VARIETAL CHARACTERIZATION AND SELECTION OF Superior ~~BEST~~ PARENTS FOR HYBRIDIZATION PROGRAMME IN GREENGRAM(*Vigna radiata* (L.) Wilczek)

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Abstract:

The present study was conducted to examine the genetic basis of yield and its related components, enabling selection based on heritability and genetic gain.~~The current study was carried out to understand the genetic nature of yield and its associated yield components on which selection can be made based on heritability and genetic gain.~~ The experiment involved the evaluation of fourteen accessions of green gram in *Kharif* season of year 2024 in a randomized complete block design. Data were collected from ten important yield related characters and analysed statistically. ANOVA revealed significant variation in the genetic material used in the study. Among the studied genotypes, CO 7, CO 4, CO 8, and CO 6 were identified as superior for seed yield based on their mean performance.~~ANOVA showed significant variation was present in the genetic material taken for the study. Among the genotypes, CO 7, CO 4, CO 8 and CO 6 was considered as the superior for seed yield trait based on the mean performance.~~ The phenotypic coefficient of variation exceeded the genotypic coefficient of variation, indicating that the observed variation between the two is primarily due to the genotypes, with minimal environmental influence. Notably, single trait,number of pods per plantexhibited both high heritability and high genetic advance.~~Phenotypic coefficient of variation was higher than the genotypic that indicated the apparent variation between phenotypic and genotypic co-efficient of variance is due to genotypes takenalong with little environmental influence. Only one trait (*i.e.*,) number of pods per plant showed high heritability coupled with high genetic advance.~~

Keywords: Green gram, variability, superior parents, selection

Introduction:

Primarily cultivated as a *Kharif*(monsoon) crop, green gram's (*Vigna radiata* (L.) Wilczek)cultivation during the *Rabi* (winter) season is confined to eastern and southern regions of India. Its widespread appeal comes from its ability to thrive in various climates, short growth

cycle, compatibility with crop rotation and intercropping, low water needs, and ease of digestion. In India, green gram is a vital pulse crop, ranking as the third most important after chickpea and pigeon pea. It is grown on about 40.38 lakh hectares, yielding approximately 31.5 lakh tonnes, which translates to a productivity rate of roughly 783 kg per hectare. Rajasthan stands out as the top producer, benefiting from optimal conditions for cultivating this legume (Khine *et al*., 2021).

Genetic variability study is also useful to understand the nature and extent of variability that is due to different causes, sensitive nature of the crop to environmental effects, heritability of the characters and genetic advance through practical breeding in developing varieties or genotypes to withstand various environmental conditions like high temperature, rainfall, humidity and so on (Jain *et al*., 2024). The success of a breeding programme for the genetic improvement of quantitative characters depends on the degree of genetic variability existing in the germplasm and the extent to which the desirable characters are inherited. The use of coefficients of variation, heritability and genetic advance to know if variability that exists in a crop species is heritable or not is precursor to the understandingof genetic nature of yield and its components on which rewarding selection can be made (Kate*et al*., 2017).

High yield can be acquired by selecting yield contributing characters that have high heritability together with high genetic advance (Priyanka *et al*., 2018). Heritability estimates and genetic advance together with genetic variability in any crop species are very important to ascertain the success of any crop improvement. The magnitude of genetic variability existing in the okra germplasm in Nigeria today and the extent to which the desirable characters are heritable are very low. Selection of okra germplasm which is the basis of breeding research has been based on yield of okra alone which has not been effective and efficient (Sabatina *et al*., 2021). Hence, successful breeding program will depend on the greater magnitude of genetic variability existing in okra germplasm and heritability. Also, efficient selection for yield in crops will not only depend on okra yield alone but on yield contributing traits or components.

As a result, this present study was carried out todetermine the genetic variability in twenty accessions of okra,estimate the genotypic and phenotypic coefficients of variation in okra accessions,study the extent of heritability along with genetic advance anddetermine the association of pod yield and its components in okra in two different years.

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Materials and methods:

Study location: The experimental study was carried out at crop cafeteria of Department of Plant Breeding and Genetics, Imayam Institute of Agriculture and Technology, Thuraiyur, Tiruchy in the state of Tamil Nadu during season *Kharif*, 2024. Fourteen greengram accessions were laid out in a single-row plot in three replications in a Randomized Complete Block Design. Each row was 4.5m long and 2m width with inter-row spacing of 0.5m. Seeds of various accessions were sown at a depth of 1cm at a spacing 30 x 10cm with three to four seeds per hole and later thinned to two per hole after germination. Weeding was carried out manually ~~at~~ three weeks after planting and when necessary to keep the field weed free.

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Observations noted: Data were collected using the International Plant Genetic Resources Institute (IPGRI, 1991) Descriptor List for green gram. Data were collected on five plants per accession in each plot by measurement or counting on the following morphological traits: plant height (cm), days to 50 per cent flowering (days), number of primary branches per plant, number of pods per cluster, number of pods per plant, pod length (cm), number of seeds per plant, test weight (g), days to maturity (days) and single plant yield per plant (g).

Statistical analysis: The data recorded from five randomly selected plants from experimental plot were used to calculate the mean value for each accession of each replication. The mean values obtained were used for the combinedestimation of variance and genetic parameters using AGRISTAT software.

Results:

ANOVA and mean performance of green gram accessions:

The analysis of variance **(ANOVA)** for different traits revealed ~~highly~~ significant ($p < 0.01$) differences for plant height, days to 50 per cent flowering, number of pods per plant, number of seeds per plant, pod length ,~~and~~ days to maturity ~~among fourteen okra accessions studied; Significant differences ($p < 0.05$) for~~ number of pods per cluster ($p < 0.05$) and seed yield per plant ($p < 0.05$) while no significant differences for number of primary branches per plant and test weight among fourteen okra accessions studied; Significant differences for (Table 1).

The mean performance of 14 accessions for seed yield per plant and other related characters for *Kharif* season ~~is shown in~~ (Table 2) and comparison of superior genotypes (graph 1) are presented~~were picturize in graph 1~~. Thetallest and shortest plants were recorded in CO 4 (59.70cm) and ADT 1 (40.80cm) respectively. Genotypes such as VBN 1, VBN 2, VBN 3, CO 4, CO 8, KM 2, CO 6, ADT 2, and PAIYUR 1 exhibit plant heights above the mean value (write mean value). The days to reach 50 per cent flowering vary from 24.03 days (VBN 3) to 49.96 days (CO 7). Genotypes such as VBN 1, VBN 2, VBN 3, CO 8, ADT 3, and CO 6 show values lower than the mean (write mean value)..The highest and lowest number of branches was recorded ~~by~~for KM1 (3.97) and CO7 (1.38).Genotypes ~~including~~ VBN 1, ADT 3, VBN 6, ADT 2, KM 1, and PAIYUR 1 have branch counts above the mean(write mean value)..

~~VBN 1, CO 6, CO 7, ADT 2, ADT 1, and PAIYUR 1 had significant value for the number~~ Number of pods per cluster recorded a ~~with~~ minimum and maximum of 2.17 pods~~by~~ for ADT 3 and 6.72 pods~~by~~ for CO 7. The maximum number of pods per plant was found in CO7 (49.31) and minimum number was observed in PAIYUR 1 (13.71). VBN 2, VBN 3, CO 8, CO 7, and KM 1 ~~have significant~~recorded higher mean values for the number of pods. The highest number of seeds per pod was in VBN 3 with 12.43 seeds and lowest number was in VBN 6 with 7.40 seeds. The longest and shortest pods were seen in VBN 1 (11.18 cm) and ADT 1 (5.10 cm) respectively. VBN 1, VBN 2, VBN 3, CO 7, CO 8, and ADT 3 had mean values higher than the population mean both for seeds per pod (write mean value) and pod length (write mean value)..

The highest test weight was recorded for VBN 1 (11.18 g) and lowest was observed in ADT 1 (5.10 g). VBN 1, VBN 2, CO 4, CO 8, ADT 1, and PAIYUR 1 ~~show~~ recorded test weights above the general mean (write mean value).. The longest crop duration was noted ~~in~~ for CO 7 at 74.96 days while shortest duration ~~in~~ for VBN 3 at 49.03 days.CO 6, ADT 3, CO 8, VBN 3, VBN 2, and VBN 1 ~~significantly~~ matured~~more quickly~~earlier than others. The highest seed yield per plant was observed ~~in~~ for CO 7 at 9.63 g and lowest ~~in~~ for ADT 3 at 5.59 g. CO 4, CO 8, CO 6, CO 7, and KM 1 had ~~significantly~~ better seed yielder~~comparatively~~ than ~~its population~~ mean population (write mean value)..

Phenotypic and genotypic coefficient of variation

The estimates of phenotypic coefficient of variation, genotypic coefficient of variation, heritability and genetic advance are shown in Table 3. Phenotypic coefficients of variation were higher than the genotypic coefficients of variation for all of the ten analysed characters. High values of GCV and PCV were recorded for the characters such as number of primary branches, number of pods per cluster, number of pods per plant and pod length. Moderate level of GCV and PCV were observed for plant height, days to 50% flowering, number of seeds per pod, test weight, days to maturity and seed yield traits. A very low value of GCV and PCV were observed for none of the characters in analysis.

Heritability and genetic advance

In this study, all the characters exhibited very high heritability (Table 3).Highest heritability was recorded for nNumber of pods per plantshowed highest heritability (99.51%)and whereas lowest least by number of pods per cluster (92.84%). The genetic advance was in the range of 22.09 (number of pods per plant) to 0.28 (seed yield per plant). High genetic advance was only observed only in for number of pods per plant.,A moderate genetic advance was recorded by for plant height, days to 50 per cent flowering and days to maturity while lower genetic advance was registeredin for number of primary branches, number of pods per cluster, number of seeds per plant, pod length, test weight and seed yield per plant.

A high heritability coupled with a high genetic advance had was noted for the number of pods per plant trait only while high heritability plus moderate genetic advance was by observed for plant height, days to 50 per cent flowering and days to maturity.conversely, A higher heritability with lower genetic advance was recorded for traits like the number of branches per plant, number of pods per cluster, number of seeds per pod, pod length, test weight, and seed yield per plant.

Discussion:

Highly significant differences were obtained among the ten characters in fourteen accessions of green gram under study showed showcasing that the variability among the accessions is very high which may be as a result of differences in the genetic components of the accessions. This is in accordance with the findings of Mahla*et al*., (2024), Thonta*et al*.,(2023),

Udayasri *et al*., (2022) and Harshitha and Jayamani (2020) who also obtained highly significant differences in all the traits they studied.

The comparison of PCV and GCV reveals that PCV is consistently higher than GCV. This indicates a significant environmental influence on plant traits like plant height, days to 50per cent flowering, number of branches per plant, number of pods per cluster, number of pods per plant, number of seeds per pod, pod length, test weight, days to maturity, and seed yield per plant. The environmental effects have greater impact on variability than the genetic effects in these traits. While GCV measures the genetic variability present in various characters, the trend of GCV expression was not uniform across all characters. Priyanka *et al*., (2023), Salman *et al*., (2023), Sineka *et al*., (2021), Muthuswamy *et al*., (2019), Susmitha *et al*., (2018) and many others worked in PCV and GCV of green gram.

Heritability in broad sense of a character is of significance to breeder because it shows the possibility of improvement through selection and it is used to determine the degree to which a character may be ~~transmitted~~ transferedfrom parent to offspring. The genetic advance can be defined as a product of heritability ratio and selection differentials.High estimates of heritability along with high genetic advance form the basis of selection for further breeding work. A high heritability coupled with a high genetic advance for the number of pods per plant suggests strong additive gene action for this trait and selection will be rewarding for improvement of this trait through simple selection. Similar results of high heritability and high genetic advance were also reported by Chandel *et al*., (2024), Salman *et al*., (2023), Thakur *et al*., (2022), Sineka *et al*., (2021) and so many researchers. Conversely, high heritability with lower genetic advance for traits like the number of branches per plant, number of pods per cluster, number of seeds per pod, pod length, test weight, and seed yield per plant indicates a considerable environmental influence on these traits. Similar results of high heritability with low genetic advance were also reported by Priyanka *et al*., (2023), Wesly *et al*., (2020) and Sandhiya *et al*., (2018).

Conclusion:

The present study concludes that the observed variation between the phenotypic and genotypic coefficients of variance is influenced not only by the genotypes themselves but also by favorable environmental factors.

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~~The present study is concluded that the apparent variation between phenotypic co-efficient of variance and genotypic co-efficient of variance is not only due to genotypes taken but also due to favorable influence of environment~~. As the environment is a non-heritable fluctuating factor, selection for improvement of such traits sometimes may be misleading. High heritability accompanied with high and moderate genetic advance was recorded for almost all of the traits studied. Selection of such characters may be effective in terms of heritability and genetic advance as percentage of mean. From the diverse genetic materials studied, the genotypes CO 7, CO 4, CO 8 and CO 6 were considered as potential accessions for hybridization programmebased on the mean performance for all the traits taken for the study including seed yield per plant.

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Table 1. Analysis of variance for some quantitative traits in Green gram genotypes

SOURCE OF VARIATION	MEAN SUM OF SQUARES		
	Replication	**Genotype**	**Error**
Degrees of freedom	2	13	26
QUANTITATIVE CHARACTERS			
Plant height (cm)	0.23	104.29**	1.40
Days of 50per cent flowering	0.22	143.43**	0.78
No.of branches/plant	0.05	1.84	0.04
No.of pods/cluster	0.05	5.08*	0.13
No.of pods/plant	0.50	347.28**	0.57
No.of seeds/pod	0.08	7.86**	0.20
Pod length (cm)	0.31	6.84**	0.15
Test weight (g)	0.03	0.81	0.01
Days to maturity	0.22	143.43**	0.78
Seed Yield per plant (g)	0.02	3.93*	0.02

** significance at 1 per cent probability level; * significance at 5 per cent probability level

Table2. Mean performance of green gram genotypes for plant characters

Genotypes	Plant height (cm)	Days of 50 per cent flowering	No. of branches/plant	No. of Pod/cluster	No. of pods/ plant	No. of seeds/ pod	Pod length (cm)	Test weight (g)	Days to maturity	Seed yield per plant (g)
VBN 1	57.60**	34.33**	3.64**	5.51**	22.35	11.10**	11.18**	3.62**	59.33**	6.50
VBN 2	57.78**	29.84**	2.30	3.69	35.57**	11.23**	7.77	3.83**	54.84**	7.43
VBN 3	55.40**	24.03**	2.20	3.74	37.01**	12.43*	8.35**	2.83	49.03**	7.50
CO 4	59.70**	44.67	1.73	4.37	17.37	10.70	5.31	4.22**	69.67	9.22**
CO 8	53.02	35.0**	2.30	3.95	35.30**	12.28**	7.42	3.38	60.0**	8.88**
ADT 3	48.39	35.55**	2.94**	2.17	17.73	10.29	7.60	2.82	60.56**	5.59
KM 2	52.69	41.56	1.91	4.44	22.15	9.86	7.08	3.05	66.56	7.21
VBN 6	47.14	42.91	2.67	3.86	15.43	7.40	6.38	2.50	67.91	7.05
CO 6	53.38	32.77**	1.54	4.63	23.25	8.59	6.89	3.14	57.77**	8.83**
CO 7	44.11	49.96	1.38	6.72**	49.31**	11.65**	8.36**	3.57**	74.96	9.63**
ADT 2	56.74**	40.73	2.49	6.07**	22.3	9.21	5.56	3.22	65.73	7.28
KM 1	45.67	40.75	3.97**	3.35	34.29**	9.43	7.81	2.42	65.75	7.79
ADT1	40.80	41.14	1.89	6.43**	14.33	8.81	5.10	3.81**	66.14	6.53
PAIYUR 1	57.12**	45.63	3.32**	5.66**	13.71	7.59	6.86	3.41*	70.63	7.21

** significance at 1 per cent probability level; * significance at 5 per cent probability level

Table 3. Variability estimates of ten quantitative traits in green gram genotypes

Characters	General mean	CV (per cent)		h^2 (per cent)	GA	GAM (per cent)
		PCV	GCV			
Plant height (cm)	52.11	11.47	11.24	96.07	11.82	22.69
Days of 50 per cent flowering	38.49	18.06	17.91	98.38	14.09	36.60
No. of branches/plant	2.45	32.72	31.58	93.17	1.54	62.79
No. of pods/cluster	4.61	28.90	27.84	92.84	2.55	55.26
No. of pods/plant	25.74	41.87	41.77	99.51	22.09	85.84
No. of seeds/pod	10.04	16.52	15.92	92.86	3.17	31.60
Pod length (cm)	7.19	21.47	20.76	93.50	2.97	41.35
Test weight (g)	3.27	16.0	15.84	97.98	1.06	32.29
Days to maturity (days)	63.49	10.95	10.86	98.38	14.09	22.19
Seed yield per plant (g)	7.62	15.10	15.00	98.69	0.28	30.69

Graph 1. Comparison of the selected best four genotypes