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ASSESSMENT OF GENETIC VARIABILITY FOR YIELD AND YIELD CONTRIBUTING TRAITS IN BLACK GRAM (*Vigna mungo* (L.) Hepper).

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ABSTRACT
Genetic variability among 64 accessions of Black gram collected from IIPR Kanpur and PDKV Akola was assessed for thirteen traits. These accessions were laid in randomized block design with three replications at Research and Education Farm, Department of Agril. Botany, College of Agriculture, Dapoli, Dist. Ratnagiri, Maharashtra state, India during *rabi* 2017-2018. The analysis of variance revealed significant differences among the genotypes for all the thirteen traits (days to 50 per cent flowering, days to maturity, plant height, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, 100 seed weight, harvest index, protein content and seed yield per plant) studied. Heritability estimates were greater for traits like 100 seed weight and pod length. High heritability with coupled with high genetic advance as per cent of mean were recorded for seed yield per plant, plant height (81%,57.32%) number of pods per plant (77%,60.03%) and number of clusters per plant (76%,44.39%). Thus, traits showing variability both at genotypic and phenotypic levels and high heritability coupled with moderate to high genetic advance need to be paid attention while formulating breeding strategies for improvement of grain yield of black gram.

KEY WORDS: Variability, Mean, PCV, GCV, Heritability, Genetic advance, Black gram.

INTRODUCTION
Pulses are a wonderful gift of nature, also known as grain legumes, are the major source of protein in Asia and constitute an important supplement to the predominantly cereal-based diet (Sahoo and Jaiwal, 2008). Among pulses, urdbean is an important short duration legume cultivated over a wide range of agro-climatic conditions. It is well known that 50 g pulses/person /day should be consumed in addition to other sources of protein such as cereals, milk, meat and egg which is a very difficult task to achieve as the production and productivity of pulse crop including black gram is very low. This has resulted in decreasing trends of their per capita availability. The low productivity of black gram attributed to excessive vegetative growth, high rate of flower and fruit drop, non-synchronous maturity, pod shattering, susceptibility to diseases and Pests etc. It has also been implicated that lack of variability is one of the main factors responsible for the poor progress made in breeding programmes of pulse crops (Jain, 1975). Many attempts have been made to assess the extent of variability for yield and its component traits in black gram. The study of inheritance of various developmental and productive traits through the estimation of different genetic parameters like components of variances, genotypic and phenotypic coefficients of variability, heritability and genetic advance is helpful for framing the effective breeding programme. Knowledge on heritability and genetic advance of the character indicate the scope for the improvement of a trait through selection (Rao *et al.* 2006). From this point of view, the present investigation was undertaken evaluate variability, heritability and genetic advance of 13 characters in 64 black gram genotypes to provide necessary information that could be useful to improve yield traits.

MATERIALS & METHODS
The experimental material comprised of 64 genotypes from different sources was evaluated during *rabi* 2017–18 at Research and Education Farm, Department of Agril. Botany, College of Agriculture, Dapoli, Dist. Ratnagiri, Maharashtra state. Among them, 25 genotypes were elite lines obtained from Indian Institute of Pulses Research, Kanpur and remaining genotypes were from Pulses Research Unit, Akola. The experiment was laid out in randomized block design (RBD) with three replications. A plot size of three rows each with a row length of 2.4 meter per replication with a spacing of 30 X 20 cm was adopted. Each row contains 12 plants thus there were 36 plants per population, constitute 108 plants per line in three replications. Recommended agronomic practices were followed to raise the crop. Observations were recorded for thirteen traits *viz*., days to 50 per cent flowering, days to maturity, plant height, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, 100 seed weight, harvest index, protein content and seed yield per plant. The data collected on individual characters were subjected to the method of analysis of variance commonly applicable to the randomized block design (Panse and Sukhatme, 1985).Observations on 13 characters in Table1 were recorded on 5 randomly selected plants in each treatment. The variability presence in the genotypes was estimated by phenotypic and genotypic variances and coefficient of

variations using the procedure suggested by Burton and De Vane (1953). The estimates of heritability and genetic advance were estimated by using the statistical methods suggested by Lush (1944) and Johnson *et al.* (1955) respectively.

RESULTS & DISCUSSION

Analysis of Variance

The analysis of variance (Table 1) revealed significant differences among the genotypes for all the traits studied indicating the presence of genetic variability within the genotypes for the thirteen characters studied showing an ample scope for selection of desirable genotypes from the present gene pool for increasing yield and productivity of black gram. The presence of large amount of variability might be due to diverse source of material taken as well as environmental influence affecting the phenotypes.

Mean performance of the genotypes

Mean performance of various genotypes exhibited wide range of variation for most of the traits studied (Table 2). Despite that some traits showed more variation like as seed yield per plant (3.50g to 21.36g), number of clusters per plant (5.67 to 21.27) and number of pods per plant (17.07 to 68.07) indicates sufficient variation among the genotypes for the above traits. The mean value for grain yield was found 7.29g. This reflected that there is greater opportunity to improve the yield and its related traits in black gram.

Phenotypic and Genotypic coefficient of variations (PCV and GCV)

The estimates of variability parameters for various yield and yield related traits are presented in (Table 2). The PCV values were revolved around 6.77% for days to maturity to 42.82% seed yield per plant and GCV values were ranged from 6.47% to 39.12% for the same traits. In the present study, PCV was greater than GCV for all the quantitative traits and were high for seed yield per plant, number of pods per plant and plant height. These results were conformity of the findings of Sateesh *et al.* (2016) and Yashoda *et al.* (2016). Lowest value of phenotypic coeffient of variation and genotypic coefficient of variation were observed for days to maturity and protein content. These results are in accordance with Yashoda *et al.* (2016) for days to maturity. The nominal variation between PCV and GCV in the traits like as seed index (0.03) and days to maturity (0.3), days to 50 per cent flowering (0.56) and pod length (0.15) showed there was considerably low influence of environment for the expression of the traits.

TABLE 1: Analysis of variance for different characters in Black gram

Sr. No.	Characters	Mean sum of squares		
		Replication (2)	Treatment (63)	Error (126)
1.	Days to 50 per cent flowering	0.26	67.81**	1.84
2.	Days to maturity	0.26	109.72**	3.41
3.	Plant height(cm)	38.21	216.89**	15.48
4.	Number of primary branches per plant	0.65	7.58**	0.53
5.	Number of clusters per plant	0.30	15.69**	1.50
6.	Number of pods per cluster	0.31	1.31**	0.16
7.	Number of pods per plant	25.21	341.87**	31.02
8.	Pod length (cm)	0.00	1.09**	0.01
9.	Number of seeds per pod	0.09	1.25**	0.09
10.	100 seed weight (g)	0.00	0.93**	0.00
11.	Harvest index (%)	3.99	43.90**	1.92
12.	Protein content (%)	1.32	12.97**	0.46
13	Seed yield per plant (g)	1.71	26.00**	1.61

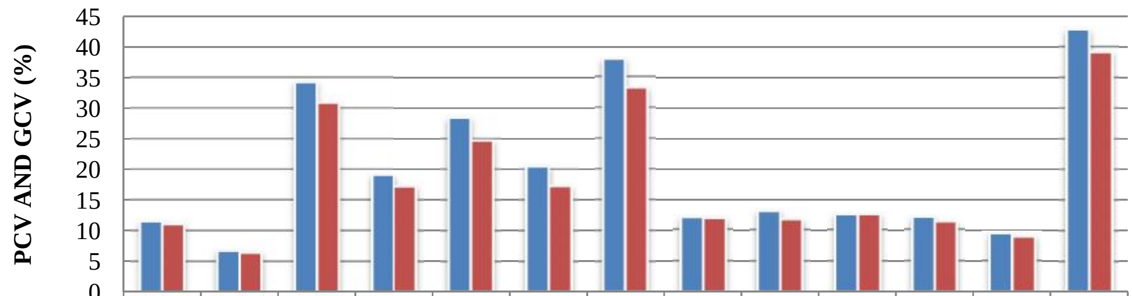
**Significant at 1% level
(Figures in parenthesis denotes degrees of freedom)

TABLE 2: Estimates of Mean, range and other variability components of 13 characters for 64 Black gram genotypes

Characters	Mean	Range		PCV (%)	GCV (%)	h^2bs (%)	GA	GAM
Days to 50 per cent flowering	42.23	32.33	54	11.56	11.1	92	9.28	21.98
Days to maturity	92.04	77.67	106.33	6.77	6.47	91	11.71	12.72
Plant height(cm)	26.55	12.6	55.6	34.24	30.87	81	15.22	57.32
Number of primary branches per plant	8.88	5.6	12.07	19.11	17.26	82	2.85	32.13
Number of clusters per plant	8.79	5.67	21.27	28.4	24.74	76	3.9	44.39
Number of pods per cluster	3.59	2.2	5.87	20.52	17.32	71	1.08	30.1
Number of pods per plant	30.64	17.07	68.07	37.86	33.22	77	18.4	60.03
Pod length (cm)	5.07	4.04	6.19	11.98	11.83	98	1.22	24.07
Number of seeds per pod	5.29	4.13	6.93	13.04	11.73	81	1.15	21.74
100 seed weight (g)	4.47	3.5	6.57	12.51	12.48	100	1.15	25.65
Harvest index (%)	33.19	27.44	43.47	12.02	11.27	88	7.23	21.77
Protein content (%)	23	16.78	26.13	9.36	8.88	90	3.99	17.37
Seed yield per plant (g)	7.29	3.5	21.36	42.82	39.12	83	5.37	73.62

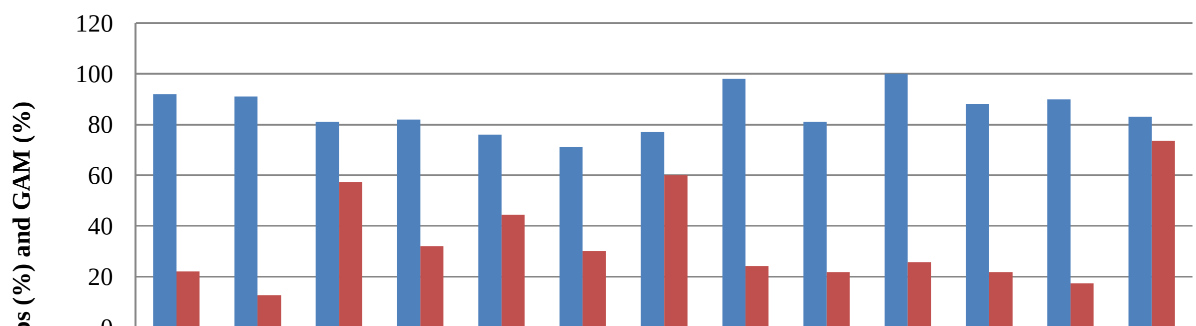
Heritability (broad sense) and Expected Genetic advance

Heritability estimates were greater for traits like 100 seed weight (100%), pod length (98%), days to 50 per cent flowering (92%), days to maturity (91%) and protein content (90%). Reena *et al* (2016) reported high heritability for the traits such as seed index and seed yield per plant. Higher estimates of genetic advance as percentage of mean were observed for seed yield per plant (73.62%), number of pods per plant (60.03%) and plant height (57.32%). High heritable values coupled with high genetic advance were observed for days to 50 per cent flowering (92%, 9.28),days to maturity (91%,11.71),plant height (81%,15.22) and number of pods per plant (77%,18.40). Pushpa *et al*. (2013) and Punia *et al*. (2014) were also found that these characters were more useful to estimate heritability value together with genetic advance in predicting the expected progress to be achieved through selection. From the results it can be concluded that all these traits are controlled by additive type of gene action.



	Days to 50 per cent flowering	Days to maturity	Plant height(cm)	Number of primary branches per plant	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100 seed weight (g)	Harvest index (%)	Protein content (%)	Seed yield per plant (g)
PCV (%)	11.56	6.77	34.24	19.11	28.4	20.52	37.86	11.98	13.04	12.51	12.02	9.36	42.82
GCV (%)	11.1	6.47	30.87	17.26	24.74	17.32	33.22	11.83	11.73	12.48	11.27	8.88	39.12

FIGURE 1: Genotypic and Phenotypic variation in Black gram



	Days to 50 per cent flowering	Days to maturity	Plant height(cm)	Number of primary branches per plant	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100 seed weight (g)	Harvest index (%)	Protein content (%)	Seed yield per plant (g)
	1	2	3	4	5	6	7	8	9	10	11	12	13
H2bs (%)	92	91	81	82	76	71	77	98	81	100	88	90	83
GAM (%)	21.98	12.72	57.32	32.13	44.39	30.1	60.03	24.07	21.74	25.65	21.77	17.37	73.62

FIGURE 2: Heritability and Genetic advance as percentage of mean in Black gram

1.Days to 50 per cent flowering	2.Days to maturity	3.Plant height (cm)
4.Number of primary branches per plant	4.Number of clusters per plant	6.Number of pods per cluster
7.Number of pods per plant	8.Pod length	9.Number of seeds per pod
10.100 seed weight	11.Harvest index	12.Protein content
13.Seed yield per plant		

CONCLUSION

From the present investigation, it is evident that the wide range of variability for different traits coupled with high heritability and high genetic advance as percentage of mean for important yield traits seed yield per plant, plant height, number of pods per plant, number of clusters per plant, protein content and number of primary branches per plant; hence selections based on the traits could improve productivity in black gram directly.

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