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Chlorophyll and Morphological Mutations Induced by Chemical Mutagens EMS, DES in *(Setaria italica(L.)Beauv.)Var .CO(Te)7* in M_2 Generation

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Abstract- The assessment of mutagen concentration is typically evaluated by the morphological and chlorophyll mutants. *Setariaitalica* var. CO(Te)7 Fox tail millet seeds were treated with the chemical mutagens namely EMS in the concentration 20, 30,40 mM and DES in the concentration 30, 40 and 50 mM . The present investigation reveals chlorophyll mutants like Albino, Chlorina, Xantha , Straita and various morphological mutants like Tall plant, Dwarf plant, Long spike, Short spike, multiple spike ,Long awn spike, Thumb branch spike, Bold seed, Sterile spike, Tip sterile spike, Anthocyanin pigment in spike, Helical spike, Brachytic, Tiller, Zebra striped, Early and late maturity mutants were observed in M_2 generation. The primary objective of the research work was to increase the availability of our traditional millet variety Tenai which was a balanced nutricereale and can be cultivated in large scale with the superior quality .They can be screened and enhanced through mutation breeding for enormous yield. The effect of EMS shows more chlorophyll and morphological mutants than DES in fox tail millet.

Keywords: Chlorophyll mutants, Morphological mutants, EMS and DES, *Setaria italica*, M_2 Generation.

I. INTRODUCTION

Setaria italica is a member of sub family panicoideaceae and is a grass known to be the important food crop with a good background of nutritional value with rich source of protein, fiber, minerals and vitamins[1]. This nutricereale is the crop of poor. They are considered to have short life span and was suitable to be a second food and fodder crop after wheat and barley. Furthermore, it is an agronomical important crop[2,3]. In addition the health promising quality is found to be additional back up energy quality for *Setaria italica*. The fox tail millet is considered as a good therapeutic diet. Such valuable crop need to be cultivated in large scale production with better characteristics by using improved methodology like mutation breeding. The *Setaria italica* is an ecofriendly plant suitable for vulnerable ecosystem, utilized as energy rich feed for love birds, grained flakes are available as quick food cereal, malt based product and for the preparation of puttu .The crop is of therapeutic potential in low glycemic index [4],reducing colon cancer [5].It has an short life span [6] alert the productivity in limited duration in yield. Records of implementation as Bioenergy crop through mutation breeding and genetic manipulation is a criterion for commercial usage [7]. Novel protein in stress tolerance identification [8] was highlighted.

Mutation act as a raw material in indicating the genetic variability for crop. The genetic modulation established through mutation breeding is used to improve the economic value in the crop and resolve themselves as genetic marker in upcoming field of plant breeding technology [9].Among the various plants breeding technique induced mutation using chemical mutagens play a great achieving role in current days in improving economic value of the crop with genetic modification. The efficient tool considered for analyzing the morphological difference, micro and macro mutants is chlorophyll and morphological mutation in M_2 generation and macro mutants were recorded in grain density cm^{-1} and yield $plantcm^{-1}$ in variety of finger millet [10].Which correlated the work for exclusive improvement of the crop *Setaria italica*. The occurrence of different chlorophyll mutation and morphological changes have been reported in 30mM concentration of EMS, 40 mM in DES. In various aspects a meager or large change over in the phenotype will produce more significant modification in the plant .The viable and desirable phenotypical changes exhibited through induced macro mutant [11] mediate as raw material for genetic modification which can be applicable through mutation breeding. The present investigation has been shown broad spectrum of mutants in M_2 generation of *Setaria italic* var .CO(Te)7[12]. The previous work initiated with M_1 generation prevailed in decline phase due to the

stress factor of chemical mutagen which later progressed in M_2 generation with recurrent mutants [13].

II. MATERIALS AND METHODS

In this research the seeds of (*Setaria italica* (L.)Beauv.)var. CO(Te)7 collected from Tamil Nadu Agriculture University Coimbatore have been selected to induce variation.

1. Chemical mutagen treatment:

Ethyl methane sulphonate (EMS) in the concentration 20, 30,40mM and Diethyl sulphate (DES) in the concentration 30,40and 50mM.

2. Experimental design:

The seeds of fox tail millet harvested from M_1 generation is proceeded to M_2 generation in complete Randomized block design. The field was fertilized with organic manure and better agricultural practice was performed.

3. Growth strategies:

Seeds of M_2 generation were germinated from respective concentrations of EMS and DES on 15^{th} day the chlorophyll and morphological mutants were isolated.

4. Isolation of mutants:

In M_2 generation from EMS, DES concentration at 15^{th} day the following chlorophyll mutants such as chlorina, Albino, xantha, varigata and viridis various morphological mutants were observed like long, short spike, Tall, Dwarf, early and late maturity of seed and sterile tip. The mutation frequency was calculated with M_2 seedlings.The chlorophyll and morphological mutants were identified and sorted out based on their classification (Table 1).

III. RESULT AND DISCUSSION

Micro and Macro mutants play an important role to assess the concentration of mutagens, almost all the mutagenic treatment showed different degree of mutants in respective concentration. Among the mutagens EMS produced more number of chlorophyll and morphological mutants than DES. Albino is pale dull white in colour and are relatively shorter than normal and lifespan of the seedling is within 10 - 20 days[14], viridis is with whitish tips of leaves leads to lethal effect, xantha is straw coloured yellow leaves, striata with normal growth mutants of EMS in M_2 generation [15]. The type of chlorophyll mutation in pearl millet, black gram, (Mungbean) [16], chickpea [17], cow pea [18], the variation found to be controlled by the genes present on several chromosome which could be located near to the centrosome and proximal segment of chromosome [19]. The present investigation albino, chlorina, xantha mutants in M_2 plants is based on the intensity of pigmentation at seedling stage in *Setaria italica*, var.CO(Te)7 and the above result was correlated with the present studies (Figure 1).The morphological mutants observed are long and short spike, tall and dwarf mutant, Barren stalk, Brittle stalk, Tiller, Tip sterility, Bushy mutant, Bold seed, late and early maturity [20]. The various chlorophyll mutants in *Setaria italica* was found to be more in response and efficient in EMS than DES. The maximum frequency of mutants was observed in 30mM(28.4%) concentration in EMS and 40 mM (25.3%) in DES, EMS was found to the more effective mutagen as reported in rice [21,22,23]. The minimum mutations were observed in lesser concentrations like 20mM (13.4%) in EMS, and 30 mM (17.2%) in DES, greater number of variations was obtained as the concentration increased similar reports was proved in *pennisetum typhoides*[24].

IV. CONCLUSION

In this investigation the frequency of chlorophyll and morphological mutants found in *Setaria italica* var.CO(Te)7 act as an indicator in analyzing the response of the chemical mutagen EMS , DES. The occurrence of mutation in the pigmentation gene led to various chlorophyll mutants . The morphological mutants obtained were essential and useful in breeding technology to obtain suitable gene coding character for more yield in the foxtail millet. The frequency of variants obtained in M_2 generation is a reflection factors observed as a result of mutagens which induced changes during M_1 generation . Thus the mutants obtained can be applied in the field of plant improvement and their varieties can be applicable in developing beneficial productive products in current years through mutation breeding in crop improvement.

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Table 1. Frequency of chlorophyll and viable mutants in M_2 generation

MUTAGEN	**EMS**			**DES**		
Concentration	**20mM**	**30mM**	**40mM**	**30mM**	**40mM**	**50mM**
Number of plants studied	290	284	263	278	256	239
Xantha	2	5	6	5	6	4
Albino	1	4	3	1	1	1
Viridis	2	2	3	2	1	2
Straita	3	7	4	2	3	2
Tall	1	6	3	2	2	3
Dwarf	1	6	3	3	2	2
Bushy	2	6	4	2	4	2
Brittle	1	3	2	1	2	2
Tiller	2	5	3	2	3	2
Narrow leaf	3	8	2	3	2	2
Zebra striped	1	2	3	1	2	1
Brevis	2	3	2	2	1	1
Barren stalk	-	4	1	1	2	2
Sterile spike	1	2	2	1	1	2

Nano dwarf	-	1	2	1	2	2
Crinkly leaf	1	2	2	1	2	2
Thumb branch	1	2	2	-	1	1
Internodal spike	-	2	2	1	2	2
Multiple spike	1	2	2	2	4	2
Brachytic	1	2	3	2	3	3
Early maturity	4	6	3	4	2	2
Late maturity	3	5	3	1	4	2
Short spike	2	2	3	2	3	2
Long spike	1	7	2	2	3	2
Bold seed	1	5	2	1	5	2
Small seed	2	3	2	3	2	1
Total	39	100	68	48	65	52
Percentage of mutation frequency	13.4	28.4	25.8	17.2	25.3	21.75

Albino(40mM) EMS

Xantha 30 (mM) DES

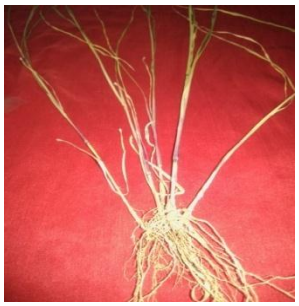
Sterile tip 30 (mM) DES

Thumb branch spike 40 mM EMS

Long awn 50 (mM) DES

Helical spiklet 30(mM) EMS

Multiple spike 30(mM) DES



Tiller 30(mM) DES

Anthocyanin Pigment 40(mM) EMS

Bushy mutant 50(mM) DMS

Long spike 40 mM DES

Figure 1. Chlorophyll and Morphological Mutants

