STUDIES by Coffman and Stanton (3); Coffman, Parker, and Quisenberry (2); and Morey (9) have shown that oat varieties differ in degree of intra-variety variability. It has been generally recognized that varieties of the species Avena byzantina show greater intra-varietal variability for plant and seed characters than sativa varieties. As a partial explanation of this, Garber and Quisenberry (6) report more natural crossing between byzantina varieties than between sativa varieties.

In heterosis studies, Coffman and Stevens (4) have shown that some varieties of oats influence the yield of F₁ progeny more than others. The variety Bond seemed to depress the yield in F₁ hybrids, whereas Markton and Victoria increased it. In some crosses, heterosis existed in kernel weight, height, panicle length, and total plant weight, whereas the culm number was usually decreased, as Coffman and Davis (1) have shown.

Hybrid progeny were frequently earlier in heading than the parents, according to Coffman and Wiebe (5). Owing to the earliness of the F₁ plants, these authors state, culms per plant and total plant weight seemed of little value as measures of hybrid vigor.

Genetic studies of quantitative characters present serious difficulties since the number of genes involved is usually large and the effect of single genes is usually small. One method of study, used in an attempt to overcome the difficulties, compares the variance of segregating and non-segregating material. Mather (8), working with oat data collected by Quisenberry, used the variance of the parents as an estimate of the environmental variance which he subtracted from the F₂ variance to get an estimate of the total genetic variance. This technique always raises the question of the genetic uniformity of the parents, since previous studies (2, 3, 9) have shown that certain oat varieties are not uniform. Poole and Grimball (10), working with watermelons, and Powers (11), working with barley, have used the variances of non-segregating material as an estimate of the environmental portion of the variances in segregating material. Powers (11) added, however, that erroneous conclusions may be drawn in estimating residual genic variability by using parental data as an absolute measure of environmental variances, since the amount of variation due to the environment is not the same for all genotypes.

This study was one of a series designed to determine if the Letoria and Fulwin oat varieties differ in genotype for the six characters, viz.: height, culm number, seed number per plant, weight of seed per plant, weight per seed, and seed number per panicle.

MATERIALS AND METHODS

Lee is classified as Avena sativa and Victoria as Avena byzantina. Fulwin is a selection from Victoria made in 1941 from the Tennessee Experiment Station.

Fifteen crosses involving different pairs of the two oat varieties, Letoria and Fulwin, were made. The F₁ seeds and the selfed seeds of the 30 F₂ plants were maintained separately. In the fall of 1948, the crosses and the seed from their respective parents were planted 4 inches apart in rows 12 inches apart in a split plot design with 4 replications. The crosses consisted of 2 F₂ rows from each cross bordered by rows of the specific parents of the cross, on each side. The character measures, culm number per plant, seed number per plant, weight per seed in grams, and seed number per panicle were determined for each of 20 F₂ plants in each row.

EXPERIMENTAL RESULTS

Crosses.—Mean squares in table 1 show that variation among Letoria parents was not significant for the six characters. On the other hand, there were significant differences among the 15 Fulwin parents for each character except number of seed per panicle, and significant differences between the crosses in the F₁ population for each of the characters except yield.

Heterosis.—If it is assumed that heterosis is the mean of the progeny is significantly greater in crosses of the parents, then heterosis in the progeny of certain varieties did exist for each character, as indicated in table 2, which gives a test of significance between the average of the parents and the means of the F₁, 2, which give a test of significance between the mean of the parents and the means of the F₂, and show in column 6 of table 2 are highly significant characters.

Genetic Variability.—If the average of the variances of the two parents is used as an estimate of the environmental contribution to the variance in F₂ rows, then after subtraction of the within F₂ from the within F₂ variance, an estimate of the contribution to the variance in the F₂ population is obtained.

Columns 2 and 3 in table 3 show the means of the parents and of the F₂'s, respectively, for characters. Column 4 gives the estimated genetic contribution to the character. Column 5 the estimated genetic variance of each character. Column 5 the estimated genetic variance percent of the total F₂ variance.

DISCUSSION

The variability found in the Fulwin variety from several possible origins. The variety may be homozygous at the time it was released, or the mixture of the byzantina variety which it was released. There is still a possibility of heterosis. According to Huskins (7), there have been many reports on the byzantina species. Apparent explanation of this, Garber and Quisenberry (6) report more natural crossing between byzantina varieties than between sativa varieties.