DIFFERENTIAL DIAGNOSIS FOR POULTRY MYCOTOXICOSIS

Symptoms	Potential cause	Description of problem	Check list	Corrective actions
ORAL LESIONS	MYCOTOXINS: T-2 toxin (T-2) Diacetoxyscirpenol (DAS)	T-2 and DAS have an alkaline action, thus causing lesions to the epithelium, increasing the speed of epithelial cell renovation.	 Positive for T-2 and/or DAS in raw materials (ELISA) or feed (HPLC) Origin of raw materials from supplier/region with history of T-2/DAS contamination Histopathology: Proliferating epithelial cells and hepatic vacuolization Overall decrease in flock performance 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines that have become contaminated by stale, wet or moldy feed
	NUTRITION: Feed granulometry	Small particles of feed block saliva ducts, which may result in oral lesions.	 Pelletized feed: Fine particles >20% Mashed feed: Check geometric mean particle diameter Histopathology: Presence of inflammatory cells and bacteria No overall decline in flock performance 	 Adjust the pelleting process Increase the sieve diameter Use pellet binders to improve pellet quality
	MANAGEMENT: Liquid methionine	Dripping of methionine in the application system produces points of high concentration of methionine in the feed.	 Methionine injector dripping inside masher Histopathology: Infiltration of inflammatory cells and necrotic lesions No overall decline in flock performance 	Clean/replace methionine injectors
	MANAGEMENT: Organic acids	Excessive concentrations of organic acids in the feed lead to caustic lesions in the oral mucosa.	 Acids injector dripping inside masher Histopathology: Infiltration of inflammatory cells and necrotic lesions No overall decline in flock performance 	 Clean/replace acid injectors Adjust dosage of organic acids
	MANAGEMENT: High temperatures	Increased frequency of drinkers during hot periods increases residues of feed in beaks.	 Histopathology: Infiltration of inflammatory cells and necrotic lesions Possible decline in flock performance Increased mortality 	 Apply vitamins in water Apply organic acids in water Increase chlorine level in water
	MANAGEMENT: Copper sulphate	Concentration between 0.05 to 0.2% in feed and excess in drinking water can promote oral lesions.	 Check concentration of CuSO₄ in premix Check concentration of CuSO₄ in water Check if water dosing system is working correctly (if applicable) 	\Box Apply group B vitamins and K ₃ vitamin in water \Box Correct set up of the water dosing system
	PATHOGENS: <i>Candida albicans</i> (Candidiasis)	The yeast <i>C. albicans</i> can lead to lesions detected in the crop but can extend to other parts, including the mouth. More common in birds with longer lifespans, such as layers and breeders.	Histopathology: Fungal hyphae present in affected mucosa	Nystatin or diflucan or imidazoles such as ketoconazole, fluconazole, etc. as treatment
	PATHOGENS: Fowl pox (Avian pox)	 Viral disease caused by Poxviridae (Avipoxvirus) often lead to cutaneous lesions on head, neck, legs and feet. Dry pox: Raised, wart-like lesions on feathered areas (head, legs, vent, etc.) which heal in about 2 weeks. Unthriftiness and retarded growth are typical symptoms. In laying hens, infection results in a transient decline in egg production. Wet pox: Canker-like lesions in the mouth, pharynx, larynx, and trachea. May also cause respiratory distress by obstructing the upper air passages. 		 Use preventive vaccination depending on prevalence and season (typically fall) Treat affected birds with antibiotics to reduce secondary infection, although the disease has to run its course
	PATHOGENS: Protozoans	Protozoans are more prevalent in birds with a longer lifespan, such as layers, breeders and turkeys, game birds and/or free-range birds.	Histopathology: Microscopic examination of a smear of mucus or fluid from the throat demonstrates the presence of trichomonads	Separate chronically infected birds from breeding birds
	PATHOGENS: <i>Trichomonas gallinae</i>	First lesions appear as small, yellowish areas on the oral mucosa.	□ Cankers referred as "yellow buttons" - yellow, rounded areas with central caseous necrotic foci	\Box Use nitroimidazoles (not approved in US by FDA and prohibited in the EU)
	PATHOGENS: <i>Histomonas meleagridis</i>	Also known as histomoniasis or blackhead disease. Common in commercial turkeys and chickens.	Cecal inflammation, ulceration, thickening of wall, ceca containing yellowish cheese like exudate	\Box Use nitroimidazoles (not approved in US by FDA and prohibited in the EU)

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GIZZARD	MYCOTOXINS: Cyclopiazonic acid (CPA) Deoxynivalenol (DON) and/or T-2 toxin (T2)	Lesions develop in the proventriculus, gizzard, liver, and spleen. The proventriculus is dilated and the mucosa is thickened and sometimes ulcerated.	 Positive for CPA, DON and/or T-2 in raw materials (ELISA) or feed (HPLC) Raw materials originated from supplier/region with history of CPA contamination Histopathology: Proventriculus hyperplasia of mucosa with heavy infiltration of lymphocytes Overall decline in flock performance 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines to become contaminated by stale, wet or moldy feed
LESIONS	MANAGEMENT: Copper sulphate	$CuSO_4$ can promote gastric lesions especially at gizzard level.	 Concentration of CuSO₄ in premix Concentration of CuSO₄ in water Water dosing system is working correctly (if applicable) 	\square Apply group B vitamins and K ₃ vitamin in water \square Correct set up of the water dosing system
	NUTRITION: Biogenic amines (Gizzerosine)	Low quality/over processed fish meal can result in high levels of gizzerosine. Hyper-production of HCl in the proventriculus causes erosions in the gizzard.	Level of gizzerosine in raw materials (especially fish meal)	 Lower level of fish meal in diet Avoid use of low quality fishmeal Replace standard fish meal with low temperature (LT) fishmeal
	NUTRITION: Rancid fats	Low quality fats (long storage, overheated) can have high levels of superoxide radicals and hydroxyl radicals.	Quality of fats in term of peroxide value, rancidity and free fatty acids	 Avoid low quality fats Use low quality fats in the grower/finisher phases Replace animal fats with vegetable fats
	NUTRITION: Tannins	Toxic levels of tannins in the feed cause oesophageal and gastric oedema, haemorrhagic ulceration, necrosis and sloughing of the mucosal lining.	\Box Level of tannins in some raw materials (sorghum) and in tannin-based products	 Use high quality tannin-based product (chestnut better than quebracho) Reduce % of sorghum in diet when high in tannins
	MANAGEMENT: Acetylsalicylic acid and sodium salicylate	Use of salicylates may induce proventriculus and gizzard ulceration.	 Dosage of salicylates used (check overestimation of feed intake in feed restricted animals) Mixability of commercial product in water 	 Avoid low quality products (low mixability, low homogeneity in water) Correct feed intake assumption in feed restricted animals
	PATHOGENS: Adenovirus serotype 1	Vertically transmitted, usually sub-clinical but provides more exposure to secondary bacterial infection. Group I is exhibited through inclusion body hepatitis (sudden onset of mortality, typically 10% and rarely up to 30%) or hydropericardium (same symptoms as IBH, but severe mortality from 20-80%). Group II is exhibited through haemorrhagic enteritis and marble spleen disease in turkeys, and avian adenovirus group II splenomegaly in chickens. Group III affects most of the poultry due to the egg drop syndrome.	\Box Isolation of serotype I or II or III from the lesions by serological assays	 Use inactivated vaccines (only available for group I) Check the breeding stock and eliminate the affected birds
	PATHOGENS: Infectious Bursal Disease Virus (IBD/Gumboro)	IBD is very immunosuppressive and causes lesions at the junction of the proventriculus-gizzard.	Maternal antibody titres are very low in day-old chicks	 Implement/correct vaccination program in breeders Change from mild to strong-reaction vaccine Correct vaccination age (Deventer formula) Increase biosecurity level

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FATTY	NUTRITION: Energy-protein ratio	Excessive energy in diets can cause lipidosis and fatty liver problems	 Carbohydrate level in diet Energy-protein ratio in diet 	 Avoid high carbohydrate diets, especially in summer Adopt proper energy-protein ratio Apply amino acids in drinking water
LIVER	NUTRITION: Rancid fats	Peroxides can impair the liver activity, creating fatty liver	Quality of fats in term of peroxide value, rancidity and free fatty acids	 Avoid low quality fats Use low quality fats in the grower/finisher phases Replace animal fats with vegetable fats Apply choline chloride and Vit B in feed or water
	MYCOTOXINS: Aflatoxins (Afla)	Young animals: Fibrosis of liver leads to hardening of the organ. Older animals: Hepatic lipidosis, with softening of the organ.	 Positive for Afla in raw materials (ELISA) or feed (HPLC) Raw materials originated from supplier/region with history of aflatoxin contamination Histopathology: Check other target organs of Afla (e.g. liver) Decrease of overall performance of the flock 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines to become contaminated by stale, wet or moldy feed
	MANAGEMENT: Hormone status	An over-stimulation of egg production may lead to excessive levels of estrogen in blood that facilitate fat storage in the liver and occurrence of fatty liver, especially in layers and bree- ders.	A Management of laying birds	 Improve management of laying birds Correct lighting program
	PATHOGENS: Viral hepatitis (IBH – Viral inclusion body hepatitis)	 Adenovirus causes yellow/hemorrhagic liver and focal necrosis. Symptoms include immuno-suppression, diarrhoea, anorexia, depression, ruffled feathers, especially in the region of head and neck. Group I is exhibited through inclusion body hepatitis (sudden onset of mortality, typically 10% and rarely up to 30%) or hydropericardium (same symptoms as IBH, but severe mortality from 20-80%). Usually in chickens older than 3 weeks 	 Clinical signs only several hours prior to death occurrence: Pale comb and wattles, depression and apathy Up to 30% mortality Necropsy: Macroscopic lesion in the enlarged, dystrophic liver with yellowish colour and crumbly texture; enlarged kidneys Histopathology: Detection of intranuclear inclusion bodies Isolation of serotype I or II or III from the lesions by serological assays 	 Use inactivated vaccines (exist only for group I) Check the breeding stock and eliminate the affected birds

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EGG		Several management issues may lead to nervous birds and/or traumatic lesions in the ovary which cause poor egg quality (fragile shell/bloodspots/meat spots).	 Lighting program Temperature of the barn Presence of frights and disturbances in the barn that may get birds nervous 	 Correct lighting program Correct temperature of the barn Improve management of laying birds
QUALITY MEAT AND BLOOD SPOTS IN	MYCOTOXINS: Aflatoxins (Afla) Cyclopiazonic acid (CPA) T-2 toxin (T-2), Ochratoxin A (OTA)	Due to the liver and kidney toxicity mycotoxins may negatively impact egg and shell formati- on, leading to poor egg and shell quality (pale eggs/small, fragile shell/bloodspots/meat spots).	 Positive for Afla, CPA, T-2 and/or OTA in raw materials (ELISA) or feed (HPLC) Raw materials originated from supplier/region with history of mycotoxin contamination Histopathology: Check other target organs of these mycotoxins (e.g. kidneys, liver) Overall decline in flock performance 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines to become contaminated by stale, wet or moldy feed
EGGS	NUTRITION: Mineral, vitamin imbalance	Improper balance of calcium, phosphorus and vitamin D may lead to thin egg shells. Also large amounts of lucerne/alfalfa meal in diet can lead to blood spots caused by vitamin K antagonists in this feed ingredient.	 Calcium/phosphorus balance in diets Calcium carbonate particle size Content of lucerne/alfalfa meal in diets 	 Correct mineral and vitamin balance Correct calcium carbonate particle size Correct amount of lucerne/alfalfa meal in diets
ALC: N	NUTRITION: Vitamin K antagonists	Use of the drug sulphaquinoxaline may have the same effect as mineral imbalance.	Presence of sulphaquinoxaline in diets	Correct medication program
	PATHOGENS: Infectious Bronchitis (IB) Virus	IB causes respiratory disease and kidney damage in growers and oviduct infection in adult hens which can cause wrinkled egg shells as well as a reduction in eggs laid.	\Box Laboratory tests to confirm the presence of the coronavirus in a swab or tissue sample	• Vaccination program must be adapted to the demands of the field situation in each particular area/epidemiology
	GENETICS: Strain of bird	Some strains of birds may be more susceptible to the occurrence of blood spots.	Genetic supplier	Replace genetics if necessary

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CARCASS	MANAGEMENT: Stunning system	Stunning system used during slaughter process can lead to the occurrence of haemorrhagic petechiae in legs and breast.	 Voltage of stunning system Time of electric shock 	Correct voltage and timing of electric shocks
	PATHOGENS: Infectious Bursal Disease Virus (IBD/Gumboro)	IBD is very immunosuppressive and can increase capillary weakness which leads to carcass bruising.	 Blood spots mainly located in the legs and the breast Necropsy: Bursa of Fabricius is swollen, enlarged and bloody Maternal antibody titres are very low in day-old chicks 	 Implement/correct vaccination program in breeders Change from mild to strong-reaction vaccine Correct vaccination age (Deventer formula) Increase biosecurity level
	MYCOTOXINS: Aflatoxins (Afla)	Afla increase capillary fragility and bruising.	 Positive for Afla in raw materials (ELISA) or feed (HPLC) Animals present jaundice-like symptoms, are dehydrated and emaciated; a presence of purple-reddish areas in the carcass Raw materials originated from supplier/region with history of aflatoxin contamination Histopathology: Check other target organs of Afla (e.g. liver) Overall decline in flock performance 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines to become contaminated by stale, wet or moldy feed

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FRATHERIOSS		Bad management of environmental conditions in the barn can cause poor feather quality. When humidity is below 50% dust occurs and birds start pecking each other. Also temperature and ventilation (too high/too low) can lead to problems.	 Temperature of barn Humidity of barn Ventilation system 	 Improve management of barn Correct temperature, ventilation rate and humidity according to management manuals
	MYCOTOXINS: Deoxynivalenol (DON) T-2 toxin (T-2) Other trichothecenes	Feathers are narrow because of radiomimetic injury to the developing barbs.	 Positive for trichothecenes in raw materials (ELISA) or feed (HPLC) Raw materials originated from supplier/region with history of trichothecenes contamination Histopathology: Check other target organs of trichothecenes (e.g. liver, for hepatic vacuolization) Overall decline in flock performance 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines to become contaminated by stale, wet or moldy feed
	NUTRITION: Amino acid (AA) deficiency/unbalance	Unpaired feather formation and feather pecking.	 Level of Total Sulphur AA (TSAA) in diet Ratio TSAA/lysine/arginine/threonine AA scale at feed mill 	Increase level of synthetic AA in low digestible diets (high levels of by-products)
	MANAGEMENT: Red mites	Poor feathering, ruffled feathers, feather loss.	Presence of red mites in the barn during the night	 Flame cages during withdrawal period Clean egg belts during withdrawal period Increase biosecurity level Use plastic egg belts whenever possible
	PATHOGENS: Infectious Bursal Disease Virus (IBD/Gumboro)	IBD is very immunosuppressive and and leads to impaired feathering (feathers are ruffled).	Maternal antibody titres are very low in day-old chicks	 Adapt vaccination program to the demands of the field situation in each particular area/epidemiology Increase biosecurity level
	PATHOGENS: Infectious Bronchitis (IB) Virus	IB causes respiratory disease and kidney damage in growers and oviduct infection in adult.	\square Laboratory tests to confirm the presence of the coronavirus in a swab or tissue sample	Adapt vaccination program to the demands of the field situation in each particular area/epidemiology

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Symptoms	Potential cause	Description of problem	Check list	Corrective actions
<section-header></section-header>	MYCOTOXINS: Ochratoxin A (OTA) Citrinin, Aflatoxins (Afla)	Due to kidney damage, uric acid excretion is reduced resulting in the accumulation of uric acid in the body. At the farm, leg problems and increased water excretion may be observed.	 Positive for OTA, citrinin or Afla in raw materials (ELISA) or feed (HPLC) Raw materials originated from supplier/region with history of OTA contamination Histopathology: Check other target organs of OTA and citrinin (e.g. kidneys) Overall decline in flock performance 	 Check average contamination levels Use Mycofix[®] at a correct dosage level Avoid feed bins or feed/water lines to become contaminated by stale, wet or moldy feed
	NUTRITION: Calcium, Sodium, Vitamin D ₃	Excess dietary calcium with low available phosphorus results in precipitati- on of sodium-urate crystals and calcium pyrophospate (pseudogout). Younger birds: Gout due to sodium intoxication observed at sodium levels >0.4% in water and >0.8% in feed. High levels of vitamin D_3 can increase calcium absorption from the gut favoring the formation and deposition of urate crystals.	Level of minerals and vitamins in diets	 Correct level of minerals and vitamin D₃ in diets Control fish meal usage (rich in salt) Control total sodium chloride content in feed (<0.3%)
	NUTRITION: Protein	>30% of protein in feed causes uric acid production leading to excretory loads in kidneys. Concurrently sulphates decrease calcium resorption causing excessive calcium secretion through urine, which favors gout.	□ Protein levels in feeds	Correct protein levels in feeds
	MANAGEMENT: Water deprivation	Water deprivation leads to concentration of uric acid and other minerals in the blood and later in the kidneys.	 Observe animal behavior to understand the cause of water deprivation Transportation and vaccination procedures Drinkers in terms of number, position and blockages that may be impeding animals to access them Chemicals added into water (disinfectants, copper sulphate, etc.) may result in water refusal, dehydration and gout 	 Improve transportation condition of birds (access to water) Adjust number, position and access to drinkers Avoid overcrowding Correct blockages in nipples
	PATHOGENS: Infectious Bursal Disease Virus (IBD/Gumboro)	IBD is very immunosuppressive and leads to kidney damage.	Maternal antibody titres are very low in day-old chicks	 Adapt vaccination program to the demands of the field situation in each particular area/epidemiology Increase biosecurity level
	PATHOGENS: Infectious Bronchitis (IB) Virus	IB causes respiratory disease and kidney damage in growers and oviduct infection in adults.	\Box Laboratory tests to confirm the presence of the coronavirus in a swab or tissue sample	□ Adapt vaccination program to the demands of the field situation in each particular area/epidemiology

*DISCLAIMER:

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