
INHERITANCE OF GREENBUG RESISTANCE IN OATS

James H. Gardenhire

Resistance to the greenbug, (Toxoptera graminum Rond.), was first observed in small grains by Atkins and Dahms (1) during greenbug outbreaks in 1942. Several barley varieties, all of Oriental origin, were observed to have tolerance to the greenbug in this natural infestation. Only small differences in reaction were observed between genotypes of oats and wheat. Additional field observations were made in 1943 and 1944 but no high degree of resistance was observed in wheat and oats. Dahms et al. (5) tested 221 varieties and strains of oats in search for resistance but observed only minor degrees of resistance. Chada et al. (3), in 1955 and 1956, screened the USDA world collection of oats for greenbug resistance and found several strains to have a relatively high degree of tolerance. Seventy-four of the 77 oats that were found to have some tolerance were subjected to additional testing and 10 of the most resistant strains were listed (3).

Several authors have reviewed the literature (3, 5, 6) on greenbugs. Also, several papers have been published on the inheritance of greenbug resistance in barley and wheat (3, 4, 5, 7, 8, 9, 10).

Two crosses were made in 1958 to study the mode of inheritance of greenbug resistance in oats. 'Russian 77', (C.I. 2898), Avena sativa L., was used as the resistant parent and was crossed to 'New Nortex', (C.I. 3422), Avena byzantina C. Koch, and to (Red Rustproof-Victoria X Richland) X Ranger, Texas Selection 2, hereafter referred to as Selection 2.

The procedure used for testing F2 plants and F3 families in a controlled environmental insectary was that described by Chada (2) and Gardenhire and Chada (8), with one exception. Twenty plants were tested from each F2 family instead of 10; therefore, 6 F3 families were tested in each flat instead of 12. The rating of the plants was the same as described by Gardenhire and Chada (8). The parents of each cross were included in each flat as the susceptible and resistant checks for comparison. The scale used was 1 to 5, with a rating of 1 indicating little or no damage and 5 indicating a plant beyond recovery. Plants rating 1, 2, and 3 were called resistant and those rating 4 and 5 were called susceptible.

The reaction of the F2 plants, F3 families, and unselected F4 heads from F3 tests for goodness-of-fit for monogenic inheritance. The F2 plants from the New Nortex X Russian 77 cross, No F2 plants and only F2 plants from one cross because of inadequate seed supplies, F2 plants from the cross Russian 77 X Selection 2 gave a poor fit (P = 0.01) to a 3:1 ratio. Some plants died before susceptible parent plants were killed. They were killed by seedling diseases, but this was determined and these plants were included in the susceptible group. Randomly selected F2 families gave a close fit to a 1:2:1 ratio (P = 0.70–0.50). In some instances the susceptible plants in the F2 families were tested in each family test.

Based on the present data it is hypothesized that the inheritance of greenbug resistance in the oat variety Russian 77 is conditioned by a single gene pair.

Table 1. Greenbug reaction of susceptible X resistant F2 families, and unselected F3 heads from F2 tests for goodness-of-fit for monogenic inheritance

<table>
<thead>
<tr>
<th>Cross</th>
<th>Generation</th>
<th>Resistant</th>
<th>Segregating</th>
<th>Susceptible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russian 77 X Sel. 22</td>
<td>F1</td>
<td>84</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>20</td>
<td>64</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>7</td>
<td>11</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Unselected heads from F2 bulk population</td>
<td>F3</td>
<td>42</td>
<td>101</td>
<td>56</td>
</tr>
</tbody>
</table>

The reaction of the F2 plants, F3 families, and unselected F4 heads from F3 tests for goodness-of-fit for monogenic inheritance. The F2 plants from the New Nortex X Russian 77 cross, No F2 plants and only F2 plants from one cross because of inadequate seed supplies, F2 plants from the cross Russian 77 X Selection 2 gave a poor fit (P = 0.01) to a 3:1 ratio. Some plants died before susceptible parent plants were killed. They were killed by seedling diseases, but this was determined and these plants were included in the susceptible group. Randomly selected F2 families gave a close fit to a 1:2:1 ratio (P = 0.70–0.50). In some instances the susceptible plants in the F2 families were tested in each family test.

Based on the present data it is hypothesized that the inheritance of greenbug resistance in the oat variety Russian 77 is conditioned by a single gene pair.

Literature Cited

2. CHADA, HARVEY L. Insectary technique for the screening of small grains to the greenbug. J. Econ. Ent. 29:1959.