Relation Between Stalk Breakage of Corn and Reaction to Diplodia maydis and Gibberella zeae

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Stalk breakage is a serious problem in corn (Zea mays L.) culture despite substantial efforts to breed for resistance. The incidence of stalk rots has been generally accepted as an indication of relative resistance to stalk breakage (10). Many corn breeders inoculate with Diplodia maydis (Berk.) Sacc. and some inoculate with Gibberella zeae (Schw.) Petch, to determine resistance to stalk rotting organisms. Numerous reports evaluate aspects of inoculation and scoring (5). Few indicate the degree of relation between resistance to stalk breakage and resistance to stalk rotting organisms. Effective use of stalk rots resistance ratings in breeding for resistance to stalk breakage depends upon a high degree of genetic correlation between these characters. This paper is an attempt to evaluate the extent to which genes responsible for reaction to inoculation with stalk rotting organisms influence resistance to stalk breakage.

Several reports in the literature correlate degree of natural infection and premature dying with host reaction to inoculation with D. maydis and other stalk rotting organisms. However, stalk breakage and host reaction are not necessarily correlated just because both are associated with stalk rot. Reported correlation coefficients between host reaction and stalk breakage differ widely. Smitn et al. (6) found a value of +0.82 between host reaction to D. maydis [D. zeae (Schw.) Lév.] and number of broken stalks in tests involving 13 single crosses. They concluded that the relative resistance to stalk rot of the hybrids in their test was measured to a satisfactory degree by means of artificial inoculation. However, Zuber et al. (10) tested 60 hybrids involving 6 inbred lines and found a correlation coefficient of —0.19 between host reaction to D. maydis and stalk breakage. The corresponding value from inoculation with G. zeae was —0.22. Jugenheimer (3) studied 145 inbred lines and obtained a correlation coefficient of +0.15 between host reaction to D. maydis and stalk breakage. A value of —0.02 between G. zeae reaction and natural breakage of stalks was obtained.

Methods

The relation between naturally occurring stalk breakage and host reaction to D. maydis and G. zeae was investigated by correlation studies within families of random F3 inbred lines derived from single-cross hybrids. Parents of the families studied represent the range of resistance to stalk breakage and host reaction found in inbreds commonly used locally. The particular families were chosen because parental contrasts indicated that substantial genetic segregation would occur for the characters studied.

Forty-four F3 lines from the hybrid W9 × C103, 50 from 4Co.63 × W32 and 30 from W187R × W22 were grown in 1960 near Madison, Wisconsin, in 3 separate experiments. A randomized complete-block design with two replications was used in each case. Plots consisted of 20 plants in single 40-inch rows with 20 inches between hills. Single-plant hills were used except for the W9 × C103 lines which were grown in 2-plant hills. Except as indicated, normal cultural practices were used.

Stalks were inoculated in the center of the first elongated internode above the soil surface. All lines of a family were inoculated on the same date, approximately 7 days after 50% silking. The D. maydis inoculum consisted of an aqueous suspension of approximately one million pycnidiospores per milliliter obtained by cultivating an isolate from a naturally infected ear of corn on whole oats.