**Topic** -**Haploidy: cytological behaviour and uses**

Sub: **Botany**

Course- M. Sc.(semester IV) , Department of Botany
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# Haploidy

The ploidy (number of set of chromosomes) that represents the gametic chromosome number of a species irrespective of whether it is a diploid or a polyploid species is called haploidy and the individuals as haploids.
Example:

| **Organism** | **Haploid chromosome number** |
|---|---|
| *Saccharomyces cerevisiae* | 16 |
| *Zea mays* | 10 |
| *Triticum aestivum* | 21 |
| *Homo sapiens* | 23 |

The haploid, or basic, chromosome number (n) defines a set of chromosomes called the haploid genome. Most somatic cells contain two of each of the chromosomes in this set and are therefore diploid (2n). Cells with four of each chromosome are tetraploid (4n), those with eight of each are octaploid (8n), and so on.

## Cytological behaviour

This topic deals as to how the chrosome acts in this particular situation i.e. in haploids during meiosis.

- These chromosomes do not have homologous partners to undergo regular segration.
- The chromosomes therefore are unpaired and are found as univalents.
- Univalents are unable to arrange themselves in a definite equatorial plate and are distributed throughout the cell at metaphase1.
- At anaphase1 random univalents move to either pole giving unequal chromosomes to either pole. The microspores so formed will abort and lead to complete sterility.
- The univalents may exhibit other alternative patterns of behaviour which include the following:

1. The univalents (one or more) may lag at the first division and may remain excluded from nuclei or divide at the second division.
2. A univalent may divide at the first division and the separating chromatids may then lag at the second division.
3. The univalents may divide at the first division and the resulting chromatids may misdivide at the second division giving rise to telocentrics or isochrosomes (morphological abnormality of the chromosome, formed by an abnormal transverse division of the centromere; the arms of the chromosome are of equal lengths).

- Formation of bivalents and multivalents- Although these are ordinarily absent, occasionally these are formed due to duplication of segments between the non homologous chromosomes arising through translocations.
- Pairing at prophase has been observed in maize which resulted due to association of duplicated segments within a chromosome through folding back of the same chromosome.
- Formation of restitution nucleus in the first division will be followed by normal equational mitotic division in the second meiotic division, so that two functional spores will be produced. This was observed in tomato by Lindstrom and Koos (1931).

**Uses of haploids**

1. Production of homozygous lines- These may be directly used as cultivars. Useful for research related to plant genetics and breeding.
2. Haploid cells are excellent tools to study gene functions as they contain a single copy of the genome and are thus unable to hide the effect of mutation.
3. Haploidy reduces breeding cycle- The time period required in haploid breeding is only 4to 5 years as against 10 years required in conventional breeding.
4. The recessive alleles are unmasked in haploids and this is used for the study of intralocus interactions.
5. Haploids are used in determining the number of genes for traits like disease resistance.
6. Using haploids heritability can be determined for traits like glucose concentration, maturity, weight etc.
7. Generation of exvlusively male plants-In some plants like Asparagus, male plants give more yield than female plants, so if haploids are produced from anthers of male plants and by diplodization super male plants can be produced.
8. Haploids provide an easier means for the inductions of mutations and its selection with desired traits.
9. Useful in Cytogenetics-
   - production of aneuploids
   - determination of the nature of ploidy
   - determination of basic chromosome number
   - evaluation of origin of chromosomes
10. Useful in induction of genetic variability

## References


1. Elrod, Susan and Stansfield, William (2002). Genetics, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Gupta, P. K. (2004). Cytogenetics, Rastogi Publications,Meerut.
3. Simmons, M. J. and Snusted, D. Peter.Principles of Genetics, John Wiley and Sons, Inc.
4. Strickberger, M. W. Genetics, Prentice Hall of India, New Delhi.