



COLLEGE OF AGRICULTURE  
AND LIFE SCIENCES  
COOPERATIVE EXTENSION  
Arizona Pest Management Center



# Ticks – Biology and Management

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Find the tick ?



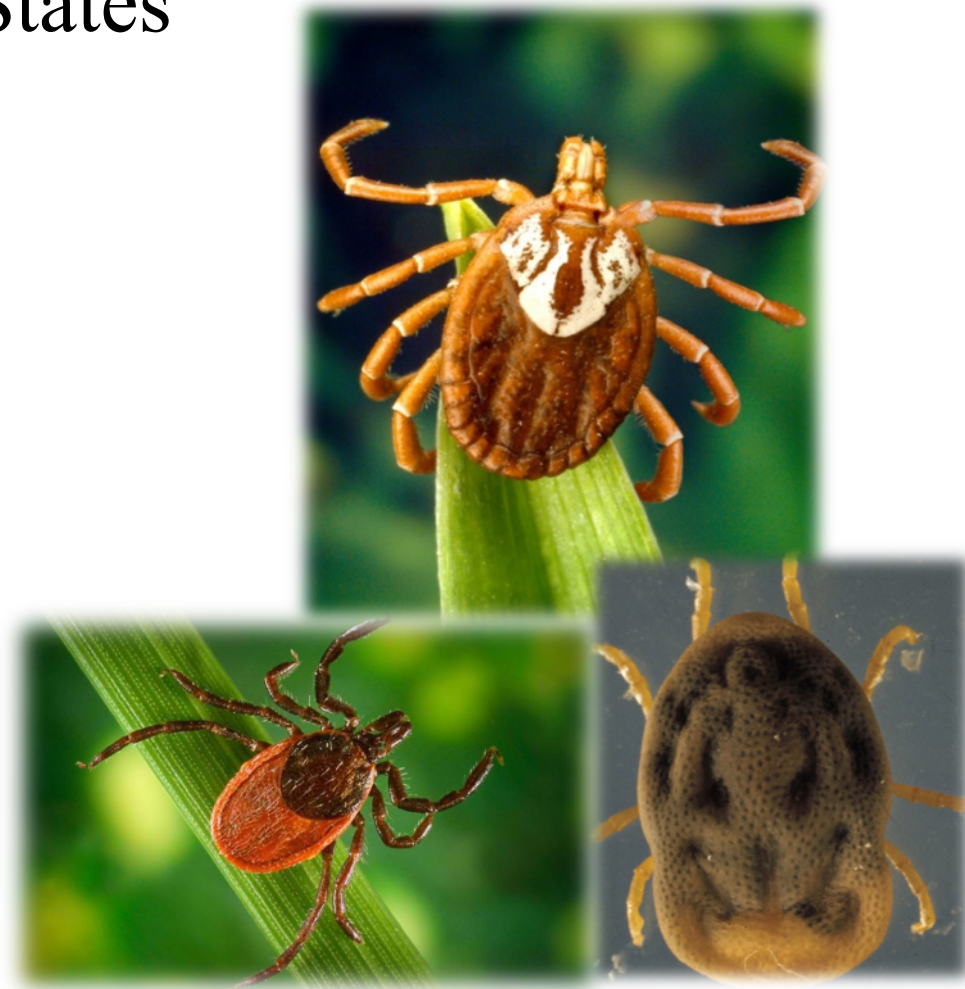
# Ticks

- Not insects
- Small arachnids; eight legs
- External parasites, feeding on blood of mammals, birds, and sometimes reptiles and amphibians

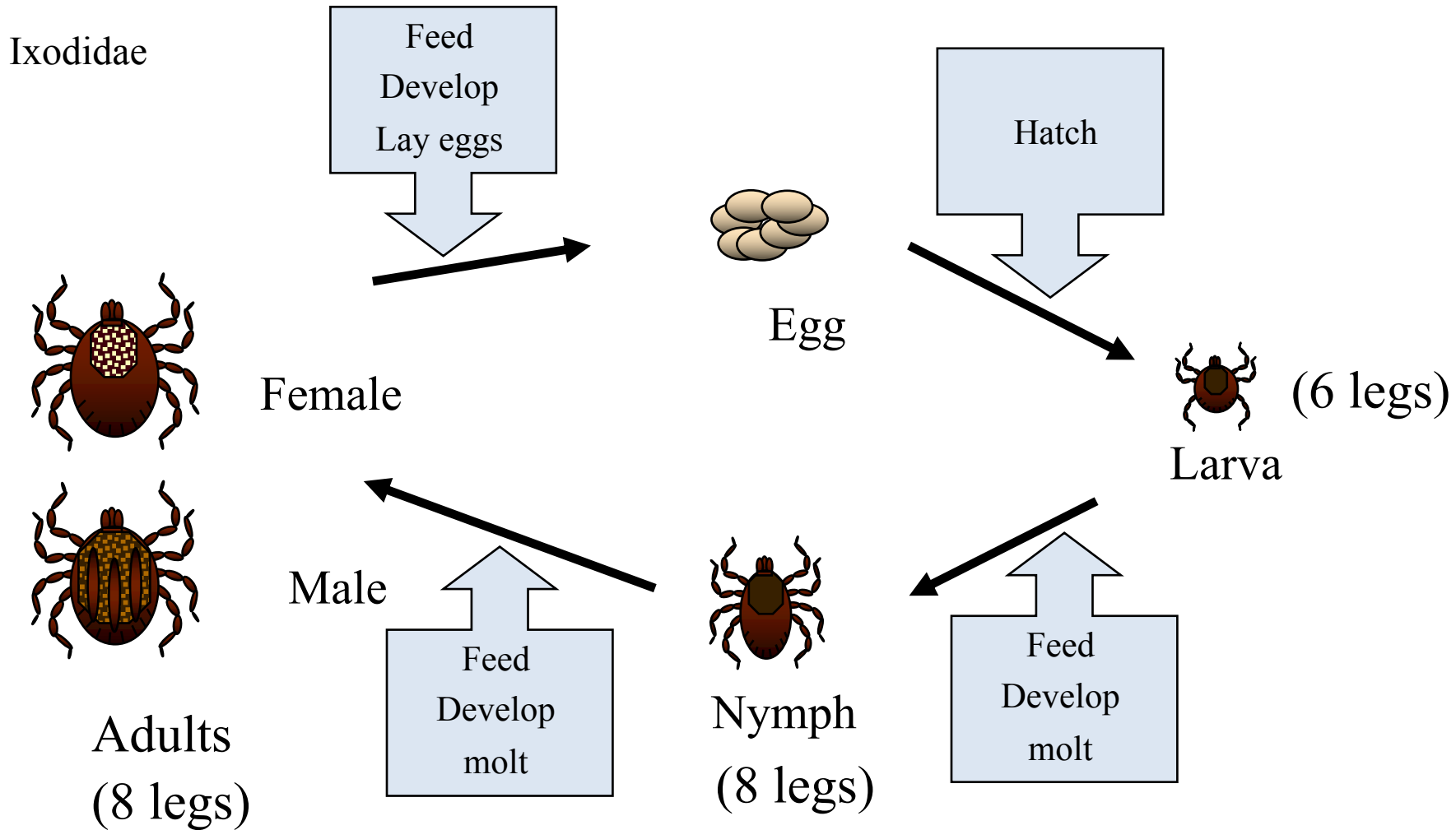


# Incredible Diversity

- About 900 species worldwide, about 85 species in the United States
- Three families:
  - Ixodidae (hard ticks)
    - >700 species
  - Argasidae (soft ticks)
    - ~200 species
  - Nuttalliellidae
    - Only 1 species



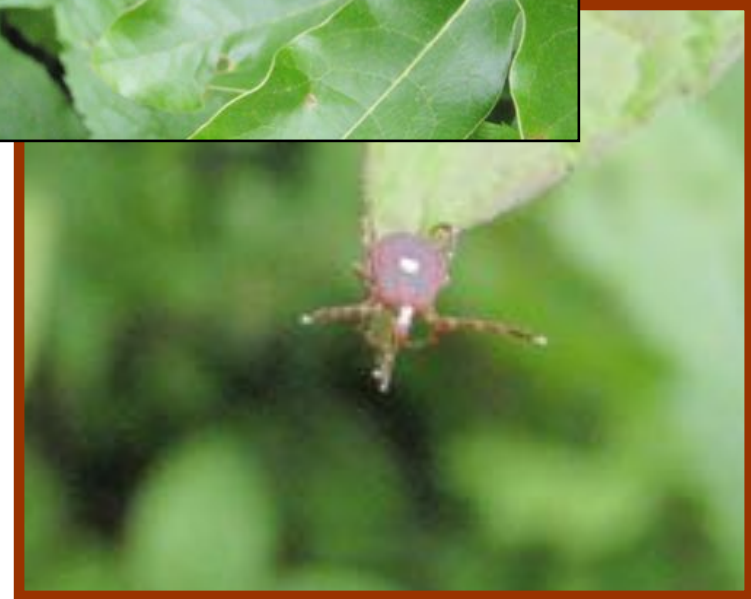
# General Life Cycle of a Tick



Brown dog tick  
*Rhipicephalus sanguineus*

# How do Ticks Find Hosts

- Ticks find a host by sensing light changes, temperature, and certain chemicals
- Carbon dioxide, heat
- Their “noses” are sensory organs on the front legs
- Questing behavior





# Public Health Importance

- Ticks transmit the **widest** variety of pathogens
- About **12** tick species of public health or veterinary importance in the US





**Babesiosis**

**Granulocytic Anaplasmosis**

**Colorado tick fever**

**Ehrlichiosis**

*Borrelia mayonii*

*Rickettsia parkeri* rickettsiosis

**Lyme disease**

**STARI (Southern tick-associated rash illness)**

**Tickborne relapsing fever (TBRF)**

**364D rickettsiosis**

**Powassan disease**

**Heartland virus**

**Bourbon virus**

**Anaplasmosis**

*Borrelia miyamotoi*

**Alpha-gal**

**Tularemia**

**Rocky Mountain spotted fever (RMSF)**



# How Do Ticks Get Infected?

- Horizontal Transmission- pathogen is acquired from a host, develops or multiplies in tick, and is transmitted to next host
- Vertical Transmission- female lays infected eggs, ticks can infect in larval form



# Ticks and Tick-Borne Diseases



*Dermacentor andersoni* (Rocky Mountain Wood tick)

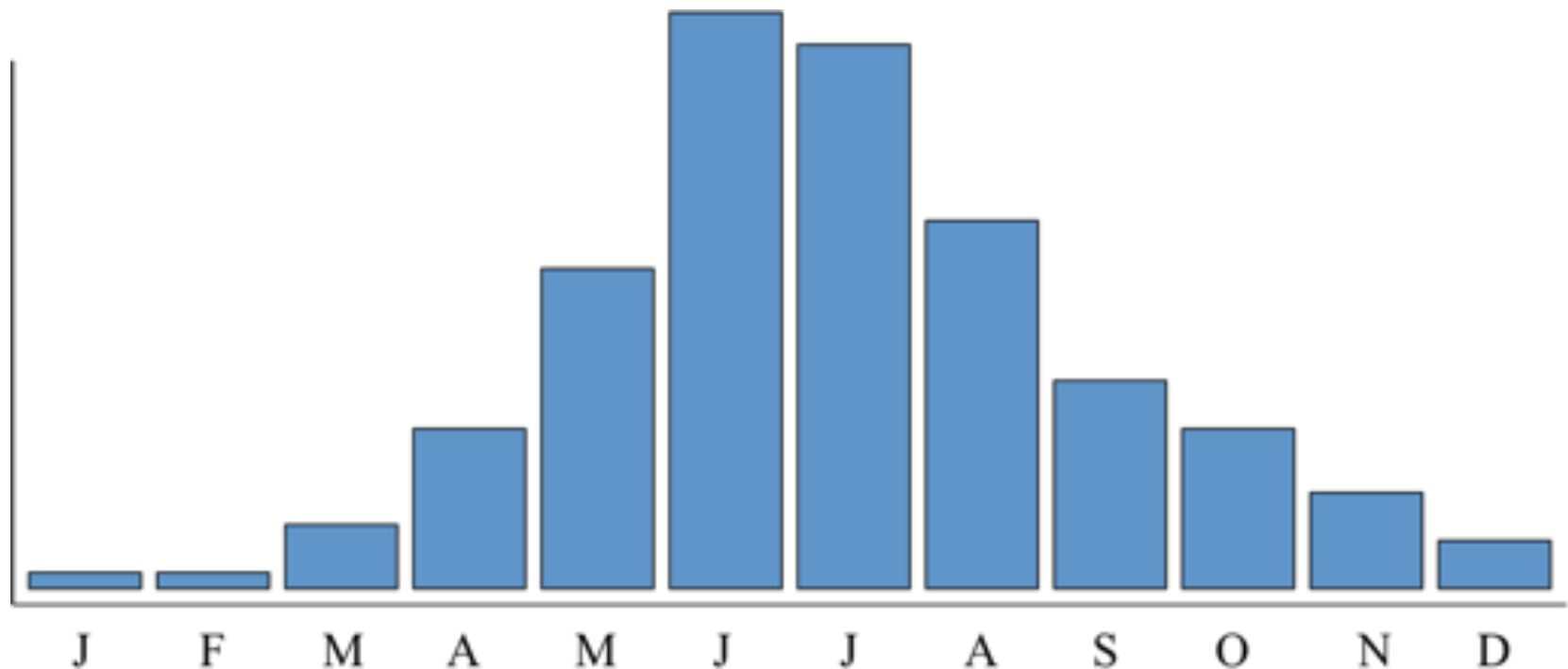
Tick-borne diseases are increasing in the United States

...worldwide as well

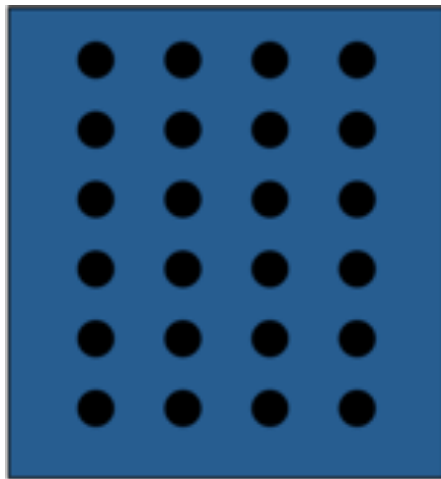
Geographic ranges of vector ticks are expanding due to climate changes

# Ticks and Their Associated Diseases are Seasonally Distributed

Peak of disease activity corresponds with peak of tick activity (especially the life stage of tick most important for transmission)



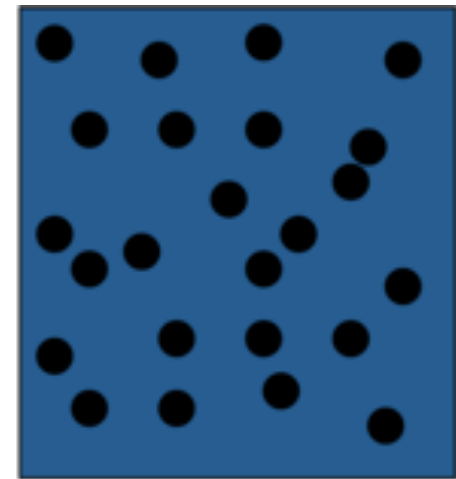
# Ticks and Their Associated Diseases are Focally Distributed (Clustered)



Non-random



Clustered



Random

Pavlovsky, E.N. 1964. Natural nidity of transmissible diseases.  
University of Illinois Press: Urbana, Illinois. (English translation)

# Tick Situation in Arizona

- One primary tick species:  
**Brown Dog Tick**  
*Rhipicephalus sanguineus*
- Close contact between humans and ticks
- Potential for transport of ticks across widespread area due to large stray dog numbers



# Tick Situation in Arizona

- Widespread tick distribution
- High tick densities in peridomestic environment (as high as 1000 ticks/hr on dry ice traps)





Larva





# Brown Dog Tick *Rhipicephalus sanguineus*

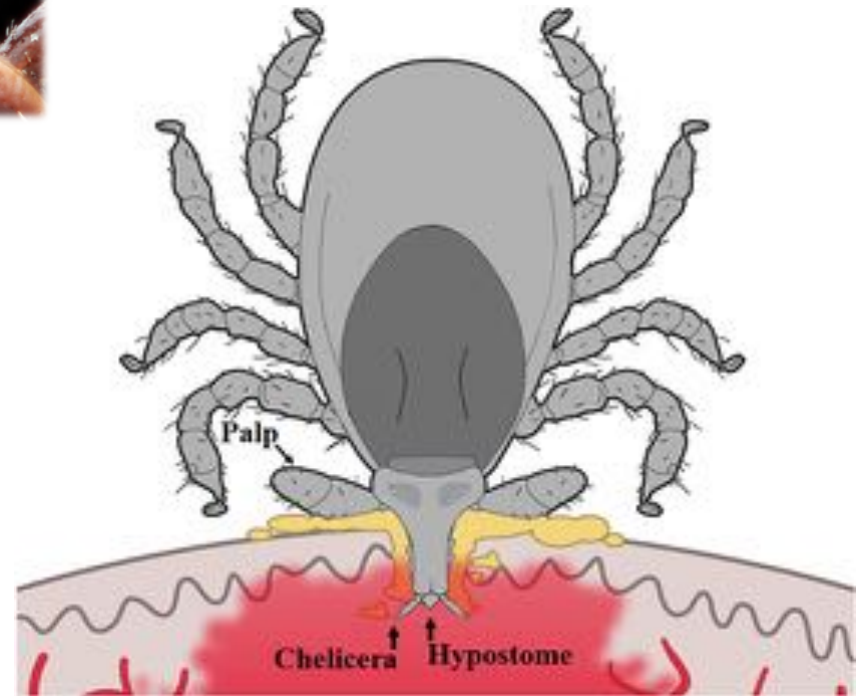
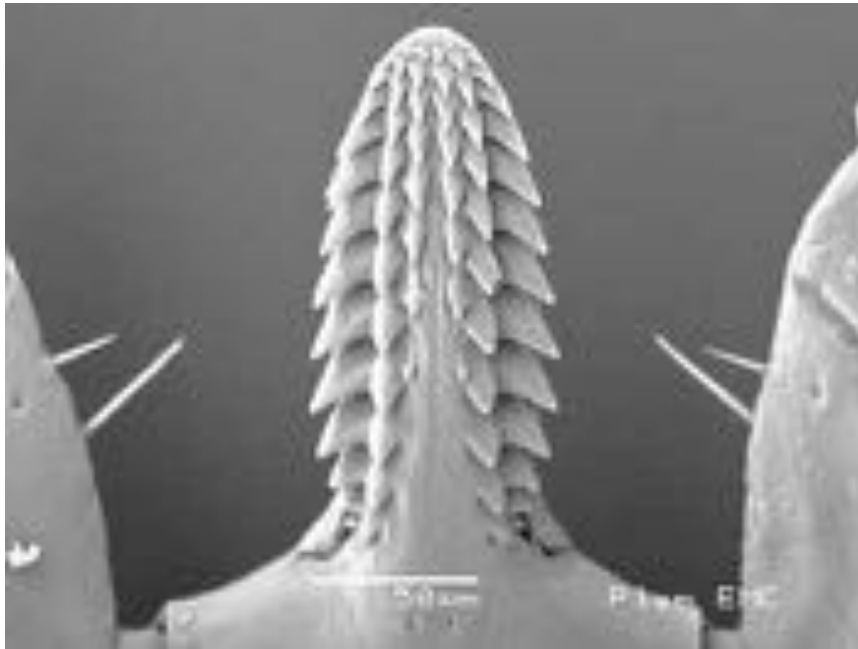
- Found worldwide, primarily feeding on dogs in all life stages as preferred host
- Larval and nymphal ticks occasionally feed on humans, especially when tick populations are high
- Transmit spotted fever *Rickettsia rickettsii*
- Vector of Rocky Mountain spotted fever (RMSF)





Bacteria *Rickettsia rickettsii* cause Rocky Mountain spotted fever: the most severe rickettsia illness of humans

# Mouthparts



# Saliva

- Excrete concrete-like saliva into wound, create feeding tube
- Contains anesthetic, anti-coagulants, immunosuppressants, vasodilators
- Also helps with water regulation

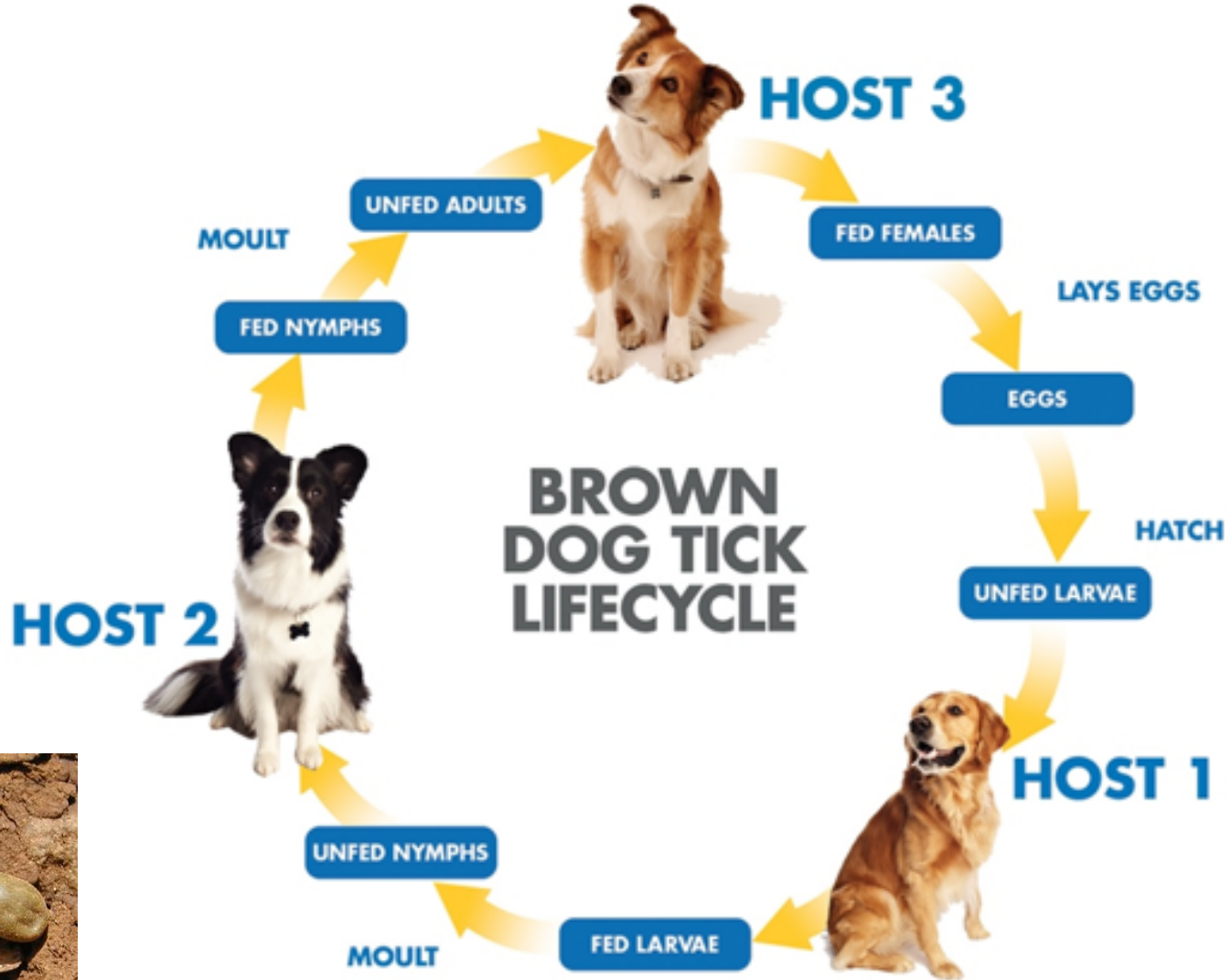


# Blood Feeding Requirements

- Sensory apparatus to locate vertebrate host
- Specialized piercing-sucking mouthparts
- Saliva components to prevent blood coagulation and host immune response
- Capacity to deal with dramatic increase in gut volume



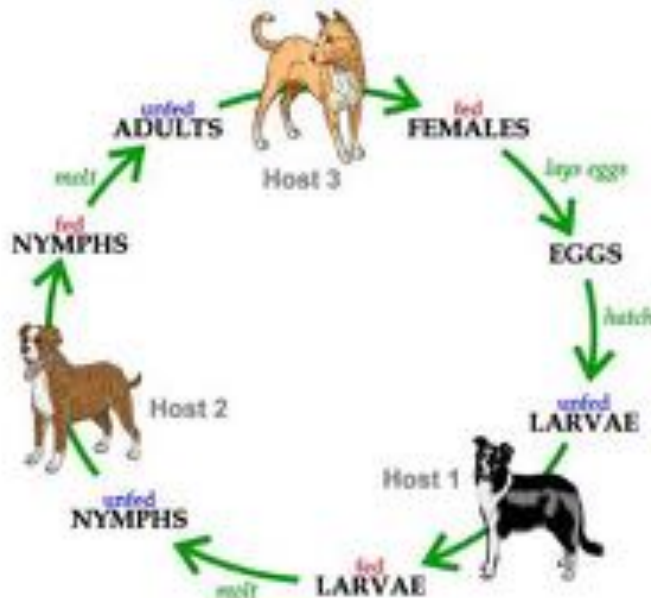
# General Life Cycle of a Tick



Brown dog tick  
*Rhipicephalus sanguineus*

# Blood Feeding Strategies

- Hard ticks attach strongly for varying periods of time (multiple days)
- Life cycle may use several hosts: one-host, two-host, and three-host ticks



- Vary from host-specific to feeding on a broad range of vertebrate hosts
- Relevant to pathogen transmission

# Peridomestic Environment



- Dog ticks live close to home
- Items in yard (old furniture, toys, appliances, trash) can provide shelter and breeding sites for ticks
- Where the dogs go, the ticks go



# Rocky Mountain Spotted Fever (RMSF)

- Transmitted through the bite of an infected tick
- Disproportionately affects children and elderly
- *Rickettsia rickettsii* infects endothelial cells
- Acute febrile illness with severe manifestations



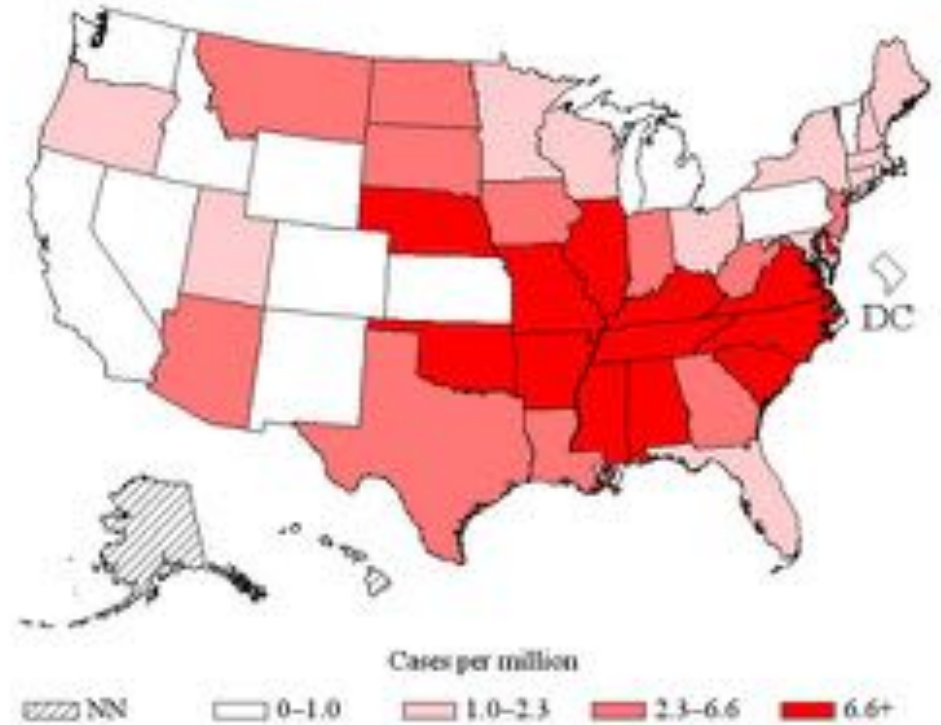
# RMSF Symptoms

- Fever
- Headache
- Rash
- Nausea & vomiting
- Stomach pain
- Muscle pain
- Lack of appetite
- Can be deadly if left untreated
  
- Most common in young children



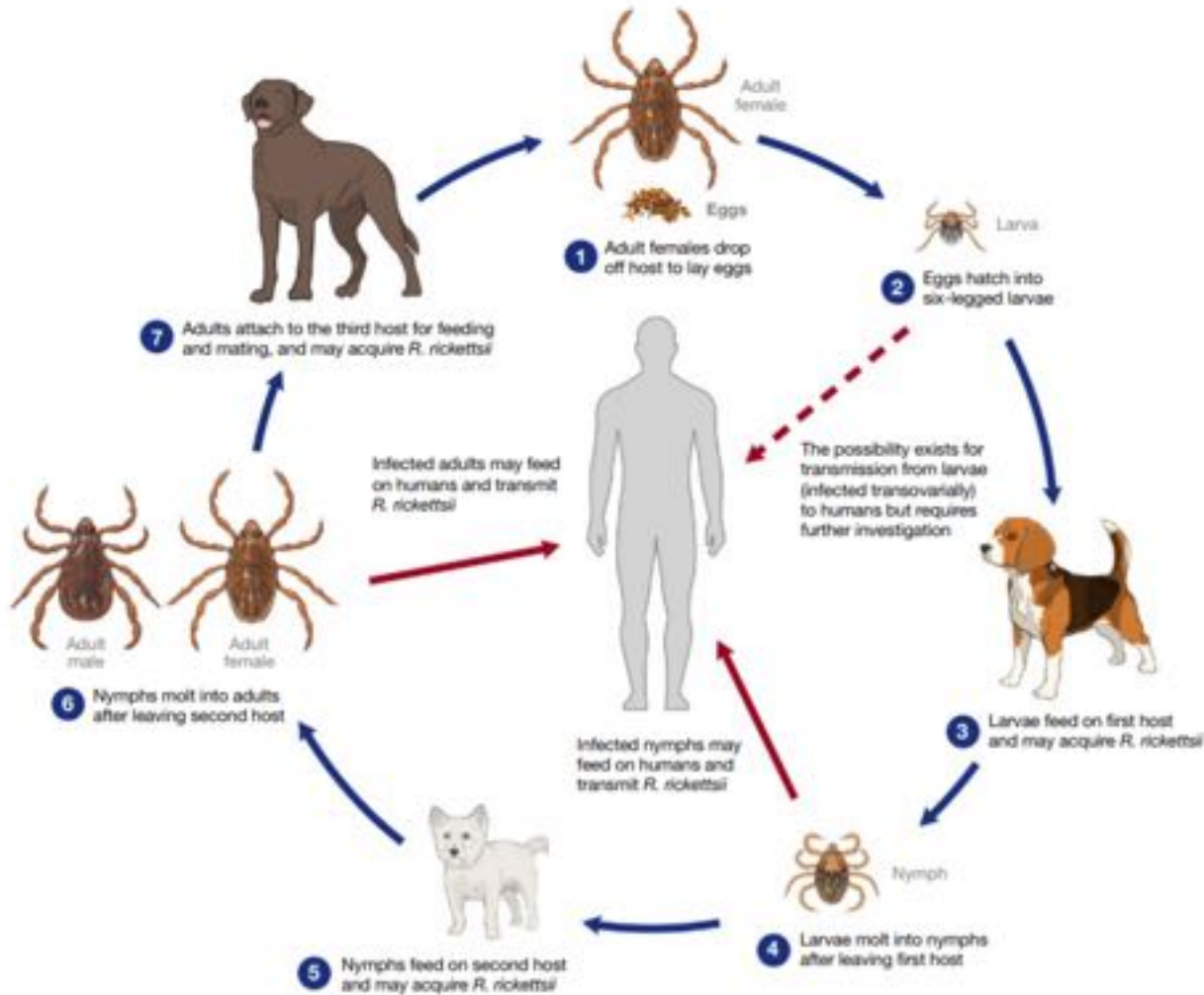
# RMSF Distribution

- In Arizona, brown dog tick is vector (*Dermacentor* ticks in other parts of the country)
- Higher case fatality rate than elsewhere in U.S.



# RMSF Disease Cycles

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



# RMSF Treatment

- Low incidence, high consequence disease
- High case fatality rate, particularly when diagnosis and treatment are delayed
- **Doxycycline** is the first line treatment for adults and children of all ages, and should be initiated immediately whenever RMSF is suspected. It is most effective if started in the first 5 days of symptoms



Mention of trade names does not imply endorsement by UA, CDC or other agencies.

# The Situation

- Brown dog ticks feed primarily on dogs
- Brown dog ticks feed rarely on people
- When dog populations rise, there is also a rise in tick numbers
- When tick numbers are high, even the occasional feeding on people becomes significant
- Close contact of humans with dogs and their ticks sets up the ideal situation for transmission

# Risk Factors

- Roaming dogs
- Dogs not spayed/neutered
- Clutter in yard
- Dogs can get RMSF too
- Dogs **CANNOT** give humans RMSF



# Prevention



- Check for ticks
- Remove ticks immediately if found
- Reduce yard clutter
- Apply tick collar or topical pesticide on dogs
- Use environmental pesticide (properly) if there is a tick infestation



# Prevent Tick Bites

- Use caution in areas where ticks are more likely to be found
- Wear light-colored pants and a long-sleeved shirt so ticks are easy to see
- Wear closed footwear and tuck pants into socks



## PREVENT TICK BITES

Use caution in areas where ticks are more likely to be found:



Wear light-coloured pants and a long-sleeved shirt so ticks are easy to see.

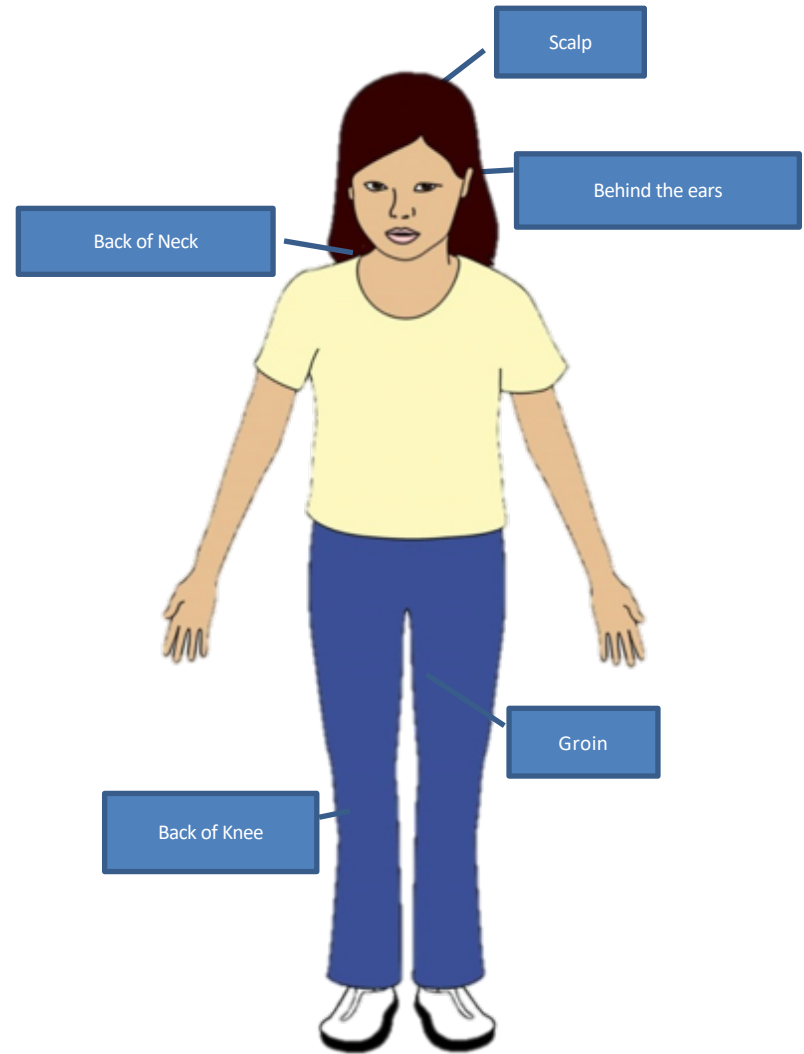


Wear closed footwear and tuck pants into socks.

# Tick Checks

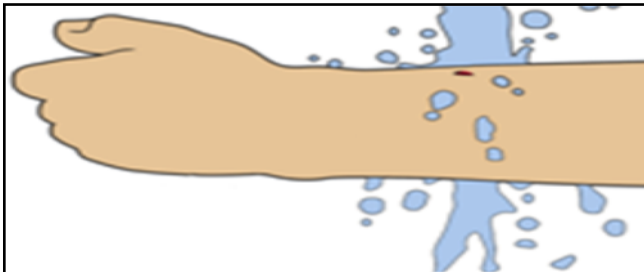
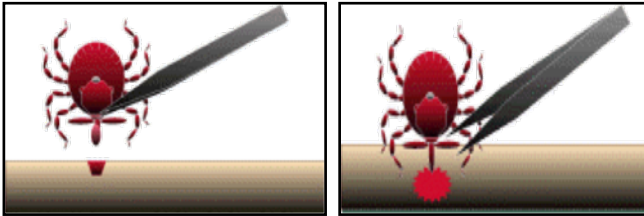
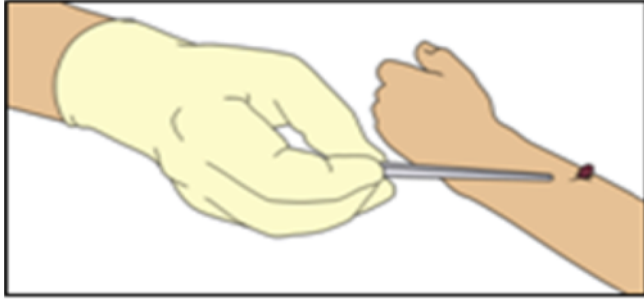


**USE** EPA approved  
Insect Repellent (DEET)  
to keep ticks from biting



**CHECK** yourself, your children  
and your dogs every day

# Tick Removal



1. Use fine-tipped tweezers to grasp tick as close to the skin as possible
2. Gently pull the tick straight upwards
3. Make sure all of the tick was removed from the skin. If any parts remained, remove them
4. Wash the bite with soap and water, or disinfect the area with rubbing alcohol

**Important: If you have a tick bite and get fever and headache 2-14 days afterwards, go see your doctor as soon as possible!**

<https://youtu.be/oGrK4ZKUfhQ>

# How to Dispose of a Live Tick

- Put it in alcohol
- Put it in a sealed bag or container
- Wrap it tightly in tape
- Flush it down the toilet

- DON'T crush a tick with your fingers



# Prevention at Home

- Reduce tick survival
- Reduce suitable host habitats

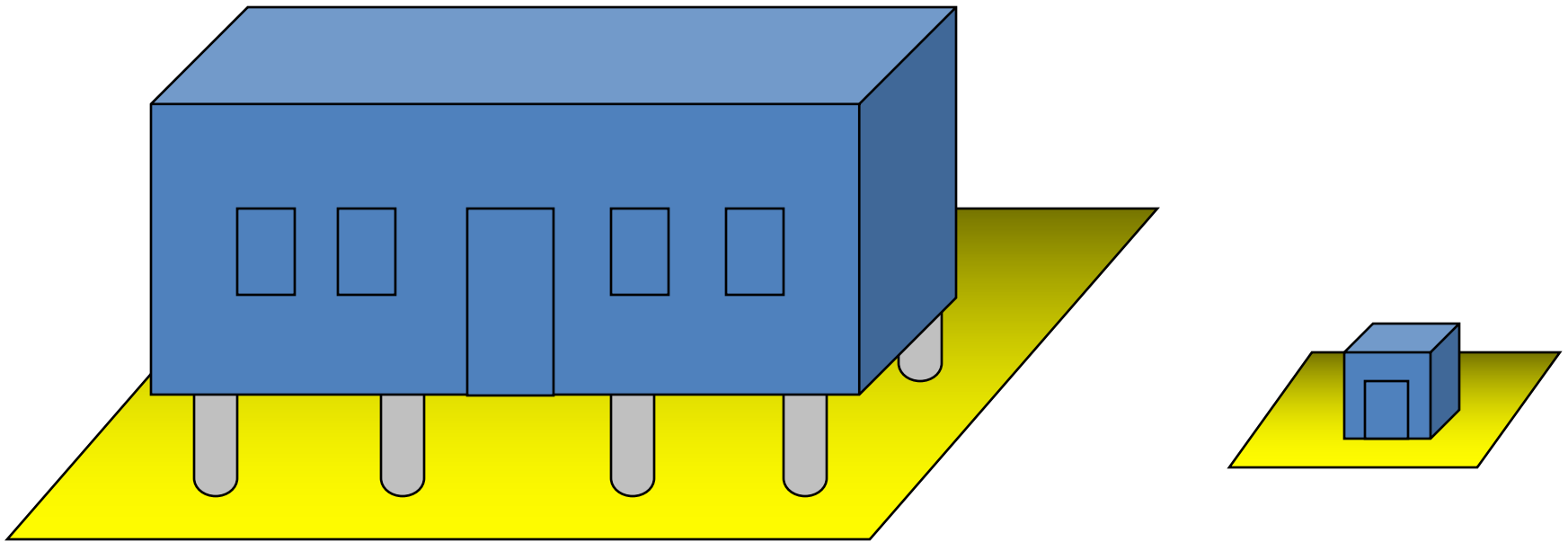


**SPRAY** pesticides that kill ticks in your yard ALL summer



**REMOVE** old furniture, mattresses and trash from the yard

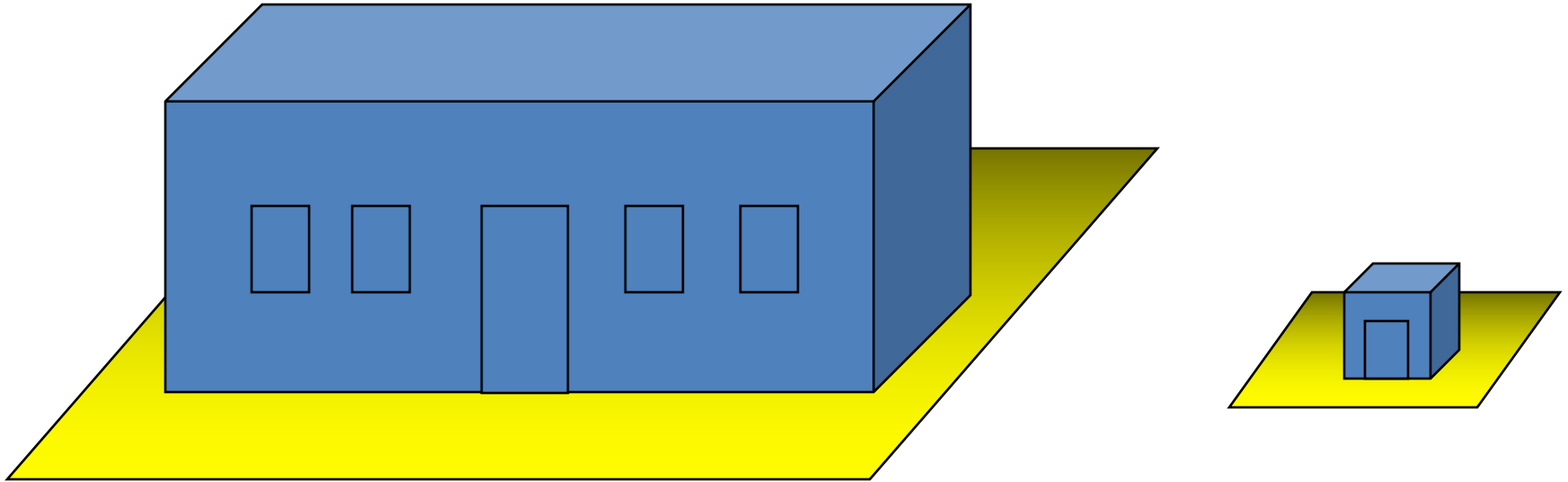
# Control of ticks around houses on piers




 Area to treat (under house and 6-10 feet beyond edge of house)

Also treat under and around dog houses, porches, decks, or other shady places that dogs lay regularly

# Control of ticks around houses on slabs



 Area to treat (band 6-10 feet beyond edge of house)

Also treat under and around dog houses, porches, decks, or other shady places that dogs lay regularly



# Tick Prevention Around the Home

- Remove leaf litter, tall grasses, and brush around homes and at the edge of lawns
- Stack wood neatly and in a dry area, away from home
- Discourage unwelcome animals from entering your yard by constructing fences
- Remove old furniture, mattresses, or trash from the yard that may give ticks a place to hide

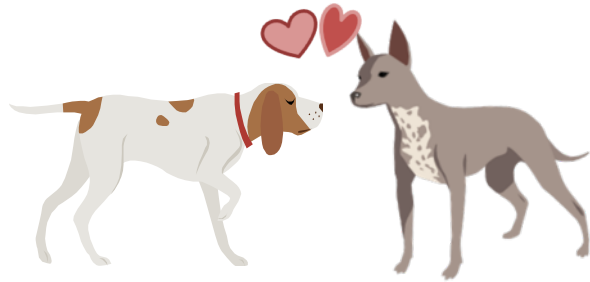


# Tick Prevention on Dogs

- Tick collars can protect dogs from ticks
  - Some top-spot treatments and tick powders can also work
- Collar all dogs in your yard
- Follow package directions to decide when the collars need to be changed
- Check your dogs for ticks regularly



# Tick Prevention on Dogs



One unneutered male dog + One unspayed female dog =

1 year = 16 dogs  
2 years = 128 dogs  
3 years = 512 dogs  
4 years = 2,408 dogs  
5 years = 12,288 dogs  
**6 years = 67,000 dogs**



# Tick Prevention on Dogs

- Spay and Neuter:
- Helps dogs live longer, healthier life
- Prevents dogs from getting sick from some diseases
- Reduces dangers of multiple pregnancies
- Reduces risk of roaming

# Control of Ticks on Dogs

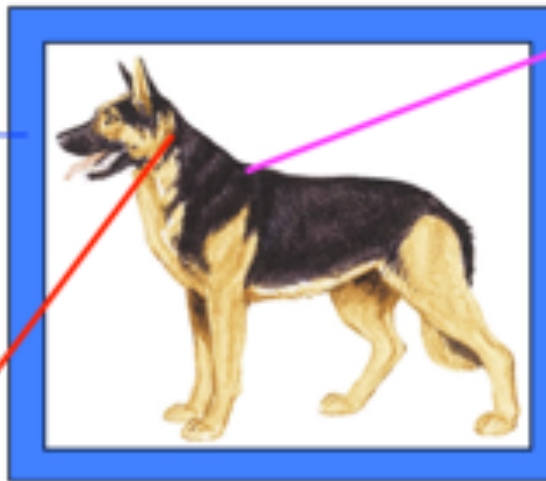
Use of  
Sprays, dips, or dusts



Tick collars

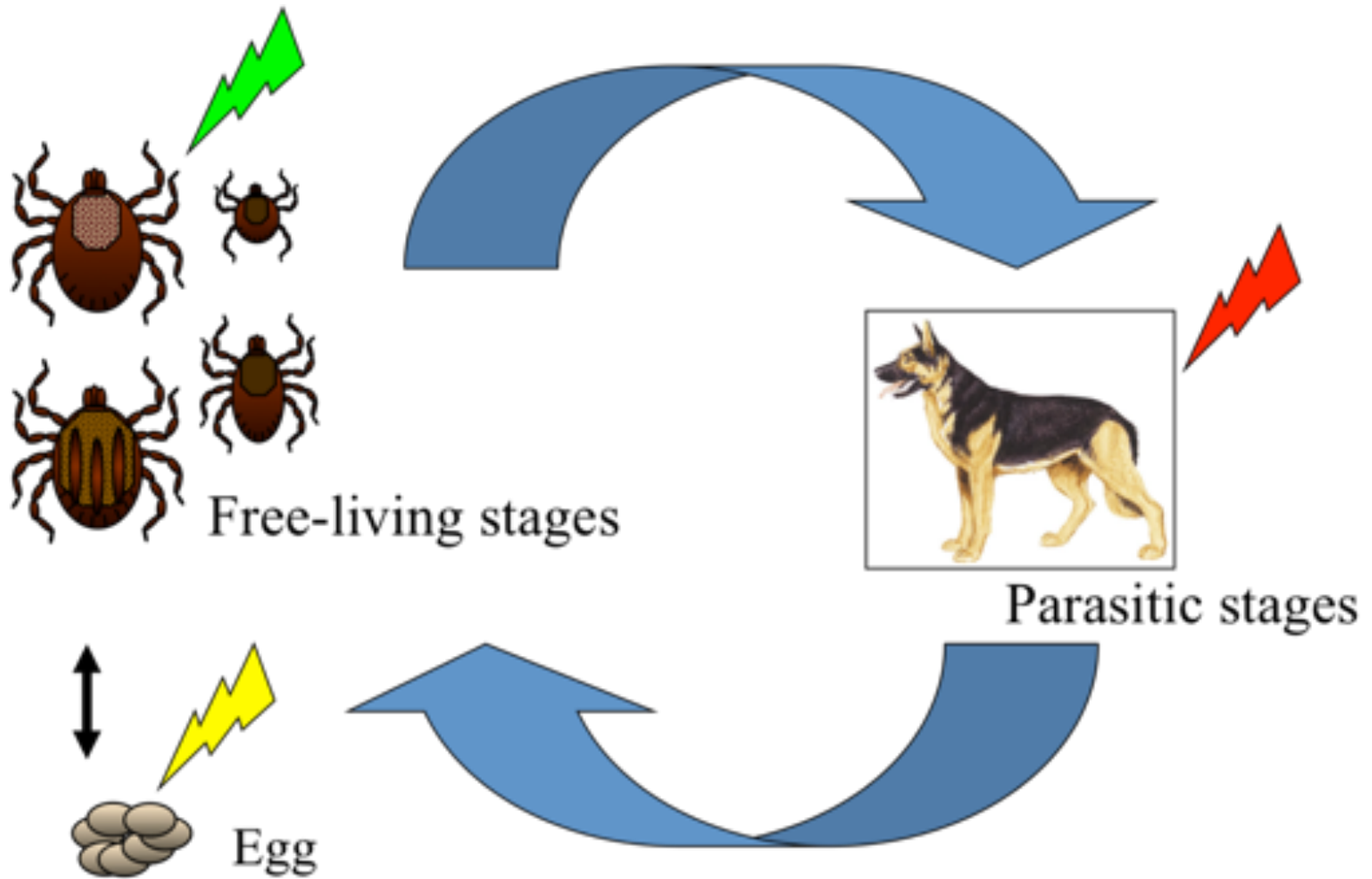


Topicals  
Spot-on treatment



# Effective Tick Control Targets

## All Life Stages



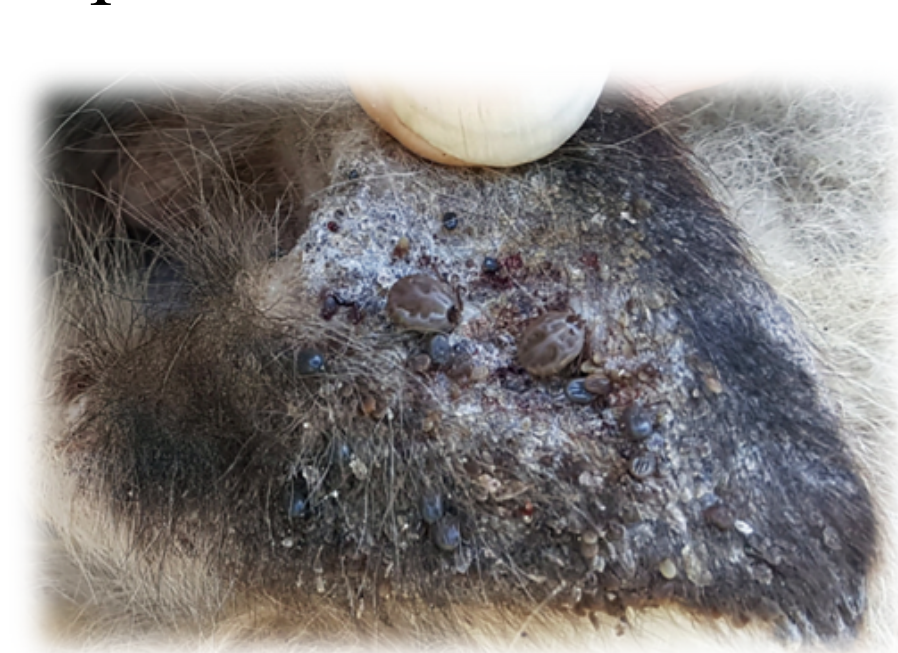
# Asian Longhorned Tick



- New in the U.S.
- AZ doesn't have it yet

# Asian Longhorned Ticks

- Native to Asia
- Established livestock pests in Australia and New Zealand
- Three-host tick with a life cycle takes a year
- Parthenogenesis (Female reproduction without the need of fertilization by a male)
- Females can lay ~2,000 eggs

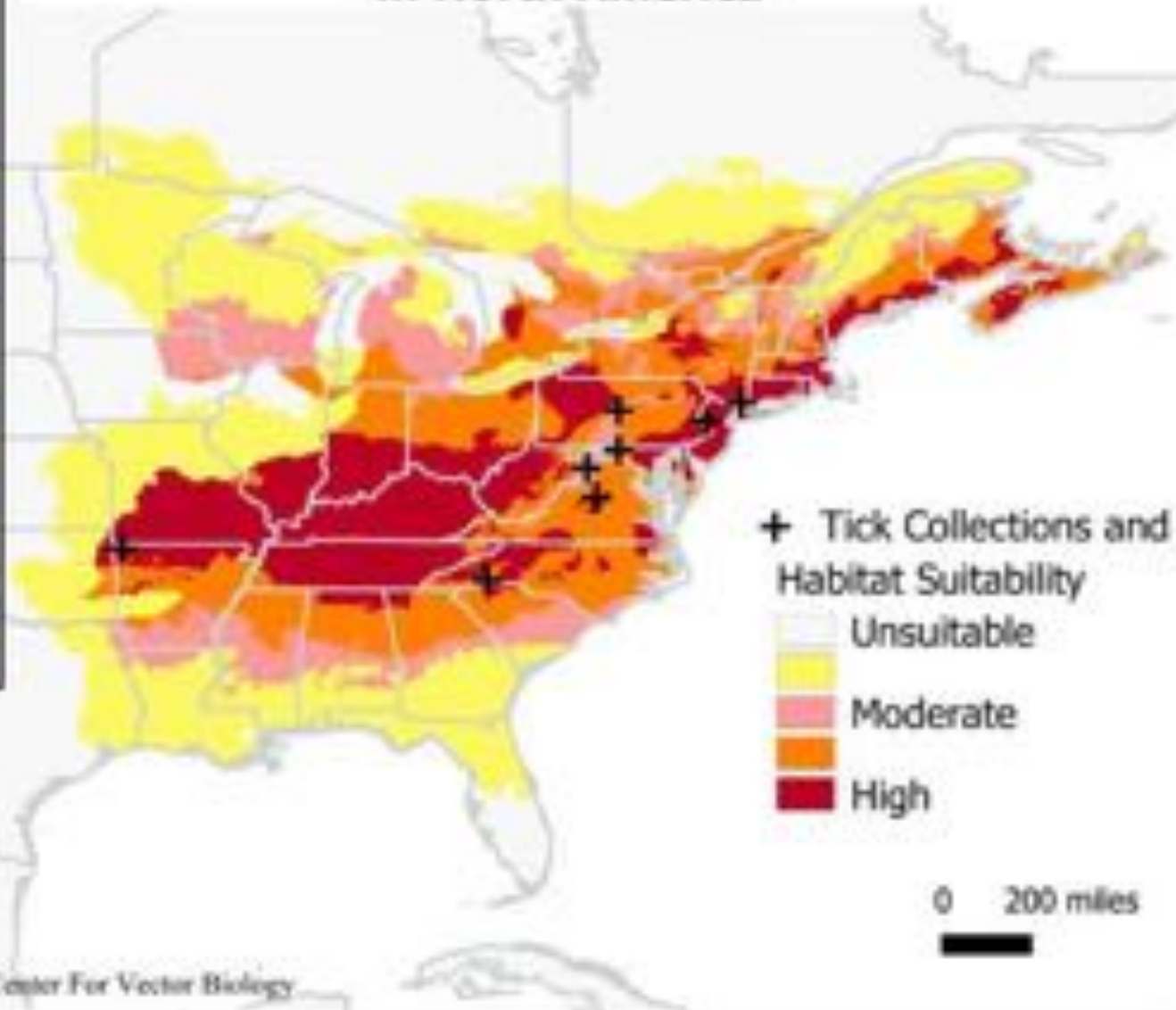






**Figure 1.** Known U.S. distribution of *Haemaphysalis longicornis* (as of August 30, 2018).

## Potential range of the Asian longhorned tick in North America





Left image is the brown dog tick, right image is the Asian longhorned tick mouthparts.

- <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1792-2019.pdf>
- <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1769-2018.pdf>



az1769

May 2018

## The Brown Dog Tick and Epidemic Rocky Mountain spotted fever in Arizona and northwestern Mexico

Kathleen Walker, Hayley Yaglom, Dawn H. Gouge, Maureen Brophy, Mariana Casal and Veronica Ortiz Encinas

### Introduction

The brown dog tick *Rhipicephalus sanguineus*, has a worldwide distribution and is found throughout the United States (US) and Mexico. This tick is driving epidemics of Rocky Mountain spotted fever (RMSF) in Arizona and northwest Mexico. As the name suggests, the tick mainly takes blood meals from dogs, but it will also feed on humans and other mammals, and can carry serious disease causing pathogens. In the early 2000's it was found to transmit *Rickettsia rickettsii*, (a gram-negative, intracellular, coccobacillus bacterium) that causes RMSF in Arizona. This was the first time this tick species has been associated with the disease in the US (Demma et al. 2005). Similar outbreaks occurred at the same time in Sonora and more recently in Baja California (Alvarez-Hernandez et al. 2017).

An unusual feature of the brown dog tick is its tendency to live around or inside homes, where it can be found crawling on walls and furniture. Outdoors, it may shelter in cracks or crevices of buildings or backyard clutter. Unlike most ticks in North America, when dogs bring ticks from the natural habitats into yards and even inside homes, the ticks may

Coconino, Gila, Maricopa, Navajo, Pima, Santa Cruz and Yavapai, Yuma counties and is likely present throughout the state. The brown dog tick is also found throughout Mexico (Herrera-Hernández et al. 2016). Its presence has been documented in the states of Coahuila, Durango, Guanajuato, Morelos, Nuevo Leon, San Luis Potosi, Sinaloa, Sonora, Baja California, Veracruz and Yucatan, and it was the most common tick species found in a recent national survey (Sosa-Gutierrez et al. 2016). In contrast to populations in the US, the brown dog tick has been known to vector *R. rickettsii* in Mexico since the 1940s (Bustamante and Varela 1943). Serious RMSF outbreaks have re-emerged in the early 21st century, particularly in the northwest of Mexico (Alvarez-Hernandez et al. 2017).

While the brown dog tick is referred to as a single species, *Rhipicephalus sanguineus* is really a complex of related species or subspecies (Dantas-Torres 2008). Taxonomists do not agree on how to separate the species, but generally recognize two main lineages – a tropical group and a temperate group (Dantas-Torres et al. 2013). A recent study found both the tropical and temperate groups present in the Arizona brown



az1792

March 2019

## Asian Longhorned Tick, an Invasive Tick in the United States

This publication is to inform veterinary, public health, and pest management professionals

Shujuan (Lucy) Li, Dawn H. Gouge, Kathleen Walker, Alfred J. Fournier

The Asian longhorned tick, *Hemaphysalis longicornis*, is also known as the cattle tick or bush tick. It is native to East Asia: China, Korea, Japan, and well established in Australia and New Zealand. It is also an invasive tick species in the United States (U.S.) (Figure 1).

This tick is a serious pest of livestock and wildlife in several countries (Heath 2016, Guan et al. 2010). If the Asian longhorned tick becomes established in Arizona, it could become a serious threat to livestock, wildlife, and pets (Figure 2).

The tick is an aggressive biter, and a competent vector of *Theileria* spp., parasites that cause benign or non-transforming theileriosis disease in cattle (Heath 2016, Guan et al. 2010). *Theileria* spp. are cosmopolitan tick-borne intracellular protozoan hemoparasites like *Plasmodium* and *Babesia* that cause the destruction of red blood cells. *Theileria* spp. are periodically detected in managed herds and wild ruminants in the U.S. Prominent symptoms in livestock include fever, anemia, weakness, abortion, difficulty breathing, increased heart rate, and lymph node enlargement.

Severe ectoparasitism (high tick burden) (Figure 3) of livestock in the U.S. has been documented, and the feeding effects and blood loss can cause significant impacts on the health of livestock. Infested animals suffer weight loss, anemia, reduced milk production, poor wool quality, and miscarriages.

The first confirmed appearance of this tick species in the U.S. occurred on a pet sheep in New Jersey during 2017. However, re-examination of archived ticks dating back as far as 2010 indicates *H. longicornis* had been present, but misidentified as the rabbit tick *Hemaphysalis leporispalustris*



Figure 1. An adult female Asian longhorned tick, unfed, about 2.3 mm long. Image courtesy of James Gathany / Centers for Disease Control and Prevention.



Figure 2. The Asian longhorned tick can be found on deer and other wildlife, as well as livestock and in-home pets. Arizona cattle are shown here. Image courtesy of Arizona Beef Council.

# Useful Resources

- <http://www.cdc.gov/rmsf/>



**I am grateful to**

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for content in this  
presentation





COLLEGE OF AGRICULTURE  
AND LIFE SCIENCES

COOPERATIVE EXTENSION  
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