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Research Note

Genetic variability, heritability and genetic advance studies in Dolichos bean (*Lablab purpureus* L.) genotypes

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Abstract
The present investigation was carried out to study the genetic variability, heritability and expected genetic advance for 18 traits in dolichos bean. The experimental material comprised of 12 genotypes of *Lablab purpureus.* The genotypes GL 243, Culture 47 and GL 671 are superior based on mean for pod yield. Wider variability was observed for plant height, number of secondary branches per plant, number of pods per inflorescence, number of inflorescence per plant, mean pod weight, number of pods per plant, 100-seed weight, pod yield per plant and pod yield per hectare. All these characters also recorded high heritability and genetic advance. Hence selection will be effective for these traits.

Keywords: *Lablab purpureus*, GCV, PCV, genetic advance, heritability.

Dolichos bean or Hyacinth bean or Sem (*Dolichos lablab* L.) is an important leguminous vegetable grown throughout the country and distributed in Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu and North eastern states. The crop has multipurpose uses. The green pods and tender leaves are popular vegetables. The dried seeds are consumed as a split pulse. Great range of variation exists in the plant morphological and yield traits among the cultivars grown all over the country. Despite many good attributes, the crop has remained unexploited owing to low productivity, long duration, photosensitivity and an indeterminate growth habit. The consumer preference also varies with respect to pod size, shape, colour and aroma. The efforts of improving the crop by utilizing indigenous and exotic germplasm have been useful in breaking the yield barriers (Shivashankar *et al*. 1993) resulting in developing compact plant type with reduced duration and photo-insensitivity.

In any crop improvement program, basic information with respect to variability present in the crop is essential. Yield being a complex trait, is collectively influenced by various component characters, which are polygenically inherited and highly influenced by environmental variations. Hyacinth bean has unique position among legume vegetables (Biju *et al.* 2001). Genetic variability, heritability and genetic advance are pre-requisite for improvement of any crop for the selection of superior genotypes and improvement of any traits. Moreover, knowledge of heritability is essential for selection based improvement as it indicates the extent of transmissibility of a character in future generations. The present study was, therefore aimed to study variability, heritability and genetic advance among 12 genotypes of dolichos bean.

Materials and Methods

The experiment was conducted at research farm of Horticultural College & Research Institute, Venkataramannagudem, West Godavari Dist. (Andhra Pradesh) during *Kharif* season of 2012 and 2013. The geographical situation is 16.8^0 N latitude and 81.5^0 E longitudes and at an altitude of 34 m ($112^{'}$) above mean sea level. Twelve genotypes of Dolichos bean *viz*. Culture 4, Culture 7, Culture 47, Culture 62, GL-243, GL-388, GL-411, GL-671, GL-416, HA-4, Arka Jay (C) and Arka Vijay (C) were grown in a randomized block design with three replications. Every genotype in each replication was grown in a plot of 3.6 m length and 3.0 m width with a spacing of 60 cm between rows and 30 cm between plants. Five plants from each replication were taken for recording observation on 18 characters *viz*. plant height (cm), number of primary branches per plant, number of secondary branches per plant, days to first flowering, days to 50 per cent flowering, number of pods per inflorescence, number of

inflorescences per plant, days to first pod harvest, days to last pod harvest, pod length (cm), pod width (cm), mean pod weight (g), number of pods per plant, number of seeds per pod, 100 seed weight (g), protein content (%), pod yield per plant (g) and pod yield per hectare (q) and their mean was obtained.

The data were statistically analyzed for computation of genetic coefficients of variation using appropriate statistical analysis. Analysis of variance was carried out as per the procedure given by Panse and Sukhatme (1967) and heritability in broad sense was estimated as per the formula given by Allard (1960) . The expected genetic advance was calculated by using formula as suggested by Johnson *et al.* (1955).

Results and Discussion

The analysis of variance revealed significant differences between genotypes indicating presence of sufficient amount of variability in all the characters studied. These results are similar with the findings of Nahar and Newaz (2005), Lal *et al.* (2005), Rai *et al*. (2008), Chattopadyay and Dutta (2010) and Upadhyay and Mehta (2010). The results of analysis of variance for eighteen characters are furnished in Table 1. Wide range of variability was observed for plant height, number of secondary branches per plant, number of inflorescences per plant, number of pods per inflorescence, number of pods per plant, pod yield per plant, 100 seed weight and pod yield per hectare indicating the scope for selection of suitable initial breeding material for further improvement. Out of 12 genotypes, GL-243 recorded the highest marketable pod yield per plant followed by Culture-47 and GL-671 due to more number of pods per plant. Other attributes like number of inflorescence per plant, number of pods per inflorescence, days to last pod harvest, pod width and hundred seed weight were also higher in these genotypes. Hence, these can be selected for further to release as a variety. The lowest marketable pod yield per plant was recorded in the genotype HA-4. Among the other genotypes, GL-388 and Culture-62 produced significantly more number of inflorescences per plant, number of pods per inflorescence, protein content and marketable pod yield per plant. Culture-7 recorded significantly lengthy pods and high protein content. Hence, these genotypes can be used as donor parents for the respective characters.

Estimates of variability, heritability and genetic advance are presented in Table 2. Among the characters studied, high PCV and GCV were observed for characters like plant height, number of secondary branches per plant, number of inflorescences per plant, number of pods per inflorescence, number of pods per plant, pod yield per plant, 100 seed weight and pod yield per hectare indicating high variability available in the germplasm for these characters for further improvement. Close relationship between GCV and PCV was found in all the characters and PCV values that were slightly greater than GCV and revealed a very little influence of environment for their expression. This was in confirmation with the results reported by Lal *et al.* (2005), Rai *et al*. (2009) , Mishra *et al.* (2008) and Upadhyay and Mehta (2010). High GCV was observed for plant height, number of secondary branches per plant, number of pods per inflorescence, number of inflorescences per plant, mean pod weight, number of pods per plant, 100 seed weight, pod yield per plant and pod yield per hectare. Moderate GCV was observed for number of primary branches per plant, days to first flowering, days to 50 per cent flowering, days to last pod harvest, pod length, pod width, number of pods per plant, number of seeds per pod and protein content whereas, days to first pod harvest recorded low GCV.

High heritability coupled with high genetic advance as per cent of mean was for all the characters except days to first harvest and pod width indicated that these characters were least influenced by the environmental effects and these characters are suitable for selection. Hence, simple selection based on phenotypic characters will be rewarding for improvement of such traits.

Hence, based on the foregoing discussion, it may concluded that genotypes GL 243, Culture 47 and GL 671 are superior based on mean for pod yield. Wider variability was observed for plant height, number of secondary branches per plant, number of pods per inflorescence, number of inflorescence per plant, mean pod weight, number of pods per plant, 100-seed weight, pod yield per plant and pod yield per hectare. All these characters also recorded high heritability and genetic advance. Hence selection will be effective for these traits.

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Table 1. Analysis of variance in dolichos bean

Character	Mean sum of squares		
	Replications (df = 2)	Treatments (df = 11)	Error (df = 22)
Plant height (cm)	0.9880	1105.3408**	1.2003
Number of primary branches per plant	0.0064	0.9436**	0.0089
Number of secondary branches	0.0808	23.1869**	0.3609
Days to first flowering	1.3448	217.8703**	0.5844
Days to 50% flowering	0.1315	236.3669**	0.7749
Number of inflorescences per plant	0.0513	24.8617**	0.3211
Number of pods per inflorescence	0.1115	6.2589**	0.1228
Number of pods per plant	0.1702	1640.2615**	0.4551
Number of seeds per pod	0.0030	0.5706**	0.0056
Mean pod weight (g)	0.0090	1.5729**	0.0046
Pod length (cm)	0.1516	4.1666**	0.1182
Pod width (cm)	0.0057	0.1077**	0.0083
Days to first pod harvest	0.7308	176.8363**	1.1199
Days to last pod harvest	0.7600	892.4038**	1.7545
Marketable pod yield per plant (g)	36.3124	16255.1076**	23.8341
100 seed weight (g)	3.4290	504.8041**	1.3363
Protein content (%)	0.0574	39.1166**	0.0868
Pod yield/ha (q)	0.2537	5030.1911**	0.1181

*, ** significant at 5% and 1% levels of significance respectively.

Table 2. Estimates of variability, heritability and genetic advance as per cent of mean in dolichos bean

Characters	Range		Mean	Variance		PCV (%)	GCV (%)	h^2 (%)	Genetic Advance	GA as per cent of mean
	Minimum	Maximum		Phenotypic	Genotypic					
Plant height (cm)	63.91	121.53	85.62	369.24	368.05	22.44	22.40	99.67	39.45	46.08
No. of 1° branches per plant	2.50	4.30	3.31	0.32	0.31	17.10	16.85	97.19	1.13	34.23
No. of 2° branches per plant	6.36	15.28	11.33	7.96	7.60	24.90	24.33	95.47	5.55	48.98
Days to first flowering	40.26	66.88	52.06	73.01	72.42	16.41	16.34	99.20	17.46	33.53
Days to 50 per cent flowering	42.38	68.90	54.65	79.30	78.53	16.29	16.21	99.02	18.16	33.24
No. of inflorescences per plant	4.07	13.53	10.42	8.50	8.18	27.96	27.43	96.22	5.77	55.43
No. of pods per inflorescences	2.91	7.93	5.95	2.16	2.04	24.70	23.99	94.33	2.86	48.01
Number of pods per plant	20.50	93.12	58.43	547.05	546.60	40.02	40.00	99.92	48.14	82.38
No. of seeds per pod	3.35	4.65	3.86	0.19	0.18	11.40	11.24	97.09	0.88	22.81
Mean pod weight (g)	2.13	4.44	3.44	0.52	0.53	21.09	20.99	99.12	1.48	43.06
Pod length (cm)	4.73	8.55	6.07	1.46	1.34	19.92	19.10	91.94	2.29	37.74
Pod width (cm)	1.52	2.08	1.82	0.041	0.03	11.19	10.00	79.86	0.33	18.41
Days to first pod harvest	68.46	90.16	78.45	59.69	58.57	9.84	9.75	98.12	15.61	19.90
Days to last pod harvest	115.39	175.51	148.63	298.63	296.88	11.62	11.59	99.41	35.39	23.80
Pod yield per plant (g)	86.30	300.83	190.49	5434.25	5410.42	38.69	38.61	99.56	151.19	79.36
100 seed weight (g)	19.68	61.63	38.19	169.15	167.82	34.05	33.92	99.21	26.58	69.60
Protein content (%)	17.74	27.66	23.21	13.09	13.00	15.58	15.53	99.34	7.40	31.89
Pod yield per ha (q)	47.82	167.48	105.80	1676.80	1676.69	38.70	38.69	99.99	84.34	79.71

GCV=Genotypic coefficient of variation, PCV=phenotypic coefficient of variation and h^2=heritability in broad sense.