

STUDY OF MUTAGENIC EFFICIENCY OF NMU IN WINGED BEAN (*PSOPHOCARPUS TETRAGONOLOBUS* (L) DC.)

Mukund Kulthe, Umesh P Mogle¹, N G Kashid²

Dept. of Botany, Milind College of Science, Nagsenvana, Aurangabad-431002

¹Dept. of Botany, JES, R. G. Bagdia Arts, S. B. Lakhotia Comm. and R. Bezonji Sci. College, Jalna (MS) India

²Dept. of Botany, Vasant Mahavidyalaya, Kaij, Dist: Beed. 431123 (M.S) India

ABSTRACT

The seeds of winged bean (*Psophocarpus tetragonolobus* (L.) DC.) variety namely EC 38955 (A) was treated with a chemical mutagen Nitrosomethyl urea (NMU). The effectiveness and efficiency of mutagen was determined by observing frequency of mutations induced by mutagenic treatment. It is concluded that as concentration of mutagen increased gradual reduction in effectiveness. The mutagenic efficiency increased with increase in concentration of mutagen. The mutation rates were calculated taking into consideration the mean values of efficiency for each treatment. Taking into consideration of lethality and sterility, variations in mutation rates were recorded.

Keywords: Winged Bean, mutation, lethality and sterility

INTRODUCTION

Winged bean (*Psophocarpus tetragonolobus* (L) DC.) has large potential to fulfill the need of staple food, rich in protein and oil for man aside from as fodder for animals. It has been recognized by US National Academy of Science of USA for its capacity to fix carbon and nitrogen in the difficult humid tropical environment and to transform its seed proteins and oil composed of nutritionally valuable configuration of amino and fatty acids (NAS, 1981). Despite possessing several positive attributes the winged bean plant could not get popularity and acceptance among the farmers because of some negative properties.

MATERIALS AND METHODS

The seed material of a variety of winged bean (*Psophocarpus tetragonolobus* (L.) DC.) namely EC 38955 (A) obtained from the National Bureau of Plant Genetic Resources, Regional Station, PKV, Akola, was used in the present study. The chemical mutagen Nitrosomethyl urea (NMU) was used in the present study. N-nitroso N-methyl

urea (NMU) an alkalyting agent manufactured by Sigma Chemical Company Ltd. U. S. A. was used in the present investigation.

Details of mutagenic treatments

To begin with the pilot experiments were conducted for determining the suitable concentrations for further studies. Prior to mutagenic treatment seeds were immersed in distilled water for 6 hours. The presoaking enhances the rate of uptake of the mutagen through increase in cell permeability and also initiates metabolism in the seeds for treatment. Such presoaked seeds were later on immersed in the mutagenic solution for 6 hours with an intermittent shaking. Seeds soaked in distilled water for 12 hours served as control.

The different concentrations used for the chemical mutagenic treatment were 0.01%, 0.02% and 0.03%. Immediately after the completion of treatment, the seeds were washed thoroughly under running tap water. Later on they were kept for soaking in distilled water for 2 hours.

Mutagenic effectiveness and efficiency

In mutation breeding it is necessary to determine the effectiveness and efficiency of mutagen. Frequency of mutations induced by mutagenic treatment is an index of the effectiveness of mutagen. The mutagenic effectiveness is a measure of factor mutations induced by a unit dose of mutagen. By observation of the values, the major trends pertaining to this parameter influenced by different concentrations of mutagen can be understood.

Konzak *et al.*, (1965) showed that mutagenic efficiency provides the best available measure to evaluate different mutagenic treatments. Ehrenberg (1960) and Kawai (1969) indicated that the mutagenic efficiency may be counted on the basis of highest mutation frequency. But highest mutation frequency may result in the undesirable changes such as lethality, sterility (Konzak *et al.*, 1965). So it is necessary to see the negative effect of such highest mutation frequency and those mutagenic treatments which can produce high mutations along with less undesirable changes.

In the present study NMU proved to effective. At the higher concentration of mutagen effectiveness values reduced considerably. It is also proved by Gaul (1962), Siddiqi and Swaminathan (1968), Harsulkar (1994) and in different plant systems.

Spence (1965), Blixt (1964), Wellensiek (1965) and Monti (1968) recorded a higher effectiveness value for chemical mutagens over the gamma rays. Konzak *et al.*, (1965) proposed that the relatively higher efficiency of lower concentration of mutagen could be ascribed to the lesser percentage of injury at such doses.

In the present investigation efficiency decreased for lethality and pollen sterility from NMU. Percentage of chlorophyll mutants is higher but lethality and pollen sterility has also increased which could hamper the working of mutagens efficiently.

RESULTS AND DISCUSSION

The mutagenic effectiveness is a measure of factor mutations induced by a unit dose of (Table 1)

mutagen. By observation of the values, the major trends pertaining to this parameter influenced by different treatments of mutagen can be understood.

In the M₂ generation of winged bean, it was observed that the numerical values of effectiveness gradually reduced with an increase in the concentration of the mutagen. The effectiveness of mutagen was highest at the 0.01% of NMU concentration. Effectiveness gradually reduced as concentration of mutagen increased. In NMU treatment it was 81.50% at 0.01%, 43.25% at 0.02% and 33.33% at 0.03% concentration.

The efficiency of mutagens indicates the extent of desirable changes excluding undesirable changes (Table 2). Percentage of lethality and pollen sterility increased as the concentration of mutagen increased. In NMU the mutagenic efficiency increased with increase in concentration of mutagen. At the 0.01% concentration it was highest and at 0.02% and 0.03% it was lowest.

The mutation rates were calculated taking into consideration the mean values of efficiency for each treatment (Table 3). This has given an idea about the average rate of mutation induction per mutagenic treatment. By considering the mutation rates based on efficiency, the order of mutagenic changes as mutagen carry different values in respect of lethality and sterility. Taking into consideration the mutation rates for lethality, the value was 0.20. When the mutation rate for pollen sterility was considered the value was 0.35.

CONCLUSION

In the present study NMU proved to be effective. At the higher concentration of mutagen effectiveness values reduced considerably. In the present investigation efficiency decreased for lethality and pollen sterility. Percentage of chlorophyll mutants is higher but lethality and pollen sterility has also increased which could hamper the working of mutagens efficiently. From this study we can get an idea about use of specific concentration of NMU for increasing its mutagenic efficiency.

Table 1: The effectiveness of mutagen NMU in *Psophocarpus tetragonolobus* (L.) DC. Var. EC38955 (A)

Mutagens	Concentration	6 hrs.	% Chlorophyll mutants (MF)	Effectiveness MF/TXC
NMU	0.01		4.89	81.50
	0.02		5.19	43.25
	0.03		6.00	33.33

Table 2: The relative efficiency of mutagenic treatments in *Psophocarpus tetragonolobus* (L.) DC. Var. EC38955 (A)

Mutagens	Concentration	% Chlorophyll mutants (MF)	Lethality (L)	(MF/L)	Pollen sterility (S)	(MF/S)
NMU	0.01	4.89	22.67	0.21	11.00	0.44
	0.02	5.19	26.70	0.19	17.00	0.30
	0.03	6.00	31.72	0.19	19.00	0.31

Table 3: The mutation rate of mutagen based on efficiency in *Psophocarpus tetragonolobus* (L.) DC. Var. EC38955 (A)

Mutagens	Lethality	Mutation rate based on sterility
NMU	0.20	0.35

LITERATURE CITED

- Blixt S, 1964.** Studies on induced mutations in peas VIII Ethylene imine and gamma ray treatment of the variety witham wonder. *Agric. Hort. Genet.* **22:** 171-183.
- Ehrenberg L, 1960.** Induced mutation in plants: Mechanism and principles. *Genet. Agric.* **12:** 364-389.
- Gaul H, 1962.** Ungewöhnlich hohe mutations ruten bei Gertr nach Anwendung Von Athul Methan Sulfonat und Rontgen Strahlen. *Naturwissenschaften*, **49:** 431-432.
- Harsulkar AM, 1994.** *Studies on the mutagenic effects of pesticides in Barley*. Ph. D. Thesis, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, India.
- Kawai T, 1969.** Relative effectiveness of physical and chemical mutagens "Induced mutation in plants". Proc. Series, IAEA, Vienna: 137-152.
- Konzak CF, Nilan RA, Wagner J and Foster RJ, 1965.** Efficient chemical mutagenesis. In: "The use of induced mutation in plant breeding", *Rad. Bot. (Supl.)*, **5:** 49-70.
- Monti LM, 1968.** Mutation in peas induced by diethyl sulfate and X-rays, *Mut. Res.* **5:** 187-191.
- National Academy of science, 1981.** The winged bean: A high protein crop of the tropics. National Academy of science, Washington, DC.
- Siddiq EA and Swaminathan MS, 1968.** Enhanced mutation induction and recovery caused by NG in *Oryza sativa* L. *Ind. J. genet.* **28:** 297-300.
- Spence RK, 1965.** The influence of sodium azide on the biological effects of ionizing radiation in moist barely seeds. M. Sc. Thesis Washington State Univ. Pullman, Wash.
- Wellensiek SJ, 1965.** Comparison of effects of EMS, Neutrons, gamma rays and X-rays in peas. In: "The use of induced mutation in plant breeding", *FAO/IAEA, Rad. Bot., (suppl.)* **5:** 227-235.

How to Cite this Article:

Mukund Kulthe, Umesh P Mogle, NG Kashid, 2013. Study of mutagenic efficiency of NMU in Winged bean (*Psophocarpus tetragonolobus* (L) DC.). *Biosci. Disc.*, **4(1):**121-123.