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GENETIC DIVERGENCE IN CLUSTERBEAN *CYAMOPSIS TETRAGONOLOBA* (L.) TAUB.

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Genetic divergence, as measured by Mahalanobis's D^2 statistic, was studied in 48 genotypes with a set of 11 characters contributing towards seed yield in clusterbean. Significant differences were observed for all the characters under study. Based on D^2 values, 48 genotypes were c lassified into nine clusters. The study also revealed that genetic divergence had less relevance to eco-geographical distribution of the varieties. Three genotypes viz., DSE 1J, Pusa Navbahar and HG 75 were most divergent and could be used in future breeding programme.

Genetically diverse parents in a breeding programme are known to produce high heterotic effects and consequently yield desirable segregants. Accordingly, the present studies were undertaken to estimate the genetic divergence in clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) which has been recognised as an important dryland and industrial crop.

MATERIALS AND METHODS

The experimental material comprised 48 genotypes of clusterbean selected from the germplasm maintained in the Department of Plant Breeding, C.C.S. Haryana Agricultural University, Hisar. The details of these lines alongwith place of collection are given in Table 1. Sowing was done in randomised block design with three replications at C.C.S. HAU Research Farm, Hisar. The plot size was single row of three metres length spaced 45 cm apart. The data were recorded on days to first bloom, plant height (cm), branches per plant, clusters per plant, pods per plant, pods per cluster,

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Table 1. Clusterbean genotypes with their place of collection

Genotypes	Place of collection	Genotypes	Place of collection
Ageta Guara 111	Punjab	GGD-79	Gujarat
Ageta Guara 112	Punjab	GGD-80	Gujarat
Guara 80	Punjab	Kutch 8	Gujarat
CP 42	Delhi	FS 277	Haryana
CP 43	Delhi	GG1	Haryana
HG 7-3/P 10-1	Delhi	GG4	Haryana
HG 7-4/P 2-1	Delhi	HFG119	Haryana
Pusa Navabahar	Delhi	HFG156	Haryana
PIG85	Delhi	HFG 244	Haryana
PIG174	Delhi	HFG 257	Haryana
Suvidha	Delhi	HFG 258	Haryana
Durgapur Safed	Rajasthan	HFG 312	Haryana
Durgajay	Rajasthan	HFG 314	Haryana
DSE 1J	Rajasthan	HFG 381	Haryana
DSE2J	Rajasthan	HG-75	Haryana
RGC137	Rajasthan	HGS 182	Haryana
RGC 197	Rajasthan	HGS 143	Haryana
RGC 410	Rajasthan	HGS 47	Haryana
RGC 471	Rajasthan	HGS 57	Haryana
RGC 916	Rajasthan	HGS 58	Haryana
SPS 119	Rajasthan	HGS 95	Haryana
2470 (12)	Rajasthan	HGS 99	Haryana
D 39-1	Gujarat	HGS107	Haryana
GGD 78	Gujarat	79-1-5	U.S.A.

seeds per pod, 100-seed weight (g), seed yield per plant (g), days to maturity and harvest index (%). Mahalanobis D^2 statistic was used to measure genetic divergence (Rao, 1952).

RESULTS AND DISCUSSION

The analysis of variance revealed the significant differences among the genotypes for all characters (Table 2), indicating thereby that considerable amount of genetic variability existed for all the characters in the present material. The varieties were classified into nine clusters (Table 3). The maximum number of varieties were included in cluster I (33 varieties)

whereas, cluster V to IX had only single variety. The cluster I included varieties from all the sources which revealed that there was no association between clustering pattern and eco-geographical origin of the varieties. The earlier finding in clusterbean (Chaudhary *et al.*, 1975; Dass *et al.*, 1978 and Rao and Paroda, 1982) also revealed that geographical diversity is not

Table 2. Analysis of variance for various characters in clusterbean

S.No	Characters	Mean sum of squares			C.D	C.V.
		Rep.	Genotypes	Error	(5%)	(1%)
1.	Days to first bloom	15.20**	102.57**	1.76	2.12	2.48
2.	Plant height (cm)	6.80	1681.78**	13.25	5.82	2.23
3.	Branches/plant	2.11	45.27**	0.80	1.43	15.24
4.	Clusters/plant	20.71*	375.90**	0.43	4.60	12.19
5.	Pods/plant	41.85	2754.97**	20.28	7.21	7.11
6.	Pods/cluster	0.41	4.93**	0.16	0.65	10.12
7.	Seeds/pod	0.94	0.84**	0.31	0.89	7.61
8.	Seed yield/plant	0.37	15.23**	0.46	1.08	14.27
9.	100-seed weight	0.02	0.33**	0.03	0.28	4.86
10.	Days to maturity	19.10	79.99**	8.50	4.66	2.22
11.	Harvest index (%)	0.38	35.65**	0.23	0.76	6.59

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

Table 3. Clustering of clusterbean genotypes

Cluster	No. of genotypes	Genotypes
I	33	HGS 47, HFG 312, HFG 314, HFG 258, HFG 119, HGS 182, GG1, HFG 257, HGS 99, HFG 156, HGS 95, HFG 381, HGS 107, FS 277, HFG 244, HGS 58, HGS 57, 79-1-5. RGC 137, DSE 2J, RGC 471, Durgapura Safed, RGC 916, RGC 197, RGC 410. HG 7-4, HG 7-3, CP 43, PLG 174, Suvidha, Kutch 8 and GCD 80.
II	5	Ageta Guara 111, Ageta Guara 112, GGD 78, SPS 119, and PLG 85.
III	3	Durgajay, HG-75, D 39-1
IV	2	HGS 43, DSE 1J
V	1	GGD79
VI	1	Guara 80
VII	1	GG4
VIII	1	Pusa Navbahar
IX	1	2470 (12)

necessarily related to genetic diversity. In this study, all the varieties were of Indian origin except 79-1-5 which was from U.S.A. Although clusterbean is believed to be of African origin, yet it has been domesticated in the north-western region of Indo-Pakistan (Hymowitz, 1972).It is likely that they have common genes. Therefore, varieties from Rajasthan, Haryana and Punjab may fall in one cluster. There has been considerable exchange of material from one place to another and most of the clusterbean genotypes in USA were introductions from India in 1903 (Hymowitz and Matlock, 1963). Therefore, 79-1-5 which is from USA also seem to have common genes.

Table 4. Average intra and inter-cluster (diagonal) D^2 value for clusterbean

Clusters	I	II	III	IV	V	VI	VII	VIII	IX
I	282.6	537.1	522.2	717.9	476.66	1483.5	1244.8	843.6	636.9
II		309.8	829.2	650.5	751.8	2138.1	1171.4	860.1	773.2
III			389.2	965.9	627.8	740.8	1611.6	1313.7	568.6
IV				220.9	1436.5	2248.2	1573.1	1860.9	834.5
V					0.0	1325.0	2000.5	987.6	900.7
VI						0.0	2909.3	2725.2	1815.0
VII							0.0	823.2	1713.1
VIII								0.0	1194.7
IX									0.0

The intra and Inter-cluster D^2 values in Table 4 indicated that intra cluster distance was higher indicating that environment of Hisar was favourable for the full expression of characters. earlier it was suggested that material studied be tested under favourable environmental conditions to study the genetic divergence (Upadhyaya and Murty, 1970; Jatasra and Paroda, 1978). The inter-cluster distance was maximum between cluster VI and VII (29093) followed by VI and VII (2725.2). The inter-cluster distance between cluster I and V was found to be the lowest (476.6). This suggested the close relationship between these clusters.

Table 5. Mean performance of divergent genotypes

Characters	Genotypes				
	Pusa	79-1-5	DSE 1J	HGS 43	HG 75
Days to first bloom	39.53	48.26	63.53	60.66	51.80
Plant height (cm)	134.80	66.40	161.20	153.26	159.23
Branches/plant	0.00	4.86	7.53	6.00	12.43
Clusters/plant	4.93	15.60	15.93	23.13	42.50
pods/plant	7.73	47.74	51.00	42.13	122.40
Pods/cluster	1.20	2.86	2.73	2.86	6.60
Seeds/pod	7.73	7.00	6.26	8.26	6.88
Seed yield/plant(g)	0.33	1.73	5.93	14.33	8.16
100-seed weight(g)	4.07	2.80	3.51	3.52	3.53
Days to maturity	135.60	124.20	128.33	131.33	138.33
Harvest index(%)	1.70	7.04	16.28	16.23	7.68

Crosses among divergent parents are likely to yield desirable combinations. Therefore, a crossing programme should be initiated between the genotypes belonging to different clusters. The important points to be considered are (i) choice of the particular cluster from which genotyptes are to be selected as parents and (ii) selection of particular genotypes from the selected group. The divergent genotypes alongwith their performance are presented in Table 5. The data from the table indicated that DSE 1J, Pusa Navabahar and HG 75 were quite divergent. In order to have high heterosis, these genotypes should be used in future breeding programme for high yield in clusterbean.

REFERENCES

Chaudhary, B.D., P.N. Bhat and V.P. Singh. 1975. Genetic diversity in clusterbean. *Indian J. Agric. Sci.* 45: 530-535.

Dass, S., N.D. Arora, O.P. Dang and L.S. Kaushik. 1978. Genetic variability and correlation studies in fodder clusterbean (*Cyamopsis tetragonologa* (L) Taub.). *Forage Res* . 4 : 91-94.

Hymowitz, T. 1972. The trans-domestication concept applied to guar. *Econ Bot.* 26 : 49-60.

Hymowitz, T. and R.S. Matlock. 1963. Guar in the United States. *Okla. Agri. Expt. Stat. Bull.* B-611 : 1-34.

Jatasra, D.S. and R. S. Paroda. 1978. Genetic divergence in wheat under different environmental conditions. *Cereal Res. Comm.* **6** : 307-317.

Rao, C.R. 1952. Advanced statistical methods in Biometrical Research. John Willey and Sons, New York.

Rao, G.V.S. and R.S. Paroda, 1982. Factor analysis in Clusterbean (*Cyamopsis tetragonoloba* (L) Taub.). *Theor. Appl..Genet.* **62** :273-276.

Upadhyay, M.K. and B.R., Murty. 1970. Genetic divergence in relation to geographical distribution in pearlmellet. *Indian J. Genet.* **30** : 704-15.