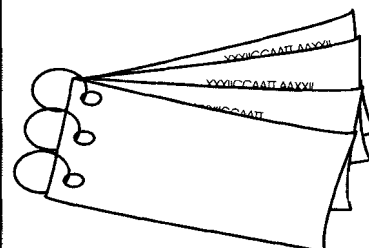


UNIT 6 MYCOTOXINS

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- Mycotoxins are toxic substances produced by fungi (moulds) growing on grain, feed or food in the field or in storage.
- Diseases in animals and human beings resulting from consumption of mycotoxins are called mycotoxicoses.
- Several mycotoxins have also been linked to increased incidence of cancer e.g. aflatoxin, zearalenone, patulin, ochratoxin and fumonisin.
- Mycotoxins have been found in many foods particularly cereals and nuts. Meat, eggs and milk from animals fed on mycotoxin-contaminated feed can provide an indirect route of exposure for us.
- Some examples of mycotoxins are aflatoxins produced by the fungi *Aspergillus flavus* and *Aspergillus parasiticus*. Ergot alkaloids are produced by the *Claviceps* spp.; Trichothecenes, fumonisin and zearalenone are produced by the *Fusarium* species and Ochratoxin by *A. ochraceus* and *Penicillium* species.
- In order to produce mycotoxins fungi require nutrients, moisture, a certain relative humidity, proper temperatures and neutral to slightly alkaline conditions.
- Contamination by fungi can occur in the field or during storage. *Claviceps* affects cereals during pre-harvest stages; *Fusarium* contamination generally occurs under field conditions and persists during early storage; *Aspergillus* and *Penicillium* are typical storage fungi infecting agricultural commodities due to improper storage. Infection with *A. flavus* can also occur in the field.

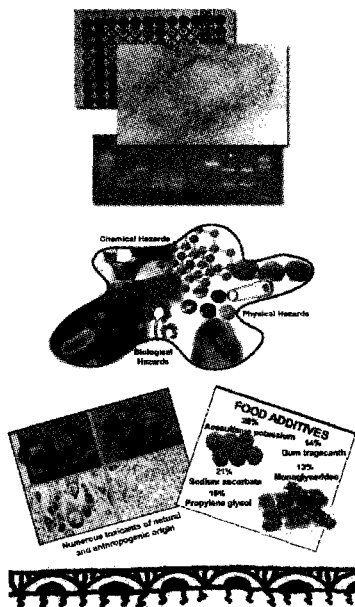
6.1 Aflatoxins

- Aflatoxin is the toxin produced by *Aspergillus flavus* and *Aspergillus parasiticus*. The foods which are at risk for aflatoxin contamination include a wide range of commodities like rice, corn, wheat, sorghum, maize, groundnut, soyabean, tree nuts and spices.

- Atmospheric or storage temperature and humidity determine suitable conditions for fungal growth and mycotoxin production.
- Aflatoxicosis is the poisoning that results from ingestion of aflatoxins in contaminated food or feed. Aflatoxin is a potent liver toxin known to cause cancer in animals.
- The adverse effects of aflatoxins can be acute or chronic. Acute aflatoxicosis is produced when moderate to high levels of aflatoxins are consumed. Vomiting, abdominal pain, pulmonary oedema, convulsions, coma and death with cerebral oedema and fatty involvement of liver, kidneys and heart characterize the syndrome.
- Chronic aflatoxicosis results from ingestion of low to moderate levels of aflatoxins.

Reducing Exposure

- Aflatoxins are considered unavoidable contaminants of food and feed, even where good manufacturing practices have been followed. The levels, however, have to be low so that they do not harm us in the long run.
- Visibly mouldy grains or seeds should be separated from healthy ones before consuming or processing them into food products.
- The refining process for groundnut oil also destroys aflatoxin. Even the process of filtering unrefined oil reduces aflatoxin content.
- If aflatoxin levels in animal feed are controlled, levels in milk automatically reduce.



6.2 Ergot Alkaloids

- Ergot is a plant disease caused by the fungus *Claviceps purpurea*. The ergot contains several alkaloids (mycotoxins) that are poisonous.
- Ergotism is a complex disease resulting from ingestion of grains and cereals infected with ergot.
- There are two sets of symptoms in serious cases: Convulsive and gangrenous ergotism. Convulsive ergotism is characterized by nervous dysfunction simulating convulsions or fits whereas in gangrenous ergotism victims may lose parts of extremities because of decrease in blood flow and the resulting infections.

Reducing Exposure

- Through careful screening out of the Ergot stage (or grains infected with ergot), ergotism is now rare.
- In order to clean seeds and grains, a flotation method has been devised. Ordinary salt water or a solution of approximately 30% potassium chloride is poured over the seeds and stirred. Good seeds sink, ergoty seeds float.
- Hand picking and sieving can be used to remove ergoty grains.

- In order to minimize ergot formation after grains have been harvested, the field is deeply ploughed so that ergot will not germinate.
- A different crop rotated in the following year that is not susceptible to ergot will break the cycle of any ergot that may have survived the previous year's ploughing.

6.3 Other Mycotoxins

The following table gives some details about other mycotoxins of concern.

Ochratoxin A	Moderately stable molecule that can survive most food processing, potent toxin affecting mainly the kidneys.
Trichothecenes	Cause acute disease involving nausea, vomiting, gastrointestinal upset, dizziness, diarrhoea and headache. Deoxynivalenol (DON) is nearly always formed before harvest. DON is thermally stable but water-soluble.
Fumonisin	Stable, not destroyed by moderate heat; linked with oesophageal cancer.
Patulin	Stomach irritant causing even ulceration; broken down by sulphur dioxide used as a preservative.
Zearalenone	Affects the reproductive system of animals, colonizes cereal crops.

6.4 Reducing Exposure to Mycotoxins: General Measures

- Toxin-producing fungi may invade during the pre-harvesting period, harvest time or during post-harvest handling and in storage. The ways of preventing and controlling hazardous fungi and their dangerous mycotoxins include: biological control; physical and chemical treatments.
- Scientists are working on developing mould resistant species of plants; alternative methods of soil cultivation discouraging growth of fungi; adequately drying grains before storing them in dry, controlled conditions.
- Separating good grains and fruit from ones with fungus either by sieving, hand picking reduces mycotoxin load in the final processed product whether it is flour or juice.
- Preventing growth of moulds by taking precautions in fields and stores is the best way. Once they are allowed to form, mycotoxins are chemically stable surviving storage and processing. Some are heat-stable and not destroyed even when food is cooked to quite high temperatures.

Key Terms

Acute: (Disease) which comes on rapidly and can be dangerous

Aflatoxicosis: Poisoning that results from ingestion of aflatoxins in contaminated food or feed.

Buoyant: Able to keep afloat or rise to the top of a liquid

Carcinogenic: Cancer causing

Convulsion: Fit

Delusion: A false belief or impression

Disorientation: Confusion as to one's whereabouts or bearings

Edema (or Oedema) : Swelling of part of the body due to accumulation of fluids in the intercellular tissue spaces

Ergot: A plant disease that is caused by the fungus *Claviceps purpurea*.

Ergotism: A complex disease that results from the ingestion of grains and cereals infected with Ergot by humans and domestic animals.

Gangrene: Death and decomposition of a part of the body tissue usually resulting from obstructed circulation

Haemorrhage: Escape of blood from a ruptured blood vessel

Histopathology: Changes in tissues caused by disease

Inadvertently: Unintentionally

Insomnia: Inability to sleep

Muscle spasm: Sudden involuntary muscular contraction

Mycotoxin: Toxin produced by fungi

Mycotoxicoses: Diseases in animals and human beings resulting from the consumption of mycotoxins.

Overt: Unconcealed

Psychedelic drug: Drug producing hallucinations

Wryneck: A more or less fixed twisting of the neck



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