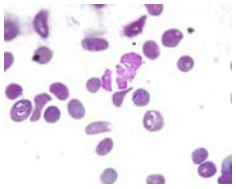
Ticks and tick-borne diseases: emerging problems ?



Andrew S. Peregrine
E-mail: aperegri@ovc.uoguelph.ca

Topics

- Ticks on dogs in Ontario and the pathogens they transmit ?
- Should dogs be routinely screened for tick-borne pathogens ?
- How should you manage a healthy dog that tests positive for a tick-borne pathogen ?

Ticks on dogs in North America

	Common name	Scientific name
	Lone Star Tick	*Amblyomma americanum*
	Gulf Coast Tick	*Amblyomma maculatum*
	Rocky Mountain Wood Tick	*Dermacentor andersoni*
→	American Dog Tick	*Dermacentor variabilis*
	Western Black-legged Tick	*Ixodes pacificus*
→	Deer Tick	*Ixodes scapularis*
	Brown Dog Tick	*Rhipicephalus sanguineus*

→ = most likely in Ontario

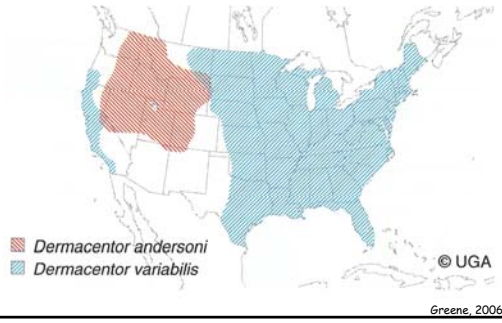
Ticks on Ontario dogs

Dermacentor variabilis

Ixodes scapularis

Ticks in Ontario ?

Distribution of *Dermacentor* species in USA



Greene, 2006

Dermacentor variabilis

"American dog tick"

Transmits (rarely/never in Canada):

(a) *Rickettsia rickettsii*
(Rocky mountain spotted fever - RMSF)

(b) *Francisella tularensis*

(c) *Cytauxzoon felis* (only southeast USA)

- causes tick paralysis (rare)

Dermacentor andersoni

"Rocky Mountain wood tick"

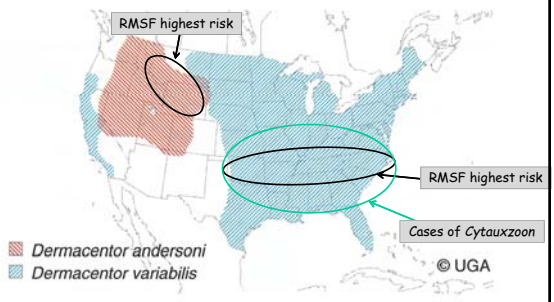
Transmits (rarely in Canada):

(a) *Rickettsia rickettsii*

(b) *Francisella tularensis*

- causes tick paralysis (rare)

Distribution of *Dermacentor* species in USA



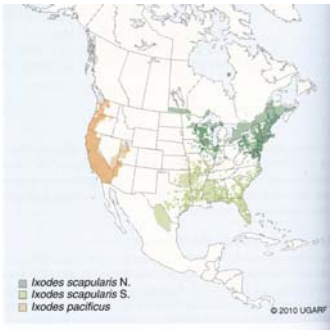
Greene, 2006

Ixodes scapularis - "deer (black-legged) tick"

Ixodes pacificus – "western black-legged tick"

- transmit *Borrelia burgdorferi* (Lyme disease) (4DxPlus)
- transmit *Anaplasma phagocytophilum* (granulocytic anaplasmosis) (4DxPlus)
- cause tick paralysis (rare)

Distribution of *Ixodes* species in North America



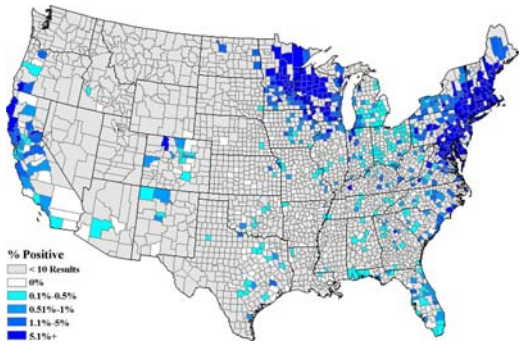
Greene, 2006

Reported Cases of Lyme Disease—United States, 2014

One dot is placed randomly within the county of residence for each confirmed case. Though Lyme disease cases have been reported in nearly every state, cases are reported based on the county of residence, not necessarily the county of infection.

http://www.cdc.gov/ncidod/dvbid/lyme/ld_incidence.htm

Proportion of dogs seropositive for *B. burgdorferi* in USA (2001-2007)



Bowman et al 2009

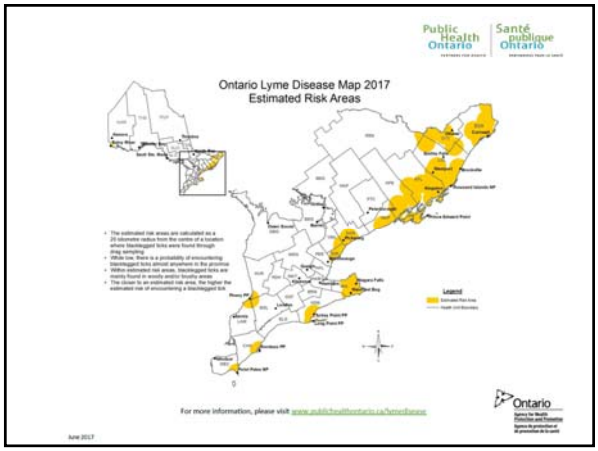
Why is the risk of Lyme disease increasing in Ontario ?

http://www.cdc.gov/ncidod/dvbid/lyme/ld_incidence.htm

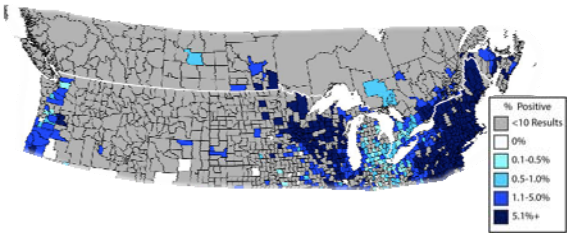
Reported Cases of Lyme Disease—United States, 2014

One dot is placed randomly within the county of residence for each confirmed case. Though Lyme disease cases have been reported in nearly every state, cases are reported based on the county of residence, not necessarily the county of infection.

http://www.cdc.gov/ncidod/dvbid/lyme/ld_incidence.htm



Percent positive canine tests for antibody to *Borrelia burgdorferi* throughout Canada (2013-2014). United States data from previously published report by Little et al. for 2010-2012.



Herrin et al 2015

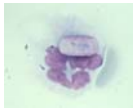
Amblyomma americanum

"Lone star tick "

- currently rare in Canada – the next endemic tick?
- transmits ***Ehrlichia ewingii***
  (canine granulocytic ehrlichiosis) (4DxPlus)
- transmits *Cytauxzoon felis* (primary vector)

Amblyomma maculatum

"Gulf coast tick"



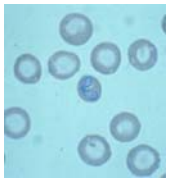
- very rare in Canada
- Gulf of Mexico & as far north as Kansas and Oklahoma
- transmits *Hepatozoon americanum* to dogs
  - *dog infected by ingestion of tick*

Rhipicephalus sanguineus

"brown dog tick"

- prefers warm, humid, climate (rare in Canada)
- only tick that can establish in homes/kennels/ veterinary hospitals

Rhipicephalus sanguineus



Transmits:

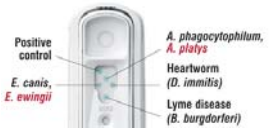
(a) *Babesia canis*
(canine babesiosis/piroplasmosis)

(b) *Ehrlichia canis*
(canine monocytic ehrlichiosis) (4DxPlus)

(c) *Anaplasma platys*
(thrombocytic anaplasmosis) (4DxPlus)

Screening of dogs for tick-borne pathogens ?

SNAP® 4Dx® Plus Test (Idexx)



- heartworm antigen
- antibody to *Ehrlichia canis*
- antibody to *Borrelia burgdorferi*
- antibody to *Anaplasma phagocytophilum*
- antibody to *Ehrlichia ewingii*
- antibody to *Anaplasma platys*

Testing of dogs with 4Dx® Test

In 2007, 68,571 dogs in Ontario were tested:

In 2008, 56,943 dogs in Ontario were tested:

In 2013/14, 77,143 dogs in Ontario were tested:

Proportion of dogs positive for:	2007	2008	2013/2014
(a) *B. burgdorferi* =	0.58%	0.47%	5.1% (eastern ON)
(b) *A. phagocytophilum* =	0.09%	0.09%	

(IDEXX Laboratories 2008; Canadian Veterinary Journal 2011, 52, 527-530; Herrin et al personal communication)

SNAP® 4Dx® Plus Test (Idexx)

- Detects antibody to C_6 surface antigen on *B. burgdorferi*.
- Use of Lyme vaccines does not interfere with this response.

Lyme Quant C_6® Test (Idexx)

- Quantifies antibody to C_6 surface antigen.
- Useful for monitoring response to treatment (determine titer on day of treatment and 6 months later).
- Correlation between titer and risk of disease currently unclear.

Ixodes scapularis and *Borrelia burgdorferi*

Important facts:

- Ticks need to be attached for a minimum of ≥36 hours before transmission occurs.
- Overall proportion of Ontario/Canada ticks infected with *B. burgdorferi* = 18.4% (2013).
- Seroconversion occurs 3-5 weeks following infection.
- Dogs become clinical 2-5 months following infection.
- ~95% infected dogs never become clinical.

Will the dog get Lyme disease ?

Options if fully engorged *Ixodes scapularis*

1. Evaluate dog for clinical signs consistent with Lyme disease for next 6 months (option most consistent with ACVIM consensus statement)

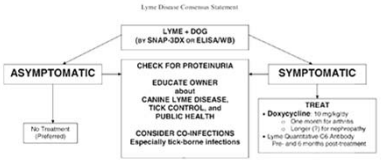
2. Carry out *B. burgdorferi* serology today and 2 months later
   - evidence of seroconversion ?

3. Submit tick for PCR evaluation of *B. burgdorferi*

If a dog genuinely tests positive for *B. burgdorferi*, how should it be managed ?

"Most seropositive dogs will never become ill with Lyme disease and do not need to be treated."

(ACVIM Consensus Statement 2006)



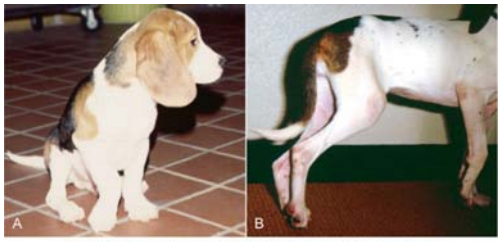
Typical clinical signs in dogs

***Borrelia burgdorferi* (Lyme disease):**

- *disease incubation = 2-5 months:*
  - fever, anorexia, polyarthritis
  - shifting leg lameness, joint swelling
  - lymphadenomegaly

Ixodes scapularis

Clinical Lyme disease



If a healthy dog tests positive for *Borrelia burgdorferi*, how should it be managed ?

- Monitor for clinical signs and proteinuria for 6 months -

Pathogen	Test
Borrelia burgdorferi	Urine protein (dipstick)

(as long as clean urine sediment, i.e. no blood/inflammation)

If clinical signs consistent with Lyme disease, or urine protein, treat with:
(a) doxycycline at 10 mg/kg, PO, q24 hours for minimum of 1 month
(b) amoxicillin at 20 mg/kg, PO, q8 hours for 30 days

If a dog tests positive for other tick-borne pathogens, how should it be managed ?

- If clinical signs consistent with pathogen, TREAT -

Typical clinical signs in dogs

Borrelia burgdorferi **(Lyme disease):**

Ixodes scapularis

- *disease incubation = 2-5 months:*
  - fever, anorexia, polyarthritis
  - shifting leg lameness, joint swelling
  - lymphadenomegaly

Anaplasma phagocytophilum **(granulocytic anaplasmosis):**

- *disease incubation = 1-2 weeks:*
  - fever, anorexia, lethargy
  - lameness, stiffness, joint swelling
  - lymphadenomegaly, splenomegaly, hepatomegaly

Typical clinical signs in dogs

Ehrlichia canis **(monocytic ehrlichiosis):**

Rhipicephalus sanguineus

- *seroconversion = 7-28 days*
- *disease incubation = 8-20 days:*
  - fever, anorexia, weight loss
  - polyarthritis
  - lymphadenomegaly, splenomegaly
  - CNS signs, dermal petechiae/ecchymoses
  - cardiac arrythmias, anterior uveitis

Ehrlichia canis: mucosal petechiae

Ehrlichia canis: scleral bleeding

Typical clinical signs in dogs

Ehrlichia canis **(monocytic ehrlichiosis):**

- *disease incubation = 8-20 days:*
  - fever, anorexia, weight loss
  - polyarthritis
  - lymphadenomegaly, splenomegaly
  - CNS signs, dermal petechiae/ecchymoses
  - cardiac arrythmias, anterior uveitis

Rhipicephalus sanguineus

Anaplasma platys **(thrombocytic anaplasmosis):**

- *disease incubation = 8-15 days?*
  - mild fever, uveitis
  - petechiae, ecchymoses

Typical clinical signs in dogs

Ehrlichia ewingii **(granulocytic ehrlichiosis):**

- *disease incubation = 18-28 days:*
  - fever, anorexia
  - stiffness, joint swelling
  - CNS signs

Amblyomma americanum

If a healthy dog tests positive for other tick-borne pathogens, how should it be managed ?

Pathogen	Test
Anaplasma phagocytophilum	CBC - thrombocytopenia
Anaplasma platys	CBC – thrombocytopenia
Ehrlichia canis	CBC – thrombocytopenia
Ehrlichia ewingii	CBC - thrombocytopenia

Retest 2-3 weeks later ?

If clinical signs consistent with pathogen, or CBC abnormality, treat with: doxycycline for 1 month