Glen: Supposed to be a huge tick problem this year...

Jim: Haven’t seen any yet...
Ohio Tick Report: 2010-2018

Glen Needham, Associate Professor Emeritus, Ohio State U.

Distribution of Key Tickborne Diseases, 2012

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## Tick-Borne Zoonoses: Ohio*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Etiologic Agent(s)</th>
<th>Important Vector(s)</th>
<th>Important Reservoir(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky Mountain Spotted Fever</td>
<td><em>Rickettsia rickettsii</em></td>
<td><em>Dermacentor spp</em></td>
<td>Small mammals</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Rhipicephalus sanguineus</em>#</td>
<td></td>
</tr>
<tr>
<td>Ehrlichiosis</td>
<td><em>Ehrlichia chaffeensis</em></td>
<td><em>Amblyomma americanum</em></td>
<td>White-tailed deer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Canids?</td>
</tr>
<tr>
<td>Ehrlichiosis</td>
<td><em>E. ewingii</em></td>
<td><em>A. americanum</em></td>
<td>Canids</td>
</tr>
<tr>
<td>Anaplasmosis</td>
<td><em>Anaplasma phagocytophilum</em></td>
<td><em>Ixodes scapularis</em></td>
<td>Small mammals?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Livestock?</td>
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<tr>
<td>Babesiosis</td>
<td><em>Babesia microti</em></td>
<td><em>Ixodes scapularis</em></td>
<td>Small mammals</td>
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<tr>
<td>Lyme Disease</td>
<td><em>Borrelia burgdorferi</em></td>
<td><em>Ix. scapularis</em></td>
<td>Small mammals</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>Ix. pacificus</em></td>
<td>Birds</td>
</tr>
</tbody>
</table>

* Arizona

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### Emerging Tick-Borne Zoonoses: Ohio*

<table>
<thead>
<tr>
<th>Tick-borne Disease</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaplasmosis</td>
<td>2</td>
</tr>
<tr>
<td>Babesiosis</td>
<td>0</td>
</tr>
<tr>
<td>Ehrlichiosi</td>
<td>15</td>
</tr>
<tr>
<td>Ehrlichiosi/Anaplasmosi undetermined</td>
<td>0</td>
</tr>
<tr>
<td>Lyme disease</td>
<td>293</td>
</tr>
<tr>
<td>Rocky Mountain Spotted Fever</td>
<td>38</td>
</tr>
</tbody>
</table>

Source: Zoonotic Disease Program, Ohio Department of Health, April 2019
The Big Three
Ticks of Public Health Importance: Ohio

American dog tick, *Dermacentor variabilis*

Blacklegged ‘deer’ tick, *Ixodes scapularis*

Lone star tick, *Amblyomma americanum*

Photos courtesy the Tick Research Laboratory, Texas A&M University
http://tickapp.tamu.edu/
Ohio Tick Phenology-April 17

American dog ticks
Adults become active late March to early April

Lone star ticks
Active late April to early May when adults and nymphs emerge

Blacklegged ticks
Adults are currently active, nymphs out any day

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“Photo used with permission from Ticks and Tick-borne Diseases in Iowa, Iowa State University Extension”
Ohio Blacklegged Tick Life Cycle

*Nymphs infect naïve mice before larval emergence*

Two-Year Life Cycle

- **Adults**
- **Nymphs**
- **Larvae (not infected)**
- **Adults**

Become Active at Leaf-Fall

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Source: ODH Zoonoses Disease Program
Tick Life Cycle: **Three Hosts**

Represents Most Common of 900 Tick Species

May take 1, 2 or 3 years to complete cycle

Larvae

Nymphs

Adults

Female & Eggs

2,000-6,000

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Figure adapted from drawing by P.D. Teel, Texas A&M University
Tick Life Cycle: Three Hosts

Blacklegged Tick Larvae on a Mouse

Larvae on a White-Footed Mouse, *Peromyscus leucopus*

Co-Infections, exchange of pathogens

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Tick Life Cycle: *Three Hosts*

Adult Blacklegged Ticks on Deer

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Tick Attachment & Feeding

Ixodids (hard ticks)

Tick Saliva

- Cement deposition
- Anti-platelet aggregation
- Multiple anti-clotting factors
- Saliva impedes host response to infection
- Anti-inflammatory
- Anti-pain
- *Males*: facilitates mating
- All diseases transmitted via the saliva

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Emergence of *Ixodes scapularis* and *Borrelia burgdorferi*, the Lyme disease vector and agent, in Ohio

Peng Wang¹, Meaghan N. Glowacki¹,², Armando E. Hoet²,³, Glen R. Needham⁴, Kathleen A. Smith⁵, Richard E. Gary⁵* and Xin Li¹*

¹ Department of Veterinary Biosciences, The Ohio State University, Columbus, OH, USA
² Department of Veterinary Preventive Medicine, The Ohio State University, Columbus, OH, USA
³ Division of Epidemiology, The Ohio State University, Columbus, OH, USA
⁴ Department of Entomology, The Ohio State University, Columbus, OH, USA
⁵ Ohio Department of Health, Columbus, OH, USA
Three-County Lyme Disease Scenario
Coshocton, Holmes, and Knox Counties - Ohio
2002 - 2011

Enzootic Lyme
*Borrelia burgdorferi* in blacklegged ticks and white-footed mice

Data Source: Ohio Disease Reporting System
Map Created By: Bob Brems, MPH, January 24, 2012

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ODH Zoonotic Disease Program
6.1% of 530 nymphs and adults were positive for the *Borrelia burgdorferi flaB* gene ranging from 36-390,000 copies per tick.

2/10 (20%) of field-captured *Peromyscus leucopus* were antibody positive for *B. burgdorferi*.

All three life stages were collected in the township, demonstrating that an established *Ixodes scapularis* population was present.
Examined ~200 heads collecting 29 *I. scapularis* from seven counties

Examined 548 deer heads from 36 counties, 98 heads from 25 counties were infested
Examined Deer Heads During Deer Gun Week in Ohio: 2011

98 deer heads, 25 counties with blacklegged ticks

DATA Summary

• 1,830 *I. scapularis* adults
• Examined 548 deer heads from 36 counties
• 18% of heads infested
• Avg. 16 ticks/head
• Some heads had >100 ticks

Deer heads, Ohio Department of Agriculture

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• Force Health Technology in the School of Aerospace Medicine, Wright-Patterson AFB.
• Used an optimized RT-PCR assay to survey Ohio ticks for Rickettsia, Borrelia and Ehrlichia.
• Significant challenge is obtaining positive controls for the RT-PCR.
• Multiple primer and probe sets were designed for a multiplex assay of DNA taken from field-collected specimens in and around WPAFB, and from Ohio. Verified identity using Next Generation Sequencing.
Surveillance for Pathogens in Ticks

Deer gun season tick collections at OH meat processors

Tick ID

Multiplexed RT-PCR

Next-Generation Sequencing
Example of a Multiplexed RT-PCR Assay with Four Lyme-Positive Ticks

Multiplex: Coxiella burnetti, Borrelia burgdorferi, Rickettsia rickettsii

Ticks positive for Lyme disease, Borrelia burgdorferi
Tick# 14-197  Kingsville Township, Ashtabula County, OH, October 10, 2014
14-218  Tiverton Township, Coshocton County, OH, October 24, 2014
14-221  Tiverton Township, Coshocton County, OH, October 24, 2014
14-235  Tiverton Township, Coshocton County, OH, October 24, 2014
RT-PCR Results Performed at Wright-Patterson AFB - 2014

- **Ixodes scapularis** ticks tested
- **Borrelia burgdorferi** positive ticks
  - Ashtabula County 4/21 = 19% pos.
  - Coshocton County 14/48 = 29% pos.
- **Ehrlichia chaffeensis** positive
  - Amblyomma americanum
  - Scioto County 2/7 = 29% positive for E. chaffeensis

- Blacklegged ticks tested from 27/88 Counties
- 444 **Ixodes scapularis** collected or submitted to WPAFB

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Confirmed & Probable Ohio Lyme Cases Since Discovery of Established Blacklegged Tick Populations in 2010

Human Cases

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>44</td>
</tr>
<tr>
<td>2011</td>
<td>53</td>
</tr>
<tr>
<td>2012</td>
<td>67</td>
</tr>
<tr>
<td>2013</td>
<td>93</td>
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<tr>
<td>2014</td>
<td>119</td>
</tr>
<tr>
<td>2015</td>
<td>154</td>
</tr>
<tr>
<td>2016</td>
<td>160</td>
</tr>
<tr>
<td>2017</td>
<td>235</td>
</tr>
<tr>
<td>2018</td>
<td>293</td>
</tr>
</tbody>
</table>

Blacklegged Tick Populations Discovered in Coshocton & Ashtabula Counties

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Green dots are 119 cases in 2014 (sites of diagnosis)

Green dots are 293 cases in 2018


ODH Zoonoses Disease Program
Cases of Lyme Disease Reported to the Ohio Department of Health by Week of Illness Onset, Ohio, 2008-2017, n=1,063

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2017 Lyme Disease Positive Dogs – 2,251

© G.R. Needham, The Ohio State University

CAPCVET.ORG
Lone Star Tick: Becoming more widely distributed, probably by migratory birds

Years: 2000-2010
938 from 68 of 88 counties

ODH Zoonotic Disease Program

http://www.birdlife.org/

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2018: *Ehrlichia* Positive Dogs – 3,216

>21% *Ehrlichia* positive

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American Dog Tick, *Dermacentor variabilis*

**Most common Ohio tick**

< 2% of adult dog ticks carry Rocky Mt. Spotted Fever

Adult Female
American dog tick

Adult Male
American dog tick

Female after 11 days of feeding

Photo credit: Ticks and Tick-borne Diseases in Iowa, Iowa State University Extension

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Rocky Mt. Spotted Fever
2018 Ohio Cases (green dots)
Compared to Incidence 2008 – 2017

38 Human RMSF Cases

https://www.cdc.gov/rmsf/symptoms/index.html

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Courtesy Lynn Denny, MPH, Epidemiologist
ODH, Bureau of Infectious Disease
Human RMSF Cases in Ohio: 2003-2018

Not an Emerging TBD

Range of 9-37 cases
Tick Bite & Disease Prevention

- Apply Tick Repellent
- **Tuck Pants in Socks/Shirt in Pants**
- **Tick-Check** frequently, daily at least
- Remove attached/crawling ticks
- **Sample** for ticks by ‘dragging’
- Test dogs, use anti-tick veterinary-recommended products for dogs & cats
- **Vaccinate dogs**
- Create a **Tick-Safe Zone**

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Landscaping & Yard Management
Private Property, Parks

- 3’ mulch border
- Leaf litter removal & mowing
- Open canopy
- Apply acaricide to mulch & grass
- Bird feeders
- Treat/vaccinate pets
- Tick jar
- Wire flag tick alert
- Tick-check pets & people.
• Shower Time Tick-Check Within 2 Hrs

• Remove and save attached/crawling ticks

Tickencounter.org

© G.R. Needham, The Ohio State University
Tick Bite & Disease Prevention

• Toilet Time Tick-Check Before Going Home

• Remove and save attached/crawling ticks

tickencounter.org
Tick-Myth Busters

• MYTH: Ticks jump from trees onto passing hosts
• TRUTH: Rarely found higher than your knees on plants, blacklegged ticks do not have eyes, so how would they ‘time their jump’.

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MYTH: Hot match, fingernail polish, rubbing alcohol or petroleum jelly cause ticks to back out.

TRUTH: None of them work, they may be dangerous and delay removal, increasing risk of disease transmission.

Tick Removal

- **Grasp** tick as close to skin as possible (tweezers).
- **Pull** with even pressure away from the skin.
- **Disinfect** site.
- **Save** tick for identification.
Dog Tick Removal from Dr. Needham
Same for Pets

Pro-Tick Remedy
Tick Attachment Site Preferences on Humans

Blacklegged tick:  
A. Ixodes scapularis

American dog tick:  
B. Dermacentor variabilis

Source: Tick Management Handbook, CDC
Kirby Stafford, CT

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Tick-Borne Disease Emergence: *Ohio*

- **Not Emerging**: Rocky Mt. spotted fever
- **Emerging**:
  - **Lyme Disease in people and dogs**
    - **Lyme Disease**
      - Human Lyme cases increased from 44 (2010) to 293 (2018)
      - Canine Lyme cases increased from 784 (2013) to 5,180 (2018)
  - **Ehrlichioses**
    - Canine ehrlichiosis increased, 626 (2012) to 3,216 (2018)

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• **Lone star ticks**: becoming more widespread. Most of the disease pressure appears to be on dogs in southern counties based on in-clinic testing by veterinarians.

• **Blacklegged ticks**: In 2010, established populations found in 2 counties. In 2011 expanded to 25 counties. Now detected in at least 67 of 88 counties and becoming more widespread.

Percentage of *Borrelia burgdorferi*-infected ticks increased from 6 to 29% between 2010 and 2014 in Tiverton Township.
Do we have a ‘Big Tick’ problem?

DOC SLICES 14-POUND TICK FROM WOMAN’S BACK!

Dr. Robert Franck thought Kristin Gillon was being squeamish when she asked him to look at the “bug bite” on her back but he understood what the poor woman was talking about when she took off her overcoat — revealing a 14-pound tick!

“As God is my witness you could have knocked me over with a feather,” the 68-year-old physician told medical reporters in Brussels, Belgium. “The damn thing looked like a garbage bag with legs and I was absolutely positively beside myself.

“Being a doctor, I tried to stay calm and sound like a professional. But all I could say was, ‘My goodness. Is that real?’ As it turned out, the tick was not only real, it had been on her back for the past five years.

“She said she had been too frightened and embarrassed to do anything about it until it got too heavy to carry.

“That’s when she asked me to take it off. I really didn’t want to touch it — but I did.”

Miss Gillon said her mite-twisting nightmare began during a stroll down a nature trail in August 1987. At the end of the hike she found a dozen tiny ticks on her clothes.

And even though she gingerly picked them off and flung them down the toilet, one had already embedded itself in her back — and she didn’t know it.

“A month or so later I happened to see the tick while I was checking my back in a bathroom mirror,” said the 68-year-old woman.

“I’m scared of bugs and just seeing it there made me shudder. I should have seen a doctor right then and there but I didn’t want to think about it. I convinced myself that it would crawl away by itself. I put it out of my mind altogether.

“That was easy in the beginning when the tick was still small. When it got bigger, I just had to tell myself to be afraid to do anything about it.”

Miss Gillon was forced to rethink her position when the tick got so heavy she couldn’t stand it any longer. Reluctantly, she made an appointment with Dr.
We have a big problem with small ticks

Blacklegged tick nymphs are active in the summer

Save ticks in alcohol/hand sanitizer in a baggie
http://www.tickencounter.org/
Thanks NACCHO & Ohio Dept. Health

grneedham@gmail.com