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Effect of different doses of gamma rays for induction of mutation in bougainvillea cv Mahatma Gandhi

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ABSTRACT

An experiment of physical mutation was conducted on bougainvillea cv. Mahatma Gandhi at 0, 500, 1000, 1500 and 2000 rads of gamma rays. The trial was carried out at the Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi from July 2011 to September 2012. The experiment was laid out in randomized block design with four replications. The analyzed results indicated that after three months of planting, reduced sprouting percentage was recorded with increased dose of gamma rays. The minimum survival of plants (41.00%) was observed at higher dose, i.e. 2000 rads and followed by 1500 rads (59.50%), 1000 rads (71.50%) and 500 rads (94.00%) respectively. In irradiated plants, difference in all the growth and floral characters was observed as compared to control. The unusual type of morphological abnormalities was observed in plant height which was drastically reduced as compared to control. The other growth characters such as number of branches/plant, length of sub-branch, number of leaves/branch, length of leaves, width of leaves, length of petiole, length of internodes, length of flower tube, length of bract, length of thorn and number of thorns/ branch were found statistically significant as compared to control. It was also observed that the cuttings treated with higher dose of 2000 rads were small and has taken more days for sprouting (62.75 day). Reduction in sprouting, survival of plants, plant height, number of branches, leaf number and size and different abnormalities were observed with increased exposure to gamma rays.

Key words: Bougainvillea, Cultivar Mahatma Gandhi, Gamma rays

Bougainvillea is an important and versatile ornamental plant of the tropics and sub-tropics of the world. It is grown in home gardens, parks, and institutional gardens in various ways, viz. bush, climber, hedge, topiary, standard, pot plant, bonsai, on pergolas and trees (Roy 1987, Sharma and Roy 2001). It is used for several multipurpose and for beautification, the demand is increasing day by day, but, its availability in sufficient quantity and versatile varieties are not available. Bougainvillea is also a drought and pollution resistant plant which can be safely planted in the industrial places and on the road dividers (Kumar and Prasad 2002). Indeed, bougainvillea is considered a true friend which keeps on blooming under adverse situations too and gives charming and very beautiful look to the surroundings, moreover, different garden design is not complete without bougainvilleas. In recent years, mutation breeding has been used as a valuable supplement to traditional methods of plant breeding in the development of better crop cultivars (Arora and Pahuja 2008). Most of the bougainvilleas are developed through selection of 'bud sports' or by mutation breeding. Mutation breeding is one of the important methods to create variability in flower crops and it also reduces the time required to develop a new variety (Kannan *et al.* 2002). The hybridization is also being done, but it is not possible in multi-bracted bougainvillea due to absence of flower tubes/flowers and all varieties are not able to set seeds at all places. Hence, a alternative method, i.e. induced mutation breeding was carried out to see the effect of gamma irradiations on Mahatma Gandhi cultivar of bougainvillea.

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MATERIALS AND METHODS

Mutation study was conducted at the Division of Floriculture and Landscaping, Indian Agricultural Research Institute, New Delhi during July 2011 to September 2012 on bougainvillea cv. Mahatma Gandhi in randomized block design with four replications. Healthy grown mature hardwood stem cuttings with individual mutagens were irradiated with 0, 500, 1000, 1500 and 2000 Grays of gamma rays (Cobalt ^{60}) in Gamma chamber. The length of each stem cutting was kept 20 cm with 4-5 buds. Each treatment consisting of 50 cuttings were irradiated and planted immediately in polyethylene bags filled with pot mixture and sand and kept under shade for rooting. The growth and flower observations were recorded as sprouting percentage, days to sprout, morphological abnormalities in

Table 1 Effect of different doses of gamma rays on vegetative characters of bougainvillea cv. Mahatma Gandhi

Treatment	Plant height (cm)	Branches/ plant	Length of main branch	Length of sub-branch	Leaves/ branch	Length of leaves(cm)	Days to sprout	Percentage of sprouts
0 rad (control)	157.75	5.50	133.00	91.50	51.25	8.50	51.00	83.50
500 rad	106.75	6.50	87.50	69.25	43.25	8.65	54.25	94.00
1000 rad	100.75	4.00	81.50	66.25	43.00	7.75	58.00	71.50
1500 rad	94.25	4.50	75.00	60.75	38.00	7.12	59.25	59.50
2000 rad	67.00	3.50	61.75	56.50	22.50	6.52	62.75	41.00
CD (P=0.05)	6.53	1.62	NS	3.37	3.54	0.70	1.76	3.29

foliage/bract colour and other various characters. The recorded data were analyzed statistically as suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The analyzed data as evident from Table 1 indicates that increase in the dose of gamma irradiation from 0 to 2000 rads resulted in decrease in the sprouting percentage. Maximum sprouting (94.00 %) was observed in cuttings treated with 500 rad gamma rays which were significantly differed from all other treatments. However, minimum rooting percentage (41.00%) was observed in cuttings treated with 2000 rad gamma rays. The days to sprout were maximum (62.75 day) in cuttings treated with 2000 rad gamma rays and it was minimum (51.00 day) under control (Table 1). It is also clear from the Table 1 that increases in dose of gamma rays from 0 to 2000 rads resulted in decreased plant height from 157.75 cm to 67.00 cm. As far as length of main branch is concerned, similar pattern was observed, but the difference was not significant. Table 1 indicates that the treatment of the stem cuttings with 2000 rad gamma rays resulted in minimum length of sub-branch (56.50 cm) as compared to control (91.50 cm). As it is evident from Table 1 that increase in gamma irradiation dose, the number of leaves/ branch were reduced to more than half (22.50) in 2000 rad treatment compared to control (51.25). Similarly leaf length also found to decrease with increase in doses of gamma rays (Table 1). Change in width of leaves showed irregular pattern, i.e. at 500 rad, it increased and with further increase in gamma ray doses, it showed decrease and then increase in width, i.e. leaf abnormality was observed in treated cuttings. The results presented in Table 2 indicate that with increase in the quantity of physical mutagen petiole length and internodes distance was increased up to 2000 rad. Table 2 also shows that the length of flower tube was maximum (1.87 cm) with 2000 rad gamma ray and it was statistically significant over all other treatments. The flower tube length observed to minimum (1.10 cm) under control.

It is clear from the Table 2 that the bract width was increasing with correspond increase in gamma irradiation doses and was maximum (2.87 cm) under 2000 rad. The minimum bract width (1.80 cm) was observed under control. Similar to bract width, increase in gamma irradiation dose increased the bract length up to 1500 rad (3.45 cm) and further increase in dose resulted in decreased bract length (Table 2). Data presented in Table 2 indicates that with increase in dose of gamma rays up to 1500 rad resulted in maximum number of thorns/ branch (27.00) while minimum thorns/branch (16.00) were recorded with 2000 rads of gamma rays. As far as length of thorn is concerned, it was increased from 0.45 cm to 1.80 cm from control to 2000 rad gamma rays. The results showed that light colour variation in foliage/bract could be determined, but it will be seen in next generation for conformity. Abraham and Desai (1977), Gupta and Shukla (1977, Gupta and Nath (1977) had reported variegated mutants by gamma irradiation in single bracted bougainvillea. Jayanthi *et al*. (1999) had also reported that reduction in sprouting, plant height and survival were recorded after irradiation in most of the cultivars. Banerji (2009) reported that reduction in plant height, growth, leaf number and floral abnormalities were observed after irradiation. Dwivedi *et al. (*2009) also reported in perennial chrysanthemum reduction in survival, plant height, branch number, leaf number, size and increase in morphological and floral abnormalities after irradiation.

Table 2 Effect of different doses of gamma rays on vegetative and flowering characters of bougainvillea cv. Mahatma Gandhi

Treatment	Width of leaves (cm)	Length of petiole (cm)	Length of flower tube (cm)	Width of bract (cm)	Length of bract (cm)	Length of thorn (cm)	Number of thorn/branch (cm)	Length of internodes (cm)
0 rad (control)	3.87	1.50	1.10	1.80	1.97	0.45	18.00	2.05
500 rad	4.70	1.57	1.32	1.90	2.35	0.57	20.00	2.47
1000 rad	3.70	1.82	1.67	2.50	3.20	0.95	18.00	2.90
1500 rad	4.90	2.05	1.75	2.75	3.45	1.30	27.00	3.77
2000 rad	5.15	2.12	1.87	2.87	3.37	1.80	16.00	3.62
CD (P=0.05)	0.43	0.16	0.15	0.11	0.33	0.11	2.92	0.31

The results of the present experiments are close conformity with the above said workers.

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