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**RESEARCH ARTICLE**

# Induced Flower Colour Mutations in *Phaseolus vulgaris* Linn through Physical and Chemical Mutagens

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**ABSTRACT**

*The seed material of Phaseolus vulgaris L variety "Varun" was treated with physical mutagen with different doses of gamma rays like 30kR ,40kR, 50kR and 60kR and chemical mutagen Ethyl Methane Sulphonate (EMS) at the different concentrations like 0.10%, 0.15%, 0.20%, 0.25%.*

*The treated M2 phenotypic progeny showed different flower colour mutations like white, purple, blue, red, and yellow as mutants developed due to the effect of physical and chemical mutagens. The control progeny showed original slight pink colour flower. The percentage of flower colour mutation increased according to the doses / concentrations of the mutagens. The highest percentage of flower colour mutation were recorded in 0.25% of EMS and lowest percentage of flower colour mutation were found in 30kR of gamma rays. The achievement of flower colour mutation could be founding higher doses/concentrations as compared to lower doses / concentrations.*

***KEYWORDS**: EMS, Gamma rays, Flower color mutation, Phaseolus vulgaris Linn*

## INTRODUCTION

French bean (*Phaseolus vulgaris L.)* belongs to Family Fabaceae. It contains proteins, fats, carbohydrates, minerals, calcium, iron etc. It is rich in protein legume. French bean can be used as carminative, diuretic, and emollient, it can be used in treatment of diabetes, diarrhea, dysentery, and kidney problems. *French* bean (*Phaseolus vulgaris* L) is the grain legume of greatest volume for direct human consumption in the world. It is one of the most important staple crops for small farmers and the urban poor in many Asian and African countries. In the developing world, most French bean production is grown on small farms without irrigation, liming or fertilizer on marginal or drought-prone land.

The primary purpose of mutation breeding is to increase genetic viability available to the plant breeder. Success of mutation breeding would appear to be greatest when he is looking for specific mutant not already available and has screening procedures to identify the mutant plant if the mutation is obtained. The mutagen dose administrated should be sufficient to kill about 50 percent of the seed to obtain the maximum number of mutation.

Mutation is sudden heritable change in organism, generally the structural change in gene. Mutation may be genic, involving deletion or molecular changes within the physical limits of genes or chromosomal, involving the rearrangement, loss, or duplication of chromosomal segments. Mutation induction in seed offers the possibility of increasing mutation ratio so as several desirable mutation might occur in same seed.

Induced mutations are highly effective in enhancing natural genetic resources and have been used improving plants. Gamma radiation and Ethyl Methane Sulfonate [EMS] have been the principal agents employed to increase mutation frequency in plants.

## MATERIALS AND METHODS

The seeds of French bean variety "Varun" were obtained from National Agriculture Research Project [P. Z. ] Ganeshkhind Pune411007, released by Mahatma Phule Krushi Vidhyapeet, Rahuri, Dist. Ahmadnagar.

Mode of treatment with mutagenic agents -
The seed material of *Phaseolus vulgaris L* variety "Varun" was treated with physical mutagen with different doses of gamma rays like 30kR , 40kR, 50kR and 60kR and chemical mutagen Ethyl Methane Sulphonate (EMS) at the different concentrations like 0.10% , 0.15 % , 0.20% , 0.25% .
Gamma Ray treatment was carried out at Department of Nuclear Chemistry, University of Pune, the seed were irradiated with $^{60}$CO source at the doses mentioned above.
EMS treatment was carried out at Department of Botany, Fergusson College, Pune.
Duration of treatments -
Pre-soaking of seed material - 4 hours - in distilled water.
Treatments of chemical mutagen - 6 hours - in EMS
Post-Soaking of treated seed material - 4 hours - in distilled water.
For each treatment 500 seed material were used. 300 seeds from each treatment were sown in the field according to randomized block design (RBD) with three replications along with control and M1 generation was started.
All the surviving M1 mutant plants were harvested separately at the maturity. The harvested seed was sown in the next season to raise M2 generation. The respective control and treatment progenies were observed several times for flower color mutations throughout the crop duration.

## RESULT AND DISCUSSION

The M2 phonotypical population of *Phaseolus vulgaris Linn* showed a large number of flower colour mutations, both physical and chemical mutagens induced the different flower colour mutations. The highest frequency 3.725 of such mutants was recorded at 0.25% EMS concentration while lowest frequency 0.954 was seen at 30kR doses of gamma rays.
The induction of flower colour mutation observed in M2 generation of *Phaseolus vulgaris* Linn - The physical and chemical mutagens succeeded in inducing the different flower colour mutations. The different flower colour mutations showed broad range of colour like white, red, purple, yellow and blue as against pink in control. The relative percentage of white flower mutant was highest followed red, purple, yellow, and blue. The induced mutation for flower colour has been reported in different plant like cow pea, cluster bean, *medicago sativa, psophocarpus. Etc*

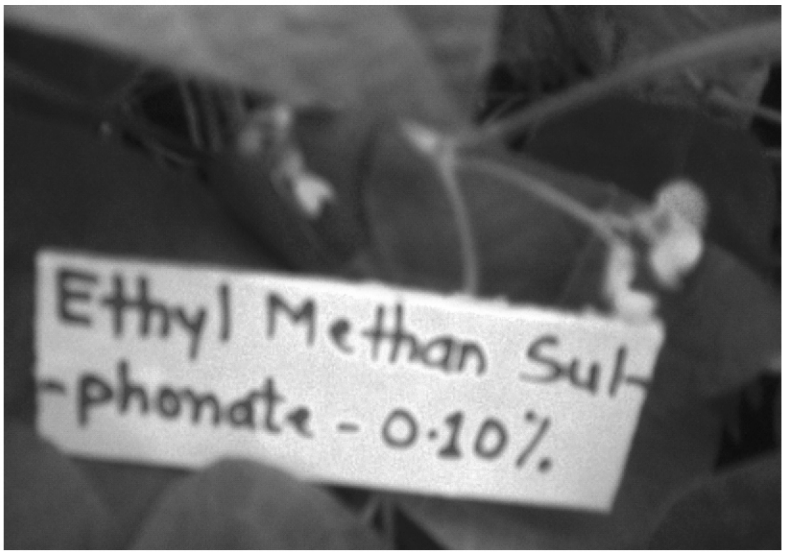
**Flower Color Mutants**

**White**

**Purple**

**Blue**

**Red**



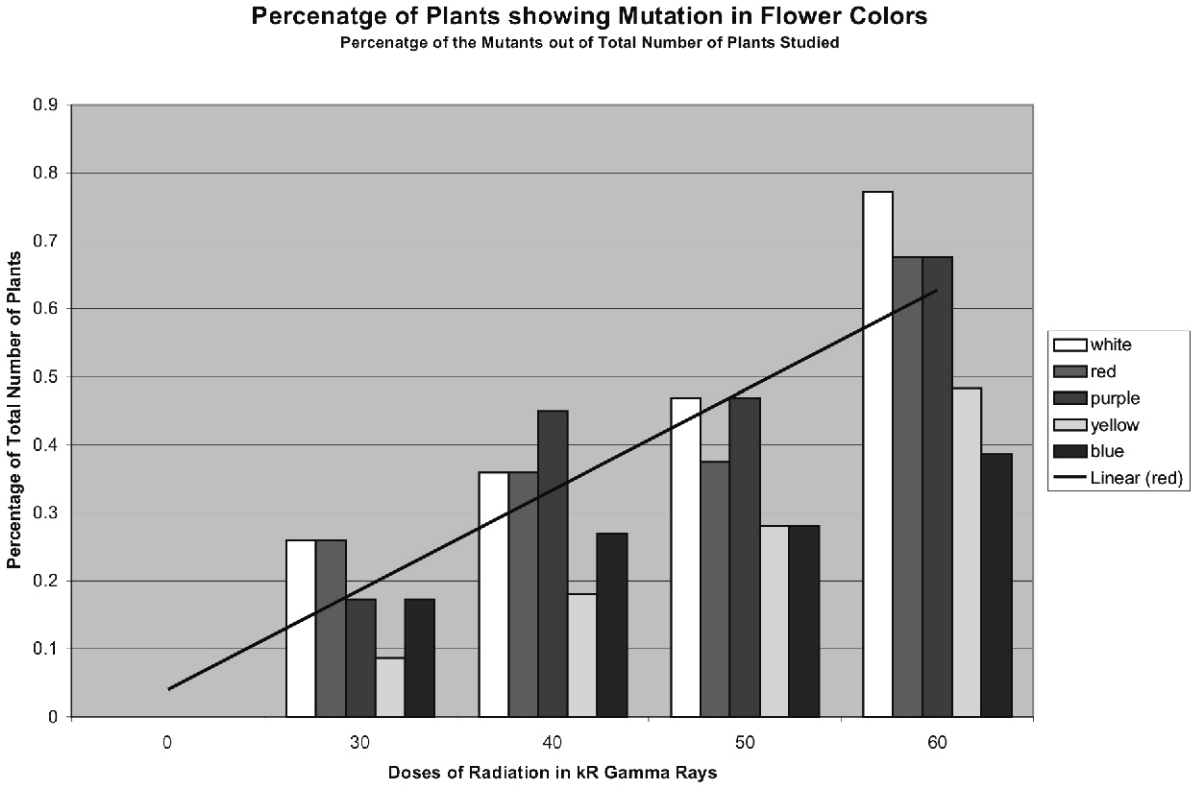
**Yellow**

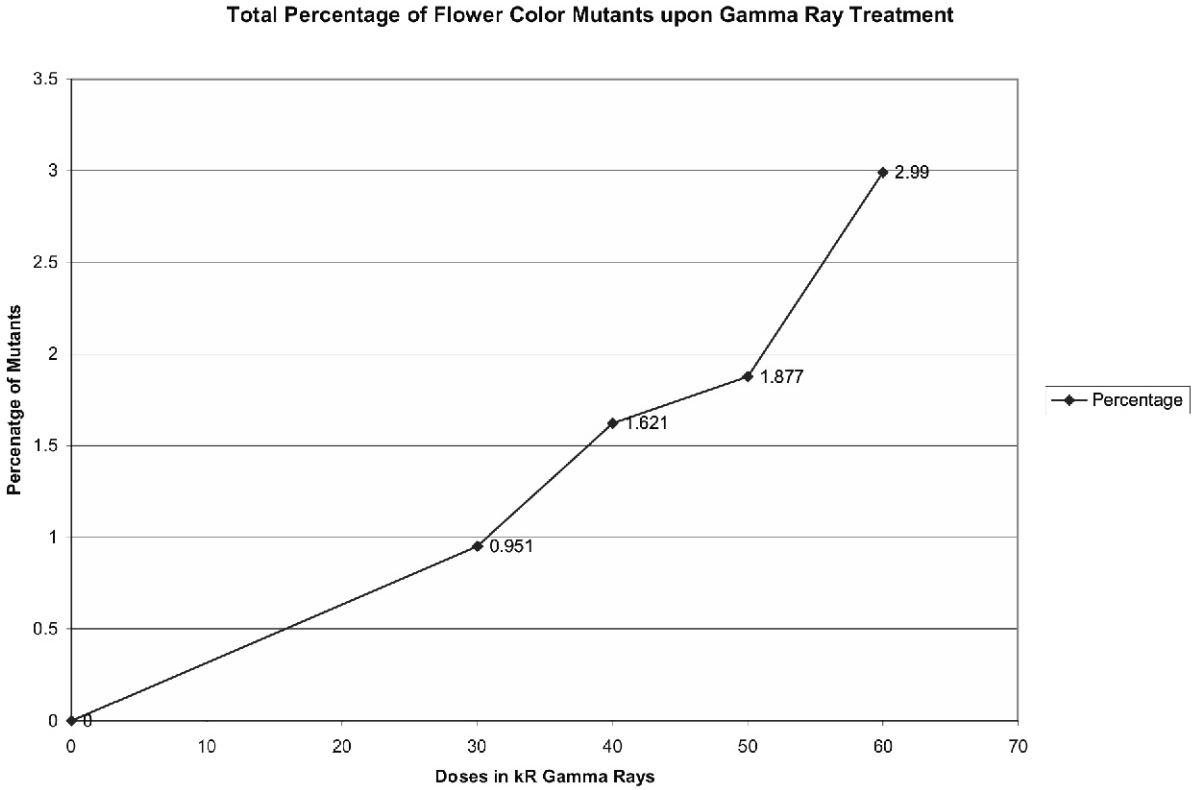

**Table1:** Effects Of Mutagens n the Frequency Of Flower Colour Mutations in M2 Generation of *Phaseolus Vulgaris Linn*.

| Mutagens | Doses / Concentrations | Number of Plants Studied in M2 generation. | Total Percentage of plants showing flower colour mutations. | **Spectrum and relative percentage of Flower Colour Mutation** | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | White | Red | Purple | Yellow | Blue |
| Gamma rays | Control | 1230 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 30Kr | 1155 | 0.951 | 0.259 | 0.259 | 0.173 | 0.086 | 0.173 |
| | 40kR | 1110 | 1.621 | 0.360 | 0.360 | 0.450 | 0.180 | 0.270 |
| | 50Kr | 1065 | 1.877 | 0.469 | 0.375 | 0.469 | 0.281 | 0.281 |
| | 60Kr | 1035 | 2.99 | 0.772 | 0.676 | 0.676 | 0.483 | 0.386 |
| Ethyl Methane Sulphonate | Control | 1200 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 0.10% | 1170 | 1.278 | 0.341 | 0.341 | 0.170 | 0.256 | 0.170 |
| | 0.15% | 1095 | 2.10 | 0.547 | 0.456 | 0.456 | 0.365 | 0.273 |
| | 0.20% | 1050 | 2.95 | 0.857 | 0.666 | 0.666 | 0.476 | 0.285 |
| | 0.25% | 1020 | 3.725 | 0.882 | 0.882 | 0.784 | 0.588 | 0.588 |

**Mutagen Gamma Rays**

Graph 1: shows Relative Percentage of flower color mutants against the amount of radiation received by the seed. As seen from the graph, white flower mutants are predominantly observed followed by Purple and Red. Blue and Yellow mutations show comparatively lesser percentage. The percentage of flower colour mutation increased according to the doses of the gamma rays.

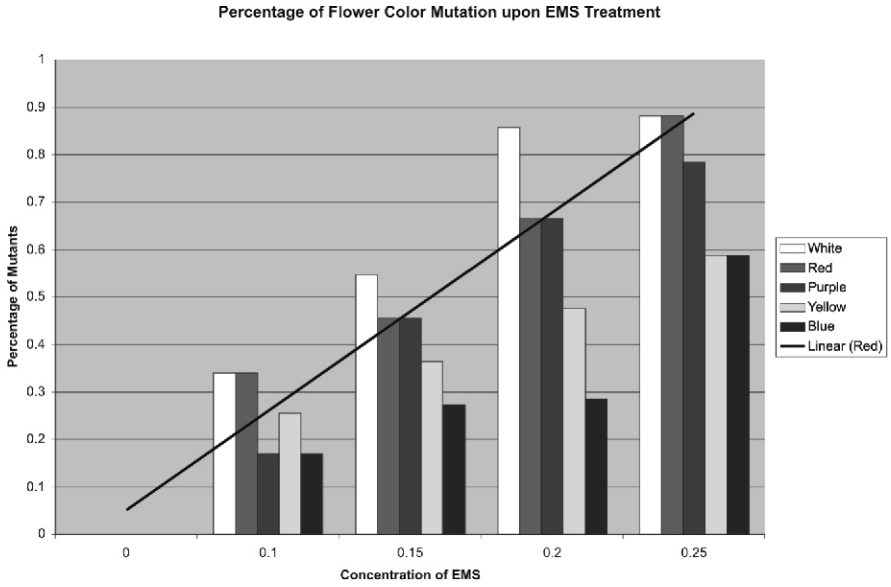

Percenatge of Plants showing Mutation in Flower Colors
Percenatge of the Mutants out of Total Number of Plants Studied
Percentage of Total Number of Plants
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
30
40
50
60
Doses of Radiation in kR Gamma Rays
white
red
purple
yellow
blue
Linear (red)


Total Percentage of Flower Color Mutants upon Gamma Ray Treatment
Percenatge of Mutants
3.5
3
2.5
2
1.5
1
0.5
0
0
10
20
30
40
50
60
70
Doses in kR Gamma Rays
0
0.951
1.621
1.877
2.99
Percentage

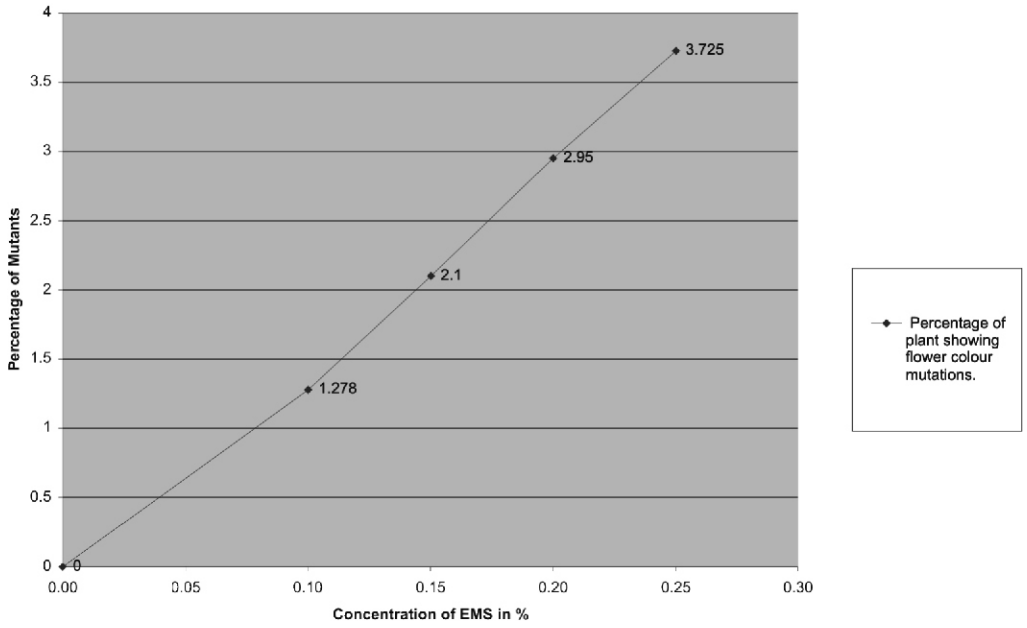
Graph 2, The highest percentage of flower colour mutation (2.99) were recorded in 60 kR and lowest percentage (0.951) of flower colour mutation were found in 30kR of gamma rays.

**Mutagen EMS**

Graph 3 shows Relative Percentage of flower color mutants against the concentration of EMS used to treat the seed. As seen from the graph, white flower mutants are predominantly observed followed by Purple and Red. Blue and Yellow mutations show comparatively lesser percentage. The percentage of flower colour mutation increased according to the concentration of EMS.




Percentage of plants showing flower colour mutations upon EMS treatment.




Graph 4: The highest percentage (3.725) of flower colour mutation were recorded in 0.25% EMS and lowest percentage (1.278) of flower colour mutation were found in 0.10% of EMS.

## CONCLUSION

The Frequency values for the individual flower colour mutant types were varied and random at different mutagenic treatments. The white colour flower mutant showed most amongst all the flower colour mutants' types. Investigation of radio sensitivity and response to gamma rays and EMS of the variety Varun showed quite encouraged percentage of the flower colour mutations. The percentage of flower colour mutation increased according to the doses / concentrations of the mutagens. The highest percentage of flower colour mutation were recorded in 0.25% of EMS and lowest percentage of flower colour mutation were found in 30kR of gamma rays.The achievement of flower colour mutation could be found in higher doses / concentrations as compared to lower doses / concentrations.The achievement of flower colour mutation was found greater in case of EMS treatment than in radiation by gamma rays Genetic variation could be induced by chemical and physical mutagens in *Phaseolus vulgaris Linn* (French Bean).

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