RELATIONSHIPS AMONG VEGETATIVE COMPATIBILITY GROUPINGS, TOXIN PRODUCTION, AND VIRULENCE OF *FUSARIUM OXYSPORUM* TO COTTON

A. A. Bell
M. H. Wheeler
Jinggao Liu
R. D. Stipanovic
Lorraine S. Puckhaber
USDA-ARS-SPARC
College Station, TX

Summary

More than 1200 isolates of *Fusarium oxysporum* obtained from cotton were used in a series of studies over 20 years. These isolates were obtained from wilted plants, roots of plants without symptoms, and live seed imported into the U.S. In some cases, these isolates were associated with the severe damage caused by root-knot or reniform nematodes. Various isolates, including type specimens of races 1-6, were obtained from culture collections and other research scientists. The virulence of all isolates to "Rowden" cotton was determined by stem-puncture assay. Based on these results isolates could be divided into a vascular competent group and a root rot group. The former group, which includes type specimens of races 1, 2, and 6, readily colonized the vascular system and caused wilt when puncture-inoculated into xylem vessels near the cotyledonary node of plants with five true leaves. The latter group, which includes type specimens of race 3, race 4, and the Australian biotype failed to colonize the xylem appreciably or cause symptoms following puncture inoculation. Both groups caused severe wilt when root dip inoculation was used.

The two groups varied in host range. The vascular competent group was virulent to okra, alfalfa, tobacco, soybeans and tomato (crown rot assay), as well as *Gossypium* species, whereas the root rot group was restricted to *Gossypium* species alone. The root rot group generally was more virulent to *Gossypium barbadense* than *Gossypium hirsutum*. No reciprocal relationships in virulence to cotton cultivars or other hosts were found within either group to justify designation of races.

These two groups also varied in their toxin profiles and regulation of fusaric acid synthesis. Both produced the nonaketide bikaverin and the depsipeptide beauvericin. The vascular competent group produced various heptaketide toxins, while the root rot group did not. Root rot isolates uniformly produced high concentrations of fusaric acid, which was incompletely inhibited by 1-10 ppm zinc in complex media. Among vascular competent isolates, fusaric acid synthesis was highly variable and readily inhibited by zinc in all media.

Results indicate that *Fusarium oxysporum* isolates that cause wilt belong to two different taxa that should be distinguished at the *formae speciales* level. It is proposed that f. sp. *vasinfectum* continue to be used for the vascular competent isolates such as type specimens of races 1, 2, and 6. Isolates previously identified as races 3, 4 and 5 or the Australian biotype should be assigned to f. sp. *gossypii*, which is consistent with their virulence being restricted to *Gossypium* species.

Most isolates of *F. oxysporum* f. sp. *vasinfectum* belong to one of three major vegetative compatibility groups which are widely distributed in the U.S. and foreign countries. The largest group could be divided further into VCG 1A, 1B, and 1C subgroups. Twenty-two minor VCGs were restricted to single locations. These included type specimens of race 1 and race 6 which were incompatible with more than 150 other isolates. The VCG groups generally showed similar virulence to all hosts, although VCG 1C was slightly more virulent than the others to *Gossypium* species.