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Effect of gamma irradiation on flowering attribute of Chrysanthemum

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Abstract
The present experiment was conducted on chrysanthemum cultivar 'Local Golden' which was irradiated with 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 Krad of gamma radiation at Department of Chemistry, University of Pune. Objectives were to study morphological change in chrysanthemum due to radiation and to explore the possibility of physical mutagen to create genetic variability in chrysanthemum. The experiment was laid out in Randomized Block Design with seven treatments replicated three times. The quantitative and qualitative characters were studied. Reduction in survival percentage, plant height, number of branches, and number of suckers per plant was observed after irradiation and with increase in dose of gamma rays.
The treatment with 2.5 and 3.0 Krad of gamma rays delayed the flower bud initiation as well as flowering. Among different gamma ray treatments, minimum number of days taken from bud to full bloom was recorded with control (45.60 days) and maximum (54.72 days) was recorded with 2.5 Krad. Yield of flowers and number of flowers per plant was maximum in control i.e. 0.551 kg and 186.00 respectively as compared to other treatments, while minimum was recorded in 3.0 Krad (0.377 kg and 127.57 respectively). Among different gamma ray treatments, the best performance was shown by treatment 3.0 Krad in flower diameter (6.31 cm) and number of ray florets per flower (201.7), followed by 2.5 Krad treatment. Maximum crop duration of 174.09 days was recorded at 3.0 Krad of gamma ray. There was no significant difference in colour of florets of treated and control plants. There were no leaf and floral abnormalities in treated plants. Chimera in ray florets of flower was observed in one plant after 1.5 Krad treatments. The original shape of ray florets was flat with small tube at the base whereas in case of tubular mutant, shape at tip was spoon type and basal portion showed pipe or tube like appearance.

Keywords: *Dendranthema grandiflora* Tzvelve, gamma irradiation, mutation, chrysanthemum

Introduction
Chrysanthemum (*Dendranthema grandiflora* Tzvelve synonymous *Chrysanthemum morifolium* Ramat.) is one of the most important floricultural (cut and loose flower) and ornamental (pot and garden flower) crop in the world. The genus chrysanthemum belong to family Asteraceae and basic chromosome number is n=9. Wide variation exhibited in respect of growth, habit, size, colour and shape of bloom make the chrysanthemum suitable for every purpose for a flower crop. It is one of the most important loose flower crop grown commercially in many part of the country. Flower of chrysanthemum used for garland making, wreath as religious offering in hall decoration etc. (Banerji & Datta, 1992) [2].
Chrysanthemum is very popular and important cut flower crop grown all over the world in Japan, China, USA, France, UK, and India. Its enjoy the second position in cut flower ranking after rose. In India, chrysanthemum is commercially cultivated in Karnataka, Maharashtra, Tamilnadu, Andhra Pradesh, and West Bengal. In Maharashtra, chrysanthemum is grown approximately 1380 ha. area mainly in the district Solapur, Ahmednagar, Parbhani, Nagpur, Satara, Sangli, and Pune and production 14950 MT of loose flower (Anon, 2011) [1]. The maximum area under chrysanthemum cultivation is in Ahmednagar and Solapur district (Bhalsing *et al*., 2012) [4].
The major objective of any mutation breeding programme is to obtain new and better genotype through the creation of genetic variability in the existing gene pool. The main advantage of mutagenesis in chrysanthemum is the ability to change one or a few characters of an excellent cultivar without changing rest of the genotype. The gamma rays have been used effectively for induction of mutation in chrysanthemum and the optimum dose range from 1.0 to 3.0 Krads depending upon the genotypes (Dilta *et al*., 2003) [6].

Material and Methods

The experimental material i.e. rooted suckers of chrysanthemum cv. 'Local Golden' were procured from the progressive farmer from village Akolner-Kedgaon Dist. Ahmednagar. Rooted suckers of yellow flower chrysanthemum cultivar were packed in polyethylene bags. A set of each containing 25 suckers was irradiated with gamma rays of 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 Krad at Chemistry Department of Pune University. A set of suckers without any irradiation was used as control. Treated suckers were planted on 20th June 2011.

The experimental was laid out in Randomized Block Design with seven treatment replicated three times. The spacing of 45x 30cm was maintained among experimental plant. After the planting of suckers the field was watered as and when necessary with a open channel system. Uniform dose of fertilizer and manure was applied to the field for conducting the experiment. Drenching of Bavistin (0.1%) was done 10 days after planting to prevent soil borne disease like root rot. Observations on twenty five randomly selected plants from each treatment in each replication were recorded during the course of experiment for vegetative growth characters and flower characters. The statistical analysis was done by standard statistical method suggested by Panse and Sukhatme (1985) [9].

Fig 1: Selection of suckers for irradiation

Result and Discussion

Effects of gamma irradiation on suckers of chrysanthemum were studied and it was found that total crop duration increased with increase in dose of gamma rays. Also, it was found that diameter of flower, number of ray floret increased with increase in dose of gamma rays. The appearance of flowering was significantly delayed in all the dose of gamma rays over untreated control treatment. Days required for bud to full bloom was noticed 45 days in the control population which was significantly delayed with exposure gamma rays at 0.5 Krad. Maximum delay of 9 days was observed in the 2.5 Krad dose of gamma rays. Similar results obtained by Misra *et al*. (2009) [8] in chrysanthemum cv. Pooja.

Somatic mutation in flower colour was not detected in treated plants. Colour of ray and disc florets as a result of mutagenesis was found to be non significant. The original colour of ray florets and disc florets is Aureolin (3/1) and Lemon Yellow (4) respectively while the no colour change was detected after gamma irradiation treatments. Shoot or tissue without chemeric growth lead to non-formation different colour variation in petals reported by Longton (1980) [7] in chrysanthemum. Somatic mutation in ray florets shape was detected in sectorial chimeric form in one branch of a plant treated with 1.5 Krad of gamma rays. The florets of original flower were flat with a small tube at the base where as in case of tubular mutant shape at tip spoon type but the basal portion gave pipe or tube like appearance to the ray florets.

Fig 2: Change in shape of ray florets

Table 1: Effect of gamma irradiation on flower characters of chrysanthemum.

Sr. No	Treatment		Days required for		Number of flower per plant	Yield of flower per plant (kg)	Total crop duration (days)	Colour of ray florets	Colour of disc florets	Diameter of flower (cm)	Number of ray florets per flower
	Code	Dose (Krad)	Bud initiation	Flowering							
1	T_1	0.5	91.75	49.17	146.95	0.428	140.3	Aureolin (3/1)	Lemon yellow (4)	5.68	195.78
2	T_2	1.0	92.48	48.51	162.16	0.465	139.59	Aureolin (3/1)	Lemon yellow (4)	5.55	189.24
3	T_3	1.5	93.27	50.39	143.37	0.418	143.25	Aureolin (3/1)	Lemon yellow (4)	5.70	186.42
4	T_4	2.0	91.59	49.12	131.22	0.382	141.76	Aureolin (3/1)	Lemon yellow (4)	5.77	197.83
5	T_5	2.5	105.63	54.72	129.05	0.379	158.57	Aureolin (3/1)	Lemon yellow (4)	6.04	195.5
6	T_6	3.0	108.67	52.99	127.57	0.377	174.09	Aureolin (3/1)	Lemon yellow (4)	6.31	201.7
7	T_7	control	89.63	45.60	186.00	0.551	135.07	Aureolin (3/1)	Lemon yellow (4)	5.22	183.61
		S.Em ±	1.41	0.907	17.05	0.010	3.59	-	-	0.010	3.54
		C.D. at 5%	4.35	2.79	52.56	0.032	11.06	-	-	0.032	10.93

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