Environment & Ecology 27 (4A) : 1891—1893, 2009
 ISSN 0970-0420

NOTE

Induction of Mutation and Isolation of High Yielding Mutants in Mungbean (*Vigna radiata* (L. Wilczek)

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Abstract

Pure dry seeds of mungbean cv Dhauli and Khurda local were treated with gamma rays (5–30kR), EMS (0.2-0.6%) and their combinations. The local var khurda local was tolerant to mutagenic treatments as compared to Dhauli. Among the mutagenic treatments, 0.4% either in single or in combination with 10kR gamma ray was found to be potent enough to induce mutations. Gamma ray induced more chlorophyll and foliar mutations whereas, combination treatments were efficient to induce desirable mutations of agroeconomic value. The present investigation resulted four high yielding mutants e. g., OGG 13-2, OGG 13-5, DGG 16-4 and OGG 35-8. A YMV tolerant mutant OGG 17-8 with moderate yield was also recovered.
Key words : Gamma rays, EMS, Chlorophyll mutations, Foliar mutations, Agronomic mutations.

Despite recognized importance of protein in the Indian diet, a significant break through in their productivity like cereals has not been achieved so for. Genetic amelioration in mungbean suffers a severe setback due to narrow variability in desirable agro-economic characters. Hence, a mutation study was undertaken to test the efficacy of ethyl methanesulphonate (EMS), gamma-rays and their combinations for widening the genetic base of variation with special reference to desirable traits of agronomic value.

Pure seeds of two varieties of mungbean e. g., Dhauli and Khurda local were treated with gamma rays (5, 10, 15, 20 and 30kR), EMS (0.2, 0.4 and 0.6%) and their combinations barring 20 and 30 kR gamma rays. Survival percentage in M_1 generation was recorded after 45 days of sowing,chlorophyll, foliar and agronomic mutants were scored as percentage of M_2 population. Foliar and agronomic mutants were confirmed in the M_3 generation.

Induction of mutation in terms of frequency increased with doses of gamma rays (Table 1). It was higher in Dhauli than the local variety at 20 and 30kR, but lower frequency than Khurd local at lower doses. Such differential genotypic response to mutagen was observed by Krishnaswamy (1). However, EMS at 0.4% seems to be the proper dose both in single and combination with 10kR gamma-rays irrespective of the variety used. This corroborates the findings of lgnacimuthu and Babu (2). Considering both the varieties, 30kR treatment recorded the highest frequency of mutations followed by 15 kR = 0.6% EMS, 10kR + 0.4% EMS and 20kR gamma rays. Survival of M_1 plants, were extremely reduced in 30 kR gamma-ray treatment primarily due to severe physiological injuries to treated seeds and morphogentic anomalies. This led to abrupt increase of mutation frequency in 30kR gamma-ray treatment as most of the M_1plants that survived this dose, expressed mutations in M_2 families.

Wide array of chlorophyll, foliar and agronomic mutants were isolated. There was more occurrence of chlorophyll mutations in gamma-ray treatments compared to EMS and their combinations. Singh et al. (3) also reported similar findings in single treatments of the above mutagens. This envisaged random distribution of genes controlling chlorophyll development on the chromosomes. While outcome of more foliar mutations can be ascribed to interaction of gamma-rays with genes governing morphogenesis. Combination treatments induced higher agronomic mutations than single treatments and are useful to broaden the genetic base of variation and to isolate mutants with improved agro-economic value. In contrast,

Table 1. Frequency of mutations in M_2 generation in mungbean.

Treatments Gamma-rays-EMS	Survival in M_1 (%)	Frequency of mutations (%)	Frequency of mutations Variety Dhauli Chloro-phyll	Foliar	Agro-nomic	Total	Variety Khurda local Chloro-phyll	Foliar	Agro-nomic	Total
Control	90.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 kR	73.3	3.56	0.00	0.48	2.13	2.61	0.41	0.41	3.70	4.52
10 kR	75.0	6.84	0.24	0.73	2.91	3.88	0.38	0.38	9.06	9.81
15kR	55.0	7.78	0.46	0.70	5.80	6.96	0.61	0.61	7.38	8.60
20kR	43.1	11.66	0.92	1.65	9.39	11.97	1.26	1.05	9.05	11.36
30 kR	9.8	18.73	4.23	2.93	12.70	19.86	2.94	1.95	12.72	17.61
Overall mutation freq			0.99	1.23	6.42		1.39	1.04	9.10	
0.2%	54.6	7.77	0.27	1.08	5.18	6.53	0.26	0.26	8.50	9.02
0.4%	36.2	10.38	0.63	0.79	8.86	10.28	0.33	0.65	9.53	10.49
0.6%	39.1	7.66	0.70	1.17	7.50	9.36	0.50	0.50	4.97	5.97
Overall mutation freq			0.56	0.98	7.49		0.36	0.45	7.47	
5 kR + 0.2%	37.9	7.90	0..39	0.19	6.83	7.42	0.36	0.18	7.86	8.39
5 kR + 0.4%	32.3	11.28	0.59	0.29	8.66	9.54	0.50	1.00	11.53	13.03
5 kR + 0.6%	44.8	11.03	0.63	1.26	10.50	12.39	0.39	0.77	8.53	9.68
10 kR + 0.2%	50.8	9.36	0.41	1.22	7.75	9.38	0.36	1.07	7.91	9.35
10 kR + 0.4%	34.8	12.40	0.62	2.17	10.56	13.35	0.57	1.43	9.45	11.46
10 kR + 0.6%	38.1	9.56	0.53	0.53	9.50	10.55	0.95	0.95	6.66	8.57
15 kR + 0.2%	39.6	10.01	0.62	1.07	8.78	10.47	0.34	1.01	8.19	9.55
15 kR + 0.4%	28.7	11.52	0.75	0.75	11.19	12.68	0.71	0.47	9.20	10.37
15 kR + 0.6%	29.4	14,04	0.92	1.65	13.03	15.59	0.83	0.83	10.83	12.50
Over all mutation freq			0.60	0.97	9.54		0.58	0.80	9.07	
Total plants scored in M_2					7997				6655	

Mishra and Samolo (4) reported higher induction of agronomic mutations by EMS.

Some of the vital agronomic mutants include desirable mutants with regard to semidwarf plant type, high branching, pod number and length of pod, medium and early maturity duration, YMV tolerance and bold seed size which hold promise for their possible use in breeding better varieties. A systematic follow up over years led to the recovery of four potentially high yielding mutant cultures e. g., OGG 13-2, OGG 13-5, OGG 16-4 and OGG 17-8 with average seed yield to the tune of 14 q/ha (Table 2) , OGG-13-2 had higher

Table 2. Seed yield and ancillary traits of some promising mungbean cultures.

Mutant culture	Pedigree	Maturity duration (day)	Plant height (cm)	No. of fruiting pry branches/ plant	No. of pods/ cluster	No. of seeds/ pod	Pod length (cm)	No. of pods/ plant	1000 seed weight	Seed yield (kg/ha)
OGG 13-2	Mutant of Dhauli	85.3	46.6	5.5	7.5	9.2	4.8	58.2	20.8	14.0
OGG 13-5	-do	86.6	48.2	4.8	7.5	12.0	6.8	52.0	26.6	15.1
OGG 16-4	-do	76.0	39.0	5.2	6.5	9.6	4.5	56.6	22.0	14.2
OGG 35-8	Mutant of Khurda Local	93.3	57.0	5.8	5.8	8.2	4.2	48.4	19.2	13.8
Dhauli	Control	87.0	52.4	3.2	5.6	7.2	4.5	46.5	20.5	10.0
Khurda local	Control	95.0	58.0	4.8	4.5	7.5	4.0	32.0	18.6	8.2

number of primary branches and pods/cluster, whereas compared to Dhauli (10 q/ha) and Khurda local (8.2q/ha). OGG 13-2 had higher number of primary branches and pods per plant, whereas OGG 13-5 bore high pod number/plant, long pods and bold seeds. OGG 16-4 had typical semi-dwarf plant type with high branching, high pod number /cluster and medium maturity duration (76 days). OGG 17-8 exhibited higher YMV tolerance and moderately high seed yield. Besides, lanceolate leaf, lobed leaf, beaked pod and black pod mutants recovered in this study, are useful as potential genetic marker in hybridization program. In the present study, a waxy/leathery leaf mutant deciphered at M_2, may be a valuable material for breeding drought tolerance. Waxy leaf conferring drought avoidance has been reported by Blum (5).

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