3-28-2019


Alexandra Cumbie  
*Old Dominion University, acumb002@odu.edu*

Erin Heller  
*Old Dominion University, eheller@odu.edu*

Anna Phan  
*Old Dominion University, aphan001@odu.edu*

Zach Bement  
*Old Dominion University, zbeme001@odu.edu*

Eric Walters  
*Old Dominion University, ewalters@odu.edu*

*See next page for additional authors*

Follow this and additional works at: [https://digitalcommons.odu.edu/graduate_school](https://digitalcommons.odu.edu/graduate_school)

Recommended Citation  
[https://digitalcommons.odu.edu/graduate_school/1](https://digitalcommons.odu.edu/graduate_school/1)
Presenter and Co-Authors
Alexandra Cumbie, Erin Heller, Anna Phan, Zach Bement, Eric Walters, Holly Gaff, and Wayne Hynes
Role of avian hosts in spread and maintenance of *Borrelia burgdorferi* and *Rickettsia* spp. in *Ixodes* spp. collected off birds in southeastern Virginia

Alexandra Cumbie, Erin Heller, Zach Bement, Anna Phan, Eric Walters, Holly Gaff, and Wayne Hynes
Department of Biological Sciences, Old Dominion University, Norfolk, Virginia

---

**Background**

Most prevalent tick-borne diseases in Virginia:
- Lyme disease
- Spotted fever group rickettsioses

Birds play host to juvenile ticks and can move infected ticks over small and large distances.

**Research Questions**

1. What role do birds play in the maintenance and transmission of *Borrelia burgdorferi* in southeastern Virginia?
2. What *Rickettsia* spp. are found in *Ixodes brunneus*, a species that feeds exclusively on birds for all life stages?

**Methodology**

**Bird and Tick Collection**
- Mistnetting from 2012-2014 at various sites across southeastern Virginia

**Tick Identification**
- *Ixodes scapularis/Ixodes affinis* nymphal peak feeding activity overlaps with larval feeding
- *Ixodes* spp. nymphal peak feeding activity occurs during different times of the year; could contribute to maintenance of tick-borne pathogens year-round

**Rickettsia Identification**
- Real time assays: *Bb23S*, *Bb16S*, *BbSS(4,5)*
- 16S and/or 12S (2,3)

**References**


**Acknowledgements**

ODU Tick Team and the Avian Ecology Lab at ODU
Special thanks to: Amy Johnson, Alexis White, Ashley Morris, Annie Sabo, Dorothy Paine, Ally Lahey, Tyler Chavers, the Nature Conservancy for use of sites and the US National Tick Collection at Georgia Southern University for tick photographs.

**Funding**
- Old Dominion University, ODU’s Research for Undergraduates in Math and Sciences, and the Virginia Academy of Science

---

**Ixodes spp. Results**

288 *Ixodes* spp. collected from birds
- *Ixodes* species: *I. scapularis*, *I. affinis*, *I. brunneus*, and *I. dentatus*
- 6.94% (20/288) *B. burgdorferi* s.s.
- Of the 288 *Ixodes* spp., 75 were identified as *I. affinis*
- *Rickettsia* spp. (59 tested): 49.15%
- 25.33% *R. parkeri* (all 75 tested)
-Co-infection
- One *I. brunneus* was positive for both *B. burgdorferi* and *R. parkeri*

**Ixodes spp. Phenology**

**Table 1. Birds with *B. burgdorferi*-infected *Ixodes* spp.**

<table>
<thead>
<tr>
<th>Bird Species</th>
<th>Brown thrasher (Toxostoma rufum)</th>
<th>Carolina wren (Thryothorus ludovicianus)</th>
<th>Swamp sparrow (Melospiza georgiana)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory status</td>
<td>Resident</td>
<td>Resident</td>
<td>Migratory</td>
</tr>
<tr>
<td>Birds captured</td>
<td>75</td>
<td>186</td>
<td>15</td>
</tr>
<tr>
<td>Birds with ticks</td>
<td>27</td>
<td>76</td>
<td>5</td>
</tr>
<tr>
<td>Birds with <em>Ixodes</em> ticks</td>
<td>13</td>
<td>34</td>
<td>3</td>
</tr>
<tr>
<td>Birds with <em>B. burgdorferi</em>-infected <em>Ixodes</em> ticks</td>
<td>2</td>
<td>9</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2. Birds with *Rickettsia*-infected *Ixodes* spp.**

<table>
<thead>
<tr>
<th>Bird Species</th>
<th>Brown thrasher (Toxostoma rufum)</th>
<th>Carolina wren (Thryothorus ludovicianus)</th>
<th>Swamp sparrow (Melospiza georgiana)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migratory status</td>
<td>R</td>
<td>R</td>
<td>M</td>
</tr>
<tr>
<td>Birds captured</td>
<td>75</td>
<td>186</td>
<td>15</td>
</tr>
<tr>
<td>Birds with ticks</td>
<td>27</td>
<td>76</td>
<td>5</td>
</tr>
<tr>
<td>Birds with <em>Ixodes</em> ticks</td>
<td>13</td>
<td>34</td>
<td>3</td>
</tr>
<tr>
<td>Birds with <em>Rickettsia</em>-infected <em>Ixodes</em> ticks</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**Discussion**

**Role of birds in *B. burgdorferi* maintenance**
- Low prevalence of *B. burgdorferi*-infected *Ixodes* spp. from birds in southeastern Virginia
- Majority of *B. burgdorferi*-infected ticks came from resident bird species

**Role of birds in *Rickettsia* spp. maintenance**
- High prevalence of *I. brunneus* were positive for *Rickettsia* spp.
- Majority of *Rickettsia*-infected ticks came from migratory bird species
- Other ticks on same bird were not positive for *Rickettsia* spp.

**Tick Phenology**
- *Ixodes* spp. larval peak feeding activity occurs during different times of the year; could contribute to maintenance of tick-borne pathogens year-round
- *Ixodes* spp. nymphal peak feeding activity overlaps with larval feeding allowing for co-feeding transmission of pathogens to potentially occur