Lyme Disease in Vermont

An Occupational Hazard for Birders
How to Prevent Lyme Disease
Lyme Disease is a Worldwide Infection

Borrelia burgdoferi

B. afzelii; and B. garinii
In the US Lyme Disease is Increasing

Reported Cases of Lyme Disease -- United States, 2001

Reported Cases of Lyme Disease -- United States, 2011

1 dot placed randomly within county of residence for each reported case

1 dot placed randomly within county of residence for each confirmed case

[Link to CDC website for interactive maps: h/p://www.cdc.gov/lyme/stats/maps/interactiveMaps.html]
Lyme is Moving Northward in Vermont

Lyme Disease in Vermont 2005: Incidence Rate of Confirmed Cases

Lyme Disease in Vermont 2012: Incidence Rate of Confirmed Cases

Cases per 100,000 population
- 0
- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 200
- > 200

March 2010
Lyme Disease 2013

Cases per 100,000 population

- 0
- 1 - 10
- 11 - 50
- 51 - 100
- 101 - 200
- > 200
What Causes Lyme Disease?

- Lyme disease is caused by a spirochete called *Borrelia burgdorferi*.
WILLY BURGDORFER, PhD
Lyme Bacteria Discoverer
This spirochete multiplies in the mid-gut of its vector the black-legged tick (Ixodes scapularis)
What is the reservoir of this spirochete?

Ticks acquire *B. burgdorferi* when tick larvae take a blood meal from an infected host:

- Mouse
- Chipmunk
- Shrews
Infected ticks can infect other mammals and birds
Life Cycle

Year 1

- Nymphs from previous year
- Questing ticks

Year 2

- Larvae
- Nymphs
- Adults

Seasons:
- Spring
- Summer
- Fall
What do black-legged ticks look like?

Black-legged tick larvae have 6 legs, and nymphs and adults have 8 legs.
Actual Tick Sizes

<table>
<thead>
<tr>
<th>What a Tick Looks Like (enlarged)</th>
<th>Stage</th>
<th>What a Tick Looks Like (actual size)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LARVA</td>
<td></td>
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<tr>
<td>![Larva Image]</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>NYMPH</td>
<td></td>
</tr>
<tr>
<td>![Nymph Image]</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>ADULT MALE</td>
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</tr>
<tr>
<td>![Adult Male Image]</td>
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<tr>
<td></td>
<td>ADULT FEMALE</td>
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<tr>
<td>![Adult Female Image]</td>
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</tbody>
</table>
Black-legged Ticks
Where are these ticks found?

- Woods
- Tall grass
- Shrubs
- Piles of leaves and brush
How do people get exposed?

• Ticks don’t fly or jump.
• Ticks crawl up vegetation and attach to people (or clothes) as they walk by (“questing”).
• A tick will then crawl to a feeding spot on the person or animal.
How does this tick transmit the spirochete?

- Once ticks bite, they attach for several days while they feed.
- Usually a tick must bite and stay attached to the skin for at least 24-36 hours before it can transmit Lyme disease.
Ticks After a Blood Meal
“Moby Tick”
Infected Black-legged Ticks in Vermont

- Nymphs 22/83 (27%)
- Adults 195/312 (62%)

Geise and Berl, 2013
# Tick Surveillance - 2013/2014

Proportion of black-legged ticks testing positive for three pathogens.

<table>
<thead>
<tr>
<th>Site</th>
<th>N</th>
<th>Borrelia</th>
<th>Anaplasma</th>
<th>Babesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colchester</td>
<td>89</td>
<td>0.69</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Hinesburg</td>
<td>71</td>
<td>0.48</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Snake Mtn</td>
<td>19</td>
<td>0.26</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Fairhaven</td>
<td>67</td>
<td>0.40</td>
<td>-</td>
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<tr>
<td>Emerald Lk</td>
<td>45</td>
<td>0.29</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Lk Shaftsbury</td>
<td>49</td>
<td>0.27</td>
<td>0.02</td>
<td>-</td>
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<tr>
<td>Guildhall</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Barnet</td>
<td>61</td>
<td>0.48</td>
<td>0.02</td>
<td>-</td>
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<tr>
<td>Newbury</td>
<td>8</td>
<td>0.50</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Thetford</td>
<td>173</td>
<td>0.65</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ascutney</td>
<td>79</td>
<td>0.51</td>
<td>0.01</td>
<td>-</td>
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<tr>
<td>Bellows Falls</td>
<td>75</td>
<td>0.49</td>
<td>0.01</td>
<td>-</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>736</td>
<td>0.51</td>
<td>0.01</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Dr. Alan Giese, Lyndon State College
Risk for Lyme Disease Transmission

- Risk is not uniformly distributed
- Risk depends on tick infection density
  - Highly endemic areas:
    - 25%-35% of nymphs infected
    - 35%-70% of adults infected
- Habitat fragmentation
  - Tick infection rate is increased in small fragmented habitats
  - Predators of mice and chipmunks are reduced in small habitat fragments
  - Mammals that are incompetent as reservoirs decrease, limiting the effect of competition.
What are the signs of Lyme disease?

- Expanding rash
- Sore muscles
- Fatigue
- Fever

Swollen joints
Confirmed Lyme Disease Cases--United States, 2001-2010

- Erythema migrans: 70%
- Arthritis: 30%
- Bell's palsy: 8%
- Meningitis/Encephalitis: 2%
- Radiculoneuropathy: 4%
- Cardiac: 1%

N = 213,515
Treating Lyme Disease

- Treatment with antibiotics is effective
- A single dose of doxycycline can be given after exposure
Other Diseases Transmitted By Ixodes scapularis

- Anaplasmosis
- Babesiosis
- Powassan-type Virus
- Other Borrelia species
Number of Anaplasmosis Cases Reported in Vermont: 2008 - 2013

Reported Cases of Anaplasmosis by County: 2008-2013
Babesiosis

- **Babesiosis**
  - Caused by *Babesia microti*
    - RBC parasite
  - Can also be transmitted through blood transfusions

- **In VT:**
  - 13 confirmed and 8 probable cases reported since 2005 – most with travel
  - First confirmed case with likely local exposure reported in 2013, Bennington County resident
Protect yourself from tick bites

When hiking or walking in grassy areas:

- Wear long pants tucked into your socks to keep ticks off you.
- Wear long-sleeved shirts and light colored clothes to make it easier to spot ticks.
REPEL

- A repellent such as 20%-30% DEET will protect your skin from ticks.

- DEET should be applied to your exposed skin (that is skin not covered by your clothes) before you go outside.

- Treat your clothes with an acaricide such as Permethrin.

- Dry your clothes at high heat.
INSPECT

After you have been outside...

- Check for ticks on your body in front of a full length mirror.
- Take a shower shortly after being outside.
REMOVE

If you find a tick on your body:

• Carefully remove the tick with a pair of fine point tweezers.
• Wash the bite with soap and water.
Landscape Management

- Keep grass mowed
- Remove brush and leaf litter
- Discourage rodent activity
- Move firewood and bird feeders away from houses
- Increase sunlight – trim branches
- Consider applying acaricides

Pets can get ticks

• Check your pet for ticks after he or she has been outside and remove any ticks.
• Ask your veterinarian about collars and other treatments that will help prevent ticks bites.
Conclusions

• Lyme disease is an inflammatory disorder caused by B. burgdorferi and transmitted by I. scapularis.

• Lyme disease is the most common tick-borne disease in the U.S. and has increased in Vermont.

• Ticks have a complex life cycle.

• Treatment with antibiotics is effective, but prevention is better.
You Can Prevent Lyme Disease
Repel-Inspect-Remove
Lyme Disease

Be Careful Out There!
References

• Vermont Dept. of Health
  - http://healthvermont.gov

• CDC
  - http://cdc.gov

• University of Rhode Island
  - http://tickencounter.org
References

- Ostfeld, RS Lyme Disease Oxford University Press, 2011
- Quammen, D Spillover WW Norton, 2012
- Shapiro, ED Lyme disease NEJM May 1, 2014