Research Note

Characterization and evaluation of north Indian clusterbean (*Cyamopsis tetragonoloba* (L.) Taub) germplasm collection

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Abstract:
Thirty genotypes of clusterbean were evaluated for horticultural traits to study the extent of variation in different agromorphological characters. Coefficient of variation was high for number of branches per plant, pod yield per plant, single poded clusters per plant, plant height and number of pods per plant. Considerable morphological variability among north Indian clusterbean landraces was identified which could be used as basis for genetic improvement programme. PCB-23, BR-112 and RGC-936 on account of better performance have been recommended for use in clusterbean improvement programme. Various economic characters needed to develop clusterbean ideotype have been discussed.

Key words: Commonbean, variability, yield

Clusterbean locally known as *Guar,* is a multipurpose crop grown for green vegetable pods, grain seeds, forage and green manure. The gum obtained from seeds is of great industrial value. India, being the chief guar growing country is the largest exporter of guar gum (Lokesha and Shivashankar, 1990). There is large number of the indigenous strains of clusterbean available in north India, which contributes considerable degree of variability with respect to qualitative and quantitative characters. Hence, there is a scope for genetic improvement of clusterbean. Before initiation of any genetic improvement programme, the characterization of the basic material on the basis of qualitative and quantitative traits is essential. The present investigations were therefore conducted to explore and understand the extent of variability for various agromorphological characters in clusterbean.

The present experiment was conducted during the rainy season from June, 2002 to September, 2002 at Vegetable Experimental Area, Punjab Agricultural University, Ludhiana. Thirty indigenous clusterbean genotypes of diverse origin along with Pusa Navbahar as check, were grown in a randomized block design with three replications. Three-row plot for each genotype was grown in each replication and recommended package of practices were followed to raise the crop. Data were recorded on eight qualitative traits viz. stem pigment, leaf size, leaf shape, leaf tip, flower colour, pod size, plant height and seed colour. Five randomly selected plants from each plot were scored for recording of observations on twelve metric traits viz. days taken for 50% germination, days taken for 50% flowering, days to first pod set, pods per cluster, clusters per plant, single poded clusters per plant, length of pod (cm), pods per plant, branches per plant at maturity, pod yield per plant (kg), days to maturity and protein content (g/100g). Protein content was estimated as described by Mckenie and Wallace (1954). The coefficient of variation was estimated according to Burton (1952). Performance of all the genotypes was compared with Pusa Navbahar and the better performing ones have been identified.

All the observations recorded on the qualitative traits are presented in Table 1. There exists a considerable variation among all the genotypes for all the twelve metric traits studied. The mean squares for replications and genotypes, range, general mean and coefficient of variation for the metric traits are presented in Table 2. Days taken for 50 per cent germination varied from 2.00 to 5.67 with a mean of 2.60 days. PCB-5 took maximum 5.67 days followed by PCB-15 (4.33). Coefficient of variation for this character was 16.95 %, which indicated medium variability for this character. Most of the genotypes were early for this trait. Days taken for 50 per cent flowering varied from 25.33 to 55.00 days with general mean of 39.91 days and low coefficient of variation (6.48%). PCB-23 took 25.33 days and found to be the earliest flowering genotype, followed by PCB-11 (28.67) and PCB-7 (30.67), while BR-112 was found to be the latest flowering genotype as it took

55.00 days. Days to first pod set were considered as an index of earliness. The genotypes taking less number of days to pod set were likely to give early marketable yield. Considerable variation was observed for this character in the material studied with PCB-23 proving to be the earliest pod setting genotype taking 28.33 days. Similar conclusions have also been drawn by Sanghi *et al.* (1964) and Vashistha *et al* (1981). Pods per cluster is an important yield component. Higher the number of pods per cluster, higher will be the yield. In the present investigation, good possibility of selection for this character was revealed, as there were significant differences among varieties for number of pods per cluster. Number of pods per cluster varied from 5.13 to 11.10 with general mean of 7.09. The number of pods per plant directly influences yield. In the present investigation highly significant differences were observed for this character. Vijay (1988) and Gipson and Balakrishnan (1990) have also reported similar results. The number of pods per plant varied from 109.78 to 623.34 with general mean of 255.47. The maximum number of pods per plant was recorded in BR-112 (623.34) closely followed by RGC-936 (580.60). Improvement in yield is the ultimate aim of every plant breeder. A lot of variability for green pod yield was observed indicating huge scope for improvement in pod yield per plant. These findings are in close association with those of Mital *et al* (1969), Henry *et al* (1986) and Singh *et al* (2001). On per plant basis highest yield was recorded in PCB-9 (0.807 Kg) followed by BR-112 (0.798 Kg). The check Pusa Navbahar produced 0.674 Kg pods per plant. Number of branches per plant is very important character, which gives higher productive nodes. So the plants with more number of branches per plant gave higher yields. The results showed that ample variation existed for this character with high coefficient of variation (27.52 %). The results corroborated with findings of Chaudhary and Singh (1976) and Sidhu *et al* (1982). Most of the genotypes remained single stemmed. Highest number of branches per plant at maturity was produced by RGC-936 (11.93) followed by BR-112 (8.67) and PCB-24 (8.00). Single branch per plant was produced by five genotypes viz. PCB-9, PCB-13, PCB-16, PCB-22 and Pusa Navbahar. The variation for protein content was not much in the investigated material due to narrow range of 3.80 to 5.88 grams per 100 grams on green pod weight basis.

The present evaluation experiment revealed that no germplasm accession had high value for all the economic traits. However, the different genotypes exhibit the high expressions for different characters. Thus, the high expression for all the economic characters in single genotype can be attained through hybridization and a gene pool can thus be created. Promising accessions of clusterbean for different economic characters have been identified and are listed in Table 3. An ideotype of clusterbean should possess smooth tender pods, medium plant height, higher yield, 4-5 branches per plant, more clusters and less single poded clusters, higher protein content and earliness. Accordingly, the genotypes PCB-9, PCB-5, PCB-23, BR-112 and RGC-936 on account of their superiority over Pusa Navbahar can be used in future breeding programmes.

References

Burton, G. W.1952. Quantitative inheritance in grasses. *Pro.c 6th Int. Grassld Confr.* pp. 277-83.

Chaudhary, B. D. and Singh, U. P. 1976. Studies on variability, correlations and path analysis in *Guar. Forage Res.,* **2:** 97-103.

Gipson, A. and Balakrishnan, R. 1990. Variability studies in clusterbeans. *South Indian Hort.* **38** : 311-14.

Henry, A. Daulay, H. S. and Krishna, G. V. S. R.1986. Correlation, path-coefficient analysis and Genetic diversity in clusterbean. *Madras Agric. J.,* **73:** 11-16.

Lokesha, R. and Shivashankar, G. 1990. Analysis of Genetic variability and character Association in clusterbean. *Mysore J. agric. Sci.,* **24** : 316-20.

Mckenie, H. A. and Wallace, H. S. 1954. Microkjeldahl's estimation of nitrogen. *Australian J. Chem.,* **7** : 553-58

Mital, S. P., Swarup, V., Kohli, M. M. and Singh, H. B. 1969. Variability in *Guar. Indian J. Genet.,* **29** : 98-103.

Sanghi, A. K., Bhatnagar, M. P. and Sharma, S. K. 1964. Genotypic and phenotypic variability in yield and other quantitative characters in *guar. Indian J. Genet.,* **24** :164-67.

Sidhu, A. S., Pandita, M. L., Arora, S. K. and Vashistha, R. N. 1982. Studies on genetic variability and correlation coefficients in clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.] *Haryana Agric. Univ. J. Res.,* **12** : 225-30.

Singh, J. V., Chander, S., Punia, A. and Jatasra, D. S. 2001. Studies on Variability, Heritability and Genetic Advance in Clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) *Annals of Biol.,* **17** : 177-78.

Vashistha, R. N., Pandita, M. L. and Sidhu, A. S.1981. Variability and interrelationship between yield and its components in *guar* under dry farming condition. *Haryana J. Hort. Sci.,* **10** : 131-35.

Vijay, O. P. 1988. Genetic variability, correlation and path analysis in clusterbean (*Cyamopsis tetragonoloba* (L.) Taub. (*Guar*). *Indian J. Hort.,* **45:** 127-31

Table 1: Qualitative traits of 30 genotypes of clusterbean along with their place of collection

Genotype	Place of collection	Stem pigment	Leaf size	Leaf shape	Leaf tip	Flower colour	Pod size	Plant height	Seed colour
PCB-1	Punjab	Absent	Large	Oval	Acute	Purplish white	Medium	Medium	Light Brown
PCB-2	Punjab	Absent	Medium	Oval	Acute	Purplish white	Medium	Medium	Pale Brown
PCB-4	Punjab`	Absent	Small	Oval	Acute	Purplish white	Large	Short	Dark grey
PCB-5	Unknown	Absent	Large	Oval	Acute	Purplish white	Medium	Short	Light Brown
PCB-6	Punjab	Present	Medium	Oval	Acute	Purplish white	Large	Short	Brown
PCB-7	Punjab	Absent	Large	Oval	Acute	Purplish white	Large	Medium	Brown
PCB-8	Punjab	Absent	Medium	Oval	Acute	Purplish white	Small	Long	Cream
PCB-9	Madhya Pradesh	Absent	Medium	Oval	Acute	White	Large	Long	Light Brown
PCB-10	Punjab	Absent	Small	Obovate	Emarginate	Purplish white	Large	Long	Light Brown
PCB-11	Punjab	Absent	Medium	Oval	Acute	Purplish white	Medium	Short	Pale Brown
PCB-12	Gujrat	Absent	Small	Oval	Acute	Purplish white	Medium	Medium	Pale Brown
PCB-13	Rajasthan	Absent	Medium	Oval	Acute	Purplish white	Medium	Short	Dark Brown
PCB-14	Punjab	Absent	Medium	Obovate	Acute	Purplish white	Small	Short	Dark Grey
PCB-15	Punjab	Absent	Small	Oval	Acute	Purplish white	Small	Short	Brown
PCB-16	Punjab	Absent	Medium	Ovate	Acute	White	Medium	Long	Light Brown
PCB-17	Punjab	Absent	Medium	Ovate	Acute	Purplish white	Small	Short	Light Grey
PCB-18	Uttar Pradesh	Present	Medium	Ovate	Acute	Purplish white	Small	Medium	Cream
PCB-19	Uttar Pradesh	Absent	Medium	Obovate	Obtuse	Purple	Large	Medium	Light Brown
PCB-20	Punjab	Absent	Medium	Obovate	Obtuse	Purplish white	Medium	Long	Dark Grey
PCB-21	Punjab	Absent	Large	Oval	Acute	Purplish white	Medium	Long	Light Brown
PCB-22	Gujarat	Absent	Medium	Oval	Mucronate	Purplish white	Large	Long	Light Grey
PCB-23	Punjab	Absent	Large	Oval	Acute	Purple	Small	Long	Cream
PCB-24	Madhya Pradesh	Absent	Small	Oval	Acute	Purplish white	Medium	Long	Black
Neelam 51	Gujarat	Absent	Medium	Ovate	Obtuse	Purplish white	Large	Long	Light Brown
Anjali	Punjab	Present	Medium	Oval	Acute	Purplish white	Small	Medium	Light Brown
New Chetna	Punjab	Absent	Large	Oval	Acute	Purplish white	Medium	Short	Cream
Vickram	Gujarat	Absent	Large	Oval	Acute	Purplish white	Large	Long	Light Grey
BR-112	Punjab	Absent	Medium	Oval	Acute	Purplish white	Medium	Long	Cream
RGC-936	Rajasthan	Absent	Medium	Ovate	Acute	Purplish white	Small	Medium	Dark Brown
Pusa Navbahar	IARI, New Delhi	Absent	Large	Ovate	Acute	Purplish white	Large	Medium	Cream

Table 2 Mean squares, range, general mean and coefficient of variation (C.V.) for 12 metric traits in clusterbean

Character	Mean Square		Range	General Mean	C.V.
	Replications	Genotypes			
Days taken for 50% germination	0.03	2.22*	2.00 – 5.67	2.60	16.95
Days taken for 50% flowering	19.21	207.81*	25.33 – 55.00	39.91	6.48
Days to first pod set	13.43	198.80*	28.33 – 60.33	44.83	7.63
Pods per cluster	0.94	8.89*	5.13 – 11.10	7.09	9.53
Length of pod (cm)	0.80**	6.19*	4.83 – 10.07	7.17	6.10
Clusters per plant	4.86	1404.31*	19.00 – 113.40	36.68	17.33
Single poded clusters per plant	1.60	22.45*	0.00 – 12.40	5.07	20.05
Pods per plant	1192.10	56005.57*	109.78 – 623.34	255.47	18.74
Pod yield per plant (kg)	0.02**	0.11*	0.098 – 0.807	0.35	21.89
Branches per plant at maturity	0.61**	25.22*	0.00 – 11.93	1.55	27.52
Days to maturity	26.41	206.32*	35.00 – 66.00	50.82	6.89
Protein content (g/100 g)	0.01	0.53*	4.02 – 5.88	4.84	1.90

* Significant at 1% level of significance
** Significant at 5% level of significance.

Table 3 Promising accessions of clusterbean for economic traits.

Character	Genotype with character mean in parentheses	Mean Value for check (Pusa navbahar)
Days to 50 % flowering	PCB-23 (25.33), PCB-11 (28.67) and PCB-7 (30.67)	39.00
Days to first pod set	PCB-23 (28.33), PCB-7 (35.00), PCB-11 (35.00) and PCB-19 (36.00).	44.33
Pods per cluster	PCB-23 (11.10), PCB-11 (10.37) and PCB-18 (10.07)	8.60
Length of pod (cm)	Neelam 51 (10.07), PCB-10 (9.52), PCB-4 (9.19) and PCB-7 (9.03).	8.98
Clusters per plant	RGC-936 (113.40), BR-112 (106.53) and PCB-14 (53.80).	32.37
Pods per plant	BR-112 (623.34), RGC-936 (580.60), PCB-18 (410.45) and PCB-12 (407.66)	277.99
Pod yield per plant (kg)	PCB-9 (0.807) and BR-112 (0.798)	0.674
Branches per plant at maturity	RGC-936 (11.93), BR-112 (8.67), PCB-24 (8.00).	1.00
Days to maturity	PCB-23 (35.00), PCB-7 (40.67), PCB-11 (41.00) and PCB-15 (42.33).	49.00
Protein content (g/100 g)	PCB-5 (5.88) and PCB-10 (5.26).	5.23