Tropane Alkaloids

Food and Feed in the Spotlight

Various plants produce tropane alkaloids (TA) as secondary metabolites. More than 200 different TA have been identified.

When growing TA containing plants in direct vicinity of crops, they might contaminate various food and feeding stuff. The risk of contamination usually increases further, if the seeds of the alkaloid containing plant resemble those of the cultivated plant. Thus, the TA-containing seeds of datura are closely similar to the cultivated pseudo-cereal buckwheat.

As stated in an Opinion of the European Food Safety Authority (EFSA), tropane alkaloids are of particular toxicological relevance in cereals and cereal-based baby foods, buckwheat, millet, oilseeds such as linseed and sunflower seeds, soy products and herbal teas.

Occurrence in Plants

In general, TA can potentially occur in all plant parts and are responsible for the toxic effects of some of these plants. TA occur naturally in the angiosperm family of plants:

- 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 cultivated species with edible plant parts. Among the Erythroxylaceae and Rhizophoraceae families are no important food species.

Occurrence in Food & Feed

Food or feed can be contaminated with TA by means of certain parts and especially seeds: Primarily reported are botanical impurities with 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).

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 March 2016, maximum levels came into force 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 via the former European Contaminants Regulation (EC) No. 1881/2006. These maximum levels for atropine and scopolamine were extended to maize-based baby foods in September 2021.

From September 2022, further maximum levels entered into force for millet and sorghum, corn, buckwheat and herbal tea. Food that has been legally placed on the market by end of August 2022 may continue to be marketed until the best-before or use-by date.

All mentioned maximum levels have been transferred to the new European Contaminants Regulation (EU) 2023/915.

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. In addition to atropine and scopolamine, Eurofins offers now the analysis of anisodamine, norscopolamine and convolvine in cereals, tea and herbal tea.

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