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Evaluation of Chrysanthemum Cultivars and Gamma Rays Induced Mutants for Growth, Flowering, Yield and Quality

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ABSTRACT: *The present investigation was carried out at Horticulture Section, College of Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola; Maharashtra (India) during the years (2011-12 to 2013-14). The experiment was laid out in a Randomized Block Design consisting five treatments (mutants/varieties) with four replications. The experiment was undertaken to study growth, flowering, yield and quality performance of different gamma rays isolated chrysanthemum mutants and varieties. The findings of the present investigation indicates that the mutant AK-CHR-MUT-05-02 found significantly superior with respect to plant height (73.41 cm), plant spread (55.16 cm), branches per plant (8.61), leaf area (50.80 cm^2) and flower heads per plant (122.29) than the other mutants. However, maximum flower yield per plant and per hectare was reported in Akola local which was at par with mutant AK-CHR-MUT-05-02. Similarly, significantly maximum weight of flower head (5.29 g), flower head diameter (6.55 cm) and vase life (11.28 days) were registered with the mutant AK-CHR-MUT-05-02 which was significantly superior over rest of the mutants and varieties.*

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora*) is one of the multipurpose flower commonly known as 'Glory of east' or as 'Mum' in USA where, it is number one dollar earning flower. In India, chrysanthemum occupies a place of pride as commercial as well as popular exhibition flower due to its diversified shape, size, beauty and various ranges of colour shades. Mutation breeding has been employed in chrysanthemum for improvement of flower colour, size, form, height, growth form and sensitivity to light quality/quantity Mutation breeding induced by physical means is one of the efficient methods to evolve new cultivars for the floriculture industry. When irradiation was employed as a means of mutagenesis in chrysanthemum, large number of promising mutants emerged in the form of solid mutants as well as partial chimeras. Considering the rapid increase in the area under chrysanthemum cultivation and its popularity in day to day life, every effort is being made in order to improve the presently grown varieties.

MATERIALS AND METHODS

The rooted cuttings having 6-7 cm length were treated with different doses (0, 0.5, 1.0, 1.5, 2.0, 2.5 K_R and untreated control) of gamma rays (Cobalt- 60) at the Bhaba Atomic Research Center, Mumbai using Gamma Cell- 220 machine, Atomic energy of Canada Ltd. The gamma rays treatments were given with an output of 750 rads per minute.

These gamma rays treated rooted cuttings along with control (unirradiated) were planted at at Horticulture Section, College of Agriculture, Akola during the year 2006-07 in Randomized Block Design (RBD) with four replications (VM_1 generation). Two hundred fifty rooted cuttings were used per treatment. All the standard cultural operations were followed except the pinching and disbudding.

The plants, which showed significant variation in flower colour, plant size (dwarfness) and number of days taken for full bloom stage (i.e. early and lateness) were isolated and planted separately in the observational rows at 60 x 60 cm along with the other treated and untreated plants during the year 2007-08 to study the stability of induced characters (VM2 generation). As the commercial important mutants

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when showed stability in their characters, they were then assessed with other varieties (2011-12 to 2013-14). The data on growth, flowering, yield and vase life were recorded and statistically analysed.

RESULTS AND DISCUSSION

The four years (2011-12 to 2013-14) pooled data in respect of growth, flowering, yield and quality characters of chrysanthemum mutants and cultivars is presented in Tables 1 and 2.

Growth: The data presented in Table 1 in respect of vegetative characters of chrysanthemum cv. 'Akola Local' and its gamma rays induced mutants exhibited significant differences amongst them. All the gamma rays induced mutants viz. AK- CHR-MUT-05-01, AK-CHR-MUT-05-02, AK-CHR-MUT-05-07 had shown significantly reduced growth over cultivar 'Akola Local' (Control). Among the various gamma rays induced mutants, significantly superior plant height (73.41 cm), plant spread (55.16 cm), branches per plant (8.61) and leaf area (50.80 cm^2) were recorded with AK-CHR-MUT-05-02 than the other mutants and it was followed by AK-CHR-MUT-05- 07 (63.90 cm, 33.50 cm, 8.06, 142.67 and 46.27 cm^2, respectively). However, significantly minimum growth (44.26 cm 31.40 cm, 4.27, 88.67 and 18.13 cm^2, respectively) was observed in the AK-CHR-MUT-05-01. Earlier, Banerji and Datta (2002) also recorded reduced leaf size and abnormalities with increasing irradiation doses.

Flowering: The data furnished in Table 1 exhibited that, the days required for bud initiation and full blooming were significantly influenced due the chrysanthemum cultivar Akola Local and its gamma rays induced mutants. Significantly an early bud initiation (66.18 days) and full blooming (127.67 days) from transplanting were noticed with the mutant AK-CHR-MUT-05-01 which was earliest by about 29 and 21 days, respectively than original cultivar 'Akola Local'. However, delayed bud initiation (113.10 days) and blooming (166.14 days) were noticed with the AK-CHR-MUT-05-07. Banerji and Datta (1990) reported significant delay in flower bud formation of chrysanthemum cv. Anupam. Similar results are also noticed by Dwivedi *et. al.* (2000), Gupta *et. al.*(2003), Sharma *et. al.* (2003) and Dilta *et. al.*(2006) with the different chrysanthemum cultivars.

Flower Yield: It is evident from the data presented in Table 2 that, the flower heads per plant, yield per plant and per hectare was significantly reduced under different gamma rays induced mutants over the cultivar 'Akola Local' (control). Significantly maximum flower heads per plant (122.29) was observed with the mutant AK-CHR-MUT-05-02 while, flower yield per plant (666.39 g) and per hectare (183.99 q) were harvested from the cultivar 'Akola Local' and was found to be at par with AK-CHR-MUT-05-02 (645.90 g per plant and 179.40 q per ha, respectively). However, minimum flower heads per plant (46.45), flower yield per plant (165.35 g) and flower yield per hectare (46.12 q) were recorded with the AK-CHR-MUT-05-01. These findings are in close conformity with the findings of the earlier workers like Banerji and Datta (1990 and 1992), Sharma *et. al.* (2003) and Dilta *et. al.*(2006).

Flower quality and vase life: The data in respect of quality of flower and vase life presented in Table 2 revealed that, the weight of flower head, diameter of flower and vase life were significantly reduced under all the gamma rays induced mutants as compared to original cultivar 'Akola Local'. Among the gamma rays induced mutants, significantly maximum weight of flower head (5.29 g), flower head diameter (6.55 cm) and vase life (11.28 days) were registered with the mutant AK-CHR-MUT-05-02 which was significantly superior over rest of the mutants. This was followed by mutant AK-CHR-MUT-05-07 (5.23 g, 5.74 cm, and 10.87 days, respectively). However, these were recorded significantly minimum with the AK-CHR-MUT-05-01 an early and dwarf mutant (3.60 g, 4.62 cm and 8.17 days, respectively). The results of this experiment are in agreement with the findings of Banerji and Datta (2002), Sharma *et. al.* (2003) and Dilta *et. al.*(2006).

Table 1
Growth and flowering performance of chrysanthemum mutants and cultivars

Mutant/cultivar	*Plant Height (cm)*	*Plant Spread (cm)*	*Branches per plant*	*Leaf area (cm^2)*	*Days to bud initiation*	*Days required for full bloom*	*Flower head per plant (g)*
T_1-AK-CHR-MUT-05-01	44.26	31.40	4.27	18.13	66.18	127.67	46.45
T_2- AK-CHR-MUT-05-02	73.41	55.16	8.61	50.80	93.54	163.83	122.29
T_3- AK-CHR-MUT-05-07	63.90	33.50	8.06	46.27	113.10	166.14	108.61
T_4-PKV Shubhra	52.89	38.12	6.16	48.34	88.60	155.32	93.12
T_5- Akola Local	86.22	63.09	8.78	80.57	95.66	148.80	113.77
S.E.(m) ±	0.61	3.205	0.21	1.291	0.304	0.431	1.273
CD at 5 %	1.84	9.582	0.62	3.835	0.928	1.323	3.836

Table 2
Yield and quality performance of chrysanthemum mutants and cultivars

Mutant/cultivar	*Flower yield per plant (g)*	*Flower yield per ha (q)*	*Weight of flower head (g)*	*Diameter of flower head (cm)*	*Vase life (days)*	*Reaction to fusarium wilt (%)*
T_1-AK-CHR-MUT-05-01	165.35	46.12	3.60	4.62	8.17	22.65
T_2- AK-CHR-MUT-05-02	645.90	179.40	5.29	6.55	11.28	16.16
T_3- AK-CHR-MUT-05-07	568.85	157.75	5.23	5.74	10.87	18.55
T_4-PKV Shubhra	458.15	127.25	4.92	5.11	9.17	27.64
T_5- Akola Local	666.39	183.99	5.82	7.86	12.01	18.47
S.E.(m) ±	7.712	1.785	0.032	0.0515	0.321	1.681
CD at 5%	23.145	5.152	0.099	0.045	0.992	5.031

Table 3
Yield and quality performance of chrysanthemum mutants and cultivars

Mutant/genotype	*Flower yield per plant (g)*	*Flower yield per ha (q)*	*Weight of flower head(g)*	*Diameter of flower head (cm)*	*Vase life (days)*	*Reaction to fusarium wilt (%)*
T_1-AK-CHR-MUT-05-01	165.35	46.12	3.60	4.62	8.17	22.65
T_2- AK-CHR-MUT-05-02	645.90	179.40	5.29	6.55	11.28	16.16
T_3- AK-CHR-MUT-05-07	568.85	157.75	5.23	5.74	10.87	18.55
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T_5- Akola Local	666.39	183.99	5.82	7.86	12.01	18.47
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CD at 5%	23.145	5.152	0.099	0.045	0.992	5.031

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