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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(8): 1205-1208
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www.thepharmajournal.com
Received: 08-05-2022
Accepted: 12-06-2022

Genetic variability, heritability and genetic advance of yield and yield attributing characters of Dolichos bean (*Lablab purpureus* L.)

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Abstract
The present investigation was carried out to evaluate Dolichos bean (*Lablab purpureus* L.) genotypes and studies on genetic variability, heritability and genetic advance were carried out. The experiment was conducted at Horticultural Research Station, Venkataramannagudem, A.P during *Rabi* season of 2021-2022. Total thirty three genotypes of Dolichos bean were evaluated in Randomized Block Design in two replications. Considerable amount of genotypic and phenotypic coefficient of variation was observed for all characters studied. Phenotypic coefficient of variation was greater than genotypic coefficient of variation for all the characters. Highest genotypic and phenotypic coefficient of variation were noted in the character pod yield per plant (68.79%, 68.86%) followed by number of pods per plant (64.43%, 64.48%), number of clusters per plant (55.72, 55.97). Heritability was observed high in all the characters. Highest heritability was reported in the characters number of pods per plant (99.83) and protein content (99.83) followed by days to 50% flowering (99.82), 100 seed weight (99.82), pod yield per plant (99.82). Genetic advance as percent of mean were recorded high in all characters except in plant height. Highest genetic advance as percent mean was observed in pod yield per plant (141.59).

Keywords: Dolichos bean, GCV, PCV, heritability, genetic advance

Introduction
Dolichos bean (*Lablab purpureus* L.) is an indigenous legume crop originated in India. Its chromosome number is 2n=2x=22 and belongs to the family Leguminosae. Dolichos bean is also called as hyacinth bean, Indian bean, field bean, bonavist bean and avarai. Based on growth habit there are two types of dolichos bean, indeterminate (pole type) and determinate (bush type). It is considered as a multipurpose crop as it can be used for food, forage, soil improvement, soil protection, beautification and weed control (Shivashankar and Kulkarni, 1989; Pengelly and Maass 2001; Maass, 2016) [15, 13].

Dolichos bean is grown throughout India, mostly confined to peninsular region and is distributed in Maharashtra, Karnataka, Andra Pradesh, Tamil Nadu and North Eastern states. It is rich in proteins (20-25%), amino acid like lysine, vitamins (A, C and Riboflavin), and minerals (Gopalan *et al.*, 1982) [6]. 100g green pods contains 6.7g carbohydrates, 3.8g protein, 210mg calcium, 1.7mg iron, 312 IU vitamin A and 0.1mg thiamine (Gopalan *et al.*, 2004) [7]. Immature pods and seeds are rich in dietary fibre and low carbohydrates and lipids.

Variability in a germplasm is very important for any crop improvement programme. It is prime important for improving the efficacy of selection from any base population. However, it is difficult to conclude whether the variability is heritable or not by environmental influence. By studying the estimates of heritability and genetic advance one can know whether the superiority of selection is inherited by the progeny or not. Keeping the above considerations in view, the present study was carried out to estimate the genetic variability, heritability and genetic advance for twenty three different characters in thirty three genotypes of dolichos bean.

Materials and Methods
The experiment was carried out at Horticultural Research Station, Venkataramannagudem, A.P during *Rabi* season of 2021-2022. Thirty three pole type dolichos bean genotypes were laid in Randomized Block Design in two replications. Sowing was done in October 2021. Twenty four genotyes were collected from NBPGR, Hyderabad and Nine were collected form NBPGR, Thrissur. All the recommended intercultural operations were followed.

Observations for twenty three traits *viz*., Plant height (cm), leaf length (cm), leaf width (cm), leaflet length (cm), days to 50% flowering, inflorescence length (cm), number of flower buds per raceme, number of nodes per raceme, flower bud length (cm), flower bud width (cm), number of clusters per plant, number of pods per cluster, pod length (cm), pod width (cm), weight of pod (g), number of pods per plant, number of locules per pod, number of seeds per pod, 100 seed weight (g), days to first picking, days to last picking, protein content (%), pod yield per plant (g) were recorded randomly from five plants in each replication. Analysis of variance is done partitioning the variation into treatments and replications according to procedure given by Panse and Sukhatme (1967). Phenotypic and genotypic variance were calculated according to the formula given by Wrickeand Weber (1986) [17]. Heritability in broad sense was calculated by the formula given by Burton and Devane (1952) [2]. The estimates of genetic advance were obtained by the formula given by Burton and Devane (1952) [2]. The estimates of genetic advance were obtained by the formula given by Johnson *et al*. (1955) [8].

Results and Discussion

Genetic variability, heritability and genetic advance

The Analysis of Variance for 35 genotypes in dolichos bean are furnished in Table 1. The genetic parameters *viz*. mean, range, genotypic variances, phenotypic variances, phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV), heritability estimates and predicted genetic advance as percent of mean for characters studied are presented in Table 2.

The analysis of variance revealed that there is significant difference among all the twenty three characters that were analysed. There were highly significant differences observed among all the genotypes indicating the presence of variability among all the genotypes.

In the present study, phenotypic coefficient of variation was higher than genotypic coefficient of variation for all the traits, but the difference was very low, indicating low environmental effect on the expression of all the traits and is suggestive of the heritable nature of the traits. These results were similar with the findings of Ganesh *et al*. (2005) [5], Asaduzzaman *et al*. (2015) [1]. Based on the GCV and PCV values all the traits observed in the experiment were recorded into three groups. The traits having higher GCV and PCV *viz*., pod yield per plant, number of pods per plant, number of clusters per plant, number of pods per cluster, raceme length, number of nodes per raceme, weight of pod, flower buds per raceme, pod length, pod width, number of seeds per pod, days to first picking. Whereas moderate coefficients of variation were observed in the characters 100 seed weight, days to 50% flowering, locules per pod, flower bud length, leaf width, leaf length, flower bud width, leaflet length, protein content, days to last pick. Lowest coefficients of variation were observed in plant height. The results pertaining to coefficient of variability were in accordance with the findings of Magalingam *et al*. (2013) [10], Parmar *et al*. (2013) [12], Salim *et al*. (2013) [14], Chaitanya *et al*. (2014) [3], Verma *et al*. (2015) [16], Chowdary *et al*. (2016), Jyothi *et al*. (2017) [9].

Heritability in broad sense for twenty three characters in thirty three genotypes of dolichos bean was estimated. The estimated heritability was in the range of 71.76% (Plant height) to 99.83% (number of pods per plant). The estimates of genetic advance as per cent mean was presented in the table 2. Results revealed that, high genetic advance as per cent mean was observed in all the characters except plant height (14.74).

Heritability coupled with genetic advance gives a clear picture of efficacy of selection in improving a trait than using heritability alone. In the present study high heritability coupled with high genetic advance was observed in the characters like leaf length, leaf width, leaflet length, days to 50% flowering, raceme length, number of flower buds per raceme, number of nodes per raceme, flower bud length, flower bud width, number of clusters per plant, number of pods per cluster, pod length, pod width, weight of pod, number of pods per plant, number of locules per pod, number of seeds per pod, 100 seed weight, days to first picking, days to last picking, protein content, pod yield per plant which indicates that the heritability is due to additive gene effects and selection may be effective.

High heritability with moderate gene action was observed in plant height which indicates that the character was governed by both additive and non-additive gene actions.

The results pertaining to heritability and genetic advance were in concurrence with the studies of Magalingam *et al*. (2013) [10], Parmar *et al*. (2013) [12], Salim *et al*. (2013) [14], Chaitanya *et al*. (2014) [3], Verma *et al*. (2015) [16], Chowdary *et al*. (2016), Jyothi *et al*. (2017) [9].

Table 1: Analysis of variance for pod yield and its component characters in Dolichos bean.

S. No.	Characters	Mean Sum of Squares		
		Replication (df=1)	Treatment (df=32)	Error (df=32)
01	Plant height (cm)	2661.53	2857.64**	469.80
02	Leaf length (cm)	0.51	2.33**	0.10
03	Leaf width (cm)	0.29	2.22**	0.05
04	Leaflet length (cm)	0.005	11.42**	0.28
05	Days to 50% flowering	259.81	325.43**	0.29
06	Raceme length (cm)	0.44	286.44**	2.26
07	Number of flower buds per raceme	18.98	34.83**	0.94
08	Number of nodes per raceme	0.07	12.44**	0.12
09	Flower bud length (mm)	0.01	0.07**	0.003
10	Flower bud width (mm)	0.01	0.04**	0.003
11	Number of clusters per plant	12.18	322.91**	1.46
12	Number of pods per cluster	0.02	8.71**	0.20
13	Pod length (cm)	0.06	18.93**	0.50
14	Pod width (cm)	0.11	0.62**	0.07
15	Weight of pod (g)	1.10	6.19**	0.06

16	Number of pods per plant	100.24	8463.01**	7.29
17	Number of locules per pod	0.17	1.57**	0.01
18	Number of seeds per pod	0.13	1.61**	0.01
19	100 seed weight	44.90	58.64**	0.05
20	Days to first picking	2.18	605.15**	1.77
21	Days to last picking	0.01	663.01**	3.57
22	Protein content (%)	21.64	8.42**	0.007
23	Pod yield per plant (g)	16687.05	266180.71**	239.56

*: Significant at 5% LOS, **: Significant at 1% LOS

Table 2: Estimates of Mean, GCV, PCV, heritability and genetic advance for different characters in Dolichos bean.

S. No.	Characters	Mean	Range		Coefficient of variation		Heritability (h^2)	Genetic advance (GA)	GA as % of Mean
			Minimum	Maximum	GCV (%)	PCV (%)			
1	Plant height (cm)	409.03	344.76	471.94	8.44	9.97	71.76	60.29	14.74
2	Leaf length (cm)	9.01	7.55	12.25	11.71	12.27	91.07	2.07	23.02
3	Leaf width (cm)	8.55	7.31	11.45	12.19	12.49	95.27	2.09	24.51
4	Leaflet length (cm)	21.57	16.50	25.60	10.93	11.21	95.08	4.74	21.96
5	Days to 50% flowering	66.13	51.50	102.00	19.27	19.29	99.82	26.24	39.67
6	Raceme length (cm)	29.90	4.47	45.70	39.86	40.18	98.43	24.36	81.47
7	Number of flower buds per raceme	12.63	2.60	23.40	32.56	33.46	94.70	8.25	65.28
8	Number of nodes per raceme	6.37	1.20	13.70	38.93	39.34	97.94	5.05	79.37
9	Flower bud length (cm)	1.51	1.09	1.85	12.71	13.27	91.73	0.38	25.08
10	Flower bud width (cm)	1.24	0.98	1.63	11.59	12.42	87.05	0.27	22.28
11	Number of clusters per plant	22.75	6.83	57.33	55.72	55.97	99.09	25.99	114.26
12	Number of pods per cluster	4.84	1.70	10.30	42.57	43.59	95.36	4.15	85.64
13	Pod length (cm)	9.39	4.45	14.62	32.30	33.17	94.85	6.09	64.81
14	Pod width (cm)	1.86	0.92	2.99	28.05	31.74	78.13	0.95	51.08
15	Weight of pod (g)	4.77	0.96	10.15	36.63	37.02	97.94	3.57	74.69
16	Number of pods per plant	100.91	14.00	244.83	64.43	64.48	99.83	133.83	132.61
17	Number of locules per pod	4.82	3.40	7.00	18.30	18.52	97.63	1.79	37.25
18	Number of seeds per pod	3.94	1.90	6.00	22.626	22.892	97.69	1.81	46.06
19	100 seed weight	27.47	16.00	40.00	19.70	19.72	99.82	11.14	40.54
20	Days to first picking	83.18	64.00	128.00	20.88	20.94	99.41	35.67	42.88
21	Days to last picking	179.01	150.00	208.50	10.14	10.19	98.93	37.20	20.78
22	Protein content (%)	19.07	16.20	23.81	10.75	10.76	99.83	4.22	22.13
23	Pod yield per plant (g)	530.02	53.40	1184.84	68.79	68.86	99.82	750.50	141.59

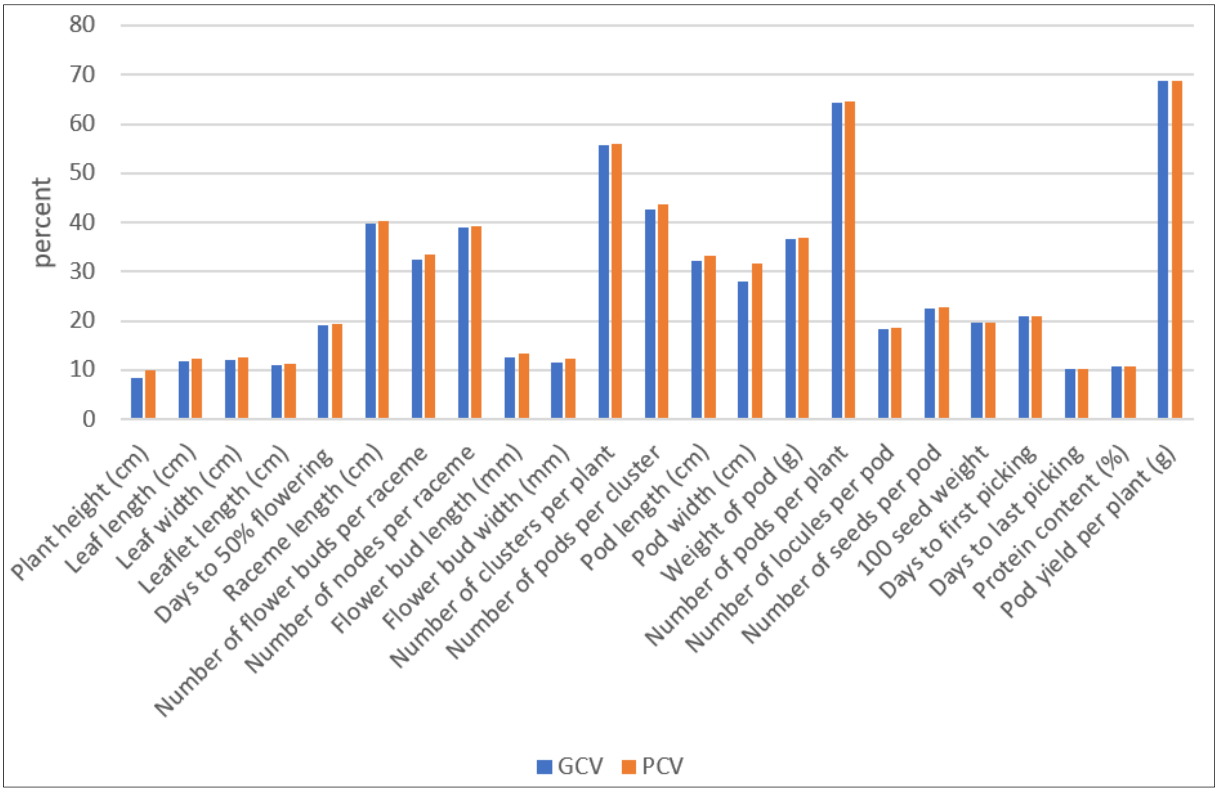

Fig 1: GCV an PCV for Quantitative traits of Dolichos bean genotypes.

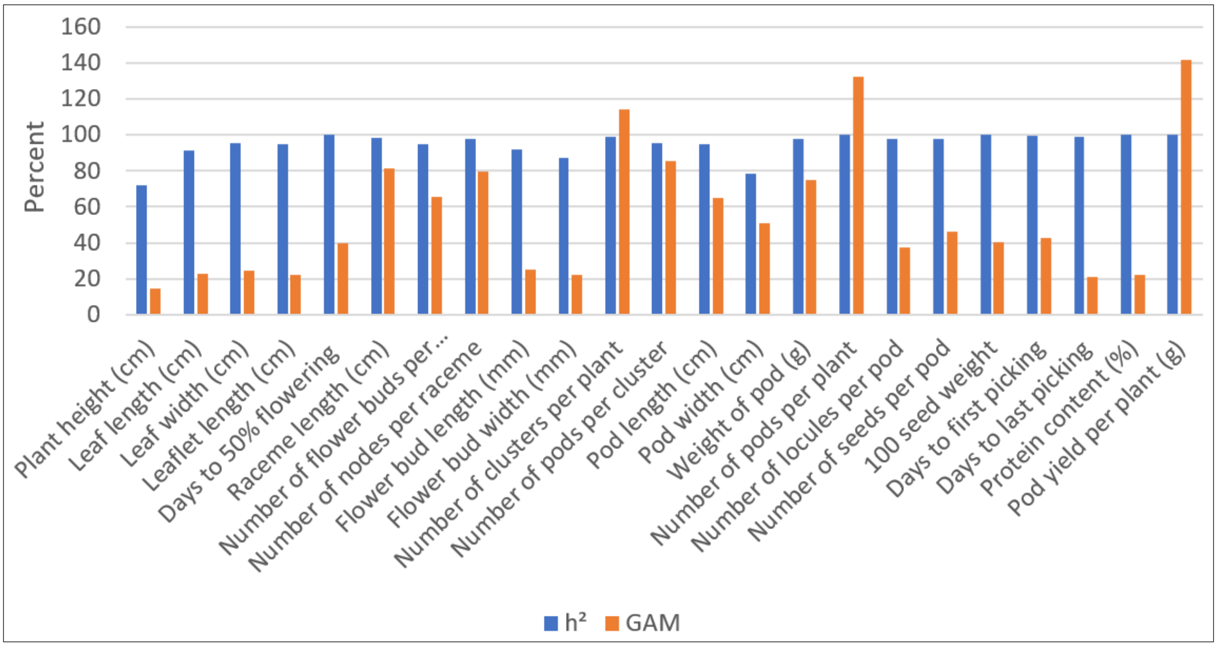

Fig 2: Heritability and genetic advance as percent mean for Quantitative traits of Dolichos bean genotypes.

Conclusion

It can be said from the estimates of genetic variability that individual plant selection for characters *viz*., raceme length, number of flower buds per raceme, number of nodes per raceme, number of clusters per plant, number of pods per cluster, pod length, pod width, pod weight, number of pods per plant, number of seeds per plant, days to first picking, pod yield per plant showing high values of heritability, genetic advance, GCV and PCV concomitantly, would directly effective in the progeny of dolichos bean. Hence, the breeder should adopt suitable breeding methodology to utilize both additive and non-additive gene effects.

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