How IPM Can Help Keep Children Safe from Lyme Disease at Schools and in Suburban Communities
Webinar Details

• Welcome

• A recording of this webinar will be available within a week at

http://www.neipmc.org/go/ipmtoolbox
We Welcome Your Questions

- Please submit a question at any time using the Q&A feature to your right at any time.

- If you’d like to ask a question anonymously, please indicate that at the beginning of your query.
Webinar Presenters

Kathy Murray, Ph.D.
Maine Department of Agriculture, Conservation and Forestry, Augusta, ME
www.maine.gov/IPM | www.maine.gov/schoolipm

Andrew Li, Ph.D.
USDA
Outline

• Scope of the tick/Lyme disease problem
• IPM Resources for Schools
SOME QUESTIONS FOR YOU
The Scope of the Tick/Lyme Problem
<table>
<thead>
<tr>
<th>Tick species</th>
<th>Distribution</th>
<th>Diseases transmitted</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ixodes scapularis</em></td>
<td>Wide distribution in Eastern half of the U.S.</td>
<td>Lyme disease, anaplasmosis, babesiosis, and Powassan disease</td>
</tr>
<tr>
<td>Blacklegged tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ixodes pacificus</em></td>
<td>Along the Pacific coast of the U.S., particularly northern California</td>
<td>Anaplasmosis and Lyme disease</td>
</tr>
<tr>
<td>Western blacklegged tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Amblyomma americanum</em></td>
<td>Widely distributed in the southeastern and eastern United States.</td>
<td>Causative agents of human ehrlichiosis, tularemia, and southern tick-associated rash illness.</td>
</tr>
<tr>
<td>Lone star tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Amblyomma maculatum</em></td>
<td>Coastal areas of the U.S. along the Atlantic coast and the Gulf of Mexico</td>
<td>Ricketsia parkeri rickettsiosis, a form of spotted fever.</td>
</tr>
<tr>
<td>Gulf coast tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dermacentor variabilis</em></td>
<td>Widely distributed east of the Rocky Mountains. Also occurs in limited areas on the Pacific Coast</td>
<td>Tularemia and Rocky Mountain spotted fever.</td>
</tr>
<tr>
<td>American dog tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dermacentor andersoni</em></td>
<td>Rocky Mountain states and southwestern Canada from elevations of 4,000 to 10,500 feet.</td>
<td>Rocky Mountain spotted fever, Colorado tick fever, and tularemia.</td>
</tr>
<tr>
<td>Rocky Mountain wood tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Rhipicephalus sanguineus</em></td>
<td>Throughout the U.S.</td>
<td>Rocky Mountain spotted fever (in the southwestern U.S. and along the U.S.-Mexico border)</td>
</tr>
<tr>
<td>Brown dog tick</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Ixodes cookei</em></td>
<td>Throughout the eastern half of the U.S. and Canada</td>
<td>Powassan disease</td>
</tr>
<tr>
<td>Woodchuck tick</td>
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<td></td>
</tr>
<tr>
<td><em>Ornithodoros spp.</em></td>
<td>Throughout the western half of the U.S. and southwestern Canada</td>
<td>Tick-borne relapsing fever (Borrelia hermsii, B. parkeri, or B. turicatae)</td>
</tr>
<tr>
<td>Soft ticks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Blacklegged Tick
the vector of
Lyme disease

✓ Erythema migrans (EM) or "bull's-eye" rash
✓ Facial or Bell's
✓ Severe headaches and neck stiffness
✓ Arthritis <pain and swelling in the large joints>
✓ Lyme carditis

~ 300,000 cases / year

Reported Cases of Lyme Disease by Year, United States, 1996-2016

*Borrelia burgdorferi

*National Surveillance case definition revised in 2008 to include probable cases; details at http://www.cdc.gov/nchphidss/mdss/casedef/lyme_disease_2008.htm
The burden of tick-borne illness, in terms of cost to both individuals and society, is astronomical and only getting worse.

**Annual Cost of Lyme disease in the United States**

**Annual Cases of Lyme Disease** The CDC raised case estimates based on national survey data by a factor of 10X in 2013

**Lyme Disease Cost Per Case**
Direct Medical Costs, Indirect Medical Costs, Lost Income, Lost Taxes, and Related Lyme Disease Costs Per Case and adjusted for 2014 dollars

**Total Annual Cost Burden**

$3,230,700,000


Jill Auerbach  
*Chairperson, Hudson Valley Lyme Disease Association  
Coordinator, Tick Research to Eliminate Diseases: Scientist Coalition*
Life cycle of the blacklegged tick

Confirmed cases by month of disease onset, 2001-2017
Distribution of *I. scapularis* ticks:

- 67.3% woods, 21.6% ecotone, 2% on the lawn
- 82% nymphs are within 3-m of the lawn edge with woods, stone walls, ecotone, etc.

Estimated 75% ticks are picked up outdoors at home.

School children are at high risk to tick bite and Lyme disease.
Confirmed Lyme disease cases by age and sex--United States, 2001-2017
QUESTIONS
Tick Management at Schools

1. Identify and Monitor Ticks
2. Develop Prevention & Action Plan
3. Employ multi-pronged tick management strategies
4. Record-keeping and evaluation
Landscape Management

- Vegetation management
  - Keep grass mown
  - Prune shrubs/trees to decrease shade and humidity
  - Widen trails
- Move playground structures away from wooded edges
- Install dry barrier (gravel or paved path) at playground/woods interface

Graphic courtesy of Dr. Kirby Stafford, CT Agricultural Experiment Station
Tick IPM Strategies (con’t)

• Discourage rodent activity on playgrounds
  – Seal stone walls
  – Close up spaces under sheds
  – Eliminate bird-feeders

• Redirect human activity away from infested areas (signage, education, barriers)

www.epa.gov/managing-pests-schools

www.maine.gov/schoolipm
Personal Protection

• Apply repellent to exposed skin
• Wear protective clothing
• Body checks
• Education and communication

Art by Hailey Mealey
haileyjaneco.com
Pesticides

**Perimeter Treatment**: Spray or granular application at wooded margins of play areas

- Commercially licensed applicator required

- 2-3 applications (in New England: ~ mid-May, mid-June, plus September if needed)

- Select pesticides with proven efficacy.

- Follow all applicable state and federal regulations.

Photo: TickEncounter.org

Good resource: www.TickEncounter.org (URI)
How are Maine Schools Managing Ticks?

Maine School IPM Coordinators Survey, 2017. 46 districts (~175 schools) responding

- Education
- Pesticide Application
- Discourage/restrict entry
- Mowing
- Nothing

Percentage
Are Schools Monitoring for Ticks?

Maine School IPM Coordinators Survey, 2017. 46 districts responding

How do you Monitor for Ticks?

- No Monitoring
- Dragging
- Track # of Ticks Removed from Students by School Nurse
- Track # of Parent Complaints

Percentage: 0.5, 0.4, 0.3, 0.2, 0.1, 0.0
Effective School IPM is a Team Effort

Nurse: Diagnosis, tick removal, communication, education

IPM Coordinator is the Team Captain

Contracted pest Service: monitoring, control communication

Business Manager: Service contracts, budgeting

Maintenance Staff and Grounds Keepers:
Turf and Grounds Maintenance

Students, Teachers, Coaches: education, tick avoidance, personal protection

Office Staff: communication, records, scheduling
Engage School Nurses in Tick IPM

NE School IPM Working Group
www.neipmc.org/schools
Why School Nurses?

• First-responders for health-threat pests

• Trained to use evidence-based practices

• Leaders and educators

• Strong Networks
Needs Assessment: What do School Nurses Want?

On-line Survey
- 827 participants
- 10 states

Video Conference
- Pre-conference survey: 46 participants
  - 8 states
- Conference: 27 participants
  - in 5 states

Findings and Recorded Conference
www.maine.gov/schoolipm
Q3: How do you view pest risk concerns in your school(s)?

- Answered: 827    Skipped: 0

On a scale of 1 (low) to 3 (high) ticks and mosquitoes are of highest concern.
What Do School Nurses Need?

• Concise pest-specific information packets
  – Clearly written protocols
  – Action/decision guides (eg flowcharts)
  – Communication tools (eg sample parent letters and staff memos)
  – Web-based materials

• Training
  – Webinars
  – On-line self-paced modules
Pest-Specific Guide Sheets

- Ticks
- Mosquitoes
- Head Lice
- Stinging Insects
- Rodents
Tick Monitoring and Response Action Chart for Schools

Tick found attached to a person’s skin?

- Yes
  - Identify tick species using reference images or an expert. Is it a disease vector species?
  - No
    - Report incident to parents, provide information on tick-borne illnesses, and advise them to monitor for and seek medical attention if symptoms develop. If parents wish to have tick tested for disease, send it home in a labeled zipper-lock bag containing a slightly damp paper towel.
  - Yes
    - Properly remove tick. Identify tick species using reference images or an expert. Is it a disease vector species?
      - No
        - Wash the bite and your hands with soap and water. Apply antiseptic to the bite if desired. Keep a detailed record of the incident.
        - Yes
          - Keep monitoring for ticks on school grounds. Use mowing, pruning and other landscaping practices to reduce tick habitat. Educate students, parents and staff to promote personal protection including daily tick checks, use of repellents, and avoidance of tick habitats. Use signage, fencing and education to keep people out of tick habitat.

- No
  - Identify tick species using reference images or an expert. If it is a vector species, record the common name of the tick and date found. If possible, record the approximate location on the school grounds where tick was found. Continue monitoring for ticks and promote personal protection, avoidance, and effective landscape modifications to reduce tick habitat on campus.
  - Properly remove tick. Identify tick species using reference images or an expert. Is it a disease vector species?
    - No
      - Wash the bite and your hands with soap and water. Apply antiseptic to the bite if desired. Keep a detailed record of the incident.
      - Yes
        - Keep monitoring for ticks on school grounds. Use mowing, pruning and other landscaping practices to reduce tick habitat. Educate students, parents and staff to promote personal protection including daily tick checks, use of repellents, and avoidance of tick habitats. Use signage, fencing and education to keep people out of tick habitat.
    - Yes
      - Report incident to parents, provide information on tick-borne illnesses, and advise them to monitor for and seek medical attention if symptoms develop. If parents wish to have tick tested for disease, send it home in a labeled zipper-lock bag containing a slightly damp paper towel.

- Report tick incident to integrated pest management coordinator or other designated staff according to school’s pest reporting protocol. Keep detailed records. Review records periodically with school’s IPM team and adjust practices if needed to minimize tick encounters and risks of tick-borne illness.

Adapted from ‘Found a Tick- Now What?’: Nolan Fernandez/Mandy Koska, Stephen Rich Lab University of Massachusetts
Communication and Outreach Tools

- Wallet cards
- Tick “spoons” and kits
- Posters
- Sample memos
Outreach to School Nurses

• **National School Nurse Association**
  - Annual Conference
  - Social media and e-news bulletins

• **State and local school nurse conferences**
Updated free Training Module for School Nurses

- Tick-borne Illness: Prevention, Assessment and Care [2019]  
  https://www.pathlms.com/nasn/courses/10995
- 1.25 CNE credits for nurses
IPM Resources for Schools

• NE IPM Center: neipmc.org/schools. Guidelines, posters, wallet cards, fact sheets and more

• IPM Institute: PestDefenseforHealthySchools.com certificate training modules

• eXtension: iSchoolPestManager.org. Free training modules and searchable repository of resources

• US EPA: www.epa.gov/managing-pests-schools. Webinars and resources
QUESTIONS
USDA Areawide Tick Control Project (2016–2021):

Preliminary research results
Tick Management Handbook

A integrated guide for homeowners, pest control operators, and public health officials for the prevention of tick-associated disease

Prepared by:
Kirby C. Stafford III
Chief Scientist
The Connecticut Agricultural Experiment Station, New Haven

Produced as part of the Connecticut community-based Lyme disease prevention projects in cooperation with the following Connecticut health agencies:
The Connecticut Department of Public Health
The Westport Weston Health District
The Torrington Area Health District
The Ledge Light Health District

Funding provided by
The Centers for Disease Control and Prevention
The Connecticut Agricultural Experiment Station

Limited number of tick control tools available

- Area spray of pesticides: **synthetic- & bio-pesticides**
- Host-targeted control (immature ticks): **Tick tube, Bait box**
- Host-targeted control (adult ticks): **4-Poster**
Area application of acaricides & biopesticides

Table 4. Acaricides with products labeled for the control of ticks in the residential landscape.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Some brand or common names*</th>
<th>Chemical type and usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bifenthrin</td>
<td>Talstar®</td>
<td>Pyrethroid insecticide. Available as liquid and granular formulations. Products available for homeowner use and commercial applicators.</td>
</tr>
<tr>
<td></td>
<td>Ortho® product</td>
<td></td>
</tr>
<tr>
<td>Carbaryl</td>
<td>Sevin®</td>
<td>Carbamate insecticide. A common garden insecticide for homeowner use, some products are for commercial use only.</td>
</tr>
<tr>
<td>Cyfluthrin</td>
<td>Tempo®</td>
<td>Pyrethroid insecticide. Available for commercial and homeowner use with concentrates and ready to spray (RTS) products.</td>
</tr>
<tr>
<td></td>
<td>Powerforce™</td>
<td></td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>Suspend®</td>
<td>A pyrethroid insecticide for commercial applicators.</td>
</tr>
<tr>
<td></td>
<td>DeltaGard® G</td>
<td></td>
</tr>
<tr>
<td>lambda-</td>
<td>Scimitar®</td>
<td>A pyrethroid insecticide for commercial applicators.</td>
</tr>
<tr>
<td>cyhalothrin</td>
<td>Demand®</td>
<td></td>
</tr>
<tr>
<td>Permethrin</td>
<td>Astro®</td>
<td>Pyrethroid insecticide. There are concentrates and ready to spray (RTS) products. Most are for homeowner use, a few are for commercial use only.</td>
</tr>
<tr>
<td></td>
<td>Ortho® products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bonide® products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tengard® SFR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>Pyrethrin</td>
<td>Pyreneone®</td>
<td>Natural pyrethrins with the synergist piperonyl butoxide (PBO) or insecticidal soap provide limited tick control. A combination of pyrethrin and PBO with either insecticidal soap or silicon dioxide (from diatomaceous earth) was found effective against ticks in one trial.</td>
</tr>
<tr>
<td></td>
<td>Kicker®</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organic Solutions All</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crop Commercial &amp; Agricultural</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multipurpose Insecticide®</td>
<td></td>
</tr>
</tbody>
</table>
Spray application of natural pesticides can quickly suppress and maintain control of both the blacklegged tick and the lone star tick populations at relatively low concentrations.
Previous studies indicate that entomopathogenic fungi can suppress host-seeking deer tick populations.

- Reduced tick abundance 55-84% on lawn and woodland plots.
- Reduced tick abundance 87-96% 3 weeks posttreatment 53-74% % 5 weeks posttreatment.

**Met52 EC**

- **ACTIVE INGREDIENT**
  - *Metarhizium anisopliae* Strain F52 11.0%
- **OTHER INGREDIENTS**
  - 89.0%
- **Total**
  - 100.0%

- Contains 5.5 x 10^9 Colony Forming Units (CFU)/gram of Met52 EC based on 5 x 10^6 viable conidia per gram of active ingredient.
- Contains petroleum distillates.
ARS “4-Poster”
Deer Treatment Bait Station

To control ticks feeding on white-tailed deer

An ARS-patented “4-poster” device that lures (with food!) deer so that they get tick-killing pesticide transferred to their heads, necks and ears while feeding at the device.
Use of “4-Poster” leads to 60–80% reduction in tick population

John Carroll / USDA-ARS; Gibson Island, MD

Sustained Control of Gibson Island, Maryland, Populations of *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) by Community-Administered 4-Poster Deer Self-Treatment Bait Stations

John F. Carroll, 1 J. Mathews Pound, 2 J. Allen Miller, 2 and Matthew Kramer 2

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**Abstract**

In 1997, a community request was received to develop a 4-Poster Deer Self-Treatment Bait Station (4-Poster station) as a part of the community-based approach to tick control. The treated site was the southeastern corner of Gibson Island, Maryland, where the black-tailed deer (Odocoileus hemionus) population was large and continues to be so to this day. In May of 1997, one 4-Poster station was placed on the island to determine its effectiveness in tick control. The station was maintained until 2008 when it was replaced by another. The untreated site was located on the eastern shore of the island, about 33 km from the treated site. The untreated site was unmonitored by community personnel. The ticks were monitored by the USDA-ARS Entomology Research Program through 2006. The population of *I. scapularis* and *A. americanum* nymphs was monitored on the island from 1998 to 2006. The mean number of nymphs per tag was calculated for each year and the results from both sites were compared. The results indicated that the mean number of ticks per tag was significantly lower on the treated site than on the untreated site. The data suggest that the 4-Poster station has been effective in reducing the tick population on the island.
Non-toxic food blocks

Wick with 3 mls of acaricide

- **Dolan et al. 2004**
  - 3-year study in Connecticut.
  - Reduced *Borrelia* infection in white-footed mice by 53%.
  - Reduced questing adults by 77%.
  - Also reduced *Borrelia* infection rate in ticks (31% vs 47%).

- **Schulze et al. 2017**
  - 2-year study in New Jersey.
  - Reduced host-seeking nymphs by 87.8% at 1 year post intervention.
  - by 97.3% at 2 year post intervention.

- **Dolan et al. 2017**
  - A study in New Jersey.
  - Reduced nymphal and larval tick burdens on small mammals by 76% and 77%.
1. Davis Force Park (Bait box + Met52)
2. Centennial Park (Untreated Control)
3. Cedar Lane Park (4-Poster + Bait box)
4. MPEA (4-Poster + Bait box)
5. Blandair Park (4-Poster + Bait box + Met52)
6. Rockburn Park (4-Poster + Bait box + Met52)
7. Wincopin Trail (Bait box + Met52)
Residential neighborhood
Recruitment of Homeowner Participation

Be part of the research!

Tick Sampling:

Tick sampling is done to monitor the tick numbers and vegetation in the area. We will be using a flagging method to cover the ground vegetation. We will be conducting our research at herbicide-treated sites.

Mice Study:

White-footed mice are the primary hosts of Lyme disease. We are interested in the status of the population. We only use traps that include Animal Care and Use Certification.

Meet the Team:

Dr. Andrew Li: Andrew is a Professor in the Department of Environmental Science and Policy and is an expert in the field of ecology. He is working on developing new methods for controlling tick populations.

Dr. Erik Machtens: Erik is a Postdoctoral Fellow in the Department of Environmental Science and Policy. He is conducting research on the behavior of ticks in different environments.

Phil Korman: Phil is a master's student in the Department of Environmental Science and Policy. He is working on developing new methods for controlling tick populations.

Grace Hennell: Grace is a graduate student in the Department of Environmental Science and Policy. She is conducting research on the behavior of ticks in different environments.

Patrick Rodka: Patrick is an undergraduate student in the Department of Environmental Science and Policy. He is working on developing new methods for controlling tick populations.

Throughout the project:

- Be patient.
- Be consistent in the area.
- Expect to see ticks.
- Sample at least once a month.
- Be sure to wear clothing that covers your body.
- Set up every tick trap in the area.
- Check mouse traps in the morning and evening.
- Keep your eyes open for any unusual tick activity.

If you have any questions, please contact us at 123-456-7890.
Treatment & mouse/tick sampling
- Bait box placement
- Tick sampling
- Mouse trapping
Tick and mouse sampling
### Lyme Infection Status

Comparison of *Borrelia burgdorferi* infection in *Ixodes scapularis* individuals removed from mice and individuals questing in 2017

<table>
<thead>
<tr>
<th>Park</th>
<th>n=</th>
<th>infected adults</th>
<th>n=</th>
<th>infected nymphs</th>
<th>n=</th>
<th>total infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL</td>
<td>2</td>
<td>0.0</td>
<td>8</td>
<td>0.00</td>
<td>10</td>
<td>0.0</td>
</tr>
<tr>
<td>CL</td>
<td>8</td>
<td>50.00</td>
<td>11</td>
<td>18.18</td>
<td>19</td>
<td>31.58</td>
</tr>
<tr>
<td>CT</td>
<td>4</td>
<td>25.00</td>
<td>15</td>
<td>20.00</td>
<td>19</td>
<td>21.05</td>
</tr>
<tr>
<td>DF</td>
<td>2</td>
<td>0.0</td>
<td>12</td>
<td>25.00</td>
<td>12</td>
<td>25.00</td>
</tr>
<tr>
<td>MPEA</td>
<td>8</td>
<td>12.50</td>
<td>18</td>
<td>5.56</td>
<td>26</td>
<td>7.69</td>
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<tr>
<td>RB</td>
<td>9</td>
<td>11.11</td>
<td>49</td>
<td>12.24</td>
<td>58</td>
<td>12.07</td>
</tr>
<tr>
<td>WT</td>
<td>9</td>
<td>0.00</td>
<td>54</td>
<td>0.00</td>
<td>63</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>42</strong></td>
<td><strong>3.38</strong></td>
<td><strong>167</strong></td>
<td><strong>7.25</strong></td>
<td><strong>207</strong></td>
<td><strong>9.18</strong></td>
</tr>
<tr>
<td><strong>MEAN</strong></td>
<td></td>
<td><strong>14.09</strong></td>
<td></td>
<td><strong>11.57</strong></td>
<td></td>
<td><strong>13.91</strong></td>
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</tbody>
</table>

### *B. burgdorferi* infection (%) in *I. scapularis* removed from *Peromyscus* in 2017

<table>
<thead>
<tr>
<th>Park</th>
<th>n=</th>
<th>infected nymphs</th>
<th>n=</th>
<th>infected larva</th>
<th>n=</th>
<th>total infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL</td>
<td>17</td>
<td>94.12</td>
<td>77</td>
<td>28.57</td>
<td>94</td>
<td>40.43</td>
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<tr>
<td>CL</td>
<td>15</td>
<td>26.67</td>
<td>59</td>
<td>30.51</td>
<td>74</td>
<td>29.73</td>
</tr>
<tr>
<td>CT</td>
<td>6</td>
<td>50.00</td>
<td>41</td>
<td>39.02</td>
<td>47</td>
<td>40.43</td>
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<tr>
<td>DF</td>
<td>31</td>
<td>48.39</td>
<td>190</td>
<td>53.68</td>
<td>221</td>
<td>52.94</td>
</tr>
<tr>
<td>MPEA</td>
<td>4</td>
<td>25.00</td>
<td>59</td>
<td>40.68</td>
<td>63</td>
<td>39.68</td>
</tr>
<tr>
<td>RB</td>
<td>3</td>
<td>66.67</td>
<td>99</td>
<td>37.37</td>
<td>102</td>
<td>38.24</td>
</tr>
<tr>
<td>WT</td>
<td>3</td>
<td>33.33</td>
<td>2</td>
<td>50.00</td>
<td>5</td>
<td>40.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>79</strong></td>
<td><strong>53.16</strong></td>
<td><strong>527</strong></td>
<td><strong>41.75</strong></td>
<td><strong>606</strong></td>
<td><strong>43.23</strong></td>
</tr>
<tr>
<td><strong>MEAN</strong></td>
<td></td>
<td><strong>49.17</strong></td>
<td></td>
<td><strong>39.98</strong></td>
<td></td>
<td><strong>40.21</strong></td>
</tr>
</tbody>
</table>
### Pathogen infection (%) in *Peromyscus* captured using Sherman traps

<table>
<thead>
<tr>
<th>Park</th>
<th># of mice</th>
<th>B. burgdorferi</th>
<th>A. phagocytophilum</th>
<th>B. microti</th>
<th>B. miyamotoi</th>
<th># of mice</th>
<th>B. burgdorferi</th>
<th>A. phagocytophilum</th>
<th>B. microti</th>
<th>B. miyamotoi</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL</td>
<td>163</td>
<td>56.4</td>
<td>1.8</td>
<td>0</td>
<td>1.8</td>
<td>215</td>
<td>62.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CL</td>
<td>94</td>
<td>33.3</td>
<td>1.1</td>
<td>0</td>
<td>4.3</td>
<td>110</td>
<td>36.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CT</td>
<td>79</td>
<td>49.4</td>
<td>0</td>
<td>0</td>
<td>1.3</td>
<td>91</td>
<td>35.2</td>
<td>0</td>
<td>0</td>
<td>1.1</td>
</tr>
<tr>
<td>DF</td>
<td>151</td>
<td>70.7</td>
<td>33.8</td>
<td>0</td>
<td>1.3</td>
<td>163</td>
<td>75.5</td>
<td>15.3</td>
<td>0</td>
<td>1.8</td>
</tr>
<tr>
<td>MPEA</td>
<td>55</td>
<td>38.2</td>
<td>5.5</td>
<td>5.5</td>
<td>0</td>
<td>32</td>
<td>28.1</td>
<td>0</td>
<td>3.1</td>
<td>0</td>
</tr>
<tr>
<td>RB</td>
<td>70</td>
<td>52.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>43.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WT</td>
<td>8</td>
<td>37.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>48.2</td>
<td>6.0</td>
<td>0.8</td>
<td>1.2</td>
<td></td>
<td>43.7</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>620</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Met52 spray*
How about ticks feeding on mice?

Mouse Trapping in 2017
- Monthly from May to September 2017
- At each of the 7 areawide parks
- Each trapping effort consisted of two consecutive days of captures, with 72 traps at each park.
- After each mouse was ear tagged, tissue, blood and ticks were collected.

Results:
- Captured a total of 341 individual mice, 620 recaptures.
- Collected a total of 1,463 mouse ear tissue and blood samples.
- Collected 625 ticks from mice.
Andrew Yongsheng Li
Invasive Insect Biocontrol & Behavior Laboratory
Research Entomologist
andrew.li@ars.usda.gov
Phone: (301) 504-5401
Fax: (301) 504-5104
Room 201

10300 BALTIMORE AVENUE
BLDG 007 BARC-WEST
BELTSVILLE, MD 20705

Projects

Prevention of Arthropod Bites
In-House Appropriated (D)
Accession Number: 427865

Deployed War Fighter Protection Program (2018)
Interagency Reimbursable Agreement (I)
QUESTIONS
Some Questions for You
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• “Find a Colleague” site
  http://neipmc.org/go/colleagues
Archive of Today’s Webinar

• Today’s Webinar will be available to view **on demand** in a few business days.

http://www.neipmc.org/go/ipmtoolbox

• You can watch as often as you like.
Upcoming Toolbox Webinars

• Industrial Hemp IPM
  – May 16, 2019 at 1:00 pm

TO REGISTER:
https://www.northeastipm.org/ipm-in-action/the-ipm-toolbox/
Acknowledgements

This presentation was funded in part by the Northeastern IPM Center through Grant #2014-70006-22484 from the National Institute of Food and Agriculture, Crop Protection and Pest Management, Regional Coordination Program.
Acknowledgements

- National Association of School Nurses
- US Environmental Protection Agency
- IPM Institute of North America
- NE School IPM Working Group and National School IPM Steering Committee
- State and Regional School Nurses Associations
- NY State IPM Program
- Northeastern IPM Center
- Maine Department of Education
- Maine Department of Agriculture, Conservation and Forestry