Effect of temperature, water activity and carbon dioxide on fungal growth and mycotoxin production of acclimatised isolates of Fusarium verticillioides and F. graminearum

ABSTRACT

Climate change is primarily manifested by elevated temperature and carbon dioxide (CO2) levels and is projected to provide suitable cultivation grounds for pests and pathogens in the otherwise unsuitable regions. The impacts of climate change have been predicted in many parts of the world, which could threaten global food safety and food security. The aim of the present work was therefore to examine the interacting effects of water activity (aw) (0.92, 0.95, 0.98 aw), CO2 (400, 800, 1200 ppm) and temperature (30, 35 °C and 30, 33 °C for Fusarium verticillioides and F. graminearum, respectively) on fungal growth and mycotoxin production of acclimatised isolates of F. verticillioides and F. graminearum isolated from maize. To determine fungal growth, the colony diameters were measured on days 1, 3, 5, and 7. The mycotoxins produced were quantified using a quadrupole-time-of-flight mass spectrometer (QTOF-MS) combined with ultra-high-performance liquid chromatography (UHPLC) system. For F. verticillioides, the optimum conditions for growth of fumonisin B1 (FB1), and fumonisin B2 (FB2) were 30 °C + 0.98 aw + 400 ppm CO2. These conditions were also optimum for F. graminearum growth, and zearalenone (ZEA) and deoxynivalenol (DON) production. Since 30 °C and 400 ppm CO2 were the baseline treatments, it was hence concluded that the elevated temperature and CO2 levels tested did not seem to significantly impact fungal growth and mycotoxin production of acclimatised Fusarium isolates. To the best of our knowledge thus far, the present work described for the first time the effects of simulated climate change conditions on fungal growth and mycotoxin production of acclimatised isolates of F. verticillioides and F. graminearum.

Keyword: climate change; Mycotoxins; Aw; CO2; Temperature; F. verticillioides; F. graminearum