

## GENETIC VARIABILITY STUDIES IN COWPEA (*VIGNA UNGUICULATA* L. WALP)

SARATH P. S. & RESHMA. T

Kerala Agricultural University, Vellanikkara, Thrissur, Kerala, India

### ABSTRACT

*Genetic variability, heritability, genetic advance and genetic advance as per cent of mean for twelve characters were assessed by field evaluation of twenty two genotypes at the college of horticulture, Vellanikkara. The high degree of variability was observed for all the characters. High magnitude of the phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance was observed for plant height, grain yield per plant and length of the pods. Seeds per pod and protein content exhibited low PCV and GCV, but high irritability and low genetic gain. The difference between the phenotype coefficient of variation and genotype coefficient of variation were found maximum in pod weight (30.15%), followed by number of pods per plant (18.12%) and test weight (16.27%).*

**KEYWORDS:** Cowpea, Variability, Heritability & Genetic Gain

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### INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp) is an ancient grain legume crop widely grown in Africa, Asia and South America. Cowpea is used as forage and vegetable crop mainly in the tropics. It is a source of protein, a vital nutrient for healthy growth in humans and livestock. Its leaves, green pods and grain are consumed as a dietary source of protein (Ghaly *et al.*, 2012). Grain legumes have been described as one of the most important crops in many countries, providing about one-quarter of the world's dietary protein. Exploitation of genetic potential of wild and close relatives of cowpea, enhancing cowpea productivity had not been well documented. The varietal requirements in terms of plant type, seed type, green pod color, maturity and use are extremely diverse from region to region, making breeding programs more complex than any other crop (Davis *et al.*, 2003). Even though there is a wide range of genetic variability available in India, not much attention has been given to the genetic improvement. Success in breeding for cowpea depends on the genetic variability and genetic potential of the parents involved in the breeding programme. Therefore, a field investigation was carried out with a view to study the genetic variability, heritability and genetic advance in cowpea by evaluating cowpea genotypes at the college of horticulture, Vellanikkara.

### MATERIALS AND METHODS

The present investigation comprised of twenty two genotypes of cowpea laid out in Randomized Block Design with two replications. The plot size was five meter square and plants were raised at a spacing of 30 x 10 cm<sup>2</sup> for bushy type. Trailing and semi trailing type were raised at a spacing of 2 x 2 m<sup>2</sup> on pandal, three plants per pit. The recommended agronomic and plant protection measures were adopted in raising good crop. Observations were recorded on ten plants chosen randomly in each replication. The observations were taken for twelve characters, namely plant height, number of branches per plant, days to first flowering, days to first harvest, days to

last harvest, number of pods per plant, length of pod, number of seeds per pod, pod weight, test weight, grain yield and protein content.

Genotypic coefficient of variation and phenotypic coefficient of variation was computed by the method of Burton and Devane (1953). Heritability (broad sense), genetic advance (GA) and genetic advance as per cent of the mean (GAM) were worked by following the method suggested by Falconer (1981).

## RESULTS AND DISCUSSIONS

The total variation present in a population arises due to genotypic and environmental effects. Hence, it is necessary to split the overall variability into its heritable and non heritable components resorting to estimation of genetic parameters such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV). In the present study estimates of PCV were higher than GCV for all the traits. The PCV and GCV were classified as suggested by Sivasubramanian and Madhavamenon, (1973) into low (0-10%), moderate (10.1-20%) and high (>20%). As per the classification PCV were high for all the traits except days to first flowering, days to first harvest and days to last harvest. These characters were having moderate PCV. High GCV was observed for traits, plant height, number of pods per plant, length of pod, pod weight, seeds per pod, test weight and yield per plant. All the other traits exhibited moderate GCV. High variability associated with the major characters indicates that there is a possibility of improvement through selection. The difference between PCV and GCV estimates was maximum for pod weight (30.15%), followed by number of pod per plant (18.12%) and test weight (16.27%). However, the difference between PCV and GCV was low in case of days to first harvest (4.19%), seeds per pod (5.17%), days to flowering (5.9%) and protein content (1.98%).

High heritability indicates high scope of genetic improvement of these characters through selection. Plant height, length of pod, seeds per pod, yield per plant and protein content recorded high heritability estimates indicating that selection would be effective in improving these traits. Findings of Karpe *et al.* (2006) and Chaudhari *et al.* (2013) also reported high heritability in the case of protein content. In case of grain yield per plant, high heritability was reported by Gupta, (2010). Moderate heritability estimates were observed for a number of branches per plant, days to first flowering, first and last harvest. Similarly, number of pods per plant, pod weight and test weight registered moderate heritability reflecting the possibility of moderate progress in these traits through selection. The findings of Singh *et al.* (2009) also suggested moderate heritability value for test weight.

Genetic advance as per cent of the men was categorized as suggested by Johnson *et al.*, (1955) as low (0-10%), moderate (10.1-20%) and high (>20%). High genetic advance as per cent of the men was observed for all the traits except days to flowering and crop duration. For those traits, genetic gain was moderate. High genetic advance for most of the traits in cowpea indicates that improvement of these traits is possible by the selection. Grain yield per plant and plant height had registered high genetic advance as per cent of the mean, indicating that gain in grain yield per plant and plant height could be expected if judicious selection is exercised. Chaudhari *et al.* (2013) also reported high genetic advance for grain yield per plant.

High estimates of heritability along with genetic advance as per cent of the men was evident for the traits, plant height, length of pods, seeds per pod, yield per plant and seed protein content. This indicates that selection will be effective for improving these traits. High heritability in conjunction with high genetic advance in case of seed protein content reported by Ushakumari *et al.* (2010). This implies that grain yield per plant can be improved through selection. Moderate

heritability estimates with high genetic advance as per cent of the mean was observed for a number of branches per plant, number of pods per plant, pod weight and test weight, implying influence of both additive and non-additive gene action on the expression of these traits. Hence, improvement of these traits could be attained by recurrent or reciprocal recurrent selection.

## CONCLUSIONS

This from the present study it can be concluded that high degree of variability was observed for all the characters studied since variety is the basis for any crop improvement program, so there is ample scope for improvement of all the characters studied through appropriate breeding programs. High magnitude of the phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance was observed for plant height, grain yield per plant and length of the pods while Seeds per pod and protein content exhibited low PCV and GCV but high heritability and low genetic gain.

## REFERENCES

1. Burton, G. M. and De Vane, E. H. 1953. Estimating heritability in tall fescue (*Festuca arundinaceae*) from replicated clonal material. *Agron. J.* 45: 478-481.
2. Chaudhari, S. B., Naik, M. R., and Patil, S. S. 2013. Combining ability for pod yield and seed protein content in cowpea over environment. *Trends Biosci.* 6: 395-398.
3. Davis, D. W., Oelke, E. A., Oplinger, E. S., Doll, J. D., and Hanson, C. V. 2003. Variability in yield and yield related traits in cowpea landraces. *Biol. Sci.* 55: 124-128.
4. Falconer, D. S. 1981. *Introduction to quantitative genetics* (2<sup>nd</sup> Ed.). Longman Ltd, London, 340p.
5. Ghaly, A. E., Alkoalk, F. N., and Hall, A. E. 2010. Extraction of protein from common plant leaves for use as human food. *Am. J. Appl. Sci.* 7(3): 323-334.
6. Guptha, R. 2010. Characterisation of seed storage protein in high protein genotypes of cowpea (*V. unguiculata*). *Physiol. Mol. Biol.* 16: 53-58.
7. Johnson, H. W., Robinson, H. F., and Comstock, R. E. 1955. Estimation of genetic variability and environmental stability in soybean. *Agron. J.* 55: 516-532.
8. Karpe, A. A., Naik, M. R., and Desai, R. T. 2006. Combining ability studies in cowpea (*V. unguiculata*). *Annu. Plant Physiol.* 20: 267-269.
9. Singh, B. B., Ajeibe, H. A., and Tarawali, B. A. 2009. Improving the production and utilization of cowpea as a food and fodder. *Field crops Res.* 84: 169-177.
10. Sivasubramanian, V. and Madhavamenon, P. 1973. Path analysis for yield and yield components of rice. *Madras Agric. J.* 60: 1217-1221.
11. Ushakumari, R., Vairam, N., Anandakumar, C., and Malini, N. 2010. Studies on hybrid vigour and combining ability for seed yield and contributing characters in cowpea (*V. unguiculata*). *Electr. J. Plant Breed.* 1: 940-947.

## APPENDICES

Table 1: Variability and Genetic Parameters for Various Characters

Character	Range		Mean	Coefficient of Variation (%)		Heritability (Broad Sence)	Genetic Advance	Genetic Gain as % of Mean
	Minimum	Maximum		PCV	GCV			
Plant height	30.53	254.48	95.71	83.28	75.37	81.89	134.49	140.51
No. of branches	4.5	9.3	6.48	23.17	15.86	46.89	1.45	22.38
Days to first flowering	27.19	55.08	44.23	18.89	12.99	47.29	8.14	18.40
Days to first harvest	38.14	70.2	57.96	16.39	12.20	55.43	10.85	18.72
Days to last harvest	65.85	127.38	104.14	16.89	10.03	35.32	12.80	12.29
No. of pod / plant	10.79	60.07	24.32	69.08	50.96	54.41	18.83	77.43
Length. of pod	12.26	53.83	26.58	56.60	46.07	66.23	20.53	77.24
Pod weight	2.65	27.04	12.88	68.29	38.14	31.18	5.65	43.88
Seeds /pod	7.92	22.28	14.62	31.94	26.77	70.22	6.75	46.22
Test weight	8.81	23.04	14.86	41.14	24.87	36.53	4.60	30.97
Grain yield/ plant	9.30	200.35	75.11	96.35	84.06	76.12	113.49	151.09
Protein content	18.15	28.50	23.41	16.67	14.69	77.69	6.24	26.68

Table 2: Per se Performance of Cowpea Genotypes for Various Traits

Genotypes	Plant Height (cm)	No. of Branches	Days to First Flowering	Days to First Harvest	Last Harvest	No. of Pod/Plant	Length of Pods (cm)	Pod Weight (g)	Seeds/ Pod	Test Weight (g)	Grain yield/ Plant (g)	Protein Content (%)
Bhagyalakshmi	37.8c	4.71	33.87	46.15	91.75	12.29	15.45	4.05	14.03	9.93	10.77	27.96
Co(cp)7	42.63	6.63	46.66	64.30	100.7	18.46	21.40	7.01	12.29	13.20	12.38	20.34
Co-2	35.11	5.69	44.45	58.93	98.88	18.55	19.11	6.01	14.11	12.03	10.01	20.17
Co-4	34.74	6.00	41.04	54.97	102.60	18.93	19.50	5.01	14.03	12.11	10.01	20.89
Co-6	36.21	5.57	51.14	65.75	99.32	19.91	15.82	7.11	11.79	13.05	11.385	20.89
Hridya	30.53	4.51	27.19	38.14	65.85	18.05	12.26	2.65	7.92	6.81	9.31	21.62
Kashikanchan	46.94	6.30	44.26	56.77	114.24	18.3	18.10	7.80	11.88	13.53	26.47	23.83
CP-2	55.10	5.83	45.94	59.38	91.67	16.67	22.74	10.75	11.90	11.89	40.70	19.39
CP-3	53.80	5.37	45.96	55.58	89.62	14.02	20.65	9.85	10.04	10.56	34.26	19.43
NBPGR1	31.39	4.59	45.92	57.98	89.23	12.70	18.19	10.88	8.93	8.85	24.88	18.15
NBPGR2	45.93	5.23	51.08	63.24	100.66	10.79	15.63	10.04	9.79	10.08	28.78	19.77
NBPGR3	40.96	6.26	41.13	55.47	108.7	16.875	17.04	9.60	8.88	10.61	32.74	19.48
Anaswaja	121.68	6.90	40.68	55.35	114.70	45.15	32.38	16.06	18.03	15.20	117.72	27.60
kanakarajony	131.15	6.73	39.96	54.39	91.25	41.21	18.10	10.03	18.04	12.03	100.86	23.38
CP-1	148.41	8.34	55.08	67.47	124.3	16.07	48.77	16.07	13.77	13.43	54.63	20.65
AV-5	90.50	6.85	36.68	47.18	105.30	60.31	24.50	19.08	20.08	21.84	166.34	23.34
PKB-3	107.25	6.83	37.32	51.72	110.17	63.63	23.40	21.07	20.10	21.90	175.40	28.5
PKB-4	93.15	7.10	37.33	48.89	104.3	55.60	22.03	16.10	17.04	23.04	138.64	28.49
Vellayandiyothika	254.48	8.01	50.47	66.68	121.10	58.24	52.49	25.03	17.85	22.60	135.73	26.07
Vijayarathi	225.52	8.04	52.83	70.20	123.10	51.37	53.37	24.07	20.13	20.51	145.49	27.05
Lola	248.33	9.39	54.94	69.11	122.21	60.07	53.83	27.04	22.28	22.86	154.94	27.75
Shanka	213.37	7.78	49.2	67.48	121.00	45.16	40.76	18.06	18.79	18.95	100.24	27.10