Tropane Alkaloids

Food and feed in the spotlight

Tropane alkaloids (TA) are secondary metabolites with more than 200 different substances identified in various plants. When growing in direct vicinity of crops, tropane alkaloid containing plants are potential contaminants of various food and feeding stuffs. The risk of contamination usually increases if seeds of the alkaloid containing plant resemble those of the cultivated plant – as it is the case for datura and buckwheat. With respect to their occurrence in food, the TAs investigated in greatest depth are (-)-hyoscyamine and (-)-scopolamine.

As stated in a recent EFSA Opinion, the analysis of tropane alkaloids may be relevant in cereals and cereal-based baby food, buckwheat, oilseeds, sunflower or soybean products and herbal tea.

Occurrence in plants

Tropane alkaloids are secondary metabolites which naturally occur in plants of seven angiosperm families:

- Brassicaceae (the mustard family)
- Solanaceae (the nightshade or potato family)
- Erythroxylaceae (the coca family)
- Convolvulaceae (the bindweed or morning glory family)
- Euphorbiaceae (the spurge family)
- Proteaceae
- Rhizophoraceae (the mangrove family)

Especially Brassicaceae and Solanaceae are known for their many grown edible species, while the families Erythroxylaceae and Rhizophoraceae do not contain any important food species.

Generally, the TAs can be found in all parts of the plants and are responsible for the toxic effects of some of these plants.
Occurrence in food & feed

Contamination of food or feed with parts (mostly seeds) of certain TA containing plant species may occur. Primarily reported are botanical impurities of seeds of Datura stramonium (Jimson weed or thorn apple) and other Datura spp. as well as berries of Atropa belladonna (deadly nightshade) and Hyoscyamus niger (henbane).

Cereals and cereal-based infant food, pseudo-cereals such as buckwheat and millet, oilseeds such as linseed, sunflower or soybean products and herbal tea may be amongst the product groups of concern.

Substances & Toxicology

Although more than 200 different TAs have been identified in various plants so far, respective data on their toxicity is limited. Most studied TAs are (-)-hyoscyamine and (-)-scopolamine. In contrast to their (+)-enantiomers, these two are formed naturally. The racemic mixture of (-)-hyoscyamine and (+)-hyoscyamine is called atropine.

With its Scientific Opinion published in 2013, the European Food Safety Authority (EFSA) established a group ARfD (Acute Reference Dose) of 0.016 µg/kg bodyweight for the sum of (-)-hyoscyamine and (-) scopolamine. The EFSA concluded that there is a possible health concern for toddlers who consume cereal based food for infants and young children.

Regulatory Provisions

In June 2015, the EU Commission published a Recommendation (2015/976) to monitor the presence of tropane alkaloids in cereal (-products), gluten-free products, nutritional supplements, (herbal) teas, legume vegetables, pulses, oilseeds and derived products.

In March 2016, Commission Regulation 2016/239 amending Commission Regulation 1881/2006 came into force laying down maximum limits of 1.0 µg/kg for each atropine and scopolamine in processed cereal-based foods and baby foods for infants and young children, containing millet, sorghum, buckwheat or their derived products.

Analysis

Our experts from the Competence Centre for Mycotoxins & Biotoxins offer the analysis of the most important tropane alkaloids atropine (sum of (+)- and (-)-hyoscyamine) and scopolamine in all relevant food and feed matrices via LC-MS/MS. Requirements regarding the limit of quantification given in the EU documents are fulfilled.