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## Research Note

# Genetic analysis on the extent of variability among the greengram (*Vigna radiata* (L.) Wilczek) genotypes

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**Abstract**
The present investigation was carried out at National Pulses Research Centre, Vamban during *Rabi* 2017-18 season to assess the extent of genetic variability among the newly developed 49 greengram genotypes based on the yield and yield contributing traits. Observations were recorded on days to 50% flowering, days to maturity, plant height (cm), the number of branches per plant, the number of clusters per plant, the number of pods per cluster, the number of pods per plant, pod length (cm), the number of seeds per pod, 100 seed weight (g) and seed yield (kg/ha). The analysis of variance revealed the presence of significant variation for all the characters studied except for the number of seeds per pod. In general, the PCV values were higher than the GCV values indicating the influence of environment in controlling these traits. Among the estimates of genetic parameters, heritability along with genetic advance are normally more helpful in predicting the gain under selection. In the present investigation, plant height, the number of branches per plant, the number of clusters per plant, the number of pods per plant, hundred seed weight and seed yield have recorded a high heritability coupled with high genetic advance. High heritability coupled with high genetic advance indicated that the selection may be effective for these traits.

**Key words**
Greengram, variability, heritability, genetic advance.

Greengram (*Vigna radiata* (L) Wilczek) is also known as mungbean, belongs to the family *Leguminaceae*, subfamily *Papilionoideae* with a chromosome number 2n=22. The area under greengram in India is around 4.32 million hectare with a production of 2.17 million tones. In Tamil Nadu it is cultivated in an area of 1.68 lakhs hectare with a production of 0.51 lakh tones (Annonymous. 2018). Though greengram is a self-pollinated species considerable genetic variation exists among the greengram cultivars and also within its related species (Bisht *et al*., 2005). Clear understanding of the variability parameters such as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability ($h^2$) and genetic advance (GA) of the breeding materials related to seed yield as well as component characters are much essential to know their inherent potential. Hence, the present investigation was carried out to assess the extent of genetic variability existed among the newly developed greengram genotypes.

The experimental materials used for the present investigation consisted of 49 greengram genotypes which were evaluated at National Pulses Research Center, Tamil Nadu Agricultural University, Vamban during *Rabi* 2017-18 season. Each genotype was sown in a plot size of 12 $m^2$ under Randomized Block Design with two replications. Plant to plant spacing of 10 cm and row to row spacing of 30 cm was adopted. The package of practices as recommended in the Tamil Nadu crop production guide was followed. The 11 quantitative traits *viz*., days to 50% flowering, days to maturity, plant height (cm), the number of branches per plant, the number of clusters per plant, the number of pods per cluster, the number of pods per plant, pod length (cm), the number of seeds per pod, 100-seed weight (g) and seed yield (kg/ha) were recorded. Mean of five plants observations per replication was used for the analysis of all traits except days to 50% flowering, seed yield (kg/ha). Phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were calculated by the method suggested by Burton (1952). Heritability ($h^2$) in the broad sense was calculated as suggested by Lush (1940) and expressed in percentage. Genetic advance and genetic advance as per cent of mean was estimated by the method formulated by Johnson *et al*. (1955).

In the present study, the analysis of variance revealed highly significant differences for all the characters studied except the number of seeds per pod indicating the existence of sufficient genetic variation among the material studied (**Table 1**). Mean performance is a basic and an important criterion in selecting superior genotypes. Mean performance of 49 greengram genotypes were presented in **Table 2**. Among the 49 greengram genotypes evaluated, days to 50% flowering ranged from 29 days (VGG 16-062 and VGG 17-015) to 38 days (VGG 17-002). Days to maturity ranged from 48.5 days (VGG 17 - 010) to 70.00 days (VGG 17 -002). Six genotypes *viz.,* VGG 17 -002, VGG17 - 019, VGG 17 - 045, VGG 17 -048, VGG 17 - 049 and VGG 17 – 050 recorded significantly higher seed yield than the best check variety VBN (Gg) 3.

In the present study, the number of branches per plant, the number of pods per plant and seed yield has recorded high genotypic and phenotypic co-efficient variation which indicates the existence of substantial amount of genetic variability. In general, the magnitude of phenotypic coefficient of variation (PCV) was numerically higher than genotypic coefficient of variation (GCV) for all the traits under study (**Table 3.)** which indicates the role of environment in the expression of the traits. These results are in accordance with the findings of Rao *et al.,* (2006), Narasimhulu *et al.,* (2013), Muralidhara *et al.,* (2015) and Susmitha and Jayamani (2008).

**Table 1. Analysis of variance for various quantitative characters in greengram**

| Source | df | Days to 50% flowering | Days to maturity | Plant height | Number of branches per plant | Number of cluster per plant | Number of pods per cluster | Number of pods per plant | Pod length) | Number of seeds per pod | 100-seed weight | Seed yield (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Replication | 1 | 0.16 | 6.36 | -0.02 | 0.06 | 0.01 | 0.00 | 0.50 | 0.00 | 0.11 | 0.04 | 495.67 |
| Genotypes | 48 | 11.92** | 31.83** | 160.08** | 0.45** | 4.78** | 0.23** | 143.38** | 0.67** | 0.56 | 0.39** | 436167.34** |
| Error | 48 | 0.43 | 9.29 | 6.32 | 0.02 | 0.40 | 0.08 | 10.79 | 0.07 | 0.36 | 0.01 | 21702.34 |

Among the estimates of genetic parameters, heritability serves as a good index for transmission of character from one generation to next generation and it should be considered in terms of selection concept (Hanson, 1956). Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection (Johnson *et al*. 1955). The estimates of variability, heritability and genetic advance for various characteristics are presented in **Table 3.**

In the present investigation, plant height, the number of branches per plant, the number of clusters per plant, the number of pods per plant, hundred seed weight and seed yield recorded high heritability coupled with high genetic advance as per cent of mean. High heritability coupled with high genetic advance indicated that the selection may be effective for these traits. Similar findings of high heritability and genetic advance were reported by Suresh *et al.,* (2010) and Kate *et al*. (2017).

Variability in a population is measured by the estimates like phenotypic and genotypic variance, genotypic

**Table 3. Genetic parameters for various quantitative characters in greengram**

| Sl. No | Characters | Mean | Range | | GCV (%) | PCV (%) | $h^2$ (%) | GAM (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | Days to 50% flowering | 33.0 | 28.5 | 37.5 | 7.3 | 7.6 | 93.0 | 14.5 |
| 2 | Days to maturity | 62.0 | 48.5 | 70.0 | 5.4 | 7.3 | 55.0 | 8.3 |
| 3 | Plant height (cm) | 46.8 | 28.9 | 65.1 | 18.8 | 19.5 | 92.0 | 37.1 |
| 4 | Number of branches per plant | 1.9 | 1.0 | 3.4 | 24.0 | 25.1 | 92.0 | 47.3 |
| 5 | Number of cluster per plant | 7.8 | 4.7 | 12.0 | 18.9 | 20.6 | 84.0 | 35.8 |
| 6 | Number of pods per cluster | 3.9 | 3.3 | 4.5 | 7.1 | 10.0 | 50.0 | 10.3 |
| 7 | Number of pods per plant | 37.8 | 18.5 | 51.5 | 21.6 | 23.2 | 86.0 | 41.2 |
| 8 | Pod length (cm) | 8.0 | 7.1 | 10.4 | 6.9 | 7.6 | 81.0 | 12.7 |
| 9 | Number of seeds per pod | 11.8 | 10.3 | 12.8 | 2.7 | 5.8 | 21.0 | 2.5 |
| 10 | 100 seed weight (g) | 3.8 | 3.1 | 4.9 | 11.4 | 11.6 | 97.0 | 23.1 |
| 11 | Seed yield (kg/ha) | 1454.2 | 433.0 | 2376.5 | 31.3 | 32.9 | 91.0 | 61.4 |

Table 2. Mean performance for various quantitative characters in greengram

| Sl. No | Characters | Days to 50% flowering | Days to maturity | Plant height (cm) | Number of branches per plant | N umber of cluster per plant | Number of pods per cluster | Number of pods per plant | Pod length (cm) | Number of seeds per pod | 100-seed weight (g) | Seed yield (kg/ ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | VGG 16- 061 | 31.5 | 60.5 | 49.7 | 1.4 | 6.8 | 3.9 | 31.5 | 7.8 | 11.5 | **3.6**** | 1151 |
| 2 | VGG 16 -062 | 28.5** | 55.5 | 38.5** | 1.3 | 6.1 | 3.9 | 25.5 | 7.3 | 11.2 | 3.4** | 916 |
| 3 | VGG 16 - 063 | 29.0** | 60.0 | 44.9 | 1.3 | 6.3 | 3.7 | 26.0 | 8.1 | 12.1 | 4.6** | 1581 |
| 4 | VGG 16- 064 | 30.0** | 59.5 | 40.2 | 1.4 | 6.0 | 3.8 | 27.0 | 8.1 | 12.0 | 4.2** | 1702 |
| 5 | VGG 16 - 065 | 30.0** | 60.5 | 45.8 | 1.2 | 6.6 | 3.7 | 24.5 | 8.1 | 11.6 | 4.4** | 1742 |
| 6 | VGG 16 - 066 | 31.5 | 60.5 | 40.7 | 1.0 | 6.3 | 4.3 | 32.0 | 7.9 | 11.7 | 3.9** | 1152 |
| 7 | VGG 16 -067 | 31.5 | 61.0 | 42.7 | 2.1 | 9.3 | 3.6 | 36.5 | 7.9 | 11.5 | 3.8** | 1518 |
| 8 | VGG 16- 068 | 31.0 | 59.5 | 43.4 | 1.6 | 8.1 | 3.8 | 36.0 | 8.75** | 12.4 | 3.8** | 1674 |
| 9 | VGG 16 -069 | 30.0** | 58.5 | 43.4 | 1.8 | 8.3 | 3.8 | 44.0 | 7.9 | 12.4 | 3.4 | 1141 |
| 10 | VGG 16 -070 | 31.5 | 59.5 | 47.1 | 1.3 | 6.7 | 3.8 | 27.5 | 8.5 | 12.1 | 3.6** | 1288 |
| 11 | VGG 17 -001 | 35.5 | 67.5 | 58.5 | 2.0 | 6.5 | 4.2 | 30.5 | 8.0 | 12.1 | 3.4 | 1779 |
| 12 | VGG 17 -002 | 37.5 | 70.0 | 61.6 | 3.4** | 12.0** | 4.1 | 51.5** | 7.5 | 11.7 | 3.6** | 2215** |
| 13 | VGG 17 -003 | 37.0 | 68.5 | 59.8 | 2.3** | 7.3 | 4.3 | 36.5 | 7.1 | 12.5 | 3.3 | 1780 |
| 14 | VGG 17 -004 | 36.0 | 67.0 | 65.1 | 2.2 | 6.1 | 3.8 | 27.0 | 7.8 | 12.0 | 3.5 | 1741 |
| 15 | VGG 17 -007 | 30.5 | 58.5 | 42.8 | 2.4** | 9.4 | 4.3 | 44.5 | 7.8 | 12.0 | 3.3 | 860 |
| 16 | VGG 17 -008 | 35.5 | 64.5 | 29.7** | 2.5** | 10.5 | 4.4 | 51.0** | 7.7 | 11.6 | 3.1 | 433 |
| 17 | VGG 17 -009 | 35.0 | 65.5 | 54.2 | 2.3** | 8.8 | 4.3 | 38.0 | 7.5 | 11.5 | 3.5 | 1929 |
| 18 | VGG 17 -010 | 34.0 | 68.5** | 53.5 | 1.7 | 6.2 | 4.4 | 27.5 | 8.0 | 12.1 | 4.2** | 2012 |
| 19 | VGG 17 -011 | 34.5 | 65.0 | 54.9 | 2.1 | 9.0 | 4.4 | 50.0** | 10.4** | 12.0 | 3.5 | 1320 |
| 20 | VGG 17 -012 | 34.5 | 67.5 | 35.6** | 2.5** | 9.3 | 4.2 | 44.0 | 8.3 | 12.8 | 3.6** | 1019 |
| 21 | VGG 17 -013 | 33.5 | 62.0 | 41.4 | 2.1 | 8.0 | 4.0 | 34.0 | 8.6 | 12.8 | 4.1** | 1722 |
| 22 | VGG 17 -015 | 28.5** | 56.5 | 35.9** | 3.1** | 10.2 | 4.4 | 48.5** | 9.0** | 12.3 | 4.2** | 1366 |
| 23 | VGG 17 -016 | 33.0 | 63.0 | 28.9** | 2.1 | 8.5 | 4.4 | 46.0 | 8.3 | 11.7 | 3.7** | 696 |
| 24 | VGG 17 -017 | 32.0 | 63.5 | 36.4 | 1.7 | 7.0 | 3.5 | 30.0 | 7.1 | 10.9 | 4.2** | 637 |
| 25 | VGG 17 -018 | 29.5 | 58.5 | 35.6 | 1.0 | 5.3 | 3.4 | 18.5 | 7.7 | 11.9 | 3.8** | 468 |
| 26 | VGG17 -019 | 35.0 | 65.0 | 53.2 | 2.3** | 10.4 | 3.4 | 47.5** | 7.7 | 12.0 | 4.8** | 2181** |
| 27 | VGG17 -020 | 33.5 | 64.0 | 57.0 | 2.0 | 8.6 | 3.4 | 45.5 | 8.1 | 11.5 | 4.1** | 1395 |
| 28 | VGG 17 -025 | 33.5 | 63.5 | 56.5 | 1.5 | 8.4 | 4.0 | 32.0 | 8.4 | 12.2 | 4.1** | 1193 |
| 29 | VGG 17 -026 | 33.0 | 61.5 | 61.8 | 2.1 | 6.9 | 3.5 | 32.5 | 8.8** | 12.2 | 4.8** | 1372 |
| 30 | VGG 17 -027 | 32.0 | 61.5 | 43.5 | 1.8 | 6.9 | 4.5** | 43.5 | 8.6** | 11.3 | 4.2** | 1237 |
| 31 | VGG 17 -028 | 35.5 | 65.5 | 50.6 | 1.5 | 7.5 | 4.5** | 47.0** | 7.8 | 11.5 | 4.3** | 1627 |
| 32 | VGG 17 -031 | 30.0** | 58.5 | 44.8 | 2.4** | 7.1 | 4.0 | 25.5 | 8.2 | 11.7 | 4.5** | 795 |
| 33 | VGG 17 -036 | 33.5 | 62.5 | 45.9 | 1.6 | 6.5 | 3.6 | 33.5 | 7.6 | 11.1 | 4.0** | 1413 |
| 34 | VGG 17 -037 | 30.5 | 57.5 | 39.3 | 1.8 | 7.3 | 3.8 | 34.5 | 7.7 | 12.1 | 3.7** | 1171 |
| 35 | VGG 17 -038 | 30.0** | 58.5 | 45.2 | 2.0 | 7.5 | 4.0 | 38.5 | 8.4 | 11.9 | 3.9** | 1382 |
| 36 | VGG 17 -039 | 30.0** | 57.5 | 41.5 | 2.0 | 8.1 | 4.0 | 41.5 | 7.9 | 11.6 | 4.0** | 1555 |
| 37 | VGG 17 -040 | 30.0** | 60.5 | 53.3 | 1.8 | 5.4 | 3.8 | 47.0** | 7.9 | 12.1 | 4.2** | 1704 |
| 38 | VGG 17 -041 | 35.0 | 63.0 | 46.1 | 2.3** | 8.4 | 3.9 | 37.5 | 7.6 | 10.9 | 3.6** | 917 |
| 39 | VGG 17 -042 | 36.0 | 65.0 | 39.4 | 2.1 | 6.7 | 3.8 | 44.5 | 8.0 | 11.4 | 4.0** | 1426 |
| 40 | VGG 17 -043 | 31.5 | 61.0 | 38.0** | 1.7 | 4.7 | 3.3 | 36.5 | 7.6 | 10.3 | 4.0** | 1589 |
| 41 | VGG 17 -044 | 35.5 | 65.0 | 32.4** | 2.2 | 9.2 | 3.3 | 41.0 | 8.4 | 11.4 | 3.8** | 1099 |
| 42 | VGG 17 -045 | 31.5 | 60.0 | 51.9 | 1.7 | 9.2 | 3.6 | 48.0** | 8.2 | 12.6 | 4.3** | 2077** |
| 43 | VGG 17 -046 | 32.0 | 60.0 | 39.6 | 1.7 | 7.6 | 4.0 | 36.0 | 8.0 | 12.8 | 3.2 | 1805 |
| 44 | VGG 17 -048 | 35.5 | 66.0 | 56.0 | 2.3** | 7.2 | 3.9 | 48.5** | 9.4** | 11.6 | 3.6** | 2188** |
| 45 | VGG 17 -049 | 34.0 | 67.0 | 59.0 | 1.8 | 9.4 | 3.5 | 50.0** | 8.0 | 11.4 | 3.2 | 2376** |
| 46 | VGG 17 -050 | 35.0 | 68.0 | 49.4 | 2.3 | 9.9 | 3.6 | 45.0 | 7.7 | 11.7 | 3.4 | 2264** |
| 47 | VBN (Gg)2 | 35.5 | 64.5 | 56.9 | 2.1 | 7.6 | 3.8 | 32.0 | 7.8 | 11.2 | 3.5 | 1478 |
| 48 | VBN (Gg) 3 | 35.5 | 65.0 | 56.2 | 2.1 | 9.9 | 4.0 | 40.0 | 8.1 | 12.7 | 3.5 | 1735 |
| 49 | CO 8 | 31.5 | 60.0 | 44.0 | 1.9 | 8.5 | 3.6 | 36.0 | 7.6 | 11.7 | 3.3 | 1441 |
| | SE | 0.35 | 0.57 | 1.28 | 0.07 | 0.22 | 0.05 | 1.21 | 0.08 | 0.08 | 0.06 | 66.71 |
| | CD(P=0.05) | 1.32 | 6.13 | 5.05 | 0.2 | 1.2 | 0.5 | 6.6 | 0.5 | 1.2 | 0.1 | 296.2 |

coefficient of variation, phenotypic coefficient of variation. In the present study, the number of branches per plant, the number of pods per plant and seed yield (kg/ha) have recorded higher GCV and PCV. Among the estimates of genetic parameters, heritability serves as a good index for transmission of character from one generation to next generation and it should be considered in terms of selection concept. High heritability coupled with high genetic advance as per cent of mean was recorded by the number of branches per plant, the number of clusters per plant, the number of pods per plant, hundred seed weight and seed yield (kg/ha). High heritability coupled with high genetic advance indicated that most likely the heritability is due to additive genetic effects and the selection may be effective. Which also suggested that the variation in the environment played relatively limited role in influencing the inheritance of these characters and thus the response to selection would be higher.

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