Tuberculosis in Farm Poultry

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Abstract
Tuberculosis is to some extent prevalent here and there among the poultry flocks of Iowa. That has been brought out in the examination of birds, or their tissues, brought or sent for diagnosis to the veterinary laboratories of the Iowa State College and from field work by the veterinary and poultry staff of the agricultural extension department. From November 1, 1909, to June 30, 1912, the pathology laboratory examined the tissues of seventy-three birds, two of which, or 2.7% were found to be affected with tuberculosis. From July 1, 1912, to September 11, 1915, two hundred fifty-five fowls were examined and it was found that in forty-three, or 16.86%, tuberculosis was the cause of sickness or death. From September 11, 1915, to June 1, 1918, there were examined in the laboratory of the Department of Veterinary Investigation two hundred and twenty-seven fowls. Eighty-three or 36.57% were found to be affected with tuberculosis. These birds or tissues came from many different flocks in various parts of the state.

Keywords
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TUBERCULOSIS IN FARM POULTRY

Hen suffering with generalised tuberculosis.

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TUBERCULOSIS IN FARM POULTRY

*By W. W. Dimock and **L. E. Willey

Tuberculosis is to some extent prevalent here and there among the poultry flocks of Iowa. That has been brought out in the examination of birds, or their tissues, brought or sent for diagnosis to the veterinary laboratories of the Iowa State College and from field work by the veterinary and poultry staff of the agricultural extension department. From November 1, 1909, to June 30, 1912, the pathology laboratory examined the tissues of seventy-three birds, two of which, or 2.7% were found to be affected with tuberculosis. From July 1, 1912, to September 11, 1915, two hundred fifty-five fowls were examined and it was found that in forty-three, or 16.86%, tuberculosis was the cause of sickness or death. From September 11, 1915, to June 1, 1918, there were examined in the laboratory of the Department of Veterinary Investigation two hundred and twenty-seven fowls. Eighty-three or 36.57% were found to be affected with tuberculosis. These birds or tissues came from many different flocks in various parts of the state.

Tuberculosis is a specific infectious disease caused by a bacterium known as the bacillus tuberculosis. The disease shows itself in poultry by the development of yellowish-white nodules. These are found principally in the liver, spleen, wall of intestines, mesentery, joints, kidneys and skin, although lesions may appear in any structure of the body. Small nodules and areas of degeneration somewhat resembling lesions of tuberculosis, may be caused by other forms of bacteria, animal parasites or lifeless irritating substances, but the true tubercule is caused only by the bacillus of tuberculosis. Unless the particular organism can be found, the disease should not be classed as tuberculosis.

The bacterium which causes tuberculosis in poultry (bacillus tuberculosis avium) is a small, slender rod, slightly curved, with round ends and, according to the author's observations, shows a marked beaded appearance, especially in stained smears from diseased tissue. While this is the specific cause of tuberculosis in fowls, there are many predisposing factors that often have a very important bearing on the spread and course of the disease in the flock. Among the causes which encourage the disease but which may be controlled are overcrowding, bad ventilation, confinement in damp houses, exposure to cold and storms, general unhygienic surroundings and spoiled foods. Infection of healthy fowls probably takes place most often from contaminated food, water and air, by which means the organisms gain entrance to the alimentary tract and respiratory passages.

SYMPTOMS

Many of the birds examined were dead before they reached the laboratory. Close observations were made, however, in the case of all living birds which ultimately died, or were killed, and found to be

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tuberculous and where opportunity offered in infected flocks. The symptoms here given as more or less typical of the disease are largely based on these observations.

The symptoms which a bird presents depend somewhat upon the location and seat of the disease. When the internal organs are the parts particularly involved, there is a loss of flesh that comes on gradually, leading to marked thinness and a paleness of the comb, the wattles and the visible mucous membranes. There is the general appearance of anemia or weakness, and an examination of the blood will show a reduction in the number of red blood corpuscles. As the disease progresses, the feathers become ruffled, the bird separates itself from the flock and diarrhea sets in, producing weakness even to the point of prostration. At first the appetite is good, even ravenous, but in many cases the affected bird will refuse food for sometime before death.

The disease often involves the joints, characterized by swelling and lameness. These swollen areas around the joints may rupture and discharge a thick, yellowish material that contains many organisms. At the point of rupture there is formed a typical ulcer; the ulcerous area being filled with a light yellow granular looking material which is easily removed leaving a round cup-shaped pit. Lameness is frequently one of the things first observed by the poultry man. Usually one leg is involved. In practically every case where lameness or "limping disease" has been reported in poultry we have found upon examination that many of the birds were affected with generalized tuberculosis. It often happens, however, that no gross lesions can be demonstrated in the joint of the clinically affected leg. The wings when involved drop low and often drag on the ground when the bird walks. Such cases are not uncommon in pigeons, wings dragging, joints swollen, many of them rupturing, and infected material constantly discharging from the ulcerous surface. The first noticeable symptoms in such cases will be the inability to fly.

If the lungs and air passages are involved there is usually difficult breathing which is brought to the attention of the owner or attendant by a wheezing or rattling sound. In such cases there is usually a discharge of a thin, slightly stained material from the nose and mouth.

If the lesions are located on the skin, they are usually in the form of round, elevated nodules covered with a thick horny growth. If these rupture they appear much the same as the ruptured areas around the joints. About the mouth, eyes, nasal passages and cavities of
the head the disease takes on various forms and may easily be confused with or mistaken for roup. The temperature usually remains about normal.

ANATOMICAL CHANGES

The changes found in the tissues of birds dead from tuberculosis are for the most part small, yellowish nodules or tubercules. The liver is the organ most frequently involved. The nodules vary from very small ones just visible to the naked eye to those of the size of a large pea. They are usually separate, although in rare cases two or three may be united, forming irregular areas. The nodules in the liver are made up of a soft, semi-solid, dead, cheesy or necrotic, center surrounded by a dense connective tissue capsule. This capsule is composed of newly formed tissue, and is produced in a protective way in that it tends to hold the tubercular organisms in a confined space and prevents, in a large measure, their spread to other parts. The nodules are easily separated from the surrounding tissue, a condition which distinguishes them from other diseased areas having a similar appearance, but a different cause. The liver is usually enlarged. Its capsule may rupture, followed by hemorrhage into the peritoneal cavity, causing sudden death.

The lesions in the spleen and kidney resemble very closely those of the liver.

In the intestine the early development of the nodules seems to be just beneath the outer covering, at which time they are very small. As they develop the capsule becomes thick and the necrotic content is comparatively small in amount. There is a tendency for an opening to form leading into the passage way of the intestines through which material from the nodules may be discharged. These nodules may occur throughout the length of the intestines. (Fig. 2.)

In the mesentery, the membranes which connect the intestines with the back wall of the abdominal cavity, the diseased areas vary from acute inflammatory nodules of a flesh color to those that have a necrotic center, surrounded by a capsule of connective tissue. The center may be semi-fluid, cheesy or hardened in character. The older lesions are of
a decided yellowish color and usually hardened or calcified. The nodules are usually more numerous in that part of the mesentery next to the intestine.

The lesions on the skin vary from small to large nodules that generally grow outward, seldom involving to any extent the underlying structures. These skin lesions are usually free from feathers and have a thick, horny surface. In the large, older nodules there are very likely to be found a number of necrotic centers separated by dense bands of connective tissue. When these nodules rupture, as they often do, there is thrown off a sticky, yellowish material, that contains many organisms.

Among the fowls examined in the veterinary laboratories, the lungs were seldom affected. When they are involved it is usually with the formation of the characteristic nodules. In one large flock the only recognizable lesion found was in the trachea; this consisted of a discharge into the trachea. The material was rather firmly attached to the lining membrane, was fibro-necrotic in character, of a reddish color and showed upon microscopic examination an innumerable number of the tubercular organisms. For a short distance over the involved area the rings of the trachea were, in every instance, of a light color, dry and very brittle. Other parts of the trachea and the lungs were in most cases red, congested and showed inflammatory changes. In all of the birds so affected there was a discharge from the nose and mouth.

Tuberculosis in the cavities of the head causes bulging of the affected part. In the joints, aside from the enlargements and possible discharge, there may be found on the membrane that lines the joint cavity the development of a rather delicate fibrous exudate. Later, the joint cavity may become filled with a cheesy, tubercular material. The lining membrane breaks down, the joint surfaces become rough and the destroyed elements are loose in the joint cavity.

Other organs that are less frequently involved are the ovaries, the heart and its membranes and the bones, in fact no organ is exempt.

The lesions in all the different organs of the body are in general characteristic nodules or tubercles varying somewhat according to the structure and resistance of the tissue.

MODE OF INFECTION

Birds suffering with tuberculosis may discharge the bacilli with their droppings, from open lesions on the skin, or from the nose and mouth. Coming from these parts the organisms are scattered in the yard, scratching pens, houses, roosts, and nests, and can easily find their way into the food and water or receptacles used for feeding and watering. From these they may readily gain entrance to the intestinal canal, from which, under favorable circumstances, they pass into the lymph channels or circulation and are carried to the various organs of the body. The organisms may gain entrance to the respiratory system. This is especially possible when the birds are closely confined in houses that are dusty.

On a squab farm started in 1905 with mostly young birds the disease soon began to appear in isolated cases. Recently, the plant was carrying 12,000 breeders and the loss will probably aggregate 1,000 birds a year from tuberculosis alone, the greatest number of cases occurring in the old birds and in the old habitations. Another instance when the disease spread rapidly was in a flock of about 500 hens. There was for several years a gradually increasing loss of birds, supposedly from roup, totaling during the last year 15 per cent of the flock. A
careful investigation demonstrated that tuberculosis, not roup, was the cause of death.

While the most common source of infection is from sick to healthy fowls, either directly or indirectly, experimental evidence shows that there is a possibility that fowls may become infected with tuberculosis from following cattle and hogs that are suffering with the disease and discharging the bacilli with the faeces; from eating the sputum of tuberculous people, milk that contains the organisms, or the carcasses of animals that have died of tuberculosis and which are so often fed to other farm animals.

Experiments have shown that it is possible for the bacilli to be transmitted through the egg to the young chick. This, however, is not common and probably takes place only when a lesion exists in the ovary, or possible when the individual is suffering with advanced generalized tuberculosis. Chicks hatched from infected eggs never reach maturity, usually dying within the first three months.

PREVENTION

As the administration of medicines will not give results and is therefore useless, all efforts should be to prevent the introduction of the
disease into healthy flocks and to check its spread in flocks where it already exists. If flocks are known to be free from tuberculosis they should, as a precautionary measure, be kept from other farm animals that may be suffering with the disease and from eating the flesh of animals so affected. Birds or eggs for hatching should not be purchased from flocks that are not known to be free from tuberculosis as there is a possibility of the introduction of infection by this means especially in the purchase of birds. After the disease is known to exist one of two courses must be followed: the whole flock must be disposed of, or the disease must be eradicated. Eradication is in most cases the logical step and is recommended for the following reasons: The disease spreads slowly in flocks when kept under proper conditions, that egg production may be maintained, the possibility of infection from eggs is slight, it is becoming increasingly difficult to purchase birds that are known to be free from tuberculosis, and that a new flock may be built up from the same variety and strain.

To control and eradicate the disease in an infected flock and at the same time build up a new, healthy flock, some radical and persistent steps are necessary. The following suggestions are recommended as a general guide. All birds showing symptoms of tuberculosis should be killed and burned. New quarters and yards should be furnished if possible and the old houses, if of little value, burned, used for fuel, and yards ploughed up and seeded. If the houses are permanent and valuable, then all loose fixtures should be removed and destroyed. All loose dirt and dust must be entirely and completely removed and the inside of the building treated with a strong disinfectant and then whitewashed.

Proper ventilation and light should be provided. Droppings from the roost should be removed daily and carried at once to a field not occupied by fowls. Surface dirt and accumulated rubbish should be scraped from the yards and removed to the open fields. Proper drainage of yards and surrounding grounds should be carried out as local conditions may indicate, especially grading to prevent collection of surface water is essential. Food and water should come from sources that are known to be free from contamination. All feeding and drinking receptacles should be so constructed as to prevent the birds from stepping in them, or otherwise contaminating them, and kept clean and disinf-
fected from time to time. The system of housing in small colonies greatly aids in the carrying out of control measures of this as well as other infectious diseases. It further permits of plowing and seed-
ing the yards which is very desirable and is recommended.

In regard to the flock itself the main steps in the eradication of the disease to be followed are that all birds showing symptoms or clinical evidence of the disease should be killed and disposed of by burning or burying deep. The remaining members of the flock should be kept under the best possible conditions and carefully watched for evidence of the disease, the object being to maintain the production of as many eggs as possible and at the same time to grow a flock of healthy chicks to take the place of the birds which are to be disposed of within the year.

Where incubators are available or it is possible to purchase them they are recommended for hatching. If the new flock is to be hatched by hens, care should be taken in the selection of the hens to set. As soon as they have hatched they should be isolated absolutely from the remainder of the flock. Chicks hatched by hens may be reared in a brooder; if left with the hen she should be removed as soon as the chickens are a few weeks old, this depending largely upon the time of year and weather. The old hens may then be placed with the rest of the flock and disposed of at the end of the year. All old hens that are to be killed for food purposes should be inspected by a competent vet-

Our records show that most of the flocks where tuberculosis was more or less serious were farm flocks where no effort was made to sell off the old hens every year. In order to do this it is necessary to mark the young chickens so that the birds can be identified and all birds that have given one year of egg production can be disposed of. The tubercu-

In case it seems desirable to kill or dispose of the entire flock, all birds showing evidence of the disease should be killed and properly disposed of. The remainder should be killed under veterinary supervision. The carcasses of birds showing lesions of tuberculosis should be destroyed by burning; those that are free from the disease should be used for food. Any birds killed that are in good flesh, altho suffering from a mild or localized form of the disease may be utilized for food provided they are properly handled and thoroughly cooked be-

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SUPERVISION.

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DIAGNOSIS

The diagnosis of tuberculosis in poultry by observing the symptoms may be possible in some typical cases. In a majority of cases, a diagnosis may be made from a study of the gross or visible part of the tissue changes found upon post mortem examination. A positive diagnosis
rests with the finding of the bacillus tuberculosis avium in microscopic preparations made directly from the lesion in the organs or tissues of birds that were suffering with the disease.

Some of the diseases and tissue changes which must be distinguished from tuberculosis are chronic cases of chicken cholera where there is lameness. Birds are not uncommonly lame from joint rheumatism, exposure to cold, gout, and sore feet. In birds dead from cholera there are often yellowish white spots, and areas of degeneration on the liver. Areas of fatty degeneration, local areas of necrosis and abscess formation, which are due to various causes and which stand out as prominent discolored spots, may by the inexperienced be mistaken for tuberculosis.

Fig. 5. Liver and intestine of chicken showing multiple tubercular nodules.
Tumors of the liver, which are usually of the lymphoma or sarcoma variety, may also be confused with tuberculosis. In some cases the development of the tumor is uniform throughout the substance of the liver, making the organ several times its normal size and giving it a mottled appearance. In other instances, tumors appear as yellowish white, firm, slightly elevated, circumscribed masses of newly formed tissue, usually larger than tubercular nodules.

Tuberculosis of the cavities of the head must be distinguished from chronic roup. Further tuberculosis of fowls must be distinguished from tumors of the skin, encysted parasites (Lamnosioptes cysticola) that are so frequently found in the subcutaneous tissue of fowls, the disease known as “going light” or asthenia, paralysis in chickens and heteral basis are not to be confused with tuberculosis. In paralysis in chickens there would be the absence of the swelling about the joints. Heteraklas is a disease characterized by extreme wasting of the muscles, caused by a round worm that lives in the caeca or blind gut. Other diseases to be considered in the differential diagnosis are chelospirosis or gizzard worm disease due to the presence of a round worm (chelospirostra hamulosa) in the muscular wall of the gizzard and characterized by emaciation and death. Teniasis, aspergillosis, chronic coccidiosis, chronic pericarditis, traumatic gastritis and chronic inflammation of the oviducts.

As the administration of medicines will not give results and is therefore useless, all efforts should be to prevent the introduction of the disease into healthy flocks and to check its spread in flocks where it already exists. If flocks are known to be free from tuberculosis they should be kept from other farm animals that may be suffering with the disease and from eating the flesh of animals so affected. Birds or eggs for hatching should not be purchased from flocks that are not known to be free from tuberculosis.

After the disease is known to exist, the whole flock must be disposed of or the disease must be eradicated.

In the diagnosis of diseases of chickens it is always advisable to kill a sick bird and make a careful post-mortem examination. In case of an individual or a small flock of valuable birds other methods may well be followed. If you wish to determine whether a particular fowl or a few for breeding purposes are free from tuberculosis the tuberculin test, intradermal method, becomes a practical procedure.

Tuberculin test: The application of the tuberculin test as a diagnostic agent to determine the presence of tubercular infection in fowls has been rather thoroughly and extensively carried out by a number of reliable men in various parts of the country and has given most satisfactory results and promises to be of great practical value in the handling of valuable flocks, especially in the selection and purchase of birds for breeding purposes. H. A. Bittenbender, professor of poultry husbandry at Iowa State College, who is familiar with the poultry industry of Iowa and the total losses from disease, through his association with the agricultural extension department, feels that if tuberculosis in fowls continues to be as prevalent as present conditions show, that it will be a practical and necessary economic step to carry out the tuberculin test on fowls. The conditions under which the test would be practical are:

- In infected flocks where it is desirable to save healthy birds to rebuild the flock.
- In the purchase of birds for breeding purposes.
- In the purchase of birds for laying purposes if from unknown sources and especially if such birds are to be placed with a healthy flock.

As a means of making a diagnosis in suspicious cases where the sac-
rifice of a bird cannot be made; in the handling of individuals or valuable flocks of small size.

The tuberculin test carried out on fowls is what is known as the intradermal or skin test of cattle and pigs. It might well be called the comb or wattle tuberculin test for chickens. The tuberculin must be made from the avian bacillus as experience has shown that tubercular chickens will only rarely react to tuberculin from other strains. The test is carried out by injecting a small quantity of tuberculin into the surface layers of the comb or wattles. The injection should be made with a strong, small gauge needle, using about 10-30 cubic millimeters of tuberculin. The reaction consists of a rather large, tense, definite swelling at the point of injection. After one has observed a number of reactions it becomes comparatively easy to tell the true reaction from slight or inflammatory enlargements due to the mere presence of the tuberculin or from complications. The reaction first shows on the day following the injection and disappears on the fifth day, but in the more typical case in 48-72 hours. Work on tuberculosis in fowls with special reference to the practicability of the test for poultry raisers is under way jointly by the poultry department and department of pathology, Iowa State College.