



REGULAR ARTICLE

STUDIES ON EFFECT OF INDUCED MUTAGENESIS ON FINGER MILLET (*ELEUSINE CORACANA* (L.) GAERTN.) VAR-CO 13 IN M₁ GENERATION

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ABSTRACT

The present study was carried out to induce chemical mutagens in Finger millet (*Eleusine coracana* (L.) Gaertn.). The seed were subjected to different treatment level of EMS and DES. The parameters like Plant height(cm), Number of leaves per plant, Leaf length (cm/plant), Number of finger per plant, Finger length (cm/plant), Days to first bloom, Yield per plant (g) and 1000 grains weight (g) were observed in M₁ generation. And the result revealed that, all the parameters except days to first blooming show a dose dependent decrease in both treatments. The LD₅₀ value was found in 30 mmol of EMS and 40 mmol of DES.

Keywords: EMS, DES, LD₅₀ value, Finger millet, M₁ germination

INTRODUCTION

Finger millet (*Eleusine coracana* (L.) Gaertn.) Popularly known as 'Ragi' belongs to family 'Poaceae'. Finger millet is having highly nutritious constituents and also medicinal properties [1]. There are reports that clearly describe the use of finger millet in diabetic patients [2]. Recent years the production of ragi is found to be highly reduced due to soil quality degradation and other environmental stresses [3]. There is urgent need to develop elite varieties of finger millet which can withstand harsh environmental conditions and defective soil problems. Apart from environmental issues, diseases are other major threat in finger millet cultivation. Since many years, there are some researches related to the development of prime varieties of plants by breeding and even through modern technologies [4].

Mutation is quite often used in modern plant breeding [5]. In the present investigation, an attempt has been made to study the effect of induced mutagenesis on Finger millet (*Eleusine coracana* (L.) Gaertn.) Var-CO 13 in M₁ generation.

MATERIALS AND METHODS

Mutagens employed

Chemical mutagens namely, Ethyl Methane Sulphonate and Diethyl sulfate were used at various concentrations to induce mutagenesis.

Mutagenic treatments

Ethyl methane Sulphonate (EMS) (CH₃SO₂OC₂H₅), an alkylating agent having molecular weight 124.16 was used in

the present study. For the treatment of EMS, the seeds were pre-soaked in distilled water for 6 h in order to make them relatively more sensitive to mutagenic action. Pre soaked seeds were treated with different concentrations of EMS (10, 20, 30, 40 and 50 mmol) for 4 hours with repeated stirring. After the chemical treatment, the treated seeds were washed thoroughly in running tap water to remove the residues of the chemicals. Healthy, well-matured and untreated seeds were used as control. Diethyl sulphate (DES) treatment was done as described previously [6].

Seeds of Finger millet were subjected to different treatment levels (20, 30, 40, 50 and 60 mmol) of Diethyl sulphate for induced mutagenesis. Before treatment, seeds were pre-soaked in distilled water for 12 h at room temperature. Later these seeds were dried on filter paper. All seeds were uniformly exposed to Diethyl sulphate solution by stirring with a glass rod. After treatment seeds were rinsed thoroughly with distilled water.

The treated seeds were sown in seed beds and watered at least once a day. After 25-30 d the seedlings were transplanted to experimental field in Completely Randomized Block Designs (CRBD) with three replicates to raise M₁ population. The M₁ generation (produced directly from mutagen treated seeds) was grown in the field.

RESULTS

Plant height (cm/plant)

Both the mutagenic treatments had an inhibitory effects of plant height when compared to control. The highest

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reduction in plant height was noted at 60 mmol of DES (48.21), followed by 50 mmol of EMS (52.65).

Number of leaves per plant

A gradual reduction of mean performance was noticed in leaves per plant for all the mutagenic concentration when compared to control. Among them, the highest reduction was observed at 60 mmol of DES (16.30) followed by 50 mmol of EMS (17.10) than control plants (25.55) and other treatments.

Leaf length (cm/plant)

Both the mutagenic treatment significantly effects the leaf length when compared to control. Among the different concentration, the highest reduction of mean values was observed in 50 mmol of EMS (37.54) followed by 60 mmol in DES (35.45).

Number of fingers per plant

The mean performance of total number of finger per plant were decreased gradually in both treatments when compared to control. The highest reduction in number of fingers per plant was recorded at 50 mmol of EMS (3.95) and 60 mmol in DES (3.55) than the control.

Finger length (cm/plant)

There was slight reduction in finger length was recorded at all the mutagenic treatments. However, among the various mutagenic treatments the highest reduction in finger length was observed in 50 mmol of EMS (6.12) and 60 mmol in DES (6.06).

Days to first bloom

The days to first bloom was gradually increasing with increasing concentration when compared to control. Among them, 50 mmol of EMS was taken more days for first bloom; whereas, in DES 60 mmol was taken more days to first bloom when compared to control.

Yield per plant (g)

A significant effect was observed on yield per plant in both mutagenic treatments. Among them, the highest reduction was observed at 50 mmol of EMS (6.37) followed by 60

mmol of DES (6.10) when compared to control and other concentrations.

1000 grains weight (g)

1000-gram weight is considered as an important character, because it directly influences the yield per plant. Both the mutagenic treatments were significantly reducing the 1000-gram weight when compared to control. The highest reduction of grains weight was recorded at 50 mmol (1.95) of EMS and 60 mmol (1.80) in DES.

DISCUSSION

In this study, the M_1 generation indicated highly significant reduction for all the traits such as Plant height(cm), Number of leaves per plant, Leaf length (cm/plant), Number of finger per plant, Finger length (cm/plant), Days to first bloom, Yield per plant (g) and 1000 grain weight (g) studied. This might be due to the first generation (M_1) had growth inhibition [7,8]. Our results are in agreement with previous reports [9-11]. The effect of sodium azide on tomato revealed that these decreased traits were concentration dependent [12]. Similar results were obtained by Sheeba *et al.* [13] when gamma rays and EMS were used to treat *Sesamum*. Peiris [14] reported that seedling emergence, seedling survival at 14 d and at maturity decreased in treated tomato plants. Flowering and maturity were also delayed in treated plants.

CONCLUSION

In this study, Plant height (cm), Number of leaves per plant, Leaf length (cm/plant), Number of finger per plant, Finger length (cm/plant), Days to first bloom, Yield per plant (g) and 1000 grains weight (g) were studied under the field condition in M_1 generation. Mean performance of different quantitative traits were better in control when compared with treated plants. Induced mutagenesis is the best method to enlarge genetic variability within short time. Creation of genetic variability by induced mutagenesis proved best for strengthening crop improvement programmers and represents a more efficient source of genetic variability than the gene pool protects by nature.

Table 5: Effect of chemical mutagens on plant height(cm), number of leaves per plant, leaf length (cm/plant), number of finger per plant, Finger length (cm/plant), days to first bloom, yield per plant (g), 1000 grains weight (g)

Mutagens	Treatments Conc. (mM)	Plant height(cm)	Number of leaves per plant	Leaf length (cm/plant)	Number of fingers per plant	Finger length (cm/plant)	Days to first bloom	Yield per plant (g)	1000 grains weight (g)
Control		66.87±1.70	25.55±1.09	49.33±1.46	6.25±0.54	8.54±0.33	53.90±0.94	8.25±0.33	3.01±0.29
EMS	10 mmol	63.70±2.24	24.00±1.08	47.19±1.02	5.70±0.43	7.99±0.27	55.21±0.82	8.02±0.23	2.91±0.30
	20 mmol	61.70±1.78	21.70±0.88	45.44±1.78	4.75±0.37	7.05±0.35	57.45±1.35	7.82±0.25	2.80±0.18
	30 mmol	58.31±2.22	19.95±0.72	40.83±1.05	4.45±0.37	6.96±0.28	60.18±1.22	7.14±0.20	2.55±0.41
	40 mmol	56.88±1.41	18.10±0.74	39.04±1.16	4.35±0.50	6.50±0.25	62.33±1.54	6.74±0.47	2.14±0.19
	50 mmol	52.65±1.14	17.10±0.97	37.54±0.75	3.95±0.43	6.12±0.18	66.90±2.36	6.37±0.22	1.95±0.18
DES	20 mmol	61.16±1.71	23.20±0.91	46.62±0.95	5.10±0.40	7.51±0.20	56.21±1.20	7.88±0.51	2.86±0.28
	30 mmol	59.05±1.81	21.00±1.03	43.67±1.00	4.70±0.37	7.28±0.30	59.32±1.40	7.74±0.25	2.74±0.40
	40 mmol	55.45±0.99	19.40±1.06	41.18±1.19	4.35±0.44	7.00±0.36	62.81±1.54	7.25±0.29	2.35±0.24
	50 mmol	52.10±1.66	18.30±1.03	37.95±1.31	4.05±0.40	6.54±0.29	65.42±1.62	7.07±0.37	2.04±0.20
	60 mmol	48.21±1.77	16.30±0.81	35.45±0.88	3.55±0.35	6.06±0.42	68.00±1.81	6.10±0.29	1.80±0.17

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