Modeling growth rate and assessing aflatoxins production by Aspergillus flavus as a function of water activity and temperature on polished and brown rice

ABSTRACT

he aim of this study was to model the radial growth rate and to assess aflatoxin production by Aspergillus flavus as a function of water activity (aw 0.82 to 0.92) and temperature (12 to 42 °C) on polished and brown rice. The growth of the fungi, expressed as colony diameter (mm) was measured daily, and the aflatoxins were analyzed using HPLC with a fluorescence detector. The growth rates were estimated using the primary model of Baranyi, which describes the change in colony radius as a function of time. Total of 2 secondary models were used to describe the combined effects of aw and temperature on the growth rates. The models were validated using independent experimental data. Linear Arrhenius–Davey model proved to be the best predictor of A. flavus growth rates on polished and brown rice followed by polynomial model. The estimated optimal growth temperature was around 30 °C. A. flavus growth and aflatoxins were not detected at 0.82 aw on polished rice while growth and aflatoxins were detected at this aw between 25 and 35 °C on brown rice. The highest amounts of toxins were formed at the highest aw values (0.90 to 0.92) at a temperature of 20 °C after 21 d of incubation on both types of rice. Nevertheless, the consistencies of toxin production within a wider range of aw values occurred between 25 to 30 °C. Brown rice seems to support A. flavus growth and aflatoxin production more than the polished rice.

Keyword: Aflatoxin; Aspergillus flavus; Brown rice; Modeling; Polished rice; Water activity; Temperature