



Research Article

Study of genetic variability and correlation in interspecific derivatives of Pigeonpea [*Cajanus cajan* (L.) Millsp.]

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Abstract :

Forty interspecific derivatives (ISD) of Pigeonpea along with five national checks derived from ICRISAT, Patancheru, Hyderabad and one local check were screened to study the extent of genetic variability for yield and yield contributing character and their interrelationship. The observations were recorded on nineteen different characters. The highest GCV was recorded for trichome-A followed by trichome-B. The high heritability estimates coupled with high expected genetic advance were observed for trichome type-A, B, number of secondary branches, trichome type D, number of pods per plant, grain yield per plant, trichome type C, per cent pod setting, per cent pollen sterility, 100 seed weight, number of primary branches, height of first primary branch from ground level and seeds per pod indicating the presence of additive gene action and phenotypic selection may be effective. Grain yield was found to be positively and significantly correlated with all characters except for percent pod damage where the association was negative and significant. It indicated that these characters are useful for taking them as the basis of selection for high yield.

Key words:

Pigeonpea, genetic variability, correlation

Introduction

The yield is a quantitative character associated with other component characters, which are influenced by environmental fluctuations. Therefore, selection for these characters is not desirable if it is based on phenotypic expression. Hence it is necessary to estimate relative amounts of genetic and non-genetic variability exhibited by different characters using suitable parameters like genetic coefficient of variability (GCV), heritability estimates (H) and genetic advance (GA). Similarly it is necessary to workout genetic association between yield and yield components, which will help in selection. With this view in mind an attempt was made to analyze the nature of genetic variability and to find out correlations among yield and yield contributing characters in Pigeonpea.

Material and methods

The present study was undertaken with forty interspecific derivatives (ISD) of Pigeonpea along with five national checks derived from ICRISAT, Patancheru, Hyderabad and one local check. These strains were grown in randomized block design with two replications at experimental farm of the Department of Agricultural Botany, Marathwada

Agricultural University, Parbhani during *kharif* 2005. The observations on twenty randomly selected plants in different genotypes in each replication recorded for nineteen metric traits.

Genetic parameter of variability viz., phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), and genetic advance in percentage of mean were estimated according to Johnson et al., (1955). Heritability in broad sense was estimated according to the method proposed by Hanson et al., (1956). The correlation coefficient was estimated by the method of Al-Jibouri et al., (1958).

Results and discussion:

There was wide range of variability observed for all the characters of ISD of Pigeonpea at both 5 percent and 1 percent level (Table -1). Similar observation reported by (Pandey and Singh 2002) in Pigeonpea..

The genetic coefficient of variation of various characters varied from 5.15 to 73.02. It was found to be highest for trichome-A (73.02), followed by trichome-B (44.47), numbers of secondary branches (43.84), trichome type -D (39.54), pods per plant (34.16) and grain yield (g) (33.15). Similar results were reported by Dani (1979) and Singh et al., (1981) in pigeonpea. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters

there by indicating greater effect of environment on the expression of these characters. Similar types of trichomes reported by Romeis *et al.*, (1999).

Although GCV is indicative of the presence of high degree of genetic variation, the amount of heritable portion can only be determined with the help of heritability estimates and genetic gain. High values of heritability estimates were obtained in characters like trichome type -C (95.5), days to 50 per cent flowering (93.7), number of pods per plant (93.2), trichome type B (92.2), days to flower initiation (91.6), days to maturity (89.9), Plant height (89.0), per cent pod setting (88.0), per cent pollen sterility, 100 seed weight (80.8), trichome type A (78.9), height of first primary branch from ground level (77.00), whereas medium heritability were recorded for grain yield (71.9) and per cent pod damage (62.27). while low heritability estimates were observed for pod length (43.5). Similar type of heritability was recorded by Patel and Patel (1998).

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. According to Johnson *et al.*, (1955), heritability estimates along with the genetic gain are usually more useful. The expected genetic advance is expressed as percent of mean ranged from 7.00 (pod length) to 133.68 % (trichome A). it may be mentioned here that characters like days to 50 % flowering, days to maturity, 100 seed weight, trichome type A and B, Per cent pod setting, percent pollen sterility and number of primary branches, height of first primary branch from ground level and seeds per pod were largely governed by additive genes and therefore to selection based on phenotypic performance is likely to yield beneficial results in improving these characters.

Genotypic correlation provides a measure of genotypic association among different characters and also helps in identifying the traits in selection program. It is observed from Table 2 that the values of genotypic correlation were higher than the phenotypic correlation among all the combinations except few which could be due to modifying effects of the environment.

Grain yield was found to be positively and significantly correlated with all characters except for per cent pod damage where the association was negative and significant. It indicated that these characters are useful for taking them as the basis of selection for high yield. Similar trend was reported by Suresh Kumar and Reddy (1983), Sarma *et al.*, (1994) in pigeonpea.

Days to flower initiation showed positive and significant genotypic and phenotypic correlation with days to 50 per cent flowering and days to maturity, trichome type C. However, negative but significant genotypic correlation was observed with percent pod damage. Similar observation recorded by Pandey and Singh (2002).

The plant height and number of primary branches showed positive significant genotypic and phenotypic correlation with number of pods per plant, number of primary branches, number of secondary branches and trichome type C and B. Whereas, percent pod damage showed negative and significant correlation with plant height. Similar observation recorded by Dhamelia and Pathak (1994). The characters number of pods per plant had positive and significant correlation at genotypic and phenotypic level with trichome type C and B. Reported by Pandey and Singh (2002).

Negative and significant genotypic and phenotypic correlation was observed between percent pod damage with pods per plant. Reported by Khandwe *et al.* (1998). The 100 seed weight showed positive and significant genotypic and phenotypic correlation with pod length, while trichome-D, B and C exhibited strong negative and significant correlation. Reported by Dhamelia and Pathak (1994). The pod length had negative and significant correlation with trichome type-C. Percent pod setting had found negative and significant correlation with pollen sterility. Similar results were reported by Saxena *et al.* (1981).

Hence simultaneous improvement in those components as well as in yield would be possible. Therefore, the selection based on these characters may be effective in breeding for high yield.

References

- Johnson, H.W.; H.F. Robinson and R.E. Comstock, (1955). Genotypic and phenotypic correlation in soybean and their implications in selection. *Agron. J.* 47 (10) : 177 - 183.
- Hanson, C.H.; H.F. Robinson and R.E. Comstock, (1956). Biometrical studies of yield in segregating population of Korean Lespedeza, *Agron. J.* 48 (6): 268 - 272.
- Al-Jibouri; H.A. Miller and H.F. Robinson, (1958). Genotypic and environmental variances and covariances in an upland cotton cross of interspecific origin. *Agron. J.* 50 (10) : 633-637.
- Dani, R.G. (1979). Variability and association between yield and yield components in pigeonpea. *Indian J. Agric. Sci.* 49 (7): 507-510.
- Saxena, K. B., Byth, D.E., Dundas, E.S. and Wallis, E.S. 1981. Genetic control of sparse pollen production in



- pigeonpea. International Pigeonpea Newsletter 1 : 17-18.
- Singh, S.P., J.N. Govil and J.N. Hayatram, 198). Genetic and environmental variability and quality traits in early pigeonpea. Pulse Crop Newsletter 1:113-114.
- Suresh Kumar, A. and T.P. Reddy, 1983. Genetic association in pigeonpea. International Pigeonpea Newsletter 2 : 26.
- Dhameliya, H.R. and Pathak, A.R 1994. Correlation studies in segregating generations in pigeonpea. International Chickpea And Pigeonpea Newsletter, 1 : 30-32.
- Sarma, B.K., Singh, Major., Singh, Gyanendra 1994. Correlation and path analysis in pigeonpea under mid altitude condition of Meghalaya. Indian J. Hill Farming, 7 (2) :210 - 211.
- Khandwe, N.; Machwe, V.G. and Khandwe, R. 1998. Correlation of larval population of *Heliothis armigera* with yield parameters of pigeonpea. Indian J. Agric. Sci., 68 (4) :198-200.
- Patel, K.N. and Patel, D.R. 1998. Studies on genetic variability in Pigeonpea, International Chickpea and Pigeonpea Newsletter, 5 : 28-30.
- Romeis, J., Shanower, T.G. and Peter, A.J. 1999. Trichomes on pigeonpea (*Cajanus cajan* (L.) Millsp.) and two wild *cajanus spp.* Crop Sci., 39:564-569.
- Pandey, N. and Singh, N.B. 2002. Association between yield and yield attribute sin Pigeonpea hybrids. Madras Agric. J., 88 (10/12) : 640-643.

**Table 1. Estimation of genetic parameters for different characters in Pigeonpea**

Parameters	Range	General mean	Genotypic variance (σ^2_g)	Phenotypic variance (σ^2_p)	GCV (%)	PCV (%)	Heritability (%)	GA (%)	EGA (%)
Days to flower initiation	78 – 130	115.19	100.27	109.37	8.69	9.07	91.6	17.14	14.87
Days to 50% flowering	99.5-159.5	37.79	135.91	145.03	8.46	8.73	93.7	16.87	12.24
Days to maturity	135-220.5	189.00	208.69	231.90	7.64	8.05	89.9	14.93	7.89
Plant height	100.80-155.70	131.12	157.33	176.68	9.56	10.13	89.0	18.59	14.17
No. of primary branches	5.30-15.10	11.19	2.65	4.35	14.56	18.62	61.1	23.45	209.56
No. of secondary branches	2.30-25.60	12.47	29.89	32.29	43.84	45.57	92.5	86.89	696.79
Height of first primary branch from ground level	9.80-31.00	25.47	9.82	12.75	12.30	14.02	77.0	22.24	87.31
No. of pods/plant	18.60-285.00	151.73	2687.03	2882.57	34.16	35.38	93.2	67.94	44.77
No. of seeds/pod	3.48-5.00	3.912	0.19	0.22	11.14	11.98	86.4	21.34	545.78
Per cent pod damage	10.82-14.31	16.83	7.47	12.001	16.24	20.57	62.27	26.40	156.86
100 seed wt. (g)	5.59-24.31	7.63	1.00	1.24	13.15	14.62	80.8	24.36	319.26
Pod length (cm)	4.41-6.35	5.45	0.07	0.18	5.15	7.81	43.5	7.00	128.44
Pod setting (%)	12.71-38.86	25.45	20.45	23.22	17.76	18.92	88.0	34.34	134.49
Pollen sterility (%)	13.33-27.88	18.36	9.57	11.75	16.85	18.67	81.4	31.32	170.58
Trichome-A	0.16-11.48	3.67	7.18	9.09	73.02	82.16	78.9	133.68	3642.50
Trichome-B	0.16-14.33	6.87	9.35	10.13	44.47	46.30	92.2	88.01	1281.07
Trichome-C	71.16-244.0	169.80	2127.61	2227.76	27.16	27.79	95.5	54.68	32.39
Trichome-D	2.50-29.16	13.46	28.32	30.46	39.54	41.00	92.9	78.54	583.50
Grain yield (g)	5.74-68.47	30.32	101.05	140.49	33.15	39.08	71.9	57.91	190.99



Table 2 Genotypic and phenotypic correlation coefficient amongst different characters in Pigeonpea

Character	D F I	Days to 50% flowering	Days to maturity	Plant height	No. of primary branches	No. of secondary branches	Height of primary branches from G.L.	No. of pods/plant	No. of seed s/pod	Percent pod damage	100 seed wt. (g)	Pod length (cm)	Pod setting (%)	Pollen sterility (%)	Trichome-A	Trichome-B	Trichome-C	Trichome-D	Grain Yield (g)
Days to flower initiation	G	0.851**	0.834**	0.128	0.059	0.162	0.130	0.170	-	-	0.045	0.057	-0.196	0.269	0.042	0.267	0.340**	0.277	0.037
	P	0.798**	0.766**	0.111	0.025	0.150	0.092	0.177	-	-	0.042	0.025	-0.158	0.244	-	0.227	0.319*	0.260	0.038
Days to 50% flowering	G		0.894**	0.134	0.036	0.034	0.123	0.042	-	-	0.053	0.070	-0.290	0.226	-	0.190	0.292*	0.292*	-
	P		0.859**	0.108	-	0.019	0.116	0.020	-	-	0.029	0.022	-0.270	0.198	-	0.159	0.272	0.273	-
Days to maturity	G			0.183	-	0.069	0.114	0.070	0.001	-	0.064	0.250	-0.158	0.205	-	0.241	0.194	0.262	-
	P			0.141	-	0.049	0.085	0.054	-	-	0.048	0.150	-0.116	0.167	-	0.228	0.187	0.244	-
Plant height	G				0.678**	0.507**	0.205	0.682**	-	-	-0.283	-	-0.034	0.217	-	0.390**	0.418**	0.175	0.649**
	P				0.517**	0.559**	0.179	0.608**	-	-	-0.249	-	-0.048	0.178	-	0.341*	0.386**	0.151	0.491**
No. of primary branches	G					0.548**	0.006	0.670**	-	-	-	-	-0.198	0.342*	0.012	0.360*	0.509**	0.169	0.567**
	P					0.452**	-	0.580**	-	-	-0.346*	-	-0.167	0.224	-	0.309*	0.390**	0.158	0.531**
No. of	G						-	0.802	-	-	-1.25**	-	-0.059	0.205	0.020	0.196	0.286	0.193	0.827



secondary branches		0.11 1	**	0.07 9	0.314 *		0.30 1							**
	P	-	0.775	-	-	-0.102	-	-0.018	0.168	0.020	0.177	0.277	0.183	0.714
		0.13 7	**	0.08 1	0.269		0.12 1							**
Height of pri. Bran. from G.L.	G		0.018	0.01 2	- 0.079	0.104	0.27 8	-0.130	0.167	0.075	0.164	0.180	0.092	0.074
	P		-	-	-	0.044	0.16 6	-0.161	0.168	0.069	0.110	0.136	0.051	-
			0.005	0.01 9	0.059									0.004
No. of pods/plant	G			0.01 3	- 0.604 **	-0.288*	- 0.07 5	-0.066	0.237	-	0.319 *	0.537 **	0.104	0.953 **
	P			0.03 5	- 0.453 **	-0.224	- 0.01 7	-0.047	0.209	-	0.303 *	0.508 **	0.103	0.882 **
No. of seeds/pod	G				0.020	-0.027	0.22 0	0.213	-	-	0.045	-	-	-
	P					0.003	0.13 3	0.195	-	-	0.058	-	-	0.011
					0.016		0.610* 1**	0.49	-0.008	-	-	-	-	0.073
Per cent pod damage	G						0.49 1**	-0.008	-	-	-	-	-	-
	P						0.442* 6	0.06	-0.046	-	-	-	-	-
									0.135	0.029	0.354 *	0.799 **	0.165	0.311 *
100 seed wt. (g)	G						0.73 4**	0.064	-	0.174	-	-	-	-
	P						0.42 2**	0.030	-	0.124	-	-	-	0.012
									0.088		0.415 **	0.536 **	0.330 *	0.059
Pod length (cm)	G							-0.110	0.001	0.172	0.001	-	-	0.001
	P								0.011	0.074	0.181	-	-	0.102
											0.365 **	0.463 **	0.286 **	
Pod setting	G								-	0.176	-	-	-	-
											0.009	0.183	0.114	



(%)				0.392 **	0.298 *	0.114	0.359 *	0.055
	P			-	0.158	-	-	0.004
				0.323 **		0.267	0.096	0.304 **
Pollen sterility (%)	G			-	0.428 **	0.182	0.330 *	0.208
	P			-	0.325 *	0.144	0.303 **	0.131
				0.021				
Trichome-A	G				-	-	-	-
	P				0.201	0.095	0.109	0.010
					0.179	-	-	-
Trichome-B	G					0.078	0.067	0.020
	P					0.456 **	0.377 **	0.165
						0.433 **	0.344 *	0.198
Trichome-C	G						0.207	0.364 *
	P						0.196	0.316 *
Trichome-D	G							0.031
	P							0.020