Culicoides Biting Midge Surveys of the Southeastern United States

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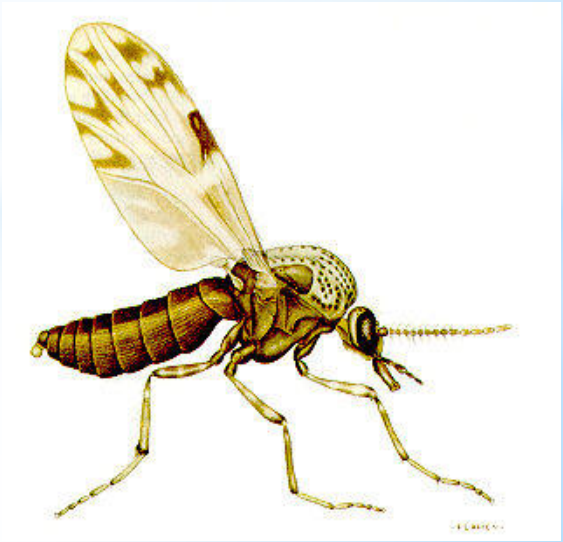


Georgia Mosquito Control Association Annual Meeting
October 16th 2013

SCWDS Exotic Arthropod Surveillance

* Conducted by the Southeastern Cooperative Wildlife Disease Study, University of Georgia through Cooperative Agreements with USDA-APHIS-Veterinary Services
* Cooperative Agreement is for Surveillance for Exotic Arthropods in the Southeast and includes (1) surveys for exotic arthropod ectoparasites on wildlife in the Southeast (2) surveys for *Culicoides spp.* in the Southeast, (3) surveys for vectors of equine piroplasmosis in south Texas, and (4) surveys for cattle fever ticks on wildlife in the quarantine zone in south Texas.

Culicoides surveillance in the SE United States - Objectives

- 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 also identifying *Culicoides* present at sites where exotic BT and EHD viruses have been found.

Image from http://www.culicoides.net

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

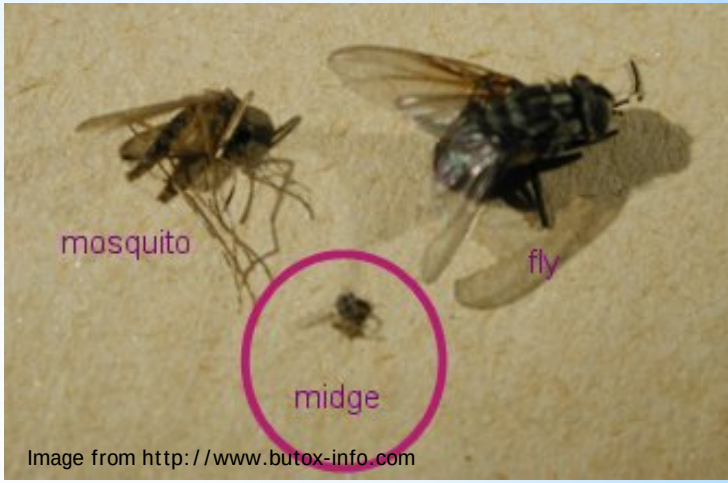


Image from http://www.butox-info.com

* 151 species known in North America, 1400+ worldwide
* Tiny insects (1-3mm), often not excluded by typical window screens, but deterred by wind
* Occupy a wide variety of habitats, usually associated with aquatic/semiaquatic, or damp
* Larval habitats include mud, wet sand, tree holes, hollow cacti, decaying vegetation, manure, etc.; often group-/species-specific
* 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

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
- 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, C. cockerellii, C. insignis, C. obsoletus, C. pusillus, ?*
- EHDV vectors in N. America:
  - *C. variipennis, ?*
- Other well-known diseases transmitted by *Culicoides* spp:
  - African horse sickness – S. Europe, Africa, Asia
  - Oropouche virus – Trinidad, Panama, Brazil, Peru

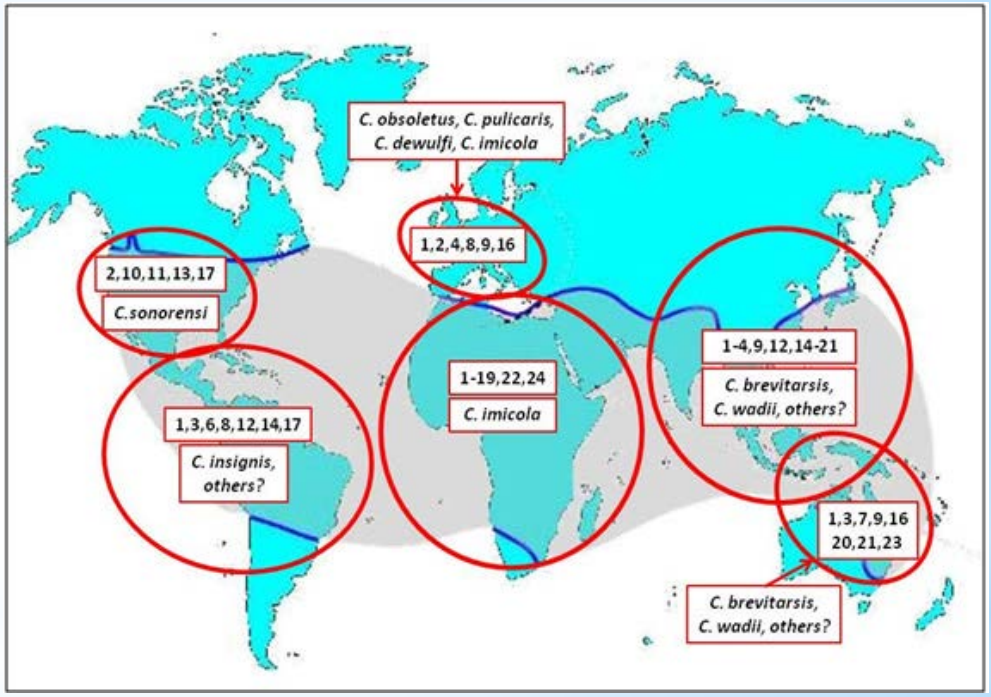
Bluetongue and Epizootic hemorrhagic disease viruses – BTV and EHDV

- 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
* Occurs seasonally during late summer and fall
* Initial symptoms include depression, fever, respiratory distress, and swelling of head, neck, and tongue; later symptoms include lameness and emaciation, and sometimes death

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
- N. America – BTV-3 has been detected at several of our *Culicoides* surveillance sites



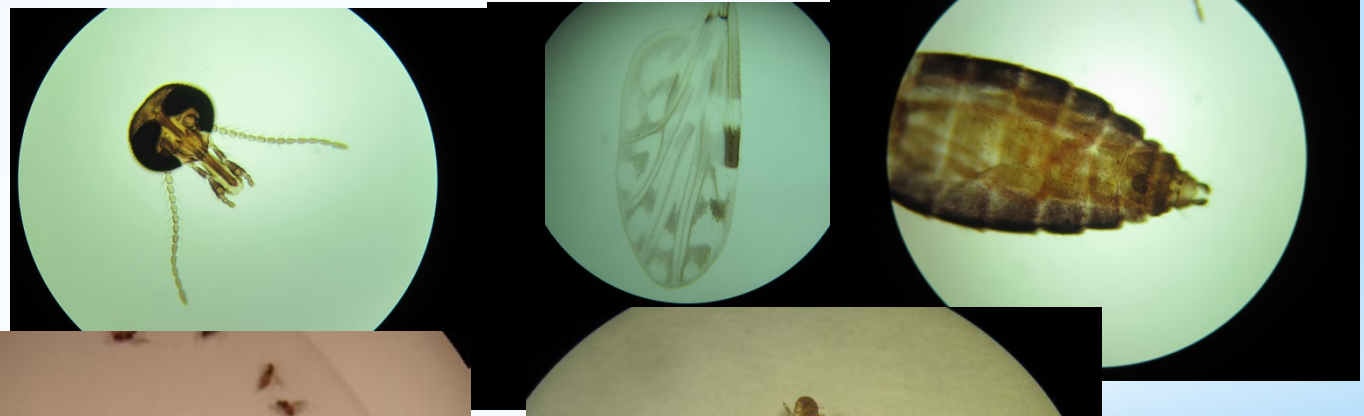
Adapted from Tabachnick (2010). J Exp Biol. 213:946-954.
http://www.sanidadanimal.info/sanidadanimal/en/actividades/emerging-online/blutongue-virus/171-evolucion-historica-y-situacion-en-europa-lengua-azul.html

Field Methods

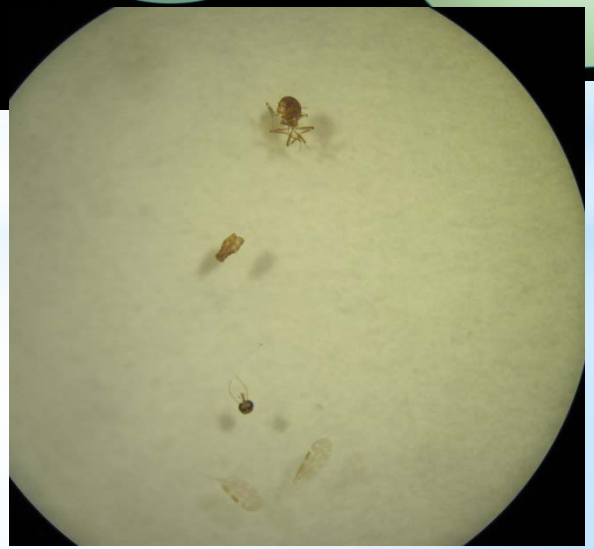
- 10 CDC miniature light traps (equipped w/ UV light and ethanol-filled collection jar) placed out on a Site in the late afternoon and collected the next morning
- Sites include primarily state/county parks, state forests, wildlife management areas, as well as private areas chosen for proximity to BTV/EHDV outbreaks or presence of an exotic serotype of BTV/EHDV
- Trapping is conducted in the late summer to early fall, though from 2007-2012 trapping was done year-round in central and south Florida

Lab Methods

- All collected insects return to SCWDS for sorting under dissecting microscope; all *Culicoides* separated and counted
- Some species IDs done by dissecting scope alone; many are dissected and slide mounted for closer inspection and positive species ID



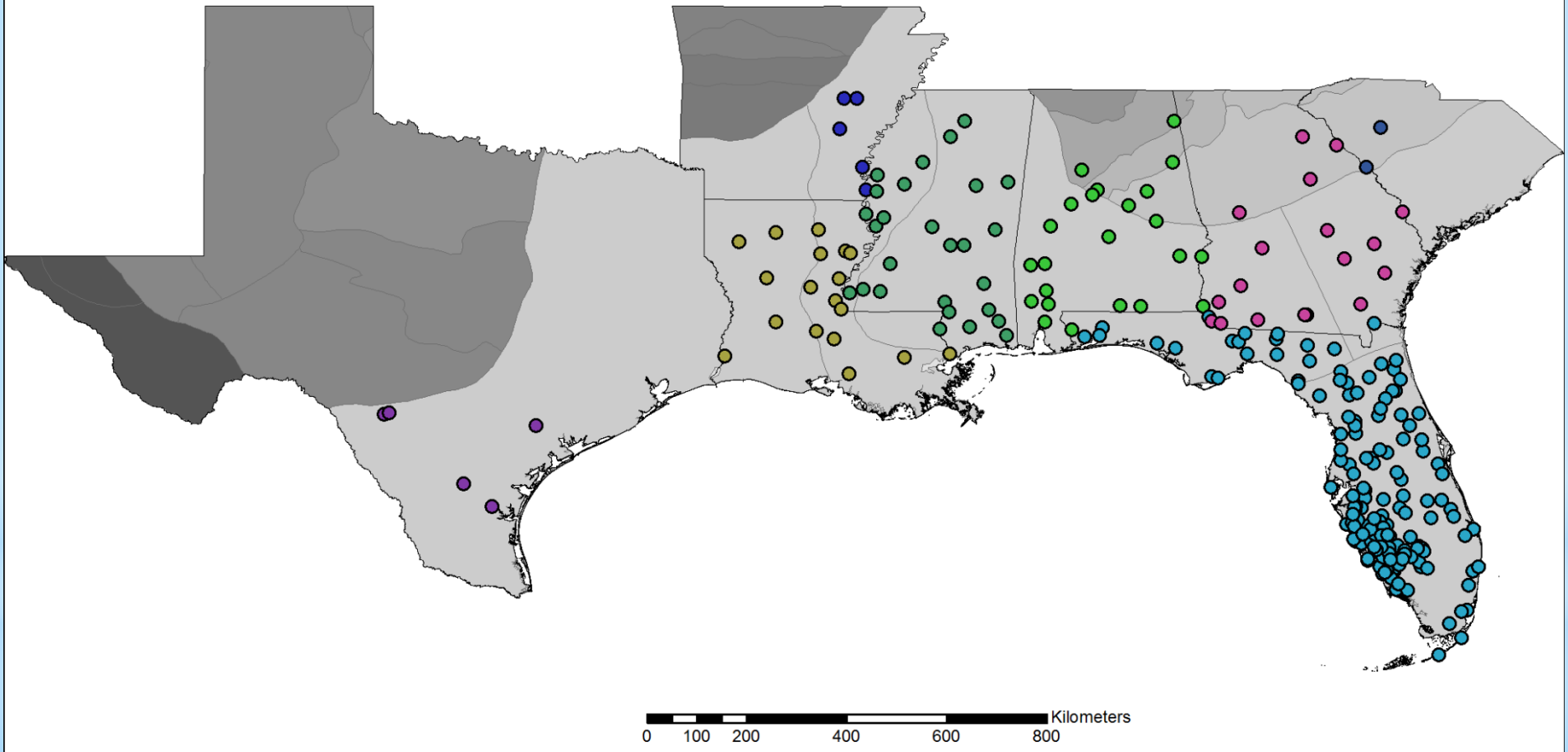
*Drop of water about the size of a quarter; a variety of *Culicoides* spp.



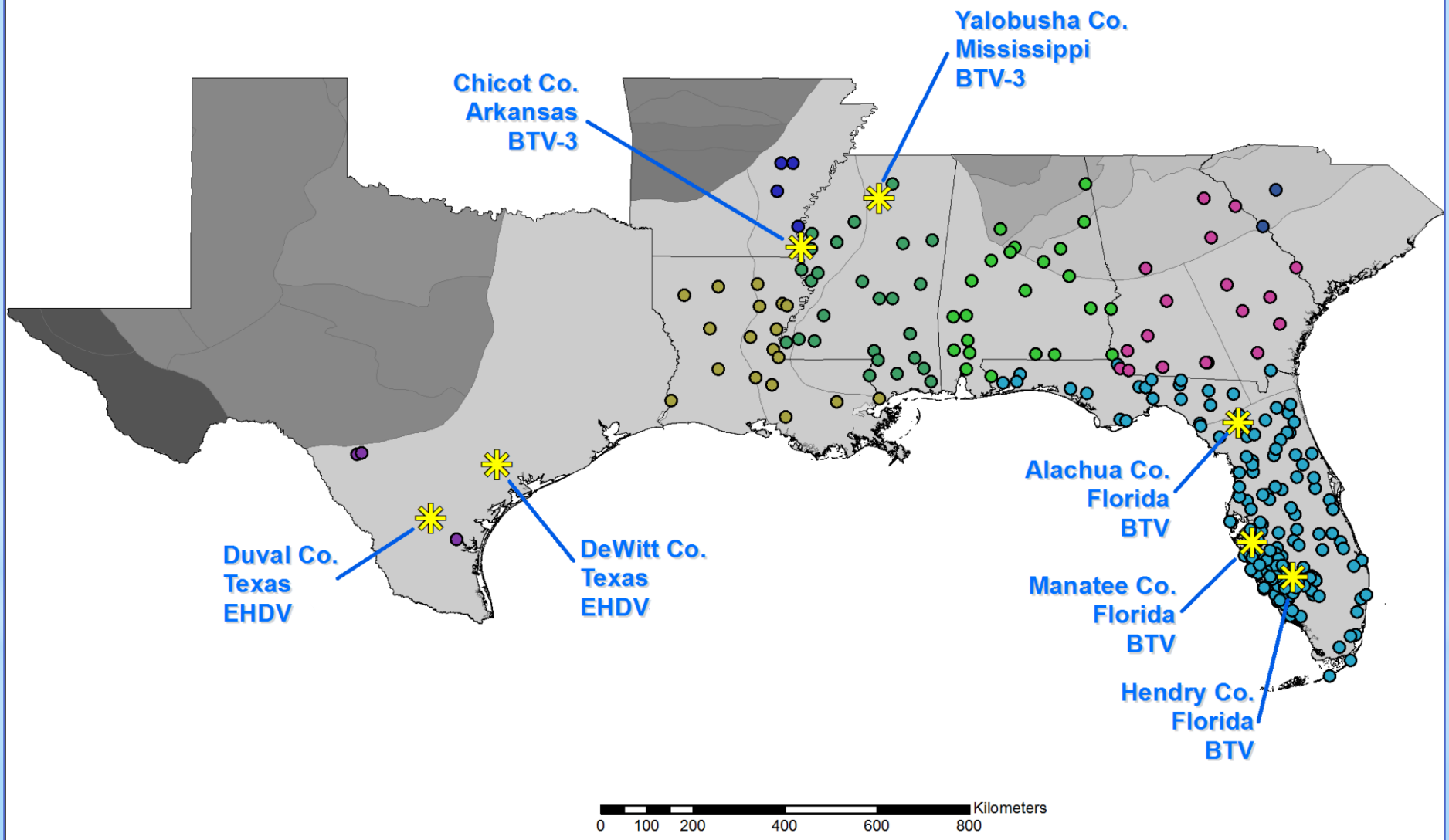
A dissected and mounted biting midge.

All Culicoides Survey Sites 2007-2013 in the SE United States

215 Sites in Eight States



Culicoides Survey Sites with Exotic BTV/EHDV



* November 2007 to October 2013

	Field Work			Lab Work			
	Total Sites	**Total Counties**	**Trap Nights**	**Traps Sorted**	**Total *Culicoides***	**Slides**	**IDs**
Florida	117	54	3,012	2,830	67,162	1,507	2,324
S. Carolina	2	2	37	0	0	0	0
Georgia	18	18	600	484	13,583	418	624
Alabama	23	28	827	727	11,710	447	917
Mississippi	27	28	862	728	58,412	757	1,422
Louisiana	18	22	526	405	17,424	441	799
Arkansas	5	5	188	88	9,596	75	144
Texas	5	4	41	41	3,364	178	177
All States	**215**	**161**	**6,093**	**5,303**	**181,251**	**3,823**	**6,407**

* Trap Efficiency

	Traps Sorted	Traps w/	Culicoides	# of spp. IDed
FL	2,830	1,419	50.1%	31 spp.
SC	0	0	-	none yet IDed
GA	484	257	53.1%	23 spp.
AL	727	383	52.7%	27 spp.
MS	728	501	68.8%	26 spp.
LA	405	310	76.5%	18 spp.
AR	88	77	87.5%	10 spp.
TX	41	31	75.6%	16 spp.
All States	5,303	2,978	56.1%	51 spp.

* Species found outside historic ranges

Culicoides spp.	New County Records:	New State Records:
C. beckae		Mississippi, Louisiana
C. oklahomensis		Arkansas, Alabama
C. alachua	St. Lucie Co., FL	Alabama, Georgia
C. hollensis	Collier Co., Lee Co., FL	
C. neopulicaris		Alabama
C. butleri		Texas
*C. insignis***	Many throughout FL	Mississippi
*C. sonorensis***	Manatee Co., Sarasota Co., FL; Clarke Co., AL	
C. barbosai		Georgia, Louisiana
C. loisae		Alabama
C. kirbyi		Mississippi

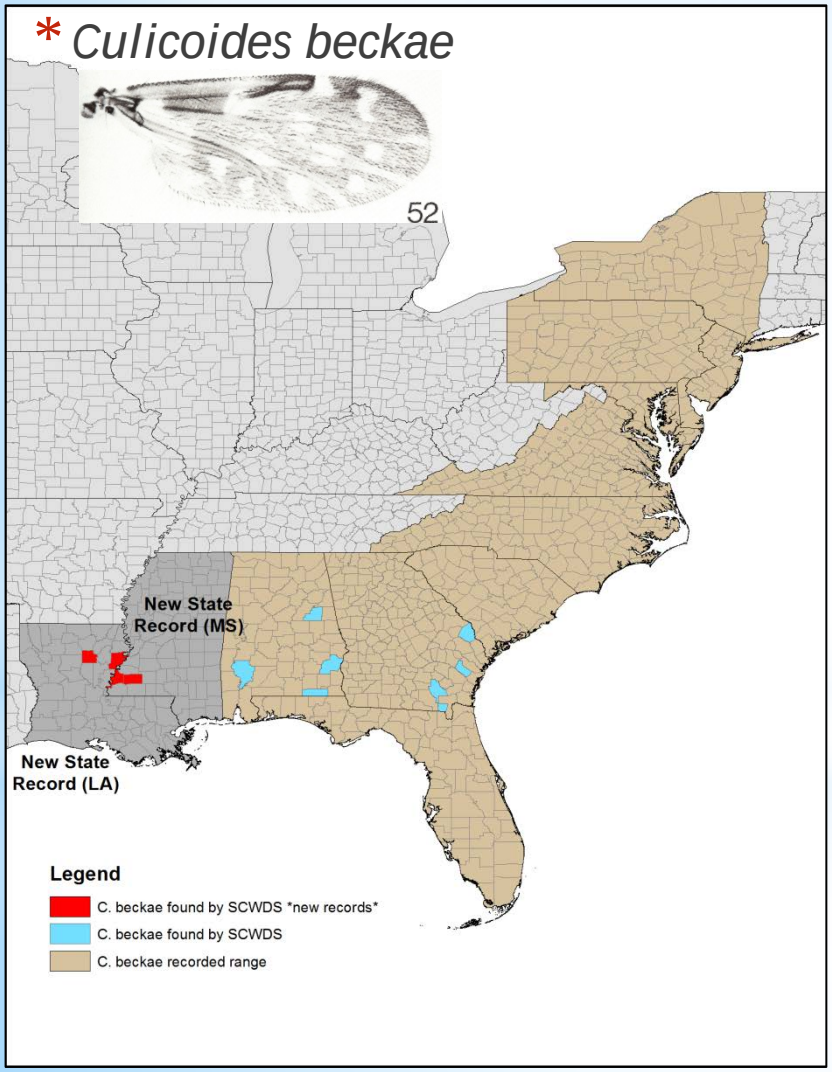
****known vectors of BTV**

Wirth, Dyce, and Peterson, 1985. An Atlas of Wing Photographs, with a Summary of the Numerical Characters of the Nearctic Species of Culicoides (Diptera: Ceratopogonidae). Contrib Am Ent Inst. 22(4): 1-46.

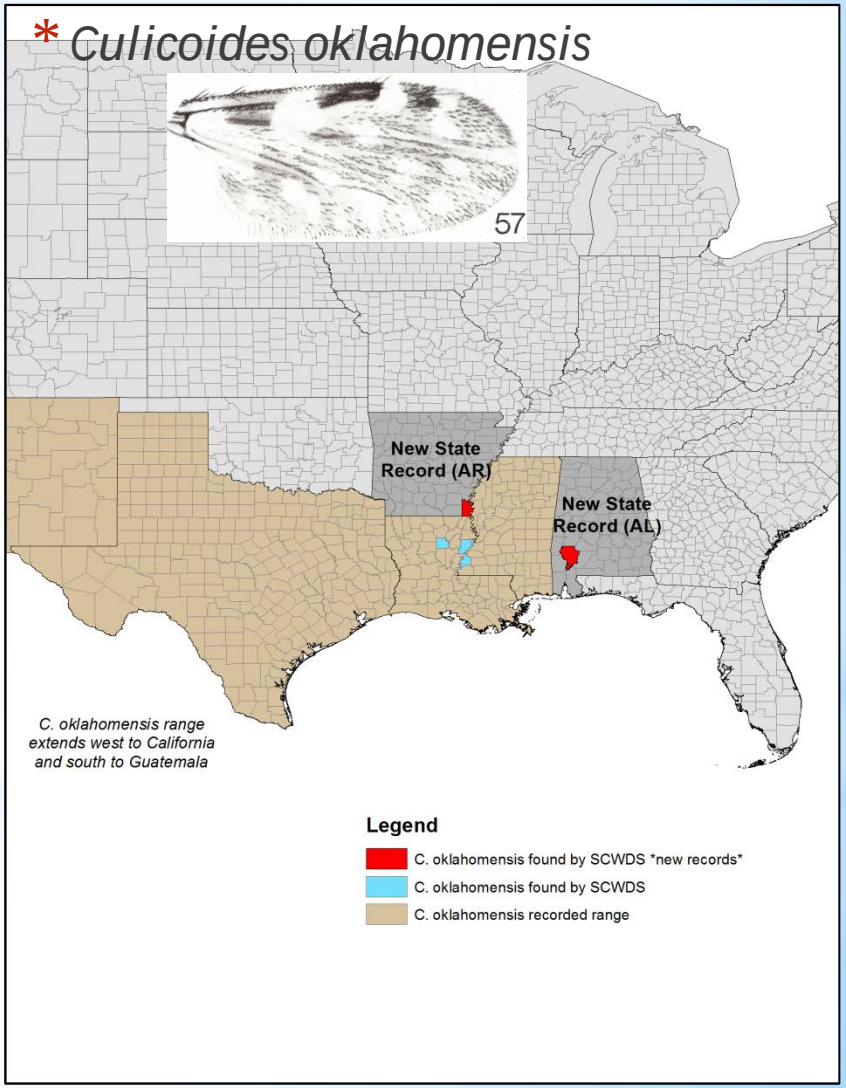
* Subgenus Amossovia

- the tree-hole breeders; primarily ornithophilic

* *Culicoides beckae*

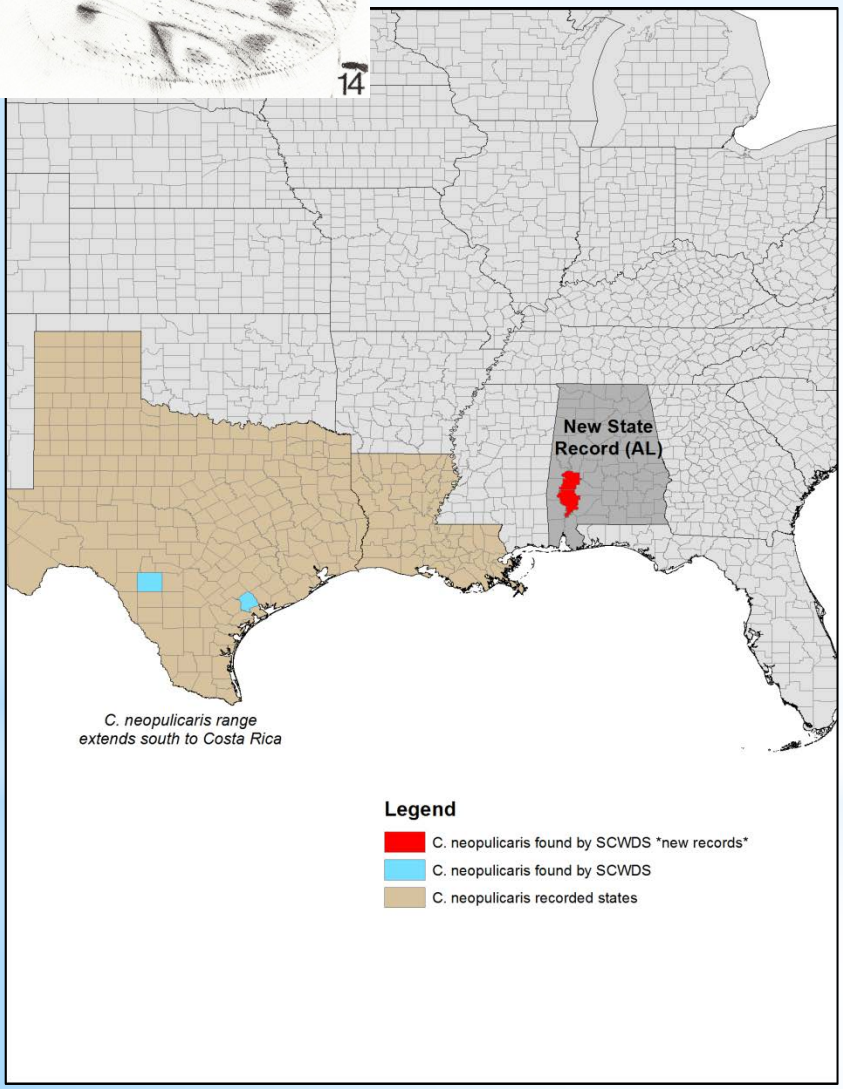


* *Culicoides oklahomensis*

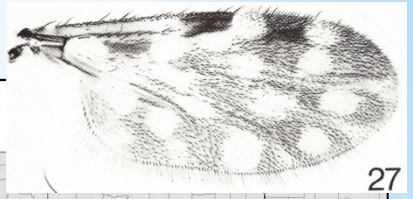


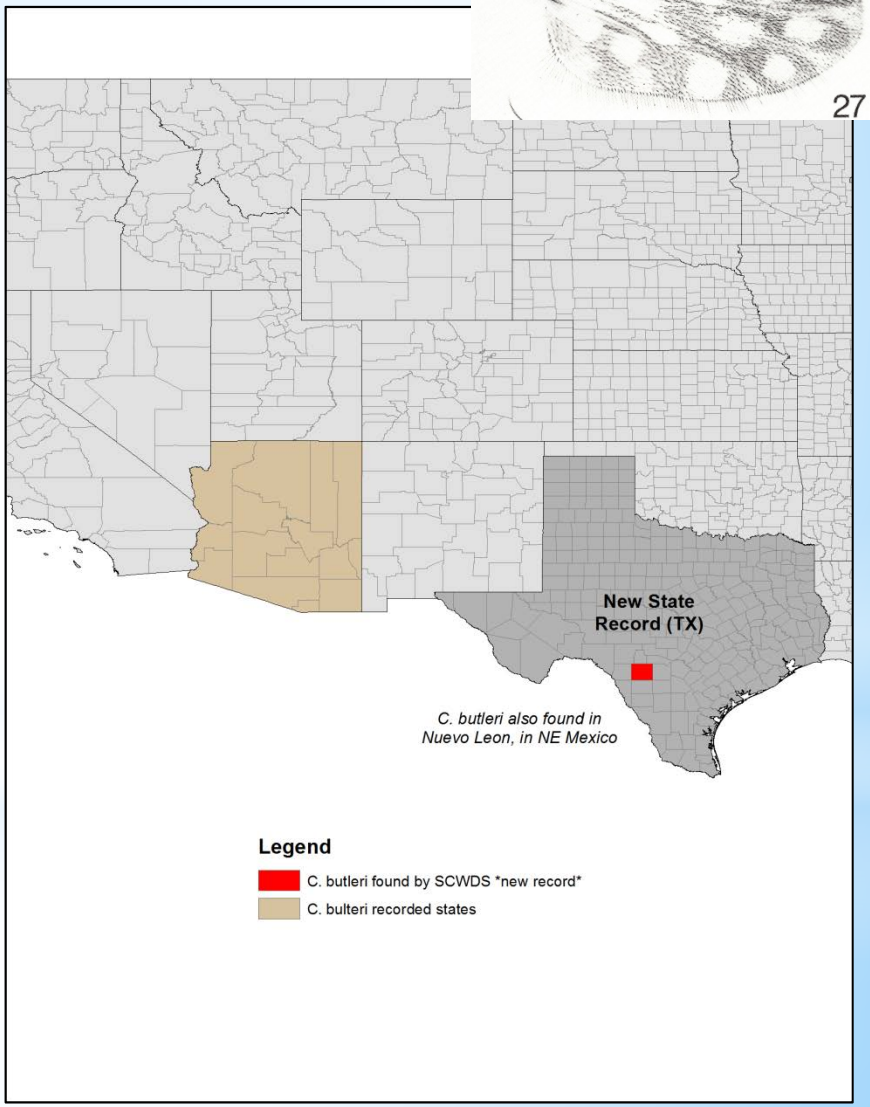
Wirth, Dyce, and Peterson, 1985. An Atlas of Wing Photographs, with a Summary of the Numerical Characters of the Nearctic Species of Culicoides (Diptera: Ceratopogonidae). Contrib Am Ent Inst. 22(4): 1-46.

* Subgenus Culicoides > *Culicoides neopulicaris*



* Subgenus Drymodesmyia> *Culicoides butleri*





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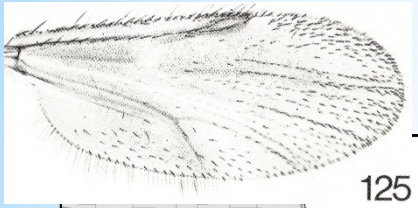
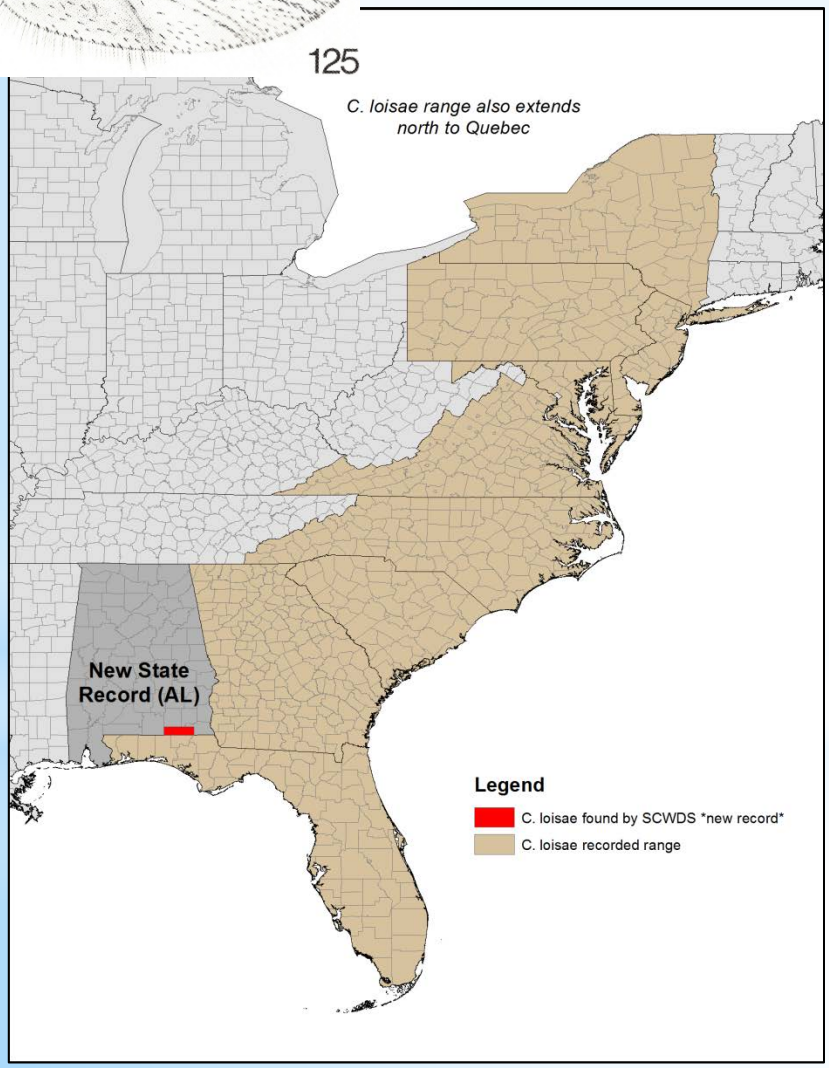
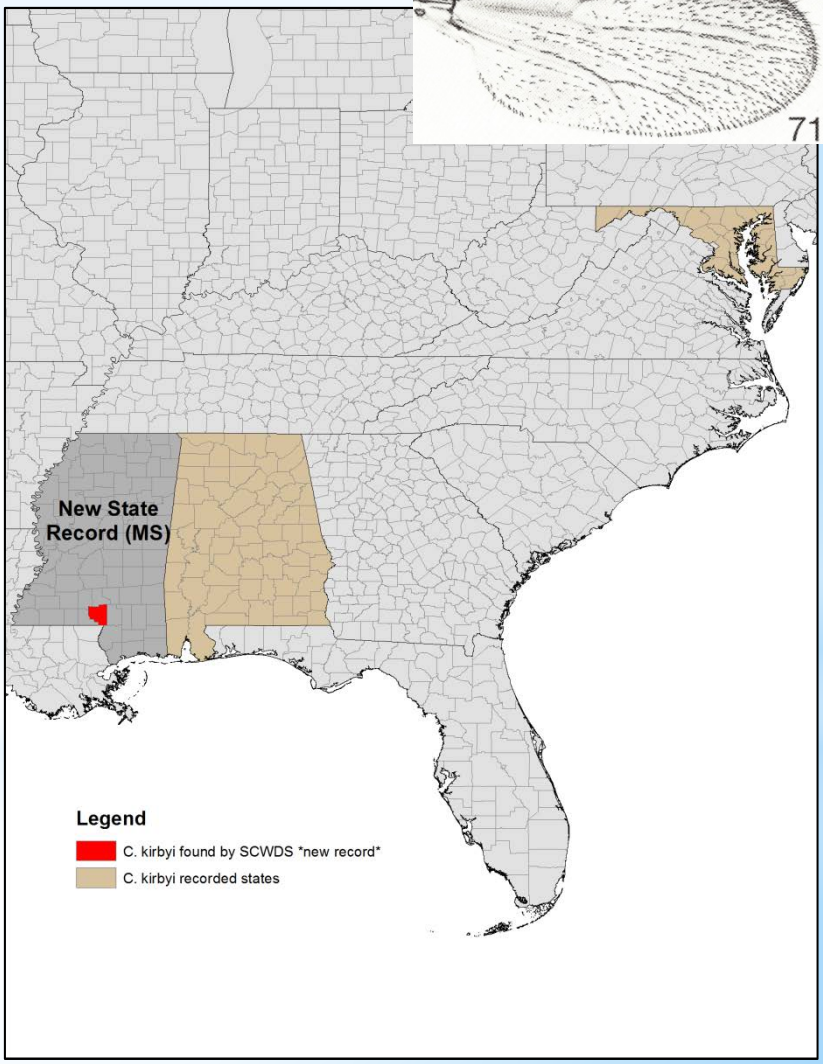
* Subgenus Silvaticulicoides > *Culicoides loisae*





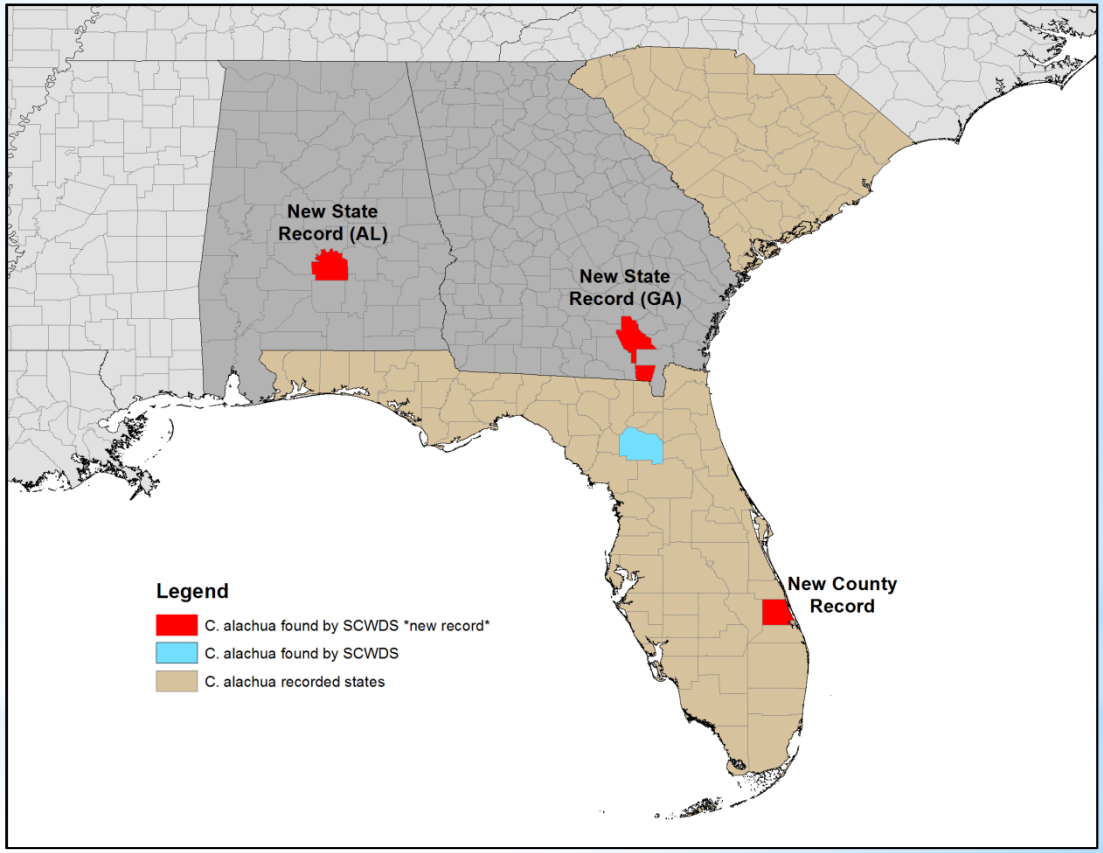
* Subgenus unplaced > piliferus species group > *Culicoides kirbyi*



* Subgenus Avaritia > *Culicoides alachua*

Wirth, Dyce, and Peterson, 1985. An Atlas of Wing Photographs, with a Summary of the Numerical Characters of the Nearctic Species of Culicoides (Diptera: Ceratopogonidae). Contrib Am Ent Inst. 22(4): 1-46.

* Species not known to be a disease vector
* In the same subgenus as:
  * *C. imicola* – vector of BTV in Africa and Southern Europe
  * *C. brevitarsis* – vector of BTV and EHDV in Australia
  * *C. pusillus** – suspected vector of BTV in neotropics
  * *C. obsoluetus** – suspected vector of BTV in Europe
  * *C. chiopterus** – suspected vector of BTV in Europe

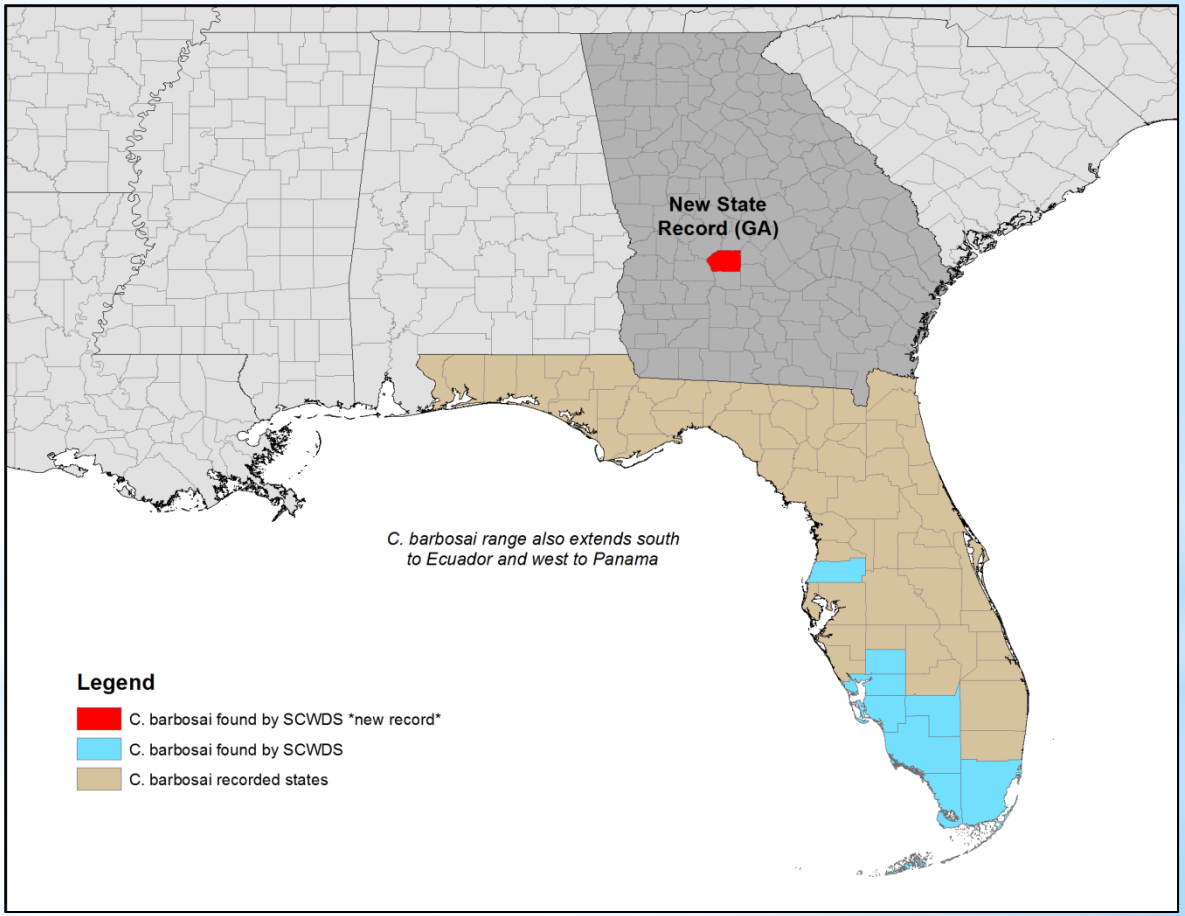


*species that are also found in North America

* Subgenus Oecacta > *Culicoides barbosai*

Wirth, Dyce, and Peterson, 1985. An Atlas of Wing Photographs, with a Summary of the Numerical Characters of the Nearctic Species of Culicoides (Diptera: Ceratopogonidae). Contrib Am Ent Inst. 22(4): 1-46.

* Neotropical range; Florida, Caribbean, Central, and northern South America
* Frequent biter of man
* Associated with mangrove swamp, coral sand beach, brackish tidal marsh



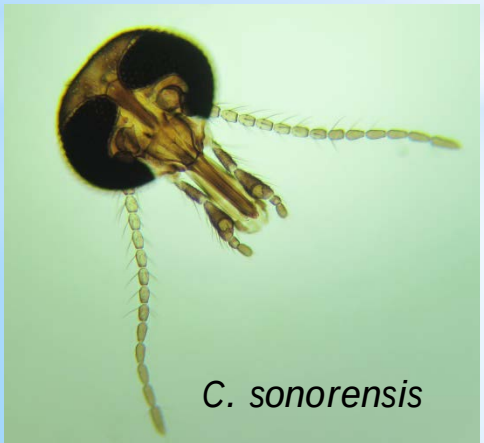
* *C. sonorensis* and *C. insignis* (complex) ranges compared
- two vectors of BTV

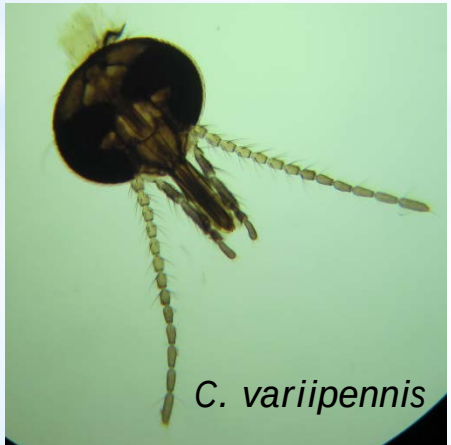
From Kramer WL, et al. 1985. Seasonal Variation in Population Size, Fecundity, and Parity Rates of *Culicoides insignis* (Diptera: Ceratopogonidae) in Florida, USA. J Med Ent. 22(2). 163-169.

* Subgenus Monoculicoides > *Culicoides sonorensis*

Wirth, Dyce, and Peterson, 1985. An Atlas of Wing Photographs, with a Summary of the Numerical Characters of the Nearctic Species of Culicoides (Diptera: Ceratopogonidae). Contrib Am Ent Inst. 22(4): 1-46.

* Primary vector of BTV in North America.
  * *C. variipennis* is the primary vector of EHDV in North America
* Reclassified in 2000 as a separate species; formerly a subspecies of *C. variipennis*
* 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





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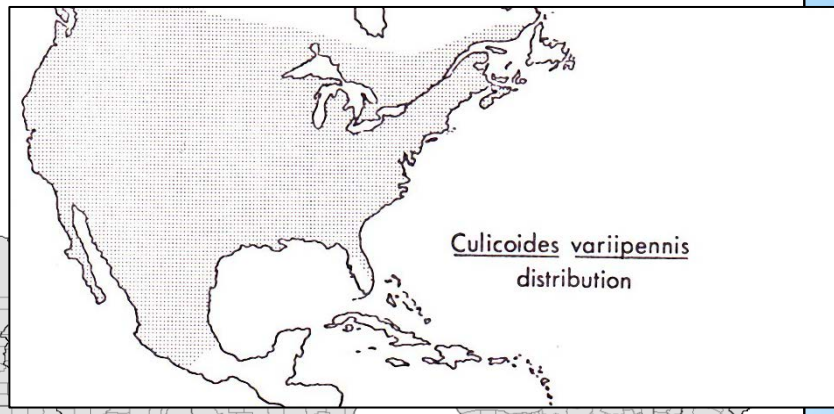
* *Culicoides sonorensis*

C. sonorensis range also extends north into western Canada and south to Mexico.

Common and widespread in the West. East of the Mississippi River C. sonorensis is usually found in scattered populations associated with livestock.



New County Records (AL)

New County Records (FL)

Notable due to NO livestock present at site.

Legend

- C. sonorensis found by SCWDS *new records*
- C. sonorensis found by SCWDS
- C. sonorensis recorded range/states

From Kramer WL, et al. 1985. Seasonal Variation in Population Size, Fecundity, and Parity Rates of *Culicoides insignis* (Diptera: Ceratopogonidae) in Florida, USA. J Med Ent. 22(2). 163-169.

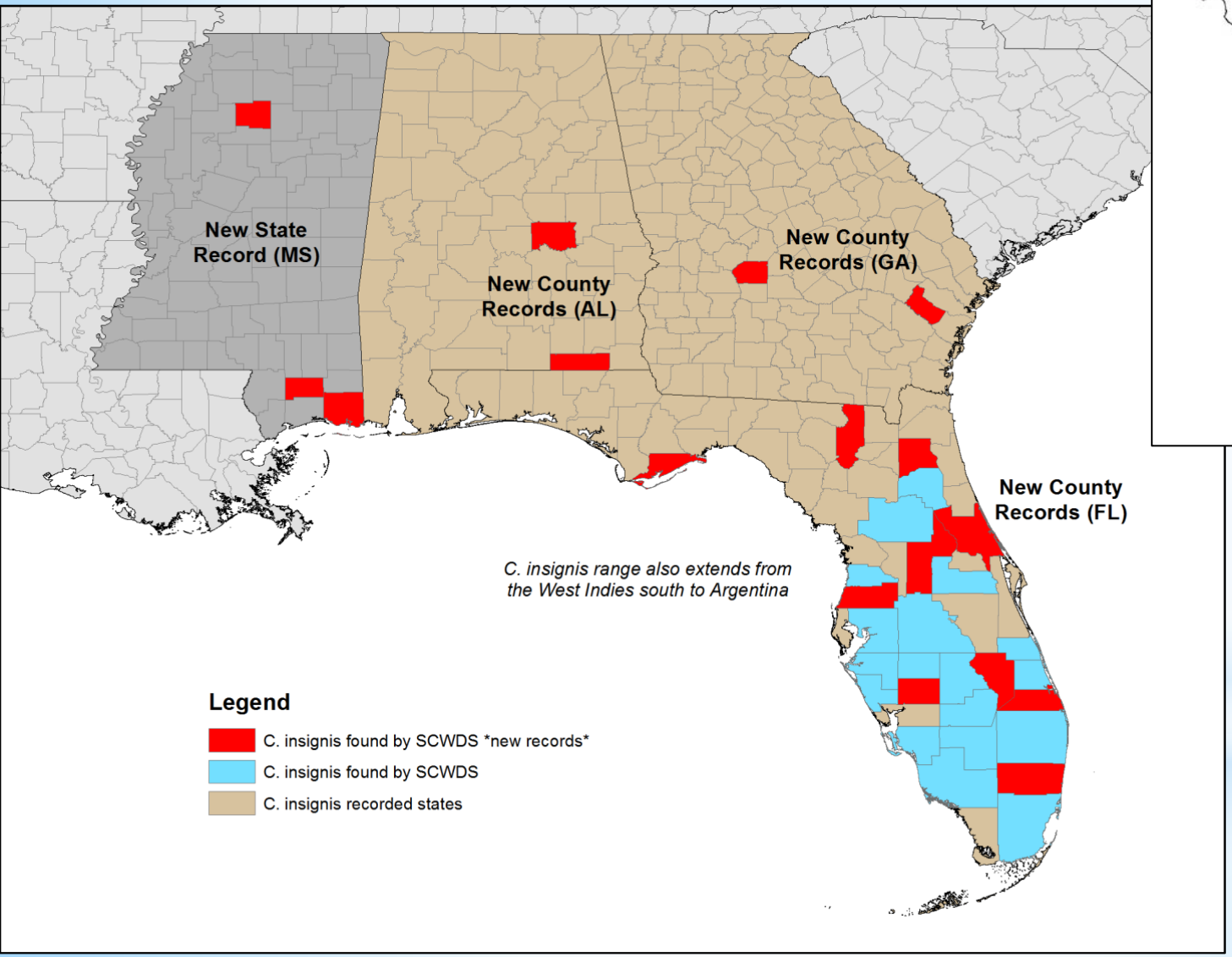
* Subgenus Hoffmania > *Culicoides insignis*

Wirth, Dyce, and Peterson, 1985. An Atlas of Wing Photographs, with a Summary of the Numerical Characters of the Nearctic Species of Culicoides (Diptera: Ceratopogonidae). Contrib Am Ent Inst. 22(4): 1-46.

* Known vector of BTV
  * Thought to be the primary vector in areas where *C. sonorensis* is not present
* Neotropical range, often locally abundant in Florida
* 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

From Kramer WL, et al. 1985. Seasonal Variation in Population Size, Fecundity, and Parity Rates of *Culicoides insignis* (Diptera: Ceratopogonidae) in Florida, USA. J Med Ent. 22(2). 163-169.

* *Culicoides insignis*



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In Conclusion

- In some instances, these could be rare species that have been present but not previously reported.
- Some may also be actual range expansions.
- Work needs to continue to determine what species are present and to determine species distributions, as well as natural history studies of important species.
- More work needs to be done to determine which species are likely current and future vectors for BTV and EHDV to help predict possible future spread of disease.

*Thank you!

* If you have any questions or comments please contact me: svigil@uga.edu
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* Thank you to Bill Grogan of the Florida State Collection of Arthropods and Wayne Kramer of Louisiana State University for help with *Culicoides* identification.
* Thank you to all the SCWDS staff who have participated in this project over the past several years.

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