GENETIC ANALYSIS AND POPULATION IMPROVEMENT IN A COMPOSITE POPULATION OF INDIAN RAPESEED (Brassica campestris L.)

ABSTRACT

A composite derived from ten intervarietal hybrid populations involving toria, yellow sarson and brown sarson of Indian rapeseed was subjected to North Carolina design II analysis, and improvement by four methods of selection namely, mass selection, gridded mass selection, selfed-plant mass selection and half-sib family selection. Model II analysis of variance of 252 full-sib progenies for 17 characters revealed significant variation among the progenies. Variation for seed and biological yield, silique/plant, harvest index and seed weight was predominantly non-additive type. The developmental characters namely, days to flower, days to maturity and plant height showed primarily additive genetic variation. Both additive and non-additive genetic variation were important for the component of branches and the silique characters. All the characters except seed density exhibited complete to overdominance gene expression. Maternal effects and repulsion linkages presumably with epistasis were indicated for most of the characters. Sufficient additive genetic variation for yield and its determinants like branches/plant, silique on main shoot and seeds/silique was present for effective selection in the composite population. Secondary branches, total branches and seeds/silique showed moderate heritability, and positive associations with seed yield both at the phenotypic and the additive genetic levels. Index selection for seed yield along with secondary branches and seeds/silique would be more effective than simple selection for yield alone. Moderate and negative additive genetic correlations of harvest index with the developmental characters and important yield components would disperse with the selection for harvest index for yield improvement. Among the intrapopulation selection methods, considering the differences in selection intensities, selfed-plant mass selection was the most efficient method followed by gridded mass selection for high yield. In all the methods, except mass selection in the first cycle, initial selection for phenotypic superiority was found to increase the effectiveness of yield selection. Discrepancies between the estimates of expected and realized responses were attributed to reduction in genetic variance consequent upon selection and genotype-environment interactions. Four populations were finally selected and evaluated along with the composite base and five check populations for yield and 13 component characters. The selected populations gave significantly higher yield than the composite base, with concomitant increase in component characters. Selection for early maturity was effective in reducing the duration by 2 - 7 days as compared to the base population. Selection for high yield alone shifted the population toward lateness. The selected populations showed yield superiority to at least one of the check populations. Further selection and evaluation over environments; disruptive mating between the early and the late populations; development of hybrids and synthetics using doubled haploids; and introgression of genes from allied species to widen genetic base of the composite were implicated.