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Genetic Association among Yield and Other Physiological Characters in Mungbean (*Vigna radiata* (L.) Wilczek)

P. Keerthi Nandan[1], Ch. Shalini[1*] and G. R. Lavanya[1]

[1]*Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad, Uttar Pradesh, India.*

Authors' contributions

This work was carried out in collaboration between all authors. Author PKN designed the study, performed field experiments and wrote the first draft of the manuscript. Author CS managed the literature searches, performed the catalase and peroxidase analysis and Author GRL prepared the final draft. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Owing to mungbean's nutritional quality, short duration, high protein and suitability for multiple cropping systems, field experiments were planned to elicit information on morpho-physiological characters, with their interactions.
Study Design: The present investigation consisted of 30 mungbean genotypes including one check in Randomized Block Design with three replications.
Place and Duration of Study: The experiment was conducted in the Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad, U.P, India.
Methodology: The data was recorded for 14 characters to study the variability, heritability, genetic advance, correlation coefficient.
Results: Genotype ABL 19 (8.23) was considered as best genotype for seed yield per plant followed by KM08-188 (8.10), (LC) K-851 (7.89). A close perusal of variability coefficients revealed

*Corresponding author: E-mail: chanamolu.shalini@gmail.com;

that the differences between PCV and GCV was small indicating little influence of environment on the expression of the characters studied. High to moderate estimates of GCV and PCV were recorded for number of pods per plant, number of clusters per plant, seed yield per plant for morphological characters and peroxidase content for physiological characters. The plant characters plant height, number of clusters/plant, 100 seed weight and harvest index showed positive significant correlation for morphological characters, whereas leaf area index, net assimilation rate, dry matter production and protein content showed positive significant correlation for physiological characters.

Conclusion: Thus, these traits are recognized as the efficient and potential for indirect selection for the improvement of mungbean productivity in the present experimental materials.

Keywords: Vigna radiate; mungbean; GCV; PCV; variability; correlation.

1. INTRODUCTION

Pulse crop plays an important role in Indian agriculture. India is the largest producer and consumer of pulses in the world. Pulses contain a high percentage of quality protein nearly three times as much as cereals. Thus, they are cheaper source to overcome protein malnutrition among human beings. Pulses are known to improve the physical characteristics of soil through tap root system, because of these good characters, pulses are called as "Marvel of Nature". It also provides nutritious fodder and feed for live stock [1].

Among pulses, mungbean (*Vigna radiata* (L).Wilczek) is one of the most ancient and extensively grown leguminous crops of India. It is short duration crop and rich in protein and vitamin B. Each physiological and morphological characteristic of mungbean may affect yield in many ways, the net effect of which depends on other characteristics, environmental conditions and agronomic practices. When growth, development and physiological basis of yield are understood it is possible to improve the yield of mungbean crop.

For yield improvement, it is essential to have knowledge on variability of different characters. Selection of superior parents exhibiting better heritability and genetic advance for various characters is an essential prerequisite for any yield improvement programme [2]. The knowledge of genetic variability existing within the different parameters contributing to the yield is an important criterion for yield enhancement but in highly self-pollinating crops like mungbean, natural variation is narrow resulting in limited selection.

Knowledge of interrelationships among yield will help the breeder in formulating the breeding and selection strategy. But the earlier work on genetic variation for different morpho-physiological characters for pulses in general and mungbean in particular is scanty.

2. MATERIALS AND METHODS

The experiment was conducted in Randomized Block Design with 30 genotypes during kharif, 2011-2012. The genotypes were replicated three times and were randomly arranged in each replication, at the field experimentation center, Department of Genetics and plant breeding, Sam Higginbottom Institute of Agriculture, technology and sciences, deemed to be University, Allahabad, Uttar Pradesh, India.

The normal recommended agronomic package of practices were followed to raise the healthy crop. Fertilizers were applied at the rate of 20:40:40 kg of NPK/ha. The full dose of phosphorus and potassium and half dose of nitrogen were applied as basal dose at the time of sowing. The rest of the nitrogen was top dressed during vegetative growth.

Five plants from middle row of each genotype in each replication were randomly taken for recording observations on plant height, number of cluster/plant, number of pod/plant and seed yield/plant. Whereas, days to 50% flowering and days to maturity were recorded on plot basis. Physiological characters such as dry matter production was obtained on per plant basis by drying the samples in hot air oven for 24 hours at 80℃ to a constant weight, Leaf Area Index [3] at 25 and 45 DAS, Crop growth rate [4] at two intervals between 25 and 45 DAS and 45 DAS and harvest, Net Assimilation Rate [4] between

25 and 45 DAS, Protein content by Lowrey's method [5], Catalase content was estimated by Hosetti and Frost method [6], Peroxidase content was estimated by titration method.

After attaining the physiological maturity, the plots were harvested manually. Mean values of different traits were subjected to Analysis of variance [7], Coefficient of variation [8]. The character association was estimated from variance and covariance components [9].

3. RESULTS AND DISCUSSION

Correlation coefficient is a statistical measure, which is used to find out the degree (strength) and direction of relationship between two or more variables. A positive value of correlation shows that the changes of two variables are in the same directions. In the present investigation correlation coefficient analysis measures the mutual relationship between various plant characters and to determine the component characters on which selection can be used for genetic improvement in yield.

3.1 Correlation Coefficient Analysis for Morphological Characters

3.1.1 Estimates of genotypic correlation coefficient analysis for morphological characters

Plant height (0.33**), Cluster per plant (0.64**), pod per plant (0.87**), 100 seed weight (0.47**) and harvest index (0.30**) exhibited significant positive correlation with seed yield per plant. Days to maturity (-0.15) registered non-significant negative correlation as shown in Table 1. The findings are in agreement with the findings of Rajan et al.[10].

3.1.2 Estimates of phenotypic correlation coefficient analysis for morphological characters

Plant height (0.32**), cluster per plant (0.59**), 100 seed weight (0.43**) and harvest index (0.29**) exhibited significant and positive correlation with seed yield per plant. Whereas days to maturity (-0.11) showed non-significant negative correlation as shown in Table 2. These findings are in accordance with the findings of Sreedevi and Sekhar [11].

3.2 Correlation Coefficient Analysis for Physiological Characters

3.2.1 Estimates of genotypic correlation coefficient analysis for physiological characters

Leaf area index (0.29**), net assimilation rate (0.28**), dry matter production (0.42**), protein content (0.28**) exhibited significant positive correlation with seed yield per plant. While catalase content (0.22) exhibited non significant positive correlation. While crop growth rate (-0.0063) and peroxidase content (-0.16) showed non-significant negative correlation as shown in Table 3.

3.2.2 Estimates of phenotypic correlation coefficient analysis for physiological characters

Leaf area index (0.26**), net assimilation rate (0.25**), dry matter production (0.41**) and protein content (0.26**) exhibited significant positive correlation with seed yield per plant. While crop growth rate (0.0021) and catalase content (0.18) showed non-significant positive correlation and peroxidase content (-0.16) showed non-significant negative correlation as shown in Table 4. The findings are in agreement with the findings of Reddy et al.[12].

Table 1. Estimates of genotypic correlation for morphological characters

S. no	Characters	Plant height	Cluster/ plant	Pod/ plant	Days to maturity	100 seed weight	Harvest index	Seed yield/ plant
1	Plant height	1.00	0.49**	0.59**	-0.10	0.57**	0.49**	0.33**
2	Cluster/ plant		1.00	0.83**	-0.08	0.37**	0.26*	0.64**
3	Pod/ plant			1.00	-0.08	0.55**	0.40**	0.87**
4	Days to maturity				1.00	-0.37*	-0.35**	-0.15
5	100 Seed weight					1.00	0.81**	0.47**
6	Harvest index						1.00	0.30**
7	Seed yield/ plant							1.00

Table 2. Estimates of phenotypic correlation for morphological characters

S. No	Characters	Plant height (cm)	Cluster/ plant	Pod/ plant	Days to maturity	100 seed weight (g)	Harvest index(%)	Seed yield per plant (g)
1	Plant height	**1.00**	0.47**	0.56**	-0.12	0.46**	0.47**	0.32**
2	Cluster/plant		**1.00**	0.78**	-0.08	0.31**	0.23*	0.59**
3	Pod/plant			**1.00**	-0.09	0.47**	0.38**	0.82**
4	Days to maturity				**1.00**	-0.23*	-0.29**	-0.11
5	100 Seed weight					**1.00**	0.68**	0.43**
6	Harvest index						**1.00**	0.29**
7	Seed yield/plant							**1.00**

Table 3. Estimates of genotypic correlation for physiological characters

S. no	Characters	Leaf area index	Crop growth rate (x10^{-3})	Net assimilation rate (x10^{-3})	Dry matter production	Protein content	Catalase content	Peroxidase content	Seed yield/ plant
1	Leaf area index	1.00	0.26	-0.02	-0.00	0.24	0.01	0.04	0.29**
2	Crop growth rate (x10^{-3})		1.00	0.27*	0.17	0.21	-0.22	0.14	-0.00
3	Net assimilation rate (x10^{-3})			1.00	0.13	0.30**	-0.16	-0.09	0.28**
4	Dry matter production				1.00	0.30**	0.20	0.07	0.42**
5	Protein content					1.00	0.27*	-0.17	0.28**
6	Catalase content						1.00	-0.16	0.22
7	Peroxidase content							1.00	-0.16
8	Seed yield/ plant								1.00

Table 4. Estimate of phenotypic correlation for physiological character

S. no	Parameters	Leaf area index	Crop growth rate ($x10^{-3}$)	Net assimilation rate ($x10^{-3}$)	Dry matter production (g)	Protein content (mg)	Catalase content (mg)	Peroxidase content (mg)	Seed yield/ plant (g)
1	Leaf area index	1.00	0.18	-0.01	0.00	0.17	0.00	0.05	0.26^{**}
2	Crop growth rate ($x10^{-3}$)		1.00	0.26^{*}	0.17	0.18	-0.18	0.14	0.00
3	Net assimilation rate ($x10^{-3}$)			1.00	0.12	0.26^{*}	-0.12	-0.08	0.25^{**}
4	Dry matter production				1.00	0.28^{**}	0.17	0.07	0.41^{**}
5	Protein content					1.00	0.24^{*}	-0.17	0.26^{**}
6	Catalase content						1.00	-0.14	0.18
7	Peroxidase content							1.00	-0.16
8	Seed yield/ plant								1.00

4. CONCLUSION

Genotype ABL 19 showed high seed yield per plant. Morphological characters like plant height, number of cluster per plant, pod per plant, 100 grain weight, harvest index and physiological characters like leaf area index, net assimilation rate, dry matter production and protein content showed positive significant correlation with seed yield and due priority should be given to these characters during selection for mungbean improvement.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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