Studies of Inheritance in Crosses Between Landhafer, Avena byzantina L., and Two Selections of A. sativa L.¹

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Materials and Methods

The materials consisted of the F₁, F₂, F₃, and F₄ generations of crosses Landhafer × (a selection from Mindo × Bond) and Landhafer × (a selection from Bond-Rainbow-Joanette). One group of F₁ seedlings was used for studying crown rust reaction and another group was used for further study.

CROWN RUST STUDIES

Crown rust reaction was studied in the seedling stage in the greenhouse. Races 6, 33, and 45 were furnished through the courtesy of M. B. Moore of the Division of Plant Pathology, University of Minnesota; races 1, 3, 4, 5, 68, and 88 were furnished through the courtesy of B. Peturson of the Dominion Rust Research Laboratory, Winnipeg, Canada; and race 2485 was furnished through the courtesy of H. G. Murphy, U. S. Dept. of Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering, Ames, Iowa.

F₃ seedling progeny of random selections of individual plants were tested to races 33 and 45 under greenhouse conditions during the winter of 1948-49. About 20 seeds of each race were planted with the progeny of parental plants, other check races, and variety Bond, used to increase the rust, were planted in convenient groups of 70 pots each. Each group was inoculated by brushing with pots of Bond which had been sporulating, and allowed to sporulate for several days in the greenhouse. The seedlings were then sprayed with a solution of the rust spore in water until the pots were covered, and then kept under mist for about 20 hours. After reinoculation with the race of interest, the seedlings were kept under mist for about 20 hours. After reinoculation with the race of interest, the seedlings were kept under mist for about 20 hours. The reaction to race 33 was measured by clipping the leaves completely off with scissors, allowed to grow until about 4 inches high and before the second leaf appeared, and reinoculated in a similar manner. The seedling infection types as described by Murphy (6) were used in this study. Type 0, indicating susceptible to infection; Type 1, indicating resistant to infection; Type 3, indicating intermediate resistance; and Type 4, indicating intermediate susceptibility to infection.

A wooden framework covered with several layers of cloth was used to cover the 70 pots. This cover was soaked in water and kept over the pots for about 20 hours. Reading of the reaction to race 33 was taken 10 to 14 days after inoculation. After readings were made, the leaves were completely clipped off with scissors, allowed to grow until about 4 inches high and before the second leaf appeared, and inoculated in a similar manner. The seedling infection types as described by Murphy (6) were used in this study. Type 0, indicating susceptible to infection; Type 1, indicating resistant to infection; Type 3, indicating intermediate resistance; and Type 4, indicating intermediate susceptibility to infection.

The reader is referred to Hayes and Immer (3) for a comprehensive review of the literature on inheritance in oats. Recent studies by Foote (1) in which he reported that a single factor from selections of Hajira-Joanette or Victoria-Hajira-Banner determines resistance to all races of stem rust and by Litzenberger (5) in which he reported that a single factor from Landhafer determines resistance to races 1 and 45 of crown rust are of interest in the present study.

As early as 1937 segregates from crosses of Bond with White Russian, Rainbow, and Iogold, which carried the Bond type of crown rust resistance, and Bond itself, were susceptible to crown rust which appeared late in the season in the rust nursery at the Minnesota station. Race 45, one of the races which attacks Bond and its derivatives, has increased in prevalence and has become more widely distributed. It was necessary therefore to plan oat breeding programs to incorporate resistance to these races to which Bond is susceptible.

The variety Landhafer, first used as a crown rust differential host in Germany, was introduced by the U.S. Dept. of Agriculture in 1938 and has proved to be resistant in the seedling stage to all collections of crown rust in this country. Several agronomically desirable selections possessing the Bond type of resistance to crown rust, a combination of factors for resistance to the smuts, and the Hajira-Joanette type of resistance to all known races of stem rust were crossed with Landhafer. The purpose of this paper is to report studies of the inheritance in crosses between Landhafer, Avena byzantina, and two selections of A. sativa with particular attention to reaction to individual races of crown rust. Data were taken also on stem rust reaction and on other characters which differentiate the parental selections.

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