Leptospiral Interspecies Infections on an Illinois Farm

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AMONG the wild animal species on the North American Continent, *Leptospira grippotyphosa* has been isolated from the raccoon (*1*), striped skunk (*2*), red fox and gray fox (*3*), opossum (*4*), western harvest mouse (*5*), and the meadow vole (*6*). Based on serologic evidence, numerous human infections caused by this organism have been reported in the United States (*7*). Two occurred in northern Illinois (*8, 9*). The first isolation from a domestic farm animal in the United States was made in 1963 from a northern Illinois dairy cow that had recently aborted (*10*).

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Because of the large and varied animal population on this farm, a long-term study was undertaken by the authors in January 1964. The primary purpose was to examine the significance of leptospiral infections in a confined population, with known parameters. This report describes the first year of the study of the domestic animal, wild animal, and human populations of the farm, where several serotypes of *Leptospira* were present. Microscopic agglutination (MA) testing of 100 serums collected from the dairy cattle on the farm in 1960 and 1962 had revealed no antibodies against *L. grippotyphosa*.

Materials and Methods

Our study was made on a State institutional farm, a roughly square area of approximately 1,100 acres (fig. 1). The agricultural section in 1964 was almost equally divided between cropland and pasture. The other section contained dormitories, administration buildings, recreation areas, and so on, for approximately 1,000 residents.

A dairy-cow herd of approximately 85 milking animals and a swine-breeding herd of approximately 40 sows were maintained separately on the farm. Dairy steers were pastured with the milking animals. A herd of 50 to 75 beef steers also was maintained separately. Each steer weighed approximately 700 pounds when purchased and was slaughtered on the

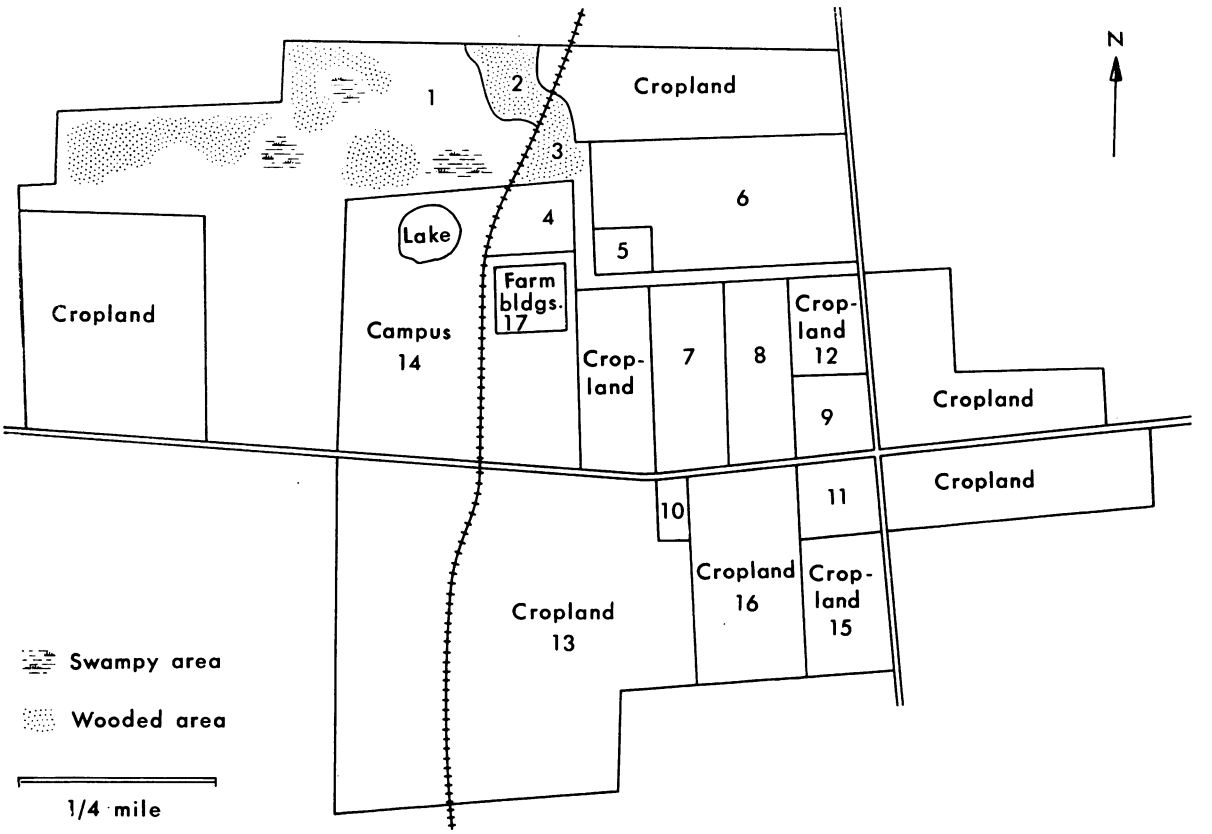


Figure 1. Location of farm pastures, croplands, and buildings, northern Illinois leptospirosis study, 1964

PASTURES

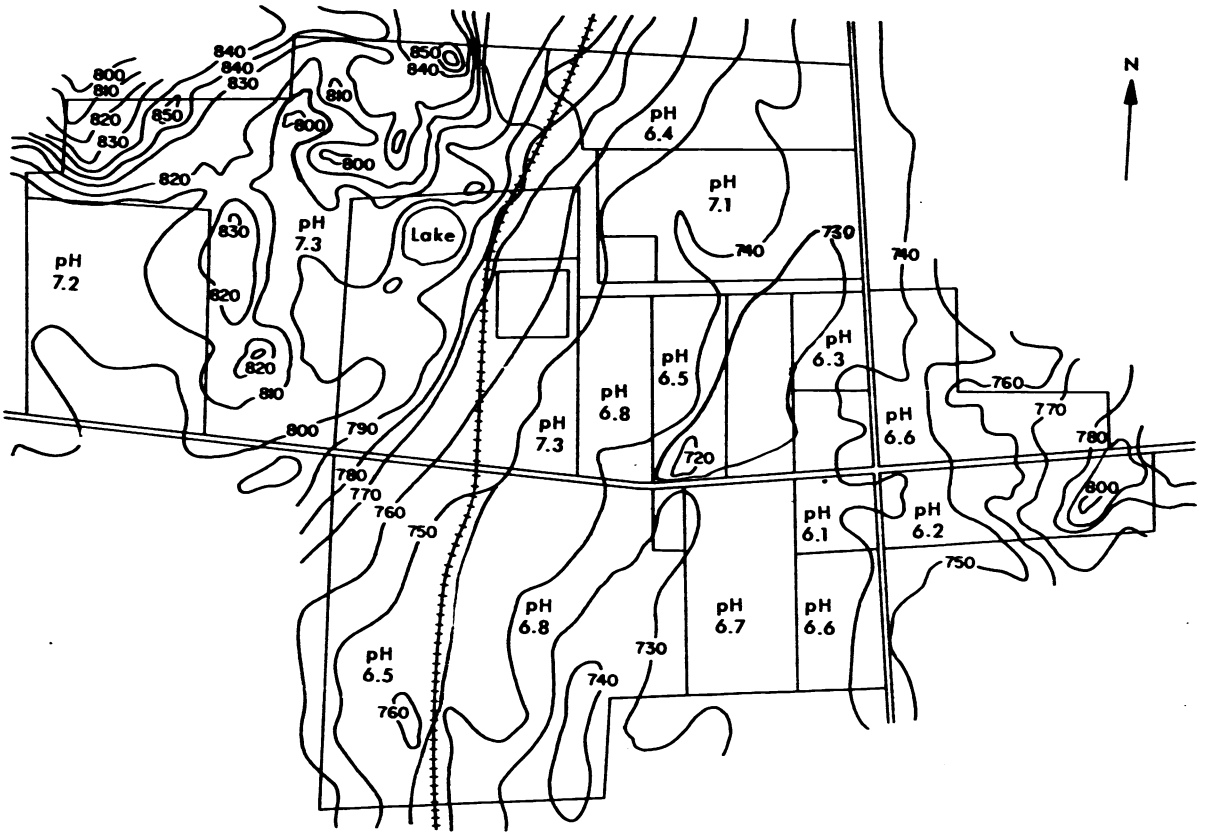
1. Rolling pasture with some wooded areas, generally good drainage except for several low, poorly drained regions.
2. Rolling pasture with some trees, good drainage.
3. Flat pasture with some trees, fair drainage.
4. Flat grassland with nursery trees and shrubs, fair drainage.
5. Flat pasture with no trees, poor to fair drainage.
6. Flat to gently rolling pasture with no trees, fair to good drainage.
7. Flat pasture with no trees, fair drainage.
8. Slightly sloped pasture with no trees, fair to good drainage.
9. Gently rolling area for swine production, fair to good drainage.
10. Flat pasture with no trees, poor to fair drainage.
11. Flat feedlot for beef steers, poor to fair drainage.

premises for local consumption when it weighed 800 to 1,000 pounds.

Urine and blood specimens for bacteriological and serologic testing were obtained during the study period from animals suspected of having leptospiral infections. Beginning January 1964, blood samples were taken from animals entering or leaving the farm. Blood samples from other animals normally were taken at least once a year.

Cattle serums were routinely tested against antigens of *L. grippotyphosa*, *Leptospira autumnalis*, and *Leptospira pomona* by means of the MA test. *Leptospira sejroe* antigen was included in tests on the bovine serums until mid-September 1964. *Leptospira hardjo* was then substituted for *L. sejroe* for the remainder of the study. In addition, bovine serums collected during December 1964 were tested against *Leptospira ballum* and *Leptospira icterohaemorrhagiae*. All swine serums were tested against antigens of *L. grippotyphosa*, *L. autumnalis*, *L. sejroe*, and *L. pomona*. The MA test was conducted with live antigens according to the method recommended by the U.S. Livestock Sanitary Association (*11*). An MA titer of 1:100 or greater was considered as positive.

Wild animals were trapped on the farm for 7 days in March, 10 days in May, and 5 days in August 1964. The species, age, sex, and location of capture were recorded for each animal. Serum specimens were collected from the wild



U.S. Geological Survey

Figure 2. Average soil pH values, northern Illinois leptospirosis study, 1964

animals for MA testing against the following antigens: *L. autumnalis*, *L. ballum*, *Leptospira canicola*, *L. grippotyphosa*, *L. icterohaemorrhagiae*, *and L. pomona*. In addition, the serums collected in March and May were tested against *Leptospira hyos* antigen, serums collected from wild animals in March and August were tested against *L. sejroe* antigen, and serums obtained in May were tested for *L. hardjo* antibodies.

Using the aseptic technique, approximately 1 to 2 gm. of kidney tissue from each animal were forced through a sterile 2½-ml. disposable syringe into 4 ml. of bovine albumin and polysorbate 80 medium (*12*) containing 200 μg. of 5 fluorouracil per milliliter (*13*). Approximately 0.5 ml. of this culture was transferred immediately into a similar tube of medium. When urine was available, two or three drops were put into a separate tube of medium. Blood specimens were collected from the jugular vein with sterile disposable syringes and needles for attempts at isolation. Two or three drops of blood were then put in 4 ml. of medium. Culture tubes were incubated at 30° C. Darkfield examinations of cultures were made at weekly intervals for 2 months.

The records of the institution's hospital were examined for histories of persons who were ill with fevers of unknown origin. The attending physicians were alerted to the presence of leptospiral infections within the animal population. They were requested to report any illnesses suggestive of leptospirosis. Serum specimens were obtained in March 1964 from personnel working on the farm or in the kitchen area. These serums were tested against antigens of *L. autumnalis*, *Leptospira australis*, *L. ballum*, *Leptospira bataviae*, *L. canicola*, *L. grippotyphosa*, *L. hardjo*, *Leptospira hebdomadis*, *L. icterohaemorrhagiae*, *L. pomona*, and *Leptospira pyrogenes*.

Maps indicating soil types, soil pH, and degree and direction of drainage were obtained from the U.S. Soil Conservation Service. A contour map (fig. 2) of the farm and adjacent areas was obtained from the U.S. Geological Survey. Daily precipitation data for 1960 through 1964 were provided by a U.S. Weather Bureau station, approximately 10 miles from the farm.

Results

Cattle. The serums collected from the milking dairy cattle in January 1964 and examined for *L. grippotyphosa* antibodies revealed a reactor rate of 36 percent (35 of 97). Fifteen of eighteen *L. autumnalis* reactors had higher titers against *L. grippotyphosa.* No other animals were tested in January. All dairy cattle were tested in April 1964. One new reactor was found among the 98 cattle composing the milking line at that time; 67 of these cattle were in the milking line both times. Eight cattle that had reacted in January tested negative in April. Only 2.3 percent (3 of 130) of the serums collected from dry cows, heifers, dairy steers, and calves reacted against *L. grippotyphosa.*

In the next 3 months, 30 dairy cattle were added to the farm's herd through purchase or birth. None of their serums reacted with the antigens used. During the period, repeat serums from 41 previously negative dairy cattle were tested. Three (7.3 percent) had developed MA titers to *L. grippotyphosa.*

A dairy heifer in pasture 1, bred in February and found by rectal examination to be pregnant 42 days after breeding, was not pregnant when re-examined July 20, 1964. When the heifer was slaughtered July 23, 1964, its serum had a titer of 1:10,000 against *L. grippotyphosa* antigen. Only 2 of 73 cattle had been reactive when they entered pasture 1 in the spring, and both had titers of 1:100.

On July 30, blood specimens from the 73 cattle in pasture 1 were cultured and tested against four leptospiral antigens. *L. grippotyphosa* was recovered from the blood of four animals. None of the four serums contained detectable *L. grippotyphosa* antibodies, but serums collected 13 days later were reactive. Eight (11 percent) of the 73 serums collected July 30 contained *L. grippotyphosa* antibodies.

Thirteen days later, blood samples were again collected from the 65 cattle whose serums had been negative on July 30. An attempt also was made then to isolate leptospira from the urine of five of six cattle that had recently developed antibodies against *L. grippotyphosa.* The organism was isolated from the urine of one cow. During the 13-day period, 21 (32.3 percent) of the 65 cattle whose serums previously were negative developed MA titers against *L. grippotyphosa.*

For the 71 serologically negative cattle in pasture 1 at the beginning of the outbreak, the 1964 conversion rate was 62 percent. During the same 9-month period (April through December) the conversion rate among the 147 previously negative dairy cattle in all other pastures was only 4.7 percent. The explosiveness of the outbreak was indicated further when 29 cattle that had been removed from pasture 1 just before the outbreak were still negative in December.

Antibodies against *L. ballum* were demonstrated in 4 of 105 mature cattle tested in December. Attempts to isolate leptospires from the urine of two of the four cattle were unsuccessful.

Of 91 serums collected from dairy calves under 6 months of age, only 3 contained *L. grippotyphosa* antibodies. The serums collected from their three dams before calving exhibited *L. grippotyphosa* titers, a result which suggested that the antibodies were colostric.

It could not be determined from the herd records which animals had aborted and which had failed to conceive; however, it was estimated that approximately 21 dairy animals had aborted during 1964. Serums from 14 of the 21 reacted against *L. grippotyphosa.* These abortions were the only evident clinical manifestations in the dairy cattle.

Serum specimens collected from 166 beef cattle when purchased were tested for leptospiral antibodies during 1964. Nineteen (11.7 percent) of the 163 tested against either *L. hardjo* or *L. sejroe* antigens were reactive.

Serums from two other beef animals contained MA antibodies, one against *L. grippotyphosa* and the other against *L. pomona.* Blood samples were taken at slaughter time from 68 cattle whose serums had been negative

Table 1. Results of leptospiral microscopic agglutination tests of domestic animals, northern Illinois leptospirosis study, 1964

Serotype and type of animal	Number tested	Number reactive [1]	Percent reactive	Negatives retested [2]	Number converted	Percent converted
Leptospira grippotyphosa:						
Dairy	353	98	27.8	232	49	21.1
Beef	166	1	.6	68	0	0
Swine	138	0	0	0		
Leptospira sejroe or *hardjo:* [3]						
Dairy	342	2	.6	232	2	.9
Beef	163	19	11.7	68	4	5.9
Swine	126	1	.8	0		
Leptospira autumnalis:						
Dairy	353	[4] 8	2.3	232	2	.9
Beef	166	0	0	68	0	0
Swine	138	[4] 7	5.1	0		
Leptospira pomona:						
Dairy	353	[4] 1	.3	232	0	0
Beef	166	1	.6	83	0	0
Swine	138	[4] 1	.7	0		

[1] Reactive: titer of 1:100 or greater.
[2] Minimum lapse of 30 days after original test.
[3] Serums collected January–September were tested against *L. sejroe* antigen; serums collected October–December were tested against *L. hardjo* antigen.
[4] 1 animal had equal titers against both *L. autumualis* and *L. pomona*.

originally for all serotypes used; 53 of the 68 had been in the beef herd for more than 2 months, and 15 had been on the farm for less than 2 months. Four of the 68 developed titers against *L. hardjo* antigen (table 1) between the September and December tests. *L. hardjo* subsequently was isolated from the kidney of a beef steer that had become reactive to this antigen in November 1964. No clinical illness was associated with the presence of leptospiral antibodies in any of the beef animals.

Swine. Serums of 138 swine were tested for leptospiral MA antibodies. Of the group, seven (5.1 percent) had 1:100 titers against *L. autumnalis* (table 1). The serum of another pig had a 1:100 titer against *L. sejroe*. It was not possible to obtain known paired serums since the swine were not individually identified. Most of the swine serums, however, were collected at slaughter time. No signs were noted in the swine.

Wildlife. Twelve animals were collected in March, all in area 17 (fig. 1): six house mice (*Mus musculus*), two white-footed mice (*Peromyscus leucopus*), two Norway rats (*Rattus norvegicus*), and two domestic cats (*Felis domestica*). *L. ballum* was isolated from the kidney tissues of four house mice and one white-footed mouse (table 2). Serums from 9 of the 12 animals were tested serologically. Serums from one house mouse reacted against *L. ballum* and from another against *L. canicola*. *L. ballum* was isolated from both mice (table 2).

Eleven isolations were made from 115 animals trapped in May. *L. ballum* was isolated from three house mice, two Norway rats, and one opossum (*Didelphis marsupialis virginiana*); *L. icterohaemorrhagiae* was isolated from three Norway rats. Two additional isolations from Norway rats were lost as a result of contamination before typing could be completed. Thirteen of 107 serums (12.1 percent) tested were reactive: 8 against *L. ballum*, 2 against *L. autumnalis*, 2 against *L. canicola*, and 1 against *L. canicola* and *L. icterohaemorrhagiae*. Seven animals were both serologically and culturally positive. The area numbers of collection of the animals that tested positive are listed in tables 2 and 3.

Nine isolations were made from the 71 animals collected in August. *L. ballum* was isolated from four house mice and one Norway rat, and *L. grippotyphosa* was isolated from three immature raccoons (*Procyon lotor*), and one adult opossum. All *L. grippotyphosa* isolations were from animals collected in pasture 1

or an adjacent field. Serums from all 71 animals were tested, and 7 reactors (9.9 percent) were found. Reactions with *L. ballum* were demonstrated in serums from two Norway rats and one house mouse. The serum from another house mouse reacted against both *L. ballum* and *L. canicola*. Both *L. grippotyphosa* and *L. autumnalis* antibodies were demonstrated in the serums of the three raccoons from which *L. grippotyphosa* was isolated. The serum from one also had *L. canicola* antibodies. Six animals were positive on both cultural and serologic examinations.

Leptospires were isolated from two animals from which kidney and urine samples had been cultured. Both kidney and urine cultures were positive. One of the animals was a raccoon which yielded *L. grippotyphosa*.

Analysis of the data by age revealed that no more than 1 immature animal of any species

Table 2. Results of testing 32 wildlife animals serologically or culturally positive for *Leptospira*, according to age, sex, collection area, and month collected

Host species, sex, and age of animals	Collection area No. [1]	Month collected	Serologic results of microscopic agglutination test	Serotype isolated
Didelphis marsupialis virginiana (opossum):				
Adult female	1	May	*L. canicola*	*L. ballum.*
Do	1	August	Negative	*L. grippotyphosa.*
Procyon lotor (raccoon):				
Adult female	1	May	*L. canicola*	Negative.
Immature female	1	August	*L. grippotyphosa, L. autumnalis.*	*L. grippotyphosa.*
Immature male	1	do	*L. grippotyphosa, L. canicola, L. autumnalis.*	Do.
Do	1	do	*L. grippotyphosa, L. autumnalis.*	Do.
Marmota monax (woodchuck): adult male	1	May	*L. autumnalis*	Negative.
Peromyscus leucopus (white-footed mouse): adult male	17	March	Not tested	*L. ballum.*
Rattus norvegicus (Norway rat):				
Adult male	1	May	Negative	*L. icterohaemorrhagiae.*
Adult female	1	do	*L. ballum*	Unknown species.
Adult male	1	do	do	*L. ballum.*
Do	1	do	do	Negative.
Adult female	1	do	do	Do.
Do	1	do	do	*L. ballum.*
Adult male	1	do	do	Negative.
Adult female	12	do	Negative	Unknown species.
Adult male	15	do	*L. ballum*	*L. icterohaemorrhagiae.*
Adult female	15	do	*L. canicola, L. icterohaemorrhagiae.*	Do.
Adult male	1	August	*L. ballum*	Negative.
Do	1	do	do	*L. ballum.*
Mus musculus (house mouse):				
Adult male	17	March	Negative	Do.
Adult female	17	do	*L. canicola*	Do.
Do	17	do	*L. ballum*	Do.
Do	17	do	Negative	Do.
Immature female	8	May	*L. autumnalis*	Negative.
Adult male	11	do	Negative	*L. ballum.*
Do	9	do	*L. ballum*	Do.
Do	12	do	Negative	Do.
Do	4	August	*L. ballum, L. canicola*	Do.
Adult female	4	do	*L. ballum*	Do.
Adult male	4	do	Negative	Do.
Adult female	4	do	do	Do.

[1] Figure 1.

Table 3. Number of wildlife animals collected for evidence of leptospiral infection, by collection area and month, 1964

Host species	Collection area No.[1]	Kidney cultures				Microscopic agglutination tests			
		March	May	August	Total	March	May	August	Total
Didelphis marsupialis virginiana (opossum)	1, 4, 13, 14	0	17	8	25	0	17	8	25
Blarina brevicauda (shrew)	1	0	0	1	1	0	0	1	1
Procyon lotor (raccoon)	1, 13	0	7	9	16	0	7	9	16
Mephitis mephitis (skunk)	13	0	1	0	1	0	1	0	1
Felis domestica (domestic cat)	1, 4, 5, 13, 14, 17	2	8	2	12	2	7	2	11
Marmota monax (woodchuck)	1	0	4	0	4	0	4	0	4
Citellus tridecemlineatus (ground squirrel)	4, 9, 13, 14	0	4	11	15	0	3	11	14
Sciurus niger niger (fox squirrel)	1, 4	0	2	2	4	0	2	2	4
Peromyscus leucopus (white-footed mouse)	1, 4, 8, 17	2	4	6	12	1	4	6	11
Microtus pennsylvanicus (meadow vole)	1, 11	0	11	3	14	0	9	3	12
Rattus norvegicus (Norway rat)	1, 8, 9, 11, 12, 15–17	2	37	20	59	2	33	20	55
Mus musculus (house mouse)	4, 5, 8, 9, 11, 12, 17	6	19	5	30	4	19	5	28
Sylvilagus floridanus (rabbit)	1, 4, 13	0	1	2	3	0	1	2	3
Passer domesticus (house sparrow)	1	0	0	2	2	0	0	2	2
Total		12	115	71	198	9	107	71	187

[1] Figure 1.

was trapped during any period, with the following exceptions: 4 of the 15 house mice collected in May were immature, as were 5 of 8 opossums collected in May, and 11 of 17 opossums collected in August. Three of 20 Norway rats and all 9 raccoons trapped in August were immature. The only isolations obtained were from three of the immature raccoons.

When serologic and isolation rates among the 37 Norway rats trapped in May were compared by sex, no differences were observed. However, in August, all isolations (one of eight) and reactions (two of eight) from Norway rats were from males. The 12 female Norway rats collected in August were serologically and culturally negative. Information on species, age, sex, collection area, month collected, and serologic and bacteriological results are in tables 2 and 3.

Human population. A search of the institution's hospital files beginning with September 1963 yielded a history of only one person who had reported to the clinic with complaints suggestive of leptospiral infection. In March 1964 blood samples were collected from this person and all other persons working on the farm or in the farm kitchen. Of 103 serums 4 had titers of 1:100 against *L. autumnalis;* 3 were from farm employees and 1 from a student working on the farm. Interrogation of the four failed to reveal a history of any illness suggestive of leptospirosis. Repeat tests of serum from three of the four persons failed to yield leptospiral titers. The institution's physicians did not report human illness suggestive of leptospirosis during the study period.

Physical environment. The pH values of most of the soil samples collected from the farm in 1963 were between 6.2 and 6.8 (fig. 2). Only soil from pastures 1 and 6 had average pH values within the alkaline range (7.3 and 7.1).

The amount of precipitation recorded at the local weather station during July and Novem-

ber 1964 was greater than during the same months of the previous 4 years. The July 1964 rainfall was 5.89 inches and the 1960–63 mean for July was 4.53 inches. The November 1964 precipitation was 3.5 inches as compared with the 1960–63 mean of 1.7 inches.

Examination of the water-drainage routes shown on the contour map (fig. 2) revealed that surface water from the pastures did not drain to the fields used by other herds. The pastures used for the beef cattle and swine herds were separated by a paved road.

Discussion

The difference in *L. grippotyphosa* reactor rates in April within the dairy herd (21 percent for the milking cattle and 2.3 percent for dry cows, heifers, dairy steers, and calves) suggested that before that time some unknown factor had been operating to contain the infection among the cattle in the milking line. The dairy cattle had been kept in pasture 1 during the summer and fall of 1963 just before the first isolation of *L. grippotyphosa.* This was the same pasture in which the *L. grippotyphosa* outbreak occurred in 1964. The development of antibody in 21 of 65 cattle within a 13-day period of the 1964 *L. grippotyphosa* outbreak indicated that a point source outbreak occurred among the animals in pasture 1.

The different reactor rates in the various pastures during 1964, plus the sudden appearance of *L. grippotyphosa* infections in wild animals trapped in this pasture during August, substantiated the theory that the outbreak was localized in this pasture. The presence of two reactor cattle in pasture 1 before the outbreak and the failure to detect *L. grippotyphosa* infection in wild animals 3 months earlier suggested that the initial source of infection may have been the cattle. There was no evidence to indicate that this particular outbreak of *L. grippotyphosa* originated in the wild animal population or that *L. grippotyphosa* reservoirs were present within the wild animal population examined on this farm.

Factors conducive to the transmission of leptospires in pasture 1 were the soil pH of 7.3, favorable terrain and precipitation, and a high percentage of susceptible cattle. The slightly alkaline soil provided a suitable environment for the survival of leptospires, while excess precipitation produced a swamp in a low area of the pasture. The introduction of leptospires into this swampy area, which was then used as a source of water by the susceptible cattle and wild animal populations, could explain the explosive nature of the outbreak.

L. hardjo conversions within the beef herd were detected in November and December, another period when the rainfall was greater than the seasonal average. The isolation of *L. hardjo* from the beef cattle in January 1965 provided evidence that the *L. sejroe* reactions actually represented cross reactions due to infection with *L. hardjo.* The authors found no published reports of an isolation of *L. hardjo* in the State of Illinois.

Most of the *L. autumnalis* titers in the dairy cattle serums apparently represent cross reactions with *L. grippotyphosa.* The presence of the low titers for *L. autumnalis* found in the swine and human serums cannot be explained on this basis. The evidence did not indicate whether these titers were specific.

L. ballum was isolated and antibodies frequently were demonstrated among the Norway rats and house mice trapped in May and August. The different rates that existed between the Norway rats trapped in May and August were due to the absence of infection in the 12 female rats collected in August. If a true difference in infection rates existed, we are unable to give the reason. The reservoir of *L. ballum* in the farm rodents provided a constant opportunity for exposure of the dairy cattle. The presence of *L. ballum* antibodies in cattle serums demonstrated that infections had occurred.

L. ballum seemed to be the most widespread serotype on the farm with some degree of probable cross infection between the cattle and wild animals. However, *L. grippotyphosa* also was isolated from both wild animals and dairy cattle. The low percentages of *L. grippotyphosa* antibodies in the swine and beef cattle serums and of *L. hardjo* reactions in the swine and dairy cattle serums suggested that the leptospiral infections were limited to specific herds maintained on the same farm.

The absence of clinical disease in man and the low reactor rate in human serums indicated that very little, if any, leptospirosis was occurring among the human population on the farm.

Summary

To examine the significance of leptospiral infections in a confined population the domestic animal, wild animal, and human populations of a northern Illinois farm were studied in 1964. Serums from 98 of 353 dairy animals exhibited microscopic agglutination titers for *Leptospira grippotyphosa*. Forty-nine animals became reactive to *L. grippotyphosa* during the 1-year study period. Twenty-one of 65 dairy cattle in one pasture converted to reactive during a 13-day period in late July 1964. Five isolations of *L. grippotyphosa*, four from blood and one from urine, were made during the outbreak. *Leptospira ballum* antibodies were detected in 4 of 105 serums examined in December. No isolations of *L. ballum* were made from cattle.

Leptospira hardjo antibodies were detected in the serums of 19 of 163 beef cattle. Four animals became reactive during the year. *L. hardjo* was isolated from the kidney of a steer. *L. grippotyphosa* antibodies were detected in the serum of only one beef animal. Seven of 138 swine reacted with *Leptospira autumnalis* antigen. No signs of leptospirosis or other leptospiral antibodies were detected, and no leptospires were isolated

Cultures were made from kidney tissues of 198 wild animals trapped on the farm during March, May, and August. *L. ballum* was isolated, during all trapping periods, from a total of four species. *Leptospira icterohaemorrhagiae* was isolated from three Norway rats. *L. grippotyphosa* was isolated from 3 raccoons and 1 opossum collected during August from the pasture where the cattle outbreak had occurred; 187 of the wild animals were tested serologically. Reactions were found against *L. autumnalis*, *L. ballum*, *Leptospira canicola*, *L. grippotyphosa*, and *L. icterohaemorrhagiae*.

The only evidence of leptospiral infection in the human population was the demonstration of microscopic agglutination titers of 1:100 against *L. autumnalis* antigen in 4 of 103 serums tested.

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Federal Publications

Working With Older People: A guide to practice. Vol. 1. The practitioner and the elderly. *PHS Publication No. 1459, vol. 1; 1966; 56 pages; 40 cents.* Presents (first of four parts) a comprehensive and integrated body of knowledge on applied gerontology. Provides valuable resource material for the development of continuing education courses for all practitioners concerned with health of the aged. Describes aging and the world of practice relating to aging. Helps the practitioner (doctor, dentist, nurse, social worker, therapist, nutritionist, podiatrist, administrator of long-term care institution) to understand the elderly and the accompanying physical, mental, and social changes that come with age. Emphasizes health maintenance in the care of the elderly. Offers background to help the practitioner in planning community services for the elderly.

Directory of Local Health Units. *PHS Publication No. 118; revised 1966; 81 pages; 30 cents.* Lists local health units of each State, by classification of unit, name of the health officer or administrative head, and the city in which headquarters is located. Indicates absence of medical, nursing, or sanitation personnel. Includes appendix tables which show the number of units and counties covered, number of units without medical, nursing, or sanitation personnel, and the units with a vacancy in position of health officer or administrative head.

A Guide for Projecting Space Needs for Schools of Nursing. *PHS Publication No. 1474; 1966; 28 pages.* Supplements the information in "Nursing Education Facilities: Programing considerations and architectural guide." Provides suggestions for programing a facility for nursing education under the Public Health Service Construction Grants Program. Also useful to schools considering expansion of nursing programs. Illustrates, with charts, how to collect detailed information on enrollment, curriculum, and budgeting. Provides a bibliography of information on recent developments in architecture and engineering used in constructing other types of schools, such as elementary and high schools, that may be adapted to nursing education facilities.

Central Sterile Supply Section of the Packaged Disaster Hospital. *PHS Publication No. 1071–F–3; July 1966; 50 pages; 25 cents.* Covers the organization of the central sterile supply section of the Packaged Disaster Hospital (PDH) and instructions for setting up and operating the equipment. Gives step-by-step procedures for cleaning, wrapping, and sterilizing supplies and instruments. Provides a suggested list of basic trays which may be composed of equipment supplied in the PDH.

Although directed primarily to those who will staff the central sterile supply section of the PDH, the publication should be of value to persons responsible for predisaster planning and training connected with the activation and operation of the PDH.

Legal Aspects of PHS Medical Care. *PHS Publication No. 1468; 1966; by Eli P. Bernzweig; 110 pages; 50 cents.* Presents, primarily for medical, paramedical, and administrative personnel of the Public Health Service, a comprehensive medicolegal manual setting forth the basic principles of professional liability in the provision of PHS medical care, with emphasis on the practical rules of malpractice claim prevention. Discusses, in detail, the Federal Tort Claims Act, personal liability of PHS medical personnel, the legal standards of care for physicians, nurses, dentists, and pharmacists, causes and prevention of malpractice claims, and current PHS policies and procedures relating to malpractice litigation. Includes copious legal citations, references to source materials, and a comprehensive subject index. This manual should also be of value to medical personnel in other Government agencies, as well as to private medical practitioners, hospital administrators, lawyers, and others interested in the medicolegal aspects of patient care. A programed instruction manual which supplements this manual is in preparation.

Check List for Developing a Packaged Disaster Hospital Readiness Plan. *PHS Publication No. 1071–F–16; revised June 1966; 20 pages; 20 cents.*

Gives a brief description of the Packaged Disaster Hospital (PDH) and its uses, and a questionnaire requiring "yes" or "no" answers to be filled out by community emergency health planners whose disaster plans include the operation of a PDH. The answers indicate whether or not all necessary plans have been made which will permit efficient setup and operation of the unit following a disaster.

Provides a suggested staffing pattern, floor plans for the operating site, requirements for outside services, and a list of printed forms and publications included in the packaged hospital.

Provides a convenient way to evaluate the state of community readiness of PDH use and indicates specific areas where more predisaster planning is necessary.

This section carries announcements of new publications prepared by the Public Health Service and of selected publications prepared with Federal support.

Unless otherwise indicated, publications for which prices are quoted are for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington D.C., 20402. Orders should be accompanied by cash, check, or money order and should fully indentify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington, D.C. 20201.

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