Determining the Location and Seasonality of Clinically Important Tick Species in Maryland

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Preceptors

- Maryland Department of Health and Mental Hygiene
  - Center for Zoonotic and Vector Borne Disease

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<table>
<thead>
<tr>
<th>Disease</th>
<th>Pathogen</th>
<th>Tick Vector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Babesiosis</td>
<td><em>Babesia microti</em></td>
<td><em>Ixodes scapularis</em> (Black-legged tick)</td>
</tr>
<tr>
<td>Lyme disease</td>
<td><em>Borrelia burgdorferi</em></td>
<td></td>
</tr>
<tr>
<td>Anaplasmosis</td>
<td><em>Anaplasma phagocytophilum</em></td>
<td></td>
</tr>
<tr>
<td>Ehrlichiosis</td>
<td><em>Ehrlichia chaffeensis,</em> <em>Ehrlichia ewingii</em></td>
<td><em>Amblyomma americanum</em> (Lone star tick)</td>
</tr>
<tr>
<td>Rocky Mountain spotted fever (RMSF)</td>
<td><em>Rickettsia rickettsii</em></td>
<td><em>Dermacentor variabilis</em> (Dog tick)</td>
</tr>
<tr>
<td>Tularemia</td>
<td><em>Francisella tularensis</em></td>
<td></td>
</tr>
</tbody>
</table>
Background

- Seasonality and life stage is important to consider in each species of tick
  - *A. americanum* can feed on humans at any stage of its life cycle, and is most active in late spring through summer
  - *D. variabilis* only feeds on humans in its adult form, and is active in late spring through summer
  - *I. scapularis* can feed on humans as a nymph and as an adult. Nymphs seek bloodmeals in the spring, and adults seek bloodmeals in the fall
- No formal tick surveillance system in Maryland
Maryland Department of Agriculture
Tick Identification Service (MDATIS)

• Passive surveillance, convenience sample
• Started in late 1990s, has been continuous though 2012
• Can be submitted year round
• Submitter notified of the tick species
• The submission form has a user-completed portion which is used to determine the geographic location where the tick was collected.
Purpose

• To expand the understanding of the geographic distribution and seasonal abundance of ticks that humans are likely to encounter in Maryland
  – Characterize data submitted through the MDATIS
  – Tick submissions data will be compared to a literature search for documented tick location
Methods

• Entered 2012 data into the MS Access database
• Analyzed MDATIS records from 2005 – 2012
• Determination of county of collection from the (MDATIS) records
• Literature search
SUBMITTER INFORMATION:

Name: 
Address: 
City: ____________ County: __________ State: _______ Zip: _______
Phone Number: Home: __________ Work: __________
Date Collected: __________ Location (Town) of Collection: 
Host: ( ) Human ( ) Pet, specify: __________ ( ) Other: __________
Bite Site: ( ) Leg ( ) Arm ( ) Trunk ( ) Head/Neck ( ) Unattached

____________________________

MDA USE ONLY

Degree of engorgement: ( ) Flat ( ) Partially Engorged ( ) Fully Engorged
Specimen condition: ( ) Live ( ) Dead (good) ( ) Dead (poor)
Life Stage: ( ) Larva ( ) Nymph ( ) Male ( ) Female

TYPE OF TICK

( ) Black-legged deer tick - Ixodes scapularis
( ) American dog tick - Dermacentor variabilis
( ) Lone Star tick - Amblyomma americanum
( ) Brown dog tick - Rhipicephalus sanguineus
( ) Winter tick - Dermacentor albipictus
( ) Other tick - ________________
( ) Other Arthropod: ( ) Louse ( ) Mite ( ) Flea ( ) Other ____________
Results

• 1027 submissions from 2005 through 2012
  – 17 (2%) ticks submitted not from the species studied
  – 47 (5%) non-tick submissions

• 916 tick submissions
  – 583 (64%) *A. americanum*
  – 165 (18%) *D. variabilis*
  – 213 (23%) *I. scapularis*
MDATIS tick submissions by year of collection (2005-2012)

- Amblyomma americanum
- Dermacentor variabilis
- Ixodes scapularis
- Total Submissions
A. americanum by year of collection (2005-2012)

- Amblyomma americanum Adult
- Amblyomma americanum Nymph
- Amblyomma americanum Larvae
- Amblyomma americanum Unknown

MDATIS Tick Submissions
D. variabilis by year of collection

- Dermacentor variabilis Adult
- Dermacentor variabilis Nymph
- Dermacentor variabilis Larvae
- Dermacentor variabilis Unknown
I. scapularis by year of collection

- Ixodes scapularis Adult
- Ixodes scapularis Nymph
- Ixodes scapularis Larvae
- Ixodes scapularis Unknown
Results

• 160 ticks of indeterminable geographic location omitted

• 756 tick submissions used in my analysis
  – 429 (57%) *A. americanum*
  – 146 (19%) *D. variabilis*
  – 181 (24%) *I. scapularis*
MDATIS tick submissions by county (2005-2012)
<table>
<thead>
<tr>
<th>County of Collection</th>
<th>MDATIS Tick Submissions</th>
<th>Found in literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allegany</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Anne Arundel</td>
<td>179</td>
<td>19</td>
</tr>
<tr>
<td>Baltimore</td>
<td>3</td>
<td>0</td>
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<tr>
<td>Baltimore City</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Calvert</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Caroline</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Carrol</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Cecil</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Charles</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Dorchester</td>
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<td>0</td>
</tr>
<tr>
<td>Frederick</td>
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<td>3</td>
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<tr>
<td>Garret</td>
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<td>1</td>
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<tr>
<td>Harford</td>
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<td>33</td>
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<td>Howard</td>
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<td>Kent</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Montgomery</td>
<td>11</td>
<td>6</td>
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<tr>
<td>Prince George's</td>
<td>86</td>
<td>13</td>
</tr>
<tr>
<td>Queen Anne's</td>
<td>9</td>
<td>2</td>
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<tr>
<td>Somerset</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>St. Mary's</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>Talbot</td>
<td>29</td>
<td>1</td>
</tr>
<tr>
<td>Washington</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Wicomico</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Worcester</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

*Anderson, Jennifer M. et al. (2006). Mammal diversity and infection prevalence in the maintenance of enzootic *Borrelia burgdorferi* along the western coastal plains of Maryland.*

*Hofmeister, Erik K. et al. (1999). Longitudinal study of infection with *Borrelia burgdorferi* in a population of *Peromyscus leucopus* at a lyme disease-enzoonotic site in Maryland.*


A. americanum found in literature

- Garrett
- Allegany
- Washington
- Carroll
- Harford
- Frederick
- Howard
- Baltimore
- Montgomery
- Cecil
- Kent
- Caroline
- Anne Arundel
- Queen Anne's
- Talbot
- Dorchester
- Wicomico
- Worcester
- Somerset

- A. americanum found in literature
- No A. americanum found in literature
A. americanum submitted to MDATIS
I. scapularis submitted through MDATIS
Limitations & Suggestions

• Tick identification service is a convenience sample, dependent on the public awareness of the service
  – Better advertising would help boost public awareness of the program

• Quality of data from user submitted form, errors associated with this type of data
  – Suggest modification of submission form “County of collection” field
Policy and Practice Implications

• Additional advertising for the MDATIS would allow for more counties with high tick prevalence to be identified
  – Counties that have particularly high numbers of submissions can be targeted for primary prevention campaigns

• Continued collaboration between the PHASE program, the Maryland DHMH, and the Maryland Department of Agriculture
  – Supplies an intern to the DHMH to work on projects that need attention, protected time
  – Helps intern complete requirements for the masters program
References


Hofmeister, Erik K. et al. Longitudinal study of infection with Borrelia burgdorferi in a population of Peromyscus leucopus at a lyme disease-enzoonotic site in Marland. American Journal of Tropical Medicine, 1999:60(4);598-609.
