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# Assessment of Genetic Variability Parameter in Blackgram [*Vigna mungo* (L.) Hepper] Germplasm

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**A B S T R A C T**

The present investigation was carried out on 28 blackgram genotypes during *Kharif*-2018 at field experimentation site of Genetics and Plant Breeding, Naini Agricultural Institute, SHUATS, Prayagraj to study about genetic variability, heritability and genetic advance. ANOVA showed highly significant genetic variability for all 28 blackgram genotypes for 12 characters studied indicating that significant amount of genetic variability present in the material. High GCV and PCV was observed in harvest index (%) (10.1, 12.68) followed by seed yield per plant (9.79, 12.17). High heritability coupled moderate genetic advance as percent of mean were observed in number of pods per plant, pod length, number of primary branches per plant, harvest index, biological yield and seed yield per plant. Mean performance for seed yield per plant and other characters taken in to consideration genotype VALLAB URD may be considered as best genotype followed by Shuats Urd (ABL)-95 and KU-96-7.

## Introduction

Blackgram is an annual leguminous crop belongs to family Fabaceae and sub-family Papilionaceae with a chromosome number 2n=22 (Dana, 1980) and originated from Indian continent [De Candolle, 1882, Vavilov, 1926]. It is popularly known as “urd bean and mash” is an important short duration and self-pollinated Kharif legume crop and is an important part of Indian diet. It is rich source o protein (25-28%), carbohydrates (62-65%), fibre (3.5-4.5%), ash (4.5-5.5%), oil (0.5-1.5%), amino acids like lysine, vitamins like thiamine, niacin, riboflavin and much needed iron and phosphorus Sohel *et al.*, (2016).

Being a leguminous crop, it restores the soil fertility by fixing atmospheric nitrogen and thus prevents soil erosion. India is the largest producer as well as consumer of blackgram. The major producing states are Andhra Pradesh, Maharastra, Madhya Pradesh, Tamil Nadu, Uttar Pradesh. India accounts for about

1.5 milliom tones annually from 3.25 million hectare area with an average productivity of 400kg per ha Anonymous (2016). Despite its great importance, blackgram cultivation is neglected as little attention is given towards its improvement. There are various reasons for the low production of crop like lack of genetic variability, absence of suitable ideotype, susceptibility to biotic and abiotic stresses and planting in marginal areas of farming. Hence, it is vital to improve the productivity of blackgram. This can be achieved by studying the genetic architecture of the crop.

The knowledge of the inheritance of various quantitative and qualitative traits through estimation of genetic parameters like phenotypic and genotypic coefficients of variability, heritability, and genetic advance is a prerequisite in conducting an effective breeding programme. Before starting any breeding programme, it is necessary to access the nature and magnitude of genetic variability in the population to improve the yield and its component traits Singh *et al.,* (2016).

Along with genetic variability, knowledge of heritability and genetic advance is essential to formulate selection criteria for improvement of seed yield. Heritability is the heritable portion of phenotypic variance which is good index of transmission of traits from parents to their offspring.

Heritability in broadsense provides an idea about the additive and non-additive gene action in the expression of traits. The estimates of heritability along with genetic advance are more important than genetic advance alone to know the resulting effect of the best individuals Johnson *et al.,* (1955). Keeping in view these points, the present investigation is conducted to assess the variability, heritability, in broad sense and genetic advance in $F_3$ generation of blackgram.

## Materials and Methods

The experimental material for present investigation was carried out during *Kharif*, 2018 at department of Genetics and Plant Breeding, SHUATS, Prayagraj, Uttar Pradesh.

Experimental material consists of 28 blackgram genotypes were sown in RBD in 3 replications, 5 rows of each genotype in each replication with 1m length. Row to row and plant to plant distance was kept at 30cm and 10cm, respectively. All the recommended package of practices was followed to raise a healthy crop.

Data was recorded on 12 quantitative characters *viz*., days to 50% flowering, plant height, primary branches per plant, number of clusters per plant, number of pods per plant, pod length, days to maturity, number of seeds per pod, biological yield, harvest index (%), seed index and seed yield per plant. The observations for days to 50% flowering and days to maturity where observations recorded for whole plot basis.

The various genetic parameters *viz*., GCV and PCV were calculated by adopting the formulae suggested by Burton (1952), while heritability, GA as % mean were calculated by adopting the formulae given by Johnson *et al.,* (1955).

## Results and Discussion

The mean performance of 28 blackgram genotypes including 1 check are presented in Table 1. The peruasal data revealed that the range is considerably high for most of characters viz., plant height ranged from T-9 (51.29cm) to PU-11-14 (65.97cm) followed by days to 50% flowering ranged from Shuats Urd (ABL)-100 (43.00) to KU-96-7 (46.67), number of primary branches varied from Shuats Urd (ABL)-88 (5.20) to LBG-20 (6.60), number of clusters per plant ranged

from Shuats Urd (ABL)-88 (7.30) to Shuats Urd (ABL)-94 (10.50), number of pods per plant ranged from Shuats Urd (ABL)-89 (25.30) to LBG-20 (36.90), pod length ranges from IU-02-13 (4.17cm) to T-9 (4.68cm) with grand mean of (4.43cm), biological yield ranged from LBG-20 (16.88g) to Shuats Urd (ABL)-85 (25.27g), number of seeds per pod ranges from P-4 (6.60) to PU-31 (7.30), days to maturity varied from P-4 (61.43) to Shuats Urd (ABL)-100 (68.43), harvest index ranged from Shauts Urd (ABL)-85 (17.94) to PU-31 (27.77), seed index varied from Shuats Urd (ABL)-99 (3.43g) to PU-31 (4.93g) and seed yield per plant ranged from LBG-20 (4.67g) to VALLAB URD (5.80g).

Mean squares due to genotypes for all the characters were significant as revealed from ANOVA indicating substantial amount of genetic variability among the genotypes under study (Table 2).

Genotypes exhibited wide range of variation for different characters viz., plant height ranged from T-9 (51.29cm) to PU-11-14 (65.97cm), biological yield ranged from LBG-20 (16.88g) to Shuats Urd (ABL)-85 (25.27g), harvest index ranged from Shuats Urd (ABL)-85 (17.94) to PU-31 (27.77). Genotype VALLAB URD may be considered as best genotype followed by Shuats Urd (ABL)-95 and KU-96-7 appeared as promising lines with respect to seed yield.

The PCV was higher than GCV for all the characters under study which indicated that the environmental factors influencing the characters studied. The present findings are in accordance with the findings of Panigrahi *et al.,* (2014), Deepshika *et al.,* (2014), Babu *et al.,* (2016), Priyanka *et al.,* (2016), Gowsalya *et al.,* (2016) and Hemalatha *et al.,* (2017). The GCV and PCV were categorized as low (less than 10%), moderate (10-20%) and high (more than 20%) as suggested by Burton and Devane (1953). The estimated GCV and PCV helped in getting a clear understanding of the variability present among various genotypes. Higher magnitude of GCV was recorded for harvest index (10.10) followed by seed yield per plant (9.79), pod length (8.80), primary branches per plant (8.18), biological yield (7.21), seed index (6.46), number of clusters per plant (5.82), days to maturity (3.27), days to 50% flowering (2.24), number of seeds per plant (1.40) and plant height (0.98).

Higher magnitude of PCV was recorded in harvest index (%) (12.68) followed by seed yield per plant (12.17), number of pods per plant (11.30), seed index (10.38), pod length (9.88), number of primary branches per plant (8.85), biological yield (7.99), number of clusters per plant (6.05), days to maturity (3.35), number of seeds per pod (2.49), days to 50% flowering (2.33) and plant height (1.35).

The estimates of variability parameters revealed that the phenotypic coefficient of variation along with least difference from genotypic coefficient of variation observed for characters viz., plant height (GCV 0.98% and PCV 1.35%), days to 50% flowering (GCV 2.24% and PCV 2.33%), number of seeds per pod (GCV 7.21% and PCV 7.99%), days to maturity (GCV 3.27% and PCV 3.35%) and number of primary branches per plant (GCV 8.18% and PCV 8.85%) indicating the greater role of genetic factors influencing the expression of these characters.

Thus it indicates the utility of these characters in the selection programme.

The estimates of heritability in broadsense for yield and attributing characters have been presented in Table 3. The prediction regarding heritability in broad sense was made as suggested by Robinson (1949) for low (less than 50%), moderate (50-70%) and high (more than 70%) heritability estimates.

**Table.1** Mean performance of 28 black gram genotypes for 12 quantitative characters

| Genotypes | Days to 50% flowering | Plant height (cm) | No of Primary branches/plant | No of Clusters/plant | No of Pods/plant | Pod length (cm) | Days to maturity | No of Seeds /pod | Biological Yield (g) | Harvest index (%) | Seed index | Seed yield/plant (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **VALLABURD** | 45.67 | 64.65 | 5.9 | 8.7 | 29.3 | 4.22 | 66.33 | 7.1 | 21.52 | 27.02 | 4.14 | 5.80 |
| **NDUK-13-6** | 44.00 | 65.63 | 6.1 | 8.4 | 31.2 | 4.32 | 65.33 | 7.0 | 18.96 | 22.57 | 3.76 | 4.27 |
| **PU-31** | 45.67 | 60.85 | 6.4 | 7.6 | 31.9 | 4.62 | 67.66 | 7.3 | 18.18 | 27.77 | 4.93 | 4.87 |
| **LBG-20** | 45.67 | 63.57 | 6.6 | 8.3 | 36.9 | 4.32 | 63.33 | 7.0 | 16.88 | 21.75 | 4.27 | 3.67 |
| **LBG-791** | 46.33 | 58.17 | 6.2 | 8.8 | 33.3 | 4.29 | 67.32 | 7.1 | 20.94 | 21.69 | 4.06 | 4.53 |
| **KU-96-7** | 46.67 | 56.24 | 6.3 | 7.6 | 27.9 | 4.32 | 63.00 | 7.0 | 20.86 | 24.36 | 3.67 | 5.07 |
| **NDUK-13-4** | 45.33 | 61.29 | 5.8 | 7.5 | 28.7 | 4.29 | 61.56 | 6.9 | 18.70 | 24.54 | 4.09 | 4.60 |
| **IU-02-13** | 45.33 | 51.47 | 6.1 | 7.9 | 27.3 | 4.17 | 64.83 | 6.7 | 19.19 | 24.69 | 4.36 | 4.73 |
| **PU-11-14** | 44.33 | 65.97 | 6.3 | 10.0 | 31.6 | 4.62 | 67.56 | 6.6 | 18.35 | 25.02 | 3.61 | 4.60 |
| **PU-38** | 44.67 | 60.31 | 6.6 | 10.1 | 30.9 | 4.65 | 66.45 | 6.6 | 19.53 | 23.16 | 4.12 | 4.53 |
| **L7** | 44.33 | 64.03 | 6.3 | 10.1 | 30.5 | 4.64 | 66.91 | 6.6 | 19.65 | 27.25 | 4.03 | 5.33 |
| **P4** | 43.33 | 58.21 | 6.5 | 9.1 | 31.1 | 4.65 | 61.43 | 6.6 | 18.71 | 26.71 | 4.09 | 5.00 |
| **T9** | 43.67 | 51.29 | 6.5 | 8.8 | 29.4 | 4.68 | 63.75 | 6.7 | 18.29 | 23.01 | 4.12 | 4.20 |
| **Shuats Urd (ABL)-84** | 45.00 | 61.71 | 6.0 | 8.3 | 28.8 | 4.24 | 67.68 | 6.8 | 19.27 | 22.29 | 4.24 | 4.27 |
| **Shuats Urd (ABL)-85** | 44.67 | 64.19 | 5.4 | 8.5 | 28.3 | 4.35 | 62.90 | 6.9 | 25.27 | 17.94 | 3.53 | 4.53 |
| **Shuats Urd (ABL)-86** | 44.00 | 52.52 | 5.9 | 7.4 | 26.9 | 4.31 | 64.48 | 6.9 | 20.14 | 27.22 | 3.89 | 5.47 |
| **Shuats Urd (ABL)-87** | 43.33 | 57.21 | 5.9 | 8.0 | 30.1 | 4.39 | 62.38 | 6.8 | 18.43 | 26.00 | 4.01 | 4.80 |
| **Shuats Urd (ABL)-88** | 43.33 | 65.64 | 5.2 | 7.3 | 25.7 | 4.43 | 64.19 | 6.8 | 19.11 | 21.99 | 4.22 | 4.20 |
| **Shuats Urd (ABL)-89** | 43.33 | 58.14 | 5.9 | 7.5 | 25.3 | 4.45 | 62.00 | 6.9 | 19.26 | 25.69 | 3.93 | 4.93 |
| **Shuats Urd (ABL)-92** | 43.67 | 56.3 | 5.5 | 8.7 | 28.4 | 4.46 | 64.54 | 7.0 | 17.62 | 26.22 | 4.13 | 4.60 |
| **Shuats Urd (ABL)-93** | 43.33 | 63.79 | 6.2 | 8.7 | 28.1 | 4.44 | 62.89 | 6.9 | 17.52 | 26.00 | 4.15 | 4.53 |
| **Shuats Urd (ABL)-94** | 44.00 | 62.4 | 5.7 | 10.5 | 34.5 | 4.35 | 67.33 | 7.0 | 20.17 | 24.49 | 3.51 | 4.93 |
| **Shuats Urd (ABL)-95** | 43.33 | 58.39 | 6.4 | 9.9 | 31.5 | 4.52 | 66.45 | 7.0 | 20.05 | 26.58 | 3.74 | 5.33 |
| **Shuats Urd (ABL)-96** | 44.00 | 54.58 | 6.0 | 9.0 | 29.3 | 4.41 | 66.87 | 6.7 | 17.25 | 24.10 | 4.21 | 4.13 |
| **Shuats Urd (ABL)-97** | 45.00 | 58.25 | 5.7 | 8.6 | 26.8 | 4.45 | 62.90 | 7.1 | 19.32 | 24.64 | 3.95 | 4.73 |
| **Shuats Urd (ABL)-98** | 44.33 | 60.21 | 5.9 | 8.3 | 25.7 | 4.42 | 64.73 | 7.2 | 20.24 | 24.09 | 4.27 | 4.87 |
| **Shuats Urd (ABL)-99** | 43.00 | 58.47 | 6.0 | 9.1 | 27.7 | 4.59 | 63.67 | 7.1 | 19.29 | 22.81 | 3.43 | 4.40 |
| **Shuats Urd (ABL)-100** | 43.67 | 55.46 | 5.7 | 8.6 | 27.3 | 4.55 | 68.43 | 7.2 | 20.55 | 22.75 | 4.49 | 4.67 |
| **Mean** | **44.39** | **59.61** | **6.0** | **8.6** | **29.44** | **4.43** | **64.89** | **6.9** | **19.40** | **24.37** | **4.03** | **4.70** |
| **Min** | 43.00 | 51.29 | 5.2 | 7.3 | 25.3 | 4.17 | 61.43 | 6.6 | 16.88 | 17.94 | 3.43 | 3.67 |
| **Max** | 46.67 | 65.97 | 6.6 | 10.5 | 36.9 | 4.68 | 68.43 | 7.3 | 25.27 | 27.77 | 4.93 | 5.80 |

**Table.2** Analysis of variance for 12 quantitative characters of blackgram

| Characters | Mean Sum of Squares | | |
|---|---|---|---|
| | Replications | Treatments | Error |
| | (df= 2) | (df= 27) | (df=54) |
| Days to 50% flowering | 0.048 | 3.042** | 0.085 |
| Plant height(cm) | 0.583 | 1.160** | 0.262 |
| No of Primary branches/plant | 5.99 | 115.26** | 6.17 |
| No of Clusters/plant | 0.03 | 0.379** | 0.01 |
| No of Pods/plant | 0.752 | 2.372** | 0.238 |
| Pod length(cm) | 3.72 | 21.884** | 1.745 |
| Days to maturity | 0.002 | 0.064** | 0.001 |
| No of Seeds/pod | 0.018 | 0.048** | 0.02 |
| Biological Yield (g) | 0.25 | 4.953** | 0.351 |
| Harvest index (%) | 53.501 | 132.428** | 21.339 |
| Seed index | 0.223 | 0.311** | 0.107 |
| Seed yield/plant (g) | 1.288 | 3.563** | 0.563 |

** Significant at 1% level of significance

**Table.3** Coefficient of variation, heritability and genetic advance for 12 characters of blackgram

| Characters | Vg | Vp | coefficient of variation | | Heritability(bs) $h^2$(%) | GA | GA as % mean |
|---|---|---|---|---|---|---|---|
| | | | GCV | PCV | | | |
| Days to 50% flowering | 0.99 | 1.07 | 2.24 | 2.33 | 92.09 | 1.96 | 4.42 |
| Plant height(cm) | 0.30 | 0.56 | 0.98 | 1.35 | 53.3 | 0.82 | 1.48 |
| No of Primary branches/plant | 36.36 | 42.53 | 8.18 | 8.85 | 85.49 | 11.49 | 15.59 |
| No of Clusters/plant | 0.12 | 0.13 | 5.82 | 6.05 | 92.31 | 0.69 | 11.51 |
| No of Pods/plant | 0.71 | 0.95 | 9.78 | 11.30 | 74.94 | 1.50 | 17.45 |
| Pod length(cm) | 6.71 | 8.46 | 8.8 | 9.88 | 79.37 | 4.76 | 16.15 |
| Days to maturity | 0.02 | 0.02 | 3.27 | 3.35 | 95.41 | 0.29 | 6.58 |
| No of Seeds/pod | 0.01 | 0.03 | 1.40 | 2.49 | 31.48 | 0.11 | 1.61 |
| Biological Yield (g) | 1.53 | 1.89 | 7.21 | 7.99 | 81.36 | 2.30 | 13.39 |
| Harvest index (%) | 37.03 | 58.37 | 10.1 | 12.68 | 63.44 | 9.98 | 16.57 |
| Seed index | 0.07 | 0.18 | 6.46 | 10.38 | 38.69 | 0.33 | 8.27 |
| Seed yield/plant (g) | 1.00 | 1.56 | 9.79 | 12.17 | 63.97 | 1.65 | 16.04 |

Pg = Phenotypic Variance, Vg = Genotypic Variance, PCV = Phenotypic Coefficient of Variance, GCV = Genotypic Coefficient of Variance, $h^2$ = Heritability (broad sense), GA = Genetic advance

In the present study high estimates of heritability were observed for days to maturity (95.41%), number of clusters per plant (92.31%), days to 50% flowering (92.09%), number of primary branches per plant (85.49%), biological yield (81.36%), pod length (79.37%), number of pods per plant (74.94%), seed yield per plant (63.97%), harvest index (63.44%), plant height (53.30%) and number of seeds per pod (31.48%) had high estimates of heritability. Similar findings were reported by Hemalatha *et al.,* (2017).

Genetic advance as percent of mean were recorded higher value for number of pods per plant (17.45%), harvest index (16.57%), pod length (16.15%), seed yield per plant (16.04%), number of primary branches per plant (15.59%), biological yield (13.39%) and no of clusters per plant (11.51%). These findings are in accordance with the result of Rajashekhar *et al.,* (2017).

High heritability coupled with moderate genetic advance as percent of mean were recorded for number of pods per plant, pod length, number of primary branches per plant, harvest index, biological yield and seed yield per plant. These findings are in accordance with the result of Dharmendra *et al.,* (2017).

Present study concluded on the basis of mean performance, genotype VALLAB URD had maximum seed yield per plant (5.80), clusters per plant (8.7), primary branches per plant (5.9), pod length (4.22) and seed index (4.14) followed by Shuats Urd (ABL)-95 (5.33) and KU-96-7 (5.07). Genotype P4 showed early maturity than other genotypes it took 61.43 days to maturity. Based on *par se* performance for seed yield per plant and other characters taken in to consideration genotype VALLAB URD may be considered as the best genotypes for seed yield per plant followed by Shuats Urd (ABL)-95 and KU-96-7. High heritability coupled with moderate genetic advance as percent of mean were observed for number of pods per plant, pod length, number of primary branches per plant, harvest index, biological yield and seed yield per plant. Selection of these traits was useful for further improvement in plant breeding programme.

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