Inheritance of Greenbug Resistance in Barley

James H. Gardenhire and Harvey L. Chada

The greenbug, (Toxoptera graminum Rondani), is a serious pest of small grains in central and southwestern United States. Since it was first described in Italy in 1852 (8) and first reported from Virginia in the United States in 1882 (16), periodic extensive outbreaks resulting in losses amounting to millions of dollars have occurred in this country (5, 6, 9, 14). Controls for the greenbug have been developed, but they are not always dependable. The use of insecticides is limited by high cost in much of the small grain growing areas of the southwest and by ineffectiveness in cold weather during which greenbugs normally develop and reproduce in fall sown grain. Cultural and biological controls have not been effective in reducing greenbug damage to the crop. Therefore, newer, more effective control methods were sought. The development of greenbug resistant varieties of small grains offers the best approach to the problem.

Atkins and Dahms (1) observed greenbug resistance in Smooth Awn 86, Esaw, Sunrise, Wong, and Nu Er Ta barley varieties during the 1942 outbreak. They also observed resistant segregates in progeny of barley crosses involving resistant varieties.

Studies of the development of greenbug resistant small grain varieties were initiated at Substation No. 6, Texas Agricultural Experiment Station, Denton, Texas, in 1951. The differential reaction of Wintex and Omugi barleys to greenbug infestation under insectary conditions is shown in Figure 1. Similar studies were undertaken at several other locations at about the same time. Several reviews of the literature on greenbug resistance in small grains have been published in recent years (1, 6, 10, 11). In 1955 Dahms et al. (5), by means of greenhouse testing techniques, demonstrated that Omugi, Kearney, and several other barleys had a high degree of greenbug resistance. They concluded on the basis of data on F, and F, populations of crosses involving greenbug resistant parents that with few exceptions resistance in barley was governed by two or more pairs of genes. Chada et al. (3) screened the U.S. Department of Agriculture collection of 1250 winter-type barley varieties for greenbug resistant germ plasm, and a number were found to be more resistant than Omugi, the resistant check variety.

Painter and Peters (12) and Daniels and Porter (7) presented F, data which indicated a single recessive gene for resistance in the wheat selection Dickinson 28A. The latter reported that there also may be modifiers or minor genes involved as the F, plants had a slightly higher tolerance than the susceptible parents. Curtis (4) found that resistance was conditioned by a single recessive gene common to both Dickinson 28A and C.I. 9058.

Data which the authors obtained during 1954–56 from testing the reaction of F, and F, selections from bulk hybrids from the cross Cordova × Omugi indicated that resistance in Omugi was monogenic. However, more definite information on the mode of inheritance in this cross is not available.

The objectives of this study were to determine the mode of inheritance of greenbug resistance in barley and to determine if the character is linked with other genes.

MATERIALS AND METHODS

Greenbug-susceptible varieties carrying tester genes for all the barley chromosomes except chromosomes 5 and 6 were used in this study. They were Cordova, Mo. B538, Caucasus, Khayyam, Hokudo and Cordova × Goliad (Tex. Sel. 47–53–1249). Only Cordova is a commercial variety. Omugi, one of the most resistant varieties known, was used as the resistant parent. All crosses used,