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STUDIES ON MORPHOLOGICAL CHANGES IN TUBEROSE (*AGAVE AMICA*) CV. BIDHAN SNIGDHA WITH APPLICATION OF GAMMA RADIATION AND ETHYL METHANE SULPHONATE (EMS) UNDER PRAYAGRAJ AGRO-CLIMATIC CONDITIONS

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ABSTRACT

The present investigation "Studies on morphological changes in tuberose (*Agave amica*) cv. Bidhan Snigdha with application of gamma radiation and ethyl methane sulphonate (EMS) under Prayagraj agro climatic conditions" was carried out in the Horticultural Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during 2023-2024. The experiment was laid out in Randomized Block Design (RBD) with 10 treatments of consisting of gamma radiation and ethyl methane sulphonate (EMS), *viz* T_0 (Control), T_1 (5 Gy), T_2 (10 Gy), T_3 (15 Gy), T_4 (20 Gy), T_5 (0.2%, EMS), T_6 (0.4%, EMS), T_7 (0.6%, EMS), T_8 (0.8%, EMS), T_9 (1.0 %, EMS) and replicated thrice. The result obtained showed that treatment T4 (20 Gy) was found to be better performing for vegetative parameters like plant height, plant spread and number of leaves while treatment T_1 (5 Gy) reported more number of bulbs per clump and higher bulb production per hectare. Among the two mutagens, gamma radiation resulted in better vegetative and bulb performance of tuberose under Prayagraj agro-climatic conditions.

Key words : Tuberose, Ethyl methane sulfonate, Gamma, Gray, Mutagen.

Introduction

Tuberose (*Agave amica*), formerly (*Polianthes tuberosa* L.) is one of the most important tropical ornamental bulbous flowering plants cultivated for production of long-lasting flower spikes and is native of Mexico. It belongs to the family Asparagaceae and basic chromosome number (n = 30). Tuberose is an important commercial cut as well as loose flower crop due to pleasant fragrance, longer vase-life of spikes, higher returns and wide adaptability to varied climate and soil. They are valued much by the aesthetic world for their beauty and fragrance. The flowers are attractive and elegant in appearance with sweet fragrance. It has long been cherished for the aromatic oils extracted from its fragrant white flowers. In India, tuberose is commonly known as Gulchari and Gulshabbo in Hindi, Rajanigandha or Nishigandha in Bengali, Sukandaraji and Nelasampengi in Telegu, Nilasampangi in Tamil and as Sugandharaja in Kannada. Tuberose blooms throughout the year and its clustered spikes are rich in fragrance; florets are star shaped, waxy and loosely arranged on spike that can reach up to 30 to 45 cm in length. The flower is very popular for its strong fragrance and its essential oil is important component of high-grade perfumes. The genetic variability in tuberose is very limited and hence different methods are adopted to bring in variation and mutation breeding is an effective and valuable method (Anu *et al*., 2003). Gamma rays have produced a greater number of beneficial mutants (Predieri, 2001) and continue to exhibit a larger potential for improving vegetatively propagated plants. Ethyl methane sulfonate (EMS) is a mutagenic, teratogenic and carcinogenic agent. Ethyl methane sulphonate (EMS) is used in chemical reactions for ethylation of compounds.

Materials and Methods

The present investigation entitled studies on morphological changes in tuberose (*Agave amica*) cv. Bidhan Snigdha with application of gamma radiation and ethyl methane sulphonate (EMS) under Prayagraj agro-climatic conditions was conducted during 2023–2024, in the Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj. The experiment was laid out in randomized block design (RBD) with three replications, having ten different treatments including, T_0 (Control), T_1 (5 Gy), T_2 (10 Gy), T_3 (15 Gy), T_4 (20 Gy), T_5 (0.2%, EMS), T_6 (0.4%, EMS), T_7 (0.6%, EMS), T_8 (0.8%, EMS), T_9 (1.0%, EMS). Analysis of variance (ANOVA) was used to do statistical analysis on the data collected throughout the experiment.

Results and Discussion

From the present investigation, it was observed that significant variations were observed among the ten different treatments in tuberose studied across all the growth parameters and the data is presented in Tables.

Vegetative parameters

Significantly taller plants (54 cm) were observed in treatment T_4 (20 Gy) which was found to be at par with treatment T_3 (15 Gy, 50.6 cm), while shorter plants (32.4 cm) were recorded in T_9 (1.0%, EMS) at 90 days after planting.

Significantly wider spread plants (57.2 cm) was observed in treatment T_4 (20 Gy) which was found to be at par with treatment T_3 (15 Gy, 56.8 cm), while narrow

Table 1 : Effect of physical and chemical mutagens on vegetative parameters of Tuberose.

Treatment notation and treatment details	Plant height (cm)	Plant spread (cm^2)	Number of leaves
T_1 (Gamma rays @ 5 Gy)	47.2	52.6	32.7
T_2 (Gamma rays @ 10 Gy)	49.5	56.2	30
T_3 (Gamma rays @ 15 Gy)	50.5	56.8	28.7
T_4 (Gamma rays @ 20 Gy)	50.6	57.2	32.6
T_5 Ethyl methane sulphonate (EMS) @ 0.2%	54	50.0	27.0
T_6 Ethyl methane sulphonate (EMS) @ 0.4%	44.4	49.7	27
T_7 Ethyl methane sulphonate (EMS) @ 0.6%	42.4	49.1	27.6
T_8 Ethyl methane sulphonate (EMS) @ 0.8%	38.1	47.4	26.5
T_9 Ethyl methane sulphonate (EMS) @ 1.0%	36.6	47.2	26.1
T_0 Control (no radiation/ EMS treatment)	32.4	52.5	29.6
F- Test	**S**	**S**	**S**
SE.d (±)	3.51	2.50	1.90
CD0.05	7.43	5.29	4.02
CV	9.63	5.89	8.08

Table 2 : Effect of physical and chemical mutagens on yield parameters of Tuberose.

Treatment notation and treatment details	Number of bulbs per clump	Bulb yield per hectare
T_1 (Gamma rays @ 5 Gy)	13.1	1,351,852.0
T_2 (Gamma rays @ 10 Gy)	12.0	1,222,222.0
T_3 (Gamma rays @ 15 Gy)	9.51	925,925.9
T_4 (Gamma rays @ 20 Gy)	8.76	882,716.0
T_5 Ethyl methane sulphonate (EMS) @ 0.2%	7.77	759,259.3
T_6 Ethyl methane sulphonate (EMS) @ 0.4%	8.09	839,506.2
T_7 Ethyl methane sulphonate (EMS) @ 0.6%	8.34	802,469.2
T_8 Ethyl methane sulphonate (EMS) @ 0.8%	7.88	746,913.6
T_9 Ethyl methane sulphonate (EMS) @ 1.0%	8.61	833,333.3
T_0 Control (no radiation/ EMS treatment)	12.4	1,265,432.0
F- Test	**S**	**S**
SE.d (±)	0.87	96,759.2
CD0.05	1.84	204,858.5
CV	11.0	12.30

spread plants (47.2 cm) was recorded in T_9 (1.0%, EMS) at 90 days after planting.

Significantly more number of leaves (32.7 cm) was observed in treatment T_1 (5 Gy) which was found to be at par with treatment T_4 (20 Gy, 32.6 cm), while narrow spread plant (26.1 cm) was recorded in T_9 (1.0% EMS) at 90 days after planting.

Gamma irradiation is ionizing radiation which interacts with atoms and molecules to create free radicals in cells and depending on the degree of irradiation, these radicals destroy or alter essential cell components and affect plant morphology, anatomy and physiology differently (Wi *et al*., 2007). The lower and intermediary doses or concentrations of gamma rays have a stimulatory effect on cell replication and elongation, yielding a biopositive vegetative effect in comparison to higher ones leading to increased plant height in lower doses (Chandrashekar, 2014).

Bulb yield parameters

Significantly higher number of bulbs per planted bulb (13.1) was observed in treatment T_1 (5 Gy) followed by treatment T_0 (control, 12.4), while lower number of bulbs per planted bulb (7.77) was observed in treatment T5 (0.2%, EMS).

Significantly higher bulb yield per hectare (1,351,852.0) was observed in treatment T_1 (5 Gy) followed by T_0 (control, 1,265,432.0), while lower yield (746,913.6) was observed in treatment T_8 (0.8% EMS).

Increased photosynthetic activity due to gamma irradiation might have led to higher photosynthate assimilation, mobilization of photosynthates from source to sink i.e., bulb, leading to higher bulb yield parameters.

Conclusion

On the basis of research trial conducted on tuberose (*Agave amica*) with gamma radiation and ethyl methane sulphonate (EMS), it is concluded that gamma ray treatment T_4 (20 Gy) performed significantly better in terms of plant height, plant spread and number of leaves. In case of bulb observation treatment T_1 (5 Gy) was observed to be better performing.

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