



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2017; 5(6): 256-260
 © 2017 IJCS
 Received: 12-09-2017
 Accepted: 13-10-2017

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Effect of gamma rays on corms of gladiolus (*Gladiolus hybrida* L.)

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Abstract

Influence of gamma irradiations was studied in ten varieties of gladiolus (*Gladiolus hybrida* L.) namely, Candyman Rose, American Beauty, Chandni, Red beauty, Punjab Morning, White Prosperity, Jester, Srijana, Psittacinous Hybrid and Priscilla were irradiated with 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0 kR doses. Earliest sprouting was recorded in 3.0 kr gamma treatment Production of corms was influenced due to various doses of gamma irradiation during both years of investigation. Lower dose (1.5 kr) of gamma irradiation exhibited more number of corms per plant during first and second year, in comparison to higher doses and control. Similarly weight of corms per plant increased with lower doses of gamma irradiation in both years. Diameter of corms were influenced significantly, whereas, lower dose (2.0 kr) resulted in bigger size of corm during first year (VM₁) and second year (VM₂). Maximum number of cormels per plant (31.61) was recorded in 2.0 kr dose of gamma irradiation.

Keywords: gamma radiations, *Gladiolus hybrida* L, corms and cormels

1. Introduction

Gladiolus is one of the most important flowers in India because of its majestic spikes containing attractive, elegant and delicate florets of various shades, sequential opening of flowers for a longer duration and good keeping quality of cut spikes (Singh, 2006). The demand of gladiolus is increasing therefore; it needs attention towards genetic improvement. These have mostly been evolved through conventional breeding but a few through mutation breeding. Mutations are induced in different crops to create variability for further improvement. In vegetatively propagated plants, mutation breeding offers great potentialities as the mutated part can be conveniently perpetuated by vegetative means resulting in the development of new forms. Gladiolus is highly heterozygous in its genetic constitution which makes it promising test material for inducing physical mutagenesis. The effects of gamma rays on gladiolus have been studied by several workers but very few varieties have been developed through gamma radiations. Hence, in the present investigation, emphasis was laid on finding out variations caused by gamma radiations in corm characters including numbers, weight and diameter of corms. An attempt was made to develop a variety by fixing the induced variation in succeeding generations.

Materials and Methods

The present experiment was carried out was at Horticulture farm, Rajasthan College of Agriculture, Udaipur (Rajasthan) during 2013-2014 and 2014-2015. The dormant corms (3.5 to 4.5 cm diameter) of ten commercial varieties of gladiolus viz Candyman Rose, American Beauty, Chandni, Red beauty, Punjab Morning, White Prosperity, Jester, Srijana, Psittacinous Hybrid and Priscilla were subjected to gamma radiations. The corms were treated with eleven doses of gamma radiations viz 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0 kR along with control (without treatment). The corms were planted in the field within 24 hours of treatment in Randomized Block Design with Factorial Concept (Panse and Sukhatme, 1967) ^[1]. Data were recorded in vM1 and vM2 generation on different flowering parameters.

Results and Discussion

Production of corms was influenced due to various doses of gamma irradiation during both years of investigation. Lower dose (1.5 kr) of gamma irradiation exhibited more number of corms per plant during first and second year, in comparison to higher doses and control. Similarly weight of corms per plant increased with lower doses of gamma irradiation in both

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years. Diameter of corms were influenced significantly, whereas, lower dose (2.0 kr) resulted in bigger size of corm during first year (VM₁) and second year (VM₂). Maximum number of cormels per plant (31.61) was recorded in control which was at par with 2.0 kr dose of gamma irradiation followed by 1.5 kr 1.0 kr 0.5 kr 2.5 kr and was significant to all other treatments. Minimum number of cormels per plant (13.71) was recorded with higher dose of gamma irradiation i.e. 5.0 kr. It was at par with 4.5 kr and 4.0 kr and statistically lowers than other treatments during first year. Similar to first year, during second year maximum number (29.81) of cormels per plant was recorded, with 2.0 kr which was at par with 1.5 kr, 1.0 kr, 0.5 kr and 2.5 kr and significant to other higher doses gamma irradiation treatments. Observations of several workers based on experimental evidences corroborated the fact that lower doses of gamma irradiation found beneficial for various traits, however, higher doses resulted in several unfavourable or undesirable responses in different flower crops. Enlargement and improvement in size and number of corms in saffron due to application of gamma irradiation was noticed by Jun *et al.* (2007). Rather and John (2000) [3] carried out a trial on Dutch iris and treated the bulbs with various doses of gamma rays. They found that number of daughter bulbs increased in various doses of gamma irradiation. In a study, Mishra and Bajpai (1983) [6] found that gamma rays at 3 kr level proved very favourable for production of more shoots per plant which forms more number of corms per plant. Present findings are also in line with the observation of Isaev *et al.* (1960) [9] in gladiolus. They found that photosynthetic activity in the treated plants was higher than untreated plants. In the present investigation increased production of corms and cormels could be accounting to a strong influence of photosynthetic rate which accelerated growth characteristics and accumulated more dry matters in the plants. These dry matters probably mobilized in the corm and cormels there by increased weight and number of cormels was found in the investigation. It further lent support of the earlier observation made by Anu *et al.* (2003) [13] who conducted an experiment on induced mutation in tuberose by gamma rays and reported that number of bulbs increased at lower dose of gamma irradiation and decreased at higher doses of gamma in comparison to control. They also

observed size of bulbs increased at lower doses and drastically decreased at higher doses in tuberose.

Number of corms was influenced significantly and cv. Candyman Rose (2.59) registered maximum number of corms per plant followed by cvs. American Beauty, Chandni, White Prosperity, Red Beauty, Srijana, Jester and Priscilla were at par during VM₁, however, during VM₂ cv. White Prosperity registered with maximum number (2.33) of corms per plant which was at par with cvs. Priscilla, Candyman Rose and American Beauty and significant to other varieties. Cultivar Jester recorded maximum diameter of corm (5.48 cm) followed by cvs. Candyman Rose, Priscilla, Red Beauty and Srijana during VM₁. Whereas, during VM₂ cv. Priscilla recorded maximum diameter (5.28 cm) of corm followed by cvs. Red Beauty, Candyman Rose and American Beauty. The differences in responses under different treatments in different varieties may be attributed to their genetic makeup. On one hand, at higher doses, the reduction in production of the corms and cormels could be because of the ill-effects of treatments, as it hampered root system (Dhaduk, 1992 and Mishra, 1998) [12, 7] and cessation of growth of the auxiliary buds present on the corm by the inactivation of enzymes and hormones. Dhaduk, (1992) [12] reported higher multiplication rate with more weight of corms and cormels was enhanced at lower doses of 1 kR and 3 kR in different varieties of gladiolus. In similar way, Misra and Mahesh, (1993) [8] recorded maximum number of corms at 1 kR treatments in cvs. *Gladiolus callianthus* var. Murielae, Christian Jane, Psittacinus Hybrid and Oscar. In comparison to VM₁, during VM₂ some varieties responded differently on production of corm and cormels. Grabowaska and Mynett (1974) [10] applied gamma doses in gladiolus and reported that higher doses are lethal for corms of gladiolus. Grabowaska and Mynett (1970) [11] irradiated corms of gladiolus cv. Polska, Jesien, Zloeista with 1.0-5.0 kr and they found that in higher dose root system was hampered in some varieties. Moreover, various corm parameters were influenced due to varieties. Present findings are in close conformity with the observations made by Shiramanagond and Hanamashetty (1999) [4] and Talukdar (2005) [5] reported that weight of corms/hill varied among different varieties of gladiolus.

Table 1: Effect of gamma irradiation on number of corms per plant in different varieties of gladiolus (I Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	2.71	2.73	2.78	2.89	2.61	2.66	2.56	2.56	2.55	2.22	2.11	2.59
American Beauty	2.15	2.77	2.81	2.88	2.9	2.83	2.67	2.55	2.50	2.20	2.14	2.58
Chandni	2.33	2.45	2.89	2.81	2.79	2.78	2.78	2.44	2.33	2.11	2.00	2.52
Red beauty	2.50	2.56	2.77	2.80	2.89	2.52	2.44	2.40	2.31	2.20	2.10	2.50
Punjab Dawn	2.20	2.22	2.45	2.67	2.86	2.78	2.63	2.50	1.89	1.93	1.11	2.29
White Prosperity	2.67	2.78	2.83	2.87	2.88	2.47	2.33	2.30	2.20	2.14	2.11	2.51
Jester	2.44	2.51	2.62	2.78	2.47	2.40	2.34	2.11	1.96	1.90	1.88	2.31
Srijana	2.70	2.89	2.90	2.93	2.44	2.39	2.34	2.30	2.22	2.10	2.00	2.47
Psittacinous Hybrid	2.69	2.78	2.89	2.91	2.22	2.17	2.10	2.00	2.00	1.89	1.33	2.27
Priscilla	2.76	2.56	2.60	2.67	2.47	2.22	2.16	2.10	1.96	1.88	1.70	2.28
Mean	2.52	2.63	2.75	2.82	2.65	2.52	2.44	2.33	2.19	2.06	1.85	
C.D. (0.05)												
T	0.21											
V	0.23											
T × V	0.71											

Table 2: Effect of gamma irradiation on number of corms per plant in different varieties of gladiolus (II Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	2.11	2.20	2.33	2.55	2.56	2.44	2.10	1.96	1.89	1.76	1.67	2.14
American Beauty	2.17	2.25	2.67	2.78	2.70	2.11	2.00	1.88	1.77	1.63	1.55	2.14
Chandni	2.33	2.67	2.80	2.89	2.30	2.20	2.11	2.00	1.90	0.00	0.00	1.93
Red beauty	2.10	2.11	2.22	2.45	2.40	2.00	1.92	1.86	1.70	1.56	1.40	1.97
Punjab Dawn	2.22	2.67	2.78	2.80	2.00	2.11	2.00	1.85	0.00	0.00	0.00	1.68
White Prosperity	2.67	2.70	2.89	2.57	2.46	2.40	2.30	2.11	2.00	1.81	1.67	2.33
Jester	2.55	2.60	2.66	2.70	2.72	1.81	1.71	1.67	1.60	1.55	0.00	1.96
Srijana	2.60	2.49	2.41	2.34	2.39	2.30	2.25	2.00	1.90	1.70	0.00	2.03
Psittacinous Hybrid	2.33	2.56	2.60	2.67	2.70	0.00	0.00	0.00	0.00	0.00	0.00	1.17
Priscilla	2.22	2.45	2.49	2.55	2.60	2.11	2.00	1.92	1.80	1.72	1.66	2.14
Mean	2.33	2.47	2.59	2.63	2.48	1.95	1.84	1.73	1.46	1.17	0.80	
C.D. (0.05)												
T	0.17											
V	0.18											
T × V	0.56											

Table 3: Effect of gamma irradiation on diameter of corms in different varieties of gladiolus (I Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	5.12	5.30	5.38	5.47	6.08	5.26	5.25	5.16	4.97	4.75	4.12	5.17
American Beauty	5.18	5.29	5.39	6.29	6.28	5.22	4.23	4.02	3.37	3.28	3.07	4.69
Chandni	4.09	4.25	4.35	5.18	5.19	5.24	5.11	3.37	3.28	3.25	3.13	4.22
Red beauty	5.18	5.23	5.33	6.27	6.40	5.11	5.09	4.17	4.16	3.42	3.27	4.88
Punjab Dawn	5.27	5.44	5.45	6.12	6.22	5.32	5.25	4.31	4.00	4.02	3.28	4.97
White Prosperity	5.00	5.22	5.29	5.38	6.31	5	4.98	4.35	4.18	4.13	3.22	4.82
Jester	5.35	6.17	6.33	6.38	6.17	5.30	5.3	5.16	5.03	5.02	4.07	5.48
Srijana	5.02	5.11	5.22	5.29	6.21	5.20	5.00	4.36	4.24	4.22	3.22	4.83
Psittacinous Hybrid	5.18	5.39	6.13	6.16	5.01	4.22	4.20	4.07	3.27	3.24	3.22	4.55
Priscilla	5.10	5.08	5.19	5.22	6.33	5.22	5.16	4.26	4.23	4.17	4.16	4.92
Mean	5.05	5.25	5.41	5.78	6.02	5.11	4.96	4.32	4.07	3.95	3.48	
C.D. (0.05)												
T	0.82											
V	0.86											
T × V	0.72											

Table 4: Effect of gamma irradiation on diameter of corms in different varieties of gladiolus (II Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	5.35	5.84	6.13	6.23	6.26	5.16	5.01	4.61	4.46	4.30	3.22	5.14
American Beauty	5.24	5.18	6.11	6.18	6.19	6.17	6.60	5.08	3.00	3.11	3.10	5.09
Chandni	5.29	6.02	6.16	6.22	6.56	5.15	4.94	3.28	3.22	0.00	0.00	4.26
Red beauty	5.22	5.27	6.13	6.20	6.00	5.22	5.08	4.94	4.29	4.16	4.10	5.15
Punjab Dawn	4.40	5.02	5.33	5.40	6.53	4.18	3.67	3.22	0.00	0.00	0.00	3.43
White Prosperity	5.00	5.11	5.24	6.23	6.58	4.94	4.38	4.37	4.22	4.20	4.11	4.94
Jester	4.95	5.13	5.20	6.11	6.18	6.31	4.58	4.28	4.22	4.13	0.00	4.64
Srijana	5.38	6.10	6.22	6.31	6.37	5.33	5.22	4.22	4.00	3.33	0.00	4.77
Psittacinous Hybrid	3.20	4.28	4.95	5.10	5.13	0.00	0.00	0.00	0.00	0.00	0.00	2.06
Priscilla	5.07	5.18	5.38	6.07	6.13	6.19	6.33	5.07	4.27	4.23	4.13	5.28
Mean	4.91	5.31	5.69	6.01	6.19	4.87	4.58	3.91	3.17	2.75	1.87	
C.D. (0.05)												
T	0.96											
V	0.10											
T × V	0.32											

Table 5: Effect of gamma irradiation on weight of corms per plant in different varieties of gladiolus (I Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	48.34	48.89	56.11	57.22	61.63	51.11	45.56	42.22	40.56	40.11	36.67	48.04
American Beauty	48.80	48.89	49.44	52.22	60.56	48.33	47.78	45.56	44.44	43.89	42.78	48.43
Chandni	47.22	49.44	49.45	51.67	58.89	61.67	45.60	45.00	44.11	43.89	42.22	49.01
Red beauty	51.11	57.20	57.22	61.11	62.22	51.10	50.55	48.89	44.44	43.89	43.33	51.91
Punjab Dawn	47.22	49.45	50.55	50.56	58.33	46.11	45.22	45.00	44.44	44.22	43.89	47.73
White Prosperity	49.45	50.00	51.11	54.44	61.60	48.89	43.89	43.80	43.00	42.78	42.22	48.29
Jester	57.22	57.78	62.00	62.22	50.00	48.89	45.00	44.44	43.89	42.22	40.00	50.33

Srijana	48.89	50.56	51.66	51.67	56.67	48.89	48.33	46.11	46.00	45.00	41.11	48.63
Psittacinous Hybrid	47.22	47.78	50.00	51.11	52.22	50.00	47.11	46.67	46.45	45.55	44.89	48.09
Priscilla	48.89	49.45	50.00	50.56	52.78	49.00	47.22	46.67	46.11	46.10	46.00	48.43
Mean	49.44	50.94	52.75	54.28	57.49	50.40	46.63	45.44	44.34	43.77	42.31	
C.D. (0.05)												
T	1.68											
V	1.77											
T × V	5.59											

Table 6: Effect of gamma irradiation on weight of corms per plant in different varieties of gladiolus (II Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	47.22	48.33	50.56	61.11	62.78	46.11	45.56	44.56	40.56	40.00	37.78	47.69
American Beauty	52.78	53.33	57.44	63.33	60.89	52.22	51.67	50.56	47.78	42.78	42.70	52.32
Chandni	48.89	50.00	52.22	55.00	62.22	48.33	44.44	43.33	42.22	0.00	0.00	40.60
Red beauty	52.78	56.67	58.33	62.20	63.30	52.22	48.89	46.67	45.00	44.44	43.33	52.17
Punjab Dawn	43.33	46.11	50.50	50.56	52.22	60.00	45.00	41.67	0.00	0.00	0.00	35.40
White Prosperity	50.00	50.56	51.67	53.89	62.70	50.00	45.00	44.44	42.78	42.22	41.11	48.58
Jester	50.00	61.00	61.60	61.67	65.00	46.67	45.00	44.44	43.89	41.11	0.00	47.31
Srijana	50.00	50.56	51.67	53.80	54.44	50.00	45.00	45.00	44.44	40.56	0.00	44.13
Psittacinous Hybrid	44.44	47.78	48.80	48.89	58.89	0.00	0.00	0.00	0.00	0.00	0.00	22.62
Priscilla	54.45	55.00	55.78	56.33	54.33	54.22	52.22	51.11	49.67	47.78	46.67	52.51
Mean	49.39	51.93	53.86	56.68	59.68	45.98	42.28	41.18	35.63	29.89	21.16	
C.D. (0.05)												
T	1.21											
V	1.27											
T × V	4.02											

Table 7: Effect of gamma irradiation on number of cormels per plant in different varieties of gladiolus (I Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	26.22	29.33	30.11	32.78	33.56	27.78	24.67	22.89	21.22	16.45	12.34	25.21
American Beauty	23.89	27.00	27.11	29.22	34.00	24.44	23.89	23.33	20.55	16.78	14.67	24.08
Chandni	20.00	26.67	28.78	31.00	31.20	24.78	24.11	20.33	17.33	15.56	11.20	22.81
Red beauty	25.89	26.67	26.78	30.00	30.42	25.89	24.67	23.89	19.78	17.33	14.33	24.15
Punjab Dawn	19.10	27.78	29.56	32.20	34.89	25.22	23.78	23.33	20.33	16.89	13.60	24.24
White Prosperity	28.78	29.78	31.66	34.22	33.00	27.44	26.00	26.40	21.00	19.20	15.44	26.63
Jester	18.78	19.00	20.34	22.56	28.22	23.00	21.56	19.10	16.45	13.89	11.89	19.53
Srijana	24.44	27.11	28.22	30.44	31.89	33.78	23.33	21.56	20.44	16.00	15.56	24.80
Psittacinous Hybrid	28.67	29.33	32.44	33.11	26.67	24.34	23.33	22.89	17.89	15.22	13.89	24.34
Priscilla	26.34	27.56	31.44	31.89	32.22	31.22	24.78	23.67	22.89	15.11	14.22	25.58
Mean	24.21	27.02	28.64	30.74	31.61	26.79	24.01	22.74	19.79	16.24	13.71	
C.D. (0.05)												
T	0.54											
V	0.56											
T × V	1.78											

Table 8: Effect of gamma irradiation on number of cormels per plant in different varieties of gladiolus (II Year)

Treatment Varieties	control	0.5 Kr	1.0 Kr	1.5 Kr	2.0 Kr	2.5 Kr	3.0 Kr	3.5 Kr	4.0 Kr	4.5 Kr	5.0 Kr	Mean
Candyman Rose	29.44	30.67	31.11	31.44	31.89	25.00	24.44	24.33	21.55	19.00	13.45	25.67
American Beauty	24.00	24.89	29.00	29.44	30.78	34.44	23.44	23.00	20.33	20.10	18.20	25.24
Chandni	20.44	20.56	23.67	24.20	26.11	26.00	19.55	18.00	13.22	0.00	0.00	17.43
Red beauty	26.33	27.44	27.89	30.11	34.22	29.11	24.78	22.89	19.00	18.33	15.00	25.01
Punjab Dawn	26.44	27.78	30.89	35.11	25.44	23.11	18.78	18.67	0.00	0.00	0.00	18.75
White Prosperity	19.45	26.44	28.56	32.11	32.56	34.67	27.56	25.67	24.55	17.11	14.55	25.75
Jester	22.00	21.22	23.00	23.44	28.22	26.78	25.34	22.33	16.22	15.11	0.00	20.33
Srijana	26.22	27.44	29.11	31.11	33.56	22.89	25.11	19.22	17.33	16.45	0.00	22.59
Psittacinous Hybrid	17.89	18.00	19.24	23.34	23.78	0.00	0.00	0.00	0.00	0.00	0.00	9.30
Priscilla	27.33	30.89	33.11	31.33	31.55	26.67	24.89	23.89	23.22	15.11	14.22	25.66
Mean	23.95	25.53	27.56	29.16	29.81	24.87	21.39	19.80	15.54	12.12	7.54	
C.D. (0.05)												
T	0.66											
V	0.69											
T × V	2.18											

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