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Influence of gamma radiations and EMS on morphological characteristics of gladiolus cv. PINK BEAUTY

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ABSTRACT : The corms of gladiolus cv. PINK BEAUTY were treated with gamma rays (0, 3, 6, 9 kR), EMS (0. 0.2, 0.4, 0.6 %) both alone and in combination including control *i.e.* untreated. Different vegetative, floral and corm parameters were recorded. The days taken for sprouting of corms were delayed after treatment with gamma rays and recorded maximum at 6 kR + 0.2 % (26.78 days). Duration of sprouting was decreased by EMS and was observed to be maximum at 3 kR gamma rays (100%). The gladiolus plants could not survive in treatments of gamma rays and its combination with EMS. On the basis of above observations, it may be concluded that 0.2 to 0.6 per cent EMS doses are suitable for inducing mutation in gladiolus.

KEY WORDS : Gladiolus, Gamma rays, EMS, Sprouting

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Gladiolus (*Gladiolus species*) belongs to family Iridaceae and subfamily Ixioidaceae. It is native of South Africa and is attributed as "Queen of bulbous ornamentals" due to its popularity amongst the bulbous ornamentals in the world. Gladiolus is an important cut flower crop which possesses a great potential for export market to European countries especially during winter. In India, gladiolus is commercially grown in west Bengal, Odisha, Uttar Pradesh, Uttarakhand, Tamil Nadu, Punjab, Haryana, Madhya Pradesh, Delhi and Rajasthan. Ever increasing demand particularly in cities and towns of India make it an important cut flower which is now available in the Indian markets round the year.

Commercial success of any crop depends upon the availability of suitable cultivars to suit the need of the consumers. Present day cultivars have arisen as a result of multicross between various species and varieties which show presence of large amount of variation exists in gladiolus. Other than hybridization, mutation also creates variation. Mutation is a natural process which creates changes in DNA sequences. The genetic variation created is useful because it helps population to survive and change over time. Similarly, experimental mutagenesis permits to increase possibilities of creation of variability with high ornamentation (Cantor *et al*., 2002). Induced mutation with gamma radiation and chemical mutagens in ornamental plants have been used for genetic changes, high flower yield, disease resistance, early maturity, etc. Gamma rays are known to influence plant growth and development by inducing cytological, genetical, biochemical, physiological and morphogenetic changes in cell and tissues (Abdullah *et al*., 2009). Ethyl methane sulphonate is a very potent mutagen which adds its alkyl group to bases in DNA, causes a mistake and produces point mutations. Therefore, the present study

has been carried out to study the effect of EMS and gamma rays on various morphological characters of gladiolus with the objective of creating genetic variations in the subjected plant material.

RESEARCH METHODS

The present investigation was carried out during 2012-13 at the Experimental farm, Department of Horticulture, Chaudhary Charan Singh Haryana Agricultural University, Hisar. Uniform sized corms (3.5-4.0 cm) of gladiolus cv. PINK BEAUTY were selected and treated with EMS (0.2, 0.4, 0.6%), gamma radiation (0, 3, 6, 9 kR) and their combinations. Gamma treatment was given in gamma radiation chamber (GC-900, Cobalt 60 source emitting 1 kR/ 16 minutes). After treating the corms with EMS and combination (EMS + gamma rays), corms were washed thoroughly in running water. The treated corms were planted in the well prepared beds of size 1 x 1 m^2 at a spacing of 25 x 25 cm and 5-7 cm deep in soil in Randomized Block Design (RBD) in replicates. Before planting the corms were dipped in 0.2 per cent bavistin for 30 minutes and air dried in shade. Standard package of practices were followed accordingly. For collection of morphological data, 16 plants in a lot per replication were observed and average was calculated. Various growth parameters such as duration of sprouting, sprouting percentage, plant height, floral characters, length of spike, corm weight, diameter, etc. were calculated and analyzed statistically at different period of time.

RESEARCH FINDINGS AND DISCUSSION

The EMS treatment and gamma radiation significantly affected the various morphological characters of gladiolus cv. PINK BEAUTY. The results obtained from the experiment are discussed below:

Effect on sprouting characters :

The data in Table 1 revealed that the treatment of corms with gamma rays alone or in combination with EMS significantly delayed the days taken for sprouting of corms as compared to control and EMS alone. The maximum delay was recorded in T_{10} (26.78 days) which was at par with T_{15} (26.59 days), T_{13} (26.00 days), T_{14} (24.33 days), T_{16} (24.08 days) and T_9 (23.21 days). The minimum days taken for sprouting of corms were observed in corms in T_3 followed by T_2 and control. The duration of sprouting was maximum in T_{10} (29.50 days) whereas the minimum duration was observed in T_2 (13.50 days) which was at par with T_3 and T_4. The treatment of corms with gamma rays alone or in combination with EMS decreased the sprouting percentage of corms as compared to control and EMS alone except in T_5, T_7 and T_{10} where sprouting percentage was increased as

Table 1 : Effect of chemical and physical mutagens on vegetative parameters of gladiolus cv. PINK BEAUTY

Treatments (Gamma + EMS)	Days taken for sprouting of corms	Duration of sprouting (days)	Sprouting percentage
T_1- 0kR + 0.0% (Control)	13.86	18.33	95.83
T_2- 0kR + 0.2%	11.83	13.50	95.80
T_3- 0kR + 0.4%	11.77	13.66	97.90
T_4- 0kR + 0.6%	14.32	15.00	97.90
T_5- 3kR + 0.0%	21.66	26.50	100.00
T_6- 3kR + 0.2%	19.49	22.50	95.83
T_7- 3kR + 0.4%	17.54	18.83	97.90
T_8- 3kR + 0.6%	18.85	24.83	95.80
T_9- 6kR + 0.0%	23.21	25.50	91.63
T_{10}- 6kR + 0.2%	26.78	29.50	97.90
T_{11}- 6kR + 0.4%	22.72	25.83	87.46
T_{12}- 6kR + 0.6%	22.69	25.16	93.73
T_{13}- 9kR + 0.0%	26.00	25.33	87.46
T_{14}- 9kR + 0.2%	24.33	27.66	83.30
T_{15}- 9kR + 0.4%	26.59	27.33	91.66
T_{16}- 9kR + 0.6%	24.08	27.00	87.50
S.E. $\pm$	1.25	1.28	3.01
C.D. (P=0.05)	3.59	3.67	8.60

compared to control, it was found maximum in 3 kR gamma rays dose alone (100%). The minimum percentage was recorded with T_{14}. The low dose levels of mutagens are responsible for stimulating sprouting substances such as enzymes which are set free by irradiation and play an important role in plant metabolic activities resulting in stimulated plat chromosome structure and cell division, which suppress growth or create lethal effect on the cells of the plant and consequently lead to delay and poor percentage of sprouting and low survival of the plant. The results in the present study are in conformity with the findings of Rather *et al*. (2002), Srivastava *et al*. (2007), Kumar *et al*. (2012) and Berenschot *et al*. (2008). Khan and Tyagi (2009) attributed the effects of mutagens on the merismetic tissues. The decrease in sprouting at higher doses of the mutagens may also be attributed to disturbances at cellular level including chromosomal damages or due to the combined effect of both.

Effect on vegetative characters :

The plant mortality was observed in corms treated with gamma rays alone or in combination with EMS hence no further observation could be recorded for these treatments. This might be due to the fact that the doses were supra optimal having negative effects on plant tissues resulting in retardation or inhibition of cell division and thereby inducing cell death. Similar results were observed by Solanki (2005) in lentil, Yadava *et al.* (2003) in kodo millet, Kharkwal (1998) and Jabee and Ansari (2005) in chick pea. The data in Table 2a depict that plant height and number of leaves per plant increased significantly with increase in the dose of EMS as compared to control. The plant height was found maximum in T_4 (125.40 cm), whereas minimum in control (114.68 cm) which was at par with T_2 (118.15 cm). The

Table 2a : Effect of chemical mutagen on vegetative and floral characters

Treatments (Gamma + EMS)	Plant height (cm)	No. of leaves per plant	Days taken for initiation of spike	No. of spike per plant	Length of spike (cm)
T_1- 0kR + 0.0% (Control)	114.68	8.79	112.29	1.43	93.04
T_2- 0kR + 0.2%	118.15	8.95	112.80	1.45	101.84
T_3- 0kR + 0.4%	120.42	8.87	114.30	1.46	110.88
T_4- 0kR + 0.6%	125.40	8.73	118.85	1.34	112.83
S.E. ±	3.30	0.06	0.98	0.06	2.90
C.D. (P=0.05)	3.5	NS	5.23	NS	7.42

NS=Non-significant

Table 2b : Effect of chemical mutagen on vegetative and floral characters

Treatments (gamma + EMS)	Days taken for opening of basal floret	No. of florets per spike	Diameter of basal floret (cm)	Duration of flowering (days)
T_1- 0kR + 0.0% (Control)	127.59	15.79	11.13	13.39
T_2- 0kR + 0.2%	126.93	15.90	11.40	13.39
T_3- 0kR + 0.4%	128.41	15.93	11.57	13.19
T_4- 0kR + 0.6%	128.43	15.59	11.62	12.57
S.E. ±	0.59	0.35	0.10	0.21
C.D. (P=0.05)	NS	NS	0.34	NS

NS=Non-significant

Table 3 : Effect of chemical mutagen on corm characters

Treatments (gamma + EMS)	No. of corms per plant	Weight of corms per plant (g)	Diameter of corm (cm)	No. of cormels per plant	Weight of cormels per plant (g)
T_1- 0kR + 0.0% (Control)	1.34	24.47	4.17	12.55	2.49
T_2- 0kR + 0.2%	1.49	30.91	4.11	14.38	2.58
T_3- 0kR + 0.4%	1.40	31.27	4.08	14.70	2.77
T_4- 0kR + 0.6%	1.34	34.77	4.57	18.21	4.25
S.E. ±	0.04	2.06	1.26	1.18	0.26
C.D. (P=0.05)	NS	6.71	NS	1.84	0.57

NS=Non-significant

number of leaves per plant did not differ significantly. Significant increase in plant height over control was also observed by Kole and Meher (2005) which is in agreement with Venkatachalam and Jayabalan (1997) findings. Mishra (1998) on contrary reported decrease in number of leaves at higher doses which may be due to activation of physiological substances present in corms at lower doses, while higher doses retard cell division by arresting mitotic cell division and causing ill effects on auxins. The mutation may be attributed to a drop in the auxin level (Gordon and Webber, 1955) and inhibition of auxin synthesis (Skoog, 1935). The maximum days taken for initiation of spike were recorded in T_4 (118.85 days) as compared to control (112.29 days). The increase or decrease in the number of spikes per plant was non-significant. However, the decrease in number of spikes may be due to deleterious effects of EMS at higher concentration. These are in conformity with results of Bhajantri and Patil (2013) in gladiolus and Roychowdhury and Tah (2011) in *Dianthus*. The length of spike also increased with increase in concentration of EMS treatment. The length of spike was observed to be longest in 0.6 per cent EMS treatment (112.83 cm) which was at par with T_3 and T_2. The shortest length of spike was observed in control (93.04 cm) which was at par with EMS at 0.2 per cent (101.84 cm).

It is evident from the data given in Table 2b that treatment of gladiolus corms with EMS delayed the number of days taken for opening of basal floret in treatment 0.2 per cent EMS. The number of florets per spike also increased except in 0.6 per cent EMS treatment; however the increase or decrease in number of days taken for opening of basal floret, number of floret per spike and duration of flowering was non-significant. The diameter of basal floret increased significantly at higher doses of EMS (0.4% and 0.6%) *i.e*. 11.57 cm and 11.62 cm, respectively. Similar stimulated effect on number of florets per spike was observed by Bhajantri and Patil (2013).

The treatment of gladiolus corms with EMS significantly increased the weight of corms per plants except 0.2 per cent EMS (Table 3). The maximum weight of corms per plant was recorded in 0.6 per cent EMS (34.77 g) whereas the minimum was found in control (24.47 g). The significantly maximum number of cormels per plant and weight of cormels were recorded in 0.6 per cent EMS (18.21 and 4.25 g, respectively) followed by T_3 and T_2 while it was minimum in control (12.55 and 2.49 g, respectively). The results are in line with the work of Roychowdhury and Tah (2011). The increase in production of corms and cormels could be due to activation of enzymes and hormones responsible for such growth.

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