PHYTOTOXICITY OF FUSARIC ACID AND ANALOGUES TO COTTON

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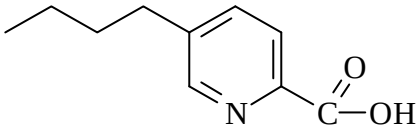
Introduction

Fusaric acid has been isolated from 11 *Fusarium* species including the cotton pathogen, *Fusarium oxysporum* f. sp. *vasinfectum*. Although fusaric acid shows low toxicity to animals, it is classified as a wilt-inducing toxin in many plants including cotton. The latter is particularly sensitive to this compound. We are interested in determining the phytotoxicity of fusaric acid analogues and as such have developed a cotton cotyledonary leaf assay. We used this assay to compare the toxicity of fusaric acid to various analogues. When the molecule of fusaric acid is deconstructed, one finds it is composed of three structural components, the central pyridine ring, the butyl side chain and the carboxylic acid group. We now report the results of our preliminary study to determine the essential components responsible for its phytotoxicity. To this end, we eliminated, changed or rearranged the butyl and the carboxylic acid groups.



Fusaric Acid

Bioassay

Compounds were dissolved in 0.1% Tween 80. Five concentrations (0.5 mM, 1.0 mM, 2.0 mM, 4.0 mM and 8.0 mM) of each compound (20 µL each) were placed on each of three locations on seven day-old cotyledonary leaves and the leaves were pierced with a needle through each drop of solution. The control was 20 µL of the 0.1% Tween 80. After two days, plants were scored independently by three persons giving ratings of 0 to 5, with 0 meaning no symptoms and 5 severely necrotic lesions (see below). Each test was replicated 4 times.

Results

Our results show that the carboxylic acid group is essential for toxicity. That is, 3-butylpyridine is not toxic. Conversion of the carboxylic acid group to the methyl ester provided a more toxic compound, while reduction of the carboxylic acid to the aldehyde provided a less toxic compound. Moving the carboxylic acid from the 2- to the 3-position (i.e., 5-butylnicotinic acid) or conversion of the fusaric acid side chain to a propyl or a pentyl group all reduced toxicity. Of the compounds tested, fusaric acid and its methyl ester were among the most phytotoxic compounds showing severe wilting at 8.0 mM and detectable necrosis at the point of piercing at 0.5 mM (Figure 1). Thus, it would appear that evolutionary pressures within *Fusarium oxysporum* have combined to produce an effective phytotoxin from the basic pyridine carboxylic acid building blocks.

Figure 1.