Journal of Food Legumes
37(1): 109-113, 2024
DOI: 10.59797/jfl.v37.i1.184

Short Communication

Studies on genetic variability parameters for seed yield and its component traits in mungbean [*Vigna radiata* (L.) Wilczek] germplasm under arid environment

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***Received:** 23 January 2024*
***Accepted:** 30 March 2024*

Handling Editor:
Dr. C.P. Nath, ICAR-Indian Institute of Pulses Research, Kanpur, India

ABSTRACT

Genetic variability is the most important factor for the success of any crop improvement program. Hence, the evaluation of germplasm has to be conducted as a preliminary step to study the extent of variability available in the germplasm and to identify suitable high-yielding genotypes that can be utilized in the crop improvement program. The present investigation was carried out to estimate genetic variability, heritability, and genetic advance for yield and yield contributing characters among seventy-nine diverse genotypes of mungbean for eleven quantitative traits. Significant differences were observed among genotypes for all eleven characters studied. The high degree of genetic variability along with high heritability and high genetic advance as percent of mean were recorded for seed yield per plant, number of pods per plant, harvest index, biological yield per plant, and plant height; which indicates that these characteristics were under the control of additive gene action and therefore, form the basis of selection for the mungbean improvement program.

***Key words*:** Genetic advance, Genotypic coefficient of variation, Heritability, Mungbean, Phenotypic coefficient of variation, Seed yield.

Mungbean [*Vigna radiata* (L.) Wilczek], also known as green gram is an ancient pulse crop widely cultivated in India. High protein, easy digestibility, and low flatulence production made this crop more acceptable to the people world over. Mungbean is a short-day, warm-season crop, grown mainly in arid and semi-arid regions. It is tolerant to moisture stress and heat. It can grow under low input conditions (Sharma 2016). Because of its short duration, wide adaptation, low water requirement, and photo insensitiveness, it can be grown in various crop rotation practices (Singh *et al*. 2015). Though India is a leading producer of green gram in the world, its productivity is very low compared to its genetic potential. Therefore, there is a great scope for its improvement by developing high-yielding, disease, and pest resistance varieties with improved nutritional value. Proper evaluation of the extent of genetic variation available for yield components, their heritability values, and genetic advance could be of great significance for the breeders to choose the best genotypes for improvement (Degafa *et al*. 2014). Estimates of genetic parameters indicate the relative importance of the various types of gene effects affecting the total variation of a plant's character. Therefore, the present study was conducted to assess genetic variability, heritability, and genetic advance in mungbean germplasm under the arid environment of Rajasthan so that promising genotypes could be identified for a breeding program to develop high-yielding varieties of mungbean for the arid zone.

The present investigation was carried out at the Experimental farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Kharif*, 2017-18. The experimental material consisting of 79 genotypes procured from NBPGR, Regional Station, Jodhpur; Rajasthan Agricultural Research Institute, Durgapura, Jaipur; Agricultural Research Station, Sriganganagar and Agricultural Research Station, Mandor, Jodhpur is given in Table 1. The germplasm under study was sown on July 6, 2017, in Randomized Block Design with three replications accommodating 3 meters long two rows per replication at 30 cm spacing under sprinkler irrigated situation. All recommended agronomic practices were adopted to raise a healthy

crop. Observations recorded for 11 characters *viz*., days to 50 % flowering, days to maturity, plant height (cm), branches per plant (no.), pods per plant (no.), seeds per pod (no.), pod length (cm), 100-seed weight (g), biological yield per plant (g), seed yield per plant (g0 and harvest index. The data on days to 50% flowering and days to maturity were recorded on a plot basis, while five randomly selected plants from each of the entries were selected for recording the remaining observations.

Analysis of variance was calculated by the method suggested by Panse and Sukhatme (1985). The estimate of genotypic variance and phenotypic variance were worked out using the method suggested by Johnson *et al*. (1955). Phenotypic and genotypic coefficients of variation were calculated based on the method advocated by Burton (1952). Heritability percentage in broad sense was estimated as per the method described by Lush (1940). The expected genetic advance for each character was

Table 1. List of mungbean genotypes used for present investigation

S. No.	Name of germplasm	Year of Collection	Source of procurement
Germplasm procured from NBPGR, Regional Station, Jodhpur			
1	IC-39269	1993	Jodhpur, Rajasthan
2	IC-39275	1993	Kherapa, Jodhpur, Rajasthan
3	IC-39279	1993	*
4	IC-39288	1993	Nimbojhai, Nagour, Rajasthan
5	IC-39293	1993	Kadampura, Nagour, Rajasthan
6	IC-39298	1993	Bambor,Jodhpur, Rajasthan
7	IC-39300	1993	Jaswasar, Bikaner, Rajasthan
8	IC-39328	1993	Lalela, Barmer, Rajasthan
9	IC-39333	1993	Dhawa, Barmer, Rajasthan
10	IC-39352	1993	Manduwa, Barmer, Rajasthan
11	IC-39368	1993	Lunawas, Jodhpur, Rajasthan
12	IC-39375	1993	Nibali, Barmer, Rajasthan
13	IC-39383	1993	Godan, Jalore, Rajasthan
14	IC-39395	1993	Aburoad, Sirohi, Rajasthan
15	IC-39399	1993	Jaspura, Palanpur, Gujarat
16	IC-39409	1993	Kapara, Banaskantha, Gujarat
17	IC-39420	1993	Nearsami, Patan, Gujarat
18	IC-39427	1993	Harij, Patan, Gujarat
19	IC-39451	1988	Lakhtarar, Surendranagar, Gujarat
20	IC-39454	1988	Surendranagar, Gujarat
21	IC-39465	1988	Kalyana, Patan, Gujarat
22	IC-39483	1988	Kalapur, Surendranagar, Gujarat
23	IC-39492	1988	Dudhai, Mahesana, Gujarat
24	IC-39495	1988	Chandrani, Kachchh, Gujarat
25	IC-39500	1988	Kishangarh, Gujarat
26	IC-39515	1988	Kauth, Gujarat
27	IC-39580	1992	Bachau, Kutch, Gujarat
28	IC-39582	1992	Chilora, Kheda, Gujarat
29	IC-39591	1992	Sevelia, Kheda, Gujarat
30	IC-39604	1992	Bholi, Rajasmand, Rajasthan
31	IC-39608	1992	Nevra, Jodhpur, Rajasthan
32	IC-39610	1992	Osian, Jodhpur, Rajasthan
33	IC-52073	1992	*
34	IC-52076	1992	*
35	IC-52078	1992	*
36	IC-52081	1992	*
37	IC-52082	1992	*
38	IC-52087	1992	*
39	IC-55069	1992	*
40	IC-102792	1986	Banar, Jodhpur, Rajasthan
41	IC-102821	1986	Gidani, Jaipur, Rajasthan
42	IC-102857	1986	Khasur, Dholpur, Rajasthan
43	IC-102963	1986	Avikanagar, Tonk, Rajasthan
44	IC-103014	1986	Alampur, Kheda, Gujarat
45	IC-103059	1986	Krakas, Amreli, Gujarat
46	IC-103204	1987	Gangawar, Chittorgarh, Raj.
47	IC-103207	1987	Dhinva, Chittorgarh, Rajasthan
48	IC-103244	1986	Bhrwasa, Didwana, Nagaur, Raj.
49	IC-103245	1987	Odda, Banswara, Rajasthan
50	IC-103785	1989	Khemlo, Vishsana, Rajasthan
51	IC-103821	1989	Nagdhan, Santrampur, Gujarat
52	IC-103973	1989	Barvalbhipor, Bhavnagar, Gujarat
53	IC-324012	-	*
54	IC-338868	1990	Sanari, Barmer, Rajasthan

Varieties procured from Agriculture University, Jodhpur, Rajasthan		
55	Sweta	CSAVAT, Kanpur
56	IPM-02-3	ICAR-IIPR, Kanpur
57	IPM-02-14	ICAR-IIPR, Kanpur
58	Samrat (PDM-139)	ICAR-IIPR, Kanpur
59	GM-4	AAU, Pulse Res. Station, Vadodara
60	MH 2-15	CCSHAU, Hisar
61	MH-421	CCSHAU, Hisar
62	IPM-205-7	ICAR-IIPR, Kanpur
63	IPM 99-125 (Meha)	ICAR-IIPR, Kanpur
64	IPM-409-4	ICAR-IIPR, Kanpur
65	GAM-5	AAU, Pulse Res. Station, Vadodara
66	COGG-912	TNAU, Coimbatore
Varieties procured from RARI, Durgapura, Jaipur, Rajasthan		
67	RMG-62	SKRAU-ARS, Durgapura, Jaipur
68	RMG-268	SKRAU-ARS, Durgapura, Jaipur
69	RMG-344	SKRAU-ARS, Durgapura, Jaipur
70	RMG-492	SKRAU-ARS, Durgapura, Jaipur
71	Keshwanand Mung-1 (RMG-975)	SKNAU-RARI, Durgapura, Jaipur
72	Keshwanand Mung-2 (MSJ-118)	SKNAU-RARI, Durgapura, Jaipur
Varieties procured from ARS, Sriganganagar, Rajasthan		
73	Ganga-1	SKRAU-ARS, Sriganganagar
74	Ganga-8	SKRAU-ARS, Sriganganagar
75	MUM-2	CCS Meerut University, Meerut
76	SML-668	PAU, Ludhiana
77	SML-832	PAU, Ludhiana
78	ML-683	PAU, Ludhiana
79	ML-818	PAU, Ludhiana

*Source was not mentioned by NBPGR, Regional Station, Jodhpur, Rajasthan, India.

calculated as suggested by Johnson *et al.* (1955).

The analysis of variance (Table 2) showed significant differences among genotypes for 11 studied characters indicating that the material has adequate genetic variability to support the breeding program for improving the seed yield of mungbean. A wide range of variability in mungbean germplasm was displayed by different characters namely; days to 50 % flowering (34-60), days to maturity (64-84), plant height (40.47-126.13 cm), number of branches per plant (1.5-3.03), number of pods per plant (1.53-55.60), number of seeds per pod (8.00-11.67), pod length (2.46-10.22 cm), 100-seed weight (2.45-5.41 g), biological yield per plant (12.20-104.33 g), seed yield per plant (0.47-26.07 g) and harvest index (1.10-38.41). Genetic variability parameters estimated for different characters of mungbean are given in Table 3. The highest GCV and PCV in mungbean germplasm were recorded for seed yield per plant followed by the number of pods per plant, harvest index, biological yield per plant, and plant height, respectively. This suggests a good scope for improvement, creating variability through hybridization followed by selection. The occurrence of moderate GCV and PCV was recorded for the number of branches per plant, days to 50 % flowering, pod length, and 100-seed weight which suggests that improvement in these characteristics might be gained to a reasonable extent. Similar findings were reported by Makeen *et al.* (2007), Bisht *et al.* (2014), Hemavathy *et al.* (2015), Bhutia *et al.* (2016), Shiv *et al.* (2017), Kumar (2023), Prasanthi *et al.* (2024) and Kumar *et al.* (2024).

The response of selection depends upon the magnitude of heritable variation present in the population. A character with high GCV and high heritability will be more valuable in a selection program. In the present investigation, high heritability estimates have been observed for days to 50 % flowering followed by seed yield per plant, number of pods per plant, biological yield per plant, 100-seed weight, harvest index, number of branches per plant, days to maturity, plant height, pod length and number of seeds per pod. Similar findings were reported by Makeen *et al.* (2007), Gadakh *et al.* (2013), Tiwari *et al.* (2014), Bhutia *et al.* (2016), Shiv *et al.* (2017), Kumar (2023) and Kumar *et al.* (2024).

The genetic advance as percent of mean provides an idea of the amount of progress that can be achieved by selection for the concerned trait. High genetic advance as a percentage of mean was estimated for seed yield per plant, number of pods per plant, harvest index, biological yield per plant, plant height, days to 50% flowering, number of branches per plant, 100-seed weight and pod length; however, moderate values were observed for days to maturity and number of seeds per pod. The heritability values coupled with genetic advance would be more reliable and useful in predicting the gain under selection than the heritability estimates alone. The high estimate of heritability coupled

Table 2. Analysis of variance for different characters of mungbean

Source of variation	d. f.	Days to 50% flowering	Days to maturity	Plant height (cm)	Branches/ plant (no.)	Pods/ plant (no.)	Seeds/pod (no.)	Pod length (cm)	100-seed weight (g)	Biological yield/ plant (g)	Harvest index (%)	Seed yield/ plant (g)
Replications	2	0.34	4.81	27.06	0.362**	0.76	0.46	0.48	0.001	2.04	0.98	0.63
Genotypes	78	250.90**	159.74**	1057.98**	0.635**	572.79**	2.84**	2.91**	0.580**	1252.01**	316.13**	162.12**
Error	156	0.18	1.79	12.36	0.006	1.99	0.20	0.16	0.003	6.87	3.07	0.37

*Significant at P = 0.05 ; ** Highly significant at P = 0.01

Table 3. Estimates of genetic variability parameters for different characters of mungbean

S. No.	Characters	Range	Mean	GCV	PCV	Heritability (%)	Genetic Advance	Genetic Advance as % of mean (GAM)
1	Days to 50% flowering	34 - 60	47.23	19.35	19.38	99.8	18.81	39.83
2	Days to maturity	64–84	74.70	9.71	9.88	96.7	14.70	19.68
3	Plant height (cm)	40.47-126.13	77.43	24.11	24.53	96.6	37.79	48.81
4	Number of branches per plant	1.50 -3.03	2.34	19.54	19.82	97.1	0.93	39.66
5	Number of pods per plant	1.53-55.60	21.89	63.00	63.33	99.0	28.26	129.11
6	Number of seeds per pod	8-11.67	10.17	9.20	10.22	81.2	1.74	17.09
7	Pod length (cm)	2.46-10.22	7.41	12.92	14.02	84.9	1.82	24.51
8	100-seed weight (g)	2.45-5.41	3.63	12.09	12.20	98.2	0.89	24.68
9	Biological yield per plant (g)	12.20–104.33	44.04	46.26	46.64	98.4	41.62	94.52
10	Harvest Index (%)	1.10- 38.41	19.16	53.31	54.09	97.1	20.74	108.25
11	Seed yield per plant (g)	0.47-26.07	9.07	80.95	81.22	99.3	15.07	166.17

with high genetic advance as a percent of mean was recorded for seed yield per plant, number of pods per plant, harvest index, biological yield per plant, plant height, days to 50% flowering, number of branches per plant, 100-seed weight and pod length. These traits are governed by additive gene effects and therefore, may be improved through direct selection. Similar findings were reported by Gadakh *et al.* (2013), Tiwari *et al.* (2014), Choudhary *et al.* (2017), Shiv *et al.* (2017), Kumar (2023) and Kumar *et al.* (2024).

Genotypes/ varieties exhibited higher seed yield along with other desirable traits were 'Ganga-1', 'MUM-2', 'COGG-912', 'Keshwanand Mung-1','RMG-268','GM-4','SML-668','RMG-492', 'Samrat','MH 2-15','MH-421','ML-683','IPM 205-7', 'GAM-5', 'SML-832', 'RMG-344', 'IPM 99-125', 'IC-39409', 'Keshwanand Mung-2', 'Ganga-8', 'RMG-62', 'IPM 02-14' and 'IC-39288'. Besides quantitative traits, all these genotypes were also found early in flowering and maturity, which are considered the most desirable traits for crop cultivation in the arid zone. Mungbean is a self-pollinated crop, therefore; all above mentioned varieties/genotypes could directly be used for cultivation under irrigated normal soil and water situation of the arid zone as well as in future breeding programmes to develop superior varieties.

The result of this study revealed that the morphological traits like seed yield per plant, number of pods per plant, harvest index, biological yield per plant, and plant height had a high degree of genetic variability along with high heritability and high genetic advance as per cent of mean; which indicates that these characters were under the control of additive gene action and therefore, form the basis of selection for the mung bean improvement program.

REFERENCES

Bhutia GM, Lal and Thomas N. 2016. Studies on genetic variability, correlation and path analysis in green gram [*Vigna radiata* (L.) Wilczek] germplasm. International Journal of Agriculture Science **8**(51): 2267-2272.

Bisht N, Singh DP and Khulbe RK. 2014. Genetic variability and correlation studies in advance interspecific and intervarietal lines and cultivars of mungbean [*Vigna radiata* (L.) Wilczek]. Journal of Food Legume **27**(2): 155-157.

Burton GW. 1952. Quantitative Inheritance in Grasses. Proceedings, 6th International Grassland Congress **1**: 277-285.

Choudhary P, Payasiand SK and Patle NK. 2017. Genetic study and selection indices for grain yield of mungbean. Legume Research **40**(5): 836-841.

Degefa I, Petros Y and Andargie M. 2014. Genetic variability, heritability and genetic advance in mungbean (*Vigna radiata* (L.)Wilczek) accessions. Plant Science Today **1**(2): 94-98.

Gadakh SS, Dethe AM and Kathale MN. 2013. Genetic variability, correlations and path analysis studies on yield and its components in mungbean [*Vigna radiata* (L.) Wilczek]. Bioinfolet **10**(2): 441-447.

Hemavathy AT, Shunmugavalli N and Anand N. 2015. Genetic variability, correlation and path coefficient studies on yield and its components in mungbean [*Vigna radiata* (L.) Wilczek]. Legume Research **38**(4): 442-446.

Johnson HW, Robinson HF and Comstock RE. 1955. Estimation of genetic and environmental variability in soybeans. Agronomy Journal **47**: 314-318.

Kumar A, Kamaluddin, Sharma V, Singh HC, Kumar H, Mourya AK, Kumar A. 2024. Genetic variability and characters of association for yield and its components in pigeon pea. Journal of Food Legumes **36**(1): 16-22.

Kumar V. 2023. Genetic Relationship and Assessment of Variability of Mungbean [*Vigna radiata* (L.) Wilzek] Genotypes Based on Morphological Traits. Legume Research **46**(12): 1578-1582.

Lush JL. 1940. Intrusive collection of regression of offspring on dams ASA method of estimating heritability of characters. Proceedings American Society of Animal Production **33**: 293-301.

Makeen K, Abrahim G, Jan A and Singh AK. 2007. Genetic variability and correlation studies on yield and its component in mungbean [*Vigna radiata* (L.)]. Journal of Agronomy **6**(1): 216-218.

Panse VG and Sukhatme PV. 1985. Statistical Methods for Agricultural Workers, I.C.A.R., New Delhi. 357 pp.

Prasanthi G, Jayalakshmi V, Trivikrama Reddy A and Khayumahammed S. 2024. Genetic variability parameters and character association studies among phenological traits, yield traits and quality traits under different dates of planting in chickpea. Journal of Food Legumes **36**(2 & 3): 126-135.

Sharma NK. 2016. Mungbean production strategy. Swami Keshwanand Rajasthan Agricultural University, Bikaner. DOR/SKRAU/NFSM Publication-2. 19 pp.

Shiv A, Ramtekey V, Vadodariya GD, Modha KG and Patel RK. 2017. Genetic variability, heritability and genetic advance in F_3 progenies of mungbean [*Vigna radiata* (L.) Wilczek]. International Journal of Current Microbiology and Applied Sciences **6**(12): 3086-3094.

Singh C, Singh P and Singh R. 2015. Modern Techniques of Raising Field Crops. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. 386 pp.

Tiwari A, Mishra SP and Nag SK. 2014. Genetic variability, heritability and genetic advance studies for yield and its components in mungbean [*Vigna radiata* (L.) Wilczek]. Trends in Biosciences **7**(1): 58-60.