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Effect of induced mutation in gladiolus (*Gladiolus grandiflorus* L.) on vM₂ generation for vegetative growth

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Abstract

The present investigation entitled “Effect of Induced mutation in *Gladiolus grandiflorus* L.) on vM₂ generation for vegetative growth” was conducted at the Horticulture Research cum Instructional Farm, Division of Floriculture and Landscaping, Department of Horticulture, College of Agriculture, IGKV, Raipur, Chhattisgarh during winter season 2017-2018. The planting materials for experiment work will consist corms obtained from vM₁ generation irradiated with 5 different doses including control (0 Gy) of 3 varieties of gladiolus viz. Candy Man, American Beauty and Her Majesty during the year 2015-16. The results showed that sprouting percentage was found maximum in variety Candyman followed by American Beauty and Her Majesty. Early sprouting was recorded in American Beauty *at par* with Her Majesty. Maximum survival percentage was recorded with 0 Gy (control). Maximum number of sprouts per corm was recorded in variety American Beauty. Among various gamma doses, for most of the vegetative characters 0 Gy (control) was found superior over all gamma doses which was followed by 15 Gy.

Keywords: Vegetative growth, gamma radiation, gladiolus

Introduction

Among the various ornamental bulbous flowering plants gladiolus (*Gladiolus grandiflorus* L.) is one of the most popular flower and is called as “Queen of bulbous flower crops”. Gladiolus belongs to family Iridaceae and it has increasing demand in the flower markets. The garden varieties of Gladiolus today has emerged from the diverse genetic parentage which are heteroploids ranging from 2n=30 to 180. due to its heterozygosity in genetic constitutions this makes it promising test material for inducing physical mutagenesis. Among various breeding methods mutation is recognized as one of the most important breeding method for the development of new promising varieties through genetic manipulation (Kumar and Kumari 2015) [7]. Gladiolus is commercially cultivated in Maharashtra, Karnataka, West Bengal, Punjab, Himachal Pradesh and Uttar Pradesh (Anon. 2018) [1]. It is very much in demand for bouquets and landscaping apart from its production as cut flower. Therefore, present investigation entitled “Effect of Induced mutation in *Gladiolus grandiflorus* L.) on vM₂ generation for vegetative growth” was carried out to observe vegetative parameters in gladiolus in vM₂ generation.

Materials and Methods

A field experiment was conducted at the Horticulture Research cum Instructional Farm, Division of Floriculture and Landscaping, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during winter season 2017-2018. The planting materials (corms) for experiment work was obtained from vM₁ generation irradiated with 5 different doses including control (0 Gy) of 3 varieties of gladiolus namely Candy Man, American Beauty and Her Majesty during the year 2015-16. For this experiment work corms of all 3 cultivar viz. Candy Man, American Beauty and Her Majesty was irradiated with 5 different gamma doses (15 Gy, 30 Gy, 45Gy, 60Gy) including control (0Gy) in vM₁ generation. vM₂ generation was grown with 3 replications and 15 treatment combinations in factorial randomized block design. The data were statistically analyzed for significance with standard error at 5%. Correlation analysis was carried out for comparing the significance among the treatment means.

Treatments

Factor I: Varieties: Candyman, American Beauty, Her Majesty

Factor II: Level of gamma rays treated in the vM₁ generation: 0 Gy (Control), 15 Gy, 30 Gy, 45 Gy, 60 Gy

Planting: Corms treatment was done by using copper oxy chloride as a preventive measure then the treated corms were planted 8-15 cm deep depending upon the size of corms at a spacing of 30 cm x 20 cm on 11th October 2017.

Results and Discussion

Sprouting and survival

Among all three varieties, Candyman took maximum days (14 days) for sprouting whereas early sprouting (10.80 days) was observed in the variety American Beauty which was *at par* with Her Majesty (11.20 days). 45 Gy was resulted in early sprouting (each 11.33 days) which was *at par* with 15 Gy and 30 Gy (each 11.33 days). However maximum days (13.55 days) to sprouting taken by 60 Gy gamma rays.

Maximum sprouting percentage with 0 Gy (99.44%) followed by American Beauty (85.33%) and Her Majesty (75%). Minimum sprouting percentage was recorded with higher dose of 60 Gy. Interaction also showed significantly influence where maximum sprouting percentage (100%) was noted in variety Candyman and American Beauty with 0 Gy (control). Maximum survival percentage (99.44%) was noted with 0 Gy (control) whereas minimum survival percentage (77.88%) was observed with higher dose 60 Gy.

These results showed that higher dose of radiations are harmful for sprouting and survival. Present findings was inline with the Sahariya *et al.* (2017) [12] who reported that early sprouting was recorded in 3.0 kr gamma rays. The decrease in growth parameter i.e. sprouting at higher doses of mutagens may caused by the disturbances at cellular level (either at physiological or physical level) or because of hormonal activities. Kayalvizhi (2017) [6] and Patel (2018) [9] who reported that the sprouting percentage and survival percentage were found to be decreasing with the increase doses of gamma rays and also in close conformity of Patil and Chawla (2017) [11] who were reported that maximum survival and sprouting percentage i.e. 100% was observed when the corms were not treated.

Number of sprouts per corm

Maximum number of sprouts per corm (2.60) was noted in variety American Beauty and 0 Gy (2.11) followed by Her Majesty (1.31) whereas minimum number of sprouts per corm (1.36) was reported in variety Candyman whereas minimum number of sprouts per corm (1.57) was noted with higher dose of 60 Gy radiation.

Similar results were found by Patil (2010) [10] who reported that maximum number of sprouts per corm was found under 2 kR treatment. American Beauty had recorded producing maximum number of sprouts per corm. Dhaduk (1992) [5] was observed in cv. Melody at 1Kr radiation dose.

Plant height

Maximum plant height at 25 DAS (24.65 cm) was noted with 0 Gy (control) which was *at par* with lowest dose of 15 Gy.

Interaction also showed significant influence on height of plant. Maximum height (26.45 cm) was observed in Cv. Her Majesty at 0 Gy (control) which was however *at par* with Her Majesty 15 Gy, Candyman with 15 Gy and 0 Gy (control) whereas minimum plant height (17.92 cm) was observed in variety Her Majesty with 60 Gy (higher dose).

At 50 DAS maximum plant height (51.26 cm) was observed in variety Candyman (52.59 cm) and with 0 Gy followed by variety Her Majesty (46.87 cm) which was however *at par* with 15 Gy whereas minimum plant height (39.84 cm) was observed in variety American Beauty. Candyman with 0 Gy (control) which was however *at par* with Candyman 15 Gy, Her Majesty with 30 Gy, 0 Gy (control) and 15 Gy.

At 75 DAS maximum plant height (63.87 cm) was noted in variety Candyman followed by Her Majesty (58.81 cm) whereas minimum plant height (47.11 cm) was noted in variety American Beauty.

This observations are inline with Kumari and Kumar (2015) [7] who reported that plants treated with higher doses of radiations showed deleterious effect although at lower dose (25 Gy) plants were not affected much. Plant height was reduced after being treated with radiations compared to untreated plants and minimum height was observed at the higher doses. Srivastava *et al.* (2007) [13] was observed that higher doses can cause harmful effects on auxins and other growth substances which influence the chromosomes and the plant tissues.

Number of leaves/plant

At 25 DAS number of leaves were found maximum (2.11) in variety American Beauty and with 0 Gy (control) (2.04) whereas minimum leaves per plant (1.63) was recorded in variety Candyman and with 60 Gy (1.08).

At 50 DAS number of leaves per plant was found maximum (4.49) in Cv. American Beauty and with 15 Gy (4.75) followed by Candyman (4.06) whereas minimum (4.01) was found in Cv. Her Majesty and in irradiation minimum number of leaves per plant (3.11) was found with higher dose 60 Gy.

At 75 DAS number of leaves per plant was found maximum (6.67) in Cv. Candyman followed by American Beauty (5.70) whereas minimum (5.29) was found in Cv. Her Majesty.

These findings are in line with Kayalvizhi *et al.* (2017) [6] who proved that length of leaf, number of leaves, width of leaf and thickness of leaf was increased with the lower doses of irradiations and decreased in the higher doses in M1V2 generation in Tuberose. Similar findings in Tuberose had been reported by Abraham and Desai (1976) [2]. Misra (1998) [8] reported that with the increase dose of irradiation number of leaves and leaf area started to decrease.

Length of leaf

At 25 DAS varieties showed non-significant influence on leaf length and at 50 and 75 DAS maximum length of leaf (37.91 cm and 43.71 cm respectively) was observed in variety Candyman and 0 Gy of gamma radiation dose followed by Her Majesty and 15 Gy gamma radiation dose whereas minimum leaf length was observed in variety American Beauty and with 60 Gy gamma radiation dose.

Banerji *et al.*, (1994) [3] in gladiolus reported that leaf length was reduced as the doses of gamma irradiation increased.

Table 1: Effect of treatments in days taken to sprouting and sprouting percentage

Variety	Days taken to sprouting						Sprouting percentage					
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean	0Gy	15Gy	30Gy	45Gy	60Gy	Mean
Candyman	12.66	14.66	14.33	13.33	15.00	14.00	100.00	91.66	90.00	83.33	78.33	88.66
American Beauty	10.66	9.00	10.66	11.00	12.66	10.80	100.00	96.66	86.66	81.66	61.66	85.33
Her Majesty	10.66	12.00	10.66	9.66	13.00	11.20	98.33	88.33	85.00	66.66	36.66	75.00
Mean	11.33	11.88	11.88	11.33	13.55		99.44	92.22	87.22	77.22	58.88	
	Varieties	Gamma doses	Interaction					Varieties	Gamma doses	Interaction		
C.D. (0.05)	1.06	1.37	NS				C.D. (0.05)	0.28	0.36	0.62		

Table 2: Effect of treatments on survival percentage and number of sprouts per corm

Variety	Survival percentage						Number of sprouts per corm					
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean	0Gy	15Gy	30Gy	45Gy	60Gy	Mean
Doses	0Gy	15Gy	30Gy	45Gy	60Gy	Mean	0Gy	15Gy	30Gy	45Gy	60Gy	Mean
Candyman	100.00	96.39	92.67	88.19	78.88	91.22	1.40	1.46	1.40	1.26	1.26	1.36
American Beauty	100.00	96.48	92.26	85.74	78.41	90.58	2.93	2.73	2.53	2.66	2.13	2.60
Her Majesty	98.33	96.02	94.05	80.00	76.36	76.36	2.00	1.80	1.26	1.66	1.33	1.61
Mean	99.44	96.29	92.99	84.64	77.88	77.88	2.11	2.00	1.73	1.86	1.57	
	Varieties	Gamma doses	Interaction					Varieties	Gamma doses	Interaction		
C.D. (0.05)	NS	0.23	NS				C.D. (0.05)	0.20	0.26	NS		

Table 3: Effect of treatments on plant height

Variety	Plant height (25 days)						Plant height (50 days)					
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean	0Gy	15Gy	30Gy	45Gy	60Gy	Mean
Candyman	23.60	23.70	19.12	18.08	13.64	19.63	60.65	55.18	48.63	49.60	42.25	51.26
American Beauty	23.92	22.90	20.56	21.18	16.85	21.08	41.70	43.58	37.90	40.26	35.76	39.84
Her Majesty	26.45	24.97	20.50	17.69	0.00	17.92	55.42	55.39	57.58	44.09	21.87	46.87
Mean	24.65	23.85	20.06	18.98	10.16		52.59	51.38	48.04	44.65	33.29	
	Varieties	Gamma doses	Inter-action					Varieties	Gamma doses	Inter-action		
C.D. (0.05)	NS	3.57	6.19				C.D. (0.05)	4.58	5.92	10.25		
Variety	Plant height (75 days)											
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean						
Candyman	75.46	67.72	61.88	61.06	53.26	63.87						
American Beauty	54.60	52.51	45.11	45.02	38.32	47.11						
Her Majesty	65.28	68.43	67.07	58.91	34.38	58.81						
Mean	65.11	62.88	58.02	55.00	41.99							
	Varieties	Gamma doses	Inter-action									
C.D. (0.05)	NS	6.63	8.56									

Table 4: Effect of treatments in number of leaves per plant

Variety	Number of leaves (25 days)						Number of leaves (50 days)					
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean	0Gy	15Gy	30Gy	45Gy	60Gy	Mean
Candyman	1.74	1.66	1.40	1.78	1.56	1.63	4.53	4.50	4.01	3.80	3.46	4.06
American Beauty	2.31	2.31	2.08	2.17	1.67	2.11	5.18	4.80	4.75	4.31	3.40	4.49
Her Majesty	2.08	2.12	2.23	1.84	0.00	1.65	4.22	4.94	4.69	3.74	2.46	4.01
Mean	2.04	2.03	1.90	1.93	1.08		4.64	4.75	4.48	3.95	3.11	
	Varieties	Gamma doses	Inter-action	C.V.				Varieties	Gamma doses	Inter-action	C.V.	
C.D. (0.05)	0.18	0.23	0.41	13.50			C.D. (0.05)	0.38	0.49	NS	12.17	
Variety	Number of leaves (75 days)											
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean						
Candyman	7.60	5.83	6.84	6.63	6.46	6.67						
American Beauty	5.92	5.93	5.66	5.51	5.50	5.70						
Her Majesty	5.23	5.47	5.96	5.55	4.26	5.29						
Mean	6.25	5.74	6.15	5.89	5.41							
	Varieties	Gamma doses	Inter-action	C.V.								
C.D. (0.05)	0.48	NS	NS	10.94								

Table 5: Effect of treatments in length of leaf (cm)

Variety	Length of leaf (cm) (25 days)						Length of leaf (cm) (50 days)					
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean	0Gy	15Gy	30Gy	45Gy	60Gy	Mean
Candy man	19.56	19.00	14.11	13.86	11.26	15.56	40.51	41.10	37.16	37.36	33.44	37.91
American Beauty	19.61	19.33	17.62	18.49	12.57	17.52	33.69	34.87	30.08	33.19	29.90	32.35
Her Majesty	25.12	20.18	20.06	15.09	0.00	16.09	41.97	39.16	36.52	37.41	19.96	35.00
Mean	21.43	19.50	17.26	15.81	7.94		38.72	38.38	34.59	35.99	27.77	
	Varieties	Gamma doses	Inter-action	C.V.				Varieties	Gamma doses	Inter-action	C.V.	

C.D. (0.05)	NS	2.72	4.72	17.14	C.D. (0.05)	2.71	3.50	6.06	10.27
Variety	Length of leaf (cm) (75 days)								
	0Gy	15Gy	30Gy	45Gy	60Gy	Mean			
Candyman	50.12	42.13	44.79	41.73	39.80	43.71			
American Beauty	33.72	34.94	31.66	34.30	30.46	33.01			
Her Majesty	43.24	39.38	39.00	39.10	31.69	38.48			
Mean	42.36	38.82	38.48	38.38	33.98				
	Varieties	Gamma doses	Inter-action	C.V.					
C.D. (0.05)	3.93	5.07	NS	13.61					

Conclusion

It can be concluded that lower doses of gamma radiations are beneficial for the vegetative growth whereas higher doses had harmful effect on vegetative traits.

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