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Studies on Genetic Variability, Heritability and Genetic Advance of Different Vegetable Cowpea (*Vigna Unguiculata* L.Walp*)* Varieties In Coastal Andhra Pradesh

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ABSTRACT

The genetic variability study was carried out with nine vegetable cowpea varieties. Genotypic and Phenotypic coefficient of variation, heritability and Genetic advance as per cent of mean were estimated for fifteen characters. High estimates of genetic variability coupled with high heritability and genetic advance were observed for plant height, number of primary branches, number of leaves, dry matter accumulation, pod length, pods per plant, mean pod weight, and pod yield per plant and these characters would be of useful criteria for selection. Days to first flowering, days to 50 per cent flowering and days to first picking showed moderate genetic advance and variability. Least genetic advance and variability were observed for Crop duration. All the characters except days to first picking showed high heritability

Key words : Cowpea, Genetic variability, Genetic advance, Heritability.

Cowpea (*Vigna unguiculata* L. Walp) is one of the important food legumes in the hot-dry tropics and sub-tropics and especially, in the sub-Saharan Africa (Uarrota, 2010). Cowpea plays a substantial role by serving as a grain and vegetable crop mainly for the rural people in the East, West, South and Central parts of Africa (Mortimore *et al*., 1997). It is a fast growing, drought resistant crop, which also improves soil fertility by fixing atmospheric nitrogen (Ortiz, 1998).

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. This is because selection of superior varieties is proportional to the amount of genetic variability present and the extent to which the characters are inherited. Heritability for example, is used to indicate the relative degree to which a character is transmitted from parent to offspring. The magnitude of such estimates also suggests the extent to which improvement is possible through selection. Brigges and Knowles (1967) put forward the view that if environmental variability is negligible compared to genetic variability, selection will be effective in improving the character if such character with high genotypic variability and also easily measurable happened to be highly correlated with yield.

The reproductive phase of cowpea represents the combined effects of many genetic and environmental factors. Ntare (1992) studied the variation in reproductive period and pod yield of cowpea under high temperature condition and reported considerable variations among cultivars in the duration of reproductive period, crop growth rate and partitioning of photosynthates. Utilization of any criterion for selection is linked with high genetic coefficient of variation and estimates of heritability. Thus, a greater understanding is needed not only of the environmental factors that interact with the genotype to influence crop reproductive development and yield but also of the genetic factors that control these characters. The knowledge of genetic variation and relationships among varieties or genotypes or cultivars will help the breeders in developing appropriate breeding strategies to solve problems of low yield in cowpea.

Previous studies regarding heritability in cowpea and other crops indicate that the magnitudes of heritability and other genetic parameters for a character would vary from location to location. Limited information is available on the nature of variability and magnitude of

heritability of vegetative and reproductive phase in cowpea in coastal Andhra Pradesh. Therefore, the objective of this study was to investigate the genetic variability, heritability and genetic advance of some vegetative and reproductive parameters in some cowpea varieties.

MATERIAL AND METHODS

A field experiment entitled "Genetic variability, heritability and genetic advance studies on different vegetable cowpea (*vigna unguiculata* l.walp*)* varieties in coastal Andhra Pradesh" was carried out during 2011 at Horticultural college and Research Institute, Dr.Y.S.R. Horticultural University, Venkataramannagudem, West Godavari District. The experiment was arranged in a randomized block design (RBD) with 3 replications. The nine varieties *viz*., Arka Garima, Arka Suman, Bhagya Lakshmi, Vellayani Local, Khashi Kanchan, Baramasi, Gomthi, Pusa Komal and Local Check were assessed for different growth and yield attributing characters in the field.

Experimental site details

Venkataramannagudem comes under coastal belt and it is situated at an altitude of 34 meters (112 feet) above mean sea level. The geographical situation is 16.83 ^{0}N latitude and 81.50 ^{0}E longitude. The location falls under Agro-climatic zone-10 of humid, East Coast Plain and Hills (Krishna-Godavari zone) with an average rainfall of 900 mm. It experiences hot humid summers and mild winters. The soil is of red sandy loam with good drainage and moderate water holding capacity.

Cultivation details

The land was prepared by ploughing once with a mould board plough followed by two harrowings. Plots of size 3.0 m x 2.7 m were made and the seeds were directly dibbled 5 cm deep on ridges adopting a uniform spacing of 60 cm between the rows and 30 cm within the row to get five rows in each plot with seven hills in each row. Before sowing, farm yard manure was applied to the soil as a basal dose as per the recommendation. Nitrogen was applied in the form of urea @ 25 kg ha^{-1} in two equal splits *ie*., as a basal dose and subsequent dose at flowering stage by placement method. Phosphorous was applied in the form of single superphosphate and Potassium was in the form of Muriate of potash (MOP). Both phosphorus and potash were applied completely as a basal dressing @ 50 kg ha^{-1}. Irrigations were given at 5 days interval depending upon moisture condition of experimental plot, to maintain uniform soil moisture throughout the crop growth period. Hand weeding was done at 15 and 30 days after germination. the crop was duly protected from pests by fortnightly spraying of Carbaryl (3g l^{-1}) for control of sucking pests, Endosulphon (2 ml l^{-1}) and Malathion (2 ml l^{-1}) were used for the control of pod borers.

Sampling and analysis details

Five plants in each plot were tagged from the net plot of each treatment in each replication for recording the observations. The observations on plant height, number of primary branches, number of leaves, dry matter accumulation per plant, days to first flowering, days to 50 per cent flowering, crop duration, pod length, pod girth, seeds per pod, pods per plant, individual pod weight, test weight and pod yield per plant were recorded.

Genotypic and phenotypic coefficients of variation were computed according to Burton (1952) based on the estimate of genotypic and phenotypic variance. Heritability has been estimated as per the formula given by Lush (1940).Genetic advance as percent mean was worked out for each character adopting the formula given by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The estimates of genotypic and phenotypic coefficient of variation, heritability and genetic advance as percentage of mean are presented in the Table-1.

All the PCV values were higher than the GCV values for each character. The high PCV and GCV values were recorded in plant height (64.10%, 63.55%), number of leaves (56.70%, 55.80%), number of primary branches (24.52%, 20.92%), dry matter accumulation (45.64%, 44.06%), pod length (32.43%, 32.41%), pods per plant (35.71%, 33.22%), mean pod weight (47.29%, 47.27%) and pod yield per plant (58.76%, 58.09%). Both GCV and PCV values showed similar pattern of changing over the characters. Similar results

Table 1. Genetic parameters for various characters in cowpea.

Characters	Range	Mean	GCV (%)	PCV (%)	Heritability (%)	Genetic advance as % of mean
Plant height (cm)	28.40-161.59	81.79	63.55	64.10	98.30	129.78
Primary branches	4.63-9.55	6.73	20.92	24.52	72.80	36.78
No. of leaves	25.00-173.66	87.00	55.80	56.70	96.80	113.11
Dry matter accumulation(g)	26.07-90.33	47.77	44.06	45.64	93.20	87.63
Days to first flowering	34.35-43.00	38.10	7.33	7.50	95.60	14.78
Days to 50% flowering	39.94-51.16	46.30	7.97	8.29	92.30	15.77
Days to first picking	42.91-56.06	47.65	6.90	9.14	57.00	10.74
Crop duration	82.40-95.54	87.95	4.81	5.53	75.90	8.64
Pod length (cm)	17.46-46.70	27.39	32.41	32.43	99.90	66.73
Pod girth (cm)	2.46-3.51	2.95	12.08	12.48	93.60	24.08
Pods/plant	9.10-25.00	14.93	33.22	35.71	86.50	97.34
Mean pod weight (g)	6.69-28.77	17.63	47.27	47.29	99.90	97.34
Seeds/pod	12.33-21.00	15.62	17.67	18.39	92.30	34.99
Test weight (g)	110.66-169.46	128.15	15.09	15.09	99.90	31.08
Pod yield per plant (g)	70.05-556.04	265.53	58.09	58.76	97.70	118.30

were reported by Harshavardhana and Savithramma (1998), Anbuselvam *et al.* (2000) and Jyothi (2001) in cowpea.

Reproductive traits like pod girth (12.48%, 12.08%), seeds per pod (18.39%, 17.67%) and test weight (15.09%, 15.09%) recorded moderate PCV and GCV values indicating moderate variability available in the varieties for these traits.

Days to first flowering (7.50%, 7.33%), days to 50 per cent flowering (8.29%, 7.97%), days to first picking (9.14%, 6.90%) and crop duration (5.53%, 4.81%) recorded less PCV and GCV values. It indicates that low variability present in the varieties for selection of these traits. Similar results were reported by Ullah *et al.* (2011), Golani *et al.* (2007).

From the present results it can be concluded that high genetic variability was present in all the characters under study and can be used as criteria for selecting a variety except for days to first flowering, days to 50 per cent flowering, days to first picking and crop duration as these showed less variability.

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. The magnitude of heritability indicates the effectiveness with which selection of the genotypes can be made based on the phenotype.

In the present investigation, the heritability estimates were high (>60) for all characters studied except for days to first picking (57). Suganthi and Murugan (2008) reported higher heritability for plant height, primary branches, days to first flowering, pods per plant, seeds per pod, pod length and hundred seed weight which is in line with the present study.

Environment has least influence for the characters with high heritability and there could be greater correspondence between phenotypes and breeding value while selecting individuals. 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. Johnson *et al*. (1955)

pointed out that high heritability along with high genetic advance would be useful than heritability values alone in predicting the resultant effect of selecting the genotype.

High values of genetic advance as percentage of mean (> 20 %) were obtained in the present study for plant height (129.78%), primary branches (36.78%), leaves (113.11%) and dry matter (87.63%). Similar results reported by Satyawan Arya *et al.* (2004) in peas, Suganthi and Murugan (2008) and Nehru *et al.* (2009) in cowpea.

Pod length (66.73%), pod girth (24.08%), pods per plant (97.34%), mean pod weight (97.34%), seeds per pod (34.99%), test weight (31.08%) and pod yield per plant (118.30%) also recorded high genetic advance. Similar results reported by Vidya *et al.* (2002) in yard long bean, by Golani *et al.* (2007) in hyacinth bean, Suganthi and Murugan (2008), Nehru *et al.* (2009) and Idahosa *et al.* (2010) in cowpea.

Days to first flowering (14.78%), days to 50 per cent flowering (15.77%) and days to first picking (10.74%) showed moderate genetic advance (10-20%). Crop duration (8.64%) showed least genetic advance. Similar findings reported by Suganthi and Murugan (2008) in cowpea and Ullah *et al.* (2011) in yard long bean.

The level of genetic variability observed for different characters would be useful for breeding varieties of cowpea for high yield. The high heritability estimates obtained suggests that these characters are highly heritable and therefore the traits can be easily transferred from parent to offspring.

In the present study, high heritability with high genetic advance which indicates the presence of flexible additive gene effects and was observed for plant height, number of primary branches, number of leaves, dry matter accumulation, pod length, pod girth, pods per plant, mean pod weight, seeds per pod, test weight and pod yield per plant and these characters would be of useful criteria for selection. The moderate-to-large genetic variance and heritability obtained in the present study suggest that substantial residual genetic variability is still available to ensure good progress to increase in pod yield.

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