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Research Note

Genetic analysis of yield and its component traits in drought tolerant genotypes of pigeonpea (*Cajanus cajan* L. Millspaugh)

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Abstract:
In the present investigation, sufficient variability was observed in the drought tolerant pigeonpea genotypes for the traits under study. Most of the yield contributing characters showed significant positive correlation whereas, number of primary branches per plant showed significant negative correlation with seed yield. Days to maturity had maximum direct effect on seed yield followed by number of pods per plant and plant height and number of secondary branches which had negative direct effect on seed yield. Number of secondary branches per plant, number of pods per plant and days to maturity were identified as important yield components and hence, selection should be focused on these traits to improve yield in drought tolerant genotypes of pigeonpea.

Key words: Pigeonpea, variability, correlation, path analysis

Pigeonpea is second important pulse crop of India after chickpea. It contains 24-25 percent protein and serves as a source of protein for vegetarian population of the country. The production potential of pigeonpea can be enhanced by developing high yielding varieties coupled with resistance to abiotic stresses like drought in addition to various biotic stresses.. The effectiveness of selection for such varieties depends on magnitude of variability for yield and component traits and interrelationship among them. When more variables are correlated with yield, it becomes difficult to identify appropriate traits for selection. In such cases, path analysis provides an effective way for finding out direct and indirect contribution of different component characters towards yield. Keeping all these facts in view, the present investigation was planned to study variability and association between yield and its components in drought tolerant lines of pigeonpea.

The experimental material comprised 23 drought tolerant genotypes of pigeonpea *viz*., ICPL 88039, ICPL 2089, ICPL 161, ICPL 288, ICPL 149, ICPL 88034, ICPL 90030, ICPL 90034, ICPL 90040, ICPL 2155, ICPL 2156, ICPL 86022, ICPL 2438, ICPL 89, ICPL 150, ICPL 90047, ICPL 90048, ICPL 91024, ICPL 93101, ICPL 90051, ICPL 20209, ICPL 20211 and ICPL 20216 received from International Crops Research Institute for Semi-Arid Tropics, Hyderabad. The experiment was conducted during *kharif*, 2009-10 at Agricultural Research Station, Tandur and sown in randomized block design with three replications. All the agronomic package of practices were followed to raise a normal crop. Data were recorded on eight quantitative characters viz., days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, 100-seed weight (g) and seed yield (g/plant). The data were collected on five randomly selected plants from each replication and were subjected to statistical analysis to work out genotypic (GCV) and phenotypic (PCV) coefficients of variation, heritability and genetic advance as per cent of mean as per standard methods. Genotypic and phenotypic coefficients of correlation were computed according to Al-Jibouri *et al.* (1958). The correlations were further partitioned into direct and indirect effects as suggested by Dewey and Lu (1959).

Analysis of variance revealed significant differences among the genotypes for all the traits studied. The general mean, range and genetic variability of different parameters presented in Table 1, revealed that sufficient variability was present in the genotypes for all the characters. This variability can be utilized effectively to develop high yielding cultivars through hybridization followed by selection.

Phenotypic coefficient of variation (PCV) was maximum for 100-seed weight followed by number of primary branches per plant, seed yield and number of secondary branches per plant, whereas days to 50% flowering and maturity and plant height had low estimates of PCV. Similar trend was observed for genotypic coefficient of variation (GCV) for almost all the traits, though they were slightly low compared to PCV. These results were in conformity with the findings of Aher *et al.* (1998).

The heritability estimate was highest for days to 50% flowering (99.6%) followed by number of secondary branches per plant (98.6%), plant height (97.8%) and days to maturity (97.5%). Number of primary branches per plant showed moderate heritability, whereas number of pods per plant, seed yield and test weight recorded low estimates of heritability. Similar results were reported by Baskaran and Muthaiah (2006). Though high heritability indicates the effectiveness of selection on the basis of phenotypic performance, it does not show any indication of the amount of genetic progress for selecting the best individuals. The highest genetic advance was observed for seed yield followed by number of secondary branches per plant and number of pods per plant. Number of primary branches per plant, days to 50% flowering, plant height and days to maturity had moderate genetic advance whereas, 100-seed weight recorded relatively low estimates of genetic advance. Number of secondary branches per plant had high heritability coupled with high genetic advance which indicated that this character is under additive genetic control and simple selection will be effective for its improvement.

Genotypic correlation coefficients among different characters are presented in Table 2. At genotypic level association of seed yield was positive and significant with all the characters except number of primary branches per plant and test weight whereas it was significantly and negatively correlated with primary branches per plant. This indicated that all the yield attributing characters contributed significantly to seed yield except the number of primary branches per plant. Days to 50% flowering showed positive significant correlation with days to maturity, plant height, number of pods per plant and 100-seed weight but negative significant correlation with number of primary branches per plant. Days to maturity exhibited significant positive correlation with plant height, number of pods per plant and 100 - seed weight and negative significant correlation with number of primary branches per plant. This indicates that in late maturing genotypes the number of pods per plant and size of seed increased. This is because more reproductive period is available for producing more number of pods as well as greater duration for seed filling resulting in bolder seeds.

Plant height had positive significant correlation with number of pods per plant but negatively correlated with number of primary branches per plant. This is because, as the plant height increased, the number of primary branches get reduced because of apical dominance. Number of primary branches per plant showed positive correlation with 100- seed weight and negative correlation with number of secondary branches per plant and number of pods per plant ultimately resulting in negative association with seed yield. Lesser the number of primary branches, more will be the number of secondary branches per each primary branch and subsequently more will be the number of pods per branch. However, because of limited nutrition under drought conditions, pod filling will be poor resulting in small sized seeds and subsequently less 100 seed weight. This indicated that lesser the number of primary branches, lower will be the 100 seed weight i.e., positive correlation and ultimately resulting in less seed yield. Number of secondary branches per plant showed positive significant correlation with number of pods per plant. These results were in agreement with the earlier findings of Mahajan *et al.*(1995).

The results obtained from path analysis taking seed yield as dependent variable and other characters as independent variables are presented in Table 3. At genotypic level, days to maturity (1.7496) followed by number of pods per plant (0.7137) exhibited largest positive direct effect resulting in positive association with seed yield. Days to 50% flowering, plant height and number of secondary branches per plant exhibited negative direct effect on seed yield. Although number of secondary branches per plant had negative direct effect on seed yield, it had positive indirect effect through number of primary branches per plant and test weight resulting in positive association with seed yield. The negative direct effects manifested by the component traits are lesser in magnitude when compared to their positive indirect effects through other characters thereby resulting in positive association with seed yield. Similar observations were recorded by Dahiya and Singh (1994).

Number of primary branches per plant had positive direct effect but negative indirect effects were manifested through secondary branches per plant and number of pods per plant resulting in negative association with seed yield. These results indicated that number of secondary branches per plant, number

of pods per plant and days to maturity were important yield contributory characters. On the basis of correlation and path analysis studies, it can be concluded that number of secondary branches per plant, number of pods per plant and days to maturity are important yield contributing traits and hence these traits should be taken into consideration while selecting desirable genotypes for higher seed yield in pigeonpea.

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Table: 1 Genetic parameters for various quantitative traits in pigeonpea

Character	Mean	Range		PCV	GCV	Heritability (bs) (%)	GA as % of mean
		Min	Max				
Days to 50% flowering	102.37	64	142	23.32	23.27	99.6	47.83
Days to maturity	159.27	114	208	19.49	19.25	97.5	39.16
Plant height (cm)	163.10	99	235	22.93	22.68	97.8	46.21
Number of primary branches per plant	6.37	2	19	107.39	50.29	21.9	48.52
Number of secondary branches per plant	11.35	1	50	91.72	91.08	98.6	186.33
Number of pods per plant	175.68	21	893	87.61	87.59	10.0	180.39
Test weight (g)	9.64	6.99	15.46	130.21	20.58	2.5	6.7
Seed yield (g/plant)	36.0	8	180	94.33	94.32	10.0	194.27

Table: 2 Genotypic correlation coefficients for various quantitative traits in pigeonpea

	Days to maturity	Plant height (cm)	Number of primary branches per plant	Number of secondary branches per plant	Number of pods per plant	Test weight (g)	Seed yield (g/plant)
Days to 50% flowering	0.997**	0.648**	-0.589*	0.307	0.421*	0.490*	0.580*
Days to maturity		0.6605**	-0.600**	0.326	0.436*	0.509*	0.597*
Plant height (cm)			-0.363	0.303	0.495*	0.344	0.42*
Number of primary branches per plant				-0.308	-0.229	0.428*	-0.307
Number of secondary branches per plant					0.768**	-0.020	0.607**
Number of pods per plant						-0.017	0.785**
Test weight (g)							0.183

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

Table: 3 Direct (diagonal) and indirect (off diagonal) effects of different characters on yield in pigeonpea at genotypic level

	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches per plant	Number of secondary branches per plant	Number of pods per plant	Test weight (g)	Seed yield (g/plant)
Days to 50% flowering	**-1.2816**	-1.2778	-0.8306	0.7549	-0.3933	-0.5396	-0.6278	**0.5802***
Days to maturity	1.7443	**1.7496**	1.1539	-1.0502	0.5700	0.7631	0.8897	**0.5969***
Plant height (cm)	-0.1539	-0.1566	**-0.2374**	0.0863	-0.0720	-0.1175	-0.0818	**0.4209***
Number of primary branches per plant	-0.0475	-0.0484	-0.0293	**0.0806**	-0.0248	-0.0185	-0.0345	**-0.3072**
Number of secondary branches per plant	-0.0061	-0.0065	-0.0060	0.0061	**-0.0198**	-0.0152	0.0004	**0.6073****
Number of pods per plant	0.3005	0.3113	0.3532	-0.1636	0.5484	**0.7137**	-0.0124	**0.7851****
Test weight (g)	0.0243	0.0252	0.0171	-0.0212	-0.0010	-0.0009	**0.0496**	**0.1832**

*-Significant at 5% level, ** - Significant at 1% level Residual effect: 0.7007