

# Mycotoxins (1. LF UK, NT)

Toxic secondary **metabolites** of filamentous fungi (mold), ~ 20 toxicologically significant mycotoxins

## Producers

- fungi of the genera *Aspergillus*, *Penicillium*, *Fusarium*

## Occurrence

- moldy food
- residues in animal tissues and products
- products obtained using cultural fungi
- products of biotechnology

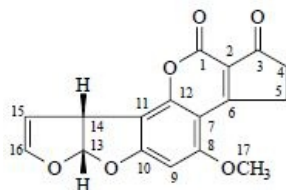
## Factors affecting contamination

- biological
- chemical
- environment (water activity, temperature, etc.)

## Aflatoxins

- Aspergillus sp.* ( *A. flavus*, *A. parasiticus* ), temperature, humidity (subtropical and tropical climatic conditions)
- aflatoxins of the B and G series
- high levels – corn, peanuts, pistachios
- lower levels – almonds, walnuts, raisins, spices
- toxicity (hepatotoxicity, mutagenicity, carcinogenicity), nephrotoxicity

- aflatoxin B1



- in animal organisms biotransformation (hydroxylation) – metabolites
- transition factor = precursor to metabolite ratio 100:1–300:1 (milk), 1000–14000 (muscle)
- inhibitors – preservatives
- stimulators - higher fatty acids, propionic acid
- detoxification of contaminated materials (very difficult) – e.g.  $\text{NH}_4\text{OH}$  extraction
- heat treatment - mostly reduction, complexes with proteins
- hygienic limits – e.g.:
  - generally  $20\text{--}40\ \mu\text{g}\cdot\text{kg}^{-1}$  (sum)
  - baby food  $2\ \mu\text{g}\cdot\text{kg}^{-1}$  (M1)
  - infant formula  $1\ \mu\text{g}\cdot\text{kg}^{-1}$  (M1)

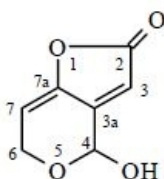


*Aspergillus flavus*

## Patulin

- Penicillium patulinum*, *P. expansum*
- apples, grapes, oranges, etc., relatively very common contaminant of concentrates and juices ( $< 0,1\ \text{mg}\cdot\text{kg}^{-1}$ )

- 4-hydroxy-4H-furo(3,2-c)pyran-2(6H)-one



- relatively stable at pH 3.0–6.5
- antibiotic, antifungal, antiviral effects vs. carcinogenicity, mutagenicity

## Changes in food processing

- storage – slow reduction of content

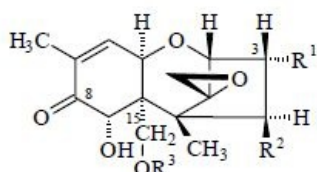
- juice thickening by vacuum distillation – 25 % reduction
- pasteurization (90 °C/10 s) – 20 % reduction
- ethanol fermentation – rapid degradation
- microwave heating - 40-9 5% reduction

### Hygienic limits – eg:

- generally 0,05–0,10 mg·kg<sup>-1</sup>
- infant products – 0,001 mg·kg<sup>-1</sup>

## Trichothecenes

- *Fusarium sp.* - toxin fumonisin
- cereals, oilseeds, beer
- deoxynivalenol, nivalenol, T-2 toxin
- deoxynivalenol, R<sup>1</sup> = OH, R<sup>2</sup> = H, R<sup>3</sup> = H

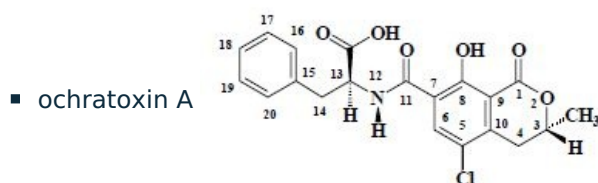


### Hygienic limits – eg:

- cereals 2 mg·kg<sup>-1</sup> (deoxynivalenol)
- flour 1 mg·kg<sup>-1</sup>

## Ochratoxins

- *Aspergillus ochraceus*, *Penicillium viridicatum*
- cereals, green coffee beans, livestock kidneys
- nephrotoxicity, hepatotoxicity, carcinogenicity, persistence



### Hygienic limits

- 5-10 µg·kg<sup>-1</sup>

## Citrinine

It is produced by the genera *Penicillium* and *Aspergillus*, is potentially NEPHROTOXIC and acts synergistically with other neurotoxins, source is contaminated food. It is associated with the cardiac form of beriberi, also referred to as "yellow rice disease".

## Ergotamine

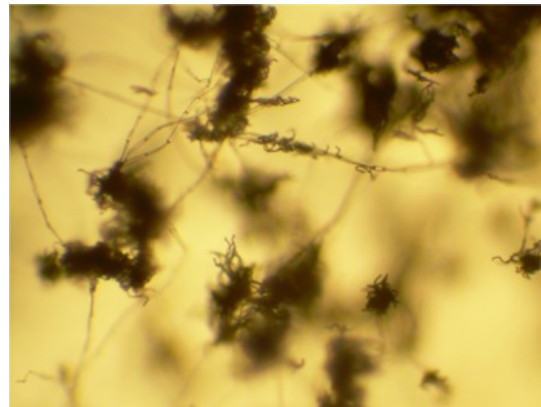
It belongs to the ergot alkaloids, it is produced by *Claviceps purpurea*. The micromycete attacks cereals (typically rice, grain), forming dark and hard formations known as ergot, which are then processed into flour during milling. Ergotamine is a vasoconstrictor, intoxication is manifested by swelling of the acral parts of the body (nose, earlobes, fingers), ends in gangrene, rarely has psychotropic effects, hallucinations are typical. In European countries, intoxication is no longer a threat (adjustment of food technology).

## Other mycotoxins

- Sterigmatocystin, cyclopiazonic acid, roquefortin C, zearalenone, penicillic acid, fusarin C, alternariols and alttoxins, ergot alkaloids, etc.

## Links

## Related Articles



Penicillium expansum

- Toxins of bacteria (1. LF UK, NT)
- Toxic substances
- Toxicity, effects of nox

## Source

- DAVÍDEK, Jiří. *14. KONTAMINANTY POTRAVIN* [online]. [cit. 2012-03-13]. <<https://el.lf1.cuni.cz/p92009169/>>.
- KUDLOVÁ, Eva, et al. *Hygiena výživy a nutriční epidemiologie*. 1. edition. Praha : Karolinum, 2009. 287 pp. pp. 251-256. ISBN 978-80-246-1735-0.
- MAREŠOVÁ, Věra. *Ekotoxikologie. Kovy. Průmyslové látky* [online]. [cit. 2016-07-06]. <<https://el.lf1.cuni.cz/p79657934/>>.