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Variability Parameters in F_2 and F_3 Populations of Cowpea Involving Determinate, Semideterminate and Indeterminate Types

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Abstract: Available variability in cowpea is meager due to its breeding behavior. However, variability is the prerequisite for improvement of yield levels in cowpea. In the present study, hybridization was followed to generate variability. Most divergent parents were involved in the crossing programme. Yield attributing traits exhibited higher magnitude of variability parameters in the cross C-152 x Goa loal than KM-1 x Goa local. It is also noteworthy hurt magnitude of PCV and GCV values were maintained in later generations (F_3) in case of C-152 x Goa local also on it is always desirable for selection to the more effective. Thus, it was found that semideterminate and indeterminate combination is more potential than determinate x indeterminate demonstrating former combination is a more potential.

Key words : Cowpea, determinate, semideterminate, indeterminate, variability.

Introduction

Cowpea (*Vigna unguiculata*) is extensively grown in southern India particularly in the states of Andhra Pradesh, Karnataka and Tamil Nadu. Cowpea fits well in a variety of cropping systems and is grown as cover crop, mixed crop, catch crop and green manure crop. It fixes atmospheric nitrogen through symbiotic bacteria to the extent of 563 kg per ha (Yadav, 1986).

The productivity levels of legume crops including cowpea have remained static unlike jumps witnessed in some cereals and oilseed crops. Cowpea, member of this family is strictly an autogamous species and hence yield improvement has to come through selection in the variable population. Variability thus becomes an important prerequisite for improvement in a species like cowpea. Cowpea breeders have created variability through hybridization and irradiation. Hybridization is the most commonly used approach for creating variability since the variation created is not random like in irradiation but is directed one. But, selection of parents for generating variability is rather restricted to only few genotypes. Thus, there has been no broadening of the genetic base, which perhaps is one of the reasons for lack of progress in cowpea improvement work. Further with the ideotype concept (Donald, 1968) the productivity in any legume species can be improvement by tailoring the plant type using well-planned recombination breeding with carefully selected parents. In cowpea genotypes representing range of plant types from determinate to indeterminate growth habit are available. Further, it is also being stressed now to use land races for transferring some of their desirable traits to the cultivated background. Keeping all these points in view, cowpea improvement programme was initiated at the department of Genetics and Plant breeding, UAS, Dharwad aiming at generating desirable variability, which in turn can be used for selecting and identifying productive lines. The programme involves Goa local a land race and two other genotypes representing different growth habit. The result concerning the first phase of this programme i.e. generation of variability are presented and discussed in this paper.

Material and Methods

Among the inbred stocks used for experimentation, one was released cultivar (C-152) with semideterminate growth habit; another was an advanced generation mutant derivative (KM-1) while the third one was local cultivar "Goa local", extensively grown around Goa region. Crosses of the type semi-determinate x indeterminate (C-152 x Goa local) and determinate x indeterminate (KM-1x Goa local) were effected. F_1's of each cross was selfed to obtain F_2 seeds. Productive lines of F_2 populations were advanced to obtain F_3 generation in kharif 2003. The plants were spaced at a distance of 60 cm between rows and 10 cm within the rows. Observations were recorded on 120 plants in each F_2 generation and 60 plants from each F_3 generation. Estimates of genetic variability parameters were computed by following standard method (Johnson *et al.,* 1955).

Results and Discussion

The two segregating populations selected for the study represent combination of determinate x indeterminate (KM-1 x Goa local) type and a semideterminate x indeterminate (C-152x Goa local) type in cowpea. It is interesting to note here that mean performance in respect of yield per plant and its component traits were same in both F_2 and F_3 of two crosses. It may be noted here that F_2 was advanced to F_3 by selecting the productive segregants in F_2. Consequently, the fact that selection has maintained the mean performance of these traits clearly indicates

Table 1. Genetic variability parameters for five quantitative traits in F_2 segregating populations of cowpea

Cross	F_2 (km^{-1} x Goa Local)						F_2 (C-152x Goa Local)					
Character	Mean	Range	PCV	GCV	h^2(bs) (%)	GAM (%)	Mean	Range	PCV	GCV	h^2(bs) (%)	GAM (%)
Pods per plant	15.56	6-33	40.30	38.32	90.42	75.06	18.33	10-40	29.84	27.58	85.46	52.53
Pod Length	17.18	13-22	10.78	10.17	89.02	19.77	17.31	13.2-23.0	11.51	8.70	57.07	13.53
Seeds per Pod	14.74	6.4-18.8	15.08	14.87	97.17	30.19	13.53	10.8-16	8.92	6.16	47.74	8.77
Hundred seed weight (g)	12.67	8.5-24.8	25.18	24.26	92.86	48.16	13.54	8.54-30.76	29.78	27.61	85.95	52.73
Seed yield per plant(g)	20.81	8.96-41.24	36.53	35.48	94.34	70.99	21.81	12.33-42.30	33.29	32.42	94.87	65.06

Table 2. Genetic variability parameters for five quantitative traits in F_3 segregating populations of Cowpea.

Cross	F_3 (KM-1x Goa Local)						F_3 C-152x Goa Local)					
Character	Mean	Range	PCV	GCV	h^2(bs)(%)	GAM(%)	Mean	Range	PCV	GCV	h^2(bs)(%)	GAM(%)
Pods per plant	17.63	10-25	21.02	17.91	72.58	31.43	18.48	9.0-33.0	29.24	26.97	85.09	51.25
Pod Length	17.51	13.8-19.6	9.78	9.13	87.15	17.55	14.73	9.0-18.20	10.31	5.27	26.15	5.55
Seeds per pod	15.16	12.2-19.0	12.30	12.05	95.98	24.31	13.31	10.6-15.4	8.43	5.30	39.52	6.87
Hundred seed weight (g)	15.64	10.22-20.5	18.41	17.57	91.22	34.56	12.09	9.11-16.88	18.38	13.47	53.72	20.34
Seed yield per plant (g)	20.76	12.11-30.22	24.74	23.16	87.60	44.65	19.44	10.09-34.36	31.49	30.28	92.77	60.08

that additive effects may be governing the expression of these traits as it is additive variance, which is fixable (Falconer, 1960). Earlier authors Tyagi *et al*. (2000), Rangaiah and Nehru (1998) and Mathur (1995) reported that expression of traits such as branch number, pod length, seed weight is governed by additive genes. It may also be seen from table 1 and 2 that the range of expression has narrowed down in F_3 for productivity and its component traits in both populations. However, the upper value of the range is almost maintained except for seed yield in which case it has slightly declined, which is expected due to complex nature of yield. The two populations differed in respect of the trend of change in PCV and GCV from F_2 to F_3. While the magnitude of PCV and GCV values were lower in F_3 of KM-1 x Goa local compared to its F_2 population, these values did not differ much in F_2 and F_3 generations of C-152 x Goa local. It may be mentioned here that C-152 x Goa local combination provides an advantageous situation compared to KM-1 x Goa local since it is always desirable that variability should be maintained in later generations also for selection to be more effective. It is also noteworthy that for productivity (seed yield per plant) and pods per plant, which is the most important component trait, variability was higher in C-152 x Goa local than in KM-1 x Goa local. The same trend is seen with heritability as well as GAM. Further, the GAM values have declined from F_2 to F_3 in KM-1 x Goa local cross, while they are rather maintained in C-152 x Goa local. So considering the fact that the value of upper range of expression for seed yield and pods per plant is particularly higher in C-152 x Goa local cross followed by relatively higher values of PCV, GCV, heritability and GAM clearly indicate that C-152 x Goa local which represents a semideterminate x indeterminate combination is more potential than KM-1x Goa local that represents determinate x indeterminate combination. 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 Selvam *et al*. (2000), Gowda *et al*. (1991) and Mehta and Zaveri (1999). In terms of diversity of the parentage involved KM-1 x Goa local cross represents higher diversity considering the plant type of parents than C-152 x Goa local, which represents optimum diversity. As demonstrated by Arunachalum et al. (1984), C-152 x Goa local representing medium thus desired diversity should be a more potential combination. And as discussed above, it has turned out to be better combination than the other.

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