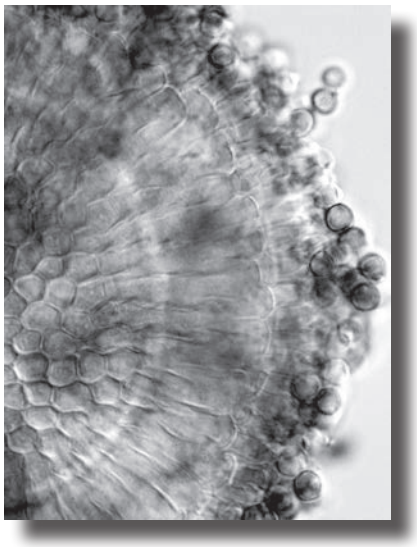
Food mycology in a globalized world - Challenges and solutions to the safety of food.

2013 June 3-5, Freising

MUTUAL REGULATION OF THE BIOSYNTHESIS OF OCHRATOXIN A AND CITRININ IN PENICILLIUM VERRUCOSUM AS AN ADAPTATION TO DIFFERENT HABITATS

Dominic A. Stoll*, Markus Schmidt-Heydt and Rolf Geisen

Max Rubner-Institut, Department of Safety and Quality of Fruits and Vegetables – Karlsruhe, Germany. *Presenter: dominic.stoll@mri.bund.de



The FAO estimates that up to 25% of the world's crop harvest is contaminated with filamentous fungi or their mycotoxins. For this reason it is important to understand the regulation of mycotoxin biosynthesis in order to develop prevention strategies to reduce the mycotoxin contamination of food and feed. In this study, the regulation of the biosynthesis of ochratoxin A (OTA) and citrinin (CIT), two hepato- and nephrotoxic mycotoxins produced by P. verrucosum, were investigated. In P. verrucosum the production of OTA and CIT is mutually regulated. On NaCl-rich media the biosynthesis of CIT is reduced, whereas that of OTA is increased. It could be shown that the production and excretion of the chloride-containing OTA molecule ensures cellular chloride-homeostasis under hypersalinic growth conditions. Changes in the concentration of NaCl in the environment are transmitted to the transcriptional level by the HOG-MAPK signal cascade, which results in an adaptation of gene expression. Ochratoxin biosynthesis seems to be regulated by the Hog-MAPK-pathway. Western Blot experiments showed a correlation between the phosphorylation status of the HOG1-homologue of P. verrucosum and induction of OTA biosynthesis. Inactivation of hog1 in P. verrucosum by gene knock out abolishes OTA biosynthesis under high NaCl conditions. In contrast, under oxidative stress conditions the biosynthesis of OTA is reduced and CIT production is increased instead. Changes in the oxidative status are often transmitted to the transcriptional level by a G-protein/cAMP/PKA signal cascade. In the current analysis a correlation between internal cAMP-levels and biosynthesis of CIT could be demonstrated. External application of cAMP resulted in a reduced biosynthesis, suggesting the involvement of such a signal cascade in the regulation of CIT biosynthesis. Citrinin is described to have antioxidative properties, which makes the induction of CIT biosynthesis under oxidative conditions favorable for the fungus. These results suggest that in P. verrucosum, the biosynthesis of OTA or CIT apparently act as an adaptation mechanism to hypersaline respectively oxidative stress conditions.