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## HISTOPLASMOSIS-ITS RELATIONSHIP TO BIRDS

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Histoplasmosis is a disease affecting man and many other animals including the dog, cat, cow, horse, and several wild animals. It is caused by a pathogenic fungus known as Histoplasma capsulatum. This fungus lives and multiplies in the ground as a mold. It prefers the undisturbed litter in and around old chicken houses or in undisturbed droppings under bird roosts. It has been found in the soil of dog kennels, under porches of old houses, under trees and bushes frequented by birds in the daytime. It has also been found in isolated caves and hollow trees. It apparently is capable of competing very well with other organisms found in the ground if the ground is enriched by fecal material of chickens, other birds or bats. It is quite significant that histoplasmosis is not found in chickens or in fresh chicken droppings. Work done by Menges (Menges et al., 1955) in Kansas City indicates that chickens and probably all birds are not susceptible to natural infection. This may be due to their high body temperatures. A chicken's temperature is about 106°F. Other birds range from 104° to 110°F.

Histoplasmosis is a very common disease today in many parts of the world. We have had more than our own share of it in Missouri. This is probably due partly to the vast research program carried on by the Communicable Disease Center in Kansas City. For example, in Boone County, a survey of all rural school children in 1952 revealed that 84% of the children were positive to the skin test by the time they were seven years of age.

When Dr. Samuel T. Darling reported the first three cases occurring between 1904-1906 and called the disease histoplasmosis, he believed that all cases ended in death because it was only observed on postmortem. This belief continued until 1934 when the fungus was cultured and animals experimentally infected. In 1949, the organism was first isolated from soil by C. W. Emmons. Since that time thousands of soil samples have been found to contain this fungus. I would like to point out, should you take soil samples, do not expect to receive a report from the laboratory in less than six weeks.

Histoplasmin skin testing was first used in 1944 and helped to establish the fact that many people have had the infection without realizing it. Before the use of the skin test and the development of improved laboratory methods, those individuals who recovered from histoplasmosis were frequently referred to as arrested tuberculosis cases because the X-rays of their lungs showed lesions very similar to tuberculosis,

The spores of this fungus usually enter the human body as an aerosol and most frequently lodge in the respiratory system, primarily in the lungs. However, the spores may be ingested, and lesions develop in the alimentary canal, liver or spleen. The spores after they enter the body multiply in the body not as spores but multiply in the yeast form.

Most authorities on human histoplasmosis believe it takes a massive dose before the average individual will show signs of clinical histoplasmosis.

For example, let's review a family outbreak that occurred in southeast Missouri. The family consisted of a mother, father, grandmother, two teenage sons, and an infant daughter. This family moved on a farm which had been unoccupied for three years. The father kept his job in St. Louis and came down to the farm only on weekends. The two boys cleaned out the chicken house and turned it into a pig pen. Eight days following their work in the chicken house, both boys became ill with malaise, fever up to 104°, mild cough, and some chest pain. They were first diagnosed as having atypical pneumonia. They were hospitalized and their X-rays showed a disseminated pneumonitis in both lungs. From the history given by the family, histoplasmosis was immediately suspected and later confirmed by the laboratory tests. Both boys were released from the hospital about two weeks following onset of illness. The grandmother and the baby sister would stand outside the pig pen and watch the hogs one or more times each day. The grandmother was hospitalized about five days after the boys. The little girl developed histoplasmosis but was not hospitalized. The mother developed a mild case which would have gone unrecognized as would the daughter's had not the three been hospitalized. The father, who came down on weekends and had little or no contact with the hog pen, was negative six weeks later to the skin test.

I would like to discuss briefly, one histoplasmosis epidemic as reported by the Communicable Disease Center, Kansas City, Kansas. Mason City, Iowa, a town of 30,000 people, had prior to the summer of 1962, a very low incidence of histoplasmosis. Willow Creek runs through the town only two blocks from the town square, the north bank is lined with homes and business establishments. The south bank was largely an unused area of large trees and dense underbrush extending about 200 yards along the creek. Large numbers of birds had used this roost for about seven years. During the last week in July, and the

first two weeks in August, bulldozers, a power shovel, and a dredge were used to remove the trees, underbrush, and widen the creek. The weather was very dry during the entire operation. Large clouds of dust drifted over a considerable area of the city, particularly so when the big trees were toppled.

The first case of histoplasmosis occurred in the power shovel operator. On August 4, he developed sudden chills and fever and a chest film revealed extensive pneumonic infiltrates. He died of histoplasmosis after an illness of seven weeks. Between August 6 and 12, three other men developed similar illness. One was the owner of the equipment, the other two were employed in a store adjacent to the area. Subsequent investigation revealed that 28 persons had acute histoplasmosis following the clearing of the area. Sixteen either worked at the site or worked within a 400 foot radius. Twelve denied any direct contact with the site. In all these patients, illness occurred with sudden onset of fever and prostration, typical of epidemic histoplasmosis.

A second death occurring in January, 1963, was attributed to this epidemic. A skin test program was carried out by the United States Public Health Service in cooperation with state and local health departments. Twenty-nine per cent of the children reacted to the histoplasmin, and there was a striking direct correlation between the per cent of reactors and the distance of their residence from the source of the epidemic.

A control study was made of the school children in Forest City, Iowa. This town is located about 35 miles from Mason City. The same method was used and the results showed that only 9 out of 645 children were positive to the skin test. This is 1.4% rate as compared to 29% at Mason City.

From the many reprints on histoplasmosis, one is inclined to believe that all bird roosts and chicken houses will show contamination with the fungus if sufficient soil samples are taken. This is not true. During January and February of 1965, for example, soil samples from three different roosts were taken and processed by the Communicable Disease Center laboratory in Kansas City. Twenty-one were taken from an old starling roost near Essex, Missouri, and all 21 were negative. Twenty-one were also taken from an active blackbird roost at Ste. Genevieve and all were negative. Only two of twenty-one specimens from another active roost at Caruthersville were positive. Similar results have also been reported by our state laboratory in Jefferson City.

Since I am from Missouri, I have been accused or credited with all the publicity that the Dexter, Missouri blackbird roost received in 1965; therefore, I will give you a brief report. When I received a request from the city of Dexter for assistance with their blackbird problem, I saw an opportunity of using the knowledge that I had received at these seminars and also had picked up from various reports. Upon

visiting the roost, I observed that it was approximately 150 feet across and contained an area roughly estimated at 10 acres. This entire area was covered with thick brush and low trees, and the minimum number of birds estimated was eight million. The flock was composed of various blackbirds and a relatively small number of starlings. The starling population was estimated between ten to thirty per cent.

In my report to the city council that evening, it was pointed out that this roost could probably be moved with the use of lights and sound but this method was not recommended because the flock might move into the city. I did state that my written report would contain recommendations for the complete destruction of the flock. This was strongly objected to by our conservation commission which recommended bulldozing, but the Missouri Division of Health strongly objected to the bulldozing method because of the danger of disseminating the fungus causing histoplasmosis.

In my written report to the city council, I recommended three methods for destroying the flock. My first choice was a blanket of water because in my opinion this roost, only 150 feet wide, with roads on three sides was nearly perfect for such a method. Furthermore, the temperature at night in Dexter was in the 20's.

My second choice was that the roost be dynamited and third choice was that the flock be destroyed by contact poisoning. Incidentally, this third recommendation had been made two years previous by the federal Fish and Wildlife Service for the destruction of the flock. Unfortunately, after submitting my report to the Dexter city council, I was incapacitated with shingles and could not do the necessary follow-up work. This flock was later dispersed by the use of fire and police sirens and lights and moved a half-mile further out of town.

Incidentally, I received many phone calls and dozens of letters offering suggestions for killing the birds or complimenting the Division of Health on our stand. We did not receive one letter or phone call condemning our recommendations for the destruction of the birds. I would have liked to have tried one suggestion which was the use of flame throwers on the roost.

The Public Health Service ran 31 soil samples on the Dexter roost and 17 were positive for Histoplasma capsulatum. The skin test results in the Dexter school children was 55% positive, however, the school nearest to the roost had a positive rating of 66%. The control group at Maiden, 30 miles away was only 37%.

What can you do if you have to work in an area that is highly contaminated with an accumulation of bird droppings? I think first you should wear a respirator. You can also wet the area down with water to lessen the amount of dust. It is believed that if you have been exposed to this fungus and have a positive skin test you are less likely to have a second attack of the disease. Tosh and others (1966) have been experimentally decontaminating soil with a 1-3-5% solution of either

formaldehyde or creosol compounds quite successfully in the laboratory. However, when they tried it in the field, the results were not as successful. In one test plot, after 20 weeks, 21% of the samples were positive after soaking the soil three times with one of the above compounds using one gallon of solution each time per square foot. Furthermore, the cost of chemicals, equipment and labor would make such a procedure prohibitive.

#### LITERATURE CITED

- Menges, Robert W. and Robert T. Habermann. 1955. Experimental Avian Histoplasmosis, Amer. J. Vet. Res. 16 (59):314-320.
- Tosh, F. E., R. J. Weeks, F. R. Pfeiffer, S. Henricks and T. D. Y. Chin. 1966. Chemical Decontamination of Soil Containing Histoplasma Capsulatum, Amer. J. Epidem. 83 (2).

#### DISCUSSION

F. GLEASON: Would you recommend burning the chicken house so that this particular soil could be used again?

DR. PRICE: Based on the work done by the CDC, I'm not sure that burning is going to get it because you'll get the top of the litter burned. It's not up in the wood part; it's in actually where the chickens have walked. So you'd burn off the top, you'd only burn down a couple of inches; you would still have the organisms down there in the soil.

F. GLEASON: In other words, you'd just keep away from that soil for years?

DR. PRICE: We don't know how many years it takes. Now you can go back in the literature and can find where somebody had built a home where there had been a chicken house, and they went out and worked in the flower bed and developed histoplasmosis from that organism. It apparently lives for years in there. We don't know why or how long it takes to die. In one roost, a real old roost, wasn't being used, been idle for years, they are still able to get fungus out of there.

B. BRINK What are the practical danger signals, if any? Where along the line do you begin to get concerned about a large population of birds?

DR. PRICE: I can't really answer that for this reason. Cases of histoplasmosis have occurred in people that were taking down a back porch of a private

home and were going to put on an addition. There had been a tree adjacent to the porch in which birds had roosted, not in great numbers, and yet one or two of these people developed histo. As far as I am concerned, any time I go into an area that I think might contain spores, I wear a respirator. And I have a positive skin test, too.

DELEGATE: What happens if this manure is hauled out of the chicken house, for example, and is spread on a garden or field? Will it continue to grow and multiply?

DR. PRICE: Well, if you spread it thinly I would assume that the sunlight would destroy it. But we've had histo where people have taken the litter out of chicken houses and used it around flowers; they have developed histo from working in the garden. I don't know how long the manure was in the garden.

A. FRISHMAN: Has any research been done on low volume high concentration of formaldehyde?

DR. PRICE: Well, Tosh has used 1, 3, and 5%; they've used up to a gallon per square foot on three occasions, and came up with 21% of the soil samples positive after twenty weeks, I think that's the right figure. They once thought they had the answer with formaldehyde; they've used the combination of formaldehyde with creosol and they still are not happy. Now they think their field work failed because they had not covered a large enough area and possibly some of these spores of the fungus moved in from adjacent areas. They used only five foot test plots.

C. MCGRIFF: We've been working in airplane hangers where we have a great concentration of bird manure on the girders. They have to be cleaned off. Now what's the danger in that?

DR. PRICE: There could be a certain amount of danger there because you are probably going to breathe some of that fecal material that you're cleaning off there. Your respirator would help you. You could wet it down, dampen it down, and cut down on some of the dust. [See letter following Discussion. Ed.]

C. MCGRIFF: We're also handling a lot of birds that we are taking out of traps and holding cages. And consequently when you get a big concentration of birds in this cage, you get a lot of beating wings and a lot of dust in the air. Now what's the danger of that, if any?

DR. PRICE: I can't actually give you the amount of danger but now we do know that that bird does not develop symptoms. Work done by

Menges says that the chicken does not get histoplasmosis perhaps because of the different body temperature. Now you would have some possible contamination from dust from the wing feathers when they're beating their wings. I don't think it would be near as great as if you went into the roost.

R. WETZEL: You said the fungus developed in the ground underneath the droppings. With regard to Mr. McGriff's question, I was wondering about these steel girders; if there's no ground however, and it's not carried in the droppings of the bird, could it come up there on the feathers of the bird?

DR. PRICE: No, I think they probably could carry it in on their feet. Things like that. It would be interesting to run some samples on straight material off girders like that.

DELEGATE: How long after exposure to infection are symptoms likely to occur?

DR. PRICE: It may be as in the case I gave you of the two boys who cleaned out the chicken roost for a pig pen. They developed symptoms, serious symptoms, within eight days. We have run as high as, I believe, about twelve days for the father and fourteen for the son who cleaned out a silo. It varies a little bit. In the case of that shovel operator, I think that actually his was less than eight days.

DELEGATE: Do you think gulls carry this the same as other birds?

DR. PRICE: I don't think that any bird actually carries the disease. No, because we cannot find it in fresh droppings; by swabbing the cloaca of the bird, or by doing a necropsy on the bird, we can't find the organism.

DELEGATE: It doesn't develop then until after the droppings are present?

DR. PRICE: After the droppings, yes.

[Letter received by E. R. Price, September 23, 1966 and forwarded to the editors. Ed.]

"Dear Dr. Price: Dr. Chin and I were pleased to hear that your paper at the Bird Seminar was well received.

"I doubt that bird droppings on girders in such places as airplane hangars would be very conducive to the growth of Histoplasma



capsulatum. The fungus seems to grow best in soil contaminated with bird excreta, and it cannot be recovered very often from chicken houses that are in use and contain a large amount of fresh droppings. If the birds roosting on the girders happen to be pigeons, there would be even less chance of Histoplasma capsulatum thriving in the manure. For some reason, this particular fungus does not grow well in pigeon excreta.

"However, Cryptococcus neoformans is frequently found growing in pigeon excreta. Cryptococcus can produce severe disease, but severe infections are not too common. Mentioning Cryptococcus gets into a new area and for your purposes you may wish to confine your answer to a statement on Histoplasma capsulatum." Fred E. Tosh, M.D., Chief, Pulmonary Mycoses Unit, Communicable Disease Center, Public Health Service, Kansas City Field Station, Kansas City, Kansas.