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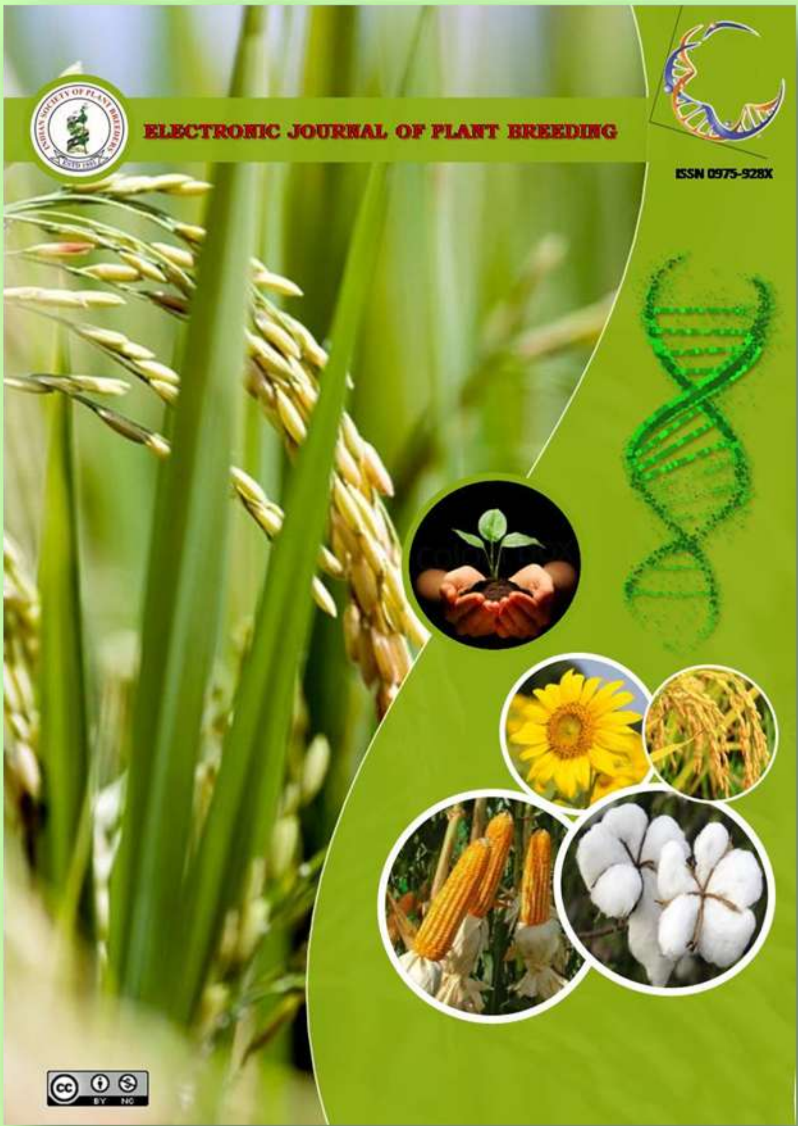

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Research Article

Correlation and path analysis in Blackgram (*Vigna mungo* L.)

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Abstract
A total of 25 genotypes of urdbean were selected and studied for correlation and path effects of seven important yield contributing traits including yield trait. Among the seven traits studied, number of clusters per plant and number of pods per plant had significantly positive correlation with yield. These two traits can be used as a selection index for improving seed yield in blackgram. Number of clusters per plant is direct and highly significant association with the number of pods per plant. Path analysis revealed that number of clusters per plant is the principle component responsible for increasing seed yield in blackgram and it showed high positive significant direct effects on seed yield. The indirect effect of number of pods per cluster and total number of pods per plant were positive on yield. Improving these characters also indirectly helps to improve the yield.

Key words
Blackgram, correlation, direct effects, path analysis, yield components

Introduction

Blackgram (*Vigna mungo*L.Hepper, 2n =22) is one of the important grain legumes cultivated in India for its nutritional quality and suitability to most of the cropping system. This crop originated from South east Asia (Indian sub continent)and mainly grown in tropical and subtropical areas of Asian continent. This is grown as a mixed crop, cash crop, sequential crop besides growing as sole crop under residual moisture conditions, either after the harvest of rice after the harvest of other summer crops under semi irrigated and dry land condition (Parveen *et al.,* 2011). This crop is tolerant to some adverse climatic condition and also improves the soil fertility by fixing atmospheric nitrogen in the soil.

It is mainly grown for human consumption and also used as fodder for cattle and green manure for soil fertility. It is one of the rich sources of vegetative protein, some essential minerals and vitamins for human. Although this crop is more important from the nutritional point of view, there has not been any significant increase in area and production during the period of 1950-51 to 2009-10.Every year India is importing around two lakh tones of pulses from other countries to fulfill the demand of the people. Major constraint in achieving higher yield in blackgram are absence of suitable ideotype for different cropping systems.

For further exploitation inbreeding programs, selection of suitable parents and selection of promising F_1 hybrids are important. The knowledge on interrelationship of plant characters with seed yield and among themselves is of paramount importance to the breeder, for making improvement in complex character like seed yield, for which direct selection is not much effective. Hence, the character association analysis was undertaken to determine the direction of selection and number of characters to be considered in improving the seed yield.

Materials and Methods

This experiment consisted of twenty five advanced cultures of black gram, which are agronomically promising and relatively high yielding with varying morphological characters. All the twenty five genotypes were raised in randomised block design with two replications at Agricultural Research Station, Pattukkottai. Each plot consisted of 12 meter square area (4M x 3 M). The sowing was taken up with a spacing of 15 cm between the plants and 30 cm between the rows. The recommended agronomical and plant protection practices were followed to get a good yield. The observation were recorded on plot basis for the characters *viz.*, days to 50 % flowering, days to 50 % pod maturity, days to maturity and seed yield. The remaining characters *viz.*, plant height, number of clusters per plant and number of pods per plant were recorded based on five randomly selected plants. Genotypic and phenotypic correlation between seven quantitative characters were

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estimated according to Al Jibouri *et al.*, 1958,where as path coefficient analysis was done by the method suggested by Dewey and Lu (1959).

Results and Discussion

Selection based on the detailed knowledge of magnitude and direction of association between yield and its attributes is very important to identify the key characters, which can be exploited in crop improvement through suitable breeding programme. The results on analysis of variance revealed that the variance due to treatment was significant for all the seven characters studied (Table 1). This gives the evidence of magnitude of genetic variability among genotypes were differed significantly. The genotypic and phenotypic correlation coefficients between yield and yield components *viz.*, days to 50 % flowering, days to 50 % pod maturity, days to maturity, plant height, number of clusters per plant and total number of pods per plant were computed and are presented in Table 2. The results revealed that the estimates of genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients for all the traits under study, clearly indicated that the strong inherent association between the traits which might be due to masking or modifying effects of environment.Similar findings were also reported by Bandi *et al.,* 2018.

In the present investigation number of clusters per plant and number of pods per plant showed significantly positive correlation with the grain yield at both phenotypic and genotypic level. It suggested that increase in growth related traits, cluster characters and pod characters might contribute to high yields in black gram.This situation meant that to select high yielding genotypes of black gram, it was essential to consider the above characters with their increasing magnitude. It helped in simultaneous improvement of all the positively correlated characters.Similar kind of positive association of pods per plant, and clusters per plant with seed yield was reported earlier by Chauhan et al. (2007),Rao *et al.* (2006), Veeranjaneyulu*et al.* (2007) and Kanimozhi*et al* (2015).

The other traits under study namely days to 50 % flowering, days to maturity showed positive and non-significant correlation with yield it clearly indicated that these traits had weak association with yield. Whereas the anothertraits *viz.*, plant height and days to 50 % pod maturity showed negative and non- significant correlation with yield.The negative and non-significant association among the traits had a complex linkage relation among the pair of combinations and had a weak association with yield. Similar findings were reported by Sohel *et al.* (2016).

The study on inter relation among the yield contributing characters, days to 50 % flowering recorded significant and positive correlation with days to 50 % pod maturity and days to maturity, plant height. On contrary, Days to 50 % pod maturity and plant height showed non-significantly negative association with clusters per plant and number of pods per plant. This indicated that the slight difference in 50 % pod maturity and plant height will not reflected in yield. Similar kind of association of plant height with number of pods per cluster and total number of pods per plant was reported by Sohel*et al*. (2016), Shivade*et al*(2011).

The estimates of correlation coefficients revealed only the relationship between yield components, but did not show the direct and indirect effects of different traits on yield. This is becausethe attributes which are in association do not exist by themselves, but are linked to other components. But the result of path coefficient analysis for grain yield and yield components can describe genotypic correlations to direct and indirect effects.In the present investigation path coefficient analysis was performed using correlation coefficient to determine the direct and indirect influence of six traits on yield (Table 2).It was observed that number of cluster per plant (0.8970) had the maximum positive direct effects on yield per hectare. Hence, selection based on these traits would be effective in increasing the seed yield. These positive direct effects observed with seed yield were in accordance with earlier findings of Hakim (2008), Venkateshwarlu (2001) and Kanimozhi *et al.* (2015). Remaining traits noticed negligible effect on seed yield per plant. The indirect effect of number of pods per cluster on grain yield was positive through number of pods per plant. The indirect effect of seed yield was positive on all the characters except plant height. The remaining traits had negligible on seed yield. The findings are accordance with the Veeramani *et al.* (2005) and Kanimozhi*et al* (2015).

Residual effect in the present study was 0.0649, which means that the characters in the path analysis expressed the variability in grain yield by 93.51 %and the remaining 6.49 %needs additional characterization for the future breeding program. Similar result was reported by Hallu *et al.,*(2016). Partitioning of correlation values showed that some of the traits could not produce significant correlation with single plant yield which might be either due to very high negative direct effects.

Considering the nature and magnitude of traitassociation and their direct and indirect effects, it can be inferred that simultaneous improvement of grain yield is possible through manifestation of number of clusters per plant and number of pods per plant. Hence, it would be rewarding to lay stress on these characters in selection programme for increasing the grain yield.

Critical analysis of results obtained from character association and path analysis indicated that the number of pods per cluster possessed both positive association and high positive direct effects. Hence, selection for these traits could bring improvement in yield and yield components.

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Table 1. Analysis of variance for 7 different quantitative traits of 25 black gram genotypes

Source of variation	df	Days to 50 % flowering	Days to 50 % pod maturity	Days to maturity	Plant Height	No of clusters/plant	No of pods per plant	Yield/ha
Replication	1	2.00	0.720	1.28	54.08	0.168	25.92	44.18
Genotype	24	3.17**	8.375**	6.37**	66.903**	1.075**	414.138**	38918.63**
Error	24	1.167	1.928	1.82	4.74	0.010	2.378	18.18

Table 2.Phenotypic and Genotypic Correlation coefficient between yield and its related traits in 25 blackgram

		Days to 50 % flowering	Days to 50 % pod maturity	Days to maturity	Plant Height	No of clusters/plant	No of pods per plant	Yield
Days to 50 %	rg	1.000	0.728**	0.585**	0.536**	0.203	0.240	0.141
flowering	rp	1.000	0.638**	0.609**	0.288*	0.122	0.167	0.098
Days to 50 %	rg		1.000	0.607**	0.151	-0.0105	-0.053	-0.164
pod maturity	rp		1.000	0.599**	0.117	-0.0.079	-0.034	-0.130
Days to maturity	rg			1.000	0.058	0.104	0.179	0.051
	rp			1.000	0.051	0.076	0.139	0.041
Plant Height	rg				1.000	-0.194	-0.218	-0.253
	rp				1.000	-0.158	-0.187	-0.234
No of	rg					1.000	0.979**	0.960**
clusters/plant	rp					1.000	0.968**	0.951**
No of pods per	rg						1.000	0.946**
plant	rp						1.000	0.942**

** significant at 1 % level (rp- Phenotypic correlation, rg- genotypic correlation)

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Table 3. Estimates of direct and indirect effects between yield and yield components

	Days to 50 % flowering	Days to 50 % pod maturity	Days to maturity	Plant Height	No of clusters/plant	No of pods per plant	Yield
Days to 50 % flowering	**0.17**	-0.108	-0.032	-0.0755	0.146	0.041	0.1415
Days to 50 % pod maturity	-0.124	**-0.149**	-0.034	-0.021	-0.075	-0.009	-0.412
Days to maturity	0.099	-0.09	**-0.056**	-0.008	0.075	0.031	0.051
Plant Height	0.091	-0.022	-0.003	**-0.141**	-0.14	-0.037	-0.252
No of clusters/plant	0.035	0.015	-0.006	0.027	**0.720****	0.168	0.959**
No of pods per plant	0.04	0.008	-0.01	0.03	0.705**	**0.172**	0.945**

Residual = 0.06491

Table 4. Heritability Percentage

Name of the trait	Heritability Percentage
Days to 50 % flowering	46.195
Days to 50 % pod maturity	62.596
Days to maturity	55.551
Plant Height	86.75
No of clusters/plant	98.106
No of pods per plant	98.85
Yield	99.70

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