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Effect of Gamma Rays in Induced Morphological Mutants on M_2 Generation of Chilli (*Capsicum annuum* L.) Var K_1

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ABSTRACT

The present study was carried out to induce morphological mutation in chilli (*Capsicum annuum* L.) var k_1. The seeds were subjected to different treatment levels of gamma rays are 20, 30, 40, 50, 60 and 70Kr along with control. The treated and untreated seeds were raised in a randomized block design to observe the different morphological characters in M_2 generation. Several unique and interesting mutants were isolated in this investigation, these independent mutants have differ from control, the most distinct mutants included tall, dwarf, bushy , flower, sterile and pod mutant, was observed in M_2 generation.

***Keywords*:** physical mutagens; chilli; Kr Mutant

1. INTRODUCTION

Chilli (*Capsicum annuum* L.) var k_1 is one of the most cultivated vegetable spice crops in tropical and subtropical climates. India is the largest consumer and exporter of chillies in the international markets and exporter dry chilli, chilli powder and oleoresins to over 90 countries. Mutations are the tools and being used to study the nature and basis of plant growth and development, thereby producing raw materials for genetics improvement of crops, induced mutation can rapidly create variability in quantitatively and qualitatively inherited traits in crops, mutagenesis is one of the most critical steps for genetics studies as well as selective breeding. Various mutagenic agents are used to induce favourable mutations at high frequency that include ionizing radiation and chemical mutagens, successful mutant isolation largely relies on the use of efficient mutagens, the physical mutagens induce a broad variation of morphological and yield structure parameters in comparison to normal plants, the present study was undertaken to gather information on the response of chilli to doses of irradiation to determine the type and frequency of mutations. Breeding is the most commonly used method for crop improvement and genetics variability is the basis of any breeding program genetics variability is also important to adopt a population to the inevitable changes in the environment and to promote the survival of the species. Mutation breeding is an important method used for the improvement of crops. Mutation may arise spontaneously or induced by using physical or chemical mutagens. The crop may undergo desirable mutation that could be at significant

benefit to mankind. The investigation of this study was to determine the LD 50 and effect of gamma rays on morphological characteristics at chilli seedling derived from irradiated seeds.

2. MATERIAL AND METHODS

Chilli (*capsicum annuum* L.) var k_1 seed were obtained from **kovilpatti 1** Tamil Nadu Agriculture Research Institute kovilpatti, Seed of chilli were irradiated with different doses of 20, 30, 40, 50, 60, and 70, kR gamma rays at TNAU Tamil Nadu Agriculture University Coimbatore. The treated seeds were sown in seed bed and watered at least once in a day. After 25-30 days, seedlings were shifted to field condition. The M_1 generation (produced directly from mutagens treated seeds) was grown in the field experiment at the Botanical Garden, Department of Botany, Annamalai University. All the recommended cultural practices were carried out during the plant growth period. All surviving M_1 plants were self and harvested to raise M_2 generation.

3. RESULT AND DISCUSSION

Mutants were characterized on morphological basis. Overall 6 mutants were isolated. The central matter in this mutation analysis concern the viable mutation may of which, whether they are morphological or physiological in character, drastic or modifying, have potential value in plant breeding. The highest rates obtained with various mutagens as well as the corresponding kinds of treatment are visualized. Frequency of mutants with desirable viable morphological plant and pod types occurred. Mutants were characterized on morphological basis. The isolated mutants were comprises tall, dwarf, bushy, sterile, flower and pod mutant and were discussed under the following headings.

3. 1. Tall mutant

The mean height of the control plants was ranged between 65 to 72.83 cm, and the highest height observed mutant was ranged between 75 to 80 cm. The tall mutant consist only few branches, the number of flowers and pod setting was higher in this plant compared to control.

3. 2. Dwarf mutants

The dwarf mutants were conspicuous by the short stature and reduced yield components. The mean height of the control was 72.83 cm whereas; it was 20.16 cm in the dwarf mutants. Their frequency was 3.63% of the total morphological mutations. The dwarf plant characterised short internodes, thick with dark green leaves.

3. 3. Bushy mutant

The variants were 31-45 cm tall and posses large number of branches and leaves, which results bushy appearance. The inter nodes are shorter, number of flowers and pods were less when compared to control.

TALL MUTANT (40kR)

BUSHY MUTANT (30kR) STERILE

MUTANT (50kR)

CONTROL

FLOWER MUTANT (40kR)

POD MUTANT (40kR)

DWARF MUTANT (40 kR)

3. 4. Flower mutant

All these mutants had flowers with 5-lobed calyx and corolla control. De Haro and Del Rio (1998) also reported mutants with change in number of petals, sepals and ovules than normal in borage (*Borago officinalis*). Several genes like Leafy and Ap1 involved in flowering have been isolated from model plants like Arabidopsis and Tomato (Leandro *et al*., 1990). Further studies would reveal weather these genes mutated in these lines are comparable with the reported genes or not. However such lines can be very helpful to understand the mechanism of flowering and fruit development and have been used to study genes involved in crop maturation (Odeigah *et al.,* 1996). Generally capsicum species has pentamerous flower but an abnormal behavior of trimerous. Tetramerous, hectamerous, nature. This is also reported mutant with change in number of sepals, petasls and ovules than in *borago officinalis*.

3. 5. Male sterility

This male sterile mutant was observed in 50 KR of Gamma rays. Normal development of the stamen and pollen is essential for the successful completion of male sexual reproduction, abnormality in any stage in stamen and pollen development can result in male sterility.

3. 6. Pod mutant

In this variant the numbers of pods were ranged between 52 to 60 in number where as in control it was more or less than 30. The pods are larger in size and having more number of seed as well as dark red in appearance when compared to control and other variants.

Table 1. Morphological Mutant in M_2 Generation.

TREATMENT GAMMA RAYS (kR)	M_2 PLANT OBSERVED	TALL MUTANT	DWARF MUTANT	BUSHY MUTANT	FLOWER MUTANT	MALE STERILE MUTANT	POD MUTANT	TOTAL FREQUENCY
30 (kR)	150	4	-	3	1	3	2	8.65 %
40 (kR)	162	7	2	5	2	-	6	13.58%
50 (kR)	160	2	6	2	5	-	1	9.37%

4. CONCLUSION

Results suggest that using a dose of 40KR can induce morphological mutations. Several unique and interesting mutations were induced in this study. There were some mutants that were completely sterile and cannot be used for further studies. The fertile mutants generated in this study could be valuable for linkage and mapping studies of *Capsicum annuum*. Further more mutants can also be used to isolate genes involved at different developmental stages of

plants. Mutants isolated in this study as well as in many previous studies could serve as genetic markers. This reveals that mutation breeding is a valid and effective crop breeding method for short genome crops like *Capsicum annuum.*

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