



Ticks and Tick-borne Diseases, with a focus on Georgia

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Overview

- Ticks and tick-borne pathogens in the United States and especially Georgia
- Trends in tick-borne diseases
- Tick surveillance efforts



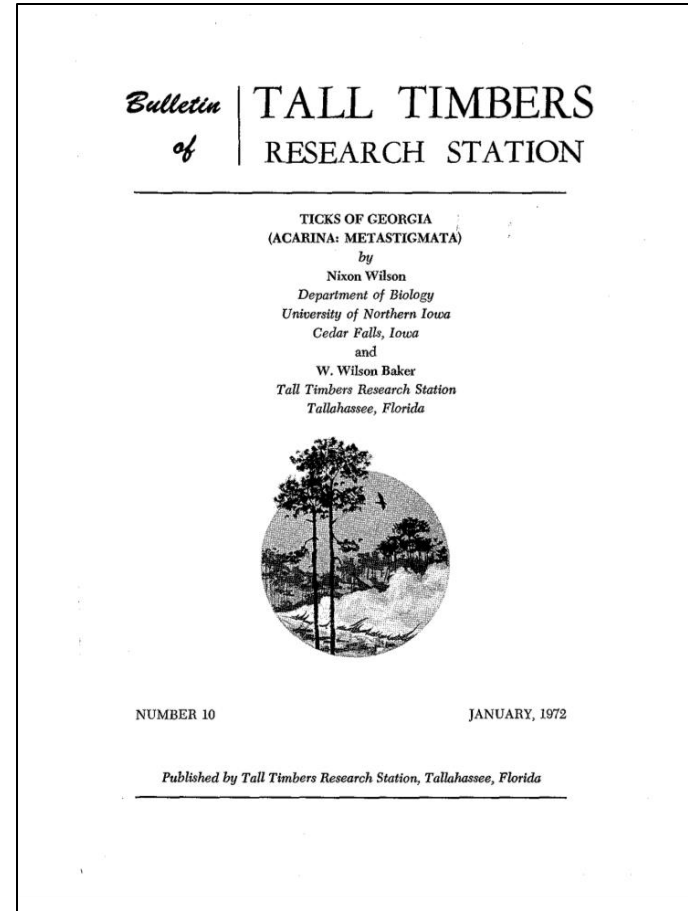
Ticks and tick-borne pathogens in Georgia

Early records of ticks in Georgia

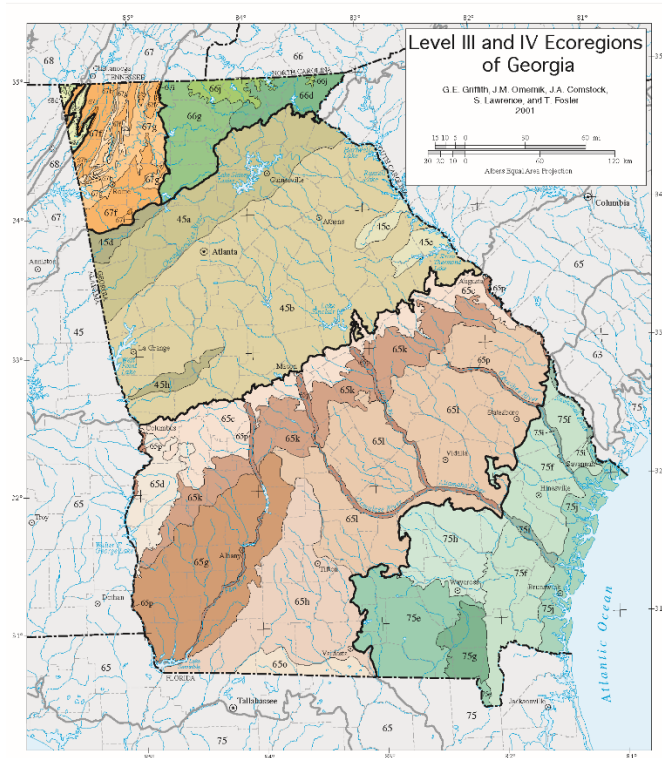
- The earliest references to ticks in Georgia were regarding the control of the cattle tick, *Rhipicephalus (Boophilus) annulatus* (Redding 1900, Willoughby 1904).
- When Hooker (1909) summarized the geographical distribution of ticks in the New World, this was the only species listed from Georgia.
- By the time Bishopp & Trembley (1945) had summarized the distribution of North American ticks, 12 species were recorded from Georgia.

Wilson and Baker 1972

- Most recent compilation of Georgia's tick fauna was published 45 years ago
- Recorded 21 species of ticks in Georgia: 4 species of Argasidae and 17 species of Ixodidae
- Since then, a total of 24 species are known to naturally occur in Georgia: 6 species of Argasidae and 18 species of the family Ixodidae.



Distribution across all ecoregions



- Ticks have been found in all six major ecological regions of the state:
- Cumberland Plateau
- Blue Ridge Mountains
- Ridge and Valley
- Piedmont
- Upper Coastal Plains
- Lower Coastal Plains

Tick species found in Georgia (2024)

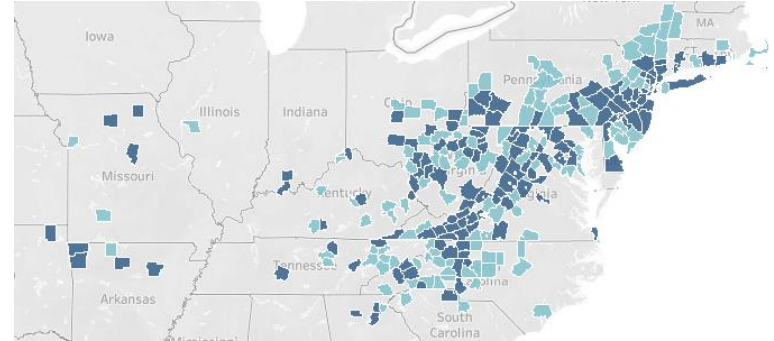
- Ixodidae
 - *Ixodes affinis*, *I. angustus*, *I. brunneus*, *I. cookei*, *I. dentatus*, *I. minor*, *I. scapularis*, *I. texanus*
 - *Haemaphysalis chordeilis*, *H. leporispalustris*, *H. longicornis*
 - *Dermacentor albipictus*, *D. variabilis*
 - *Amblyomma americanum*, *A. dissimile*, *A. maculatum*, *A. tuberculatum*
 - *Rhipicephalus sanguineus* (temperate lineage)
- Argasidae
 - *Carios capensis*, *C. kelleyi*
 - *Ornithodoros yumatensis*, *Otobius megnini*
 - *Argas miniatus*, *A. radiatus*

Exotic/imported ticks, not known to be established

- *Dermacentor nitens*
- *Amblyomma geoemydae*
- *Amblyomma latum*
- *Amblyomma longirostre*
- *Amblyomma triguttatum*
- *Amblyomma rotundatum*
- *Rhipicephalus* (formerly *Boophilus*) *annulatus*
- *Rhipicephalus microplus*
- *Amblyomma cajennense* (probably *A. mixtum*)
- *Ixodes kingi*
- *Ixodes woodi*

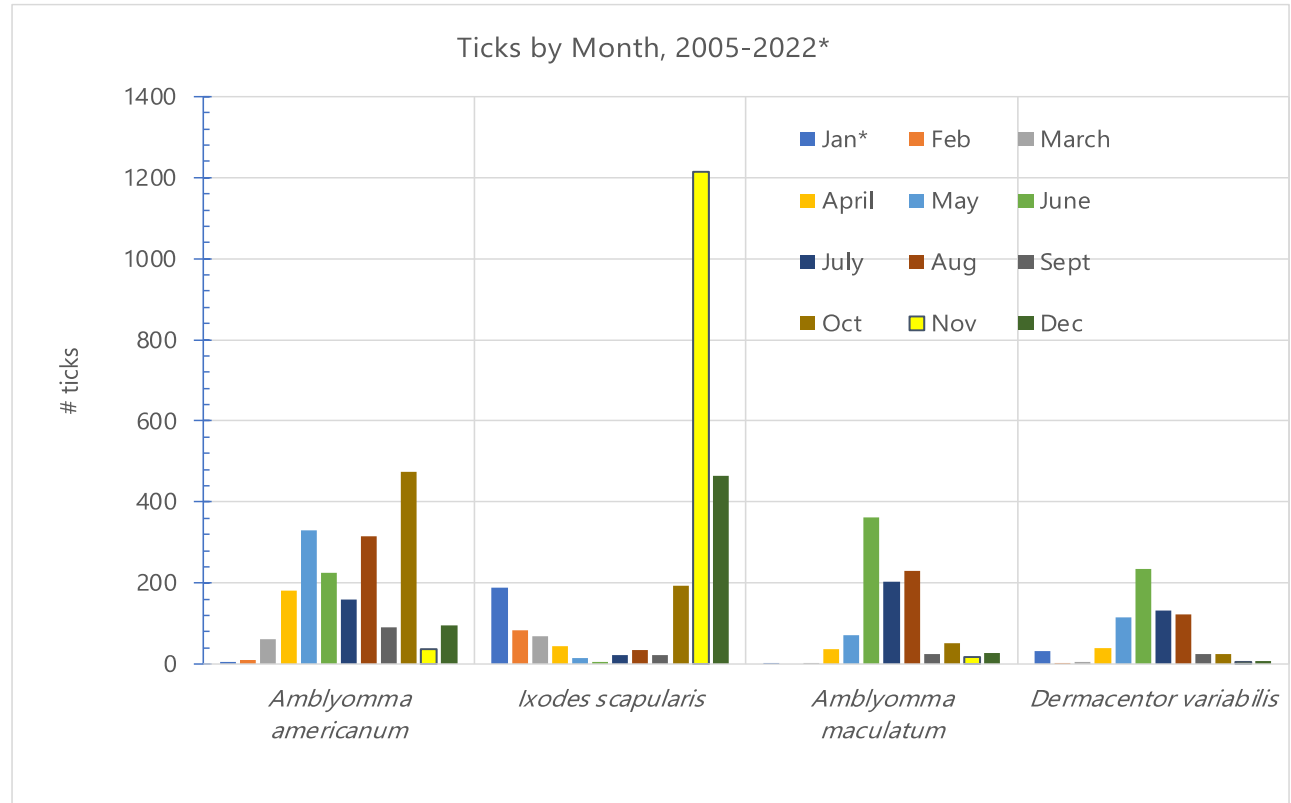
Haemaphysalis longicornis (Asian longhorned tick)

- First seen outside quarantine in 2017 (NJ) on sheep
- Retrospectively identified from 2010 on white-tailed deer
- Now found in 21 eastern and central states and DC; recognized from GA in 2021
- Currently found in 4 GA counties (Pickens, Hall, Habersham, and White)
- Primary concern to agriculture due to blood loss and transmission of a protozoan parasite, *Theileria orientalis* Ikeda strain



Georgia ticks collected by month (2005-2022)

- 4 tick species are the primary ticks encountered.
- Phenology (when ticks are present) varies across the year by species.



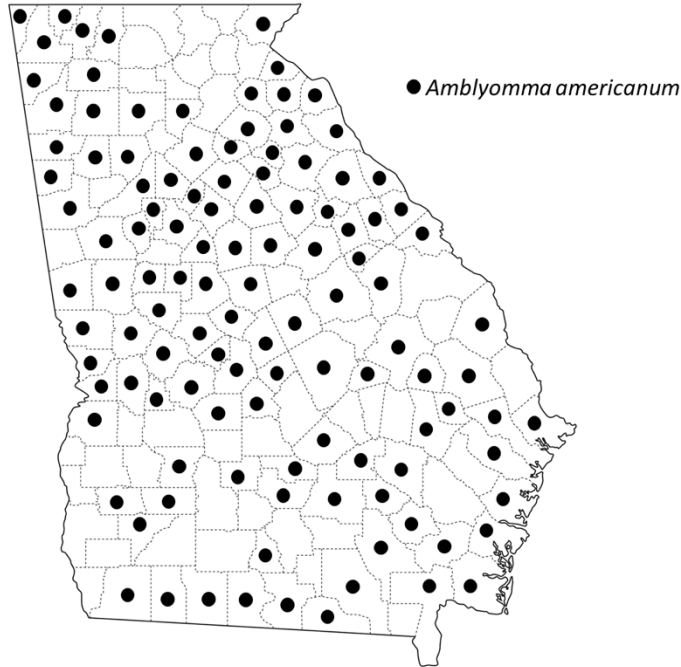
Data from R. Kelly

Amblyomma americanum (Linnaeus)

- Lone star tick
- Important human-biting tick associated with ehrlichiosis (*E. chaffeensis* and *E. ewingii*), Heartland virus, Bourbon virus, and alpha-gal syndrome



Amblyomma americanum



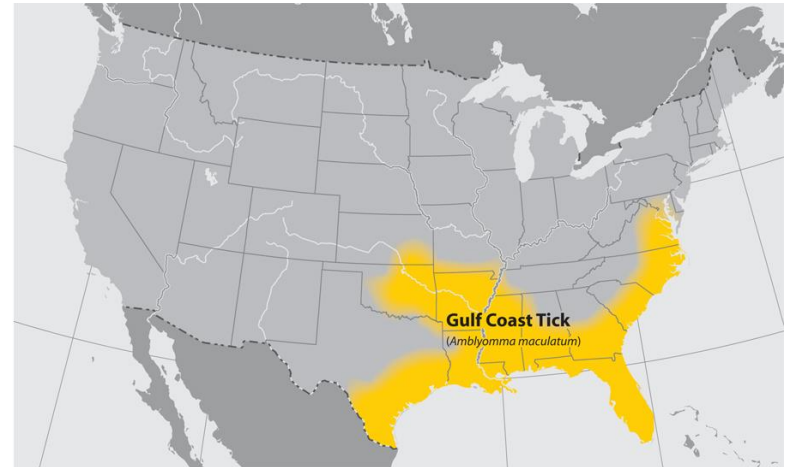
- *Amblyomma americanum* was recorded from 118 (74%) counties of the state.
- This tick was collected from vegetation and from 35 vertebrate host species (23 mammals, 12 birds).

Amblyomma maculatum Koch

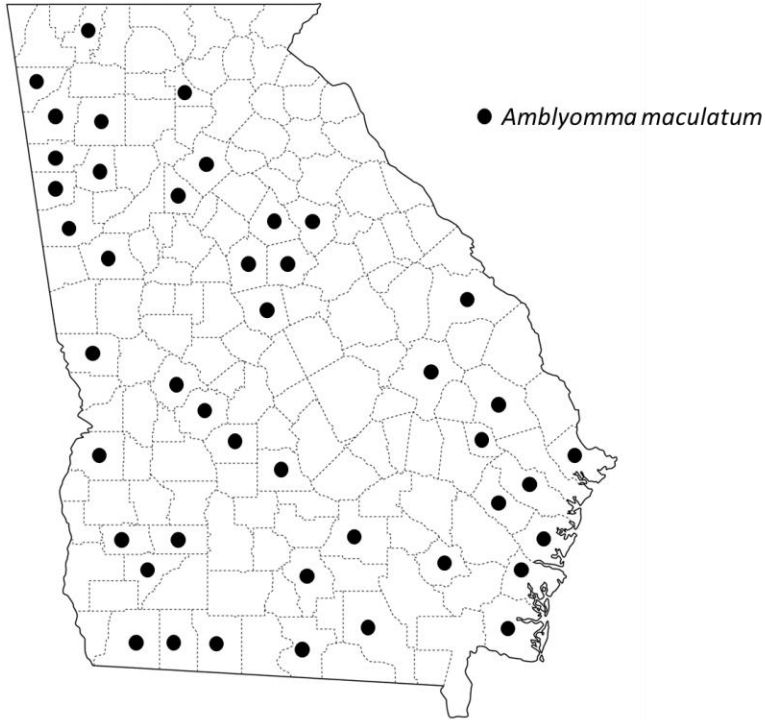
- Gulf coast tick



- Human-biting tick associated with *Rickettsia parkeri* rickettsiosis.



Amblyomma maculatum



- The Gulf Coast tick was recorded from 44 (28%) counties of the state.
- This ticks was collected from vegetation and from 21 vertebrate host species (13 mammals, 8 birds).

Dermacentor variabilis (Say)

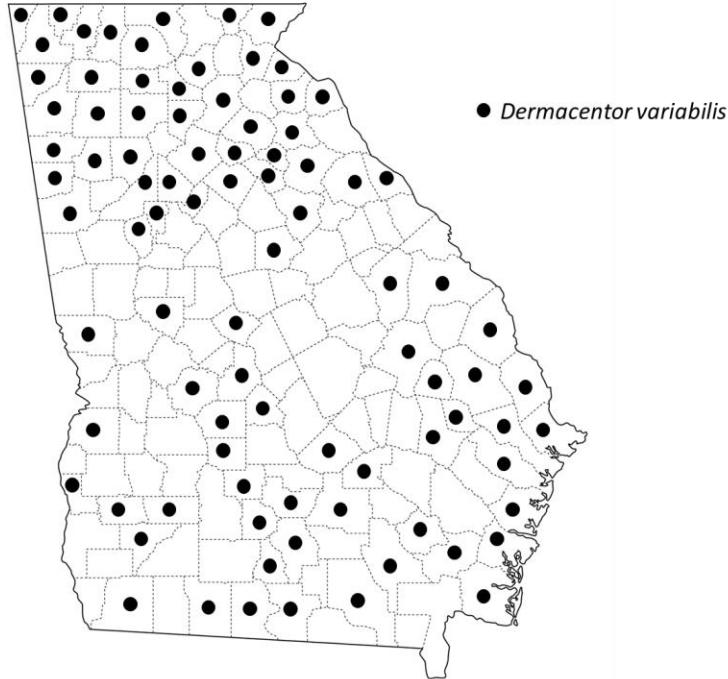
- American dog tick



- Important human-biting tick associated with Rocky Mountain spotted fever (*Rickettsia rickettsii*)



Dermacentor variabilis



- The American dog tick was recorded from 89 (56%) counties of the state.
- This tick was collected from vegetation and 28 vertebrate host species (26 mammals, 1 bird, 1 reptile).

Ixodes scapularis Say

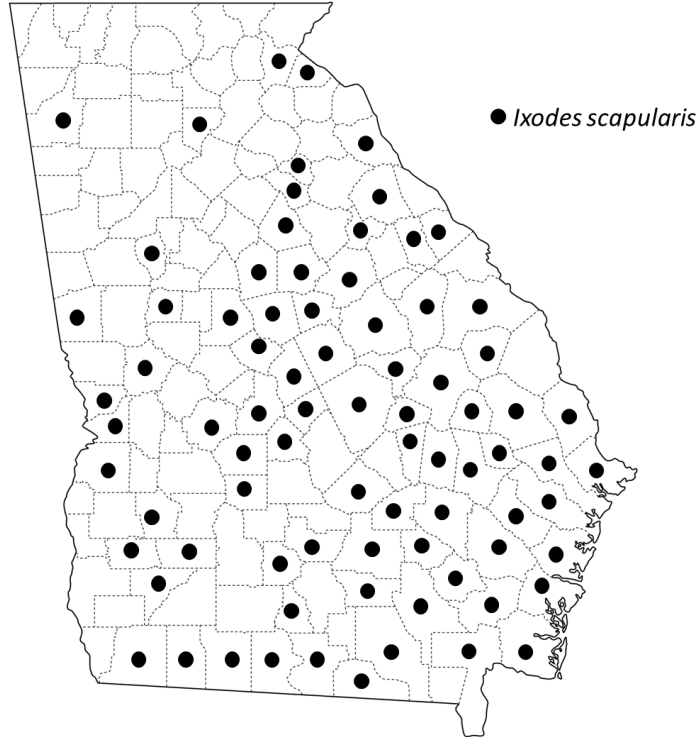
- Blacklegged tick



- Human-biting tick associated with Lyme disease (*Borrelia burgdorferi*), anaplasmosis (*A. phagocytophilum*), babesiosis, and Powassan virus.



Ixodes scapularis



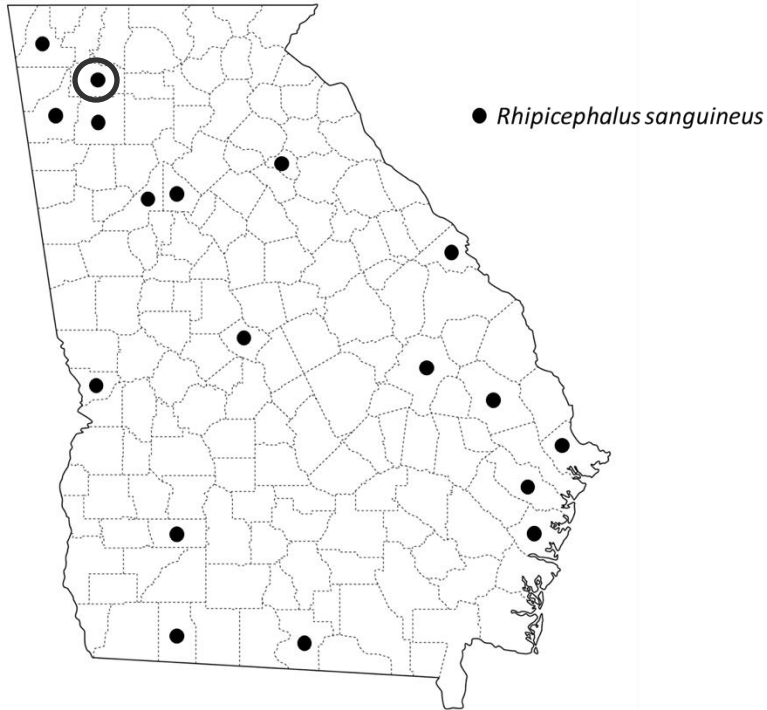
- The blacklegged tick was recorded from 81 (51%) counties of the state.
- This tick was collected from 32 vertebrate host species (23 mammals, 6 birds, and 3 reptiles).

Rhipicephalus sanguineus Latreille

- Brown dog tick
- Human-biting tick that is associated with Rocky Mountain spotted fever (*Rickettsia rickettsii*)



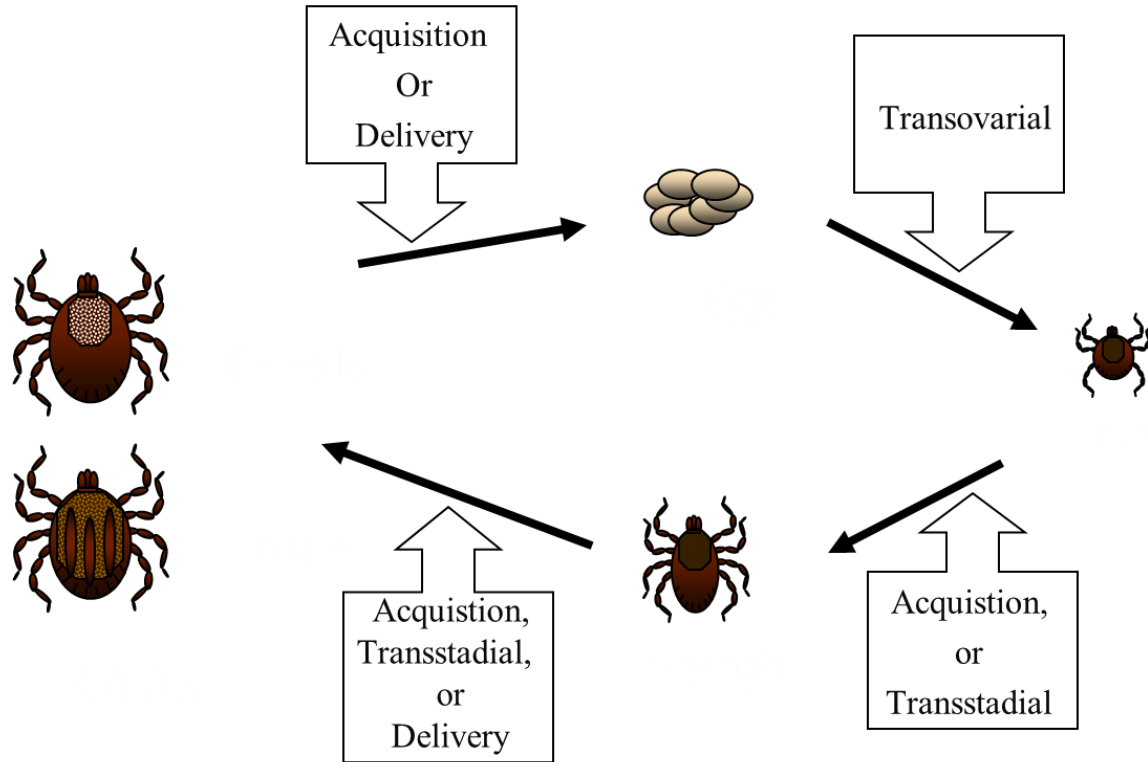
Rhipicephalus sanguineus



- The brown dog tick was recorded from only 18 (11%) of the state's 159 counties. Actual distribution is likely much wider.
- This tick was collected only from vegetation, dogs, and a human.
- Infected ticks found in backyard of fatal RMSF case in Gordon County (2009) [circled]

Trends in tick-borne diseases

Pathogen maintenance and transfer

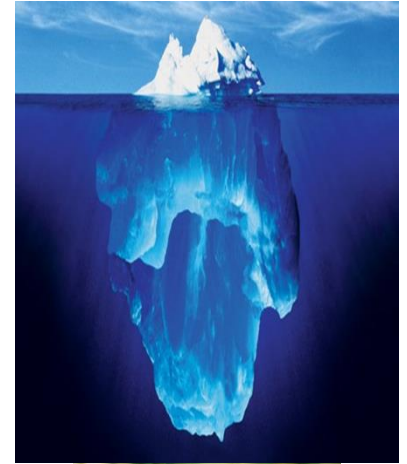


Diversity of human pathogens transmitted by ticks

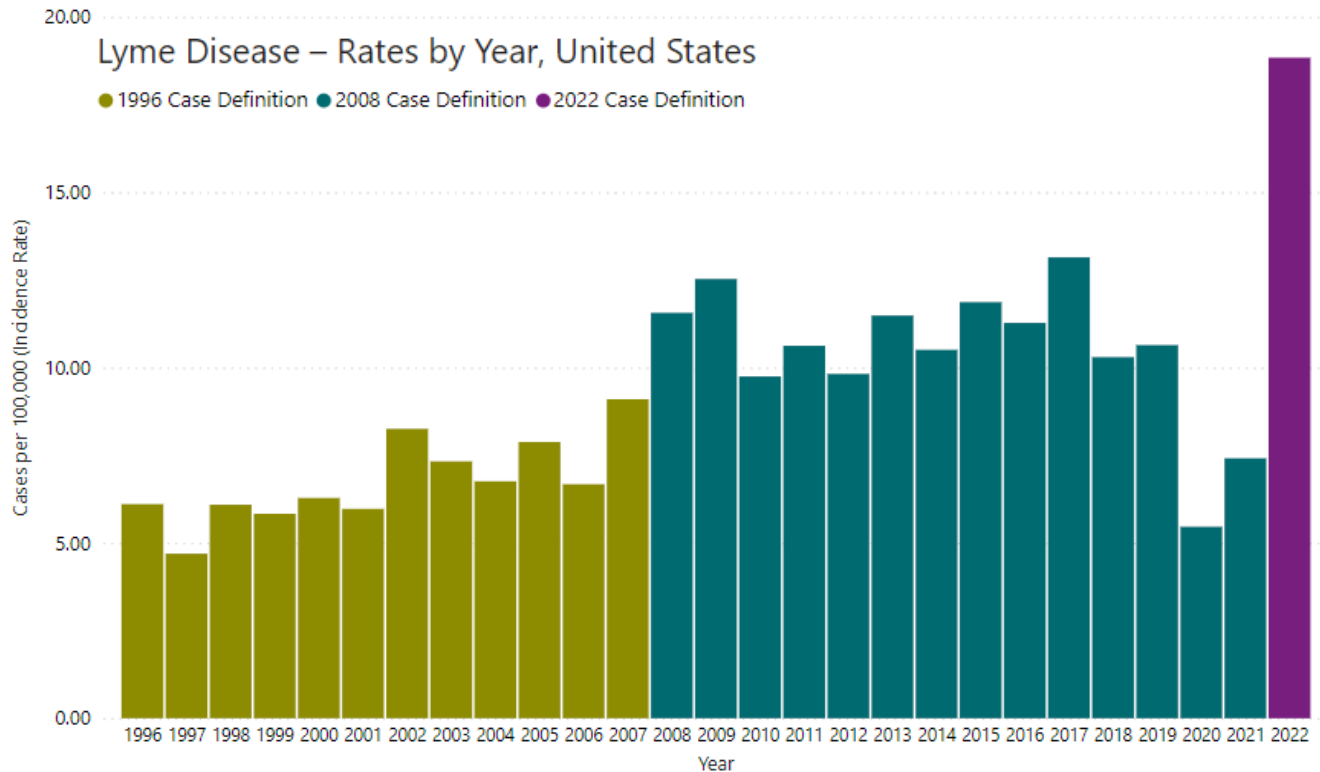
- Bacteria
 - *Borreliae*
 - *Rickettsiae*
 - *Francisella*
- Protozoa
 - *Babesia*
- Viruses
 - Powassan virus (POWV lineage I)
 - Deer tick virus (POWV lineage II)
 - Colorado tick fever virus
 - Heartland virus
 - Bourbon virus

Tick-borne diseases are increasing in the U.S.

- Tickborne diseases (TBDs) account for over 80% of all reported vector-borne disease cases.
- Ticks are becoming increasingly widespread
- The range of known tick-borne pathogens are expanding
- Incidence of reported TBDs have more than doubled over the past two decades
- Reported cases substantially underestimate actual disease occurrence (e.g., Lyme disease: estimates ~476,000 diagnosed and treated cases/year)
- New tick-borne pathogens and conditions continue to be discovered

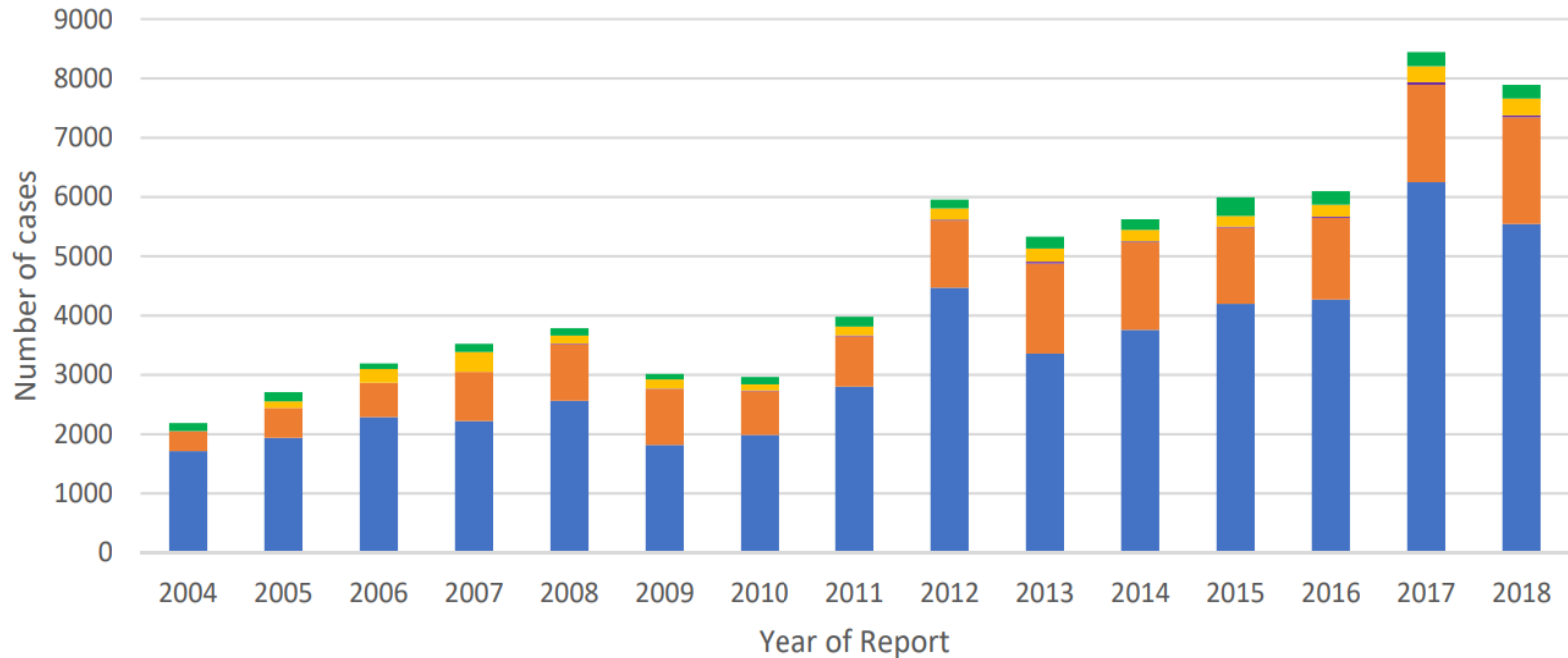


Lyme disease increasing rates in the U.S.: 1996-2022



*These data were reported according to different Lyme disease case definitions. Only major case definition changes are denoted.

Metastriate-transmitted tickborne diseases in the United States, 2004 – 2018



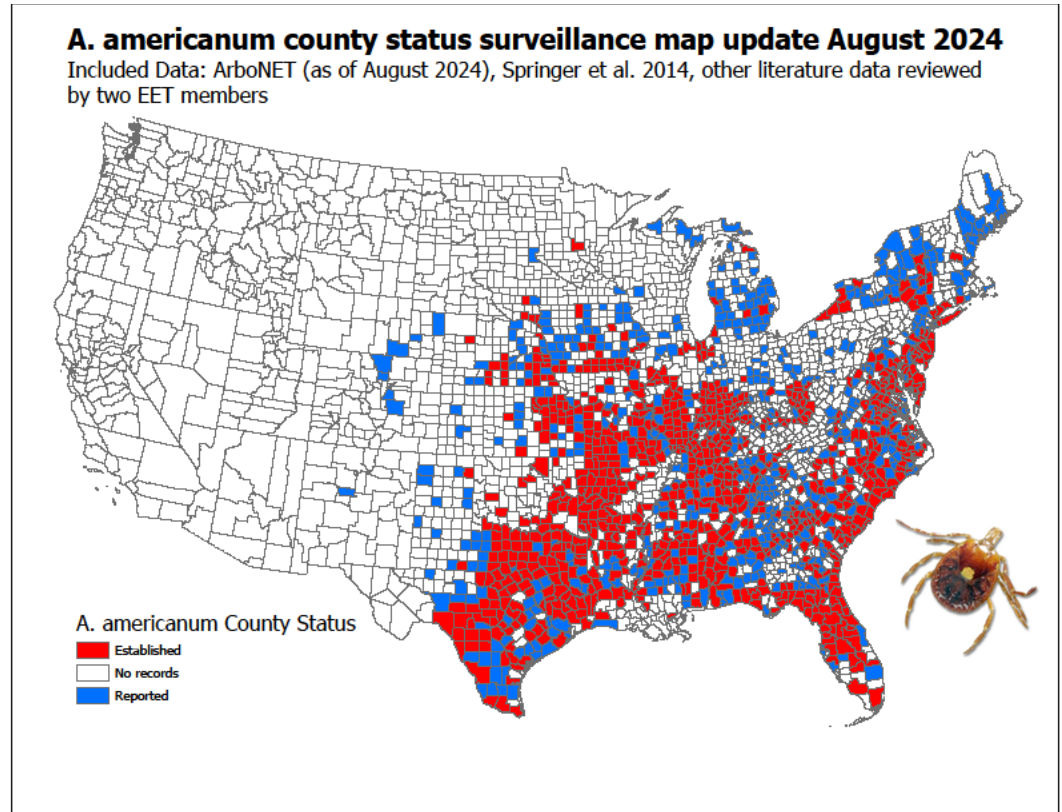
■ Spotted Fever Rickettsioses ■ *Ehrlichia chaffeensis* ehrlichiosis ■ Undetermined *Ehrlichia/Anaplasma*

Source: https://www.cdc.gov/ticks/pdfs/Tick_surveillance-P.pdf

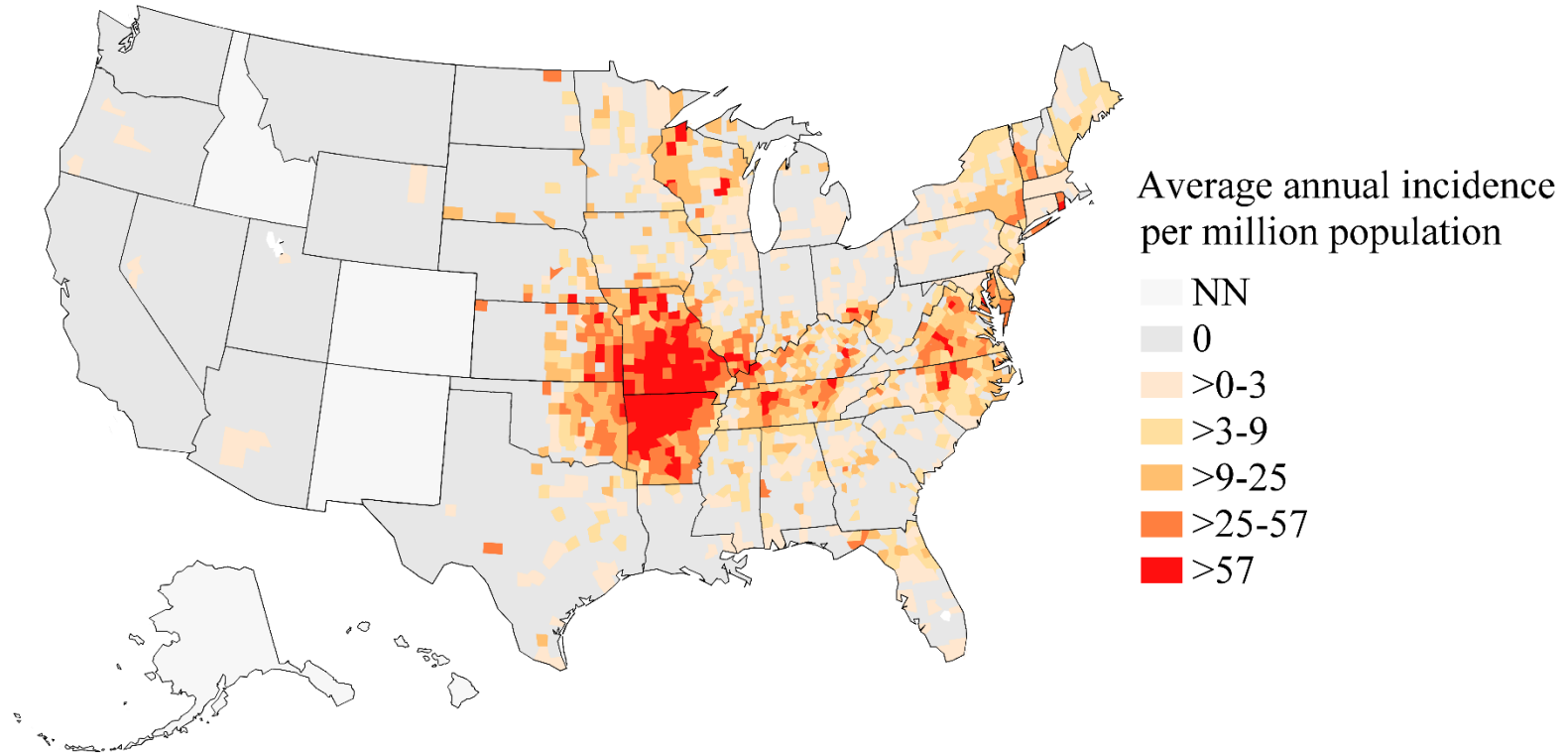
■ *Ehrlichia ewingii* ■ Tularemia

Distribution: Lone star tick, *Amblyomma americanum*

- Occurrences are being documented further north and west
- Many counties have established populations across historical range of the tick
- Most common human-biting tick in the southeastern and south-central United States

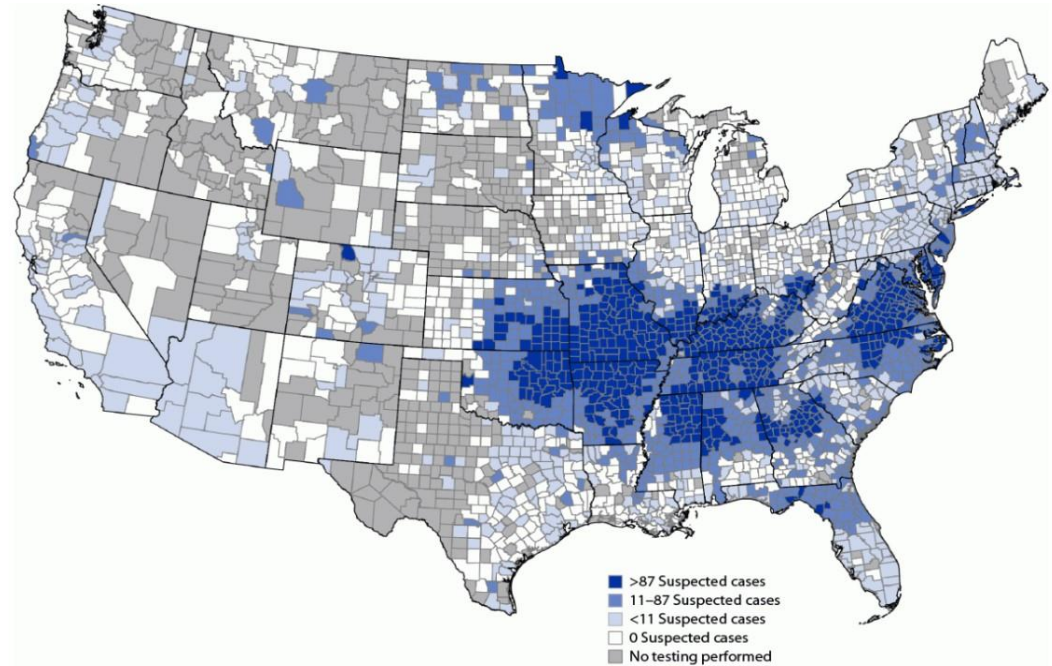


Increasing range of ehrlichiosis in the United States: *Ehrlichia chaffeensis* incidence (2013-2021)



Geographic distribution of suspected AGS cases per 1 million population per year — U.S., 2017–2022

- Newly recognized condition associated with lone star tick bites
- 450,000 individuals in the U.S. have been estimated to have AGS
- Viracor data: In Georgia, there were 3,261 people positive for IgE to alpha-gal (suspect cases)
- 78% of HCPs in the U.S. have little to no knowledge of the diagnostic or clinical features of AGS



Rocky Mountain spotted fever (RMSF) in the Southwest

- *Rhipicephalus sanguineus*, the brown dog tick, has emerged as a major vector of *Rickettsia rickettsii* in the Southwestern U.S. and in multiple states of Mexico.
- The annual incidence of RMSF in affected tribal lands in Arizona is about 150x that of the rest of the United State and has a higher case fatality rate.
- Brown dog ticks are associated with high tick population with large numbers of free-roaming dogs, transporting ticks throughout the communities.
- Ongoing control efforts require routine surveillance

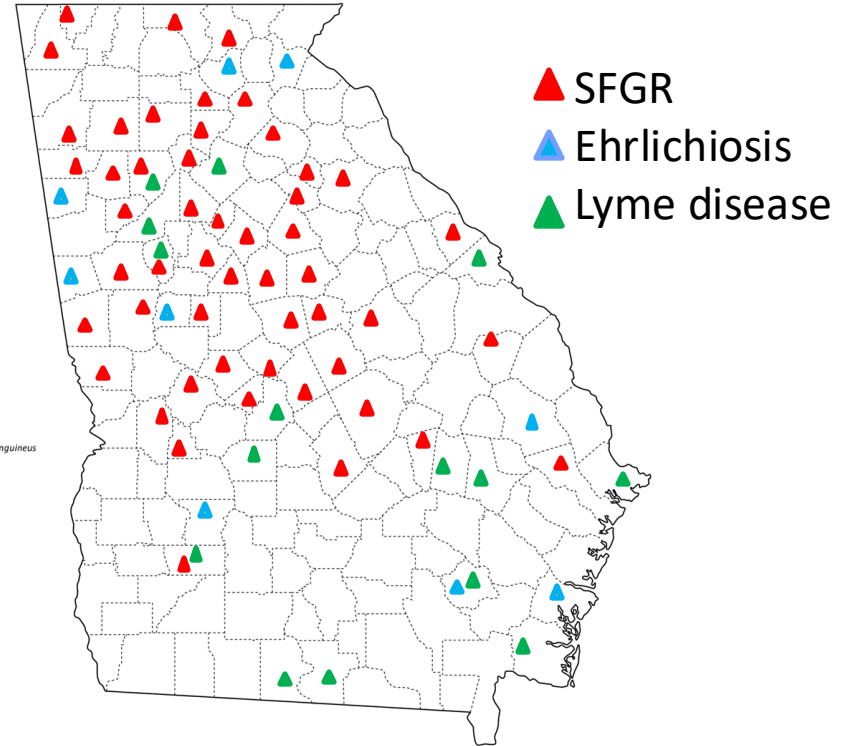
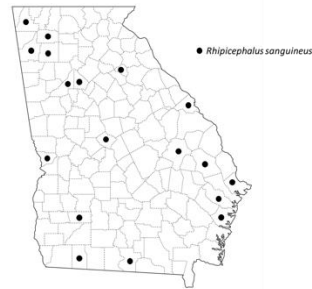
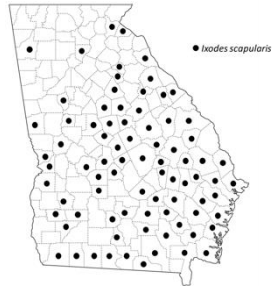
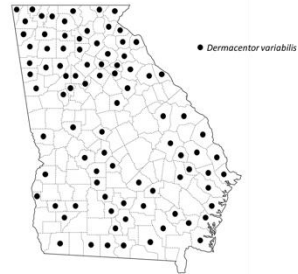
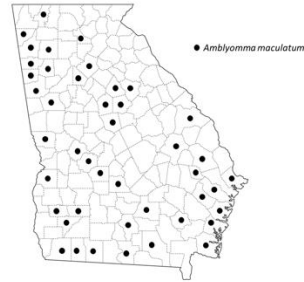
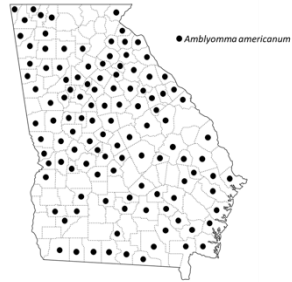


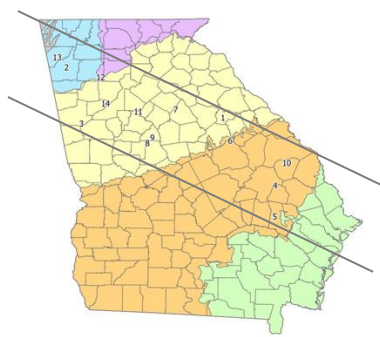
Georgia rickettsial diseases: are they underreported?

- **CDC: Case counts reported from Georgia**

Condition	2015	2016	2017	2018	2019	2020	2021
SFR	114	74	71	1	27	26	24
Ehrlichia chaffeensis	33	12	2	-	3	8	9
Ehrlichia ewingii	0	0	0	0	0	0	0
Anaplasma phagocytophilum	0	0	0	0	0	0	1
Ehrlichiosis/Anaplasmosis undetermined	1	2	1	0	0	0	0

Distribution of Georgia counties reporting tick-borne diseases (2016-2019)





Survey of ticks across Georgia (2016)

Table 2: Number of adult ticks collected from each state park that were tested for each of the below listed pathogens (Prevalence). Colors indicate which physiographic region a collection site was located as indicated in (Figure 1).

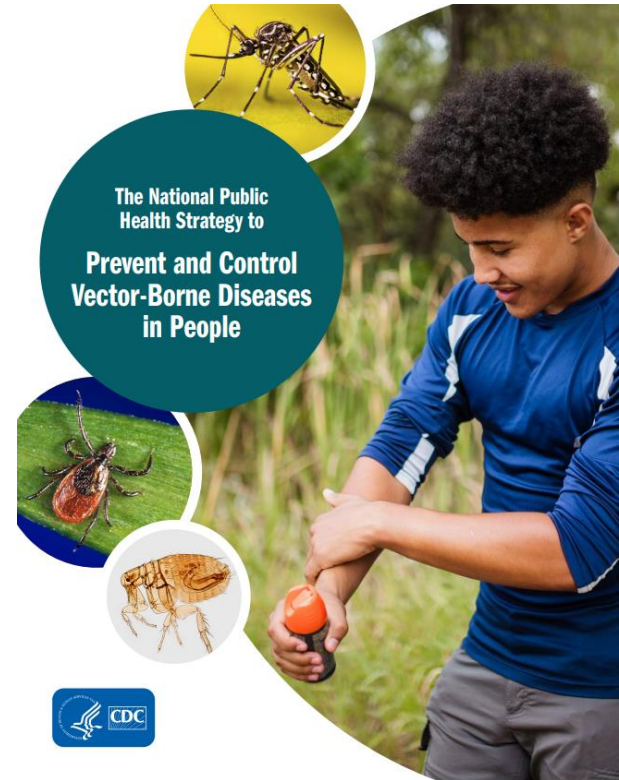
Site No.*	State Park Collection Site	<i>A. americanum</i> positive for <i>chaffeensis</i>	<i>A. americanum</i> positive for <i>ewingii</i>	<i>A. americanum</i> positive for <i>lonestari</i>	<i>A. maculatum</i> positive for <i>R. parkeri</i>
1	A.H. Stephens State Park	0/2	0/2	0/2	0/0
2	Berry College	0/1	0/1	0/1	48/93 (51.6%)
3	Chattahoochee Bend State Park	0/82	4/82 (4.9%)	0/82	1/9 (11.1%)
4	George L. Smith State Park	0/9	0/9	0/9	0/0
5	Gordonia State Park	2/22 (9.1%)	0/22	0/22	0/0
6	Hamburg State Park	0/2	0/2	0/2	1/10 (10%)
7	Hard Labor Creek State Park	0/51	1/51 (2%)	0/51	0/0
8	High Falls State Park	1/39 (2.6%)	0/39	0/39	0/0
9	Indian Springs State Park	1/104 (1.0%)	1/104 (1.0%)	1/104 (1.0%)	0/0
10	Magnolia Springs State Park	0/20	0/20	1/20 (5.0%)	0/3
11	Panola Mountain State Park	3/74 (4.1%)	2/74 (2.7%)	1/74 (1.4%)	0/0
12	Red Top Mountain State Park	0/0	0/0	0/0	9/33 (27.3%)
Total		7/406 (1.7%)	8/406 (2.0%)	3/406 (0.7%)	59/148 (39.9%)

*Site numbers correspond to the collection site numbers in Figure 1.

Tick surveillance for public health

National Strategy: Public health needs and priorities to address VBDs

- *Better understand when, where, and how people are exposed to and become sick or die from VBDs*
- Develop, evaluate, and improve tools, methods, and guidance to diagnose VBDs
- Develop, evaluate, and improve tools, methods, and guidance to prevent and control VBDs
- Develop and assess drugs and treatment strategies for VBDs
- *Disseminate and implement public health tools, programs, and collaborations to prevent, detect, diagnose, and respond to VBD threats*



The CDC National Tick Surveillance Program

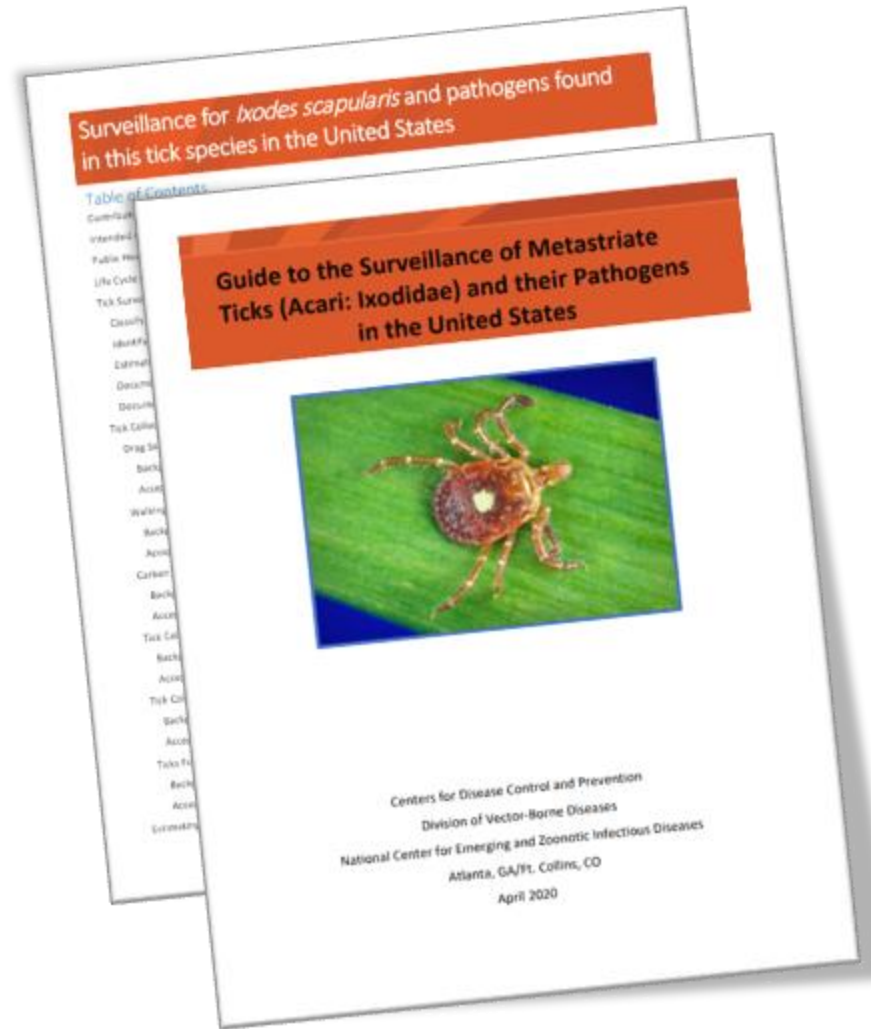
- A program initiated by DVBD in 2018 to establish and enhance surveillance for medically important tick species and tickborne pathogens in the U.S.

CDC provides assistance to public health and academic agencies conducting tick surveillance

- Epidemiology and laboratory capacity (ELC) cooperative agreements
- Regional Vector-Borne Disease Centers of Excellence (COEs)
- Identification and testing of field-collected ticks for tick-borne pathogens
- Consultation, training, and assistance related to program planning and surveillance methods
- National tick surveillance database and public-facing data summaries

Tick surveillance guidance

- Guidance documents can be found at our website cdc.gov/ticks/surveillance
- Additional assistance is available by contacting ticksurveillance@cdc.gov, including:
 - Laboratory protocols and guidance
 - Surveillance program and sampling strategy consultation
 - Data reporting to the ArboNET national database
 - Summary and calculated data requests



Challenges include limited resources and personnel

- Tick surveillance activities are resource intensive
 - Pathogen testing is often the costliest aspect of defining acarologic risk
 - Limited states conduct their own testing
- Participation in tick surveillance is uneven across states and regions
- Many states lack personnel and get help from colleges and universities
- There is a need to expand the public health entomology workforce at the state / county level
 - CDC funded Centers of Excellence and Training and Evaluation Centers are working to train the next generation of public health entomologists
 - Limited states have permanent entomologist positions

Some resources online:

Centers for Disease Control & Prevention
www.cdc.gov/ticks

Georgia Dept. of Public Health
dph.georgia.gov/epidemiology/zvbd/tbd

Thank you for listening!



Acknowledgements

State/local public health and
academic partners



For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 www.cdc.gov

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Thank you for the invitation to present at the 2024 Georgia Mosquito Control Association meeting

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