

Mycotoxins and Mycotoxicoses

Dr. Poonam Shakya

INTRODUCTION

- ▶ Mycotoxicoses are acute or chronic infections produced by intoxication of toxic metabolites of fungal origin.
- ▶ For Eg.– *Aspergillus*, *Fusarium* , *Penicillium* *etc.*

Factors influencing the production of mycotoxins

▶ 1. In Stored food

Conditions of harvesting
Transporting and storage
Moisture content
Temperature
Aeration
Suitable substrate

▶ **2. In Growing crop/pasture**

Plant species

Stage of development of plant

▶ **3. Modifying factors**

Species of fungus

Concentration of mycotoxin in food

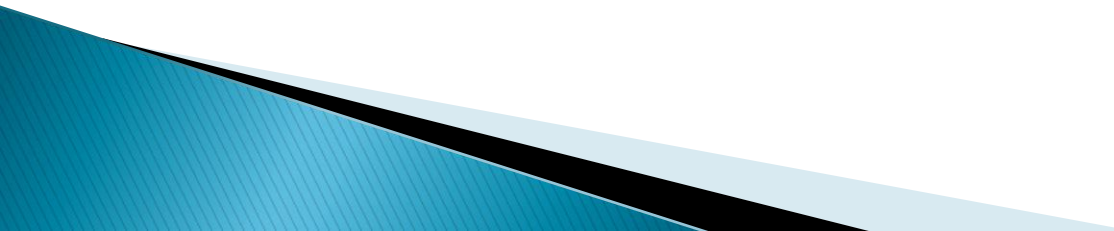
Susceptibility of animal species

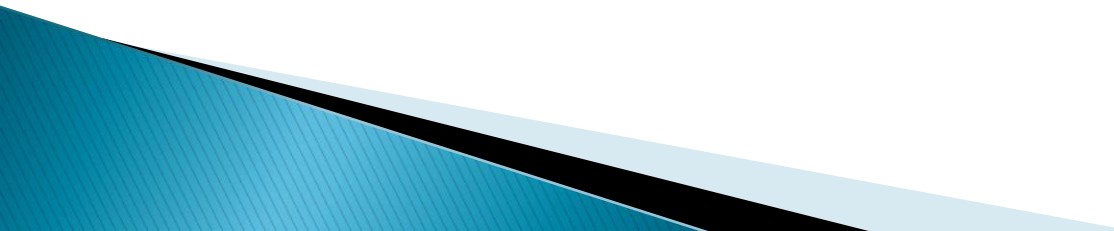
Age, sex, health status

Duration of exposure

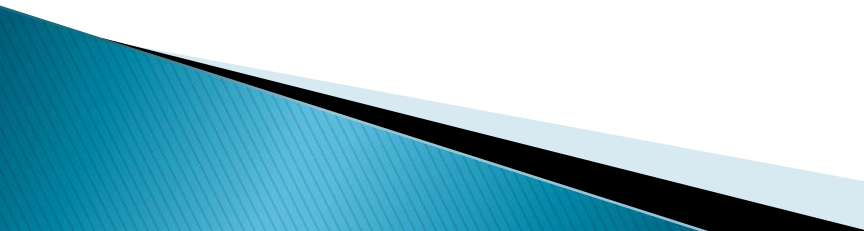



Characteristics of Mycotoxins

1. Secondary fungal metabolites
 2. Produce toxic effects including immunosuppression, mutagenesis, carcinogenesis and teratogenesis
 3. Low-molecular-weight, heat-stable substances that are active at low dietary levels
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4. Non-antigenic; exposure does not induce a protective immune response
 5. May affect specific target organs or tissues such as the liver or central nervous system
 6. Human exposure may result from excretion in milk or accumulation in food-animal tissues
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Principal features of mycotoxicoses

1. Outbreaks are often seasonal and sporadic
 2. May be associated with particular batches of stored feed or certain types of pasture
 3. Susceptibility can vary with the species, age and sex of the animals exposed
 4. Clinical presentation may be ill-defined
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5. Antimicrobial treatment is ineffective
 6. Recovery depends on type and amount of mycotoxin ingested and the duration of exposure to contaminated food
 7. Characteristic lesions in target organs of affected animals provide supporting diagnostic evidence
 8. Confirmation requires demonstration of significant levels of a specific mycotoxin in suspect feed or in tissues of affected animals
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Mycotoxigenesis of domestic animals and poultry

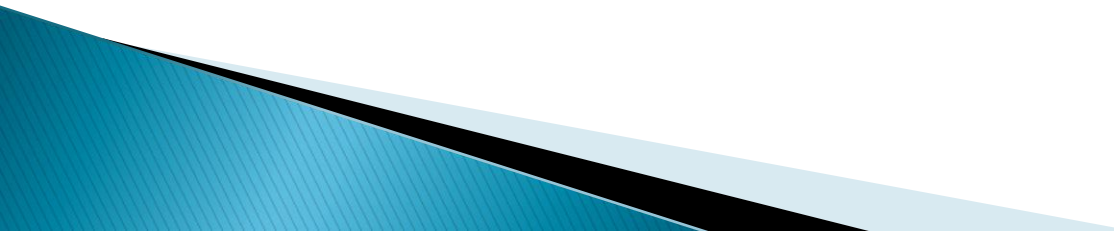
Disease	Fungus	Crop or substrate	Mycotoxin	Animals affected
Aflatoxicosis	<i>1. Aspergillus flavus</i> <i>2. Aspergillus parasiticus</i>	Ground nut, maize and nut crops	Aflatoxins B1, B2, G1, G2	Cattle, pig, poultry and dogs
Ergotism	<i>Claviceps purpurea</i>	Seed heads of many grasses and grains	Ergotamine and ergometrine	Cattle, Sheep, Pig, Horse and Poultry
Ochratoxicosis	<i>1. Aspergillus ochraceus</i> <i>2. Penicillium viridicatum</i>	Barley, wheat and Maize	Ochratoxin –A	Pigs & Poultry

Aflatoxicosis

- ▶ Aflatoxins are toxic compounds produced by some strains of *Aspergillus flavus*, *Aspergillus parasiticus* and a number of other *Aspergillus* species during growth on natural substrates including growing crops and stored food.
- ▶ The name 'aflatoxin' derives from *Aspergillus*(a-), *flavus* (fla-) and *toxin*.

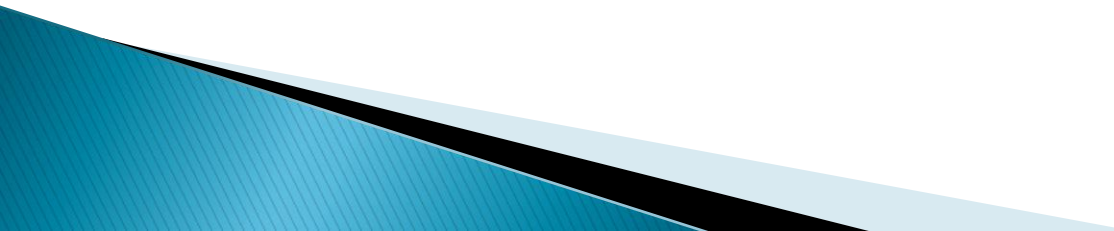
Aspergillus flavus (toxigenic strain) on Sabouraud dextrose agar, five days



- ▶ Ubiquitous,
 - ▶ saprophytic moulds
 - ▶ grow on a variety of cereal grains and foodstuffs such as maize, cottonseed and groundnuts.
 - ▶ High humidity and high temperatures favour the growth of *A. flavus* and toxin production.
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Aflatoxins

- ▶ Aflatoxins are compounds with toxic, carcinogenic, teratogenic and mutagenic activity.
- ▶ The four major aflatoxins are B1, B2, G1 and G2.
- ▶ Aflatoxin B1 (AFB1) is the most commonly occurring and also the most toxic and carcinogenic member of the group.
- ▶ These mycotoxins are named according to their position and fluorescent colour on thin-layer chromatograms, when viewed under ultraviolet light.
- ▶ AFB1 and AFB2 produce a blue
- ▶ AFG1 and AFG2 a green fluorescence.

- ▶ Heat Stable
 - ▶ Retain much of their activity after exposure to dry heat at 250°C and moist heat at 120°C but may be degraded by sunlight.
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Biological effects of aflatoxins

- ▶ **Acute toxicity**

Hepatic injury

Nervous signs such as ataxia and convulsions

Death may occur suddenly.

- ▶ **Chronic toxicity**

Reduction in food conversion efficiency

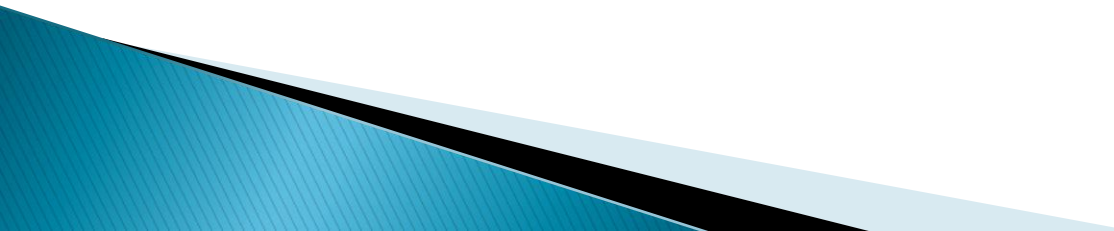
Decreased milk production

Immunosuppression

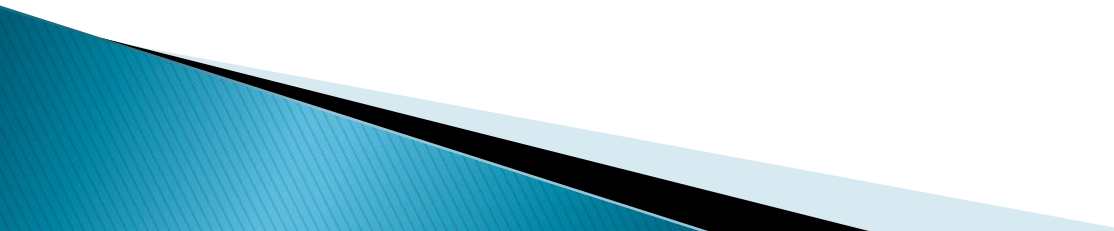
Symptoms

- ▶ Calves– blindness, circling, grinding of teeth, diarrhoea, tenesmus and convulsions.
- ▶ Dairy cattle– aflatoxin M1 and M2 are excreted in the milk.
- ▶ Pigs–drowsiness, inappetance, jaundice, weight loss and yellow urine
- ▶ Other important Signs include anorexia, poor growth rate, ataxia and opisthotonus, followed by death
- ▶ Birds – subcutaneous haemorrhages of legs and feet

Lesions

- ▶ Principle target organ is liver.
 - ▶ Depending on the severity of intoxication–
 1. Hepatomegaly
 2. Necrosis
 3. Marked bile duct hyperplasia
 - ▶ Acute hepatic failure
 - ▶ In chronic toxicity– degenerative changes in the kidney
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DIAGNOSIS

- ▶ Sample collection–Feed /Tissues
 - ▶ Chemical identification of Mycotoxins
 - ▶ Concentration of aflatoxin B1 in excess of 100µg /kg of feed are considered toxic for cattle.
 - ▶ Thinlayer chromatography
 - ▶ HPLC
 - ▶ Radio immuno assay
 - ▶ ELISA
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CONTROL AND PREVENTION

- ▶ Prevention of contamination at all stages of food production, storage and use
- ▶ Decontamination procedures like physical removal and chemical treatment of aflatoxin contaminated feeds such as with acids, alkalies, aldehydes, oxidizing agents or selected gases (ammonia) have been used for degrading aflatoxins.
- ▶ High affinity inorganic compounds such as benzoic and propionic acid have been widely used as preservatives for stored agricultural products.