



Variability, Heritability and Genetic Advance in Vegetable Cowpea (*Vigna unguiculata* (L.) Walp)

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ABSTRACT

Different parameters were estimated to assess the magnitude of genetic variability in 22 diverse genotypes of vegetable cowpea (*Vigna unguiculata* subsp. *unguiculata*). The analysis of variance indicated the prevalence of sufficient genetic variation among the genotypes from all the characters studied. The high phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were observed for pod weight, plant height, and pod length. High heritability coupled with high genetic advance were observed for all characters studied, except days to first flowering and days to first harvest indicating that these characters are governed by additive gene action. Hence, direct selection may be followed for the improvement of vegetable cowpea for these characters.

Key words : Genetic advance, Heritability, Variability, Vegetable cowpea.

Vegetable cowpea (*Vigna unguiculata* (L) Walp.) is native of Africa. It is one of the most popular and cosmopolitan vegetable crop grown in many parts of India and elsewhere in the world. It is a rich and inexpensive source of vegetable protein. It enriches soil fertility by fixing atmospheric nitrogen. Because of its quick growth habit it has become an essential component of sustainable agriculture in marginal lands of the tropics. For any planned breeding programs to improve yield potentials of crops, it is necessary to obtain adequate information on the magnitude and type of genetic variability and their corresponding heritability, genetic advance and genotypic and phenotypic coefficient of variation. This is because selection of superior genotypes is proportional to the amount of genetic variability present and the extent to which the characters are inherited. Since, many economic traits are quantitative in nature and highly influenced by the environment, the progress of breeding is governed by the nature of genetic and non genetic variations, it will be useful to partition the overall variability into its heritable and non heritable components to know whether superiority of selection is inherited by the progenies. Therefore, the present investigation was undertaken to estimate the variability, heritability and genetic advance in 22 cowpea genotypes.

MATERIAL AND METHODS

The experiment was carried out at Department of Olericulture, College of Agriculture, Vellayani (8° 5' N latitude and 77° 1' E longitude at an altitude of 29 m above mean sea level) during 2011-2012 with 22 vegetable cowpea genotypes. Soil type is a red loam belonging to Vellayani series, texturally classified as sandy clay loam. The trial was laid out in a randomized block design with three replications. Seeds were sown at a spacing of 45 X 30 cm. Timely crop management practices were adopted as recommended by Kerala Agricultural University (KAU, 2007) to raise healthy crop. Observations on growth, yield as well as yield contributing characters was noted on five randomly selected plants in each plot at different stages of the crop. The analysis of variance was carried out and was used for calculating other genetic parameters. Genotypic and phenotypic coefficients of variation were calculated as per the formula suggested by Comstock and Robinson (1952). Heritability in broad sense and expected genetic advance were calculated as per formula given by Allard (1960) and Jhonson *et al.* (1955) respectively.

Table 1. Biometric characters of 22 vegetable cowpea genotypes.

Accessions	Plant height (cm)	Primary branches per plant	Days to first flowering	Days to first harvest	Pod length (cm)	Pod girth (cm)	Pod weight (g)	Pods per plant	Yield per plant (g)
VU 1	170.53	7.33	37.12	46.25	28.20	2.93	12.14	30.28	252.15
VU 2	91.97	6.78	33.38	42.35	17.87	2.37	6.60	42.38	282.26
VU 3	80.63	6.33	33.30	43.42	19.97	2.03	6.41	32.25	156.35
VU 4	177.77	6.56	36.24	45.24	17.30	2.33	5.72	36.62	181.04
VU 5	101.50	5.33	31.40	40.62	18.60	2.37	8.10	51.05	233.37
VU 6	83.47	4.78	31.29	41.25	21.83	2.83	9.44	38.56	310.41
VU 7	166.83	5.78	31.40	41.50	17.60	2.43	6.68	58.10	261.70
VU 8	119.27	5.22	31.40	41.08	17.00	1.87	5.13	70.30	230.63
VU 9	129.37	6.22	35.08	44.58	27.83	2.57	10.59	48.68	196.77
VU 10	106.83	5.56	33.48	42.65	16.53	2.33	5.32	42.32	214.87
VU 11	97.30	7.44	33.12	42.65	16.57	2.53	5.87	32.69	160.11
VU 13	135.43	5.56	36.25	45.60	16.73	2.13	4.78	35.42	210.19
VU 14	161.27	5.11	38.40	47.71	20.37	2.30	5.44	38.15	253.96
VU 15	178.20	4.22	33.18	42.68	16.60	2.20	5.28	33.00	150.86
VU 16	168.23	5.44	33.62	41.52	18.50	2.73	6.75	47.20	225.89
VU 17	134.53	5.67	34.05	42.65	19.27	2.07	5.33	55.45	241.14
VU 18	80.53	5.44	37.36	44.36	24.00	2.60	8.86	44.35	262.04
VU 19	97.73	5.22	35.02	43.69	26.47	2.87	10.90	26.12	237.70
VU 20	75.53	6.39	33.76	42.60	32.53	2.17	12.44	26.38	238.74
VU 21	114.57	5.22	32.14	41.62	16.87	2.13	7.28	46.54	154.30
VU 22	182.97	6.78	34.72	43.28	21.90	2.53	8.54	23.35	213.40
VU 24	58.90	5.33	31.65	40.69	12.40	1.83	4.83	39.00	197.89
CD (5%)	10.468	0.188	1.26	0.88	0.988	0.149	0.284	5.167	23.253
Mean	123.34	5.81	33.97	43.09	20.22	2.37	7.38	40.83	221.17

RESULTS AND DISCUSSION

All the genotypes differ significantly with respect to different characters studied. A wide range of variation was observed in all the characters. Plant height varied from 58.9 cm (VU 24) to 182.97 cm (VU 22), primary branches from 5.22 (VU 19 and VU 21) to 7.44 (VU 11), days to first flowering from 31.29 (VU 6) to 38.40 (VU 14), days to first harvest from 40.69 (VU 24) to 47.71 (VU 14), pod length from 12.40 cm (VU 24) to 32.53 cm (VU 20), pod girth from 1.83 cm (VU 24) to 2.93 cm (VU 1), pod weight from 4.83 g (VU 24) to 12.44 g (VU 20), pods per plant from 23.35 (VU 22) to 70.30 (VU 8) and yield per plant from 150.86 g (VU 15) to 310.41 g (VU 6) (Table 1).

The extent of variability present in the vegetable cowpea genotypes was measured in terms of genetic parameters viz., genotypic and phenotypic coefficients of variation, heritability in broad sense and genetic advance along with mean and range of different characters are presented in Table 2.

In the present investigation, for majority of the characters, magnitude of GCV and PCV were closer, suggesting greater contribution of genotype rather than environment. So, the selection can be very well based on the phenotypic values. Such a closer PCV and GCV for different characters were earlier reported by Girish *et al.* (2006), Jithesh (2009). High values of PCV with corresponding high values of GCV for plant height, pod weight, pod length, pods per plant and yield per plant which indicates that there exist high genetic variability and better scope for improvement of these characters through selection. Similar results were reported for pod weight and yield per plant by Vidya *et al.* (2002), Sobha and Vahab (1998), for pods per plant by Selvam *et al.* (2000), Narayankutty *et al.* (2003), for plant height by Malarvizhi *et al.* (2005), Girish *et al.* (2006) and for pod length by Mathura Rai *et al.* (2004), Sobha and Vahab (1998) in cowpea. From the foregoing discussions, it is clear that the characters viz., pod weight, pods per plant, pod length and yield per plant offer good scope for selection in vegetable cowpea.

The variability existing in a population is the sum total of heritable and non-heritable components. A high value of heritability indicates that the phenotype of that trait strongly reflects its

genotype. In the present investigation, the heritability estimates were high for all characters studied except primary branches per plant. High heritability for yield and yield attributes in vegetable cowpea were reported by many workers (Tyagi *et al.*, 2000; Venkatesan *et al.*, 2003; Suganthi and Murugan, 2008 and Jithesh, 2009).

Heritability estimates were high for all the characters studied. The values were especially high for plant height, days to first harvest, pod length, pod girth, pod weight, yield of vegetable pods per plant and number of pods per plant. High heritability for vegetable pod yield and pod weight reported by Sobha and Vahab (1994), Resmi (1998) and Vidya *et al.* (2002) support the present findings. Further, similar to the present results, high heritability for number of pods per plant and pod length was reported by Anbumalarmathi *et al.* (2005), Suganthi And Murugan (2007). High values of genetic advance as percentage of mean (> 20 %) were obtained in the present study for all the biometric characters studied except days to first flowering and first harvest.

In present study yield per plant, plant height, primary branches, pod length, pod girth pod weight and pods per plant recorded high heritability coupled with high genetic advance. These results confirm the findings of Sobha and Vahab (1998) and Anbumalarmathi *et al.* (2005) who reported high heritability coupled with high genetic advance for plant height, primary branches, pod length, pods per plant and yield per plant.

Johnson *et al.* (1955) suggested that high heritability combined with high genetic advance is indicative of additive gene action and selection based on these parameters would be more reliable.

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Table 2. Genetic variability parameters of vegetable cowpea genotypes.

Characters	Range	Mean	GCV	PCV	Heritability (%)	Genetic advance
Plant height (cm)	58.90-182.97	123.34	31.64	32.05	97.42	64.32
Primary branches per plant	5.22-7.44	5.81	13.79	14.88	85.83	26.34
Days to first flowering	31.29-38.40	33.97	6.02	6.42	87.72	11.60
Days to first harvest	40.69-47.71	43.09	4.38	4.55	92.58	8.68
Pod length (cm)	12.40-32.53	20.22	23.85	24.04	98.38	48.70
Pod girth (cm)	1.83-2.93	2.37	12.62	13.18	91.76	25.00
Pod weight (g)	4.83-12.44	7.38	37.85	37.94	99.55	77.76
Pods per plant	23.35-70.30	40.83	27.59	28.64	92.80	54.67
Yield per plant (g)	150.86-310.41	221.17	19.03	20.07	89.92	37.18

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