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Mutation Breeding in Rose (*Rosa indica* L.)

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A B S T R A C T

The observations recorded on plant height, plant spread, leaf area, number of thorns on flower stalk, days required for first flower bud initiation, average weight of flower, length of peduncle, number of petals per flower, vase life and petal area were significantly influenced by chemical mutagens and their different concentrations. The results on days required for bud sprouting and colour of flower were not found significant. Among the various concentrations of two chemical mutagens i. e. EMS and MMS the results of treatment EMS 0.20% was found to be promising for plant spread, leaf area, average weight of flower, number of petals per flower, length of peduncle, vase life and petal area.

Introduction

Rose (*Rosa indica*) has always been the most favorite flower in the world. Rose cut flowers play an important role in interior decoration and add charm to different occasions like marriage ceremonies, arrival and departure of different dignitaries, gift on birthdays, valentine's day etc. Flowers are mentioned the social fabric of our country. Now-a-days, roses are available in numerous attractive colors and shades. All present day colorful roses are the result of extensive hybridization, spontaneous and induced mutations and selections. For a modern and industrialized horticulture, there is always demand and necessity for new varieties. To develop new varieties through genetic manipulation, there are several plant breeding techniques. Through cross breeding technique, the main attempt of plant breeder is to combine the beneficial characters from different sources into one genotype. From such pooled genotypes, sometimes it is possible to select directly a particular genotype which is superior to the existing cultivar. Mutation breeding on the other hand, is an established method for plant improvement.

By this method plant genes are altered by treating seeds or other plant parts to chemical or physical mutagens. Mutation breeding has been most

successful in roses in inducing novelties. The possibilities for creating different forms and improving roses are infinite, and a breeder will always have future goals to work towards it.

Materials and Methods

The present study on Mutation Breeding in Rose (*Rosa indica* L.) was conducted at the Department of Floriculture and Landscaping, College of Horticulture, Pune, MPKV Rahuri during 2013-2014. The field experiment was conducted in Completely Randomized Design (CRD) consisting 09 treatment and four replications.

Local Rose cultivar Gladiator was selected for the present experiment. Rose is commercially propogated by T-budding. Scions of about 10-12 cm in length having 4-5 healthy buds from one year old growth were selected for mutagenic treatment. Developing buds were treated by dipping the scion wood with dormant buds in various concentrations of EMS and MMS (0.20%, 0.25%, 0.30%, 0.35%) respectively for 8 hours. The treated and control eye buds were budded on the same day on root stock *Rosa multiflora*. The observations recorded on days required for bud sprouting, plant height, plant spread, leaf area, number of thorns on flower stalk, days required for first flower bud initiation, average weight of flower, length of peduncle, color of petals, number of petals per flower, vase life and petal area. All the observations except days required for bud sprouting and for first flower bud initiation were recorded at flowering stage.

Results and Discussion

All the observations except days required for bud sprouting and color of petals were recorded significant.

Effect of chemical mutagens on morphological characters of rose

Observation on days required for bud sprouting showed non-significant effect where sprouting of buds was enhanced at lower concentrations while it was delayed at higher concentrations. Treated buds at higher concentrations of both EMS and MMS took longer time to sprout.

Minimum (24.85 days) for sprouting were recorded for (T_9) control. It revealed from the results that higher concentration of chemical mutagens suppressed sprouting on the other hand time taken for sprouting was also increased. This was may be due to inactivation of auxins and biological effect of alkylation of EMS and MMS. Treatment T_4 (EMS 0.35%) recorded maximum number of days required for sprouting than all other treatments This finding was supported by Kaicker and Swarup (1972), where they found that with the increase in concentration of chemical mutagens the sprouting was delayed.

The plant height differed significantly in various treatments. Treatment T_9 (control) recorded maximum plant height (33.05 cm) while treatment T_4 (EMS 0.35%) recorded minimum plant height (25.25 cm). Reduction in plant height was observed with increasing concentration of EMS and MMS and it was more in EMS. The present findings are in conformity with the work of Gupta and Shukla (1971), where they observed that with increased radiation in garden roses, decrease in level of auxin and chromosomal damage was responsible for plant height reduction. Reduction in plant height with increase in dose of physical mutagen was also observed by Gupta and Shukla (1970). Kiran Kumari *et al.,* (2013) reported reduction in plant height in chrysanthemum when treated with physical mutagen.

Chemical mutagen treatment T_1 (EMS 0.20%) had significant influence on the East-West and North-South plant spread. Maximum plant spread of East-West (20.50cm) and North-South (22.16cm) was recorded with the minimum concentration of EMS (0.20%). Increase in plant spread in lowest concentration of EMS (0.20%) over control may be due to stimulatory effect of chemical mutagens. The East-West spread was found minimum in treatment

T_8i.e. MMS 0.35% (18.58 cm) and North-South plant spread was found minimum in treatment T_4 i.e. EMS 0.35% (16.65 cm). The present findings are in confirmity with the work reported by Senapati *et al.,* (2008) in rose cv. First Red.

The treatment T_1 EMS (0.20%) recorded maximum leaf area at the time of flowering (46.53 cm^2) which was significantly superior over other treatments and was at par with treatment T_2 which had leaf area 40.31 cm^2. In the treatment T_9 (control) minimum leaf area (24.08 cm^2) was recorded. More increase in leaf area over control was observed in different concentrations of EMS as compared to MMS. It may be because MMS predominantly methylates guanine whereas EMS ethylates guanine and adenine too. These results are in agreement with those of Senapati *et al.,* (2008) who reported morphological variation between mutant and control plants with regard to leaf size in rose cv. First Red.

Significant variations were observed in number of thorns on flower stalk. The treatment T_5 (MMS 0.20%) had maximum thorns (17.63), which was at par with treatment T_1 EMS 0.20% (15.04). The reduction in number of thorns was found in treatment T_4 EMS 0.35% (10.59) and T_3i.e. EMS 0.30% (10.99). Reduction in number of thorns with increasing concentration of EMS may be due to biological effect of ethylation. Smilansky *et al.,* (1986) stated that the appearance of mutations such as thorniness after treating with various doses of gamma rays and EMS was less frequent.

Effect of chemical mutagens on floral characters of rose

The number of days required for first flower bud emergence was significantly affected by different treatments of chemical mutagens. The treatment T_9 showed early emergence of flower buds. Delay in the emergence of flower bud was recorded with the increasing concentration of chemical mutagen treatments. This may be due to the fact that in mutation many biosynthetic pathways are altered which are directly or indirectly associated with the flowering physiology (Mahure *et al.,* 2010). The average weight of flowers was significantly affected by different treatments of chemical mutagens. The treatment T_1 gave highest weight of flowers by 2.38 g more in comparison with control which gave minimum weight of flowers.

The increase in average weight of flower in lower dose of chemical mutagen was may be due to increase in peduncle length, number of petals per flower and petal area. These results are in agreement with Lata (1980) who found detectable variations in leaf, flower and plant growth when treated with gamma rays.

The significant variations were observed in number of petals per flower. The treatment T_1 had maximum number of petals per flower (84.21) which was at par with treatment T_2 (81.91). The minimum number of petals was found in treatment T_9 i.e. control (61.59). This variation in number of petals per flower may be due to alteration in biosynthetic pathways which directly or indirectly affect the flowering physiology (Mahure *et al.,* 2010). These results are in agreement with those of Smilansky *et al.,* (1986); Senapati *et al.,* (2008) and Yamaguchi *et al.,* (2003).

Significant differences were observed in peduncle length of flower among various treatments. Reduction in length of peduncle with increase in mutagen concentration was recorded. The length of peduncle was significantly increased in treatment T_1 (7.31 cm) which was at par with treatment T_2 (7.15 cm). Peduncle length was reduced at treatment T_4 having minimum length of peduncle (5.10 cm).

This may be due to that in chemical mutation phosphate alkylation occurs in addition to base alkylation when treated with alkylating agents like EMS and MMS. Kaicker and Kumar (1992) also observed change in peduncle length in cv. 'Folklore' when treated with gamma irradiation.

Table.1 Effect of chemical mutagens on morphological characters of Rose cv.Gladiator.

Treatments	Days required for sprouting	Plant Height (cm)	Plant spread (cm)		Leaf area (cm^2)	Number of thorns on flower stalk
			N-S	E-W		
T_1 EMS 0.20%	27.50	29.59	22.16	20.50	46.53	15.04
T_2 EMS 0.25%	29.30	29.13	21.65	20.24	40.31	10.99
T_3 EMS 0.30%	30.63	28.32	20.93	19.39	35.77	13.07
T_4 EMS 0.35%	31.97	25.25	16.65	19.38	32.77	10.59
T_5 MMS 0.20%	28.15	30.40	21.25	19.94	33.64	17.63
T_6 MMS 0.25%	28.28	29.90	20.42	19.73	32.69	13.73
T_7 MMS 0.30%	28.31	28.98	19.91	18.71	31.21	13.73
T_8 MMS 0.35%	30.79	28.68	19.02	18.58	29.32	12.77
T_9 Control	24.85	33.05	20.79	19.99	24.08	14.04

Table.2 Effect of chemical mutagens on floral characters of Rose cv.Gladiator.

Treatments	Days to first flower bud initiation	Average weight of flower (gm)	Number of petals/flower	Length of peduncle	Vase life (days)	Change in colour of flower
T_1 EMS 0.20%	23.63	7.47	84.21	7.31	9.15	No
T_2 EMS 0.25%	25.21	7.43	81.91	7.15	8.20	No
T_3 EMS 0.30%	25.68	6.69	76.21	5.87	7.94	No
T_4 EMS 0.35%	26.71	5.74	67.58	5.10	7.74	No
T_5 MMS 0.20%	23.39	6.17	70.48	6.16	8.11	No
T_6 MMS 0.25%	24.96	5.98	70.58	6.06	7.94	No
T_7 MMS 0.30%	26.79	5.38	63.65	6.01	7.93	No
T_8 MMS 0.35%	27.51	5.22	62.32	5.84	7.87	No
T_9 Control	22.85	5.09	61.59	5.75	7.55	No

Colour of flower as a result of effect of chemical mutagens was found to be non significant as there was no variation in color of flowers obtained from treated plants. This can be attributed to the fact that no chimeric growth was developed in shoot as result of mutagenesis.

Tissues of shoots without chimeric growth lead to non formation of different color variation in petal. However, Smilansky *et al.*, (1986), Gupta and Shukla (1971); Kaicker and Swarup (1972); Gupta and Shukla (1970); Yamaguchi *et al.*, (2003) reported color change in rose after treated with various doses of physical and chemical mutagens.

The vase life of rose was significantly affected due to chemical mutagens treatments. The maximum days of vase life was recorded at T_1 treatment i.e. EMS 0.20% (9.15 days).

The minimum vase life was noted at control treatment i.e. (7.55 days). It may be due to increase in number of petals and area of petals which lead to increase in level of sucrose and other soluble sugars and which is responsible for more vase life. In the present study, the enhanced effect on longevity of the stalk may be due to the positive effect of lower concentration of chemical mutagens on growth hormones.

Significant variations were observed in petal area of

flower. The treatment T_1i.e. EMS 0.20% had maximum petal area of flower (20.24 cm^2) followed by T_5 i.e. MMS 0.20% (20.10 cm^2). The minimum petal area was found at treatment T_9 i.e. control (19.50 cm^2). Petal area was reduced with the increasing concentration of EMS and MMS which may be due to inactivation of auxins, chromosomal aberrations and biological effect of alkylating agents (EMS and MMS). These results are in agreement with those of Kaicker and Kumar (1992) who found change in petal area in cv. 'Folklore' as a result of mutation.

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