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Estimates of Genetic Parameters, Correlation Coefficients and Path-coefficient Analysis in Gram *(Cicer arietinum L.)*

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ABSTRACT

Using 30 varieties of gram genetic parameters like genotypic coefficient of variation, heritability, genetic advance, phenotypic and genotypic correlation coefficients and path-coefficient analysis for yield components were worked out. Eight characters *viz.*, plant height, plant spread, branches per plant, pods per plant, seeds per plant, 100-seed weight, seeds per pod and yield per plant were studied. Highest genotypic coefficient of variability was observed for seeds per plant and lowest for seeds per pod. Heritability estimates were fairly high for plant height, 100-seed weight, seeds per plant and yield per plant. High heritability along with high value of genetic advance as percentage of mean was observed for seeds per plant, yield per plant and 100-seed weight. Correlation studies revealed that at phenotypic level pods per plant was highly and positively correlated with seeds per plant and yield per plant. Seeds per plant was significantly correlated with yield per plant while significantly negatively correlated with 100-seed weight. At genotypic level pods per plant was highly correlated with seeds per plant. One hundred-seed weight was negatively correlated with seeds per plant and yield per plant. Path-coefficient analysis for yield components indicated that pods per plant was most important component for seed yield as it gave the highest direct positive effect. Number of seeds per plant and 100-seed weight did not have direct effect but through other components they were found effective.

INTRODUCTION

Expression of quantitative attributes which are governed by large number of genes is affected by environment. The heritable variation is masked by nonheritable variation, which creates difficulty in selection programme. This suggests the need of partitioning the overall variances into heritable and nonheritable components which may enable the breeders to plan out proper breeding programme. Association of plant characters, which is determined by correlation coefficients, is useful as a basis for selecting the desirable parents. They further permit the evaluation of relative influence of various characters on yield. Path-coefficient analysis is applied to partition the correlation coefficients into direct and indirect effects so that the real contribution of each component to the end product could be assessed. Such informations are available in other pulse crops but in gram these are very limited (Chandra, 1968 and Sandha and Chandra, 1969). The present study was undertaken mainly to determine the estimates of genetic parameters, correlation coefficients and path-coefficient analysis in gram.

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MATERIALS AND METHODS

The field experiment was laid out in a randomized block design with 30 varieties and three replications at Regional Station of Agricultural Research, Vallabhanager during *rabi* 1971-72. Each plot consisted of one row of 6m length, with row to row spacing of 45 cm and plant to plant spacing of 30 cm. Ten plants were selected at random from each plot in each replication and data were recorded on plant height (cm), plant spread (cm), branches per plant (no.), pods per plant (no.), seeds per plant (no.) seeds per pod (no.) yield per plant (g) and 100-seed weight (g). Mean values were subjected to statistical analysis.

Genetic coefficent of variation was calculated according to Burton (1951), heritability in broad sense in percentage according to Johnson *et al.* (1955) and genetic advance according to Lush (1949). Correlation coefficients both at genotypic and phenotypic level were computed according to Fisher (1954). Path-coefficient analysis was done according to the method used by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The estimates of genetic parameters are presented for 8 characters in Table 1. The analysis of variance revealed that the differences among the varieties were significant for all the plant characters studied.

TABLE 1. Estimates of genetic coefficient of variation (G. C. V.), heritability (H) and genetic advance (G. A.) for eight characters in gram

Character	G. C. V.	H (%)	G. A.	G. A. as % of mean
Plant height	12.45	95.35	8.98	43.96
Plant spread	14.55	79.78	5.83	27.37
Branches per plant	11.97	60.68	3.91	20.36
Pods per plant	24.18	76.02	17.63	43.96
Seeds per pod	8.57	62.50	0.27	19.28
100 - seed weight	57.21	97.94	24.36	117.11
Seed per plant	70.95	94.91	216.66	143.29
Yield per plant	57.03	95.93	32.27	116.49

Genotypic coefficient of variability was maximum for seeds per plant (70.95) followed by 100-seed weight (57.21) and yield per plant (57.03) while it was lowest for seeds per pod (8.57). Heritability estimates which help the breeder in selection on the basis of phenotypic performance was highest for 100-seed weight (97.94 per cent) followed by yield per plant (95.93 per cent) plant height (95.35 per cent) and seeds per plant (94.91 per cent) while lowest was observed for branches per plant (60.68 per cent). Heritability estimates were fairly high for rest of the characters *viz.*, plant spread, pods per plant and seeds per pod. This is because of the fact that these characters are less influenced by environment and there would be greater correspondence between phenotypic and breeding values. Johnson *et al.* (1955) have suggested that heritability along with genetic advance is more useful than heritability estimates alone in predicting the resultant effect for selecting the best individuals. High heritability with high genetic advance as percentage of mean shows the most effective condition for selection and was observed for seeds per plant, yield per plant and 100-seed weight. This condition appears due to additive gene action. There are also certain characters like plant height which shows high heritability but low genetic advance. This condition arises due to non additive additive gene action i. e. dominance and epistasis (Liang and Walter, 1968). High heritability followed by high genetic advance had been reported by Chandra (1968) for pods per plant in gram. High heritability had also been reported by Chandra (1968) for plant height and branches per plant in gram.

Analysis of correlation coefficient (Table 2) indicates that at phenotypic level pods per plant had highly significant correlation with seeds per plant and yield per plant. Seeds per plant was highly and significantly correlated with yield per plant whereas it had significant negative correlation with 100-seed weight.

TABLE 2. Estimates of phenotypic (P) and genotypic (G) correlation coefficients for yield components in gram

Character		100 - seed weight	Yield per plant	Seed per plant
Pods per plant	P	0.1918	0.8882**	0.9160**
	G	0.1744	0.2969	0.9970
Seeds per plant	P	—0.4089*	0.9480**	
	G	—0.4756*	0.9415**	
Yield per plant	P	—0.1412		
	G	—0.1736		

*, ** Significant at 5 and 1% levels

TABLE 3. Path-coefficient analysis for yield components in gram

Character	Effects through			Genotypic correlation with yield per plant.
	Pods per plant	Seeds per plant	100 - seed weight	
Pods per plant	+ 1.6211	— 1.1490	— 0.1752	+ 0.2969
Seeds per plant	+ 1.6162	— 1.1525	+ 0.4777	+ 0.9415
100 - seeds weight	+ 0.2827	+ 0.5481	— 1.0045	— 0.1736

The underlined figures denote the direct effect

Residual effect = 0.9754

At genotypic level high and significant positive correlation was observed between pod per plant and seeds per plant whereas it was low with 100-seed weight and yield per plant. Seeds per plant was highly and significantly correlated with yield per plant whereas it was significantly and negatively correlated with 100-seed weight.

Analysis of path coefficient revealed that pods per plant had marked positive direct influence on seed yield per plant. This effect is however cancelled out by the indirect effect of number of pods per plant on seed yield through the other two components of yield *viz.*, number of seeds per plant and 100-seed weight. The direct effect of number of seeds per plant on seed yield is negative while this component has pronounced indirect effect through pods per plant and 100-seed weight on seed yield. Similarly 100-seed weight has no direct effect on seed yield but it does have effect through number of pods per plant and seeds per plant.

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