An constituting a genome is called the basic

An organism having more than two sets of homologous chromosomes is known as polyploidy. I) Euploidy (Eu-even true, ploid-unit): Genome containing whole set of chromosomes or those whose somatic complements are exact multiple of basic number are called euploid e. g. haploid (n), diploid (2n) and triploids (3n) etc.

i) Haploid:

Individuals with one set of chromosomes are called haploid or monoploid e.

g. Datura. Haploids are seldom observed in animals like male honey bee however can be produced experimentally in plants. They also occur naturally. These plants are characterized by reduction in size of vegetative and floral parts with having low viability and high sterility. In plants, an unfertilized egg may be stimulated to develop into embryo by chemical treatments, electric shocks or other experimental procedures.

Genome:

The complete set of chromosomes found in the gamete of a true diploid is called genome e. g.

Zea mays 2n = 20 (n= 10). A set of 10 chromosomes is called genome. If ‘ a’ is genome then genomic constitution is ‘ A’.

Basic number:

Number of chromosomes constituting a genome is called the basic number i.

e., number of chromosomes found in the gamete of a true diploid. Organisms having three or more sets of chromosomes i. e., genomes are called polyploids.

They are very common in plants however it is very rare in animals due to their delicate sex balance. Polyploids arise by several ways viz., spore or gamete may be produced with unreduced chromosomes. When such gametes are fertilized by normal gametes, triploids (3n) or tetraploids (4n) are produced. It depends on whether one or both types are diploid. There are two types of polyploidy according to the origin of the chromosomes:

1.

Autopolyploidy:

Autopolyploids have arisen from a single individual through multiplication of the same sets of chromosomes of a genome. All the sets of chromosomes of autopolyploids are homologous or identical to each other e. g. triploid AAA, tetraploid AAAA etc. Since an autopolyploid remains sterile and cannot produce seeds therefore, it has great commercial value in producing seedless varieties of economic plants e.

g. Watermelon, Grape, Banana and Sugar beet. In autopolyploids, the vegetative growth is more vigorous, leaves are broader and darker green. Floral parts, fruits, seeds are bigger than diploid i. e. having gigas characters. They are rare.

The pairing is more complex i. e. autosyndetic (pairing between chromosomes of same parental origin).

Abnormal meiosis results in less fertility than diploids. The flowering is delayed with slow rate of growth. II) Allopolyploids: They arise from hybrids between more or less distantly related species. It brings quantitative characters in hybrid. Almost all naturally occurring polyploids are al- lopolyploids. They are more fertile.

i) Amphidiploid:

When two species which are genetically not related to each other are crossed they show sterility. This sterility is due to formation of univalents.

This can be overcome by doubling the chromosomes of hybrid, so that pairing will be normal. Such double diploid organism in which the chro- mosome number is doubled is called amphidiploid or allotet- raploid.

i) Aneuploidy: (aneu-uneven, ploid-unit):

The organisms whose somatic number is not exact multiple of monoploid i. e., genome containing irregular number of chromosomes.

Blakeslee and Belling (1924) studied in Datura for the first time. They occur either due to addition or deletion of one or more chromosomes from normal diploid chromosome compliment. Normally in diploid, homologous chromosomes segregate during meiosis and gametes with haploid set of chromosomes are formed but due to accident, deficiency or duplication for a particular chromosome occur, thus two gametes i. e., (n+1) and (n-1) are formed and when such gametes fertilized by normal gamete (n) give rise to aneuploids.

Autopolyploids:

1. Autopolyploids arise from single individual 2. Multiplication of same set of chromosomes or genome. 3. The genomes are homologous. 4. Autopolyploids are rare.

5. Common in ornamental and vegetatively propagated plants. 6. Autopolyploids are more sterile. 7. e. g.

AAA, AAAA.

Allopolyploids:

1. Allopolyploids arise from two or more distantly related species.

2. Multiplication of different sets of chromosomes. 3. Lack of homology between genomes. 4.

Allopolyploids are common. 5. Almost all crop plants. 6. Sterility overcomes by developing amphidiploid.

7. e. g. AABB.

They are:

A) Hyperploidy:

A aneuploidy with addition of one or more same or different chromosomes.

i). Triosomics:

Organism having an extra chromosome than normal somatic complement. They are produced by selfing trip- loids or crossing diploid x triploid e. g. Datura strumarium (Jimson weed).

a) Primary: An added chromosome is unmodified. b) Secondary: Arise from primary trisomies and consist of these chromosomes, two of which are normal while extra chromosome had similar ends. i. e., Isochromosome.

c) Tertiary: Consists of three chromosomes of which two normal and third is made up of part of non homologous chromosome.

ii) Double Triosomic (2n + 1 + 1):

Addition of two different chromosomes in normal chromosome complement.

iiii) Tetrasomic (2n + 2):

Addition of one pair of chromosomes in normal chromosome complement.

B) Hypoploidy:

Loss of one or more chromosomes from normal chromosome complement.

i) Monosomies (2n -1):

Individual lacking chromosome from normal chromosome complement.

If lacking chromosome is small, individual may survive and create major imbalance. The number of possible mono-somics in an organism will be equal to haploid chromosome number (non homologous).

ii) Double monosomies (2n -1- 1):

Individual lacking two different chromosomes from a normal chromosome complements.

iii) Nullisomics (2n – 2):

Individual lacking both members of specific pair which are obtained by selfing monosomies.

Induction of polyploidy:

The earliest methods used for inducing polyploidy includes high temperature treatment for short period as in maize or use of Indole Acetic Acid (IAA) in growing tip of tomato. Other chemicals like Chloral hydrate and Sulphaniamide also induce polyploidy. However, Blakeslee and Nebel (1937) showed that the alkaloid colchicines obtained from the seeds of Colchicum autumncile was very effective in producing disturbances in spindle formation during cell division and results in doubling chromosome formation during cell division.

When growing root tips were placed in appropriate concentration of colchicine, chromosomes duplicate properly but spindle formation was abnormal and cytokinesis did not occur. Some cells show doubled chromosome number and these cells were propagated to produce tetraploid plants. Colchicine may be applied in aqueous solution or paste mixed with lanolin. It can be applied to shoot apices or young seedlings with 0. 2 to 0. 4 percent solutions.

Role of allopolyploidy in evolution of wheat:

The common or bread wheat (Triticum aestivum) is an allohexaploid having two copies each of the genomes A, B and D; its somatic complement is therefore AABBDD.

The sources of A and D genomes were once more or less unanimously accepted as Triticum monococcum (AA) and Aegilops squarrosa (DD) respectively. There is considerable doubt about the source of B genome. According to one hypothesis Aegilops speltoides may be the source of this genome but recent evidences do not support this. It is currently believed that the source of B genome is an unknown and possibly extinct species. Further, the source of D genome is most likely T. tauschii and not A. squarrosa as believed earlier. The amphidiploid AABB was initially produced which gave rise to the tetraploid wheat.

(T. turgidum). This amphidiploid (AABB) subsequently out crossed with T. tauschii and ultimately yield the hexaploid wheat (AABBDD).