NaturoMedic.com

Giving Life to the Living! ™

The Truth About Lyme Disease

Part 1 of a 3 Part Series

July 19, 2012

Dr. Michael Um ND, HBSc. Dr. Mary Magnotta ND, MSc., HBSc. and Dr. Michael Prytula ND

296 Welland Avenue, St. Catharines, Ontario, L2R 7L9. **Phone**: **(905) 684-4934 Fax:**(905) 684-1849 **www.NaturoMedic.com**

"Thanks to warmer temperatures, the Ixodes scapularis (Lyme disease carrying tick) bug has become a most unwelcome U.S. import, moving further north with each passing year, and flourishing in some of the most populated parts of Canada. Scientists say that increasing populations of the black-legged tick means a ***certain rise in the risk of Lyme disease.*** *Warmer temperatures are the primary reason why the numbers have exploded, according to a recent Canadian study. In 2010, about 18 per cent of inhabited parts of eastern Canada had ticks – by 2020, that is expected to rise to* ***80 per cent****. (A West Coast version of the black-legged tick, Ixodes pacificus, which also carries Lyme disease, is making its own steady advance into British Columbia.) 'If we have conditions in the future where temperatures are warmer than they are now, that's going to speed the spread of ticks in new areas,' says Patrick Leighton, an assistant professor of Veterinary Medicine at the University of Montreal who co-authored a recent study tracking the tick invasion. 'The public health issues raised with that will be confronting us more quickly.'" (*The Globe and Mail; Sunday, May 06 2012)

Introduction

Lyme disease is an unwanted infection on the rise. The emerging reality is a well known fact for those suffering with Lyme disease, but the political opinion appear to be two steps behind. The Truth About Lyme Disease is a 3 part series, the first an introduction to Lymes, ticks, and signs and symptoms, the second will focus on the politics around Lymes and diagnostic tests and the final paper will emphasize treatments. The series is designed to act as a resource for current research, answer the unasked questions and help those as they embark on their difficult journey with Lyme disease.

Lyme disease is an illness caused by the bacteria *Borrelia burgdorferi* and transmitted through the bite of certain types of ticks. It is the most common vector-bourne disease in Europe, Asia and throughout much of North America. The ticks themselves first become infected when they feed on mice, squirrels, birds and other small animals that can carry the bacterium (*B. burgdorferi*). Once the tick is infected they can then spread it to humans. The bite is painless and most people do not know that they have been bitten.

There are two types of ticks that are responsible for the transmission of the bacteria causing Lyme: the western blacklegged tick *Ixodes pacificus* in British Columbia and the blacklegged tick *Ixodes scapularis*, often referred to as a 'deer tick', in other parts of Canada. The female ticks are larger than males and when they are fully engorged can be as big as a grape. Male ticks do not expand in size because they do not engorge on blood. Larvae and nymphs (the juvenile life stages) are smaller. The ticks themselves are picked up by people and pets by brushing against grass, and shrubs. Surveillance indicates that the populations of blacklegged ticks are spreading and are increasing in number, in much of southern Canada.

Table 1: Known and suspected Lyme endemic areas in Canada.
(http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php)

Province	Approximate Location	Status
Lyme disease risk where the western blacklegged tick is the vector		
British Columbia	Southern mainland, Vancouver Island	Known endemic in some areas, suspected over a wider region
Lyme disease risk where the blacklegged tick is the vector		
Manitoba	Restricted region of western shore of Lake of the Woods	Known endemic
	Parts of the Stanley Trail/Thompson Trail	Known endemic
	The area around Pembina Valley Provincial Park	Known endemic
	Locations in the Pembina Valley	Suspect area
	St. Malo area	Suspect area
	Arbakka area	Suspect area
	Beaudry Provincial Park	Suspect area
Ontario	Point Pelee National Park	Known endemic
	Rondeau Provincial Park	Known endemic
	Turkey Point Provincial Park	Known endemic
	Long Point peninsula including Long Point Provincial Park and the National Wildlife area	Known endemic
	Wainfleet bog region near Welland	Known endemic
	Prince Edward Point	Known endemic
	Parts of the Thousand Islands National Park	Known endemic
Quebec	Montérégie	Five known endemic areas
New Brunswick	Northern St John area	Known endemic
	North Head, Grand Manan Island	Known endemic
Nova Scotia	Lunenburg County (Blue Rocks, Garden Lots, Heckmans Island, First Peninsula as well as the areas immediately surrounding them)	Known endemic
	Halifax County: Admirals Cove in Bedford;	Known endemic
	Shelburne County: Gunning Cove	Known endemic
	Gavelton near Yarmouth	Known endemic
	Pictou county areas around Melmerby Beach, Egerton, Kings Head, and Pine Tree	Known endemic

The number of documented endemic areas in Canada is increasing (Table 1 & Figure 1). In the early 1990s, only one geographically discrete population of *I. scapularis* was known, at Long Point on the Ontario shore of Lake Erie. Today with the continuous climate changes and warmer seasons, the expansion of *I. scapularis* into Canada will continue (Figure 2). Warmer temperatures and the spreading of ticks on animals, migratory birds and deer are the two most influential factors for the increasing establishment of ticks in Canada.

Figure 1: Distribution of *I. scapularis*, from information submitted to provincial and federal public health agencies from 1990 to 2003 and Lyme Disease Association of Ontario from 1993 to 1999. Areas known to have populations of *I. scapularis* are indicated with arrows. (CMAJ June 9, 2009 vol.180 no12, 1221-1224)

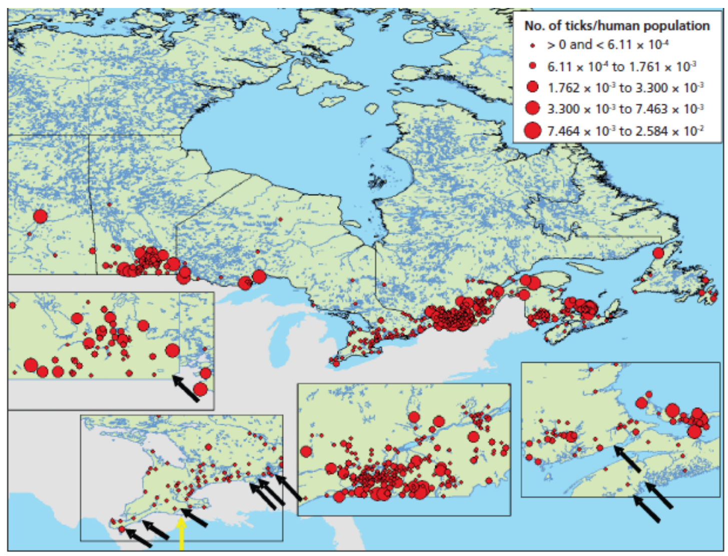
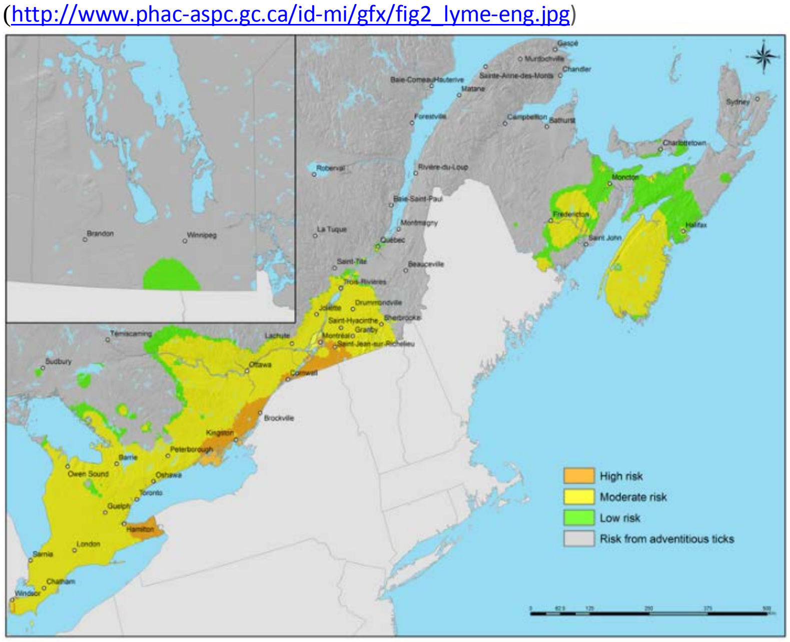


Figure 2: Predicted areas at risk for emergence of Lyme.
(http://www.phac-aspc.gc.ca/id-mi/gfx/fig2_lyme-eng.jpg)



History

The devastating impact of ticks on disease has been known since the 19th century (Table 2). Theobald Smith and Fred Kilbourne proved in 1893 that Texas cattle fever (cattle babesiosis) was caused by a microorganism transmitted by an infected tick. Rocky Mountain spotted fever was the first human tick-bourne disease identified in the United States and in fact was the major tick-associated disease in the late 1800s. The blacklegged tick, *I. scapularis*, was present on Naushon Island, Massachusetts, in the 1920s and 1930s. Ticks collected in the late 1940s and early 1950s from Montauk Point, Long Island, New York, were found infected with Lyme disease bacteria, *B. burgdorferi*.

I. scapularis

"By 2020, it is expected that 80 per cent of inhabited parts of eastern Canada will have ticks!"

Table 2: Important ticks of northeastern states.
(http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1010.pdf)

Tick	Common name	General Distribution
Hard Ticks		
Ixodes scapularis	Blacklegged tick	Northeastern, southeastern & mid-western U.S.
Ixodes pacificus	Western blacklegged tick	Pacific coast & parts Nevada, Arizona, Utah
Ixodes cookei	A woodchuck tick	Eastern United States & northeast Canada
Ixodes dentatus	A rabbit tick	Eastern United States
Amblyomma americanum	Lone star tick	Southeastern U.S., Texas to S. New England
Dermacentor variabilis	American dog tick	Eastern U.S. & parts of the west coast
Dermacentor andersoni	Rocky Mountain wood tick	Rocky Mountain states south to NM & AZ
Dermacentor albipictus	Winter tick	Canada, United States south to Central America
Dermacentor occidentalis	Pacific coast tick	California, Oregon, northern Baja peninsula
Rhipicephalus sanguineus	Brown dog tick	All U.S. and worldwide
Soft Ticks		
Ornithodoros species ticks	Relapsing fever ticks	Western United States
Carios kelleyi	A bat tick	A bat tick

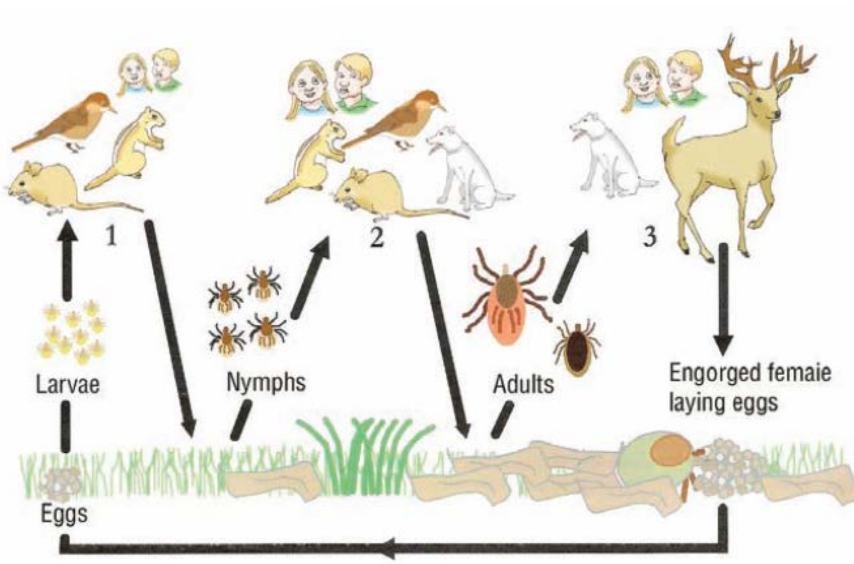
Lyme disease was first recognized as a distinct clinical condition from a group of arthritis patients in the area of Lyme, Connecticut, in 1975. At the time this disease, however, already had a prominent history throughout Europe. In 1981, Dr. Willy Burgdorfer and co-workers discovered spirochetes in the mid-gut of some *I. scapularis* ticks from Long Island, New York. The *Borrelia burgdorferi* bacteria was later named after Dr. Brugdorfer (why anyone would want a bacteria named after them is beyond this paper).

In 1984 and 1985 a Lyme disease testing program by the Connecticut Agricultural Experiment Station and Connecticut Department of Public Health found the greatest prevalence in towns east of the Connecticut River. Incidences of the disease have expanded dramatically since initial screening in the 80s. Current U.S. reports estimate 20,000 to 24,000 new cases of Lyme disease annually. Tragically these approximations are very conservative and may only represent 10-20% of the actual figures in the U.S.

In Canada from 1994 to 2004, the Public Health Agency's Notifiable Disease Reporting System (NDRS) reported only **345 cases.** The Ontario Ministry of Health and Long Term Care estimated that Lyme disease cases have "remained fairly constant at about **five cases yearly, with no noticeable increase."** When taking a closer look at the dramatic difference in Lyme disease cases between the U.S. and Canada, one must take into consideration that Lyme disease has only recently been endorsed by the Communicable Disease Network Surveillance and added back onto the NDRS list in December of 2006. Regardless, this is an absurdly low level of suspected cases in an area endemic with Lyme.

Tick Biology and Behaviour

Figure 3: 3 Host Life Cycle.
(Tick Management, Kirby C. Stafford III, Ph.D. Experiment Station, New Haven)



The pesky tick requires a host for food and development. Their life cycle often occurs in four stages (Figure 3): the egg, the 6-legged larva (seed ticks), the 8-legged nymph and adult (male or female). The egg hatches producing a 6-legged larva. Larvae and nymphs need to feed on blood in order to progress to the next stage. With Lyme disease, the ticks responsible for the transmission of the bacteria actually require three hosts in order to complete the 4 stages life cycle (Figure 3). Each active stage feeds on a different individual host animal, the larvae feed on one animal, drop to the ground and change to a nymph. The nymphs then attach to another animal, engorge, drop to the ground and change to an adult. The adult tick feeds on a third animal to complete and continue the life cycle for the next generation. Amazingly the female tick produces about 1000 to 18000 eggs before it dies (Figure 4). Human infection can actually occur at any of the 3 active feeding stages although more commonly at the adult stage.

Figure 4: **A**. Left to right, larva, nymph, male and female *I. scapularis*. **B**. Unfed and engorged female. **C**. Female egg mass.
(Tick Management, Kirby C. Stafford III, Ph.D. Experiment Station, New Haven)

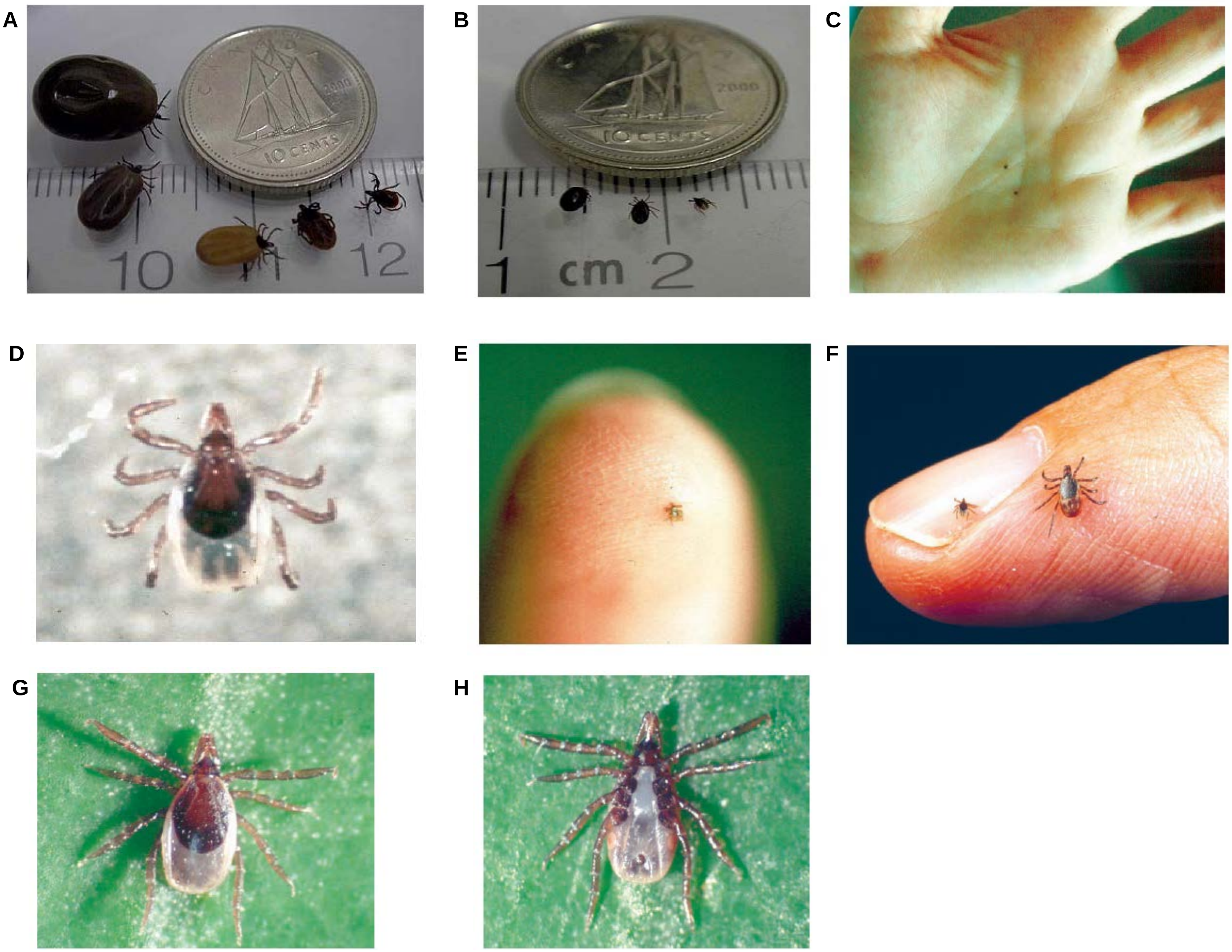
A

B

C

Figure 5: **A**: Female blacklegged ticks in various stages of feeding. Note the change in size and colour. **B**. Unfed, partially and fully engorged nymphs of the blacklegged tick. Note change in size and colour. **C**. *I scapularis* nymph in the hand. **D**. Close-up of an *I. scapularis* nymph (finger like projections of the tick mid-gut where the Lyme spirochetes are found are visible through the tick cuticle). **E**. *I scapularis* nymph on finger. **F**. *I scapularis* female and nymph on finger. **G & H**. *I scapularis* Nymph dorsal and ventral views.

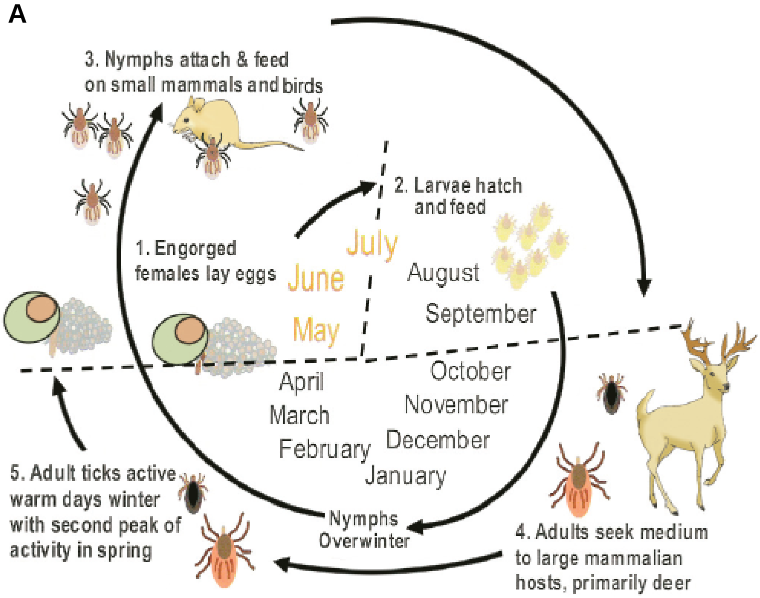
(Tick Management, Kirby C. Stafford III, Ph.D. Experiment Station, New Haven) (http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php)



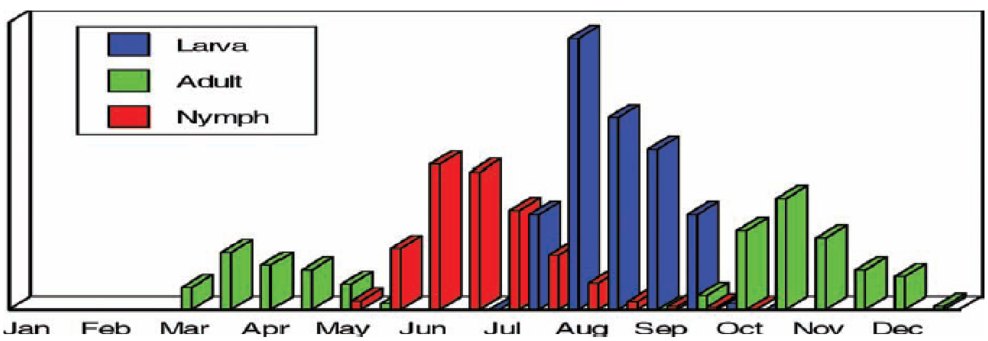
The two year life cycle of a tick is responsible for the survival of the Lyme disease causing bacteria *B. burgdorferi* (Figure 6). Eggs are laid by the female in May; the larvae hatch in mid- to late July with August being the peak month for larval tick activity. After feeding, the larvae drop from the host, change to nymphs and appear the following year in late spring. May, June and July are peak months for nymphal tick activity in the northeast. The nymphs that survive the winter can infect more animal hosts. Across Canada the winter of 2011 was unseasonably warm allowing for a larger nymph population to persist for 2012. Adult *I. scapularis* do not hibernate and may be active on warm winter days and the following spring. Adult *I. scapularis* are more heavily infected with *B. burgdorferi* than the nymphs because the tick has had two opportunities to become infected, once as a larva and once as a nymph.

Figure 6: **A**. Two-year Life Cycle for *I. scapularis.* **B**. Seasonal acitivity of *I. scapularis* larvae, nymphs and adults. **C**. Seasonal Guide to Major Ticks Affecting Humans in Connecticut.
(Tick Management, Kirby C. Stafford III, Ph.D. Experiment Station, New Haven)

A



B



C

Basic Seasonal Guide to Major Ticks Affecting Humans in Connecticut
(Also see seasonal graph for *I. scapularis*)

Fall (October-November)
Adult *Ixodes scapularis* active

Winter (December-February)
Adult *Ixodes scapularis* active during periods of warm weather (the ticks do not hibernate)

Early Spring (March-April)
Adult *Ixodes scapularis* (second peak of activity)
Adult *Dermacentor variabilis* appear late April
Adult *Amblyomma americanum* appear mid-April
(lone star ticks still are not common in CT)

Late Spring (May)
Adult *Ixodes scapularis* are disappearing
Nymphal *Ixodes scapularis* appear about mid-May
Nymphal *Amblyomma americanum* appear mid-May
(lone star ticks still are not common in CT)

Early Summer (June-July)
Nymphal *Ixodes scapularis* peak period activity
Adult *Dermacentor variabilis*
Nymphs *Amblyomma americanum*
(lone star ticks still are not common in CT)

Late Summer (August-September)
Larval *Ixodes scapularis peak*
A few nymphs of *Ixodes scapularis* &
adults of *Dermacentor variabilis* may still be present

Signs and Symptoms

According to the Public Health Agency of Canada the symptoms of Lyme disease typically occurs in three stages. The first sign of infection is usually a circular rash called erythema migrans or EM (Figure 7). The rash appears in 70-80% of infected individuals, presents after a delay of three days to one month and can persist for up to eight weeks. In reality less than 50% of Lyme disease cases will experience an EM. The bacteria *B. burgdorferi*, will multiply in the area of the infected tick bite spreading within a few days to weeks via the lymph and blood to various organs particularly skin, joints, nervous or cardiac tissue. Nonspecific viral-like symptoms generally mark early disseminated infection including: fatigue, chills, fever, headache, muscle and joint pain and swollen lymph nodes. Days or weeks following the initial bite of an infected tick, migratory joint and muscle pain (also brief, intermittent arthritic attacks), debilitating malaise and fatigue, neurologic or cardiac problems may occur.

The second stage of the disease is referred to as disseminated Lyme disease, where the bacterium has now spread throughout the body. Symptoms can last up to several months and include: central and peripheral, nervous system disorders, multiple skin rashes, arthritis and arthritic symptoms, heart palpitations, extreme fatigue and general weakness.

If left untreated the disease enters the third stage of Lymes where symptoms can persist for months to years and can include: recurring arthritis, continuous joint swelling, neurological symptoms such as numbness and tingling of the extremities, sensory loss, weakness, diminished reflexes, disturbances in memory, mood or sleep, cognitive function deficits and late encephalomyelitis which may be confused with multiple sclerosis. In fact, chronic Lyme disease or post-Lyme disease syndromes present symptoms similar to chronic fatigue syndrome and fibromyalgia. Late stages of Lyme have been linked with chronic infection and infection-induced autoimmune diseases. This relentless disorder might be due to a slowly resolving infection, residual tissue damage, inflammation from remains of dead spirochetes, immune-mediated reactions in the absence of the spirochete or co-infection with other tick-borne pathogens.

The above statements is a conservative view of the impact of Lyme, in actuality Lyme disease can mimic the symptoms of Fibromyalgia, Chronic Fatigue Syndrome, MS, ALS, Parkinson's, Alzheimer's, Crohn's disease, Rheumatoid arthritis, Heart disease, Autism as well as more than some 350 other diseases.

Figure 7: (Canadian Family Physician, Oct 2008, Vol.54 no.10 1381-1384)

Neurological Symptoms

Some of the neurological signs include radiculopathy (pain in affected nerves and nerve roots; can be sharp and jabbing or deep), cranial neuropathy such as Bell's palsy and peripheral neuropathy. Systemic involvement includes lymphocytic meningitis, encephalomyelitis (parenchymal inflammation of brain or spinal cord, with focal abnormalities).

Musculoskeletal Signs

Musculoskeletal signs of Lyme present as arthritis. It can also affect the temporomandibular joint.

Cardiac Signs

Intermittent atrioventricular heart block, involving the atrioventricular node has been associated with Lyme disease.

Tick Associated Diseases

Table 3: Tick-associated diseases in the U.S.
(Tick Management, Kirby C. Stafford III, Ph.D. Experiment Station, New Haven)

Disease	Pathogen or causal agent	Tick Vector
Anaplasmosis, granulocytic	*Anaplasma phagocytophilum*	*I. scapularis, I. pacificus*
Babesiosis	*Babesia microti*	*I. scapularis, I. pacificus*
Colorado tick fever	CTF virus (Retoviridae)	*D. andersoni*
Ehrlichiosis, monocytic	*Ehrlichia chaffeensis*	*A. americanum*
Lyme disease	*Borrelia burgdorferi*	*I. scapularis, I. pacificus*
Southern rash illness	*Borrelia lonestari* (?)	*A. americanum*
Powassan encephalitis	Powassan virus	*I. cookei*
Rocky Mountain spotted fever	*Rickettsia rickettsia*	*D. variabilis, D. andersoni*
Tick-borne Relapsing Fever	*Borrelia* species	*Ornithodoros* species ticks
Tularemia	*Franciscella tularensis*	*D. variabilis, A. americanum*, others
Tick paralysis	Toxin	*D. variabilis, D. andersoni*

There are approximately eleven recognized human diseases associated with ticks in the United States. The three most common are Lyme disease, anaplasmosis (ehrlichiosis) and babesisois (Table 3). Tularemia can be transmitted through contaminated animal tissue. Babesisois and anplasmosis **can be transmitted perinatally and through blood transfusion.** A tick bite can infect the host with more than one infection, in many cases there are co-infections. For example in a Connecticut and Minnesota study, 20% of Lyme disease patients also had serological evidence of exposure to another tick-borne agent.

Submitting Ticks for Identification and Testing

(Taken from the Public Health Agency of Canada)

- To remove ticks that are embedded in skin, use tweezers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick.
- Do not try to burn or smother the tick.
- Cleanse the bite area with soap and water, alcohol or household antiseptic
- Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister.
- A bit of moistened paper towel placed inside the container will keep ticks from drying out. Dried out ticks are more difficult to identify and test for infection.
- If members of the public are concerned about removing a tick from themselves or a member of their family, it is advisable that they ask for assistance from a healthcare professional, who can also advise on possible symptoms of tick-borne diseases to permit early recognition of infection and prompt treatment.
- Similarly local veterinarians will be able to remove ticks from pets and advise on any treatments they may require.
- When possible, ticks should be sent to provincial collaborators who will identify the tick and then forward only the blacklegged ticks to the Agency's National Microbiology Laboratory (NML).
- Staff at the NML will conduct diagnostic testing for the Lyme disease agent as well as several other disease-causing agents. For information on where to send tick specimens in your area, contact the NML through phone or email at:
  National Microbiology Laboratory
  Phone: (204) 789-2000
  Email: ticks@phac-aspc.gc.ca
- Please note that it usually takes at least two weeks for ticks submitted to the NML to be identified, tested and for results to be reported to the original submitter.
- During the peak periods of adult activity (October to December), the processing time at the NML can extent to 4-6 weeks because of the large volume of tick samples received.
- Please follow the guidelines for handling and shipping ticks and complete and attach a Tick Submission Form (PDF Document - 79 KB - 1 page) with the submission.

References

1. Advanced Topics In Lyme Disease, Joseph J. Burrascano JR., MD.
2. Public Health Agency of Canada (http://www.phac-aspc.gc.ca/id-mi/lyme-fs-eng.php#s1)
3. Public Health Agency of Canada (http://www.phac-aspc.gc.ca/id-mi/tickinfo-eng.php) Lyme disease and other tick-borne diseases: Information for health professionals
4. CMAJ June 9, 2009 vol. 180 no. 12 1221-1224 The emergence of Lyme disease in Canada
5. Tick Management Handbook An integrated guide for homeowners, pest control operators, and public health officials for the prevention of tick-associated disease. Kirby C. Stafford III, Ph.D. Vice Director, Chief Entomologist Connecticut Agricultural Experiment Station, New Haven
6. CanLyme (www.canlyme.com)
7. International Lyme and Associated Diseases Society (www.ilads.org)
8. The Infectious Diseases Society of America (www.idsociety.org)
9. Ending Denial: The Lyme Disease Epidemic A Canadian Public Health Disaster, A Call For Action From Patients, Doctors, Researchers, And Politicians. Edited by Helke Ferrie
10. National Lyme Disease Meeting (March 8-9, 2006) Public Health Agency of Canada

NaturoMedic.com: 296 Welland Avenue, St. Catharines, Ontario, L2R 7L9. **Phone**: **(905) 684-4934 Fax:**(905) 684-1849
www.NaturoMedic.com