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Research Note

Genetic variability studies in F_2 and F_3 generations of cowpea (*Vigna unguiculata* (L.) Walp)

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Abstract:
Cowpea is a self pollinated crop and availability of variation is insufficient for further crop improvement. Two genetically diverse parents belonging to determinate and indeterminate were crossed (V-1188x Goa local) and advanced to F2 and F3 generations. The magnitude of variability observed in F2 was more than in F3.

Key words:
Cowpea, determinate, indeterminate variability, segregating generation.

Cowpea known as southern pea is an important grain legume cultivated extensively in arid, semi arid and tropical regions throughout the year as it is photo insensitive. It is relatively drought tolerant and an important food legume. It is an essential component of cropping system in drier regions and marginal areas of tropics and subtropics. In India, cowpea occupies an area of 3.9 m. ha with a production of 2.2 m.t. and a productivity of 562 kg/ha. Lack of genetic variability for economically important traits is one of the reasons attributed for the very little progress in the crop improvement of cowpea. Cowpea is a self pollinated crop and efforts to evolve high yielding genotypes are mainly done by exercising selection in segregating generations. In India cowpea improvement is restricted to assembling a limited number of germplasm and hybridization among randomly chosen parental lines with narrow genetic base. Hence it is advocated that extensive hybridization involving large number of parents of diverse origin be adopted to synthesize a broad based gene pool. The ability to accumulate the variability by recombination and isolation of desired genotypes from segregating population hold the key to success of any crop improvement program. With this background two genetically diverse individuals differing for important economic characters were chosen for hybridization from which productive recombinants can be isolated in the segregating generations.

V-118, a released variety of Indian Agriculture Research Institute, New Delhi has an erect determinate growth habit with medium branching small seeds while Goa local is a local variety with indeterminate habit , low branching with extraordinary bold seeds(25 g/100 seeds). Crosses were made between these two diverse parents keeping V-118 as a female parent and the F_1 was advanced to F_2 and later to F3 generation. The plants were raised with wider spacing with recommended agronomic practices. All the variability parameters were estimated by using standard formulae. Observations were recorded on 450 plants in both F_2 and F_3 generation. Estimates of genetic variability parameters were computed by method suggested by Johnson *et al*., 1955.

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The two parents chosen were distinctly different from each other. Goa local is an extra bold seeded type while V118 had higher number of clusters , more number of branches per plant and number of pods per plant. The yield and yield attributing traits in F2 and F3 were of the same magnitude in terms of mean and range. F3 generation was raised by selecting the most promising individuals in the F2. Based on this information on mean we can infer that additive gene effects may be determining the traits (plant height, braches per plant, canopy spread, 100 seed weight) which are due to additive variance and hence fixable (Falconer, 1960). Similar observations were made by Salimath *et al*. (2007) ,Tyagi *et al*. (2000), Rangaiah and Nehru (1998) and Mathur (1995) and they reported that number of branches, pod length and seed weight are governed by additive genes. It can also be noted that range values for yield and its attributes were reduced in F3 compared to F2. There are also differences in GCV and PCV values and it is of lower magnitude in F3. This is possibly due to cowpea being a self pollinated crop and genotypes attained homozygous condition and stabilized in F3 and further selection will not result in any gain. Similar trend is also observed with heritability and genetic advance as per cent mean. Heritability and GAM values have declined in F3 indicating selection will not be effective in further advanced generation. Plant height, pods/plant, seed yield could be considered for selection as they had higher PCV and GCV values coupled with appreciable heritability and genetic advance as per cent mean. Higher magnitude of phenotypic and genotypic coefficient of variability coupled with broad sense heritability and genetic advance in percentage over mean for many characters was reported by Gowda *et al* (1991) and Mehta and Zaveri 1999. The two parents selected for this study are genetically diverse for important productive traits and hence wide variation is observed in the segregating generation.

In order to generate high yielding genotypes in cowpea, there is a need to generate variations involving diverse genotypes. V-118 and Goa local are the genotypes belonging to determinate and indeterminate types. Wide variation is observed in segregating generation for all the yield attributing traits studied and most productive genotypes in segregating generation can be identified after stabilization and evaluation.

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Table 1. Genetic variability parameters for different quantitative traits in F_2 (V-118 X Goa Local) and F3 generation of Cowpea

Characters	Generation	Mean	Range	Phenotypic Coefficient of variance	Genotypic Coefficient of variance	Heritability (%)	Genetic Advance	Genetic Advance as % Mean
Plant height (cm)	F_2	46.74	50-69	20.8	20.20	96.00	18.68	39.96
	F_3	44.16	34.0-56.0	10.03	8.88	80.48	10.53	23.86
Branches/plant	F_2	5.85	3.0-8.1	26.16	19.85	60.10	1.64	28.03
	F_3	5.44	3.0-7.0	19.80	12.00	39.00	0.79	14.61
Canopy spread (cm^2)	F_2	28.91	20.0-38.0	16.14	12.16	60.20	5.78	19.99
	F_3	28.66	20.0-40.0	15.16	11.19	54.36	3.9	13.61
Clusters/plant	F_2	8.82	3.0-20.0	41.00	38.42	93.80	6.91	78.34
	F_3	9.06	5.0-14.0	23.63	21.06	78.59	2.18	24.12
Pods/plant	F_2	16.46	6.0-34.0	40.22	38.46	90.42	11.66	70.84
	F_3	17.66	10.0-25.0	20.02	18.16	72.58	9.04	51.21
Pod length(cm)	F_2	17.68	13.0-23.0	10.48	10.16	89.02	3.9	22.06
	F_3	17.75	13.8-19.8	13.8	9.76	9.16	87.15	0.98
Seeds/pod	F_2	14.54	6.5-18.0	15.64	14.68	98.04	4.65	31.98
	F_3	15.15	12.4-19.0	12.60	10.06	95.98	1.04	6.97
100 seed weight (g)	F_2	12.89	8.5-15.00	26.48	23.46	92.60	6.40	49.65
	F_3	15.56	10.4-20.6	18.60	17.67	91.22	3.16	20.34
Seed yield/plant	F_2	21.00	8.9-42.2	38.83	35.48	94.64	15.66	74.57
	F_3	20.66	12.1-30.1	25.0	23.16	87.20	12.41	60.08