Mutagenic effects of chemical mutagens on tuberose *(Polianthes tuberosa* L.*)* Var. Prajwal

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ABSTRACT

An investigation on the induction of mutation in tuberose was carried out at the Department of Floriculture and Landscaping, TNAU, Coimbatore with the objective of examining the effect of chemical mutagens *viz.*, Diethyl Sulphate (DES) @ 15, 20, 25 and 30 mM and Ethyl Methane Sulphonate (EMS) @ 30, 45, 60 and 75 mM on bulb sprouting, survival percentage and growth parameters. Lower doses (15 mM of DES and 30 mM of EMS) were found to favour bulb sprouting and growth parameters. In general, variations in floral characters were observed invariably in all the treatments except control. The LC_{50} values fixed for the chemical mutagens were 25 mM for DES and 60 mM for EMS. It was interesting to observe that lower doses of the mutagens had recorded higher values for morphological and floral parameters than untreated control.

Key words: Tuberose, mutation, DES and EMS

Tuberose (*Polianthes tuberosa* L.) belonging to the family Amaryllidaceae is native of Mexico. It is widely grown in Asia and is one of the most important cut flowers and loose flowers in tropical and subtropical areas. It is commercially cultivated in various parts of India. It is one of the most common and delightful flowers in the garden, producing tall spikes bearing white flowers, which emit an exquisite fragrance. Its importance among the commercially grown flowers is due to its potential for cut flower trade, long vase life and essential oil industry. Tuberose flowers are a good source of essential oil that can be used for preparation of various perfumes (Sadhu and Bose 1973). In spite of its great importance in floriculture, the species does not have much natural variability either in flower color or type. Unlike many other flowers, there is no attractive color variation in tuberose flowers.

Spontaneous and induced mutations have played a vital role in the origin of new cultivars in crop species. Further, the lowest dose in case of both the chemicals had recorded the highest values for all the vegetative parameters and floral parameters except floret length and floret diameter.

Mutation can be induced chemically with alkylating agents such as Ethyl methane sulphonate (EMS), Diethyl Sulphate (DES) etc. The alkyl group of chemical mutagens reacts with the DNA of the plant causing changes in nucleotide sequence and leads to point mutation. (Broertijes and Van Harten, 1988). EMS alkylates are guanine bases and lead to mispairing-alkylated G pairs with T instead of C, resulting in primarily G/C to A/T transitions (Bhat *et al.* 2007 and sega, 1984).

Research reports on mutation breeding of tuberose are meager. Attempts have been made by a few scientists to induce mutation by ionizing radiation and also by EMS in tuberose (Singh *et al.,* 2013) which resulted in limited success. The variety (Prajwal) selected for the present experiment is strictly vegetatively propagated and hence any mutant recovered will have the advantage of perpetual propagation without any alteration of character unlike the case with seed propagation. The present investigation was therefore taken up to study the effect of DES and EMS in inducing genetic variability in both vegetative and floral characters in M_1V_1 generation in the cultivar Prajwal of Tuberose.

MATERIALS AND METHODS

The investigation was carried out at the Department of Floriculture and Landscaping, TNAU, Coimbatore during 2013-14 to evaluate the effect of different concentrations of chemical mutagens *viz.*, DES and EMS. The chemical mutagens DES and EMS were used in different concentrations (15, 20, 25 and 30 mM & 30, 45, 60 and 75 mM respectively) and compared with untreated control. For the chemical mutagenesis, the bulbs were soaked in EMS at different concentrations for 8 hours (25 ± 2^{o}C) with intermittent stirring and the pH of the solution was maintained at 7 by using phosphate buffer (Sambanthamurthi, 1983). For the treatments involving DES, the bulbs were soaked in aqueous solution for 8 hours. The solution was changed for every 45 minutes duration with freshly prepared solution, as the effectiveness of DES will persist for 1.77 hours only at 25^{o}C (Konzak *et al.* 1965). The chemical mutagens treated bulbs were washed thoroughly in distilled water before soaking in 2% Carbendazim solution for 5 minutes. Planting was taken up on same day. Data were recorded on bulb sprouting, survival percentage, and growth and flowering characters in the M_1V_1 generation. The data of the field observations were analyzed using 'F' test following the methods given by Panse and Sukhatme (1964).

RESULTS AND DISCUSSION

Effect of different concentrations of DES and EMS mutagens on morphological and flowering parameters such as plant height, number of leaves, leaf length and width, number of florets/spike, spike length, number of spikes, floret length and diameter and weight of single floret in M_1V_1 generation were studied in this experiment. The results revealed that DES and EMS treated bulbs adversely affected all the vegetative parameters. The chemical mutagen DES @ 15 mM (T_1) significantly influenced the vegetative parameters namely plant height (135.25 cm), number of leaves (105.51Nos.), leaf length (45.51 cm) and width (2.21 cm) which were higher than the values recorded in control when compared with control (T_9) (Table 1). Likewise the plant height (128.30cm), number of leaves (99.80 Nos.) and leaf width (1.80 cm) were higher in treatment T_5 (30 mM EMS) than control. This result is in agreement with the opinion that the stimulative effect of Ethyl Methane sulphonate (EMS) might be attributed to enhanced cell division resulting from enhanced synthesis of growth hormones like auxin {(Joshi, 2011); Kumar and Gupta (2007) in *Nigella sativa.*and Kanagarasu *et al.*, 2014 in Cassava}. Improvement was observed with lower concentration of DES (15 mM) in floral characters namely, number of florets/spike (49.00 nos.), number of spike/plant (5.00), floret length (5.17 cm), single floret weight (1.28 g) when compared to control. Likewise, EMS also led to improvement in floral characters at lower concentration (30 mM) for number of florets/spike (47.00 Nos.), number of spike/plant (5.00 Nos.), floret length (5.55 cm), floret diameter (4.89 cm) and single floret weight (1.32 g) than the untreated control (Table 2). These findings are in line with Singh *et al.*, 2015 in tuberose and Dhivya *et al.*, 2015 in crossandra.

Table 1: Effect of chemical mutagens on vegetative characters of tuberose var. Prajwal in M1V1 generation

Treatments	Plant height (cm)	No. of leaves (Nos.)	Leaf length (cm)	Leaf width (cm)
T_1 15 mM DES	135.25	105.51	45.51	2.21
T_2 20 mM DES	125.34	95.82	40.81	2.00
T_3 25 mM DES	120.81	107.85	37.05	1.77
T_4 30 mM DES	118.74	100.74	39.21	2.45
T_5 30 mM EMS	113.40	100.15	32.43	1.56
T_6 45 mM EMS	128.30	99.80	38.22	1.80
T_7 60 mM EMS	111.80	93.20	29.51	1.42
T_8 75 mM EMS	109.80	98.12	30.03	1.31
T_9 control	120.50	98.14	40.50	1.50
MEAN	**120.44**	**99.93**	**37.03**	**1.78**
SEd	**2.09**	**1.73**	**0.65**	**0.03**
CD (P=0.05)	**4.43****	**3.67****	**1.37****	**0.07****

Table 2: Effect of chemical mutagens on floral characters of tuberose var. Prajwal in M_1V_1 generation

Treatments	No. of florets / spike (Nos.)	Spike length (cm)	No. of spike / plant (Nos.)	Floret length (cm)	Floret diameter (cm)	Single floret weight (g)
T_1 15mMDES	49.00	79.00	5.00	5.17	4.32	1.28
T_2 20mMDES	45.00	77.34	4.00	6.00	4.88	1.15
T_3 25mM DES	43.00	75.54	3.00	5.89	4.53	1.12
T_4 30 mMDES	39.00	72.00	2.00	4.91	4.21	0.98
T_5 30mMEMS	47.00	70.32	5.00	5.55	4.89	1.32
T_6 45mMEMS	41.00	74.50	3.00	5.63	4.31	1.24
T_7 60mMEMS	35.00	72.42	3.00	5.12	4.17	1.11
T_8 75mMEMS	33.00	70.13	2.00	5.10	4.95	1.00
T_9 control	41.00	90.81	3.00	4.98	4.80	1.02
MEAN	**41.44**	**75.78**	**3.33**	**5.37**	**4.56**	**1.14**
SEd	**0.72**	**1.32**	**0.06**	**0.09**	**0.08**	**0.02**

CONCLUSION

The LC_{50} value fixed for DES and EMS were 25 mM and 60 mM respectively. The vegetative and floral characters were found to be best in lower concentrations of the chemical mutagens compared to higher concentrations and the untreated control in M_1V_1 generation. However, performance of the treated plants will be observed in subsequent generations.

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