

CHAPTER 10 - TROPANE AND PYRROLIZIDINE ALKALOIDS IN FOOD



Datura Stramonium

NATURAL TOXINS, NOT PESTICIDE RESIDUES

Numerous plant species synthesise secondary metabolites with ecological functions. Some may become unwanted food contaminants when wild plants or parts of them are harvested alongside crops, or when their products reach materials intended for consumption.

Tropane and pyrrolizidine alkaloids belong to different families and must not be confused. Their natural origin does not automatically make them harmless: chemical identity, quantity and mode of exposure all matter in their assessment.

TROPANE ALKALOIDS: ATROPINE AND SCOPOLAMINE

Atropine and scopolamine can be produced by certain plants, including species of the genus *Datura*. Seeds and plant fragments accidentally harvested with cereals and other crops can contaminate batches. Concern includes grains and cereal-based products under particular supply-chain conditions.

These alkaloids act on the parasympathetic nervous system through antimuscarinic effects. At sufficient doses they can cause acute symptoms, including changes in heart rate, dryness of mucous membranes and neurological symptoms. Severity depends on dose; analytical detection and clinical poisoning are not synonymous.

PYRROLIZIDINE ALKALOIDS: A DIVERSE FAMILY

Various pyrrolizidine alkaloids are synthesised by plants belonging, among others, to the Asteraceae, Boraginaceae and Fabaceae families. Fragments of weeds can enter plant-derived raw materials; transfer through nectar and pollen can also affect some bee products.

Certain compounds in this family, particularly relevant 1,2-unsaturated alkaloids and their N-oxides, are of concern because of their potential genotoxicity and carcinogenicity. Not all molecules have identical biological activity. EFSA assessments have examined exposure particularly through tea, herbal infusions, honey and botanical supplements.

FOODS AND CONTAMINATION PATHWAYS

For tropane alkaloids, the issue may be accidental contamination of harvested crops by seeds of weed species. Raw-material selection, field practices and cleaning of equipment play a significant role.

For pyrrolizidine alkaloids, herbal infusions, tea, botanical products and honey may be relevant. It would be incorrect to conclude that all honey or herbal tea contains concerning amounts: botanical composition, origin and supply-chain management influence actual exposure.



EUROPEAN LIMITS AND ANALYSIS

Regulation (EU) 2023/915 sets maximum levels for particular food categories concerning atropine and scopolamine and the sum of specified pyrrolizidine alkaloids. Comparing results against these limits requires attention to which compounds are included in the sum, units of measurement and product categories.

Liquid chromatography coupled with mass spectrometry is widely used for targeted analyses. A panel limited to a single molecule does not characterise an entire family: analytical coverage, reference standards and performance in the relevant food matrix must be assessed.

HOW CAN EXPOSURE BE REDUCED?

Prevention begins in fields with weed management and continues through harvesting, cleaning, selection and traceability. Cooking and infusion must not be regarded as universal guarantees that unwanted molecules will be eliminated.

Consumers are advised to favour products from controlled supply chains and avoid botanical preparations of uncertain origin, especially those promising medicinal effects without reliable information. As with other contaminants, producers, laboratories and control authorities retain the decisive role.

SCIENTIFIC AND REGULATORY REFERENCES

- EFSA (2017), Pyrrolizidine alkaloids in teas, herbal infusions and supplements [↗ Source](#)
- EFSA, scientific opinion on tropane alkaloids [↗ Source](#)
- Regulation (EU) 2023/915, tropane and pyrrolizidine alkaloids [↗ Source](#)