* Culicoides Biting Midges of the Southeastern United States

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* **Diptera > Ceratopogonidae > Culicoides** biting midges or “no-see-ums”

* 151 species known in North America, 1300+ worldwide (every continent except Antarctica)
* Taxonomically not well described - 31 subgenera, 38 species groups, and another 13% of species have not been categorized
* Tiny insects (1-3mm)

* Females take a blood meal to complete a gonotrophic cycle (most spp.)
* Mammals/birds usually primary hosts; many species have more specific host and microhabitat preferences
* Some species significant pests to people/livestock/wildlife, also vectors of disease
* Diptera > Ceratopogonidae > *Culicoides*
biting midges or “no-see-ums”

* Very diverse and occupy a wide variety of habitats/microhabitats
* Larval habitats include mud, saltmarsh, wet sand, tree holes, hollow cacti, decaying vegetation, manure, etc.
* Very group-/species-specific
* Medical Importance of *Culicoides*

* Bite irritation - welts, dermatitis, subsequent infections, and hypersensitivity reactions ("sweet itch" in horses, sheep)

* Transmit many arboviruses, protozoa, filarial parasites worldwide
  * African horse sickness - S. Europe, Africa, Asia
  * Schmallenberg virus - Europe
  * Oropouche virus - Trinidad, Panama, Brazil, Peru

* In North America, primarily of veterinary importance as vectors of bluetongue virus (BTV) and epizootic hemorrhagic disease virus (EHDV)

* BTV vectors in N. America:
  * *C. sonorensis*
  * Other possible vectors: *C. insignis, C. obsoletus, C. cockerellii, C. pusillus, C. debilipalpis, C. stellifer*, ?

* EHDV vectors in N. America:
  * *C. sonorensis?*
Bluetongue and Epizootic hemorrhagic disease viruses - BTV and EHDV

- genus Orbivirus

* Similar but genetically distinct viruses that cause same clinical symptoms termed hemorrhagic disease
* In N. America it is the most important viral disease of white-tailed deer
  * BTV infects many wild and domestic ruminants; great impact on sheep, high mortality rates
  * EHDV infects wild and domestic ruminants; greatest impact on deer, high mortality rates in certain regions
* Initial symptoms include depression, fever, respiratory distress, and swelling of head, neck, and tongue; later symptoms include lameness and emaciation, and sometimes death
* Enzootic in the SE; frequent disease, minimal symptoms, low mortality
  * Occurs seasonally: late summer/fall
Evidence of BTV spread

* Europe: pre 2006 BTV outbreaks restricted to the southern Mediterranean Basin countries
  * In 2006 BTV-8 detected for the first time in the Netherlands; it spread to Germany, Belgium, France, and Luxembourg—all areas that never had BTV outbreaks before
  * In 2007/2008 BTV-8 spread to Switzerland, Scandinavia, Czech Rep., UK and Spain
  * In subsequent years outbreaks continued and BTV-1, -6, -25, and -11 were found in central/northern/western Europe

* Similar recent incursions have occurred globally; Israel, Australia

* Culicoides surveillance in the Southeastern United States

* Determine Culicoides spp. present in the Southeast, including at selected sites where exotic BTV or EHDV have been detected.

* Mapping the current distribution of Culicoides in the Southeast, trying to identify changes in species distributions, and identifying Culicoides present at sites where exotic serotypes of BT and EHD viruses have been found.
* Surveillance Methods - adult midges

* 8-12 CDC miniature light traps per site
  * Equipped with UV fluorescent bulbs and ethanol-filled collection jars
* Traps remain active from late afternoon to early morning
* Most sites included state WMAs, parks, forests
  * Some private sites (often with livestock)
  * Sites proximal to BTV/EHDV outbreaks
* Trapping is conducted in the late summer to early fall
  * From 2007-2012 trapping was done year-round in central and south Florida.
Identification Methods

* All collections are sorted under dissecting microscope; *Culicoides* are separated and counted
* All identifications done by morphological characteristics; many slide-mounted
* Morphological identification of *Culicoides* is time-intensive and requires a high level of expertise

*Drop of water about the size of a quarter; a variety of *Culicoides* spp.*
* November 2007 to October 2015

<table>
<thead>
<tr>
<th></th>
<th>Field Work</th>
<th>Lab Work</th>
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<tbody>
<tr>
<td></td>
<td>Total Sites</td>
<td>Total Counties</td>
</tr>
<tr>
<td>Florida</td>
<td>178</td>
<td>58</td>
</tr>
<tr>
<td>S. Carolina</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>N. Carolina</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Tennessee</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Georgia</td>
<td>25</td>
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</tr>
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<td>Alabama</td>
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<td>Mississippi</td>
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<td>Louisiana</td>
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<td>22</td>
</tr>
<tr>
<td>Arkansas</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Missouri</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Texas</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>All States</td>
<td><strong>318</strong></td>
<td><strong>212</strong></td>
</tr>
</tbody>
</table>
SCWDS Culicoides Survey Sites 2007-2015

318 Sites in 11 States
Over 6,900 Trap-Nights
### Common *Culicoides* species in the Southeast U.S.

- Total *Culicoides* spp. to date: 55 spp.
- Total spp. from SE (not FL): 34 spp.
- Total Florida spp.: 32 spp.
- Trap efficiency: 60%

<table>
<thead>
<tr>
<th><em>Culicoides</em> sp.</th>
<th>Sites present</th>
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<tbody>
<tr>
<td><em>C. haematopotus</em>*</td>
<td>96%</td>
</tr>
<tr>
<td><em>C. stellifer</em></td>
<td>88%</td>
</tr>
<tr>
<td><em>C. debilipalpis</em></td>
<td>86%</td>
</tr>
<tr>
<td><em>C. arboricola</em></td>
<td>77%</td>
</tr>
<tr>
<td><em>C. paraensis</em></td>
<td>65%</td>
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<table>
<thead>
<tr>
<th>Florida</th>
<th><em>Culicoides</em> sp.</th>
<th>Sites present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>C. insignis</em>*</td>
<td>77%</td>
</tr>
<tr>
<td></td>
<td><em>C. edeni</em></td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td><em>C. stellifer</em></td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td><em>C. furens</em></td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td><em>C. haematopotus</em></td>
<td>29%</td>
</tr>
</tbody>
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* Proposed as possible vectors of BTV/EHDV
** Known vector of BTV/EHDV
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<tbody>
<tr>
<td><em>C. beckae</em></td>
<td>Eastern seaboard of N. America</td>
<td>Mississippi, Louisiana</td>
<td>New York to Alabama</td>
<td>West along Gulf Coast</td>
</tr>
<tr>
<td><em>C. alachua</em></td>
<td>Inland N. Florida</td>
<td>Alabama, Georgia, south Florida</td>
<td>Florida, S. Carolina</td>
<td>West along Gulf Coast</td>
</tr>
<tr>
<td><em>C. oklahomensis</em></td>
<td>Neotropical, Central America; SW U.S.</td>
<td>Arkansas, Alabama</td>
<td>California to Guatemala and Mississippi</td>
<td>North and East along Gulf Coast</td>
</tr>
<tr>
<td><em>C. neopulicaris</em></td>
<td>Neotropical; Central America</td>
<td>Alabama</td>
<td>Texas, Louisiana to Costa Rica</td>
<td>North and East along Gulf Coast</td>
</tr>
<tr>
<td><em>C. barbosai</em></td>
<td>Neotropical; Caribbean</td>
<td>Georgia, Louisiana</td>
<td>Florida to Ecuador</td>
<td>North and West</td>
</tr>
<tr>
<td><em>C. insignis</em>*</td>
<td>Neotropical; Caribbean</td>
<td>Mississippi, Louisiana, FL counties</td>
<td>Argentina to Alabama, Georgia</td>
<td>North and West</td>
</tr>
<tr>
<td><em>C. sonorensis</em>*</td>
<td>Scattered across N. America</td>
<td>Manatee Co., Sarasota Co., FL; Clarke Co., AL; Newberry Co., SC</td>
<td>Across N. America</td>
<td>Uncommon in the Southeast; no evidence of change</td>
</tr>
</tbody>
</table>

*subgenus Avaritia
**known vectors of BTV
* Subgenus Monoculicoides > Culicoides sonorensis

* Primary vector of BTV in North America.
* Pre-2000, considered a subsp. of C. variipennis--(the variipennis complex)
* Now, classified as 3 distinct species: C. sonorensis, C. variipennis, C. occidentalis
* Range includes most of North America; while common in the West, east of the Mississippi River it is found in scattered populations, usually associated with livestock

*Culicoides sonorensis* presence across all survey sites (2007-2014)

![Map showing the presence of Culicoides sonorensis across survey sites in the southeastern United States from 2007 to 2014. The map highlights 10 sites marked with purple stars.]
* C. variipennis (complex) and C. insignis ranges compared - two vectors of BTV

* Subgenus Hoffmania > *Culicoides insignis*

* **Proven vector of BTV**
  * Thought to be the primary vector in areas where *C. sonorensis* is not present

* Neotropic range from Argentina, north through the Caribbean to Florida

* Can be locally abundant

* Often associated with livestock

* Also found in a variety of other habitats: mangrove swamps, tidal mud flats, drainage ditches, sugarcane fields, etc.

* Frequent pest of livestock; bites can cause generalized skin reactions
*Culicoides insignis*, historical range

From Blanton and Wirth 1979. The Sandflies (Culicoides) of Florida (Diptera: Ceratopogonidae).

Borkent and Grogan’s Catalog of New World Biting Midges North of Mexico (2009) listed *C. insignis* as recorded from Florida, Georgia, and Alabama.

Fig. 78. Florida distribution of *Culicoides insignis*.

SCWDS Survey Sites with *Culicoides insignis*


SCWDS Survey Sites with Culicoides insignis

- C. insignis 2007-2013
- All Survey Sites 2007-2014

Culicoides insignis distribution

[Map showing distribution of SCWDS survey sites with Culicoides insignis, with green dots for 2007-2013 and purple dots for all sites 2007-2014.]
* Some final thoughts

* *Culicoides sonorensis*, is uncommon and may not be the primary vector of BTV/EHDV in the Southeastern United States—especially in wildlife populations.

* *C. insignis* is becoming more widespread, and is also capable of transmitting BTV in the Neotropics.

* Some species of *Culicoides* appear to be undergoing range expansion and/or shifts, and their vector status in North America is unknown.

* The BTV/EHDV-*Culicoides* system is in flux, and will continue to make things interesting.
*Thank you!*

*If you have any questions or comments please contact me: svigil@uga.edu*

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*Thank you to all the SCWDS staff who have participated in this project over the past several years.*