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Frequency of Viable Mutants in M_2 and M_3 Generation of Black Gram [*Vigna mungo* (L.) Hepper] Through Induced Mutation

Loyavar Ramchander*, N. Shunmugavalli, A. Muthuswamy and S. Rajesh

Department of PBG, AC&RI, TNAU, Killikulam, Vallanadu-628252, India

**Corresponding author*

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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 [*Vingo 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

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 M_2 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 M_2 generation was raised from M_1 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 M_2 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 M_2 population by visual observation throughout the growth period and the frequency was calculated on M_2 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 M_2 seedling basis. The maximum frequencies of viable mutant were recorded in 350 Gy on M_2 plant basis and in EMS treatment ranged from 0.37 to 1.77 on M_2 seedling basis. The maximum frequencies of viable mutant were recorded in 40 mM on M_2 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 M_2 seedling basis. The maximum frequencies of viable mutant were recorded in 300 Gy on M_2 plant basis and in EMS treatment ranged from 0.38 to 1.32 on M_2 seedling basis. The maximum frequencies of viable mutant were recorded in 40 mM on M_2 seedling basis and in M_3 viable mutants were detected by visual observation throughout the growth period and the frequency was calculated on M_3 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 M_3 plant basis. The maximum frequencies of viable mutant were recorded in 350 Gy on M_3 plant basis and in EMS treatment ranged from 0.55 (20 mM) to 0.80 (mM) on M_3 plant basis. The maximum frequencies of viable mutant were recorded in 30 mM on M_3 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 M_3 plant basis. The maximum frequencies of viable mutant were recorded in 350 Gy on M_3 plant basis and in EMS treatment ranged from 0.18 to 0.31 on M_3 seedling basis. The maximum frequencies of viable mutant were recorded in 20 mM on M_3 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 M_2 and M_3 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 M_2 generation for VBN 4 and ACM 07002

Treatment	Number of M_2 seedlings				Mutant frequency	
	Scored		Segregated		Per 100 M_2 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 M_3 generation for VBN 4 and ACM 07002

Treatment	Number of M_3 seedlings				Mutant frequency	
	Scored		Segregated		Per 100 M_3 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 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.

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