Chick Diseases in Michigan
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CHICK DISEASES IN MICHIGAN

THEIR CAUSE, RECOGNITION, PREVENTION AND CONTROL

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Clean houses, clean range, clean chicks

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INTRODUCTION

The poultry industry has grown rapidly in magnitude and importance. Farmers now raise thousands of chicks under very artificial conditions where a few years ago they raised but a few by the natural method, using hens as brooders. Hatching eggs, baby chicks and poultry breeding stock are shipped back and forth across the continent. Eggs that are laid in New York may be purchased as hatching eggs by a farmer in Michigan. The chicks may be grown in Michigan and the cockerels sold as breeding males to poultrymen in Kansas or even out on the west coast. This great migration of breeding stock from community to community, section to section, state to state, has spread all common poultry diseases to almost every community.

Years ago poultry disease outbreaks were localized and remained within community boundaries. Now all common poultry diseases are found in practically every community. Some folks labor under the impression that the increase in prevalence and seriousness of poultry disease outbreaks is partly or largely attributable to the lack of vitality in the poultry stock of the present day, resulting from the artificial condition under which poultry is kept, or perhaps resulting from a lack of vitality brought about by continuous breeding for heavy egg production and other man-desired characteristics. This contention is without foundation. There is no reason to believe that the vitality and disease resistance of the modern hen is not just as great as in her ancesters of a few generations ago.

The rearing of large numbers of chicks on small areas creates a new problem in disease control. Disease organisms may remain in the soil from season to season. Congested quarters make the spread of disease easy from bird to bird. Crowded conditions make it more difficult for the weak to survive.

Prevalence of disease in growing chicks has created a demand for information on the nature of the common diseases of chicks, their cause, and their control. In this bulletin the writer has tried to discuss common chick diseases in a practical manner, realizing that it is impossible, in a bulletin of this kind, to deal scientifically and completely with all known chick diseases. It is the hope of the writer that poultrymen may be able to identify common chick diseases in their flocks and with the aid of this bulletin may be able through sanitation, prevention or treatment to lessen their chick losses.

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ASPERGILLOSIS (BROODER PNEUMONIA)

This is a disease affecting the respiratory organs of poultry caused by a mold (Aspergillus fumigatus). Young birds are more susceptible than adults and since the disease develops most frequently while the chicks are in the brooder house, brooder pneumonia has become a common name for this malady.

Source of Infection—Moldy litter constitutes the main source of infection. The chicks inhale dust contaminated with mold spores which grow on the moist mucous membranes of the bronchi and lungs producing inflammation (pneumonia).

Symptoms—The outstanding symptoms are difficult breathing, diarrhea, and "going light." Difficult breathing is invariably present but diarrhea and "going light" appear only in protracted cases. Such general symptoms as drooping wings and weakness will also be observed.

Lesions—The bronchi may contain grayish or greenish-gray exudate and the lungs may show white spots varying in size from that of a pinhead to fairly extensive white areas. The airsacks may also contain varying amounts of white cheesey material.

Diagnosis—It is very difficult, in most cases, to diagnose aspergillosis positively without the aid of a microscope. Such symptoms as difficult breathing and diarrhea occur in bacillary white diarrhea, a disease much more common in Michigan than the one under discussion. White spots in the lungs also occur in a considerable number of cases of bacillary white diarrhea, so that neither symptoms nor lesions reveal the true nature of the disease. Gapes and coccidiosis may also be mistaken for aspergillosis if symptoms alone are used as a basis for a diagnosis. One must find the molds in the tissue exudate in order to be able to say definitely that the case at hand is aspergillosis, and this cannot be done without a microscopic examination.

Treatment and Prevention—There is no effective treatment for this disease but prevention is not difficult. By keeping the brooderhouses, feed and litter *dry* one will prevent molds from growing and this is the important factor in the prevention of aspergillosis. Feed and litter, as well as the interior of the brooderhouse itself, should be inspected fre-

quently to see if molds are developing. The writer has seen molds grow on old sacks used for sundry purposes in the brooderhouse. It apparently did not occur to the owners that this was a source of danger to their chicks.

AVITAMINOSIS (VITAMIN DEFICIENCY)

Forms of avitaminosis.

1. Nutritional roup
2. Polyneuritis
3. Rickets.

Green leaves, eggs, milk, the covering of most grains, cod liver oil and many other food articles are known to furnish certain substances which are essential for growth and health. These substances are called vitamins and, as far as the poultryman is concerned, three of these, namely: Vitamins A, B and D are very important. When the ration fed is lacking in any one or all of these vitamins the birds will sooner or later become diseased.

Lack of vitamin A causes nutritional roup characterized by *white, odorless* cankery material in the eye, loss of weight, paleness, ruffled feathers and, at time, diarrhea, small nodular elevations in the esophagus and large pale kidneys streaked with a network of white lines.

Lack of vitamin B causes polyneuritis (inflammation of nerves) characterized by nervous symptoms such as: incoordination of movement, weakness or paralysis of the legs and neck, dark muscles and shrunken internal organs.

Lack of vitamin D causes rickets characterized by leg weakness, deformed bones, enlarged joints and, since this disease occurs most frequently in chicks, stunted growth is a common symptom.

A number of diseases not associated with lack of vitamins may show one or more of the symptoms associated with the different forms of avitaminosis. Hence, when disease appears in the flock one should not, without good reason, follow the common practise of "laying it to the feed."

Treatment and Prevention—A ration containing all parts of such grains as wheat and yellow corn, green leaves, milk and cod liver oil will prevent nutritional roup, polyneuritis and rickets. The same substances will also effect a cure of not too advanced cases. Most modern rations contain all the food articles just mentioned with the exception of cod liver oil, which is not always included. Sunlight furnishes the antirickitic factor, vitamin D, and for this reason it seems superfluous to feed cod liver oil to birds that are exposed to a liberal amount of direct sunlight. The addition of lime to the ration is sometimes necessary to prevent or cure rickets.

CANNIBALISM (TOE PECKING)

The most common form of cannibalism among chicks is toe pecking. This is, as a rule, just a vicious habit which, of course, is not always limited to pecking at the toes.

Cause—If chicks are left too long in a well lighted room without food they will begin to peck persistently at anything that attracts their attention. The bright red blood vessels of the feet may be the first object of their curiosity or desire to satisfy their hunger, hence they begin pecking at each others feet. Sooner or later they will draw blood, and may eventually kill the chicks affected.

Leaving dead or weak chicks in the brooder house may cause the chicks to acquire the habit of pecking at each other. Chicks with bloody droppings adhering to the vent or those that have been injured so that the vents bleed become particular victims of their cannibalistic fellows. If this habit is not discovered soon, and effective steps taken to eliminate it, the caretaker may find himself in a situation which is exceedingly difficult to cope with.

Faulty feeding may bring on vicious habits, but chicks are usually fed well enough so that cannibalism resulting from nutritional deficiency is rare.

Treatment and Prevention—Chicks should not be left long in a well lighted room without feed. Preferably, they should be fed a little as soon as they are put in the brooder house. This would necessitate holding them in chick boxes or in other dark places for about seventy-two hours after they are hatched. Dead or weak chicks should be removed as soon as they are discovered. Should the habit be started, one must do something to turn the attention of the chicks into other channels. Suspending bright colored buttons throughout the house high enough so that the chicks have to stretch or jump to pick at them has been recommended as an effective remedy. It is said that painting the windows sky blue will prevent the chicks from seeing blood and will thus prevent toe pecking. Should there be good evidence of faulty feeding the method of feeding must be corrected.

Crowding

The significance of crowding is so generally misunderstood and misinterpreted that it deserves special mention in a bulletin of this sort.

In the first place crowding is not to be considered as a disease in itself, neither is it a primary cause of disease. It will be granted that chicks can be housed in quarters that are too small, a condition which will tend to lower the state of health by not allowing adequate room for exercise, feeding, or air. Under such conditions dormant or mild infections may result in outbreaks of acute infectious diseases. Those who contemplate raising chicks and do not know what constitutes a suitable house for a given number of chicks should by all means acquire this useful bit of information. However, the question to be answered here is, *Why do*

chicks crowd when housed in sufficient quarters? Poultrymen usually are of the opinion that chicks are sick because they crowd, while the reverse is most often the case. In other words, chicks crowd because they are sick. They may also crowd when kept in chilly houses. Once they have started to crowd, habit may play its part in continuing this trouble.

When a person has fever, he will feel cold and so he puts on more clothes, stands by the fire or goes to bed. Animals on the range huddle when it is cold, and chicks crowd when they feel cold no matter whether that chilly feeling is due to fever or lack of heat in the brooder house. Infectious diseases are generally febrile, hence they are the most common causes of crowding. In Michigan bacillary white diarrhea, coccidiosis, and blackhead seem to be the chief offenders in this respect.

Treatment and Prevention—It should be evident from what has been said that in order to eliminate crowding one must combat the diseases of which crowding is a conspicuous symptom. Elimination of moisture, proper heating, and sufficient room for exercise and feeding will help materially to prevent crowding.

BACILLARY WHITE DIARRHEA

Bacillary white diarrhea is an infectious disease of chickens caused by a germ called *Salmonella* (or *Bacterium*) *pullorum*. In chicks the disease is often very acute and is undoubtedly the greatest killer of baby chicks known.

Mode of Spread—As the germ causing this disease has a marked tendency to invade the ovaries of laying hens and to localize there, we find, as a result, infected eggs whence come infected chicks. In other words, chicks inherit the infection and may die in the shell or may become diseased after being hatched. A number of infected chicks survive and may become the starters of new cycles of infection. Broken infected eggs and infected chicks may contaminate the incubator so that the chicks hatched from clean eggs in the same incubator may contract the infection either by the respiratory or the digestive tract. In the brooder house and outside, clean chicks may pick up the infection by eating material contaminated with droppings of infected chicks or adult chickens. Attendants may carry the germs into the brooder house on their shoes from infected ground or other sources of contamination.

The time of occurrence of the disease is a fair indication of the source of the infection. Numerous chicks dead in the shell (low hatchability) or high mortality up to four to six days after hatching indicate quite definitely ovary-egg-to-chick infection. When the hatchability is good and the disease appears about six to eight days after hatching, one may be justified in concluding that most of the infection might have been contracted in the incubator. When the disease breaks out about eight to fourteen days after hatching, or even later, it is possible that a good share of the infection was picked up in the brooder house. One must remember that a few infected chicks, under given conditions, may start

a severe outbreak of bacillary white diarrhea among chicks that were free from the infection at the time of hatching and unless the breeding stock is entirely free from carriers of the germ one must be prepared for such misfortunes.

Symptoms—In the acute form of bacillary white diarrhea there may be a conspicuous lack of symptoms. Chicks simply die without much warning. When less acute attacks occur, one may observe difficult breathing (gaping), general droopiness, drooping wings, standing on one leg, crowding, sharp and continued peeping, evidence of pain when voiding droppings, large abdomen, white pasty bowel discharge that may stick to the vent, dropsy and perhaps other symptoms. One should bear in mind that the absence of "white diarrhea" does not necessarily mean that bacillary white diarrhea is not present. In young chicks bacillary white diarrhea is very commonly a septicemia (blood infection) and may kill the chicks before diarrhea has time to develop. It is also a mistake to think that all chicks that show "white diarrhea" have bacillary white diarrhea. Diarrhea will be discussed under a separate heading.

Lesions—Chicks dying of very acute attacks may show little or no changes in the tissues. Generally one will find retained yolks, ocher or yellowish colored livers, sometimes with small grayish spots, grayish or white spots in the lungs, and occasionally a dropsical condition under the skin and in the abdominal cavity.

Diagnosis—The symptoms and lesions are not always sufficiently characteristic to form a basis for a positive diagnosis. A good indication of the presence of bacillary white diarrhea is the fact that considerable numbers of chicks die in the shell or that, in spite of careful incubation, faultless brooding, etc., an unusually high morbidity and mortality take place early after hatching. A well trained veterinarian can do much towards establishing a diagnosis by carefully comparing the history of the outbreak, symptoms and lesions. However, an absolutely positive diagnosis can be made only by isolating and identifying the causative organism, *Salmonella pullorum.* If such a diagnosis is desired, fresh specimens must be submitted to a bacteriological laboratory. Decomposed chicks are not satisfactory, so dead chicks should not be sent in for this purpose. Under the most favorable circumstances it will take about forty-eight hours to identify the germ.

Treatment and Prevention—No effective treatment is known. The disease may be prevented by observing the following precautions:

1. If possible, hatch from bacillary white diarrhea free stock, or from tested stock.
2. Clean and disinfect the incubator between each hatch.
3. Do not place eggs from disease free or tested stock in incubators where eggs from infected stock are hatched, a practice not uncommon in custom hatcheries.
4. Keep chicks in small batches, in chick boxes or other compartments, preferably in the dark, for at least seventy-two hours before placing them in the brooder house. This materially checks the spread of infection and facilitates the proper handling of an early outbreak, which is the most fatal.

5. Carefully clean brooder houses with soap and water, then disinfect, using any standard disinfectant according to manufacturer's directions.
6. Watch for sick or dead chicks and remove them promptly.
7. Protect feed and drinking water from contamination with droppings.
8. Caretakers should not walk from contaminated poultry houses or grounds into a brooder house without, either carefully rubbing the shoes on a mat soaked with a three to five per cent coal tar disinfectant or better, putting on a pair of rubbers or boots when entering the brooder house. *These rubbers or boots should be kept and used in the brooder house only.* This is a simple precaution and would do much to cut down the losses not only from bacillary white diarrhea, but other diseases as well.
9. Clean and, if possible, disinfect the brooder house often.
10. Do not scatter droppings and litter removed from a brooder house or laying house in places where chicks may range later. It will generally be good economy to burn such material.
11. When chicks are let outside they should be put on ground that has not been used for poultry for at least two years.

Coccidiosis

Coccidiosis is an infectious disease of poultry caused by a microscopic animal parasite called *Eimeria* (or *Coccidium*) *avium.* This disease is particularly fatal to chicks and occurs most commonly when they are from four to eight weeks of age. Younger and older chicks are also quite susceptible.

Mode of Spread—Infected birds (young or adults) discharge the parasites with their droppings. However, the coccidia are harmless when they are discharged and require an incubation period of about four days under airy and moist conditions in order to become infective. Damp floors, moist feed and wet, hard ground furnish ideal conditions for the development of these germs. Puddles and pools of water in the poultry yard are very objectionable because they furnish the necessary moisture for the sporulation (development of coccidia from the harmless to the infective stage) of the parasite. Coccidia do not multiply in the soil or on the floors of poultry houses but, when they are picked up by chickens after sporulation, they multiply in the mucous membranes of the intestines producing disease by destroying these membranes.

Symptoms—Chicks affected with very acute attacks may die without showing marked symptoms. Large numbers of chicks may die in one day or night, not because the disease spreads rapidly from one chick to others, but because a large number of chicks became infected at the same time, possibly from the same source, such as a puddle of water or a feed trough. The more outstanding symptoms are: bloody or brownish droppings, ruffled feathers and a very ragged appearance, droopiness, leg weakness and paralysis. Generally chicks have the type of coccidiosis which affects the ceca (blind pouches) but numerous cases have been observed in chicks four to six weeks of age, which showed only duodenal (upper part of small intestines) infection. In such cases

bloody droppings do not as a rule appear, neither are chicks so affected generally droopy, but they will show marked leg weakness and often paralysis.

Lesions—The ceca may be enlarged and contain brownish, cheesy blood-streaked material. In some cases the ceca may be filled with a thin or partly coagulated bloody mass. When the infection is limited to the small intestines there may be small white spots on the mucous membrane and also hemorrhages (red spots). These may show on the serous surface (outside covering) of the intestines. Marked thickening of the duodenum is common. At times the liver may show numerous grayish white spots arranged in dense clusters. The full significance of these changes is not known.

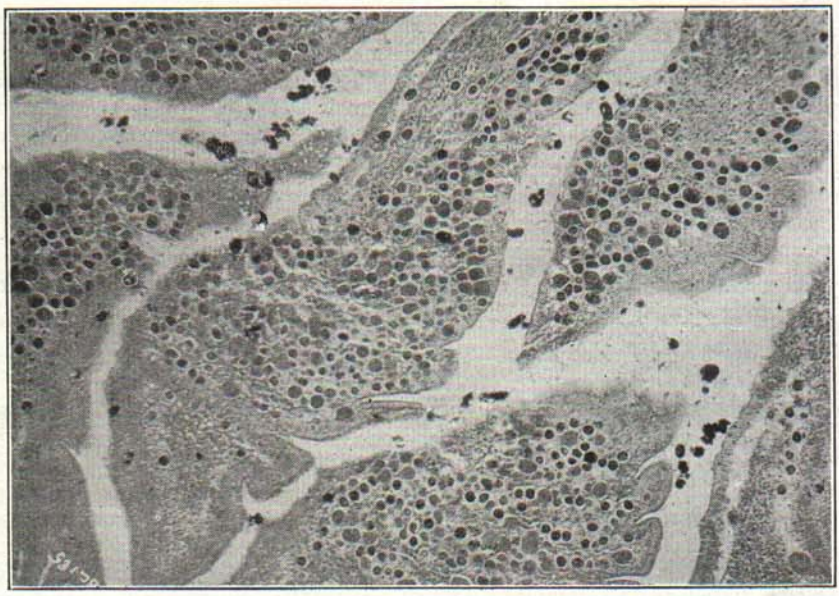

Fig. I.—Cross section of intestines of chicken infected with Coccidia (dark spots). This is a photograph of a microscopic preparation magnified about 280 times.

Diagnosis—Bloody droppings and the changes in the tissues described above make it possible to make a diagnosis in the field. However, the demonstration of the coccidium under the microscope constitutes the only infallible diagnosis.

Treatment and Prevention—A mash containing 40 per cent of dried skim milk or dried buttermilk is said to be useful as a preventive and cure of milder cases. The following sanitary measures should be observed:

1. Do not allow chicks to eat raw eggshells as infection is often found on them. Shells of hard boiled eggs are safe for feeding.
2. Eliminate moisture from houses and yards as much as possible.

3. As a disinfectant for coccidia use Iodine suspensoid Merck, diluted 20 times with water, instead of the common disinfectants.
4. The cleaning and disinfection of the brooder house should take place every fourth day.

In addition follow carefully the directions given in steps 5, 6, 7, 8, 10 and 11 under the paragraph on prevention of bacillary white diarrhea, pages 9 and 10.

DIARRHEA

Diarrhea is another of those manifestations of deranged health which is so often misunderstood that it deserves special mention. When a chicken, young or adult, has white droppings many poultrymen conclude immediately that it has "white diarrhea" usually meaning thereby bacillary white diarrhea. When the droppings are greenish, "cholera" is usually said to be the cause. White droppings are not always signs of bacillary white diarrhea; neither are green droppings necessarily a symptom of fowl cholera.

Causes of Diarrhea—Various infectious and parasitic diseases, faulty feeding, exposure to extremes of temperature and the ingestion of too much sand (sand scours or sand colic) may cause diarrhea.

Treatment and Prevention—One cannot intelligently treat or prevent a disease without knowing its cause, thus it is necessary, in the case of chicks showing symptoms of diarrhea, to obtain a reliable diagnosis. If they have an infectious disease, such as bacillary white diarrhea, they must be handled accordingly and the same is true with coccidiosis, brooder pneumonia and worms. Each one of these diseases requires special and specific preventive measures. If infectious diseases or parasites are not present one may find exposure or faulty feeding as a cause, in which case change in management may be necessary.

It is customary to put sand on the floor of the brooder house and then to put ravenously hungry chicks in it. In an attempt to satisfy their hunger the chicks will eat too much sand and they get sand scours or sand colic as a result. If sand is to be used one should cover it up with paper for a few days until the chicks can be fed quite liberally.

FAILURE TO FEATHER OUT

Failure to feather out is also a symptom and not a disease. Worm infestation has been found to be the cause in some cases observed at this experiment station. This conclusion was drawn because the chicks feathered out and started to grow normally as soon as they were rid of worms.

Another cause might be faulty diet but with all the excellent information available on feeding there is no excuse for feeding rations that are so defective as to bring on this trouble.

There may be other causes not known at this time; so it is advisable to consult a specialist on poultry diseases for the purpose of finding the cause in case a problem like this is encountered.

Failure to feather out, of course, must not be confused with loss of feathers. This subject will be discussed in Extension Bulletin No. 54.

FOWL TYPHOID

Fowl typhoid is an infectious disease of poultry caused by a germ *Salmonella* (*or Bacterium*) *gallinarium*. This disease occasionally affects chicks and is then indistinguishable from bacillary white diarrhea except by bacteriological examination. As the disease spreads in the same way as bacillary white diarrhea the preventive measures will be the same for both these diseases.

GAPES

A small roundworm (*Syngamus trachealis*), reddish in color, sometimes infests the mucous membrane of the trachea of chickens, turkeys and other birds causing severe inflammation with difficult breathing, wheezing and frothy discharge from the beak. Adult turkeys are most commonly affected but young poults seem to be the only ones that are seriously affected.

Gapes is a very rare disease in Michigan but as "gaping" is a prominent symptom of several common infectious diseases it is usual to find people who think that their chickens have gapeworms when they have some other wellknown disease.

Treatment and Prevention—The many treatments recommended for removing gapeworms are usually ineffective. It is better to rely on preventive measures in combating this parasite. The source of the infestation is contaminated soil and water. Hence, it follows that, besides eliminating infested birds from the flock and keeping chicks away from turkeys, one should practice rotation of yards and ranges as recommended for other parasitic diseases.

INFECTIOUS ENTERO-HEPATITIS (BLACKHEAD)

Infectious entero-hepatitis is an infectious disease of poultry caused by a microscopic animal parasite (*Trichomonas* or *Histomonas meleagridis*). The disease is commonly known as blackhead but this name is so misleading that one is justified in using the scientific name, infectious entero-hepatitis, which means an inflammation of the intestines

(entero) and liver (hepatitis) brought about by a microorganism (infectious). This name indicates exactly the nature of this disease. The darkening of the head (blackhead) is an indication of faulty circulation, which may be due to various diseased conditions and not of a disease of the head. Thus it should be evident that to chop off a turkey's head and send it to a laboratory for examination for blackhead is a useless procedure.

Mode of Spread—The germ is discharged with the droppings of infected birds and once the premises have become contaminated it is difficult to get rid of the infection as the parasites are able to stay in the soil for a long time without losing their disease producing power. Turkeys are more susceptible than chickens and poults are more susceptible than older turkeys. Chicks may contract the infection. Adult chickens have a high degree of resistance and may carry and spread the infection without showing signs of disease.

Symptoms—Poults and chicks may die in a few days after showing the first signs of disease. Drowsiness, ruffled feathers, weakness, lack of appetite, drooping wings, soft, yellowish droppings and a dark purplish color of the head, are outstanding symptoms.

Lesions—In most cases the liver shows regular, circular, depressed areas colored in a very artistic manner with red, yellow, gray and other colors. There may be a yellowish center surrounded with concentric rings and from the yellow center there are usually distinct red lines radiating towards the periphery of the lesion. The liver may also be enlarged.

The ceca (blind pouches) may be enlarged and contain a cheesy, grayish mass. The walls of the ceca and, at times, of other parts of the intestines may be ulcerated.

Diagnosis—One cannot depend on the symptoms for a positive diagnosis but the changes in the liver described above are so characteristic that one can safely base a diagnosis on them. However, there are many cases of infectious entero-hepatitis which do not show such lesions and then it will be necessary to consult a veterinarian.

Treatment and Prevention—No effective treatment is available. One-third teaspoonful of powdered crude catechu per gallon of drinking water has been recommended, but its action is uncertain. The constipation resulting from catechu is counteracted by the use of epsom salts, one teaspoonful to every ten poults in the drinking water.

For the purpose of prevention the following precautions should be observed:

1. Do not raise turkeys and chickens together.
2. Hatch eggs in incubators.
3. Disinfect hatching eggs by dipping them in 70 per cent alcohol or, perhaps better, in iodine suspensoid Merck diluted 20 times with water.

Further, observe precautions given in steps 5, 6, 7, 8, 9, 10 and 11 under the paragraph on prevention of bacillary white diarrhea.

LEGWEAKNESS AND PARALYSIS

Legweakness or paralysis must not be considered as a disease in itself. We find legweakness, paralysis and incoordination associated with a number of diseases such as, coccidiosis, leukemia, worm infestation, rickets and even other poultry ailments. Therefore, when chicks show legweakness, paralysis or incoordination of movement one should make an attempt to find the exact cause by having some affected chicks examined by a qualified veterinarian. If this is not possible specimens may be sent or brought to the Veterinary Division at Michigan State College. To attempt to treat symptoms like legweakness or paralysis, as is so often done, without knowing the cause of the trouble, is just a waste of time, effort and money.

DISINFECTION AND DISINFECTANTS

Most people have an exaggerated opinion of what a disinfectant will do. It should be remembered that the penetrating power of any disinfectant is rather slight. For this reason the sprinkling of a little disinfectant solution on top of litter, dropping boards covered with droppings, dirty floors or the ground does little or no good.

In order to kill germs disinfectants must come in contact with them; so that it is essential that thorough mechanical cleaning should precede the application of the disinfectant solution. The following outline for procedure in disinfecting poultry houses should be followed:

1. Remove litter and if it cannot be disposed of in a place where poultry will not come in contact with it for at least tnree years, it should be burned.
2. Clean mechanically as thoroughly as possible, using soap and water or hot lye solution, if necessary scrubbing with a stiff brush in order to remove droppings or other organic matter that may stick to the surface to be disinfected.
3. Apply the disinfectant liberally, that is, flood the surface to be disinfected and allow it to act for a couple of hours before sweeping it off.
4. The floor, perches, dropping boards and the lower part of the walls (2-3 feet from the floor) should be included in the disinfecting process.
5. Use the disinfectants in proper solution. Coal tar disinfectants may be applied in two or three per cent solution (2 or 3 parts of the disinfectant to about 100 parts of water). If crude carbolic acid is used, a five per cent solution is necessary. Other disinfectants should be used according to the manufacturer's instructions.

NOTE: **Do not rely on fumigation for disinfection of poultry houses!**

Feeding and drinking utensils should be boiled, if possible, for at least ten minutes. Scalding may be fairly effective if boiling water or steam is used and the scalding continued for fifteen minutes. If disinfectants are to be used the utensils should be carefully cleaned by first scrubbing with soap and water. Any standard disinfectant diluted as indicated above may be used. When metal utensils are used, avoid disinfectants that corrode metals.

Disinfecting of Incubators—In disinfecting incubators it is also necessary to clean mechanically before applying the disinfectant. The exact method of procedure will depend upon the type of incubator. Some incubators must be washed out by using a hose and then sprayed with a disinfectant until all inner parts are wet thoroughly. In the case of other incubators, certain parts can be submerged in a disinfectant solution or one may apply the disinfectant with brushes or rags. The thing to do is to select the most convenient method without sacrificing efficiency. Dilute the disinfectants as indicated above.

Disinfection of Yards—Soil cannot be disinfected chemically. Contaminated ground should be left exposed to sunlight for several months after which it may be subjected to cultivation. In this way one will assist nature in purifying the soil. Some disease producing germs live longer in soil than others. As a general rule one should not use the same runs for chicks oftener than once in three years and this may not be entirely safe if the ground should happen to be badly contaminated with coccidia or blackhead germs.

Antiseptics in Drinking Water—In order to inhibit the spread of certain infectious diseases, particularly those spread through the discharges of the mouth and nostrils, it may be advisable to use antiseptics in the drinking water. For this purpose potassium permanganate may be employed in about one-tenth per cent solution (approximately ¼ teaspoonful of potassium permanganate to 1 gallon of water). This solution is purplish or deeply wine colored. A disappearance of this color indicates loss of antiseptic power. It is, therefore, necessary to watch the solution and to renew it or add more of the drug when fading out is noticed. The use of such a solution must not be considered as a cure or as an absolute preventive. It is merely an additional precaution to be employed along with isolation of infected individuals, cleaning and disinfection of houses and utensils.

OTHER DISEASES

Occasionally chicks have diseases other than the ones described in this bulletin. For information on these diseases see Extension Bulletin No. 54.