

Spectrum of viable mutants in M₂ generation of blackgram, *Vigna mungo* (L) Hepper through induced mutation

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ABSTRACT

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 (ethyle methane sulphonate) doses at 20, 30 and 40 mM. In variety VBN 4 a total of 40 mutants were observed in the gamma rays and 17 mutants in the EMS treated plants. The more number of mutants was recorded in gamma ray and less number of mutants was recorded in EMS. Among the four doses of gamma rays treatment and three doses of EMS, the dose 350 Gy in gamma ray mutagen and 40 mM in EMS mutagen registered highest frequency. In ACM 07002 a total of 28 mutants were observed in the gamma rays and 16 mutants in the EMS treated plants. The more number of mutants was recorded in gamma ray and less number of mutants was recorded in EMS. Among the four doses of gamma rays treatment and three doses of EMS the dose 300 Gy in gamma ray mutagen and 40 mM in EMS mutagen registered highest frequency.

Keywords: Blackgram; VBN 4; ACM 07002; gammaray; EMS; viable mutants

INTRODUCTION

Blackgram, *Vigna mungo* (L) Hepper is popularly known as Urd bean, Urd or Mash. It is an important food legume crop of the Indian subcontinent and is widely cultivated here comprising India, Burma, Bangladesh and Sri Lanka (Nag et al 2006). It is a rich source of protein (20.8 to 30.5%); its total carbohydrates range from 56.5 to 63.7 per cent. It is also a good source of phosphoric acid and calcium. It contains a wide variety of nutrients and is

popular for its fermenting action and thus largely used in making fermented foods. It is an important pulse crop occupying a unique position in Indian agriculture. A number of economically important varieties of crops are released through induced mutagenesis. Since induced mutations are useful to produce new genetic variation and to select favourable mutants, systematic study of induced mutagenesis by physical mutagens (gamma ray) and chemical mutagens (EMS) in black gram was attempted.

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. 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 to 350 Gy with an interval of 50 Gy and ethyl methane sulphonate (EMS) at three different doses ranging from 20 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 in 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. Wide ranges of viable mutants were isolated in M_2 generation. The viable mutants were scored in M_2 generation based on their phenotypic expression on different characters and were categorized into several groups as stature, duration, leaf, pod and seed.

RESULTS and DISCUSSION

The viable mutants were scored in M_2 generation based on their phenotypic expression on different characters. They

were categorized into several groups as stature, duration, leaf, pod and seed. The mutant frequency computed in the segregating families and the spectrum of viable mutants in M_2 generation are presented in Table 1 and 2.

In variety VBN 4 a total of 40 mutants were observed in the gamma rays treated plants and 17 in the EMS treated plants. The more number of mutants was recorded in gamma ray and less number of mutants was recorded in EMS. Among the four doses of gamma rays treatment and three doses of EMS, the dose 350 Gy in gamma ray mutagen and 40 mM in EMS mutagen registered highest frequency. Among the stature of mutants, four different statures viz tall, dwarf, spreading and twinning type of plants were observed. The dose 350 Gy produced more number of different stature mutant types and 200 Gy recorded low number of mutants. The dose 30 mM EMS produced more number of different statured mutant types.

In ACM 07002 a total of 28 mutants were observed in the gamma rays treated plants and 16 in the EMS treated plants. The more number of mutants was recorded in gamma ray and less number of mutants was recorded in EMS. Among the four doses of gamma rays treatment and three doses of EMS, the dose 300 Gy in gamma ray mutagen and 40 mM in EMS mutagen registered highest frequency. Among the stature of mutants, four different

Viability spectrum of mutants in blackgram

Table 1. Spectrum of viable mutants in M₂ for VBN 4

Type of mutant	Mutagen dose γ - ray (Gy)	Frequency of viable mutants γ - ray (Gy)	Mutagen dose EMS (mM)	Frequency of viable mutants EMS (mM)	Percentage	
					γ - ray (Gy)	EMS (mM)
Stature mutant						
Tall type	250	2	-	-	7.50	-
	350	1				
Dwarf	200	1	40	1	5.00	5.88
	350	1				
Spreading	200	2	20	1	10.00	17.64
	350	2	30	2		
Twinning	350	1	-	-	2.50	
Leaf mutant						
Narrow leaf	200	1	30	1	10.00	11.76
	300	1				
	350	2	40	1		
Lanceolate	350	2	30	2	5.00	17.64
	350	2	40	1		
Duration mutant						
Early	300	2	40	1	5.00	5.88
Late	350	1	-	-		
Pod mutant						
Small pod	250	1	40	1	7.50	5.88
	300	2				
Colour variation	350	3	40	2	7.50	11.76
Hairy pod	350	7	-	-	17.50	
Petiole colour						
Pink	350	1	-	-	2.50	-
Dark brown	350	1	40	1	2.50	5.88
Seed mutant						
Small seed	250	1	20	1	7.50	11.76
	300	2	30	1		
Bold seed	300	1	30	1	7.50	5.88
	350	2				
Total		40		17		

Table 2. Spectrum of viable mutants in M₂ generation for ACM 07002

Type of mutant	Mutagen dose γ - ray (Gy)	Frequency of viable mutants γ - ray (Gy)	Mutagen dose EMS (mM)	Frequency of viable mutants EMS (mM)	Percentage	
					γ - ray (Gy)	EMS (mM)
Stature mutant						
Tall type	300	2	30	1	7.14	6.67
Dwarf	200	1	40	1	10.71	6.67
	300	2				
Spreading	200	1	30	1	3.57	6.67
Twinning	250	1	-	-	3.57	-
Leaf mutant						
Narrow leaf	200	2	20	1	14.28	6.67
	300	2				
Lanceolate	250	1	40	1	7.14	6.67
	300	1				
Duration mutant						
Early	300	3			10.71	-
Late	350	1	40	2	3.57	13.33
Pod mutant						
Small pod	300,	2	40	2	10.71	13.33
	350	1				
Colour variation	200	1	-	-	7.14	-
	350	1				
Petiole colour						
Pink	250	1	-	-	3.57	-
Dark brown	300	1	30	2	7.14	13.33
	350	1				
Seed mutant						
Small seed	250	1	20	2	7.14	13.33
	350	1				
Bold seed	300	1	30	1	3.57	20.00
Total			40	2		

Viable mutants spectrum in blackgram



Pod colour variation with hairyness



Petiole colour and leaf variation in M_2 generation



Spreading type plant

Dwarf type plant

Twinning type plant

statures viz tall, dwarf, spreading and twinning type of plants were observed. The dose 300 Gy produced more number of different stature mutant types and 250 Gy recorded low number of mutants. The dose 30 mM EMS produced more number of different statured mutant types in M_2 generation.

In the leaf mutants, two leaf mutant types viz narrow leaf and lanceolate leaf types were recorded. A total of 6 different leaf mutants each were registered among the gamma rays for both VBN 4 and ACM 07002 and 5 and 2 different leaf mutants were registered for the EMS treatment of VBN 4 and ACM 07002 respectively. In

both the cultures (VBN 4 and ACM 07002) the frequency of leaf mutants in gamma rays 350 and 300 Gy levels recorded more number of leaf mutant and minimum was observed in 200 and 250 Gy levels. In chemical mutagenic treatment with EMS, 40 mM produced more leaf mutants in VBN 4 and 20 mM doses recorded equal proportion of leaf mutants in ACM 07002. Similar mutants were reported earlier by Lal et al (2009), Selvam et al (2010) and Bhosale and Hallale (2011) in blackgram. Dwarf mutants have been reported by Gautam et al (1998) in blackgram.

Considering both physical and chemical mutagenic treatments in the duration of plants a total of 3 early mutants and 1 late mutant were registered in VBN 4 variety and 3 early and 3 late mutants were recorded in ACM 07002. Mutants related to duration have been reported by Arulbalachandran and Mullainathan (2009) in blackgram and early flowering and high yield was reported by Girhe and Choudhary (2002) in M_3 generation of gamma rays in *Lathyrus*.

In the pod mutants small pods, variation in colour of the pod and hairiness on pod were also recorded. A total of sixteen different pod mutant types were recorded among the gamma rays and EMS in VBN 4. The gamma rays dose 350 Gy produced more number of different pod types and the EMS dose 40 mM produced

more number of different pod types in VBN 4. In ACM 07002, a total of 7 different pod mutants were recorded both in gamma and EMS treatments. The gamma rays 350 Gy and EMS dose 40 mM produced more number of pod mutants.

Pink and brown colour petioles were recorded in 350 Gy treatment of gamma rays and dark brown petiole colour was recorded in 40 mM treatment of EMS in VBN 4. In ACM 07002 culture pink colour petiole was observed in 250 Gy treatment of gamma rays and brown colour petiole was observed in 300 and 350 Gy treatment of gamma rays and 30 mM dose of EMS.

Two types of seed mutants viz small and bold seed types were observed. The dose 300 Gy produced higher number of seed mutants in gamma treatments and 30 mM produced higher seed mutants in EMS treatments of VBN 4. Small seeded mutants were observed in 250 Gy and 350 Gy of gamma ray treatment in ACM 07002. Bold seeded types were observed in 30 and 40 mM and small seeded were noticed at low dose of 20 mM. Besides pod mutants, seed mutants like small seed, bold seed and brownish seed mutants were also recorded. Isolation of bold seed mutants in blackgram was reported by Charumathi et al (1992) and brown seeded mutants were reported earlier by Vanniarajan (1989) in blackgram.

REFERENCES

- Arulbalachandran B and Mullainathan L 2009. Chlorophyll and morphological mutants of blackgram (*Vigna mungo* (L) Hepper) derived by gamma rays and EMS. *Journal of Phytology* **1(4)**: 236-241.
- Bhosale UP and Hallale BV 2011. Gamma radiation induced mutations in black gram (*Vigna mungo* (L) Hepper). *Asian Journal of Plant Science and Research* **1(2)**: 96-100.
- Charumathi M, Rao MVB, Babu VR and Murty KB 1992. Efficiency of early generation selection for induced micromutations in blackgram (*Vigna mungo* (L) Hepper). *Journal of Nuclear Agriculture and Biology* **21(4)**: 299-302.
- Gautam AS, Sood KC and Mittal RK 1998. Induced mutations in blackgram (*Vigna mungo* (L) Hepper). *Crop Research* **16(3)**: 344-348.
- Girhe S and Choudhary AD 2002. Induced morphological mutants in *Lathyrus sativus*. *Journal of Cytology and Genetics* **3(1)**: 1-6.
- Lal GM, Toms B and Lal SS 2009. Mutagenic sensitivity in early generation in black gram. *Asian Journal of Agricultural Sciences* **1(1)**: 9-11.
- Nag N, Sharma SK and Kant A 2006. Agronomic Evaluation of some induced mutants of Urd bean (*Vigna mungo* (L) Hepper). *SABRAO Journal of Breeding and Genetics* **38(1)**: 29-38.
- Selvam YA, Elangaimannan R, Venkatesan M, Karthikeyan P and Palaniraja K 2010. Chemically induced mutagenesis in blackgram (*Vigna mungo* (L) Hepper). *Electronic Journal of Plant Breeding* **1(4)**: 921-924.
- Vanniarajan C 1989. Studies on induced mutagenesis in blackgram (*Vigna mungo* (L) Hepper). MSc (Agric) thesis, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.

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