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Induced viable mutants in *Vigna mungo* (L.) Hepper

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Mutations were induced in blackgram (*Vigna mungo* (L.) Hepper) varieties namely ADT 3, ADT 5 and APK 1. Different types of macro mutants and micro mutants were screened in M_2 generation. The frequency and the spectrum of the viable mutants were estimated in M_2 generation both in M_1 plant basis and M_2 seedling basis. The highest frequency of viable mutants was recorded in ADT 3. Mutation spectrum was much wider at 60kR and it was narrow at 50kR. The variety ADT 5 had recorded wider spectrum at 60 kR and APK 1 showed higher spectrum at 50kR.

Key words :Blackgram ADT3, ADT5, APK1

INTRODUCTION

Blackgram [*Vigna mungo* (L.) Hepper] is an important kharif crop in India grown on about 2.7 lakh hectares. The seeds are mostly consumed by the people owing to its high protein content (Akhaury 1991). The natural productivity of blackgram is only 480 kg/ha (Chaturvedi and Ali, 2002). This low yield may be due to non availability of high yielding and disease resistant varieties. Natural variability is an essential pre-requisite for any successful breeding programme. Mutation breeding is a supplementary breeding programme to identify the mutants with high yield potential, early maturity, disease and pests resistance (Singh, 1981). Both physical and chemical mutagens have been used for induction of mutation in blackgram. Several high yielding varieties of blackgram were developed by mutation induction method like Co 4. The present investigation was undertaken to induce and screen mutants and recorded the spectrum and frequency of viable mutants.

MATERIALS AND METHODS

Seeds of blackgram varieties ADT 3, ADT 5 and APK 1 were used for induction using the gamma ray. For irradiation, dry seeds of blackgram seeds were exposed to 10 to 100 kR gamma ray from ^{60}CO source at "Indira Gandhi Atomic Research Centre", Kalpakkam. After fixing the LD_{50} value, the treated seeds were sown in the field using randomized block design (RBD) with three replications. The M_1 generation was studied at kharif season. The M_2 generation was raised from the seeds collected from the individual M_1 plant basis as plant to progeny method. The recommended package of practices was followed. The frequency and the spectrum of viable mutants were estimated and tabulated in Table 1 and 2 for all the three varieties.

RESULTS AND DISCUSSION

Frequency :

Viable mutants detected in M_2 population by visual observation through out the growth period and the frequencies were calculated on M_1 plant basis and M_2 seedling basis (Table 1).

ADT 3 :

The frequency of viable mutants ranged from 20.00 to 40.00 on M_1 plant basis and 1.25 to 3.06 on M_2 seedling basis due to gamma ray treatment. The maximum frequency of viable mutant was recorded at 40 kR and 60 kR in M_1 plant basis and at 60 kR on M_2 seedling basis.

ADT 5 :

The viable mutants frequency ranged from 20.00 to 50.00 (80 kR and 40 kR) on M_1 plant basis and 1.01 (70 kR) to 2.12 (80 kR) on M_2 seedling basis. The maximum frequency was recorded in 40 kR and 80 kR in M_1 and M_2 seedling basis, respectively.

APK 1 :

Frequency ranged from 30.00 (40 kR and 60 kR) to 50.00 (80 kR) on M_1 plant basis and 1.11(80 kR) to 2.65 (60 kR) on M_2 plant basis.

Among the three varieties studied the highest

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Table 1. Frequency of viable mutants in M_2 Generation

Doses	Number of M_1 plant progenies		Number of M_2 plants		Mutant frequency	
	Scored	Segregated	Scored	Segregated	Per 100 M_1 plants	Per 100 M_2 plants
ADT 3						
40 KR	10	4	398	5	40.00	1.25
50 KR	10	3	441	8	30.00	1.81
60 KR	10	4	326	10	40.00	3.06
70 KR	10	3	409	6	30.00	1.46
80 KR	10	2	418	8	20.00	1.91
ADT 5						
40 KR8	10	5	587	7	50.00	1.19
50 KR	10	3	465	8	30.00	1.72
60 KR	10	3	468	7	30.00	1.49
70 KR	10	4	497	5	40.00	1.01
80 KR	10	2	377	8	20.00	2.12
APK 1						
40 KR	10	3	418	5	30.00	1.20
50 KR	10	4	362	7	40.00	1.80
60 KR	10	3	376	10	30.00	2.65
70 KR	10	4	401	6	40.00	1.49
80 KR	10	5	359	4	50.00	1.11

frequency of viable mutants were recorded in ADT 3 at 60 kR and the lowest frequency value was recorded in ADT 5 at 70 kR. Incase of APK 1 there was no dose dependent relationship on M_1 plant basis. Gamma ray produces high frequency at 40 kR in ADT 3. Rathinaswamy (1975) has also reported in Lablab that gamma ray had greater frequency.

Spectrum :

The spectrum of mutations consisting of those affecting plant height, leaf characters, duration, seed size and seed coat colours was observed. The percentage of different types of mutations was estimated from the total number of mutations induced by gamma ray among all the three varieties. The data are presented in Table 2.

In M_2 generation, a total of 184 mutants were observed in all the three varieties and the more number of mutants were recorded in variety APK 1 and less number of mutants was registered in variety ADT 5. Among the five doses of the treatment the dose 60 kR registered highest frequency of fifty five mutants types where as the 80 kR registered a low level of mutants of 27 types. Regarding the stature of mutants, seven different statures *viz.*, tall, dwarf, spreading, (Fig.1) semi spreading, open, and compact and twinning (Fig. 4) natured plants observed. A total of 58 different statured mutant types were registered among these the variety APK 1 registered the highest frequency of mutants (22) and the lowest frequency was registered by the entry ADT 3 (17). Regarding the dose 40 kR produced more number of different statured mutant types and 80 kR recorded low number of mutants (6). Dwarf mutants (Fig. 2) are recorded in all varieties. The same observation was reported in mungbean by Kulkarni *et al.* (1990). Tall and dwarf mutant were also reported by Ignacimuthu and Babu (1988).

Regarding the leaf mutants six leaf mutant types *viz.*, crinkled, large and thick, small, narrow, tip lobed leaf and tip ovate types (Fig. 5) were recorded. A total of 35 different leaf mutants were registered among the three varieties studied. The frequency of leaf mutants among the three varieties are more or less in equal proportion.

Table 2. Spectrum of viable mutants in M_2 Generation

S. No.	Type of mutants	Mutagen dose where Viable mutants recorded			Frequency			Percentage		
		ADT 3	ADT 5	APK 1	ADT 3	ADT 5	APK 1	ADT 3	ADT 5	APK 1
I	Stature mutants									
a)	Tall type	60,80 KR	50,70 KR	40,70 KR	3	2	2	5.00	3.44	3.03
b)	Dwarf	60,70 KR	40,50,60 KR	40,50 KR	3	3	4	5.00	5.17	6.06
c)	Spreading	60,70 KR	40,70 KR	40,50 KR	2	3	3	3.33	5.17	4.54
d)	Semispreading	40,70 KR	60,70 KR	40,50 KR	2	3	4	3.33	5.17	6.06
e)	Open	40,80 KR	60,70 KR	40,70 KR	2	3	3	3.33	5.17	4.54
f)	Compact	40,80 KR	50,70 KR	40,70,80 KR	3	2	4	5.00	3.44	6.06
g)	Twirning	40,50 KR	70,80 KR	60,70 KR	3	3	2	5.00	5.17	3.03
II	Leaf mutants									
a)	Crinkled leaf	50,60 KR	50,70 KR	40,50 KR	2	3	3	3.33	5.17	4.54
b)	Large and thick leaf	50,60,80 KR	40, 60 KR	40,70 KR	4	3	2	6.66	5.17	3.03
c)	Small leaf	40,60 KR	70,80 KR	50,60 KR	3	2	2	5.00	3.44	3.03
d)	Narrow leaf	50,70 KR	40,50 KR	50,60 KR	3	2	2	5.00	3.44	3.03
e)	Tip lobed leaf	40 KR	-	60 KR	-	-	2	-	-	3.03
f)	Tip ovate leaf	-	50,60 KR	-	-	2	-	-	3.44	-
III	Duration mutants									
a)	Early	40,70 KR	60,70 KR	50,80 KR	2	3	2	3.33	5.17	3.03
b)	Late	60,80 KR	40,80 KR	50,60 KR	2	2	3	3.33	3.44	4.54
IV	Pod mutants									
a)	More no. of pods	40 KR	60,80 KR	60,70 KR	2	2	2	3.33	3.44	3.03
b)	Small pod	60,70 KR	80 KR	40,70 KR	2	2	3	3.33	3.44	4.54
c)	Colour variation	70, 80 kR	60 kR	-	2	2	-	3.33	3.34	-
d)	Non hairy pod	60,80 KR	-	-	2	-	-	3.33	-	-
V	Stem modification									
	Basal branching	50,70 KR	-	40 KR	2	-	2	3.33	-	3.03
VI	Seed mutants									
a)	Small seed	60,70 KR	40,60 KR	50,60 KR	3	2	2	5.00	3.44	3.03
b)	Bold seed	70,80 KR	40,60 KR	50,60 KR	3	4	5	5.00	6.89	7.57
c)	Brownish seed	60,70 KR	80 KR	-	3	4	-	5.00	6.89	-
d)	Light greenish seed	40 KR	-	60,70 KR	2	-	4	3.33	-	6.06
VII	Sterile mutants									
a)	Semi sterile	40,60 KR	70,80 KR	60 KR	2	3	2	3.33	5.17	3.03
b)	Completely sterile	-	50,60 KR	50,80 KR	-	3	4	-	5.17	6.06
VIII	Others									
a)	Chimeric type	60,70 KR	-	40,80 KR	3	-	4	5.00	-	-
				Total	60	58	66			

VIABLE MUTANTS

Fig. 1 : Spreading

Fig. 2 : Dwarf

Fig. 3 : More clusters

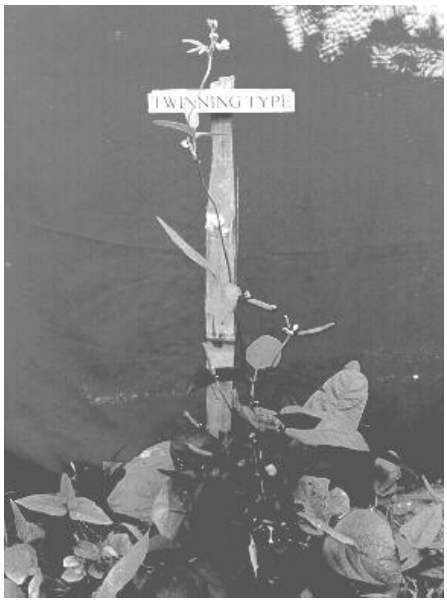

Fig. 4 : Twinning

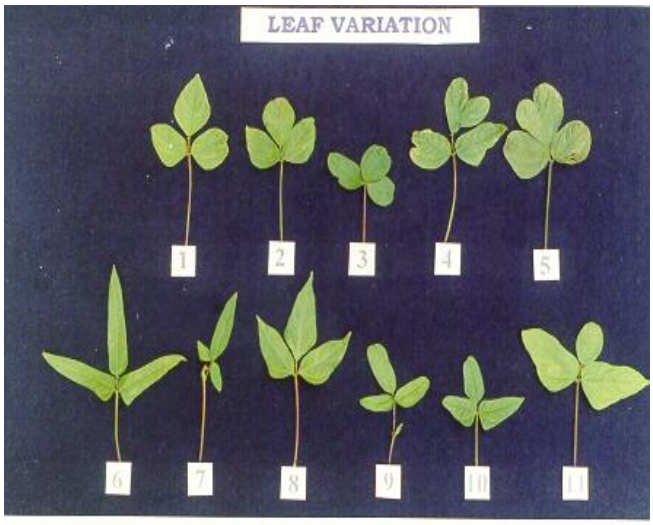

Fig. 5 : Leaf Variation

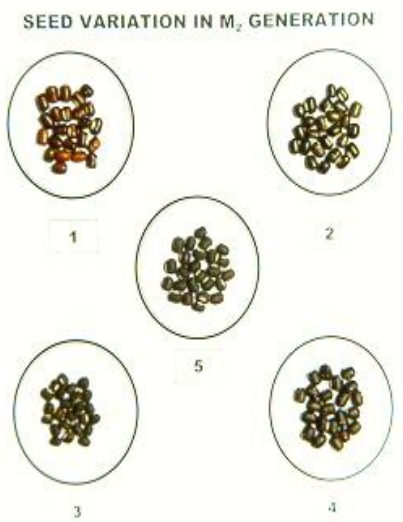

Fig. 6 : Seed variation in M_2 Generation

However, under 60 kR and 50kR level more number (13 and 12) were recorded and minimum leaf mutant types of only two were recorded in 80 kR level. The mutants affecting leaf shapes were reported Rao and Prabaker (1978) in cowpea. Regarding the Days to 50 % flowering a total of 7 early mutants for 50% flowering and 7 late flowering mutants were registered. There are no significant differences on duration for flowering was observed among the varieties. The 60 kR dose registered highest frequency mutant types numbering 2 and 3, respectively. More difference on flowering period was noticed in variety APK 1.

Regarding the number of pods (Fig. 3) per plant and the size and other characters of the pod, the number of pods was increased from 21 to 72 in variety ADT 3, 19 to 72 in ADT 5 and 20 to 68 in APK 1. When compared the three varieties, there is no relationship between the doses and the increased number of pods per plant. On pod mutant small pods, variation in colour of the pod and non hairiness on pod were also recorded.

A total of twenty two different pod type mutants were recorded, among these the dose 60 kR produced more number of different pod types. The variety ADT 3 and ADT5 produced higher number of pods mutants.

Beside these basal branched mutant types where also recorded in variety ADT 3 and APK 1 only.

Four types of seed mutants (Fig. 6) *viz.*, small seeded, bold seeded type, brownish seed sand light greenish seed types where observed. The variety ADT 5 registered more number of seed mutants and the dose 60kR produced higher number of seed mutants. The seed coat colour variation mutant are recorded in ADT 3, ADT 5 as like the colour mutants were reported by Moh (1971) in french bean, Krishnaswami *et al*. (1971) in green gram, Thakur and Sethi (1993) in black gram.

Two types of sterile mutant's *viz.*, semi sterile and completely sterile types were observed. The variety ADT 5 and APK 1 produced more number of sterile plants and the dose 60 kR is responsible for the production of the above types.

Besides these chimeric types of mutants were also observed in variety ADT 3 and APK 1, the more number of chimeric types were observed in variety APK 1.

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