NMR STRUCTURAL STUDIES ON THE BIOSYNTHESIS OF FUSARIC ACID IN FUSARIUM OXYSPORUM F. SP. VASINFECTUM

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

Abstract

Fusarium wilt of cotton is caused by *Fusarium oxysporum* Sclecht f. sp. *vasinfectum* (Atk.) Sny. and Hans (*F.o.v.*). *F.o.v.* occurs in most countries where cotton is grown (Bell, 1999; Hillocks, 1992). U.S. cotton producers lost >$24M as a result of infections by *F.o.v.* race 1 in 2005. A genetically unique biotype of the Fusarium wilt pathogen was first recognized in wilted and dead Upland cotton seedlings in Australia in 1993. Since that time, it has spread rapidly despite strict containment practices. On some Australian farms where it was first discovered, losses above 90% have forced cotton production to be abandoned. Australian biotypes were inadvertently introduced into the U.S. in at least two shiploads of cottonseed imported into California for dairy feed. Bell found 17 *F.o.v.* isolates per 10,000 seed; twelve of these showed molecular relationship to race 3 *F.o.v.*, and one of these was vegetatively compatible with the Australian biotype. The Australian *F.o.v.* strain is favored by heavy clay soils and does not require nematodes for severe disease. Thus, it is a threat to 4-6 million acres of cotton grown on heavy alkaline soils in the U.S. (i.e., Texas to California). There is reported to be limited resistance to the Australian *F.o.v.* strain within U.S. cultivars. The Australian biotypes have not yet been found in California cotton fields. However, *F.o.v.* race 4 was identified for the first time in the U.S. (California) in 2000, and races 3 and 8 were recently identified in both California and Louisiana. Race 4 causes severe Fusarium wilt in Pima cultivars (*G. barbadense*). No resistance against race 4 has yet been found in Pima cultivars, although tolerance has been found in a few lines. The phytotoxin fusaric acid has been identified within cotton infected with *F.o.v.* Both the Australian *F.o.v. biotype* and race 4 produce prodigious quantities of the phytotoxin fusaric acid in culture. To investigate the importance of this phytotoxin to pathogenicity, we began an investigation of the biosynthesis of fusaric acid using 13C-labelled acetate. Our preliminary results confirm earlier studies that three acetate units are probably introduced *via* a polyketide synthase and two additional units are introduced *via* aspartate or oxaloacetate.