Frequency of Viable Mutants in M$_2$ and M$_3$ Generation of Black Gram [Vigna mungo (L.) Hepper] Through Induced Mutation

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A B S T R A C T

The present investigation was conducted during the Kharif season of 2013, seeds of black gram [Vigna mungo (L.) Hepper] variety VBN 4 and ACM 07002 were exposed to gamma rays doses at 200, 250, 300 and 350 Gy and EMS (Ethyl Methane Sulphonate) doses at 20, 30 and 40 mM. Wide ranges of viable mutants were isolated in M$_2$ and M$_3$ generation. The mutational change in each quantitative trait can be large or small. Such changes in both macro and micro mutation are of significance in breeding depending on the characters involved. Among the seven doses of treatment in gamma rays and EMS, the dose 350 Gy and 40 mM in VBN 4 and 300 Gy and 40 mM in ACM 07002 registered highest frequency of viable mutants in M$_2$ generation and similarly in M$_3$ generation highest viable mutants were recorded in doses of 350Gy and 30 mM in VBN 4 and 350 Gy and 20 mM in ACM 07002

Keywords: Blackgram, VBN 4, ACM 07002, Gamma ray, EMS, Viable mutants

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Introduction

Blackgram [Vigna mungo (L.) Hepper] is popularly known as urd bean, urd or mash. It is an important self-pollinating diploid grain legume and belongs to the family Leguminosae and subfamily Papilionaceae.

It is an important food legume crop of the Indian subcontinent, it is rich protein content. And is widely cultivated grain legume in the Indian sub-continent, comprising of India, Burma, Bangladesh, and Sri Lanka (Nag et al., 2006). The essential amino acid composition of blackgram is tryptophan, lysine, methionine, phenyl alanine, threonine, valine, leucine and isoleucine. Among them, methionine is the primary limiting essential aminoacid in grain legumes. Black gram also plays in important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen. Being a drought resistant crop, it is suitable for dry land farming and predominantly used as an inter crop with other crops.

Mutation induction has become an establishment tool in plant breeding to supplement existing germplasm and to improve cultivars in certain specific traits. It is relevant with various fields like, morphology, cytogenetics, biotechnology, and molecular biology etc. Mutation breeding has become increasingly popular in recent times as an effective tool for crop improvement (Acharya et al., 2007).
Materials and Methods

The present investigation was conducted at Agricultural College and Research Institute, Killikulam during Kharif 2013 with the promising cultures of black gram viz., VBN 4 and ACM 07002 respectively. The seeds for M₂ generation of VBN 4 and ACM 07002 culture were procured from Agricultural College and Research Institute, Madurai.

The variety VBN 4 and culture ACM 07002 were treated with Gamma rays at four different doses ranging from 200 Gy to 350 Gy with an interval of 50 Gy and Ethyl Methane Sulphonate (EMS) at three different doses ranging from 20 mM to 40 mM with an interval of 10 mM. The M₂ generation was raised from M₁ plant basis following plant to progeny method in a Randomized Block Design with three replications an Kharif season. The seeds were sown with adequate spacing of 30 × 10 cm. The recommended agronomic practices and plant protection measures were followed uniformly for all the treatments. The viable mutants were scored in M₂ generation based on their phenotypic expression on different characters. They are categorized into several groups as stature, duration, leaf, pod and seed.

Results and Discussion

Viable mutants were detected in M₂ population by visual observation throughout the growth period and the frequency was calculated on M₂ seedling basis which are tabulated (Table 1).

In variety VBN 4, the frequency of viable mutants of the gamma ray treatment ranged from 0.56 (200 Gy) to 2.70 (350 Gy) on M₂ seedling basis. The maximum frequencies of viable mutant were recorded in 350 Gy on M₂ seedling basis.

In ACM 07002 the frequency of viable mutants of the gamma ray treatment ranged from 0.74 (200 Gy) to 1.84 (300 Gy) on M₂ seedling basis. The maximum frequencies of viable mutant were recorded in 300 Gy on M₂ plant basis and in EMS treatment ranged from 0.38 to 1.32 on M₂ seedling basis. The maximum frequencies of viable mutant were recorded in 40 mM on M₂ seedling basis and in M₃ viable mutants were detected by visual observation throughout the growth period and the frequency was calculated on M₃ plant basis which are tabulated (Table 2).

In variety VBN 4, the frequency of viable mutants of the gamma ray treatment ranged from 0.20 (300 Gy) to 0.97 (350 Gy) on M₃ plant basis. The maximum frequencies of viable mutant were recorded in 350 Gy on M₃ plant basis and in EMS treatment ranged from 0.55 (20 mM) to 0.80 (mM) on M₃ plant basis. The maximum frequencies of viable mutant were recorded in 30 mM on M₃ plant basis.

In ACM 07002 the frequency of viable mutants of the gamma ray treatment ranged from 0 (200 Gy) to 0.98 (350 Gy) on M₃ plant basis. The maximum frequencies of viable mutant were recorded in 350 Gy on M₃ plant basis and in EMS treatment ranged from 0.18 to 0.31 on M₃ seedling basis. The maximum frequencies of viable mutant were recorded in 20 mM on M₃ plant basis.

The mutational change in each quantitative trait can be large or small. Such changes in both macro and micro mutation are of significance in breeding depending on the characters involved. In M₂ and M₃ plant basis, the maximum frequency of viable mutants was observed in the higher doses. Viable mutant like tall, dwarf, bushy and tendril types of mutants were observed by Khan and Tak (2000) in blackgram.
Table 1 Frequency of viable mutants in M₂ generation for VBN 4 and ACM 07002

| Treatment | Number of M₂ seedlings | Mutant frequency |
|-----------|------------------------|------------------|
|           | Scored | Segregated | Per 100 M₂ plants scored |
|           | VBN 4 | ACM 07002 | VBN 4 | ACM 07002 | VBN 4 | ACM 07002 |
| γ-ray (Gy) |        |           |        |           |        |           |
| Control   | 290    | 286       | -      | -         | -      | -         |
| 200       | 545    | 540       | 3      | 4         | 0.56   | 0.74      |
| 250       | 444    | 491       | 3      | 4         | 0.67   | 0.81      |
| 300       | 421    | 433       | 5      | 8         | 1.18   | 1.84      |
| 350       | 407    | 396       | 11     | 5         | 2.70   | 1.26      |
| EMS (mM)  |        |           |        |           |        |           |
| Control   | 290    | 286       | -      | -         | -      | -         |
| 20        | 527    | 514       | 2      | 2         | 0.37   | 0.38      |
| 30        | 449    | 468       | 5      | 4         | 1.12   | 0.85      |
| 40        | 395    | 378       | 7      | 5         | 1.77   | 1.32      |

Table 2 Frequency of viable mutants in M₃ generation for VBN 4 and ACM 07002

| Treatment | Number of M₃ seedlings | Mutant frequency |
|-----------|------------------------|------------------|
|           | Scored | Segregated | Per 100 M₃ plants scored |
|           | VBN 4 | ACM 07002 | VBN 4 | ACM 07002 | VBN 4 | ACM 07002 |
| γ-ray (Gy) |        |           |        |           |        |           |
| 200       | 734    | 422       | 2      | 0         | 0.27   | 0         |
| 300       | 1437   | 590       | 3      | 2         | 0.20   | 0.33      |
| 350       | 715    | 612       | 7      | 6         | 0.97   | 0.98      |
| EMS (mM)  |        |           |        |           |        |           |
| 20        | 545    | 638       | 3      | 2         | 0.55   | 0.31      |
| 30        | 621    | 527       | 5      | 1         | 0.80   | 0.18      |
| 40        | -      | 395       | -      | 1         | -      | 0.25      |
In the present investigation, large number of viable mutants with changes in attributes like plant stature, duration, Leaf, pod and seed were recorded. The number of viable mutants was more in gamma rays and less number of mutants was recorded in EMS. These results were agreement with Tickoo (1987). Among the seven doses of treatment in gamma rays and EMS, the dose 350 Gy and 40 mM in VBN 4 and 300 Gy and 40 mM in ACM 07002 registered highest frequency of viable mutants in M₂ generation and similarly in M₃ generation highest viable mutants were recorded in doses of 350 Gy and 30 mM in VBN 4 and 350 Gy and 20 mM in ACM 07002.

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