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Research Article

GENETIC VARIABILITY, CORRELATION AND PATH ANALYSIS IN MUNGBEAN (*Vigna radiata* (L.) Wilczek)

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Abstract: *Vigna radiate*, a plant species, belongs to the legume family commonly known as mungbean is important not only for nutritious point of view but also economic point of view for pulse growers in India. This research, thus, concentrated on the studies on genetic variability, correlation and path analysis in mungbean (*Vigna radiata* (l.) wilczek) for developing high yielding variety. The estimates of genotypic coefficient of variability, heritability and genetic advance were high for seed yield per plant, 100-seed weight, number of seeds per pod, number of pods per plant and number of nodes on main stem. A positive and significant correlation was noticed with number of pods per plant, 100-seed weight, days to first picking maturity, primary branches per plant and number of pods per cluster. Path coefficient analysis is indicated that number of pods per plant, number of seeds per pod, number of clusters per plant had maximum direct contribution on seed yield. The analysis of variant indicates that the mean square due to treatments is highly significant for all the character at 1 % level of significant.

Keywords: *Mungbean, Genetic Variability, Heritability, Path analysis*

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Introduction

Mungbean (*Vigna radiata* (L)Wilczek) is an economically most important pulse crop of India [1]. In India mungbean is grown in area about 4.5 million ha with massive production volume of 2.6 MT. The productivity of mungbean in India is about 548 kg/ha [2]. Various characters are associated with the yield (*i.e.* complex character) and are interrelated to each other. For the development of new higher yielding variety, the information about genetic variability is very essential and utmost important in the available germplasm. To accumulate optimum contribution of yield contributing characters, it is essential to know the association of various characters along with path coefficients. The main objectives of this present study were undertaken to examine the nature and magnitude of genetic variability and association among characters in mungbean.

Materials and Methods

The experimental material comprising of 64 genotypes (8 Parents *viz*. Pusa baisakhi, Pant mung-2, Pant M-3, Pusa bold (visal), Pusa-105, ML-613, Narendra mung-1 and P.S.-16 and their diallel F1 cross and F2) were grown in a randomized block design with three replications at Crop Research Farm, Post Graduate College, Ghazipur, U.P. India, during *Kharif* 2018-2019. Each plot consisted of two rows of three meters length with plant to plant and row to row 10 cm and 30 cm respectively. For the data collection five plants were selected randomly in each row. The observations were recorded on the characters such as days to 50% flowering, days to first picking maturity, plant height (cm), primary branches per plant, number of nodes on main stem, number of clusters per plant, number of pods per cluster, pod length (cm), number of pods per plant, number of seeds per pod, 100-seed weight (g), protein content in seeds and seed yield per plant (g). The mean values were used for estimation of genotypic and phenotypic coefficients of variation, heritability in broad sense and genetic advance as percentage of mean according to Johnson, *et al.,* (1955) [3]. Correlation and path analysis were done in this study according to Dewey and Lu (1959) [4].

Results and Discussion

The analysis of variance revealed highly significant differences among all the genotypes for all characters. Johnson, *et al.,* (1955) [3] has suggested that GCV (genotypic coefficient of variation) together with heritability would give best picture of amount of advance to be expected from selection. Seed yield per plant, 100 seed weight, number of seeds per pod, number of pods per plant, 100-seed weight, number of seeds per pod, number of pods per plant and number of nodes on main stem exhibited high estimates of GCV (genotypic coefficient of variation), PCV (phenotypic coefficient of variation) heritability, genetic advance and genetic advance as percentage of mean [Table-1]. As the traits shown in [Table-1] have great response due their high genetic variability, thus these traits can be used for the selection purposes. This study shows close conformity to the Parameswarappa, (2005) [5].

In their study they have reported that mungbean seed yield expressed high genetic advance when coupled with genotypic coefficient of variation and high heritability. For days to 50% flowering and days to first picking maturity [Table-1], higher heritability with low GCV, PCV and genetic advance were recorded during the observation. High heritability with moderate genetic advance, GCV, PCV for number of nodes on main stems, clusters per plant, plant height and number of pods per cluster indicate their limit scope in the improvement through selection due to presence of moderate variability.

Phenotypic and genotypic correlations between all pairs are displayed in [Table-2]. In this Table genotypic correlations were found higher than the phenotypic correlations in this research for all most of the cases. Further, this study also indicates that the environmental influences were not marked enough to alter the degree of association of all the characters. Seed yield per plant possessed highly significant positive correlation with number of pods per plant, 100 seed weight, days to first picking maturity, primary branches per plant and number of pods per cluster. Days to 50% flowering showed positive significant correlation with days to first picking maturity.

Table-1 *Estimation of grand mean, range, coefficient of variation. Heritability, Genetic advance and genetic advance as percentage of mean for different characters of mungbean*

Character	Grand Mean	Range	Coefficient of variation		Heritability	Genetic advance	Genetic advance at % of Mean
			GCV	PCV			
Days to 50% Flowering	37.19	34.33 - 42.67	4.36	4.76	0.839	3.06	8.22
Day to first picking maturity	69.61	62.89 - 73.11	2.83	3.16	0.803	3.64	5.22
Plant height	40.92	39.44 - 44.78	2.42	2.95	0.675	1.68	4.10
Primary branches/ plant	3.13	2.22 - 3.89	11.74	16.33	0.517	0.54	17.25
No. of Nodes on main stem	6.82	5.44 - 8.22	8.46	10.69	0.626	0.94	13.78
No. of Clusters/ plant	14.81	11.89 - 17.33	7.14	8.61	0.689	1.81	12.22
No. of Pods/ Cluster	4.11	2.89 - 5.34	12.36	16.70	0.548	0.77	18.73
Pod length	7.11	6.33 -7.90	4.53	7.69	0.347	0.39	5.48
No. of Pods/ plant	57.25	42.00 - 63.88	9.45	9.62	0.966	10.96	19.14
No. of Seeds/ pod	6.52	5.21- 8.33	10.33	13.30	0.604	1.08	17.28
100 seed weight	3.18	2.00-4.13	11.31	14.18	0.637	0.59	18.55
Protein content in seed	21.21	20.16 - 22.67	2.75	3.64	0.571	0.91	4.29
Seed yield/ plant	12.97	06.93 -16.40	18.10	18.78	0.929	4.66	35.92

Table-2 *Genotypic(G) and Phenotypic (P) correlation among the 13 characters in mungbean*

Character		Days to first picking maturity	Plant height	Primary branches/ plant	No. of nodes on main stem	No. of Clusters/ plant	No. of Pods/ cluster	Pod length	No. of Pods/ plant	No. of Seeds/ pod	100 seed weight	Protein content in seed	Seed yield / Plant
Days to 50% Flowering	G	0.486**	-0.001	-0.217	0.174	-0.475**	-0.247*	0.341**	-0.372**	0.006	0.151	0.188	-0.252*
	P	0.395**	-0.006	-0.114	0.135	-0.364**	-0.191	0.236	-0.335**	0.001	0.124	0.119	-0.216
Days to first picking maturity	G		-0.187	-0.276*	0.291*	0.039	-0.205	0.377**	-0.564**	-0.025	0.428**	0.038	0.558**
	P		-0.133	-0.163	0.216	0.034	-0.191	0.156	-0.497**	0.002	0.318*	0.048	0.454**
Plant height	G			0.239	0.140	-0.196	0.300*	0.260*	0.0263*	0.138	-0.083	0.203	0.286*
	P			0.129	0.135	-0.127	0.119	0.075	0.209	0.097	-0.035	0.126	0.243
Primary branches/ plant	G				0.097	0.074	0.386**	-0.036	0.302*	0.050	-0.199	0.106	0.402**
	P				0.080	0.091	0.200	0.091	0.215	0.020	-0.111	0.045	0.265*
Number of nodes on main stem	G					0.076	0.168	0.437**	-0.159	0.289*	0.198	-0.082	-0.064
	P					0.062	0.045	0.208	-0.123	0.133	0.096	-0.050	-0.027
No. of Cluster/plant	G						0.211	-0.244	0.065	-0.164	0.034	-0.371**	-0.024
	P						0.144	-0.116	0.060	-0.051	0.044	-0.262*	-0.038
No. of Pods/cluster	G							0.128	0.305*	0.065	-0.175	-0.059	0.361**
	P							0.090	0.225	0.029	-0.097	-0.065	0.265*
Pod length	G								-0.452**	-0.101	0.418**	-0.197	-0.369**
	P								-0.252*	-0.010	0.126	-0.124	-0.216
No. of Pods/plant	G									-0.016	-0.489**	0.203	0.905**
	P									-0.017	-0.379**	0.147	0.854**
No. of Seeds/pod	G										0.054	0.018	0.176
	P										0.086	0.011	0.151
100 seed weight	G											-0.156	0.470**
	P											-0.06	0.344**
Protein content in seed	G												0.217
	P												0.148

* Significant at 5% level of significance, ** Significant at 1% level of significance

Table-3 *Direct and indirect effects among their characters towards seed yield in mungbean*

Characters		Days to 50% Flowering	Days to first picking maturity	Plant height	Primary branches/ plant	No. of nodes on main stem	No. of Clusters/ plant	No. of Pods/ cluster	Pod length	No. of Pods/ plant	No. of Seeds/ pod	100 seed weight	Protein content in seed	G & P Correlation with yield/plant
Days to 50% Flowering	G	0.160	-0.062	0.000	-0.025	-0.005	-0.023	-0.011	0.035	-0.328	0.001	-0.004	0.008	-.252*
	P	0.078	-0.018	0.000	-0.009	0.008	0.027	-0.013	-0.013	-0.273	0.001	-0.003	-0.001	-0.216
Days to first picking maturity	G	0.078	-0.127	0.012	-0.032	-0.008	0.002	-0.009	0.039	0.497	-0.005	-0.012	0.002	0.558**
	P	0.031	-0.045	-0.003	-0.013	0.013	-0.003	-0.013	-0.008	0.405	0.000	-0.008	0.000	0.454**
Plant height	G	0.000	0.024	-0.066	0.028	-0.004	-0.009	0.014	0.027	0.232	0.029	0.002	0.009	0.286*
	P	0.000	0.006	0.021	0.010	0.008	0.009	0.008	-0.004	0.170	0.015	0.001	-0.001	0.243
Primary branches/ plant	G	-0.035	0.035	-0.016	0.115	-0.003	0.004	0.018	-0.004	0.226	0.011	0.005	0.005	0.402**
	P	-0.009	0.007	0.003	0.077	0.005	-0.007	0.014	-0.005	0.175	0.003	0.003	0.000	0.265*
Number of nodes on main stem	G	0.028	-0.037	-0.009	0.011	-0.026	-0.004	0.008	0.045	-0.140	0.061	-0.005	-0.004	0.064
	P	0.011	-0.010	0.003	0.006	0.058	-0.005	0.003	-0.011	-0.100	0.020	-0.002	0.000	-0.027
No. of Cluster/plant	G	-0.076	-0.005	0.013	0.009	-0.002	0.048	0.010	-0.025	0.057	-0.035	-0.001	-0.016	-0.024
	P	-0.029	-0.002	-0.003	0.007	0.004	-0.074	0.010	0.006	0.049	-0.008	-0.001	0.002	-0.038
No. of Pods/cluster	G	0.040	0.026	-0.020	0.045	-0.004	0.010	0.046	0.013	0.268	0.014	0.005	-0.003	0.361**
	P	-0.015	0.009	0.003	0.015	0.003	-0.010	0.070	-0.005	0.180	0.004	0.002	0.000	0.256*
Pod length	G	-0.055	-0.048	-0.017	-0.004	-0.011	-0.012	0.006	0.103	-0.399	-0.022	-0.012	-0.009	-0.369**
	P	-0.019	-0.007	0.002	0.007	0.012	0.009	0.006	-0.054	-0.205	-0.002	-0.003	0.001	-0.216
No. of Pods/plant	G	-0.060	0.072	-0.017	0.035	0.004	0.003	0.014	-0.046	0.881	-0.003	0.014	0.009	0.905**
	P	-0.026	0.022	0.004	0.016	-0.007	-0.004	0.016	0.014	0.841	-0.003	0.009	-0.001	0.854**
No. of Seeds/pod	G	0.001	0.003	-0.009	0.006	-0.008	-0.008	0.003	-0.010	-0.014	0.213	-0.001	0.001	0.176
	P	0.000	0.000	0.002	0.002	0.008	0.004	0.002	0.001	-0.014	0.149	-0.002	0.000	0.151
100 seed weight	G	0.024	-0.054	0.005	-0.023	-0.005	0.002	-0.008	-0.043	0.431	0.011	-0.028	-0.007	0.470**
	P	0.010	-0.014	-0.001	-0.008	0.006	-0.003	-0.007	-0.007	0.308	-0.013	0.024	0.000	0.344**
Protein content in seed	G	0.030	-0.005	-0.013	0.012	0.002	-0.018	-0.003	-0.020	0.179	0.004	0.004	0.044	0.217
	P	0.009	-0.002	0.003	0.003	-0.003	0.019	-0.005	0.007	0.119	0.002	0.001	-0.006	0.148
Residual (G) = 0.1057		Residual (P) = 0.2147												

Similarly, protein content had negative and significant correlation with number of clusters per plant; number of pods per plant with days to 50% flowering, days to first picking maturity and pod length; number of clusters per plant with days to 50% flowering. Similar result has been reported by Hussain, *et al*., (2003) [6], Ahmed, *et al.,* (1981) [7], Prakash, (2006) [8], Verma and Garg (2007) [9].

Path coefficient analysis revealed that the trait, number of pods per plant had high positive direct effect on seed yield followed by number of seeds per pod and days to 50% flowering [Table-3].

These traits also recorded strong positive correlation with seed yield per plant which are in accordance with the result of Rao, *et al.*, (2006) [10]. The residual effect is low (0.214) indicating appropriateness of characters chosen. Number of clusters per plant, pod length, days to first picking maturity and protein content had negative direct effects.

Days to First picking maturity, plant height, primary branches per plant, number of pods per cluster, 100 seed weight, protein content in seed recorded high positive indirect effect on seed yield via number of pods per plants. These findings are in agreement with Rao, *et al.*, (2006) [10], Verma and Garg (2007) [9], Prakash (2006) [8]. Hence number of pods per plant, days to first picking maturity, primary branches per plant, number of pods per cluster and 100-seed weight are the most important yield contributing components as they recorded high direct and indirect effects towards seed yield in mungbean.

Application of research: This information could be beneficial for selection and the development of new higher yielding varieties of mungbean.

Abbreviations: GCV: Genotypic Coefficient of Variation;
PCV: Phenotypic Coefficient of Variation

Research Category: Genetics and Plant Breeding

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Study area / Sample Collection: Crop Research Farm, Post Graduate College, Ghazipur

Cultivar / Variety / Breed name: Mungbean (*Vigna radiata* (L.) Wilczek)

Conflict of Interest: None declared

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