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Variability studies in winged bean [*Psophocarpus tetragonalobus* (L.) DC.]

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Abstract
Thirty winged bean genotypes were evaluated for genetic variability, heritability and genetic advance in 18 quantitative characters at the Instructional-Cum-Research Farm of Horticulture Section, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur during the *Kharif* season 2021-22. The GCV and PCV were high in seven characters *viz.*, seed yield per vine, tuber yield per vine, pod yield per vine, pod weight, 10 pod weight, pod width and number of primary branches per vine. Traits like seed yield per vine followed by tuber yield per vine showed high heritability coupled with high genetic advance indicating their importance in selection programme for further improvement.

Keywords: Genotypic coefficient of variation, phenotypic coefficient of variation

Introduction
Winged Bean [*Psophocarpus tetragonalobus* (L.) DC.] is a tuberous, underexploited and multipurpose leguminous vegetable, belongs to family Leguminoceae or Fabaceae, sub-family Papilionoidea and have diploid chromosome number is 2n=2x=18 (Sarode and Dodake, 2019) [8]. It is self-pollinated, dicotyledonous climbing tuberous vegetable crop. Winged bean is commonly known as god-sent vegetable, asparagus pea, four angled bean, goa bean and princess pea which has been grown in prominence as a protein rich multipurpose crop in recent years (Amoo *et al*., 2006) [1] and also considered as "SOYBEAN OF TROPICS" and "GREEN GOLD" (Sarode and Dodake, 2019) [8]. Winged bean is also known as "supermarket on a stalk" and "one species supermarket" because of its high nutritionally rich green pods, tuberous roots, leaves, immature and mature seeds.
Winged bean is a tropical legume growing copiously in hot, humid tropical countries like India, Sri Lanka, Nigeria, Indonesia, Malaysia, Vietnam, Burma, Thailand and Philippines (Prasanth *et al*., 2014; Mohanty, *et al*., 2013) [7, 2]. In India, it is commonly grown and consumed by local peoples in southern and north-eastern regions, such as Mizoram, Manipur and Tripura. Also, in Male Mahadeshwara Hills of South Karnataka, winged bean is grown by twining on wild trees (Mohamadali, *et al*., 2004) [3].

Material and Methods
Thirty local germplasms with standard check variety (Revati) were grown in Randomized Block Design with two replications at the Instructional-Cum-Research Farm of Horticulture Section, Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur during the *Kharif* season 2021-22. These germplasms were collected from different locations of Maharashtra and some other states like Kerala, Manipur, Goa and Karnataka. All the recommended agronomic practices were carried out to raise a healthy crop. Seeds of each genotype were sown in rows at spacing of 1.2 m between rows and 1 m between plants. Morphological observation on various characters *viz*., Days to first initiation of flowering, Days to 50% flowering, Days to last pod maturity, Days to first harvest, Number of primary branches per plant, Vine length, Pod length, Pod width, Pod weight, Number of pods per plant, Pod yield per plant, Number of seeds per pod, Seed yield per plant, 100 seed weight, 10 pods weight, Tuber yield per plant and Crop duration were recorded from five randomly selected plants of each genotype and the average value was used for statistical analysis. The analysis of variance was carried out following the Panse and Sukhatme (1967) [6] procedure.

Results and Discussion

The analysis of variance for eighteen characters is presented in Table- 1. It is revealed that there were highly significant differences among the genotypes for all the characters under study, showing wide range of variation in thirty genotypes of winged bean except days to last pod maturity. Estimates of mean, range, phenotypic and genotypic variance, phenotypic and genotypic coefficient of variation, heritability and expected genetic advance for all the characters are presented in Table-2. The GCV and PCV were high in seven characters *viz*., seed yield per vine, tuber yield per vine, pod yield per vine, pod weight, 10 pods weight, pod width and number of primary branches per vine. Similar findings were closely with results of Mohamadali *et al*., (2004) [4], Prasanth and Kumary (2014) [7] and Sarode and Dodake (2019) [8].

In the present study, seed yield per vine, tuber yield per vine, pod width, pod length and pod weight gave high heritability estimates with high genetic advance in comparison to other traits, which indicates that additive gene effects may provide a rapid genetic improvement. The findings are in close harmony with the results of Nandan *et al*., (2009) [5], Prasanth and Kumary (2014) [7], Yadav (2018) [9] and Sarode and Dodake (2019) [8].

Table 1: Analysis of variance for 18 characters of winged bean

Sr. No.	Parameters	Mean sum of square	
		Treatments	Error
1.	Days to first initiation of flowering	46.49 **	12.15
2.	Days to 50% flowering	67.06**	14.46
3.	Days to first harvest	83.34**	19.27
4.	Days to last pod maturity	323.29	172.36
5.	No. of primary branches per vine	12.22**	0.75
6.	Vine length (cm)	21903.71**	8120.08
7.	Pod length (cm)	15.24**	0.75
8.	Pod width (cm)	0.66**	0.01
9.	Pod weight (g)	37.82**	2.49
10.	No. of pods per vine	189.59**	53.34
11.	Pod yield per vine (kg)	0.32**	0.02
12.	No. of seeds per pod (g)	4.73**	0.88
13.	Seed yield per vine (g)	7542.32**	147.19
14.	100 seed weight (g)	116.62**	18.93
15.	10 pods weight (g)	3217.05**	193.94
16.	Tuber yield per vine (g)	40131.80**	950.11
17.	Crop Duration	302.48**	156.80
18.	Protein content (%)	27.14**	7.60

Table 2: Different parameters of variability in winged bean

Sr. No.	Characters	Mean	Range		Components of variance			GCV (%)	PCV (%)	Heritability (B. S.) %	Genetic advance	Genetic advance as % of mean
			Min.	Max.	σ2g	σ2p	σ2e					
1.	DFIF	61.72	54.60	70.30	17.17	29.32	12.15	6.71	8.77	58.56	6.53	10.58
2.	DFPF	71.01	62.00	81.70	26.30	40.76	14.46	7.22	8.99	64.51	8.48	11.94
3.	DFH	82.58	72.80	96.20	32.03	51.30	19.27	6.85	8.67	62.43	9.21	11.15
4.	DLPM	179.66	157.80	203.90	75.46	247.83	172.36	4.83	8.76	30.45	9.87	5.49
5.	NPBPV	10.73	6.00	15.10	5.73	6.48	0.75	22.30	23.72	88.41	4.63	43.20
6.	VL (cm)	696.82	494.00	905.00	6891.81	15011.90	8120.08	11.91	17.58	45.91	115.87	16.62
8.	PL (cm)	14.83	9.97	20.04	7.24	8.00	0.75	18.14	19.06	90.56	5.27	35.56
9.	PW (cm)	2.39	1.37	3.37	0.32	0.34	0.01	23.76	24.36	95.12	1.14	47.74
10.	PW (g)	15.89	8.81	21.62	17.66	20.16	2.49	26.44	28.25	87.63	8.10	51.00
11.	NPPV	77.08	59.50	91.30	68.12	121.47	53.34	10.70	14.29	56.09	12.73	16.51
12.	PYPV (g)	1.10	0.59	2.10	0.15	0.17	0.02	35.13	38.00	85.46	0.73	66.90
13.	NSPP	9.27	6.50	11.00	1.92	2.80	0.88	14.95	18.07	68.44	2.36	25.48
14.	SYPV (g)	132.02	48.56	229.71	3697.56	3844.76	147.19	46.04	46.95	96.17	122.84	93.02
15.	HSW (g)	38.02	22.64	50.63	48.84	67.77	18.93	18.38	21.65	72.07	12.22	32.14
16.	TPW (g)	163.46	80.58	252.72	1511.55	1705.49	193.94	23.78	25.26	88.63	75.39	46.12
17.	TYPV (g)	306.76	125.43	560.32	19590.85	20540.96	950.11	45.62	46.72	95.37	281.58	91.79
17.	CD	194.42	171.30	216.90	72.84	229.64	156.80	4.38	7.79	31.72	9.90	5.09
18.	PC (%)	28.85	24.09	35.17	9.77	17.37	7.60	10.83	14.44	56.22	4.82	16.73

DFIF- Days to 1st initiation of flowering, DFPF- Days to 50% flowering, DFH- Days to 1st harvest, DLPM- Days to last pod maturity, NPBPV- No. of primary branches per vine, VL- Vine length, PL- Pod length, PW- Pod width, PW- Pod weight, NPPV- No. of pods per vine, PYPV- Pod yield per vine, NSPP- No. of seeds per pod, SYPV- Seed yield per vine, HSW- 100 seed weight, TPW- 10 pod weight, TYPV- Tuber yield per vine, CD- Crop duration, PC- Protein content

Conclusion

The present genetic studies in winged bean concluded that there was significant wide variation observed within all the winged bean genotypes under study. The GCV and PCV were high in seven characters *viz*., seed yield per vine, tuber yield per vine, pod yield per vine, pod weight, 10 pod weight, pod width and number of primary branches per vine. Traits like seed yield per vine followed by tuber yield per vine showed

high heritability coupled with high genetic advance indicating their importance in selection programme for further improvement.

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