Research Article (Open access)

Induction of Genetic Variability in Soybean in M3 Generation for Quantitative Traits by Using Mutagens

Geeta P. Patil[1*], C. T. Sharma[2]

[1]Department of Botany, Asst. Prof., Arts, Commerce and Science College, Bodwad Dist- Jalgaon, India
[2]Department of Zoology, Asst. Prof., Arts, Commerce and Science College, Bodwad Dist- Jalgaon, India

[*]**Address for Correspondence:** Dr. Geeta P. Patil, Department of Botany, Asst. Professor, Arts, Commerce and Science College, Bodwad Dist- Jalgaon, India

Received: 22 March 2016/Revised: 13 April 2016/Accepted: 02 May 2016

ABSTRACT- By using gamma rays (physical) and EMS (chemical) mutagens the various genetic variability parameters were estimated of two soybean cultivars i.e. PKV-1 and JS-335. Characters studied i.e. Plant height, no. of branches per plant, no. of clusters per plant, no. of pods per plant, yield per plant, 100 grain wt. shows that the genotypic coefficient of variation (G.C.V.) and phenotypic coefficient of variation (PCV), heritability was significantly high. In both the varieties, all the mutagenic treatments were effective in inducing genetic variability.

Key-Words: Gamma rays, EMS, Mutagens, Genetic Variability

----------IJLSSR----------

INTRODUCTION

Mutation breeding can be applied to altering the specific character in otherwise better variety in a comparatively shorter time than conventional breeding method. Attempts to induce mutations in soybean would be quite useful in creating genetic variability. 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 the strengthening crop improvement programme and represents a more efficient source of genetic variability than the gene pool conserves by nature [1].

Access this article online	
Website: www.ijlssr.com	**DOI:** 10.21276/ijlssr.2016.2.3.19
Quick Response Code:	

ISSN 2455-1716

This study was undertaken to assess 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 Soybean 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 30 kR of gamma rays. Also same no. 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 of Department of Botany, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola immediately after the treatment during Kharip season 2002. 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 M_1 generation.

The seeds from each M_1 plants were harvested separately and sown subsequently in progeny row basis to grow M_2 generation in next Rabbi Season. The seeds harvested from M_2 generation were also sown to rise M_3 generation in next Kharip season. The observation was recorded on variability parameters viz., plant height, no. of branches per plant, no. of pods per plant, no. of clusters per plant, yield per plant, 100 grain weight in M_3 generation.

RESULTS AND DISCUSSION

The data on various genetic parameters are presented in Table. 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, no. of branches per plant, no. of clusters per plant, no. of pods per plant, yield per plant, 100 grain wt. The treatment mean values were found to deviate from the respective control mean values and indicated that, mutagens used were effective and induced variability for plant height, no. of branches per plant, no. of clusters per plant, no. of pods per plant, yield per plant, 100 grain wt. in M_3 generation. The significant positive shift in all doses &/or concentrations was observed in no. of pods per plant and yield per plant. However, negative shift was recorded in no. of branches, plant height and 100 grain wt. similar results of increased range, mean and variance are also reported by [2] in Bengal gram. [3] in Soybean, [4,5] in Mung bean. Higher and medium doses &/ or conc. recorded maximum genotypic and phenotypic coefficient of variation in all the parameters. Also the same doses and conc. recorded maximum heritability.

However, as suggested by [6], the genetic variation could not be estimated with the help of genotypic coefficient of variation alone. 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, no. 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, no. of branches, no. of clusters, no. of pods, and yield per plant. Relatively higher doses of mutagen shows high variance except 100 grain wt., the 15kR dose of JS-335 recorded maximum variance. Regarding coefficient of variation grain yield per plant, no. of clusters, no. of pods, higher doses of mutagens recorded maximum coefficient of variation, whereas in plant height and 100 grain wt. somewhat lower doses recorded maximum coefficient of variation. The data revealed that 30 kR gamma rays and 0.15% EMS conc. recorded highest genotypic and phenotypic coefficient of variation in both the cultivar for plant height, no. of branches per plant, no. of clusters per plant, no. of pods per plant, yield per plant. In case of 100 grain wt. somewhat lower doses shows high genotypic and the phenotypic coefficient of variation. The results obtained for variability parameters were also reported by [7,8] in mungbean, [9] in *Pigeon pea*. It was also reported by [10,11] in mung bean.

The heritability in broad sense it was found to be higher in 30 kR and 20 kR gamma ray 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 in [12] in Faba bean. In case of no. of branches per plant and 15kR dose in JS-335 recorded high heritability, which is in agreement with those of [13,14] in mung bean.

CONCLUSIONS

The given study concluded that sufficient genetic variability was induced by all the mutagenic treatments and may facilitate in substantial improvement through the selection for each of the characters studied.

There was increased in genotypic and phenotypic coefficient of variation, heritability and expected genetic advance.

ACKNOWLEDGMENT

The authors are highly grateful to the North Maharashtra University, Jalgaon and Principal of Institution to carry out the present investigation.

REFERENCES

[1] Brock RD (1965). Induced mutations affecting quantitative characters. In.: Use of induced mutations in Plant Breeding. Rad. Bot. 5(suppl.): 451-64.

[2] Nerkar YS, Mote SB (1978). Induced mutagenesis in Bengal gram *Cicer arietinum* L. II Micromutation. *J. Maharashtra Agric. Univ.* 3(3): 180-83.

[3] Upadhay DD, Singh BB, Chauhan KPS (1984): Induced sterile mutant in soybean, Current science, 53(8): 733-35.

[4] Tikoo JL, Jain HK (1974): Mutation studied in mung bean. Mutation Breeding Newsletter, 3: 10-11.

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

[6] Burton GW (1952): Quantitative inheritance in grasses.In: Proc. 6th Int.. Grassland Congress, 1: 227-83.

[7] Rajput MA (1974): Increased variability in M2 of gamma irradiation in mung bean. Rad. Bot. 14: 85-84.

[8] Shakoor AHM, Ahsan Ul, Sadiq M (1978): Induced variation in mung bean(*V. radiate* L.*) Env. Exp. Bot*. 18: 169-75.

[9] Nandarajan NR. Sethupathi Ramlingam, N.Sivaswami (1985): Biological effect of mutagenic treatment in *Cajanus cajan* L. Millsp. Madras Agric. J. 72(6): 301-05.

[10] Sinha RP, Bharati RC (1990): Variability in mutant populations of urd bean (*Vigna mungo* (L.) Hepper.) *J. Nuclear Agric. Biol.* 19: 44-46.

[11] Charumati MM, Rao VB, Ravindra-babu V, Krishna-Murthy B (1992): Efficiency of early generation selection for induced micromutations in black gram(*Vigna mungo* (L.) Mill sp.): I*ndian J. Genet*. 48(3): 303-04.

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

[13] Chopade PR (1976): Chemical mutagenesis in Pigeon pea (*Cajanus cajan* (L) Millsp): *Pl. Br. Abstr.* 46(11) Sr. No. 1083.

[14] Khan IA (1983): Mutation studies in mung bean induced polygenic variability after seed irradiation conc. *J. Genet. Cytol*. 25: 289-303.

M_3 GENERATION

Table 1: Plant height

Treatments	Range		Mean	Shift	Variance	C.V. %	G.C.V.	P.C.V.	H2
PKV-1									
15kR(gamma)	40	55	46.27	-10.34	17.50	3.89	6.00	7.15	70.46
20kR	32	60	42.53	-17.57	62.98	6.70	12.31	14.02	77.16
25kR	35	68	46.07	-10.72	99.50	7.88	15.09	17.02	78.56
30kR	28	66	39.13	-24.16	148.41	10.68	21.39	23.91	80.03
Dry control	45	60	51.60		24.69	2.77	5.72	6.36	80.96
0.05%	37	59	46.93	-8.21	39.64	5.30	9.20	10.62	75.10
0.10%	30	53	41.73	-18.38	49.92	6.21	11.85	13.37	78.44
0.15%	35	57	43.00	-15.91	50.71	5.91	11.54	12.97	79.20
soaked control	41	60	51.13		33.41	4.16	7.71	8.76	77.48
JS-335									68.58
15kR(gamma)	40	55	46.27	-11.43	45.50	6.14	9.07	10.96	70.15
20kR	32	60	42.53	-17.69	79.10	8.74	13.40	16.00	84.01
25kR	35	68	46.07	-4.91	104.83	6.08	13.93	15.20	71.25
30kR	28	66	39.13	-12.65	153.54	11.09	17.46	20.69	71.91
dry control	45	60	51.60		22.35	3.42	5.48	6.46	81.01
0.05%	37	59	46.93	-7.43	116.10	7.78	16.06	17.85	90.57
0.10%	30	53	41.73	-10.04	182.14	6.95	21.55	22.65	83.15
0.15%	35	57	43	-6.65	129.92	7.57	16.81	18.43	57.18
Soaked control	41	60	51.13		29.70	5.71	6.60	8.73	

Table 2: No. of branches /plant

Treatments	Range		Mean	Shift	Variance	c.v. %	GCV	PCV	H2
PKV-1	4	8							
15kR(gamma)	3	7	5.80	-13.81	1.17	15.32	11.05	13.84	63.79
20kR	3	8	5.13	-23.77	1.55	18.79	15.23	19.43	61.45
25kR	3	8	5.27	-21.69	2.21	14.76	17.33	21.51	64.94
30kR	4	8	5.00	-25.70	2.00	11.50	18.07	21.13	73.13
Dry control	3	8	6.73		1.20	6.53	9.65	12.32	61.29
0.05%	4	7	5.20	-25.71	2.60	16.42	21.07	24.70	72.73
0.10%	4	7	5.53	-21	0.84	11.71	10.52	12.20	74.39
0.15%	4	8	5.53	-21	0.84	18.86	10.61	13.13	65.26
soaked control			7		1.28	6.53	7.82	11.51	46.15
JS-335									
15kR(gamma)	3	7	5.13	-29.33	1.55	11.47	16.04	18.08	78.71
20kR	5	9	6.80	-6.33	1.31	14.94	11.55	13.29	75.51
25kR	3	7	5.00	-31.12	1.29	12.55	15.20	17.45	75.91
30kR	4	8	6.07	-16.39	1.78	14.48	14.22	17.50	66.01
dry control	6	9	7.26		0.78	8.41	7.87	9.34	71.68
0.05%	3	8	5.53	-21	1.98	8.24	18.32	19.47	88.52
0.10%	3	9	5.73	-18.14	4.64	10.21	25.14	30.01	70.17
0.15%	4	8	5.40	-22.85	1.26	22.92	13.17	16.27	65.47
soaked control	5	9	7		1.28	7.83	10.54	12.99	65.77

Table 3: No. of pods/plant

Treatments	Range		Mean	Shift	Variance	C.V.%	GCV	PCV	H2
PKV-1									
15kR (gamma)	144	189	163.40	15.72	191.26	2.90	6.01	6.67	81.17
20kR	138	182	157.73	11.71	213.78	3.43	6.32	7.19	77.28
25kR	119	178	152.00	7.65	346.57	3.47	8.90	9.55	86.82
30kR	110	182	146.60	3.82	499.11	5.21	10.81	12.00	81.15
Dry control	124	153	141.20		74.17	3.02	3.92	4.95	62.79
0.05%	127	185	150.27	6.82	310.50	3.50	8.46	9.16	85.41
0.10%	122	184	158.00	12.32	417.43	2.51	9.57	9.89	93.58
0.15%	92	174	144.93	3.03	575.07	6.06	11.57	13.06	78.44
soaked control	124	159	140.67		98.95	3.14	4.68	5.64	69.02
JS-335									
15kR (gamma)	112	171	136.93	10.47	397.92	4.15	10.47	11.26	86.42
20kR	119	168	143.33	7.28	243.67	4.88	7.28	8.77	68.98
25kR	110	176	140.40	10.32	438.26	5.36	10.32	11.63	78.76
30kR	112	173	142.87	11.70	531.27	4.55	11.70	12.55	86.85
dry control	100	132	121.20	4.84	82.60	3.28	4.84	5.85	68.61
0.05%	112	158	137.00	5.47	181.14	6.11	5.47	8.20	44.51
0.10%	89	143	118.20	9.48	252.74	4.73	9.48	10.59	80.07
0.15%	88	195	130.13	13.89	786.70	8.68	13.89	16.38	71.92
soaked control	102	132	113.33	5.16	84.38	4.07	5.16	6.57	61.71

Table 4: No. of clusters/plant

Treatments	Range		Mean	Shift	Variance	C.V.%	GCV	PCV	H2
PKV-1									
15Kr (gamma rays)	49	78	59.33	19.14	86.10	6.07	10.74	12.34	75.80
20kR	45	72	58.40	17.27	93.26	4.22	12.14	12.85	89.23
25kR	28	69	45.33	-8.97	142.38	8.76	18.54	20.51	81.73
30kR	18	68	46.07	-7.50	228.07	11.48	23.15	25.84	80.27
Dry control	35	59	49.80		51.31	6.31	9.49	11.40	69.36
0.05%	38	62	51.87	2.10	71.41	6.51	11.09	12.86	74.34
0.10%	30	72	44.20	-12.99	149.03	8.77	14.39	16.85	72.93
0.15%	30	63	45.80	-9.84	123.46	10.37	16.39	19.40	71.41
soaked control	38	60	50.80		48.46	3.76	9.79	10.48	87.13
JS-335									
15Kr (gamma rays)	45	81	64.20	25.06	190.17	12.49	11.63	17.06	46.44
20kR	25	78	44.80	-12.73	229.60	7.09	24.63	25.63	92.35
25kR	30	78	52.73	2.73	204.92	12.46	17.95	21.85	67.50
30kR	25	80	53.53	4.29	277.12	13.23	20.16	24.12	69.92

dry control	38	64	51.33		57.95	5.32	10.35	11.63	79.07
0.05%	23	55	39.47	-11.11	100.84	7.14	16.78	18.23	84.68
0.10%	23	68	41.33	-6.91	160.24	14.50	20.16	24.83	65.89
0.15%	22	72	53.67	20.87	186.81	11.30	16.69	20.15	68.56
soaked control	30	59	44.40		72.11	9.34	12.25	15.41	63.23

Table 5: No. of Yield/plant

Treatments	**Range**		**Mean**	**Shift**	**variance**	**C.V. %**	**CV**	**CV**	**H2**
PKV-1									
15KR(gamma)	16.50	46	33.42	19.71	76.67	9.10	18.26	20.40	80.09
20KR	17	48	30.34	8.69	85.24	9.56	21.68	23.70	83.71
25KR	18	53	35.93	28.71	105.07	10.49	19.89	22.49	78.24
30KR	19	48	31.79	13.87	123.79	11.47	24.86	27.38	82.44
Dry control	22.70	35.13	27.92		16.33	7.08	9.41	11.78	63.85
0.05%	24	49	33.29	36.41	54.48	8.70	15.35	17.64	75.66
0.10%	18	53	31.28	28.18	115.26	15.65	22.82	27.67	68.02
0.15%	16.91	42	28.90	18.42	70.67	10.61	20.04	22.68	78.10
soaked control	17.85	29.98	24.40		15.65	7.26	10.39	12.68	67.19
JS-335									
15KR (gamma)	19.20	48	37.75	19.14	93.65	7.21	18.67	20.01	87.04
20kr	15.62	52	33.42	5.50	150.41	12.53	26.04	28.89	81.20
25kr	20.76	57	39.43	24.45	137.70	8.33	21.59	23.14	87.04
30KR	16.16	48.92	30.35	-4.20	107.35	10.47	24.58	26.72	84.64
dry control	22	36.24	31.68		15.82	5.78	8.01	9.87	65.76
0.05%	20.23	58	38.93	14.52	107.10	8.42	18.44	20.27	82.74
0.10%	14.67	66.28	30.66	-9.81	199.58	19.93	29.48	35.58	68.61
0.15%	22	51	37.46	10.19	87.28	10.71	16.70	19.84	70.87
soaked control	28	43	33.99		19.23	6.37	8.20	10.38	62.36

Table 6: 100 grain wt

Treatments	Range		Mean	shift	variance	C.V.%	GCV	PCV	H2
PKV-1									
15KR (gamma)	12	17	15.13	4.05	2.67	4.79	6.99	8.47	68.07
20KR	11	15	13.65	-6.12	1.12	3.61	4.97	6.14	65.49
25KR	11	16	14.02	-3.58	2.44	4.59	7.59	8.87	73.24
30KR	11	16	14.02	-3.58	2.44	4.59	7.59	8.87	73.24
Dry control	12	16	14.54		1.30	3.33	5.27	6.23	71.40
0.05%	12	15	13.70	-0.58	0.72	2.45	4.03	4.72	72.95
0.10%	12	15	13.76	-0.14	0.76	3.02	3.79	4.85	61.12
0.15%	11	15	14.02	1.75	1.54	3.30	5.96	6.81	76.48
soaked control	12	15	13.78		0.83	3.06	4.36	5.32	66.94
JS-335									
15KR (gamma)	11.54	16.37	13.92	4.42	2.53	4.65	6.66	8.12	67.27
20kr	8.78	15.2	10.77	-19.20	4.35	8.59	12.68	15.32	68.55
25kr	7.6	15.2	11.56	-13.27	6.15	9.27	14.32	17.06	70.46
30KR	9.7	15.35	12.38	-7.12	2.90	5.20	9.44	10.78	76.72
dry control	11.17	16.39	13.33		2.88	5.92	8.27	10.17	66.14
0.05%	9.7	16.57	12.61	-11.63	6.35	13.21	9.35	16.18	33.37
0.10%	9.35	16.4	13.05	-8.54	4.77	7.78	10.71	13.24	65.50
0.15%	9.39	14.5	12.37	-13.31	1.81	5.33	6.67	8.54	61.01
soaked control	10.54	16.8	14.27		2.98	6.08	7.76	9.86	61.94

