



Induced variability in mungbean [*Vigna radiata* (L.) Wilczek]

Gajraj Singh, P. K. Sareen, R. P. Saharan and Ajit Singh

Department of Genetics, CCS Haryana Agricultural University, Hisar 125 004

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The present study was conducted to evaluate the effect of gamma rays, EMS and ECH on four quantitative characters in mungbean (*Vigna radiata* L.). Mungbean, being a self-pollinated crop, has very limited genetic variability and induced mutations can provide additional source of variability in an ongoing breeding programme [1]. Hence an experiment was conducted to evaluate the extent of genetic variability in the four quantitative characters in M₂ generation following mutagenesis with gamma rays, Ethyl methane sulphonate (EMS) and Epichlorhydrin (ECH). Uniform, healthy and dry seeds of mungbean cv. PS-16 were exposed to 20, 30 and 40 kR doses of gamma rays (Source Cobalt 60), EMS (0.05, 0.1, 0.2 and 0.3 per cent) for 6h and ECH (0.1, 0.2, 0.3 and 0.4 per cent) for 6h. The solutions of EMS and ECH were prepared in phosphate buffer (pH = 7.4). After the treatment, the seeds were dipped in 5 per cent aqueous solution of sodium thiosulphate for 10 minutes and then washed thoroughly with running water. Seeds soaked in distilled water for 6h were used as control. Complete randomized block design was used to raise M₁ and M₂ generations. Seeds from all the M₁ plants of each treatment were harvested and were bulked to grow a representative bulk M₂ generation. Observations were recorded on 60 randomly selected plants from each replication and there were three replications. Data recorded on a total of 180 plants to study four quantitative traits viz., number of pods/plant, number of seeds/pod, 100-seed weight and plant yield. The range of induced variability was assessed by basic statistics such as range, mean, variance and coefficients of variation. Broad sense heritability (h²) and genetic advance were also estimated.

The results (Table 1) show that the mean and range increased significantly for all the four traits in most of the treated populations. The increase in mean values could be due to the occurrence of polygenic mutations with cumulative effects. Similar results have been reported earlier in mungbean [2]. The results also show that the induced variability was more in treated populations as compared to the control for all the four

Table 1. Parameters of Genetic variability for various quantitative characters in the M₂ generation of mungbean

Mutagen and dose	Range (R)	Mean ± SE (X)	GCV (%)	h ² (%) (broad sense)	GA (% of mean)
Number of pods/plant					
Control	8-25	17.84 ± 0.69	-	-	-
Gamma rays					
20 kR	6-35	20.02* ± 0.87	19.93	35.01	24.32
30kR	5-39	21.32** ± 0.94	22.65	44.27	30.86
40kR	6-42	23.68** ± 1.01	25.37	55.15	38.68
EMS					
0.05%	7-35	19.98 ± 0.97	26.02	47.94	36.38
0.1%	4-42	21.46** ± 1.07	28.18	57.71	45.57
0.2%	5-48	24.75** ± 1.12	32.95	69.39	56.54
0.3%	7-45	21.40** ± 1.08	31.85	58.35	44.82
ECH					
0.1%	6-34	20.85** ± 1.00	24.11	46.28	33.62
0.2%	6-47	23.41** ± 1.07	29.54	62.61	48.31
0.3%	5-38	21.25** ± 1.01	26.58	52.08	39.43
0.4%	5-42	20.92** ± 1.03	28.12	54.13	42.63
Number of seeds/pod					
Control	5-10	7.65 ± 0.17	1.72	-	-
Gamma rays					
20 kR	6-11	8.02 ± 0.22	13.34	40.06	17.09
30 kR	5-12	8.53** ± 0.28	19.81	63.63	33.42
40 kR	4-13	9.03** ± 0.31	22.59	70.89	38.98
EMS					
0.05%	5-11	8.22** ± 0.23	15.32	48.34	21.65
0.1%	5-12	8.63** ± 0.27	19.23	61.69	31.17
0.2%	3-13	9.12** ± 0.32	23.87	73.37	41.88
0.3%	4-12	8.85** ± 0.32	23.16	71.04	40.11
ECH					
0.1%	4-13	8.20* ± 0.24	16.36	51.54	24.39
0.2%	5-13	8.82** ± 0.31	23.40	71.23	40.58
0.3%	5-12	8.45* ± 0.23	19.81	62.03	31.95
0.4%	4-12	8.24* ± 0.24	15.22	49.70	22.97

Table 1. (Contd.)

Mutagen and dose	Range (R)	Mean \pm SE (X)	GCV (%)	h^2 (%) (broad sense)	GA (% of mean)
100-seed weight					
Control	2.20-3.44	2.85 \pm 0.028	-	-	-
Gamma rays					
20 kR	2.42-3.48	2.97* \pm 0.038	6.87	44.44	9.27
30 kR	2.54-3.48	3.05** \pm 0.042	7.86	54.55	11.80
40 kR	2.58-3.55	3.32** \pm 0.048	9.31	64.28	14.45
EMS					
0.05%	2.38-3.42	3.03** \pm 0.036	6.00	37.50	7.21
0.1%	2.40-3.46	3.14** \pm 0.044	8.28	58.33	13.37
0.2%	2.45-3.68	3.38** \pm 0.015	9.41	66.67	15.88
0.3%	2.42-3.60	3.18** \pm 0.053	10.35	70.58	18.75
ECH					
0.1%	2.56-3.35	2.96* \pm 0.038	7.25	44.45	9.38
0.2%	2.39-3.56	3.27** \pm 0.046	8.56	61.54	14.06
0.3%	2.60-3.40	3.13** \pm 0.040	7.48	50.00	10.52
0.4%	2.41-3.43	3.05** \pm 0.051	10.15	68.75	18.68
Yield/plant					
Control	2.94-6.53	4.55 \pm 0.20	-	-	-
Gamma rays					
20 kR	2.55-6.98	5.20* \pm 0.25	22.44	34.69	27.21
30 kR	2.60-7.42	5.68* \pm 0.28	27.83	49.40	40.52
40 kR	2.75-9.38	6.69** \pm 0.34	31.57	61.48	51.75
EMS					
0.05%	2.84-7.50	5.18* \pm 0.25	20.88	31.96	24.55
0.1%	2.58-8.65	5.81** \pm 0.28	24.96	45.54	35.66
0.2%	2.65-9.82	7.27** \pm 0.31	26.52	59.22	42.05
0.3%	2.88-9.56	6.40** \pm 0.34	33.58	64.34	55.49
ECH					
0.1%	2.90-6.93	5.24* \pm 0.25	20.28	30.62	23.12
0.2%	2.48-8.68	6.75** \pm 0.31	26.96	56.54	41.88
0.3%	2.75-7.48	5.81** \pm 0.27	23.85	43.36	32.35
0.4%	2.70-7.78	5.26* \pm 0.26	23.97	38.31	30.61

*, ** Significant at P = 0.05 and 0.01, respectively.

characters studied. The estimates of genetic parameters showed higher values for phenotypic and genotypic coefficient of variation for number of pods/plant, number of seeds/pod and plant yield. Increase in variability after mutagenic treatments has also been reported in mungbean [1, 3, 4]. The maximum genetic variability was recorded for yield/plant followed by number of pods/plant and seeds/pod. Induced greater variability

in polygenic traits might due to increased mutations and recombinations induced by gamma rays, EMS and ECH [5].

Estimates of heritability and genetic advance increased significantly in the treated populations and varied from trait to trait. Further the combination of higher values of heritability and genetic advance were noticed for the characters like pods/plant, seeds/pod and yield/plant. Higher values of heritability and genetic advance were reported earlier in mungbean [6, 7]. The characters viz., number of pods/plant, number of seeds/pod and 100-seed weight showed considerable increase in heritability and genetic advance, indicating that these characters can be transmitted to future generations and potential gain could possibly be achieved through selection in early generations. The success of selection, however, will be greater in subsequent generations when there will be increased recombinations and eliminations of cytological variants [8]. The higher value of heritability coupled with higher values of genetic advance recorded in the present investigation envisage that the further improvement is likely to be very effective in this variety through induced mutagenesis.

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