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Induced genetic variability for quantitative traits in M_2 generation in soybean by mutagens

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ABSTRACT

The various genetic variability parameters were estimated using physical (gamma rays) and chemical (EMS) mutagens using two cultivars i.e. PKV-1 and JS-335. Results indicated that genotypic coefficient of variation and phenotypic coefficient of variation, heritability were significantly high for different characters studied i.e. Plant height, number of branches per plant, number of clusters per plant, number of pods per plant, yield per plant, 100 grain weight. All the mutagenic treatments were effective in inducing genetic variability in both the varieties.

Introduction

Soybean is an important oil crop with the highest area production and export in the world. Being an autogamous crop the naturally existing genetic variability is insufficient for the improvement. Mutation breeding offers great scope and promises for generating useful variability for its improvement. Broad spectrum genetic variability is prerequisite for any successful breeding programme. Besides the use of induced mutation in fundamental studies, it may be used to create additional genetic variability for quantitative traits. Generation of genetic variability by induced mutagenesis provided a base for strengthening crop improvement programme and represents a more efficient source of genetic variability than the gene pool conserves by nature (Brock, 1965). This study was undertaken asses the effect of gamma rays and ethyl methane sulphonate on induction of variability in soybean varieties PKV-1 and JS-335.

Materials and Methods

Two varieties of *Glycine max* viz., PKV-1 and JS-335 were treated with gamma rays and EMS. Dry and healthy seeds of two cultivars were treated with 15, 20, 25, and 30kR of gamma rays. Also same number of seeds were presoaked in water and were treated with freshly prepared 0.05,0.10 and 0.15 percent aqueous solution of EMS. The irradiated seeds were sown in the field immediately after the treatment. Seeds, treated with the chemical mutagens were thoroughly washed in a running water and were sown in the field along with untreated seeds of each variety as control in Factorial randomized block design (FRBD) replicated thrice , to grow M1 generation. The seeds from each M1 plants were harvested separately and sown subsequently in progeny row basis to grow M2 generation. The observation were recorded on variability parameters viz., plant height , number of branches per plant, number of pods per plant, number of clusters per plant, yield per plant, 100 grain weight.

Results and Discussion

The data on various genetic parameters are presented in Tables. Wide range of variation was noticed for most of the characters which indicated great scope for their improvement. Increased variance and coefficient of variation were noted for almost all the parameters i.e Plant height, number of branches per plant, number of clusters per plant, number of pods per plant, yield per plant, 100 grain weight. The treatment mean values were found to deviate from respective control mean values and indicated that, mutagens used were effective and induced variability for plant height, number of branches per plant, number of clusters per plant, number of pods per plant, yield per plant, 100 grain weight. in M2 generation. The significant positive shift in all doses and/or concentrations was observed in number of pods per plant and yield per plant. However negative shift was recorded in number of branches, plant height and 100 grain Weight. Similar results of increased range, mean and variance are also reported by Nerkar and Mote (1978) in Bengal gram. Upadhey and Singh (1984) in Soybean, Tikoo and Jain (1974) and Khan (1983, 1984) in Mung bean.Higher and medium doses and/ or conc. Recorded maximum genotypic and phenotypic coefficient of variation in all the parameters. Also the same doses and conc. Recorded maximum heritability.

The estimates of heritability were also essential to get the best picture of the genetic gains to be expected from selection. It indicates the effectiveness with which selection for genotype can be based upon its phenotypic performance. In general the heritability estimates for almost all the characters under study were high except for plant height, number of clusters per plant, yield per plant.

As regards the variance, maximum variance was noted in cv. PKV-1 as against JS-335 plant height, number of branches, number of clusters, number of pods, and yield per plant. Relatively higher doses of mutagen shows high variance except 100 grain weight, the 15kR dose of JS-335 recorded maximum variance. Regarding coefficient of variation grain yield per plant, number of clusters, number of pods, higher doses of mutagens recorded maximum coefficient of variation. Whereas in plant height and 100 grain weight somewhat lower doses recorded maximum coefficient of variation. The data revealed that 30kR

gamma rays and 0.15% EMS conc. Recorded highest genotypic and phenotypic coefficient of variation in both the cultivar for plant height, number of branches per plant, number of clusters per plant, number of pods per plant, yield per plant. In case of 100 grain weight. somewhat lower doses shows high genotypic and phenotypic coefficient of variation. The results obtained for variability parameters were also reported by Rajput(1974) and Shakoor et al.(1978) in mungbean, Nandarajan et al. (1985), in *pigeon pea*. It was also reported by Khan (1983, 1984), Sinha and Bharati (1990) and Charumati et al.(1992) in mung bean.

The heritability in broad sense it was found to be highest in 30kR and 20 kR gamma rays dose and 0.15% and 0.10% EMS conc. Recorded high heritability in PKV-1 and JS-335 in case of all the parameters. The increased heritability and differential response of varieties with higher dose/ conc. Of mutagens were also reported by Sinha and Bharati (1990) in urd bean and Kumari (1996) in Faba bean. In case of number of branches per plant and 15kR dose in JS-335 recorded high heritability case of number of branches per plant and 15kR dose in JS-335 recorded high heritability which are in agreement with those of Chopade (1976) in Pigeon pea, Khan (1983, 1984) ,Charumati et al. (1992) in mung bean.

Table 1. Plant height variability in M_2 generation of soybean

Treatments	range		mean	shift	variance	c.v.%	G.C.V.	P.C.V.	H2
PKV-1									
15KR(gamma)	44	73	53.73	9.66	100.64	4.66	13.71	14.48	89.65
20KR	30	70	50.73	3.52	203.58	9.04	20.12	22.06	83.19
25KR	22.6	58	36.78	-24.94	144.37	14.74	21.15	25.78	67.3
30KR	16	58	31.11	-36.52	201.22	19.28	30.46	36.05	71.4
Dry control	44	58	49		22.43	2.84	6.79	7.36	85.14
0.05%	32	58	45.8	-9.37	67.74	6.84	12.45	14.21	76.81
0.10%	27	58	42.47	-15.96	72.27	8.39	12.88	15.37	70.23
0.15%	18	61	36.33	-28.1	137.38	10.3	22.73	24.95	82.95
soaked control	42	58	50.53		19.84	3.19	6.01	6.81	78.03
JS-335									
15KR(gamma)	27	45	37.87	-18.74	28.84	6.61	9.26	11.38	66.23
20kr	14	44	33.13	-28.9	84.27	11.28	18.82	21.94	73.58
25kr	8	51	30.73	-34.05	161.92	14.99	28.11	31.86	77.85
30KR	10	54	28.07	-39.77	192.21	19.78	33.68	39.06	74.34
dry control	37	56	46.6		260.40	5.29	7.17	8.91	64.77
0.05%	20	38	32.33	-16.38	33.95	8.36	11.87	14.52	66.87
0.10%	8	48	34.13	-11.72	148.7	10.18	19.66	22.14	78.86
0.15%	15	44	30.87	-20.17	92.84	14.81	25.46	29.46	74.74
soaked control	34	45	38.67		13.81	4.79	6.15	7.8	62.25

Table 2. Number of branches /plant variability in M_2 generation of soybean

Treatments	range		mean	shift	variance	c.v.%	GCV	PCV	H2
PKV-1									
15KR(gamma)	4	12	7	-5.4	5.57	15.32	21.59	26.47	66.5
20KR	3	10	5.67	-23.34	4.81	18.79	25.03	31.29	63.96
25KR	3	9	5.53	-25.27	4.7	14.76	26.53	30.36	76.38
30KR	2	8	5.27	-28.78	2.78	11.5	20.26	23.3	75.65
Dry control	6	9	7.4		1.26	6.53	9.18	11.26	66.4
0.05%	3	10	5.33	-25.24	4.67	16.42	26.11	30.84	71.66
0.10%	4	10	6.33	-11.22	4.38	11.71	21.76	24.71	77.55
0.15%	3	10	6.6	-7.43	6.69	18.86	25.35	31.6	64.37
soaked control	4	9	7.13		1.26	6.53	11.25	15.21	54.72
JS-335									
15KR(gamma)	4	9	6.47	-10.19	2.7	11.47	16.7	20.26	67.96
20kr	3	9	5.67	-21.3	3.1	14.94	20.03	24.99	64.27
25kr	3	7	4.93	-31.48	1.78	12.55	17.49	21.53	66.01
30KR	3	9	4.8	-33.33	3.03	14.48	20.78	25.33	67.29
dry control	6	9	7.2		1.46	8.41	10.66	13.58	61.63
0.05%	5	9	6.27	-7.84	1.78	8.24	13.87	16.13	73.91
0.10%	3	8	4.73	-30.39	2.21	10.21	18.83	21.42	77.3
0.15%	1	8	4.4	-35.29	4.4	22.92	29.39	37.27	62.19
soaked control	5	8	6.8		0.89	7.83	8.2	11.34	52.3

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Table 3. Number of clusters/plant variability in M_2 generation of soybean

Treatments	range		mean	shift	variance	c.v.%	GCV	PCV	H2
PKV-1									
15KR(gamma)	35	58	48.2	8.23	45.89	5.93	9.01	10.79	69.72
20KR	18	54	40.6	-8.83	136.4	11.43	19.51	22.61	74.47
25KR	16	66	46.13	3.59	259.27	15.49	23.36	28.03	69.45
30KR	13	60	34.33	-22.9	264.67	17.66	32.56	37.04	77.26
Dry control	32	54	44.53		38.27	5.47	9.46	10.93	74.96
0.05%	34	62	47.87	5.28	57.7	7.7	10.15	12.74	63.5
0.10%	26	64	45.73	0.59	122.35	8.85	16.9	19.07	78.49
0.15%	19	55	37.93	-16.57	111.64	10.07	19.57	22.01	79.06
soaked control	38	56	45.47		36.55	5.79	8.91	10.63	70.32
JS-335									
15KR(gamma)	42	55	45.73	-12.05	21.35	3.62	7.02	7.89	79.02
20kr	35	48	41.33	-20.51	15.52	3.75	6.38	7.4	74.33
25kr	15	55	39.87	-23.33	119.55	10.85	18.16	21.15	73.68
30KR	16	47	32.13	-38.21	90.7	10.85	20.48	23.17	78.09
dry control	46	56	52		11.14	2.93	4.19	5.11	67.24
0.05%	34	50	39.73	-16.53	21.21	5.25	7.74	9.35	68.48
0.10%	32	49	37.53	-21.15	28.27	5.92	9.42	11.13	71.72
0.15%	9	42	29.8	-37.39	101.74	15.39	21.76	26.66	66.66
soaked control	40	58	47.6		29.4	4.48	7.66	8.88	74.51

Table 4. Number of pods/plant variability in M_2 generation of soybean

Treatments	range		mean	shift	variance	c.v.%	GCV	PCV	H2
PKV-1									
15KR(gamma)	132	186	159.13	6.28	226.98	3.3	6.65	7.42	80.27
20KR	138	188	162	8.19	263.86	3.08	7.18	7.81	84.47
25KR	126	198	155.87	4.1	549.84	5.1	10.56	11.73	81.06
30KR	102	187	154.13	2.94	846.7	7.1	13.15	14.94	77.43
Dry control	138	161	149.73		46.92	2.17	2.96	3.66	65.07
0.05%	140	200	166.6	14.37	317.11	4.57	7.25	8.57	71.57
0.10%	135	180	153.07	5.08	205.64	3.78	6.42	7.45	74.26
0.15%	111	181	150.53	3.34	602.84	5.87	11.45	12.87	79.18
soaked control	130	158	145.67		68.67	2.44	3.66	4.39	69.26
JS-335									
15KR(gamma)	135	183	159.27	9.44	320.64	3.51	8.09	8.82	84.11
20kr	111	176	150.47	3.39	486.98	3.78	10.65	11.3	88.79
25kr	126	186	154.27	6	450.64	6.76	8.76	11.06	62.67
30KR	124	178	154.87	6.41	346.41	3.9	8.55	9.4	82.75
dry control	129	156	145.53		60.98	1.61	3.61	3.95	83.49
0.05%	110	191	147.27	9.63	493.21	4.26	10.9	11.7	86.73
0.10%	122	190	140.53	4.62	430.12	3.81	10.8	11.45	88.92
0.15%	120	182	146.73	9.23	589.92	3.78	12.2	12.77	91.24
soaked control	115	147	134.33		95.24	2.71	4.97	5.66	77.06

Table 5. Yield/plant variability in M_2 generation of soybean

Treatments	range		mean	shift	variance	c.v.%	GCV	PCV	H2
PKV-1									
15KR(gamma)	20	60	33.67	37.21	170.1	14.68	26.95	30.69	77.11
20KR	20	62	35	42.65	200.71	16.35	27.45	31.95	73.82
25KR	15.75	60	37.9	54.45	293.07	16.46	31.76	35.77	78.83
30KR	59	35.56	44.93	295.57	17.34	34.06	38.22	79.41	
Dry control	45	24.54		72.94	12.83	24.07	27.28	77.88	
0.05%	63	33.17	15.61	170.5	14.2	27.55	30.99	79.02	
0.10%	62	35	21.98	168.14	15.26	24.84	29.15	72.61	
0.15%	56	32	11.54	241.62	19.46	33.37	38.63	74.63	
soaked control	42	28.69		67.19	11.39	19.72	22.78	75	
JS-335									
15KR(gamma)	64	50.4	27.1	62.54	5.45	11.02	12.29	80.38	
20kr	62	46.26	16.67	79.54	5.66	13.82	14.94	85.63	
25kr	62	43.33	11.8	121.67	8.05	17.44	19.21	82.45	
30KR	64	45.57	14.92	207.48	12.35	21.65	24.93	75.47	
dry control	46	39.65		24.13	3.9	8.52	9.37	82.68	
0.05%	58	44.01	16.74	153.07	9.75	19.81	22.08	80.48	
0.10%	62	40.19	6.61	232.34	11.75	27.28	29.7	84.36	
0.15%	65	44.16	17.15	228.2	12.05	24.03	26.88	79.92	
soaked control	48	37.7		27.89	4.13	9.92	10.75	85.23	

Table 6.Grain weight variability in M_2 generation of soybean

Treatments	Range		Mean	Shift	Variance	c.v.%	GCV	PCV	H2
PKV-1									
15KR(gamma)	8	14	10.91	-12.92	4.74	9.27	12.05	15.2	62.82
20KR	8	15	12.17	-2.88	5.2	7.8	12.12	14.41	70.73
25KR	9	17	12.14	-3.11	4.89	8.55	11.88	14.64	65.87
30KR	7	12	9.77	-22.03	1.69	7.73	7.63	10.86	49.35
Dry control	10	15	12.53		2.48	5.65	7.04	9.02	60.86
0.05%	6	13	9.51	-24.52	4.34	9.75	14.19	17.21	67.92
0.10%	10	16	13.84	9.84	3.53	6.43	8.63	10.76	64.27
0.15%	7	13	9.1	-27.77	3.96	5.52	14.82	15.82	87.84
soaked control	10	15	12.6		1.89	5.12	7.08	8.73	65.68
JS-335									
15KR(gamma)	9	16	12.34	-28.95	5.56	8.26	11.8	14.41	67.11
20kr	9	18	13.49	-22.33	6.21	8.8	11.96	14.84	64.87
25kr	11	17	13.74	-20.89	2.83	4.99	6.86	8.48	65.41
30KR	11	17	13.6	-28.78	3.17	5.47	8.56	10.16	71.02
dry control	12	16	13.93		1.64	4.54	5.93	7.47	63.08
0.05%	11	18	13.86	6.45	3.91	6.43	9	11.06	66.22
0.10%	7	13	10.47	-19.58	2.88	7.23	10.55	12.79	68.06
0.15%	9	15	12.76	-1.99	4.02	7.08	10.03	12.27	66.73
soaked control	11	16	13.02		2.66	5.84	7.75	9.7	63.76

References

Brock, R.D. (1965). Induced mutations affecting quantitative characters. In. : Use of induced mutations in Plant Breeding. Rad. Bot. 5(suppl.): 451-464.

Charumati, M.M.; V.B. Rao; V.Ravindra babu and B. Krishna Murthy (1992). Efficiency of early generation selection for induced micromutations in black gram(*Vigna mungo* (L.) Millsp.): Indian J. Genet. 48(3) : 303-304.

Chopade, P.R. (1976). Chemical mutagenesis in Pigeon pea (*Cajanus cajan*(L)Millsp): Pl. Br. Abstr. 46(11) Sr. No.1083.

Khan, I.A.(1983). Mutation studies in mung bean induced polygenic variability after seed irradiation conc. J. Genet. Cytol. 25:289-303.

Khan, I.A.(1984). Mutation studies in mung bean (*Vigna radiate*) variability and genetic advance after selection in quantitative characters. Bangaladesh. J. Biol. Sci. 11-13.

Kumari, R. and Singh, Y. (1996). Effect of gamma rays and EMS on seed germination and plant survival of *Pisum sativum* L. and *Lens culinaris*. Medic. Neo. Botanica 4(1): 25-29.

Nandarajan, N.R. ; Sethupathi Ramlingam and Sivaswami, N. (1985). Biological effect of mutagenic treatment in *Cajanus cajan* L. Millsp. Madras Agric. J. 72(6): 301-305.

Nerkar, Y.S. and Mote, S.B. (1978). Induced mutagenesis in Bengal gram *Cicer arietinum* L. II Micromutation. J. Maharashtra Agric. Univ. 3(3): 180-183.

Rajput, M.A. (1974). Increased variability in M2 of gamma irradiation in mung bean. Rad. Bot. 14: 85-84.

Shakoor, Abdul Haq M. Ahsan Ul and Sadiq , M. (1978). Induced variation in mung bean(*V. radiate* L.) Env. Exp. Bot. 18: 169-175.

Sinha, R.P. and Bharati, R.C. (1990). Variability in mutant populations of urd bean (*Vigna mungo* (L.) Hepper.) J. Nuclear Agric. Biol. 19: 44-46.

Upadhay, D.D.; B.B. Singh and Chauhan, K.P.S. (1984). Induced sterile mutant in soybean, Current science. 53(8): 733-735.

Tikoo, J.L. and Jain, H.K. (1974). Mutation studied in mung bean. Mutation Breeding Newsletter 3: 10-11.

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