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Estimation of Genetic Variability in Cluster Bean [*Cyamopsis tetragonoloba* (L.) Taub.] Genotype for Vegetable Pod Yield and Seed Yield Traits

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ABSTRACT

Thirty one genotypes of cluster bean including check Pusa Navabhar were estimated for variability, heritability and genetic advance over mean for vegetable pod yield and seed yield traits during Kharif- 2015 at the vegetable research farm, Department of Horticulture SHIATS, Allahabad located in South-East part (Zone 4) of Uttar Pradesh. The investigation was laid out in Randomised Block Design with three replication. On the basis of per se performance the genotypes like, HG-3-100, HGS-884, AVT-1 GR-12 and IC 13496 for vegetable pod yield as well as HG-04-875, Pusa Navabhar, HGS-881, RGC-1025 and IC 3773 for seed yield showed promising performance. Higher magnitude of GCV and PCV for vegetable yield trait was recorded for pod length (cm), pod breadth (cm), ten fresh pod weight (g), number of vegetable pods per plant and vegetable pod yield per plant (g). While number of clusters per plant and dry pod yield (g) per plant showed high GCV and PCV for seed yield parameter. High heritability along with high genetic advance for vegetable yield parameter was registered for number of vegetable pods per plant (86.06, 76.66) and vegetable pod yield per plant (82.35, 106.02).While number of clusters per plant (93.13, 22.52) and dry pod yield per plant (g) (96.13, 51.37) showed high heritability along with high genetic advance for seed yield traits, it indicates that most likely the heritability is due to additive gene effect and selection may be effective

Key words*: GCV, PCV, Heritability, Genetic advance, Cluster bean,*

INTRODUCTION

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.] is also known as Guar is a drought hardy and warm season leguminous crop. The pods are used as a green vegetable or as a cattle feed besides extraction of guar gum in accordance with[5]. Guar is cultivated in India and other parts of southern and south-eastern Asia as a vegetable and fodder crop. In spite of its vegetable use cluster bean also grown for seed purpose, seeds are mainly used for extraction of endospermic gum having good binding properties and high demand in food industry as an ingredient in products like sauces and ice creams. In agriculture, guar gum is used as water retainer[12], soil aggregate and anticrusting agent.

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It is used as an adsorbent in waste water treatment and in textile industry as an flocculating and exchanging agent. In waste water purification, guar gum is used as a gelatinizing agent[9]. Development of new varieties mainly depends on the magnitude of genetic variability in the base material for the desired trait. Genetic variability is of greatest interest to the plant breeder as it plays a vital role in framing successful breeding programme. The knowledge of genetic variability, heritability, genetic advance and relationship between yield and its contributing characters in a given crop species is of paramount importance for the success of any plant breeding programme[4].

MATERIAL AND METHOD

Thirty one genotypes of cluster bean including check Pusa navabhar were estimated to genetic variability in *Kharif*- 2015 at the vegetable research farm, Department of Horticulture SHIATS, Allahabad located in South-East part (Zone 4) of Uttar Pradesh. The investigation was laid out in randomised block design with three replication. The plot size of single rows each with 3m length was followed with spacing of 45cm between rows and 20 cm between the plants. Observations were recorded on five randomly selected plants in each replication of 17 different growth, vegetable pod yield and seed yield parameters *viz.*, plant height at 45 DAS (cm), plant height at 90 DAS (cm) number of branches per plant, days to fifty per cent flowering, days to first pod picking, pod length (cm), pod breadth (cm), ten fresh pod weight (g), vegetable pods per plant, vegetable pod yield per plant (g), number of clusters per plant, number of pods per cluster, ten dry pod weight(g), ten dry pod seed weight(g), number of seeds in 10 dry pod, 50 seed weight(g), dry pod yield per plant(g). The data were subjected to Burton statistics to measure the phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV). Heritability (h^2) was worked out by using formula suggested by Lush[7], Burton and Devane[1]. The genetic advance in terms of the expected genetic gains was worked out by using the formula suggested by Johnson *et al*[4].

RESULTS AND DISCUSSION

The mean sum of squares values for seventeen characters are given in table 1. The mean sum of squares due to treatments was significant for all the seventeen characters. The significant difference among the genotypes for all the characters under study suggested that there was ample scope for selection of promising cluster bean genotypes for yield improvement. Similar finding is observed in Vikas Kumar *et al.*[13]. Analysis of variance showed that there were significant differences among treatments for concerned characteristics, indicating wide variation among the genotypes. These findings of mean sum of squares are in accordance with the finding of Rai *et al.*[11, 12], Mukherjee *et al.*[10] and Girish *et al.*[2] who also observed significant variability for yield and it's components in cluster bean. Based on the *per se* performance genotypes like, HG-3-100, HGS-884, AVT-1 GR-12 and IC 13496 for vegetable pod yield as well as HG-04-875, Pusa Navabhar, HGS-881, RGC-1025 and IC 3773 for seed yield showed promising performance.

In the present investigation, it is depicted that, estimates of phenotypic coefficient of variation (PCV) was found higher than their corresponding genotypic coefficient of variation (GCV) for all traits *viz.*, growth, vegetable pod yield and seed yield parameters, indicating that the little influence of environment on the expression of these characters. These findings of greater PCV than GCV are in accordance with the finding of Malaghan *et al.*[8], Shabarish *et al.*[11] and Vikas Kumar *et al.*[6,13] who also observed greater value of phenotypic coefficient of variation than genotypic coefficient of variation. Higher magnitude of GCV and PCV was recorded for number of branches per plant (48.28, 49.42), suggesting sufficient variability and thus scope for genetic improvement through selecting for these trait, while plant height at 45 DAS (cm) (14.88, 16.07) and plant height at 90 DAS (cm) (14.86, 16.43) depicted moderate genotypic

coefficient of variation and phenotypic coefficient of variation for growth parameters are given in table 2. High heritability along with high genetic advance for growth parameter was registered for plant height at 45 DAS (cm) (85.65, 11.45) and plant height at 90 DAS (cm) (81.86, 27.59). Similar results were reported by Shabarish Rai *et al.*[11] for plant height trait, suggesting predominance of additive gene action in the expression of these traits. Therefore these characters can be improved by mass selection and other breeding methods based on progeny testing. High genetic advance (as percent of mean) for growth parameter was observed in character, like plant height at 45 DAS (cm) (28.34), plant height at 90 DAS (cm) (27.70) and number of branches per plant (97.11).

Higher magnitude of GCV and PCV for vegetable yield parameter was recorded for pod length (cm) (25.63, 26.23), pod breadth (cm) (10.80, 12.57), ten fresh pod weight (26.40, 29.09), number of vegetable pods per plant (32.02, 34.51) and vegetable pod yield (g) per plant (50.14, 52.07). Similar results were reported by Vikas Kumar *et al.*[13] for ten fresh pod weight and number of vegetable pods per plant. High heritability along with high genetic advance for vegetable yield parameter was registered for number of vegetable pods per plant (86.06, 76.66) and vegetable pod yield (g) per plant (82.35, 106.02). High genetic advance (as percent of mean) for vegetable yield parameter was observed in ten fresh pod weight (g) (99.43), vegetable pod yield (g) per plant (71.32) pod length (cm) (51.50) and number of vegetable pods per plant (42.3) is shown in table 3.

Higher magnitude of GCV and PCV for seed yield parameter (table 4) was recorded for number of clusters per plant (25.87, 27.00) and dry pod yield per plant (g) (41.54, 41.57). Similar results were reported by Vikas Kumar *et al.*[13] for number of clusters per plant and dry pod yield per plant. High heritability along with high genetic advance for seed yield parameter was registered for number of clusters per plant (93.13, 22.52) and dry pod yield per plant (96.13, 51.37). Johnson *et al.*[4] showed that high heritability should be accompanied by high genetic advance to arrive at more reliable conclusion. These results are in accordance with Malaghan *et al.* [8] and Hanchinamani[3], for number of cluster per plant. The breeder should cautious in making selection based on heritability as it includes both additive and non-additive gene effect.

Table 1: Analysis of variance for different growth, vegetable and seed yield traits in cluster bean

S. No	Source of variation	Replication	Treatment	Error
1.	Plant height at 45 DAS (cm)	166.08	114.43**	6.05
2.	Plant height at 90 DAS (cm)	465.50	705.97**	48.55
3.	Number of branches per plant	7.70	66.99**	1.05
4.	Days to fifty per cent flowering	17.43	5.80**	2.83
5.	Days to first pod picking	43.19	15.69**	4.37
6.	Pod length (cm)	0.47	11.71**	0.18
7.	Pod breadth (cm)	0.004	0.026**	0.01
8.	Ten fresh pod weight (g)	47.21	153.21**	3.90
9.	Vegetable pods per plant	1504.13	10629.30**	544.48
10.	Vegetable pod yield per plant(g)	1879.8	4950.17**	330.03
11.	Number of clusters per plant	3.43	402.38**	11.70
12.	Number of pods per cluster	0.09	3.29**	0.69
13.	Ten dry pod weight(g)	0.67	2.59**	0.22
14.	Ten dry pod seed weight(g)	0.01	0.56**	0.06
15.	Number of seeds in 10 dry pod	15.63	142.19**	11.24
16.	50 seed weight(g)	0.01	0.24**	0.05
17.	Dry pod yield per plant(g)	0.32	1868.44**	0.66

All significant at 1% level

Table 2: Estimates of components of variance, heritability and genetic advance for growth parameters in cluster bean

Sl. No.	Character	GV	PV	GCV (%)	PCV (%)	h^2 (%)	GA	GAM (%)
1	Plant height at 45 DAS (cm)	36.12	42.17	14.88	16.07	85.65	11.45	28.34
2	Plant height at 90 DAS (cm)	219.14	267.69	14.86	16.43	81.86	27.59	27.70
3.	Number of branches per plant	21.97	23.03	48.28	49.42	95.42	9.43	97.11

GV - Genotypic variance
PV - Phenotypic variance
h^2 - Heritability
GCV - Genotypic coefficient of variance
PCV - Phenotypic coefficient of variance
GA -Genetic advance
GAM -Genetic advance over mean

Table 3: Estimates of components of variance, heritability and genetic advance for vegetable yield parameters in cluster bean

S.NO	Character	GV	PV	GCV (%)	PCV (%)	h^2	GA	GAM (%)
1.	Days to 50% flowering	0.99	3.82	3.07	6.03	25.89	1.04	3.25
2.	Days of first pod picking	3.77	8.15	4.25	6.25	46.26	2.72	5.91
3.	Pod length (cm)	3.84	4.02	25.63	26.23	95.47	3.94	51.50
4.	Pod breadth (cm)	0.008	0.01	10.80	12.57	73.86	0.15	1.80
5.	Ten fresh pod weight (g)	49.76	53.67	26.40	29.09	92.71	13.99	99.43
6.	Number of vegetable pods per plant	1540.04	1870.08	32.02	34.51	86.06	76.66	42.33
7.	Vegetable pod yield per plant (g).	3361.60	3906.09	50.14	52.07	82.35	106.02	71.32

GV - Genotypic variance
PV - Phenotypic variance
h^2 - Heritability
GCV - Genotypic coefficient of variance
PCV - Phenotypic coefficient of variance
GA - Genetic advance
GAM - Genetic advance over mean

Table 4: Estimates of components of variance, heritability and genetic advance for seed yield parameters in cluster bean

S.NO	Character	GV	PV	GCV (%)	PCV (%)	h^2	GA	GAM
1.	Number of clusters per plant	130.23	140.93	25.87	27.00	93.13	22.52	51.04
2.	Number of pods per cluster	0.87	1.56	11.68	15.68	66.58	1.43	17.93
3.	Ten dry pod weight(g)	0.79	1.01	16.53	18.64	82.13	1.63	30.20
4.	Ten dry pod seed weight(g)	0.17	0.23	12.56	14.58	74.16	0.73	22.28
5.	Number of seeds in 10 dry pod	43.65	54.89	9.10	10.20	80.12	12.14	16.72
6.	50 seed weight(g)	0.07	0.11	14.01	18.25	59.28	0.41	22.16
7.	Seed yield per plant(g)	622.59	623.25	41.54	41.57	96.13	51.37	85.53

GV - Genotypic variance
PV - Phenotypic variance
h^2 - Heritability
GCV - Genotypic coefficient of variance
PCV - Phenotypic coefficient of variance
GA - Genetic advance
GAM - Genetic advance over mean

CONCLUSION

As per the above result it can be concluded that, some of the genotypes like, HG-3-100, HGS-884, AVT-1 GR-12 and IC 13496 for vegetable pod yield as well as HG-04-875, Pusa Navabhar, HGS-881, RGC-1025 and IC 3773 for seed yield showed promising performance for vegetable and seed yield traits, therefore they may be useful for constitution of high yielding varieties of cluster bean. A wide range of variability recorded for maximum character as indicated that there is difference among the genotypes in terms of performance for yield and component traits. The superior genotypes in the population may be attributed to the possible accumulation of favourable genes reservoir of variability for different character of plant species resulting from available natural or artificially synthesized variants constitute its germplasm.

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