
Georgia Tick Surveillance, 2021



Asian Longhorned ticks (Haemaphysalis longicornis), questing

Ticks and Tick-Borne Diseases

Overview

Surveillance for ticks has been mostly lacking in Georgia, even where tick-borne diseases have been reported. Tick surveillance is intended to monitor changes in the distribution and abundance of ticks. While several short-term attached tick studies have been completed, no surveillance for presence and prevalence have been undertaken due to lack of funding.

Currently, tick surveillance at the Georgia Department of Public Health (GDPH) is only done in collaboration with the Georgia Department of Agriculture's (GDA) tick attach study and with DNR, checking deer and bear at check stations on Wildlife Management Areas during hunts. While this is an acceptable method of determining presence of tick species, it does not provide prevalence data. GDPH has also collaborated with the Southeastern Center of Excellence in Vector Borne Diseases to do tick drags along Georgia's borders with North and South Carolina and Tennessee. With sufficient funding, active surveillance using tick drags could be provided in a larger area and in response to detection of tick-borne diseases. It may be possible to submit ticks to the CDC for testing, allowing the determination of presence and prevalence of pathogens in ticks. Carbon dioxide traps would be used as a secondary method of determining the presence of *Amblyomma americanum* in an area.

The major tick-borne diseases in the southeastern US include Lyme disease, Rocky Mountain spotted fever, STARI, ehrlichiosis, and anaplasmosis. In addition to tick-borne diseases, a toxin can be transmitted through the saliva of a tick bite that causes progressive paralysis, a condition known as "tick paralysis." Tick feeding also may result in mild to severe allergic reactions in some individuals. Many tick-borne diseases are successfully treated if symptoms are recognized early. When the disease is not diagnosed during the early stages of infection, treatment can be difficult and chronic symptoms may develop or death may occur. It is the risk of these diseases that supports a need for more active surveillance and a more tick robust program.

Current Goals:

- Obtain a better understanding of tick species found in Georgia
- Map potential tickborne disease risk
- Monitor for *Haemaphysalis longicornis* (East Asian or longhorned tick)

To date, Asian longhorned ticks have been found in Arkansas, Connecticut, Delaware, Georgia, Kentucky, Maryland, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Virginia, and West Virginia.

Background

At least two surveys of ticks attached to humans have been done in Georgia since 1990. The first, which ran from 1990-1995, was a collaboration between the Medical College of Georgia and Georgia Southern University, and is published in the *Journal of Parasitology*, 1996. The second study was done between April 2005 and December 2006 by the Georgia Department of Public Health (GDPH). This study was not published, but information from this study is included in a paper on *Rickettsia parkeri* published in *Emerging and Infectious Diseases*, 2009. Data from this second survey are included in this summary.

The Georgia Department of Agriculture (GDA) has conducted an ongoing survey on ticks attached to animals since at least 2005. In 2018, the GDPH Environmental Health Section (DPH/EHS) reached an agreement with the GDA to assist with the study in exchange for access to the data. The GDA shared data from 2005 to the present. When the Vector Surveillance Coordinator program was funded, DPH provided tick collection kits and mailers to local veterinarians around the state. The ticks were sent for ID and testing to the National Veterinary Services Laboratories in Iowa. Currently, a few veterinarians continue to send in ticks, and it is hoped that DPH/EHS interns will also be able to reach out to veterinarians in their surveillance areas in order to collect ticks. Data from all sources are returned to the GDA, who send the raw data to the GDPH for analysis.

Richmond County Department of Health Mosquito Control program (RCMC) had also partnered with the State Entomologists for GDPH and the GDA to survey collected ticks from felines and canines in Richmond County, GA. All veterinary clinics in Richmond County were called by the regional Entomologist to request participation and explain procedure. RCMC used the same tick collection kits, containing tick forms and vials of isopropyl alcohol, along with GDA collection forms. These were disseminated to local veterinary clinics willing to participate, as well as Augusta Animal Services. Clinics were called to check for collected ticks about once every 2 months. Ticks were picked up in vials with forms and returned to the lab to be identified, followed by shipment to GDA for verification and to be included in a state-wide survey in Georgia. This program is currently on hold.

Additional tick data were collected in collaboration with the Georgia Department of Natural Resources. Entomologists from DPH attended 11 quota hunts at 5 different Wildlife Management areas (BF Grant, Rum Creek, Oaky Woods, Clybel and Cedar Creek) in order to check deer and bear brought in for tagging for ticks.

Data are put into an Excel spreadsheet for analysis. Information collected include the date the tick was collected, the tick genus and species, the life stage, the number collected from the animal host, and the county where the tick was collected. Additional information (accession number, case number, and species to which the tick was attached) are preserved in an Access database but not used in analysis.

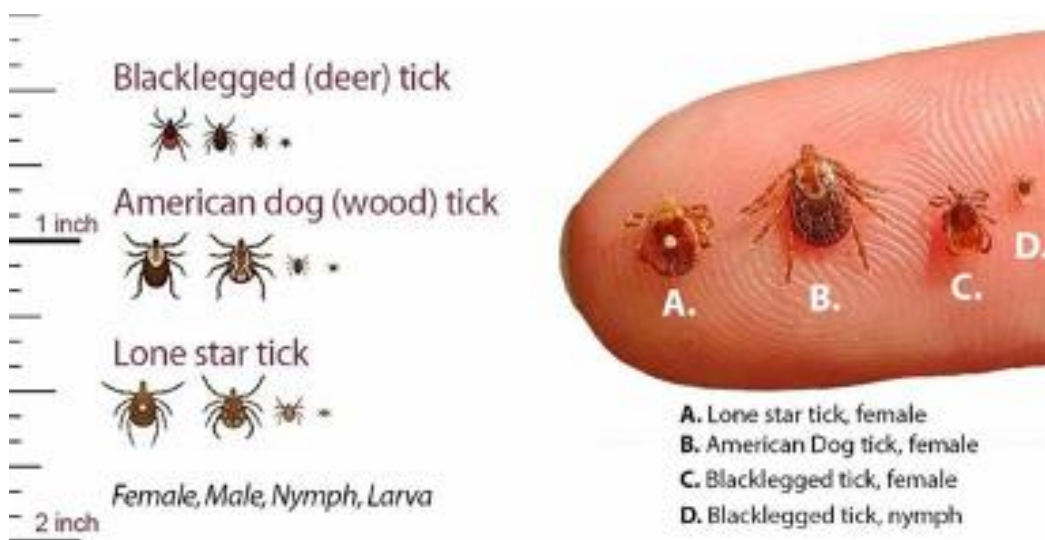
Tick Biology

Ticks are arthropods in the Class Arachnida. Along with mites, they constitute the subclass Acari. Almost all ticks belong to one of two major families, the Ixodidae or hard ticks, and the Argasidae or soft ticks. Adults have ovoid or pear-shaped bodies, which become engorged with blood when they feed, and eight legs. In addition to having a hard shield on their dorsal surfaces, hard ticks have a proboscis at the front containing the mouthparts, whereas soft ticks have their mouthparts on the underside of their bodies. Both families locate a potential host by odor or from changes in the environment.

Ticks have four stages to their lifecycle: egg, larva, nymph, and adult. Ixodid ticks have three hosts, taking at least a year to complete their lifecycle. Argasid ticks have up to seven nymphal stages (instars), each one requiring a blood meal. Because of their habit of ingesting blood, ticks are vectors of many diseases that affect humans and other animals.

Larval ticks hatch with six legs, acquiring the other two after a blood meal and molting into the nymph stage. In the nymphal and adult stages, ticks have eight legs.

While adults are the most commonly found stage of the tick because of their size, immature stages are also important to the disease transmission cycle. Typically, the larval tick picks up a disease organism while feeding. The disease organism stays with the tick during the molt and can now be transmitted to the next host. Nymphs are most implicated in disease transmission, although the disease organism does stay with the tick into the adult stage.



Surveillance

Vector surveillance can be defined as the monitoring of arthropod populations responsible for the transmission of pathogens. Vector surveillance can be used to:

- Better understand vector ecology, for example:
 - Vector population distribution or density
 - Vector species diversity
 - Seasonal variation and population dynamics
- Detect the presence/absence of a vector population, for example:
 - Detection of an “exotic” vector species in a region not known to be colonized
 - Evaluation of vector control programs
 - Surveillance of the presence of insecticide resistance genes in a vector population
- Assess the risk of vector-borne pathogen transmission, for example:
 - An early-alert system based on routine pathogen detection in vector populations
 - The evaluation of vector abundance

Types of Sampling

Drag/Flag Sampling

Many adult ixodid ticks can be collected while questing for hosts from the vegetation. Dragging or flagging is done with a 1 m² piece of white cotton flannel attached to a 1.5 m wooden dowel. Dragging is more effective in more open areas, where a greater surface area of material would contact the tick environment. Flagging, where the flannel is waved back and forth under, in, and around vegetation or leaf litter works better in heavy vegetation. These data can be used to determine tick densities.

Carbon Dioxide Trapping

To construct a CO₂ trap, simply place some dry ice in a vented, insulated container and set the container in the center of a sheet or board on the ground. If the trap will not be monitored, tape can be attached, sticky side out, on the perimeter to capture attracted ticks. A half-pound of dry ice will last about 2 hours at 80°F in an insulated container.

Live/Dead Host Collection

This is a passive method of tick collection that can provide useful information on the presence and abundance of ticks. Ticks collected from hosts should only be included in assessments of county status when travel history is considered.

Estimating Density of Host-Seeking Ticks

The density of host-seeking nymphal or female ticks varies spatially and temporally. To get a representative sample of the density of host-seeking nymphs or females, the sampling area should be at least 750 m of linear transects, or 50 transects of 15 m dragged with a cloth measuring 1 m wide. Distance sampled can be assessed using several methods including: (1) setting fixed sampling grids where flags, stakes or other objects are used to mark the start and end points of each measured length of the transect; (2) using a measured rope or cable and dragging or flagging its full length; or (3) measuring the collector's stride length and walking a fixed number of strides prior to checking the flag or drag. Because ticks can drop off from the drag or flag easily, inspecting the cloth at regular intervals is important, typically between 10-20 m; adults detach more readily than nymphs and therefore the drag or flag should be checked minimally every 10-15 m. Sampling should NOT be conducted when it is raining, when the vegetation is wet enough to saturate the tick drag, or when it is unseasonably cold or extremely windy.

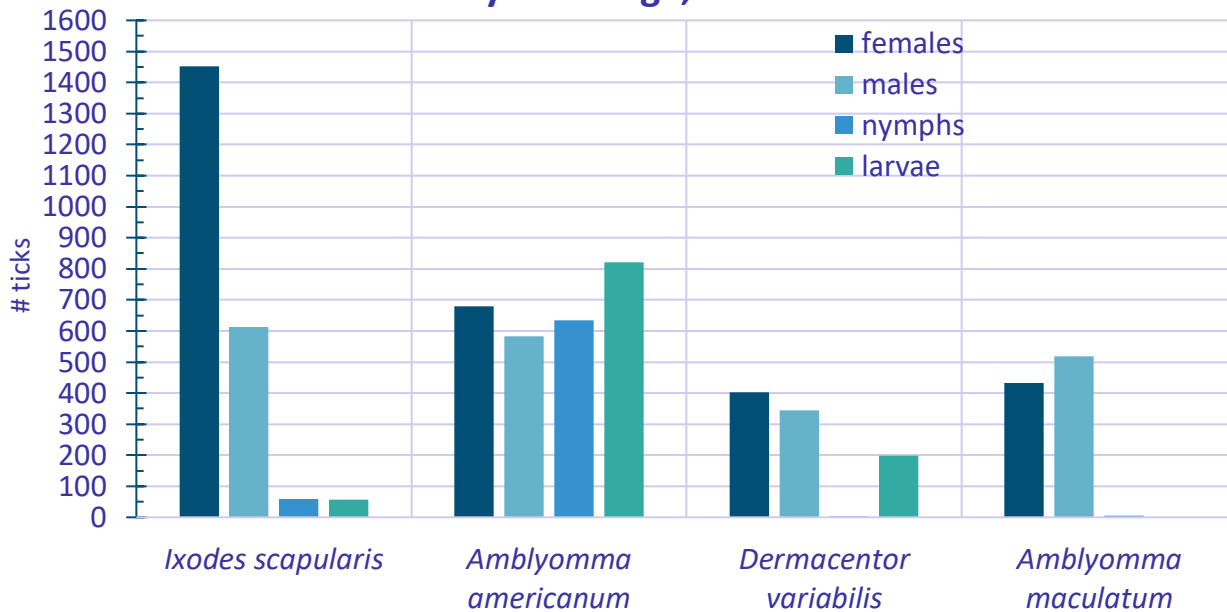
Density of host-seeking nymphs (DON) is estimated as the total number of nymphs collected per total area sampled. DON can be scaled per 100 m² by multiplying the total number of nymphs collected per sampling session by 100 m², then dividing the product by the total area sampled. Density of host-seeking females (DOF) is estimated as the total number of females collected per total area sampled. DOF can be scaled per 100 m² by multiplying the total number of females collected per sampling session by 100 m², then dividing the product by the total area sampled.

Ticks in Georgia

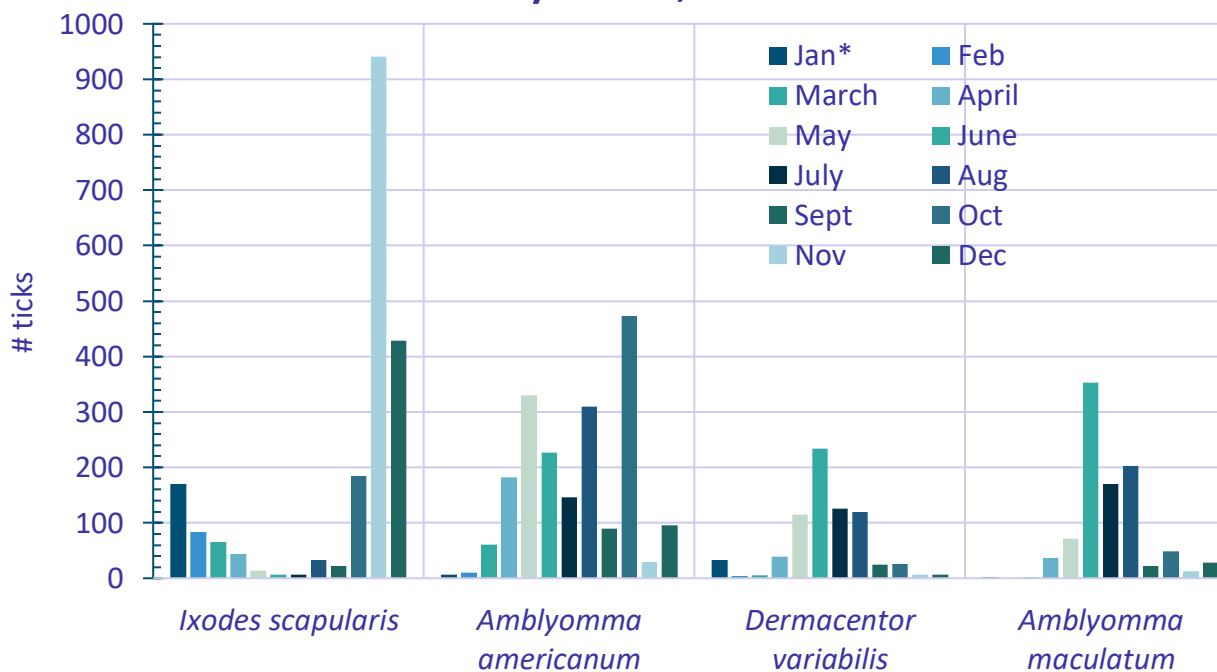
Tick Species Collected in Georgia 2005-2021

Species	females	males	nymphs	larvae	unknown	Grand Total
<i>Amblyomma americanum</i>	679	582	635	820	14	2730
<i>Amblyomma hebraeum</i>	1	4				5
<i>Amblyomma maculatum</i>	432	518	6			956
<i>Amblyomma spp.</i>			22	7		30
<i>Amblyomma tuberculatum</i>			2			2
<i>Amblyomma variegatum</i>			1			1
<i>Argas lahorensis</i>			3			3
<i>Dermacentor albipictus</i>	1	4				5
<i>Dermacentor variabilis</i>	402	345	3	198	48	996
<i>Haemaphysalis leporispalustris</i>			1			1
<i>Haemaphysalis parva</i>			1			1
<i>Ixodes affinis</i>	25	18	1	4		48
<i>Ixodes brunneus</i>	5		4			9
<i>Ixodes cookei</i>	1					1
<i>Ixodes minor</i>	1					1
<i>Ixodes scapularis</i>	1452	612	60	56	23	2203
<i>Ixodes spp.</i>					1	1
<i>Ixodes texanus</i>			5			5
<i>Rhipicephalus evertsi evertsi</i>	1	3				4
<i>Rhipicephalus sanguineus</i>	34	30	2		4	70
<i>Rhipicephalus simus</i>		1				1
<i>Rhipicephalus spp.</i>			1			1
Grand Total	3034	2117	747	1085	91	7074
*does not include 2000 <i>I. scapularis</i> larvae from one source						

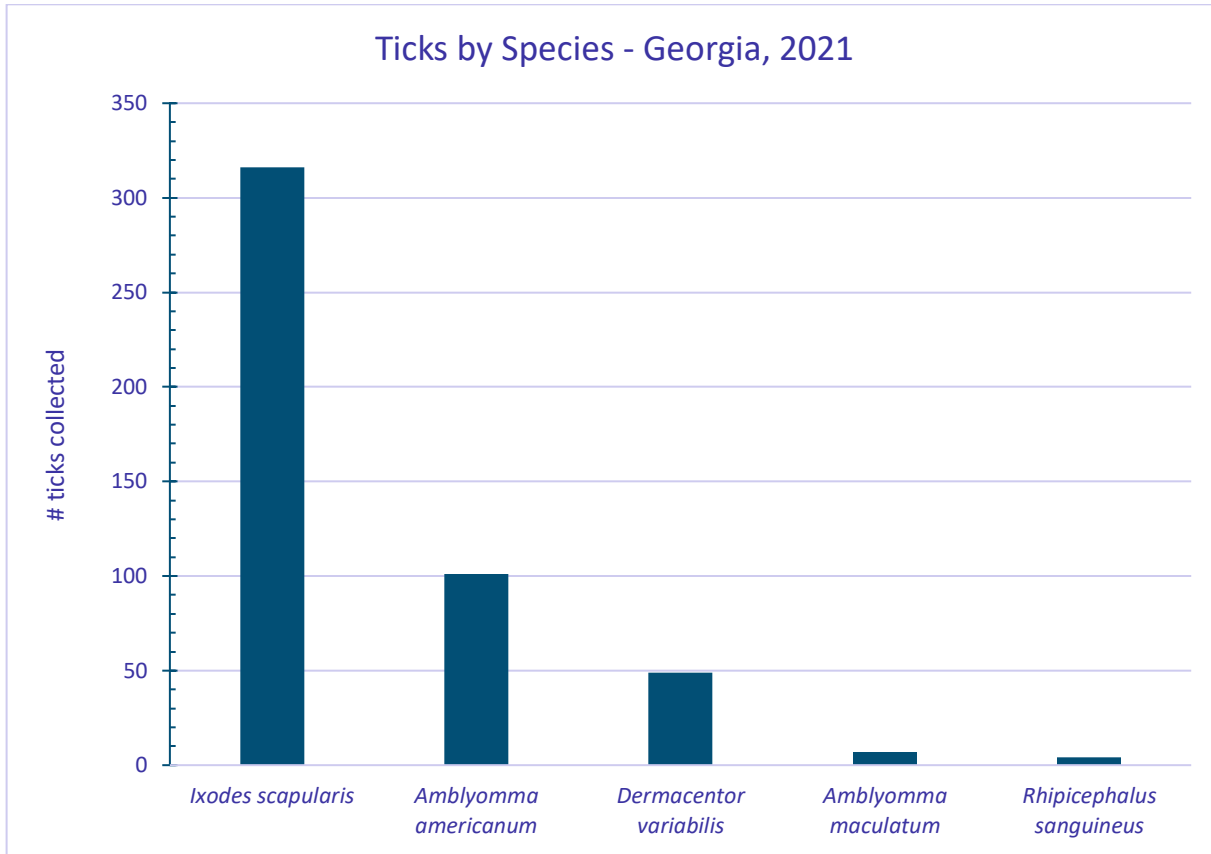
Ticks by Life Stage, 2005-2021



Ticks by Month, 2005-2021



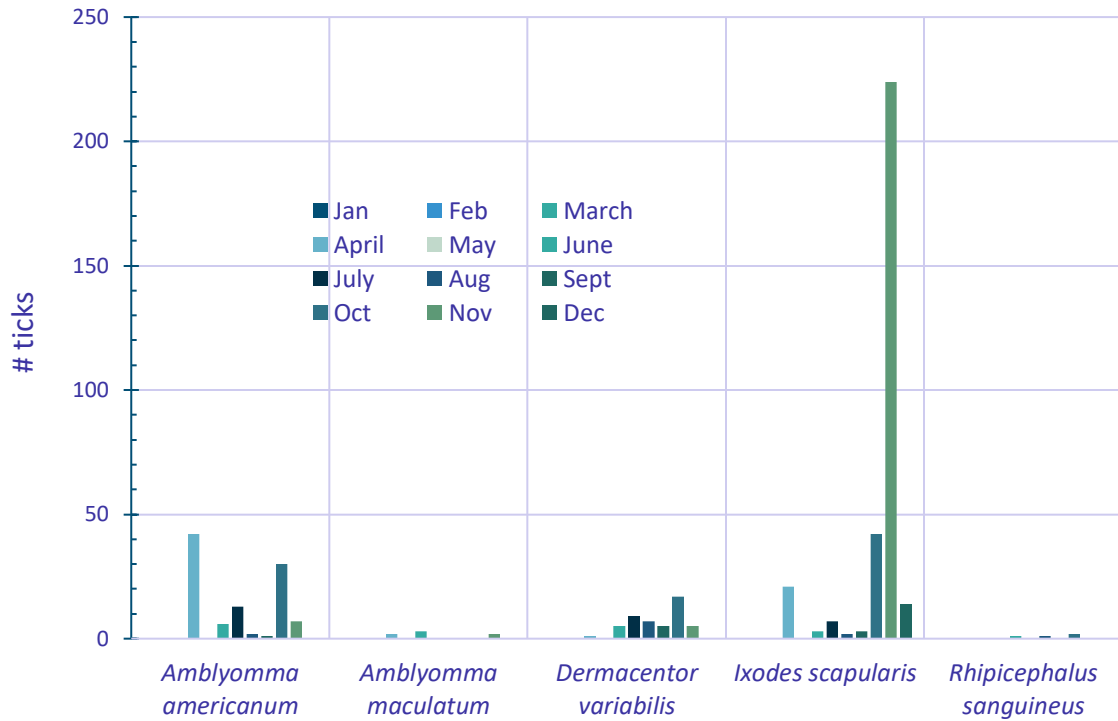
Ticks Collected in 2021



species	2005	2006	2008	2009	2010	2011	2012	2013
<i>Amblyomma americanum</i>	451	90	184	56	596	278	117	117
<i>Ixodes scapularis</i> *	362	4	50	1	56	204	86	82
<i>Dermacentor variabilis</i>	113	23		4	64	248	103	103
<i>Amblyomma maculatum</i>	22	24	5	3	17	45	42	122
<i>Rhipicephalus sanguineus</i>	7				29	17		

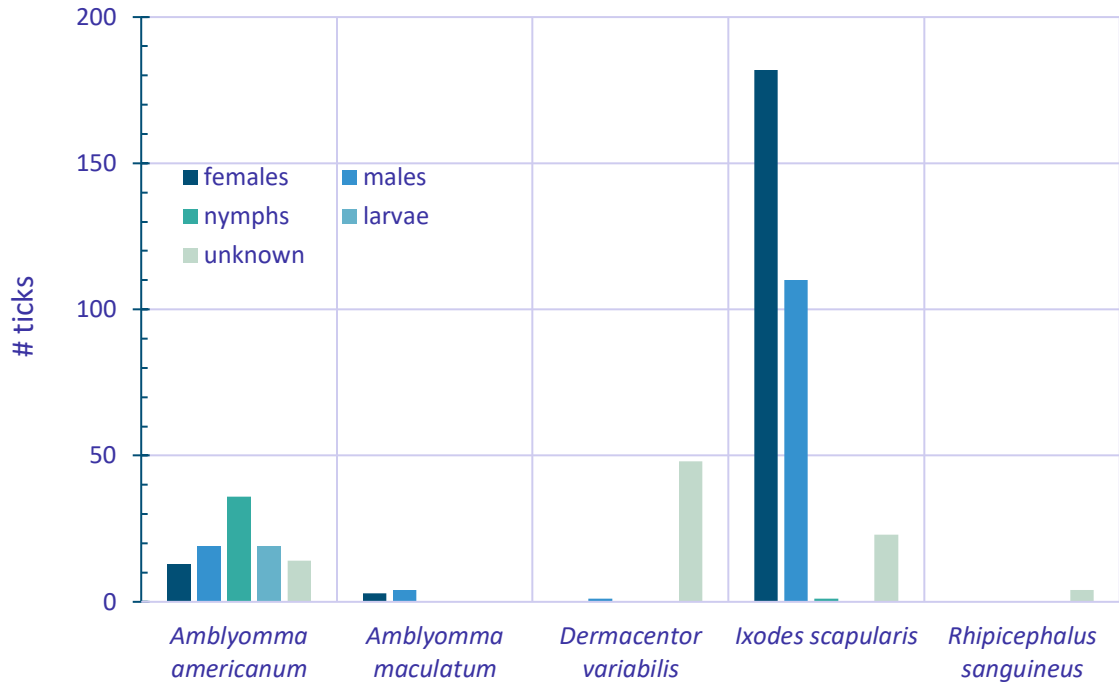
species	2014	2015	2016	2017	2018	2019	2020	2021
<i>Amblyomma americanum</i>	37	17	18	81	32	271	270	101
<i>Ixodes scapularis</i> *	13	97	111	75	67	170	507	316
<i>Dermacentor variabilis</i>	62	12	22	56	58	69	10	49
<i>Amblyomma maculatum</i>	159	110	149	74	54	90	29	7

Ticks by Month - Georgia, 2021



Species, 2021	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Grand Total
<i>Amblyomma americanum</i>	42		6	13	2	1	30	7		101
<i>Amblyomma maculatum</i>	2		3					2		7
<i>Dermacentor variabilis</i>	1		5	9	7	5	17	5		49
<i>Ixodes scapularis</i>	21		3	7	2	3	42	224	14	316
<i>Rhipicephalus sanguineus</i>			1		1		2			4
Grand Total	66	0	18	29	12	9	91	238	14	477

Ticks by Life Stage - Georgia, 2021



Species	females	males	nymphs	larvae	unknown	Grand Total
<i>Amblyomma americanum</i>	13	19	36	19	14	101
<i>Amblyomma maculatum</i>	3	4				7
<i>Dermacentor variabilis</i>		1			48	49
<i>Ixodes scapularis</i>	182	110	1		23	316
<i>Rhipicephalus sanguineus</i>					4	4
Grand Total	198	134	57	26	90	477

FEMALE AMERICAN DOG TICK



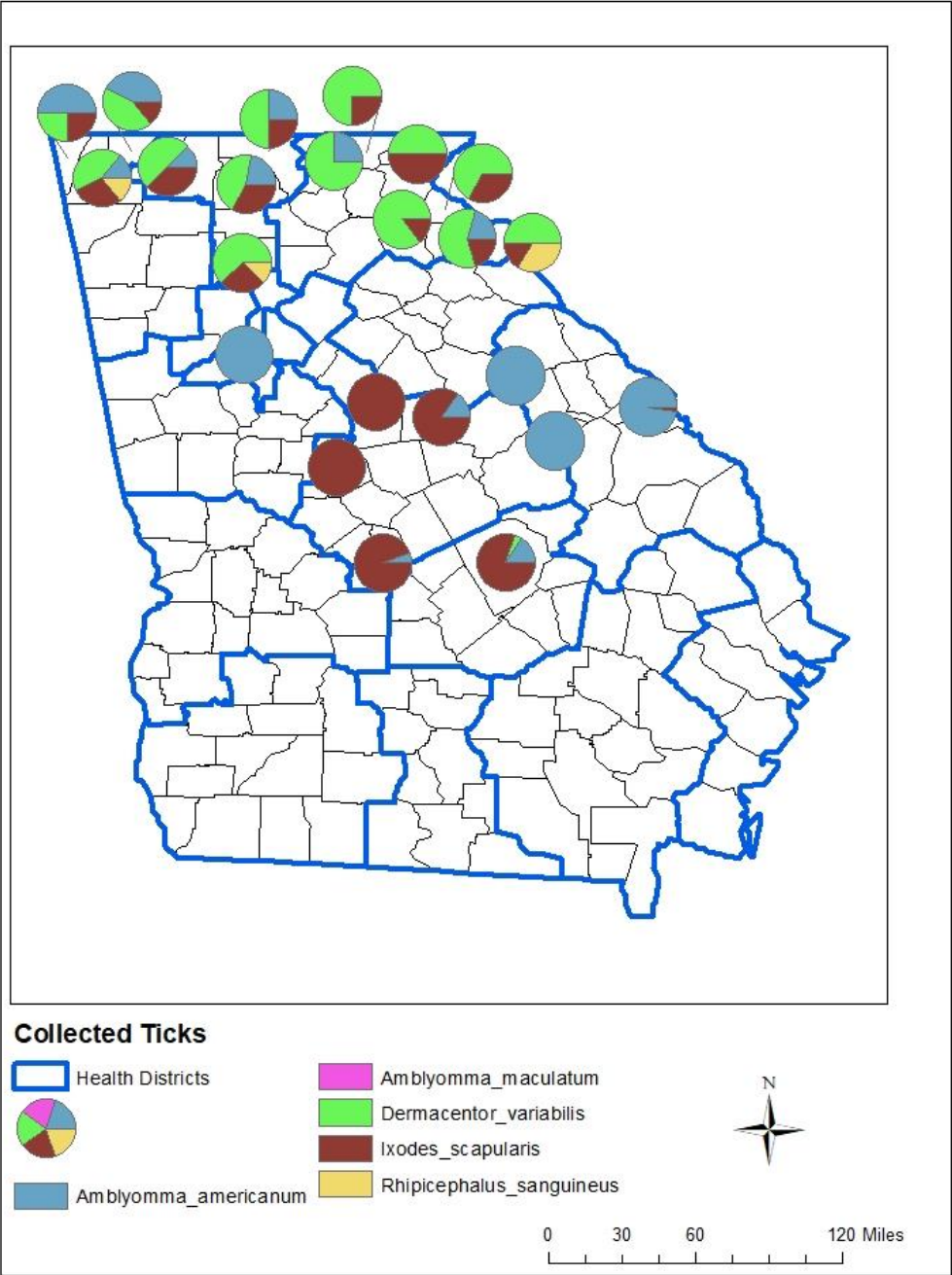
Tick Hosts, 2021

HOST	<i>Amblyomma americanum</i>	<i>Amblyomma maculatum</i>	<i>Dermacentor variabilis</i>	<i>Ixodes scapularis</i>
bear				14
dog	5	5	1	20
white-tail deer	35	2		258



Location of Ticks Collected in 2021

Georgia Tick Distribution 2021

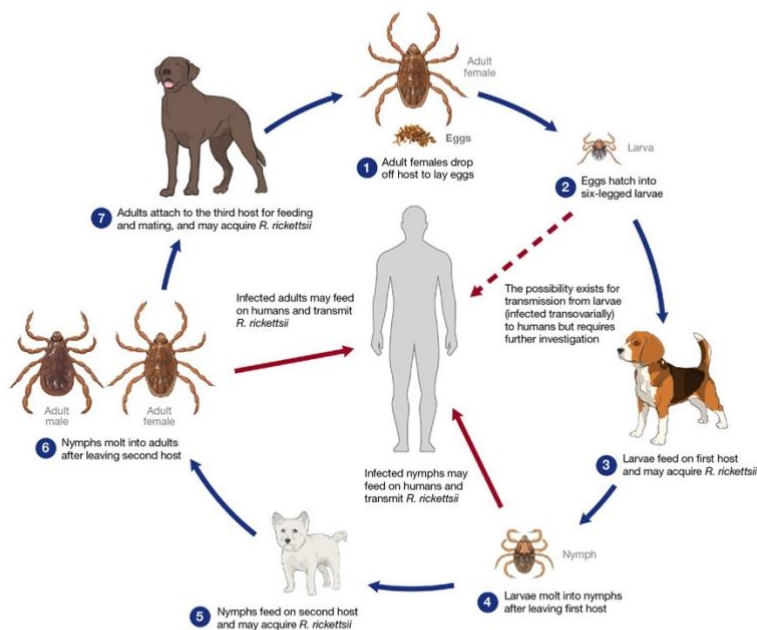


Tick Distribution Status, 2005-2021

Tick surveillance is intended to monitor changes in the distribution and abundance of ticks and to assess the presence and prevalence of tickborne pathogens to provide actionable, evidence-based information on infection risk to clinicians, the public, and policy makers (<https://www.cdc.gov/ticks/index.html>).

- Counties classified as “established” are those where six or more ticks of a single life stage or more than one life stage of the tick were collected in the county within a 12-month period.
- Counties classified as “reported” are those where less than six ticks of a single life stage were collected in the county within a 12-month period.
- Counties classified as “no records” should not be interpreted as the tick being absent. No records could arise either from a lack of sampling efforts, lack of tick collection during sampling efforts, or lack of reporting or publishing the results of sampling efforts.

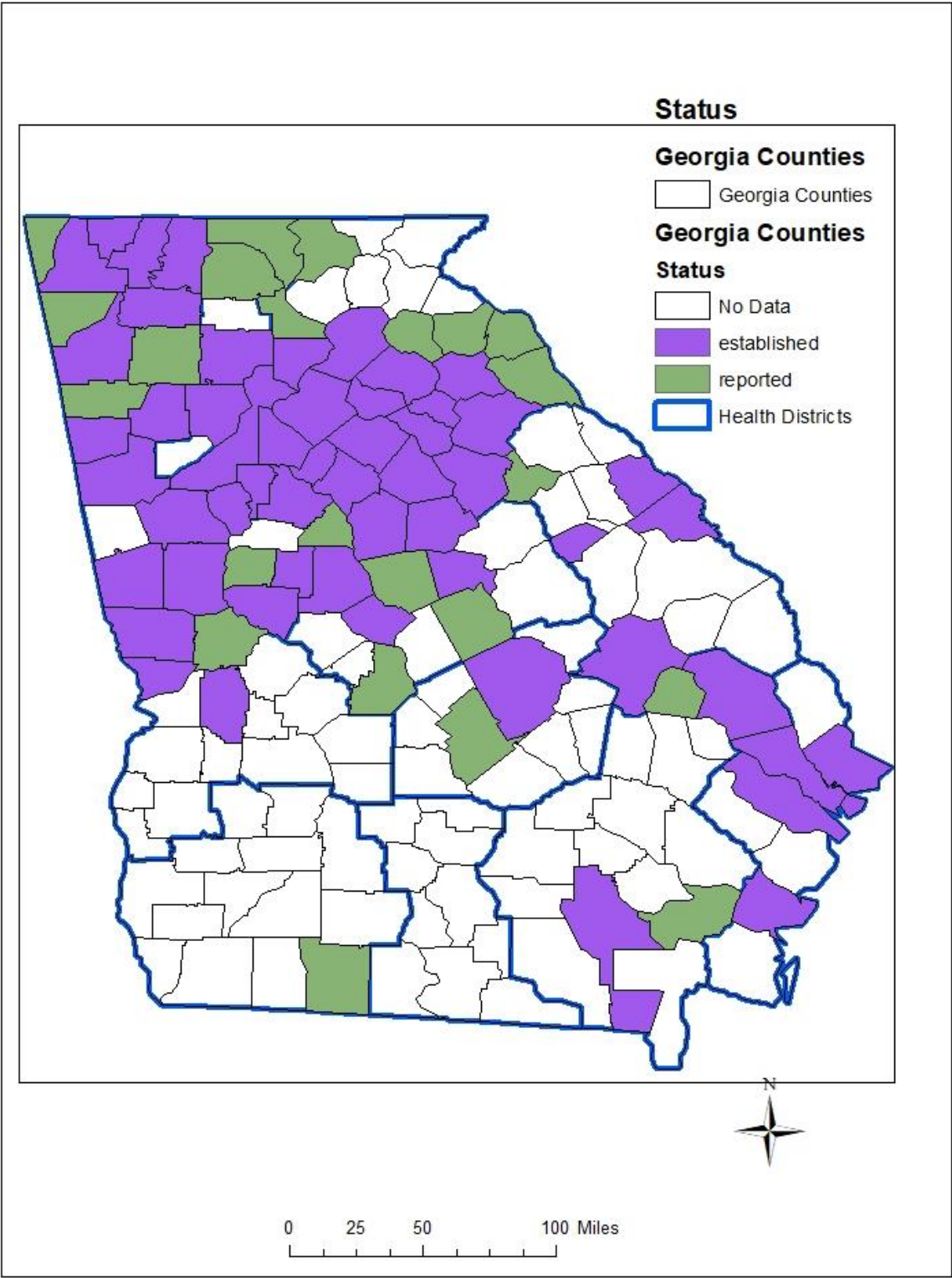
Life cycle of *Rhipicephalus sanguineus* and the transmission of *Rickettsia rickettsii* (the causative agent of Rocky Mountain Spotted Fever)



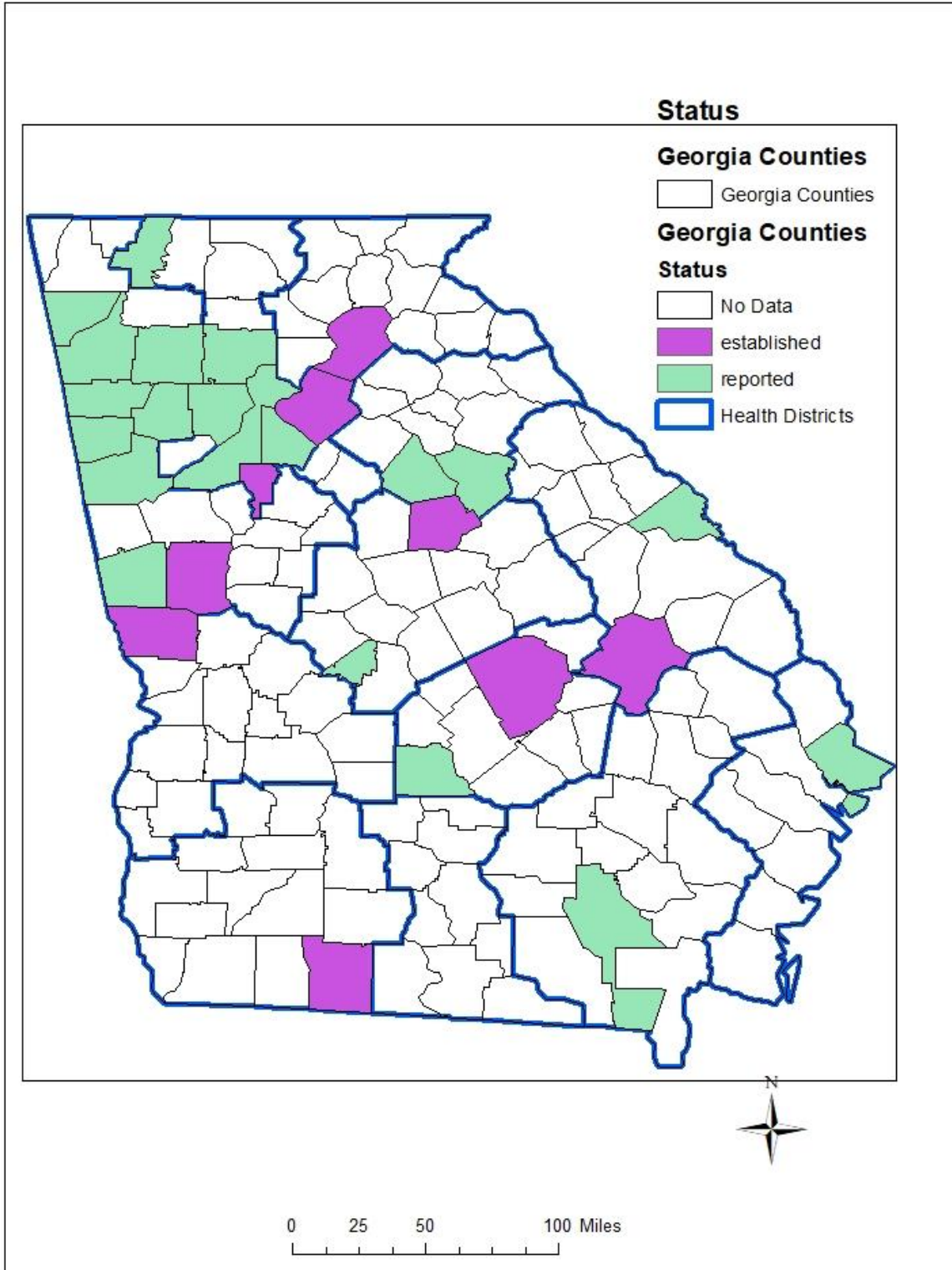
Images are not drawn to scale. *R. sanguineus* can maintain *R. rickettsii* between life stages. Humans, as well as dogs, may become infected when bitten by a tick infected with *R. rickettsii*.



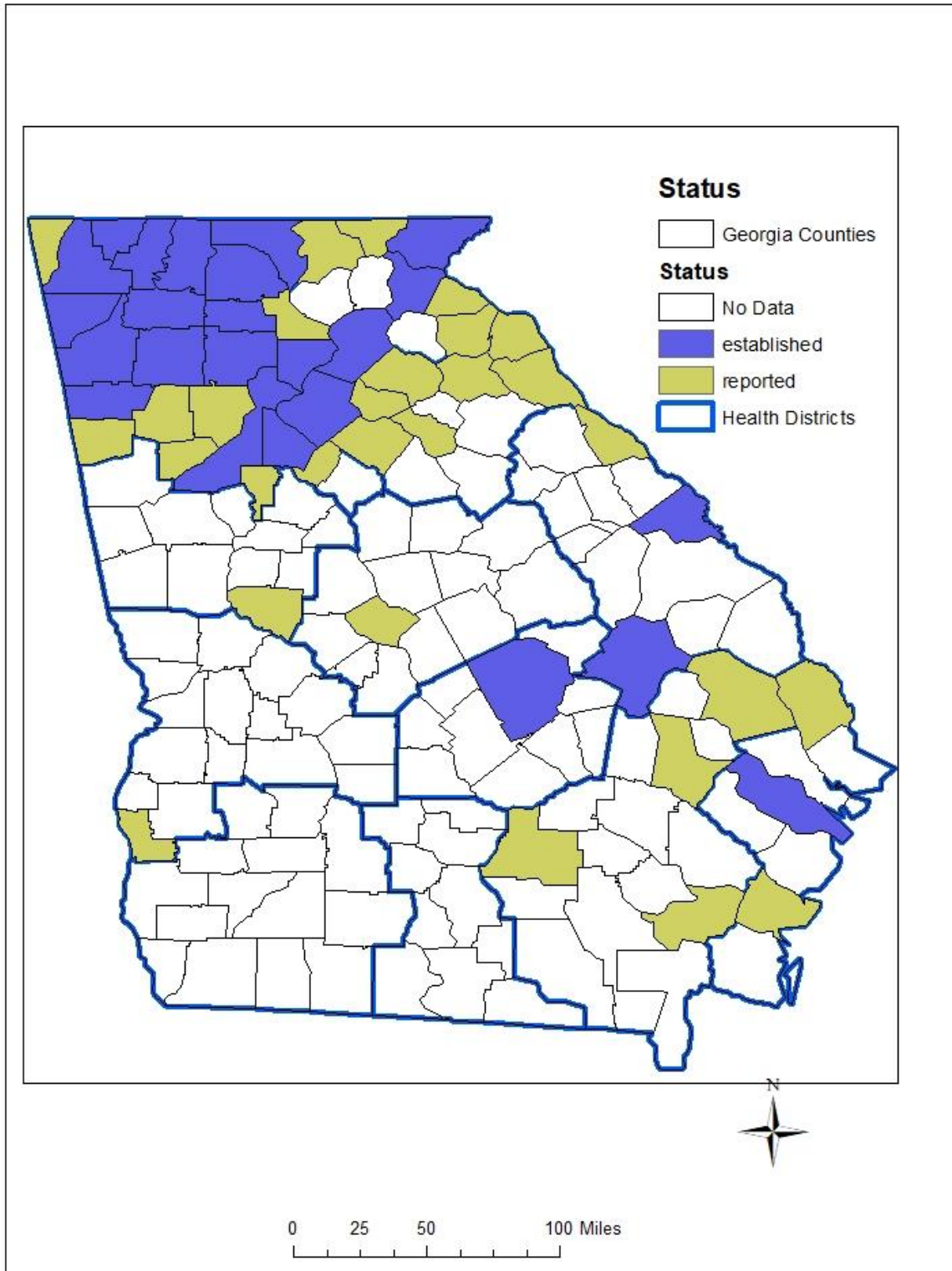
Status of *Amblyomma americanum*
Georgia, 2005-2021



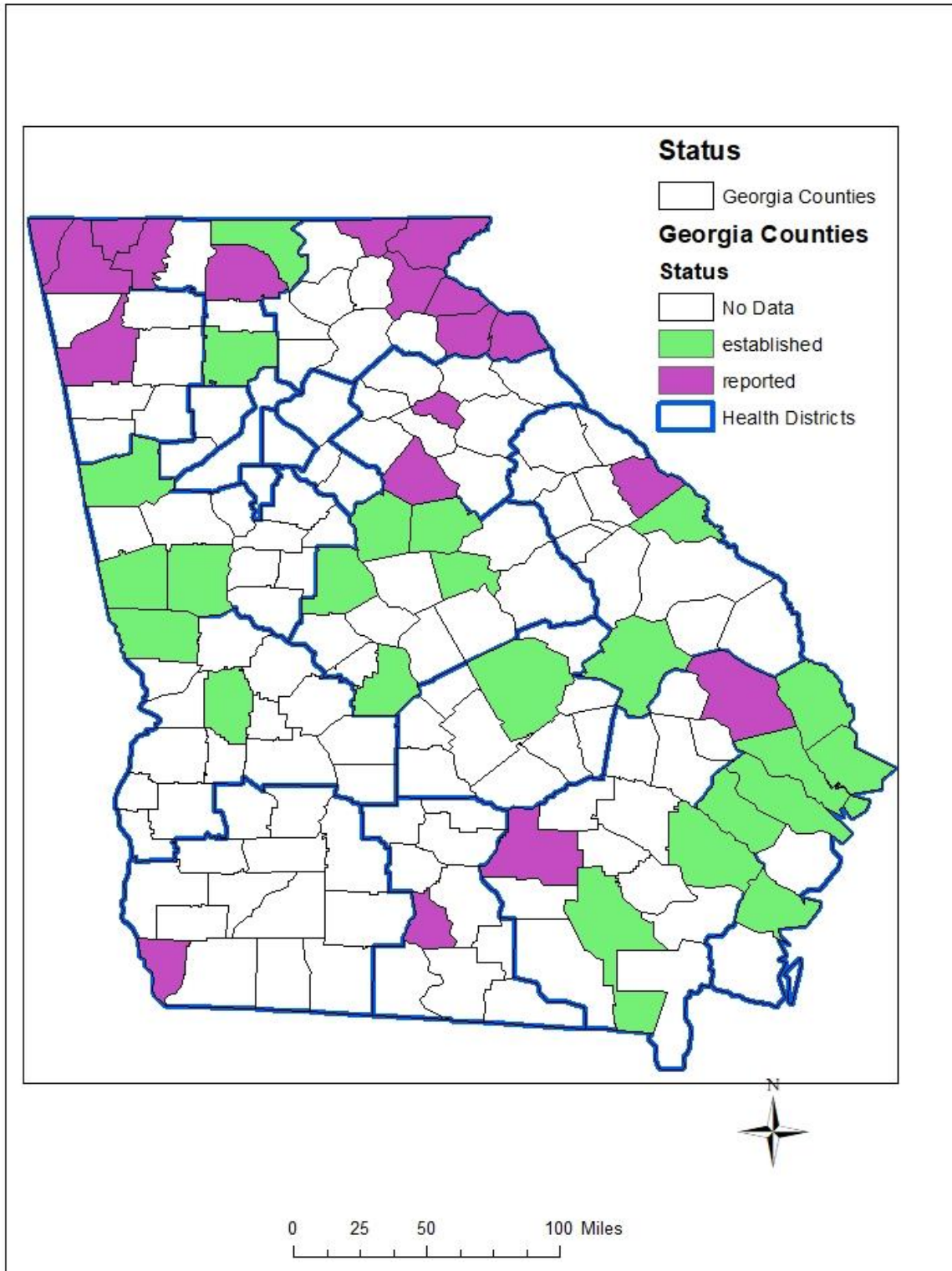
Status of *Amblyomma maculatum*
Georgia, 2005-2021



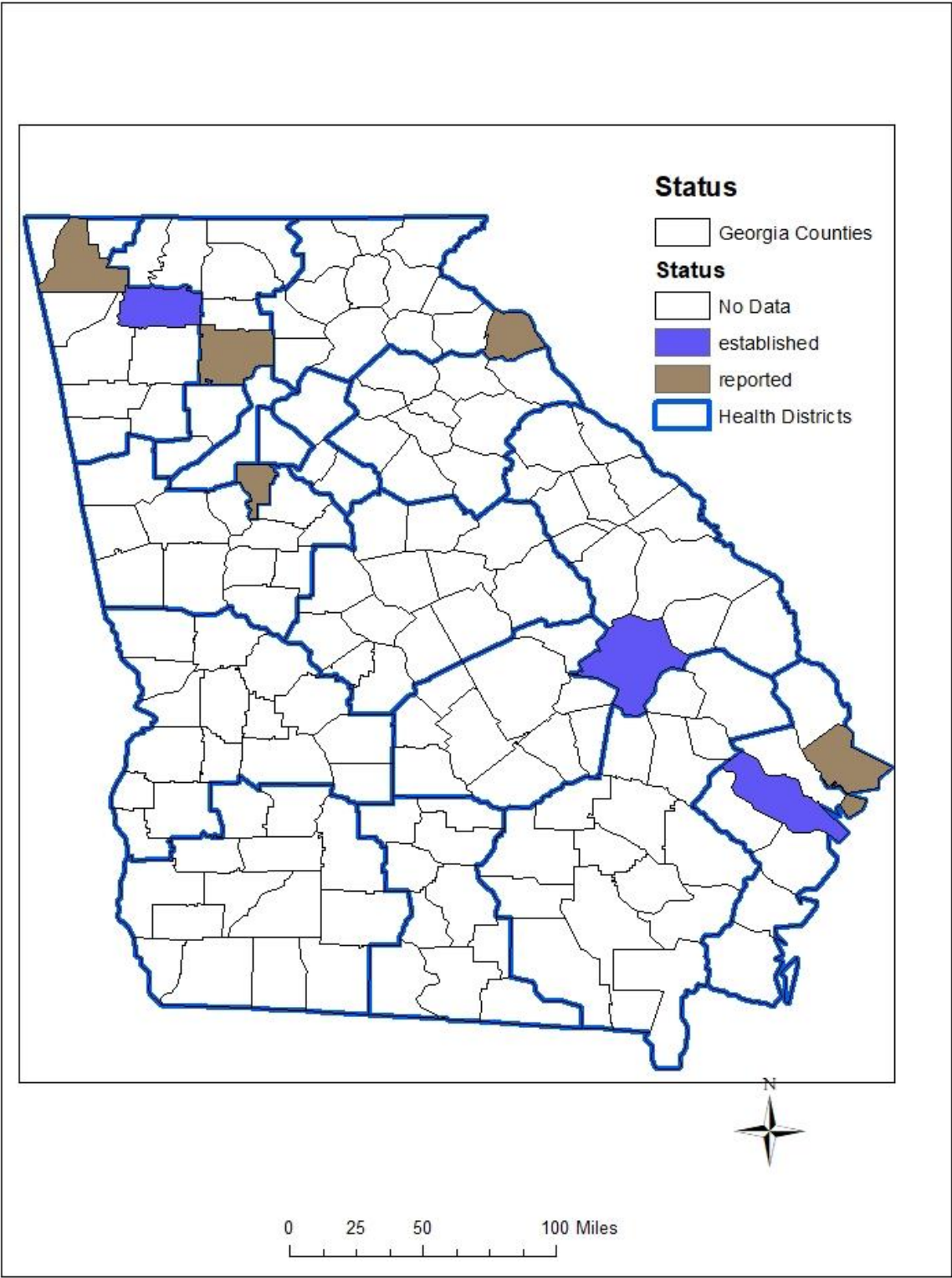
Status of *Dermacentor variabilis* Georgia, 2005-2021



Status of *Ixodes scapularis* Georgia, 2005-2021



Status of *Rhipicephalus sanguineus*
Georgia, 2005-2021



Tickborne Diseases

Ticks collected in Georgia during this period of surveillance are known transmitters of disease to humans and animals. Common tick-borne diseases in Georgia include Lyme disease, Rocky Mountain spotted fever, anaplasmosis, ehrlichiosis, and Southern tick-associated rash illness. Infected ticks spread disease once they've bitten a host, allowing the pathogens in their saliva and mouth get into the host's skin and blood. Tick bites are typically painless, but the site of the bite may later itch, burn, turn red, and feel painful. Individuals allergic to tick bites may develop a rash, swelling, shortness of breath, numbness, or paralysis. Tick bite treatment involves cleaning the area with soap and water and monitoring the site of the bite.

Anaplasmosis is a disease caused by the bacterium *Anaplasma phagocytophilum*. These bacteria are spread to people by tick bites primarily from the blacklegged tick (*Ixodes scapularis*) in Georgia. People with anaplasmosis will often have fever, headache, chills, and muscle aches. Doxycycline is the drug of choice for adults and children of all ages with anaplasmosis.

Ehrlichiosis is the general name used to describe diseases caused by the bacteria *Ehrlichia chaffeensis*, *E. ewingii*, or *E. muris eauclairensis* in the United States. These bacteria are spread to people primarily through the bite of infected ticks including the lone star tick (*Amblyomma americanum*) and the blacklegged tick (*Ixodes scapularis*). People with ehrlichiosis will often have fever, chills, headache, muscle aches, and sometimes upset stomach. Doxycycline is the treatment of choice for adults and children of all ages with ehrlichiosis.

Lyme disease is the most common vector-borne disease in the United States. Lyme disease is caused by the bacterium *Borrelia burgdorferi* and rarely, *Borrelia mayonii*. It is transmitted to humans through the bite of infected blacklegged ticks. Typical symptoms include fever, headache, fatigue, and a characteristic skin rash called erythema migrans. If left untreated, infection can spread to joints, the heart, and the nervous system.

Spotted fever rickettsioses are a group of tickborne infections caused by some members of the genus *Rickettsia*. Rocky Mountain spotted fever (RMSF) is an illness caused by *Rickettsia rickettsii*, a bacterial pathogen transmitted to humans through contact with ticks. *Dermacentor* species of ticks are most commonly associated with infection, including *Dermacentor variabilis* (the American dog tick), *Dermacentor andersoni* (the Rocky Mountain wood tick), and more recently *Rhipicephalus sanguineus* (the brown dog tick). Symptoms include acute onset of fever, headache, and a macular or maculopapular rash, often present on the palms and soles. In addition to RMSF, human illness associated with other spotted fever group *Rickettsia* species, including infection with *Rickettsia parkeri* (associated with *Amblyomma maculatum* ticks), has also been reported.

Tick paralysis, or toxicosis, is an acute, ascending, flaccid motor paralysis that can be confused with Guillain-Barre syndrome, botulism, and myasthenia gravis. In the US, tick paralysis is associated with *Dermacentor andersoni* (Rocky Mountain wood tick), *D. variabilis* (American dog tick), *Amblyomma americanum* (Lone Star tick), *A. maculatum* (Gulf Coast tick), *Ixodes scapularis* (black-legged tick), and *I. pacificus* (western black-legged tick). Onset of symptoms usually occurs after a tick has fed for several days. If unrecognized, tick paralysis can progress to respiratory failure and may be fatal in approximately 10% of cases. Prompt removal of the feeding tick usually is followed by complete recovery.

A recently discovered reaction to the bite from the Lone Star tick is that it can cause people to develop an allergy to red meat, including beef and pork. This specific allergy is related to a carbohydrate called alpha-gal and is best diagnosed with a blood test. Although reactions to foods typically occur immediately, in the instance of allergic reactions to alpha-gal, symptoms often take several hours to develop. Owing to the significant delay between eating red meat and the appearance of an allergic reaction, it can be a challenge to connect the culprit foods to symptoms. Therefore, an expert evaluation from an allergist familiar with the condition is recommended. The Lone Star tick has been implicated in initiating the red meat allergy in the US, and this tick is found predominantly in the Southeast, from Texas to Iowa and into New England.

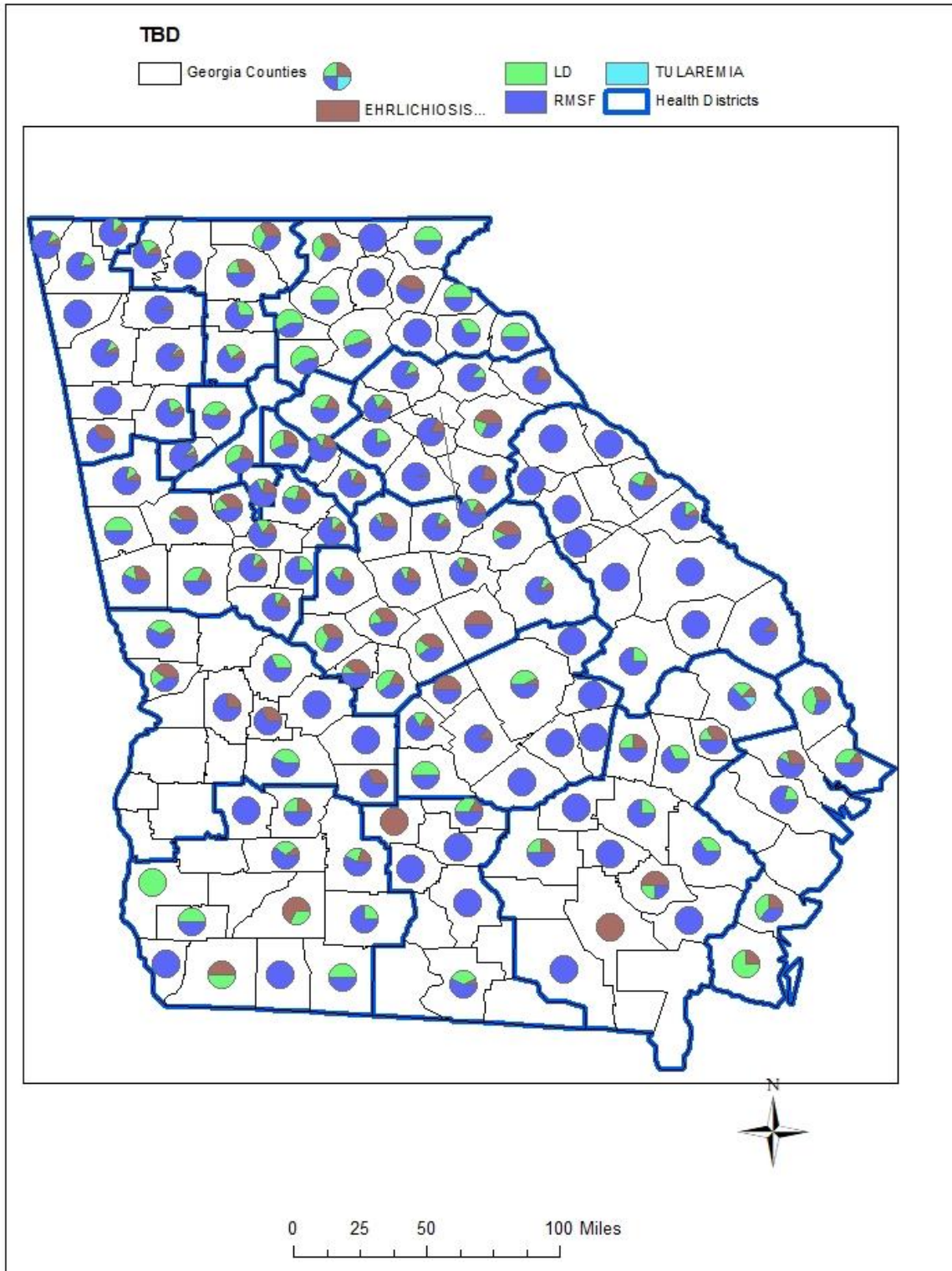
Patients with delayed anaphylaxis to red meat whose serum contained IgE antibodies to alpha-gal



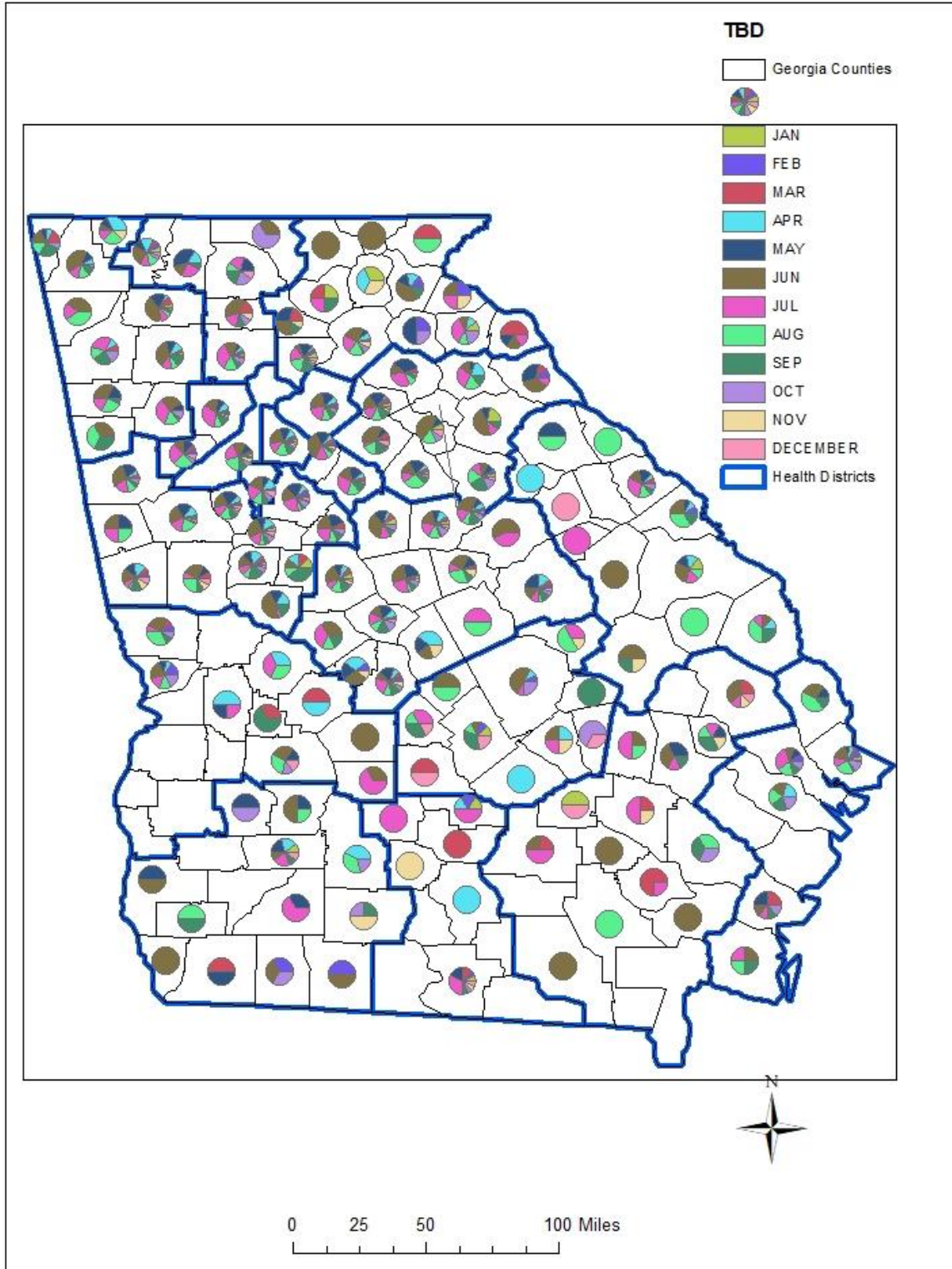
Commins S. et.al. J Allergy Clin Immunol 2011;127:1286-93

DISEASE, 2021	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
EHRlichiosis				4	1	3							8
LYME DISEASE	1	1	5	3	4	6	4	7	1		1	1	34
ROCKY MOUNTAIN SPOTTED FEVER			1	4	3	8	5	1	1	2	1		26
TULAREMIA							3						3
Grand Total	1	1	6	11	8	17	12	8	2	2	2	1	71

Tickborne Diseases Georgia, 2000-2021



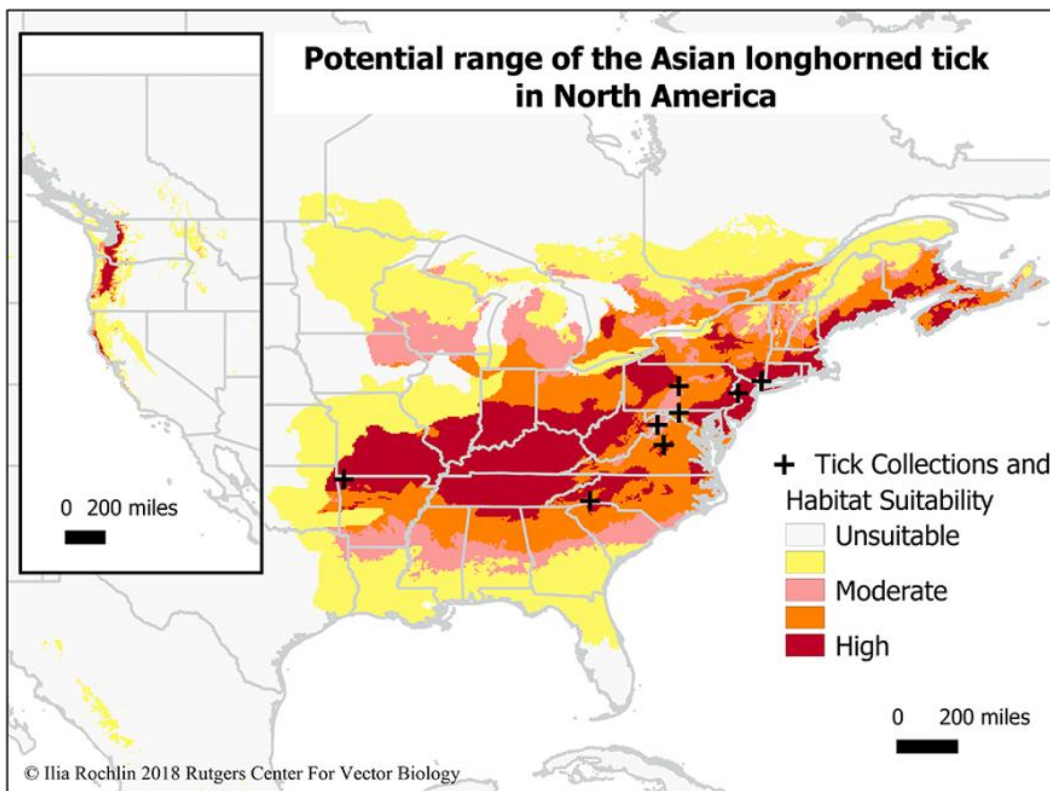
Tickborne Diseases by Month Georgia, 2000-2021



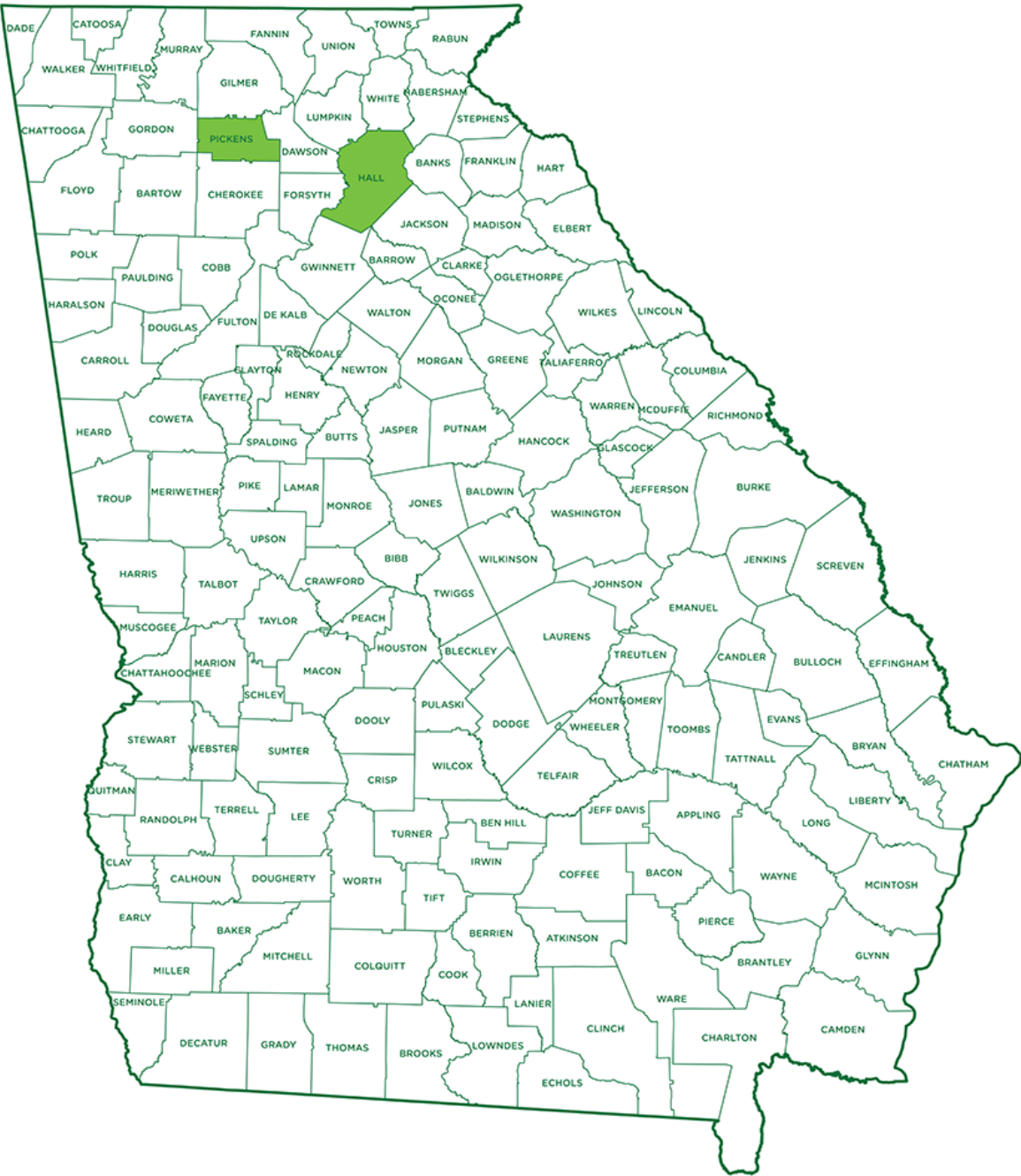
Asian Longhorned Tick

Asian longhorned ticks were not normally found in the Western Hemisphere but were reported for the first time in the United States in 2017. Asian longhorned ticks have been found on pets, livestock, wildlife, and people. One reason this tick is so successful is that the female ticks can lay eggs and reproduce without mating. Compared with well-known native ticks (such as the blacklegged tick, lone star tick and American dog tick), the Asian longhorned tick appears to be less attracted to human skin. However, in countries where this tick is normally found, they have been found to transmit disease to both people and animals. One recent experimental study found that this tick is not likely to contribute to the spread of Lyme disease bacteria in the United States.

Research is ongoing.



Georgia counties that have confirmed presence of the Asian Longhorned Tick



<https://www.agr.georgia.gov/asian-longhorned-tick.aspx>

Want to get your tick identified? Go to <https://arcs.is/1XSuSD>

Before You Go Outdoors

- **Know where to expect ticks.** Ticks live in grassy, brushy, or wooded areas, or even on animals. Spending time outside walking your dog, camping, gardening, or hunting could bring you in close contact with ticks. Many people get ticks in their own yard or neighborhood.
- **Treat clothing and gear** with products containing 0.5% permethrin. Permethrin can be used to treat boots, clothing and camping gear and remain protective through several washings. Alternatively, you can buy permethrin-treated clothing and gear.
- **Use** EPA-registered repellents containing DEET, picaridin, IR3535, Oil of Lemon Eucalyptus (OLE), para-menthane-diol (PMD), or 2-undecanone. Always follow product instructions. Do not use products containing OLE or PMD on children under 3 years old.
- **Avoid Contact with Ticks**
 - Avoid wooded and brushy areas with high grass and leaf litter.
 - Walk in the center of trails.

After You Come Indoors

Check your clothing for ticks. Ticks may be carried into the house on clothing. Any ticks that are found should be removed. Tumble dry clothes in a dryer on high heat for 10 minutes to kill ticks on dry clothing after you come indoors. If the clothes are damp, additional time may be needed. If the clothes require washing first, hot water is recommended. Cold and medium temperature water will not kill ticks.

Examine gear and pets. Ticks can ride into the home on clothing and pets, then attach to a person later, so carefully examine pets, coats, and daypacks.

Shower soon after being outdoors. Showering within two hours of coming indoors has been shown to reduce your risk of getting Lyme disease and may be effective in reducing the risk of other tickborne diseases. Showering may help wash off unattached ticks and it is a good opportunity to do a tick check.

Check your body for ticks after being outdoors. Conduct a full body check upon return from potentially tick-infested areas, including your own backyard. Use a hand-held or full-length mirror to view all parts of your body. Check these parts of your body and your child's body for ticks:

- Under the arms
- In and around the ears
- Inside belly button
- Back of the knees
- In and around the hair
- Between the legs
- Around the waist

Resources

<https://dph.georgia.gov/tick-borne-diseases>

<https://www.slideshare.net/AllergyChula/alpha-gal-allergy-red-meat-allergy>

<https://www.cdc.gov/ticks/longhorned-tick/index.html>

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

https://www.cdc.gov/ticks/resources/TickSurveillance_Iscapularis-P.pdf

<https://www.contagionlive.com/news/rutgers-investigators-create-pictorial-key-for-accurate-identification-of-asian-longhorned-tick>

<https://zookeys.pensoft.net/article/30448/>

<https://www.cdc.gov/mmwr/preview/mmwrhtml/00040975.htm>

<https://scwds.shinyapps.io/haemaphysalis/>

<https://www.aphis.usda.gov/aphis/maps/animal-health/asian-longhorned-tick>

Pictorial Key to the Adults of Hard Ticks, Family Ixodidae (Ixodida: Ixodoidea), East of the Mississippi River. JAMES E. KEIRANS AND TAINA R. LITWAK. *J. Med. Entomol.* 26(5): 435-448 (1989)

Ticks Parasitizing Humans in Georgia and South Carolina, Michael W. Felz, Lance A. Durden, James H. Oliver and Jr. *The Journal of Parasitology*, Vol. 82, No. 3 (June 1996), pp. 505-508



GEORGIA



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District Map

