The Pharma Innovation Journal 2022; 11(2): 741-744

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 741-744

www.thepharmajournal.com
Received: 07-12-2021
Accepted: 16-01-2022

Palekar AR
Ph.D., Scholar, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Tambe TB
Head, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Ghormade GN
Ph.D., Scholar, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Palekar AR
Ph.D., Scholar, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Effect of induced mutagenesis on growth, flowering and quality of chrysanthemum varieties in M_1 generation

Palekar AR, Tambe TB and Ghormade GN

Abstract
The present experiment was conducted at Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth Parbhani. (Maharashtra) during the year 2019-2020 in Factorial Randomized Block Design (FRBD) of three replications. The present work was undertaken to observe the response of chrysanthemum varieties V_1-Pink Cloud, V_2- Devi and V_3-Bidhan Agnisikha over EMS T_1 -0.05%, T_2 - 0.1%, T_3 -0.5%, T_4 -1.0%, T_5- Gamma rays 0.5 kR, T_6 -1.0 kR, T_7 -1.5 kR, T_8 -2.0 kR, T_9 - Control treatments. The different treatments to rooted cuttings of chrysanthemum varieties with EMS and gamma rays had significantly influenced the vegetative growth, yield and quality characters and also created the variability. Significant reduction occurred in both EMS and gamma rays treated seedlings of chrysanthemum varieties in terms of plant spread, diameter of main stem, chlorophyll content index, number of flowers per plant, yield of flowers per plant, weight of single flower and diameter of flower as compared to control.

Keywords: Chrysanthemum, Induced mutation, chemical and physical mutagen, EMS, Gamma rays, M_1 generation

Introduction
Chrysanthemum (*Chrysanthemum indicum* L.) is one of the most critical cuts and loose flower crops are grown commercially in many parts. It is among the most widely cultivated herbaceous perennial plants which is commonly known as "Autumn Queen" or "Queen of East" and belongs to the family Asteraceae. Mutation breeding has now been widely recognized as a useful complementary tool for improving modern-day chrysanthemum cultivars. The induction of mutations in commercial chrysanthemum has attracted considerable attention because any modification in the dormant genes is easily expressed in the first generation. Considering the rapid increase in the area under chrysanthemum cultivation and its popularity in day-to-day life, every effort is being made to improve the presently grown varieties. However, with the increasing demand for chrysanthemum for various purposes, there is a good scope for increasing the production and improving the present-day cultivars through mutation breeding.

Material and Methods
Chrysanthemum cultivars Pink Cloud, Devi and Bidhan Agnisikha of seedlings raised by using shoot tip cuttings of 6 to 8 cm has been collected from the Department of Horticulture, Dr. PDKV, Akola. Cuttings were first treated with 0.2% bavistin for 5 min. and then planted in a pot filled with coco peat and sand. An experimental land was ploughed one to two times followed by harrowing were given to bring the soil to the fine tilth. The soil then loosened, and ridge and furrow were prepared at 45 cm apart. The field should be irrigated one day before transplanting. Uniform and healthy rooted cuttings were selected for treatment. The rooted cuttings were treated with different Ethyl methane sulphonate (EMS) concentrations immersed in Ethyl methane sulphonate (EMS) solution for 2 hours. In control, the rooted cuttings were immersed in distilled water for 2 hours. After the treatments, these cuttings were dipped in STS (sodium thiosulphate) solution (0.3%) for 15 minutes to remove the stresses of the solution on plant parts. Then, these cuttings were washed in running tap water for few minutes. Remaining rooted cuttings were irradiated with four doses of gamma rays (0.5, 1.0, 1.5 and 2.0 kR) in Gamma Cell-200 (Cobalt – 60) at Bhabha Atomic Research Centre (BARC), Trombay, Mumbai. These cuttings were planted at 45 X 30 cm distance on the experimental field in Factorial Randomized Block Design (FRBD) of three replications with nine blocks in a row of three different varieties.

All the standard cultural practices were followed, except the pinching and disbudding operations.

Result and Discussion

A) Growth parameters

Significant reduction occurs in induced mutagens treated seedlings of chrysanthemum varieties in terms of plant spread, diameter of main stem and chlorophyll content index over control. Among the induced mutagen maximum plant spread (34.04 cm) was recorded at 0.5 kR gamma rays (T_5) which was at par with T_1 EMS 0.05% (32.48 cm) and minimum (21.15 cm) plant spread was observed in gamma rays 2.0 kR (T_8). Among the varieties maximum plant spread was recorded in variety Bidhan Agnisikha V_3 (29.80 cm) which was at par with Pink Cloud (V_1) (28.97 cm) and minimum in Devi V_2 (24.25 cm). However, among the treatments maximum diameter of main stem (8.93 mm) was recorded at 0.05% EMS (T_1) which was at par with T_5 gamma rays 0.5 kR (8.52 mm) and minimum (5.62 mm) diameter of main stem were observed in gamma rays 2.0 kR (T_8). Among the varieties maximum diameter of main stem was recorded in variety Bidhan Agnisikha V_3 (8.37 mm) and minimum in Devi V_2 (5.70 mm). Whereas, among the induced mutagen maximum chlorophyll content (58.71 cci) was recorded at gamma rays 0.5 kR (T_5) which was at par with T_6 (56.43 cci), T_1 (54.29 cci) and minimum (43.38 cci) chlorophyll content was observed in gamma rays 2.0 kR (T_8). Among the varieties maximum chlorophyll content was recorded in variety Devi V_2 (52.83 cci) which was at par with V_3 (52.44 cci) and minimum in Pink Cloud V_1 (50.33 cci).

Gunckel and Sparrow (1961) [4] explained that, the reduction in plant spread could be due to physiological, morphological and cytological disturbances caused by radiation and EMS. Similar results in chrysanthemum are documented by Gupta *et al.* (2003) [5], Sharma *et al.* (2003) [10] and Dilta *et al.* (2006) [2] who reported the significant reduction in the spread of the gamma rays treated plants and the reduction of plant spread was increased with an increase in the dose of gamma rays. Chromosomal aberrations and disturbances of auxin synthesis occurred due the EMS and gamma rays which inhibits physiological process and retard cell division by arresting the mitotic division thereby reduction of stem diameter of plant. The results obtained are in conformity with the findings of Kapadiya *et al.* (2014) [6] and Vaidya *et al.* (2016) [11] in chrysanthemum.

B) Yield parameters

Significant reduction occurs in induced mutagens treated seedlings of chrysanthemum varieties in terms of number of flowers per plant and yield of flowers per plant over control. Among the induced mutagen maximum number of flowers per plant (38.02) was recorded at 0.05% EMS (T_1) and minimum (13.92) number of flowers per plant was observed in gamma rays 2.0 kR (T_8). Among the varieties maximum number of flowers per plant was recorded in variety Pink Cloud V_1 (34.30) and minimum in Devi V_2 (19.09). An interaction effect among varieties (V) treated with induced mutagens (T) on number of flowers per plant revealed the maximum number of flowers per plant (48.62) in treatment combination V_1T_1 of variety Pink Cloud at 0.05% EMS which was at par with V_1T_5 (45.94) and minimum (11.13) in (V_2T_8) variety Devi at 1.5 kR gamma rays in M_1 generation. Whereas, among the induced mutagen maximum yield of flowers per plant (108.17 g) was recorded at 0.05% EMS (T_1) which was at par with T_5 (101.54 g) and minimum (39.28 g) yield of flowers per plant was observed in gamma rays 2.0 kR (T_8). Among the varieties maximum yield of flowers per plant was recorded in variety Pink Cloud V_1 (95.86 g) and minimum in Devi V_2 (45.74 g). An interaction effect among varieties (V) treated with induced mutagens (T) on yield of flowers per plant of chrysanthemum varieties maximum yield of flowers per plant (136.13 g) was recorded in treatment combination V_1T_1 of variety Pink Cloud at 0.05% EMS which was at par with V_1T_5 (128.63 g), V_3T_1 (125.21 g) and minimum (26.71 g) in (V_2T_8) variety Devi at 2.0 kR gamma rays in M_1 generation.

The significant reduction in number of flowers per plant and flower yield per plant was observed due to gamma rays and EMS treatments over the non-treated control in both the generation. This might be due to reduction in branches of lateral bud, while the other control plants are splitted with more number of lateral branches. So that the number of bud was reduced ultimately number of flowers per plant and yield of flowers per plant in treated plants. These finding are in closer conformity with the findings of the earlier workers like Sharma *et al.* (2003) [10], Dilta *et al.* (2006) [2], Kapadiya *et al.* (2014) [6], Patil *et al.* (2015) [9], Vaidya *et al.* (2016) [11] and Patil *et al.* (2017) [8].

C) Quality parameters

Significant reduction occurs in induced mutagens treated seedlings of chrysanthemum varieties in terms of weight of single flower per plant and diameter of flower over control. Among the induced mutagen maximum weight of single flower (3.14 g) was recorded at 0.05% EMS (T_1) which was at par with T_5 gamma rays 0.5 kR (2.92 g) and minimum weight of single flower (1.91 g) was observed in gamma rays 2.0 kR (T_8). Among the varieties maximum weight of single flower was recorded in variety Bidhan Agnisikha V_3 (3.14 g) and minimum in Devi V_2 (2.20 g). However, among the induced mutagen maximum diameter of flower (4.96 cm) was recorded at 0.05% EMS (T_1) which was at par with (T_5) (4.62 cm) and minimum diameter of flower (3.61 cm) was observed in gamma rays 2.0 kR (T_8). Among the varieties maximum diameter of flower was recorded in variety Bidhan Agnisikha V_3 (4.53 cm) and minimum in Devi V_2 (3.96 cm).

In general, it could be concluded that, the weight of flower was decreased in all the radiation and EMS treatments as compared to the control. This inferior result might be due to the chromosomal aberrations and disturbances in the production and distribution of auxin which might have resulted in abnormal physiological, morphological and cytological processes caused by the gamma radiation and EMS. The results obtained are in conformity with the findings of Kapadiya *et al.* (2014) [6], Patil *et al.* (2015) [9], Vaidya *et al.* (2016) [11] and Patil *et al.* (2017) [8] in chrysanthemum. Also decrease in the flower diameter with the gamma radiated and EMS treated plants could be attributed due to the poor growth of flower heads due to some physiological, morphological and cytological disturbances caused by the mutagenic treatment. Kapadiya *et al.* (2014) [6], Vaidya *et al.* (2016) [11] reported, decreasing trend in diameter of flower head with increasing levels of mutagenic treatments in chrysanthemum. Bhajantari and Patil (2013) also reported same results.

Table 1: Effect of induced mutagens on growth, yield and quality of chrysanthemum varieties in M_1 generation

Treatments	Plant spread (cm)	Diameter of main stem (mm)	Chlorophyll content index	Number of flowers per plant	Yield of flowers per plant (g)	Weight of single flower (g)	Diameter of flower (cm)
Factor A – Varieties (V)							
V_1 (Pink Cloud)	28.97	7.64	50.33	34.30	95.86	2.30	4.23
V_2 (Devi)	24.25	5.70	52.83	19.09	45.74	2.20	3.96
V_3 (Bidhan Agnisikha)	29.80	8.37	52.44	27.95	89.92	3.14	4.53
SE (m)	0.56	0.15	1.04	0.61	1.64	0.05	0.08
CD at 5%	1.60	0.42	2.96	1.74	4.68	0.15	0.24
Factor B – Induced mutagens (T)							
T_1 (EMS) 0.05%	32.48	8.93	54.29	38.02	108.17	3.14	4.96
T_2 (EMS) 0.1%	29.26	7.57	49.43	31.09	89.03	2.75	4.45
T_3 (EMS) 0.5%	27.82	6.82	46.87	26.53	75.64	2.55	4.1
T_4 (EMS) 1.0%	24.3	6.57	44.66	19.04	53.99	2.18	3.78
T_5 Gamma 0.5 kR	34.04	8.52	58.71	35.51	101.54	2.92	4.62
T_6 Gamma 1.0 kR	26.18	7.16	56.43	23.2	65.83	2.35	3.9
T_7 Gamma 1.5 kR	23.26	6.01	51.89	16.81	47.36	2.05	3.77
T_8 Gamma 2.0 kR	21.15	5.62	43.38	13.92	39.28	1.91	3.61
T_9 Control	37.38	9.37	61.14	39.87	113.7	3.24	5.23
SE (m)	0.98	0.26	1.81	1.06	2.85	0.09	0.15
CD at 5%	2.78	0.73	5.12	3.02	8.11	0.26	0.42

Table 2: The interaction effect of induced mutagens on growth, yield and quality of chrysanthemum varieties in M_1 generation

Treatment combination	Plant spread (cm)	Diameter of main stem (mm)	Chlorophyll content index	Number of flowers per plant	Yield of flowers per plant (g)	Weight of single flower (g)	Diameter of flower (cm)
V_1T_1	32.71	9.18	52.33	48.62	136.13	2.92	4.96
V_1T_2	30.79	7.93	48.79	39.81	111.46	2.41	4.45
V_1T_3	29.31	7.24	46.92	32.19	90.13	2.23	4.23
V_1T_4	25.49	7.11	45.11	23.31	65.26	1.94	3.83
V_1T_5	34.69	8.72	53.97	45.94	128.63	2.62	4.62
V_1T_6	27.68	7.66	53.46	28.79	80.61	2.06	3.91
V_1T_7	24.92	6.46	50.77	21.28	59.58	1.87	3.66
V_1T_8	23.72	6.14	44.91	17.31	48.46	1.81	3.53
V_1T_9	37.82	9.76	56.71	51.42	142.45	2.98	5.16
V_2T_1	27.94	7.49	55.81	26.32	63.16	2.63	4.61
V_2T_2	25.56	5.95	49.88	19.34	46.41	2.32	4.11
V_2T_3	24.35	5.3	45.91	18.61	44.66	2.17	3.41
V_2T_4	21.94	4.96	43.76	14.31	34.34	1.91	3.56
V_2T_5	28.73	6.88	62.43	23.41	56.18	2.49	4.31
V_2T_6	23.46	5.61	58.71	17.13	41.14	2.11	3.49
V_2T_7	21.36	4.69	52.73	13.41	32.18	1.84	3.76
V_2T_8	18.21	4.18	41.44	11.13	26.71	1.72	3.81
V_2T_9	32.46	7.82	64.81	28.11	66.87	2.82	4.92
V_3T_1	36.79	10.11	54.72	39.13	125.21	3.86	5.31
V_3T_2	31.44	8.83	49.61	34.13	109.21	3.51	4.79
V_3T_3	29.79	7.93	47.79	28.79	92.12	3.24	4.66
V_3T_4	25.46	7.64	45.11	19.49	62.36	2.69	3.96
V_3T_5	38.69	9.96	59.72	37.19	119.82	3.66	4.92
V_3T_6	27.39	8.22	57.11	23.67	75.74	2.88	4.31
V_3T_7	23.49	6.88	52.16	15.73	50.33	2.46	3.89
V_3T_8	21.52	6.54	43.79	13.34	42.68	2.23	3.76
V_3T_9	41.88	10.54	61.91	40.09	131.79	3.94	5.63
SE (m)	1.71	0.45	3.12	1.84	4.94	0.16	0.26
CD at 5%	N/S	N/S	N/S	5.23	14.04	N/S	N/S

Conclusion

The different treatments to rooted cuttings of chrysanthemum varieties with EMS and gamma rays had significantly influenced the vegetative growth, yield and quality characters and also created the variability.

Acknowledgement

I Abhishek Rajendra Palekar thankful to Chattrapati Shahu Maharaj Research, Training and Human Development Institute (SARTHI), PUNE for providing financial assistance to carry out the research work entitled on “Effect of induced mutation on different varieties of Chrysanthemum (*Chrysanthemum indicum* L.)”.

References

1. Bhajantari A, Patil VS. Studies on ethyl methane sulphonate (EMS) induced mutations for enhancing variability of gladiolus varieties (*Gladiolus hybridus* Hort) in M1V2 generation. Karnataka Journal of Agricult ural Sciences. 2013;26(3):403-407.

2. Dilta BS, Sharma YD, Dhiman SR, Verma VK. Induction of somatic mutation in chrysanthemum by gamma irradiation. International Journal Agricultural Science. 2006;2(1):77-81.
3. Dilta BS, Sharma YD, Gupta YC, Bhalla R. Effect of gamma rays on vegetative and flowering parameters of chrysanthemum. Journal of Ornamental Horticulture. 2003;6(4):328-334.
4. Gunckel JE, Sparrow AH. Ionization radiations: Biochemical, physiological and morphological aspects and their effects on plants. Encyclopedia of Plant Physiology. 1961;16:555-611.
5. Gupta YC, Dilta BS, Bhalla R, Sharma BP. Effect of gamma rays on vegetative and flowering parameters of chrysanthemum. J Ornamental Hort. (New series). 2003;6(4):328-334.
6. Kapadiya DB, Chawla SL, Patel AI, Ahlawat TR. Exploitation of variability through mutagenesis in Chrysanthemum (*Chrysanthemum morifolium* Ramat.) var. Maghi. The Bioscan an International Quarterly Journal of Life Science. 2014;9(4):1799-1804.
7. Padmadevi K, Janaharlal M. Induction of in *vitro* mutation in chrysanthemum (*Dendranthema grandiflora* Tzvelev) ray florets (var. Ravi Kiran) using gamma rays and EMS. Floriculture and Ornamental Biotechnology. 2011;5(1):74-77.
8. Patil UH, Karale AR, Katwate, Patil MS. Mutation breeding in Chrysanthemum (*Dendranthema grandiflora* T.). Journal of Pharmacognosy & Phytochemistry. 2017;6(6):230-233.
9. Patil UH, Deshmukh GN, Kazi NA. Mutation Breeding in Chrysanthemum (*Dendranthema grandiflora* T.) Asian Journal of Multidisciplinary Studies. 2015;3(4):25-27.
10. Sharma YD, Gupta YC, Dilta BS, Bhalla R, Sharma BP. Effect of gamma-rays on vegetative and flowering parameters of chrysanthemum. J Ornamental Hort. 2003;6(4):328-334.
11. Vaidya PP, Dalal SR, Mahadik MK. Vegetative Mutagenesis Studies in Chrysanthemum. Advances in Life Sciences. 2016;5(12):4831-4835.