Properties of Gamma Radiation on Certain Morphological Characteristic of Tomato (Solanum Lycopersicum L.)

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Abstract:- In instruction to study the properties of gamma rays on seed germination percentage, plant survival percentage, number of leaves, number of branches and plant height of Solanum lycopersicum L. present trial was lead. Parched seeds of Solanum lycopersicum L. (Var. Garima S1) were exposed with10, 15, 20, 25, 30, 35, 40 and 50 kR at the Bhabha Atomic Research Centre (BARC), Mumbai.The outcome displayed that the gamma radiation exaggerated all the above stated parameters. It was observed that all the traits showed decreasing trend in there mean value with the increasing intensity of gamma irradiation. Seed germination percentage was meaningfully exaggerated and late at higher doses of gamma rays. The highest doses of gamma rays such as 40kR and 50kR exposure caused death of all seedlings and no seed germination was observed.

Keywords:- *Gamma radiation, morphology, Tomato, Solanum lycopersicum L.*

I. INTRODUCTION

Nuclear techniques, in distinction to conformist refinement techniques, are broadly useful in cultivation for refining genetical diversity. Contrasting conformist refinement actions which involve, the construction of new genetic combinations from previously existing parental genes, nuclear technology causes completely new gene combinations with high mutation frequency. Basic tool of nuclear technology for yield enhancement is the use of ionizing radiation which reasons induced mutations in plants. These mutations might be valuable and have sophisticated efficient values. Extensive assortments of characters which have been enhanced through induced mutation breeding include plant architecture, yield, blossoming and adulthood duration, superiority and tolerance to biotic and abiotic pressures. About 89 % of mutant variations have been established using physical mutagens such as X-rays, gamma rays, thermal and fast neutrons where as with gamma rays alone accounting for the development of 60 % of the mutant varieties (Kharkwal, 2000). There are numerous practices of nuclear techniques in agriculture. In plant development, the radiation of seeds may source genetic, variability that permit plant breeders to choice new genotypes with better characteristics such as precocity, salinity tolerance, grain yield and quality (Ashraf, 2003). Therefore, the intention of this effort is to test the properties of the mutagens as a means of generating variations and useful traits in tomatoes.

II. MATERIALS AND METHODS

The parched and vigorous seeds of local cultivar of Solanum lycopersicum L. have been used in the present study. The seeds were exposed to different doses of gamma rays (Viz. 10, 15, 20, 25, 30, 35, 40 and 50kR) at Bhabha Atomic Research Centre, Mumbai. After irradiation, sixty seeds of each dose were sown in pots, five in each pot. Data was calculated on morphological traits such as seed germination, plant survival and plant height compared with control. The data on seed germination and morphological traits was recorded right from the seedling stage in each treatment, including control. Mean germination percentage was resolute by counting the seedlings emerged in each pot per total number of seeds sown multiplied by hundred.

III. RESULTS AND DISCUSSION

➢ *Seed germination and plant survival percentage*

In control maximum number of seeds germinated after one week of sowing. The percentage of Seed germination was 100%. Germination percentage showed steady reduction from lower to higher doses of Gamma radiations which were 78.34%, 68.34%, 58.34%, 51.67%, 46.67% and 36.67% for 10kR, 15kR, 20kR, 25kR, 30kR and 35kR respectively (Table1).According to the data, the percentage of plant survival decreased with the increasing intensity of gamma radiation (Fig-1).The plant survival percentage also decrease with increase of gamma ray exposures, the survival percentage was recorded in control 100% but for treatment ones, survival percentage was 65.86% for 15kR, 51.43% for 20kR, 32.26% for 25kR, 21.43% for 30kR and finally the lowest 13.63% 35kR (Table2). The lethal dose where the 100 percent of germination is inhibited at the gamma dose 40 and 50kR. Same result has been recorded by (Saba and Mirza, 2002) in Lycopersicon esculentum L., (Aruna et al., 2010) in Solanum melongena L., (Iqbal and Datta, 2006) in Withania somnifera., (Watanabe et al., 2007) in Solanum lycopersicum L., (Sri Devi and Mullainathan, 2012) in Capsicum annuum L., (Bharathi et al., 2013) in Withania somnifera., (Sikder et al., 2013) in Solanum lycopersicum L., (Bhosale and More, 2014) in Coriandrum sativum L.

Mutagen	Doses	Seed Germination%	Plant survival%
	Control	100	100
Gamma irradiation	10kR	78.34	76.59
	15kR	68.34	65.86
	20kR	58.34	51.43
	25kR	51.67	32.26
	30kR	46.67	21.43
	35kR	36.67	13.63

Table1. Effect of mutagen on Seed germination and Plant survival percentage in Solanum lycopersicum L.

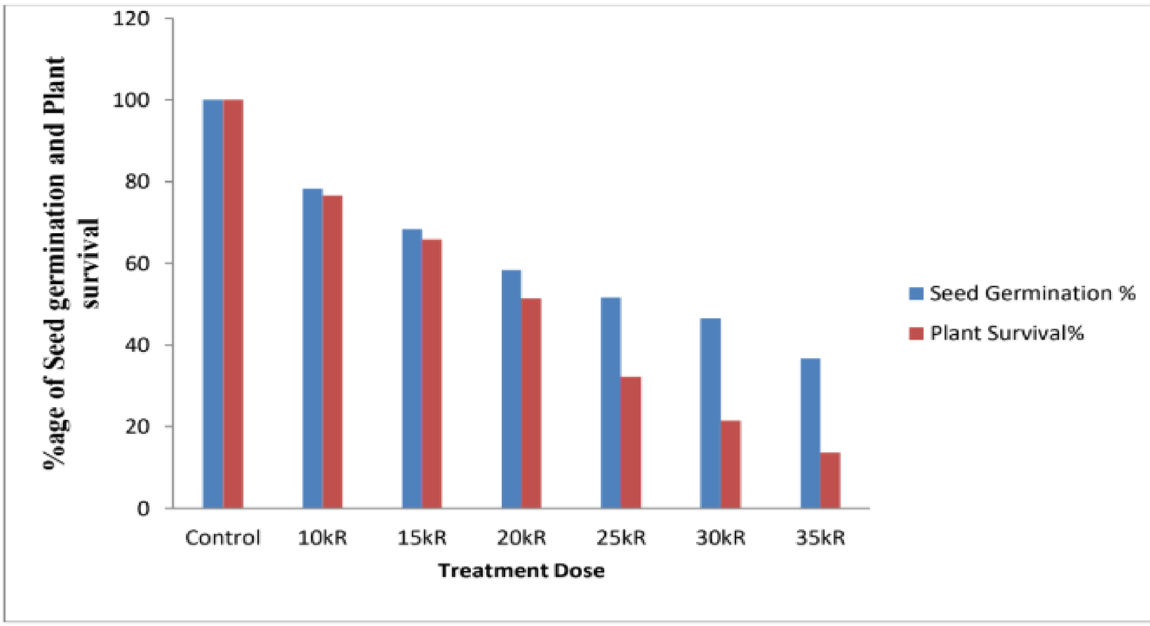

Fig 1:- Effect of gamma radiations on seed germination and plant survival in M1 generation of Solanum lycopersicum L.

Treatment dose	Plant height(cm)/mean+sd	Number of leaves/plant	Number of branches/plant
Control	43.4-6.79	74.4-6.48	12.8-2.40
10kR	40.9-2.95	73.3-3.87	12.5-2.11
15kR	40.6-4.08	73.1-3.78	12.3-1.79
20kR	40.1-4.50	72.5-5.55	12.2-1.83
25kR	39.9-4.01	72.1-3.53	11.9-2.59
30kR	39.2-3.40	70.7-4.10	11.1-1,37
35kR	37.6-4.10	68.6-3.04	10.7-1.49

Table 2. Effect of mutagen on plant height, number of leaves and number of branches in Solanum lycopersicum L.

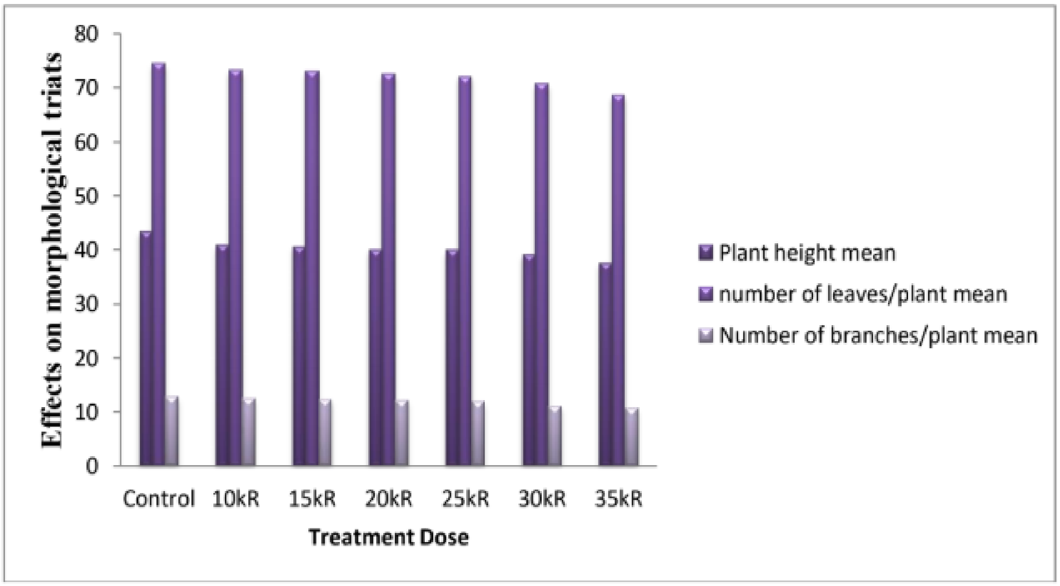

Fig 2:- Effect of gamma radiations on various morphological traits in M1 generation of Solanum lycopersicum L.

IV. EFFECT OF GAMMA RADIATION ON PLANT HEIGHT (CM)

Effect of gamma irradiation on average plant height of 60-day-old Solanum lycopersicum L. was measured in the control (Figure 2) and irradiated experimental groups. (Table 2) shows the average mean plant heights of the control was 43.4 cm and that of plants exposed to 10, 15, 20, 25, 30 and 35 kR gamma irradiation were 40.9, 40.6, 40.1, 39.9, 39.2 and 37.6 respectively. The highest plant height 40.9 cm was observed in 10kR (Table 2) which may be due to stimulatory effect of irradiation treatment. In general, the average plant height was reduced with the increasing treatment doses. All the doses showed decrease in the average mean plant height and showed inverse proportionality to the radiation intensity (Fig-2). (Irfaq & Nawab, 2001) and (Chaudhary, 2002) reported decrease in average plant height in response to gamma radiation.

V. EFFECT OF GAMMA RADIATION ON NUMBER OF LEAVES/PLANT

The effect of different doses of gamma rays was observed for number of leaves per plant (Table 2) on Solanum lycopersicum L. The mean value of number of leaves in control was observed (74.4) and other irradiated doses, showed the mean value of number of leaves decreased with increasing irradiation doses (Figure 2). In present study, the higher exposer of gamma rays affected the total number of leaves per plant. Similar results were reported by (Naheed, 2014).

VI. EFFECT OF GAMMA RADIATION ON NUMBER OF BRANHES/PLANT

The effect of different doses of gamma rays was observed for number of branches per plant were measured and compared with the control population (Figure 2). The mean number of branches showed constant decrease with the increasing dose of gamma rays (Ariraman et al, 2014). The highest (12.8) mean value of number of branches was measured in control and the lowest (10.7) mean value of number of branches was noticed in 35kR treated plants of gamma radiations (Table 2). Similar result was reported by (Shamsi and Sofajy, 1980) in broad bean, (Khah and Verma, 2015) in wheat.

VII. CONCLUSION

From above investigations it is clear that gamma rays are capable in inducing damage to plants at molecular level and is capable of inducing mutation. Higher the dose of Gamma rays more will be the damage and chances of getting variables may increase. The present investigation clearly demonstrated that induced mutation can be successfully utilized to create genetic variability when it is desired to improve specific traits in plants. In conclusion, it can be supposed that physical mutagenic actions working in the current research work flourished in persuading superior genotypes with important changes in growth and metabolism of the plant body.

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