* *Culicoides* Biting Midges of the Southeastern United States

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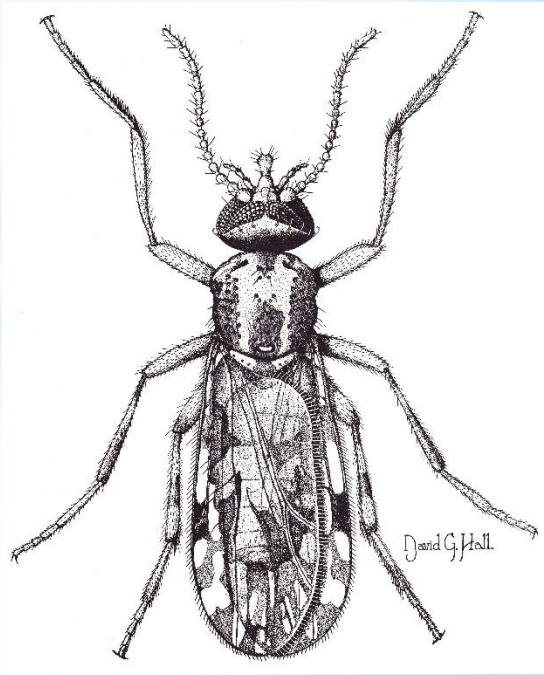

Georgia Mosquito Control Association
38th Annual Meeting
October 14-16th, 2015

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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)

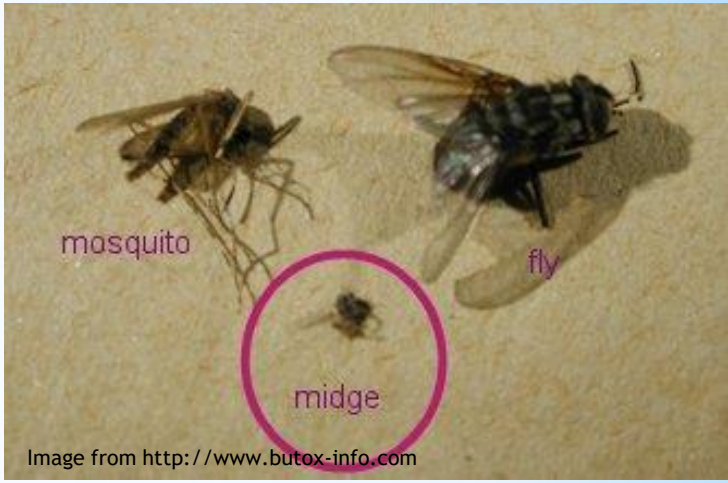


Image from http://www.butox-info.com

* 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?*

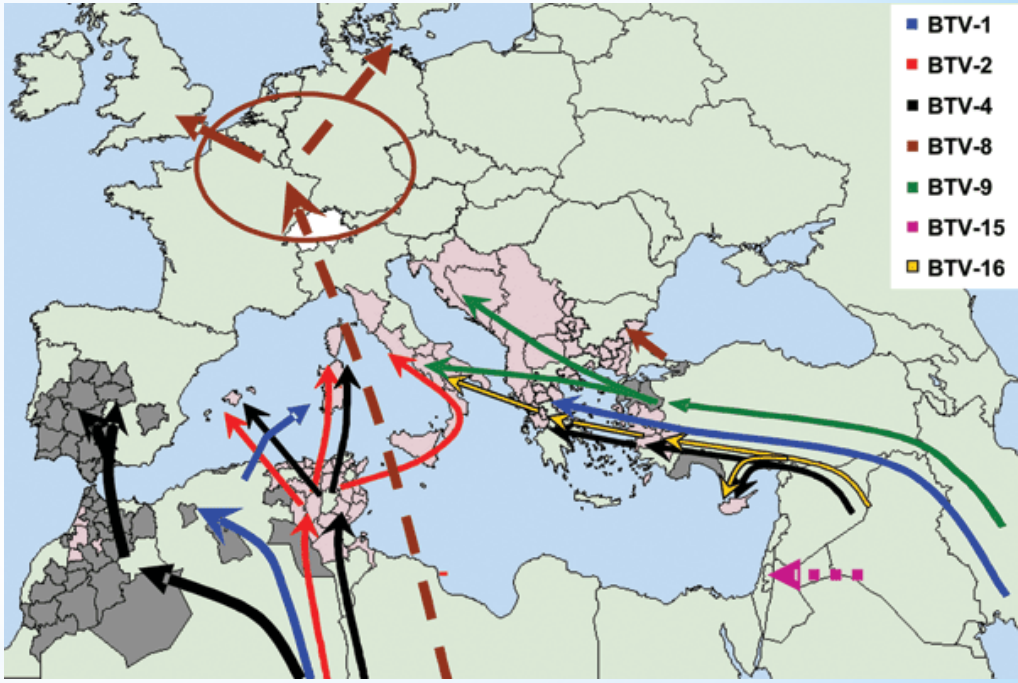
Bluetongue and Epizootic hemorrhagic disease viruses – BTV and EHDV

- 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



"Map of molecular epidemiology of bluetongue virus in Europe" by Claude Saegerman,* Dirk Berkvens,† and Philip S. Mellor‡ - http://www.cdc.gov/EID/content/14/4/539-G1.htm.

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.

Image from http://www.culicoides.net

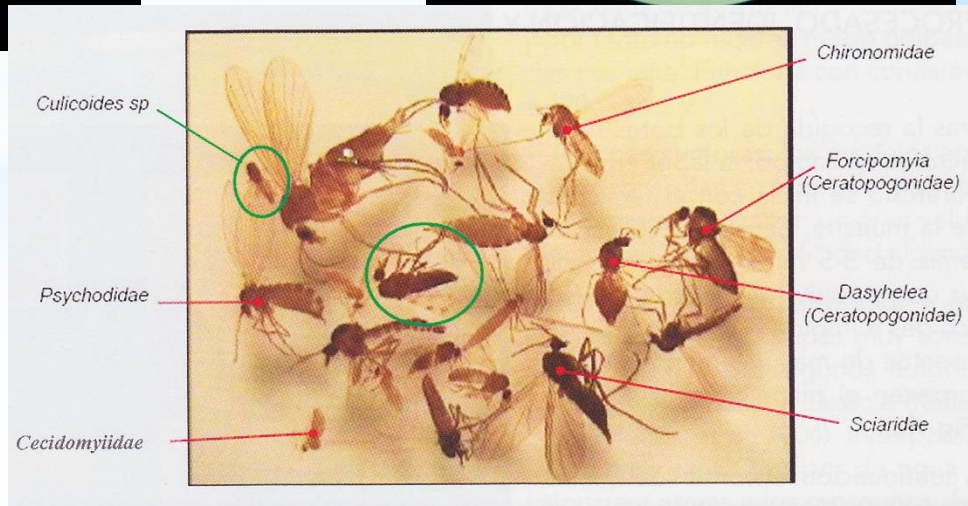
Surveillance Methods – adult midges

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

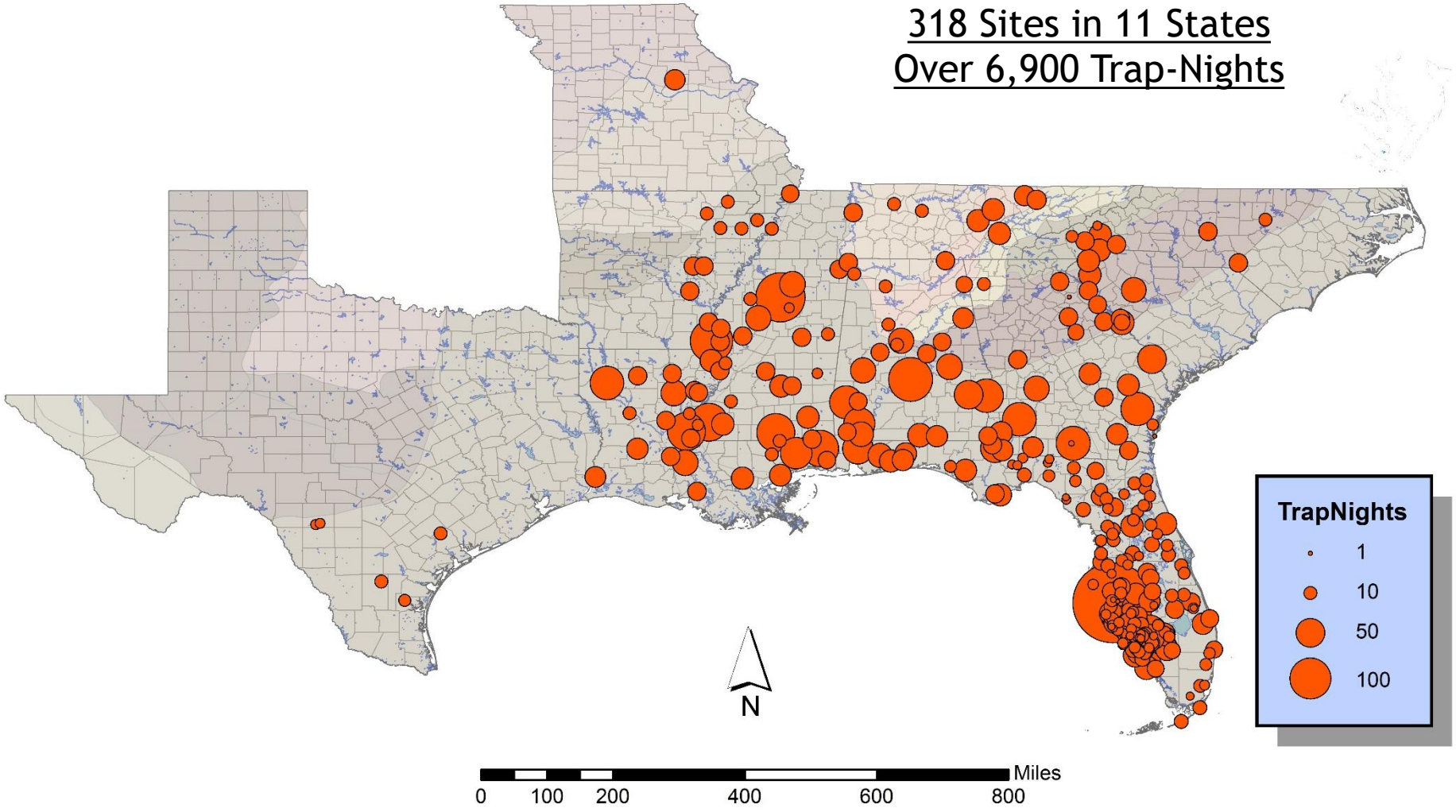
*Drop of water about the size of a quarter; a variety of *Culicoides* spp.



* November 2007 to October 2015

	Field Work			Lab Work			
	Total Sites	Total Counties	Trap Nights	Traps Sorted	Total *Culicoides*	Slides	IDs
Florida	178	58	3,013	2,911	82,694	1,558	2,569
S. Carolina	5	6	132	132	762	21	136
N. Carolina	9	10	129	129	2,262	16	29
Tennessee	10	13	128	166	3,096	0	0
Georgia	25	24	680	679	60,624	608	1,214
Alabama	27	33	857	865	13,309	503	1,095
Mississippi	30	30	892	890	59,973	860	1,894
Louisiana	18	22	526	525	25,234	444	946
Arkansas	10	11	238	237	25,514	103	449
Missouri	1	1	25	25	22	7	7
Texas	5	4	41	41	3,364	178	173
All States	**318**	**212**	**6,909**	**6,600**	**276,854**	**4,298**	**8,509**

SCWDS *Culicoides* Survey Sites 2007-2015



*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%**

SE U.S. - NC, SC, GA, AL, MS, LA, AR

Culicoides sp.	Sites present
*C. haematopotus**	96%
*C. stellifer**	88%
*C. debilipalpis**	86%
C. arboricola	77%
*C. paraensis**	65%

Florida

Culicoides sp.	Sites present
*C. insignis***	77%
C. edeni	40%
*C. stellifer**	35%
*C. furens**	32%
*C. haematopotus**	29%

* Proposed as possible vectors of BTV/EHDV

** Known vector of BTV/EHDV

* Species found outside historic ranges

Culicoides spp.	Range	New Records:	Recorded states/prov. (2009):	Direction of range shift:
C. beckae	Eastern seaboard of N. America	**Mississippi, Louisiana**	New York to Alabama	West along Gulf Coast
*C. alachua**	Inland N. Florida	**Alabama, Georgia, south Florida**	Florida, S. Carolina	West along Gulf Coast
C. oklahomensis	Neotropical, Central America; SW U.S.	**Arkansas, Alabama**	California to Guatemala and Mississippi	North and East along Gulf Coast
C. neopulicaris	Neotropical; Central America	**Alabama**	Texas, Louisiana to Costa Rica	North and East along Gulf Coast
C. barbosai	Neotropical; Caribbean	**Georgia, Louisiana**	Florida to Ecaudor	North and West
*C. insignis***	Neotropical; Caribbean	**Mississippi, Louisiana, FL counties**	Argentina to Alabama, Georgia	North and West
*C. sonorensis***	Scattered across N. America	**Manatee Co., Sarasota Co., FL; Clarke Co., AL; Newberry Co., SC**	Across N. America	Uncommon in the Southeast; no evidence of change

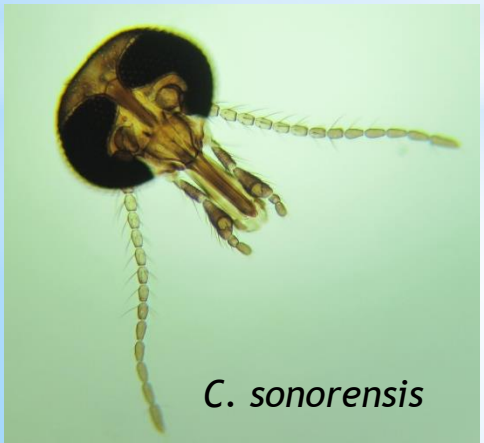
***subgenus Avaritia**

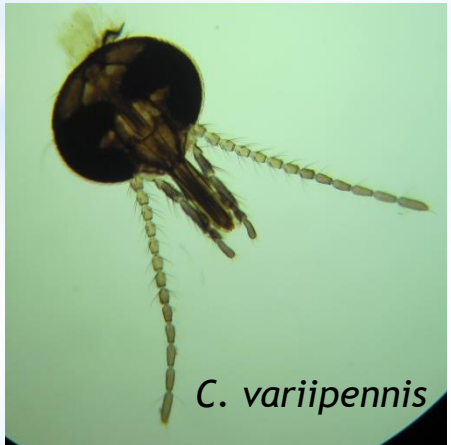
****known vectors of BTV**

* 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.

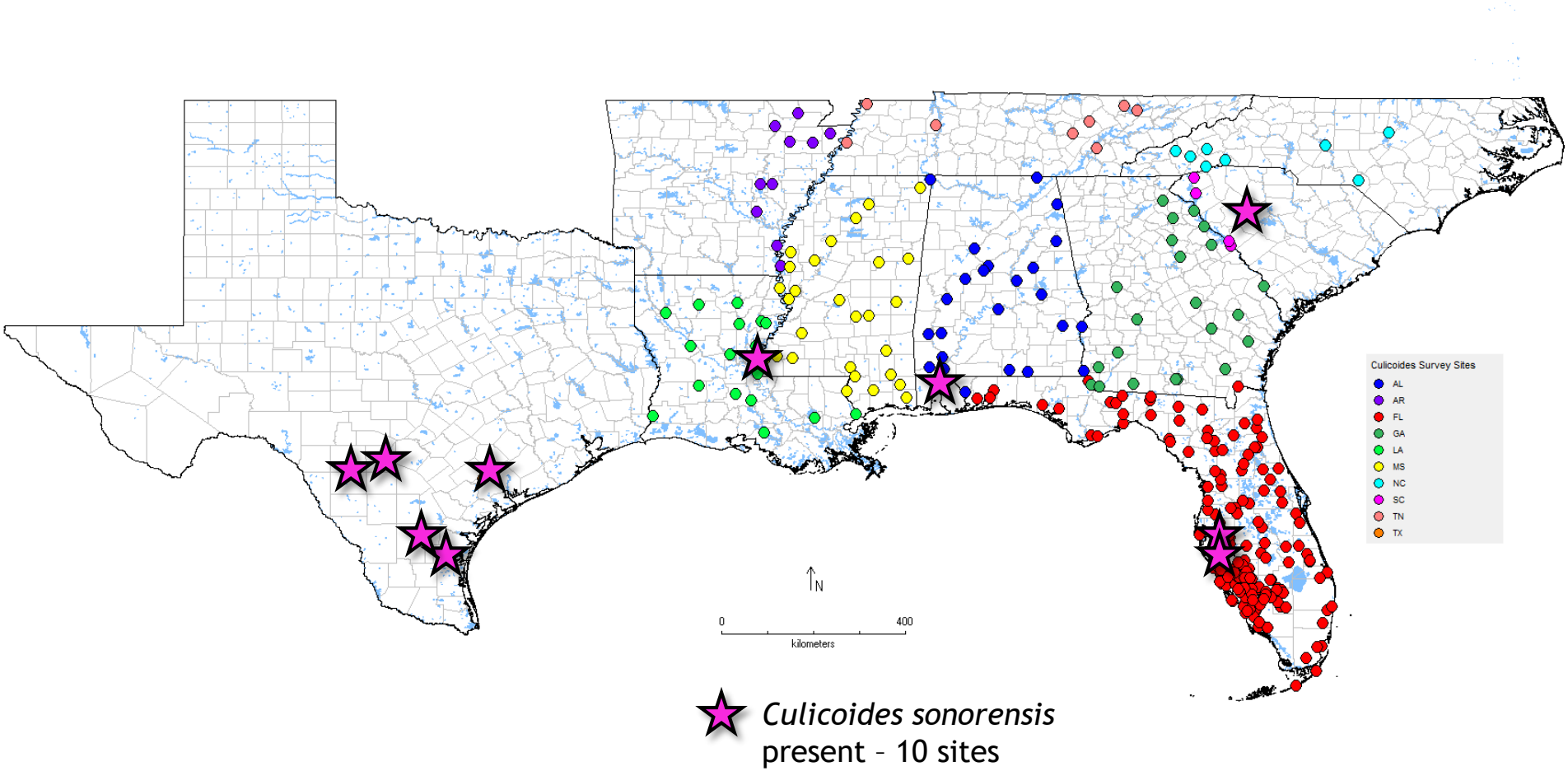
* Primary vector of BTV in North America.
* Pre-2000, considered a subsp. of *C. variipennis*--(the variipennis complex)
* Now, classified as 3 distinct species: *C. sonorensis*, *C. variipennis*, *C. occidentalis*
* Range includes most of North America; while common in the West, east of the Mississippi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


C. sonorensis


C. variipennis

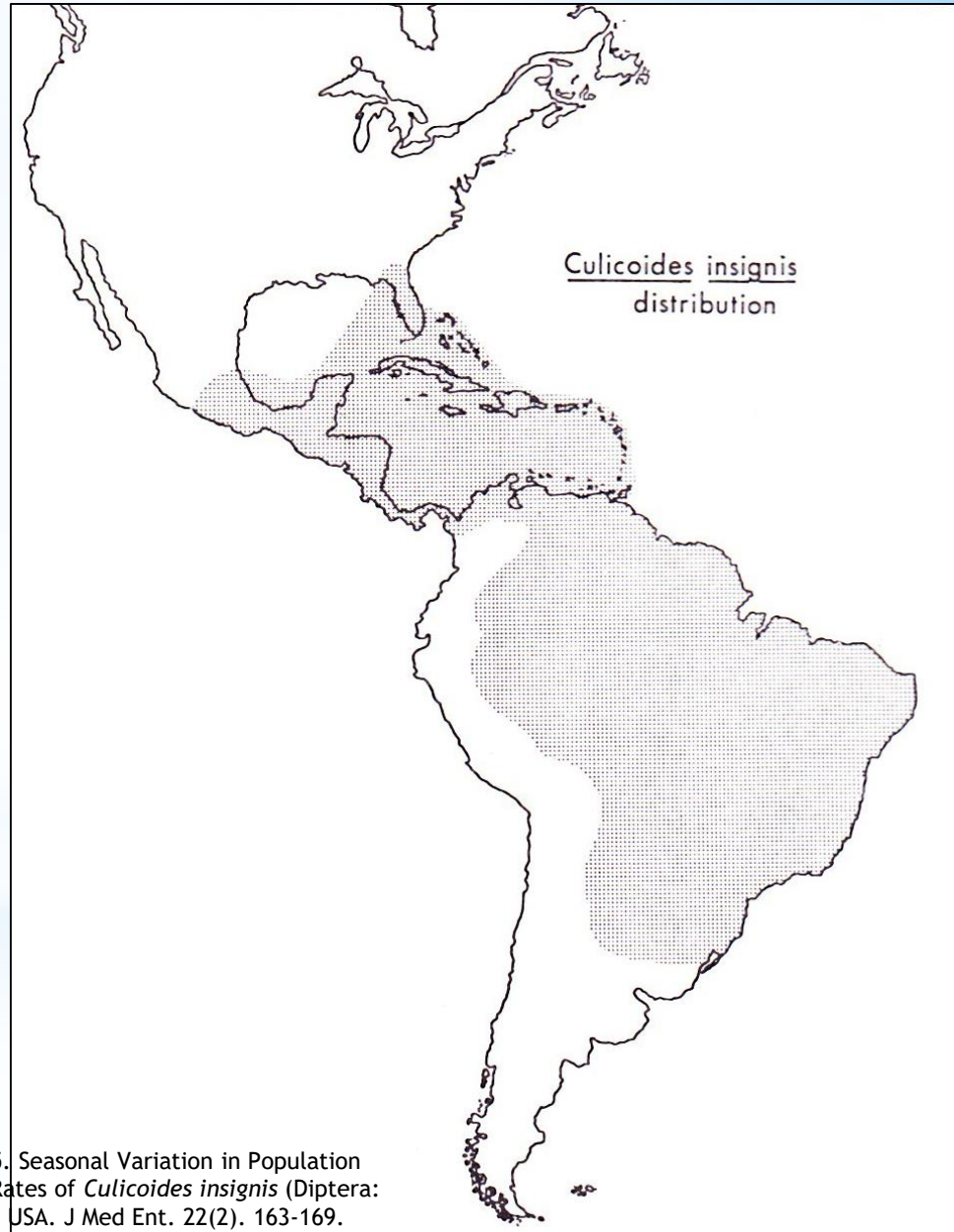
From Kramer WL, et al. 1983. Seasonal Variation in Population Size, Fecundity, and Parity Rates of *Culicoides insignis* (Diptera: Ceratopogonidae) in Florida, USA. J Med Ent. 22(2). 163-169.

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



Culicoides sonorensis
present – 10 sites

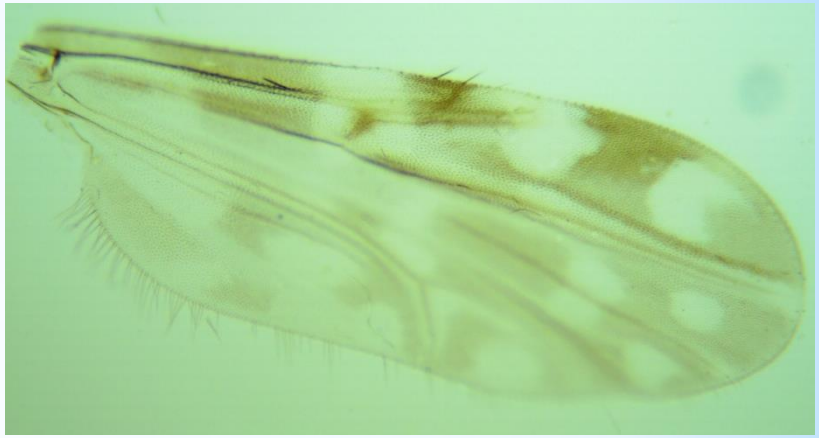
* *C. variipennis* (complex) and *C. insignis* ranges compared
- two vectors of BTV



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 Hoffmania > *Culicoides insignis*

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

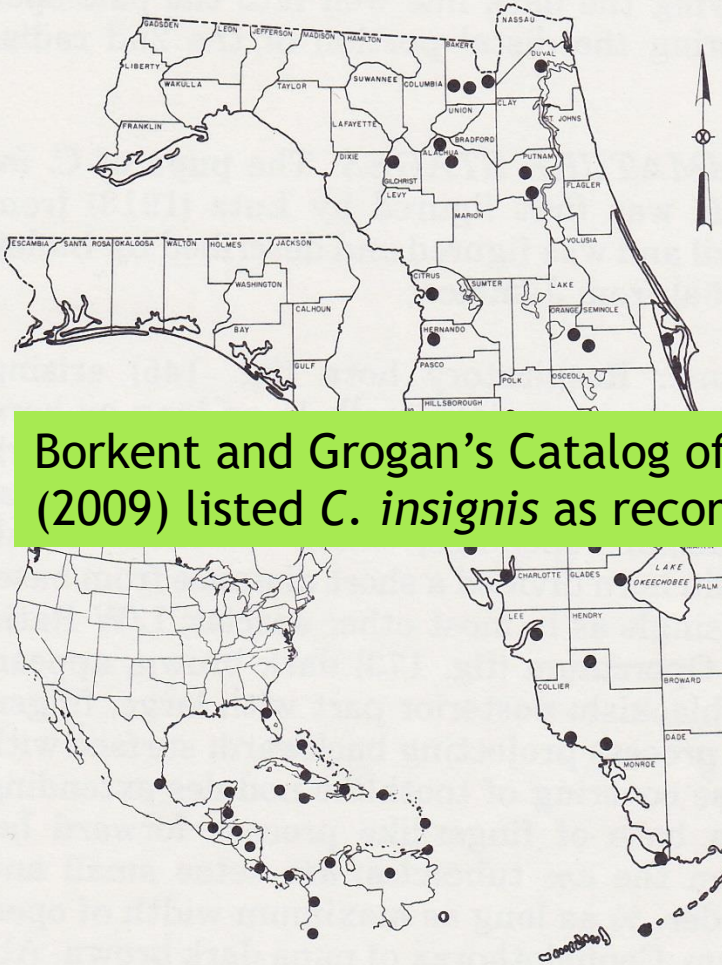
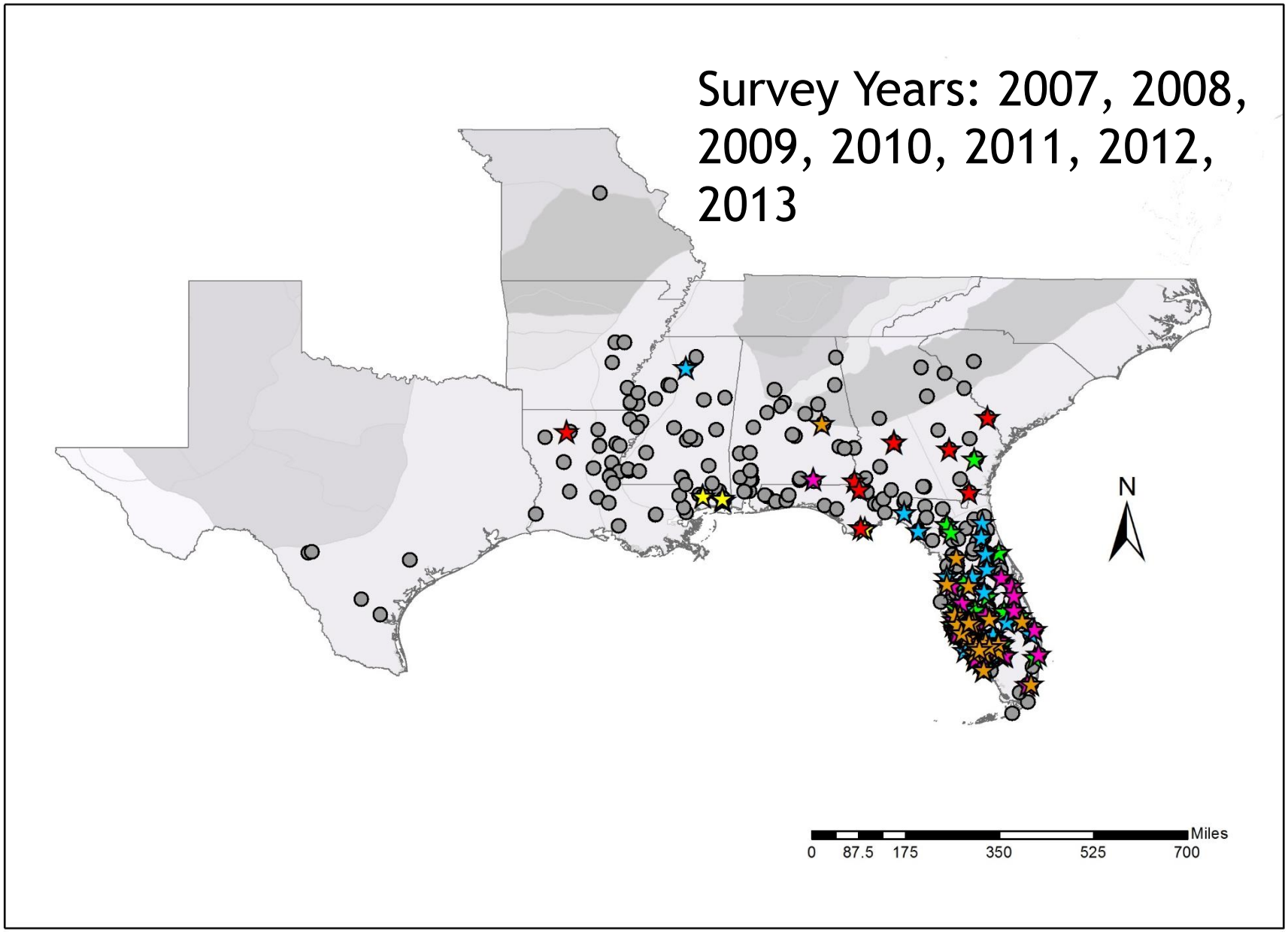


Fig. 78. Florida distribution of *Culicoides insignis*.

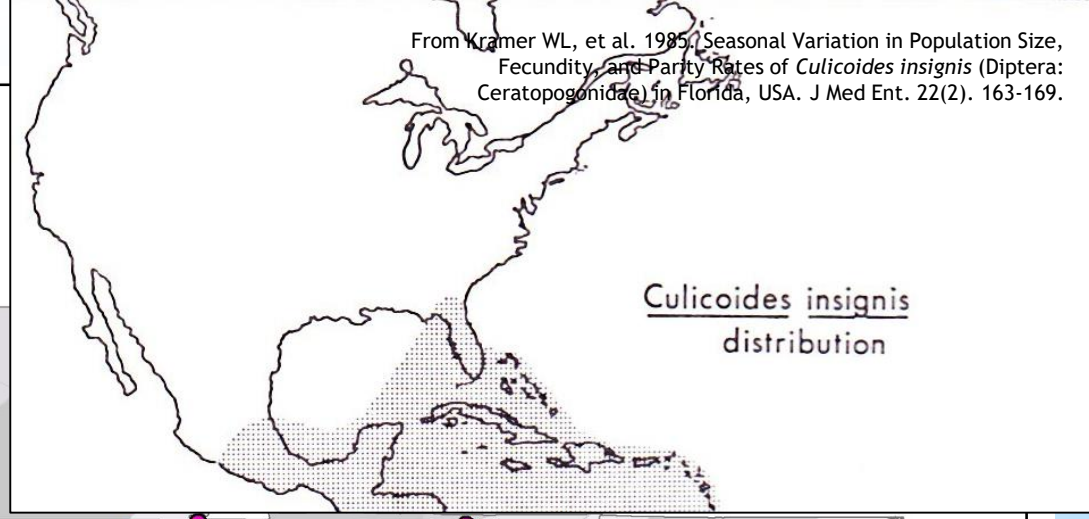
Borkent and Grogan's Catalog of New World Biting Midges North of Mexico (2009) listed *C. insignis* as recorded from Florida, Georgia, and Alabama.

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.

SCWDS Survey Sites with *Culicoides insignis*



SCWDS Survey Sites with *Culicoides insignis*



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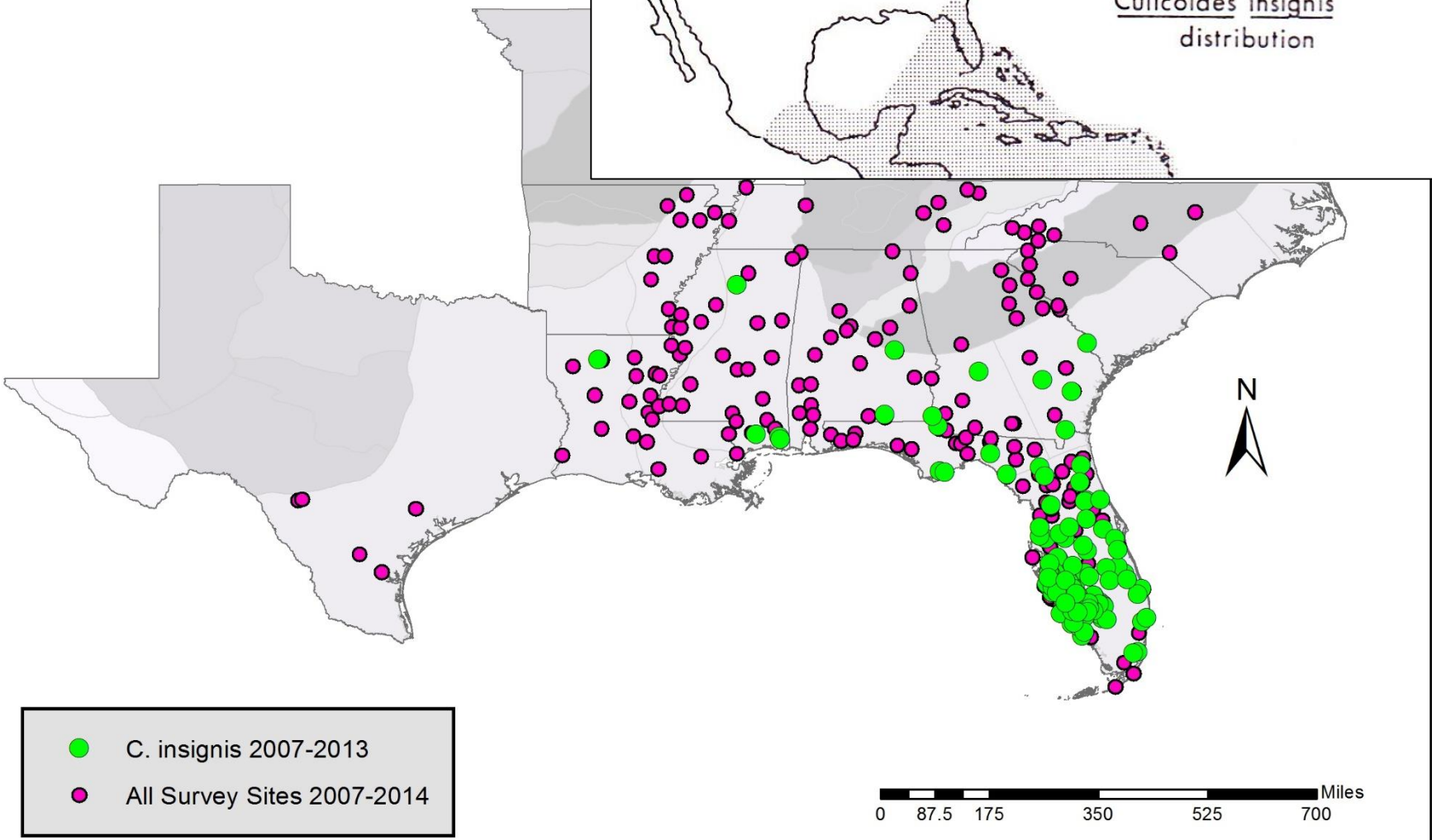
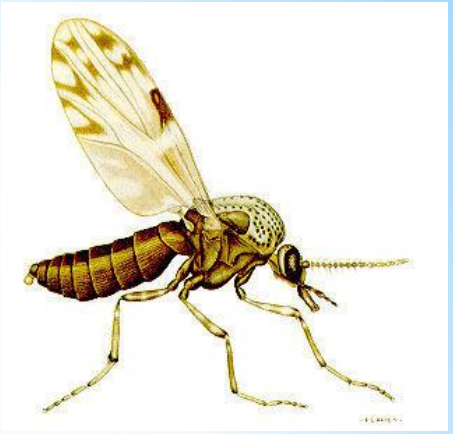


Some final thoughts



- *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
* This project is funded by the USDA-APHIS-Veterinary Services.
* Thank you to all the SCWDS staff who have participated in this project over the past several years.

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