Coccidiosis of Poultry

Causes, symptoms, lesions, and preventive measures

By ROBERT GRAHAM and C. A. BRANDLY

Chicks infected with coccidiosis show varying symptoms of unthriftiness, such as loss of weight, ruffled feathers, weakness, drowsiness, and huddling in groups.

Circular 485

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Coccidiosis is widely distributed in Illinois poultry flocks. The specific cause is a group of microscopic protozoa known as coccidia. There are at least three species of coccidia that are capable of causing serious disease in chickens.

**Symptoms** of the acute form of the disease, which is usually confined to young chickens, include bloody diarrhea, weakness, and paleness, accompanied by high mortality. In the chronic malady, which generally occurs in pullets or cockerels, varying degrees of un thriftiness are observed. Fowls affected with either type of the disease perpetuate the disease on the premises and are thus a constant threat to healthy stock.

**Diagnosis** of coccidiosis may require careful consideration of the history of the outbreak, symptoms, and autopsy findings, altho usually the presence of the disease is conclusively demonstrated by the finding of coccidia in intestinal contents or droppings when these are subjected to microscopic examination.

**Prevention** of coccidiosis is largely a problem of sanitary management. Frequent cleaning of brooder houses, the providing of well-drained, uncontaminated grounds, and the adoption of sanitary feeding methods are valuable control methods.

**CONTENTS**

<table>
<thead>
<tr>
<th>CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Several Species Affect Chickens</td>
<td>3</td>
</tr>
<tr>
<td>Life Cycle of Coccidia</td>
<td>4</td>
</tr>
<tr>
<td>How Coccidiosis Spreads</td>
<td>5</td>
</tr>
<tr>
<td>Cecal Coccidiosis in Chickens</td>
<td>6</td>
</tr>
<tr>
<td>Intestinal Coccidiosis in Chickens</td>
<td>8</td>
</tr>
<tr>
<td>Early Diagnosis Important</td>
<td>9</td>
</tr>
<tr>
<td>Preventive Measures Are of Primary Importance</td>
<td>10</td>
</tr>
<tr>
<td>Checking Outbreaks of Coccidiosis</td>
<td>12</td>
</tr>
<tr>
<td>Resistance to Coccidiosis</td>
<td>14</td>
</tr>
</tbody>
</table>
COCCIDIOSIS OF POULTRY

By Robert Graham and C. A. Brandly

CHICKENS, turkeys, geese, ducks, and guinea fowls are all subject to coccidiosis, a disease caused by microscopic parasites, called coccidia, which are taken into the body in contaminated feed and water. The parasites (single-celled protozoa) invade the walls of the intestines, where they cause inflammation and injury of varying degrees.

Altho all barnyard fowls are susceptible to this disease, each is attacked by a distinctly different kind, or species, of coccidium, and consequently the disease is not communicable from one species of fowls to another. The species of coccidia that affect chickens, for example, do not affect turkeys, ducks, geese, or guinea fowls; and the species that infest other fowls do not affect chickens.

The small intestines and the ceca, or blind pouches, are the parts mainly invaded by this parasite, tho one species that attacks geese is known to invade the kidneys.

The information in this circular has largely to do with coccidiosis of chickens, tho the preventive measures outlined here are effective in controlling the disease in all kinds of poultry.

SEVERAL SPECIES AFFECT CHICKENS

At least six species of coccidia live and multiply in the intestines of chickens. One species (Eimeria tenella) develops in the walls of the ceca, or blind pouches, and causes the cecal type of the disease in young chickens, a type that is often acute and fatal. The two species that lodge in the small intestines usually produce a chronic (slow) type of the disease, altho occasionally they produce a severe (acute) form. These two species are E. necatrix and E. maxima. Three other species (E. mitis, E. praecox, E. acervulina) are capable of inducing mild inflammatory changes in the intestine, which are seldom accompanied by symptoms of illness.

Thus an outbreak of coccidiosis in poultry may be caused by a single species; or two or more species may be present as a mixed coccidiosis infection of the intestine and the ceca. Other strains may be present without causing any apparent illness.

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Knowledge of the life history of the organism that causes coccidiosis is of practical importance to the poultryman in applying effective preventive measures.

All the different species of coccidia affecting chickens and other fowls have essentially the same life cycle. Droppings of infected fowls carry in them the coccidia in the oocyst, or egg, stage (Fig. 1). When freshly voided, these oocysts are incapable of infecting susceptible birds. A period of a day or more outside the body of the bird is required for them to develop to the infective stage, the exact time depending upon temperature and moisture conditions. When the

![Diagram of the Life Cycle of Fowl Coccidia](image)

**Fig. 1.—Diagram of the Life Cycle of Fowl Coccidia**

Under favorable conditions the entire life cycle of the parasite which causes coccidiosis may be completed in 8 to 10 days. In the egg state it gets into the intestinal tracts of chickens by means of contaminated food and water.
infective oocysts (sporocysts) are picked up by the fowls and enter the intestinal tract, the life cycle is started. After reaching that part of the intestine (small intestine or ceca) adapted to their development, the sporocysts escape from the oocysts and penetrate the lining wall, where asexual multiplication (schizogony) takes place rapidly. It is during this stage that serious injury to the lining of the intestine and ceca occurs.

Upon termination of the asexual stage, sexual multiplication (gametogony), which terminates with the development of the oocyst (Fig. 1), takes place in the lumen of the intestine. In the oocyst stage the resistant coccidia leave the intestinal tract in the droppings of the fowl, to survive in the outside world until taken into the intestinal tract of poultry in feed or water or until destroyed by natural forces or sanitary measures.

The fact that oocysts on contaminated premises are capable of surviving under ordinary conditions from one season to another often explains the recurrence of the disease in successive years on the same farms.

**HOW COCCIDIOSIS SPREADS**

Coccidiosis in poultry is spread both directly in polluted feed or water and indirectly by more remote mechanical means.

**Direct spread.** The pollution of feed and water with the droppings of infested birds is the most common and direct means by which this disease is spread. A fact often overlooked is that some birds, altho apparently recovered from an attack of cecal coccidiosis may, for as long as six months, continue to pass viable coccidia. There is also evidence that older birds may harbor and spread other species indefinitely even tho they are not exposed to reinfestation. That coccidia may be transmitted within the egg is only remotely possible, for it has been shown that oocysts placed on the shells of chicken eggs do not survive the incubation period of the eggs.

**Indirect spread.** Mechanical transmission of coccidiosis by various animals, rodents, birds, as well as the shoes and clothing of man, are factors in the indirect spread of the disease. Particles of dust may bear coccidia from one place to another by wind or air currents. Surface drainage and streams likewise may carry coccidia. Poultry crates and other contaminated equipment carried from farm to farm may also serve to spread coccidiosis. In addition to flies and other insects, other of the smaller forms of animal life may serve as mechanical spreaders by transporting coccidia in or on their bodies and leaving them where they may be ingested by susceptible fowls.
Another mode of spread is by different barnyard fowls carrying coccidia to which they are not susceptible. The turkey, for instance, may ingest coccidial oocysts from the droppings of chickens and later expel them uninjured in the droppings, where they ultimately may be picked up by susceptible chickens. Furthermore, sparrows and pigeons may be indirectly responsible for transporting and spreading coccidiosis from one poultry flock to another. While the importance of this indirect mode of spreading coccidiosis is not definitely established, it cannot be entirely disregarded in some localities.

CECAL COCCIDIOSIS IN CHICKENS

Chickens between three and twelve weeks of age seem most susceptible to the cecal type of coccidiosis (*Eimeria tenella*), altho older and younger birds also become infected. The cecal type, which is usually the acute form, frequently causes heavy death losses in a flock. In moderately severe infestations only a few birds may die, altho many may show symptoms of the disease.

**Symptoms.** Cecal coccidiosis sometimes develops very rapidly in a flock and causes heavy losses without producing the usual symptoms of the disease. In fact the onslaught may be so sudden as to suggest chemical or food poisoning. Chicks so affected show marked weakness, paleness, and rough feathers, and tend to seek warm places. They are unsteady in movement, have blood in their droppings, blood-soiled vents, and often sit quietly with eyes closed and wings drooped (Fig. 2). Birds that have bloody droppings and blood-soiled vents may appear pale as the result of severe hemorrhage into the ceca.
Lesions. In chickens affected with the cecal type of coccidiosis the ceca or blind pouches are usually the only parts directly affected. At autopsy one or both pouches may be enlarged, and the walls thickened and discolored (Fig. 3). In chickens that are acutely affected the contents of the cecum may be either fluid or firm in consistency, and they may show a dark color or contain varying amounts of fresh blood (Fig. 4), depending upon the extent of the hemorrhage. Occasionally hemorrhages may occur also in the lining of the walls of the intestines below and above the cecal openings. In chickens not so acutely affected, the ceca may be filled with cores of impacted yellowish cheesy substance marked with dark patches.
INTESTINAL COCCIDIOSIS IN CHICKENS

Coccidiosis of the small intestines of chickens is generally chronic or subacute, altho it occasionally occurs in the acute form. The upper part (duodenum) and middle part (jejunum) of the small intestine, as well as the lower part (ileum), may show varying degrees of inflammation. In infestations with *E. necatrix* a phase occurs in which the lining of the ceca is invaded but not injured seriously.

**FIG. 5.—PULLET AFFECTED WITH COCCIDIOSIS**

In pullets six to eight months old the outstanding symptoms of coccidiosis are unthriftiness accompanied by diarrhea, indifferent appetite, emaciation, paleness of the comb and wattles, leg weakness, or a slow, sluggish attitude in walking.

As a rule, intestinal coccidiosis occurs in birds somewhat older than those which are susceptible to the cecal type. Pullets in laying houses may be affected (Fig. 5). The chronic intestinal form develops and spreads more slowly within the flock or unit than the cecal type, but as in the cecal form, the severity of the disease is determined largely by the number of coccidia actually swallowed by the susceptible birds. Many birds may survive but remain unthrifty and unprofitable.

**Symptoms.** Coccidia causing the intestinal or chronic form of the disease (*E. necatrix, E. maxima*) usually do not produce so many oocysts as the cecal type (*E. tenella*). The rate of spread is less rapid, and the course of the disease tends to be less severe. Symptoms of chronic intestinal coccidiosis—unthriftiness, poor appetite, loss of flesh, paleness, poor or rough feathering, weakness and dullness—are often poorly defined and a specific disease is not always suspected. Often the symptoms of chronic coccidiosis cannot be distinguished from those
caused by various infectious diseases of poultry or by internal or external parasites or dietary deficiencies.

Lesions. The intestinal type of coccidiosis is characterized by chronic inflammation and thickening of the intestinal wall, together with hemorrhages and yellowish-white necrotic areas. The ceca are seldom seriously involved. In some infested fowls hemorrhage may not be evident at autopsy; there may be merely a thickening of the intestinal walls and an excess of mucus (Fig. 6). So-called casts, or false membranes, resulting from inflammatory and exudative changes, may line a portion of the gut. A severe hemorrhagic form of coccidiosis of the intestines may result where crowding of stock and insanitary measures bring about heavy exposure to the disease.

In the intestinal type of the disease microscopic examination of the intestinal contents permits a definite diagnosis to be made.

Fig. 6.—SECTION OF INTESTINE OF PULLET, SHOWING LESIONS OF CHRONIC COCCIDIOSIS

In the intestinal type, as well as in the cecal type of coccidiosis, the invasion of the epithelial cells lining the walls causes the walls to become thickened, discolored, and spotted with hemorrhages (see arrows).

EARLY DIAGNOSIS IMPORTANT

Prompt application of control measures is highly important in the control of coccidiosis. Diagnosis should therefore be made as quickly as possible after any symptoms appear.

In young birds three to ten weeks old the presence of coccidiosis may first be suggested by paleness, weakness, blood-stained or dark droppings, together with high death losses.

In pullets or mature fowls chronic unthriftiness and wasting, together with a history of previous outbreaks of coccidiosis on the premises, should be regarded with suspicion and should be followed
FIG. 7.—OOCYST OR EGG STAGE OF *Eimeria tenella*

*A*, enlarged × 100; *B*, × 300; *C*, × 900. These microscopic protozoan parasites in the droppings of infected fowls contaminate the premises and spread the disease to other susceptible fowls. The photomicrographs are from a direct smear preparation made from the inner lining of the ceca of a chick suffering from acute coccidiosis.

Immediately with further examination. Since these and other symptoms may be encountered in other intestinal diseases as well as in coccidiosis, positive diagnosis is often dependent upon microscopic detection of coccidia in the intestinal contents or droppings (Fig. 7).

Not only is early diagnosis essential in preventing the rapid spread of the acute and fatal type of coccidiosis in a flock, but it is also important in preventing the losses in egg production that are caused by the chronic type of the disease.

**PREVENTIVE MEASURES ARE OF PRIMARY IMPORTANCE**

Like other parasitic and infectious diseases, coccidiosis of poultry is perpetuated by the passage of the disease agent from the infected host to the susceptible host. Coccidia passing from an infected fowl require favorable conditions outside the body for a short time (21 to 48 hours) to develop or ripen, and become infective. Consequently preventive measures based on management practices are effective in checking coccidiosis. Susceptible fowls must be protected against direct or indirect contact with exposed, infected, or recovered stock. All birds over three weeks of age not definitely known to be free from coccidia, or exposure thereto, should be considered potentially dangerous.

Avoid contaminated soil and range. Various factors such as type of soil, drainage, and shade determine the length of time over
which ranges, yards, and other areas contaminated with coccidia remain a source of danger. Poorly drained soils rich in humus remain contaminated much longer than light, sandy soil. Drying and exposure to sunlight tend to destroy coccidia. Ordinarily land on which young or old coccidiosis-affected stock has ranged should not be used for poultry the following year. A four-year range rotation program on well-drained ground will usually curtail soil-perpetuated coccidiosis in poultry.

Avoid contamination of feed and water. Sanitary feeders and watering utensils which prevent the pollution of feed and water by droppings are helpful in the prevention of coccidiosis.

Common disinfectants useless against coccidia. Unfortunately, coccidia are particularly resistant to chemicals which are markedly destructive to bacteria. They may, for example, not only remain uninjured when subjected to 5-percent solutions of formaldehyde, carbolic acid, sulfuric acid, and copper sulfate, but may develop or ripen in such solutions. The dampness produced by spraying and washing solutions may thus favor the development of coccidiosis. It is therefore useless in most cases to employ the common disinfectants in an effort to destroy coccidia.

Heat effective against coccidia. Heat is highly effective in the destruction of coccidial oocysts. Boiling water destroys them instantly, and is recommended for daily washing of the drinking utensils.

Actual contact of the coccidia with hot or boiling water is, however, necessary. Application of hot water or a direct flame to dirty floors or contaminated equipment is often without effect because the heat does not penetrate sufficiently. Largely for this reason the so-called fire guns are not practical for destroying coccidia. Careful and thorough cleaning of equipment and floors is usually most effective. Lye water (one can to 20 or 30 gallons of boiling water) is effective in dissolving organic matter and cleaning the floors of brooder houses.

Cull out carriers of intestinal type. The prevention of the cecal type of coccidiosis is usually a much less serious problem than the prevention of the intestinal type. The course of the cecal type is shorter, resistance to it seems to develop more quickly, and the susceptible and carrier stages do not persist so long as in the intestinal type. Disposal of the mature infected or recovered stock has been found an almost essential measure in eliminating the source of intestinal coccidiosis on some premises. Birds apparently healthy frequently give off large numbers of coccidia with their droppings.
Guard traffic between flocks and flock units. Adult stock to be added to a flock should be obtained only from healthy flocks and should be quarantined for several weeks before being placed with the flock. Where fowls of all ages are kept on one farm, it is desirable to separate them into age groups and then to use all practical means to prevent contact between the different groups. Contact by means of insects, wild birds, rodents, and other vermin should not be overlooked.

CHECKING OUTBREAKS OF COCCIDIOSIS

Milk-mash treatment has value. In outbreaks of cecal and acute intestinal coccidiosis the milk-mash treatment has been widely used with considerable success. It is not, of course, a specific remedy for coccidiosis. Its effectiveness in combating the disease seems to lie in the high nutritive value of the milk mash, which tends to support the strength and vitality of the bird during the period of greatest injury from coccidiosis.

Milk mash is prepared by adding dried skim milk to the regular mash at the rate of 40 pounds of dried skim milk to 60 pounds of mash. This milk mash is then fed to the flock or brood over a period of five to ten days, depending on the extent of the disease and the response observed in the infected birds. No other feed is provided during this period, tho a liberal supply of water should be available. The litter should be changed at least once a day, or oftener if it becomes damp. Additional warmth may be desirable for affected broods during cool or damp weather.

If the disease persists, the milk-mash treatment may be repeated after feeding the regular mash for a few days.

The milk treatment does not seem to be of value in the control of chronic coccidiosis. Hence strict sanitary measures, including frequent culling, must be relied upon in flocks affected with the chronic type. If these measures are not successful, it may be necessary to dispose of the entire flock.

Drug treatments not effective. Altho a mild laxative of Epsom salt¹ may be helpful in the beginning of an outbreak, any harsh medicinal or other measures should be avoided in birds weakened by loss of blood and impaired nutrition. It has been shown repeatedly that drugs are of no value in treating or controlling coccidiosis of poultry. To date a specific remedy for coccidiosis has not been dis-

¹The dosage for each 300 to 400 chicks (4 to 6 weeks old) is one pound. It is dissolved in water and used to make up a moist mash sufficient for one feeding.
Coccidiosis of Poultry

Covered; and if such a treatment were known, it would not prevent reinfection.

Because of the nature of coccidiosis, control must rest largely upon preventive measures—culling, clean utensils, sanitary floors, dry clean litter, and clean ranges—rather than treatment.

**Cod-liver oil helpful.** Since coccidiosis causes injury to the intestine, normal digestion and assimilation of food is interfered with. Nutritional diseases, such as rickets (avitaminosis D) may therefore develop during or following an outbreak. In such cases cod-liver oil often becomes a desirable addition to the ration.

**Culling.** Rigid culling to remove all sick birds should be supplemented by frequent cleaning. Badly affected fowls should be killed and burned. Those which recover should be fed for early marketing.

**Wire floors.** False floors of wire mesh or “hardware cloth” help to protect the birds against contact with their droppings. Even these floors, however, may fail to control the disease because of the collection of minute amounts of feces between the meshes and the supports.

**Clean range.** On range, division of the flock or brood into small units temporarily placed in movable wire enclosures about 8 feet in diameter has been employed to advantage during warm weather by some poultrymen. Several times a day the unit is moved a few feet to a clean area. Thus the same results are obtained as in houses where the litter is removed and replaced daily. Avoiding ranges near groves of trees frequented by wild birds may also be helpful in coccidiosis control and prevention.

**Crowding and dampness.** Crowding and dampness favor exposure to and spread of coccidiosis. Frequent cleaning not only reduces dampness but removes the oocysts before they ripen to the infective stage. The use of inexpensive litter such as straw, ground corncobs, or shavings allows frequent cleaning. Ground corncobs have been found to absorb twice as much moisture as shavings and straw litter.

Cleaning should be done daily during an outbreak of the acute type of the disease. The medication of litter for the control of coccidiosis has shown no advantages in tests at the Illinois Station.

**Litter disposal.** Proper disposal of litter at all seasons and at all times is highly important in coccidiosis control. Burning may be the only safe way, altho the use of the litter as fertilizer on ground far removed from the poultry plant is usually safe if the litter is hauled away immediately or is kept out of reach of the flock until it is hauled out for spreading. In properly constructed and screened manure pits
the heat generated by bacterial and other activity will effectively destroy coccidia, particularly if the poultry litter is mixed with horse manure.

**RESISTANCE TO COCCIDIOSIS**

The number of coccidia which a bird swallows often determines the severity of the disease. Small numbers of the coccidia may be overcome but large numbers may lead to serious injury or death. Management methods that will reduce the intake of coccidia are therefore highly important.

While poultry sometimes appear to develop some degree of resistance to coccidiosis as a result of light or mild coccidial infestations, the developing of resistance in this manner is not to be depended upon as a means of controlling the disease. Experimental feeding of small numbers of oöcysts to birds has failed to produce a measurable resistance to this disease. Furthermore, any resistance which may develop as a result of mild infestations is apparently limited to the type of coccidium which produced it. And infections with two or more species of coccidia apparently serve to delay or prevent the development of any appreciable resistance to the disease.
Laboratory Diagnosis

Positive diagnosis of coccidiosis in fowls is dependent on laboratory findings. Live chicks or pullets suspected of being infected with coccidiosis may be taken to the local veterinarian for diagnosis, or where laboratory facilities are not available in the community, they may be sent parcel post or express prepaid for free examination to the Diagnostic Laboratories, Animal Pathology Building, University of Illinois, Urbana.
For the Prevention and Control of Coccidiosis

1. Guard against bringing into the flock stock that is infested with coccidiosis, or that has been exposed to this disease, or has recovered from it. Purchase only healthy stock from healthy flocks and quarantine all purchased birds for several weeks before placing them with the flock.

2. Guard against the mechanical introduction of the disease by visitors to the premises, by contaminated crates, and by carrier animals, including birds, rodents, and other vermin.

3. Use sanitary containers to prevent contamination of feed and water.

4. Clean all floors and equipment thoroly and frequently—once a day or oftener—in outbreaks of cecal coccidiosis in brooders or houses.

5. Cull and isolate affected birds promptly.

6. Burn contaminated litter and droppings or spread them on ground far removed from the poultry plant.

7. Brood chicks on fresh ground, and rotate the ranges of pullets and hens.

8. Prevent contact between fowls of different ages.