

Oklahoma Agricultural Experiment Station,

STILLWATER, OKLAHOMA.

BULLETIN NO. 63, MAY 1904.

TUBERCULOSIS IN HOGS.

There has been considerable experimental work done to prove the transmissibility of tuberculosis from cattle to other animals. This work has been carried on principally with hogs and smaller experimental animals, such as rabbits, guinea pigs, etc. Sufficient experimental work has been done in this line to prove conclusively that hogs are easily infected with the disease. This is demonstrated when hogs are inoculated with tuberculous material from diseased cattle or when they are fed milk containing the tubercle germs. When the virulence of the tubercle germs from the human being and cattle is compared by inoculating them into the lower animals, such as hogs or rabbits, it is found that the germs from cattle are much more virulent as a rule than those obtained from man, and in nearly all cases where cultures of germs from cattle are used either for inoculation or feeding experiments the result is to produce tuberculosis in the hog.

Tuberculosis has long been considered a very dangerous disease among cattle and much time and money has been expended in studying it; while on the other hand very little attention has been given to the fact that the disease is present to a very great extent among hogs. The presence of the disease among hogs must necessarily follow where the disease is present in cattle, on account of the very general practice of feeding milk to hogs. This practice is common to some extent in all localities, but to a much greater extent in dairy districts on account of feeding skim milk.

In May, 1901, the tuberculin test was applied to the college herd, and two of the cows were found to be tuberculous, as they gave a very positive reaction to the test. One of the cows was not giving

milk at the time but the milk from the other was fed to a number of pigs in order to see if the milk contained the germ of the disease. Afterwards some of these hogs were tested with tuberculin and post mortem examinations made. The results obtained are very conclusive, so far as demonstrating the presence of the tubercle germ in the milk is concerned, as well as showing hogs to be generally easily infected. If the milk of all cows that respond to the tuberculin test could be similarly tested, it would give a fair idea of the per cent of diseased cows that would be capable of scattering infection through the milk. In an experiment conducted by the Bureau of Animal industry it was found that during the entire experiment the milk of 21.4 per cent of the diseased cows contained virulent tubercle germs, as was proven by feeding the milk to small experimental animals.

Hogs are very susceptible to tuberculosis and may be easily infected by tubercle germs of either human or bovine origin. According to experiments conducted by Dinwiddie, hogs are more easily infected by germs of human origin than are any other domestic animal, while all of the species of domestic animals usually experimented on are easily infected by tubercle germs obtained from cattle.

There has been a great deal of discussion for the past few years as to whether tuberculosis was transmissible from cattle to man by means of either the meat or milk. The announcement made by Koch that the disease was not transmissible awakened new interest in the subject and has stimulated investigation along every line that was open to experimental work. Possibly a majority of those whose knowledge of the subject entitled them to consideration were from the outset opposed to Koch's view, and since the very essential basis of Koch's announcement has been proven to be untrue, a great many have supported the theory of the transmissibility of the disease from cattle to man, who were before in doubt. In Koch's paper on the subject of transmission of tuberculosis from cattle to man, he records a number of experiments where he inoculated cattle with tubercle germs of human origin and sums up the result of his experiments as follows: "So the animals we experimented on were affected by the living bacilli of human tuberculosis exactly as they would have been by dead ones—they were absolutely insusceptible to them." As is indicated by the above, Koch does not believe tuberculosis of man is transmissible to cattle, but results obtained by other experimenters are directly opposed to such a conclusion. Cultures of human origin have been inoculated into cattle so frequently

and the results have been so uniformly successful in causing the disease that the question of transmission of the disease from man to cattle can hardly be said to be in dispute. Experiments carried on by Klebs, Kitt, Bollinger and others all confirm this view. If the experimental evidence points to the conclusion that the disease may be transmitted from man to cattle or the reverse it is as reasonable to conclude that other of the lower animals such as the hog may infect man through diseased meat. While recent experiments have added much to our knowledge of the subject, the fact remains that to prove conclusively that tuberculosis is transmitted from lower animals to man would require direct experimentation on man, but until there is absolute proof to the contrary, the great majority of investigators will always hold that tuberculosis is transmissible by means of meat and milk from the food animals to man. Since, in all probability, such views are correct, we should know that cattle and hogs used for food are as free from tuberculosis as they are from other forms of disease. The importance of the subject to agricultural interests cannot be over estimated. The disease among cattle has long occupied public attention and has been the cause of great loss to this branch of agriculture and if, through the milk of tuberculous cows, another food animal becomes diseased, the question is of still greater importance to the stockman and packer as well as to the consumer.

Very little interest is manifested in regard to the prevalence of tuberculosis among hogs, but it is becoming a very important disease and measures calculated to reduce its prevalence should be taken. Statistics furnished by meat inspectors at the various abattoirs, and published in the last three reports of the Bureau of Animal industry, indicate the general prevalence of the disease as well as show that it is becoming more prevalent. The figures indicate the number of post mortem inspections and the number of carcasses and parts of carcasses condemned at official abattoirs.

In 1900, 23,428,996 hogs were inspected; 4,379 entire carcasses and 1,061 parts were condemned.

In 1901, 24,720,482 hogs were inspected; 8,650 entire carcasses and 44 parts were condemned.

In 1902, 25,311,781 hogs were inspected; 14,927 entire carcasses and 4,700 parts were condemned. This loss from inspection at the abattoir is greater than that of any other disease except hog cholera and swine plague combined, the loss by inspection from these two diseases being in 1902, 16,980 head.

In this experiment the milk was fed to the pigs in considerable quantities for about two months. A portion of the hogs were tested with tuberculin, the first test being made in May, the others were made at intervals following this as shown by the tables. On May first, one of the hogs died, and a post mortem examination showed the cause of death to be generalized tuberculosis. Notes taken at that time are as follows: Male pig, weight about 150 pounds, physical condition fair. Tubercles were abundant in liver, spleen and lymph glands. The lungs were almost a solid tubercle. Adhesions over a large part of the pleural surfaces.

The appearance of the lesions of tuberculosis differs in the hog from the general appearance seen in cattle. In the hog the tendency is almost without exception to undergo calcareous degeneration. In none of the cases examined were the tubercles in a condition to break down and cause cavity formation. In the one case that died from the effect of the disease the lungs were almost a solid mass of tubercles and in the center of some of these there was a purulent-like material. When the knife is passed through the tubercle there is a gritting sound as if the tissue was filled with sand, and in alcoholic specimens it is necessary to infiltrate and work as soon as possible in order to section for microscopic examination. In a few instances abscesses were found near the surface of the body and these were filled with a yellowish-white pus which in one case had become dry and hard. The external appearance of the tubercle is about the same as is seen in cattle and they are generally found in the same tissues, although in the hog they appear to be more common in the spleen and lymphatic glands than in the lung and liver. The submaxillary glands were found to be diseased in every animal showing tubercular lesions in other parts of the body and in several where the disease could not be found except in these glands. They were sometimes enlarged to the size of a walnut or even larger and always showed, when opened, the yellowish calcareous material so characteristic of the disease. The spleen was found diseased in the majority of cases, the tubercles generally having the appearance of small yellowish or white bodies slightly raised above the surface of the organ. The lymphatic glands near the entrance of the esophagus into the stomach and those of the mesentery were generally found to be diseased.

The effect of tuberculosis on the physical condition of these hogs was not very marked. Some of the animals that showed a generalized

condition of the disease at the time of post mortem examination had the disease almost a year, and they were in apparent good physical condition. In the one that died from the effect of the disease, the physical condition was not such as to cause suspicion of generalized tuberculosis. In fact, the entire lot of diseased hogs were in a marketable condition so far as flesh was concerned, and a number of them were killed under official inspection, their condition being such that they were considered fit for market. Forty-four hogs were subjected to official inspection at the abattoir and twenty-one, or 47.72 per cent of them were condemned as tuberculous. None of them were subjected to the tuberculin test.

The test with tuberculin was made in order to determine the value of this agent in diagnosing tuberculosis in hogs. Very few tests of this character have been made and it is desirable to know if tuberculin can be used to diagnose the disease in hogs with the same success as it is used to determine the presence of the disease in cattle. In order to save handling and consequently worrying the hogs every time the temperature was taken, they were kept confined in shipping crates. Even with this precaution the scuffling and worry of the animal often caused a rise of temperature of from one to three degrees. From the experience gained in this test it is evident that the temperature following the injection of tuberculin can not be relied upon always to indicate whether the animal is tuberculous or not, especially when the work is done in warm weather or when the hogs are not accustomed to being handled. It was found by actually testing the temperatures that the least excitement or worry would cause a rise of temperature. When the test was made that is recorded in table number three, the weather was cool and all of the hogs were very quiet as a rule and the temperature readings were about as they might be expected to run under favorable conditions. By comparing the post mortem notes with the temperature readings it will be seen that all of the animals showing a rise of temperature were not diseased, but on the other hand, no animal was found diseased that did not show a rise of temperature after the tuberculin was injected.

The hogs that were killed under official inspection at the abattoir were killed in two lots, one in January and the other in April, 1902. These hogs were from seven to ten months old. Those that were tested with tuberculin and killed at the college were examined during May and June, as shown by the tables. The entire number of hogs killed and inspected that belonged to the infected lot were 55, and of this number

26, or 47.2 per cent were found to be tuberculous on post mortem examination.

The large number of pigs exposed to the infection gives a better idea of the per cent of animals that may be expected to contract the disease than can be had when a few pigs are used, either for the purpose of feeding milk containing tubercle germs, or for inoculation with pure cultures. From the entire experiment it seems reasonable to conclude that 45 per cent, or more, of young pigs may be infected by feeding milk containing the virulent germs of bovine tuberculosis.

TABLE No. 1--TEMPERATURES.

BEFORE INJECTION						AFTER INJECTION					
May 2, 1902	1	2	3	4	5	May 3, 1902	1*	2*	3	4	5
2 p. m.	105.	104.8	105.	104.6	104.2	7 a. m.	103.	104.6	101.4	102.8	102.4
5 p. m.	103.	103.4	102.2	102.4	102.8	9 a. m.	102.6	104.8	101.8	101.2	101.4
.....	.....	.....	.....	.....	.....	11 a. m.	102.	104.8	102.	.....	101.
.....	.....	.....	.....	.....	.....	1 p. m.	102.4	106.	103.	.....	100.8
.....	.....	.....	.....	.....	.....	3 p. m.	103.2	105.8	103.	101.8	101.8
.....	.....	.....	.....	.....	.....	5 p. m.	104.	106.1	104.	102.	102.
.....	.....	.....	.....	.....	.....	7 p. m.	104.	106.	.....	.....	.....

Hogs were worried in getting them into the crates, this accounts for the high temperatures at 2 p. m. on May second. They were injected with tuberculin at 12 p. m., May second, each animal receiving one and one-half cc of tuberculin that had been in the laboratory about one year.

Number four broke out of crate, which accounts for the blanks at 11 a. m. and 1 p. m.

POST MORTEM NOTES.

*Found tubercular on post mortem examination.

May 6. Killed number two. Black sow, weight about 150 pounds, physical condition good. A generalized tubercular condition was found. Lymph glands of neck, chest, mesentery, and glands at entrance of esophagus to stomach were found enlarged and tubercular. Abundant tubercles in liver, spleen and lungs. The tubercles in liver were very small but abundant. Tendency to calcareous degeneration noticed in nearly all of the tubercles.

May 6. Killed number one at butcher's pen. Spotted pig, male, weighing about 150 pounds. Generalized tubeculosis, more advanced case than number two. Lungs were badly involved, showing fibrinous adhesions to chest wall. Spleen, liver, and lymph glands all showed

TUBERCULOSIS IN HOGS.

marked tubercular lesions. The butcher was ordered to return the meat to the experiment station.

May 6. Killed number four at butcher's pen. Close inspection failed to show any tubercular lesions.

May 7. Killed No's. three and five. No tubercular lesions could be found in either animal.

TABLE No. 2--TEMPERATURES.

BEFORE INJECTION							
May 15, 1902	1	2	3	4	5	6	7
1:30 p. m.	106.	104.8	106.6	106.2	103.	103.	105.8
3:00 p. m.	106.8	105.2	107.2	107.2	102.6	102.4	106.
5:00 p. m.	106.6	104.2	107.4	107.4	102.4	103.	106.
8:00 p. m.	106.4	103.8	107.6	107.4	101.8	102.8	105.
10:00 p. m.	106.2	103.8	107.8	107.	102.4	102.8	104.4
11:30 p. m.	105.4	103.4	107.2	106.8	101.8	104.2	103.4
AFTER INJECTION							
May 16, 1902	1*	2	3*	4*	5	6	7
7:00 a. m.	103.4	102.8	104.8	105.2	101.4	102.8	103.4
9:00 a. m.	104.5	104.2	105.	105.6	102.	103.8	104.4
11:00 a. m.	105.4	104.2	105.4	105.8	101.8	103.2	104.6
1:00 p. m.	106.	105.4	106.	106.2	102.8	103.8	107.
3:00 p. m.	106.6	104.2	106.2	106.4	102.4	104.	107.
5:00 p. m.	107.	104.6	106.4	106.6	102.	104.6	107.4
8:00 p. m.	106.4	103.4	106.6	104.4	102.2	103.6	107.4
10:00 p. m.	106.2	104.2	106.2	105.4	102.6	100.8	107.2
11:00 p. m.	105.4	104.	106.	105.6	101.8	101.8	107.

Tuberculin was injected at 12 p. m., May 15. Each hog received one and three-fourths cc.

POST MORTEM NOTES.

*Found tubercular on post mortem examination.

June 2. Killed number one. Liver, lungs and spleen show small tubercles. Large tubercles in lymph glands of chest.

June 2. Killed Number two. No tubercular lesions.

June 2. Killed number five. No tubercular lesions.

June 7. Killed number four. Lymph glands of neck found tubercular. No other tubercles found in the body.

June 8. Killed number seven. No tubercular lesions.

June 16. Killed number three. Lymph glands in the neck tubercular. No other tubercles found in the body.

June 16. Killed number six. No tubercular lesions.

Number seven was a large breeding animal and was not exposed to infection in any way, and is not included in calculating the per cent of diseased hogs.

TABLE No. 3--TEMPERATURES.

BEFORE INJECTION					AFTER INJECTION				
Oct. 28, 1902	1	2	3	4	Oct. 29, 1902	1	2	3	4
5:30 p. m.....	102.6	101.4	103.4	104.4	8:00 a. m.....	101.5	99.6	102.1	102.8
7:30 p. m.....	103.4	100.6	102.8	102.8	10:00 a. m.....	100.6	99.6	102.4	102.6
9:30 p. m.....	103.4	100.4	103.2	102.	12:00 a. m.....	100.4	99.6	102.	101.
11:30 p. m.....	101.6	100.4	103.2	101.8	2:00 p. m.....	100.8	99.8	101.4	101.
.....	.....	.....	.....	.....	4:00 p. m.....	101.1	99.2	102.2	104.*
.....	.....	.....	.....	.....	6:00 p. m.....	100.8	99.4	102.4	102.

*High temperature due to recrating animal after it had broken out.

The high temperatures before injection was due to worrying the animals while crating them. Each animal was injected at 12 p. m., with 2 cc of fresh tuberculin.

None of the above animals were fed any of the milk from the tuberculous cow, but they had been in pens with the diseased hogs for several weeks and the test was made to see if any would react. The negative diagnosis of tuberculosis could not be confirmed by post mortem examination as none of the hogs were killed.

L. L. LEWIS,
Veterinarian.