Update on SCWDS Arthropod Surveys

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2 National Veterinary Services Laboratories, USDA-APHIS
SCWDS Arthropod Surveillance

USDA-APHIS-Veterinary Services Cooperative Agreement (FY2017)

- Cattle Fever Ticks in South Texas
- Tropical Bont Ticks in the Caribbean
- Tick Vectors of Piroplasmosis
- Culicoides in the Southeast
Objective: Determine wildlife species serving as hosts for *Rhipicephalus (Boophilus) annulatus* and *Rhipicephalus (Boophilus) microplus* in South Texas

- Surveys 2012 - present
  - 2012 & 2014: small mammals, mesomammals, birds
  - 2013: check stations feral swine, javelina, white-tailed deer
  - 2015: feral swine
Tick Surveys in South Texas
Deer and other wild ruminants

• Examining deer and other wild ruminants in South Texas
  • November 2016 & January 2017
  • December 2017 & January 2018
• 2016-2017
  • Five processing facilities
  • 342 hunter-harvested animals examined from 17 counties
# Texas Tick Surveys
## Year 1 findings

### November 2016 & January 2017

<table>
<thead>
<tr>
<th>Host species</th>
<th>n</th>
<th># infested with ticks</th>
<th>Tick species identified</th>
</tr>
</thead>
</table>
| White-tailed deer  | 324| 125 (39%)             | *Dermacentor albipictus*  
Dermacentor variabilis  
*Amblyomma maculatum*  
*Amblyomma mixtum*  
*Amblyomma inornatum*  
*Amblyomma sp.*  
*Ixodes tovari* |
| Nilgai             | 15 | 5 (33%)               | *Dermacentor variabilis*  
*Amblyomma mixtum*  
*Amblyomma sp.*  
*Anocenter nitens* |
| Axis deer          | 2  | 0                     |                                                            |
| Blackbuck          | 1  | 0                     |                                                            |
| Gemsbok            | 1  | 0                     |                                                            |

Upcoming surveys in December and January
Surveys for the tropical bont tick (A. variegatum) conducted in Vieques 2014-2016

- Focused on Vieques NWR
- Cattle egrets, mongoose, feral horses

Survey planned for November 2017 cancelled because of the impact of Hurricane Maria

To date, tropical bont ticks have not been found during the surveys
Surveys for Tick Vectors of Piroplasmosis

• During 2017, tick surveys on wild small mammals were conducted prior to international equestrian events as requested by USDA-APHIS-VS
  • Tryon International Equestrian Center (Tryon, NC) in preparation for the 2018 World Equestrian Games
  • Gulfstream Park (Hallandale Beach, FL) in preparation for the 2017 Caribbean Classic

• Surveys based on the risk assessment and surveys done at the Kentucky Horse Park in preparation for the 2010 World Equestrian Games
Surveys for Tick Vectors of Piroplasmosis
Tryon International Equestrian Center

June 2017
- Mesomammals: 370 trap nights
- Small mammals: 460 trap nights
- 11 tick drags over 1,100 m
  - Yielded 3 ticks

<table>
<thead>
<tr>
<th>Host species</th>
<th>n</th>
<th># infested with ticks</th>
<th>Tick species identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia opossum</td>
<td>21</td>
<td>9 (43%)</td>
<td>Pending</td>
</tr>
<tr>
<td>Raccoon</td>
<td>7</td>
<td>7 (100%)</td>
<td></td>
</tr>
<tr>
<td>Striped skunk</td>
<td>1</td>
<td>1 (100%)</td>
<td></td>
</tr>
<tr>
<td><em>Peromyscus</em> spp.</td>
<td>29</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

September 2017
- Mesomammals: 400 trap nights
- Small mammals: 400 trap nights
- 4 tick drags over 400 m
  - Yielded 0 ticks

<table>
<thead>
<tr>
<th>Host species</th>
<th>n</th>
<th># infested with ticks</th>
<th>Tick species identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia opossum</td>
<td>34</td>
<td>2 (6%)</td>
<td>Pending</td>
</tr>
<tr>
<td>Raccoon</td>
<td>13</td>
<td>7 (54%)</td>
<td></td>
</tr>
<tr>
<td>Eastern woodrat</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Hispid cotton rat</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><em>Peromyscus</em> spp.</td>
<td>9</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
SCWDS *Culicoides* Surveys
2007-2017

- CDC type black light traps
- Primarily August-Sept
- Natural areas
- 10-12 traps per site

336 sites, 10 states, ~8,200 trap nights
(Texas not pictured)

USDA-APHIS-VS funded project to document *Culicoides* spp. distributions
### SCWDS Culicoides Surveys 2007-2017

Aim to better define spatial variation in species composition across diverse physiographic regions.

<table>
<thead>
<tr>
<th>State/Region</th>
<th># of species</th>
<th>Top 5 Culicoides spp. by site presence percentage</th>
</tr>
</thead>
</table>
| Florida      | 33           | C. insignis (79%)
|              |              | C. edeni (40%); C. stellifer (36%)
|              |              | C. haematopotus (31%)
|              |              | C. furens (31%) |
| Southeast    | 42           | C. debilipalpis (85%)
|              |              | C. haematopotus (76%)
|              |              | C. stellifer (68%)
|              |              | C. paraensis (60%)
|              |              | C. hinmani (56%) |
| Texas        | 16           | C. sonorensis (100%)
|              |              | C. crepuscularis (80%)
|              |              | C. haematopotus, C. loughnani, and C. jamaicensis (60%) |
Long-term *Culicoides* and HD Monitoring

- Whitehall Experimental Forest (University of Georgia)
  - Piedmont region of Georgia
  - Natural and planted pine, mixed pine-hardwood, upland and bottomland hardwood habitats

*Culicoides* spp. Present in Light Traps July 2016-Aug 2017

To date, 25 species identified
Top Six *Culicoides* spp. present 2016-2017

*Whitehall Exp. Forest (Clarke Co, GA)*

**Spring**
- *C. stellifer*: 35%
- *C. haematopotus*: 36%
- *C. debilipalpis*: 4%
- *C. biguttatus*: 14%
- *C. spinosus*: 2%
- *C. travisi*: 30%
- All other spp.: 1%

**Summer/Fall**
- *C. stellifer*: 51%
- *C. haematopotus*: 30%
- *C. debilipalpis*: 4%
- *C. crepuscularis*: 8%
- *C. paraensis*: 2%
- *C. hinmani*: 4%
- All other spp.: 1%

EHDV-2 outbreak
Culicoides on the move?

From 2007-2017, 14 species of *Culicoides* have been identified outside of previously established ranges. Most notably, *C. insignis*.

**SCWDS Culicoides Survey Sites, 2007-2015**
Culicoides on the move?

In-range: Present at 71% (120/168) of sites
Out-of-range: Present at 11% (16/142) of sites
Update on 2017 Hemorrhagic Disease Activity in Wild Ruminants and SCWDS EHDV/BTV Research Activities

Mark G. Ruder, Clara Kienzle, Rebecca Poulson & David E. Stallknecht
Southeastern Cooperative Wildlife Disease Study
Department of Population Health
College of Veterinary Medicine
University of Georgia
SCWDS EHDV & BTV Diagnostics

• Virus isolation attempts on tissues submitted by state wildlife agencies and diagnostic labs
  • Primarily dead/moribund wild ruminants
    • Primarily spleen, lung, and/or blood
  • Isolates typed by neutralization or RT-PCR

J Plaxico, KDFWR
J Allen, NCWRC
2016 Virus Isolations by SCWDS

49 viruses isolated from deer in 12 states

<table>
<thead>
<tr>
<th>Virus</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHDV-1</td>
<td>1</td>
</tr>
<tr>
<td>EHDV-2</td>
<td>27</td>
</tr>
<tr>
<td>EHDV-6</td>
<td>6</td>
</tr>
<tr>
<td>BTV-2</td>
<td>1</td>
</tr>
<tr>
<td>BTV-3</td>
<td>10</td>
</tr>
<tr>
<td>BTV-13</td>
<td>1</td>
</tr>
<tr>
<td>BTV-17</td>
<td>3</td>
</tr>
</tbody>
</table>
2016 BTV-3 Outbreak Follow-up

1. Post-outbreak serology
   • Hunter-harvested deer in the area

2. Viral genome sequencing
   • Phylogenetic comparison with previous BTV-3 isolates
   • USDA-ARS (ABADRU)

3. *Culicoides* survey during outbreak
   • 12 trap nights mid-Sept 2016
   • Hardy County in area of outbreak

4. Experimental infection of WTD
<table>
<thead>
<tr>
<th>State</th>
<th>County</th>
<th>% (pos/n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WV</td>
<td>Hardy</td>
<td>15 (16/106)</td>
</tr>
<tr>
<td></td>
<td>Hampshire</td>
<td>2 (2/102)</td>
</tr>
<tr>
<td></td>
<td>Mineral</td>
<td>0 (0/2)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>0 (0/3)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>8 (18/213)</td>
</tr>
<tr>
<td>VA</td>
<td>Frederick</td>
<td>10 (2/20)</td>
</tr>
<tr>
<td></td>
<td>Shenandoah</td>
<td>12 (13/109)</td>
</tr>
<tr>
<td></td>
<td>Warren</td>
<td>0 (0/3)</td>
</tr>
<tr>
<td></td>
<td>Clarke</td>
<td>0 (0/12)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>0 (0/4)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10 (15/148)</td>
</tr>
</tbody>
</table>

CDC light traps (12 trap nights)
September 21-28, 2016
37 Culicoides collected
C. haematopotus (35)
C. sanguisuga (2)
BTV-3 experimental infection of WTD

Mild clinical disease, no mortality

Lorelei Clarke, unpublished
BTV-3 Outbreak Investigation

- Outbreak localized but caused significant mortality in deer
- Source of virus remains unclear
- Livestock involvement remains unclear
- Additional *Culicoides* surveys need to be performed in this region
- Experimental infection of WTD fawns (4-8 weeks old) resulted in efficient virus replication and mild clinical disease
  - No characteristic clinical pathology abnormalities and no humoral response could be detected at 12 dpi in two the two remaining fawns
  - Contact transmission suspected
2017 HD Submissions to SCWDS

As of October 6, 2017

192 submissions from 22 states

Number of Submissions by Week

<table>
<thead>
<tr>
<th>Week</th>
<th>Submissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-Jul</td>
<td>1</td>
</tr>
<tr>
<td>24-Jul</td>
<td>2</td>
</tr>
<tr>
<td>31-Jul</td>
<td>3</td>
</tr>
<tr>
<td>7-Aug</td>
<td>5</td>
</tr>
<tr>
<td>14-Aug</td>
<td>8</td>
</tr>
<tr>
<td>21-Aug</td>
<td>11</td>
</tr>
<tr>
<td>28-Aug</td>
<td>1</td>
</tr>
<tr>
<td>4-Sep</td>
<td>3</td>
</tr>
<tr>
<td>11-Sep</td>
<td>12</td>
</tr>
<tr>
<td>18-Sep</td>
<td>3</td>
</tr>
<tr>
<td>25-Sep</td>
<td>3</td>
</tr>
<tr>
<td>2-Oct</td>
<td>1</td>
</tr>
</tbody>
</table>

Species:
- White-tailed deer: 185
- Mule deer: 2
- Bighorn sheep: 1
- Elk: 1
- Cow: 1
- Domestic goat: 1
As of October 6, 2017

110 viruses isolated from WTD or cattle in 17 states

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>EHDV-1</td>
<td>2</td>
</tr>
<tr>
<td>EHDV-2</td>
<td>92</td>
</tr>
<tr>
<td>EHDV-6</td>
<td>8</td>
</tr>
<tr>
<td>BTV-2</td>
<td>1</td>
</tr>
<tr>
<td>Pending</td>
<td>7</td>
</tr>
</tbody>
</table>
Severe EHD outbreak extending along the Cumberland Plateau from Tennessee to Ontario.

2017 EHD Outbreak

<table>
<thead>
<tr>
<th>Virus</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHDV-2</td>
<td>88</td>
</tr>
<tr>
<td>EHDV-6</td>
<td>7</td>
</tr>
<tr>
<td>Pending</td>
<td>5</td>
</tr>
</tbody>
</table>

As of October 6, 2017
Epizootic Hemorrhagic Disease Reports 2017
As of October 10, 2017

Total # of cases reported: 4288
Northern Expansion of HD
The trend continues?

HD outbreaks continue to occur in the upper Midwest and Northeast

We need to better understanding potential drivers and the potential impact on northern deer populations

Stallknecht et al. 2015
**Objective:** Characterize variation in EHDV infection rates in *Culicoides sonorensis* feeding on infected WTD over the course of viremia.

- *C. sonorensis* allowed to feed at each time point
- Midges held 10 days at 25 C
- Virus isolation/titration on midges and deer
EHDV-2 Transmission Study
Deer-to-Culicoides

Deer 2

Deer 3

Deer 4

Deer 5

Deer 6

- Deer viremia
- % positive midges
EHDV-2 Transmission Study
Deer-to-Culicoides

- EHDV-2 midge infection rates track fluctuations in WTD viremia
- Low infection rates may still be significant in the field as the attack rate on WTD by *Culicoides* midges has been shown to be extremely high.
- Peak viremia is important for efficient EHDV-2 transmission
Acknowledgements

• Continued support from SCWDS member states

• Cooperative agreement
  • USDA-APHIS-VS

Multiple collaborators

• Numerous biologists, veterinarians and other staff at state wildlife agencies

• T Sturgill, E Ostlund & D Johnson (NVSL)

• ABADRU scientists and research staff

• SCWDS staff and students
Questions?