Research letter

Presence of spirochete causing Lyme disease, *Borrelia burgdorferi*, in the blacklegged tick, *Ixodes scapularis*, in southern Ontario

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Lyme disease, the most common tick-borne disease in North America, is a multisystemic illness of humans and domestic animals caused by the spirochete *Borrelia burgdorferi sensu lato* ("in the broad sense").[1] Small mammals are the main reservoir hosts for this bacterium, and *Ixodes scapularis* (blacklegged tick; Fig. 1) and *Ixodes pacificus* (western blacklegged tick) found in British Columbia are the principal vectors in Canada.[2]

As part of collaborative research between the Vector-borne Diseases Laboratory, BC Centre for Disease Control, and the Lyme Disease Association of Ontario, Ontario veterinarians submitted 139 *I. scapularis* ticks (collected from dogs in 1997 and 1998 in southern Ontario locations) to the laboratory to be tested for *B. burgdorferi*. For removal, a tick was held as close to the host's skin as possible with fine-pointed tweezers, and was removed from the skin with gentle but steady pressure. Each tick was stored in a small plastic vial with a moist paper towel for shipment to the laboratory for analysis.

The hosts of 121 (87%) of the ticks had no reported history of out-of-province travel. Two (1.6%) of these 121 ticks (1 from Mississauga and 1 from Etobicoke [part of Toronto]) produced motile spirochetes, which were subsequently identified as *B. burgdorferi* by monoclonal antibody and polymerase chain reaction tests (Table 1). In an additional 7 (5.8%) of the 121 ticks, *B. burgdorferi* was detected directly by polymerase chain reaction (Table 1). The first blood sample from host dogs was normally taken 4–6 weeks after tick removal. Subsequently, serum samples from all 9 dogs were tested by indirect immunofluorescence antibody assay and Western blot to identify specific antibodies against *B. burgdorferi*; such antibodies were observed in all samples. In a few cases the indirect immunofluorescence antibody titres were low (Table 1); however, all of the Western blots were reactive, with 5 or more bands needed for identification. Because most dogs with Lyme disease are asymptomatic, Western blot provides valuable diagnostic information about the presence of *B. burgdorferi* infection.

Fig. 1: Left: Blacklegged tick, *Ixodes scapularis*, unfed adult female. This tick is a competent vector for the spirochete causing Lyme disease, *Borrelia burgdorferi*. Total body length ranges from 2.0 to 3.5 mm; this specimen is 3.2 mm in length. Right: American dog tick, *Dermacentor variabilis*, unfed adult female. Total body length ranges from 3.0 to 5.0 mm; this specimen is 4.5 mm in length. This is the tick species most frequently submitted for identification in Ontario; it is not a competent vector for *B. burgdorferi*. Both ticks are found in southern Ontario.

The wide distribution of *I. scapularis* ticks and the fact that some of them carry *B. burgdorferi* shows that the bacterium is present in southern Ontario. The fully engorged female ticks collected in Mississauga and Etobicoke not only produced live cultures of *B. burgdorferi*, but also laid eggs that hatched into larvae. The fact that these females had mated recently indicates that *I. scapularis* may be established in these locations, as well as at Long Point, Point Pelee National Park and Rondeau Provincial Park (on the north shore of Lake Erie), where the species is endemic. The Mississauga occurrence is the first report of a gravid *I. scapularis* female producing larvae in Ontario at a location other than Long Point. The other locations at which

Table 1: Presence of *Borrelia burgdorferi* in engorged female *Ixodes scapularis* collected from dogs resident in southern Ontario with no history of out-of-province travel (1997 and 1998)

Collection site	Date of collection	Test results	IFA titre*	Comments
Mississauga	Apr. 24, 1997	PCR (c) positive Mab reactive	1:64	Antibiotic given same day tick was collected
Point Pelee	May 5, 1997	PCR positive	1:512	Antibiotic started 39 days after tick was collected
Ottawa	May 11, 1997	PCR positive	1:64	Antibiotic started 17 days after tick was collected
Bramalea	May 12, 1997	PCR positive	1:64	No antibiotic (dog had received Lyme vaccine 6 mo before tick was found)
Hamilton	May 13, 1997	PCR positive	1:256	Lyme vaccine given same day tick was collected
Scarborough	May 13, 1997	PCR positive	1:64	Antibiotic given after blood sample was drawn
Chatham	Apr. 9, 1998	PCR positive	1:128†	Antibiotic given after second blood sample was drawn
Etobicoke	Apr. 21, 1998	PCR(c) positive Mab reactive	1:256†	Antibiotic given after second blood sample was drawn
Westport	Nov. 1, 1998	PCR positive	1:256†	Antibiotic given after second blood sample was drawn

Note: PCR = polymerase chain reaction, (c) = live culture, Mab = monoclonal antibody test of live spirochete isolate, IFA = indirect fluorescence assay.
*All serum samples included in this table were tested by Western blot (MarDx Diagnostics, Inc., Carlsbad, Calif.) and were found to be reactive. A titre of 1:64 signifies a negative result, 1:128 an equivocal result and 1:256 a positive result.
†Two blood samples were tested by IFA, both with the same result.

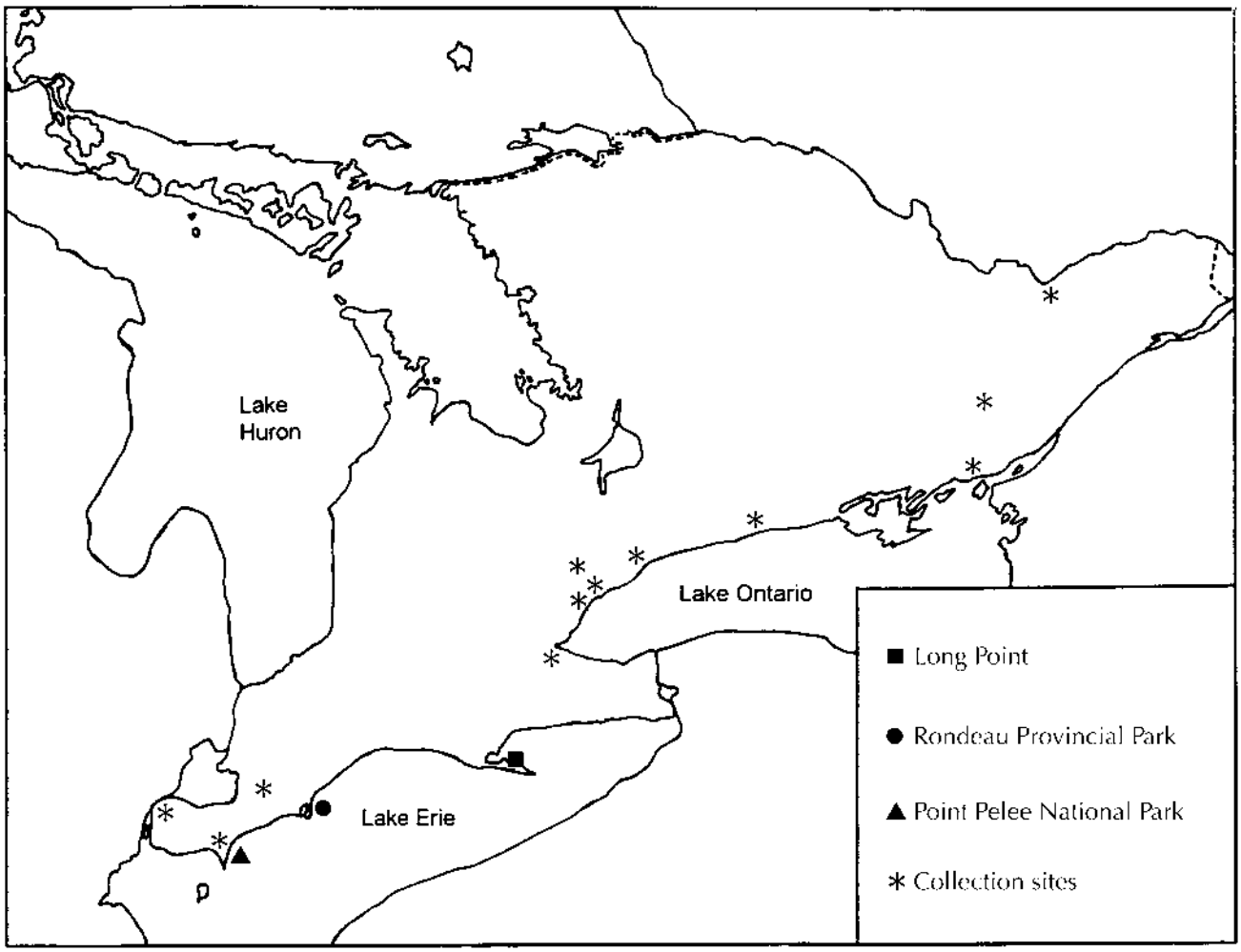

Fig. 2: Locations in southern Ontario (asterisks) where *Ixodes scapularis* ticks carrying *Borrelia burgdorferi* were collected, in 1997–1999, from dogs with no history of out-of-province travel. *Ixodes scapularis* ticks carrying *B. burgdorferi* are endemic at Long Point. At Rondeau Provincial Park *I. scapularis* ticks are established and *B. burgdorferi* is present.[3] *Ixodes scapularis* ticks are also established at Point Pelee National Park.

I. scapularis were positive for *B. burgdorferi* include Bramalea, Chatham, Hamilton, Ottawa, Point Pelee, Scarborough (part of Toronto) and Westport (Fig. 2).

On Apr. 28, 1997, a domestic cat from Aylmer, Que., was taken to an emergency veterinary clinic in nearby Ottawa where a fully engorged *I. scapularis* tick was removed; the tick later tested positive for *B. burgdorferi* (by polymerase chain reaction). Eight days before removal of the tick, the cat had been symptomatic (displaying anorexia and lethargy) and had been treated with antibiotics. This incident demonstrates that people and pets can bring *I. scapularis* ticks infected with *B. burgdorferi* into Ontario from bordering areas. Current evidence suggests that *I. scapularis* does not have an established population across southern Ontario. However, *I. scapularis* ticks are dropped haphazardly by birds during spring migration,[4] and in a recent study *B. burgdorferi* was isolated from an *I. scapularis* nymph retrieved from a common yellowthroat, *Geothlypis trichas*, in Nova Scotia during spring banding.[5]

A total of 280 cases of Lyme disease in humans were reported from 1981 to 1998 in Ontario. In 127 of these cases there was no history of out-of-province travel. In only 14 cases was there exposure at Long Point (Charles A. LeBer, Ontario Ministry of Health and Long-Term Care: personal communication, 1999). A recent study also reported co-infection by *B. burgdorferi* and *Babesia* spp. in a patient who had travelled to Nantucket, Mass.[6]

Across Canada, *B. burgdorferi* has been isolated in Prince Edward Island,[7] Nova Scotia,[5] New Brunswick, Quebec, Ontario,[8] Manitoba (unpublished data; isolate provided by Harvey Artsob, Laboratory Centre for Disease Control, Health Canada, Winnipeg, 1997), Alberta[9] and British Columbia.[10] Even though the risk of acquiring Lyme disease in Ontario is low, the possibility of *B. burgdorferi* infection should not be ignored.

The present study indicates that *I. scapularis* is widespread in southern Ontario and may act as a source of *B. burgdorferi* infection for humans, domestic animals and wildlife. Consequently, the medical community should be aware that people who frequent the outdoors may be exposed to *I. scapularis* ticks and are at risk of contracting Lyme disease.

Addendum

In 1999 isolates of *B. burgdorferi* were cultured in our laboratory from *I. scapularis* ticks collected in southern Ontario at Kingston, Cobourg and LaSalle. The ticks were removed on Oct. 25, Nov. 11, and Nov. 18 respectively, from dogs with no history of out-of-province travel.

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