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Correlation and path analysis for quantitative traits in greengram

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ABSTRACT

The present study was carried out during *the summer*, 2021 to study the association among the characters and to determine the direct and indirect effects of different yield attributes on seed yield among thirty greengram genotypes. The experiment was laid out in randomized block design (RBD) with three replications. The analysis of variance showed significant variation among the test genotypes for all the traits studied. Association among the characters was studied by correlation coefficients analysis, and path analysis was carried out to determine the direct and indirect effects of different yield attributes on seed yield among thirty greengram genotypes. The association study result indicated close correspondences between phenotypic and genotypic correlation coefficients (direction remaining the same), indicating an almost negligible masking effect of environment on character association and, thus, providing reliability of selection at the phenotypic level. The characters like plant height, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, and 100-seed weight exhibited a significant positive correlation with seed yield per plant both at phenotypic and genotypic levels, indicating their importance for genetic improvement of productivity in greengram. The path analysis revealed that the number of pods per plant, days to maturity, and 100-seed weight are the most prominent characters contributing directly to seed yield. Also, characters *viz.*, plant height, number of clusters per plant, pod length, and number of seeds per pod were found to contribute indirectly through different component traits for seed yield. These characters could be considered important yield attributes for practicing selection in greengram.

Key words : *Correlation, Greengram, Path analysis, Yield attributes*

Introduction

One of the most important edible legume crops is the mung bean (*Vigna radiata* L.), which is cultivated on more than 6 million hectares worldwide (about 8.5% of the world's pulse area) and is primarily consumed by Asian households. Mung bean, otherwise known as greengram, is a staple food in the Indian diet and contains 23% protein rich in lysine, minerals as well as vitamins meeting the dietary needs of the vegetarian population. It is widely grown throughout the nation because of its quick growth, low water demand, soil fertility restoration through biological nitrogen fixation, ability to reduce greenhouse gas emissions, and increased carbon sequestration. In India, greengram's optimum time of sowing is the first fortnight of July as a *kharif* crop and from March to April as a *summer* crop. In India, it occupies 29.03 million hectares of area with average productivity of 8.06 quintals/ha. Andhra Pradesh, Odisha, Maharashtra, Madhya Pradesh, and Rajasthan are the major greengram-producing states in India. In Odisha, its productivity is 559 kg/ha (Economic Statistics Bureau, 2019). Although greengram is recognized as an important legume crop, its yield and productivity levels are still too low to satisfy people's nutritional requirements. The lower yield and productivity of this crop are mainly due to its sowing on marginal and sub-areas as rainfed crops, lack of high-yielding genotypes, negligence in crop production measures, and occurrence of different biotic and abiotic stresses. The primary step in any crop improvement programme is to evaluate and characterize the available genotypes for genetic variability. Correlation study helps to understand the association between yield and yield attributes, which ultimately helps in the realization of higher crop productivity. Path analysis helps to measure the direct and indirect contributions of independent variables to the dependent ones. It splits the correlation coefficient into two components, i.e., direct and indirect effects. Correlation and path analysis will describe the extent of association between seed yield and its attributes and also indicate the relative importance of their direct and indirect effects. The knowledge of existing genetic variability among the genotypes for different characters and the estimation of character association is important to make the selection programme effective.

Materials and Methods

The experimental materials used in the present investigation consisted of thirty greengram genotypes. The test genotypes were collected from the Centre for Pulses Research, OUAT, Brahmapur, and evaluated at Agricultural Research Station, Faculty of Agriculture, Siksha 'O' Anusandhan (Deemed to be University), Binjhagiri, Bhubaneswar during February 2021. The experiment was laid out in randomized block design (RBD) with three replications using 30 genotypes of greengram. The experimental materials were sown in three-row plots of 2.25 square meters with row-to-row distance of 30 cm and plant-to-plant spacing of 10 cm. A light irrigation was given after sowing to get good germination. The recommended crop management practices were followed, including need-based plant protection to raise a normal crop. Observations were recorded in respect of nine quantitative traits. Out of the nine traits, days to 50% flowering and days to maturity were recorded on a plot basis, and for the rest of the seven characters, observations were recorded on five competitive plants selected randomly from the middle rows of each plot in each replication.

The analysis of variance was carried out separately for each trait following the procedures of randomized block design analysis (Panse and Shukhatme, 1954). Phenotypic and environmental correlations between character pairs were computed according to Robinson *et al*., 1951; Johnson *et al*., 1955 and Al-Jibouri *et al*., 1958. The path coefficients were obtained by solving the following simultaneous equations, which give the basic relationship between correlations and path coefficients in a system of correlated causes (Wright, 1921 and Dewey and Lu, 1959).

Results and Discussion

The analysis of variance showed significant variation among the test genotypes for all the traits studied. The results indicated that the genotypic correlation coefficients, in general, were higher than the phenotypic correlation coefficients (Table 1). The seed yield per plant was positively correlated with plant height, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, and 100-seed weight both at genotypic and phenotypic levels, whereas days to 50% flowering and days to maturity displayed non-significant association with seed yield per plant both at genotypic and phenotypic levels. The days to 50 % flowering was positively correlated with days to maturity and plant height both at genotypic and phenotypic levels. The days to 50 % flowering exhibited non-significant association with the number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, and 100-seed weight. The days to maturity was positively correlated with plant height, pod length, and number of seeds per pod. The association of days to maturity with the number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, and 100-seed weight was non-significant. The rest of the component traits exhibited significant positive association among them both at genotypic and phenotypic levels.

The association study result indicated close correspondences between phenotypic and genotypic correlation coefficients (direction remaining same), indicating almost negligible masking effect of environment on character association and, thus, providing reliability of selection at the phenotypic level. In the present investigation, plant height, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, and 100-seed weight exhibited significant positive correlations with seed yield per plant, indicating their importance for genetic improvement of productivity in greengram. A highly significant and positive correlation between seed yield and number of pods per plant was also noticed by Yadav *et al.,* 2017; Ramakrishnan *et al*., 2018; Sandhiya and Saravanan, 2018 and Mohan *et al.,* 2019 observed a positive association among seed yield per plant with number of pods per plant, clusters per plant and seeds per pod.

The merit of any of these characters is further ascribed to their positively correlated response through other component traits. In the present investigation, days to 50 % flowering was positively correlated with days to maturity and plant height. The days to maturity was positively correlated with plant height, pod length, and number of seeds per pod. The rest of the characters, like plant height, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, and 100-seed weight, displayed significant positive correlations among them. The results of correlation studies to assess character association among the nine traits is in partial agreement with the finding of Khajudparn and Tantasawat, 2011; Aijaz *et al.*, 2013; Singh and Kumar, 2014; Yadav *et al.*, 2017; Sandhiya and Saravanan, 2018 and Ramakrishnan *et al*., 2018.

The path coefficient analysis helps in the analysis of the association of seed yield with direct and indirect components to interpret the cause-and-effect relationship. At the phenotypic level, number of pods per plant (0.478), days to 50% flowering (0.365), 100-seed weight (0.238), number of clusters per plant (0.138), plant height (0.102) showed a direct positive effect on seed yield whereas the direct effect of days to maturity on seed yield per plant (-0.319) was negative (Table 2). The indirect effects were recorded as small and nominal for many character pairs with a few exceptions. The days to maturity had a higher positive indirect effect via days to 50% flowering (0.302). The plant height displayed maximum positive indirect effect via number of pods per plant (0.306) and 100-seed weight. Higher positive indirect effect was contributed by number of seeds per pod (0.149), number of pods per plant (0.147), pod length (0.120), number of clusters per plant (0.119) and plant height (0.101) via 100-seed weight on seed yield. Similarly, a higher positive indirect effect was noticed by plant (0.306), number of clusters per plant (0.260), pod length (0.255), number of seeds per pod (0.355), and 100-seed

Table 1. Genotypic (r_g) and phenotypic correlation (r_p) among nine characters in greengram

Characters	Correlation coefficient	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of clusters perplant	Number of pods per plant	Pod length (cm)	Number of Seeds per pod	100-seed weight (g)
Days to maturity	r_g	0.987**							
	r_p	0.828**							
Plant height (cm)	r_g	0.350**	0.363**						
	r_p	0.292**	0.278**						
Number of clusters per	r_g	0.156	0.153	0.669**					
plant	r_p	0.066	0.114	0.507**					
Number of pods per	r_g	-0.134	-0.073	0.743**	0.698**				
plant	r_p	-0.119	-0.073	0.641**	0.543**				
Pod length (cm)	r_g	0.136	0.300**	0.292**	0.472**	0.615**			
	r_p	0.122	0.272**	0.253*	0.357**	0.535**			
Numberof seeds per	r_g	0.146	0.275**	0.661**	0.564**	0.831**	0.801**		
pod	r_p	0.158	0.226*	0.587**	0.426**	0.742**	0.709**		
100-seed weight (g)	r_g	-0.038	-0.014	0.459**	0.629**	0.718**	0.600**	0.693**	
	r_p	-0.054	-0.011	0.426**	0.500**	0.617**	0.505**	0.626**	
Seed yield per plant (g)	r_g	0.044	0.049	0.752**	0.778**	0.897**	0.547**	0.738**	0.754**
	r_p	0.074	0.004	0.598**	0.571**	0.763**	0.465**	0.631**	0.649**

weight (0.295) via number of pods per plant on seed yield. The residual effect was found to be 0.299 at the phenotypic level.

At the genotypic level, number of pods per plant (0.883), days to maturity (0.777), 100-seed weight (0.288), and number of clusters per plant (0.207) were found to have direct positive effect on seed yield in that order. The direct effects of days to 50% flowering (-0.467), pod length (-0.280), number of seeds per pod (-0.267) and plant height (-0.164) were found negative. However, a positive correlation was noted for seed yield per plant with pod length and number of seeds per pod. The indirect effects were recorded as small and nominal for most of the character pairs, with a few exceptions. It is revealed that days to maturity (-0.461) and plant height (-0.164) exhibited negative indirect effects via days to 50% flowering. Characters, i.e., days to 50% flowering (0.767), plant height (0.282), pod length (0.233), number of seeds per pod (0.214), and number of clusters per plant (0.119) displayed maximum positive indirect effect via days to maturity on seed yield.

The maximum indirect effect was contributed by number of seeds per pod (0.877), plant height (0.784), 100-seed weight (0.758), number of clusters per plant (0.736) and pod length (0.649) via number of pods per plant on seed yield. Similarly, number of pods per plant (0.207), number of seeds per pod (0.200), number of clusters per plant (0.181), and pod length (0.173) exhibited maximum positive indirect effect via 100-seed weight on seed yield. The negative indirect effect was contributed by number of seeds per pod (-0.225), 100-seed weight (-0.168), and number of clusters per plant (-0.132) via pod length on seed yield.

Residual effect was found to be 0.299 and 0.132 at phenotypic and genotypic levels, respectively, thus indicating that 70.1 and 86.8 per cent of total variability was contributed by the above-mentioned variables at phenotypic and genotypic levels, respectively. The path analysis study in the present investigation revealed that number of pods per plant, days to maturity, and 100- seed weight were the most prominent characters contributing directly to seed yield. The characters viz., plant height, number of clusters per plant, pod length, and

Table 2. Path coefficient analysis of direct (diagonal) and indirect effects of various traits on seed yield per plant

Sl. No.	Characters		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100 -seed weight (g)	Correl. with seed yield per plant
1	Days to 50% flowering	Genotypic	**-0.467**	0.767	-0.057	0.032	-0.142	-0.038	-0.039	-0.011	0.044
		Phenotypic	**0.365**	-0.265	0.030	0.009	-0.057	0.010	-0.005	-0.013	0.074
2	Days to maturity	Genotypic	-0.461	**0.777**	-0.059	0.032	-0.077	-0.084	-0.073	-0.004	0.049
		Phenotypic	0.302	**-0.319**	0.028	0.016	-0.035	0.022	-0.008	-0.003	0.004
3	Plant height (cm)	Genotypic	-0.164	0.282	**-0.164**	0.138	0.784	-0.082	-0.177	0.132	0.752**
		Phenotypic	0.107	-0.089	**0.102**	0.070	0.306	0.021	-0.020	0.101	0.598**
4	Number of clusters per plant	Genotypic	-0.073	0.119	-0.109	**0.207**	0.736	-0.132	-0.151	0.181	0.778**
		Phenotypic	0.024	-0.036	0.052	**0.138**	0.260	0.029	-0.015	0.119	0.571**
5	Number of pods per plant	Genotypic	0.063	-0.057	0.023	-0.172	**0.883**	0.172	-0.222	0.207	0.897**
		Phenotypic	-0.043	0.023	0.065	0.075	**0.478**	0.044	-0.026	0.147	0.763**
6	Pod length (cm)	Genotypic	-0.064	0.233	-0.048	0.098	0.649	**-0.280**	-0.214	0.173	0.547**
		Phenotypic	0.044	-0.087	0.026	0.049	0.255	**0.082**	-0.025	0.120	0.465**
7	Number of seeds per pod	Genotypic	-0.068	0.214	-0.108	0.117	0.877	-0.225	**-0.267**	0.200	0.738**
		Phenotypic	0.058	-0.072	0.060	0.059	0.355	0.058	**-0.035**	0.149	0.631**
8	100- seed weight(g)	Genotypic	0.018	-0.011	-0.075	0.130	0.758	-0.168	-0.185	**0.288**	0.754**
		Phenotypic	-0.020	0.004	0.043	0.069	0.295	0.041	-0.022	**0.238**	0.649**

Residual effect: 0.299 (Phenotypic path) Residual effects: 0.132 (Genotypic path) number of seeds per pod were found to contribute indirectly through different component traits on seed yield. Therefore, major emphasis should also be given to number of pods per plant and days to maturity for higher seed yield. Similar results have also been reported by Tabassum *et al.*, 2010; Aijaz *et al.*, 2013; Patel *et al.*, 2014; Pinchhyo *et al.*, 2016; Varma *et al.*, 2018 and Mohan *et al.*, 2019.

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Conflict of interest

The authors declare no conflict of interest.

References

Aijaz, A., Razvi, S.M., Rather, M.A., Gulzafar, Dar, M.A. and Ganie, S.A. 2013. Association andinter-relationship among yield and yield contributing characters and screening against cercospora leaf spot in mungbean (*Vigna radiate* L.). *Academic Journals*. 8 (41): 2008-2014.

Al-Jibouri, H.A., Miller, P.A. and Robinson, H.F. 1958. Genotypic and environmental variances and covariances in an upland cotton cross of inter specific origin. *Agronomy Journal*. 50: 633-636.

Dewey, O.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Journal of Agronomy*. 57: 515-518.

Economic Statistics Bureau, 2019, http://mospi.nic.in/data.

Johnson, H.W., Robinson, H.P. and Comstock, E.R.1955. Estimates of genetic and environmental variability in soybeans. *Agronomy Journal*. 47: 314-318.

Khajudparn, P. and Tantasawat, P. 2011. Relationships and variability of agronomic and physiological characters in mungbean. *African Journal of Biotechnology*. 10:9992-10000.

Mohan, S., Sheeba, A. and Kalaimagal, T. 2019. Genetic diversity and association study in greengram (*Vigna radiata* (L.) Wilczek). *Legume Research*.1: 1-6.

Panse, V.G. and Sukhatme, P.V. 1954. Statistical methods for agricultural workers. *Indian Council of Agricultural Research. New Delhi*.2:381

Patel, S.R., Patel, K.K. and Parmar, H.K. 2014. Genetic variability, correlation and path analysis for seed yield and its components in greengram (*Vigna radiata* (L.) Wilczek). *The Bioscan*. 9(4): 1847-1852.

Pinchhyo, B., Lal, G.M. and Neha, T. 2016. Studies on genetic variability, correlation and path analysis in greengram (*Vigna radiata* (L.) Wilczek) germplasm. *International Journal of Agricultural Sciences*. 8(51): 2267- 2272.

Ramakrishnan, C.K.D, Savithramma, D.L. and Vijayabharathi, A. 2018. Studies on genetic variability, correlation and path analysis for yield and yield related traits in greengram (*Vigna radiata* (L.) Wilczek). *International Journal of Current Microbiology and Applied Sciences*. 7(3): 2753-2761.

Robinson, H.F., Comstock, R.E. and Harvey, P.H. 1951. Genotypic and phenotypic correlations in corn and their implications in selection. *Agronomy Journal*. 43: 282-287.

Sandhiya, V. and Saravanan, S. 2018. Genetic variability and correlation studies in greengram (*Vigna radiata* L. Wilczek). *Electronic Journal of Plant Breeding*. 9(3): 1094-1099.

Singh, J. and Kumar, P. 2014. The inter-relationship of various traits with seed yield in mungbean (*Vigna radiata* (L.) Wilczek). *Electronic Journal of Plant Breeding*. 5(4): 869-874.

Tabassum, A., Saleem, M. and Aziz, I. 2010. Genetic variability, trait association and path analysis of yield and yield components in mungbean (*Vigna radiata* (l.) Wilczek). *Pakistan Journal of Botany*. 42(6): 3915-3924.

Varma, N.P., Baisakh, B. and Swain, D. 2018. Study on genetic variability, correlation and path coefficient analysis for yield and component traits in greengram. *International Journal of Current Microbiology and Applied Sciences*. 7(10): 3429-3436.

Wright, S. 1921. Correlation and causation. *Journal of Agricultural Research*. 20: 557-585.

Yadav, R, Ram BL, Suresh BG and Lavanya GR. 2017. Studies on genetic variability, character association for yield and yield components in greengram (*Vigna radiata* (L.) Wilczek). *Journal of Pharmacognosy and Phytochemistry*. 6(4): 1988-1991.