Contribution of Cytology to Taxonomy.

- **Cytology: The branch of biology which deals with the structure and function of cells.**
- **Cytological characters play an important role in modern systems of plant classification.**
- **Many taxonomic problems have been solved using the cytological and chromosomal data.**
- **Use of cytology in the study of taxonomy is called Cytotaxonomy.**
- **Studies of cytotaxonomy involve the study of Karyotypes and Idiograms of the species in question.**

Cytology in relation to taxonomy or Cytotaxonomy

- The term karyotype is used for the phenotypic appearance of the somatic chromosomes.
- The diagrammatic representation of karyotype is termed as *idiogram*.
- The characteristics of the chromosomes, which have proved to be of taxonomic value include
- Chromosome number
- Chromosome size
- Chromosome morphology
- Chromosome behavior during meiosis.

Chromosome Number

- The chromosome number is fixed in all the individuals of a particular species, which is different from other species.
- The constant chromosome number of the species is of no taxonomic importance.
- Change in chromosome number occurs due to Aneuploidy (addition or deletion of one or two chromosomes but not a complete set) or Polyploidy (addition of one, two or more sets of chromosomes). This can form the basis of cytotaxonomic considerations.
- Such studies have been used in studying taxonomy of some genera like:

  Carex, Datura, Taraxacum and Chlorophytum.
- The tribes of family Compositae have been delimited on the basis of chromosome number.

Chromosome Size

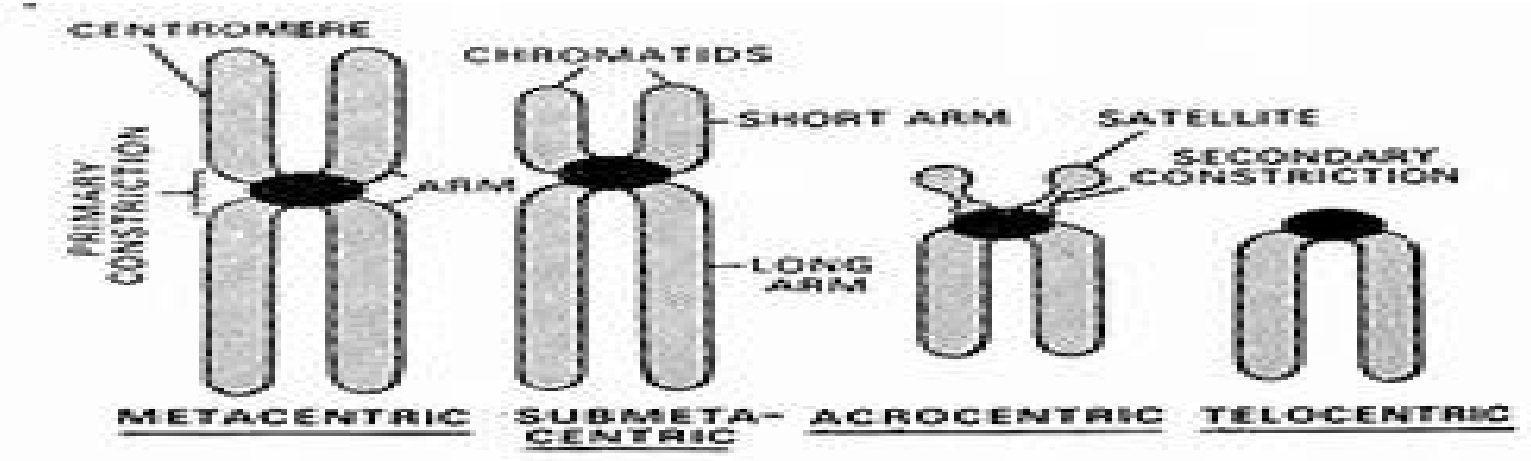
- Changes in the size and structure of chromosomes can occur by addition, deletion or rearrangement of the genetic material.
- These changes in chromosome size and structure are used in cytotaxonomy to rearrange the taxa at various levels.

Chromosome behaviour

- The pairing and separation behavior of chromosomes during cell division helps in taxonomic studies.
- The chromosome behavior is responsible for the development of aneuploids, polyploids and also origin of new species.

Chromosome Morphology

- Chromosome morphology is determined by the position of the centromere.
- A secondary constriction may also be present in some chromosomes in addition to the primary constriction.
- The terminal segment of chromosome present above the secondary constriction is called satellite.
- The tribes of family Ranunculaceae have been regrouped on the basis of chromosome morphology.



Examples of Systematic Value of Cytological studies

- Sharma (1956) on the basis of his studies of Araceae, Amaryllidaceae and Dioscoreaceae families proposed that the changes in the karyoptypes of somatic tissue play a distinct role in evolution.
- On the basis of his studies he proposed that large chromosomes, low chromosome number and symmetric karyotype represent a primitive status, whereas small chromosomes, high chromosome number and asymmetric karyotype indicate advanced status.
- Taxonomy of family Alismataceae has also been studied using these parameters.
- Hexaploid bread wheat (*Triticum aestivum*, 2n=42), durum wheat (*Triticum durum*,2n=28) and diploid wheat (*Triticum monococcum*,2n=14) can be differentiated on the basis of genome constitution.

Systematic value of cytological studies

- Jackson (1971)
- Members of Cyperaceae and Juncaceae possess chromosomes with diffuse or non-localized centromere, and also show inverted meiosis. This reflect a close association between these two families.
- *Yucca* had long been treated as a member of Liliaceae because of superior ovary, and **Agave** of Amaryllidaceae because of inferior ovary. Hutchinson shifted both plants to Agavaceae because of the presence of 25 small and 5 large chromosome in both of them

Systematic value of cytological studies

- The basic chromosome number in Loranthaceae is n=9 while in Viscaceae there is a series of aneuploid numbers ranging b/w 10 and 14. Wiens (1975) separated them from each other on basis of cytological evidence.
- In the subfamily Bambusoideae of Graminae n=12 and in the subfamily Poideae n=7. this indicates that the chromosome numbers have proved to be of taxonomic utility also at the subfamily level.
- Stebbins (1958) provided information on the evolution of grasses on the basis of cytogenetic.

Systematic value of cytological studies

- On the basis of cytological studies, Lewis (1951) submerged the genus *Godetia* in *Clarkia* (Onagraceae)
- Naik (1977) differentiated three species of Chlorophytum of Liliaceae on the basis of cytological data. According to him *C.bharuchae* has 2n=16 while *C.glaucum* and *C. glaucoides* have 2n=42. both the later species having differ karyomorphology.
- Warburg(1938) studied taxonomy of Gerniales on the basis of cytological studies.

Systematic value of cytological studies

- Manton(1932) confirmed the formation of subdivision of Brassicaceae on the basis of cytological studies. All the families have different base chromosome numbers.
- Genus *Cistus* (Cistaceae), formerly included in *Helianthemum*, has chromosome number 8 while *Helianthemum* has base chromosome number 9. so *Cistus* should be recognized as a separate genus
- A new classification of the genus Narcissus of Amaryllidaceae has been proposed by Frenandes (1951) on the basis of cytological studies.