



# EFFECT OF EMS MUTAGEN ON BARNYARD MILLET (*Echinochloa esculanta* L.)

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**Abstract:** Minor millets has immense importance in the human diet due to its short life cycle, potentiality, protein, vitamin mineral content and high fibre content compared to other cereals. Barnyard millet (*Echinochloa esculanta* L.) is locally known as bhagar. Mutation breeding is the most deciding method in crop improvement strategies for the desirable qualitative and quantitative characters. In this research work, different concentrations of the chemical mutagens Ethyl Methane Sulphonate (EMS) and Sodium Azide at varying concentrations (10mM, 20mM, 30mM, 40mM, 50mM, 60mM, 70mM, and 80mM) where used. The seeds of Barnyard millet (*Echinochloa esculanta* L) variety Phule Barti-1 was procured from Zonal Agriculture Research Station, Shenda Park, Kolhapur used to raise M1 generation. The observations like variations in germination percentage, development of anthocyanin pigment, panicle structure and pattern, height of the plant, tillering pattern in response to various concentrations of the mutagens as compared to the control were noted.

**Keywords:** Barnyard millet, EMS Mutagen, Various concentrations, Physical Parameters

## 1. INTRODUCTION

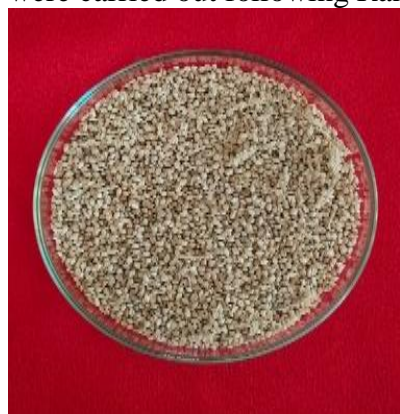
Millets fall under the category of minor cereals of grass family including foxtail millet, finger millet, pearl millet, proso millet, kodo millet, little millet and barnyard millet. Out of total agricultural land in India, the millet cultivation is only one-tenth of the food grain basket (National Conference on Kharif Campaign, 2022). Millets are generally grown in semi-arid regions of African and Asian countries of (especially in Nigeria and India). Developing nation account for 97% of millet production (ICMR-IIMR, 2017). Millets are the 6th most vital grain and nourish about 33% of the aggregate world population (Saleh et al., 2013). They are resilient to changes in the climatic conditions and a low water requirement, withstand extreme temperature capacity and grows properly on less fertile soil with less efforts and minimum management. They are inherently bio-diverse, easy to cultivate and can be grown together with variety of crops. It is a staple cereal in areas where climatic conditions are not suitable for rice cultivation. The year 2023 was observed as International Year of Millet's by United Nations, to accentuate the vitality of millet's at a global level. The Barnyard millet (*Echinochloa esculanta* L.) belongs to the family Poaceae. It is known for high-quality protein, calcium and mineral content. It has morphological problems like low tillering and heavy stem lodging so, research work is important to undertake to enhance high tillering, enhance grain quality and minimize stem lodging, enhance to reduced anti-nutritional factors. In spite, of high nutritional and important agronomic resource it remains underutilized crop. Barnyard millet is highly recommended for cultivation in growing areas of Maharashtra State. The seeds of Barnyard millet Phule Barti-1 used in this experiment.

### I. Research Methodology

**Plant Material-**The seeds of Barnyard millet (*Echinochloa esculanta* L) variety Phule Barti-1 was procured from Zonal Agricultural Research Station, Mahatma Phule Agricultural University, (Shenda Park), Kolhapur-416012, in order to study mutation, by using chemical mutagen EMS.

**Chemical Mutagen:****Ethyl Methane Sulphonate and Sodium Azide****Method:**

The seeds of Barnyard millet (*Echinochloa esculanta* L.) were obtained from Zonal Agriculture Research Station, Shenda Park, Kolhapur, India, got outhunted from Botanical Survey of India, letter no BSI/WRC/iden.Cer/2023/0402230016060. Ethyl Methane Sulphonate (EMS) ( $\text{CH}_3\text{SO}_2\text{OC}_2\text{H}_5$ ) molecular weight 124.16, and Sodium Azide (SA) Sigma Chemical Co. With mol. weight is 65.0099 were used as mutagens in present investigation for seed treatments. Healthy and uniform seeds of Barnyard millets were selected for this treatment. Different concentrations of EMS and SA (10mM, 20mM, 30mM, 40mM, 50mM, 60mM, 70mM and 80mM) were prepared in distilled water. The experiments were conducted to determine the lethal dose (LD50) of various concentrations of EMS, SA. A four-hour duration was fixed for seed treatment. seeds were soaked in different concentrations of EMS and SA for four hours. The untreated seeds served as control. The treated seeds washed thoroughly under tap water for one hour to leach out the residual chemicals. Three replications of both mutagens of each concentrations 10 seeds per petri dishes were sown lined with germination paper. The treated seeds from each treatment was used for raising M1 generation in field with untreated seeds as control. Results were recorded on seventh day. Percent seed germination, seedling height, root and shoot length were recorded. The field experiments were conducted on the research plot at Kharadi, Pune. The soil type of the experimental field was slightly deep, fine and with good drainage. The experiments were carried out following Random Block Design method. Each plot had 50 plants.

**Photograph no. 1 Seeds****Photograph- 2 EMS Treatment****Photograph -3 Research Plot****Photograph 4 Panicle capping****Photograph 5 Various panicles****Photograph no. 6 Milky stage panicle 70mM**

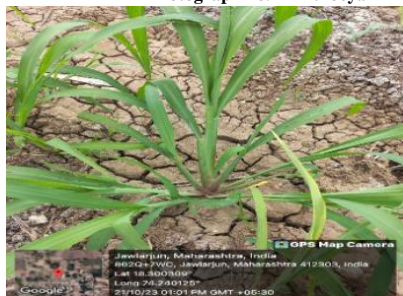
IV. RESULTS AND DISCUSSION



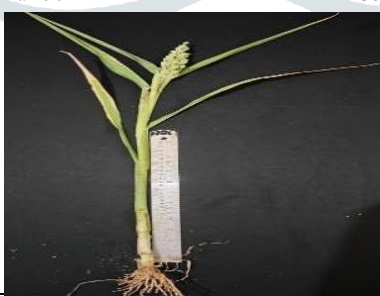
Photograph no. 7 Anthocyanin Pigmented Panicle



Photograph no. 8 Normal Panicle



Photograph no.10 Whole plant



Photograph no. 9 Multiple tillers at 70mM



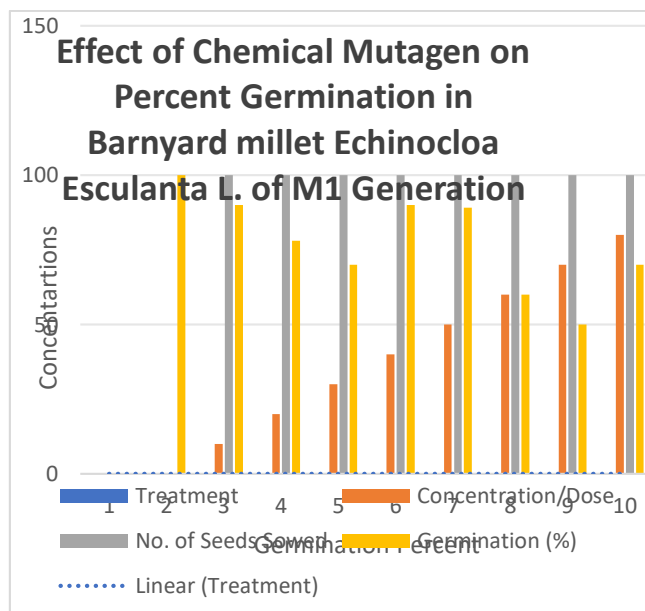
M1 generation Different growth patterns of Panicles

In the present study, the lethal dose LD50 is at 70mM. The seed germination and seedling survival were reduced with increasing in concentration above 70mM. The EMS mutagen LD50 is 70mM shows the most promising result as compare to SA. Maximum germination percentage was recorded on the 7<sup>th</sup> the day of sowing. Anthocyanin pigment was found in M1 generation.

**Table 1: Effect of Chemical Mutagen on Percent Germination in Barnyard millet *Echinochloa Esculanta* L. of M1 Generation**

Treat ment	Concentr ation	No. of Seeds Sowed	Germination (%)
Contr ol	-----	100 Seeds	100
EMS	10	100	90
	20	100	78
	30	100	70
	40	100	90
	50	100	89
	60	100	60
	70	100	50
	80	100	70

**Graph 1. Effect of Chemical Mutagen on Percent Germination in Barnyard millet *Echinochloa esculanta* L. of M1 Generation**



**Table no. 2 Physical Parameters of Barnyard millet Phule Barti-1**

Sr. no.	Physical Parameters	Observations
1	Plant height (cm)	70.5
2	Length of Panicle (cm)	16
3	No. of fingers	25
4	Finger length (cm)	0.15
5	Finger width (cm)	0.10
6	Length of Fingers cm	2.4
7	No. of internode	8
8	Intermodal distance (cm)	4.7
9	No. of branches	4
10	No. of basal tillers	3
11	Days to 50% flowering	150
12	No. of leaf on main tiller	6
13	No. of panicles per plant	8-9
14	Grain weight per panicle (g)	1.56
15	Grain yield (g)	9.344

The seed germination LD50 (lethal dose) values were calculated at 50% of reduction seed germination. The maximum phenotypic variations were recorded for panicle shape, size, structure, colour & weight. The seed germination and seedling survival at different mutagenic treatments indicate that mutagen had an effect on these parameters. The research outcomes of the present study concluded that how ethyl methane sulphonate (EMS) affect the rates of seed. Anthocyanin pigmentation was found in panicle of barnyard millet cultivars. The results indicated that the highest germination percentage (86 %) was obtained with lower doses of EMS (70 mM), i.e. LD 50 value whereas lowest (64 %) germination percentage obtained with doses (40 mM). Percent seed germination and seedling height was inhibited by increasing doses of mutagens. The mutagen EMS was effective in M1 generation.

## V. ACKNOWLEDGMENT

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