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VARIATION AND CHARACTER ASSOCIATION STUDIES IN CLUSTERBEAN (*CYAMOPSIS TETRAGONOLOBA* (L.) TAUB.)

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Analysis of variance for ten quantitative characters in 81 genotypes of clusterbean showed significant variability for all the traits. Branches plant^{-1}, pods plant^{-1}, pods cluster^{-1} and seed yield plant^{-1} had high genotypic coefficient of variability, high heritability and high genetic advance (% of mean). Seed yield per plant showed significant and positive correlation with pods per plant, clusters per plant and pods per cluster at genotypic and phenotypic levels, while it had significant and positive phenotypic association with plant height and branches per plant. Both genotypic and phenotypic correlations of pods plant^{-1} with clusters plant^{-1} and pods cluster^{-1} were significant and positive.

Key words: Clusterbean, *Cyamopsis tetragonoloba*, analysis of variance

Clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) locally known as guar is an important *kharif* season, drought tolerant leguminous crop, particularly of arid and semi-arid areas of north-western Indian desert. It is grown for seed, fodder and as a vegetable crop either pure or in mixture. Guar seed contains gum or mucilage, mannogalactan, which is used in various industrial products. Variability in the population, especially for the characters where improvement is sought for, is important for successful crop improvement programme, whereas, character association will help in simultaneous selection of two or more characters at a time. Therefore, the present investigations were undertaken to study variation and character association in clusterbean.

MATERIALS AND METHODS

Eighty-one genotypes of clusterbean were grown in Randomized Block Design with three replications atAgricultural Research Station, Mandor, Rajasthan, during *kharif* season of 1993 under rainfed situations. Each plot consisted of two rows, 3 m long and 45 cm apart. Plant to plant distance was maintained at 15 cm. Observations were recorded on 5 randomly selected competitive

plants in each plot and data were collected on 10 attributes viz., days to flowering, days to maturity, plant height (cm), branches plant^{-1}, seeds pod^{-1}, 1000-seed weight (g) and seed yield plant^{-1} (g).

Mean data were subjected to statistical analysis. Genotypic (Vg) and phenotypic (Vph) variances were calculated (Panse and Sukhatme, 1967). The genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were computed out according to the method suggested by Burton (1952). Heritability in broad sense (h^2), expected genetic advance as per cent of mean (GA as % of mean) and genotypic and phenotypic correlation coefficients were estimated according to Johnson *et al.* (1955 a,b).

RESULTS AND DISCUSSION

The statistical analysis of variance indicated highly significant differences amongst the genotypes for all the attributes under study. Estimates of Vg, Vph, GCV, PCV, h^2 (broad sense) and GA (as per cent of mean) for characters studied are given in Table 1.

Pods plant^{-1} had recorded maximum Vg and Vph values whereas, seeds pod^{-1} showed their minimum values. GCV and PCV were high for traits, like, seed yield plant $^{-1}$, pods plant^{-1}, pods cluster^{-1} and branches plant^{-1}. These results are in agreement with those reported by Dabas *et al.* (1982).

Heritability estimates were high (> 70%) for 1000-seed weight, branches plant^{-1}, pods plant^{-1}, pods cluster^{-1} and days to flowering, indicating that they are less influenced by the environments. These results are in close conformity with the findings of Mathur (1984). The expected genetic advance as per cent of mean varied from 7.38 for days to maturity to 57.16 for pods per plant, which were observed in the descending order pods plant^{-1} > seed yield plant^{-1} > pods cluster^{-1} > seed yield plant^{-1} > pods Cluster^{-1} > branches plant^{-1}, thereby indicating the possibility of maximizing genetic gain through selection for these attributes.

Genotypic (r_g) and phenotypic (r_{ph}) correlation coefficients among various charcters are presented in Table 2. Seed yield plant^{-1} showed strongest positive association with pods plant^{-1} followed successively by pods cluster^{-1} and clusters plant^{-1} at genotypic and phenotypic levels. The correlations of seed yield with plant height and branches plant^{-1} were positive but significant only at phenotypic level.

The positive significant association was obtained between days to flowering and days to maturity both at genotypic and phenotypic levels. However, both these traits exhibited significant positive correlation with plant height and significant negative association with 1000-seed weight. This revealed that the late types had more plant height but decreased seed weight. Plant height had significant negative association with 1000-seed weight. Plant height had

significant and positive association with pods plant^{-1} both at genotypic and phenotypic levels, while its positive correlation with clusters plant^{-1} was significant only at phenotypic level. These results indicated that tall plant had more numbers of clusters and pods per plant.

Table 1. Estimates of genotypic variance (v_g), phenotypic variance (V_ph), genotypic and phenotypic coefficients of variability (GCV, PCV), heritability in broad sense (h^2), genetic advance (GA) and GA as per cent of mean

Characters	Range	Mean ± SEm	Vg	Vph	GCP	PCV	h^2 (%)	GA	GA as % of mean
Days to flowering	33.3-47.0	39.48 ± 1.73	13.26	17.74	9.22	10.67	74.75	6.49	16.43
Days to maturity	76.3-96.0	88.16 ± 2.32	15.27	23.32	4.43	5.48	65.48	6.51	7.38
Plant height (cm)	37.7-77.3	56.11 ± 4.88	53.85	89.57	13.08	16.87	60.12	11.72	20.89
Branches plant^{-1}	0.1-7.3	4.42 ±0.55	1.71	2.17	29.63	33.35	78.80	2.39	54.07
Clusters plant^{-1}	3.8-20.1	14.38 ±1.78	7.56	12.32	19.12	24.41	61.36	4.44	30.88
Pods cluster^{-1}	1.2-5.5	2.54 ± 0.37	0.60	0.80	30.42	35.18	75.00	1.38	54.33
Pods plant^{-1}	15.3-59.0	35.81 ± 5.02	127.95	165.79	31.59	35.96	77.17	20.47	57.16
Seeds pod^{-1}	5.6-8.8	7.56 ± 0.35	0.22	0.40	6.22	8.41	55.00	0.72	9.52
1000 seed weight (g)	21.7-35.9	28.45 ± 0.87	8.10	9.24	10.00	10.68	87.66	5.49	19.30
Seed yield plant^{-1} (g)	2.8-11.3	6.74 ± 1.12	4.63	6.52	31.94	37.91	71.01	3.74	55.49

Branches plant^{-1} showed significant positive associations (r_g and r_{ph}) with clusters plant^{-1} and pods plant^{-1} indicating that plant with more branches led to produce more numbers of clusters as well as pods plant^{-1}. Pods plant^{-1} had significant positive genotypic and phenotypic correlations with clusters plant^{-1} and pods cluster^{-1} but it showed significant negative association with seeds pod^{-1} at genotypic level.

Table 2. Genotypic (rg) and phenotypic (rph) correlation coefficients among various characters clusterbean

Characters		Days to maturity	Plant height (cm)	Branches plant^{-1}	Clusters plant–1	Pods cluster^{-1}	Pod plant–1	Seed pod^{-1}	1000-seed weight (g)	Seed yield plant–1
Days to flowering	rg	0.848**	0.667**	0.153	0.080	0.196	0.219	–0.043	–0.437**	–0.027
	rph	0.616**	0.496**	0.111	0.068	0.151	0.162	–0.023	–0.359**	–0.023
Days to maturity	rg		0.695**	0.076	0.001	0.155	0.128	–0.060	–0.269*	–0.081
	rph		0.571**	0.082	0.097	0.064	0.129	–0.048	–0.247*	–0.019
Plant height (cm)	rg			–0.023	0.177	0.217	0.352**	–0.148	– 0.132	–0.141
	rph			0.060	0.278*	0.126	0.339**	–0.049	–0.141	0.224*
Branches plant^{-1}	rg				0.497**	–0.054	0.301**	–0.074	–0.109	0.187
	rph				0.518**	–0.052	0.339**	–0.034	–0.104	0.234**
Clusters plant^{-1}	rg					–0.247*	0.545**	–0.110	–0.219	0.348**
	rph					–0.272*	0.534**	–0.018	–0.203	0.390**
Pods cluster^{-1}	rg						0.620**	0.253*	–0.189	0.586**
	prh						0.582**	–0.171	–0.122	0.494**
Pods plant^{-1}	rg							–0.238*	–0.185	0.862**
	rph							–0.157	–0.181	0.812**
Seed pod^{-1}	rg								–0.038	0.004
	rph								–0.012	0.086
1000-seed weight (g)	rg									0.158
	rph									0.118

*, ** Significant at P = 0.05 and 0.01 respectively.

It was interesting to note that the genotypic and phenotypic correlation coefficients of clusters plant^{-1} with pods cluster^{-1} was significant and negative. Thus with increase in number of clusters per plant, the number of pods per cluster decreased. Likewise, pods cluster^{-1} was inversely correlated with seeds pod^{-1}.

In the present investigation higher GCV, heritability and expected genetic gains were observed for characters viz., pod plant^{-1}, pods cluster^{-1}, branches plant^{-1} and seed yield plant^{-1}, indicating the predominance of additive gene effects. These results are in conformity with those of Choudhary and Singh (1976). The traits pods plant^{-1}, pods cluster^{-1} and clusters plant^{-1} exhibited positive significant genotypic and phenotypic correlations with seed yield, Hence direct selection of individual plant for pods plant^{-1}, pods cluster^{-1} and clusters plant^{-1} can be made for the improvement in yield *per se*.

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