

Efficacy of potential biocontrol agents for control of *Fusarium verticillioides* and fumonisin B₁ under different environmental conditions

ABSTRACT

A mycotoxigenic strain of *Fusarium verticillioides* previously isolated from Malaysian maize kernels and identified morphologically and molecularly was used in the present work. The objectives were (1) to screen the competitiveness of three potential antagonists isolated from Malaysian maize and three other known candidates for control of growth of *F. verticillioides* in vitro based on interaction scores, growth rates and hyphal area of *F. verticillioides*, and (2) to examine the best candidates using different spore/cell ratios on milled maize agar at different water activity conditions on relative control of fumonisin B₁ (FB₁). Three fungi and three bacteria (BCAs 1-6) were examined for antagonistic effects against *F. verticillioides* in dual-culture assays. These showed that all fungal candidates intermingled with *F. verticillioides* while all bacterial candidates inhibited *F. verticillioides* on contact or at a distance, which in turn decreased the growth rates and hyphal area of *F. verticillioides* significantly. Although BCA1 (*Clonostachys rosea* 016) did not inhibit growth or hyphal area of *F. verticillioides*, it was included in FB₁ inhibition studies with other bacterial candidates (BCA4, *Streptomyces* sp. AS1; BCA5, Gram-negative rod; BCA6, *Enterobacter hormaechei*) because of its established mycoparasitism. The FB₁ inhibition studies were conducted on milled maize agar with different spore/cell ratios of pathogen:antagonist mixtures at 0.95/0.98 water activity (a_w) and 25 °C for 14 days. FB₁ biosynthesis for all treatments was significantly higher at 0.95 than 0.98 a_w . Of the four antagonists tested, the best was BCA1 which inhibited FB₁ biosynthesis by 73 and 100% at 0.95 and 0.98 a_w , respectively. BCA5 was the next best, resulting in 38 and 78% FB₁ inhibition at 0.95 and 0.98 a_w , respectively. The pathogen:antagonist ratios for BCA1 and BCA5 showed best results at 50:50 and 25:75. These results were discussed in context of using biocontrol agents to minimise fumonisins in maize.

Keyword: Biocontrol; Fungal and bacterial antagonists; Environmental factors; Growth inhibition; Mycotoxin control