

Field Evaluation of Corn Inbreds and Selections for Resistance to *Exserohilum turcicum* Race 2

W. L. PEDERSEN, Assistant Professor, and J. M. PERKINS, Assistant Plant Pathologist, Department of Plant Pathology, University of Illinois, Urbana 61801; J. A. RADTKE, Northrup King Company, Mt. Joy, PA 17552; and R. J. MILLER, Holden Foundation Seeds, Williamsburg, IA 52361

ABSTRACT

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Ninety-eight corn inbreds and selections were evaluated for qualitative resistance (lesion type) to *Exserohilum turcicum* race 2 under field conditions in Iowa, Illinois, and Pennsylvania. Plots were inoculated with an indigenous isolate of *E. turcicum* obtained from susceptible lesions on inbreds with the *Ht* gene. Twelve lines had chlorotic-type resistant lesions at all locations; however, several lines were resistant at one or two locations and intermediate, susceptible, or segregating at the other locations.

Additional key words: host-parasite interactions, northern corn leaf blight, *Setosphaeria turcica*, *Zea mays*

Northern corn leaf blight (NCLB) is caused by *Exserohilum turcicum* (Pass.) Leonard & Suggs (teleomorph: *Setosphaeria turcica* (Luttrell) Leonard & Suggs). In 1974, an isolate of *E. turcicum* from Hawaii that was virulent on corn (*Zea mays* L.) inbreds with the *Ht* gene was found and designated race 2 (1). *E. turcicum* race 2 was identified from a seed production field near Brook, IN, in 1979 (8) and from Ohio in 1980 (5). Jordan et al (4) confirmed race 2 was present in most of the U.S. corn belt in 1982. Perkins and Hooker (6) evaluated 84 sources of chlorotic-type lesion resistance, 11 backcross selections, and three susceptible inbreds for resistance to three races (races 1-3) of *E. turcicum* in the greenhouse. The objective of this study was to evaluate potential sources of resistance to *E. turcicum* race 2 at three field locations.

MATERIALS AND METHODS

Eighty-four sources of resistance, 11 backcross selections with the *Ht*, *Ht2*, or *Ht3* genes, and three susceptible inbreds (inbreds and selections are referred to as lines throughout this study) were evaluated for resistance to *E. turcicum* race 2 under field conditions at Williamsburg, IA (1981 and 1982),

Urbana, IL (1982-1984), and Mt. Joy, PA (1982). Each plot consisted of a single row 4 m long with about 12 plants per row; rows were 0.76 m apart. The lines were arranged in randomized complete block designs with two replicates. Corn leaves with susceptible NCLB lesions from plants with the *Ht* resistance gene were obtained from each location and incubated for 48 hr at 20 C in glass petri dishes (9 cm in diameter) lined with moist filter paper. Single conidia from each location were transferred to petri plates containing lactose-casein hydrolysate agar (7) and incubated at 20 C for 21 days. The race of each isolate was determined under greenhouse conditions as described previously (3), using B37, B37*Ht*, B37*Ht2*, and Oh42*Ht3* as differential cultivars. Inoculum for greenhouse and field inoculations was prepared by flooding the plates with distilled water, loosening the conidia with a rubber policeman, and filtering the suspension through four layers of cheesecloth. The conidial concentration was adjusted to about 10,000 conidia per milliliter. Plants were inoculated in the greenhouse study by spraying the seedlings to runoff, incubating them in a mist chamber for 12 hr at 100% relative humidity, and placing them on a greenhouse bench at 23 ± 3 C. Plants in the field study had 20 ml of the conidial suspension sprayed into the whorl at growth stage 2 (2).

Lesions were evaluated 17 days after inoculation (both greenhouse and field) and classified using a modification of the rating scale of Perkins and Hooker (6), where R = chlorotic lesion with little or no necrosis, I = necrotic lesion surrounded by a chlorotic border, S = wilted and necrotic lesion without chlorosis, and Seg = line segregating for R or I and S.

RESULTS

The isolates of *E. turcicum* used in this study from the three locations were identified as race 2; B37 and B37*Ht1* were susceptible and B37*Ht2* and Oh43*Ht3* were resistant (produced chlorotic-type lesions).

Thirty-five lines were classified as resistant, intermediate, or segregating at one or more locations. A summary of the reactions of these lines and their reactions under greenhouse conditions as described by Perkins and Hooker (6) is presented in Table 1. Fourteen lines (including the backcross selections B37*Ht2*, B37*Ht3*, Oh43*Ht2*, and Oh43*Ht3*) were resistant or intermediate at all locations. Four additional lines were resistant or intermediate at two locations, but seedlings did not emerge at one location so reaction type was not determined. Seven lines were resistant or intermediate in Illinois and Pennsylvania but susceptible in Iowa; two lines (R109B and AA8*Ht*) were resistant in Pennsylvania but susceptible in Iowa and Illinois. One line (H52) was resistant in Iowa but susceptible in Pennsylvania. The remaining seven lines were susceptible in Iowa and intermediate, segregating, or susceptible in Illinois or Pennsylvania. A summary of the reactions of the 35 lines and their reactions in the greenhouse as described by Perkins and Hooker (6) is presented in Table 1. Sixty-three lines were susceptible at all locations and are not presented.

DISCUSSION

In this study, the same 98 lines used in the study by Perkins and Hooker (6) were evaluated at three locations (Iowa, Illinois, and Pennsylvania) with an indigenous isolate of *E. turcicum* race 2 from that location. Thirty-five lines were resistant, intermediate, or segregating for resistance at one or more locations. Differences among locations for disease reaction may have been due to variation among isolates of *E. turcicum* race 2, environmental effects, or differences among evaluators. Plants in Iowa and Illinois were rated by the same individual, but the plants in Pennsylvania were rated by a different individual. However, the rating was qualitative and the presence of a chlorotic margin indicated a resistant- or intermediate-type lesion. Therefore, it is possible that different individuals could

Present address of third author: Sungene Technologies Corporation, Box 508, Slater, IA 50244.

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Table 1. Reactions of 35 corn selections and inbreds inoculated with *Exserohilum turcicum* race 2 in the field and greenhouse

Inbred or selection	Disease rating ^a			
	Iowa	Illinois	Pennsylvania	Greenhouse (1-9)
AA8Ht	S	... ^b	R	6.2 ^c
Alexho	S	I	...	2.0
B37Ht2	R	R	R	2.0
B37Ht3	R	R	R	2.1
B37HtN	S	I	Seg	2.6
BS8-258	S	Seg	Seg	1.7
BS8-260	R	R	R	1.6
BS8-261	R	R	R	1.9
BS8-262	S	R	R	2.9
BS8-263	R	R	R	2.0
BS8-264	I	...	R	2.0
BS8-265	S	S	Seg	1.7
BS8-267	S	R	R	3.5
BS8-268	S	I	Seg	2.1
BZU158	S	R	R	2.5
CBSA	R	I	R	2.0
EES647	S	R	R	6.2
EES650	S	I	R	7.6
H52	R	R	S	3.6
K4 Ky36-11	...	I	R	2.0
K55-537	R	I	R	3.5
K720	S	I	R	3.6
Ladyfinger	R	R	R	5.9
MP311	R	I	...	2.0
NK51036	...	I	R	7.2
NN14B	R	R	R	2.0
Oh43Ht2	R	R	R	2.0
Oh43Ht3	R	R	R	2.0
R109B	S	S	R	4.2
R109BR-	R	R	R	4.2
R109BR+	R	R	R	3.2
R134	S	I	Seg	2.6
TZU-39	S	I	R	2.0
081	S	I	...	2.1
407	R	R	R	2.0

^a Lesions were rated as follows: R = chlorotic lesion with little or no necrosis, I = necrotic lesions surrounded by chlorotic border; S = wilted and necrotic lesions without chlorosis, and Seg = line segregating for R or I and S.

^b Indicates missing data.

^c Data from Perkins and Hooker (6).

rate the same line resistant or intermediate, but it is unlikely that they would rate a susceptible (no chlorosis) differently.

The greenhouse reactions (6) of the 35

lines ranged from 1.6 to 7.6 when inoculated with an isolate of *E. turcicum* from Brook, IN (8). Most lines resistant in the field also were resistant in the

greenhouse. However, Ladyfinger popcorn, an original source of resistance to race 1 (3), was resistant at all locations but was rated 5.9 in the greenhouse. A number of lines that were rated 3.0 (resistant) in the greenhouse were susceptible at one or more locations. The differences in field and greenhouse reactions may have been due to environmental differences (light, temperature, relative humidity, etc.), growth stage of the plants, or differences among isolates of *E. turcicum* race 2. The isolate of *E. turcicum* used by Perkins and Hooker (6) and the isolates used in this study were all designated race 2, i.e., virulent on plants carrying the *Ht* gene. However, these isolates may differ for other virulence genes that have not been described.

According to these data, several additional sources of chlorotic-type lesion resistance are available for control of *E. turcicum* race 2. It also appears that with more differential cultivars, additional races of *E. turcicum* may be described.

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