Foreword – special issue Mycotoxins in China

Mycotoxin contamination in agro-food systems has been a serious concern over the last few decades around the world, and very much as well in China. The change of climate and farming methods are favourable for prevalence of toxigenic fungi and consequently cause the increase of mycotoxins in food and feed. Against this background, this special issue 'Mycotoxins in China', consisting of five review and 12 original research articles, is dedicated to the most recent advances in both fundamental and applied mycotoxin research. Most of the authors are senior experts with multidisciplinary background. They provide a comprehensive discussion on state-of-the-art studies on mycotoxins in China, covering microbiology, toxicology, chemistry and statistics. We hope that the papers collected here will provide deep insight and inspiration to the readers to further improve strategies, technologies and methods dealing with the analysis, degradation and prevention of mycotoxin, not only in China, but around the world.

Highlights of this special issue can be classified into the following research areas:

Development of field control strategies

Fusarium head blight (FHB) is one of the most damaging diseases of wheat in China, causing yield reduction and severe mycotoxin accumulation in kernels. The use of FHB-resistant wheat cultivars is considered to be the most cost-effective strategy to control the disease and reduce mycotoxins in wheat. Yan *et al.* (2020) evaluated FHB resistance levels of a nationwide collection of 129 Chinese wheat cultivars to assess the impact of prolonged breeding for reduced infection/FHB (Type II resistance) as well as effects on mycotoxin accumulation (Type III resistance). A strong correlation was found between the regions from which the cultivars originate and disease index. The middle and lower reaches of Yangtze River Region showed the highest disease resistance, followed by the upper reaches. FHB resistance of cultivars from Huanghuai Region was lowest and all cultivars in these regions are highly or moderately susceptible. Yan *et al.* found FHB resistance was not well correlated with toxin accumulation, especially within the ecological regions. By comparing the toxin content of cultivars from different regions with similar resistant levels, they also found the cultivars in Yangtze River Region may have independent type III resistant genes. These indicated that selection of cultivars with low toxin accumulation by disease evaluation could result in overlooking cultivars that show type III resistance with low toxin accumulation. Based on the results, they recommend that besides scoring for disease index also mycotoxin accumulation in cultivars is incorporated in breeding procedures and the evaluation of cultivars. This will be helpful to improved FHB resistance in

cultivars, which is urgently needed due to the dramatically increased disease and mycotoxin contamination in China.

Because of lack of resistant wheat varieties, FHB management relies heavily on fungicides application in China nowadays. Due to the increase of fungicide resistance to carbendazim and triazoles and environmental protection requirements, it is imperative to screen for new, environmentally friendly, fungicides. Shi *et al.* (2020) investigated the toxicity of the biofungicide tetramycin in *Fusarium graminearum* *in vitro* and evaluated its control efficiency for FHB in the field. Tetramycin showed strong inhibitory activity on the mycelial growth and spore germination in lab, two-years field trials indicated its good control efficiency for both disease index and deoxynivalenol (DON) accumulation. This is also the first report that besides reducing disease severity, inhibiting Tri5 expression is another important way of tetramycin to reduce DON contamination. Shi and coworkers also reported the synergistic effect between tetramycin and metconazole, which was potentially important for reducing the application of chemical fungicides and protection of the environment. Overall, they concluded that tetramycin is an alternative option for FHB and mycotoxin management.

Development of immunochromatographic assays

Lateral flow assays (LFAs) are one of the most popular mycotoxin detection methods because of their rapidity, easy handling, visualisation of the test results and ability to use them cost-effectively also for single samples. So far, several LFAs have been developed for the rapid detection of ochratoxin A (OTA), however, most of them are based on the traditional OTA-conjugates or chemosynthetic mimotope peptides, which are very high-cost reagents

with a detrimental effect on environment and operators. You *et al.* (2020) developed a novel environmental-friendly and low-cost LFA for OTA detection with biosynthesised mimetic OTA-conjugates. The biosynthetic mimetic OTA-conjugates are 'cloneable' homogeneous products expressed from a constructed express plasmid, which can be prepared reproducibly in large scale and at low cost. Also, the novel developed LFA for OTA is 10-fold more sensitive than chemosynthetic mimotope peptide based LFA and it is potential to be used for detecting other mycotoxins.

Other bio-control approaches

The most effective way for avoiding the accumulation of aflatoxins in food supplies is to prevent its production in the field before harvest. Gong *et al.* (2020) identified a potential biocontrol agent, the marine bacterium *Staphylococcus saprophyticus* strain L-38, which showed high antifungal activity toward nine phytopathogenic fungi including *Aspergillus flavus*. The effective compound produced by L-38 was further identified as 3,3-dimethyl-1,2-epoxybutane (3-DE). Artificial inoculation experiments on maize and peanuts showed L-38 can significantly inhibit *A. flavus* germination and almost completely block aflatoxin biosynthesis. This work indicated L-38 and 3-DE could be potential broad-spectrum biocontrol agents against toxigenic and phytopathogenic fungi and provide new options for mycotoxin management pre- and post-harvest.

Risk assessment associated with multiple mycotoxins exposure

The risk of human exposure to multiple mycotoxins raised a growing concern about their potential impact on human health. Dong *et al.* (2020) characterised the risk of dietary exposure of aflatoxins, fumonisins (FBs), DON and zearalenone (ZEN) in maize from the Shandong province. Evaluation of mycotoxins in 520 maize samples showed that the average concentration did not exceed the Chinese regulatory limit, although the incidences of each mycotoxin in maize were high. Based on the investigation of dietary exposure, exposure to FBs, DON and ZEN by all four groups were low at the mean maize consumption level, while exposures to FBs and DON were higher at the high maize consumption level. Risk assessment also showed a low risk for liver cancer due to consumption of aflatoxin B₁ contaminated maize.

In addition, other fine contributions to this special issue include three articles on prevention strategies, three on biodiversity of toxigenic fungi, four on detection method development, two on toxicological aspects and a study on mycotoxin degradation.

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