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ISOLATION OF MUTANTS AND THEIR FREQUENCIES UNDER M2 GENERATION IN RICE BEAN (*Vigna umbellata* L. THUMB)

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ABSTRACT

Two varieties of rice bean (*Vigna umbellata*) cv. RBL-50 and L-1 were treated with gamma rays (50,60, 70, 80 and 90 KR), EMS (0.3, 0.4, 0.5 0.6 and 0.7%) and combination of gamma and EMS (30KR+ 0.2%, 40KR + 0.2%, 30KR+0.3% and 40KR+0.3%).Among the varieties, L-1 and among the mutagens, gamma rays induced more number of chlorophyll and viable mutants. The viridis types were predominent than albinia, xantha and chlorina types , irrespective of the variety. The gamma doses of 60KR in RBL-50; 50KR, 90KR in L-1 and among the EMS treatments 0.5, 0.6 per cent in RBL-50; 50 KR, 90KR in L-1 were considered the best doses/concentrations, based on mutagenic effectiveness and efficacy. Twelve types of viable mutants were observed with abnormal leaves and coloured seeds being prominent among them. In the variety L-1, the doses/concentrations which have brought out highest chlorophyll mutations, also brought out highest viable mutations.

KEY WORDS: Rice bean, Gamma rays, EMS, Chlorophyll mutation

Rice bean is a native of South and South East Asia. This underutilised crop is uaually grown in the rice-fallow and has got lot of potential due to its high nutritional quality and high grain yield. But it has certain drawbacks, such as long duration, indeterminate habit and non-synchronous maturity of the pods. Artificial induction of polygenic mutations has been proposed as a less disruptive and quick method of enlarging genetic variability in crop plants(Gregory,1955). The present investigation was carried out to estimate the frequency and spectrum of chlorophyll and viable mutations in M2 generation, to isolate desired mutants and to determine the effectiveness and efficiency of physical (gamma rays)and chemical (EMS) mutagens and their combination treatments.

MATERIALS AND METHODS

Two varieties of rice bean, viz., L-1 and RBL-50 which were high yielding among the 14 germplasm lines available at UAS Bangalore, were treated with different doses of gamma rays (50,60,70,80 and 90 KR), concentrations of EMS (0.3,0.4,0.5, 0.6 and 0.7%) and their combination of (30KR+0.2% , 40KR +0.3%, 30KR+0.3% and 40KR+0.3%). Individually harvested M1 generation plant seeds were sown on plant to row basis and raised during February –May 1989 to get M2 population. The chlorophyll mutations were recorded upto the harvest and frequency was estimated on M2 plant basis. Mutagenic effectiveness and efficiency were calculated as suggested by Konzak et al.(1965) to find out the dose and concentrations.

RESULTS AND DISCUSSION

The frequency and spectrum of chlorophyll mutations in M2 generation is presented in Table-1. Among the gamma treatments, the variety L-1 exhibited linear relationship from 70KR onwards indicating increased frequency of chlorophyll mutants with increasing doses, the variety L-1 exhibited linear relationship from 70KR onwards indicating increased frequency of chlorophyll mutants with increasing doses, the variety RBL-50 did not show linear relationship with doses (Table 1). The highest frequencies of mutants were found at 60KR (1.99%) and 90KR (3.44%) in the varieties RBL-50 and L-1 respectively, while in EMS treatments, the highest frequencies were observed at 0.7 per cent (2.44% in RBL-50) and 0.5 per cent (1.66% in L-1). The variety L-1 induced more number of chlorophyll mutants (22.00%) as compared to RBL-50 (19.47%).

The virids type was observed in highest frequencies in all the mutagenic treatments (Table 1), while albinia was more frequent in gamma rays and combination treatments, than in EMS treatments. Chlorina and Xantha types were induced in all the treatments, irrespective of the

Table 1. Frequency and spectrum of chlorophyll mutations in M_2 generation in two varieties (RBL-50 & L-1)

Treatments	Frequency of chlorophyll mutants based on M2 plants		Mutagenic effectiveness		Mutagenic efficiency		Spectrum of chlorophyll mutations (on M2 plant basis)							
							Albina		Xantha		Chlorina		Viridis	
	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1
Control	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I. Gamma rays :														
50kR	0.92	2.48	0.018	0.049	0.018	0.058	0.30	0.39	-	0.26	0.12	1.04	0.49	0.78
60kR	1.99	1.47	0.033	0.024	0.043	0.039	0.49	0.32	0.16	0.16	0.33	0.32	0.99	0.65
70kR	1.11	1.12	0.015	0.016	0.021	0.024	0.31	0.11	-	0.11	-	0.56	0.79	0.33
80kR	1.85	2.00	0.023	0.025	0.033	0.043	0.61	-	-	-	0.61	0.50	0.61	1.50
90kR	1.80	3.44	0.020	0.038	0.027	0.063	-	-	-	-	-	-	1.80	3.44
II. EMS :														
0.3%	0.49	1.17	0.272	0.650	0.015	0.041	-	-	0.06	1.00	0.18	-	0.24	0.16
0.4%	1.45	1.20	0.604	0.500	0.041	0.039	-	-	0.24	0.10	0.24	0.20	0.97	0.90
0.5%	1.82	1.66	0.606	0.550	0.038	0.047	0.12	-	-	-	0.85	0.23	0.85	1.40
0.6%	1.73	0.52	0.480	0.140	0.059	0.013	-	-	-	-	1.20	0.39	0.50	0.13
0.7%	2.44	1.48	0.580	0.350	0.053	0.035	0.97	0.10	-	-	0.32	0.31	1.14	1.06
III Combination :														
30kR+0.2%	0.50	3.22	0.027	0.089	0.012	0.072	-	0.53	-	-	0.11	1.61	0.46	1.07
30kR+0.3%	1.42	0.46	0.052	0.008	0.021	0.011	0.17	-	0.53	0.23	0.35	-	0.35	0.23
40kR+0.2%	0.57	1.27	0.024	0.026	0.009	0.024	0.09	-	-	-	0.09	0.63	0.30	0.63
40kR+0.3%	1.38	0.51	0.038	0.007	0.025	0.008	0.13	0.17	0.13	-	-	0.17	1.10	0.17
Total freq:	19.47	22.00	-	-	-	-	3.19	1.62	1.12	1.86	4.40	5.96	10.59	12.45

Table 2. Frequency of viable mutations in M2 generation in the varieties RBL-50 and L-1

Treatments	No.of M2 plants scored		No.of viable mutants observed		Frequency of viable mutants based on M2 plants (%)	
	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1
Control	1200	525	-	-	-	-
I. Gamma rays :						
50kR	1510	595	44	41	2.91	6.89
60kR	553	526	28	72	5.06	13.66
70kR	534	782	29	78	5.43	9.97
80kR	412	113	12	28	2.91	24.77
90kR	87	44	9	13	10.34	29.54
II. EMS :						
0.3%	1535	512	83	52	5.40	10.15
0.4%	611	896	27	69	4.41	7.70
0.5%	714	387	20	41	2.80	10.59
0.6%	346	715	27	43	7.80	6.01
0.7%	529	873	17	46	3.21	5.26
III. Combination :						
30kR+0.2%	835	141	29	31	3.47	21.98
30kR+0.3%	423	366	20	31	4.72	8.46
40kR+0.2%	867	271	13	28	1.49	10.33
40kR+0.3%	684	345	18	27	2.63	7.82
Total Freq.	-	-	-	-	62.58	173.13

mutagen. The frequency of albinia was higher in RBL-50 (3.19%) than in the L-1 (1.62%). The frequency of xantha was found slightly higher in L-1 (1.86%) than in RBL-50 (1.12%), while chlorina was observed predominantly in both the varieties. Earlier workers(Krishnaswamy and Rathinam, 1980) indicated that viridis types were most frequent in gamma rays, EMS and their combination treatments in green gram, which are in agreement with the present study.

The gamma ray doses 60KR in RBL-50 and 50KR in L-1 were considered as the best doses based on the highest mutagenic effectiveness and efficiency values,which in EMS treatment, 0.6 per cent in RBL-50 and 0.5 per cent in L-1 were decided as the best concentrations. Among the combination treatments, 30KR+0.3% and 40KR+0.3% in RBL-50 and 30KR+0.2% in L-1 were considered as the best combination doses.

The frequency and spectrum of viable mutants are presented in Tables-2 and 3.For viable mutations, both the varieties showed almost dose dependent relationships indicating increase in frequency as the dose increased in gamma ray treatment. Among the EMS treatments, there was no clear concentration dependent relationship. However, the higher frequency was found at 0.6 per cent in RBL-50(7.80%) and 0.5 per cent in L-1 (10.59%). The combination treatments at lower doses induced highest viable mutants in both the varieties (30KR+0.2% in L-1(21.98%) and 30KR + 0.3% in RBL-50 (4.74%) In general , variety L-1 manifested high frequency of viable mutants(173.13%) as compared to RBL-50 (62.58%) and gamma rays induced high frequency as compared to other mutagenic treatments.The dwarf plants were prominent only in L-1 variety. Although, high yielding mutants were recorded in

Table 3. Spectrum of viable mutations (%) in M2 generation in the varieties RBL-50 and L-1 on M2 plant basis.

Treatments	Useful viable mutants (%)												Other* viable mutants	
	Dwarf plants		Early		Synchronous maturity		High yield		Bold seed		Pod shattering resistant			
	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1	RBL-50	L-1
Control	-	-	-	-	-	-	-	-	-	-	-			
I. Gamma rays :														
50kR	0.19	0.50	0.26	0.50	0.72	1.00	0.19	0.33	-	0.33	0.13	0.65	1.42	3.58
60kR	-	0.38	0.18	0.38	0.90	2.28	0.72	1.33	-	-	-	1.14	3.26	8.15
70kR	0.18	0.38	0.56	1.53	0.37	1.27	0.18	0.51	0.37	-	0.37	0.63	3.40	5.65
80kR	-	1.76	-	2.65	-	5.30	0.24	0.85	-	0.88	-	3.53	2.67	9.80
90kR	4.59	13.63	-	-	-	-	-	-	-	-	-	4.54	5.75	11.36
II. EMS :														
0.3%	-	-	0.19	0.78	0.97	0.78	0.58	0.78	0.32	0.39	1.36	1.17	1.98	6.25
0.4%	0.16	0.44	-	0.66	-	-	0.49	0.55	-	-	0.87	1.22	2.80	4.83
0.5%	-	0.25	0.28	0.51	0.28	1.80	0.28	2.32	0.14	0.25	0.42	1.29	1.40	4.17
0.6%	-	0.11	1.15	-	1.73	0.41	1.73	0.69	-	0.27	0.28	0.41	2.91	4.12
0.7%	-	0.11	-	-	0.56	0.22	0.56	0.34	-	0.11	0.18	0.68	1.91	3.80
III. Combination :														
30kR+0.2%	-	-	-	1.47	0.59	2.83	0.23	3.54	0.23	-	0.11	2.83	2.31	11.31
30kR+0.3%	-	0.54	0.23	0.81	0.94	-	0.70	0.81	0.23	0.27	-	-	2.62	6.03
40kR+0.2%	-	-	-	-	0.23	1.84	0.11	1.47	0.11	0.73	-	0.73	1.04	5.56
40kR+0.3%	-	0.28	0.14	0.28	0.14	0.57	0.29	0.28	-	0.26	-	0.28	2.34	5.87
Total Freq.	5.12	18.38	2.99	9.57	7.43	18.30	6.30	13.83	1.40	3.49	3.72	19.10	35.81	90.48

* Other viable mutants consisted of abnormal leaves, big leaves, white flower, high branching types, coloured seeds, white pod types.

both the varieties. Variety L-1 (13.82%) had more of them. Further the frequency of mutation for high yield was in EMS treatment. The bold seeded mutants were found largely in L-1 variety (3.84%) than in RBL-50 (1.40%). The EMS treatment induced more of pod shattering resistant tupes. Similarly, several workers (Malik,1988; Sinha,1980; Sumanggono, 1987 and Tickoo,1987) obtained useful mutants as observed in the present study.

Although, other viable mutants (Table-3) such as abnormal, big leaves, white flower, big branching, white pod, coloured seed types were obtained in high frequencies in both varieties, they are not having immediate impact on farmer's field, but such mutants can be used in further improvement of rice bean crop especially in hybridization programme.

The compared data of frequency of chlorophyll and viable mutations revealed that in the variety L-1 the same doses (90KR gamma) or concentrations (EMS 0.5%, combination 30KR+0.2%) which brought out the highest chlorophyll mutations also gave highest viable mutations. Such relationships between two types of mutations may facilitate plant breeders in making early attention to increase the required treated populations so as to get number of viable mutants. Some of the mutants such as early types, determinate habit, synchronous pod maturity, bold seeded mutants are of practical value from the point of application in farmer's field immediately after confirming stability of mutants and also in hybridization programme.

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EFFECT OF DISTILLERY EFFLUENT AND ORGANIC AMENDMENT ON RICE YIELD AND SOIL FERTILITY STATUS

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ABSTRACT

Field experiments were conducted during 1996-99 at College of Agriculatural Engineering, Kumulur to study the effect of distillery effluent and organic amendments on rice productivity. The distillery effluent with different dilutions was taken in the main plots (10,25,50,75,100 times and water). These treatments were superimposed with different organic amendments viz., FYM at 12.5t/ha, pressmud at 12.5t/ha, gypsum at 5t/ha, neem leaves at 5.25 t/ha and no manure as control. Results revealed that in the areas where water is available in adequate amount, applications of neem leaves at 6.25 t/ha was found to be suitable and in the areas where effluent is available, it should be diluted 50 times with water along with application of neem leaves at 6.25 t/ha to increase the rice yield without any detrimental effect on soil health. The treated distillery effluent irrigations resulted in significant increase in soil pH, E.C and organic carbon.

KEY WORDS: Rice, Effluent, Dilution, Organic amendments, Yield, Soil fertility status