

# VARIATION IN COWPEA FOLLOWING HYBRIDIZATION AND MUTAGENESIS

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CONFLICTING views have been expressed by various authors regarding the role of induced mutations as a supplement to hybridization in releasing variability for quantitatively inherited traits. Krull and Frey (1961) could obtain release of additional variability following irradiation in the  $F_2$  generation. Gregory, (1961) also observed occurrence of increased variation following irradiation of hybrids. Gupta and Virk (1977) observed that the variations induced by radiation and by hybridization were not always cumulative.

The present investigation compares the magnitude of variation in a few quantitative traits as generated by hybridization alone and hybridization in combination with induced mutations.

## MATERIALS AND METHODS

The  $F_2$  seeds of a cross between 'S-488' and 'Mississippi Purple' varieties of cowpea were used for treatment with ethyl methane sulphonate (EMS). The seeds were soaked for four hours in distilled water before administering the treatment with chemical mutagen. The pre-soaked seeds were treated with aqueous solutions of 0.6 per cent EMS for four hours at  $25 \pm 1 \pm 0^\circ\text{C}$  with intermittent shaking. The treated seeds were washed in running water to remove the excess chemical and toxic products.

The treated  $F_2$  seeds were sown in the field along with the untreated  $F_2$  seeds. The successive generations were designated as follows:

$F_2$ : The progeny raised from  $F_2$  seeds;  $F_2M_1$ : The progeny from  $F_2$  seeds after administering mutagen treatment;  $F_3$  &  $F_4$ : Progeny from randomly selected plants of  $F_2$  and  $F_3$  generations respectively;  $F_3M_2$  &  $F_4M_3$ : The progeny from randomly selected plants of  $F_2M_1$  and  $F_3M_2$  generations respectively.

For each generation nearly 600 plants were raised and a sample of 400 plants were studied for (1) number of pods per plant (2) number of seeds per pod and (3) seed weight per plant. The significance of the variance values were tested as the ratio of larger variance to the smaller variance.

## RESULTS AND DISCUSSION

The data on mean and variance for the three quantitative traits in different generations has been presented in Table 1 and 2 respectively.

In respect of all the three quantitative traits studied, the mean values were found to be less in  $F_2M_1$  population as compared to  $F_2$  population. Negative shifts in mean values following mutagen treatment has been reported as a general phenomenon attributed to the occurrence of deleterious or harmful mutations which are supposed to occur more frequently than the favourable ones. In subsequent generations ( $F_3$  and  $F_4$ ) the mean values in mutagen treated population increased gradually and tended to be near or equal to those of untreated

TABLE 1

*Mean values of three yield components in different generations following hybridization and mutagenesis*

Trait	Generation					
	F <sub>2</sub>	F <sub>2</sub> M <sub>1</sub>	F <sub>3</sub>	F <sub>3</sub> M <sub>2</sub>	F <sub>4</sub>	F <sub>4</sub> M <sub>3</sub>
Pods/plant	17.58 (± 0.42)	15.30 (± 0.46)	16.28 (± 0.43)	15.94 (± 0.46)	21.43 (± 0.52)	20.51 (± 0.53)
Seeds/pod	11.48 (± 0.11)	10.78 (± 0.11)	12.19 (± 0.12)	11.55 (± 0.11)	11.26 (± 0.13)	11.36 (± 0.11)
Yield/plant	18.02 (± 0.43)	14.65 (± 0.43)	20.13 (± 0.48)	17.27 (± 0.45)	21.28 (± 0.56)	19.19 (0 ± .52)

TABLE 2

*Variance for three yield components in different generations following hybridization and mutagenesis*

Trait	Generation					
	F <sub>2</sub>	F <sub>2</sub> M <sub>1</sub>	F <sub>3</sub>	F <sub>3</sub> M <sub>2</sub>	F <sub>4</sub>	F <sub>4</sub> M <sub>3</sub>
Pods/plant	72.21 (100)	84.41 (117.00)	72.81 (100)	85.10 (116.88)	107.63 (100)	112.44 (104.47)
Seeds/pod	4.64 (100)	4.86 (104.74)	6.19 (100)	5.19 (83.84)	6.69 (100)	5.15 (77.00)
Yield/plant	73.37 (100)	72.60 (98.95)	93.57 (100)	80.05 (85.55)	123.19 (100)	107.85 (87.55)

*Note:*—Values in parenthesis indicate variance in terms of percentages.

population. This trend was more evident in case of number of seeds per pod. The tendency of the mean values in mutagen treated populations to gradually increase and attain a value equal to untreated control mean has been observed in wheat by Borojevic and Borojevic (1972). This phenomenon has been attributed to the process of elimination of lethal mutations in successive generations thus increasing the general mean value.

The variance component showed a different trend with different characters. For number of pods a significant increase in variance was evident in mutagen treated population in F<sub>2</sub> and F<sub>3</sub> generations, thus indicating a cumulative effect of hybridization and mutagenesis. Whereas in case of number of seeds

per pod and total seed weight per plant the variance was significantly less in treated populations than in untreated ones thus indicating a non-cumulative effect.

A comparison based on variance values among the different generations following hybridization alone ( $F_2$  to  $F_4$ ) and among different generations following combinations of hybridization and mutagenesis ( $F_2M_1$  to  $F_4M_3$ ) revealed a highly significant increasing trend in variance values in respect of the two traits viz. number of pods per plant and seed weight per plant. However, in respect of number of seeds per pod the variance among different generations following hybridization was highly significant and showed an increasing trend but in generations following mutagenesis the difference in variance was not significant, and the variance remained almost unaltered.

It is evident from the present study and the reports of the previous workers that the combined effect of hybridization and mutagenesis is not always cumulative. The cumulative nature may be dependent on many factors—such as the genetic architecture of the quantitative trait, the efficiency of the mutagen used in inducing mutations, the population size studied and the extent of diversity of parents used in the cross—if the variation released from the particular cross is enormous it may mask the variation generated by mutagenesis.

#### SUMMARY

A study of magnitude of variation released, in respect of three quantitative traits, following hybridization alone and in combination with mutagenesis in Cowpea (*Vigna unguiculata* (L.) Walp) revealed that the cumulative effect of hybridization and mutagenesis varies with the nature of the quantitative trait studied. While for number of pods a cumulative effect was evident, such effect was not found for traits like seeds per pod and seed yield. The variance values in advancing generations of both hybridization alone ( $F_2$  to  $F_4$ ) and hybridization combined with mutagenesis ( $F_2M_1$  to  $F_4M_3$ ) showed a significant increasing trend in respect of the traits viz. number of pods per plant and seed weight per plant, while such trend was observed only following hybridization in case of number of seeds per pod. In general, the mean values in mutagen treated populations were less as compared to untreated populations. In successive generations, however, the mean values in mutagen treated populations showed a tendency to gradually increase and approached untreated control mean values.

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