Tick Talk: Tick Biology, Ecology, and Management in Delaware

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Tick Taxonomy

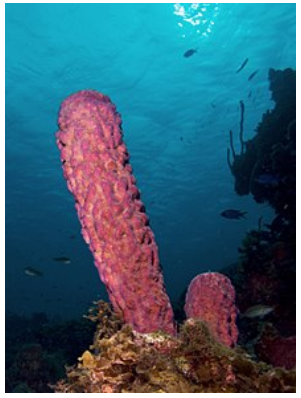
Kingdom Animalia











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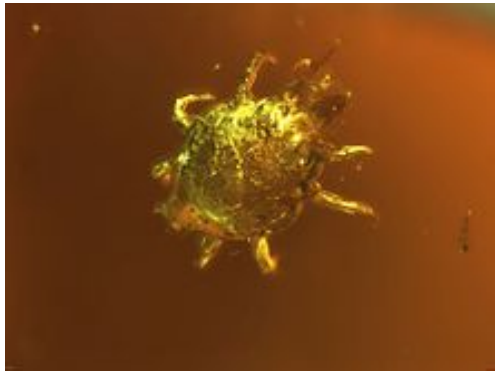

Tick Taxonomy

Kingdom Animalia

Phylum Arthropoda

Class Arachnida

Subclass Acari

Order Ixodida

Families Argasidae (soft ticks) and Ixodidae (hard ticks)

Prehistoric Ticks

- **Ticks have been discovered well-preserved in Cretaceous amber (99 million years old).**
- **These ancient ticks fed on feathered dinosaurs– the ancestors of today's birds (Peñalver et al. 2020).**

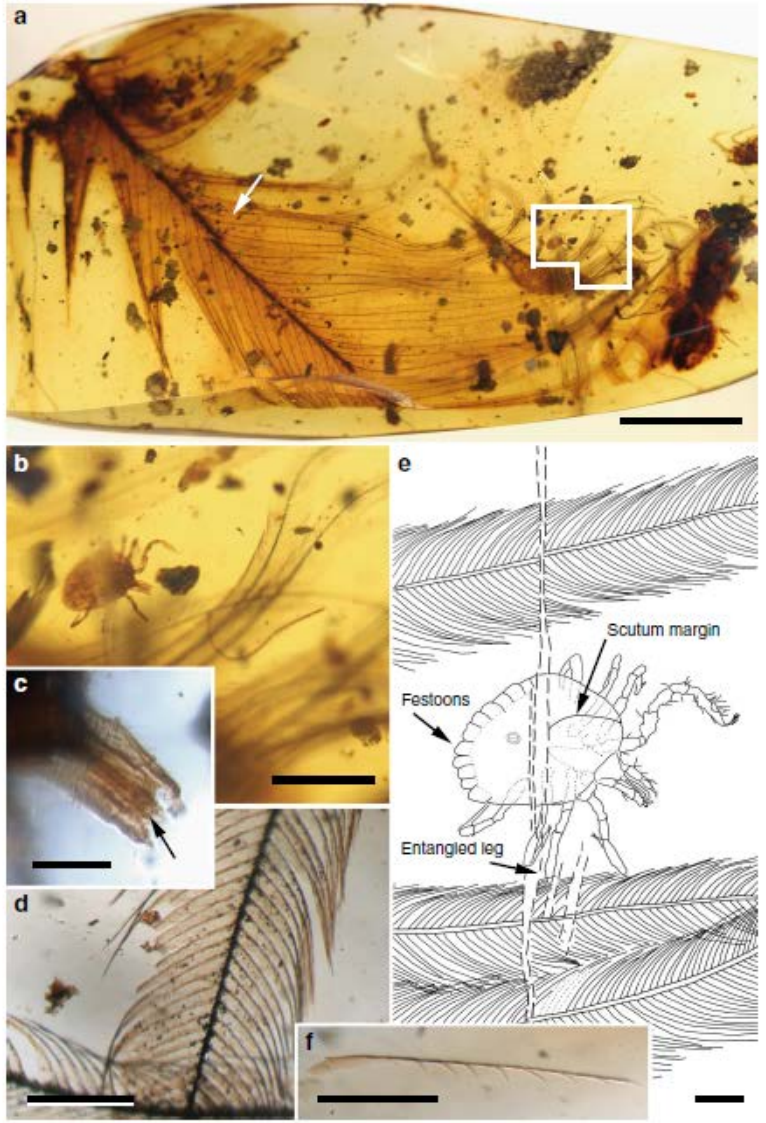

Fig. 1 *Comupalpatum burmanicum* hard tick entangled in a feather. **a** Photograph of the Burmese amber piece (Bu JZC-F18) showing a semicomplete pennaceous feather. Scale bar, 5 mm. **b** Detail of the nymphal tick in dorsal view and barbs (inset in **a**). Scale bar, 1 mm. **c** Detail of the tick's capitulum (mouthparts), showing palpi and hypostome with teeth (arrow). Scale bar, 0.1 mm. **d** Detail of a barb. Scale bar, 0.2 mm. **e** Drawing of the tick in dorsal view indicating the point of entanglement. Scale bar, 0.2 mm. **f** Detached barbule pennulum showing hooklets on one of its sides (arrow in **a** indicates its location but in the opposite side of the amber piece). Scale bar, 0.2 mm

Why are ticks such good vectors?

- They're tough!
- Must take multiple blood meals to complete life cycle (3 host ticks).
- Generalist feeders: Feed on multiple species, making zoonoses possible.
- Feeding takes a long time (hours-days)– increasing chances of transmission.
- Travel long distances by hitchhiking on birds: e.g., each spring, 3 billion passerine birds bring 50-175 million *I. scapularis* ticks into Canada.

Purple Finch with ticks. © Hilton Pond Center

Tick Surveillance

The following activities help us figure out WHERE and WHEN different tick species are most active in the state so people can take action to protect themselves from tick bites.

Tick Surveillance

Active Surveillance:

- **Dragging/flagging vegetation**
- **Carbon dioxide traps**
- **Collecting from hunter-harvested animals, banded birds, etc.**

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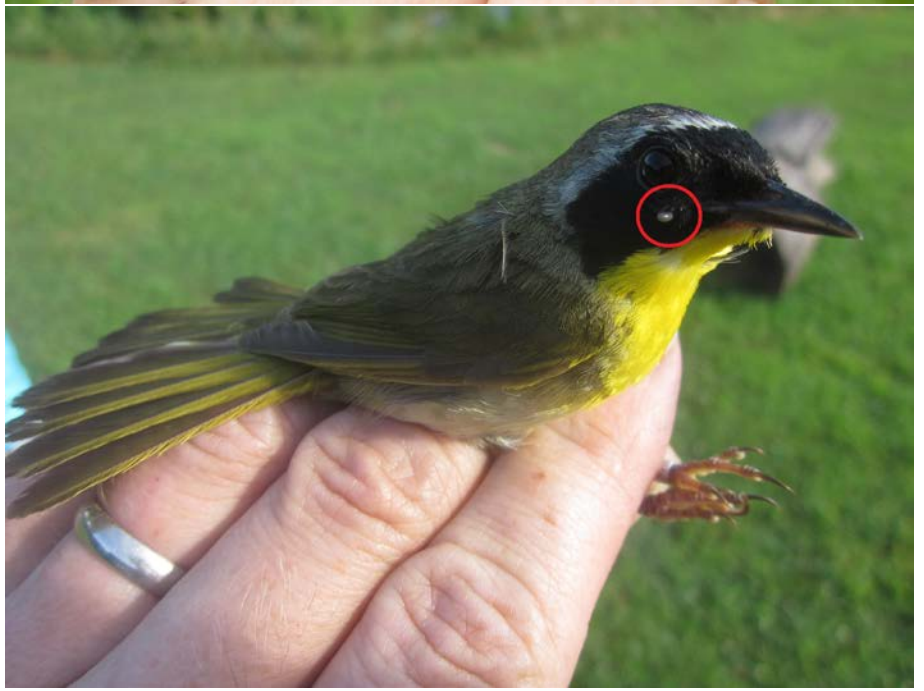

Photos by Ian Stewart

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Photos by Wil Winter

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Tick Surveillance

Passive Surveillance/

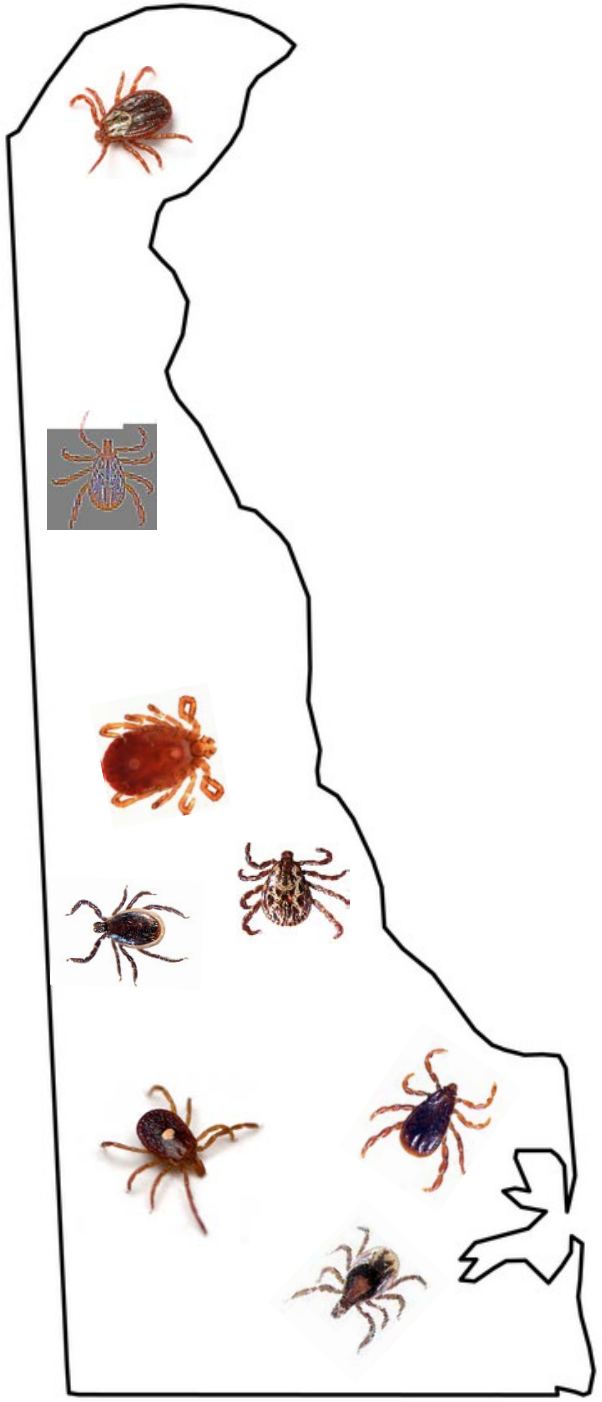
Crowd-sourcing from:

- **People**
- **Pets**
- **Horses**
- **Livestock**

Ticks of Delaware (1945)

8 known species:

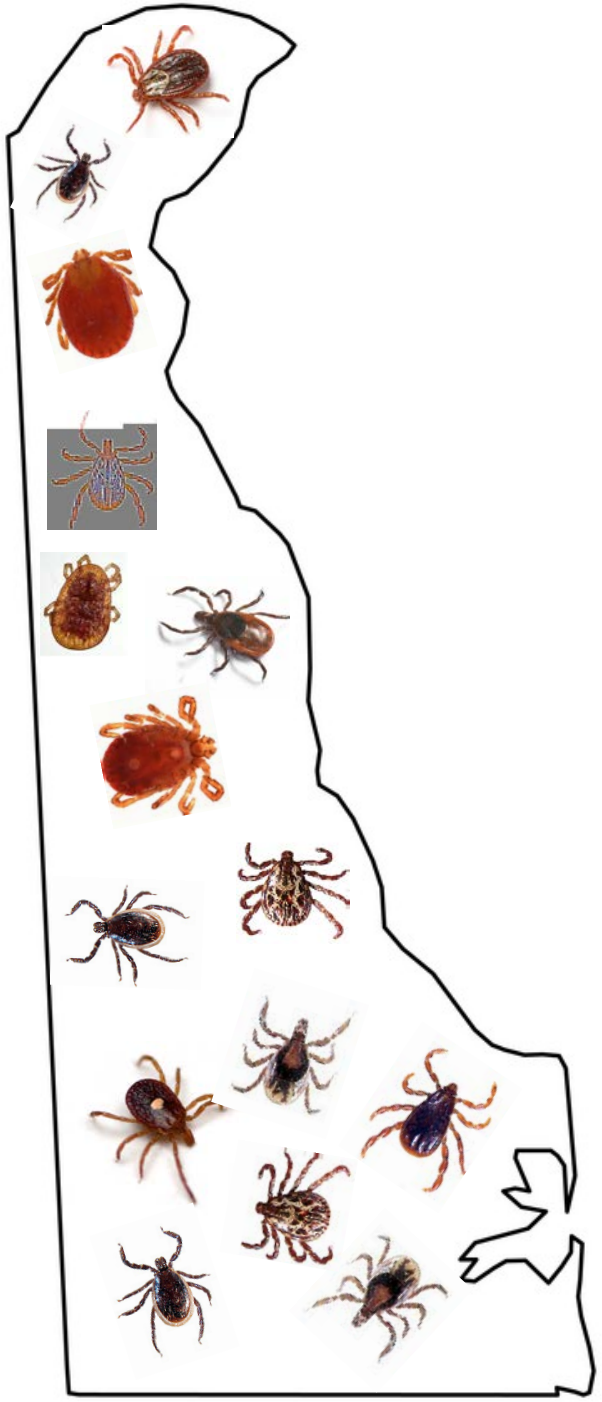
- ***Amblyomma americanum*** (Lone star tick)
- ***Amblyomma maculatum*** (Gulf Coast tick)
- ***Dermacentor variabilis*** (American dog tick)
- ***Haemaphysalis leporispalustris*** (Rabbit tick)
- ***Ixodes cookei*** (Groundhog tick)
- ***Ixodes dentatus***
- ***Ixodes marxi*** (Squirrel tick)
- ***Rhipicephalus sanguineus*** (Brown dog tick)



Ticks of Delaware (2022)

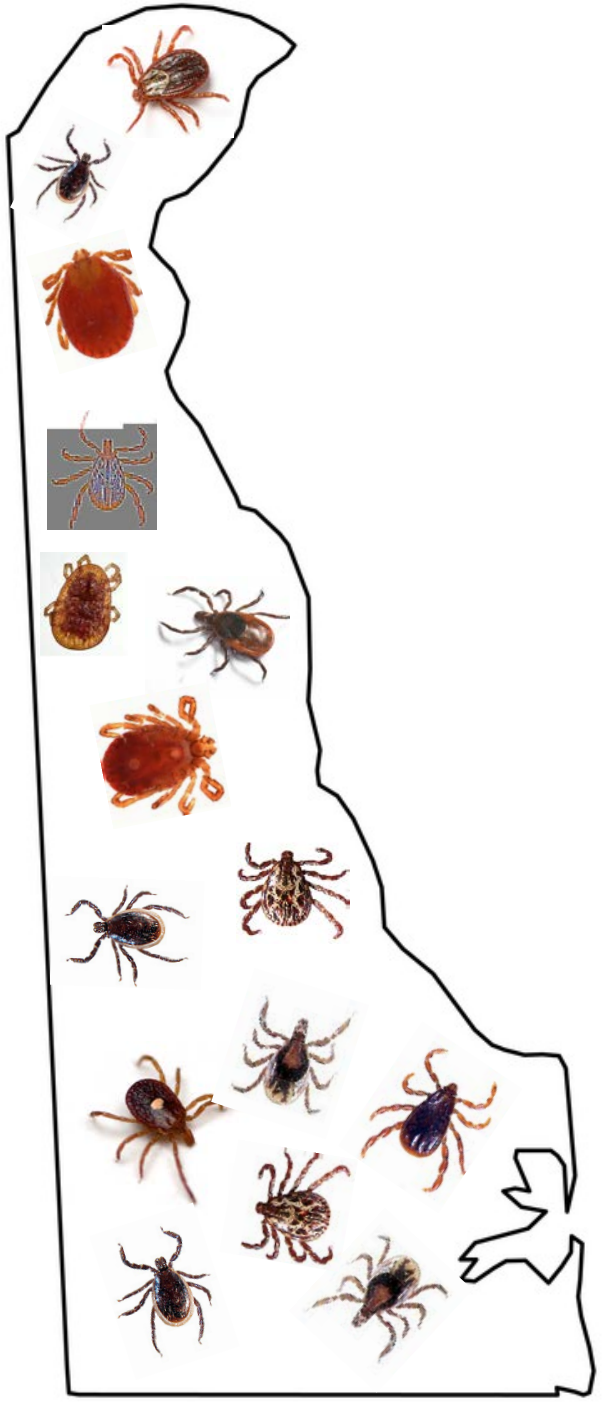
15 known species (Underline indicates new):

- *Amblyomma americanum* (Lone star tick)
- *Amblyomma maculatum* (Gulf Coast tick)
- *Argas persicus* (Fowl tick)
- *Dermacentor albipictus* (Winter tick)
- *Dermacentor variabilis* (American dog tick)
- *Haemaphysalis leporispalustris* (Rabbit tick)
- *Haemaphysalis longicornis* (Asian longhorned tick)
- *Ixodes brunneus*
- *Ixodes cookei* (Groundhog tick)
- *Ixodes dentatus*
- *Ixodes marxi* (Squirrel tick)
- *Ixodes minor**
- *Ixodes scapularis* (Blacklegged tick)
- *Ixodes texanus* (Raccoon tick)
- *Rhipicephalus sanguineus* (Brown dog tick)

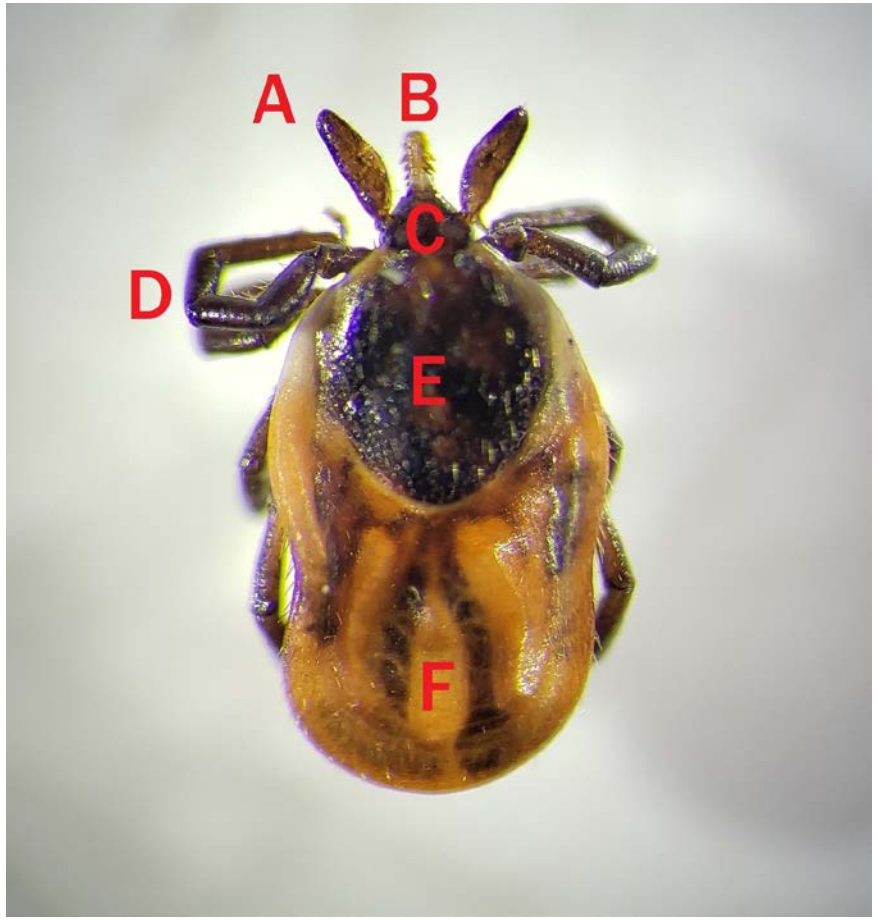


Most Common Ticks in DE

1. ***Amblyomma americanum***
   (Lone star tick, 96% of ticks collected in 2021)
2. ***Ixodes scapularis***
   (Blacklegged tick, 1.5%)
3. ***Dermacentor variabilis***
   (American dog tick, 1.3%)
4. ***Haemaphysalis longicornis***
   (Asian longhorned tick; 0.5%)
5. ***Amblyomma maculatum***
   (Gulf Coast tick, 0.3%)



Tick Anatomy



A: Palps (sensory appendages)

B: Hypostome

C: Basis capituli

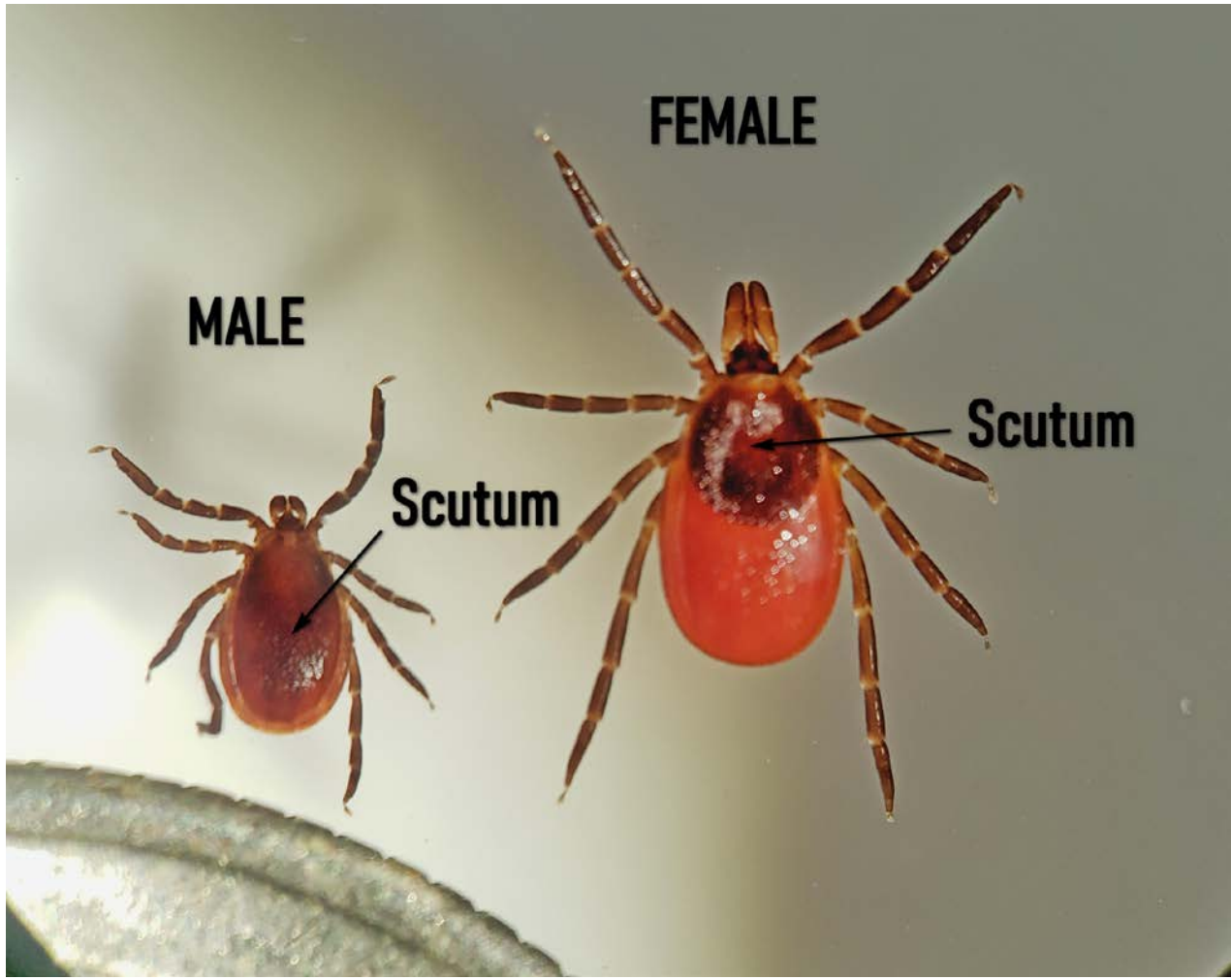
D: Legs

E: Scutum (dorsal shield)

F: Idiosoma

Identification

- **The scutum is a useful feature used in species ID (shape, color) as well as distinguishing males from females.**
- **In males, it covers the entire dorsum (back).**
- **In females, it only covers the first half; this allows the idiosoma to distend as the female engorges with blood.**



Lone Star Tick (*Amblyomma americanum*)

- **Habitat generalist: Found in forests, fields**
- **Long mouthparts**
- **Sexually dimorphic:**
  - **Females have white spot on scutum (shield)**
  - **Males lack spot, but have varied streaks of white on shield margins.**
- **Hosts: Prefers deer but frequently bites humans**

Lone Star Tick (*Amblyomma americanum*)

Medical concerns:

- **Vector of *Ehrlichia* spp. (agents of ehrlichiosis).**
- **Associated with alpha-gal syndrome.**

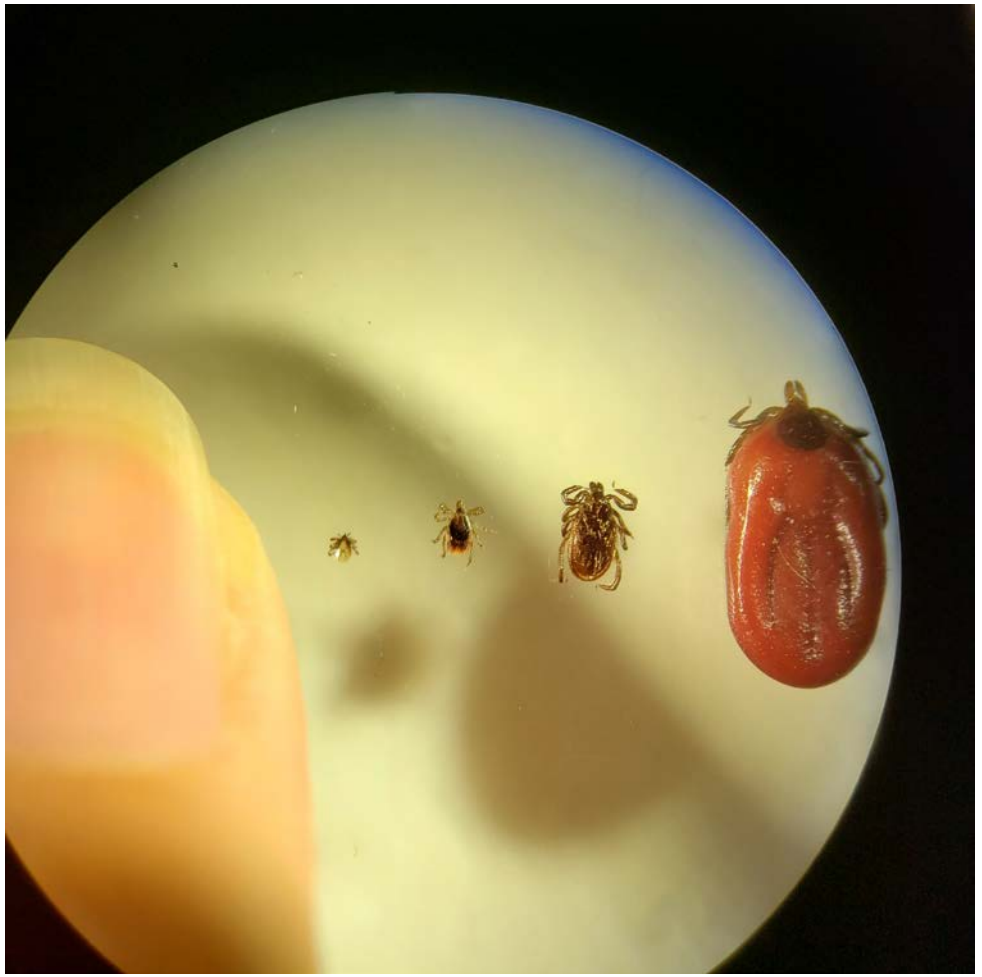
Blacklegged Tick (*Ixodes scapularis*)

- a.k.a. “deer tick”
- Habitat: Prefers forests
- Dark brown, oval-shaped scutum and legs in contrast to red-brown body.
- Teardrop body shape
- Hosts: Generalist feeder. Immature stages prefer rodents, adults prefer deer, but all stages frequently bite humans

Blacklegged Tick (*Ixodes scapularis*)

Medical concerns:

- **Vector of *Borrelia burgdorferi* (agent of Lyme disease)**
- **Vector of *Babesia* spp. (agents of babesiosis)**
- **Vector of *Anaplasma phagocytophilum* (agent of human granulocytic anaplasmosis)**
- **Vector of Powassan virus**



American Dog Tick (*Dermacentor variabilis*)

- **Habitat: Prefers fields**
- **Pale, marbled shield in contrast to dark red-brown body.**
- **Short mouthparts.**
- **Hosts: Prefers dogs but frequently bites humans. Only adults bite humans; commonly attached to head.**

American Dog Tick (*Dermacentor variabilis*)

- **Medical concerns:**
  - **Vector of *Rickettsia rickettsii* (agent of Rocky Mountain spotted fever).**

Asian Longhorned Tick (*Haemaphysalis longicornis*)

- **Habitat generalist: Found in forests, fields**
- **Red-brown; scutum only faintly visible.**
- **Palps project sharply outward.**
- **Native to eastern Asia.**
- **Hosts: Generalist feeder. Prefers deer and dogs. Rarely bites humans.**

Asian Longhorned Tick (*Haemaphysalis longicornis*)

- **Medical concerns:**
  - **Associated with many pathogens in native range.**
  - **Not associated with human illness in US (yet).**
  - **May be a vector of *R. rickettsii* (agent of Rocky Mountain spotted fever).**
  - **Associated with alpha-gal syndrome.**

Gulf Coast Tick (*Amblyomma maculatum*)

- **Habitat: Prefers fields and wetlands.**
- **Used to be restricted to the Gulf Coast states, but distribution has expanded dramatically– now found as far north as CT.**
- **Long mouthparts**
- **"Ornate" appearance: Pale, marbled shield in contrast to dark red-brown body**
- **Hosts: Prefers deer and birds but frequently bites humans.**

Photo by Emily Struckhoff

Gulf Coast Tick (*Amblyomma maculatum*)

- **Medical concerns:**
  - **Vector of *Rickettsia parkeri* (agent of Tidewater spotted fever).**
  - **May carry *Ehrlichia* spp., but not considered a competent vector for them.**

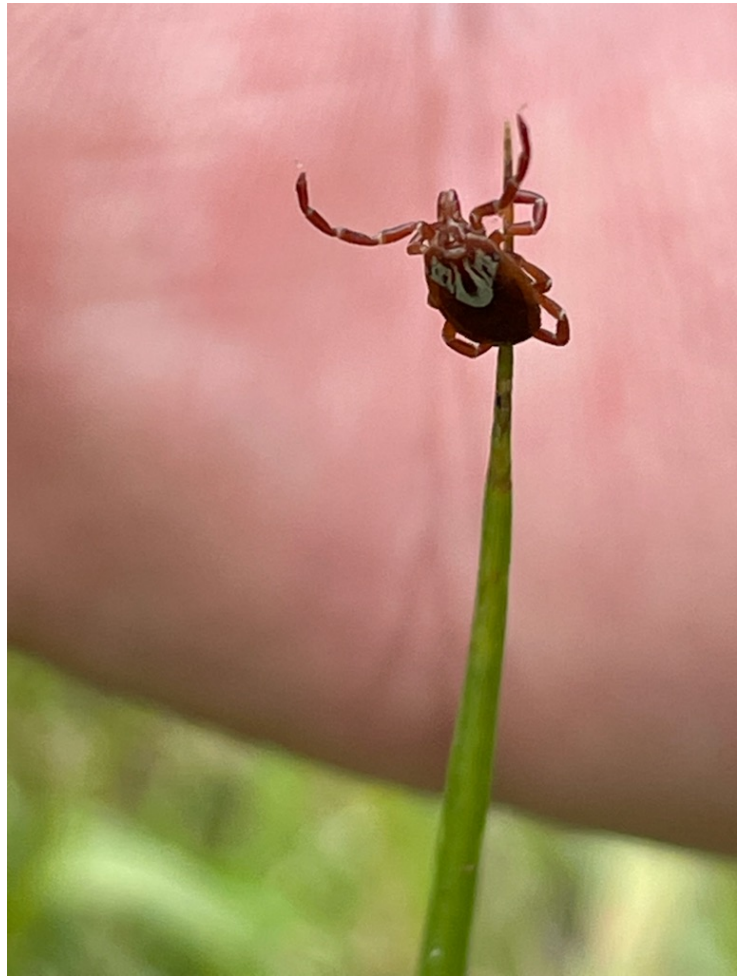


Photo by Wil Winter

Tick-borne Pathogens in the US

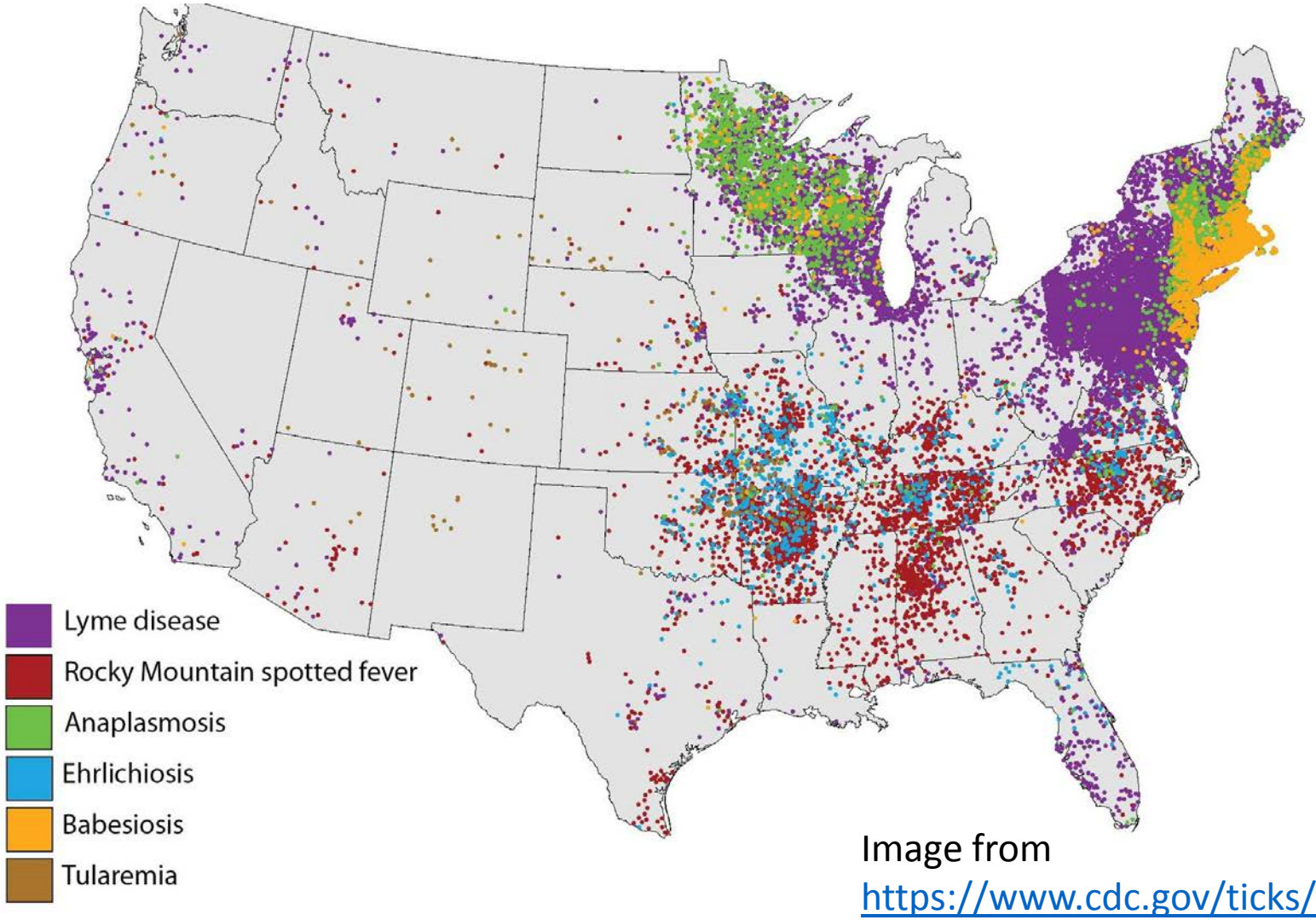


Image from
https://www.cdc.gov/ticks/tickbornediseases/

Lyme Disease

- **Pathogen: *Borrelia burgdorferi* (bacteria)**
- **Signs & symptoms may include fever, arthralgias, myalgias, fatigue, bull's eye rash.**
- **Note that associated rash can appear differently on different skin tones; this can complicate & delay diagnosis.**
- **Delayed diagnosis & inadequate treatment increase risk of neurological & cardiac complications.**

https://www.cdc.gov/lyme/signs_symptoms/rashes.html

Rocky Mountain Spotted Fever

- **Pathogen:** ***Rickettsia rickettsii*** **(bacteria)**
- **Vectors:**
  - **American dog tick** ***Dermacentor variabilis***
  - **Brown dog tick** ***Rhipicephalus sanguineus***
- **Symptoms: Fever, headache, rash, nausea, vomiting, muscle pain, stomach pain.**
- **Treatment: Antibiotics**

Image from https://www.cdc.gov/rmsf/symptoms/

Rocky Mountain Spotted Fever

- **Despite the name, more common on East Coast than in Rockies.**
  - **Most cases in NC, OK, AR, TN, and MO.**

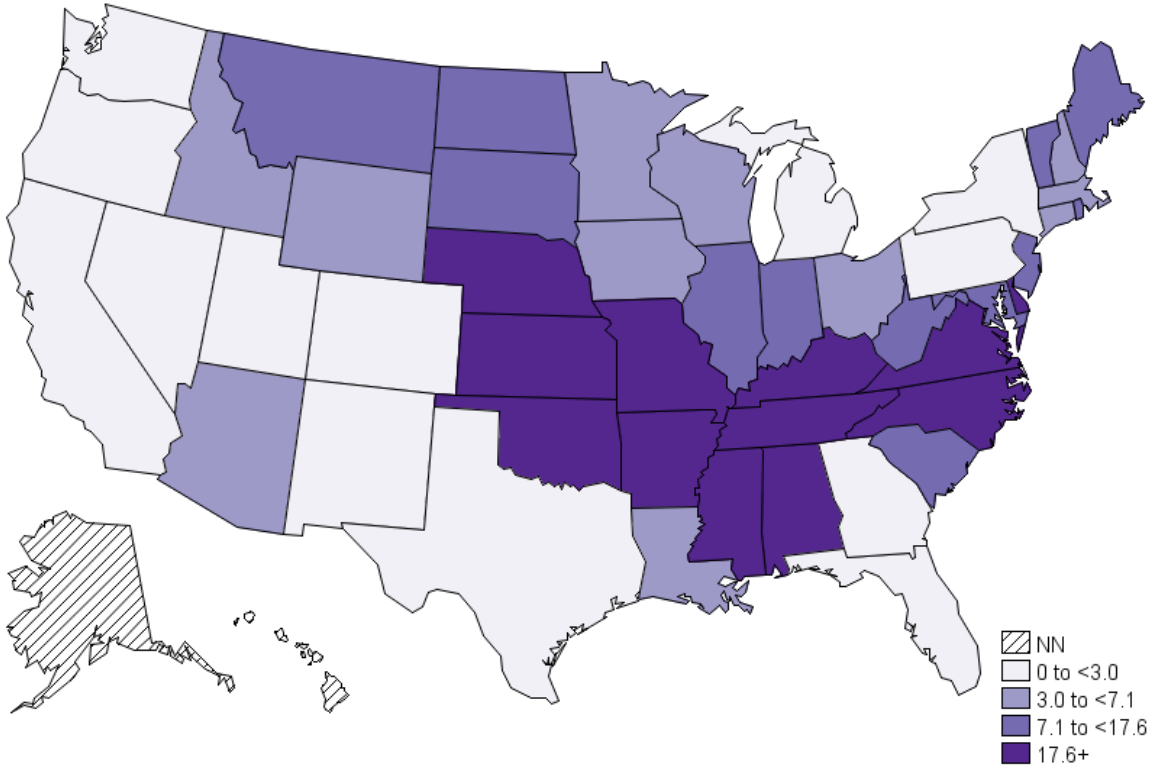


Image from https://www.cdc.gov/rmsf/stats/index.html

Ehrlichiosis

- **Pathogen:** ***Ehrlichia*** **spp. (bacteria)**
  - ***E. chaffeensis***
  - ***E. ewingii***
  - **"Panola Mountian"** ***Ehrlichia***
- **Vector:**
  - **Lone star tick (*Amblyomma americanum*)**
- **Symptoms**
  - **Fever, headache, malaise, myalgias, nausea**

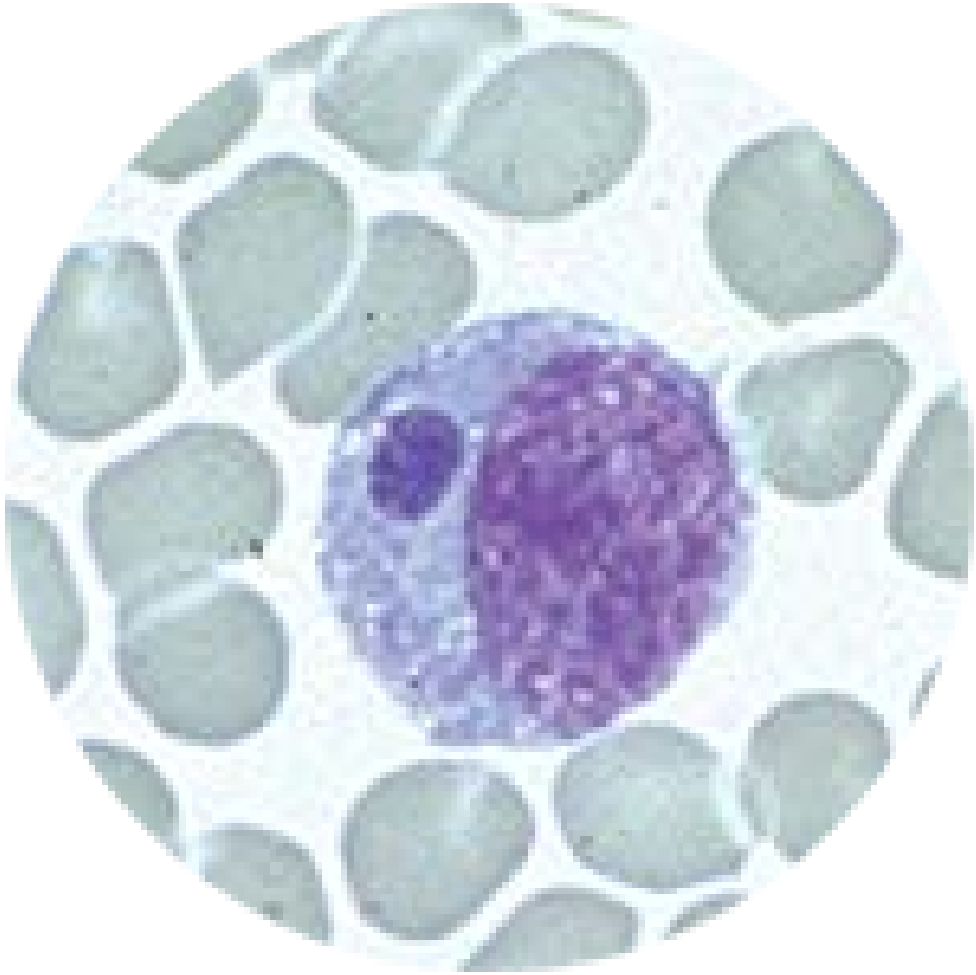


Image from https://www.cdc.gov/ticks/tickbornediseases/ehrlichiosis.html

Ehrlichiosis

- **Pathogen:** ***Ehrlichia*** **spp. (bacteria)**
  - ***E. chaffeensis***
  - ***E. ewingii***
  - **"Panola Mountian"** ***Ehrlichia***
- **Vector:**
  - **Lone star tick (*Amblyomma americanum*)**
- **Symptoms**
  - **Fever, headache, malaise, myalgias, nausea**

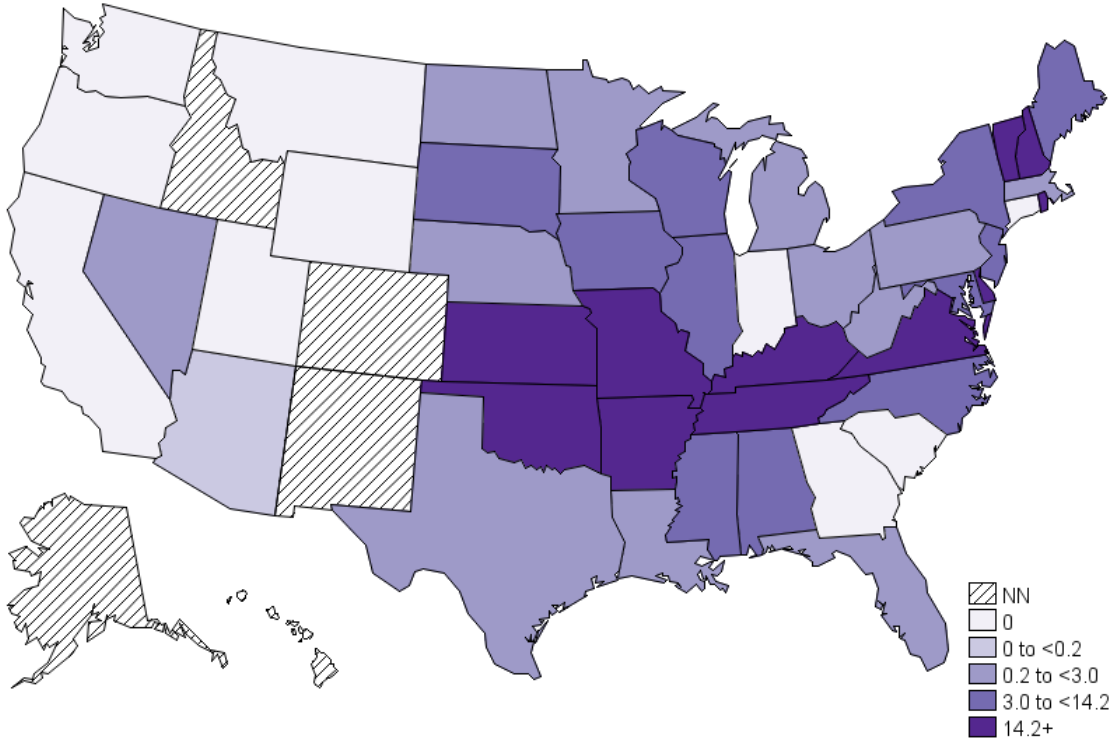


Image from https://www.cdc.gov/ticks/tickbornediseases/ehrlichiosis.html

Human granulocytic anaplasmosis (HGA)

- **Pathogen:** ***Anaplasma phagocytophilum*** **(bacteria)**
- **Vector:** ***Ixodes scapularis***
- **Symptoms: Fever, headache, muscle aches, nausea, loss of appetite, photosensitivity, loss of basic motor skills, fatigue, confusion, memory loss.**
- **Treatment: Antibiotics**

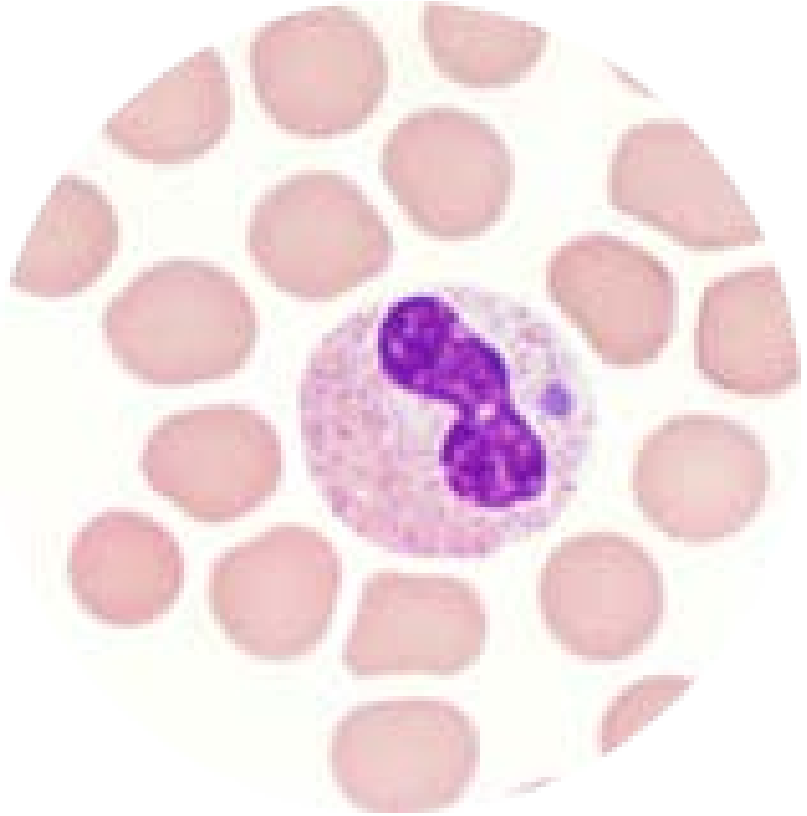


Image from https://www.cdc.gov/ticks/tickbornediseases/anaplasmosis.html

Babesiosis

- **Pathogen: *Babesia microti* & *B. duncani* (protozoan)**
- **Vector: *Ixodes scapularis***
- **Symptoms: Malaise, fever, enlarged spleen and/or liver, jaundice, nausea.**
- **Can also be spread through blood transfusions, so patients are not allowed to donate blood.**

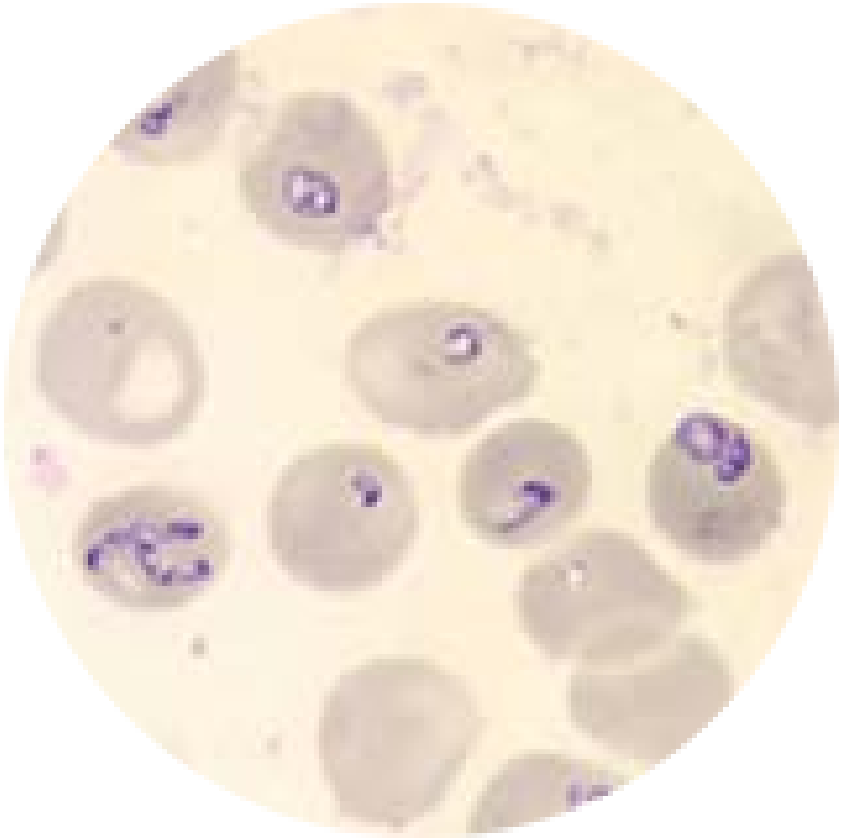


Image from https://www.cdc.gov/ticks/tickbornediseases/babesiosis.html

Alpha-gal Syndrome (Mammalian Meat Allergy)

- Lone star ticks transmit alpha-gal into the bloodstream when feeding.
- The human immune system releases antibodies to attack the foreign carbohydrate.
- Future intake of mammal meat (& sometimes dairy) containing alpha-gal triggers allergic reaction.
- Reactions are delayed (~3-8 hours after ingestion).
- Clinical guidance: Avoid red meat, dairy, and related foods (e.g., gelatin and by-products).

Image from https://www.cdc.gov/ticks/alpha-gal/index.html

Winter ticks on moose

- *Dermacentor albipictus*
- Moose in New England are suffering from severe winter tick loads– enough to exsanguinate them (death by blood loss).
  - Normal tick load: ~1,000-20,000
  - In recent years, moose have been recorded with >100,000
- "Ghost moose": Moose that are so infested with ticks they rub off much of their hair and skin in an attempt to relieve itching.
- New Hampshire moose population dropped from 7,500 to 4,500 because of ticks.
- Luckily, not as big a problem for deer!

Ticks on birds

- Ticks feeding on birds can cause avian tick paralysis, which can be fatal.
- Ticks feeding near birds' eyes can reduce their eyesight, contributing to mortality from window strikes or predation.

Photo by Ian Stewart

Protecting Yourself from Ticks

- Wear repellent (DEET-based for skin, permethrin for clothing/shoes).
- Wear light-colored clothing, tall boots, long sleeves, pants tucked into socks.
- Stay on trails/away from tall grass & other vegetation.
- Conduct frequent & regular tick checks after being in tick habitat and remove ticks promptly.

How to Remove a Tick

- **Use fine-tipped tweezers to grasp the tick as close to the skin's surface as possible.**
- **Pull upward with steady, even pressure. Don't twist or jerk the tick; this can cause the mouth-parts to break off and remain in the skin.**
- **After removing the tick, thoroughly clean the bite area and your hands with rubbing alcohol or soap and water.**
- **Save the tick for identification.**
- **Check for more ticks!**

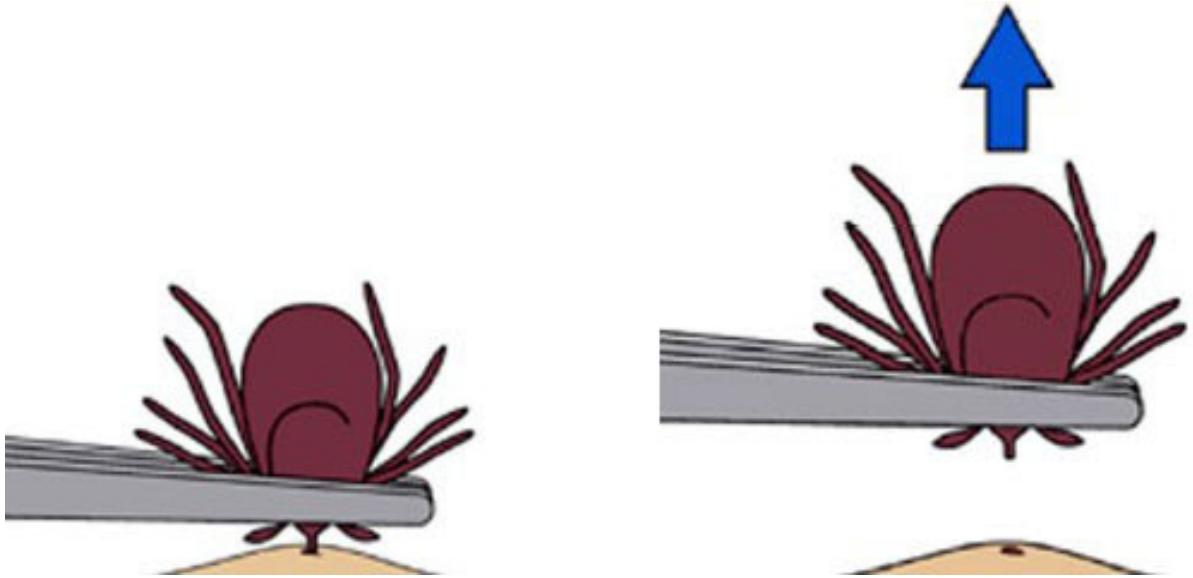


Photo courtesy of cdc.gov

Keeping Your Pets Safe

- Keep pets up-to-date on tick preventatives.
- Include your pets in your regular tick checks.
  - Ticks attached for >24 hours are more likely to transmit pathogens.

Keeping Your Yard Safe

Mythbusting: Chickens & guinea fowl do <u>not</u> appreciably reduce tick numbers.

Keeping Your Yard Safe

Remove invasive vegetation such as:

- **Multiflora rose**
- **Japanese barberry**
- **Oriental bittersweet**
- **Amur honeysuckle***
- **Japanese honeysuckle**

All of these species are positively associated with *Ixodes scapularis*.

***Also positively associated with *Amblyomma americanum*.**

Keeping Your Yard Safe

Identify the areas of your yard used most frequently for recreation and make those areas less suitable for ticks & their hosts (e.g., mice) by:

- **Keeping grass short.**
- **Removing leaf litter & brush piles.**
- **Reducing groundcover.**
- **Widening trails.**
- **Trimming branches to let in more sunlight.**

Before intervention

After intervention

Images from CAES Tick Management Handbook

Keeping Your Yard Safe

But remember that leaf litter & vegetation serve important ecological roles.

Good tick habitat is also good habitat for beneficial arthropods.

Good mouse habitat is also good habitat for other wildlife.

Try to maintain part of your yard as wildlife habitat– but limit your recreation in that area to avoid ticks.

Thanks for listening!

Contact:

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