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A.R. Stickley Jr.
USDA-APHIS-ADC

J.R. Pruitt
Warren County Health Dept.

C.E. Hume
Warren County Health Dept

T. Pass II
Morehead State University, Morehead, KY

C.H. Gayle
Kentucky Dept. Agriculture, Division of Pest & Noxious Weed Control

DECONTAMINATION OF A HISTOPLASMA CAPSULATUM-INFESTED BLACKBIRD ROOST: USE OF A SPRINKLER SYSTEM TO APPLY FORMALIN

by A. R. Stickley, Jr.,[1/] J. R. Pruitt[2/], C. E. Hume[2/,3/], T. Pass II,[4/], and C. H. Gayle[5/]

ABSTRACT

When disturbed, blackbird/starling roost sites can be sources of locally severe outbreaks of histoplasmosis; therefore decontamination with formalin is sometimes prudent. We describe the use of a $5000 sprinkler system for spraying formalin on a Histoplasma capsulatum-infested roost site. This system precludes direct worker involvement in the application of this hazardous chemical to the area. Analysis of soil samples collected and cultured both before and after formalin treatment confirmed the eradication of H. capsulatum from the 1.3 ha site. Cost was approximately $17,000 with sprinkler system provided at no charge.

INTRODUCTION

Histoplasmosis-infested blackbird (Icterinae) and European starling (Sturnus vulgaris) roosts in the central Mississippi River Valley and tributaries are known to be sources of low-grade histoplasmosis infections in local communities (Chin et al. 1970, Tosh et al. 1970, Chick et al. 1980). These roost sites can also be sources of locally severe outbreaks of histoplasmosis when they are disturbed (D'Alessio et al. 1965, Tosh et al. 1966a, Latham et al. 1980). Therefore, if disruption of H. capsulatum-infested sites is planned, then decontamination is prudent. To date, the only known effective decontaminant is formalin (U.S. Dept. of Health, Education, and Welfare, undated, Histoplasmosis Control). It was first used as such in 1966 (Tosh et al. 1966b), and has since been used occasionally for this purpose (Bartlett et al. 1982). Past formalin application techniques required worker-held hoses, which were disagreeable and dangerous to the personnel involved (formalin is a severe irritant and known carcinogen {U.S. Dept. of Health, Education, and Welfare, undated, Formaldehyde}). We describe the application of formalin to a H. capsulatum-infested roost site via a network of irrigation pipes and sprinklers.

Site Description, Materials, and Methods

The roost site was a 2 ha area in the middle of a 20 ha old field on the north side of the Springhill Subdivision 1000 m west of Kentucky Highway 68-80 in Bowling Green, Kentucky. Prior to January 1980, eastern red cedars (Juniperus virginiana) predominated here. The 1.2 ha western part of the site contained young red cedars (10-15 cm DBH), whereas mature ones (23-36 cm DBH) occupied the 0.8 ha eastern section. Wintering blackbirds and starlings began to occupy both parts sometime before the winter of 1978-79 when their numbers reached approximately 1 million. Occupancy was cut short the next winter (January 1980) when the 1.2 ha western side of the roost was bulldozed (Stickley et al. 1986).

Because a case of histoplasmosis had been diagnosed in a resident of the Springhill Subdivision, 40 sur-

1/USDA-APHIS-ADC Research, Kentucky Research Station, 334 15th Street, Bowling Green, KY 42101
2/Warren County Health Dept., 1133 Adams Street, Bowling Green, KY 42101
3/Deceased
4/Professor of Microbiology, Morehead State University, Morehead, KY 40351
5/Kentucky Dept. Agriculture, Division of Pest & Noxious Weed Control, Frankfort, KY 40601

face soil samples were taken from the 2-ha site in November 1979 and cultured for the presence of H. capsulatum at Morehead State University, Morehead, Kentucky. Smith's modified oil flotation technique (Smith 1971) was followed in the soil sample processing except that: 1) the antibiotics were not added until after the soil samples had been strained into the blender; and 2) 5 mg/ml of cycloheximide was also added to the suspension. Media preparation differed from Smith's technique only in that cycloheximide (0.5 g/l, dissolved in acetone) was added to the media before autoclaving. Mouse injection and necropsy techniques were as described by Smith (1971). The result was that 7 of the 10 samples taken from the 0.8 ha eastern section containing mature red cedars were positive for H. capsulatum.

In March 1981, with the site scheduled for sale and possible development, we sampled the 1.2 ha western section again to see if a H. capsulatum infestation had developed. Using the same techniques described above, we found that 19 of the 37 samples taken were positive for the fungus. However, these were confined to a 0.5 ha strip adjacent to the 0.8 ha eastern section already found to be infested with H. capsulatum.

At this point the Warren County Health Department decided that the 1.3 ha of infested land should be decontaminated to prevent a possible outbreak of histoplasmosis when and if the site was disrupted. The Kentucky Department of Agriculture agreed to provide transportation for the formalin (which the landowner purchased), and the Kentucky Research Station of the U. S. Fish and Wildlife Service (now USDA-APHIS-Animal Damage Control Research) agreed to provide a sprinkler system that had previously been used experimentally to apply a surfactant (PA-14) to winter-roosting blackbirds and starlings.

In June 1981, on advice of the U.S. Public Health Service, the vegetation was removed by bulldozer from the H. capsulatum-infested area (at a time when the ground was damp) so that only weeds and forbs were left. Brush was piled up along the east and west sides of the target area (Fig. 1). Next, the sprinkler system was set up in an 18.3 m (60 ft) grid pattern (Figs. 1 & 2). It consisted of 9.1 m (30 ft) horizontal sections of 5.1-cm (2 in) and 7.6-cm (3 in) diameter irrigation pipe, and vertical 2.5-cm (1 in) diameter risers 1.6 m (5 ft) in height, with Toro Ag-2 Model 358 sprinklers each equipped with two 0.44-cm (11/64 in) diameter nozzles (Fig. 3). Because not enough pipe was available to spray the 1.3- ha area at one time, the site was treated in two stages (Fig. 1). Approximately 20 man-hours were required to put the system in place for the first application. In this position, where the spray from some sprinklers would likely reach the trailer park 30 m distant on the north side, baffles were installed on these sprinklers.

On the evening of 9 July 1981, formalin (37% formaldehyde gas [by wt/wt] in water stabilized with 10-15% methanol) was delivered to the spray site in a 10,850-liter capacity Kentucky Department of Agriculture tank truck. At 2300 hours we began to inject the formalin into the 6.4 cm-diameter (2.5 in) fire hose line that supplied the water to the sprinkler system from a hydrant located approximately 300 m from the spray site. A fire truck at the hydrant pumped the water at a rate of 662 liters/min (175 gpm) at a pressure of 862 kilopascals (kpa) (125 psi). This resulted in approximately 414 kpa (60 psi) at the sprinklers with a resultant spray radius of 17 m. The formalin was drawn from the tank truck by a truck-mounted pump and injected into the fire hose line at a 6% rate by a 10.2 cm (4 in) proportioning device. We operated the system for 3 hours,

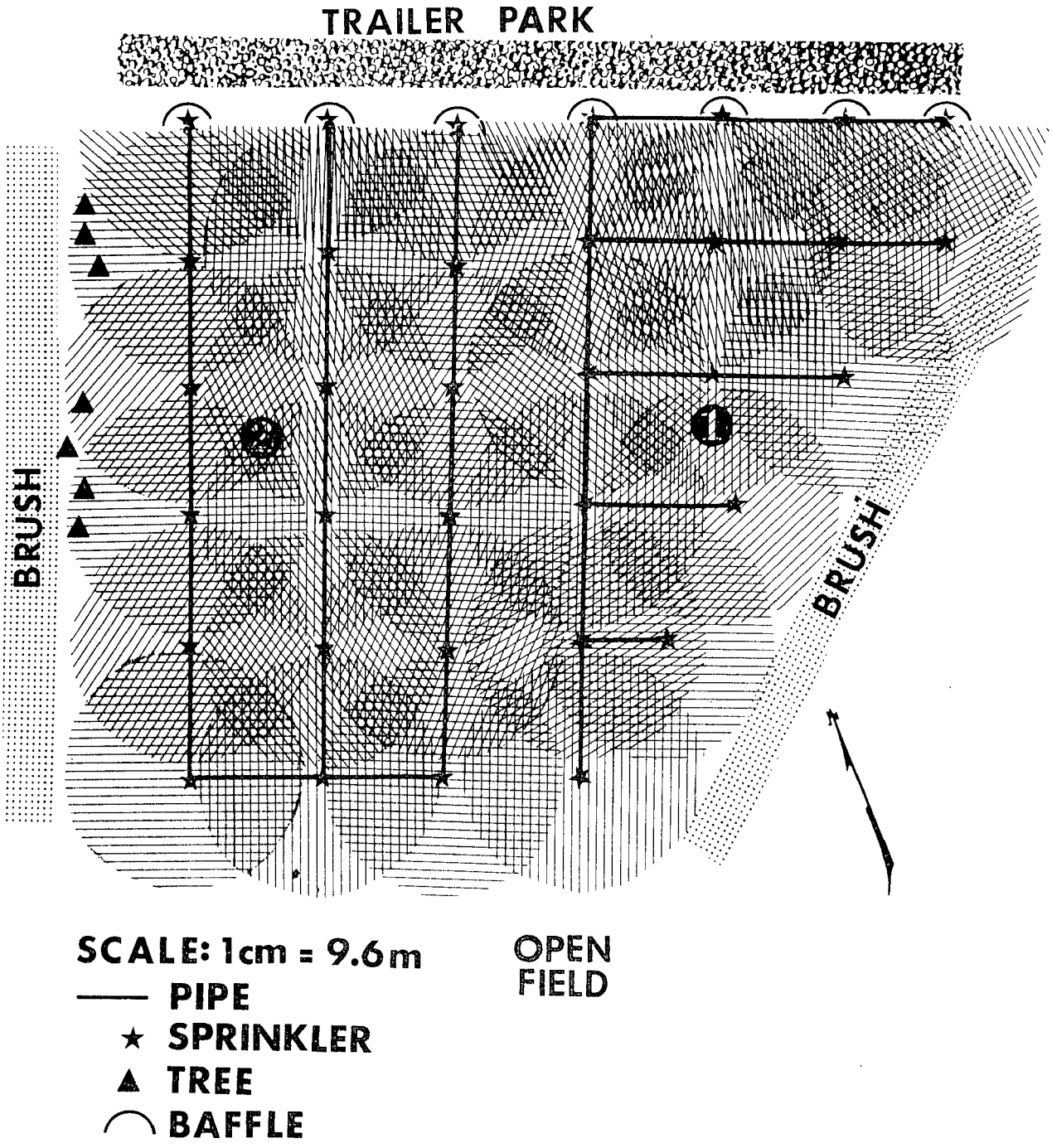

Figure 1. The two positions of the sprinkler system on H. capsulatum-infested site. Overlaid circular hatching indicates spray patterns for sprinklers.

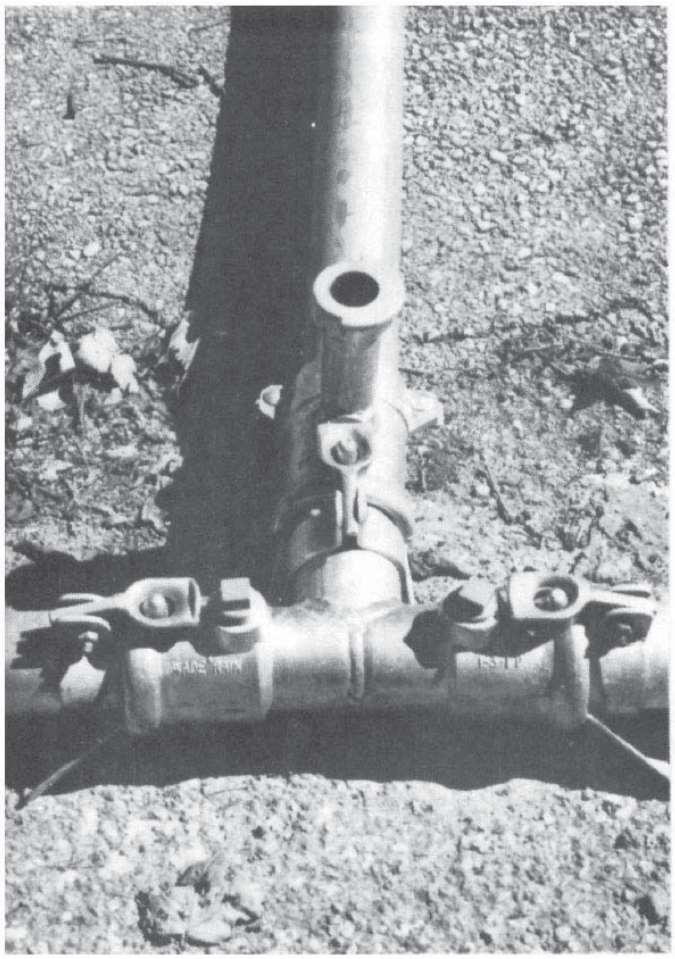

Figure 2. Close-up of irrigation pipe and connections used to spray formalin. A 5 ft riser is placed in the hole in the center of the upright connector.

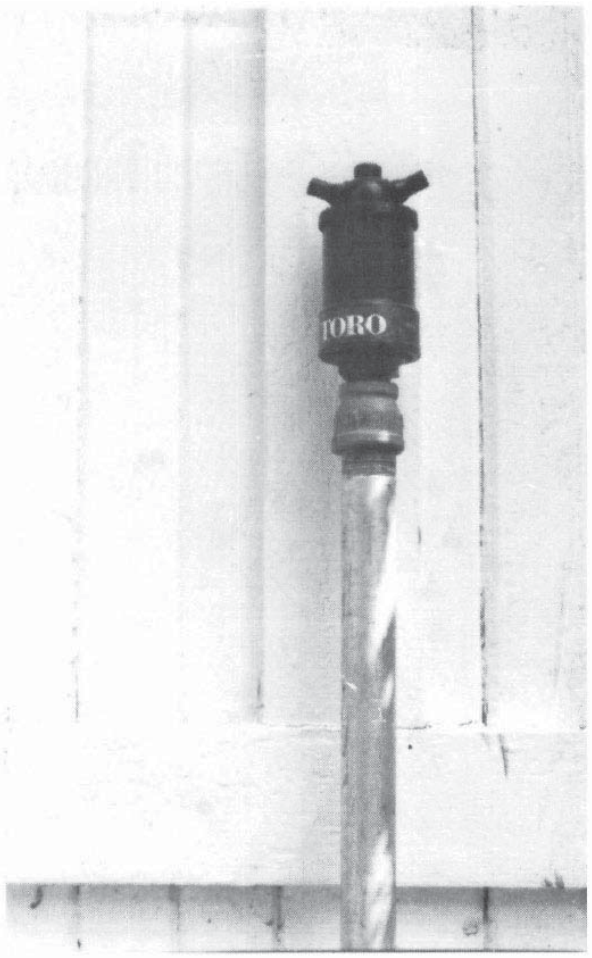

Figure 3. A Toro sprinkler on top of a 5 ft riser.

applying approximately 116,200 liters of 6% formalin to a 4684 m^2 area, or 24.8 liters of 6% formalin per m^2 (0.61 gal/ft^2), and then applied 4.3 liters of water per m^2 to soak the formalin into the soil.

Despite the presence of strong formalin fumes, we shifted the sprinkler system to the second position (Fig. 1) in 16 man-hours on 10 July 1981 and again put baffles on the sprinklers nearest the trailer park. We pumped 6% formalin from another tank truck load of formalin for 4 hours beginning at 2000 hours. We applied 152,900 liters of 6% formalin to 5688 m^2 of land, or 26.9 liters of 6% formalin per m^2 (0.66 gal/ft^2), followed by 4.3 liters/m^2 of water.

We conducted the operations at night because of lower temperatures and winds. The sprinkler system operator wore a self-contained breathing apparatus. The local Civil Defense Unit closely monitored the spray operations, and the local utility company installed a backflow prevention system in the fire hose line to prevent formalin from entering the city water supply.

Temperatures during the operating ting hours on the night of 9-10 July 1981 averaged 27°C with a 2-5 km/h breeze from the south. The following night, temperatures averaged

29°C with a 2-5 km/h westerly breeze.

On 16 July 1981, 30 soil samples including 8 core samples taken at a depth of 20-25 cm were collected. These samples were processed at Morehead State University on 17 July 1981 using the procedures previously described.

RESULTS AND DISCUSSION

All soil samples collected on 16 July 1981 were found to be negative for H. capsulatum, and the site was declared free of the fungus. All vegetation that had remained on the area was killed by the formalin application except for several deciduous trees (Sassafras albidum).

As of October 1987, the site had not been further disturbed, and no more histoplasmosis cases had been reported from the area.

The night of 9-10 July the southerly breeze caused some formalin fumes to drift into the adjacent trailer park on the north side. However, the residents were inside, and all of the trailers were operating air conditioners. This situation did not recur the next night because the westerly breeze caused the fumes to drift high to the east out of range of a trailer park located 370 m distant on that side. In the trailer park to the north, one vegetable garden and the lawns within 30 m of the spray area were damaged.

We used a more concentrated solution of formalin applied at a lower volume than called for in CDC instructions (40.7 liters of 3% formalin per m^2 [1 gal per ft^2]) (U.S. Dept of Health, Education, and Welfare, undated, Histoplasmosis Control). Running the sprinkler system for the 14 hours necessary to attain the higher volume would have been impractical.

Total cost of the operation to treat 1.3 ha is estimated at $17,000, or approximately $13,000 per ha. This was less expensive than an operation described by Bartlett et al. (1982) at roughly $23,000 per ha. Total manpower requirements were approximately the same (740 man-hours for our operation compared with 660 for Bartlett's), but Bartlett's operation treated 2.5 times as much acreage. The latter operation employed two tank trucks to drive back and forth over the acreage for a 2-week period and another larger truck to hold the formalin supply. Apparently the major part of the cost differential came from leasing the trucks, and to a minor extent, the cost of formalin. The formalin in our operation cost $0.23/liter compared with $0.41/liter for the Bartlett operation.

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