RESEARCH ARTICLE Legume Research- An International Journal, Volume Issue : ()

Characterization of Mungbean Mutants [*Vigna radiata* (L.) Wilczek] in M_4 and M_5 Generations

Deepshikha Saikia, Akashi Sarma, Dibosh Bordoloi

10.18805/LR-4992

ABSTRACT

Background: An understanding the mungbean mutant lines with the check varieties can help in identifying mutants in better adoption. The present experiment was conducted to assess the genetic variation and morpho-metric characteristics of mungbean mutants in M_4 and M_5 generation.

Methods: A set of 7 M_3 progenies along with parent Pratap and 5 check was evaluated for M_4 and M_5 generation using randomized complete block design with three replications during *kharif* 2018 and summer 2019 in the experimental area of Instructional cum Research Farm, College of Agriculture, Assam Agricultural University, Jorhat, Assam.

Result: Significant differences were observed for most of the traits in both M_4 and M_5 generation. High heritability estimate coupled with high genetic advance as per cent of mean was documented for numbers of branches per plant, pods per plant, percentage of disease incidence, 100 seeds weight and seed yield per plant in both the generation indicate the pre-ponderance of additive gene action. Seed yield per plant was found to be significantly and positively correlated with numbers of pods per cluster, seeds per pod, pod length and 100 seeds weight at genotypic and phenotypic level in both M_4 and M_5 generation. The traits 100 seeds weight and branches per plant had showed positive direct effect on seed yield in both the generations; hence these two traits might be most effective for selection of higher yield mutants in mung bean.

Key words: Correlation, Genetic advance, Heritability, Mung bean, Path analysis.

INTRODUCTION

Mungbean [*Vigna radiata* (L.) Wilczek] is one of the major pulse crops of India, which is cultivated from humid tropic to arid and semi arid regions. Mungbean is considered rather wild as it still gives low seed yield (<1 t/ha), with uneven maturity and year to year variation in yield is also remarkably high. This opens an ample room for mungbean breeders to improve the crop on the aspect of early and synchronous maturity. The conventional breeding approaches have their limitations in increasing production of crops with narrow range of variability. In such cases, mutation breeding may provide a suitable alternative. It has been established that radiations as well as chemical mutagens, when applied to plant provide many opportunities in exploitations of mutation, recombination and in increasing genetic variability of the quantitatively inherited characters. From the works already reported by several authors in self pollinated crops (Williams and Hanway, 1961; Chaturvedi and Singh, 1980). It is evident that the polygenic mutants result in release of considerable variability in mutagen treated populations. Keeping the above facts in view, the present investigation was undertaken to study the genetic variation and morpho-metric characterization of selected mutants of mung bean.

MATERIALS AND METHODS

The seeds of cultivar Pratap were treated with Gamma rays (100, 200 and 300 *Gy)* and EMS (0.1%, 0.2% and 0.3%) in the year 2017. The gamma ray doses irradiation was done at Bidhan Chandra Krishi Vishwavidyalaya (BCKV), West Bengal (WB). About 240 plants selected in M_2 generation in 2017 were grown as single plant to progeny rows in M_3 generation during summer 2018. Uniform progenies with desirable traits like synchronous maturity, dense clustered, long podded and brown podded were identified and single plant harvested. A set of these 7 M_3 progenies along with parent *Pratap* and 5 checks *viz*., BARC-I, BARC-II, BARC-III, BARC-IV, BARC-V and SGC-20 (Table 1) was evaluated for M_4 and M_5 generations using Randomized Complete Block Design with three replications during kharif 2018 and summer 2019 in the experimental area of Instructional cum Research Farm, College of Agriculture, Assam Agricultural University, Jorhat, Assam. The progenies and checks were accommodated in a plot of 5 rows of 5 m length with a row to row and plant to plant spacing of 30 and 10 cm, respectively. Observations were recorded for characters namely days to 50% flowering (D50%F), days to pod initiation (DPI), days to maturity (DM), plant height (cm) (PH), number of branches per plant (BPL), cluster per plant (CPL),

Krishi Vigyan Kendra, Karimganj, Assam Agricultural University, Jorhat-785 013, Assam, India.

Corresponding Author: Dibosh Bordoloi, Department of Plant Breeding and Genetics, Assam Agricultural University, Jorhat-785 013, Assam, India. Email: diboshjrt@gmail.com

How to cite this article: Saikia, D., Sarma, A. and Bordoloi, D. (2022). Characterization of Mungbean mutants [*Vigna radiata* (L.) Wilczek] in M_4 and M_5 Generations. Legume Research. DOI: 10.18805/LR-4992.

Submitted: 25-06-2022 **Accepted:** 30-09-2022 **Online:** 12-10-2022

pods per cluster (PCL), seeds per pod (SPP), percentage of disease infection (%DI), pod length (cm) (PL), 100 seeds weight (g) (100SW) and seed yield (g) (SYD). The data generated were subjected to analysis of variance (ANOVA), genotypes as fixed effects in Windostat v.9.2 (indostat@hotmail.com).

RESULTS AND DISCUSSION

Analysis of variance

Analysis of variance for seed yield and the yield attributing characters revealed highly significant differences among the genotypes for most of the characters except for days to pod initiation and pod length in M_4 generation and days to pod initiation and plant height in M_5 generation (Table 2 and Table 3).

Mean performances

Among the genotypes grown in M4 generation, SM-2 showed earliest flowering (35 days) with lowest pod maturation period (40 days) (Table 4a and 4b). Whereas LP (42 days) was observed to be the late flowering genotype and SM-1 (43 days) was documented to require more days for pod initiation than the rest of the genotypes. SGC-20 (62 days) was investigated to be the earliest maturing genotype and DC (75 days) was experimented to be showing late maturity. SM-3 showed highest number of branches per plant (9.22) along with highest number of clusters per plant (4.15). Percentage of disease infection was investigated lowest for SM-1 (13.31%) and 100-seed weight was found highest for BP (5.81g). As for the M_5 generation, BARC-III was found to be the earliest flowering genotype (33 days) and also showed earliest maturity (58 days). LP (35 days) showed early pod maturation. SM-1 (42 days) was observed to be the late flowering genotype and DC (43 days) was detected to require more days for pod initiation than the rest of the genotypes. BARC-I was observed to have lowest percentage of disease infection (22.20%). Genotype BP showed highest pod length (6.65 cm) and highest 100 seeds weight (5.56 g). However, seed yield per plant was observed to be highest in SGC-20 (4.09 g).

Table 1: List of mutants/genotypes used in present investigation with their source of origin.

Genotype code	Genotype name	Type	Source
SM-1	Synchronous-maturity-I	Mutant	Department of Plant Breeding and Genetics, AAU, Jorhat-13
SM-2	Synchronous-maturity-II	Mutant	
SM-3	Synchronous-maturity-III	Mutant	
DC	Dance-cluster	Mutant	
LP	Long-pod	Mutant	
BP	Brown-pod	Mutant	
BARC-I	TMB-122	Check	Bhabha Atomic Research Centre, Mumbai
BARC-II	TMB-124	Check	
BARC-III	TMB-127	Check	
BARC-IV	TMB-148	Check	
BARC-V	TMB-152	Check	
SG-1	Pratap	Parent	Department of Plant Breeding and Genetics, AAU, Jorhat-13
SGC-20	SGC-20	Check	RARS, Shillongoni, AAU, Jorhat-13

Table 2: Analysis of variance for yield and yield component characters in *Vigna radiata* (L.) Wilczek for M_4 generation.

Source of		Mean squares											
variations	df	D50 % F	DPI	DM	PH (cm)	BPL	CPL	PCL	SPP	%DI	PL (cm)	100 SW (g)	SYD (g)
Replicates	2	2.33	1.00	1.25	10.04	0.005	0.004	0.008	0.284	5.41	0.25	0.003	0.001
Genotype	12	9.88*	3.12	63.30*	14.89*	5.13*	0.27*	0.62*	2.76*	33.21**	0.455	1.62**	1.92**
Error	24	2.30	2.72	12.15	3.077	0.006	0.067	0.002	0.43	1.39	0.205	0.002	0.024
CV (%)		3.82	3.93	5.21	5.32	1.23	7.11	1.64	6.81	5.72	7.62	0.86	4.09

Table 3: Analysis of variance for yield and yield component characters in *Vigna radiata* L. Wilczek for M_5 generation.

Source of		Mean squares											
variations	df	D50% F	DPI	DM	PH (cm)	BPL	CPL	PCL	SPP	%DI	PL (cm)	100 SW (g)	SYD (g)
Replicates	2	15.87	3	2.87	4.29	0.01	0.08	0.01	0.02	1.17	0.61	0.01	0.22
Genotype	12	22.36*	12.58	46.81**	10.46	0.57**	0.56**	0.56**	2.90**	47.89**	0.77*	1.62**	0.54*
Error	24	3.96	4.17	4.54	3.03	0.01	0.03	0.01	0.10	0.55	0.15	0.00	0.08
CV (%)		5.28	5.34	3.37	5.15	1.97	5.16	1.42	3.98	2.63	6.50	0.89	8.07

*, **Significant at 5% and 1% level, respectively.

Genetic parameters

High phenotypic and genotypic coefficient of variation was registered for seed yield per plant and number of branches per plant in M_4 generation (Table 5). In the case of M_5 generation, none of the traits showed a high phenotypic and genotypic coefficient of variation but the number of clusters per plant, pods per cluster, seeds per cluster, seeds per pod, percentage of disease infection, 100-seed weight and yield showed a moderate phenotypic and genotypic coefficient of variation. High estimates of genotypic coefficient of variation indicated the presence of wide variation for the character under study to allow further improvement by the selection of individual traits. These results align with that of Pathak and Patil (1993), Longnathan *et al.* (2001), Samad and Lavanya (2005) and Makeen *et al.* (2007). High heritability estimate coupled with high genetic advance as per cent of mean was registered for the number of branches per plant, pods per plant, percentage of disease infection, 100-seed weight and seed yield per plant in M_4 and for number of clusters per plant, pods per cluster, seeds per pod, percentage of disease infection and 100-seed weight in M_5 generation indicate the preponderance of additive gene action. The similar findings were observed by Singh *et al.* (2009) and Narasimhulu

Table 4: Mean performance of yield and yield attributing traits of mung bean mutants.

Genotype	D 50% F		DPI		DM		PH		BPL		CPL	
	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5
SM-1	41.67	42	43.33	37.67	62.67	65	32.67	31.97	6.27	4.7	4.1	3.59
SM-2	34.67	40.33	39.67	35.33	68.67	64.33	34.4	33.82	7.27	4.3	3.47	3.77
SM-3	40.33	39	43	38	74	64.67	30.56	36.03	9.22	5.22	4.15	3.5
DC	39.33	39	41.67	43	75	64.67	35.53	34.26	6.18	4.64	3.9	3.49
LP	41.67	34.33	42.67	34.67	68	72.67	33.87	34.58	7.51	5.62	3.43	3.27
BP	40.67	35.67	42.33	38.67	72.67	65.33	33.73	34.98	7.48	5.23	3.22	3.4
BARC-I	41.33	34.33	42.33	38.33	66.33	63	33.53	30.33	5.43	4.17	3.67	3.53
BARC-II	40	38.67	41	37.67	66.33	59.67	33.13	35.4	7.18	4.35	3.4	4.33
BARC-III	39.67	33.33	42.33	39	60.67	58	32.07	33.19	6.17	5.35	3.57	3.55
BARC-IV	38.67	37.67	40.67	38.67	64.67	62.33	37	37.19	6.19	4.65	3.57	2.62
BARC-V	39.67	38.67	42.67	37.67	64.33	64	32.2	33.06	6.08	4.94	3.4	3.28
SG-1	39.33	40.67	41.67	38	64.33	61	28	32.36	4.61	4.76	3.5	3.59
SGC-20	38.67	35.67	41.67	40.33	62	57	32	32.31	4.29	4.6	4	4.28
Mean	39.67	37.64	41.92	38.23	66.9	63.21	32.98	33.81	6.45	4.81	3.64	3.55
Range	35-42	33-42	40-43	35-43	62-75	57-73	28-37	30.33-37.19	4.29-9.22	4.3-5.62	3.22-4.15	2.62-4.33
C.D. 5%	2.57	3.37	2.69	3.46	5.91	3.61	2.97	2.95	0.13	0.16	0.44	0.31

Table 4a: Mean performance of yield and yield attributing traits of mung bean mutants.

Genotype	PCL		SPP		%DI		PL(cm)		100 SW (g)		SYD (g)	
	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5
SM-1	2.58	2.42	8.37	8.51	13.31	25.18	5.58	5.95	4.79	4.68	3.28	3.05
SM-2	2.18	2.62	9.13	8.36	19.53	26.53	5.63	6.04	4.12	4.01	2.53	3.64
SM-3	2.48	2.29	8.73	8.41	21.67	27.96	5.41	6.14	3.14	3.03	2.62	2.71
DC	2.15	2.61	9.31	7.57	23.22	26.53	6.06	5.3	5.67	5.58	4.45	3.91
LP	1.77	2.82	9.13	9.52	23.65	29.32	5.36	6.4	4.79	4.68	2.75	4.04
BP	2.77	2.64	9.76	8.37	22.5	32.08	5.78	6.65	5.81	5.69	4.44	3.81
BARC-I	2.75	2.02	10.13	8.07	17.58	22.2	5.85	6.1	4.7	4.59	4.55	3.58
BARC-II	3.19	2.15	9.75	7.3	17.4	37.85	6.24	6.13	5.21	5.1	4.63	3.58
BARC-III	2.78	3.14	8.8	7.41	21.47	30.64	5.85	4.86	4.71	4.62	4.4	3.53
BARC-IV	1.7	3.17	9.63	7.42	22.25	31.26	6.28	6.32	5.67	5.56	3.65	3.02
BARC-V	2.45	3.45	9.53	5.29	18.58	25.57	6.16	6.15	5.13	5.02	3.69	3.45
SG-1	3.05	2.82	11.33	8.14	20.36	25.29	6.63	5.43	4.21	4.14	4.1	3.98
SGC-20	2.75	3.18	11.67	7.5	26.14	27.28	6.37	5.44	5.15	5.03	4.66	4.09
Mean	2.51	2.72	9.64	7.84	20.59	28.28	5.94	5.92	4.85	4.75	3.83	3.57
Range	1.70-2.78	2.02-3.45	8.37-11.67	5.29-9.52	13.31-26.14	22.2-37.85	5.36-6.63	4.86-6.65	3.14-5.81	4.01-5.69	2.53-4.66	2.71-4.09
C.D. 5%	0.07	0.07	1.11	0.53	2	1.26	0.77	0.65	0.07	0.07	0.27	0.49

et al. (2013) were supportive of the present study. Hence, the results of the most of the traits showed high heritability in M_5 generation compare with the M_4 generation indicates selection of the traits would be effective in present investigation.

Correlation

In the present study, seed yield per plant was found to be significantly and positively correlated with the number of pods per cluster, seeds per pod, pod length and 100- seed weight at the genotypic and phenotypic level in M_4 generation and with the number of clusters per pod, pod length and 100 -seed weight in M_5 generation (Table 6 and Table 7). The significant negative correlation of seed yield per plant at the genotypic level was recorded in the number of branches per pod for M_4 generation and plant height for M_5 generation. Similar findings were also reported by Nazir *et al.* (2005), Singh *et al.* (2009) and Ahmed *et al.* (2013). Percentage of disease infection showed a significant negative correlation with days to pod initiation and number of pods per cluster in M_4 generation, while in M_5 generation, number of clusters per pod showed a significant positive correlation with days to maturity, plant height, number of branches per plant and pods per cluster. The present correlation result is due to multiple effects of the same gene, the selection for one character will improve another character simultaneously. Hence, correlations among traits influence the effectiveness of selection. These results are in agreement with the findings of Ahmad *et al.*, (2013) and Narasimhulu *et al.*, (2013).

Path analysis

The genotypic correlation coefficients were used for carrying out path coefficient analysis in 13 genotypes and the analyzed had revealed low residual value 0.398 and 0.278 in M_4 and M_5 generation, respectively (Table 8 and Table 9). Considering the direct effect of the component traits on seed yield in the genotypes it was observed that 100 seeds weights had the highest direct effect (2.974) followed by number of branches per plant (0.877), cluster per plant (0.782) and days to pod initiation (0.070) in M_4 generation. Although in M_5 generation the trait hundred seed weights

Table 5: Estimates the genetic parameters of different characters in green gram [*Vigna radiata* (L.) Wilczek] for M_4 and M_5 generation.

Character	PCV (%)		GCV (%)		$h^2_{b.s.}$ (%)		GA (% of mean)	
	M_4	M_5	M_4	M_5	M_4	M_5	M_4	M_5
D50% F	5.54	8.44	4.01	6.58	52.30	60.80	5.97	10.57
DPI	4.03	6.91	0.87	4.38	4.64	40.22	0.39	5.72
DM	8.08	6.83	6.17	5.94	58.40	75.64	9.72	10.64
PH	8.03	6.94	6.02	4.66	56.13	45.00	9.29	6.43
BPL	20.30	9.20	20.26	8.99	99.64	95.44	41.66	18.09
CPL	10.01	12.87	7.05	11.79	49.60	83.91	10.23	22.24
PCL	18.11	15.99	18.04	15.93	99.18	99.21	37.00	32.69
SPP	11.39	12.97	9.13	12.34	64.30	90.57	15.09	24.20
%DI	16.82	14.29	15.82	14.04	88.41	96.62	30.64	28.44
PL (cm)	9.04	10.09	4.86	7.72	28.96	58.52	5.39	12.16
100 SW (g)	15.15	15.47	15.12	15.45	99.68	99.67	31.1	31.77
SYD (g)	21.16	13.60	20.76	10.94	96.27	64.77	41.96	18.14

Table 6: Genotypic (upper diagonal) and phenotypic (lower diagonal) correlation coefficients between different characters in *[Vigna radiata* (L.) Wilczek] for M4 generation.

	D50% F	DPI	DM	PH (cm)	BPL	CPL	PCL	SPP	%DI	PL (cm)	100SW (g)	SYD (g)
D50% F		2.400**	0.001	-0.096	0.091	0.253	0.199	-0.082	-0.246	-0.381*	0.142	0.241
DPI	0.516**		-0.068	-0.746**	0.393*	0.936**	0.447**	-0.934**	-0.700**	-0.655**	-0.387*	-0.173
DM	-0.011	0.004		0.232	0.706**	0.073	-0.273	-0.342*	0.287	-0.570**	-0.077	-0.227
PH (cm)	-0.242	-0.336*	0.233		0.182	-0.195	-0.748**	-0.467**	0.146	-0.215	0.678**	0.001
BPL	0.060	0.061	0.532**	0.149		-0.031	-0.267	-0.768**	-0.054	-0.992**	-0.345*	-0.603**
CPL	0.033	0.224	0.017	-0.097	-0.032		-0.035	-0.144	-0.034	-0.343*	-0.426**	-0.159
PCL	0.127	0.072	-0.211	-0.541**	-0.263	-0.047		0.418**	-0.317*	0.497**	-0.126	0.583**
SPP	-0.228	-0.100	-0.154	-0.181	-0.623**	-0.099	0.338*		0.426**	1.053**	0.187	0.587**
%DI	-0.145	-0.024	0.191	0.067	-0.056	-0.028	-0.291	0.350*		0.277	0.171	0.114
PL (cm)	-0.111	-0.345*	-0.227	-0.173	-0.534**	-0.063	0.270	0.540**	0.021		0.513**	0.899**
100 SW (g)	0.095	-0.099	-0.056	0.517**	-0.344*	-0.293	-0.126	0.150	0.161	0.275		0.603**
SYD (g)	0.161	0.033	-0.211	-0.048	-0.588**	-0.130	0.572**	0.480**	0.135	0.444**	0.588**	

*, **Significant at 5% and 1% level, respectively.

showed highest direct effect (1.261) followed by number of branches per plant (1.047), seeds per pod (0.552), pod length (0.407), percentage of disease incidence (0.190) and days to 50% flowering (0.181). The traits hundred seeds weight and number of branches per plant had showed positive direct effect on seed yield in both the generation;

Table 7: Genotypic (upper diagonal) and phenotypic (lower diagonal) correlation coefficients between different characters in *[Vigna radiata* (L.) Wilczek] for M_5 generation.

	D 50% F	DPI	DM	PH (cm)	BPL	CPL	PCL	SPP	%DI	PL (cm)	100 SW (g)	SYD (g)
D 50% F		-0.257	0.009	-0.002	-0.424**	0.107	-0.187	-0.092	-0.186	0.101	-0.272	-0.389*
DPI	0.171		-0.629**	-0.293	-0.231	0.137	0.096	-0.445**	-0.093	-0.713**	0.532**	0.166
DM	0.082	-0.312*		0.155	0.459**	-0.500**	-0.183	0.532**	-0.164	0.759**	-0.074	-0.028
PH (cm)	0.153	0.160	0.255		0.391*	-0.398*	0.115	0.062	0.813**	0.522**	0.131	-0.390*
BPL	-0.293	-0.145	0.359*	0.219		-0.371*	0.364*	0.234	0.197	0.061	-0.100	0.001
CPL	0.034	0.013	-0.419**	-0.302	-0.326*		-0.332*	-0.030	0.161	-0.369*	-0.169	0.398**
PCL	-0.138	0.084	-0.160	0.075	0.351*	-0.309*		-0.513**	-0.019	-0.286	0.301	0.199
SPP	-0.046	-0.262	0.434**	0.026	0.221	0.046	-0.476**		-0.030	0.203	-0.321*	0.107
%DI	-0.143	-0.032	-0.142	0.569**	0.193	0.174	-0.021	-0.027		0.221	0.326*	-0.018
PL (cm)	-0.014	-0.344*	0.381*	0.242	0.030	-0.251	-0.206	0.197	0.172		0.100	-0.311*
100SW (g)	-0.205	0.337*	-0.063	0.102	-0.098	-0.153	0.299	-0.306	0.322*	0.075		0.397*
SYD (g)	-0.252	0.049	0.011	-0.296	0.004	0.311*	0.178	0.105	-0.036	-0.187	0.313*	

*, **Significant at 5% and 1% level, respectively.

Table 8: Genotypic path analysis direct (diagonal values in bold face) and indirect effects of component characters on seed yield per plant in *[Vigna radiata* (L.) Wilczek] for M_4 generation.

	D50 % F	DPI	DM	PH (cm)	BPL	CPL	PCL	SPP	%DI	PL (cm)	100S W (g)	R
D50%F	-0.808	0.169	0.000	0.231	0.080	0.198	-0.107	0.005	0.047	0.004	0.421	0.241
DPI	-1.938	0.070	0.016	1.792	0.345	0.733	-0.241	0.060	0.135	0.007	-1.151	-0.173
DM	-0.001	-0.005	-0.232	-0.557	0.619	0.057	0.147	0.022	-0.055	0.006	-0.228	-0.227
PH (cm)	0.078	-0.052	-0.054	-2.401	0.159	-0.152	0.403	0.030	-0.028	0.002	2.017	0.001
BPL	-0.074	0.028	-0.164	-0.436	0.877	-0.024	0.144	0.049	0.010	0.011	-1.025	-0.603**
CPL	-0.205	0.066	-0.017	0.468	-0.027	0.782	0.019	0.009	0.007	0.004	-1.266	-0.159
PCL	-0.161	0.031	0.063	1.795	-0.234	-0.027	-0.539	-0.027	0.061	-0.005	-0.375	0.583**
SPP	0.066	-0.066	0.079	1.121	-0.674	-0.112	-0.225	-0.064	-0.082	-0.011	0.555	0.587**
%DI	0.199	-0.049	-0.067	-0.350	-0.047	-0.027	0.171	-0.027	-0.193	-0.003	0.508	0.114
PL (cm)	0.308	-0.046	0.132	0.517	-0.871	-0.268	-0.267	-0.067	-0.053	-0.011	1.526	0.899**
100S W (g)	-0.114	-0.027	0.018	-1.629	-0.302	-0.333	0.068	-0.012	-0.033	-0.005	2.974	0.603**

Residual effect 0.39973.

Table 9: Genotypic path analysis direct (diagonal values in bold face) and indirect effects of component characters on seed yield per plant in *[Vigna radiata* (L.) Wilczek] for M_5 generation.

	D50 % F	DPI	DM	PH (cm)	BPL	CPL	PCL	SPP	% DI	PL (cm)	100 SW (g)	r
D50%F	0.181	0.253	-0.014	0.003	-0.443	-0.013	0.032	-0.051	-0.035	0.041	-0.343	-0.389*
DPI	-0.047	-0.982	0.926	0.426	-0.241	-0.017	-0.017	-0.245	-0.018	-0.290	0.670	0.166
DM	0.002	0.617	-1.472	-0.225	0.480	0.061	0.031	0.294	-0.031	0.309	-0.093	-0.028
PH (cm)	0.000	0.288	-0.229	-1.453	0.409	0.048	-0.020	0.034	0.155	0.212	0.165	-0.390*
BPL	-0.077	0.226	-0.675	-0.568	1.047	0.045	-0.062	0.129	0.038	0.025	-0.126	0.001
CPL	0.019	-0.135	0.737	0.578	-0.388	-0.122	0.057	-0.017	0.031	-0.150	-0.213	0.398**
PCL	-0.034	-0.094	0.269	-0.167	0.381	0.040	-0.172	-0.283	-0.004	-0.117	0.379	0.199
SPP	-0.017	0.436	-0.784	-0.090	0.245	0.004	0.088	0.552	-0.006	0.083	-0.405	0.107
% DI	-0.034	0.091	0.241	-1.181	0.207	-0.020	0.003	-0.017	0.190	0.090	0.411	-0.018
PL (cm)	0.018	0.700	-1.117	-0.758	0.064	0.045	0.049	0.112	0.042	0.407	0.126	-0.311*
100SW (g)	-0.049	-0.522	0.109	-0.190	-0.105	0.021	-0.052	-0.177	0.062	0.041	1.261	0.397*

Residual effect 0.27817.

*, **Significant at 5% and 1% level, respectively.

hence these two traits might be most effective for selection of higher yield mutants in green gram. This is in broad conformity with path analysis studies in greengram as reported by Mishra and Singh (2012), Prasanna *et al*. (2013), Makeen *et al*. (2007), Rahim *et al*. (2010) and Muthuswamy *et al*. (2019).

CONCLUSION

The study of variability parameters among 7 mungbean mutants for 12 traits has provided valuable information regarding the genetic variability, heritability and genetic advance for the characters and efficacy of different mutagenic treatment. Genetic parameters of traits, correlation among traits and path analysis revealed that selection for 100 seeds weight and number of branches per plant would be effective in observation of high yielding mutants.

Conflict of interest: None.

REFERENCES

Ahmad, A., Razvi, S.M., Rather, M.A., Dar, M.A. and Ganie, S.A. (2013). Association and inter-relationship among yield and yield contributing characters and screening against cercospora leaf spot in mung bean (*Vigna radiadiata* L). Academic Journals. 8(41): (2008-2014).

Chaturvedi, S.N. and Singh, V.P. (1980). Gamma rays induced quantitative variation in mungbean. J. Cytol. Genet. 15: 64-67.

Loganathan, P., Saravanan, K. and Ganesan, J. (2001). Genetic variability in green gram. Research on Crops. 2: 396-397.

Makeen, K., Garard, A., Arif, J. and Singh, A.K. (2007). Genetic variability and correlation studies on yield and its component in mungbean [*Vigna radiata* (L.) Wilczek]. J. of Agron. 6(1): 216-218.

Mishra, D. and Singh, B. (2012). Genetic divergence and character association in micromutants of green gram [*Vigna radiata* (L.) Wilczek] variety sujata. Academic Journal of Plant Sciences. 5(2): 40-44.

Muthuswamy, A., Jamunarani, M. and Ramakrishnan, P. (2019). Genetic variability, character association and path analysis studies in green gram [*Vigna radiata* (L.) Wilczek]. Int. J. Curr. Microbiol. App. Sci. 8(4): 1136-1146.

Narasimhulu, R., Naidu, N.V., Shanthi Priya, M., Rajarajeswari, V. and Reddy, K.H.P. (2013). Genetic variability and association studies for yield attributes in mungbean *Vigna radiata* (L.) Wilczek. Indian J. of Plant Sciences. 2(3): 2319-3824.

Nazir, A., Sadiq, M.S., Hanif, M., Abbas, G. and Haidar, S. (2005). Genetic parameters and path analysis in mungbean, (*Vigna radiata* L. Wilczek). J. of Agricultural Research, Lahore. 43(4): 339-347.

Pathak, H.C. and Patel, M.S. (1993). Selection criteria in summer mungbean [*Vigna radiata* (L.) Wilczek]. GAU Res. J. 19: 64-69.

Prasanna, L.B., Rao P.J.M., Murthy, K.G.K. and Prakash, K.K. (2013). Genetic variability, correlation and path coefficient analysis in mungbean. Enviro. and Ecolo. 31(4): 1782-1788.

Rahim, M.A., Mia, A.A., Mahmud, F., Zeba, N. and Afrin, K.S. (2010). Genetic variability, character association and genetic divergence in mungbean [*Vigna radiata* (L.) Wilczek]. Plant Omics. 3(1): 1.

Samad, S.S. and Lavanya, G.R. (2005). Variability studies for yield parameters in mungbean [*Vigna radiata* (L.) Wilczek]. J. of Maharashtra Agric. Universities. 30(2): 168-170.

Singh, S.K., Singh, I.P., Singh, B.B. and Singh, O. (2009). Correlation and path coefficient studies for yield and its components in mungbean [*Vigna radiata* (L.) Wilczek]. Legume Res. 32(3): 180-185.

Singh, T., Sharma, A. and Alie, F.A. (2009). Morpho-physiological traits as selection criteria for yield improvement in mungbean [*Vigna radiata* (L.) Wilczek]. Legume Research. 32(1): 36-40.

Williams, J.H. and Hanway, D.G. (1961). Genetic variation in oil and protein content of soyabean induced by seed irradiation. Crop Sci. 1: 34-36.