CYTOTAXONOMY

MBOTCC-6 M. Sc. Sem-II
Unit-III (2018-20)

Introduction:

Cytotaxonomy is a specialized sub-discipline of Taxonomy which uses the diverse characteristics of somatic chromosomes and some other cellular structures in resolving controversial systematic positions of different taxonomic ranks, and in the reassessment of phylogenetic relationships where morphological traits largely fail to reach widely acceptable conclusions. The number, structure and behaviour of chromosomes are of immense significance in modern taxonomy, with chromosome number being the most widely used feature. Somatic chromosome number ($2n$) is primarily used in taxonomic treatment of species dealing with a polyploid series (3x, 4x, 5x, etc.) in which the chromosome number in a basic set (x) is often quoted. Centromeric position, chromosome arm ratio, meiotic terminalization co-efficient, etc. also offer valuable taxonomic clues in establishing evolutionary relationships. Thus cytological data are regarded as more reliable attributes in strengthening the foundations of taxonomy based on simple morphological features. Biosystematics employs data from various disciplines to render classical taxonomy a more reliable and strong foundation.

Cytotaxonomic Approach in Systematics:

1. The Genetic Compliment

(i) DNA is the essential hereditary material. It is believed that the heterochromatic segments are associated with differences in the metaphase thickness.

(ii) Even now, it is not known that a given quantity of DNA and protein is

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Stimulated at Mitosis to become distributed into a particular member of chromosomes.

2. DNA Hybridization

(i) Hybridization between single stranded DNA components from different origins provides a physico-chemical means for assuming genetic relatedness among the species.

(ii) It is known that DNA is extracted from organisms and made to hybridize in vitro with the cell lines of other organisms.

(iii) DNA matching techniques are much easier for solving complex taxonomic problems. Such taxonomic implications have been studied by Hoyer et al. (1960).

3. Karyological Studies

(i) Chromosomal and karyological studies have been extensively used by plant taxonomists.

(ii) Karyotype characteristics including chromosome number, size and morphology constitute a definite and constant character of individual species.

(iii) Number, shape and banding patterns of chromosomes can be determined by using various dissecting and staining techniques.

(iv) Chromosomal taxonomy can be much useful both in determining the phylogenetic relationships of the taxa as well as in the segregation of sibling cryptic species.

Significance of Cytotaxonomy:

(i) Cytotaxonomy provides minute variations among individuals which can be used in comparative taxonomic treatments and in determining phylogenetic relationships where morphological traits provide incomplete information to be relied upon.

(ii) Variations in chromosomal DNA are responsible for variations among the individuals, species and genera. Thus DNA

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variations can be used to determine exact taxonomic positions where morphological or physiological traits become clueless. Thus cytological data are regarded as having more significance than other taxonomic evidences.

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