Original Research Article

Unveiling key correlation studies in local germplasm of green gram [*vigna radiata* (l.) Wilczek]

ABSTRACT

The present investigation entitled "Unveiling key correlation studies in local germplasm of green gram [*Vigna radiata* (L.) Wilczek]" was conducted at Agricultural Botany section farm, College of Agriculture, Dhule during *kharif*-2022. The experimental material included 42 genotypes of mungbean which were evaluated in a Randomized Block Design (RBD) with two replications, representing different eco-geographic regions and the source of material was Assistant Pulse Breeder, Oilseed Research Station, Nimkhedi, Jalgoan and local collection from Dhagdaon, Akkalkua, Nandurbar of Maharashtra state. Genotypes were evaluated for twelve diverse characters and correlation coefficient studies were conducted. The weight of 100 seeds (0.5054), the number of seeds per pod (0.4168), the thickness of the pods (0.339), the number of clusters per plant (0.2602), the number of pods per plant (0.2232), and the seed output per plant were the most significant and favourable relationships. It has a negative and non-significant correlation with the number of pods per cluster (-0.0534), but a positive correlation with plant height (0.1748), pod length (0.1737), protein content (0.159), 50 per cent flowering (0.0282) and days to maturity (0.0071). Based on the results, the highest yield of mungbean may be obtained from genotypes with higher protein content, early flowering and ripening, maximum plant height, long and thick pod size, more seeds per pod, and superior seed weight.

KEYWORDS: Correlation, green gram, quantitative traits, local germplasm, genotypes.

INTRODUCTION

In order to create a directional model for a direct or indirect improvement in grain yield, correlation analysis was used to reveal the interrelationships of key plant characteristics (Patil *et al*., 1988). "The correlation coefficient among yield traits and its components help to provide information about their performance and association with one another in the selection programme, whereas path coefficient analysis provides information about their direct and indirect cause of association" (Barde *et al*., 2024). Finding characters who promote yield by having high correlation between their output and their output-contributing characters is crucial. For that, correlation studies are very important and this study focuses on that aspect of local germplasm of green gram.

"Mungbean (green gram) is a significant pulse since it doesn't cause heaviness or gas, has more easily digested proteins, and is a source of calories in Asian diet" (Engel, 1978). "Ten main Indian states were Haryana, Maharashtra, Madhya Pradesh, Karnataka, Bihar, Andhra Pradesh, Orissa, Tamil Nadu, Gujarat, and Telangana account for more than 80% of the country's mungbean production" (Sehrawat, *et al*., 2021). "2.85 Mt mungbean's were produced in India in total, 1.48 Mt in *kharif* and 1.37 Mt in rabi season. This amounts to 10% of the country's total pulse production". (Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, 2022).

"Mungbean is a creeping annual crop. It can grow extensively on all types of soil but largely sown by the farmers in arid and semi-arid regions" [25,26]. It requires warm climate for seed germination (28-30°C) and better growth performance (30-35°C) throughout the life cycle. The mungbean (*Vigna radiata* L. Wilczek), is a warm season annual legume with enormous potential that shows a short duration life cycle.

MATERIAL AND METHODS

The Assistant Pulse Breeder, Oilseed Research Station, Nimkhedi-Jalgoan, and a local collection from Dhagdaon provided the experimental materials for this study, which contained 42 genotypes of mungbean from various eco-geographic locations. During *kharif* 2022, the 42 genotypes were assessed using a Randomised Block Design (RBD) with two replications spaced 30 cm apart by 10 cm. Variables such as plant height (cm), number of pods per plant, length (cm), thickness (mm), number of clusters per plant, number of pods per cluster, number of seeds per pod, 100 seed weight (g), protein content (%), and seed yield per plant (g) were among the many characteristics that were assessed for the plants.

The protein content in dry seed was determined by estimating the organic nitrogen through the Kjeldahl method outlined by Hawk *et al.* (1954). "Seeds sample from the five selected plants per genotype were bulked and seeds grinded in a grinder. The 0.2 g of grinded samples were analyzed in the laboratory for nitrogen content by wet digestion method at Department of Soil Science, College of Agriculture, Dhule. The analysis of variance for different characters was carried out using the mean data into different sources by following the method" given by Panse and Sukhatme (1995). The correlation coefficient will be worked out by adopting the method described by Singh and Chaudhary, 1979.

RESULTS AND DISCUSSION

"In a betterment of any crop, seed yield is most important character that has to be taken into consideration. An efficiency of selection program is improved with knowledge of inter relationship among the characters especially with yield. The development of relation between attributes and on the genes which contribute to the variation is basis for degree of correlation. A positive correlation is result from changes of genes supplying precursors. Selection strategy based on these characters having high direct effect coupled with positive correlation with seed yield will be rewarding in mungbean improvement programme" (Ahmed and Belwal 2020).

The phenotypic correlation does not account for true genetic relationship but exhibits

observed relationships between two characters. It indicates effects of both heredity as well as environment. The genotypic correlation gives an estimate of an inherent association between genes. Hence genetic correlation has greater significance and can effectively be utilized in formulating an effective selection scheme. The correlation coefficient estimation also helps to identify the characters that prove to be of little or no importance in selection program.

According to table 1, analysis of variance manifested highly significant differences among genotypes for all characters under present study. The observations were subjected to estimate population mean, range, coefficient of variation. The mean sum of square for all traits due to treatments was significant, indicating that significant difference across the genotypes existed.

In present investigation, for most of the characters studied, the values of genotypic correlation coefficient were greater than phenotypic correlation co-efficient. Further study also indicates that environment has little influences to alter the degree of association of all the characters (Singh *et al*. 2021). The seed yield per plant showed highly significant and positive association with seeds per pod (0.616), 100 seeds weight (0.6076), number of clusters per plant (0.4734), number of pods per cluster (0.3597), and protein content (0.2915), whereas character number of pods per plant (0.2106), plant height (0.1919), pod thickness (0.0148), and days to maturity (0.0028) had positive but non-significant association with seed yield at genotypic level. A negative and non - significant association given by pod length (-0.1233), and days to 50 per cent flowering (- 0.0231).

At phenotypic level, seed yield per plant shown highest significance and positive correlation with 100 seeds weight (0.5054), number of seeds per pod (0.4168), pod thicknesss (0.339), number of clusters per plant (0.2602), and pods per plant (0.2232). It has negative and non-significant correlation with number of pods per cluster (-0.0534) and positive with plant height (0.1748), pod length (0.1737), protein content (0.159), 50 per cent flowering (0.0282) and days to maturity (0.0071). The inter relation between yield components.

For genotypic correlation as described in table 2, days to 50 per cent flowering showed significant and positive correlation with protein content (0.7337), followed by number of pods per plant (0.6732), number of seeds per pod (0.6586), 100 seeds weight (0.6219), number of pods per cluster (0.3901), and plant height (0.2708). Days to 50 per cent flowering had given negative and non-significant correlation with seed yield (-0.0231) at genotypic level, indicated that early flowering genotypes are desirable for grain yield per plant, these results confirm the earlier finding of Degefa *et al.* (2014), Dhoot *et al*.(2017), Sandhiya *et al.* (2018) and Goyal *et al.* (2021).

Days to maturity showed significant and positive correlation with plant height (0.4962), and number of pods per plant (0.299). It showed positive but non-significant correlation with protein content (0.2034), 50 per cent flowering (0.092), 100 seeds weight (0.0522) and seed yield (0.0028). It showed negative but significant relation with number of seeds per pod (-0.5106), and number of pods per cluster (-0.3365), whereas negative and non-significant correlation with number of clusters per plant (0.1931), pod length (-0.1811), and pod thickness (-0.0318). Days to maturity had non-significant but negative correlation with pod length, indicated that early maturing genotypes could be desirable for this trait. This result confirms the earlier findings of

Singh *et al.* (2021).

Plant height showed strong positive and significant correlation with days to maturity (0.1429), plant height (0.2966) and 50 per cent flowering (0.2708). Number of pods per plant showed highly significant and the highest positive correlation with 50 per cent flowering (0.6732), 100 seeds weight (0.5492), seeds per pod (0.4348), number of pods per cluster (0.345), protein content (0.3339), days to maturity (0.299) and plant height (0.2966). Pods per plant had highly significant and negative correlation with pod length (-0.8398), and pod thickness (-0.4298), and non-significant negative correlation with number clusters per plant (-0.1201). Pod length showed strongly significant and positive correlation with pod thickness (0.8061), 100 seeds weight (0.5275), number of pods per cluster (0.4893), protein content (0.4813), and number of seeds per pod (0.3651).

Pod thickness showed significant and positive correlation with pod length (0.8061). It gives positive but non-significant correlation with plant height (0.1358), and seed yield (0.0148). Pod thickness gives negative and significant correlation with protein content (-0.7785), pods per clusters (-0.517), 100 seeds weight (-0.4442), pods per plant (-0.4298), number of clusters per plant (-0.3885) and number of seeds per pod (-0.3477). Results are conformity with the observation made by Canci *et al.* (2014). Number of clusters per plant exhibited positive and significant correlation with seed yield per plant (0.4734). Pods per cluster showed significant positive correlation with seeds per pod (0.8273),

100 seeds weight (0.6125), protein content (0.5093), pod length (0.4893), days to 50 per cent flowering (0.3901), seed yield (0.3597), and number of pods per plant (0.345). 100 seeds weight showed significant and positive correlation with number of seeds per pod (0.6953), days to 50 per cent flowering (0.6219), pods per cluster (0.6125), seed yield (0.6076), etc. Protein content showed highly significant and positive correlation with 50 per cent flowering (0.7337), number of seeds per pod (0.6384), 100 seeds weight (0.563), pods per cluster (0.5093), pod length (0.4813), and number of pods per plant (0.3339). The results are in conformity with the result reported by Reddy *et al.* (2005), Dhuppe *et al.* (2005), Srivastava and Singh (2012), Gadakh *et al*. (2013), Eswaran *et al.* (2015), Jadhav *et al.* (2019), Ahmad and Belwal (2020) and Sing *et al.* (2021).

At phenotypic level, days to 50 per cent flowering showed significant and positive correlation with 100 seeds weight (0.2626) but significant and negative correlation with number of pods per cluster (-0.2418). Days to maturity showed positive but non-significant correlation with number of cluster per plant (0.0962), pod length (0.0875), plant height (0.0797), protein content (0.0753), 100 seeds weight (0.0384), days to maturity (0.0131), and seeds yield per plant (0.0071). Plant height showed strong positive and significant correlation with number of clusters per plant (0.3135). It does not shown negative and non-significant correlation with any of the character. Number of clusters per plant showed highly significant and the high positive correlation with 100 seeds weight (0.4742), plant height (0.3135), pod thickness (0.2769), and seed yield per plant (0.2602). Pods per plant had highly significant and highest negative correlation with number of pods per cluster (-0.718). Number of clusters per plant gives positive and significant correlation with seed yield 0.2602), days to 50 per cent flowering (0.1828), and days to maturity (0.0962) at phenotypic level. It is described in table 3 below.

Pods per cluster showed negative and non-significant correlation with seeds yield (-0.0534). A negative and non-significant correlation found for number of pods per cluster and pod length same by Asari *et al*. (2019). Number of pods per plant showed positive and significant correlation with number of pods per cluster (0.5126), and seed yield per plant (0.2232). Seeds per pod showed positive and non significant correlation with seed yield (0.4168), pod thickness (0.1099), pod length (0.0949), and protein content (0.0451). Seeds per pod showed highly significant and positive correlation with seed yield (0.4168). Similar results were also reported by Garg *et al*. (2017), Joseph *et al.* (2020) and Kumar *et al.* (2021). Pod length showed strongly significant and positive correlation with pod thickness (0.4635), and 100 seeds weight (0.3427). Pod thickness showed highly significant and positive correlation with 100 seeds weight (0.48), pod length (0.4635), seed yield per plant (0.339), number of clusters per plant (0.2769) and protein content (0.2227).

Pod thickness reported highly significant and positive correlated with seed yield (0.339). Pod width and length strongly contribute to grain weight and obviously with seed yield. Result conformity with the results reported by Canci *et al.* (2014). The 100 seeds weight has exhibited highest significant and positive correlation with seed yield per plant (0.5054), pod thickness (0.48), number of clusters per plant (0.4742), protein content (0.3526), pod length (0.3427), and 50 per cent flowering (0.2626). Protein content showed highly significant and positive correlation with 100 seeds weight (0.3526), pod thickness (0.2227) and significant but negative with pods per cluster (-0.2834).

Seed yield per plant shown highest significance and positive correlation with 100 seeds weight (0.5054), number of seeds per pod (0.4168), pod thicknesss (0.339), number of clusters per plant (0.2602), and pods per plant (0.2232). It has negative and non-significant correlation with number of pods per cluster (-0.0534) and positive with plant height (0.1748), pod length (0.1737), protein content (0.159), 50 per cent flowering (0.0282) and days to maturity (0.0071).

SUMMARY AND CONCLUSIONS

In present investigation, genotypic correlations in general were with higher magnitude than corresponding phenotypic correlation. Correlation at both genotypic and phenotypic level recorded to resolve the direction as well as magnitude of association among the characters. Seed yield per plant shown the highest significance and positive correlation with 100 seeds weight (0.5054), number of seeds per pod (0.4168), pod thickness (0.339), number of clusters per plant (0.2602), and pods per plant (0.2232). It has negative and non-significant correlation with number of pods per cluster (-0.0534) and positive with plant height (0.1748), pod length (0.1737), protein content (0.159), 50 per cent flowering (0.0282) and days to maturity (0.0071).

An association between seed yield with number of seeds per pod and 100 seeds weight with pod length, pod thickness was significantly positive, which is desirable situation for improvement of these traits simultaneously in mungbean. From given result, it can be concluded that, genotype with more protein content, early flowering and maturing, maximum plant height with long and thick pod size, having more number of seeds per pod and better seed weight can give maximum yield in mungbean.

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Table 1: Analysis of variance for twelve characters in mungbean

Sr. No.	Characters	Mean sum of squares		
		Replication (1)	Genotypes (41)	Error (41)
1	Days to 50% flowering	3.24	1.81**	1.10
2	Days to maturity	4.30	2.07**	1.07
3	Plant height (cm)	3.52	67.88**	13.80

4	Number of clusters per plant	0.15	1.28**	0.17
5	Number of pods per cluster	0.01	2.92**	0.20
6	Number of pods per plant	0.17	7.18**	3.42
7	Number of seeds per pod	0.52	3.95**	0.09
8	Pod length	0.00	1.10**	0.50
9	Pod thickness	0.22	0.21**	0.06
10	100 seeds weight	0.00	1.34**	0.06
11	Protein content	2.29	2.29**	1.02
12	Seed yield per plant	0.10	2.53**	0.36

* ,** significant at 5 and 1 per cent level, respectively.

Values in parenthesis indicates the degrees of freedom

Table 2: Genotypic correlation for twelve characters in forty two genotypes of mungbean

Characters	Days to 50% flowering	Days to maturity	Plant height	No. of pods per plant	Pod length	Pod thickness	No. of clusters per plant	No. of pods per cluster	No. of seeds per pod	100 seeds weight	Protein content	Seed yield per plant
Days to 50% flowering	**1.0000**	0.0920	0.2708*	0.6732**	-0.4859**	-0.1817	-0.3183**	0.3901**	0.6586**	0.6219**	0.7337**	-0.0231
Days to maturity		**1.0000**	0.4962**	0.299**	-0.1811	-0.0318	-0.1931	-0.3365**	-0.5106**	0.0522	0.2034	0.0028
Plant height			**1.0000**	0.2966**	-0.1763	0.1358	-0.0686	0.1637	-0.0362	0.0968	-0.0434	0.1919
No. of pods per plant				**1.0000**	-0.8398**	-0.4298**	-0.1201	0.3450**	0.4348**	0.5492**	0.3339**	0.2106
Pod length					**1.0000**	0.8061**	0.1256	0.4893**	0.3651**	0.5275**	0.4813**	-0.1233
Pod thickness						**1.0000**	-0.3885**	-0.5170**	-0.3477**	-0.4442**	-0.7785**	0.0148
No. of clusters per plant							**1.0000**	0.1474	0.1355	-0.1106	0.1041	0.4734**
No. of pods per cluster								**1.0000**	0.8273**	0.6125**	0.5093**	0.3597**
No. of seeds per pod									**1.0000**	0.6953**	0.6384**	0.6160**
100 seeds weight										**1.0000**	0.5630**	0.6076**
Protein content											**1.0000**	0.2915**
Seed yield per plant												**1.0000**

***=Significant at 5% level, **= Significant at 1% level**

Table 3: Phenotypic correlation for twelve characters in forty two genotypes of mungbean

Characters	Days to 50% flowering	Days to maturity	Plant height	No. of clusters per plant	No. of pods per cluster	No. of pods per plant	No. of seeds perpod	Pod length	Pod thickness	100 seeds weight	Protein content	Seed yield per plant
Days to 50% flowering	**1.0000**	0.0131	-0.1298	0.1828	-0.2418*	-0.1214	-0.1809	0.0433	0.1328	0.2626*	0.0946	0.0282
Days to maturity		**1.0000**	0.0797	0.0962	-0.0796	-0.0045	-0.1282	0.0875	-0.0691	0.0384	0.0753	0.0071
Plant height			**1.0000**	0.3135**	-0.1119	0.1069	-0.0418	0.0289	-0.034	0.1105	0.0530	0.1748
No. of clusters per plant				**1.0000**	-0.7180**	-0.0700	-0.0821	0.1582	0.2769*	0.4742**	0.2007	0.2602*
No. of pods per cluster					**1.0000**	0.5126**	-0.1186	-0.2541*	-0.3087**	-0.4811**	-0.2834**	-0.0534
No. of pods per plant						**1.0000**	-0.2662*	-0.2987**	-0.2180*	-0.2512*	-0.0947	0.2232*
No. of seeds per pod							**1.0000**	0.0949	0.1099	-0.1117	0.0451	0.4168**
Pod length								**1.0000**	0.4635**	0.3427**	0.0849	0.1737
Pod thickness									**1.0000**	0.4800**	0.2227*	0.3390**
100 seeds weight										**1.0000**	0.3526**	0.5054**
Protein content											**1.0000**	0.1590
Seed yield per plant												**1.0000**

=**Significant at 5% level, *= Significant at 1% level