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Effect Of Sodium Azide and Ems On Morphological and Yield Parameters of Two Varieties of Cicer Arietinum L

[1] Ramdeo Prasad Yadav
[1] Research Scholar (Botany)
VILL- RAMGADH, PO- MAPHO, PS- MEHUS, DIST- SHEIKHPURA , ST- BIHAR

Abstract: **- EMS is more suitable than SA for creating desirable productive Mutants in Cicer arientum. Desi variety found to be more suitable than Kabuli variety for Chemical Mutagenesis studies. 0.8% EMS remain suitable for both varieties of Ciecer arientum L. for increasing productivity. 0.06% and 0.08% SA also proved to be suitable for Kabuli variety in inducing variations.Desi variety shows maxium spectrum of variation than Kabuli variety, but both varieties have scope for Chemical Mutragenesis studies for increasing productivity of this Crop Species.Increased productive Mutagens and Gigas Mutant isolated during this research study will be useful in the dirction of prteinaceous food security in our country.**

INTRODUCTION

Mutation breeding is the purposeful application of mutations in plant breeding area. It offers good prospects for the domestication of promising underutilised wild species for agricultural or horticultural uses as well its for improving adaptation of recently introduced crops to unsuitable environments. Mutagenesis has remained popular for close to a century because of its simplicity, technical and economic viability, applicability to all plant species and usability at small or large scales (Siddiqui and Khan 1999). More than 2,000 plant varieties that contain induced mutations have been officially released for cultivation either directly as new varieties or used as parents to derive new varieties without the regulatory restrictions faced by genetically modified .material (Maluszynski *et al.* 2000). The main strategy in mutation-based breeding has been to upgrade the well-adapted plant varieties by improving a few desirable major yield and quality traits (Ahloowalia *et al*, 2004). Besides, the increased yield and enhanced quality of the novel varieties included several other components such as subsequent use for breeding, improved harvest index from heterosis in hybrid cultivars also in response to increased agronomic inputs, and consumer preference.

Mutation refers to the change in a DNA sequence, which may involve only few bases or the large-scale chromosome abnormality. It can be induced either spontaneously or artificially both in seed and vegetative propagated crops. Induced mutations have recently become the subject of biotechnology investigation. Induced mutations are highly effective in enhancing natural genetic resources and have been used in developing beneficial variations for practical plant breeding purpose and novel crop cultivars (Lee and Lee, 2002). During the last seven decades, more than 2000 mutant varieties have been officially released in the world (Khan *et al*., 2009). Induced mutations have been used to improve major crops such as wheat, rice, barley, cotton, peanut and cow pea, which are seed propagated (Kumar & Singh, 2004; Sharma and Kumar, 2003; Rakshit and Singh, 2001). Early flowering and high yielding mutants in *Ocimum sanctum* line was induced by physical (gamma rays) and chemical mutagens, sodium azide (SA) and ethylmethane sulphonate (EMS) (Nasare and Choudhary, 2011).

Chickpea (*Cicer arietinum* L.) is an annual, autogamous legume,and the only cultivated species within the genus *Cicer*. India is a major producer of chickpea (65%) followed by Turkey (67%) in the world (Anon., 2005). The existing chickpea germplasm indicates limited variability for improvement of economic traits. Mutation breeding is a powerful and effective tool in the hands of plant breeders especially for autogamous crops having narrow genetic base (Micke, 1988). Although induced mutations have been undertaken in the past on some grain legumes, however limited attempts have been made on chickpea (Kharkwal, 2003: Haq *et al.*, 2001; Haq *et al.*. 2002; Gaur & Gaur, 2002). The literature is scarce for the comprehensive comparative and systematic studies of frequency of mutations induced by a wide array of treatments of chemical mutagens on distinctly diverse genotypes of chickpea.

REVIEW OF LITERATURE

Induced mutagenesis has been employed to create desired genetic variability, the base of crop improvement. Mutation induction was most frequently used method to develop direct mutant varieties, as improvement by acclimatization,

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selection and hybridisation have proven to be time consuming, laborious with limited genetic variation. Thus mutation breeding has been recognized since the beginning of this century as one of the driving force of evolution, besides selection. Mutation breeding is a useful technique for creation and selection of desirable variability in a crop and could be a driving force for evolution besides selection in a crop like chickpea, where designed cross pollination is tedious. Mutations could be induced through physical and chemical mutagens (Ahlooyyalia *et al*, 2004; Chopra, 2005; Jain, 2005; Sangsiri, 2005). Several authors previously reported positive effect of synchronous pod maturity in seed yield (Afzal *et al*, 2003).

Although extensive studies have been undertaken on mutagenesis in cereal crops (Rajendra & Mani, 1997; Konzak *et al*, 1965; Nilan *et al*, 1965), its utilization was limited for improving pulse crops (Haq *et al*, 2001, 2002; Kharkwal, 1998; Kharkwal *et al.*, 1988; Nadarajan *et al*, 1982). The ethylated agents, ethylmethane sulphonate (EMS) have been found more effective and efficient than physical mutagens in crops like lentil (Gaikwad & Kothekar, 2004), cowpea (John, 1999), *Lathyrus sativus* (Waghmare & Mehra, 2001) and chickpea (Khakwal, 1998).

MATERIALS AND METHODS

Material: Gram (Cicer orientinum L.)

Gram commonly known as 'chick pea' or Bengal gram is the most important pulse crop of India. India alone has nearly 75 per cent of the world acreage and production of gram. Gram occupies about 37 per cent of area under pulses and contributes about 50 per cent of the total pulse production of India. It is used for human consumption as well as for feeding to animals. It is eaten both whole fried or boiled and salted, or more generally in the form of the split pulse which is cooked and eaten. Both husks and bits of the 'dal' are valuable cattle feed. Fresh green leaves are used as vegetable (sag) in Bihar. Straw of gram is an excellent fodder for cattle. The grains are also used as vegetable. Gram flour (besan) is used in the preparation of various types of sweets. Gram is considered to have medicinal effects and it is used for blood purification. Gram contains approximately 21.1 per cent protein, 61.5 per cent carbohydrate, 4.5 per cent fat. It is also rich in calcium, iron and niacin.

Experimental Material : Mutagens Used

1. Ethylmethane sulphonate (EMS)- $CH_3SO_2OC_2H_5$

i. Manufactured by Koch-light laboratorie Ltd., Coin Brook Bucks, England.

ii. EMS is a monofunctional alkylating agent, causes depurination, transition and formation of triesters in the backbone of DNA molecule.

2. Sodium azide (SA)-NaN_3

i. Manufactured by India drugs and Pharmaceutical Ltd. (A Govt, of India undertaking), Hyderabad, India.

ii. It is used as respiratory inhibitor. During duplication of DNA by base transition mechanism, it causes point mutation.

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CONCLUSION AND SUGGESTIONS

Marked varietal differences were present in the expression of induction of mutations at different doses/concentrations of mutagens due to genetic differences existing among the two varieties of *Cicer arietinum L.* Among the mutagens, chemical mutagen EMS was found to be most effective and potent in inducing the mutations than SA. On the overall basis of two genotypes, that the genotypes desi was most reponsive and kabuli was less responsive for induced mutations. Genetic differences even of a single gene, induce significant changes in mutagen sensitivity that influence not only the rate but also the spectrum of recoverable mutations. It is further suggested that as all the SA and EMS doses

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induced reasonable mutations transferable up to M_2 and M_3 generations, hence all these treatments could be used in mutation breeding programs for inducing viable mutations. Crop improvement requires diverse plant genetic resources. These resources may extend from commercial cultivars to wild or exotic species. A narrow genetic base could result in a crop being highly vulnerable to stresses. Therefore, it is important that attempts be made to expand the genetic diversity by utilizing new and unrelated sources of germplasm. The utilization of the genetic variability of the primitive accessions has been limited because most require short days to initiate flowers and produce fruit.

Marked varietal differences were present in the expression of induction of mutations at different doses/concentrations of mutagens due to genetic differences existing among the two varieties of *Cicer arietinum L.* Among the mutagens, chemical mutagen EMS was found to be most effective and potent in inducing the mutations than SA. On the overall basis of two genotypes, that the genotypes desi was most reponsive and kabuli was less responsive for induced mutations. Genetic differences even of a single gene, induce significant changes in mutagen sensitivity that influence not only the rate but also the spectrum of recoverable mutations. It is further suggested that as all the SA and EMS doses induced reasonable mutations transferable up to M_2 and M_3 generations, hence all these treatments could be used in mutation breeding programs for inducing viable mutations. Crop improvement requires diverse plant genetic resources. These resources may extend from commercial cultivars to wild or exotic species. A narrow genetic base could result in a crop being highly vulnerable to stresses. Therefore, it is important that attempts be made to expand the genetic diversity by utilizing new and unrelated sources of germplasm. The utilization of the genetic variability of the primitive accessions has been limited because most require short days to initiate flowers and produce fruit.

- (1) The Desi variety showed more sensitiveness to both types of Mutagen (SA and EMS) than Kabuli variety of *Cicer arietinum*.
- (2) Genetic variation initiated yield characters showed a general decreasing trend by increasing the concentration of Mutagen in both varieties of Gram.
- (3) 0.8% EMS produced better results with regard to yield and protein content in Desi variety of Gram and 0.08% SA and 0.8% EMS both produced effective mutants in Kabuli variety.
- Thus on the basis of the findings of this research work, the following suggestions are prescribed:-
- (1) EMS is more suitable than SA for creating desirable productive Mutants in *Cicer arientum.*
- (2) Desi variety found to be more suitable than Kabuli variety for Chemical Mutagenesis studies.
- (3) 0.8% EMS remain suitable for both varieties of *Ciecer arientum L.* for increasing productivity. 0.06% and 0.08% SA also proved to be suitable for Kabuli variety in inducing variations.
- (4) Desi variety shows maxium spectrum of variation than Kabuli variety, but both varieties have scope for Chemical Mutragenesis studies for increasing productivity of this Crop Species.
- Increased productive Mutagens and Gigas Mutant isolated during this research study will be useful in the dirction of prteinaceous food security in our country.