Ticks in the Local Landscape

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Outline

– Ticks
– Trends for Lyme and other diseases
– Reducing the risk
Tick biology and natural history

• 15 species in Wisconsin
• Common species include:

Dermacentor variabilis
“wood tick”
American dog tick

Ixodes scapularis
“deer tick”
Black-legged tick
Deer or blacklegged ticks
Ixodes scapularis

Wood tick
Dermacentor variabilis
New Ticks?

Lone Star Tick
Blacklegged Tick (*Ixodes scapularis*)

- Adult female
- Adult male
- Nymph
- Larva

Lone Star Tick (*Amblyomma americanum*)

Dog Tick (*Dermacentor variabilis*)
“Her pants are in our freezer”

Asian longhorned tick
Tick Life Cycle

- Nymph
- Larva
- Female
- Male
Blood feeding adults

Unfed | Day 1.5 | Day 2 | Day 3 | Day 4 | Day 7

CLICK HERE TO WATCH THEM GROW

Female Adult-stage *Ixodes scapularis*
Growth Comparison

https://tickencounter.org/
Blood = eggs
Adult tick hosts

White tailed deer are important for adult deer tick blood meals but they don’t infect ticks (with Lyme bacteria)
Blood feeding nymph
Many animals can feed larvae and nymphs of deer ticks.
How do ticks get infected with Lyme disease spirochetes? From host animals.
Ticks don’t burrow under skin
Removing a tick

A. Arugay 2002
L. A. County West Vector Control District
History & Disease
First Wisconsin records of deer ticks 1958-1965
Hunter killed deer- Tick Surveys

1981

1994

2008-2009

Wisconsin Surveillance of Ticks Collected from Deer During Hunting Season, 2008-2009

Dark color of the pie = % deer infested with *Ixodes* ticks.
Changing distribution of deer tick in the Upper Midwest.
Red means established and breeding. Blue means detected but not clearly established. White means no records.

Geographic area of risk is expanding
Lyme disease average annual incidence
Wisconsin, 1990-2010, by county from Wisconsin DHS

1990-1992
1993-1995
1996-1998
1999-2001
2002-2005
2008-2010

Statewide average incidence = 35.1/100,000
Landcover correlates with disease incidence in Wisconsin: note the southern and eastern area of lower incidence. Less forest.

Deer ticks don’t like open and dry!
Impacts

Tickborne diseases such as Lyme hit record highs in the U.S., CDC says

The real burden of tickborne infection is probably 10 times what is reported, experts say.
Geographic distribution of Lyme disease in USA

Reported Cases of Lyme Disease – United States, 2017

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

From CDC:https://www.cdc.gov/lyme/stats/maps.html
* Previous to 2008 only confirmed cases were reported. Beginning 2008, the total number of cases includes confirmed and probable cases. Surveillance changed in 2012.
https://dhsgis.wi.gov/DHS/EPHTracker/#/map/Lyme%20Disease/
Note: Kids age 5-9

Average Lyme Disease *(B. burgdorferi)* Cases by Age Group (2013–2017)

Lyme disease cases are highest in Wisconsinites aged 5-14 years and 50-69 years.
Emergence of deer tick-borne pathogens in the USA & Wisconsin

- 1969: 1st Lyme Case in USA
  - Wisconsin
- 1968; 1957: Babesia microti: Nantucket
- 1970: Powassan/Deer tick virus
- ca. 1968; 1957: Babesia microti: Nantucket
- 1969:
- 1980:
- 1990: Increasing surveillance of Lyme
- 2000: Anaplasma phagocytophilum (Minnesota & Wisconsin)
- 2010: Ehrlichia muris
- 2012: Borrelia mayonii
- 2017: Borrelia miyamotoi
Tick-transmitted diseases in Wisconsin

Lyme Borreliosis
Anaplasmosis
Ehrlichiosis
Babesiosis
Powassan virus

Wisconsin Reported Cases of Anaplasmosis/Ehrlichiosis 1999-2017 (n=6,651)

Anaplasmosis

Wisconsin Reported Confirmed Babesiosis, 2000-2017 (n=408)

BABESIOSIS

Wisconsin Ehrlichia/Anaplasma Annual Incidence 2017 (n=847)

Statewide Incidence = 14.7/100,000

Incidence per 100,000 (confirmed and probable cases)
- <1
- 1-15
- 16-30
- 31-60
- 61-90
- 91-120
- >120

This map is based on the county of residence, thus infections may have been acquired during travel to other areas.

Revised 05/18/2018

Data Source: Wisconsin Division of Public Health
Control of ticks and disease

Protect Yourself Against Lyme Disease in Spring, Summer, and Fall

1. Walk in the middle of trails, away from tall grass and bushes.
2. Wear a long-sleeved shirt.
3. Wear white or light-colored clothing to make it easier to see ticks.
4. Wear a hat.
5. Spray tick repellent on clothes and shoes before entering woods.
6. Wear long pants tucked into high socks.
7. Wear shoes—no bare feet or sandals.
Permethrin on clothes and rubber boots
Research

Surveillance and Control of Tickborne Disease

• What affects human risk?
Abundance of nymphs
How often are **nymphs** infected with the **Lyme** bacteria?

Nymphs do most of the Lyme Disease transmission. Peak is in June but nymphs continue to be active until fall.
Ticks in Oneida County

Sampling in June

Ecology: deer, small mammals
- ALNH
- Bearskin Lake

~2/3 mile (1000 m)
# Ticks in Oneida County: ALNH Abundance and infection in nymphs

<table>
<thead>
<tr>
<th>Year</th>
<th>Density</th>
<th>Infection</th>
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<tbody>
<tr>
<td>2012</td>
<td>30.8</td>
<td>24%</td>
</tr>
<tr>
<td>2013</td>
<td>64.9</td>
<td>12.5</td>
</tr>
<tr>
<td>2014</td>
<td>22.6</td>
<td>16.7</td>
</tr>
<tr>
<td>2015</td>
<td>ND</td>
<td>27%</td>
</tr>
</tbody>
</table>

~2/3 mile (1000 m)
## Bearskin Lake: prevalence of infectious agents in nymphs

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Borrelia burgdorferi</em></td>
<td>3-22%</td>
</tr>
<tr>
<td><em>Borrelia mayonii</em></td>
<td>0-2%</td>
</tr>
<tr>
<td><em>Borrelia miyamotoi</em></td>
<td>3-4%</td>
</tr>
<tr>
<td><em>Anaplasma phagocytophilum</em></td>
<td>0-4%</td>
</tr>
<tr>
<td><em>Babesia microti</em></td>
<td>6%</td>
</tr>
</tbody>
</table>

[Map of Rhinelander]
Unusual places where we find nymphal deer ticks

- Big Bearskin Lake
- Eau Claire
- Mirror Lake
- UW Arboretum
The Tick App: 2019 Launch April 22nd

- Information for you:
  - Tick 101
  - Coming this year:
    - Tick Activity
    - Tick identification

- Information provided by you:
  - Daily log: What (outdoor) activities do you do?
  - Report-a-Tick: What tick species do you find? Where did you get it? What were you doing?

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**What is it about?** Lyme disease! And other things related to ticks: how to identify them, how to report them and, most importantly for the research team, it asks about your whereabouts and tick encounters.

**This is research?** Yes, and it also reminds you to check for ticks and take precautions to not get bitten!

**What do I need to do? How can I participate?**
1. Download the app (≥18 yo old)
2. Complete the consent form and enrollment questions
3. Start filling in daily tick diaries

**More information:** www.thetickapp.org or tickapp@wisc.edu

**What is in it for me?**
1. You have a free reminder to check for ticks
2. You can report a tick at any time
3. Your shared information helps to identify risk factors for ticks encounters and this will be used to develop better prevention strategies.
Evidence-based tick control

- Landscape management
- Barrier sprays between woods/grassy yards
- Target mice
Tick hosts & disease source

- Larvae and nymphs
- White-footed mice
Decreased Density of Nymphs Among Tick Tube Treatments

** Figure: **

- **Y-axis:** Density of *Ixodes scapularis* nymphs per plot
- **X-axis:** Treatment
  - Control
  - Buckthorn
  - Permethrin
  - Both

- **2014:**
  - Control: Low density
  - Buckthorn: Low density
  - Permethrin: Low density
  - Both: Low density

- **2015:**
  - Control: Low density
  - Buckthorn: Moderate density
  - Permethrin: High density
  - Both: Low density

- **2016:**
  - Control: Low density
  - Buckthorn: Moderate density
  - Permethrin: Moderate density
  - Both: Low density

- **2017:**
  - Control: Low density
  - Buckthorn: Moderate density
  - Permethrin: Moderate density
  - Both: Low density

**Legend:**
- *: p < 0.05
- **: p < 0.01
- ***: p < 0.001
Tick tube use 2018 was poor

- BSL – 18 homes (~18% used)
  - All cotton removed – 0 homes
  - All cotton left in tubes – 6 homes
- ML – 14* homes (~29% used)
  - All cotton removed – 1 home
  - All cotton left in tubes – 2 homes*

<table>
<thead>
<tr>
<th>Use (appr. %)</th>
<th>Cotton left (gram)</th>
<th>Scale</th>
<th>ML</th>
<th>BSL</th>
<th>n</th>
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</thead>
<tbody>
<tr>
<td>All used</td>
<td>0</td>
<td>0</td>
<td>22</td>
<td>13</td>
<td>35</td>
</tr>
<tr>
<td>&gt;75.99%</td>
<td>&gt;0 to 1</td>
<td>.2</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>&gt;50.75%</td>
<td>&gt;1 to 2</td>
<td>.4</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&gt;25-50%</td>
<td>&gt;2 to 3</td>
<td>.6</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>&gt;0-25%</td>
<td>&gt;3 to 4</td>
<td>.8</td>
<td>8</td>
<td>9</td>
<td>17</td>
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<tr>
<td>No use</td>
<td>4 or more</td>
<td>1</td>
<td>51</td>
<td>69</td>
<td>120</td>
</tr>
<tr>
<td>Not recovered</td>
<td>Unknown</td>
<td>NA</td>
<td>7</td>
<td>10</td>
<td>17</td>
</tr>
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</table>
Tick control study - 2019

- 40 residential properties
- Have a lawn with border of woods / trees
- At least 30-40 yd wide (can be combined with neighbor)
- Willing to treat lawn/edge with an insecticide
- Property visits: Mid-late May for treatment with follow-up for tick collection
Go to http://labs.russell.wisc.edu/wisconsin-ticks/
Or Google “Wisconsin Ticks”

Page over to check out the Tick App, our new tool for providing mobile information about ticks, Lyme Disease, and other tick-borne diseases. Get your ticks identified and learn about the activity of ticks in your county. Fill out tick diaries to keep track of your exposures and participate in a citizen science tick research project!

LATEST NEWS

DISEASES FROM MOSQUITOES AND TICKS INCREASING
Acknowledgments

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And many more