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Genetic Parameters, Associations and Path Analysis in Blackgram* (*Vigna mungo* (L.) Hepper)

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Phenotypic and genotypic coefficients of variability, heritability (broad sense), genetic advance, correlations and path coefficients were studied in 20 strains of blackgram *Vigna mungo* (L.) Hepper). Pod length and plant height were found to have high genotypic coefficients of variation, heritability and genetic advance. High heritability in conjunction with low genetic advance was obtained for seeds per pod 100-seed weight and pods per cluster. The grain yield per plant showed significant positive correlation with number of branches, pods and clusters per plant. Path analysis revea'ed that clusters per plant had maximum positive direct effect on grain yield and it was followed by pods per plant.

Information on the nature and magnitude of variation in the available germplasm and associations of characters with yield and among themselves are necessary for a purposeful programme of breeding. Veeraswamy *et. al.* (1973) reported that due emphasis has to be laid on three characters viz. plant height, pods per plant and yield per plant, while Soundrapandian *et. al.* (1975) stressed the importance of plant height and grain yield for meaningful selections in this crop. Singh *et. al.* (1975) observed that height number of branches, clusters per plant and test weight were the main components of yield.

Little information on these aspects is available in blackgram. An attempt has therefore been made in the present investigation to study the variability, correlations and their direct and indirect effects on some quantitative characters in blackgram.

MATERIAL AND METHODS :

Twenty cultivars of blackgram having diverse origin were grown in RBD with four replications. Each plot consisted of six rows, 5 m. long, with a distance of 30 cm. between rows and 5 cm. within rows. Plot means on per plant basis were used for statistical computation. Coefficients of variation, heritability and gernatic advance, correlation of coefficients and paths analysis were calculated according to standard methods.

RESULTS AND DISCUSSION :

The differences among twenty entries were significant for all the ten characters (Table-1). The range of variability for pods per plant was from

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19.80 to 56.95, for clusters per plant from 16.10 to 30.75 and for grain yield from 4.19 to 13.73 gm. These indicated that material under study contained fairly large variability for yield and its attributes. Comparatively high GCV for pod length, plant height and grain yield per plant suggested greater scope for improvement for these characters. The low variability for seeds per pod, test weight and pods per cluster indicated limited scope of selection for these traits. The small difference between genotypic and phenotypic coefficients of variability with respect to days to flowering, plant height, test weight and seeds per pod indicated less environmental influence on these traits.

The heritability was highest for days to flowering (96.49%) and it was followed by plant height (86.20%). The clusters per plant (66.54%) and test weight (58.00%) had moderate heritability, where as pods per plant, grain yield per plant and branches per plant had low heritability. The high heritability for days to flowering and seed weight and low heritability for grain yield and branches per plant was also reported by Chaudhary *et. al.* (1969). Singh *et.al.* (1975) obtainted moderate estimates of heritability for test weight. Veeraswamy *et. al.* (1973) and Soundrapandian *et. al.* (1975) reported moderate estimates of heritability for grain yield and high values for pod length and plant height in this crop.

A high genetic gain along with high heritability would suggest suitable conditions for making successful selections (Gandhi *et. al.* 1964). The plant height and length of pod showed high heritability as well as high genetic gain. This may be attributed to the additive gene effects (Panse, 1957). It therefore, appears that selections for these characters would be very effective. The clusters per plant (66.54%) and days to flowering (96.49%) which showed high heritability but moderate genetic advance (29.28% and 27.43% respectively) indicated that these characters could be improved by simple selection methods. The pod length appeared to have been more influenced by environment which would reduce selection efficiency. The low or moderate heritability for other characters together with low genetic advance suggested that environmental factors play an important role in the expression of these characters.

It can be observed (Table-2) that the values of genotypic correlations were higher than the phenotypic correlations for most of the combinations which might be due to masking or modifying effects of environment. In case of branches per plant with clusters per plant and grain yield per plant with pods per plant, the phenotypic correlations were higher than the genotypic correlations and the environmental correlations were higher than either of the two which indicated that these traits were more influenced by environment.

The test weight was strongly and negatively associated with the number of pods, clusters and branches per plant alongwith seed yield. This suggested that any increase in test weight would result in corresponding reduction in number of branches, clusters and pods per plant which appeared to be important yield components. Thus, it would be rather difficult to combine the characters of large seed size with more number of branches, clusters and pods per plant. It might be possible if linkages between these characters could be broken. Similar results were reported by Reddy (1977).

Seed yield is a very complex characters directely, as well as indirectly *viz*. other component traits. Hence, path analysis was used to determine the direct and indirect effects of various characters on yield. These relationships are shown in Table-3.

A perusal of the results obtained in path analysis revealed that the maximum direct effect on seed yield was exerted by clusters per plant (0.4900) and it was followed by pods per plant (0.4239), branches per plant (0.2983) and seed weight (0.2436). The seed weight in the present study showed a negative correlation with grain yield, but the path analysis revealed positive direct contribution. The negative correlation of this character with yield was probably due to it's indirect contribution through number of pods, branches and clusters per plant. Thus, the number of pods clusters and branches per plant alongwith seed weight appeared to be the major component characters for yield improvement in blackgram. This finding is in agreement with that of Singh *et. al*. (1976).

In the present study, the residual effect was of low magnitude (0.1095) suggesting that most of the important components contributing to seed yield have been utilized in this analysis.

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Table-1. Principal genetic Parameters obtained in medium duration blackgram strains.

Charater	Mean	SE	Phentypic Range.	Heritability %	PCV %	GCV %	Genetic Advance % of mean
Days to flowering	45.6	±0.5	36.7 to 56.7	96.4	13.7	13.5	27.4
Height of plant (cm)	61.3	±4.4	34.0 to 94.0	86.2	38.5	35.8	68.5
Branches per plant	2.4	±0.2	1.7 to 3.5	30.8	23.0	12.7	14.8
Clusters per plant	21.5	±1.3	16.1 to 30.7	66.5	21.3	17.4	29.2
Pods per plant	39.6	±5.9	19.8 to 56.9	20.7	33.4	15.2	14.3
Pods per cluster	2.3	±0.1	1.6 to 2.7	42.6	14.3	9.6	12.5
Length of pod (cm)	4.7	±1.0	4.4 to 5.3	46.9	59.2	40.5	57.2
Seeds per pod	6.9	±0.1	6.3 to 7.5	42.7	7.4	4.9	6.6
100-Seed weight (gm)	4.7	±0.1	4.1 to 5.2	58.0	7.5	5.9	9.0
Seed yield per plant (gm)	9.7	±1.5	4.17 to 13.7	25.3	37.0	18.6	19.3

GCV = Genatic coefficient of variation
PCV = Phenotypic coefficient of variation.

Table-2 Genotypic (rg.), Phenotypic (rp) and Environmental (re) correlation coefficients.

		1	2	3	4	5	6	7	8	9
1	rg		-0.32	-0.08	0.61**	0.88**	0.86**	-0.17	0.21	-0.57**
	rp		-0.01	-0.10	0.48*	0.77**	0.90**	0.07	0.20	-0.21
	re		0.60**	-0.19	0.43	0.80**	0.94**	0.21	0.19	-0.12
2	rg			0.70**	-0.00	-0.17	-0.59**	0.56**	0.58**	0.65**
	rp			0.63**	0.07	-0.06	-0.04	0.39	0.41	0.25
	re			-0.10	0.48*	0.84**	0.80**	0.18	0.09	-0.12
3	rg				-0.01	-0.20	-0.59**	0.88**	0.68**	0.64**
	rp				0.07	0.12	-0.14	0.57**	0.44	0.26
	re				0.26	0.10	-0.05	0.15	0.09	-0.17
4	rg					0.64**	0.63**	0.08	0.19	0.61
	rp					0.06**	0.59**	0.00	0.24	-0.12
	re					0.91	0.61**	0.03	0.28	0.03
5	rg						0.97**	0.40	-0.02	-0.64**
	rp						0.90**	0.00	0.08	-0.35
	re						0.88**	0.51**	0.22	-0.20
6	rg							0.56**	0.03	-0.77**
	rp							0.01	0.13	-0.35
	re							0.26	0.18	-0.14
7	rg								0.87**	-0.89**
	rp								0.05	0.04
	re								-0.61**	-0.89**
8	rg									-0.02
	rp									-0.04
	re									-0.02

* and ** significant at 5% and 1% probability level.

1 = Grain yield/plant, 2 = Days to flowering, 3 = Plant height, 4 = Branches/plant, 5 = Clusters/plant, 6 = Pods/plants, 7 = Pod length 8 = Seeds/pod and 9 = 100 grain weight.

Table-3 Direct and indirect effects of some quantitative characters in blackgram.

Variety 7	Days to flowering	Plant height	Branches/plant	Clusters/plant	Pods/plants	100-grain	Genetic correlation with seed yield
Days to flowering	0.015	0.033	0.001	0.084	0.161	0.087	0.321
Plant height	-0.010	0.047	0.004	-0.009	0.125	0.107	0.084
Branch/plant	0.000	-0.000	0.298	0.167	0.227	0.779	0.615
Clusters/plant	0.002	-0.009	0.102	0.490	0.411	-0.108	0.887
Pods/plant	0.006	-0.014	0.159	0.475	0.423	0.188	0.862
100-grain weight	0.005	0.021	-0.295	0.218	0.528	0.243	-0.572

Residual effect : 0.1059 Figures underlined indicates the direct effect.