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Correlation and path analysis in the F_2 generation of greengram (*Vigna radiata* (L.) Wilczek)

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Abstract : The correlation and path coefficients were worked out in seven parents and F_2 population of their 21 crosses in greengram for 13 characters. Seed yield had significant positive genotypic correlation with number of secondary roots at maturity, dry weighty of plants at maturity, plant height, clusters per plant, pods per plant, seeds per pod and hundred grain weight and harvest index. Number of pods, clusters per plant and harvest index showed high positive correlation on grain yield and also with each other. Path analysis revealed that pods per plant had the highest positive direct effect on grain yield followed by hundred grain weight and number of seeds per pod. Plant height showed high indirect effect through number of pods, seeds per pod and hundred grain weight on grain yield. The study revealed that genetic improvement of grain yield is possible by selecting characters having high positive correlation and positive direct effect. *(Key Words : Greengram, F_2 generation, Correlation, Path analysis).*

Yield is a complex character, controlled by polygenes. Therefore, selection made on the basis of its phenotypic expression alone are likely to be misleading. It is therefore essential to measure the contribution of various traits to the yield through correlation and partitioning the correlation coefficient into the components of direct and indirect effects. The present study was undertaken to derive information on phenotypic and genotypic correlation, direct and indirect effect of various traits, in the F_2 generation of greengram and effectively utilize the transgressive segregants for evolving superior variety for higher yield with good nitrogen fixing potential for the effective contribution of sustainable agriculture.

Materials and Methods

The experimental material consists of seven promising parental varieties, Pusa-9333, KM-1285, NDM-88-14, MG-368, IIPRM-3, CoGG-902 and LGG-444 and F_2 seeds collected from their 21 crosses. The F_2s along with the parents were raised in randomized block design with three replications during 1998-99 in rabi season. The seeds were sown at a spacing of 25 x 10 cm in 3m² plots, so that 240 plants could be accommodated in each plot. Recommended package of practices of Kerala Agricultural University were followed to raise a good crop (KAU, 1996). Observations were recorded from ten plants selected at random from each treatment on

Table 1. Phenotypic (r_p) and genotypic (r_g) correlation coefficents among yield components in the F_2 generation of greengram (*Vigna radiata* (L.) Wilczek)

Characters		Length of primary root at 50% flowering	No. of secondary roots at maturity	Shoot/ root ratio	Weight of nodules in the root at 50% flowering	Dry weight of plant at maturity	N content in plant at maturity	Plant height	No. of clusters per plant	No. of pod	No. of seeds per pod	100 grain weight	Grain yield
No. of secondary roots at maturity	r_p	-0.074											
	r_g	-0.085											
Shoot / root ratio	r_p	0.110	0.083										
	r_g	0.033	0.075										
Weight of nodules in the root at 50% flowering	r_p	0.064	-0.370**	-0.150									
	r_g	0.119	-0.508**	-0.249									
Dry weight of plants at maturty	r_p	0.094	0.111	0.464**	-0.066								
	r_g	0.067	0.117	0.608**	-0.079								
N2 content in plants at maturity	r_p	0.061	-0.003	-0.284*	0.292	-0.082							
	r_g	0.079	0.004	-0.623**	0.338**	-0.215							
Plant height	r_p	0.289*	0.177	0.278*	-0.156	0.437**	-0.157						
	r_g	0.319*	0.182	0.406**	-0.221	0.507**	-0.365**						
No. of clusters per plant	r_p	0.093	0.069	0.218	-0.074	0.078	-0.042	0.276*					
	r_g	0.201	0.035	0.264*	-0.061	0.084	-0.065	0.371**					
No. of pods	r_p	-0.220	0.159	0.098	-0.254*	0.000	-0.101	0.227	0.436**				
	r_g	-0.267	0.169	0.123	-0.279*	0.037	-0.062	0.244	0.454**				
No. of seeds per pod	r_p	0.202	0.147	0.213	0.120	0.337**	-0.324**	0.446**	0.061	0.092			
	r_g	0.274*	0.162	0.316*	-0.137	0.492**	-0.460**	0.690**	0.053	0.132			
100 grain weight	r_p	0.149	0.208	-0.087	-0.144	0.177	0.302*	0.198	0.333**	-0.019	-0.058		
	r_g	0.236	0.274*	-0.101	-0.154	0.218	0.555**	0.248	0.386*	-0.012	-0.036		
Grain yield	r_p	-0.013	0.283*	0.123	-0.322**	0.201	-0.059	0.468**	0.522**	0.781**	0.439**	0.450**	
	r_g	-0.002	0.320*	0.164	-0.355**	0.266**	0.101	0.546**	0.579**	0.808**	0.362**	0.507**	
Harvest inded	r_p	0.015	0.088	-0.157	-0.143	-0.519**	-0.006	0.101	0.386**	0.489**	0.068	0.209	0.529**
	r_g	0.010	0.093	-0.237	-0.157	-0.591**	0.107	0.156	0.404**	0.529**	-0.028	0.236	0.558**

* Significant at 5% level
** Significant at 1% level

Table 2. Direct and indirect genetic effects via various paths of twelve agronomic characters on grain yield in F_2 generation of greengram

S.No.	Characters	No. of secondary roots at maturity	Weight of nodules in the root at 50% flowering	Dry weight of plant at maturity	Plant height	No. of clusters per plant	No. of pods	No. of seeds per pod	100 grain weight	Genotypic correlation with yield
1.	No. of secondary roots at maturity	**-0.009**	0.009	-0.004	0.017	0.000	0.129	0.038	0.140	0.320
2.	Weight of nodules in the root at 50% flowering	0.004	**-0.018**	0.003	-0.020	0.001	-0.214	-0.032	-0.079	-0.0355
3.	Dry weight of plants at maturty	-0.001	0.001	**-0.034**	0.046	-0.001	0.028	0.115	0.112	0.266
4.	Plant height	-0.002	0.004	-0.017	**0.091**	-0.004	0.186	0.161	0.127	0.546
5.	No. of clusters per plant	0.000	0.001	-0.003	0.034	**-0.009**	0.347	0.012	0.198	0.579
6.	No. of pods	-0.002	0.005	-0.001	0.022	-0.004	**0.763**	0.031	-0.006	0.808
7.	No. of seeds per pod	-0.001	0.003	-0.017	0.063	-0.001	0.101	**0.233**	-0.019	0.362
8.	100 grain weight	-0.002	0.003	-0.001	0.023	-0.004	-0.009	-0.008	**0.512**	0.507

The effects along the diagonal are direct effects.
Residual effect (R^2) = 0.0009

(i) length of primary root at 50 per cent flowering (ii) number of secondary roots at maturity (iii) shoot / root ratio (iv) weight of nodules in the root at 50 per cent flowering (v) dry weight of plants at maturity (vi) nitrogen content in plants at maturity (vii) plant height (viii) number of clusters per plant (ix) number of pods (x) number of seeds per pod (xi) 100 grain weight (xii) grain yield and (xiii) harvest index. The data were averaged to single plant basis for purpose of statistical analysis. The genotypic and phenotypic correlation coefficients were estimated and path coefficient analysis was done (Singh and Chaudhary, 1985 and Dewey and Lu, 1959).

Results and Discussion

Analysis of variance revealed that all the entries were significantly different in all the characters under study. The phenotypic and genotypic correlation for the 13 characters presented in Table 1 showed that genotypic correlations were higher than their corresponding phenotypic correlation for all the characters. This may be due to the modifying effect of environment on association of characters at genic level. This was in line with the findings of Philip (1987) in blackgram.

Grain yield had positive genotypic correlation with all characters except for length of primary root at 50 per cent flowering and weight of nodules at 50 per cent flowering. This reveals the importance of these components in increasing the seed yield. The highest degree of association between pods per plant and grain yield indicated that, pods per plant is the most reliable component of yield and can be very well utilized as an indicator of grain yield. Holkar and Raut (1992), Reddy *et al.* (1994), Borah and Hazarika (1995) in greengram and Veerupakshappa *et al.* (1980) in F_2 population of cowpea also reported similar results. Number of pods per plant, number of cluster per plant and harvest index were highly correlated with grain yield and also having intercorrelation with each other. Similar results were obtained for Veerabadhiran and Jehangir (1995) for pods per plant, clusters per plant and seeds per pod in greengram.

A high positive intercorrelation of shoot / root ratio with plant height, plant height with dry weight of plant at maturity, hundred grain weight with nitrogen content in plants at maturity, plant height with number of seeds per pod and number of pods with harvest index was observed. This is in conformity with the results of Hedge *et al.* (1996).

The weight of nodules in the root at 50 per cent flowering had significant positive correlation with nitrogen content in plants at maturity, as reported by Singh and Murthy (1988) in greengram.

Path analysis

The correlation coefficients are inadequate to interpret the cause and effect relationships. However, path analysis technique furnishes a method of partitioning the correlation coeffcients between various characters into direct and indirect effects and provide the actual contribution of an attribute and its influence through other traits. Eight significantly correlated characters were considered for path analysis (Table 2).

Of the eight characters the direct effect of plant height, number of pods, number of seeds per pod and hundred grain weight are positive, whereas in the case of number of secondary roots at maturity, weight of nodules in the root at 50 per cent flowering, dry weight of plants at maturity, and number of clusters per plant, the direct effect was low and negative. Number of pods per plant exerted highest direct effect on grain yield as reported by Veerabadhiran and Jehangir (1995) and Manivannan and Nadarajan (1996) in greengram. This indicated that number of pods per plant is a highly reliable component on yield. Another important character with high direct effect on grain yield was hundred grain weight is inconformity with the results of Vidyadhar *et al.* (1984) in greengram. Plant height showed positive direct effect and high indirect effect through number of pods, number of seeds per pod and hundred grain weight on grain yield.

In this study residual effect was relatively very low ($R_2 = 0.0009$) indicating that adequate characters were utilized for this study. It is obvious from this study that selection on the basis of pods per plant in segregating population of greengram will be more effective in the development of promising genotypes.

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