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Effect of chemical mutagens on growth and flowering of Chrysanthemum (*Dendranthema grandiflora* L.) cv. Pusa Shwet

Shikha and Dr. Jujhar Singh

Abstract
The present research "Effect of chemical mutagens on growth and flowering of Chrysanthemum (*Dendranthema grandiflora* L.) cv. Pusa shwet" was carried out at Experimental Farm, Department of Agriculture, Mata Gujri College, Fatehgarh sahib, Punjab during winter season of 2022-23. The experiment was laid out in randomized block design with seven treatments and the treatments were replicated thrice. There were seven treatments such as Ethyl methyl sulphonate (EMS 0.2% 0.3% 0.5%) and similarly colchicine (0.2%, 0.3%, 0.5%) plants were treated for 5 hours. Observation were recorded for vegetative and flowering parameters. Maximum vegetative (Plant height, leaf length, plant spread, number of branches, number of leaf, stem length) and flowering (day for first flowering, number of flower per branch, number of flower per plant, diameter of flower, weight of flower) parameter were recorded in T_1 i.e. control (when plants were treated with water). EMS and colchicine has negative impact on vegetative and flowering parameters as compare to control. Vegetative and flowering parameters found best in control (distilled water).

Keywords: Chrysanthemum, EMS, colchicine, mutations

Introduction
Chrysanthemum (*Dendranthema grandiflora* L.) cv. Pusa Shwet is the most important flower crops in India. It is member of Asteraceae family. It is commonly referred to as "Guldaudi", it is also known as "Queen of the East". Chrysanthemums are one of the most beautiful perennials that bloom in the early autumn. This is also known as the November flower of the month. Flower crop is achievable due to the great variation demonstrated by a huge number of genotypes. The diversity of chrysanthemum varieties is vast in light of climate, particularly temperature and the relationship between temperature and cultivar occurs for each advancement features.

Mutation breeding is crucial in plant breeding because it aids in the formation of genetic variety, which leads to novelty. Chemical mutagens like colchicine has long been utilized as a polyploidizing agent. Normally, in colchiploidy breeding, chromosomal duplication and its implications on phenotypic are prioritised. Colchicine is a chromosomal doubling agent with antimicrotubular activity. Mutations caused by colchicine treatment have received little attention, despite the fact that they are already possible in various crop plants. EMS is a typical alkylating agent. However, these compounds have also demonstrated their use as mutagens capable of inducing genetic diversity. As a result, they have become a significant tool for improving crop plant agronomic features. EMS had the most mutagenic potential. Colchicine was shown to have the highest mutagenic efficiency.

Materials and Methods
The present investigation was conducted at Research Farm, Mata Gujri College, Fatehgarh Sahib, Punjab. Field of experimental site lies at 30.6435° North latitude and 76.3970° East longitudes. The altitude of the location is 246 meter above the mean sea level. During the period of investigation (July, 2022 to January, 2023) maximum temperature was 32 °C and minimum temperature was 5.1 °C. The experiment was laid out in Randomized Block Design (RBD) with three replications and seven treatments.

The seedlings of chrysanthemum were treated with different level of chemical mutagens expect control were treated with water. Ethyle methyl sulphonate (EMS) (0.2, 0.3, 0.5) percent solution of EMS, 0.2 mili litre of EMS were dissolved in 100ml of distilled water.

To prepare 0.3 percent, 0.3 mili litre of EMS were dissolved in 100 ml of distilled water and to make 0.5 percent, 0.5 mili litre were dissolved in 100 ml of distilled water. Colchicine (0.2, 0.3, 0.5) to prepare, 0.2 percent of colchicine, 0.2 gram were dissolved in 100ml of water. For 0.3 percent solution, 0.3gram of colchicine were dissolved in 100 ml distilled water and to make 0.5 percent, 0.5 gram of colchicine were dissolved in 100 ml distilled water.

Result and Discussion

Plant height (cm) and plant canopy (cm^2)

The Ethyle methyl sulphonate (EMS) chemical mutagens effect the plant at different concentration was recorded. In growth parameters significantly reduction occurs in treated seedling of Chrysanthemum cv. Pusa Shwet in term of plant height, plant spread over the control. In additional maximum plant height (35.73 cm) was recorded in T_1 i.e. when plant were treated with distilled water. Minimum plant height (0.00 cm) was recorded in T_4, when seedlings were treated with EMS @ 0.5% concentration. In treated seedlings, high dose of chemical mutagens cause the seedlings continuous cell multiplication which results the lethal effects in treated seedlings. Similar trends of plant height reduction in treated plants have been observed by Ghormade *et al*., (2020) [3]. Maximum plant spread (23.19 cm^2) was recorded in T1 i.e. control when seedlings were treated with distilled water. Minimum plant spread (0.0 cm^2) was recorded in T_4, when seedlings were treated with 0.5% of EMS. Higher EMS dose promotes the physiological disruption, and reduced the mitotic division. This observation was similar explain by Gunckel *et al*., (2021) [9].

Number of leaves per plant and leaf length (cm)

The information regarding the number of leaves per plant depend upon the different treatments. Maximum number of leaves per plants (39.13 cm) was recoded in T_1 i.e. when seedlings were treated with water. Minimum was recorded (0.0 cm) in T_4 when seedlings were treated with 0.5% EMS concentration. This is because of cytological and phenotyoic effect promotes the lethal effect in plants. The findings of Rathod (2018) [10] as well as Amiri *et al*., (2010) [11]. The control plants T_1 leaves were found to be significant longest of any of the treatment plants. Maximum leaf length of untreated plants (7.39 cm) was obtained in treated T_1 i.e. control when plant were treated with water and (0.00 cm) was found in T_4 i.e. EMS @ (0.5%) concentration. This was due to various physiological, cytological, morphological disturbances affect by increase the dose of EMS recorded in plants leaf. These results are agreement to that of Singh *et al*., (2010) [12].

Number of flowers per plant

In flowering parameters significant reduction was found in chemical mutagens treated seedlings of Chrysanthemum in term of number of flowers per plant as compared to control. Among the treatment maximum number of flowers per plant was examined in T_1 (41.67 cm) that was control the lethal effect was recorded in T_4 (0.00 cm). It was found that the EMS treatments considerably reduced the quality of bloom per plant as compared to the untreated control. This was due to because there were more lateral bud branches, whereas the other control plants had less lateral branches. The outcome was that the treated plants had fewer total buds, which ultimately translated into fewer blooms per plant. These findings are more consistent with earlier studies by Paleker *et al*., (2022) [13].

Flowers Diameter (cm)

Chrysanthemum seedlings exposed the chemical mutagens show an apparent decrease in the diameter of a blooms of the plants as compared to the control. The biggest diameter of a flower (7.80 cm) in T_1, that was control the plants were treated with ordinary water. Due to the lethal effect in T_4 i.e EMS @ 0.5% diameter of a single flower was recorded (0.00 cm). The poor growth of flower heads produced by several physiological, morphological, and cytological abnormalities treatment may be responsible for the decrease in floral diameter with EMS treatment plants. According to Kapadiya *et al*., (2014) [4] and Paleker *et al*, (2022) [12]. In additional Chrysanthemum flower heads are getting smaller as mutagenic treatments are applied at higher concentrations. The same results were previously reported by Bhajantari *et al*., (2013) [14].

Table 1: In additional Chrysanthemum flower heads are getting smaller as mutagenic treatments are applied at higher concentrations

Treatments		Plant height (cm)	Plant spread (cm^2)	Number of leaves per plant	Leaf length (cm)	Number of flower per plant	Flower diameter (cm)
T_1	Control (Distilled water)	35.73	23.19	39.13	7.39	7.39	7.80
T_2	EMS (0.2%)	26.67	14.10	25.93	6.81	6.81	7.20
T_3	EMS (0.3%)	28.40	14.40	28.93	6.90	6.90	7.43
T_4	EMS (0.5%)	0.00	0.00	0.00	0.00	0.00	0.00
T_5	Colchicine (0.2%)	11.57	10.21	22.87	5.81	5.81	5.87
T_6	Colchicine (0.3%)	12.30	9.57	19.80	6.05	6.05	5.57
T_7	Colchicine (0.5%)	13.87	11.20	24.20	6.88	6.88	5.90
Sem±		1.42	1.41	2.64	0.49	0.51	1.90
$CD_{0.005}$		4.37	4.33	8.13	1.51	1.58	5.87

Conclusion

EMS and colchicine has negative impact on vegetative and flowering parameters as compare to control. High doses of chemical mutagens (0.5%) - has lethal effect on plant because chemical mutagens cause a decrease in the rate of cell multiplication. The reduction in plant length and other parameters can be utilized as dwarf plant variety development.

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Conflict of Interest: I have not any personal interest to publish my paper. I want to publish it for professional interest.

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