Inheritance of Resistance to Methyl Parathion in Sorgo
Otto H. Coleman and Jack L. Dean

SOME varieties of sorgo, Sorghum vulgare, Pers., grown near cotton fields are severely damaged by the drift of certain insecticides and defoliants applied to cotton. Insecticide damage was first observed near Crossville, Alabama, and near Jackson, Tennessee, in 1957 in the regional sorgo variety tests. Damage to the well-known variety, 'Honey', was severe but decreased as the distance from the adjoining cotton fields increased. Fortunately, some varieties appeared to have resistance to insecticides used in these areas. This paper reports the results of a genetic study evaluating the effects of the cotton insecticide, methyl parathion, on two varieties of sorgo ('Honey' and 'Wiley') and their progenies at Meridian, Mississippi.

LITERATURE REVIEW

Reed (1) in 1930 and Karper (2) in 1931 reported that red seedling color in sorgum is a simple dominant to green seedling color. Ayyangar (3) in 1937 reported that a heavy waxy bloom was a simple dominant to light waxy bloom. Wiebe and Hayes (4) in 1960 reported that DDT severely damaged some varieties of barley. They also gave an excellent literature review regarding agricultural chemical injury to plants.

METHODS

Table 1 includes the genetic description of the two varieties and their F1.

The F1 and F2 generations were grown in rows 3.5 feet apart with the plants spaced approximately 2 feet apart in the rows. The F2 generation was planted in 1/1000-acre plots with 2 replications in a check plot design which included 1 parent every 25 rows. The plants were sprayed with commercial grade methyl parathion when they were 8 to 12 inches tall at the recommended concentration and rate for cotton insect control. The spray band was about 1.5 feet wide. Ratings for methyl parathion damage were made about 3 days after treatment. Methyl parathion damage on leaves is characterized by irregular necrotic blotsches that tend to follow the vein pattern. At first the blotches appear grey and dry but they soon become colored by whatever color the particular sorgo variety is capable of producing as a reaction to injury. Under conditions of severe and repeated exposure, all leaves on very susceptible varieties are completely killed. Seedling color was determined immediately after the seedlings emerged. Waxy bloom ratings were made at maturity.

RESULTS

Three F2 generation families were involved in the Honey × Wiley and Wiley × Honey progenies used to evaluate the inheritance of seedling color and resistance to methyl parathion. The homogeneity P-value was between 0.80 and 0.70. Consequently, the data from these families were pooled for genetic interpretation. Chi-square analyses indicated that red seedling color and resistance to methyl parathion were each controlled by single dominant genes in these families. Also, there was no indication of linkage between these two factor pairs.

Five F2 families were included in the studies on waxy bloom and resistance to methyl parathion. The homogeneity P-value was between 0.70 and 0.50. Consequently, the data from these families were pooled for genetic interpretation. Chi-square analyses indicated that heavy waxy bloom and resistance to methyl parathion were each controlled by single dominant genes in these families. Furthermore, there was no indication of linkage between these factor pairs.

Table 2 includes the F3 distributions for the Honey–Wiley crosses. Resistance to methyl parathion is shown to be inherited independently of Rsrs controlling seedling color and Hh controlling waxy bloom.

DISCUSSION

Both the chlorinated hydrocarbons and the phosphate insecticides severely damaged susceptible sorgo varieties, consequently, there was a question as to whether the insecticide or the carrier caused the damage. Commercial grade methyl parathion without the carrier applied to sorgo plants killed the leaves of the susceptible variety Honey but did not seriously damage the resistant variety Wiley. The major damage by the commercial grade of methyl parathion used in this study, therefore, appears to be by the chemical rather than the carrier.

In areas such as the Delta of Mississippi where airplane dusting and spraying is a common practice, susceptible

Table 1. Honey and Wiley and F1 descriptions.

<table>
<thead>
<tr>
<th>Seedling color</th>
<th>Waxy Bloom</th>
<th>Reaction to methyl parathion</th>
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</thead>
<tbody>
<tr>
<td>Honey</td>
<td>Red (RsRs)</td>
<td>Heavy (Hh)</td>
</tr>
<tr>
<td>Wiley</td>
<td>Red (RsRs)</td>
<td>Light (hh)</td>
</tr>
<tr>
<td>F1</td>
<td>Red (RsRr)</td>
<td>Red (RsRr)</td>
</tr>
</tbody>
</table>

1 Cooperative investigations of the Crops Research Division, ARS, USDA, and Mississippi Agricultural Experiment Station. Received for publication Jan. 18, 1964.
2 Research Agronomist and Research Pathologist, Crops Research Division, ARS, USDA.