ALTHOUGH yield reductions in barley due to black stem rust, *Puccinia graminis*, Eriks., and Henn. have not averaged very high in the past, there are, nevertheless, several reasons why additional research is needed on this disease. Losses in certain years have amounted to 10 or 15% for entire states or the United States as a whole. Moreover, the sudden increase in prevalence of race 15B has made it desirable to determine sources of resistance to it and the mode of inheritance of this resistance as well as the degree of correlation of reactions of barley varieties at various stages of growth under different environmental conditions. This paper reports such studies.

REVIEW OF LITERATURE

Black stem rust has been studied much more intensively in wheat than in barley because of the greater economic losses in wheat yield and quality. Several reviews have been prepared which summarize the information on resistance of wheat to black stem rust (1, 4, 10). Others have reviewed the literature on the effect of environmental factors on stem rust reaction in seedlings and adults particularly to the same race of stem rust (2, 4). Hart has considered the nature of resistance of wheat to stem rust (3).

Smith (6) reviewed the literature on inheritance of stem rust reaction in barley. In most cases investigators report resistance to be governed by a single major factor plus one or more modifying factors in a cross (4, 5, 7, 8). These biotypes can be differentiated by means of their reaction on certain varieties resistant and susceptible in the same field. A good agreement was found between seedling reactions, using 69 varieties at temperatures of 16°, 20°, 24°, and 28° C. and using races 17, 19, and 56 of stem rust. He found resistance to be conditioned by a single major factor plus one or more modifying genes (4). He obtained in F$_2$ a 15:1 ratio of resistant to susceptible plants. Patterson also reported work on the effect of temperature on seedling reactions, using 69 varieties at temperatures of 16°, 24°, and 28° C. and using races 17, 19, and 56 of stem rust. He found 28° C. to be the temperature at which best differentiation would be made between varieties resistant and susceptible in the field. A good agreement was found between seedling reaction to the same race of rust.

Race 15B has been reported by several investigators to have several biotypes (2, 4, 5, 7, 8). These biotypes were identified by means of their reaction on certain varieties resistant and susceptible in the same field. A good agreement was found between seedling reactions, using 69 varieties at temperatures of 16°, 20°, 24°, and 28° C. and using races 17, 19, and 56 of stem rust.

MATERIALS AND METHODS

All barley varieties studied had the spring growth habit. Many of them were in rod row tests at St. Paul and Minnesota in 1951 and 1952. However, the largest group came from the World Collection of barleys of the United States Department of Agriculture and were obtained originally from many sources both foreign and domestic. Seed of these varieties was provided by Dr. G. A. Wiebe of the Field Crops Research Service of the United States Department of Agriculture.

This research was initiated in the field in the summer of 1951 when 1,042 varieties from the World Collection and additional segregating material tested with races 15B, 17, 19, 38, 56, and 59A of stem rust. The writers are indebted to the Federal Rust Laboratory, St. Paul, Minn., for supplying all races of stem rust used in these studies.