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Philip J. Spear

Technical Director National Pest Control Association, Elizabeth, NJ

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CONCLUDING REMARKS OF APPRECIATION WITH
COMMENTS ON HISTOPLASMOSIS AND CRYPTOCOCCOSIS

Philip J. Spear, Technical Director National
Pest Control Association, Elizabeth, N. J.

The record of this meeting will stand as a permanent tribute to Dr. Walter Howard and his associates. It should remind them for years to come of their worthwhile contribution in conceiving, organizing, promoting, and handling the details of this first Vertebrate Pest Control Conference. Those of us privileged to attend will be grateful for the opportunity to enlarge our acquaintance with the workers in the vertebrate pest control field, and to share in this exchange of information.

The National Pest Control Association, whose members provide among other services, control of many vertebrate pests, draw information and guidance from many of the participants, as well as the organizations they represent. Therefore, NPCA welcomed Dr. Howard's invitation to participate in the meeting and to publish the proceedings.

The vertebrate pest problems and control methods of the past, as well as of the present, have been well covered at this meeting. As noted by the keynote speaker, the record will be a guide to the future. Important as we may feel the meeting to be now, it is likely that its benefits will be even greater as new problems arise in the future.

As the public or some segments of it are affected by pests, it is essential that full knowledge of the problems be assembled and communicated to the public at large. Without understanding on the part of the general population, there can be neither acceptance of necessary drastic control methods nor support for long range management programs based on sound knowledge of the biology and ecology of the pests.

If the past is a guide to the future we can expect to be surprised by outbreaks of new pests or old pests in new environments. The development of conditions suitable for the creation of vertebrate pest problems can be foreseen. Participation in outdoor recreation is expected to triple in the next 40 years. In part, this is due to the turnpike system being constructed under the national highway program. These same parkways, that bring people to the "Wilderness," also are protected avenues into residential areas over which many vertebrates travel and find protection close to man.

Finally, some of the problems which now are understood poorly, if at all, will receive proper study and evaluation. For example, we are now learning much from studies of the role of bats and birds as reservoirs for disease or in creating conditions suitable for dissemination of human disease. Among the diseases which are closely associated with pest birds are histoplasmosis and cryptococcosis.

Histoplasmosis is a disease of humans that is acquired by inhaling spores of the fungus, Histoplasma capsulatum. Among other places, the fungus thrives in soil that is contaminated by bird or bat droppings. Starlings have been associated with most of the recently reported epidemics.

Cryptococcosis is a disease of humans that is acquired by inhaling spores of the fungus, Cryptococcus neoformans. These spores are commonly found in accumulations of pigeon droppings, or dust from them.

The threat of these diseases justifies:

1. Control or dispersal of bats and birds that roost in areas frequented by humans,
2. Use of respiratory protection for PCO's and others working in areas infested by bats and birds, and
3. Treatment of potentially contaminated soil and feces with disinfectants or at least with water plus a wetting agent.

Histoplasmosis

Distribution

The fungus, Histoplasma capsulatum, is reported to thrive in constantly warm, moist environments. Decaying excreta which

accumulate under starling and other bird roosts may supply the dampness, heat and chemicals needed for growth of the fungus. It has been associated with soil in, under or around chicken houses, pigeon and starling roosts. Other apparently favorable sites include caves, silos, storm cellars, river banks and wooded ravines. Bats use such sites for roosts and may also be involved in the dissemination of histoplasmosis as well as aiding its growth by contaminating soil with their droppings. Diseases which have been called cave sickness, bat fever, speleologists disease or Mississippi valley fever are probably histoplasmosis.

Histoplasmosis has been reported to be most prevalent in the central Mississippi River Basin. It is also prevalent, however, in the St. Lawrence River Valley and in the other river basin areas of the Central and Eastern States. In addition, it is present in Panama, where it was first identified as a disease, and in Honduras, Argentina, Brazil, Java, Japan and England. (1)

Case Histories of Histoplasmosis

Histoplasmosis has been discussed in a number of recent editorials (2, 3) and reports in medical and public health journals. The highlights of three reports illustrate how birds may be involved, and the effect of this disease on man.

Case I (4) A 56-year-old male resident of the Memphis, Tennessee area was stricken with fever, shaking chills

and a cough. Drugs as prescribed by a physician did not bring improvement. X-rays showed both lungs to be infected and the victim was hospitalized. The fever was reduced by drugs but the lung condition continued. He was admitted to a second hospital four weeks after the original fever was noted. A diagnosis of acute pulmonary histoplasmosis was made. The only treatment was bed rest. Over a period of six months, during which the victim had no symptoms or fever, his lungs showed gradual, but not complete, clearing and he was permitted to return to work.

Investigation of this case was non-productive at first, but on the third round of questioning, the victim recalled that five days before becoming ill he had purchased 5 or 6 small sacks of "top soil." When he spread this material on his flower beds, he noted that it was primarily bird droppings and very dusty. The "top soil" had come from an area in a cemetery where, for at least 2 years, a large flock of birds, mostly starlings, had roosted in winter. The soil in this area as well as in the flower bed contained cultures of Histoplasma capsulatum, whereas soil from another part of the victim's property and under three other starling roosts, were negative.

Case II (5) In Mexico, Missouri, a park in the center of the city had been a roosting place for starlings. Bird

droppings were evident on the soil in part of the park. On March 28, 1959, 64 boy scouts spent a day in the park raking and burning leaves and debris. Within two weeks, ten of the boys got sick and half of them had a moderately severe illness of one to six weeks' duration characterized by chills, fever, cough, and chest discomfort. The other five had a mild infection, like a cold, that lasted a few days. All of these boys had histoplasmosis. All had worked in an area of the park which was heavily infected with H. capsulatum.

Investigation of the epidemic revealed that in the 64 boys who worked in the park, evidence of histoplasmosis was found in 97% by skin tests, 60% by blood tests and 47% had active lesions shown in X-ray films. Of 46 other scouts of the same troop but who did not work in the park, evidence of histoplasmosis was found in 41% by skin tests and 25% by blood tests and X-rays. In fact, 55% of the Junior High School students of Mexico, other than boy scouts, are positive to the skin test. This indicates that many of these boys apparently were previously infected, which explains their failure to get reinfected. (6) Soil samples from the park as a whole were 62% positive for the fungus as compared to only 1 positive in 68 samples of soil taken from favorable locations elsewhere within the city or the adjoining three miles.

We have been informed that several doctors who were studying the epidemic, a mycologist (specialist on fungi) who visited the area and an equipment operator were also infected. (6)

Case III (7) In Milan, Michigan, skin tests showed that 61 percent of the school children in the town had or had had histoplasmosis. In the surrounding areas the comparable infection rates range from two to eleven percent. At Milan, school children used a playground as well as entered and left school buses under trees used as a starling roost and where the ground was white with droppings. By the time the students graduate from high school, few have escaped being infected with histoplasmosis.

Characteristics of Histoplasmosis

Histoplasmosis is not a contagious disease, that is, it is not spread from man to man or from birds or animals to man. It is contracted, instead, by breathing the fungus spores. These tiny vegetative particles are easily borne on a wind or distributed in air by any slight disturbance of infected soil. The fungus is reported to grow in soil or decaying vegetative matter in mycelial form but in living animals it grows as a yeast form.

In histoplasmosis, the time interval between exposure and symptoms is 7 to 14 days. Generally, one infection protects

against subsequent infections. Reinfection has been reported, however, where heavy contamination of the environment occurred.

Dogs, cats and other animals may be infected with histoplasmosis. (8)

Benign (Mild) Histoplasmosis

In the majority of human cases, histoplasmosis follows a mild course characterized by tiredness, slight fever, and possibly a cough. Needless to say, this form is seldom recognized, but is passed off as a cold, flu or some other common mild ailment. The lesions which may form in the lungs, heal, often with calcification which may be seen by X-ray for months or years after. Effects of these deposits, if any, are not recognized by the persons affected.

It was estimated (9) that some 30 million people in the United States have had histoplasmosis. Such estimates are based on skin tests of samples' of the total population. The skin histoplasmin tests show if a person has or has had the disease. In areas of high infection 70 to 85 percent of the population (3) may show a positive reaction, indicating the widespread presence of the disease in at least a mild form. One out of three persons infected have lung changes that can be seen by X-rays, although biopsy or surgery may be required to prove the damage is due to histoplasmosis and not to another cause. Serological tests, using serum from blood, help to determine if the disease is active.

Chronic (Severe) Forms of Histoplasmosis

In addition to the mild or benign form, histoplasmosis may be a very serious illness in its chronic forms. Chronic pulmonary histoplasmosis is often confused with tuberculosis of the lungs. It may form abscesses and cavities in the lung. If the infection becomes established outside the lungs, it is called chronic disseminated histoplasmosis. It occurs mostly in infants, the aged, or person's ill with other diseases.

Frequency of Infection

The American Medical Association (2) recently estimated that 500, 000 persons are infected per year and that one-fourth to one-third of these have a mild flu-like disease. A smaller number possibly 100, 000 seek medical attention. The same source estimates that one or two cases per 1, 000 infections develop into a severe, often fatal illness. Thus, it appears that there may be at least 500 cases per year in which histoplasmosis is so severe that most of the victims die and the survivors are incapacitated with little hope for useful lives.

Birds and Histoplasmosis

Epidemics of histoplasmosis are frequently associated with birds, especially starlings. Some other birds such as blackbirds and grackles are sometimes involved. Earlier records showed that poultry droppings on soil or debris also provide a favorable environment for the development of the fungus. Histoplasma has been

isolated from pigeon droppings only where they were mixed with soil. (10)

When the fungus, H. capsulatum, was identified in the District of Columbia, a report (11) from the U. S. Public Health Service stated that:

" . . . Dr. Chester W. Emmons, Chief of the Medical Mycology Section of the National Institute of Allergy and Infectious Diseases, revealed that the fungus, Histoplasma capsulatum, was isolated in soil contaminated by starlings, which was taken from beneath sycamore trees in two of Washington's public parks--at Pennsylvania Avenue between 7th and 8th Streets, N. W., and at Massachusetts Avenue and E Street, N. E.

"Previously many investigators have believed that the fungus grew only in the soil of rural areas and small towns.

"Past reports by Dr. Emmons and other scientists have indicated that droppings from some species of wildbirds as well as from domestic fowl create a soil condition highly suitable for the growth of the fungus . . . "

"Referring to the site of his latest findings, Dr. Emmons pointed out in his report that 'the park had

been periodically and recently cleaned and there was no obvious contamination with bird excreta, although it is known that the soil under the sycamore trees where the collections were made is regularly contaminated with such material.

" 'It is obvious,' he said, 'that roosting starlings can create a soil environment suitable for the growth of Histoplasma capsulatum even though bird excreta do not accumulate and remain on the surface of the soil. '

"The report emphasized that other scientists also have suggested 'an urban type of human exposure¹ to histoplasmosis, and noted that histoplasmosis is already well-documented as 'an important medical problem in Washington, D. C., and surrounding areas. ' . . . "

Other recent records of histoplasmosis epidemics and H. capsulatum identifications generally involve starlings. Although our information is sketchy, it appears that most of these records involve areas where starlings have been established for a decade or more, and none come from areas where this bird has been uncommon - as in the southwest and far west. At any rate, in most of the areas in North America where starlings are numerous, their droppings on

soil provide a favorable environment for the growth of the fungus causing histoplasmosis. Humans, and apparently dogs, cats and other animals as well, often contract the disease when using, or working in the infected area or when they are exposed to dust or soil from such areas.

Bats and Histoplasmosis

Bat droppings on soil or guano also can create an environment suitable to the growth of the fungus H. capsulatum. Emmons (12) has reported repeated isolations from bat-infested soil around a house in Maryland where several children apparently acquired histoplasmosis with one fatality. He also reviewed literature indicating that several proved cases of histoplasmosis have appeared in persons entering caves infested with bats. Other records indicate that illnesses in persons entering or working on bat-infested property probably can now be diagnosed as histoplasmosis on the basis of present knowledge of the disease.

In the Maryland case the house was infested by the brown or house bat, Eptesicus fuscus. Several bushels of bat dung were found in the attic and more was found on the soil adjacent to the house. The fungus, H. capsulatum, was found in 45 of the 66 soil samples taken within 5 feet of the house but in only 2 of 29 taken 6 to 18 feet from the house. Three of ten samples taken near a dog house 40 feet from the house proper were positive for H. capsulatum.

According to a recent report (13) from Panama, H. capsulatum has been recovered from the liver and spleen of bats. It is not possible to say at this time if this occurrence of the fungus in the organs of the bats means they are ill with histoplasmosis or if bats are involved in the dissemination of the disease. The bat species involved, Chilonycteris rubiginosa fusca, occurs only in Central America and southern Mexico. In the same study the fungus was also recovered from the soil about the building from which the fungus-bearing bats were captured.

It is evident that bat droppings on soil create a favorable environment for the presence of Histoplasma. The role of bats in disseminating the fungus needs to be determined.

Cryptococcosis

Another fungus disease of man, also associated with birds, is cryptococcosis. Infections are acquired by inhaling spores of Cryptococcus neoformans. Virulent strains of this fungus grow readily in pigeon droppings. Typical sites for the occurrence of such contamination include nests or roosts in or on attics, cupolas, ledges, and exposed parts of a variety of structures including schools, offices, warehouses, mills, barns, park buildings and signs. Cryptococcosis is not a disease of pigeons, but it does thrive in pigeon manure. It occurs throughout the world.

Veterinarians encounter cryptococcosis often in dogs and occasionally in cats. (8) In such animals the disease, if recognizable, is usually fatal.

In man two types of cryptococcosis are known. The cutaneous form is characterized by skin eruptions like acne, or ulcers plus nodules which develop just under the skin. It may precede or follow the second type or generalized form. In the latter, the primary infection in the lungs is followed by invasion of the rest of the body particularly the central nervous system. Fever may be present and a cough usually accompanies lung infection. In either case the disease is a very serious one. Untreated infection of the central nervous system is invariably fatal.

Sources of Cryptococcosis Infection

Pigeon manure, even when dry, mortar-like and at least a year old, appears to be an important source of C. neoformans in the environment. Cultures have been found in pigeon droppings on and under roosts and in old nests. (12) In samples taken from typical sites for the occurrence of such contamination in or near Washington, D. C., C. neoformans were isolated from 63 of 91 specimens. (14) From specific sources the number of positive specimens and the number of specimens collected were: 7 out of 7 from cupola on a high school; 7 of 10 from an old school building used as an office; 17 of 18 from the window ledges of Federal and municipal office buildings

and 3 out of 5 from a grain mill. None was isolated from 7 soil specimens in a city park.

Rural environments, particularly if pigeons are present, also may provide suitable situations for cryptococcosis. (15)

Significance of Histoplasmosis and Cryptococcosis to Pest Control Operators

The close association between pest birds and the two diseases described in this release needs to be recognized by all pest control operators. Here are two diseases, known to be hazardous to man, which flourish because of contamination of man's environment by birds or bats. These are pests which this industry can and should control. The threat of these diseases justifies bird control or management campaigns in communities, residential and industrial areas as well as on individual buildings.

Since pest control operators often must enter areas contaminated by birds or bats, they should be warned of the hazards involved and provided with appropriate protective equipment.

Infected Sites Cannot Be Readily Recognized

There is no quick means of determining if a site is hazardous because of infection with the fungi discussed in this release. Specific culture methods are used in laboratory identification but these are time-consuming. They would only indicate the status of the sample examined. Since samples showing no fungus are often found in

areas where fungi are common, it is the custom to test a number of samples and depend upon the percentage of samples showing the pathogenic fungus to determine the degree of hazard.

Both fungi have been isolated at all seasons of the year from sites known to be infected. (16)

At present, it appears wise to consider any soil that is contaminated with bird or bat droppings as a potential source of histoplasmosis and any deposit of pigeon droppings as a potential source of cryptococcosis. In either case the greatest danger is from dust which might be inhaled.

Decontamination of Soil and Bird Droppings

There are no generally useful methods of destroying cryptococcosis and histoplasmosis spores in soil in bat or bird droppings or in the dust from them.

Pentachlorophenol in oil is understood to be effective in decontaminating soil. In the absence of official recommendations, we suggest 5 percent penta in fuel oil or-better grade oils. The limitation of this treatment is that it will destroy not only fungi but all other plant life in the soil. Milder fungicides, tested to date, that are safe on soils are not effective in destroying fungi.

For removal of possibly contaminated soil as from a starling roost, a bat roost or a chicken house, it is suggested that PCO's use a water spray to reduce air-borne dust. The addition of a cresol disinfectant may offer some added protection, but this

possibility is not yet substantiated. A wetting agent or household detergent can be added to increase the wetting power of the spray.

Protection of Workers

Protection of pest control operators or others working in infected environments must be based upon the following:

1. Avoid inhaling dust.
2. Personal hygiene.

Workers should be provided with appropriate coveralls, gloves, caps and dust-proof respirators. Respirators need to be properly fitted, comfortable, with low breathing resistance, and of a quality that permits approval by the U. S. Bureau of Mines for nuisance dusts.

The respirators should be worn whenever air-borne dust or soil from bird or bat infested environments is likely to be encountered. This will include the time during which coveralls, caps, etc. are removed and shaken.

That the continued use of the dust respirator is necessary during exposure is illustrated by the experience of a medical doctor who developed histoplasmosis while he was investigating the Mexico, Missouri epidemic. It is believed that when he got rather warm while working in the park cleared by the boys, and raised his mask for a while, he inhaled sufficient spores to get infected.

A daily complete bath and change of clothes should be a routine procedure for PCO's but is particularly necessary for those working in areas contaminated by droppings or dust from bats or birds.

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