Response of Selected Maize Inbreds to *Erwinia stewartii* and *E. zeae*

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ABSTRACT

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Sixty maize lines, 58 of which were inbreds, were tested in the seedling state and just before tasseling for response to artificial inoculation with two cultures of *Erwinia stewartii* and one of *E. zeae*. Eleven inbreds were resistant to all three cultures at both dates, four inbreds and the known susceptible control were susceptible to all three cultures at both dates, and four inbreds responded differentially to cultures or dates of inoculation. The responses of the remaining lines varied too much to be classified. Results indicate that specificity is an important feature of the *E. stewartii* association with *Zea mays*. Reaction to *E. zeae* could not be separated from reaction to *E. stewartii*.

Erwinia stewartii isolations from Missouri cornfields in 1976 also yielded an atypical *Erwinia* isolate from the House Springs area, named *E. zeae* (2). Our objectives were to determine the response of maize lines to inoculation with *E. stewartii* and *E. zeae* and to determine the basis for host response.

MATERIALS AND METHODS

The 58 maize lines selected from the Maize Research and Breeder's Manual (3) represented a wide range of the northern and southern corn belt. Seed was supplied by cooperative investigators. Two sweet corn lines were included as inoculation controls: Jubilee, known to be susceptible to *E. stewartii*, and FaHt32B × FaHt32C, of unknown reaction character.

The experimental design was a randomized split-split plot for cultures and inoculation dates with two replicates. The seed was planted 16 seeds per 4.6-m row. The atypical *E. zeae* (culture 26) and two typical *E. stewartii* cultures (22A and GC6) were grown in 2-L quantities in 3.8-L jugs on a jiggling shelf in a walk-in growth chamber at 24 C for 28 hr. The inoculum was then transferred to the field site, where it was diluted 1:2 in water for a final concentration of $1.6–2.3 \times 10^8$ cells per milliliter. On 14 June, seedlings in the three or four leaf stage were inoculated with a wounding device (4), and the whorl of the plant was then filled with diluted inoculum using an alcohol-disinfected turkey baster. The entire process was repeated on 21 June because adverse weather conditions may have killed the inoculum used earlier. On 5 July just before tasseling, late inoculations were done with a large-scale version of the wounding device (1) and inoculum of the same concentration.

Disease ratings were made 4 wk after inoculations. Two scales were used to evaluate leaf damage from the two bacterial pathogens. In the Symptom Rating scale, 1 = no symptoms, 2 = chlorosis, 3 = watersoaking and wilt, 4 = necrosis, and 5 = death of plants. In the Area Rating scale, 1 = 0–10%, 2 = 11–25%, 3 = 26–50%, 4 = 51–75%, and 5 = 76–100% of the leaf area infected. Used together, ratings on the two scales define the type of symptoms involved and the extent of the inoculated leaf area exhibiting the symptoms; eg, a rating of 3-4 indicates that 51–75% of the inoculated leaf area was wilted, watersoaked, or both. Combined ratings were arbitrarily grouped into classes to indicate resistant, intermediate, and susceptible host responses. Combined ratings 1, 2-1, 2-2, 3-1, 3-2, and 4-1 indicate resistant responses; combined ratings 2-3, 4-2, 2-4, 2-5, and 3-3 indicate intermediate host responses; combined ratings 3-4, 3-5, 4-3, 4-4, and 5 indicate susceptible host responses.

RESULTS

In 40 lines (A188, A334, A659, AKd36, AR202, AY499, B73, B79, Fa32, Fa56, FaHt32B × FaHt32C [a sweet corn hybrid from Florida used as a control], H60, Ha30, HP302, Ky21, Ky128, M14, Mp412, Mp496, MS116, MS153, N7B, NC246, ND203, NY378, Oh7B, R177, SA24, SC333, SC401, Sg16, T115, T226, Tx127, Tx303, Tx601, W64A, W117, W703) (3), responses varied greatly from plant to plant within a line or the results were conflicting between replications, which made resistance classification of these lines uncertain.

The remaining 20 lines were relatively homogeneous for reaction to the two bacterial cultures. The type, source, and derivation of these 20 lines are as follows: Inbred lines 33-16, white dent (Indiana), Johnson Co. White; B64, yellow dent (Iowa), (41.2504B × B14[3]) Sel.; GA203, white dent (Georgia), T61 × NC37; GA313, white dent (Georgia), Coker 811 × GA24[6]; Ky225, white dent (Kentucky), NCIaDDc × Coah.8; L605, yellow dent (Louisiana), yellow Tux.; Mp311, white dent (Mississippi), Whately Variety; MS211, yellow dent (Michigan), Pickett, O.P.; MS1334, yellow dent (Michigan), (Golden Glow × Maize Amargo) × Golden Glow; N6, yellow dent (Nebraska), Hays Golden; N38, yellow dent (Nebraska), (WF9 × 38-11)38-11[2]; N103, yellow dent (Nebraska), SSS III; N142, yellow dent (Nebraska), Nebraska BIII Syn.; NC230, yellow dent (N. Carolina), K55 × Yel. Single Cross; Oh545, yellow dent (Ohio), (M14 × 1187-2)Oh45 × (Oh45A × Oh45T)Oh45; SC76, yellow dent (S. Carolina), Hastings Prolific × Yellow Tuxpan; T8, yellow dent (Tennessee), Jarvis Prolific; T246A, yellow dent (Tennessee), (Va25 × T204) T204; W153RHt, yellow dent (Wisconsin), Rec. 1153; and Jubilee, sweet corn (Clyde Black and Sons, Iowa).

The lines that proved resistant to the three cultures of *E. stewartii* and *E. zeae* at both inoculation dates were as follows: GA313, L605, Mp311, N6, N142, NC230, Oh545, T8, T246A, SC76, and 33-16. The lines susceptible to the three cultures at both inoculation dates were: B64, W153, MS1334, MS211, and Jubilee. Four lines responded differentially. At both inoculation dates, GA203 and Ky225 were resistant to cultures 22A and 26 but not to culture GC6; N103 was resistant to all late inoculations and susceptible to all early inoculations, and N38A was resistant to cultures GC6 and 26 but not to culture 22A at both inoculation dates.

DISCUSSION

The results of this experiment indicate that the relationship of *E. stewartii* and *Zea mays* is based at least in part on specificity. Inheritance of reaction to *E. stewartii* was not separable from inheritance of reaction to *E. zeae*. The mechanisms for resistance and inheritance of resistance may be entirely different for the two organisms, but no maize line tested exhibited any such difference.

We conclude that the inoculation

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technique was not the source of the variability observed in some lines because of the uniform results observed in the susceptible control line, Jubilee, and in 19 of the inbred lines.

Because response to Stewart's wilt and to halo blight of maize appears to be based on specific interaction of the host and the pathogen, the procedures used in breeding for resistance should be those that can best take advantage of this relationship.

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