Taxonomy in Relation to Cytology

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Introduction

- Modern taxonomists consider that the gross morphological characters are not always sufficient to provide means of differentiation in determining the genetically and evolutionary relationship between taxa.

- To achieve this the taxonomical evidences from anatomy, embryology, palynology, cytology, are discussed.

- Dr. V. Puri has said “One of the most significant modern trends in plant taxonomy is towards a synthesis between the older methods, outlook and more recent developments in our knowledge of plants”.

Plant Taxonomy : Cytology

- 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.

Plant Taxonomy: Cytology-Chromosome Number

- Homoploids (*Pinus* and *Quercus*, n=12 chromosomes)
- Polyploids (different species of Aster have n=9 or n=18 or n=27)
- Euploidy
- Aneuploidy (different species of *Brassica* bear n=6,7,8,9, or 10)

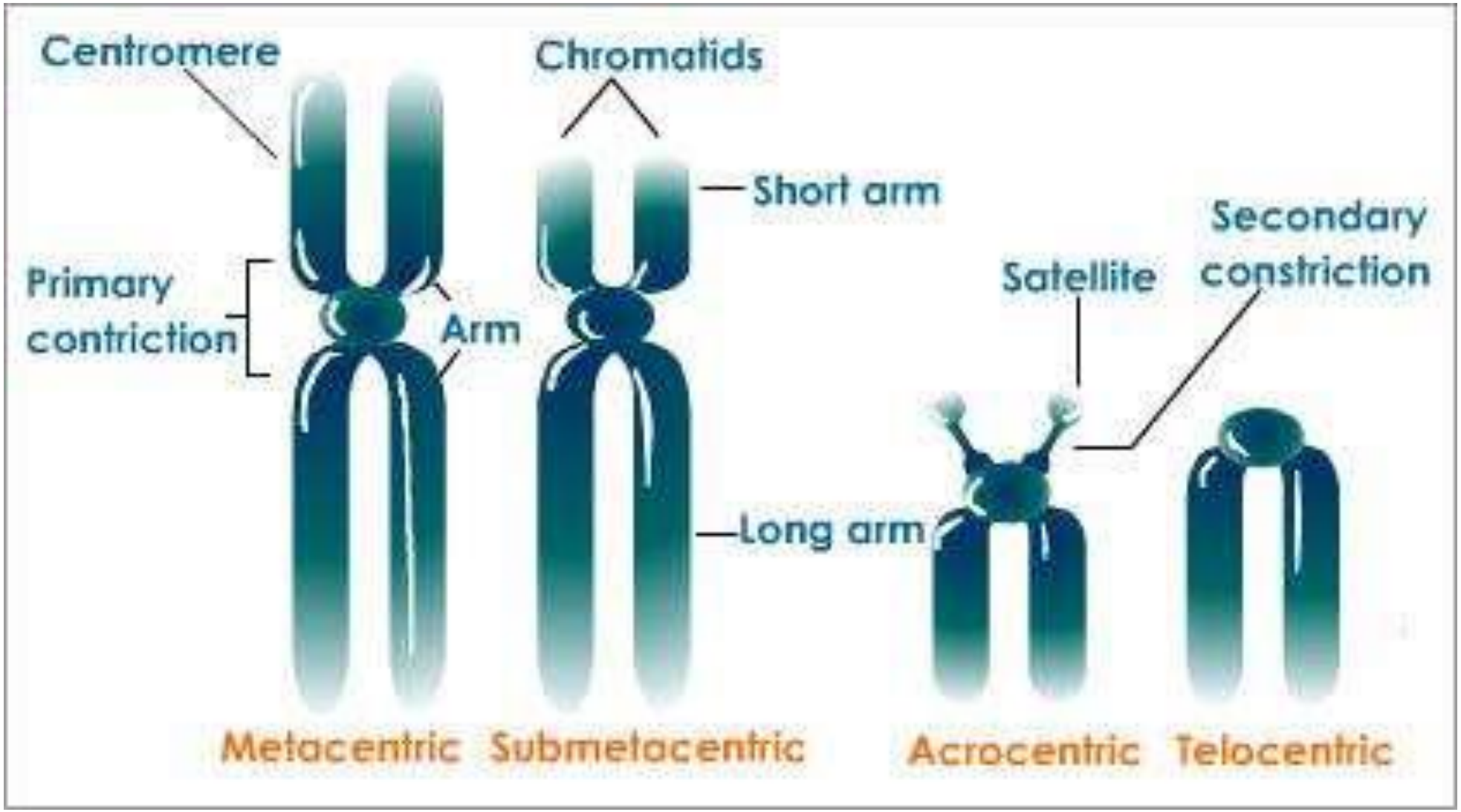
Plant Taxonomy: Cytology- Chromosome Size

- 0.5 to 3 μ
- According to Stebbins (1938) the chromosome size is characteristics of only certain groups and families, and not related to phylogeny of angiosperms.

Plant Taxonomy: Cytology- Chromosome Morphology

- Relative length of the arms of the chromosomes, position of the cento mere, presence of satellites, etc. are some character of taxonomic significance.
- A secondary contraction may be present near the terminal end of a chromosome, separating its small segments called satellite.
- Chromosome may be symmetrical and asymmetrical

Plant Taxonomy: Cytology- Chromosome Morphology



Plant Taxonomy: Cytology- Chromosome Behavior at Mitosis

- Degree of sterility and occurrence of hybridization are determined by the behavior of chromosomes during meiosis.

- Abnormalities in meiosis, such as non-pairing, crossing over, unequal interchanges or translocations, bridge formation, lagging chromosomes etc. have all proved to be systematic value.

Plant Taxonomy: Cytology- 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

Plant Taxonomy: Cytology- Systematic Value of Cytological Studies

- The basic chromosome number in Loranthaceae is n=9 while in Viscaceae there is a series of aneuploidy 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.

Plant Taxonomy: Cytology- 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 Geraniales on the basis of cytological studies.

Plant Taxonomy: Cytology- 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.

Plant Taxonomy: Cytology- Systematic Value of Cytological Studies

- Sharma (1956) on the basis of his studies of Araceae, Amaryllidaceae and Diosoreaeceae, proposed that the changes in karyotypes of somatic tissue play a distinct role in evolution. He further proposed that large chromosomes, low chromosome number and symmetrical karyotype represent a primitive status, while small chromosomes, high chromosome number and extreme asymmetry of karyotype present the advance status.

- These principles provided interesting results in taxonomy of Alismataceae, Liliaceae, Amaryllidaceae and Dioscoreaceae.