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Genetic Divergence in Pigeonpea*

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ABSTRACT

The genetic divergence was assessed using Mahalanobis D^2 statistic where in 70 genotypes of pigeonpea were grouped in as many as 14 clusters. The clustering pattern of the genotypes was independent of their geographical origin. The characters grain yield per plant, number of pods per plant, plant height and number of primary branches per plant showed high genetic divergence. Based on the inter cluster distance, cluster XIV showed high genetic divergence with XIII, XII and X. It was therefore concluded that the genotypes belonging to these clusters be included/utilised for improving seed yield in pigeonpea.

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INTRODUCTION

Now a days pigeonpea is getting popularity in rainfed areas. Therefore it is essential to develop the genotypes having high productivity under such condition. For developing such genotypes, diversity among characters contributing towards the yield is a must. The present study was undertaken to identify diversed genotypes for effective breeding programme.

MATERIALS AND METHODS

Seventy geographically diversed genotypes were planted in *kharif* 1990 on Instructional Farm of Agriculture College, Navsari. The material was sown in single row plots of 5 m length at a distance of 90 x 20 cm in randomised block design with 3 replications. Five competitive plants selected at random were used for recording observations on 10 characters (Table 1). From estimates of variances and covariances, V statistic, which utilises Wilk's 'A' criterion, a simultaneous test of difference between mean values of a number of correlated variables was done. Genetic diversity was calculated using Mahalanobis D^2 statistic as suggested by Rao(1952). On the basis of magnitude of D^2 values, varieties were grouped in to a number of clusters by Tocher method(Rao 1952). The mutual relatioship was also determined by using the principal component analysis.

RESULTS AND DISCUSSION

A high significant difference among genotypes revealed the existance of sufficient

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TABLE 1

ANOVA and coefficient of variability fcr 70 genotypes of pigeonpea.

Character	Mean sum of square			Coefficient of variability (%)
	Replication (2 df)	Genotypes (69 df)	Error (138 df)	
Grain yield per plant (g)	29.37	1162.17**	39.54	8.83
Number of pods per plant	344.87	2931.58**	226.45	10.65
Number of seeds per pod	0.11	0.35**	0.04	5.58
100 seed weight (g)	0.04	3.24**	0.10	2.90
Height of plant (cm)	5.75	1575.16**	127.66	7.64
Number of primary branches per plant	0.97	2.65**	0.25	7.22
Length of secondary branch (cm)	24.69	267.72**	43.51	8.68
Pod length (cm)	0.02	0.50**	0.05	4.21
Days to flower	44.75	222.16**	17.88	4.44
Days to maturity	785.50	438.43**	37.33	3.73

** Significant at 1% probability.

TABLE 2

Cluster composition of seventy genotypes of pigeonpea.

Cluster	Number of genotypes	Genotypes and origin
I	25	BP 434, BP 84-46, BP 449, BP 84-72, BP 433-BP 84-76, BP 84-42, BP 84-202, BP 84-91, BP 84-83, BP 1107, BP 463, BP 2060, BP 471, BP 84-41, T-15-15, GAUT 85-18 (Gujarat), ICPL 7203, ICPL 86026, ICP-81 (ICRISAT), Pusa -1 (IARI), TT 6 (Trombay) BDN 1, BDN 7 (Maharashtra), BAU 1 (Bihar).
II	14	BP 86-109, BP 444, BP 1103, BP 84-48, GAUT 85-21 (Gujarat), T 21. (U.P.), ICPL 315 (ICRISAT), MKU 66, BDN 2 (Maharashtra), C 21, Pusa 33 (IARI), AL 56 (Punjab), CORG 3 (Tamilnadu), VR 3 (A.P.).
III	10	PPE 45-2, ICPL 186 (ICRISAT), BP 450, BP 1148, GAUT 87- 10(Gujarat), UR 10 (Orissa), MTH 9, MTH 20, BDNA 5 (Maharashtra), BKW 23 (Bihar).
IV	3	GAUT 85-22, BP 1809 (Gujarat), BSMR 198 (Bihar).

1.	2.	3.
V	2	BP 86-126, BP 84-51 (Gujarat).
VI	3	TAT 10 (Trombay), ICP 909 (ICRISAT), Pusa Ageti (IARI)
VII	3	BP 476, GAUT 8299 (Gujarat), BSMR 736 (Bihar)
VIII	2	SPMA 8(Karnataka), ICP 84060 (ICRISAT).
IX	3	GAUT 82-92 (Gujarat), ICPL 87, ICPL 83024 (ICRISAT)
X	1	UPAS 120 (U.P.)
XI	1	Nylon (Israel)
XII	1	CO 5(Tamilnadu)
XIII	1	Bhadbhoot (Gujarat)
XIV	1	ICPL 89044 (ICRISAT)

amount of variability in the material studied(Table 1). On the basis of magnitude of D^2 values, all the seventy genotypes were grouped in 14 clusters (Table 2). The cluster I was the largest which consisted 25 genotypes from Trombay, ICRISAT, IARI, Bihar, Maharashtra and Gujarat. Cluster II which was the second largest, accommodated 14 genotypes from IARI, Punjab, ICRISAT, Gujarat, Maharashtra, Andhra Pradesh, Tamilnadu and Uttar Pradesh. Cluster III had 10 genotypes whereas clusters IV, VI, VII and IX possessed 3 genotypes from Gujarat, Trombay, ICRISAT, IARI and Bihar. Cluster V and VIII contained 2 genotypes from Gujarat, ICRISAT and Karnataka. The clusters from X to XIV were single variety cluster which included varieties from Uttar Pradesh, Israel, Tamilnadu, Gujarat and ICRISAT respectively. Thus the clustering pattern of genotypes was not as per their geographical origin as the varieties of same geographical area were grouped in different clusters and of different areas in the same cluster which is in accordance to Singh *et al.* (1988) and Murty and Dorairaj (1990). Such clustering pattern may be because of genetic drift and selection in different environments resulting in considerable diversity than the geographical isolation (Murty and Arunachalam,1966). The free exchange of seed material among different regions may consequently also cause character constillations because of human interferance and material may loose its individuality.

The inter cluster distance (Table 3) was maximum (D^2 = 1749.66) between clusters XIII and XIV followed by clusters XII and XIV (D^2=1513.44) and it was minimum (52.46) between I and IX (Fig. 1) indicating relative closeness of genotypes of these clusters. The intra-cluster distance ranged from 0.0 to 55.65

TABLE 3

Inter and intra cluster average values of D^2 in pigeonpea.

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
I	43.08 (6.56)	73.52 (8.57)	68.87 (8.29)	79.91 (8.93)	69.87 (8.35)	98.41 (9.92)	93.48 (9.66)	125.29 (11.19)	52.46 (7.24)	253.35 (15.91)	142.50 (11.93)	333.69 (18.26)	364.86 (19.10)	644.22 (25.38)
II		44.52 (6.67)	81.67 (9.03)	252.58 (15.89)	137.10 (11.70)	73.37 (8.56)	95.52 (9.77)	64.08 (8.00)	138.02 (11.74)	151.52 (12.30)	272.46 (16.50)	224.66 (14.98)	252.95 (15.90)	1033.31 (32.14)
III			38.87 (6.23)	140.08 (11.83)	79.09 (8.89)	63.18 (7.94)	132.22 (11.49)	95.23 (9.75)	98.56 (9.92)	167.93 (12.95)	208.86 (14.45)	254.04 (15.93)	394.59 (19.83)	739.65 (27.19)
IV				37.80 (6.14)	136.14 (11.65)	228.92 (15.13)	186.18 (13.64)	252.03 (15.87)	139.53 (11.81)	477.70 (21.85)	106.17 (10.30)	565.22 (23.77)	540.87 (23.25)	400.41 (20.01)
V					51.57 (7.31)	124.95 (11.17)	134.61 (11.60)	98.97 (9.94)	149.45 (12.22)	297.55 (17.24)	121.18 (11.00)	399.84 (19.99)	355.87 (18.86)	743.80 (27.27)
VI						55.65 (7.45)	157.14 (12.53)	123.45 (11.11)	96.00 (9.78)	111.82 (10.57)	166.13 (12.88)	354.44 (18.82)	404.01 (20.10)	915.27 (30.25)
VII							43.60 (6.60)	117.02 (10.81)	161.99 (12.72)	319.71 (17.88)	250.43 (15.82)	155.18 (12.45)	193.92 (13.92)	919.49 (30.32)
VIII								29.68 (5.44)	223.87 (14.94)	199.43 (14.12)	103.33 (10.16)	285.02 (16.88)	222.62 (14.92)	1054.79 (32.47)
IX									47.26 (6.87)	199.58 (14.12)	265.76 (16.30)	368.42 (19.19)	498.42 (22.32)	721.23 (26.86)
X										– –	518.25 (22.76)	485.41 (20.86)	483.67 (21.99)	1308.02 (36.18)
XI											– –	631.55 (25.13)	479.96 (21.90)	897.56 (29.95)
XII												– –	208.41 (14.43)	1513.44 (38.90)
XIII													– –	1749.66 (41.82)
XIV														– –

Fig. 1 : Inter cluster distance between different clusters (D values)

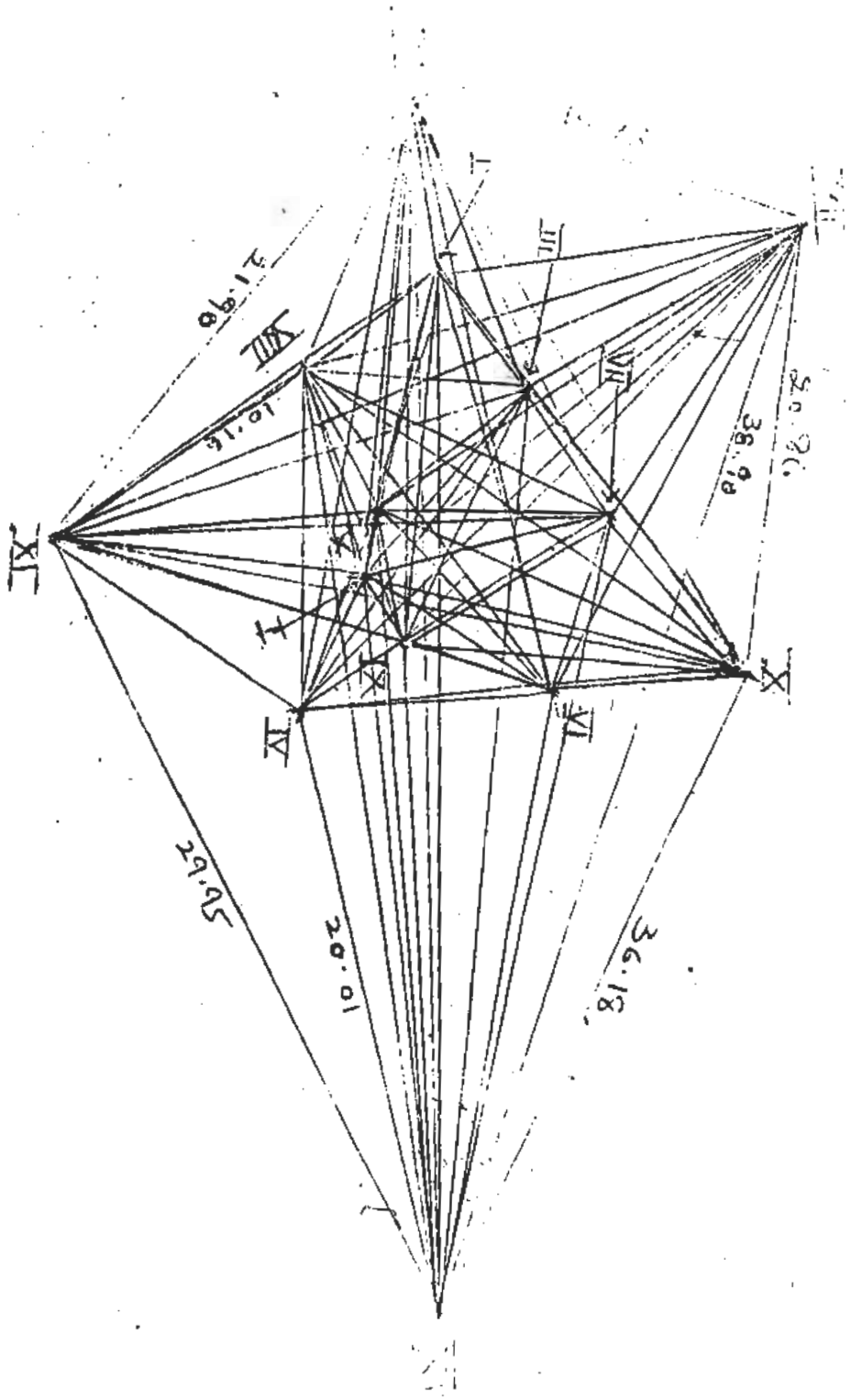

TABLE 4

Cluster mean for different characters in pigeonpea.

Cluster No.	Number of population	X_1 Grain yield plant (g)	X_2 Number of pods/ plant	X_3 Number of seeds/ pod	X_4 100 seed weight (g)	X_5 Plant height (cm)	X_6 No. of primary brancnes /plant	X_7 Length (cm) of secondary branch	X_8 Pod length (cm)	X_9 Days to flowering	X_{10} Days to maturity
I	25	71.34	143.53	3.717	11.42	154.452	7.036	78.508	5.141	95.919	175.022
II	14	76.195	150.059	3.595	10.315	148.375	6.953	75.123	5.255	93.142	169.645
III	10	54.500	110.126	3.438	10.173	131.630	6.520	71.366	4.672	94.460	166.810
IV	3	67.555	136.400	3.444	12.530	149.150	7.144	78.355	4.858	101.444	184.978
V	2	71.000	137.600	3.608	10.322	175.917	7.408	78.130	5.490	109.833	181.733
VI	3	59.444	104.623	3.516	9.768	129.222	5.544	62.955	5.022	79.888	163.666
VII	3	99.444	194.289	3.427	12.340	161.570	7.888	79.800	5.180	98.222	163.000
VIII	2	87.700	171.200	3.441	10.242	156.866	7.467	80.150	4.639	123.833	191.100
IX	3	48.444	105.755	4.266	11.180	108.577	6.138	60.95	5.295	86.666	164.289
X	1	38.000	79.067	4.217	8.737	80.467	3.967	60.600	4.200	82.000	164.067
XI	1	84.667	180.400	3.783	12.200	190.800	5.667	91.400	5.440	115.333	222.800
XII	1	155.000	254.500	4.433	12.657	187.800	9.807	95.400	5.560	89.667	166.330
XIII	1	152.000	174.800	3.583	12.913	198.133	7.800	103.200	5.583	110.000	184.367
XIV	1	105.000	191.000	3.617	12.637	135.333	8.000	83.100	4.117	106.000	174.800
Mean		82.16	152.38	3.720	11.245	150.607	6.957	78.502	5.044	101.172	175.829
S. Em. ±		8.576	12.290	0.090	0.354	8.740	0.371	3.332	0.125	4.9499	4.543
C. V. %		39.055	30.223	9.057	1.389	21.644	19.973	15.879	9.459	18.306	9.668

which was the highest in clusters VI and the lowest in cluster VIII (D^2=29.68). Clusters X to XIV had no intra-clusters values and such clusters are supposed to have maximum diversity with the other varieties.

The cluster means of various clusters presented in table 4 denoted high coefficient of variations for the traits like seed yield, pods per plant and plant height and low for test weight and number of seeds per pod. Cluster XII had the high mean values for grain yield,number of pods per plant;number of seeds per pod, test weight and number of primary branches whereas,cluster XIII was good for test weight, plant heigth length of secondary branch and pod lenght. For earliness cluster VI had the lowest values for days to flowering and maturity. Therefore it is concluded to have inter crossing of genotypes involving these clusters for creating wide spectrum variabliity and improving seed yield in rainfed pigeonpea.

REFERENCES

Murty, B. R. and Arunachalam,V.(1966).The nature of genetic divergence in relation to breeding system in crop plants.*Indian J.Genet.* **26A** :188-198.

Murty, Ganes, K. and Dorairaj Stephen, M. (1990). Genetic divergence in pigeonpea. *Indian J. Genet.* **50** : 279-282.

Rao, C. R.(1952). "Advanced statistical methods in Biometrical Research". John Willey and Sons. Inc. New York. pp 236-278.

Singh, S. P., Govil, J. N., Hayat Ram and Mehra, R. B. (1988). Genetic divergence in relations to plant type in pigeonpea.*Indian J. agric. Sci.*, **58** : 165-170.