

Mycotic Allergy:

Allergic condition developed due to sensitization of tissue with fungi. *A. fumigatus* is the main species which cause mycotic allergy. Other species like *A. flavus*, *A. medurans*, *A. higher*, some species of mucour and rhizopus are also causing mycotic allergy.

Mycotic mastitis:

Mycotic mastitis is prevalent throughout the world and it is common in cattle, buffalo and rare in sheep, goat, equine and swine.

Mycotic mastitis occasionally occurs in epizootic form so far as yeast like fungi are concern and Grains (Mouldy/infected) are main source of infection.

There are various groups of fungi contribute to mycotic mastitis

1. *Cryptococcus neoformans*

This fungus is present in pigeon dropping which contaminate dairy utensils by yeast spores of filamentous fungi. It also presents in air of cow shed and lead to disease in milch animals.

2. *Aspergillus spp.*

These fungi enter into teat canal through contaminating intramammary infusions (Antibiotic tube). It enters into wall of teat cistern and teat canal and extend to the surrounding tissue developing densely fibrous granulomatous lesions and some time in chronic cases, necrotic pyogenic lesion can be observed.

3. *Candida spp.*

Administration of antibiotics may aggravate fungal mastitis as *Candida spp.* utilize penicillin and tetracyclines as a source of nitrogen. These fungi cause chronic fibrotic thickening of underlying tissue and septum of mammary gland.

Diagnosis:

- Based on history and clinical sign
- Microscopic examination of fungi from suspected milk sample: Centrifuge milk sample at 12000 rpm for 10 min and prepare smear from sediment and stain slide and observed under microscope.
- Isolation of fungi on SDA medium

Treatment:

Antifungal drugs like: -

- Nystatin, natamycin – for yeast mastitis
- Amphotericin B – geotrichum

Cryptococcal mastitis: There is granulomatous lesions are observed in acute and chronic type of mastitis destroying entire framework of udder except glands. And supra mammary lymph node become swollen due to several cellular reaction.

Zygomycetes:

Most of these fungi are saprophytes and widespread in environment and they are opportunistic pathogens. The order *Mucorales* and *Entomophthorales*, are of veterinary importance

- These fungi are commonly known as 'Pin' or 'Bread' moulds because their dark sporangia resemble pinhead and they are often found growing on stale bread



Mucorales

- Genus *Absidia*, *Mucor*, *Rhizomucor*, *rhizopus* are typical zygomycetes
- *Mortierella* form spores only on nutrient deficient media
- Immunesuppression may predispose to infection
- *Mortierella wolfii* associated with abortion and pneumonia in cattle

Entomophthorales

- Sporangium function as single conidium
- Hyphae, sometime septate, produce in animal tissue
- Granulomas caused by *Basidiobolus* and *Conidiobolus* species, most common in horses

Habitat:

Mucorales are saprophytes present in soil and vegetation and their spores are often air born. *M. wolfii* has been often isolated from **soil near silage and rotting hay**.

Colony character:

- Growth of *Absidia*, *Mucor*, *Rhizomucor* and *Rhizopus* species is rapid grown on medium with greyish or brownish grey fluffy colonies
- *M. wolfii* grows with white velvety colonies with lobulated outlines on **hay-infusion agar**.

Mycotic bovine abortion

The mycotic abortion occurs sporadically. Most of these agents are saprophytic fungi found in moist organic environments such as soil, hay, poor-quality silage and grains.

Etiologic Agents:

- *Aspergillus fumigatus* is the most commonly isolated fungus, accounting for 60% to 80% of mycotic abortions.
- Other *Aspergillus* species, including *Aspergillus flavus*, *Aspergillus terreus*, and *Aspergillus nidulans*, are encountered less frequently.
- The Zygomycetes compose the second most commonly encountered group; these include *Absidia*, *Mortierella wolfii* (More common in northern New Zealand), *Rhizopus*.
- Some species of penicillin and candida
- *Mortierella wolfii* is probably the only pathogenic species being an important causal agent of **bovine mycotic abortion, pneumonia and systemic mycosis** in New Zealand, Australia, Europe and USA.

Epidemiology:

- The incidence of bovine mycotic abortion varies widely, ranging from 2% to 20%.
- Mycotic abortions occur sporadically. Rarely are more than 10% of pregnant cows affected in a herd.
- The age of the cow does not appear to be a factor predisposing to mycotic abortion.
- Some evidence suggests that abortions associated with *M. wolfii* are linked to nonstandard methods of silage preparation, particularly inadequate wilt-time before storage or inadequate silage compaction or storage due to incomplete sealing of the container.

Clinical Findings:

- Abortion occurs in **late pregnancy**, most often between **6 and 8 months** of gestation, although they can occur as early as 2 months of gestation.
- It causes Placentitis, abortion and inner cotyledonary areas of **placenta are thickened, leathery and necrotic**
- **Aborted foetus may have raised cutaneous plaque resembling ringworm infection.**

Pathogenesis:

- Respiratory and gastrointestinal tracts are the most likely routes of exposure.
 - The fungal conidia enter blood vessels in alveolar septa and reach the placenta through the systemic circulation
 - Rumen infections, omasal ulcers, and intestinal lesions also may be factors predisposing to hematogenous spread to the gravid uterus, perhaps by facilitating penetration of mucosal barriers.
- **The hematogenous route is believed to be the primary route of infection** because the lesion develops initially in the placentomes and infection subsequently spreads to the interplacental space between cotyledons.
- **Fetal tissues** may be involved, primarily **skin and lungs**. Brain or liver involvement occurs occasionally.

Diagnosis:

- Based on history (Feeding of mouldy hay and silage) and clinical sign (Abortion in late pregnancy) and symptoms.
- Based on cultural isolation of fungi from infected tissue (Foetal abomasal content)
- Histopathological identification of fungi from infected placental tissue

Mycotic pneumonia:

The pneumonia that develops in cows after *Mortierella wolfii* –associated abortions is thought to result from a lung-uterus-lung cycle. After abortion, a large number of fungal elements are absorbed from the uterus, causing an acute, fulminating, embolic pneumonia in the cow. **This typically occurs 2 to 4 days after abortion.**

Aspergillosis: -

Aspergillosis is primarily a disease of the respiratory system characterized by **inflammatory granulomatous necrotizing lesion on lung often** with hematogenous spread to another organ. The spread of the organism leads to lesions in eye, skin, meninges and respiratory tract infection.

- This slow **growing fungal infection** gradually damages tissues in the body over a period of weeks to months, often with little obvious evidence of illness until an organ or system is severely compromised.
- Aspergillus fungus exists in the **environment as microscopic spores** that are found everywhere, particularly in soil, moist nesting material, and moldy foods. The spores persist in the environment and are very resistant to disinfection.
- Aspergillus is normally an environmental contaminant and is **not contagious from bird to bird**. It more commonly affects birds whose immune systems have been compromised by other diseases or by malnutrition.
- Birds with healthy immune systems may be exposed to Aspergillus spores and not develop infection. However, even healthy birds exposed to large numbers of these spores (in dust, mold, soil, etc.) may be infected.
- Steroid use, long term antibiotic use, excessive stress, poor husbandry or hygiene, respiratory irritants (such as cigarette smoke), viral infections and other chronic infections can all cause immune suppression and lead to secondary infection with Aspergillus.
- **Birds on all-seed diets may be more prone to this disease because seeds lack vitamin A, a nutrient essential to keeping both birds' respiratory tracts and immune systems healthy.**
- **"Birds on an all-seed diet may be more prone to this disease."**
- In **young birds** produces **acute disease**
- In **adult birds** produces **chronic disease**

Aspergillosis is a fungal infection that commonly causes respiratory disease in pet birds. It can cause both upper (nose, sinuses, eye, and trachea) and lower (lungs and air sacs – a specialized part of the respiratory tract that birds have) respiratory problems or more broadly distributed systemic infections.

Disease: **Aspergillosis/Brooder pneumonia**

Species: *A. fumigatus*, *A. flavus* and *A. niger*

Avian species (Chicken, turkey, ducks, pigeon, quails)	Acute Aspergillosis (Brooder's pneumonia) Chronic Aspergillosis
Bovine	Abortion , pneumonia and mastitis
Ovine	Pneumonia, and abortion
Horse	Abortion and diarrhoea
Dog	Ear and nasal infection
Cat	Abortion , Fatal pulmonary aspergillosis

Habitat:

- Present in soil and decomposing organic matter
- *A. fumigatus* present in poor quality of hay
- Spores are present in dust and air

Colony character:

The colony of fungi grows rapidly and are flat, but when mycelium grows, they are first **white and slightly Fuzzy/Velvety**, but as conidia develops, they become **dark bluish** and appear powdery.

Penicillium: Greenish in colour

Microconidia: vesicle like inverted flask with rounded bottle with long grown neck

Symptoms/pathogenicity:

Mostly disease occur in poultry

Acute form: High morbidity and mortality occur in young birds and associate with considerable losses. This form of the disease occurs very rapidly and is believed to be caused by exposure to large number of Aspergillus conidia.

- Dyspnea, Gasping, Open mouth breathing
- Sudden depression, Loss of appetite
- Crop stasis, Cyanosis (bluish/purplish comb)
- Increase respiration, rise in temperature
- Foety diarrhoea, affected birds die within 24 hrs.

Chronic form: This form of the disease has a much more subtle onset, taking several weeks to months to develop.

- Lethargy, Change or loss of voice, Weight loss
- Coughing and Open mouth breathing
- Cyanosis (blue/purple comb/wattles)
- Decreased appetite

In cat 70% abortion cause by Aspergillus spp. and 30% is by mucor

Diagnosis:

Isolation of *Aspergillus* require cautious approach because these fungi are most contaminant of laboratory and it is routinely isolated from skin, but repeated isolation of *Aspergillus* fungus from the sample and absence of other causative organisms (*E. coli*, and *salmonella spp.*) will decide or confirm diagnosis.

Control:

- No treatment for avian Aspergillosis
- Find source of sporulating fungus like in litter material, dust and any other new material introduce infection can be identify and remove.

Mycotoxins:

Mycotoxin are metabolite produced by fungi that may be found in grain and forages. Mycotoxicosis is disease syndrome that results from the ingestion of mycotoxins. Mycotoxins are neither infectious nor contagious, chemically they are low molecular weight compound and non-antigenic and capable of causing toxic effect.

There are 3 main types of mycotoxicosis

1. **Acute mycotoxicosis:** In this type of mycotoxicosis often causes mark sign of disease or immediate death
2. **Chronic (Primary mycotoxicosis):** chronic condition result from intake of moderate to low level of mycotoxins. This generally result in reduced productivity and inferior market quality
3. **Secondary mycotoxicosis:** In this type of mycotoxicosis condition result from intake of very low concentration of specific mycotoxins which do not cause overt mycotoxicosis but which predisposing to infectious disease through impairment of immunogenesis or native host defense.

Characteristics of mycotoxins

- Low molecular weight, heat-stable substances
- Unlike many bacterial toxins, non-antigenic, exposure does not induce a protective immune response
- Many are active at low dietary levels
- Specific target organs or tissues affected
- Toxic effects include immunosuppression, mutagenesis, teratogenesis and carcinogenesis
- Accumulation in tissues of food-producing animals or excretion in milk may result in human exposure

Aflatoxicoses:

There are various type of fungal species produces aflatoxins including *Aspergillus flavus*, *A. parasiticum* and some time by various spp. of penicillium, rhizopus, Streptomyces etc.

Source:

Colonization of toxin production occurs in grain such as corn, cotton seed and pea nuts. In all phase of production in warm and moist climate is most favorable condition for fungus growth.

- Name aflatoxin derives from *Aspergillus flavus* toxin
- The four major aflatoxins are B1, B2, G1 and G2. These mycotoxins are named according to their position and fluorescent colour on thin layer chromatography
- **B1 and B2 produce blue colour and G1, G2 gives green fluorescence.**
- Aflatoxins M1, M2 are hydroxylated metabolites of B1 and B2 that are excreted in the milk of lactating animals such as dairy cows.
- **In milk and meat Aflatoxin M1 is present**
- Ducklings are mostly susceptible

Aflatoxin can cause

- Per acute condition/toxicity
- Chronic toxicity, teratogenic, mutagenesis, oncogenesis depending on the disease and age of animals and amount and duration of aflatoxin exposure
- Birds are extremely sensitive that is 1 ppb (0.001ppm) in diet may be carcinogenic
- Young swine and pregnant sow are also sensitive to this toxin followed by calves (0.2ppm) in feed for 16 weeks cause mild liver damage

Prevention and control:

- Prevention is to give toxin free food and immediate withdrawal of mouldy diet. It prevents by rapid drying of grains until it is below critical moisturecontent (13 to 15%).
- Grain can be preserved by using preservative like acetic acid: propionic acid (60:40) mixture by spraying over grain.

Trichothecene toxicosis:

Produce by: *Fusarium spp.* and *Myrothecium spp.*

Toxin produce: Vomitoxin, T-2 which inhibit protein synthesis

Symptoms: Vomiting, immunosuppression and haemorrhages

Fumonisin:

Produced by: *Fusarium spp.*

It also responsible for “**Mouldy corn poisoning of horse**” or “**Equine**

luekoencephalomalacia”

Symptoms: Liquification necrosis in cerebrum and neurological sign

Tremerogen intoxication:

Produced by: *Aspergillus spp.*, *Penicillin spp.* and *Claviceps spp.*

Symptoms: Neurological – Neurotoxicity, muscle tremors, incoordination, convulsiveseizure and stagger gait

Ergotism:

Produced by: *Claviceps purpurea*

Toxin: Ergotamine, ergometrine, ergocristine

- Fungi present on seed heads of rye grasses and cereals such as barley and toxin may retain in silage

Symptoms: Neurotoxicity and vasoconstriction, gangrene of extremities, agalactiae, hyperthermia in hot climate.

Ochratoxin:

Produced by: *Aspergillus* and *Penicillium*

Toxin: Ochratoxin A, B, C (Immunosuppression and carcinogenic) Symptoms: Degenerative renal changes, polydipsia, polyuria in pig

Fall in egg production in birds