[Article ID : 01/VII/08/0721]

MUTATION BREEDING AND ITS ROLE IN CROP IMPROVEMENT

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Introduction

Sudden heritable change within the phenotype of an individual is known as mutation. Within the molecular term, mutation is defined because the permanent and comparatively rare change within the number or sequence of nucleotide. In other words, mutations arise caused by change in DNA bases. Mutation breeding sometimes mentioned as variation breeding, is that the process of exposing seeds to chemicals or radiation so as to get mutants with desirable traits to be bred with other cultivars. Plants obtained through mutagenesis are sometimes called mutagenic plants or mutagenic seeds.

Mutation

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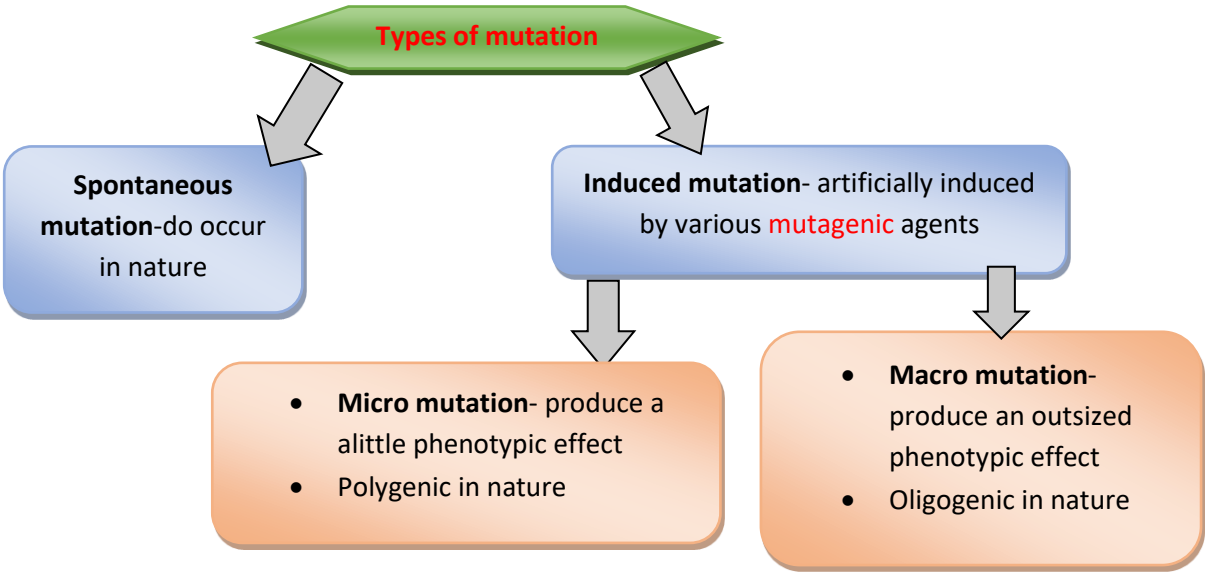
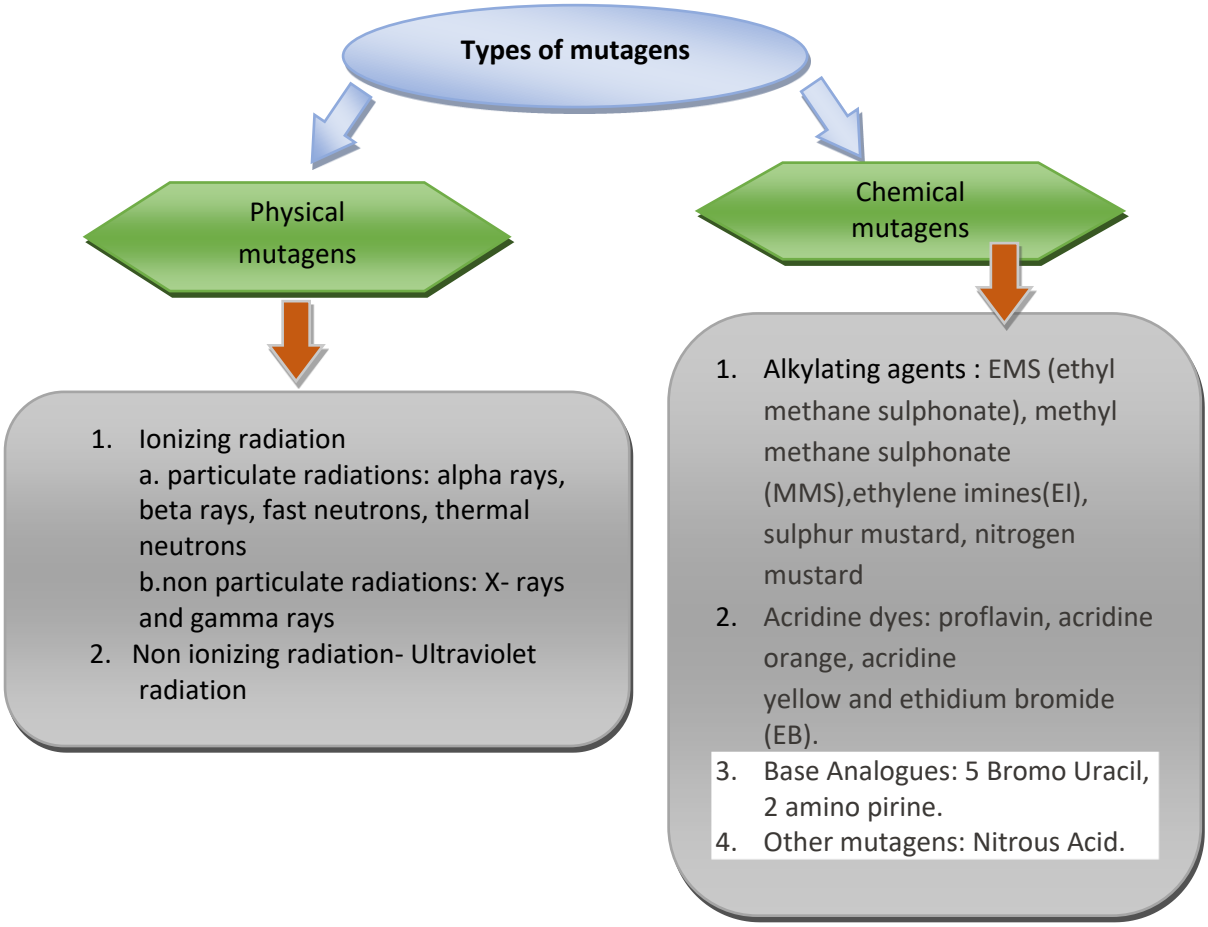


MUTAGENS : Mutagen may be a physical or chemical agent that permanently changes genetic material , usually DNA, in an organism and thus increases the frequency of mutations above the natural noise level.

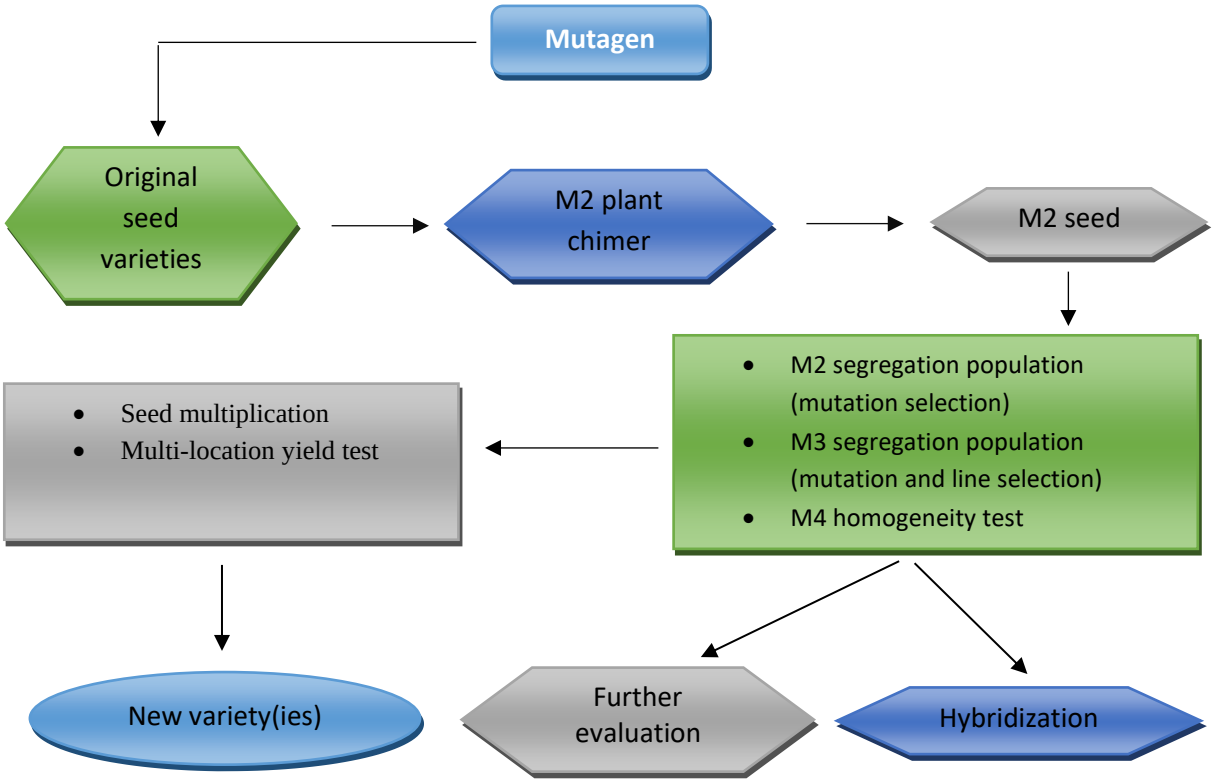


What is mutation breeding?

Mutation breeding is that the deliberate induction and growth of mutant lines for crop improvement. Its most ordinarily utilized in asexually propagated crops and self pollinated crops.

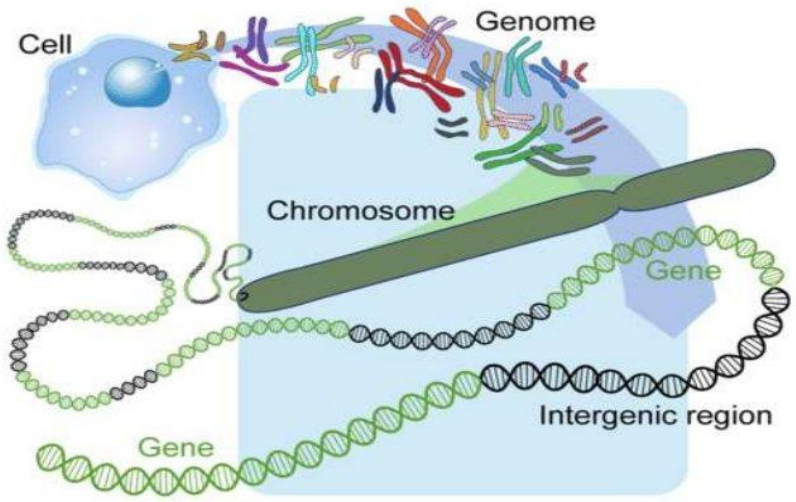
Natural selection operates to cause about evolution of latest races and species through the variability created by natural mutations and amplified by subsequent recombination of genes during amphimixis. Besides natural mutations that occur spontaneously caused by various sorts of radiations and cosmic rays received from the sun and also emitted by several radioactive elements, mutation also can be artificially induced by a variety of physical agents like gamma rays and X-rays and number of other sorts of chemical agents belonging to few specified groups referred to as chemical mutagens. And using an equivalent effectively through elaborate method of selection techniques in various generations for improvement of a specific crop species for desired objectives is named mutation breeding.

Method of mutation breeding



Role of mutation breeding in crop improvement

- Development of improved varieties: in India improved varieties are developed through mutation breeding in wheat, rice, barley etc. Besides high yield , varieties with better quality, earliness, dwarfness, disease resistance and low toxin contents are developed in various crops.
- Induction of male sterility: GMS has been induced in durum wheat and CMS induced in barley. Its reduces the value of hybrid seed production.
- Creation of variability: induced mutations are used for increasing the range of genetic variability in barley, wheat.
- Improvement in adaptation: Induced mutations play an crucial role in improving adaptation of some crops.



Future Prospects

In recent years in vitro mutagenesis technique has enhanced the crop yield and germplasm innovation by the event of quality and improved resistance traits. In in vitro culture techniques, a little amount of tissues and calli can be subjected to mutagenesis for the betterment of crop species. Currently, the utilization of in vitro mutagenesis is low, little or no number of plants like banana and sugarcane are regenerated through this technique.

On the other side, many seed propagated plants such as wheat, rice, maize and barley can now be regenerated from cell suspension cultures. In future expansion of in vitro cell selection techniques for disease resistance would be equally important. A coordination of the recent techniques of anther and microspore culture, cell suspension, irradiation of haploid cells and chromosome doubling and regeneration of doubled haploid plants might be utilized to get genotypes with desired traits. The induced mutation has also proved useful within the preparation of genetic maps which will facilitate molecular marker assisted plant breeding in future.

Mutation breeding has become increasingly popular in recent times as an efficient tool for crop improvement . The direct use of mutation in the growth of molecular maps in structural and functional genomics could lead to rapid improvement of plant yield and quality. The molecular techniques of DNA fingerprinting and molecular mappings like RAPD (Random Amplified Polymorphic DNA,) AFLP (Amplified Fragment Length Polymorphisms) and STMS (Sequence-Tagged Microsatellite Sites) have contributed significantly in the screening and analysis of mutants. Site directed insertion of transgenes supported chimeric RNA/DNA oligonucleotides as done in tomato and maize and mutant tagging are going to be widely used in gene technology.

Varieties developed in india through mutation breeding

Crop	Varieties	Special character
Wheat	Sharbati sonara NP 836	Semi dwarf non-lodging mutant variety
Rice	Jagannath	Bold seed size
	Prabhavati	Short stature
	Mohan	Salt tolerance variety
Cotton	MA-9, MCU-7, Pusa ageti	Salt tolerance variety
Chickpea	Pusa 408, Pusa 413, Pusa 417, Pusa 547	Ascochyta blight, Fusarium wilt resistance Bold seeds, better cooking quality Bold seeds, better cooking quality and high yield performance
Mung Bean	Pant Mung-2	high yield performance
Barley	RDB-1	Short stature
Groundnut	TG 47 TBG 39	Large seed and early maturity High oleic acid

Conclusion

At present genetic variability is narrowed using conventional breeding approaches for a long period, induced mutagenesis are one among the foremost important approaches for broadening the genetic variation and variety in crops to bypass the bottleneck conditions.

Induced mutagenesis, although almost a seven decades old technique, demonstrably can contribute to unleashing the potentials of plant genetic resources and thereby avail plant breeders the raw materials required to get the envisaged smart crop varieties. Crop varieties obtained through the exploitations of mutation breeding are significantly contributing to global food and nutritional security and improved livelihoods.