Advances in Crop Science and Technology
ISSN: 2329-8863

sarwar and Butt, Adv Crop Sci Tech 2015, 3:5
http://dx.doi.org/10.4172/2329-8863.1000196

Research Article Open Access

Evaluation of Mutant Lines of *Rosa* Species

Atif sarwar* and Shahid Javed Butt

Department of Horticulture, PMAS-Arid Agriculture University, Rawalpindi, Pakistan

Abstract

Among the highly fragrant rose species, *R. centifolia* and *R. gruss* an teplitz have high commercial importance and value added potential. Most of the modern roses are the result of hybridization, selection and spontaneous mutation. For floriculture trade, there is always demand and necessity for new varieties due to change in taste and fashion. Mutation breeding is an established method for crop improvement. Mutant lines were taken from the Plant Tissue Culture Laboratory of Department of Horticulture, PMAS-Arid Agriculture University, Rawalpindi. Rose genotypes mutants were sown in the field at similar conditions of irrigation, fertilizers and pest/disease management. Plants were treated with different levels of gamma rays and colchicine through solution. Data of various parameters like plant height shoot length, fresh leaf weight, dry leaf weight, flower diameter, rose water, number of shoots, number of flowers/plant/week, weight/10 flowers and number of petals were collected for different treatments. Gamma radiations show greater improvement in *R. centifolia* but colchicine impact was more on *R. gruss* an teplitz.

Keywords: *R. centifolia*; *R. gruss an teplitz*; Rose mutants; Colchicine application; Irradiated mutants

Introduction

Rose is one of the most important commercial flower crops belonging to family *Rosaceae* which is mostly used in perfumery, cosmetic industry and for medicinal purposes. Gamma radiations are basically the source of mutation and mutation is the sudden change in heredity material of the plant cells. While colchicine is a basically alkaloid which is obtain from colchicine aquatus tree. It actually doubles the chromosomes by stopping the spindle fiber growth by affecting the meiosis process. Mutation induction methods can largely increase the gene mutation frequency and produce new materials, germplasm and new cultivars in a normally short period. Rose species were bringing in the western world since ancient times and rigorous rose breeding was commenced since the 18th century. Introduction of new genotypes and replacement of species and cultivars by travelers significantly increases the genetic changes to the horticulturists and the propagation of the species: this importantly involved a decreasing of genetic changes available [1]. The establishment of cultivar of roses is mainly has three equal phases: the past (1876-1968) and the future (1966) moreover significant achievements are underlined [1] Considered that of the 250-350 identified species of rose, only 15-25 have added to the growth of some new cultivars of rose. Rose breeding majorly attempted by developed companies and their checked inherited awareness[1]. Different biotechnological methods are recently available for rose breeding. *R. centifolia* is commercially significant among the perfumed roses and yield highly fragrant important oil. Its petals have commercial significance and used in perfume industry, food stuff and medicines. More than 400 unstable compounds have been known in the floral bouquet of different rose cultivars. The flowers are commercially harvested for the manufacturing of rose oil which is normally used in perfumery [2]. The present research study was conducted to find out the performance of different rose genotypes for different morphological and yield parameters.

Materials and Methods

Present research work was carried out at the research area of PMAS-Arid Agriculture University, Rawalpindi, during the year 2011-2012. Design used for this purpose was randomized complete block design (RCBD) with 3 replications. The experimental material consist of plant of two varieties (*R. centifolia* and *R. gruss-an-teplitz*) treated *in vitro* with mutagens (Tables 1 and 2) Plants were treated with different level of gamma radiations (Table 1) and colchicine through solutions (Table 2). These treated plants were proliferated and rooted in Plant Tissue Culture Laboratory before acclimitization in green house. Now the mutant lines were taken from the Plant Tissue Culture Laboratory of Department of Horticulture, PMAS-Arid Agriculture University, Rawalpindi [3].

Field was prepared by plugging and hoeing the field followed by planking. Different plots were prepared for transplanting the rose genotypes mutants of two varieties (*R. centifolia* and *R. gruss an teplitz*). Rose genotypes mutants of two varieties (*R. centifolia* and *R. gruss an teplitz*) were sown in the field on October, 2011. The total length of the research area was 130 ft and width 33 ft. The plant to plant distance was 3 ft and row to row distance was also3 ft. All the cultural practices such as irrigation, weeding, hoeing, insects and pest control measures were given uniformly to all the treatments. The parameters such asplant

	Gamma radiation (Gy)						
Rose species	T_0	$T_{1,,,}$	T_2	T_3	T_4	$T_{5,,,}$	T_6
R. centifolia	00	10	20	30	40	50	60
R. gruss an teplitz	00	10	20	30	40	50	60

Table 1: Gamma radiations.

	Colchicine (mg L^{-1})				
Rose species	T_0	T_1	T_2	T_3	T_4
R. centifolia	00	100	300	500	700
R. gruss an teplitz	00	100	300	500	700

Table 2: Colchicine solutions.

***Corresponding author:** Atif sarwar, Department of Horticulture, PMAS-Arid Agriculture University, Rawalpindi, Pakistan Tel: 0092-0-333-5203643; E-mail: atif_malikuos@ymail.com; sbutt2@hotmail.com

Received December 18, 2015; **Accepted** October 12, 2015; **Published** October 19, 2015

Citation: Sarwar A, Butt SJ (2015) Evaluation of Mutant Lines of *Rosa* Species. Adv Crop Sci Tech 3: 196. doi:10.4172/2329-8863.1000196

height, shoot length, fresh leaf weight, dry leaf weight, flower diameter and rose water were collected. The data were collected from different treatments laid in RCBD which were statistically analyzed through the analysis of variance techniques and the tables of variance were constructed.

Results and Discussion

Effect of gamma radiations on rose mutant lines

Plant height of two rose lines (Figure 1) depicted significant difference under varying levels of gamma radiations. Results revealed the maximum (32.66 inches) was observed in *R. centifolia* at T_2 and (29.00 inches) in case of *R. gruss an teplitz* at T_1.[3]Martin observed that plant height increase by increasing the irradiation doses and the best result of irradiation was shown on sapota and blue blood plant height [4].

Shoot length of both the lines were depicted a great difference at different levels of gamma radiations. The maximum by *R. centifolia* (11.33 inches) at T_2 and *R. gruss an teplitz* shows (7.33 inches) at T_1. Gamma irradiation effects upon the shoot lengths constituents so some of aromatic herbs and spices were studied and their results shows significant results by Calucci et al [5].

There was a significant difference seen in fresh leaf weight of both the lines (Figure 2) at different levels of gamma radiations. *R. gruss an teplitz* depicted the maximum (74.56 mg) at T_1 and *R. centifolia* show (60.36 mg) at T_2. The decline in fresh weights coincided with the onset of flower wilting and desiccation [6]. According to our findings gamma rays show greater improvement.

Dry leaf weight of both the lines (Figure 3) was also significantly different from each other. Maximum was observed in (Figure 4) *R. gruss an teplitz* (27.16 mg) at T_1, *R. centifolia* shows (19.32 mg) at T_2. Similar results were found by Hong et al. [7]. Observed that dry weight of leaves of rose plant was significantly increased as result of gamma rays compared with control in the seasons.

Flower diameter of *R. gruss an teplitz* and *R. centifolia* showed a significant at various treatments of gamma radiations. Maximum was observed (6.26 cm) at T_1 in *R. gruss an teplitz* and in *R. centifolia* reveal (5.76 cm) at T_2. *R. gruss an teplitz* and *R. centifolia* were showing a significant difference of about (0.5 cm). Our results are not relevant to

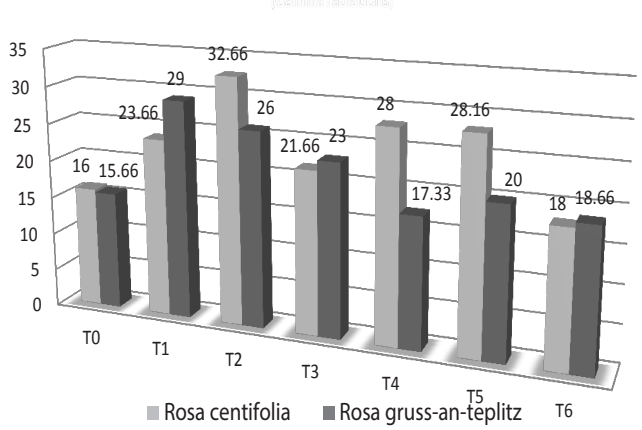

Figure 1: Bar chart graph showing the effect of gamma radiations on Plant height (inches) of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

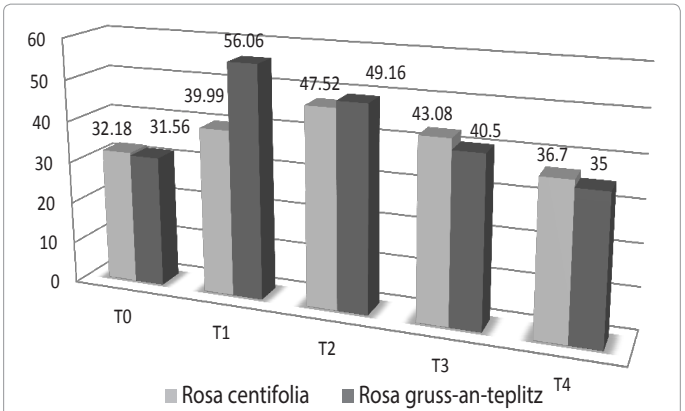

Figure 2: Bar chart graph showing the effect of colchicine solutions on Fresh leaf weight (mg) of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

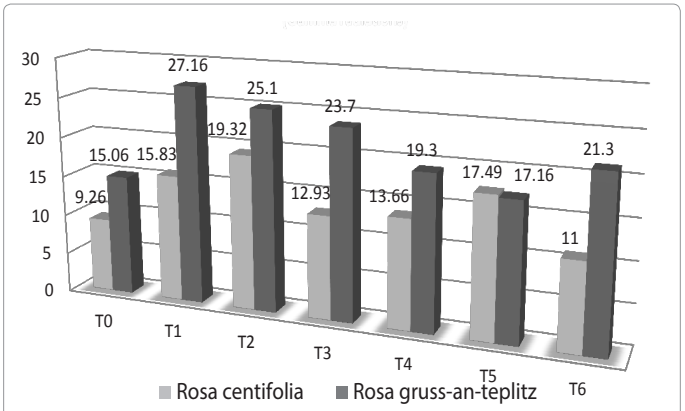

Figure 3: Bar chart graph showing the effect of gamma radiations on Dry leaf weight (mg) of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

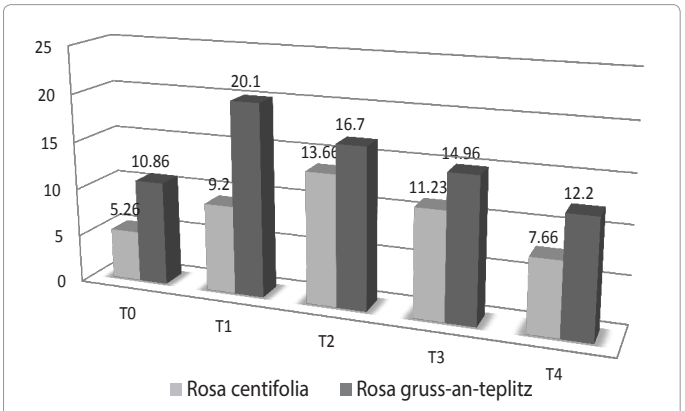

Figure 4: Bar chart graph showing the effect of colchicine solutions on dry leaf weight (mg) of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

Bendini et al. [8] that flower diameter has no significant results with the application of gamma radiations. Rose water percentage (Figure 5) was also revealed a significant difference among both the lines at different levels of gamma radiations. *R. centifolia* shows the rose water percentage (3.70%) at T_3 and *R. gruss an teplitz* (1.36%) at T_1. Results are agreed with Hanson et al. [9]. As he also observed that gamma radiation show significant water rose % in case of *R. centifolia*.

Effect of gamma radiations on number of shoots in *Rosa centifolia* and *R. gruss an teplitz* showed a significant difference that *R. centifolia* with maximum (6.00) in T_2. While in *R. gruss an teplitz*, maximum (4.33) in T_1. The results supported with the observations of Muthuswamy and Pappiah (1976) conducted experiment on *J. auriculatum* under climatic conditions; it was found that gamma rays produced beneficial effect on quantum of new shoots. It shows that the application of gamma radiation at different ratios increased the number of branches compared to untreated plants in *J. sambac* and *J. auriculatu*m [3].

Number of flowers/plant/week was significantly reveals that in *R. centifolia*, maximum (11.00) was found in T_2. But in *R. gruss an teplitz*, examined that maximum (7.66) was found in T_1 with minimum (5.00) in T_3. Similar findings are reported by Khattak et al. [10] he observed that maximum number of flower were 20.6.

Weight/10 flowers of *R. gruss an teplitz* and *R. centifolia* showed a significantly results at various treatments of gamma radiations. *R. centifolia*, maximum in T_2 treatment (31.99) as compared to lowest in T_0 (19.09). *R. gruss-an-teplitz*, the highest weight/10 flowers were observed in T_1treatment (17.33) as compared to lowest in T_0 (12.30). The results are in consonance with the findings of Nikabakht [11] who observed that those of *Rosa gruss-an-teplitz* and *Rosa indica* showed the lowest values (1.358g and 1.388g, respectively) for flower weight.

Gamma radiations treatments showed significant results in both *Rosa* varieties. *R. centifolia*, maximum number of petals (36.00) were noted in T_2 treatment in comparison with lowest in T_0 (21.66). While in *R. gruss an teplitz*, maximum (34.33) were noted in T_1 treatment with lowest in T_0 (21.00). The present results are so much agreed with the findings of Kaul et al. [12] who found that number of petals were 38, 32 and 47, respectively. Similar findings were observed by Tabaei-Aghdaei et al. [13] that positive correlation was observed between number of petals and number of stamens.

Effect of colchicine solutions on rose mutant lines

Colchicine has been used for a long time as a polyploidizing agent. It has been used successfully to produce polyploids for cytogenetic research and for breeding programme in many plant species. Plant height of two rose lines depicted significant difference under varying colchicine treatments. Results revealed the maximum (25.33 inches) was observed in *R. gruss an teplitz* at T_1 and (25.00 inches) at T_2 in case of *R. centifolia* but the control shows the minimum plant height (17.00 inches) at T_0 in *R. centifolia*. Our findings show same results as mentioned by Mensah et al. [14] reported colchicine application revealed that increase in plant height at moderate application but decrease at high.

Shoot length of both the lines were reveal a great difference at various levels of colchicine treatments. The maximum (8.00 inches) at T_2 in *R. centifolia* and *R. gruss an teplitz* shows (7.33 inches) at T_1. Agreed with our results that data show the increase in shoot length (inches) over the application of colchicine [15].

There was a significant difference seen in fresh leaf weight of both the lines (Figure 4) at different levels of colchicine treatments. Data shows the increase in fresh leaf weight (mg) over the application of colchicine [15].

Dry leaf weight of both the lines was also significantly different from each other. Maximum was observed in *R. gruss an teplitz* (20.10 mg) at T_1 and the minimum dry leaf weight were recorded in *R. centifolia* (13.61 mg) at T_2. Same results were found by some of other scientist as our results that shoot dry weight increases by the application of colchicine [14].

Flower diameter of *R. gruss an teplitz* and *R. centifolia* show a significant results at various treatments of colchicine. Maximum (5.76 cm) at T_2 in *R. centifolia* and in *R. gruss an teplitz* (5.56 cm) at T_1. Hessayon [16] observed that varying flower diameters in different rose cultivars showed similar results as founded. Rose water percentage (Figure 6) showed a significant difference among both the lines at different levels of colchicine treatments. *R. centifolia* shows (2.83%) at T_2 and in *R. gruss an teplitz* (1.46%) at T_1.

Number of shoots was significantly different from each other. *R. centifolia* shows maximum (6.33) at T_1, while *R. gruss an teplitz* shows (4.33) in T_1 treatment. Senapati and Rout [17] observed that *R. gruss an teplitz* and *R. centifolia* showed significant results having 2.809 and 2.158 number of shoots, respectively. Shoot multiplication rate varied in different species and was specific to culture medium.

Maximum number of flowers/plant/week shows significant results at various colchicine treatments. *R. centifolia* (11.33) was found in T_2, while *R. gruss an teplitz* showed maximum (8.66) was found in T_1. The useful mutant lines isolated and treated with colchicine to establish any changes in locus for the increase of number of flower/plant/week reported by Biswas.

Weight/10 flowers (Figure 7) indicated significantly results from

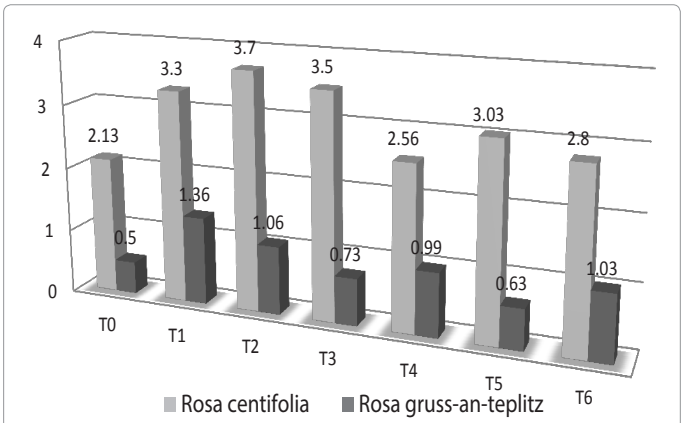

Figure 5: Bar chart graph showing the effect of gamma radiations on rose water % of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

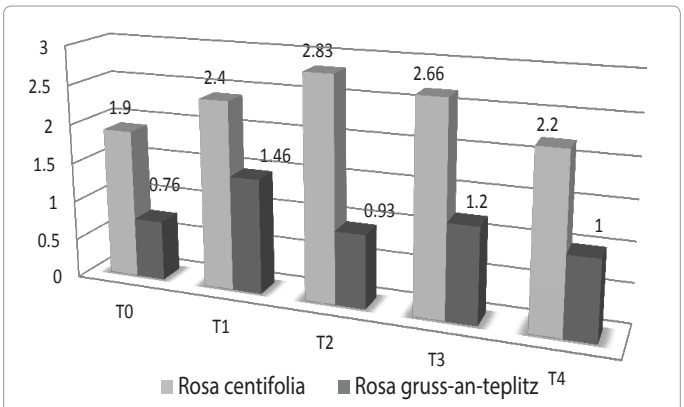

Figure 6: Bar chart graph showing the effect of colchicine solutions on Rose water (%) of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

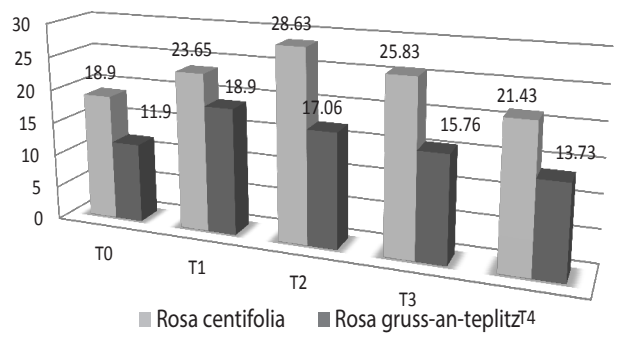

Figure 7: Bar chart graph showing the effect of colchicine solutions on weight / 10 flowers of *Rosa centifolia* and *Rosa gruss-an-teplitz*.

Sr.#	Parameters	Control	*R. centifolia*	*R. gruss an teplitz*
1.	Plant height (inches)	16.00± 2.73 15.66± 1.45	32.66 ± 1.86	29.00 ± 1.53
2.	Shoot length (inches)	3.00± 0.88 4.66 ± 0.33	11.33 ± 0.88	7.33 ± 0.33
3.	Fresh leaf weight (mg)	39.20± 4.20 56.40 ± 1.48	60.36 ± 4.93	74.56 ± 1.45
4.	Dry leaf weight (mg)	9.26± 1.22 15.06 ±0.69	19.32 ± 1.01	27.16 ± 0.45
5.	Flower diameter (cm)	2.33± 0.60 4.80 ± 0.15	5.76 ± 0.21	6.26 ± 0.12
6.	Rose water (%)	2.13± 0.20 0.50 ± 0.15	3.70 ± 0.35	1.36 ± 0.12
7.	No of shoots	1.66± 1.20 1.33 ±0.58	6.00 ± 0.58	4.33 ± 0.58
8.	No of flowers/plant/ week	4.33 ± 0.58 5.33 ± 0.33	11.00 ± 1.00	7.66 ± 0.33
9.	Weight / 10 flowers (g)	19.09 ± 1.92 12.30 ± 0.56	31.99 ± 2.36	17.33 ± 0.07
10.	No of petals	21.66± 0.88 21.00 ± 1.20	36.00 ± 3.52	34.33 ± 0.58

Values are not significantly different by LSD (P < 0.05)

Table 3: Effect of gamma radiations on both Rosa varieties.

Sr.#	Parameters	Control	*R. centifolia*	*R. gruss an teplitz*
1.	Plant height (inches)	15.66±1.45 22.33 ± 0.88	25.00 ± 0.58	25.33 ± 0.88
2.	Shoot length (inches)	4.66±0.33 4.33 ± 0.33	8.00 ± 0.58	7.33 ± 0.33
3.	Fresh leaf weight (mg)	32.18±1.48 31.56 ± 0.81	47.52 ± 0.46	56.06 ± 1.57
4.	Dry leaf weight (mg)	15.06±0.69 10.86 ± 0.65	13.66 ± 0.35	20.10 ± 0.87
5.	Flower diameter (cm)	4.80±0.15 3.70 ± 0.06	5.76 ± 0.15	5.56 ± 0.09
6.	Rose water (%)	1.90 ± 0.06 0.76 ± 0.13	2.83 ± 0.03	1.46 ± 0.15
7.	No of shoots	1.33 ± 0.56 2.33 ± 0.33	6.33 ± 0.24	4.33 ± 0.18
8.	No of flowers/plant/week	6.33 ± 0.55 3.66 ± 0.33	11.33 ± 0.33	8.66 ± 0.33
9.	Weight/10 flowers (g)	18.90 ± 0.58 11.90 ± 0.21	28.63 ± 0.56	18.90 ± 0.35
10.	No of petals	28.00 ± 0.58 19.33 ± 0.33	37.00 ± 0.58	25.66 ± 0.88

Values are significantly different by LSD (P < 0.05)

Table 4: Effect of colchicine solution on both *Rosa* varieties.

each other. *R. centifolia* shows maximum (28.63) in T_2 treatment, similarly *R. gruss an teplitz* shows (18.90) in T_1. Colchicine solution has no significant effect on increase in flower weight reported by Barnabas et al. [18].In another study it is revealed that *R. centifolia* showing great variation in its wait as compared to *R. gruss an teplitz* [19].

Numbers of petals create a significant difference in between both lines. *R. centifolia* illustrated that maximum (37.00) were noted in T_2 similarly *R. gruss an teplitz* found that (31.00) in T_1. However, the counting petals with large size which will be further conducted accurately [20].

Conclusion

On the basis of results as summarized above, it is concluded that the considerable difference for both the lines by application of different levels of gamma radiations and colchicine as compared to control. Gamma radiation showed great variation in its results as compared to colchicine treatment. Gamma radiations reveals significant improvement in mutant line *R. centifolia* instead of *R. gruss an teplitz* but the colchicine treatment show great variation in line *R. gruss an teplitz* as compared to *R. centifolia*. Also suggests that an extensive research work should be carried out to reach in a final conclusion for using such treatments in roses for plant height, flower color and size to increase in their commercial value.

References

1. Devries DP, Dubois AM, Morisot A, Ricci P (1996) Rose breeding: past, present prospects. Second Int symposium on roses, Antibes, France. Acta Hort 424: 241-248.
2. Lavid N, Wang J, Shalit M, Guterman I, Bar E, et al. (2002) O-Methyl transferases involved in the biosynthesis of volatile phenolic derivatives in rose petals. Plant Physiol 129: 1899-1907.
3. Martin G (1980) Use of thin layer and gas liquid chromatography for analysis of some essential oils metadysoverm. Moscow. USSR. Chem Abst 84: 19-90.
4. Hase Y, Shikazono N, Tano S, Watanae H (2002) Introduction to PlantPhysiology. Plant physiol 129: 60-64.
5. Calucci L, Pinzono C, Zandomeneghi M, Capocchi A (2003) Effects of γ-irradiation on the free radical and antioxidant contents in nine aromatic herbs and spices. J Agri and Food Chem 51: 927-934.
6. Reid MS, Evans RY, Dodge LL, Mor y (1989) Ethylene and silver thiosulfate influence opening of cut rose flowers. J Amer Soc Hort Sci 114: 436-440.
7. Hong V, Wrostlad O (1990) Use of HPLC separation/photodiode array detection for characterization of anthocyanin. J Agric Food Chem 38: 708-715.
8. Bendini A, Toschi TG, Lercker G (2002) Antioxidant activity of oregano leaves. Ital J Food Sci 14: 17-25.
9. Hanson RE, Zwick MS, Choi S, Islam-Faridi MN, McKnight TD, et al. (1995) Fluorescent in situ hybridization of a bacterial artificial chromosome. J Agri and Food Chem 38: 646-651.
10. Khattak AM, Dawar SH, Khan MA, Razaq A (2011) Effect of summer pruning on the quality and performance of rose cultivars. Sarhad J Agric 27: 1.
11. Nikabakht A, Kafi M (2008) A study on the relationship between Iranian people and damask rose (Rosa damascena) and its therapeutic and healing properties. Acta Hort 790: 251-254.
12. Kaur N, Sharma RK, Sharma M, Singh V, Ahuja PS (2007) Molecular evaluation and micro propagation of field selected elites of Rosa damascena. Gen Appl Plant physiol 33: 171-186.
13. Tabaei-Aghdaei, Babaei SRA, Khosh-Khui M, Jaimand K, Rezaee MB, et al. (2007) Morphological and oil content variations amongst Damask rose (Rosa damascene) landraces from different regions of Iran. Hort Sci 113: 44-48.
14. Mensah JK, Obadoni BO, Akomeah PA, Ikhajiagbe B, Ajibolu J (2006) The effects of sodium azide and colchicine treatments on morphological and yield traits of sesame seed (Sesame indicum). Afr J Biotechnol 6: 534-538.

15. Amiri S, Kazemitabaar SK, Ranjbar G, Azadbakht M (2010) the effect of trifluralin and cholchicine treatments on morphological characteristics of Jimsonweed (Datura stramonium). Turk J Sci 8: 47-61.

16. Hessayon DG (1988) The Rose expert. Pub, Britanica House, Waltham Cross, Herts, England.2003.

17. Senapati KA, Rout DC (2010) Gamma irradiation for insect disinfestations damages native Australian cut flowers. Hort Sci 52: 343-355.

18. Barnabas B, Obert B, Ovacs GK (2009) Colchicine an efficient genome-doubling agent for maize (Zea mays L.) microspores cultured. Plant cell Rep 18: 858-862.

19. Ojomo OA (2007) Pollination, fertilization and fruit characters in cowpea (Vigna unguiculata). Gha J Sci 10: 33-37.

20. Raufe S, Khan IA, Khan FA (2006) Colchicine-induced tetraploidy and changes in allele frequencies in colchicine-treated populations of diploids assessed with RAPD markers in (Gossypium arboreum). Turk J Biol 30: 93-100.

Citation: Sarwar A, Butt SJ (2015) Evaluation of Mutant Lines of *Rosa* Species. Adv Crop Sci Tech 3: 196. doi:10.4172/2329-8863.1000196