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Relationship between Yield and its Components Traits in Inter Sub-Specific Derivatives of *Vigna mungo* x *Vigna mungo* var. *silvestris*

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ABSTRACT

Blackgram (*Vigna mungo* L. Hepper) is one of the important pulse crops in India. The present study was aimed to study the inter-relationship between yield and among related traits in inter sub-specific derived lines of blackgram. Correlation analysis revealed that significant positive association was observed in pods per plant (0.89), clusters per plant (0.74), plant height (0.62), primary branches per plant (0.52), hundred seed weight (0.52), seeds per pod (0.51) and pod length (0.49) with single plant yield at the genotypic level. At the phenotypic level, pods per plant (0.88), clusters per plant (0.69) and plant height (0.54) with a single plant yield. Clusters per plant (0.630), seeds per pod (0.625) and hundred seed weight (0.366) had a positive direct effect on single plant yield. Plant height (0.253) and pods per plant (0.202) had a moderate positive direct effect on single plant yield. Pod length (0.137) and 50 percent flowering (0.106) had a low positive direct effect on single plant yield. Plant height, clusters per plant, pods per plant, seeds per pod and hundred seed weight had a high influence on single plant yield. Hence, emphasis could be given to the above traits during selection for the improvement of yield in blackgram.

Introduction

Blackgram (*Vigna mungo* L, *Hepper*) is an annual leguminous crop that belongs to the family Fabaceae and sub-family Papilionaceae with a chromosome number of 2n=22. It is popularly known as "urdbean, urd or mash", and an excellent source of easily digestible good quality proteins, carbohydrates, calcium and phosphoric acid, also popular for its fermenting action. Besides, being an important source of human food and animal feed, it also plays an important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen. Blackgram is the fourth important pulse crop in India which holds 13 per cent of the total pulse area and contributing about 10 percent to the total pulse production. In India, blackgram is grown an area of 54.39 lakh hectares with a production of 35.26 lakh tonnes and 655 kg/ha productivity (Annual Report, 2017-18).

Generally, pulses are poor yielder due to the cultivation in marginally poor soils and rainfed conditions, narrow genetic diversity, photoperiod sensitivity, indeterminate growth habit, pod shattering and susceptible to pest and diseases. Seed yield is a complex quantitative trait that is influenced by several yield contributing traits.

Correlations are of value to indicate the degree to which various characters are associated with yield. A correlation coefficient is useful in quantifying the magnitude and direction of components influence in the determination of main characters. However, it did not provide the relative importance of direct and indirect effects of such components.

Selections based on simple correlation coefficients without considering interactions among yield and yield components may mislead the breeders to reach their main breeding purposes. Path analysis can be used to calculate the quantitative impact on seedyield through direct and indirect effects caused by one or the other component traits. It provides an effective means of partitioning correlation coefficients into direct and indirect effects and illuminates the relationship in a more meaningful way. Keeping all these things in view, the present study was undertaken to fix the efficient selection criteria for the improvement of yield in blackgram.

Materials and Methods

The experimental material consisted of 191 stabilized lines derived from a cross viz., VBN (Bg) 5 x *Vigna mungo* var. *silvestris* 22/10, a wild progenitor of blackgram. The experiment was laid out in a homogeneous block following randomized block design replicated twice during *rabi*, 2018-2019 at the Department of Pulses, Tamil Nadu Agricultural University, Coimbatore.

The lines were planted in a row of 4 m in length with a spacing of 30×10 cm. The recommended package of practices was followed to raise a healthy crop. Observations on 10 biometrical traits *viz.*, days to 50% flowering, plant height, branches per plant, clusters per plant, pods per cluster, pods per plant, pod length, seeds per pod, hundred seed weight and single plant yield were recorded in three randomly selected plants in the 191 lines.

The mean data was subjected to statistical analysis for the study of correlation and path coefficient analysis (Dewey and Lu, 1959). Statistical analysis was done using statistical software, GENRES 7.01 by pascal intl software solutions.

Results and Discussion

The selection based on the detailed knowledge of magnitude and direction of the association between yield and its component traits is very important to identify the key characters which can be exploited in crop improvement through a suitable breeding programme.

In the present investigation, high significant and positive association was observed for plant height, branches per plant, clusters per plant, pods per plant, pod length, seeds per pod, and hundred seed weight with a single plant yield.

The estimate of the correlation coefficient is furnished in Table 1. The traits with a positive correlation on yield was reported by Sidramappa *et al.,* (2020) for plant height, branches per plant, clusters per plant, pods per plant, pod length, and hundred seed weight; Hadimani *et al.,* (2019) for pods per plant, clusters per plant, pods per plant, pod length, and seeds per plant; Mohanlal *et al.,* (2018) for plant height, clusters per plant, pods per plant, pod length, and seeds per pod; Blessy and Pavan (2018) for clusters per plant, pods per plant, pod length and seeds per pod; Rajasekhar *et al.,*(2017) for branches per plant, clusters per plant, and pods per plant; Suguna *et al.,* (2017) plant height, branches per plant, clusters per plant, pods per plant, pod length, seeds per pod and hundred seed weight;Sohel *et al.,* (2016) for pods per plant, pod length, and hundred seed weight; Kumar *et al.,* (2015) for plant height, branches per plant, clusters per pod, pods per plant, pod length, seeds per pod, and hundred seed weight; Panigrahi *et al.,* (2014) for clusters per plant, pods per plant and hundred seed weight and Konda *et al.,* (2008) for plant height, branches per plant, clusters per plant, pods per plant, pod length, seeds per pod and hundred seed weight. Hence these traits can be utilized in indirect selection to improve the crop yield.

The estimated correlation revealed only the relationship between yield and yield component traits but did not show the direct and indirect effect of different traits on yield.

This is because, the attributes which are in association do not exist by themselves, but linked to other components. The estimate of the path coefficient is furnished in Table 2.

The measurement of the direct and indirect effects was characterized as negligible (0.00 to 0.09), low (0.10 to 0.19), moderate (0.20 to 0.29), high (0.30 to 0.99) and very high (>1.00).

Path coefficient analysis revealed that clusters per plant had a high positive and direct effect on single plant yield followed by seeds per pod, hundred seed weight, plant height, pods per plant, and 50 per cent flowering. The different traits with a positive and direct effect on single plant yield were reported by several authors in blackgram *viz.,* Konda *et al.,* (2008) for clusters per plant, and seeds per pod; Panigrahi *et al.,* (2014) and Shanthi *et al.,* (2019) for clusters per plant; Parveen *et al.,* (2011) for plant height, seeds per pod and hundred seed weight; Rajasekhar *et al.,* (2017) for 50 per cent flowering, and seeds per pod; Sidramappa *et al.,* (2020) for days to fifty per cent flowering and Gowalya *et al.,* (2016) for seeds per pod.

Pods per cluster and pod length showed a low negative direct effect on single plant yield. The negative direct effect indicates that these traits had low association and selection based on these traits would not be effective.

Pods per plant showed a high positive indirect effect on single plant yield through clusters per plant followed by seeds per pod, and plant height.

Plant height showed a high positive indirect effect on single plant yield through clusters per plant followed by seeds per pod, hundred seed weight, and pods per plant. It also showed a high negative indirect effect through branches per plant.

It is very difficult to have complete knowledge of all component traits of yield. Residual effect measures the role of other possible independent variables which were not included in the study on the dependent variables. The residual effect is estimated with the help of direct effects and simple correlation coefficients.

In the present study, the residual effect for direct and indirect effects was0.3702. The high residual effect indicates that besides the characters studied, some other attributes contributes to a single plant yield.

Table.1 Relationship of yield and yield contributing traits in blackgram

		50 percent flowering	Plant height	Branches per plant	Clusters per plant	Pods per cluster	Pods per plant	Pod length	Seeds per pod	Hundred Seed weight	Single plant yield
50 percent flowering	G	1	0.17	0.40	0.09	-0.07	-0.03	-0.08	0.07	0.20	0.08
	P	1	0.10	0.14	0.06	-0.05	-0.03	-0.05	0.06	0.16	0.05
Plant height	G		1	0.72**	0.65**	0.24	0.53**	0.39	0.38	0.42	0.62**
	P		1	0.39	0.57**	0.22	0.47	0.38	0.31	0.32	0.54**
Branches per plant	G			1	0.52**	-0.23	0.14	0.29	0.64**	0.51**	0.52**
	P			1	0.37	0.12	0.27	0.18	0.32	0.13	0.31
Clusters per plant	G				1	0.31	0.82**	0.20	0.15	0.24	0.74**
	P				1	0.35	0.77**	0.17	0.14	0.16	0.69**
Pods per cluster	G					1	0.46	0.07	0.07	0.05	0.39
	P					1	0.46	0.08	0.09	0.01	0.38
Pods per plant	G						1	0.33	0.25	0.23	0.89**
	P						1	0.29	0.25	0.15	0.88**
Pod length	G							1	0.60**	0.46	0.49*
	P							1	0.58**	0.40	0.45
Seeds per pod	G								1	0.39	0.51**
	P								1	0.31	0.49*
Hundred Seed weight	G									1	0.52**
	P									1	0.44
Single plant yield	G										1
	P										1

** significant at 1%.   * significant at 5%.

Table.2 Direct and indirect effects of yield and yield component traits in blackgram.

	Fifty percent flowering	Plant height	Branches per plant	Clusters per plant	Pods per cluster	Pods per plant	Pod length	Seeds per pod	Hundred Seed weight	Correlation with Single plant yield
50 percent flowering	**0.106**	0.041	-0.258	0.058	0.011	-0.006	0.010	0.042	0.071	0.076
Plant height	0.017	**0.253**	-0.463	0.410	-0.037	0.108	-0.054	0.240	0.152	0.626**
Branches per plant	0.042	0.182	**-0.644**	0.329	0.035	0.027	-0.040	0.401	0.190	0.525**
Clusters per plant	0.009	0.164	-0.335	**0.630**	-0.049	0.167	-0.026	0.095	0.087	0.745**
Pods per cluster	-0.007	0.060	0.145	0.198	**-0.155**	0.093	-0.010	0.046	0.018	0.390
Pods per plant	-0.003	0.135	-0.088	0.522	-0.072	**0.202**	-0.045	0.158	0.084	0.897**
Pod length	-0.008	0.099	-0.188	0.123	-0.011	0.066	**-0.137**	0.379	0.167	0.492*
Seeds per pod	0.007	0.097	-0.413	0.096	-0.011	0.051	-0.083	**0.625**	0.141	0.507**
Hundred Seed weight	0.020	0.105	-0.334	0.150	-0.008	0.046	-0.062	0.240	**0.366**	0.526**

Residual effect = 0.3702 Diagonal value are direct effects

Based on correlation and path analysis, clusters per plant, seeds per pod, hundred seed weight, plant height and pods per plant have a high influence on single plant yield. These are the most important traits to be considered for further yield improvement in blackgram.

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