**Evolution of new crop/ varieties**

**Meaning of Evolution:**

A divergent process which increases genetic diversity and leads to change in allelic frequencies in a population is known as evolution. In other words, a process which leads to significant deviation in the characteristic features of existing individuals as compared to their pre-existing individuals is termed evolution. Thus, evolution leads to change in genetic composition of a population or individuals of population.

**The evolution is of two types, viz:**

(1) Natural evolution

(2) Man-made evolution.

In case of natural evolution, natural selection operates, while in man-made evolution human selection operates. Thus, both natural and human selections play significant role in the process of evolution. Plant breeding is considered as current phase of crop evolution.

Changes which are brought out as a result of evolution are measured in terms of morphological, anatomical, embryological, physiological, biochemical and genetic modifications in the present forms of individuals as compared with their past forms.

#### Genetic Basis of Evolution:

Selection plays a key role in the process of evolution. Selection either by nature or by human has been responsible for evolution of various crop plants. However, selection is effective in changing the features of species only when vast variability exists in the population of that species.

**Three genetic factors or forces, viz:**

(1) Polyploidy,

(2) Introgression, and

(3) Mutations

These three factors aid in the process of evolution by way of inducing additional genetic variability, which is a basic requirement for selection to operate.

**The role of above three factors in evolution of crop plants is briefly described below:**

**1. Polyploidy:**

Polyploidy refers to numerical change in the genome (A basic set of chromosomes).

**Polyploidy is of two types, viz:** (a) Autopolyploidy, and

(b) Allopolyploidy.

**a. Autopolyploidy:**

This is also known as simple polyploidy or single species polyploidy, because the increase in chromosome number relates to the same species. This type of polyploidy can occur in nature as well as can be induced by colchicine treatment. Increase in chromosome from diploid to tetraploid state leads to increase in vigour and size of flowers and fruits over diploid forms.

However, polyploid plants exhibit slow growth rate and reduced fertility due to chromosomal imbalance. Autopolyploidy has been used in crops like banana, apples, sugarbeet, watermelon, potato, oranges, tulips, etc. The commercial banana is autotriploid (3n), which has seedless and larger fruits than diploid forms.

Some varieties of apples in USA are triploids, which are propagated asexually by budding and grafting. Triploid varieties of sugarbeet have higher sugar content than diploids Triploid watermelons, which are produced from a cross between tetraploid and diploid, are -seedless, early maturing and resistant to diseases. In USA, triploid watermelons cover about 10% of the area under this crop.

The commercial potato is regarded as an autotetraploid though interspecific hybridization may also be involved. Triploid oranges (which are seedless) are produced by pollinating diploid plants with pollen of tetraploid plants. Triploid tulips are propagated asexually. Autopolyploidy in Petunia, an ornamental plant, leads to brighter flower colour than diploid forms.

**b. Allopolyploidy:**

This is also known as hybrid polyploidy or bispecies or multispecies polyploidy depending upon the species involved. Such polyploidy is obtained by doubling of chromosome number by colchicine treatment. Allopolyploidy has been more instrumental in evolution of crop plants, because 50% of the crop plants are alloployploids.

Hybrid polyploidy has played significant role in the evolution of crops like wheat, tobacco, cotton, Brassica, oat, etc. Examples of artificially produced allopolyploids include triticale, strawberry and loganberry.

Triticale is a man-made new cereal (between wheat and rye), which combines high yield of wheat and disease and drought resistance of rye. Strawberry is a polyploid between North and South American species, and loganberry is a polyploid between raspberry and blackberry.

**Introgression:**

Incorporation of gene of one species into the genetic background of another species by means of interspecific hybridization and backcrossing is known as introgression (Anderson, 1949). The interspecific hybrid backcrosses in nature with one of the parental species.

As a result of introgression, genes from two divergent species are combined. A true breeding recombinant form favoured by natural selection may give rise to a new species. Introgressive hybridization between primitive maize and wild grass. Tripsacum is considered to be responsible for the evolution of modern forms of maize.

**3. Mutation:**

Mutations are important sources of creating variability in a genetic population. Mutations can occur in nature as well as can be induced by the use of physical or chemical mutagenic agents. In hexaploid wheat, a natural mutation is responsible for homologous pairing.

Spontaneous mutations have played significant role in the evolution of crop plants. Spontaneous mutations can be used either as a cultivar or as a parent in the hybridization programme. Induced mutations have played key role in improving yield, quality, earliness, adaptation, and disease and insect resistance in various crop plants.