Protecting egg quality from the effects of mycotoxins

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Mycotoxin contamination of feed is a known problem that poses a serious risk to birds and costs the poultry industry billions of dollars worldwide. In the US alone, economic losses due to aflatoxin, fumonisins and deoxynivalenol were estimated at around US $900 million per year. Ducks, turkeys and chickens are all susceptible to the negative effects of mycotoxins, though to different degrees and depending upon a number of factors on the farm. Among metabolites that are of concern for the poultry industry, residues from aflatoxins, ochratoxins and fumonisins have been shown to carry over into animal products such as eggs, tissues and blood.

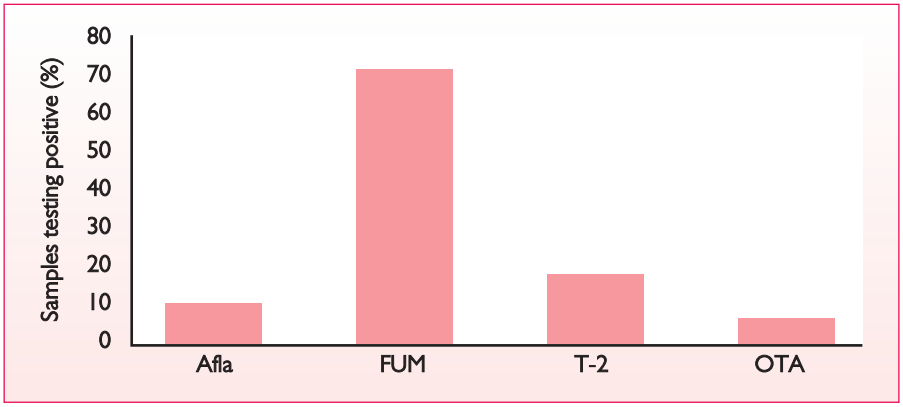

Fig. 1. Positive samples (Biomin Mycotoxin Survey, January to June 2015).

	Afla	T-2	FUM	OTA
Number samples tested	450	335	428	339
Average of positive (µg/kg)	48	86	1,343	2
Maximum (µg/kg)	291	484	16,258	7

Table 2. Biomin Mycotoxin Survey results for corn (2015).

Harm to chicken embryos

Toxicity experiments on chick embryos were carried out over recent years for several groups of mycotoxins. Most of the publications focus on three main parameters: toxicity effects, pathological and eventual teratogenic effects.

Table 1 summarises the results of scientific studies on mycotoxins that are most relevant to the poultry industry and where the carry over of residues in eggs was demonstrated. The main effects of fusarium toxins (fumonisins and T-2 toxin), aflatoxin B1 (AFB1) and ochratoxin A (OTA) concentrations are shown in Table 1.

All experiments were carried out in ovo under laboratory conditions.

Since 2004, the annual Biomin Mycotoxin Survey has tested finished feed and a broad range of feed raw materials including all major grains, protein sources and by-products. Table 2 shows the latest survey results for corn (maize) regarding occurrence, average concentration, number of samples tested and maximum concentration. For fumonisins and aflatoxins, average concentration levels in

Continued on page 13

Table 1. Summary of relevant mycotoxins' effects on poultry embryos.

Toxin	Concentration (ppb)	Main effects
Fumonisin B1, B2 and B3	40 to 1280ppb/egg	Several organ lesions were observed after microscopic examination at day 10. Fumonisin B1 lethal to half of population after 72 hours incubation at 340ppb.
AFB1 and OTA1	5ppb/egg alone, 46ppb/egg in combination	Everted viscera, exencephaly, crossed beak, mortality ranged from 27.5% (one toxin at the lowest concentration) to 37.5% (combination of toxins at the lowest concentration).
T-2 Toxin	250ppb, radio-labelled	0.04% T-2 was found in egg yolk and 0.13% T-2 was found in egg white after 24 hours. T-2 toxin has embryotoxic and teratogenic effects in embryo, inducing malformation and high mortality.

Continued from page 11
the field matched levels used in the toxicity experiments, which is unexpectedly high.

For OTA and T-2, the average concentration level was considerably lower than the laboratory test: something that is more commonly expected.

Find one, find many

While a single mycotoxin alone can negatively impact birds and embryos, a decade worth of data indicates that in the field several mycotoxins are often found together. According to the latest results, 60% of corn samples analysed worldwide contain two or more mycotoxins, while another 32% contain at least one.

As mycotoxin detection technology becomes more sophisticated, the picture becomes even more crowded.

Using a powerful new tool (Spectrum 380) for the detection of mycotoxins and their metabolites, based on liquid chromatography coupled to tandem mass spectrometry (LC-MS/MS), analysis reveals that 18 different metabolites were found in more than 50% of the samples analysed (Fig. 2).

This co-occurrence of mycotoxins can pose further danger, since a number of mycotoxins have been found to have synergisms, or enhanced negative effects on poultry. For example, the aflatoxin/ochratoxin combination in Table 1 increased the mortality rate by 10 percentage points. This means that even low levels of mycotoxins can interrupt egg production.

Risk management

The EU registration represents a benchmark for quality and proves the safety and effectiveness of feed additives. The adsorption strategy is over 90% effective against aflatoxins.

Biotransformation is the degradation of mycotoxins into non-toxic compounds. In the case of fusarium toxins (trichothecenes including T-2 and fumonisins), degradation is carried out by a patented bacterial strain (Biomin BBSH 797) and a purified enzyme (FUMzyme), directly in the intestinal tract of the animal. Mycofix degrades 100% of fumonisins.

Furthermore, Biomin MTV – non-pathogenic yeast – protects against OTA and ZEN. The bioprotection strategy uses a mix of algae and plant extracts to protect the liver and strengthen the natural immune support, compensating for the adverse effects of mycotoxins.

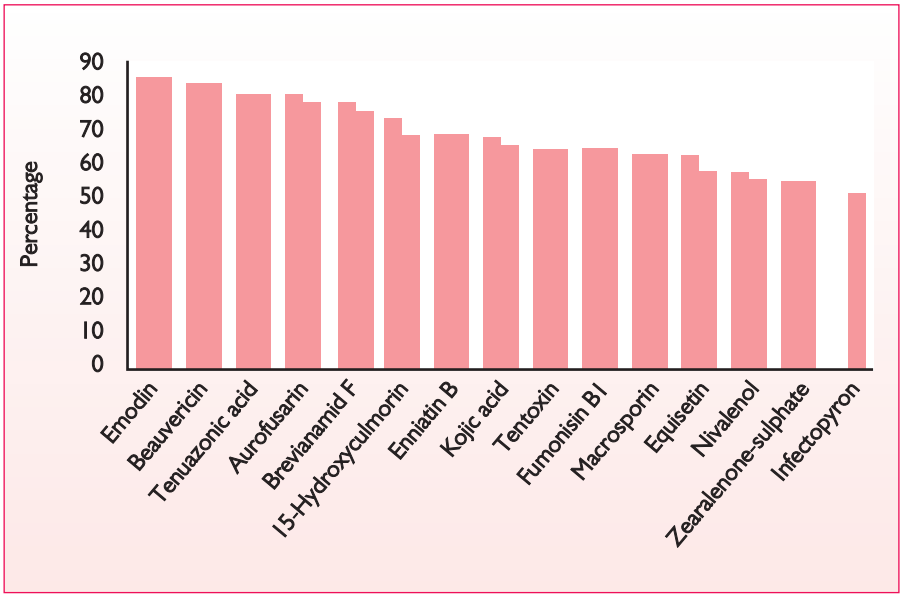

Fig. 2. Mycotoxin occurrence using Spectrum 380 for corn samples worldwide. Cut off for each metabolite was 1ppb, except for aflatoxins (0.5ppb).

Conclusion

Mycotoxins have a strong carcinogenic potential that negatively effects hatchable eggs, inducing mutations in the offspring in some cases. The negative impact of mycotoxins on embryos can be further aggravated by the co-occurrence of different metabolites.

Robust mycotoxin risk management that includes regular detection coupled with the use of an authorised deactivating product will help to ensure overall animal health and performance, egg production and offspring viability. ■

References are available from the author on request