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Aneuploidy

Individuals carrying chromosome numbers other than the diploid (2x, and not 2n) number are known as heteroploids, and the situation is termed as heteroploidy. Heteroploidy involving one or a few chromosomes of the genome is known as aneuploidy.

Aneuploid individuals from which one chromosome pair is missing (2n-2) are termed as nullisomics, while those lacking a single chromosome (2n-1) are called monosomics. A double monosomics individual lacks two chromosomes belonging to two different chromosome pairs (2n-1-1). An individual having one extra chromosome (2n+1) is known as trisomic, and that having two extra chromosomes each belonging to a different chromosome pair is called double trisomic (2n+1+1). When an individual has an extra pair of chromosomes, it is known as tetrasomic (2n+2).

Of the various aneuploids, monosomics (in polyploid species, such as tobacco, wheat and oats) and trisomics (in diploid species, e.g. Datura, maize, pearmillet, tomato, rye, pea, spinach, etc.) are the most commonly used in genetic studies. Nullisomics are viable in a few highly polyploid species only, e.g. wheat and oats; they are not viable even in tobacco, which is an allotetraploid. Therefore, we shall consider here trisomic and monosomic analysis.

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A trisomic is known as Primary trisomic if the extra chromosome is the same as a chromosome of haploid genome i.e., it is not modified. In a Secondary trisomic, the additional chromosome is an isochromosome; the two arms of an isochromosome are identical. A tertiary trisomic has a translocated chromosome as the extra chromosome

Applications in crop improvement

1. Aneuploids are useful in studies on the effects of loss or gain of an entire chromosome or a chromosome arm on the phenotype of an individual. Studies of aneuploids have clearly demonstrated that character expression is governed by a balance between a large number of genes present in the genome, that is, a loss or a gain of chromatin upsets the normal development.
2. Aneuploids are useful in locating a linkage group and a gene to a particular chromosome. By using a secondary or tertiary trisomic, the gene may be located to one of the two arms of a chromosome, or even to a part of the chromosome arm. This is the most important application of aneuploids, and will be considered in the next section.
3. Study of aneuploids has shown the homoeology among A, B and D genomes of Wheat (T. aestivum), since a chromosome of A genome compensates for loss of the corresponding chromosome from

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genome B or D. For example, tetrasomic condition of 2B compensates for the nullisomic condition of 2A or 2D so that a tetra-2A + nulli-2B or 2D plant appear normal.

4. Aneuploids are useful in identifying the chromosomes involved in translocations.

5. They are useful in the production of substitution may be desirable for studying the effects of individual chromosomes of a variety or for transfer of genes carried by specific chromosomes of a variety into another one.

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