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Mutagenic Effectiveness of Chlorophyll and Viable Mutants in M_2 Generation of Black Gram (*Vigna mungo* (L.) Hepper)

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ABSTRACT

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. The high mutagenic effectiveness of chlorophyll mutants was observed at 300 Gy (gamma ray), 40 mM (EMS) doses in both VBN 4 and ACM 07002. The high mutagenic effectiveness of viable mutants was recorded in 350 Gy in M_2 seedling basis in VBN 4, 300 Gy in ACM 07002 (gamma ray) and 40 mM (EMS) in both VBN 4 and ACM 07002. The effectiveness of chlorophyll and viable mutants were less in EMS than the gamma rays in M_2 seedling basis. The mutagenic effectiveness was high in higher doses and less in low doses.

Key words: *Black gram, VBN 4, ACM 07002, Gamma ray, EMS, Chlorophyll and viable mutants.*

INTRODUCTION

Blackgram (*Vigna mungo* (L.) Hepper) is an important pulse crop of our country. It is a highly self-pollinated crop with cleistogamous in nature. Creation of variability through pollination and artificial hybridization is very difficult as the flowers are cleistogamous and very delicate to handle. Even if hybridization is carried out the seed set is less than 5 per cent. Also, this crop lacks proper male sterility system commercially to be utilized for hybridization. Hence, the present investigation aims at creation of variation through induction of mutation through physical and chemical mutagens. Mutation is a sudden heritable change in an organism generally the structural change in gene. It's produced by change in the base sequence of genes and it can be induced either spontaneously or artificially both in seed and vegetatively propagated crops. Mutation breeding is one of the conventional breeding methods in plant breeding. It is relevant with various fields *viz.*, morphology, cytogenetics, biotechnology and molecular biology *etc*. Mutation breeding has become increasingly popular in recent times as an effective tool for crop improvement[1].

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MATERIAL 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 chlorophyll and macro mutations were scored treatment wise to study the mutagenic effectiveness of each treatment. Data on chlorophyll and viable mutation frequencies in M_2 generation were used to determine the mutagenic effectiveness according to the formula suggested by Konzak *et al*[4].

Mutagenic effectiveness = Mp / kR
(Physical mutagen)
Mutagenic effectiveness = Mp / C x t
(Chemical mutagen)

Where,

Mp = Chlorophyll or viable mutants per 100 M_1 plant progenies
kR = Dose of gamma radiation
C = Concentration of chemical (mM)
t = Time (hr)

RESULTS AND DISCUSSION

The mutagenic effectiveness of chlorophyll mutants on M_2 seedling basis are tabulated (Table 1). The mutagenic effectiveness of gamma rays ranged from 0.36 (200 Gy) to 0.71 (300 Gy) and 0.30 (200 Gy) to 0.70 (300 Gy) on M_2 seedling basis in VBN 4 and ACM 07002 respectively. The maximum value was observed only at 300 Gy on M_2 seedling basis. The mutagenic effectiveness of EMS ranged from 0.47 (20 mM) to 0.94 (40 mM) and 0.50 (20 mM) to 0.67 (40 mM) on M_2 seedling basis in VBN 4 and ACM 07002 respectively. The effectiveness of gamma rays and EMS in inducing viable mutants is tabulated (Table 2). The mutagenic effectiveness due to gamma rays in viable mutants ranged from 0.27 (250 Gy) to 0.77 350 Gy) and 0.32(250 Gy) to 0.61(300 Gy) on M_2 seedling basis in VBN 4 and ACM 07002 respectively. The highest value was recorded in 350 Gy in M_2 seedling basis in VBN 4 and 300 Gy in ACM 07002. The mutagenic effectiveness due to EMS in viable mutants ranged from 0.30 (20 mM) to 0.73 (40 mM) and 0.31 (20 mM) to 0.55 (40 mM) on M_2 seedling basis in VBN 4 and ACM 07002 respectively. The effectiveness of chlorophyll and viable mutants were less in EMS than the gamma rays in M_2 seedling basis. This was in conformity with the finding of Gautam *et al.*[2], Khan and Siddique[3] and Thilagavathi and Mullainathan[5]. The mutagenic effectiveness was high in higher doses and less in low doses.

Table 1: Mutagenic effectiveness of chlorophyll mutants in M_2 seedling basis for VBN 4 and ACM 07002

Mutagen treatment	Number of M_2 plants		Number of M_2 plants mutated		Mutation rate on M_2 plants (Mp)		Effectiveness Mp/dose	
	VBN 4	ACM 07002	VBN 4	ACM 07002	VBN 4	ACM 07002	VBN 4	ACM 07002
γ-rays (Gy)								
200	545	540	4	3	0.73	0.6	0.36	0.30
250	444	491	6	6	1.35	1.2	0.54	0.48
300	421	433	9	9	2.13	2.1	0.71	0.70
350	407	396	7	7	1.71	1.8	0.48	0.51
Mutagen treatment	**Number of M_2 plants**		**Number of M_2 plants mutated**		**Mutation rate on M_2 plants (Mp)**		**Effectiveness Mp/ C X t**	
EMS (mM)								
20	527	514	3	3	0.57	0.6	0.47	0.50
30	449	468	5	5	1.11	1.1	0.61	0.61
40	395	368	9	6	2.27	1.6	0.94	0.67

Table 2: Mutagenic effectiveness of viable mutants in M_2 seedling basis for VBN 4 and ACM 07002

Mutagen treatment	Number of M_2 plants		Number of M_2 plants mutated		Mutation rate on M_2 plants (Mp)		Effectiveness Mp/dose	
	VBN 4	ACM 07002	VBN 4	ACM 07002	VBN 4	ACM 07002	VBN 4	ACM 07002
γ-rays (Gy)								
200	545	540	3	4	0.56	0.74	0.28	0.37
250	444	491	3	4	0.67	0.81	0.27	0.32
300	421	433	5	8	1.18	1.84	0.39	0.61
350	407	396	11	5	2.70	1.26	0.77	0.36
Mutagen treatment	**Number of M_2 plants**		**Number of M_2 plants mutated**		**Mutation rate on M_2 plants (Mp)**		**Effectiveness Mp/ C X t**	
EMS (mM)								
20	527	514	2	2	0.37	0.38	0.30	0.31
30	449	468	5	4	1.12	0.85	0.62	0.47
40	395	368	7	5	1.77	1.32	0.73	0.55

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