LYME disease SURVEILLANCE SUMMARY

Bacterial Zoonoses Branch
Division of Vector-Borne Infectious Diseases
National Center for Infectious Diseases
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ISOLATION OF *BORRELIA BURGDORFERI* FROM *IXODES SPINIPALPIS* TICKS IN CALIFORNIA AND COLORADO

The Division of Vector-Borne Infectious Diseases in Fort Collins, CO and Dr. Robert Lane, Principal Investigator of CDC Cooperative Agreement #U50/CCU906594 at the University of California at Berkeley, have recently isolated *Borrelia burgdorferi* from enzootic cycles involving rodents and *Ixodes spinipalpis* ticks in Colorado and California, respectively. The isolations are a result of CDC's previously described national program of research on vector ecology of Lyme disease transmission (**LDSS**, June 1991:V2/N4). These are the first descriptions of infection of this *Ixodes* species with the causative agent of Lyme disease; the public health implications of these reports will be discussed below.

I. spinipalpis is widely distributed in the western United States and Canada. It has been reported from 10 states: California, Colorado, Idaho, Montana, Nevada, Oregon, South Dakota, Texas, Utah, and Washington. Its hosts are primarily rodents and lagomorphs, although immatures occasionally infest birds. Numerous isolates of *B. burgdorferi* have been obtained from *I. spinipalpis* and its predominant woodrat host, *Neotoma fuscipes* in northern California. In Colorado, *I. spinipalpis* nymphs and adults were collected during studies aimed at testing control methods for ectoparasites in Mexican woodrats (*Neotoma mexicana*). Spirochetes were isolated from *I. spinipalpis* collected from *N. mexicana* as well as from ear biopsies of *N. mexicana*.

In Colorado, spirochetes were cultured from 6/15 (40%) individual *I. spinipalpis* nymphs and from 3/3 tick pools, including 1 pool of adult males. Spirochetes were also isolated from ear biopsies of 24/38 *N. mexicana*. Isolations were made in BSK-H medium incubated at 33°C. To date, the *I. spinipalpis*-derived bacteria have been characterized by five methods, including polymerase chain reaction using two different gene targets: polyacrylamide gel electrophoresis of the spirochetal proteins; immunoblotting with monoclonal antibodies to OspA, Fla, and P39; pulsed-field gel electrophoresis of bacterial plasmids; and infectivity in laboratory mice. In all tests, these spirochetes were indistinguishable from *B. burgdorferi sensu lato*.

The finding of enzootic cycles of *B. burgdorferi* involving two species of woodrat in two widely separated geographic localities reinforces the findings in California of the importance of *Neotoma* spp in the enzootic maintenance of *B. burgdorferi*. The public health importance of *I. spinipalpis* as a vector species for transmitting *B. burgdorferi* to humans appears to be minimal, especially in areas with a low humidity. In the arid Rocky Mountain region, *I. spinipalpis* appears to be limited to the confines of rodent nests, where relative humidities are high enough to sustain this tick. In the Pacific Northwest, where the general relative humidity is higher, these ticks may be found occasionally in the immediate vicinity of rodent nests. Reports of human infestation with this tick are rare. There is a historical record of a female *I. spinipalpis* removed from a child in Linn County, Oregon in 1942.[1] The paucity of reports of this tick biting humans suggests that it will pose minimal risk of human exposure to *B. burgdorferi*.

The importance of the finding of enzootic *B. burgdorferi* involving *I. spinipalpis* and *Neotoma* spp. may be more related to the potential for this established cycle to involve a vector tick which is a more avid human biter. In northern California, for example, *Ixodes pacificus* feeds on the same woodrat hosts as *I. spinipalpis*, and bridges the gap between the enzootic cycle and infection of humans. In Colorado, *Dermacentor andersoni* readily feeds on humans and is known to parasitize rodents involved in this newly described transmission cycle; the closely related species, *D. andersoni* and *D. occidentalis*, are considered to be incompetent transmitters of *B. burgdorferi*.

1. Cooley, RA & Kohls, GM. 1945. The Genus *Ixodes* in North America. National Institutes of Health Bulletin No. 184. 246pp.

CDC FUNDING FOR LYME DISEASE RESEARCH AND EDUCATION - 1993

For FY 93, twenty-three institutions were awarded continuation funding for Lyme disease research and education through CDC cooperative agreements. The following Tables summarize the distribution of funding.

CDC FUNDING FOR LYME DISEASE COOPERATIVE AGREEMENTS, FY 93
FUNDING BY CATEGORY

CATEGORY	AMOUNT	% OF TOTAL FUNDS
DIAGNOSIS	$ 810,576	30.0
EDUCATION	677,289	25.1
SURVEILLANCE/EPIDEMIOLOGY	474,928	17.6
ECOLOGY	353,006	13.1
PREVENTION/CONTROL	382,630	14.2
TOTAL	$2,698,429	100.0

CDC FUNDING FOR LYME DISEASE COOPERATIVE AGREEMENTS, FY 93
FUNDING BY TYPE OF INSTITUTION

TYPE OF INSTITUTION	NUMBER FUNDED	AMOUNT	% OF TOTAL FUNDS
HEALTH DEPARTMENT	7	$ 893,949	33.1
ACADEMIC	11	1,322,172	49.0
PRIVATE	5	482,308	17.9
TOTAL	23	$2,698,429	100.0

CDC FUNDING FOR LYME DISEASE COOPERATIVE AGREEMENTS, FY 93
FUNDING BY GEOGRAPHIC REGION

GEOGRAPHIC REGION	AMOUNT	% OF TOTAL FUNDS
Middle Atlantic	$1,210,677	44.9
South Atlantic	510,772	18.9
Northeast	687,004	25.5
Pacific	183,299	6.8
North Central	106,677	3.9
TOTAL	$2,698,429	100.0

CDC FUNDING FOR LYME DISEASE COOPERATIVE AGREEMENTS, FY 93
FUNDING BY STATE AND NUMBER OF AWARDS

STATE	AWARDS	FUNDING
NEW YORK	7	$ 936,493
CONNECTICUT	4	513,999
LOUISIANA	1	238,514
CALIFORNIA	2	183,299
PENNSYLVANIA	1	144,329
NEW JERSEY	2	129,855
GEORGIA	1	98,863
MASSACHUSETTS	1	96,358
NORTH CAROLINA	1	89,299
VIRGINIA	1	84,096
RHODE ISLAND	1	76,647
MICHIGAN	1	65,384
WISCONSIN	1	41,293
		$2,698,429

CONTRACT FUNDING FOR LYME DISEASE RESEARCH - FY 93

The contract with Indiana University of Pennsylvania, Determine the Distribution of Lyme Disease in Pennsylvania Through Sampling Wildlife Species, will be completed in FY 93. The results of this project, which began in 1990, provide valuable information on the current distribution of Lyme disease in the state, and will aid in the selection of specific wildlife species to use in national surveillance programs.

Another contract which began in 1990 with Maine Medical Center, Determine Whether the Lyme Disease Spirochete Can Be Maintained on Islands Off the Coast of New England Devoid of the Principal Reservoir Host, *Peromyscus leucopus* (White-Footed Mouse), will be completed in FY 93. Investigations funded by this contract have identified the Norway rat as the principal reservoir host of ***B. burgdorferi*** on Monhegan Island, have described the bionomics of transmission of ***B. burgdorferi*** there, and are conducting trials of control methods.

In July, 1982, the Small Business Innovation Development Act was signed, requiring the agencies of the Public Health Service (PHS), Department of Health and Human Services (DHHS), and certain other federal agencies to set aside a specified amount of their research and development (R&D) budgets for a Small Business Innovation Research (SBIR) program. During FY 93, Phase I of two contracts for Lyme disease research funded through the SBIR program will be completed. Phase II funding is awarded to continue research or R&D efforts initiated

in Phase I. The objective of Phase III, where appropriate, is for the small businesses to pursue non-federal funds for the commercialization of the results of the research or R&D.

BioCenotics' project, Development of Systemic Acaracide Bait(s) for Controlling Ticks and Rodents, proposes to develop an important tool in controlling the complex transmission cycle of Lyme disease. The system which uses baited polyvinylchloride tubes, will have potential commercial applications, available for use by public health officials and the general public with relative safety. It could be used in areas accessible to children, pets, and other non-target animals to minimize the potential for Lyme disease transmission, as well as for arresting/controlling outbreaks for the disease.

Platt Systems' Mathematical Model Software for Lyme Disease will develop user friendly microcomputer software simulating transmission risk which would have applications in research, risk management, and teaching. With further enhancement and refinement, the model could be generalized, extending its application to include other multi-reservoir vector-borne infections.

Lyme Disease Surveillance Summary (LDSS) is edited by Drs. Robert Craven and David Dennis. If you have information to contribute or wish to receive a **LDSS**, please contact them at:

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