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VARIABILITY AND HERITABILITY STUDIES FOR POD YIELD AND ITS COMPONENT CHARACTERS IN WINGED BEAN [*PSOPHOCARPUS TETRAGONOLOBUS* (L.) DC.]

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ABSTRACT
In the present investigation, twenty one genotypes of winged bean were evaluated to estimate variability, heritability and genetic advance over mean for vegetable pod yield and related attributes during 2013-14 under Kerala conditions. The analysis of variance showed significant difference among all the genotypes for yield and its attributing traits studied. The results indicated that the traits *viz.,* primary branches per plant (79.32, 39.52), days to first flowering (93.68, 49.62), days to 50 per cent flowering (96.60, 49.95), days to first harvest (95.15, 38.50) and pod weight (78.79, 28.43) exhibited high heritability (Ã 60 %) coupled with high to moderate genetic advance as percent mean indicates the presence of flexible additive gene effects, which may be improved through simple plant selection methods. While, the remaining traits showed high to moderate heritability (30-60) coupled with moderate (10-20) to low (<10) genetic advance as percent of mean, suggesting predominance of non-additive gene action in the expression of the traits, therefore may be potentially utilized in recombination breeding. Furthermore, based on the genetic parameters and per se performance, the suitable genotypes for these traits could be isolated and utilized for various winged bean improvement programmes.

INTRODUCTION

Winged bean is an under exploited leguminous vegetable crop growing mainly in the rural households of southern parts of India, particularly Kerala. As all the parts i.e., tubers, leaves, flowers, tender green pods and seeds can be consumed by incorporating in a variety of cuisines, concerted efforts are needed to improve this protein rich legume as a potential vegetable. Critical analysis of the genetic variability is a prerequisite for initiating any crop improvement programme and for adoption of appropriate selection techniques (Dhanwani *et al.,* 2013). The adequate information on extent of variability parameters may be helpful to improve the yield by selecting the yield component traits because yield is a complex trait, whose manifestation depends on the component traits (Mehandi *et al.,* 2013). Generally, the estimates of heritability (h^2) of traits are environment specific (Shimelis and Shiringani, 2010). These estimates should be incorporated and specifically applied only to the population and environment sampled. Thus, selection made on the basis of h^2 alone is likely to be misleading and it becomes necessary to determine the parameters under targeted production environment. Thus, selection of traits based on h^2 and genetic advance as percent of mean is of great importance to the breeder for making criteria for improvement in a complex character. Earlier workers, *viz.,* Philip and Ramachandran (1986) and Mohamadali and Madalageri (2004), reported considerable variability for pod yield and contributing characters in winged bean. Thereafter only little emphasis was given for the improvement of this nutrient rich crop.As preliminary studies in winged bean are very meager, there is an urgent need to identify and develop suitable genotypes for specific purposes. Therefore, in this present investigation, an attempt was made to estimate the extent of genetic variability for yield and yield component traits.

MATERIALS AND METHODS

Twenty one genotypes of winged bean collected from different sources were sown in randomized block design with three replications during April 2013 at the Department of Olericulture, College of Agriculture, Vellayani, Trivandrum (Kerala). All the recommended cultural practices were followed to raise a healthy crop. Seeds of each genotype were sown in rows at spacing of 125 cm between rows and 50cm between plants. Treatments were allotted at random in rows of each replication. Five plants were selected at random from each experimental plot for recording observations on green vegetable pod yield and yield component characters. The genotypic and phenotypic coefficients of variation were computed according to Burton and Devane (1953). The broad sense heritability was computed according to Falconer (1981) and genetic advance over mean was worked out as per Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The analysis of variance showed significant difference among all the genotypes for yield and its attributing characters (Table

Table1: Mean performance of 21 winged bean genotypes for yield and yield attributes

Genotypes	Vine length (cm)	Primary branches/ plant	Days to first flowering	Days to 50 % flowering	Days to first harvest	Days to final harvest	Pod length (cm)	Pod girth (cm)	Pod weight (g)	Pods/ plant	Yield/ plant (g)	Days to edible maturity
PT 1	696.66	9.00	80.22	85.78	104.76	323.33	20.31	7.63	20.41	104.22	2000.00	16.67
PT 2	705.00	13.33	99.66	112.07	137.81	298.33	20.26	7.89	21.63	107.85	2120.00	16.00
PT 3	633.33	14.00	116.93	125.81	143.98	281.67	21.89	7.72	19.65	127.24	2000.00	16.67
PT 4	700.00	7.66	86.55	89.54	97.13	293.33	20.29	7.77	21.43	135.87	2320.00	16.00
PT 5	553.33	11.33	119.25	127.24	146.24	276.67	17.58	6.76	14.30	47.43	696.67	11.67
PT 6	725.00	12.33	139.44	143.73	153.70	318.33	21.43	8.75	21.74	98.66	1946.67	17.33
PT 7	767.66	11.66	175.22	183.25	190.35	298.33	20.16	8.32	20.76	99.42	2083.33	11.33
PT 8	683.33	10.33	97.88	113.67	123.64	301.67	18.79	8.30	21.15	66.68	1266.67	10.33
PT 9	551.33	14.33	141.44	150.08	159.46	316.67	17.44	7.01	16.86	104.94	1630.00	14.67
PT 10	716.66	10.00	114.00	122.22	134.95	308.33	15.65	7.87	15.66	73.10	1320.00	10.67
PT 11	686.66	12.33	124.33	127.72	145.92	293.33	17.13	7.31	17.78	95.79	1730.00	13.00
PT 12	690.00	15.33	116.00	121.83	144.33	311.67	18.00	7.22	17.01	91.29	1606.67	14.00
PT 13	697.33	13.66	119.77	130.48	141.83	293.33	20.31	7.78	20.35	62.10	1133.33	16.33
PT 14	604.00	9.66	77.07	84.71	104.15	298.33	18.84	8.48	20.90	91.43	1843.33	14.00
PT 15	598.66	10.33	100.00	112.52	124.95	286.67	18.45	8.22	20.64	66.66	1110.00	16.33
PT 16	711.66	12.66	124.66	127.65	162.32	300.00	19.99	8.41	21.83	56.58	1030.00	16.00
PT 17	670.66	13.33	110.33	185.78	130.51	293.33	16.03	7.16	17.05	54.28	853.33	16.00
PT 18	813.33	15.66	178.83	187.23	192.67	320.00	14.84	5.03	10.13	44.98	750.00	13.67
PT 19	601.33	8.66	77.77	94.30	111.82	315.00	17.31	6.85	18.24	67.32	1126.67	11.33
PT 20	642.66	8.66	111.59	116.39	128.86	283.33	21.63	7.20	22.62	67.85	1423.33	16.33
PT 21	770.00	6.33	75.05	87.34	97.34	335.00	20.64	7.73	21.74	154.49	2703.33	17.00
S.Em±	20.79	0.72	4.23	3.34	3.41	4.55	0.59	0.18	0.89	14.61	257.22	0.54
C.D (0.05)	59.43	2.08	12.11	9.55	9.77	13.01	1.69	0.54	2.54	41.75	735.16	1.55
Mean	677.07	11.46	113.65	125.21	136.98	302.22	18.90	7.59	19.13	86.58	1556.82	14.53

Table 2: Estimation of genetic parameters for various characters in winged bean

Characters	Range		GV	PV	GCV	PCV	h^2 (%)	GA at 5%	Genetic advance as % of mean
	Min.	Max.							
Vine length (cm)	551.33	813.33	4285.13	5582.53	9.66	11.03	76.75	118.14	17.44
Primary branches/plant	6.33	15.66	6.09	7.68	21.54	24.19	79.32	4.53	39.52
Days to 1st flowering	75.05	178.83	799.98	853.91	24.88	25.72	93.68	56.39	49.62
Days to 50 % flowering	84.71	187.23	954.39	987.94	24.67	25.11	96.60	62.55	49.95
Days to 1st harvest	97.13	192.67	688.97	724.03	19.16	19.64	95.15	52.74	38.50
Days to final harvest	107.98	237.66	211.01	273.21	4.81	5.46	77.23	26.29	8.69
Pod length (cm)	14.84	21.89	3.76	4.81	10.25	11.61	78.11	3.53	18.67
Pod girth (cm)	5.03	8.75	0.62	0.73	10.41	11.27	85.28	1.50	19.76
Pod weight (g)	10.13	22.62	8.86	11.24	15.55	17.52	78.79	5.44	28.43
Pods / plant	44.98	154.49	673.47	1313.84	29.97	41.86	51.26	38.27	44.20
Yield / plant (g)	696.6	2703.33	235907.6	434395.2	31.19	42.33	54.30	737.33	47.36
Days to edible maturity	10.33	17.33	5.01	5.91	15.41	16.72	84.91	4.25	29.24

1). A wide range of variation was noticed for pods per plant. Maximum number of pods and pod yield per plant were obtained from PT 21 followed by PT 4. Days to first flowering showed significant differences between genotypes. PT 21 recorded the minimum number of days required for flowering which was followed by PT 14 and PT 19, whereas PT 18 recorded the maximum days required for flowering. There was significant difference between treatments with respect to days to first harvest. PT 4 recorded the shortest days and PT 18 recorded longest days required for first harvest. PT 21 recorded the longest harvest duration. Similar patterns were also recorded by Nandan *et al.* (2010). This indicated that there is scope of effective selection and can be used for further crop improvement programme.

PCV and GCV are the components used to measure the variability present in a population. The GCV provides a valid basis for comparing and assessing the range of genetic variability for quantitative characters and PCV measures the extent of total variation.The values for range, the phenotypic (PV) and genotypic (GV) variance, genotypic (GCV) and phenotypic (PCV) coefficients of variations, broad sense heritability (h^2), genetic advance (GA) and genetic advance over mean (GAM) are presented in Table 2. The highest range of variation was recorded in yield per plant.

The GCV was very near to PCV for most of the characters, indicating a highly significant effect of genotype on phenotypic expression, with very little effect of environment. So the selection can be effective based on the phenotypic values.High values of PCV and GCV were observed for yield per plant followed by pods per plant, days to first flowering, days to 50 per cent flowering and primary branches per plant. Rest of the characters showed moderate to low GCV and PCV and these findings also get corroborated with Philip and Ramachandran (1986), Seth *et al.* (1988), Dahiya *et al.* (1989), and Mohamadali and Madalageri (2004) in winged bean and Manju (2006) Madhukumar (2006) and Jithesh (2009) in yard

long bean.

Heritability is good index for identification of traits. It is an important selection parameter and provides clues on possible improvement (Makeen *et al.,* 2007). In the present investigation, the heritability estimates were high for characters like days to first flowering, days to 50 per cent flowering, days to first harvest, pod girth and days to edible maturity. Moderate heritability was observed for yield per plant and pods per plant. High heritability can be attributed to the greater role of additive gene and additive X additive gene action, which can be exploited by following simple selection. Similar results have earlier been reported by Mohamadali and Madalageri, 2004 and Nandan *et al.,* 2010. High heritability estimates indicate the effectiveness of selection based on good phenotypic performance but does not necessarily mean high genetic gain for the particular character. High values of genetic advance as percentage of mean (Ã 20 %) were observed for days to 50 per cent flowering, days to first flowering, yield per plant, pods per plant, days to first harvest and days to edible maturity. The results are in line with the findings of Mohamadali and Madalageri (2004). High heritability coupled with high genetic advance was recorded in traits like days to first flowering, days to 50 per cent flowering, days to first harvest and pod weight indicates the presence of flexible additive gene effects and will be a useful criterion for selection of these characters. These results are in agreement with Philip and Ramachandran (1986), Singh and Khanna (1995) and Nandan *et al.* (2010). Rest of the traits showed high to moderate heritability coupled with moderate to low GAM suggesting the existence of non-additive gene action in the expression of the traits and may be exploited better in recombination breeding.

Hence, based on the genetic parameters and per se performance of genotypes, it may be concluded that; the superior genotypes for these traits may be isolated and further utilized for winged bean genetic improvement programmes.

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