undergo subsequent divergence through time, the modified descendant's resemble each other in decreasing degrees. The degree of resemblance professionally decreases as we pass on to different species of the same genus, genera or the same family, families of the same order, and so on.

Taxonomy establishes such relationships among individuals or biological species. This biological classification is called "taxonomic hierarchy". This can be illustrated by a "nesting box system" a box-within-box arrangement made by Jeffrey (1968) as shown in figure. The outermost box represents a family and includes smaller boxes, the genera, (A-C) with varying number of species signifying the size of the genera. Taxonomic groups exist in nature and terms such as 'categories', 'ranks' are relative terms often used to denote taxonomic hierarchy, or to taxonomic groups. The basic unit in classification is the 'species' and the whole super structure of taxonomic hierarchy revolves round this. As one goes from one group to another higher rank

in hierarchy the number of individuals decreases with a consequent increase in the range of variation. At lower levels, the number is less but, they have more in common. At higher levels, the number is higher but, they are less similar.

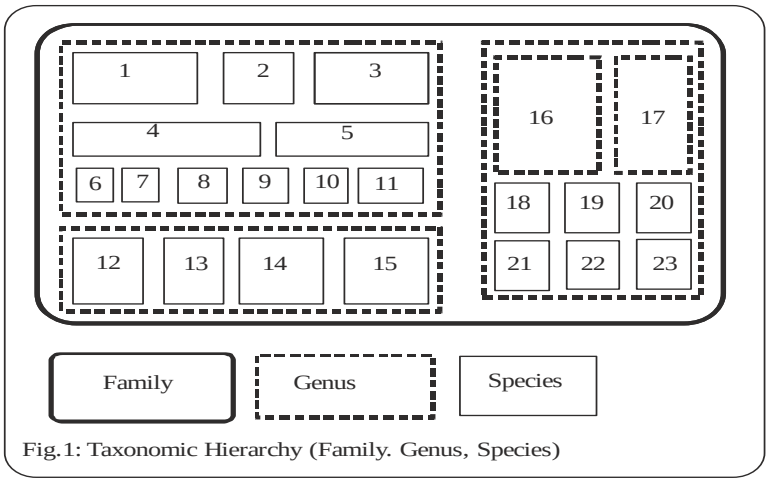

Fig.1: Taxonomic Hierarchy (Family. Genus, Species)

DIVISION	Angiosperm
CLASS	Magnoliopsida
SUBCLASS	Caryophyllidae
ORDER	Caryophyllales
FAMILY	Caryophyllaceae
TRIBLE	Polycarpae
GENUS / SPECIES	*Polycarpa corymbosa*

The major categories and the endings of their names as stipulated in the international

Categories	**Endings of Names**	**Example**
Kingdom		Plantae
Division	-phyta	Magnoliophyta
Sub - division	-icae	Pinicae
Class	-opsida	Magnoliopsida
Sub - class	-ideae	Magnolideae
Order	-ales	Geraniales
Suborder	-ineae	Geranineae
Family	-aceae	Geraniaceae
Subfamily	-oideae	Rosoideae
Tribe	-eae	Roseae
Genus		*Malva*

Subgenus	Ranunculus subg. batrachium
Section	Rosa section Canina,
Subsection	villosae
Species	*Silene dioica*
Sub species	*ssp. zeylanica*

CONCEPT OF GENUS

Davis and Heywood recognized genus on the basis of (a) naturalness (b) delimitation of closely related genera, and (c) practicability of keeping them distinct of including them in other genera. The concept of monophyletic taxa has been quite useful in determining the naturalness and demarcation between genera.

CONCEPT OF FAMILY

A family is composed of one or more genera which are related by common characters, ideally, they have to be natural and monophyletic. Certain insectivorous families like Droseraceae, Nepenthaceae and Lentibulariaceae are characterized by very distinctive insect-trapping mechanisms of their own. Cactaceae can be recognized by the cactoid habit, though this character is shared by some *Euphorbia* species.

Most families are characterized by flower and fruit characters like Asteraceae, Apiaceae, and Fabaceae. Walters (1961) has recognized into two categories, viz., definable and indefinable.

Families like Brassicaceae, Apiaceae, Asteraceae, Acanthaceae and Poaceae are definable and are very homogeneous. Indefinable families include great diversity of structure and are not as distinctive as the definable families, like Ranunculaceae, include diverse floral structure, vegetative structures which are heterogeneous. Families like Lamiaceae and Verbenaceae are homogeneous inspite of diversity.

Categories above family level

Categories above the family level, commonly used in taxonomic hierarchy are order (Co-hort). Class, Division, Kingdom and their subdivisions. As one goes higher and higher in the taxonomic hierarchy, the diversity increases, along with the degree of subjectivity in classification. Ideally, all such groups should be monophyletic. But, rank often depends upon the extent of morphological discontinuity.

BIOLOGICAL NOMENCLATURE

The function of nomenclature is to apply a correct name to a taxon. The taxon has to be identified first and then a proper name should be applied to it. Hence, plant nomenclature and plant identification are closely related and are overlapping.

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