

Genetic Variability Studies in Diverse Genotypes of Cowpea (*Vigna unguiculata* L.)

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Abstract

The present investigation was carried out during Kharif season of 2014-15 at Vegetable Research Farm, Department of Horticulture, College of Agriculture, JNKVV, Jabalpur (M.P.). The experimental material was comprised of 15 genotypes of cowpea. The analysis of variance revealed highly significant variance for all the traits depicting greater variability in the existing material. The PCV & GCV was highest for characters viz., number of flower cluster plant⁻¹ (49.79% & 47.57%), number of pods plant⁻¹ (35.69% & 34.24%), number of pods cluster⁻¹ (27.86% & 25.44%), number of branches at 30 DAS (24.94%), pod weight (24.81% & 23.79%) and pod length (23.83% & 23.62%). Heritability estimates were observed very high for pod length (98.29%), number of pods plant⁻¹ (92.04%), pod weight (91.98%), number of flower cluster plant⁻¹ (91.28%) and pod width (91.78%). The highest estimate of genetic advance as percentage of mean was recorded for number of flower cluster plant⁻¹ (93.63%) followed by number of pods plant⁻¹ (67.67%), pod length (48.24%), number of pods cluster⁻¹ (47.84%), pod weight (47.01%), pod width (38.17%), number of flower cluster⁻¹ (36.49%), number of branches at 30 DAS (21.68%), pod yield plot⁻¹ (21.55%), pod yield ha⁻¹ (21.55%) and pod yield plant⁻¹ (20.86%).

Key words: Cowpea (*Vigna unguiculata* L.), genetic variability, heritability, GA

Introduction

The success of most crop improvement programme largely depends upon the genetic variability and heritability of desirable traits. The magnitude and type of genetic variability help the breeder to determine the selection criteria and breeding scheme to be used for improvement purpose. The phenotypic variability and heritability of character determine to a large extent the rate of genetic advance. Hence, it is essential to partition the overall variability into the heritable and non heritable component in order to determine the most effective breeding procedure.

Genetic variability are reported by different workers in previous study of cowpea viz., reported that significant differences for days to first flowering, pod plant⁻¹, pod length and number of seeds pod⁻¹^[10], significant variability for days to 50 per cent flowering, flowers plant⁻¹ and pods plant⁻¹^[7], high degree of genetic variability number of seeds pod⁻¹, number of pods plant⁻¹, number of pods cluster⁻¹, number of branches plant⁻¹, number of cluster plant⁻¹, plant height and number of days to 50 per cent flowering^[18]. Number of pods plant⁻¹ and pod weight^[8], number of pods plant⁻¹ and plant height^[9,11], number of pods plant⁻¹^[17]. Keeping in view of the above points

the present investigation entitled: Genetic variability, heritability and genetic advance of yield and its component traits in Cowpea (*Vigna unguiculata* L.) was taken up.

Material and Methods

The field trial was conducted at Vegetable Research Farm, Department of Horticulture, JNKVV, Jabalpur (M.P.), during *Kharif* season of 2014-2015. Jabalpur is situated in "Kymore plateau and Satpura Hills" agro-climatic region of Madhya Pradesh. It falls on 23.9° North latitude and 79.58° East longitudes with an altitude of 411.8 meters above mean sea level. The average annual rainfall is about 1375 mm and the average minimum & maximum temperature ranged from 6.8 °C to 46.6 °C. The experiment lay out in a Randomized Complete Block Design (RCBD) with 3 replications. Cowpea seeds were sown on plot size of 3.0 m× 2.4 m. The row and plant spacing was maintained at 60×30 cm respectively. The experimental material consisting of 15 genotypes including 2 checks (2011/COPBVAR-7, 2012/COPBVAR-1, 2012/COPBVAR-2, 2012/COPBVAR-3, 2012/COPBVAR-5, 2012/COPBVAR-6, 2014/COPBVAR-1, 2014/COPBVAR-2, 2014/COPBVAR-3, 2014/COPBVAR-4, 2014/COPBVAR-5,

Results and Discussion

Analysis of variances

Analysis of variance for all the characters studied has been presented in (Table 2). Mean square due to genotypes were highly significant for all the characters studied, indicating that the presence of sufficient amount genetic diversity in the existing material^[1,3,5,7,10].

Mean performance of cowpea genotypes

The mean performance of the genotypes (Table 1a & 1 b) revealed a wide range of variability for all the traits. The variation was highest for pod yield plant⁻¹ (153 - 240 g), followed by pod yield ha⁻¹ (85.13-134.39 q), number of pods plant⁻¹ (29.33-77.0), number of flower cluster plant⁻¹ (11.90 -

2014/COPBVAR-6, Gomti, Kashi Kanchan (C)- IIVR Varanasi and Arka Garima (C) - IIHR Bangalore). Sampling was done at 30 days interval till harvest for growth analysis, 5 plants were randomly selected from each genotype and replication for the study from net plot. The data recorded on various parameters viz., plant height (cm), number of branches plant⁻¹, days to first flowering, days to 50 % flowering, number of flowers cluster⁻¹, number of flower clusters plant⁻¹, days to first picking, number of pods plant⁻¹, pod length (cm), pod width (cm), pod weight (g), number of seeds pod⁻¹, pod yield plant⁻¹ (g), pod yield plot⁻¹ (kg), pod yield ha⁻¹ (q), Flower:(Colour/White/Purple/Light purple), Pod Shape:(Straight/Slightly curved/Curved), Pod Colour: (Dark green/Light green/Green),Stringiness in pods: (Fiber Present/Fiber Absent), Fleshy or non fleshy green pods, Seed Colour (Light maroon/Maroon / Creamish), Incidence of pod borer and Incidence of diseases. The data based on the mean of individual plants selected for observation were statistically analyzed. PCV and GCV were calculated^[14], and also categorized into low moderate and high as follows; Low (0-10%), Moderate (10-20%), High (20% & >).

49.66), pod weight (28.33 - 63.0 g), pod length (14.87 - 33.28 cm), plant height at 90 DAS (44.72 - 62.88 cm), days to first picking (80.00 - 90.67 days), plant height at 60 DAS (25.88 - 33.57 cm), days to 50 per cent flowering (64.00 - 70.00 days), days to first flowering (55.33 - 59.33 days), pod yield plot⁻¹ (6.13 - 9.68 kg), number of flower cluster⁻¹ (2.93 - 5.53), plant height at 30 DAS (11.18 - 14.06 cm), number of pods cluster⁻¹(1.53 - 3.46), number of branches at 60 DAS (2.53 - 4.26), number of branches at 90 DAS (6.26 - 7.80) and number of branches at 30 DAS (1.40 - 2.73). The findings were quite similar to as reported by earlier investigators^[1,3,6,7,8,9,10,15,18].

Table 1 (a) Mean performance of Morphological, Phenological and incidence of disease and insect pest characters in cowpea

Genotypes	Morphological characters						Phenological characters					Incidence of disease and insect pest	
	Plant height (cm)			Number of branches plant ⁻¹			Days to first flowering	Days to 50 per cent flowering	No. of flowers cluster ⁻¹	No. of flower clusters Plant ⁻¹	Days to first picking	Pod borer (%)	Incidence of alterneria blight (%)
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS							
2011/COPBVAR-7	11.72	30.82	47.28	1.80	3.07	6.27	53.67	64.67	4.80	11.90	78.57	16.40	3.33
2012/COPBVAR-1	12.27	32.33	57.37	2.00	3.47	6.53	58.00	67.00	3.60	19.37	74.67	18.47	3.67
2012/COPBVAR-2	12.06	29.49	55.50	1.73	3.53	6.67	54.67	67.33	3.07	37.12	78.83	18.37	1.67
2012/COPBVAR-3	12.50	29.98	54.78	1.53	3.53	7.53	56.67	66.67	2.93	18.17	78.63	22.80	2.00
2012/COPBVAR-5	12.08	31.65	56.72	1.53	3.40	7.07	57.00	68.00	3.27	25.70	80.53	20.03	1.67
2012/COPBVAR-6	12.57	31.94	48.27	1.67	3.40	6.93	54.33	66.67	3.07	49.66	77.67	19.47	2.33
2014/COPBVAR-1	11.18	25.88	44.72	1.73	3.47	6.53	57.33	66.67	3.87	32.35	80.33	21.60	3.33
2014/COPBVAR-2	11.57	30.71	53.38	1.67	3.40	7.00	57.67	68.33	4.27	28.17	78.17	19.63	1.33
2014/COPBVAR-3	12.31	32.88	59.99	2.27	4.00	7.80	53.33	64.00	5.53	13.53	74.50	28.60	1.67
2014/COPBVAR-4	14.06	33.57	62.88	2.73	4.26	7.73	53.67	65.67	5.07	13.88	78.90	29.33	1.67
2014/COPBVAR-5	12.80	31.11	53.45	1.93	3.33	6.47	55.33	69.33	4.13	14.43	81.43	27.60	1.33
2014/COPBVR-6	11.91	29.16	56.80	1.47	3.13	6.93	59.33	70.00	3.80	19.85	84.16	24.10	1.00
Gomti	13.51	30.21	56.63	1.80	3.40	6.60	54.67	68.00	3.33	19.35	77.87	26.63	1.66
Arka Garima (C)	12.73	29.77	54.65	1.40	2.53	6.27	55.33	68.00	3.73	16.40	78.07	22.80	2.66
Kashi Kanchan (C)	13.45	32.20	62.16	2.27	4.07	7.53	53.67	64.00	4.20	12.47	77.93	15.33	1.66
S.Em±	0.39	0.85	1.01	0.20	0.16	0.22	0.94	0.76	0.18	1.88	0.80	1.60	0.49
C.D. (at 5%)	1.12	2.47	2.93	0.58	0.48	0.64	2.73	2.19	0.51	5.45	2.30	4.63	1.42

Table 1(b): Mean performance of yield characters in Cowpea

Character	Pods cluster ⁻¹	Pods plant ⁻¹	Pod length (cm)	Pod width (cm)	Pod weight (g)	Seeds pod ⁻¹	Pod yield plant ⁻¹ (g)	Yield plot ¹ (kg)	Yield ha ⁻¹ (q)
2011/COPBVAR-7	1.93	29.33	20.59	0.67	49.33	12.47	153.00	6.13	85.13
2012/COPBVAR-1	1.93	35.67	23.85	0.78	48.33	10.73	173.67	6.95	96.42
2012/COPBVAR-2	1.53	75.67	17.25	0.65	30.66	11.33	215.00	8.57	118.91
2012/COPBVAR-3	1.33	30.00	33.28	0.67	63.00	13.86	186.67	7.48	103.87
2012/COPBVAR-5	1.66	39.33	32.34	0.61	45.33	12.20	176.67	7.05	97.86
2012/COPBVAR-6	1.53	77.00	26.05	0.55	42.33	10.13	240.00	9.68	134.38
2014/COPBVAR-1	2.33	56.00	15.45	0.71	28.33	10.33	218.67	8.78	121.87
2014/COPBVAR-2	2.40	67.67	14.87	0.79	28.33	8.80	206.67	8.30	115.16
2014/COPBVAR-3	3.47	47.00	22.99	0.85	45.00	10.00	211.67	8.42	116.82
2014/COPBVAR-4	3.20	44.00	21.54	0.77	40.67	9.40	180.00	7.20	99.94
2014/COPBVAR-5	2.73	39.33	19.57	1.04	57.33	10.93	226.67	9.07	125.85
2014/COPBVAR-6	2.13	42.33	21.19	0.99	56.00	11.53	236.67	9.43	130.93
Gomti	2.33	45.00	22.30	0.82	48.33	11.07	216.67	8.67	120.29
Arka Garima (C)	2.47	31.00	21.83	1.07	62.67	11.07	183.33	7.34	101.91
Kashi Kanchan (C)	2.57	32.00	27.81	0.75	53.67	12.53	170.00	6.77	93.92
S.Em±	0.15	2.68	0.41	0.03	1.89	0.45	9.93	0.38	5.27
C.D. (at 5%)	0.43	7.77	1.18	0.08	5.48	1.31	28.75	1.10	15.25

Table 2 Showing genetic variability, heritability and genetic advance in twenty characters in Cowpea

S.No.	Characters	Grand mean	Range		CV		Heritability (%)	GA	GA as % of mean
			Min.	Max	PCV	GCV			
X ₁	Plant height at 30DAS	12.49	11.18	14.06	7.64	5.43	50.40	0.99	7.93
X ₂	Plant height at 60DAS	30.78	25.88	33.57	7.23	5.42	56.17	2.58	8.37
X ₃	Plant height at 90 DAS	54.97	44.72	62.88	9.69	9.15	89.20	9.79	17.81
X ₄	No. of branches at 30 DAS	1.83	1.40	2.73	24.94	16.20	42.21	0.40	21.68
X ₅	No. of branches at 60 DAS	3.46	2.53	4.26	13.86	11.15	64.75	0.64	18.48
X ₆	No. of branches at 90 DAS	6.92	6.26	7.80	8.74	6.74	59.52	0.74	10.71
X ₇	Days to first flowering	55.64	53.33	59.33	4.15	2.94	50.21	2.38	4.29
X ₈	Days to 50 % flowering	66.95	64.00	70.00	3.11	2.42	60.51	2.80	3.88
X ₉	No. of flower cluster ⁻¹	3.91	2.93	5.53	20.69	19.15	85.61	1.43	36.49
X ₁₀	No. of flower cluster plant ⁻¹	22.15	11.90	49.66	49.79	47.57	91.28	20.74	93.63
X ₁₁	Days to first picking	78.68	74.50	84.16	3.36	2.87	72.91	3.98	5.05
X ₁₂	No. of pod cluster ⁻¹	2.251	1.53	3.46	27.86	25.44	83.36	1.08	47.84
X ₁₃	No. of pod plant ⁻¹	46.11	29.33	77.00	35.69	34.24	92.04	31.22	67.67
X ₁₄	Pod length(cm)	22.72	14.87	33.28	23.83	23.62	98.29	10.96	48.24
X ₁₅	Pod width(cm)	0.78	0.55	1.07	20.41	19.45	90.78	0.30	38.17
X ₁₆	Pod weight (g)	46.62	28.33	63.00	24.81	23.79	91.98	21.92	47.01
X ₁₇	No. of seed pod ⁻¹	11.09	8.80	13.86	13.15	11.11	71.33	2.14	19.33
X ₁₈	Pod yield plant ⁻¹ (g)	199.68	153.0	240.0	15.05	12.35	67.28	41.66	20.86
X ₁₉	Pod yield plot ⁻¹ (kg)	7.98	6.13	9.68	14.98	12.52	69.84	1.72	21.55
X ₂₀	Pod yield ha ⁻¹ .(q)	110.88	85.13	134.38	14.98	12.52	69.84	23.89	21.55

Coefficient of Variation

Result indicated that the value of phenotypic coefficient of variations was higher in magnitude than that of genotypic coefficient of variation for all the characters showing that the environment had an important role in influencing the expression of the characters^[9].

Phenotypic coefficient of variations

The phenotypic coefficient of variation (Table 2) ranged from 3.11% for days to 50 per cent flowering to 49.79% for number of cluster plant⁻¹. The phenotypic coefficient of variations was highest for characters viz., number of flower cluster plant⁻¹ (49.79%), number of pods plant⁻¹ (35.69%), number of pods cluster⁻¹ (27.86%), number of branches at 30 DAS (24.94%), pod weight (24.81%), pod length (23.83%), number of flower cluster⁻¹ (20.69%) and pod width (20.41%). However, it was exhibited in moderate for characters like number of seeds pod⁻¹ (13.15%), number of branches at 60 DAS (13.86%), pod yield plot⁻¹ (14.98%), pod yield ha⁻¹ (14.98%) and pod yield plant⁻¹ (15.05%)^[2,4,7,15].

Genotypic coefficient of variation

It is revealed from the (Table 2) that genotypic coefficient of variation varied from 2.42% for days to 50 per cent flowering to 47.57% for number of cluster plant⁻¹. High genotypic coefficient of variation was observed for number of flower cluster plant⁻¹ (47.57%), number of pods plant⁻¹ (34.24%), number of pods cluster⁻¹ (25.44%), pod weight (23.79%) and pod length (23.62%). It was moderate for rest of the characters such as pod width (19.45%), number of flower cluster⁻¹ (19.15%), number of branches at 30 DAS (16.20%), pod yield plot⁻¹ (12.52%), pod yield ha⁻¹ (12.52%), pod yield plant⁻¹ (12.35%), number of branches at 60 DAS (11.15%) and number of seeds pod⁻¹ (11.11%) as also reported earlier^[7,16].

Heritability

The estimates of heritability (b^2 s) for all the characters have been discussed as follows (Table 2). It was partitioned as very high (above 90%), high (70 to 90%), medium (50-70%) and low (less than 50%). Result

indicated that the heritability estimates were observed very high for pod length (98.29%), number of pods plant⁻¹ (92.04%), pod weight (91.98%), number of flower cluster plant⁻¹ (91.28%) and pod width (91.78%). However, it was recorded to be high for plant height at 90 DAS (89.20%), number of flower cluster⁻¹ (85.61%), number of pods cluster⁻¹ (83.36%), days to first picking (72.91%) and number of seeds pod⁻¹ (71.33%). Moderate heritability were recorded for pod yield plot⁻¹ (69.84%), pod yield ha⁻¹ (69.84%), pod yield plant⁻¹ (67.28%), number of branches at 60 DAS (64.75%), days to 50 per cent flowering (60.51%), number of branches at 90 DAS (59.52%), plant height at 60 DAS (56.17%), plant height at 30 DAS (50.40%) and days to first flowering (50.21%). Whereas, low estimate of heritability was recorded for number of branches at 30 DAS (42.21%). The findings were also mentioned by many investigators^[12,13,18].

Genetic advance

Genetic advance (Table 2) as percentage of mean ranged between 3.88% for days to 50 per cent flowering and 93.63% for number of flower cluster plant⁻¹. The highest estimate of genetic advance as percentage of mean was recorded for number of flower cluster plant⁻¹ (93.63%) followed by number of pods plant⁻¹ (67.67%), pod length (48.24%), number of pods cluster⁻¹ (47.84%), pod weight (47.01%) pod width (38.17%), number of flower cluster⁻¹ (36.49%), number of branches at 30 DAS (21.68%), pod yield plot⁻¹ (21.55%), pod yield ha⁻¹ (21.55%) and pod yield plant⁻¹ (20.86%). Number of seeds pod⁻¹ (19.33%), number of branches at 60 DAS (18.48%), plant height at 90 DAS (17.81%), number of branches at 90 DAS (10.71%) showed moderate value of genetic advance as percentage of mean. Whereas, low estimates were observed for plant height at 60 DAS (8.37%), plant height at 30 DAS (7.93%), days to first picking (5.05%), days to first flowering (4.29%) and days to 50 per cent flowering (3.88%) similar results were also reported in the past^[6, 16,17].

Conclusions

Analysis of variance revealed highly significant difference among the genotypes for all the characters studied. The variation was maximum for pod yield ha⁻¹ followed by number of pods plant⁻¹, number of flower cluster plant⁻¹, pod weight, pod length, plant height at 90 DAS and days to first picking. The PCV was higher than GCV for all the traits. The heritability estimate were observed very high for pod length followed by number of pods plant⁻¹, number of cluster plant⁻¹, pod weight, number of flower cluster plant⁻¹ and pod width⁻¹. The high estimate of genetic advance was recorded for number of flower cluster plant⁻¹, number of pods plant⁻¹, pod length, number of pods cluster⁻¹, pod weight pod width, number of flower cluster⁻¹, number of branches at 30 DAS, pod yield plot⁻¹, pod

yield ha⁻¹ and pod yield plant⁻¹. The highest production observed in genotype 2012/COPBVAR-6 (134.38 q ha⁻¹) and 2014/COPBVAR (130.93 q ha⁻¹). The low incidence of pod borer was found in genotypes Kashi Kanchan and 2011/COPBVAR-7 and low incidence of Alternaria blight was found in the genotypes 2014/COPBVAR-6, 2014/COPBVAR-2 and 2014/COPBVAR-5.

Acknowledgment

The authors are highly acknowledged to Director Research Services, Director Instruction, Dean Collage of Agriculture and Univ. Prof. & Head, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) for help in conducting the trial successfully, continuous guidance and technical support during field investigation.

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