

UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF BACTERIOLOGY

TUBERCULOSIS OF POULTRY



Fig. 1. Injecting Tuberculin, Showing manner of holding bird and syringe.

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WILLIAM M. GIBBS

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*In co-operation with U. S. Department of Agriculture.

TUBERCULOSIS OF POULTRY

C. H. Werkman
William M. Gibbs

ECONOMIC IMPORTANCE

Tuberculosis as a disease of poultry is of sufficiently common occurrence among the flocks of Idaho to require the attention of every person interested in the raising of poultry, turkeys, or other domestic fowls. The insidious nature of the disease, with deaths occurring only at intervals, serves to make less apparent its economic importance. Were tuberculosis a plague-like disease, causing a great number of deaths within a few days, its importance would be fully realized.

Tuberculin tests performed on over 4600 birds, and post-mortems of over 300, indicate the extent of the disease and the need for eradictory measures. In one series of tests performed on 856 birds in all parts of Idaho, including 127 ranch, backyard, and specialized flocks, 18.3 per cent of the total number tested, gave a positive reaction. Frequently in tuberculous flocks as high as 80 per cent of the individual fowls are infected. This condition is particularly noticeable in flocks containing two and three-year-old birds maintained under insanitary conditions. The absence of tuberculosis among flocks housed under approved conditions, in contrast to the number of cases in flocks housed under insanitary conditions, is striking. When the prevalence of tuberculosis is taken into consideration, the question of its eradication must appeal to every poultryman as fundamental to the life of the industry.

Tuberculosis under favorable conditions causes a very heavy death rate. A survey of Idaho flocks made in 1920 showed that in 89 infected flocks, originally containing 5,147 birds, exclusive of chicks, approximately 1507 (29.3 per cent) had died of the disease during the spring and summer months. Sanitary conditions in these cases were very unsatisfactory.

It is not only unprofitable to feed, house, and care for diseased birds, but they are a constant source of infection for the healthy ones. In a field test the egg production of 67 healthy hens was compared with that of an equal number of tuberculous ones. The average daily egg production of the healthy group was 26.2 per cent, while that of the tuberculous group was 8.2 per cent.

CAUSE

Tuberculosis is a germ disease caused by a specific micro-organism

known as the avian tubercle bacterium (*Bacterium tuberculosis avian*), a germ closely related to that causing tuberculosis in cattle and swine and to that responsible for tuberculosis in the human.

It is doubtful if the avian tuberculosis bacterium can cause tuberculosis in humans, and it is quite probable that natural transmission to human beings from poultry does not occur. Conversely, the transmission of the human type to fowls has been reported, but is rare, and results only in unusual cases where birds have access to infective material of tuberculous patients. Transmission of tuberculosis from poultry to pigs or calves may occur.

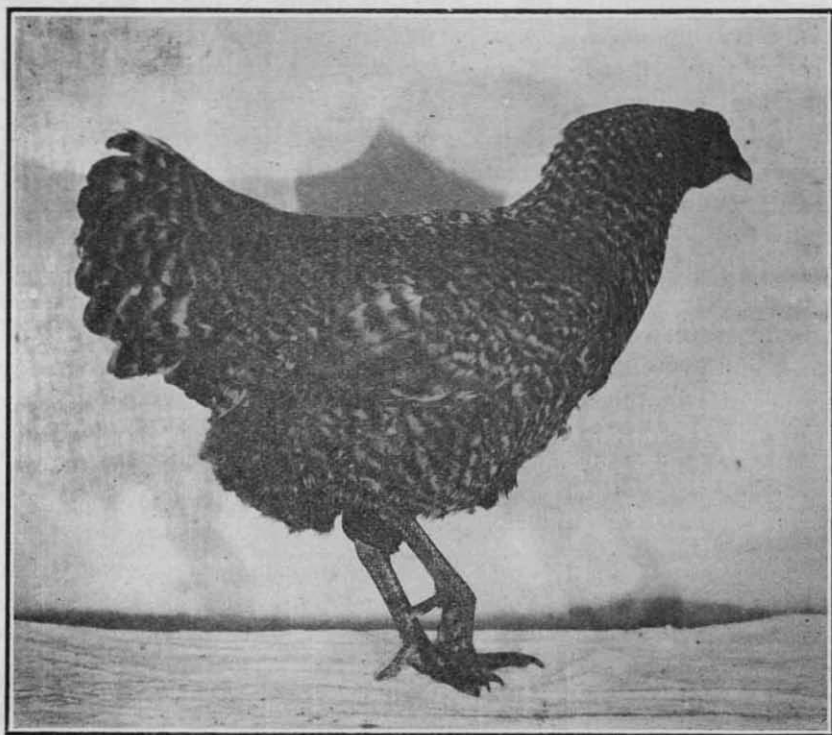


Fig. II. Tubercular Arthritis, "Limping Disease", "Rheumatism." A characteristic position of hen with joint infection.

SYMPTOMS

Typical symptoms of the disease are apparent only in advanced cases when diseased birds usually show great loss of flesh. This condition becomes noticeable in the breast muscles. In handling the bird its extreme lightness and sharp prominent breast bone will be noticed. The comb

and wattles usually are pale, the feathers show a ruffled appearance, and the bird manifests a general unthrifty condition. Extreme weakness, and joint infection may bring about a disinclination to forage. In cases of joint infection the bird may be observed standing with one foot resting lightly on the ground, or suspended in the air. (See Figure II). When it walks or runs the gait is unnatural and awkward. This form of the disease is known as *tubercular arthritis*, commonly called "limping disease" or "rheumatism," by local poultrymen. This condition was found in approximately 15 per cent of the cases observed, resulting in swollen

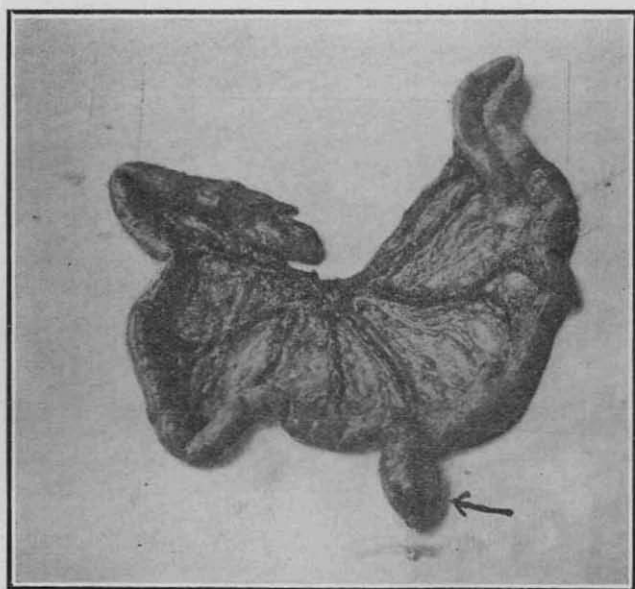


Fig. III. Large Tubercle on Intestine.

joints or lameness. These swollen areas commonly show no gross lesions, however, they may occasionally rupture and a yellow infective discharge of creamy consistency exude. (On post mortem examination, birds suffering with *tubercular arthritis* ordinarily show generalized lesions in the liver, spleen, and intestines). The wings may occasionally be involved, in which case they relax, often dragging the ground.

The appetite ordinarily remains good, the birds eating ravenously up to within a few days of death. Diarrhea often develops. The skin and underlying visible membranes appear pale and dry, taking on a "dead" appearance. The lungs and air passages are rarely involved, which indicates that infection takes place through the alimentary canal

and not by inhalation. The skin is occasionally involved and forms round, horny, raised nodules which rupture and spread infection. The disease is not often noticed in chicks, due perhaps to the long period of incubation before symptoms appear.

Chickens, turkeys, guinea fowl, ducks, geese, pigeons, swans, ostriches, parrots, canaries, pheasants, sparrows and many species of wild birds are susceptible to infection.

POST-MORTEM APPEARANCE

Numerous tubercles, principally on the visceral organs, are found in birds dead of tuberculosis. These tubercles have a dirty white appearance when small, while the larger and more advanced ones are yel-

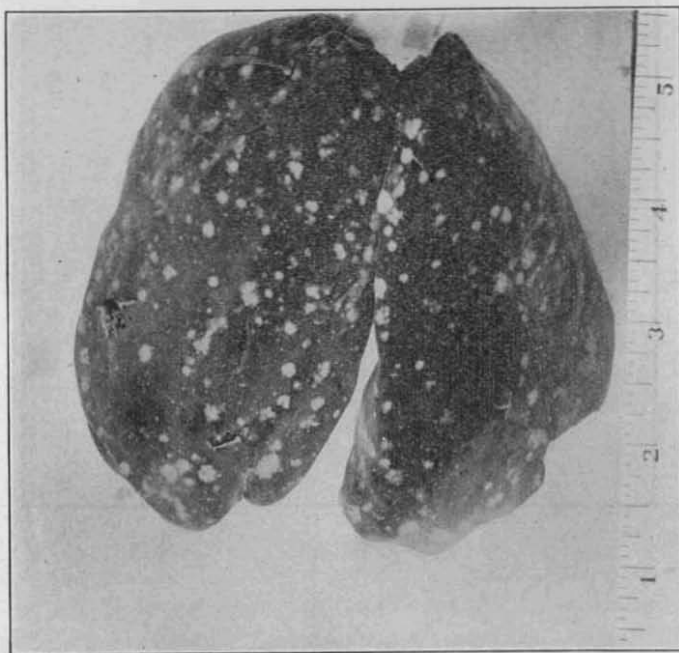


Fig. IV. Liver of hen in advanced stage of tuberculosis, showing numerous tubercles over the entire organ.

low. The tubercles vary in size according to their age, ranging from those barely visible to those the size of a large pea. Tubercles of the liver and spleen may often be recovered whole from the soft, friable, degenerated tissue, and upon cutting through the tissue many may be seen imbedded within. By sectioning through a tubercle the interior appears soft and cheesy, which mass is surrounded by a tough connective

tissue capsule. The liver and spleen usually show the greatest infection, the spleen at times containing two or three large tubercles, with little functioning tissue left. (See Figure V). The liver is commonly studded with numerous small tubercles which occasionally become confluent. (See Figure IV). Degenerative changes in the liver tissue, brought about by the presence of tubercles, cause that organ to become soft and friable, resulting at times in severe hemorrhage. The organ is usually enlarged. The intestines may be studded with several large nodules. (See Figure III). A tubercular lesion upon microscopic examination will reveal enormous numbers of the tubercle bacteria.

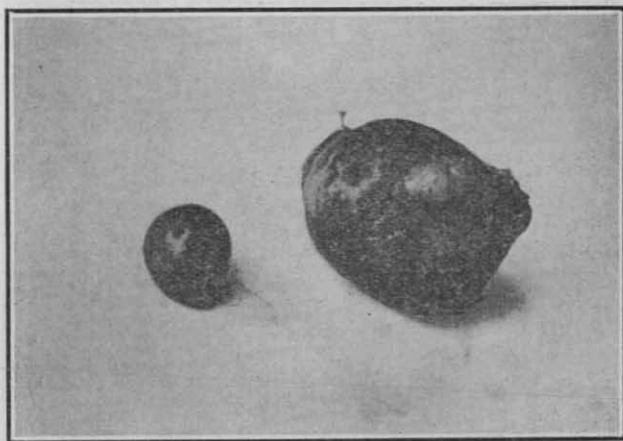


Fig. V. Normal and Tuberculous Spleen.

Tuberculosis should not be confused with aspergillosis, a fungous disease affecting the lungs and air sacs. Nodules caused by tapeworms resemble, somewhat, tubercular nodules but are confined to the intestines. Nodular lesions not involving the liver or spleen are probably not of tubercular origin. This is substantiated by the fact that 244 out of 246 tubercular birds examined by the department of bacteriology were found to have liver or spleen infection.

TRANSMISSION

In view of the prevalence of intestinal infection, the droppings must be regarded as the chief source of transmission. Enormous numbers of tubercle organisms are revealed microscopically in the lesions discharging into the intestines. The tubercle bacilli are thus discharged with the droppings, contaminating the yards, feed, drinking water and houses.

Although transmission through infective eggs may occur, this chan-

nel of transmission is probably not an important one. In all probability infected eggs fail to hatch in the great majority of cases. The use of eggs from tuberculous hens can not be unqualifiedly recommended for breeding purposes; undoubtedly the use of eggs from healthy birds has much to commend it and should be the routine practice. However, if it is desired to retain the original strain and build up the flock, the practice of using eggs from infected hens probably offers no great risk of transmission.

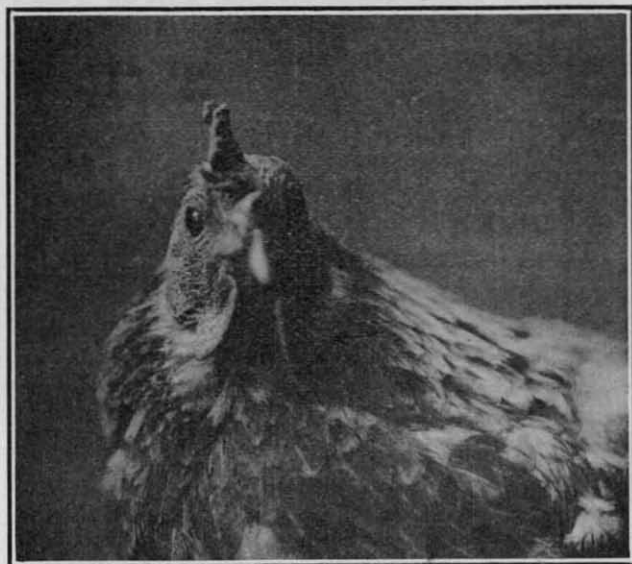


Fig. VI. The Reaction to Tuberculin. Note swollen and enlarged wattle.

Since the common sparrow is quite susceptible to avian tuberculosis, its importance in the transmission is somewhat uncertain. The better flocks of Idaho, kept under approved conditions but located in the sparrow infested regions of the state, proved free of tuberculosis when given the tuberculin test. The sparrow may transmit the disease but from the practical standpoint, its importance as a carrier is to be doubted. Transmission within the flock is of inestimably greater significance. The too common practice of permitting carcasses of birds dead of tuberculosis to remain on the grounds is to be severely condemned. Such a practice makes certain the infection of the entire flock in the shortest possible time since birds eating such tubercular material become infected.

Considerable care must be exercised in the purchase of new stock

to see that it is free from disease. Setting hens should not be borrowed as the disease may be introduced in this way. It must be borne in mind that avian tuberculosis from the poultryman's point of view is a contagious disease and that one diseased bird infects the entire flock.

USE OF THE TUBERCULIN TEST

Tuberculin consists of a bouillon in which the tubercule bacteria have grown for five or six weeks. The bacteria are then removed and the bouillon concentrated to a definite volume. Such a product is known as "O. T.," meaning "old tuberculin," a product first prepared by the eminent bacteriologist, Robert Koch. As practiced by this Station in a tuberculosis survey of the state, approximately 0.3 c. c. of the standard "O. T." was injected intradermally into the left wattle. By filling a 5 c. c. syringe with tuberculin and having an assistant hold the birds, 15 to 20 birds were injected averaging not over 10 seconds per bird. The tuberculin should be injected just sufficiently beneath the surface that rupture does not occur. Usually a small white lump will appear as the injection is made. (See Figure I). It is not necessary to disinfect the wattle before making an injection but care must be exercised that no undue injury is done. In approximately 5,000 injections there has not been observed a single infection. Twenty-four to fifty-eight hours after injecting the tuberculin, the wattles of tuberculous birds will appear swollen. The wattle should be felt with the hand and compared with the uninoculated one. The organ will appear smoother than normal and quite pale, the swelling ranging from two to five times normal size. (See Figure VI). Occasionally, especially if the injection has been made a little too deep, both wattles may swell. A small percentage of results will be doubtful but this is of no great importance since such birds may be considered positive if in a tuberculous flock. In one series of 774 tests, 16 birds gave doubtful reactions amounting to 2.8 per cent; autopsy of six of these birds resulted in four showing tubercular lesions.

In conducting these tests an attempt was made to observe the birds about 30 hours after injecting the tuberculin. This was not always possible under field conditions. Reactions have been observed to take place as early as the second hour and as late as the 82nd hour. The intensity of the reaction is no indication of the severity of the infection. Occasionally birds suffering with an advanced case will show no reaction. Of a series of 158 tuberculous fowls the post mortem examinations revealed 7 cases (4.4 per cent) of advanced tuberculosis which had not reacted to the test. Each of these showed marked external symptoms of the disease. Occasionally it was noticed that in an apparently clean, disease-free flock there were one or two somewhat doubtful reactors, which upon autopsy revealed no lesions of tuberculosis. Whether these birds are in the

incubation period of tuberculosis and the lesions not yet visible or whether the reaction is the occasional result of too heavy an injection of tuberculin, is not clear. The tuberculin as made in this laboratory contained 25 per cent glycerine which might possibly have been the cause of reaction in those few cases in which no lesions were found. The efficiency of the tuberculin test depends largely upon the skill of the operator. Practice and experience greatly increase the value of the test.

The tuberculin test is of particular value to the specialized poultryman: for the testing of new birds before introduction into the flock; for the detection of tuberculosis in the flock; as a check upon the introduction of the disease into a flock by sparrows, rats, or other similar agencies; or as a means of retaining the strain when the flock is infected. This last condition requires considerable skill and perseverance. It is necessary to test the entire flock, remove the reactors, and transfer the non-reactors to new ground. The old houses must be thoroughly disinfected before used again. The test may be applied a second time at a later period to discover additional reactors. In this manner the disease may eventually be removed and the strain maintained. This method is of uncertain value, however, because of the amount of time and labor required.

Poultrymen offering their poultry or eggs for sale, should be able to guarantee their birds free of tuberculosis. Prospective customers should insist upon healthy stock or eggs from clean healthy stock.

PREVENTION

The prevention of tuberculosis lies mainly in the exclusion of infected birds from healthy flocks. New birds should not be introduced into a healthy flock unless known to be free from disease. Medical treatment of tuberculosis is futile. Although eggs may possibly transmit the infection, this source is not of great importance since few infected eggs hatch.

Strict attention must be given to the sanitary conditions of the houses and equipment if tuberculosis is to be kept out of the flock. The application of some good coal-tar disinfectant (tri-cresol, Lysol, Creolin, liquor cresolis, etc.) is to be recommended. Carbolic acid (5 per cent), or bichloride of mercury (1 part to 500 parts water) may be applied. The disinfectant must be sprayed in a thorough manner. The floor of the house may be soaked with the solution or sprinkled with a light covering of quicklime. Maintaining a tuberculosis-free flock is not a difficult matter; on the other hand eradicating the disease is relatively difficult. If the disease is already prevalent in the flock, under average conditions it is advisable to dispose of the entire flock, thoroughly dis-

infect the premises, which should be kept free of poultry for a season, and then restock with healthy birds. Restocking immediately after disinfection permits of too great an opportunity for re-infection. Infective material will have become harmless after a few months. This method of disposing of the entire flock is particularly applicable to ranch conditions where flocks are relatively small and possess no particular breeding value.

If for some particular reason it is not desirable to dispose of the entire flock an attempt may be made to eradicate the disease by means of the tuberculin test. Under this method all reactors must be slaughtered. Non-reactors should be furnished with clean ground and preferably new houses and equipment.

The results of some of Idaho Station tuberculin tests as shown in the following figures, indicate that the prevalence and extent of the disease in an infected flock is proportional to the age of the birds:

Age	Total number Inoculated	Number in flocks known to be infected	Reactors	Percentage infected
Pullets and Cockerels	516	161	1	0.19
2-yr.	2337	1836	494	21.10
3-yr.	608	426	176	28.95
Older than 3 yrs.	98	68	51	52.04

It is probable that pullets on free range under Idaho conditions of climate and environment may not become infected before they are put in the houses for the winter. Of 516 tuberculin tested pullets and cockerels only one reacted, even though 161 of these were members of tuberculous flocks. However, upon leaving their winter quarters 494 reactors were found among 2337 birds, 1836 of which were from tuberculous flocks. In other words over one-fourth of the non-reactors became reactors during the winter housing, presumably due to association with tuberculous birds in insanitary houses during the close confinement of winter. At the end of the second winter confinement 608 birds were tested, 426 being members of tuberculous flocks, resulting in 176 reactors. It was not always possible to obtain the accurate age of the birds, especially in the case of the older ones. Birds in their third year were grouped with those which were probably older. Thus in one instance included within this group were a number of 5 year old hens. Taking these old hens as a group, 51 reactors were found in 98 tests, 68 being in tuberculous flocks. This is 75 per cent of the birds exposed to known infection from tuberculous companions. Thus the elimination of old birds from

the flock is not only good poultry husbandry but is of importance in controlling tuberculosis.

DISINFECTATION OF A POULTRY HOUSE

In the disinfection of a poultry house it is essential that all dirt or filth be removed and the interior thoroughly scrubbed with a strong soap solution. Removable dropping boards, nests, roosts, and other equipment should be scraped or swept and thoroughly disinfected. Several good disinfecting agents give a wide range of choice. Any of the coal-tar disinfectants are efficient. Tri-cresol, Lysol, Creolin, liquor-cresolis, Disinfectall, or any similar agent offers a safe and efficacious choice when used in 1 per cent solution and thoroughly sprayed so that the entire surface of the article is covered. The purchase of a spray pump is to be recommended and the uses it may serve warrants the investment in some form of foot pump to be used in connection with a bucket. With this form of pump the disinfectant can be driven into the cracks and crevices, which is essential in disinfection. Disinfection that is not thorough is useless. After disinfecting the house, whitewash should be applied or may be applied with the germicide at the time of disinfection.

Cement floors are to be preferred in poultry houses because they are easily cleaned and kept sanitary. Where dirt floors exist, as is common in Idaho, it is desirable in making a thorough clean-up to remove 3 or 4 inches of the floor and replace it with clean fresh soil. Sunlight is a powerful germicide and must always be admitted. This can not be too strongly emphasized, as sunlight, good fresh air, and sanitary environment are necessary for the health and contentment of poultry.

Since the drinking water may serve as a means of transmission of contagious diseases it is desirable to furnish well protected sanitary vessels in order that the birds may not get their feet into the water. The use of potassium permanganate in the water, when an outbreak of disease is feared, is to be recommended. Use 1 part of permanganate to 10,000 parts water or simply add enough of a saturated watery solution of the permanganate to the water to give it a light wine color. Copper sulphate (bluestone) may be used in the same manner adding just enough to impart a light blue-green color. Bi-chloride of mercury may be used in the proportion of 1 part bichloride of mercury to 8000 parts of water. This is probably the best disinfectant to be used in the drinking water but it is well to bear in mind that in concentrated form it is extremely poisonous to both man and animals and considerable care must be exercised in its use. It must also be remembered that these germicides are used to prevent the spreading of disease and not as a cure. Once the bird is infected with tuberculosis medical treatment is useless.