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Isolation and Identification of Novel Escherichia Marmotae Spp.: Their Enzymatic Biodegradation of Zearalenone and Deep-oxidation of Deoxynivalenol

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Abstract : Fusarium spp. produce numerous mycotoxins, such as zearalenone (ZEN), deoxynivalenol (DON), and its acetylated compounds, 3-acetyl-deoxynivalenol (3-ADON) and 15-acetyl-deoxynivalenol (15-ADON) (15-ADON). In a co-culture system, the soil-derived Escherichia marmotae strain degrades ZEN and DON into 3-keto-DON and DOM-1 via enzymatic deep-oxidation. When pure mycotoxins were subjected to Escherichia marmotae in culture flasks, degradation, and detoxification were also attained. DON and ZEN concentrations, ambient pH, incubation temperatures, bacterium concentrations, and the impact of acid treatment on degradation were all evaluated. The results of the ELISA and high-performance liquid chromatography-electrospray ionization-high resolution mass spectrometry (HPLC-ESI-HRMS) tests demonstrated that the concentration of mycotoxins exposed to Escherichia marmotae was significantly lower than the control. ZEN levels were reduced by 43.9%, while zearalenone sulfate ([M/z 397.1052 C18H21O8S1) was discovered as a derivative of ZEN converted by microbes to a less toxic molecule. Furthermore, Escherichia marmotae appeared to metabolize DON 35.10% into less toxic derivatives (DOM-1 at m/z 281 of [DON - O]+ and 3-keto-DON at m/z 295 of [DON - 2H]+). These results show that Escherichia marmotae can reduce Fusarium mycotoxins production, degrade pure mycotoxins, and convert them to less harmful compounds, opening up new possibilities for study and innovation in mycotoxin detoxification.

Keywords : mycotoxins, zearalenone, deoxynivalenol, bacterial degradation
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