

TAXONOMIC EVIDENCES FROM CYTOLOGY

Cytology plays an important role in the study of plant taxonomy, systematic and evolution. A new area of research named Cytotaxonomy has emerged which utilizes cytological information for the elucidation of taxonomic problems. The chromosome number, morphology and behaviour at meiosis are the parameters considered significant.

A. Chromosome number

Chromosome number is constant in many species which is considered as an important taxonomic characters. The International Association of Plant Taxonomy (IAPT) has published an index to Plant chromosome number in its series "Regnum vegetabile" in 9 volumes between 1967 and 1977. The chromosome number in Angiosperm exhibit considerable variation. The lowest number is ($n = 2$) is recorded in *Haplopappus gracilis* (Asteraceae) and the highest ($n = 132$) in *Poa littorea* (Poaceae). Whereas the record of highest chromosome number ($n = 630$) is found in *Ophioglossum reticulatum* (Pteridophytes).

Polyploid species are not recognised as species unless they are morphologically distinct. In *Saxifraga* diploid and polyploids are clearly distinct and recognised as separate species – *Saxifraga hyperborean* ($2n = 26$) and *Saxifraga rivularis* ($2n = 52$). In *Tephrosia* of Fabaceae all the species have $2n = 22$ chromosome number, except *Tephrosia constricta* where $2n = 16$ justifying its separation as a new genus *Sphinctospermum*. Both the plants *Cicendia filiformis* and *Mixrococala pusila* of Gentianaceae were placed under *Cicendia*. The former have the basic chromosome number 13 and the later with 10 justifying their separation into different genera.

B. Chromosome morphology

The structure of chromosome set in a species is termed Karyotype and it is diagrammatically represented in the form of an Ideogram. Extensive studies have revealed that symmetrical karyotype (chromosome essentially similar and mainly metacentric) is primitive and an asymmetric Karyotype (different types of chromosome) is advanced. Symmetrical karyotype with low chromosome number and long metacentric chromosomes indicate primitive characteristics. Whereas symmetrical karyotype with high chromosome number and short acrocentric chromosomes are the advanced characteristics.

An interesting example of utilization of chromosomal information is family Agavaceae. The family contains about 16 genera such as *Agave* (and others formerly placed in Amaryllidaceae due to inferior ovary) and *Yucca* (and others formerly placed in Liliaceae due to superior ovary). These genera were shifted and brought into Agavaceae on the basis of great overall similarity. This was supported by the distinctive bimodal karyotype of Agavaceae consisting of 5 large and 25 small chromosomes.

Cyperaceae and Juncaceae were earlier placed far apart due to distinct floral structure. Both families have small chromosomes without distinctive centromere. As such both the families are now considered to be closely related.

C. Chromosomal behaviour

Behaviour of chromosome at meiosis helps to help find out the relationship of different species and the population as a whole. Two aspects of chromosome behaviour like synopsis during meiotic prophase and frequency of Chiasma appeared very effective in commenting on phylogeny. Genome analysis has confirmed that the hexaploid *Senecio cambrensis* is an allohexaploid between tetraploid *Senecio vulgaris* and diploid *Senecio squalidus*. Similarly the tetraploid *Tragopogon mirus* is the result of hybridization between the two diploid species *Tragopogon dubius* and *Tragopogon porrifolius*. The classical example is represented by hexaploid bread wheat *Triticum aestivum* which was derived from tetraploid *Triticum dicoccum* and diploid *Aegilops tauschii*.