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GENETIC VARIABILITY AND CORRELATION IN GREEN GRAM [*Vigna radiata* (L.) R. Wilczek]

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ABSTRACT

The current empirical study on "Genetic variability and correlation in green gram (*Vigna radiata* (L.) R. Wilczek)" was conceded to assess variability, heritability, genetic advance and correlation in 72 genotypes of green gram. At the Pluses Research Station, Junagadh Agricultural University, Junagadh Gujrat India, the experiment was carried out in RBD with 3 replications during the *kharif* 2021–22. On 11 traits, observations were recorded. The results of the analysis of variance showed that there was a significant amount of variability in the experimental material used. Although PCV was slightly greater than GCV, it was indicated that environmental variation had a negligible impact on all of the characters and that there was enough variability to be noticed. The estimates of high heritability and high genetic advance expressed as a percentage of the mean were found for number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, 100-seeds weight and grain yield per plant. At both genotypic and phenotypic levels, there was a highly significant and positive correlation with grain yield per plant was observed for number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod and weight of 100 seeds.
Keywords: Genetic variability, correlation and *Vigna radiata* (L.) R. Wilczek.

Introduction

In Indian agriculture, pulse crops play an important role. Quality protein is higher in pulses nearly three times as compared to cereals. Green gram is a legume cultivated for its edible seeds and sprouts across Asia. It has a diploid chromosome number of 2n=2x=22 and is a member of the fabaceae family and subfamily papilionaceae. Green gramme is a native of Central Asia and India, claims Vavilov (1939). Green gram contains about 24 % protein, this is being about 2/3 of the protein content of soybean, twice that of wheat and thrice that of rice. This protein is relatively high in an amino acid and lysine that is lacking in cereal grains. So, green gram and cereal grains diet combining form a balanced amino acid diet. Every 100 g green gram seed contain 132 mg calcium, 2.251 mg niacin, 4.8 mg ascorbic acid, 0.621 mg thiamine, 0.233 mg riboflavin and 114 IU vitamin A (Haytowitz and Matthews, 1986).

37.5 per cent of the global area and 32 per cent of global production are devoted to growing pulses. At present the area under pulses in the world is 68.9 m. ha with a production of 69 m. t. and an average yield of 999 kg/ha. Green gram productivity in India is 548 kg/ha, with a total production of 2.51 lakh tonnes grown on 45.81 lakh ha of land. (Anon., 2019-20). In Gujarat, it is cultivated on 1.35 lakh hectares, producing 1.04 lakh metric tonnes annually, with an average yield of 772 kg/ha. (Anon., 2019-20).

Any effort to improve crops should have as its prime aim an increase in crop production. The trait, yield has a complicated gene action and is the result of many factors. Different factors influencing the yield must be taken into account and assessed with regard to their contribution towards the yield for a crop to study it properly. In order to choose a superior plant type, it is necessary to be aware of the genetic and nongenetic causes of variability present in breeding material.

In exercising selection programs, the information on the relationships between traits and seed production is of considerable importance. Multiplicative end product of many factors is being a polygenic complex trait and sensitive to environmental variations in grain yield. There are also numerous component characters of grain yield. So, a thorough understanding of grain yield contributing traits and a correlation study involving these traits and yield is necessary for an effective selection for higher yields.

Materials and Methods

72 genotypes of green gram from different origins obtained from the Pulses Research Station, J.A.U., Junagadh gujrat India were sown in a RBD with 3 replications during

kharif 2021 at Pulses Research Station, J.A.U., Junagadh. Each genotype was arranged in a single row that was 4 metres long with spacing of 45 cm × 10 cm.

The observations were recorded for 11 traits *viz.,* days to 50 % 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, number of seeds per pod, length of pod (cm), 100-seeds weight (g) and grain yield per plant (g) and mean values were used for statistical analysis.

Analysis of variance for RBD was performed as per Panse and Sukhatme (1985). GCV and PCV were computed as per the formula proposed by Burton (1952). The formula given by Allard (1960) was used to measure heritability and genetic advance. Genotypic and phenotypic association for all the pair wise traits was worked out as per Al-Jibouri *et al.* (1958).

Result and Discussion

The analysis of variance (Table 1) revealed that mean squares due to genotypes were highly significant for days to 50 % flowering, days to maturity, plant height, number of pods per plant, number of seeds per pod and grain yield per plant indicating the presence of sufficient amount of variability in the experimental material used. These results are in agreement with the findings of Kumar *et al.* (2010) and Garg *et al.* (2017) indicating adequate genetic variability among the genotype which provide ample scope for identifying genotypes with desirable character to improve yield, provided the material be subjected to sensible pressure. It reveals that the selection of superior genotypes for development of new varieties may be helpful.

The magnitude of PCV was slightly greater than GCV for all the traits, revealed a very little influence of environmental variation for their expression. This indicated that phenotypic variability may be considered as reliable measure of genotypic variability. For seed production per plant (20.51%), a significant phenotypic coefficient of variation was recorded. Identical results were also reported by Yadav *et al.* (2017), Abbas *et al.* (2018) and Abhisheka and Mogali (2020).

Table 1: Analysis of variance for eleven traits in 72 genotypes of green gram

Source of variation	d.f	Days to 50 % flowering	Days to maturity	Plant height (cm)	Number of primary branches per plant	Number of clusters per plant	Number of pods per cluster
Replications	2	5.03	4.12*	2.48	0.31	0.15	0.03
Genotypes	71	6.07**	10.03**	120.3**	0.61	0.89	1.05
Error	142	2.36	4.59	14.18	0.11	0.08	0.10

Source of variation	d.f	Number of pods per plant	Number of seeds per pod	Length of pod (cm)	100-seeds weight (g)	Grain yield per plant (g)
Replications	2	8.18**	2.18	0.27	0.12	1.93
Genotypes	71	38.38**	3.68**	0.74	1.25	7.72**
Error	142	2.88	0.72	0.09	0.04	0.70

*, ** Significant at 5 and 1 % levels, respectively

Moderate value for GCV and PCV was observed for plant height, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod and 100-seeds weight. In addition to this, the characters grain yield per plant also exhibited moderate value for GCV only. The moderate GCV and PCV for plant height, 100-seeds weight, number of pods per cluster, number of seeds per pod was reported by Asari *et al.* (2019). Moderate GCV and PCV for plant height, number of branches per plant, number of clusters per plant, number of pods per cluster and 100-seeds weight were in agreement of Abhisheka and Mogali (2020). While Tabasum *et al.* (2010) reported moderate GCV and PCV for number of pods per plant and moderated GCV for grain yield per plant. The characters showed moderate GCV and PCV indicated that selection would be effective based on the heritable nature of these characters.

Low value for GCV and PCV was observed for days to 50% flowering, days to maturity and length of pod. These results are in accordance with Dangi *et al.* (2017), Yadav *et al.* (2017) and Dhunde *et al.* (2021a). Kumar *et al.* (2010) reported low values for days to 50 % flowering and days to maturity. Low values of GCV and PCV indicated low range of variation for traits in the genotypes, thus offering little scope for further improvement of these characters through simple selection.

High heritability (>60 %) in broad sense estimates (Table 2) were observed for 100-seeds weight followed by number of pods per plant, grain yield per plant, number of clusters per plant, number of pods per cluster, plant height, length of pod, number of primary branches per plant, number of seeds per pod and days to 50 % flowering. Similar conclusion is derived by Muthuswamy *et al.* (2019). Abbas *et al.* (2018) for plant height, number of clusters per plant, number of pods per plant, 100-seeds weight and grain yield per plant; Mohammed *et al.* (2020) for number of branches per plant, days to 50 % flowering, 100-seeds weight, plant height, pod length, grain yield per plant, number of pods per plant and number of seeds per pod. Heritability of a metric character is a parameter of particular significance to the breeder as it measures the degree of resemblance between the parents and the off-springs and its magnitude indicates the efficacy with which a genotype can be identified by its phenotypic expression. Characters with high heritability suggest that the selection would be more effective.

Table 2: Phenotypic range, mean, range coefficient (%), GCV (%), PCV (%), heritability, genetic advance and genetic advance as per cent of mean for 11 traits in green gram

Characters	Phenotypic range	Mean	Range coefficient (%)	GCV (%)	PCV (%)	Heritability in broad sense (%)	Genetic advance	Genetic Advance expresses as % of mean
Days to 50% flowering	35.33-41.67	38.37	8.23	2.90	3.71	61.10	1.79	4.67
Days to maturity	66.33-75.33	71.27	6.35	1.89	2.57	54.20	2.04	2.86
Plant height (cm)	48.93-73.67	59.24	20.18	10.04	10.69	88.20	11.51	19.43
Number of primary branches per plant	1.93-3.73	2.72	31.80	15.02	16.63	81.50	0.76	27.93
Number of clusters per plant	2.00-4.33	2.90	36.81	17.91	18.80	90.80	1.02	35.16
Number of pods per cluster	2.53-4.93	3.56	32.17	15.75	16.59	90.10	1.10	30.79
Number of pods per plant	13.20-28.20	17.99	36.23	19.11	19.88	92.50	6.81	37.87
Number of seeds per pod	7.67-12.60	9.86	24.32	10.09	11.24	80.50	1.84	18.65
Length of pod (cm)	6.60-8.73	7.53	13.89	6.20	6.62	87.90	0.90	11.98
100-seeds weight (g)	3.56-5.96	4.50	25.21	14.11	14.35	96.70	1.29	28.60
Grain yield per plant (g)	4.90-12.03	7.82	42.11	19.56	20.51	90.90	3.01	38.42

Table 3: Genotypic (r_g) and phenotypic (r_p) correlation coefficients among eleven traits in green gram

Characters		Days to 50% 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	Number of seeds per pod	Length of pod (cm)	100-seed weight (g)	Grain yield per plant (g)
Days to 50% flowering	r_g	1.000	0.893**	0.181	0.016	-0.456**	-0.567**	-0.502**	-0.171	-0.061	0.289*	-0.334**
	r_p	1.000	0.618**	0.145	0.036	-0.339**	-0.441**	-0.396**	-0.087	-0.032	0.227	-0.249*
Days to maturity	r_g		1.000	0.372**	0.104	-0.673**	-0.712**	-0.835**	0.263*	0.080	0.539**	-0.267*
	r_p		1.000	0.277*	0.060	-0.515**	-0.549**	-0.593**	0.174	0.078	0.381**	-0.192
Plant height (cm)	r_g			1.000	0.191	-0.092	-0.111	-0.127	0.302**	0.336**	0.165	0.135
	r_p			1.000	0.156	-0.085	-0.107	-0.122	0.258*	0.284*	0.159	0.117
Number of primary branches per plant	r_g				1.000	0.323**	0.218	0.304**	0.118	0.165	0.201	0.458**
	r_p				1.000	0.305**	0.202	0.261*	0.101	0.133	0.196	0.395**
Number of clusters per plant	r_g					1.000	0.660**	0.818**	-0.139	0.134	-0.254*	0.469**
	r_p					1.000	0.617**	0.750**	-0.121	0.100	-0.231	0.424**
Number of pods per cluster	r_g						1.000	0.809**	-0.020	0.063	-0.290*	0.539**
	r_p						1.000	0.738**	-0.021	0.060	-0.273*	0.482**
Number of pods per plant	r_g							1.000	-0.093	0.082	-0.339**	0.612**
	r_p							1.000	-0.084	0.084	-0.320**	0.619**
Number of seeds per pod	r_g								1.000	0.341**	0.116	0.473**
	r_p								1.000	0.293*	0.099	0.486**
Length of pod (cm)	r_g									1.000	-0.026	0.250*
	r_p									1.000	-0.014	0.235*
100- seeds weight (g)	r_g										1.000	0.387**
	r_p										1.000	0.363**

*, ** Significant at 5 and 1 % levels, respectively

The estimates of high heritability coupled with high genetic advance expressed as per cent of mean was observed for number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, 100-seeds weight and grain yield per plant. These characters may have contributed to preponderance of additive gene action and selection pressure could profitably be applied on these characters for their rationale improvement. The same outcome is reported by Muthuswamy *et al.* (2019) and Abhisheka and Mogali (2020).

For the majority of the traits, genotypic correlation was found to be somewhat higher than phenotypic correlation. This indicated a greater role of genetic factors in determining these associations which reflected that the environment could not deviate the expression of phenotypic association (Table 3). There was found to be relatively little difference between genotypic and phenotypic association. The occurrence of higher estimates of genotypic correlation than the corresponding phenotypic correlation between grain yield and yield components in green gram has also been reported by Prasanna *et al.* (2013) and Abbas *et al.* (2018).

Grain yield per plant had highly significant and positive correlation with number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod and 100-seeds weight at both genotypic and phenotypic levels indicating any improvement in these traits with positive correlation with grain yield will results in a substantial increment of grain yield. Such result also reported by Prasanna *et al*. (2013) for number of primary branches per plant, number of clusters per plant and number of pods per plant; Baisakh *et al.* (2016) for number of clusters per plant, number of pods per plant and number of seeds per pod; Mohammed *et al.* (2020) for number of branches per plant, number of clusters per plant, number of seeds per pod and number of pods per plant; Sarkar *et al*. (2014) for number of seeds per pod and 100-seeds weight at genotypic level; Garg *et al*. (2017) for number of primary branches per plant, number of pods per plant and number of seeds per pod at phenotypic level; Abhisheka and Mogali (2020) and Dhunde *et al*. (2021b) for number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod and 100-seeds weight at phenotypic level. Grain yield per plant had significant and positive correlation with length of pod at both genotypic and phenotypic level. Similar association has been reported by Baisakh *et al.* (2016).

Significant and positive relationship among these pair of characters suggested that the enhancement in one will bring the enhancement in another which, in turn automatically leads to increase in grain yield.

Conclusion

From the present investigation, it can be suggested that additive gene action was operating for number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, 100-seeds weight and grain yield per plant as it showed high heritability coupled with high genetic advance as a per cent of mean. Study of correlation coefficient and path analysis clearly showed that the number of pods per plant and 100-seeds weight was most important trait**.**

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