

1 **Technical Report: Coccidiosis in poultry with an emphasis on backyard poultry**

2 Dr. Geoffrey Lossie, edited by Dr. Pat Wakenell: Purdue University- Indiana Animal Disease Diagnostic
3 Lab

4 **Abstract:**

5 Coccidia are single celled, eukaryotic organisms that affect a wide range of birds from the tiniest finch to
6 the biggest eagle and everything in between, but especially poultry. In fact, coccidiosis is the most costly
7 disease to the poultry industry with losses from decreased weight gain, feed efficiency, and cost of
8 treatment and prevention exceeding 1.5 billion (in 1999) ⁶. Coccidiosis, however, is not just a problem
9 for the commercial industry. In a survey of postmortem examinations done on backyard poultry in
10 California, coccidiosis was the third most common disease encountered ². The most common complaint
11 of owners with birds with suspect coccidiosis is diarrhea. Common clinical signs of coccidiosis are
12 diarrhea (often bloody or spotted with blood), dehydration, listlessness and weakness with ruffled
13 feathers, anemia, and decreased growth rates and egg production ³. Diagnosis is based on clinical signs,
14 fecal screening, gross lesions at the time of necropsy, and histopathologic examination. Treatment can
15 be complicated especially in backyard flocks, as coccidiosis is largely a matter of poor or inadequate
16 husbandry. Typically, a short course of anticoccidial medication and addressing the husbandry issues is
17 usually enough to break the cycle.

18 **Introduction:**

19 Coccidiosis is a protozoal disease of the intestines (or kidneys in geese) caused primarily by parasites in
20 the genus Eimeria. There are nine described species of Eimeria in chickens and seven in turkeys, but not
21 all of the species are capable of causing disease. It is important to note that coccidia is species specific,
22 meaning that chicken coccidia do not affect turkeys and vice versa. The terms coccida/ coccidiosis/ and
23 coccidiasis do not refer to any particular species but to the clinical and subclinical (coccidiasis)
24 manifestation of infection by any of the different species. This technical report will use the term
25 coccidiosis to refer to active disease producing clinical signs. The coccidial life cycle is complex but
26 direct, with infection occurring via the fecal-oral route. Oocysts (similar to an egg) are shed directly in
27 the feces where they can contaminate feed, water, litter, and soil. Fresh oocysts are not infective until
28 they incubate in the environment for 1-2 days and become sporulated at the proper temperature,
29 moisture, and oxygen levels ¹. Mechanical and biological vectors are important as well. Mice and flies
30 can transport infective oocysts during their normal feeding habits, while other insects such as darkling

31 beetles can ingest the oocysts which can remain infective until the darkling beetle is consumed by a
32 chicken. The most common means of spread, however, is via movement of personnel between pens,
33 houses, or farms that are harboring oocysts on their clothes or boots⁵. Once the oocyst is ingested,
34 sporozoites are released and initiate multiple stages of asexual replication. Following is a sexual
35 reproduction phase that produces thousands of new oocysts in the intestines and ceca³. The whole
36 cycle from ingestion to the release of new viable oocysts is 4-6 days³. Lesions in the gut are produced by
37 destruction of the epithelial cells via development, multiplication, and release of various life cycle stages
38 from the epithelial cells³. The intestinal mucosa and submucosa are also affected³. Damage from the
39 continuation of the coccidia life cycle leads to diarrhea, dehydration, weight loss, rectal prolapse and
40 death⁸. Coccidiosis can also increase the severity of or predispose birds to other diseases like
41 *Clostridium perfringens*, *Salmonella typhimurium*, and *Histomonas meleagridis* (commonly referred to as
42 black head)⁵. Any immunosuppressive disease like Marek's disease or infectious bursal disease, or any
43 condition that ends up producing immunosuppression, can increase the severity of coccidiosis⁵.

44 **Coccidia in Chickens:**

45 Coccidiosis in chickens is observed in all types of production from the backyard flock owner with three
46 chickens up to multi million commercial hen operations. One of the challenging aspects regarding
47 coccidia, not only in chickens but other poultry, is that due to its ubiquitous nature, coccidia cannot be
48 eliminated or prevented by quarantine, disinfection, or sanitation⁵. Coccidiosis in chickens is caused by
49 nine recognized species, with multiple species often infecting the same bird⁵. Each species of coccidia
50 has its preferred anatomic location for infection and produces relatively unique lesions. Less pathogenic
51 species tend to cause few or no lesions whereas the more pathogenic species cause diarrhea that can be
52 muroid or bloody³. Beyond diarrhea and dehydration, birds soon develop ruffled feathers, anemia,
53 become listless and weak, and have decreased growth rates and egg production³ (**Figure 1**). *Eimeria*
54 *acervulina* is the most frequently encountered species in poultry in both North and South America⁵.
55 Reduction in weight gain, watery and muroid droppings, and loss of pigmentation from the blood and
56 skin, due to decreased absorption of various pigments in the gut are the most common clinical signs⁵.
57 The classic gross lesion associated with *E. acervulina* is transverse, white to gray, striations along the
58 upper third of the intestinal mucosa³. *Eimeria necatrix* is one of the more pathogenic species causing
59 severe enteritis with congestion, hemorrhage, and necrosis of the middle third (see figure 1) of the
60 intestines and is associated with high mortality³. *Eimeria tenella* is a highly pathogenic species that
61 causes spectacular lesions of the paired cecae. Blood, and in later stages of infection, cheesy, cecal,

62 cores, can be found occluding the entire lumen³. Determining the species of coccidia infecting your
63 birds is not nearly as important for backyard producers, as the treatment is generally the same
64 regardless of coccidia species. Commercial producers are more interested in speciating coccidia as it is
65 important to determine if the primary species affecting the flock is one of the species for which the flock
66 has been vaccinated.

67 **Coccidia in Turkeys:**

68 The clinical signs associated with coccidiosis are similar to that seen in chickens. There are seven
69 recognized species of *Eimeria* in turkeys with four species recognized as pathogenic³. *Eimeria*
70 *meleagridis* is one of the more prevalent species of coccidia found in turkey operations and is
71 moderately pathogenic³. *E. meleagridis* causes congestion and petechiae from the duodenum to the
72 ileum, with lesions being more severe in the jejunum³. In young poults there can be weight loss,
73 dehydration, general unthriftiness, and even death³. One of the most pathogenic and common species
74 of coccidia in turkeys is *Eimeria adenoides* which affects the distal third of the intestines causing liquid
75 feces containing mucus and flecks of blood³. The cecum often contains hardened mucosal debris that
76 appears as loose, whitish, cecal cores³.

77 **Coccidia in other poultry species:**

78 As mentioned previously, coccidia are species specific and so it should be no surprise that other species
79 of poultry have their own coccidia capable of causing disease. Coccidia is sporadic in ducks but has been
80 shown to cause moderate to heavy mortality in commercial duck farms in New York, New Jersey,
81 Hungary, and Japan⁵. Coccidia in ducks is caused by three different genera: *Eimeria*, *Wenyonella*, or
82 *Tyzzeria*⁵. Finally, coccidiosis in pigeons is similar to that in chickens caused by *E. necatrix*⁵. The most
83 common species in pigeons are *Eimeria columbarum* and *Eimeria labbeana* with mortality varying from
84 5-70%⁴. Clinical signs include anorexia, dehydration, cachexia, and greenish diarrhea (that can be blood
85 tinged)^{4,5}.

86 **Diagnosis:**

87 Diagnosis of clinical coccidiosis is relatively straightforward but can be impaired by postmortem changes
88 in birds that have been dead for an hour or longer⁵. Diagnosis in backyard flocks is typically made via
89 observation of clinical signs, and is easily confirmed by running a fecal flotation test. It is recommended
90 that backyard poultry keepers have their birds feces tested once to twice a year to determine overall
91 parasite burden. Diagnosis of coccidiosis in cases where postmortem examination and histopathologic

92 examination are performed is based on gross pathology findings and histopathologic findings. Mild
93 coccidia infection with concurrent lesions is common in birds of 3-6 weeks of age, so diagnosis of clinical
94 coccidiosis relies on the presence of clinical signs, gross lesions, histopathologic lesions, and
95 demonstration of the organism ⁵.

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97 **Prevention and Control:**

98 Successful prevention and control in both backyard flocks as well as commercial flocks depends entirely
99 upon identifying the predisposing factor that allows for increased numbers of coccidial oocysts in the
100 environment. Poultry density is a key factor in preventing coccidia outbreaks. Stocking birds at high
101 densities increases the overall number of oocysts in the environment, and once a critical level is
102 reached, a clinical outbreak can occur. Density issues tend to occur with new poultry keepers unfamiliar
103 with proper stocking densities and during the winter months when large numbers of birds are housed in
104 temporary housing or coops ⁷. Keeping the poultry house clean is another key component. Litter should
105 be cleaned out regularly and with increased frequency if the poultry density in the house is high. To
106 reduce oocyst numbers in the environment dilute bleach or lime can be applied to the soil on a monthly
107 basis followed by rototilling of the soil ⁷. For backyard producers it is highly recommended to use
108 commercial, non-organic, poultry feed as it contains low levels of amprolium, a coccidiostatic drug, that
109 helps keep coccidiosis under control. Organic feed does not contain amprolium, and owners feeding
110 their birds organic feed must be vigilant for signs of coccidiosis. Submitting a pooled fecal sample once or
111 more a year is a good way to screen for coccidia and alert the grower to any potential issues.

112 Prevention of coccidiosis in commercial poultry is much different, but even more important as by the
113 time signs of coccidiosis are noticed within a flock, the damage to the intestines and subsequent
114 decrease in either meat or egg yield has already occurred ⁵. Vaccination, within the egg or at hatch, is
115 key to controlling coccidia in production medicine. In broiler production a practice known as a “shuttle
116 program” is used. Within a shuttle program, a coccidiostatic drug is used in the starter feed, and one to
117 even three different products are then used during the grow-out and finishing period ⁵. The purpose of
118 the shuttle program is to improve coccidia control and to help prevent resistance to a single
119 coccidiostat. Drug resistance in coccidia is a worldwide problem and well documented in the United
120 States, South America, and Europe ⁵.

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123 **Treatment:**

124 While coccidia is considered to be self-limiting in normal birds, in an environment that is not heavily
125 contaminated with oocysts, treatment in the event of an active outbreak is required to reduce clinical
126 signs and prevent mortality. Amprolium, a poultry labeled product, is dosed via the drinking water, and
127 is the medication of choice. Backyard producers may have trouble finding Amprolium labeled for
128 poultry, but can use the cattle product off label with recommendation by their veterinarian. The
129 treatment course is for 5-7 days (follow label directions), but may need to be extended in difficult or
130 persistent cases. Treatment will never be successful as long as the predisposing factors remain.

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152 **Figure 1:** Two backyard chickens with coccidiosis in a repurposed swine barn. There are multiple piles of
153 loose stool. Both birds were listless with a hunched posture. This image illustrates the necessity of
154 having appropriate litter that can be regularly cleaned.

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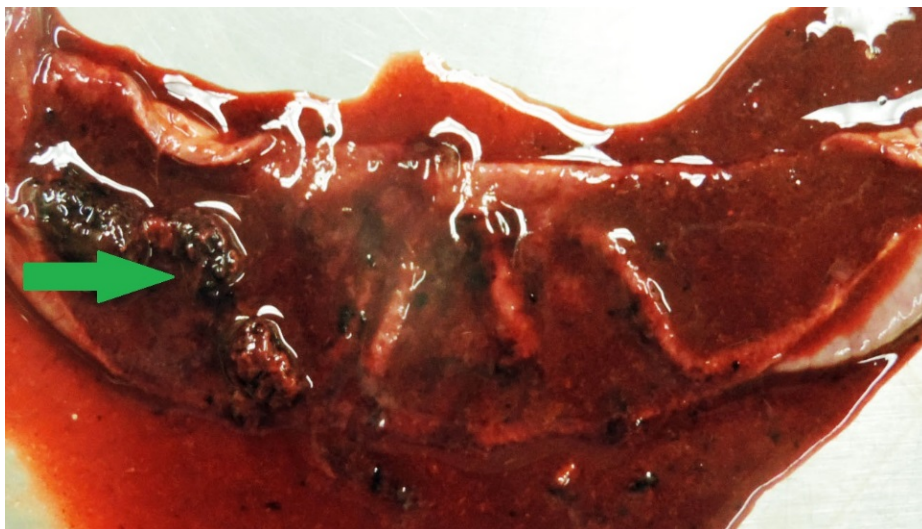
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Figure 2: Small mobile chicken coop housing numerous birds. In the winter this coop was used to house the birds in the image. This amount of space was inadequate, and the birds developed clinical coccidiosis.



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Figure 3: Section of small intestine from chicken infected with *E. necatrix*. The lumen is full of frank blood with flecks of clotted blood. Note the necrotic, hemorrhagic, debris within the lumen (green arrow).