Coccidiosis of the Chicken

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Coccidiosis is the most prevalent infectious disease known to specialized poultry farming.

Strict sanitation alone positively controls the disease. Applying strict sanitation depends upon a knowledge of the parasite and the nature of the disease.

In addition to sanitation, liberal milk feeding for a limited period is used to control severe outbreaks.
Fig. 1. Infection cycle of Coccidia (types capable of causing death)—eight to ten days required to complete.
Coccidiosis of the Chicken

By

W. T. Johnson

The parasite responsible for coccidiosis of chickens is no doubt the most widely distributed disease-producing agent in Oregon's specialized flocks. It is doubtful whether any such flocks entirely escape. According to reports emanating from other parts of the continent, it is probable that this situation prevails elsewhere, and to a more serious degree in those sections where frequent spring and summer rains prevail.

Coccidiosis as a severe disease is largely due to the development of specialized poultry raising. Responsible for it are: (1) the large rearing unit, (2) limited range, (3) continuously used range, (4) proximity of poultry farms, and (5) increased trafficking in fowls.

This statement does not signify that specialized poultry farming is doomed to failure because of coccidiosis. It does, however, emphasize the necessity of recognizing the importance of this problem and becoming adequately informed. Facts are available which definitely determine means of control and make it possible to eliminate many disastrous losses, so prominent only a few years ago.

The disease is seldom severe in mature fowls. Greatest losses are encountered during the brooding period.

The cause of coccidiosis. A small parasite distinguishable only under the microscope has been established beyond question as the cause of coccidiosis. Various forms of mismanagement or feeding of the flock, resulting in lowered vigor, are often regarded as primary factors in the production of the disease, but erroneously so. There is so much experimental and field evidence to disprove these assumptions, that they would not be worthy of mention here if it were not for the fact that many interested in poultry still cling to such misconceptions. It should be obvious that these muddle the situation, and stand in the way of successful control.

Species and types of coccidia. At least four kinds (Fig. 2) of chicken coccidia are found in Oregon flocks—three affecting the small intestine and the ceca. Unless otherwise specified it will be understood that only two are being referred to, those definitely known to produce serious consequences. The one causing severe small-intestine infection occurs more commonly in older growing stock and the cecal type more commonly in the younger fowls. Both types are capable of causing very severe hemorrhage. Where fowls of various ages are concerned the coccidium capable of producing severe hemorrhage of the small intestine is decidedly the most destructive of the four. A satisfactory diagnosis, therefore, necessitates recognizing species.

It is of interest to note* that fowls on the other side of the continent are also affected with four kinds of coccidia, possibly the same four occurring here.

*Tyzzer, E. E.: Personal communication, Mar. 1928.

Species and strains of coccidia in poultry, Jour. Parasitol. XIII (1927); 3, p. 215.
The structure of the different coccidia is such that, in most cases of coccidiosis, microscopic examination readily differentiates them. When infection with large numbers occurs, those experienced can recognize the serious kinds without the aid of the microscope.

**The nature of the parasite and the disease.** The parasite gains entrance by the fowl eating contaminated material and passes into the intestines. It has been found so seldom in organs other than the intestines that for practical purposes its presence elsewhere in the body may be ignored. In the intestine the parasite undergoes various changes and finally emerges in an egg form, or what is known as an oocyst, which cannot be distinguished with the naked eye. This oocyst has a wall that compares with the shell of a hen egg, fluid with the white of the egg.

![Image](Image)

*Fig. 2. Species and types of Coccidia. Magnified approximately 550 times.*

A—Oocysts developed in the small intestine (see also Fig. 4-C) and apparently non-injurious.

B—Oocysts developed in the ceca (see also Fig. 3-B) and accompanied by hemorrhage. Similar to *coccidium* which causes hemorrhage of small intestine (see also Figs. 4-A and 4-B).

C—Oocysts developed in small intestine and apparently non-injurious.

and a spherical body comparable to the yolk (oocyst, non-infective, see Fig. 1). This is as far as the parasite develops in the fowl. It then passes out in the droppings. This stage is not capable of producing disease. The fresh droppings from an infected fowl will not produce coccidiosis.

After being passed in the droppings the oocyst undergoes a change (oocyst, infective, see Fig. 1), if proper conditions of moisture, air, and temperature are provided. In this change the part which compares with the yolk of the egg divides into four bodies, which in turn divide. At this stage the parasite is capable of producing disease. This has been repeatedly accomplished in approximately forty-eight hours under laboratory conditions at room temperature.

Five or six days are required for the parasite to attain much development after being consumed. If the fowl then survives the attack for a few days longer, it may discharge millions of oocysts in the droppings, and thus expose others to infection.
Severity of the disease dependent upon number of parasites consumed. The number of oocysts consumed determines the severity of the disease in fowls not seriously infected previously. Fowls infected with small numbers appear perfectly healthy. Young fowls infected with a large number for the first infection regularly die with the disease. This is more especially true of growing stock. Older fowls may show considerable cecal hemorrhage or bleeding and recover but are not so likely to recover with severe small-intestine infection. The fact that the severity of the disease is determined by the number of coccidia is of considerable importance, as it means that reducing the number serves as a control measure. This is accomplished by sanitation.

Coccidiosis self-limiting. Cecal coccidiosis is self-limiting and this is also apparently true of the other forms. The parasite goes through a rather definite period of development, stops reproducing, passes out of the intestinal walls and then out in the droppings. Fowls infected experimentally, killed and examined a month or less later, showed few or no coccidia. Since the oocysts pass out in greatest numbers during the first week after symptoms develop, the value of frequent cleaning during that period is obvious.

Immunity and resistance. Fowls are naturally highly susceptible to coccidiosis infection. Even under commercial flock conditions this may continue until after the fowls are mature, but is not likely to be the case. One severe or mild infection, continued long enough, results in varying degrees of resistance, if not complete immunity. This holds true for the four kinds of coccidia. One species does not produce immunity to another, in so far as the cecal and the two relatively harmless small-intestine coccidia are concerned. Knowing that the parasite is so widely distributed, that the disease occurs so frequently, and that infection develops resistance or immunity, it is logical to expect surviving commercially reared fowls to acquire resistance regularly. This is established. From this it is apparent that commercially reared mature fowls do not require as rigid sanitation for coccidiosis control as do young stock.

The fact that resistance or immunity is produced as a result of previous infection explains why serious coccidiosis does not occur over a period of years on some farms where insanitary methods prevail. That a given farm has successfully reared a flock of pullets without a severe outbreak of coccidiosis, and with what is generally recognized as insanitary conditions, does not signify that another would be equally successful with similar equipment and management. In these cases control is a chance occurrence and while the fowls may consume a small number of the parasites they are likely to consume a large number as the first dose. Under the latter circumstances disastrous results are certain to follow.

The knowledge that previous infection produces resistance points to the possibility of more accurately analyzing management conditions by experimentation. This may be accomplished by a study of resistance shown by fowls on different farms and analyzing the relationship of this to management factors. This and other phases, particularly the possibility of producing immunity by controlled inoculation, require further
investigations before practical relationships can be definitely worked out, so that they may be applied by the poultry raiser.

The method of distribution of the parasite from one poultry farm to another is a question frequently raised. Sufficient evidence is available to make reasonably certain what are some of the agencies involved. The parasite may be carried mechanically on the shoes, by flies, birds, used brooder equipment which has not been thoroughly cleaned, streams, or irrigation ditches. Used feed sacks may also act as a carrier, but are probably not a frequent source. In other instances the purchase of infected fowls is a source of infection. Whatever the source of the infection, it is customarily impracticable to attempt to determine this in each individual case.

The readiness with which the parasite is sometimes distributed is borne out by the not infrequent occurrence of coccidiosis in the case of incubator-hatched chicks placed in a new brooder house, with previously unused brooder equipment, and turned out on ground not used by poultry before. Furthermore, fowls kept under laboratory conditions in cages with half-inch-mesh wire bottoms, so that the droppings readily pass through, and provided with outside drinking and feed vessels, sometimes develop some coccidiosis. It is probable that insects and mice are important carriers in these instances.

It is highly important to remember that mature fowls provide a very likely source of infection for young stock on the same farm. Droppings from the mature fowls, adhering to the attendants' shoes, perhaps afford the most common means of carrying the parasite to the brooder stock.

Seasonal conditions exercise a distinct influence on the development of coccidiosis. This is due to the fact that moisture and warmth provided during the spring and summer months permit of rapid and regular development of the oocyst to the stage which is capable of producing the disease. Therefore it more frequently occurs in severe form at such times. In Western Oregon the month of April can regularly, and March occasionally, be expected to provide such conditions. Coccidiosis is, therefore, more readily controlled in early hatches. Even though moisture is provided during the early hatching season, the necessary warmth is lacking.

It is possible for severe coccidiosis to develop during the winter. When this occurs the source of infective oocysts is soil or material contaminated during the warm season or contaminated material kept warm by the brooder stove.

Where the poultry yard has standing water during the summer, or is traversed by streams, the period of favorable conditions for oocyst development is prolonged, increasing accordingly the chance for coccidiosis.

Symptoms and diagnosis. The symptoms in many cases of coccidiosis may not differ from those of a number of other diseases. This is particularly true when moderate infection exists. Where very mild infection occurs there may be no outward evidence. These cases can be diagnosed only with the aid of a microscope. There are times, however, when the average poultry raiser could hardly be mistaken in making a diagnosis.

Severe sudden outbreaks of cecal and sometimes small-intestine coccidiosis are accompanied by the passage of distinct amounts of pure
blood in the droppings. Sometimes, and especially under brooder conditions, these bloody droppings may be readily overlooked or minimized. Young fowls affected with severe coccidiosis may die suddenly, without any symptoms having been noticed, the only evidence being a pale comb, and a slight amount of blood on the vent fluff. Fowls dying under such circumstances should be examined and the condition of the intestines noted. Such fatal cases of coccidiosis will often show the ceca or blind intestines bulging with pure blood (Fig. 3), or in other instances such material will occur in the small intestine (Fig. 4-A and B) usually some distance below the gizzard. This is the most characteristic evidence of coccidiosis. When the small intestine is so affected, it is common for it to be distinctly enlarged where the infection is most severe. The enlarged portion is very readily torn and numerous blood spots, which are readily seen from the outside, occur in the intestinal wall. The opened intestine often gives off a distinctly foul odor at time of death. Fowls dying with this condition may be in perfect flesh and show no symptoms until a few hours before death. Such cases are readily produced experimentally.

If the infection is moderately severe the fowl will usually be droopy for several days up to a week or two, lose weight, and die during this period, or gradually show less symptoms and come back to normal weight. Under commercial flock conditions the fowls are less likely to recover, as they are then subjected to more trampling and fighting.

The presence of brick-red or salmon-colored material in the droppings must not be interpreted as definitely signifying coccidiosis. This type of dropping is frequently passed by young or mature stock without infection being present.

Fowls which survive severe cecal coccidiosis usually have yellowish or whitish cheese-like "cores" in the ceca in a few days following development of symptoms. These cores signify that the disease has run its course. Since cheese-like material may occur in the ceca of young fowls which are not affected with coccidiosis, a careful examination should be made before establishing the diagnosis. If the outer part of the core is skin-like, and the interior is reddish and crumbly, it is
very probably due to coccidiosis. The type of cheesy material which occurs in the ceca of chicks up to two weeks of age is likely to be due to some other cause.

**Relationship of breeding stock to the disease.** Poultry raisers are occasionally advised not to purchase eggs or chicks coming from stock affected with coccidiosis. While it is theoretically possible to carry out such advice, it is not practicable, and so far as this writer is aware is not

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**Fig. 4.** A. Fatal small-intestine infection. Such severe infection occasionally occurs naturally. Blood spots in intestinal wall and dilation of duodenum (D to F) and first part of free portion (F to O) are typical. Intestine filled with blood. Fatal cases may show much less marked bleeding than this specimen. The most severe coccidiosis known but the least common. B. Same specimen as A, above, but intestine opened and showing pure blood content. C. An apparently non-injurious type of coccidiosis of small intestine. Whitish patches represent masses of oocysts. Intestine is opened and lining exposed. Whitish patches not seen unless heavy infection occurs. Not accompanied by bleeding. The most common coccidiosis in Oregon flocks.
being done. It is theoretically possible for hatching eggs to become contaminated because of coming from infected breeding stock and the chicks in turn infected from the eggs, but this has not been definitely demonstrated. A number of other agencies previously mentioned provide common sources of infection.

It is thought by some that rearing fowls under conditions which favor coccidiosis will eventually result in immune strains of fowls which will not develop the disease. If all or a high percentage of those which become infected die and a sufficient percentage are naturally immune this would be possible. This possibility is almost nullified by the fact that experimental inoculation shows that there cannot be more than a small percentage which are naturally immune. Furthermore, increased resistance or immunity is commonly developed in susceptible fowls by repeated infections taking place and these fowls can be expected to reproduce susceptible offspring.

Coccidiosis and paralysis. Paralysis is not infrequently stated to be brought on by coccidiosis. Since coccidiosis is so wide-spread it is not at all surprising that the two are frequently found in the same fowl. This does not signify that paralysis is due to coccidiosis. Paralyzed fowls may show large numbers of coccidia or none at all. This does not prove that coccidia are or are not the cause of paralysis. Fowls which are free from coccidiosis may have been infected in the past and in fowls which are infected the parasites may have no relationship to the paralysis. Substantial evidence at hand contradicts the hypothesis that paralysis is due to coccidia themselves. Fowls experimentally infected show no paralysis even when kept for months. Such inoculations include using four kinds of coccidia.

CONTROL

Prevention. "Sanitation is the foundation of coccidiosis control... The inauguration of sanitary measures on an economic basis cannot be expected totally to eliminate coccidium infection, but they should result in holding infection down to a low degree, and permit of successful rearing." These statements,* made a number of years ago, are still consistent with the known facts. Sanitation is chiefly concerned with preventing infection being carried from the mature stock to the brooder stock, kind of soil and types of brooding.

Mature stock as a source of infection. The flock owner should constantly keep in mind the fact that mature stock is a possible source of infection for the brooder stock. Planning the farm so as to separate the young stock from the others is of signal importance as a preventive measure. Use of separate attendants for the chicks and for the mature fowls is a precaution that can be taken on some farms. If the same attendant cares for both classes of stock, wearing rubber and removing them before entering the brooder house or yards is of especial merit. An entirely separate feed room and equipment, particularly cleaning utensils, might well be provided.

Sandy soil provides the most suitable land. This type dries out more readily and therefore assists in preventing development of the oocyst.

Those which do develop are likely to die more quickly in dry soils than in damp soils.

The common practice of plowing the yards and growing a crop is to be recommended but this cannot be relied upon to rid the soil of all coccidia. Annual plowing and leaving the yards idle for three or four years will probably result in practically all of the oocysts being destroyed since they would, during such time, be subjected to drying, which is very destructive to them. Where only one or two yards are provided it is perhaps best not to plow at all, but to sweep the yards and haul the sweepings away. Plowing or spading the yards during an outbreak only serves to encourage the disease.

Fig. 5. A neat, well constructed, permanently located brooder house with concrete yard, on a prominent specialized Oregon poultry farm.

Types of brooding and equipment. The colony brooder, which is moved to new land, offers one means of controlling coccidiosis. Until recent years it has been the most accepted method of brooding to control intestinal parasites. This method has the disadvantage of high labor cost. In addition, when coccidiosis does occur, it is sometimes difficult to control the disease since it is not practicable to shut the fowls in or move the house frequently. In spite of these objections it is a reasonably satisfactory means of coccidiosis control.

The permanently located brooder provides a particularly desirable type of brooding from the standpoint of convenience and labor. It is frequently open to objection because of its tendency to aggravate the development of coccidiosis. This is particularly true when the brooder is used for chicks of various ages, or when the same compartment is used for more than one brood during the same season. Providing several yards and using only one each year does not help matters much as heavy contamination may result very quickly with coccidiosis due to the relatively short time required for the parasite to develop in large numbers.

In order to overcome the objection to the permanently located brooder, because of its favoring intestinal parasitic diseases, the use of a
Concrete yard* in connection is suggested. This yard (Fig. 5) which preferably extends the length of the brooder, is 15 to 20 feet wide. Having such a yard permits of cleaning it as thoroughly as the house and with a minimum of labor. It is desirable to have this yard sloped about eight to ten inches away from the brooder and covered with a small amount of sandy soil.

One should not conclude that the concrete yard itself eliminates the losses. It merely provides suitable conditions for assisting in prevention and particularly for control when a severe outbreak occurs. It also assists in controlling other intestinal parasite diseases, especially roundworms and some tapeworms.

Where this yard is used, the plan is to confine the chicks to the house and concrete yard for the entire brooding period. They are not permitted to go beyond the concrete yard. The fowls are kept under brooder conditions no longer than necessary, as with this arrangement there is a tendency toward cannibalism. As soon as brooding is completed the fowls should be moved to range houses provided with wire floors high enough to prevent access to the droppings.

The tendency toward cannibalism can be reduced by increasing the amount of exercise. A strip of green feed growing along the outer edge of the concrete yard and covered with poultry netting high enough from the ground so the fowls cannot reach through to the soil may be advisable. Besides increasing exercise this also provides some green feed. Access to such an area would not be advisable during a period of severe coccidiosis.

Drinking vessels placed on wire-covered or slatted frame (Fig. 6) will prevent access to moist places. If moisture prevails under the hover, frames covered with half-inch-mesh hardware cloth may be employed to advantage for the chicks to brood upon. This not only as-

Fig. 6. Equipment for preventing access to moist places which harbor infective oocysts found around drinking utensils. A. Hardware-cloth (wire) covered frame—especially suitable for placing brooder drinking vessels upon. B. Slatted platform.


sists in preventing them from consuming moist droppings but also lessens the danger from piling because of being enabled to obtain air from beneath.

When extreme difficulty is consistently encountered on a given farm in controlling coccidiosis and other intestinal parasites such as worms, one may be justified in equipping the brooder house and small yards with half-inch-mesh hardware cloth for the chicks to walk upon. This wire may be fastened to wooden frames for convenience in handling. Another method used by some consists in brooding small units of chicks in batteries equipped with wire bottoms. In either case the droppings pass through the wire and infection from this source is largely eliminated.

Before the brooding season starts the brooder and equipment should be thoroughly cleaned. One pound of lye to each fifty gallons of water for scrubbing is recommended. Lye in itself is not an effective agent in destroying coccidia but it serves as a cleansing agent. If this solution is hot it destroys coccidia to some extent and also assists in more thorough cleaning.

Treatment is of secondary importance, and can be recommended only as a means of making the best of an already bad situation, not as a routine preventive. Coccidiosis occurs in spite of any treatment which has been tried experimentally, but proper treatment can be expected to lessen the severity of cecal coccidiosis. Some of the drugs tried out experimentally to a limited extent are quinine sulfate, crude catechu, triple sulfocarbolates, epsom salts, creolin, potassium bichromate, bichloride of mercury, and ipecac. Feeding a ration consisting of about 20 percent powdered skim milk or buttermilk* is perhaps the most effective treatment. It is applicable only for short periods because of its limited value, expense, and tendency to cause too early egg production. When this amount of dried milk is given an ample supply of water must be provided, as considerably more is consumed than normally. It is advisable also to provide more drinking space.

It is probable that other milk products high in milk sugar are as efficient as powdered milk and may be had at a much lower cost.

Control of sudden, severe outbreaks. When outbreaks of this nature occur, the above-mentioned milk feeding is advised, to be continued for a week or ten days. The following, which is essentially the Wisconsin ration, is recommended:†

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Parts by weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground yellow corn</td>
<td>80</td>
</tr>
<tr>
<td>Wheat middlings</td>
<td>20</td>
</tr>
<tr>
<td>Bone meal</td>
<td>5</td>
</tr>
<tr>
<td>Limestone grit</td>
<td>5</td>
</tr>
<tr>
<td>Fine salt</td>
<td>1</td>
</tr>
<tr>
<td>Dried milk (skim milk or buttermilk)</td>
<td>30</td>
</tr>
</tbody>
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If no concrete yard is available and the house provides ample room the fowls are confined to the house. Daily cleaning of the house is an advantage and the same holds true for the concrete yard. Under these circumstances the soil may be omitted and the yard swept or washed off daily for a period of a week or ten days, or until marked improvement in the flock results.

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Coccidiosis of the Chicken

If the weaker fowls are separated from the others they do much better, the deaths are less, and the well fowls are less likely to become infected.

Moist places frequently occur where the fowls drink. Special precautions are taken to eliminate these moist places during warm weather and near the brooder stove at all times.

Flocks showing a severe outbreak can sometimes be handled to advantage by taking the cockerels out and placing them in fattening crates with wire bottoms so that the droppings pass through and cannot be reached by the fowls. This management alone will prevent further losses other than those already severely infected.

Additional heat is necessary during acute outbreaks, particularly when feeding liberally of milk or milk products. More careful observation is necessary to prevent losses from crowding and trampling due to huddling.

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SUMMARY

Coccidiosis is the most wide-spread infectious disease in Oregon's specialized flocks, causing the most severe losses during the brooder stage.

The cause is a parasite indistinguishable to the naked eye. When eaten by the fowl the parasite attacks various parts of the intestines.

Four species or three species and two types in one of the three are recognized. Only two are known to cause serious results.

Fresh droppings can not produce the disease. About forty-eight hours' exposure is required under favorable conditions for the droppings to become infective.

Five to six days are required for the parasite to develop much after being consumed. The droppings contain oocysts in six to eight days following inoculation.

Severity of the disease is determined by the number of parasites consumed. Small numbers of the most severe type produce no symptoms.

About a month after inoculation surviving fowls are practically free of the parasite unless reinoculated.

Immunity or resistance develops to all species if sufficient parasites are consumed. One species does not produce immunity to another, in so far as the cecal and the two relatively harmless small-intestine coccidia are concerned.

The parasite may be distributed by infected fowls, shoes, flies, birds, brooder equipment, streams, and used feed sacks.

Warm weather accompanied by occasional rains decidedly favors the occurrence of coccidiosis.

Considerable pure blood in the droppings or intestines is most characteristic of coccidiosis. Sudden death after symptoms are shown, lingering illness and finally death or gradual recovery may result. For definite diagnosis of mild infection microscopic examination is necessary.

The recommendation that hatching eggs should come from coccidiosis-free flocks is theoretically possible to carry out but very impractical with present conditions of the poultry industry.

There is no definite evidence that paralysis is due to coccidium infection.

Sanitation is the foundation of coccidiosis control. This includes segregation of mature and young stock, well-drained soil, and proper brooding and rearing equipment.

Acute outbreaks are controlled by daily cleaning and by feeding a ration containing twenty percent powdered milk for a week or ten days. The milk ration alone can not be expected always to control the disease.