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Genetic variability, Heritability and Genetic advance studies in Yardlong bean (*Vigna unguiculata* spp. *sesquipedalis*) genotypes

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ABSTRACT

A field experiment was carried out at farmer field in Pudukurapettai village, Virudhachalam, Tamilnadu during 2019 to study genetic variability, heritability and genetic advance expressed as per cent of mean for yield and yield attributing characters in thirty three genotypes of yardlong bean. The mean performance recorded on days to first flowering was in the range of (46.78 to 57.33 days), vine length (196.76 to 386.32 cm), days to first picking (57.33 to 67.53 days), pod length (14.18 to 60.08 cm), pod width (1.76 to 3.43 cm), fresh pod weight (171.43 to 995.45 g), number of pods per plant (26.53 to 56.40), number of picking (10.00 to 14.20) and pod yield per plant (171.43 to 995.45 g). The genotypic and phenotypic coefficient of variation showed higher value for pod yield per plant (46.69 % and 46.70 %), fresh pod weight (42.27 and 42.28 %) and pod length (41.66 and 41.66 %). High heritability was observed for the all nine characters. Genetic advance as per cent of mean was higher for pod yield per plant (96.18 %), fresh pod weight (87.08 %), pod length (85.81 %), vine length (36.93 %), pod width (34.16 %) and number of pods per plant (30.04 %).

Keywords: Yardlong bean, Range, GCV, PCV, heritability and genetic advance

INTRODUCTION

Yardlong bean *Vigna unguiculata* spp. s*esquipedalis* belonging to family Leguminaceae is cultivated mainly for its crisp and tender green pods which are consumed in both fresh as well as in cooked form. It is also known as Snake bean, Asparagus bean due to its long slender pods. Yard long bean is considered to be originated in Central Africa and widely distributed in India, Indonesia, Phillippines and Sri-Lanka. Estimating the parameters of variability, especially heritability and genetic gain are important indicators for improvement of characters through selection whereas the selection for highly heritable characters is more effective. Therefore, heritability along with other parameters of variability can be used in predicting the gain for a given selection intensity and expected genetic gain further gives the idea of the extent of improvement in a character through simple selection (Yumkhaibam *et al,* 2019). The objective of this study was to analyse the genetic variability, heritability and genetic advance studies of yardlong bean for better crop improvement.

MATERIALS AND METHODS

The present investigation was carried at farmer's field in Pudukurapettai village, Virudhachalam, Tamilnadu during the January 2019 to April 2019. Thirty three genotypes viz. IC- 622569, IC- 622579, IC-622590, IC -622597, IC- 622598, IC- 622599, IC-622600, IC -622601, IC- 622602, IC- 626137, IC- 626138, IC-626139, IC-626140, IC- 626142, IC -626143, IC-626145, IC-626146, IC-626147, IC-626148, IC-626149, IC-626152, IC 630380, IC 630381, IC-626153, IC-626154, IC-630377, IC-630378, IC-630379, IC-630383 were evaluated in randomized block design with three replications with spacing of 1.50 x 0.45 m. The size of the each experimental plot is 8.75 m. The seeds were directly sown in experimental field on 5th January 2019. Manures and fertilizers were applied as per recommended dose viz. 25 tonnes of farmyard manure ha^{-1} and recommended dose of fertilizer 25:75:60 kg NPK ha^{-1}. Observations were recorded on randomly selected five plants in each experimental plot. The observations were recorded on days to first flowering, vine length (cm), days to first picking, pod length (cm), pod width (cm), fresh pod weight (g), number of pods per plant, number of pickings and pod yield per plant (g). The

variability for different quantitative characters was estimated as per the procedure for analysis of variance suggested by Panse and Sukhatme (1978), genotypic and phenotypic coefficient of variation were worked out by the formulae given by Burton (1952). According to Sivasubramanian and Madhavamenon, (1973), the phenotypic and genotypic co-efficient of variation were classified into three categories (Low=below 10 %, Moderate- 10-20 % and High=above 20 %). Heritability in broad sense was calculated according to Lush (1940) expressed in percentage, Sivasubramanian and Madhavamenon, (1973) classified heritability estimate of cultivated plants into three categories (Low = 30 %, Moderate = 30-60 % and High = above 60 %). Genetic advance was worked out based on the formula given by Johnson *et al.* (1955). According to Robinson *et al.* (1949), genetic advance as per cent of mean was classified into three categories (Low = below 10 %, Moderate = 10-20 % and High = above 20 %).

RESULTS AND DISCUSSION

The analysis of variance on days to first flowering, vine length (cm), days to first picking, pod length (cm), pod width (cm), fresh pod weight (g), number of pods per plant, number of picking and pod yield per plant (g) showed significant variation for the traits among the different accessions (Table 1). The analysis of variance showed significant differences among the thirty three genotypes for all the nine characters indicating the existence of genetic variability. The results obtained were in the confirmation with those of Magalingam *et al,* (2013) in dolichos bean; Siddika *et al,* (2013) in garden pea and Kumar *et al,* (2014) in cluster bean. The ranges in days to first flowering (46.78 to 57.33 days), vine length (196.76 to 386.32 cm), days to first picking (57.33 to 67.53 days), pod length (14.18 to 60.08 cm), pod width (1.76 to 3.43 cm), fresh pod weight (5.42 to 27.27 g), number of pods per plant (26.53 to 56.40), number of pickings (10.00 to 14.20) and pod yield per plant (171.43 to 995.45 g) were recorded in yardling bean genotypes.

Variability was measured by estimation of mean, coefficient of variation such as genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance (Table 2). The results indicated that phenotypic coefficient of variation was higher than the genotypic coefficient of variation for all the characters indicating the influence of the environments to some degree. Similar observations were reported by Parmar *et al,* (2013) in dolichos bean and Prakash *et al,* (2015) in french bean. The genotypic coefficient of variation showed a range of 3.29 to 46.69 %. Highest GCV was recorded for pod yield per plant (46.69 %), fresh pod weight (42.27 %) and pod length (41.66 %). whereas it was moderate for vine length (17.93 %) and pod width (16.69%) and number of pods per plant (14.61 %). The lowest GCV was recorded for number of picking (9.29 %), days to first flowering (5.06 %) and days to first picking (3.29 %).

Table 1: Analysis of variance for morphological characters of Yardlong bean

S. No.	Characters	Mean Sum of Square		
		Replication	Genotype	Error
		df=2	df=32	df=64
1.	Days to 1st flowering	0.761	21.405**	0.123
2.	Vine length cm)	0.170	8325.190**	2.760
3.	Days to 1st picking	0.508	13.673**	0.223
4.	Pod length (cm)	0.165	439.939**	0.007
5.	Pod width (cm)	0.006	0.529**	0.002
6.	Fresh pod weight	0.0003	77.669**	0.007
7.	Pods / plant	0.320	86.627**	0.137
8.	Number of picking	0.932	3.597**	0.035
9.	Pod yield / plant	9.764	129155.128**	9.369

**Significant at 5%, **Significant at 1%*

The phenotypic coefficient of variation showed a range of 3.37 to 46.70 %. Highest PCV was recorded for pod yield per plant (46.70 %), fresh pod weight (42.28 %) and pod length (41.66 %). whereas it was moderate for vine length (17.94 %), pod width (16.81 %) and

number of pod per plant (14.65 %). The magnitude of PCV was, in general, higher than corresponding GCV indicating the influence of environmental factors in their expression (Johnson *et al,* 1955). These results are similar to those of Magalingam *et al,* (2013) and Singh *et al,* (2016), which indicated that greater the genetic variability among the parents, more are the chances of further improvement. This shows more preponderance of environmental factors of yield and yield attributing characters in yardlong bean. The lowest GCV was recorded for number of picking (9.42 %), days to first flowering (5.11 %) and days to first picking (3.37 %). In the present study, pod yield per plant, fresh pod weight and pod length recorded high PCV and GCV which coincides with the results obtained by Magalingam *et al,* (2013) in dolichos bean. Kumar *et al,* (2014) in cluster bean and Singh *et al,* (2016) in winged bean. Moderate GCV and PCV were reported by Goudar *et al,* (2017) in cluster bean, Siddika *et al,* (2013) in pea and Dewangan *et al*, (2017) in dolichos bean. Lower GCV and PCV was recorded for days to first flowering, days to first picking and number of picking. The results are in consonance with the results of Singh *et al,* (2016) and Ghimire *et al,* (2019) in common bean.

Table 2: Comparison of magnitude of variability, heritability and genetic advance as per cent of mean for different morphological traits in Yardlong bean

Characters	General Mean	Range		GCV %	PCV %	H^2 %	GAM %
		Minimum	Maximum				
Days to 1st flowering	52.54	46.78	57.33	5.06	5.11	98.27	10.34
Vine length cm)	293.64	196.76	386.32	17.93	17.94	99.90	36.93
Days to 1st picking	64.26	57.33	67.53	3.29	3.37	95.23	6.62
Pod length (cm)	29.06	14.18	60.08	41.66	41.66	99.99	85.81
Pod width (cm)	2.51	1.76	3.43	16.69	16.81	98.64	34.16
Fresh pod weight	12.03	5.42	27.27	42.27	42.28	99.97	87.08
Pods / plant	36.72	26.53	56.40	14.61	14.65	99.52	30.04
Number of picking	11.72	10.00	14.20	9.29	9.42	97.12	18.86
Pod yield / plant	444.3	171.43	995.45	46.69	46.70	99.98	96.18

GCV: Genotypic co-efficient of variation, PCV: Phenotypic co-efficient of variation, H^2: Heritability, GAM: Genetic advance as % of mean

The heritability is a measure of the extent of phenotypic variations caused by the action of the genes. High heritability values of all the nine characters ranged from (95.23 to 99.99 %). High heritability was observed for pod length (99.99 %), pod yield per plant (99.98 %), fresh pod weight (99.97 %), vine length (90.90 %), number of pods per plant (99.52 %), pod width (98.64 %), days to first flowering (98.27 %), number of picking (97.12 %) and days to first picking (95.23 %). Similar finding was reported by Dewangan *et al,* (2017) in dolichos bean. Genetic advance as per cent of mean in this study was in the range of (6.62 to 96.18 %). High genetic advance as per cent of mean were observed for pod yield per plant (96.18 %), fresh pod weight (87.08 %), pod length (85.81 %), vine length (36.93 %), pod width (34.16 %), number of pod per plant (30.04 %), indicating the least influence of environment in their expression, thus, suggesting that selection for these characters based on phenotypic appearance would be reliable. High genetic advance coupled with high heritability was observed for pod yield per plant, fresh pod weight, pod length, vine length, pod width and number of pod per plant. These results are similar to those of Dewangan *et al,* (2017) and Parmar *et al,* (2013) in dolichos bean. High heritability coupled with moderate genetic advance was observed for number of picking and days to first flowering. High heritability coupled with low genetic advance was observed for days to first picking. This indicates the influence of non additive gene action and considerable influence of environment on the expression of this trait. The results are in consonance with the results of Ukkund *et al*, (2007).

Based on the results of the present study, variability, heritability and genetic advance were observed higher in pod length, fresh pod weight and pod yield per plant, Hence yield improvement in yardlong bean would be achieved through the selection associated with these characters.

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