Ergot: Causes, Challenges and Controls

Ergot is a fungal disease that mostly affects annual cereal crops such as rye, triticale, wheat, oats and barley along with some grasses (rye, brome, etc.). The fungus invades the head of the seed during the flowering stage. Crops that have especially long flowering stages, like rye for example, are more susceptible and prone to ergot. If conditions are optimum for fungal growth during flowering in May and June (damp and cool), it replaces the grain kernel with an ergot body that contains poisonous alkaloid chemicals (*Pedrosa and Griebler, 2010*). These toxic compounds can be divided into two classes: ones that cause reduced blood flow to the extremities (vasoconstriction) and others that are toxic to the nervous system (*Thompson, 2016*). There are more than 50 different types of alkaloid compounds that have been detected in grains infected with the fungus that causes ergot (*Claviceps spp.*). In North America, there are six common alkaloids that can be detected by current analytical procedures (*Thompson, 2016*). Unfortunately, there has been a trend for much higher levels of ergot in western Canadian grains in the last several years compared to the long term norm (*Blakely, 2016*). One challenge with grains contaminated with ergot is that there can be a range of different alkaloids types and concentrations which therefore causes a wide range and severity of problems (*Pedrosa and Griebler, 2010*).

When ergot contaminated grain is fed to poultry it can have neurotoxic effects causing reduced feed intake, difficulty breathing and birds being reluctant to move. It can also reduce performance (ie: growth, egg production), affect the intestinal tract causing diarrhea and in extreme cases high mortality and lastly can restrict blood flow to the extremities causing gangrene of the toes, beaks, claws and combs – see Figure 1 (*Bandyopadhyay et al., 1998; Rotter et al., 1985 and Woinarowicz et al., 2006*). Clinical symptoms can take effect in as little as a few hours or up to several months depending on the levels and types of ergot alkaloids present in the grain (*Thompson, 2016*). It is also well documented that the effects of some ergot poisoning can be made much worse when the temperatures are colder or hotter than normal due to the birds' inability to get blood flow to its extremities. This can be a significant problem for laying hens and broiler breeders as egg production can be severely affected (*Pedrosa and Griebler, 2010*). The ergot alkaloid chemicals are very toxic compounds. Poultry are a little more tolerant to ergot than other species but can still have negative effects at low concentrations. Ergot levels as low as 200 parts per billion (ppb – 1,000 times smaller than a ppm) in the diet have been known to have significant impacts on health and performance (*Thompson, 2016*).

There are a range of recommended limits for feeding poultry and discrepancies in the research and opinions of safe levels to feed. The upper recommended ergot alkaloid concentration in poultry feed in Canada is 6-9 ppm (*Charmley and Trenholm, 2000*). Recommended feeding rates of ergot alkaloids range from 0.75 ppm for low risk to 3.0 ppm for higher risk in the complete diet (*Coufal-Majewski et. al, 2016*). Because the ergot bodies are quite big and easily identifiable there are "rules of thumb" that "safe" limits are 10 ergot bodies in one liter of grain sample. Just going by visual detection is dangerous due to the range of alkaloid chemicals, their potency and how they are distributed in a truck or bin of grain. Measuring the exact alkaloid content in a representative sample is by far the most accurate way of knowing the ergot content of the grain/feed (*Scott, 2009*). It just isn't the ergot bodies that are a threat to livestock. It also needs to be noted that the dust and fines can carry significant concentrations of the alkaloids (*Thompson, 2016*).

There are a number of different detection methods and control measures available. Gravity tables and color sorters are used very routinely to sort and remove ergot from contaminated grain. There are other technologies, such as near infrared reflectance (NIR), enzyme linked immunosorbent assays (ELISA),

higher performance liquid chromatography (HPLC) and liquid chromatographs and mass spectrometry (LCMS), now available to accurately detect and in some cases remove ergot bodies. Unfortunately, an accurate on-site ergot alkaloid screening tool or rapid test does not currently exist at the present time (*Thompson, 2016*). There are a number of labs that can test grain and feed for alkaloid content. Another tool to reduce the risk of ergot poisoning is the addition of clay based mycotoxin binding products. Specific additives can bind ergot alkaloids with varying degrees of success – see Figure 2.

At the present time the best control strategies for the feedmill or poultry producer is to monitor the incoming grain for ergot bodies, clean or sort heavily contaminated grain samples, test the high risk grains so you know the type of alkaloids present and their respective concentrations and dilute the alkaloid content down to an appropriate level for the type of poultry you are feeding and the level of risk you want to take or add a clay-based mycotoxin binder. It is important to note that the levels of ergot alkaloids can be quite inconsistent in a load of grain or feed which may overwhelm the binding product or dilution strategies. Some simple risk reduction actions that producers can implement while the crops are in the field, especially if you are growing a more susceptible crop and the conditions are optimum for fungus growth during late May and June, is to keep the grass cut in the ditches around the fields. It is well known that ergot thrives in many types of brome grass species and can be at extremely high levels of infestation in the ditches. The fungus can then invade the grain crop from the perimeter and move slowly towards the center. Keeping the ditch grass mowed minimizes the fungus from growing in the head of the seed during flowering. Another approach is to combine the outer edge of the infected field and unload it separately as it would be the highest level of ergot contamination (*Blakely, 2016*).

In the end, it is a combination of these strategies, along with being vigilant and testing appropriately, that will help you reduce the threat of ergot poisoning in your birds.

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*References available upon request.

**For additional information please refer to the following attachment.

Figure 1.

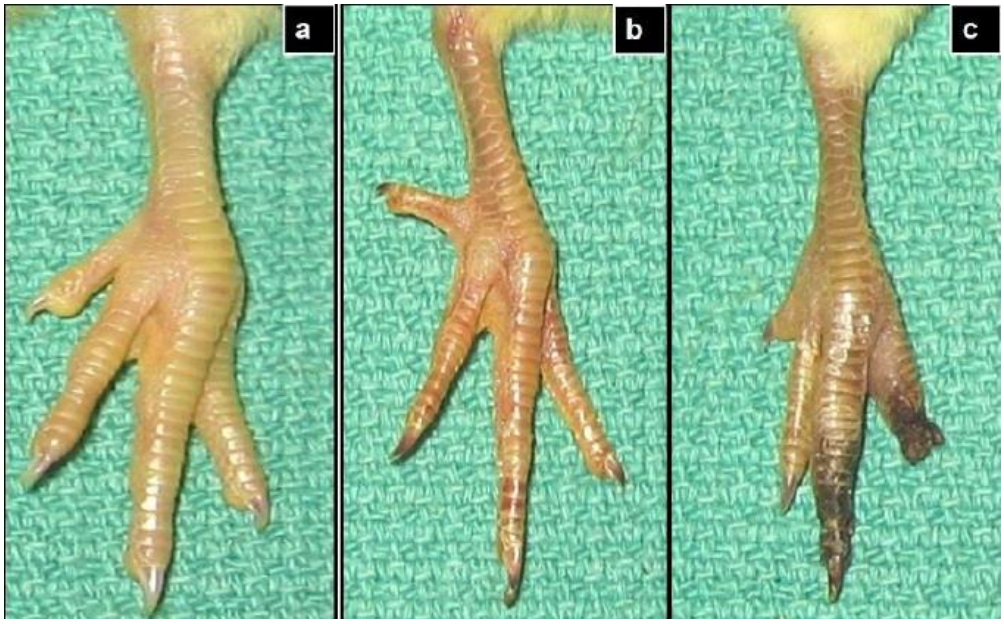

Figure 1 – Comparison of feet from a healthy (a) to chicks consuming moderate (b) and high (c) concentrations of ergot. Source: *Woinarowicz et al.*

Figure 2.

Percentage of bound ergot alkaloids at pH = 3 (left) and pH = 6.5 (right).

pH = 3	Binder #1	Binder #2	Binder #3
Ergometrine	44	34	64
Ergosine	97	97	99
Ergotamine	97	97	99
Ergocornine	94	93	99
Ergocryptine	96	94	99
Ergocristine	97	96	99
Ergometrinine	72	62	85
Ergosinine	97	97	99
Ergotaminine	98	98	99
Ergocorninine	97	96	99
Ergocryptinine	98	98	99
Ergocristinine	99	99	99

pH = 6.5	Binder #1	Binder #2	Binder #3
Ergometrine	31	30	53
Ergosine	92	93	98
Ergotamine	94	95	98
Ergocornine	89	88	98
Ergocryptine	91	91	98
Ergocristine	92	93	98
Ergometrinine	60	59	78
Ergosinine	92	94	98
Ergotaminine	93	95	98
Ergocorninine	89	88	98
Ergocryptinine	90	91	98
Ergocristinine	92	93	98

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