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Estimates of PCV, GCV and Heritability Studies for Yield components and Nutritional Traits in Blackgram [*Vigna mungo* (L.) Hepper]

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ABSTRACT: Blackgram is one of the most important pulses crop in India. However, most of the cultivated blackgram genotypes are marginal yielders with minimal nutritional traits, mainly due to lack of genetic variability. Present research work was carried out at RARS, Lam during *Rabi* 2020-21 with 78 genotypes to address these problems. Good amount of genetic variability in a population determines the success of any breeding programme. In addition to genetic variability, knowledge of heritability and genetic advance assists the breeder in developing an appropriate breeding strategy. Studies were conducted on 15 parameters, for PCV, GCV, heritability (broad sense) and Genetic Advance as per cent of mean. For the traits *viz*., days to 50% flowering, number of branches/plant, number of clusters/plant, number of pods/cluster, number of pods/plant, seed yield/plant, protein content, iron content and zinc content, expressed high GAM and heritability indicating that these characters are controlled by additive gene action and simple selection would be effective for improvement of these traits. PCV and GCV were found to be high for the characteristics seed yield plant per plant and zinc content, indicating significant genetic diversity in the genetic material. In the current study, PCV estimations were greater than GCV values for all variables, indicating the influence of environment on genotype performance.

Keywords: Blackgram, PCV, GCV, Genetic Advance, variability, Heritability.

INTRODUCTION

Blackgram most popularly known as urad bean or minapa pappu, is one of the most important nourishing pulses crop. According to Dana (1980) blackgram has 2n=2x=22 chromosomes annual crop with small genome size 574 Mbp. India is one of the highest pulses producing country in the world. India ranks first, both in crop coverage and seed production with 31.0 per cent and 28.0 per cent respectively. Blackgram enriches soil fertility through biological nitrogen fixation (50-55 kg N/ha (Motsara *et al.*, 2004)) and prevents soil erosion as a cover crop. Black gram is the ultimate source of protein for vegetarian persons (Pandey *et al*. 2016). Blackgram supplies a good quantity of vitamins like thiamine (B1), riboflavin (B2) and niacin (B3) along with minerals like phosphorus, calcium, magnesium and potassium etc., (Elangaimannan *et al.* 2008a). Pulses are mostly cultivated as rainfed crop in marginal soils, resulting poor yields. Blackgram (*Vigna mungo* L. Hepper) is an important short-duration legume crop cultivated in all agro climatic zones of our country (Bansal *et al.*, 2019). Majority of the cultivated genotypes are indeterminate type, photoperiod sensitive, with less genetic variability among them and susceptibility to biotic and abiotic conditions. Due to lack of much genetic diversity in the genotypes used in crossing, the productivity in the present day cultivars is limited. Based on results about genetic parameters, helps in selecting good genotypes for crop improvement. Having complete knowledge on the accurate nature of genetic variability present in the breeding material is critically essential.

MATERIAL AND METHODS

Present research includes seventy eight blackgram genotypes (released varieties, land races and advanced cultures) along with five released varieties as checks, *viz*., LBG 623, LBG 752, LBG 787, OBG 103 and GBG 1 were sown in Augmented Block Design. Each entry under testing is sown in 2 rows by dibbling the seeds in plot with length of 4 mts. The recommended spacing of 30 cm × 10 cm spacing was practiced along with package of practices for good standing crop. Data was recorded for 15 parameters *viz*., plant stand, days to 50% flowering, days to maturity, plant height (cm), number of 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, protein content (%), iron content (mg/100g), zinc content (mg/100g) and seed yield per plant (g) by randomly selecting five plants from each genotype.

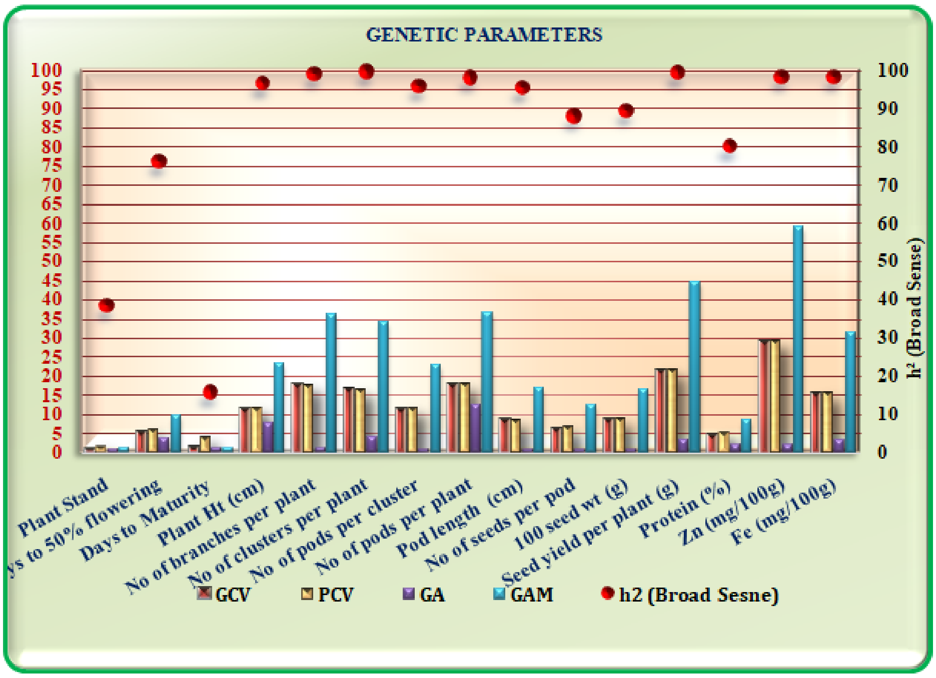
RESULTS AND DISCUSSION

The results revealed presence of significant differences amount genotype under testing, indicating that presence of satisfactory amount of variability. A perusal of the results on mean performance, genetic parameters and frequency distribution of genotypes for all the traits under study are discussed hereunder and presented in Table 1 and 2 and Fig. 1.

A significant degree of genotype diversity is essential for accomplishing any goals in plant breeding. Gene heritability and genetic variability estimates would aid in providing a more accurate assessment of the genetic gain expected from the selections. The amount and direction of variation are important factors since they directly relate to responsiveness to selection. The results revealed existence of significant variability among the blackgram genotypes for all the yield, yield components and nutritional traits indicating presence of adequate amount of genetic variability.

Phonetypic and Genotypic coefficient of variation: For the traits seed yield per plant and zinc content, PCV and GCV were observed to be high, indicating high genetic variation in the genetic material. For the characters *viz.*, plant height, number of branches/plant, number of clusters/plant, number of pods/cluster, number of pods/plant and iron content documented modest phenotypic and genotypic coefficient of variation indicating modest variation among the genotypes. Low amount of coefficient of variation both genotypic and phonotypic was documented for plant stand, flowering, maturity, pod length, number of seeds/pod, 100 seed weight and protein content. For all the characters under study the estimates of PCV were greater than GCV estimates, indicating the influence of environment on genotype performance.

High PCV & GCV for seed yield were in accord to the results of Putta Bhanuprasad *et al*. (2022); Siva Kumar and Roopa Lavanya (2022); Gomathi *et al.* (2023) and results of high PCV & GCV for zinc content are in consonance with publications of Jayalakshmi *et al.* (2019); Misra *et al.* (2020); Singh *et al*. (2020b). Results of Moderate PCV and GCV for plant height are according to Priya *et al.* (2021); Siva Kumar and Roopa Lavanya (2022), for number of branches/plant, number of cluster/plant and number of pods/plant are in consonance with Sushmitharaj *et al.* (2018); Rajalakshmi (2020); Sai Deekshitha *et al*. (2022), results for number of pods/cluster are by Sandip Singh *et al*. (2019) and for iron content the publications of Anusha *et al.* (2020); Misra *et al.* (2020) are in line. Days to 50% flowering recorded low phenotypic and genotypic coefficients in accordance with publications of Priya *et al.* (2021), for days to maturity with Sood *et al.* (2021); Sai Deekshitha *et al*. (2022) ; Putta Bhanuprasad *et al.* (2022), for pod length similar results are reported by Sood *et al.* (2021); Sai Deekshitha *et al*. (2022); Putta Bhanuprasad *et al*. (2022); Siva Kumar and Roopa Lavanya (2022), number of seeds/pod similar results are published by Priya *et al.*(2021) ; Putta Bhanuprasad *et al*. (2022) and 100 seed weight are in consonance with Punithavathy (2020); Rajalakshmi (2020) and similar results for protein content by Singh *et al*. (2020b); Saran (2021).



GCV: Genotypic Coefficient of Variation, PCV: Phenotypic Coefficient of Variation, GA: Genetic Advance, GAM: Genetic Advance as per cent of mean, h^2 (Broad Sense): Heritability (%)

Fig. 1. Genetic paramers PCV, GCV, Heritability and GAM for yield, yield components, quality and nutritional traits in blackgram genotypes.

Table 1: Analysis of variance for yield, yield components, quality and nutritional traits in blackgram genotypes.

Source of Variation	DF	Yield components											Nutritional traits			Seed yield/ plant (g)
		Plant Stand	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of branches/ plant	Number of clusters/ plant	Number of pods/ cluster	Number of pods/ plant	Pod length (cm)	Number of seeds/ pod	100 seed weight (g)	Protein (%)	Zn (mg/ 100g)	Fe (mg/ 100g)	
Block (eliminating Check+Var.)	3	2.183	0.368	4.281	0.032	0.011 *	0.003	0.001	0.335	0.018	0.003	0.009	0.826	0.012	0.005	0.016
Entries (ignoring Blocks)	77	1.287	6.671 **	10.999	16.935 **	0.365 **	4.868 **	0.189 **	45.943 **	0.167 **	0.210 **	0.192 **	1.750 **	1.538 **	3.904 **	3.286 **
Checks	4	1.175	2.569	20.415	10.383 **	0.383 **	7.512 **	0.154 **	35.132 **	0.072 **	0.146 **	0.167 **	1.906 **	9.558 **	5.329 **	1.310 **
Varieties	72	1.297	6.965 **	10.574	17.296 **	0.368 **	4.784 **	0.187 **	45.960 **	0.174 **	0.216 **	0.190 **	1.737 **	1.106 **	3.080 **	3.428 **
Checks vs. Varieties	1	0.992	1.931	3.883	17.208 **	0.022 *	0.346 **	0.493 **	87.979 **	0.027	0.003	0.423 **	2.025 *	0.627 **	57.506 **	1.006 **
ERROR	12	1.975	1.409	8.592	0.481	0.003	0.016	0.006	0.73	0.007	0.021	0.017	0.291	0.017	0.044	0.021

* Significant at 5% level, ** Significant at 1% level; Df : degrees of freedom

Table 2: Genetic parameters for yield, yield components, quality and nutritional traits in blackgram genotypes.

Sr. No.	Characters	Mean	Range		GCV	PCV	Heritability (%)	GAM
			Minimum	Maximum				
	Yield component traits							
1.	Plant stand	79.3	76.0	80.0	0.934	1.506	38.47	1.193
2.	Days to 50 per cent flowering	39.6	34.0	46.0	5.353	6.135	76.13	9.622
3.	Days to Maturity	81.2	74.0	87.0	1.561	3.935	15.73	1.275
4.	Plant height (cm)	32.2	21.4	39.6	11.471	11.672	96.59	23.224
5.	Number of Branches/plant	3.1	1.6	4.4	17.672	17.763	98.97	36.216
6.	Number of clusters/plant	11.8	8.0	16.8	16.57	16.604	99.59	34.065
7.	Number of pods/cluster	3.4	2.4	4.4	11.302	11.551	95.73	22.781
8.	Number of pods/plant	33.8	22.2	49.8	17.834	18.011	98.04	36.377
9.	Pod length (cm)	4.4	3.4	5.4	8.421	8.622	95.39	16.942
10.	Number of seeds/pod	6.2	4.9	7.4	6.37	6.79	88.01	12.31
11.	100 seed weight (g)	4.4	3.1	5.2	8.512	9.002	89.4	16.58
	Nutritional traits and grain yield							
12.	Protein content (%)	23.4	20.1	25.7	4.623	5.165	80.11	8.525
13.	Zinc content (mg/100g)	3.3	1.8	6.8	28.87	29.146	98.12	58.909
14.	Iron content (mg/100g)	10.0	6.3	13.2	15.427	15.565	98.23	31.498
15.	Grain yield plant^{-1}(g)	7.7	4.5	11.7	21.623	21.703	99.26	44.377

PCV: Phenotypic Coefficient of Variation, GCV: Genotypic Coefficient of Variation, GAM: Genetic Advance as per cent of mean

Heritability and genetic advance as percent of mean (GAM). Results for yield, yield components and nutritional traits *viz.*, seed yield/plant, plant height, number of branches/plant, number of clusters/plant, number of pods/cluster, number of pods/plant, iron content and zinc content, expressed high heritability and high GAM, specifying role of additive genes in their inheritance and improvement through simple selection. For seed yield/plant, plant height, number of branches/plant and number of cluster/plant, the outcomes are inconsonance with Punithavathy (2020); Barsha Rani Barik *et al*. (2021); Priya *et al.*(2021); Siva Kumar and Roopa Lavanya (2022), the observations for number of pods/cluster are supported by Sandip Singh *et al*. (2019); Priya *et al.*(2021), alike results for number of pods/plant in blackgram were published by Barsha Rani Barik *et al*. (2021); Putta Bhanuprasad *et al*. (2022); Gomathi *et al.* (2023), for iron content and zinc content the publications of Jayalakshmi *et al.* (2019); Misra *et al.* (2020); Singh *et al.* (2020b) are in line. For pod length, number of seeds/pod and 100 seed weight, documented heritability as high and GAM as moderate, revealing additive and non-additive gene actions control over the trait and the results are in consonance with Sood *et al.* (2021); Sai Deekshitha *et al*. (2022); Putta Bhanuprasad *et al*. (2022).

Days to 50% flowering and protein content expressed heritability and GAMas high and low respectively, indicating non-additive gene action and supported by Anuradha *et al*. (2020); Barsha Rani Barik *et al*. (2021); Priya *et al*. (2021) for flowering and by Singh *et al*. (2020b); Saran (2021) for protein in their publications. Days to maturity recorded low values for heritability and GAM, indicating role of non-additive gene actions with limited possibility for betterment and are in line with conclusions of Sood *et al.* (2021); Sai Deekshitha *et al*. (2022); Putta Bhanuprasad *et al*. (2022).

CONCLUSIONS

Simple selection would be effective in improving the traits days to 50% flowering, number of branches/plant, number of clusters/plant, number of pods/cluster, number of pods/plant, seed yield/plant, protein content, iron content, and zinc content as they have recorded high GAM and heritability values. Other characters under study expressed high heritability in association with GAM (moderate to low), indicating non-additive gene action, these characters improved through heterosis breeding. For the traits seed yield/ plant and zinc content, coefficient of variation both genotypic and phonotypic found to be high, indicating high genetic variability in the genetic material.

FUTURE SCOPE

Knowledge on PCV, GCV, heritability and GAM assists the breeder in understanding genetic variability and geneaction for individual traits and influence of environment. This help in selection of elite germplasm lines as parental material with good amount of genetic variability for improvement of yield and yield components and nutritional traits through recombination breeding in blackgram.

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Conflict of Interest. None.

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