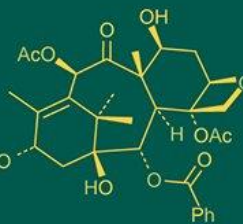
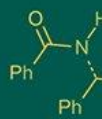


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Genetic variability studies in yardlong bean (*Vigna unguiculata* ssp. *sesquipedalis* L.) genotypes under hill zone of Karnataka

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Abstract

The present study was carried out during the *Rabi* season of 2025-26 under open field conditions at the Experimental Block, Department of Vegetable Science, College of Horticulture, Mudigere, to evaluate genetic variability, heritability and genetic advance as per cent of mean in yardlong bean (*Vigna unguiculata* ssp. *sesquipedalis* L.) for growth, yield and quality attributes under the hill zone of Karnataka. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications to evaluate twenty yardlong bean genotypes. The analysis of variance revealed highly significant differences among the genotypes for all the growth, yield and quality traits studied, indicating the existence of substantial genetic variability and providing immense scope for effective selection and genetic improvement. The higher estimates of genotypic and phenotypic coefficients of variation coupled with high heritability and genetic advance as per cent of mean were observed for plant height, pod length, pod girth, pod yield per plant and chlorophyll content, indicating the predominance of additive gene action. Therefore, direct selection for these traits would be effective in developing superior yardlong bean genotypes.

Keywords: Genetic variability, genetic advance, heritability, yardlong bean, yield

Introduction

Yardlong Bean (*Vigna unguiculata* ssp. *sesquipedalis* L.) is one of the most important leguminous vegetable crops. It is called as chinese long bean, string bean, snake bean, snake pea, snap pea, pea bean and asparagus bean and its chromosome number is $2n = 2x = 22$. The crop is mainly cultivated for its green pods that are used as a vegetable. The crop is referred to as an underutilized leguminous crop as it is neither cultivated commercially on a big scale nor traded widely due to a lack of knowledge and improved varieties of the crop.

It is widely grown in Southeast Asia, South China, Indonesia, Philippines, Taiwan, and Thailand (Rachie, 1985) [12]. Now-a-days it is being cultivated in several states of India. It is most extensively cultivated in Kerala, Karnataka, and Maharashtra. In Karnataka, it is cultivated in south-western districts like Kodagu, Belgaum, Uttara Kannada, Dakshina Kannada, Udupi, Chikkamagaluru, Hassan and some parts of Bengaluru as intercrop, mixed crop, and sole crop. In India, it is generally cultivated in an area of 18,560 -20,160 ha annually (Toppo *et al.*, 2018) [17].

Being leguminous vegetable, it is generally valued for its nutritive value. It contains a good amount of digestible protein both in pods (23.50 - 26.30%) and in leaves. Yard long beans are a good source of vitamins A and C, providing (17% and 31%) of the recommended daily allowance for these vitamins respectively. It is also rich in calcium (72.0 mg), phosphorus (59 mg), iron (2.5 mg), carotene (564 mg), thiamine (0.07 mg), riboflavin (0.09 mg) and vitamin C (24 mg) per 100 g of edible pods. It is also a good source of micronutrients containing 102.69 - 120.02 mg kg⁻¹ of iron, 32.58-36.66 mg kg⁻¹ of zinc, 2.92-3.34 mg kg⁻¹ of manganese, and 0.33- 0.57 mg kg⁻¹ of cobalt. It is also known as "poor man's meat" as it is an abundant and inexpensive source of digestible protein (23.5-26.3%) (Ano and Ubochi, 2008). A wide range of genetic variability is available in the yardlong bean providing good scope for improvement in yield and associated traits through selection. Performance of the genotypes differs with region, season and other growing conditions.

As a result, a prominent genotype performing well in one region may fail to perform well in other regions of different climatic conditions. Ultimately, the yield production of high quality pod depends upon the selection of suitable genotypes for a particular region (Rao *et al.*, 1997) ^[14].

Materials and Methods

The present study was conducted at the Experimental Block, Department of Vegetable Science, College of Horticulture, Mudigere, which is situated in the western ghats and represents the typical hill zone (Zone - 9 and Region -V) of Karnataka and lies at 13.13° North latitude and 75.63° East longitude with an altitude of 980 m above mean sea level, during the *Rabi* season of 2025-26, with twenty yardlong bean genotypes (Table 1). The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The seeds were sown by dibbling at a spacing of 45 × 30 cm with a plot size of 2.7 × 1.5 m.

Recommended cultural practices were followed throughout the crop period. Observations were recorded on growth, flowering, yield and quality parameters that include plant height (cm), internodal length (cm), number of primary branches per plant, days to first flowering, days to first harvest, days to last harvest, number of pods per cluster, pod length (cm), pod girth (mm), pod yield per plant (g), number of seeds per pod, 100 seed weight (g), total chlorophyll content (mg g⁻¹) and keeping quality (PLW).

The data were subjected to analysis of variance (ANOVA) to determine the significance of differences among genotypes following Panse and Sukhatme (1957) ^[10]. Genotypic and phenotypic coefficients of variation (GCV and PCV) were estimated to assess the extent of variability according to Burton and Vane (1953) ^[3]. Heritability in broad sense (h²), genetic advance (GA) and genetic advance as per cent of mean (GAM) were estimated following Johnson *et al.* (1955) ^[6].

Results and Discussion

The analysis of variance for the different characters (Table 2) revealed significant differences among the twenty genotypes of yardlong bean for all the characters studied. The mean sum of squares due to genotypes was highly significant for most of the traits, indicating the presence of considerable genetic variability among the genotypes. The significant variation observed among the genotypes suggests that the experimental material possessed adequate variability, which could be effectively exploited for the improvement of growth, yield and quality attributes in yardlong bean.

The extent of genetic variability among the twenty yardlong bean genotypes was assessed in terms of range, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense, genetic advance (GA) and genetic advance as per cent of mean (GAM) (Table 3). The range of variability for plant height at 30 and 60 DAS (22.50 to 71.88 cm and 106.17 to 231.93 cm, respectively), internodal length at 30 and 60 DAS (2.59 to 4.78 cm and 9.15 to 11.85 cm, respectively), number of primary branches per plant at 30 and 60 DAS (0.76 to 3.46 cm and 1.60 to 5.27 cm, respectively), days to first flowering (50.21 to 74.37 days), days to first harvest (65.43

to 86.47 days), days to last harvest (110.13 to 115.52 days), number of pods per cluster (1.57 to 3.60), pod length (31.50 to 69.49 cm), pod girth (5.34 to 9.31 mm), pod yield per plant (160.22 to 356.56 g), number of seeds per pod (11.75 to 18.21), 100 seed weight (12.73 to 18.58 g), chlorophyll content (0.85 to 1.61 mg g⁻¹) and keeping quality (26.75 to 40.89%) indicated considerable variability among the genotypes.

High GCV and PCV (>20%) were observed for plant height at 30 DAS, number of primary branches per plant at 30 and 60 DAS and pod yield per plant. High GCV and PCV indicate a greater magnitude of genetic variability for these characters. Hence, selection for these traits is expected to be effective, as the response to selection is directly associated with the extent of variability present in the experimental material. The high variability observed for pod yield and its contributing characters indicates considerable scope for their improvement through selection. Similar findings have been reported Yoseph *et al.* (2022) ^[18] in mung bean, Kusmiyati *et al.* (2022) ^[7] and Reddy *et al.* (2024) ^[15] in yardlong bean. Moderate GCV and PCV (10-20%) were recorded for plant height at 60 DAS, internodal length at 30 DAS, pod length, pod girth, number of seeds per pod, chlorophyll content and keeping quality. The moderate magnitude of variability for these characters indicates the presence of appreciable genetic variation among the genotypes. Both genetic and environmental factors may contribute to their expression, and therefore, selection for these traits may result in moderate genetic improvement. Similar observations of moderate variability were earlier reported by Devendra *et al.* (2011) ^[4] in Dolichos bean, Manggoel *et al.* (2012) ^[8] in cowpea and Airina *et al.* (2024) ^[2] in yardlong bean.

Low GCV and PCV (<10%) were observed for internodal length at 60 DAS, days to first flowering, days to first harvest, days to last harvest and 100 seed weight. The low magnitude of genetic variability indicates a relatively narrow genetic base for these characters in the material studied. Consequently, selection based solely on these traits may be less effective due to limited variability available for exploitation. Similar findings were reported by Ramkumar *et al.* (2021) ^[13] and Pornsuriya *et al.* (2021) ^[11] in yardlong bean and Yoseph *et al.* (2022) ^[18] in mung bean.

The study revealed high heritability coupled with high genetic advance as per cent of mean observed for plant height at early growth stage, number of primary branches per plant, pod length, pod girth, pod yield per plant and chlorophyll content. High heritability together with high genetic advance indicates the predominance of additive gene action in the inheritance of these traits. Therefore, phenotypic selection for these characters would be effective for achieving genetic improvement. Moderate heritability coupled with moderate genetic advance was observed for days to first flowering, number of seeds per pod and 100 seed weight, indicating the involvement of both additive and non-additive gene effects. In particular, the high heritability and genetic advance associated with pod yield and its important contributing traits indicate their usefulness as selection criteria for improving productivity in yardlong bean. Similar results were reported by Mesera *et al.* (2022) ^[9] in common bean, Haque *et al.* (2021) ^[5], Sathish *et al.* (2023) ^[16] and Reddy *et al.* (2024) ^[15] in yardlong bean.

Table 1: List of genotypes and check used for the study

Sl.No.	Genotypes	Place of collection
1.	Arka Mangala	IIHR, Bengaluru
2.	Lola	KAU
3.	Githika	KAU
4.	Vyjayanthi	TNAU
5.	Sumanth	Tanindo Seed Pvt Ltd., Bangalore
6.	NS-634	Namdhari seeds, Bengaluru
7.	NS-621	Namdhari seeds, Bengaluru
8.	Bhadri	Sumashi seeds, Tamil Nadu
9.	Karkoonthal	Wayanad local
10.	Red long local	Mysore
11.	Vellayani jyothika	KAU
12.	Valley green	Sumashi seeds, Tamil nadu
13.	Fola	East west seeds India Pvt Ltd., Aurangabad
14.	Mary green	East west seeds India Pvt Ltd., Aurangabad
15.	Ande	East west seeds India Pvt Ltd., Aurangabad
16.	Konkan wali	Dr. BSKKV, Dapoli
17.	Rocket	Tanindo Seed Pvt Ltd., Bangalore
18.	Reenu	East west seeds India Private Limited, Aurangabad
19.	Harish	NSC, Raipur
20.	Mudigere local (Check)	Farmers field, Mudigere

Table 2: Analysis of variance for growth and flowering parameters in Yardlong bean genotypes

Sl. no.	Source	Replication	Treatment	Error
	Degrees of freedom	2	19	38
1.	Plant height (cm) at 30 DAS	5.04	553.17**	9.46
2.	Plant height (cm) at 60 DAS	437.90	3903.99**	312.09
3.	Internodal length (cm) at 30 DAS	0.02	1.27**	0.08
4.	Internodal length (cm) at 60 DAS	0.14	1.75**	0.67
5.	Number of primary branches per plant at 30 DAS	0.01	1.60**	0.02
6.	Number of primary branches per plant at 60 DAS	0.03	3.41**	0.07
7.	Days to first flowering	6.22	110.27**	22.97
8.	Days to first harvest	9.36	97.81**	33.92
9.	Days to last harvest	3.16	7.69*	3.25
10.	Number of pods per cluster	0.12	0.68**	0.10
11.	Pod length (cm)	5.24	349.41**	20.24
12.	Pod girth (mm)	0.06	4.50**	0.35
13.	Pod yield per plant (g)	53.91	12671.96**	432.84
14.	Number of seeds per pod	0.33	10.29**	1.42
15.	100 seed weight (g)	0.34	7.99**	1.65
16.	Chlorophyll content (mg/g)	0.002	0.13**	0.01
17.	Keeping quality (PLW)	2.28	49.07**	6.79

DAS - Days After Sowing

Table 3: Estimates of genetic variability for growth and flowering parameters in Yardlong bean genotypes

Characters	Mean	Range		GV	PV	GCV (%)	PCV (%)	h ² (%)	GA	GAM (%)
		Minimum	Maximum							
Plant height (cm) at 30 DAS	36.33	22.50	71.88	181.24	190.70	37.05	38.01	95.04	27.04	74.41
Plant height (cm) at 60 DAS	177.18	106.17	231.93	1197.30	1509.38	19.53	21.93	79.32	63.49	35.83
Internodal length (cm) at 30 DAS	3.46	2.59	4.78	0.40	0.48	18.21	19.91	83.68	1.19	34.32
Internodal length (cm) at 60 DAS	10.35	9.15	11.85	0.36	1.03	5.79	9.80	34.90	0.73	7.05
Number of primary branches per plant at 30 DAS	1.66	0.76	3.46	0.53	0.55	43.73	44.57	96.27	1.47	88.38
Number of primary branches per plant at 60 DAS	3.08	1.60	5.27	1.11	1.18	34.24	35.26	94.32	2.11	68.50
Days to first flowering	61.22	50.21	74.37	29.10	52.07	8.81	11.79	55.89	8.31	13.57
Days to first harvest	74.39	65.43	86.47	21.30	55.22	6.20	9.99	38.57	5.90	7.94
Days to last harvest	113.54	110.13	115.52	1.48	4.73	1.07	1.92	31.31	1.40	1.24
Number of pods per cluster	2.54	1.57	3.60	0.19	0.29	17.35	21.17	67.21	0.74	29.31
Pod length (cm)	55.42	31.50	69.49	109.72	129.96	18.90	20.57	84.43	19.83	35.78
Pod girth (mm)	7.33	5.34	9.31	1.38	1.73	16.05	17.97	79.79	2.16	29.53
Pod yield per plant (g)	255.91	160.22	356.56	4079.70	4512.55	24.96	26.25	90.41	125.11	48.90
Number of seeds per pod	15.08	11.75	18.21	2.96	4.38	11.40	13.87	67.51	2.91	19.29
100 seed weight (g)	16.19	12.73	18.58	2.11	3.76	8.98	11.98	56.15	2.24	13.86
Chlorophyll content (mg/g)	1.31	0.85	1.61	0.04	0.05	15.09	17.13	77.53	0.36	27.36
Keeping quality (PLW)	33.49	26.75	40.89	14.09	20.88	11.21	13.64	67.50	6.35	18.97

Conclusion

In conclusion, the evaluation of twenty yardlong bean genotypes revealed significant genetic variability for growth, yield and quality attributes, indicating considerable potential for crop improvement. High genotypic and phenotypic coefficients of variation, along with high heritability and genetic advance, were observed for several important yield and yield-contributing traits, suggesting good prospects for effective selection in breeding programmes. Traits such as plant height, number of primary branches per plant and pod yield per plant exhibited greater variability and heritability, indicating their importance in improving productivity. The study highlights the usefulness of the available genetic diversity for identifying and developing superior yardlong bean genotypes with improved yield and nutritional quality, thereby enhancing its commercial potential and economic value.

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