



## Short length Article

# Study of mutagenic efficiency of Ethyl methane sulphonate in Winged Bean

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### ABSTRACT

The winged bean (*Psophocarpus tetragonolobus* (L.) DC.) seeds variety EC 38955 (A) is treated with Ethyl methane sulphonate (EMS). The effectiveness and efficiency of mutagen is determined by observing Frequency of mutations induced by mutagenic treatment. In the present experiments from results it is observed that effectiveness is reduced when concentration of mutagen increased. 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.

**Key words:** Winged Bean, EMS, Mutagen

### INTRODUCTION

Winged bean (*Psophocarpus tetragonolobus* (L.) DC.) is a potential crop with staple food, rich in proteins and edible oil. But it could not get popularity and acceptance among the farmers because of the labor intensive nature of the crop, long duration of its life cycle, antinutritional factors in its seeds/tubers. To overcome these negative properties the conventional breeding programme is not enough. We have to make many changes in the genetic make up of the species. One way to get all these desirable attributes is the mutation breeding. Induced mutation has played an important role in getting desirable varieties.

The seed material of winged bean (*Psophocarpus tetragonolobus* (L.) DC.) var. 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 Ethyl methane sulphonate (EMS) was used in the present study.

#### Ethyl methanesulphonate (EMS)

Ethylmethanesulphonate a monofunctional alkylating agent manufactured by Sigma Chemical Company Ltd. U. S. A. was used in the present investigation.

### Details of mutagenic treatment

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 0.05%, 0.10% and 0.15% ,after 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.

Mutagenic effectiveness is a measure of the frequency of 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) stated 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 EMS proved effective. At the higher concentration of mutagen effectiveness values reduced considerably. It is also proved by Kulthe et al (2013), Gaul (1962), and Harsulkar (1994) 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 lower concentrations of mutagen are effective by observing mutagenic efficiency; injuries are at low when concentration of mutagenic treatment is low.

In the present investigation efficiency decreased for lethality and pollen sterility from EMS. Mutagenic efficiency is observed positive, measuring the chlorophyll mutants and it is shown negative by observing lethality and pollen sterility. 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 treatments of mutagen can be understood.

In the M<sub>2</sub> 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 0.05% concentration in EMS treatment. Effectiveness gradually reduced as concentration of mutagen increased. In EMS treatment it was 20.00% at 0.05%, 12.78% at 0.10% and 9.56% at 0.15%

#### **Mutagenic efficiency: (Table II)**

The efficiency of mutagens indicates the extent of desirable changes excluding undesirable changes. In EMS treatment efficiency of EMS mutagen reduced because undesirable mutations increased as concentration of EMS increased. Percentage of lethality and pollen sterility increased as the concentration of mutagen increased. In EMS the mutagenic efficiency increased with increase in concentration of mutagen. It is highest at 0.05% concentration and lowest at the 0.15% concentration.

#### **Mutation rate: (Table III)**

The mutation rates were calculated taking into consideration the mean values of efficiency for each treatment. 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 0.29. When the mutation rate for pollen sterility was considered the value was 0.42. By observing all these trends it is proved that EMS works better in inducing positive mutations. As increase in the concentration of mutagen the effectiveness values reduced considerably. It is seen in the present study that mutagenic efficiency is decreased for lethality and pollen sterility. Percentage of chlorophyll mutants is higher but lethality and pollen sterility has also increased which could become obstacle in the working of mutagens efficiently. From this study we can get an idea about use of optimum concentration of EMS for increasing its mutagenic efficiency.

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

Mutagens	Concentration	6 hrs.	% Chlorophyll mutants (MF)	Effectiveness MF/TXC
EMS	0.05		6.00	20.00
	0.10		76.7	12.78
	0.15		8.61	9.56

**Table II: 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)
EMS	0.05	6.00	20.00	0.30	13.00	0.46
	0.10	7.67	25.72	0.29	18.50	0.41
	0.15	8.00	30.60	0.28	20.57	0.39

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

Mutagens	Lethality	Mutation rates based on sterility
EMS	0.29	0.42

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