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Studies on Genetic Variability in Blackgram (*Vigna mungo* (L.) Hepper)

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Abstract
The present experiment was conducted at Field Experimentation Centre, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during *Kharif* 2016 in Randomized Block Design with three replications. The study was undertaken on the 14 blackgram genotypes along with one check (T-9) to study the genetic variability. Analysis of variance showed highly significant differences among (14+1check) blackgram genotypes for 13 quantitative characters studied. High GCV and PCV were recorded for number of clusters per plant, number of primary branches, and number of pods per plant. High heritability coupled with high genetic advance as percentage of mean were recorded for number of clusters per plant, seed index coupled with number of primary branches number of pods per plant.

Keywords: Black gram, variability, heritability, genetic advance as percentage of mean

Introduction
Blackgram (Vigna mungo (L). Hepper, 2n=22), known as urdbean, is an important grain legumes for its nutritional quality and the suitability to any cropping system. India is the world's largest producer as well as consumer of blackgram. It produces about 1.5 to 1.9 million tons of blackgram annually from about 3.5 million hectares of area, with an average productivity of 500 kg per hectare. Blackgram output accounts for about 10% of India's total pulse production (Ministry of Agriculture, Govt. of India, 2015). Blackgram has the potential of supplying a major portion of protein demand and restoring the soil health at the same time. Heritability of a character is important for the blackgram breeder because it provides an idea of the extent of genetic control for the expression of a particular character. Heritability estimates together with genetic advance are more important than heritability alone to predict the resulting effect of selecting the best individuals (Johnson *et al*., 1955) [3].

Materials and Methods
Plant materials
The experiment has been conducted in the experimentation centre of Sam Higginbottom University of Agriculture and Technological sciences, Allahabad in *kharif* 2016. Fourteen blackgram genotypes were taken as materials with one nationally released variety which is used as check T-9. Each row of 1 m length consists of 10 plants with a spacing of 10cm between the plants and 30 cm between two rows was maintained. The observations were recorded on days to 50% flowering, days to 50% pod setting, days to 50% maturity, plant height (cm), number of branches per plant, clusters per plant, pods per plant, pod length (cm), seeds per pod, seeds per plant, 100 seed weight (g/pl),biological index (g) seed yield (g/pl) and harvest index (%) at harvest stage. The statistical analysis and variance due to different sources was worked out according to Panse and Sukhatme (1967) [4]. Phenotypic and genotypic coefficients of variation were calculated based on the method advocated by Burton (1952) [1]. Heritability in broad sense and genetic advance as percent of means were estimated suggested by Jhonson *et al*. (1955).

Result and discussion
Analysis of variance was carried out for 13 characters in black gram genotypes and the results are presented in Table 1. The variance due to treatment was significant for all thirteen characters. This gives the evidence of magnitude of genetic variability among genotypes were differed significantly. The estimates of phenotypic coefficients of variation were higher than genotypic coefficients of variation which indicating that the environmental factors influencing the characters studied (Table 2). Higher magnitude of phenotypic coefficient of variation (PCV) was recorded for number of clusters per plant (127.45), number of primary

Branches (118.76) and number of pods per plant (86.93) suggesting that sufficient phenotypic variability was present for these traits in the materials and the favorable effect of environment. These results are in agreement with the findings of Umadevi and Ganesan (2006) [5]. Higher magnitude of Genotypic coefficient of variation (GCV) was recorded for it is maximum for number of clusters per plant (126.84), number of primary branches (111.49) and number of pods per plant (86.00) indicating the presence of variation for these characters in the materials and improvement could be possible through selection of these characters. These results are in agreement with the findings of Umadevi and Ganesan (2006) [5] indicated that grain yield was significantly associated with the number of clusters per plant, number of pods per plant, pod length and number of seeds per pod. Heritability estimates provides the assessment of amount of transmissible genetic variability to total variability, happens to be the most important basic component that determines the genetic improvement or response to selection. In the present study, the highest heritability (broad sense) was recorded for number of clusters per plant (99.05) followed by seed yield per plant (99.01), number of pods per plant (97.76), biological yield (95.09). High heritability estimates for number of clusters per plant, number of pods per plant, number of primary branches, seed yield per plant and Biological yield indicating that these traits are likely to be controlled by additive genetic component. Medium heritability is recorded for number of primary branches (88.13), seed index (83.59), harvesting index (79.86), plant height (78.80), days to 50% flowering (79.57). indicating that the selection of these traits are likely to accumulate more additive genes leading to further improvement of their performance and these traits may be used as selection criteria in blackgram breeding program. Genetic advance has been recorded for the following characters seed index (54.86), number of pods per plant (26.70), number of clusters per plant (22.54). High heritability coupled with high genetic advance for number of pods per plant, number of pods per cluster and number of primary branches. These characters are mainly controlled by additive genes and selection of such traits might be effective for the improvement of grain yield. Wani *et al., (*2007) [6] for reported high heritability coupled with high genetic advance for number of pods per plant, number of pods per cluster, plant height and seed yield per per plant. Hence, priority should be given to those traits which recorded higher estimates of genetic advance as percent of meanwhile deciding selection strategies and selection of these characters may be effective. Genetic advance as percent of mean has revealed that it was recorded for number of clusters per plant (260.04) followed by number of primary branches (215.61) number of pods per plant (175.16) seed index (105.12). Medium genetic as percent of mean was recorded for Seed yield per plant (70.14), biological yield (50.73), plant height (cm) (45.68) harvesting index (37.96), number of seeds per pod (36.31). However, heritability values coupled with genetic advance would be more reliable (Johnson *et al*., 1955) [3] and useful in formulating selection procedure. In the present study, heritability estimates in broad sense and genetic advance as percent of mean were estimated. High genetic advance as percent of mean coupled with moderate to high heritability was observed for number of primary branches, number of clusters per plant, number of clusters per plant, seed index, biological yield, seed yield per plant. Hence selections based on the traits could improve productivity in blackgram directly.

Table 1: Analysis of variance for 13 different quantitative characters of 15 black gram genotypes

Source of variation	d.f.	Days to 50% flowering	Days to 50% maturity	Days to 50% pod setting	Plant height	Primary branches/ plant	Clusters/ plant	Pods/ plant	Pod length	Seeds/ pod	Seed index	Biological yield/ plant	Harvest index	Seed yield/ plant
Replications	2	23.822	124.156	72.622	47.539	0.453	0.054	5.956	0.042	0.153	1.041	0.045	0.974	0.109
Treatments	14	36.184*	32.898*	51.689*	120.168*	5.874*	121.294*	173.184*	0.190*	1.610*	903.987*	0.400*	20.369*	13.034*
Error	28	8.560	14.156	24.956	29.662	0.757	1.164	3.937	0.054	0.751	166.575	0.093	0.345	0.043

* significant at 5% probability level.

Table 2: Genetic parameters for 13 biometrical characters of 15 blackgram genotypes.

Characters	Vg	Vp	GCV	PCV	h^2	GA	GA AS % mean
Days to 50% flowering	33.33	41.89	11.09	12.44	79.57	10.61	20.38
Days to 50% maturity	28.18	42.34	6.94	8.50	66.56	8.92	11.66
Days to 50% pod setting	43.37	68.33	9.96	12.51	63.48	10.81	16.35
Plant height (cm)	110.28	139.94	24.98	28.14	78.80	19.20	45.68
Number of primary branches	5.62	6.38	111.49	118.76	88.13	4.59	215.61
Number of clusters per plant	120.91	122.07	126.84	127.45	99.05	22.54	260.04
Numberof pods per plant	171.87	175.81	86.00	86.98	97.76	26.70	175.16
Pod length(cm)	0.17	0.23	10.43	11.97	75.94	0.74	18.72
Number of seeds per pod	1.36	2.11	21.96	27.35	64.44	1.93	36.31
Seed Index	848.46	1015.04	55.81	61.04	83.59	54.86	105.12
Biological yield	6.67	7.02	25.25	25.90	95.09	5.19	50.73
Harvesting index	0.37	0.46	20.62	23.07	79.86	1.12	37.96
Seed yield per plant	4.33	4.37	34.22	34.39	99.01	4.27	70.14

Conclusion

Magnitude of phenotypic coefficients of variation in selected blackgram germplasm was higher than genotypic coefficients of variation, indicating that environmental factors are influencing studied characters. High heritability and high genetic advance has been observed in number of cluster per plant,number of pods per plant, number of primary branches and seed index hence the parameters could be used for selection.

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