Cocoa-associated filamentous fungi for the biocontrol of aflatoxigenic Aspergillus flavus

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Abstract

Aflatoxin and other mycotoxin contamination are major threats to global food security and present an urgent need to secure the global food crop against spoilage by mycotoxigenic fungi. Cocoa material is noted for naturally low aflatoxin contamination. This study was designed to assess the potential for harnessing cocoa-associated filamentous fungi for the biocontrol of aflatoxigenic Aspergillus flavus. The candidate fungi were isolated from fermented cocoa beans collected from four cocoa-growing areas in Ghana. Molecular characterization included ITS-sequencing for identification and PCR to determine mating type. Effects of the candidate isolates on growth and aflatoxin-production by an aflatoxigenic A. flavus isolate (BANGA1) were assessed. Aflatoxin production was monitored by UV fluorescence and quantified by ELISA. Thirty-six filamentous fungi were cultured and identified as Aspergillus, Cladosporium, Lichtheimia or Trichoderma spp. isolates. The isolates generally interacted negatively with BANGA1 growth and aflatoxin production. The A. niger and A. aculeatus biocontrol candidates showed the strongest colony antagonism (54–94%) and reduction in aflatoxin production (12–50%) on agar. In broth, the A. niger isolates reduced aflatoxin production by up to 97%. Metabolites from the A. niger isolates showed the strongest inhibition of growth by BANGA1 and inhibited aflatoxin production. Four of the candidate isolates belonged to the MAT1-1 mating type and 12 identified as MAT1-2. This may be indicative of the potential for genetic recombination events between fungi in the field, and finding which is particularly relevant to the risk posed by A. flavus biocontrol measures that rely on atoxigenic A. flavus strains.

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