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VARIABILITY CHARACTER ASSOCIATION AND PATH COEFFICIENT STUDIES ON GENOTYPES OF EARLY MATURITY GROUP IN PIGEONPEA (*Cajanus cajan* (L.) Millsp.)

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The nature of genetic variability, character association and direct and indirect contributions of different traits to grain yield was studied in genotypes of early maturity group in pigeonpea. Out of the eight traits studied, five traits namely, primary branches, Secondary branches, pods per plant 100-seed weight and yield per plot exhibited high estimates of phenotypic and genotypic coefficients of variation, heritability and genetic advance per cent of mean suggesting predominance of additive gene effects. Plant height, days to maturity, primary branches, Secondary branches, pods per plant, seeds per pod and 100-seed weight showed positive and significant association with yield per plot. Further, the path coefficient analysis indicated high direct and indirect contributions of days to maturity, pods per plant, seeds per pod and 100-seed weight to yield per plot and of plant height, primary branches and secondary branches to pods per plant respectively suggesting that these traits may be used for yield improvement in pigeonpea.

Pulses are the main source of protein in our vegetarian diet. However, there is a huge gap in the demand and supply of almost all pulses. This gap is, primarily, believed to be due to their low yield potential and susceptibility to diseases. Pigeonpea is no execption to this generalization. Therefore, there is currently an emphasis on the need to improve the yield levels of pigeonpea, as of all other edible pulses, to meet the ever growing demand. This gap can be bridged through development of high yielding genotypes. This in turn necessiates an effort to obtain information on variability and character association, besides, knowledge of genetic architecture of yield and other traits to formulate meaningful breeding strategy for developing improved genotypes. Keeping this in view, the present study was conducted, and results pertaining to variability, character association and path coefficient analysis are presented in this communication.

MATERIALS AND METHODS

Twenty nine genotypes of pigeonpea were grown in a randomized block design with three replications during 1982 at the research farm of Department of Agricultural Botany. Each entry was assigned to a plot of three rows of 5 m length with a distance of 40 cm and 20 cm between rows and plants respectively.

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Five plants from the central row of each plot in all replications were used for recording of data on different traits except yield per plot for which whole central row was taken into consideration.

The estimate of phenotypic and genotypic coefficient of variation, heritability and genetic advance as per cent of mean were obtained following Johanson *et al.*, (1955). The correlation coefficients and path coefficient analysis were conducted following methods given by Al Jibouri *et al.*, (1958) and Dewey and Lu (1959) respectively.

RESULTS AND DISCUSSION

The analysis of variance indicated genotypic differences for all traits except for harvest index. Further, out of the eight traits studied five traits namely, primary branches, secondary branches, pods per plant, 100-seed weight and yield per plot showed moderate to high values to phenotypic and genotypic coefficients of variation (Table 1). These traits also showed high estimates of heritability and genetic advance as per cent of mean suggesting predominance of additive gene effects. These observations further indicated that sufficient improvement may be made for these traits. However, other traits like plant height, days to maturity, seeds per pod though showed moderate to high estimates of heritability but exhibited low values for phenotypic and genotypic coefficient of variation as well as genetic advance as per cent of mean.

Table 1 Estimates of phenotypic and genotypic coefficients of variation, heritability and genetic advance for eight traits in pigeonpea

S. No.	Character	PCV	GCV	Heritability	Genetic advance as per cent of mean
1.	Plant height (cm)	0.48	0.44	83.94	2.49
2.	Days to maturity	2.18	2.16	98.80	13.32
3.	Primary branches	8.19	5.56	46.07	23.31
4.	Secondary branches	11.23	10.26	79.11	56.39
5.	Pods per plant	8.99	7.10	62.75	34.67
6.	Seeds per pod	2.90	2.10	52.57	9.45
7.	100-Seed weight (g)	7.06	7.05	99.00	42.63
8.	Yield per plot (g)	14.18	13.26	87.41	76.64

The estimates of correlation coefficients are presented in Table 2. The genotypic correlation coefficients exhibited similar trend to that of phenotypic correlation coefficients in terms of sign and magnitude. However, only the significance of phenotypic correlation coefficients is being tested due to nonavailability of a suitable test for testing the significance of genotypic correlation coefficients.

Seven traits namely, plant height, days to maturity, primary branches, secondary branches, pods per plant, seeds per pod and 100-seed weight showed positive and significant association with yield per plot (Table 2). Similar results were also reported by Reddy *et al.* (1975), Tiwari *et al.*, (1978) and Malik *et al.*, (1980). Similarly, all significant *inter se* associations were also positive except the association of secondary branches with seeds per pod. This indicated that all these traits had positive effect on yield per plot and may be considered for yield improvement.

Table 2 Estimates of phenotypic, genotypic and environmental correlation coefficients among eight traits in pigeonpea.

Character		Plant hight (cm)	Primary branches	Secondary branches	Pods per plant	Seeds per pod	100-seed weight (g)	Yield per plot (g)
Days to maturity	P	0.400**	0.139	0.136	0.164	0.098	0.060	0.427**
	G	0.512	0.229	0.210	0.192	0.192	0.107	0.502
	E	0.101	0.012	0.021	0.102	0.008	−0.060	0.250
Plant height (cm)	P		0.604**	0.645**	0.435**	0.435**	−0.136	0.600**
	G		0.723	0.742	0.635	0.596	0.235	0.820
			0.001	0.004	0.195	0.042	−0.009	0.209
Primary branches	P			0.686**	0.635**	0.303*	−0.041	0.344*
	G			0.802	0.792	−0.404	−0.102	0.404
	E			0.025	0.198	0.181	0.069	0.251
Secondary branches	P				0.556**	−0.379**	0.130	0.371*
	G				0.635	−0.388	0.199	0.404
					0.299	0.099	−0.150	0.122
Pods per plant	P					0.414**	−0.076	0.430**
	G					0.494	−0.095	0.560
	E					0.005	0.051	0.050
Seeds per pod	P						0.390**	0.438*
	G						0.410	0.644
	E						0.090	0.221
100-seed weight (g)	P							0.323*
	G							0.593
	E							0.101

*, ** Significant at 5% and 1% level respectively.

Further, out of seven traits showing positive and significant association with yield per plot, the direct and indirect contributions to yield per plot of only four traits i.e. days to maturity, pods per plant, seeds per pod and 100-seed weight were worked out through path coefficient analysis (Table 3), since only these traits in the biological sense appeared to contribute towards yield per plot in a more direct manner. With a similar view, the direct and indirect contributions of primary branches, secondary branches and plant height towards pods per plants were also worked out (Table 4).

The direct contributions of all the four traits to yield per plot were higher as compared to indirect contributions via other traits (Table 3), indicating their importance in yield improvement. The order of their contribution in terms of direct effects was pods per plant, 100-seed weight, seeds per pod and days to maturity. These results are in conformity with those of Wakankar and Yadav (1975), and Singh *et al.*, (1982) The indirect contributions of days to maturity and seeds per pod via 100-seed weight to yield per were substantial. However, days to maturity via seeds per pod and 100-seed weight, seeds per pod via pods per plant and 100-seed weight and 100-seed weight via seeds per pod also showed substantial indirect contributions to yield per plot (Table 3) suggesting the importance of these traits in determination of yield.

Table 3. Estimates of direct underlined values and indirect contributions of four traits on yield per plot in pigeonpea.

Character	Days to maturity	Pods per plant	Seeds per pod	100-seed weight [g]	Genotypic correlation coefficient
Days to maturity	<u>0.286</u>	0.022	0.094	0.100	0.502
Pods per plant	0.022	<u>0.432</u>	0.026	0.010	0.560
Seeds per pod	0.020	<u>0.184</u>	<u>0.320</u>	0.126	0.640
100-seed weight [g]	0.074	—0.008	0.098	<u>0.421</u>	0.593

Residual effect = 0.390.

Path coefficient analysis of primary branches, secondary branches and plant height with pods per plant indicated that magnitude of direct effects was higher than that of indirect effects (Table 4). The maximum direct contribution was shown by secondary branches followed by primary branches and plant height respectively. Primary branches via secondary branches and plant height, and plant height via primary branches showed maximum indirect contributins to pods per plant indicating their importance in determining pods per plant which itself is an important yield contributing trait.

It may be concluded from the above discussion, that in the genotypes of early maturing group of pigeonpea traits like days to maturity, plant height, primary branches, secondary branches, pods per plant, seeds per pod and 100-seed weight are all important yield contributing traits. Further, it is also tempting to suggest that these traits may be used in any future breeding programme for yield improvement in pigeonpea.

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Table 4 Estimates of direct [underlined values] and indirect contributions of three traits on pods per plant in pigeonpea.

Character	Primary branches	Secondary branches	Plant height [cm]	Genotypic correlation coefficier
Primary branches	<u>0.554</u>	0.140	0.105	0.799
Secondary branches	0.072	<u>0.632</u>	0.022	0.736
Plant height [cm]	0.155	0.055	<u>0.425</u>	0.635

Residual effect = 0.495

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