Tick-Borne Disease

ONE HEALTH KANSAS

Connecting animals,people and their environment, through education

KANSAS STATE UNIVERSITY | Olathe

What is a zoonotic disease?

- an animal disease that can be transmitted to humans (syn: zoonosis)
- **dictionary.reference.com**/browse/**zoonotic+disease**

Terms to know:

Ectoparasite: An organism that attaches to the outside of a host and feeds on that host (example: ticks feed on host's blood.) (Compared to an endoparasite which lives inside a host's body.)

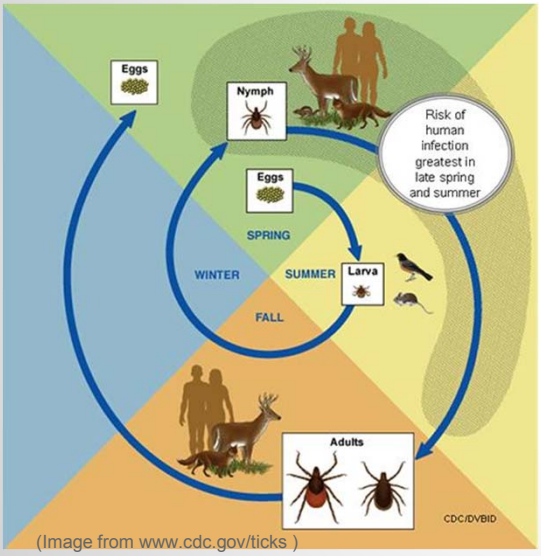
Vector: Species that carry and spread disease to other organisms.

Host: The organism that the vector/parasite is attached to / feeding on.

*** Reservoir Host: Species that commonly carry the disease agent & acts as a potential source of the disease. (Often a rodent or small bird in the case of tick-borne diseases.)**

*** Incidental Host: Not a preferred feeding species for the parasite, but occasionally will be fed upon if it happens to come in contact with the parasite. (Example, Deer are preferred hosts for Black-legged and Lone Star ticks, however humans are often incidental hosts.)**

Tick life cycle



(Image from www.cdc.gov/ticks)

Ticks have 4 life stages:

* egg
* six-legged larva
* eight-legged nymph
* adult

After hatching from the eggs, ticks must eat blood at every stage to survive. Ticks can take up to 3 years to complete their full life cycle, and most will die because they don't find a host for their next feeding.

How Ticks Find Hosts

*Ticks can detect animals´ breath and body odors, and sense body heat, moisture, and vibrations. Ticks can't fly or jump, they wait for a host, resting on the tips of grasses and shrubs in a position known as "questing".

* When a host brushes the spot where a tick is waiting, it quickly climbs aboard.

* Some ticks attach quickly, others will wander before attaching.

Ticks in Kansas:
in order of abundance

- **American Dog Tick (*Dermacentor variabilis*)**
- **Black-legged / Deer Tick (*Ixodesscapularis*)**
- **Lone Star Tick (*Amblyomma americanum*)**
- **Brown Dog Tick (*Rhipicephalus sanguineus*)**

- **American Dog Tick (*Dermacentor variabilis*)**

Transmits: Rocky Mountain Spotted Fever and Tularemia

Larva Nymph Male Female Fully-fed

(Images from www.tickencounter.org)

- **Black-legged / Deer Tick (*Ixodesscapularis*)**

Transmits: Lyme Disease, Human Babesiosis, and Human Anaplasmosis

Larva Nymph Male Female Fully-fed

- **Lone Star Tick (*Amblyomma americanum*)**

Transmits: Human Ehrlichiosis, Tularemia, STARI, and Heartland Virus

Larva Nymph Male Female Fully-fed

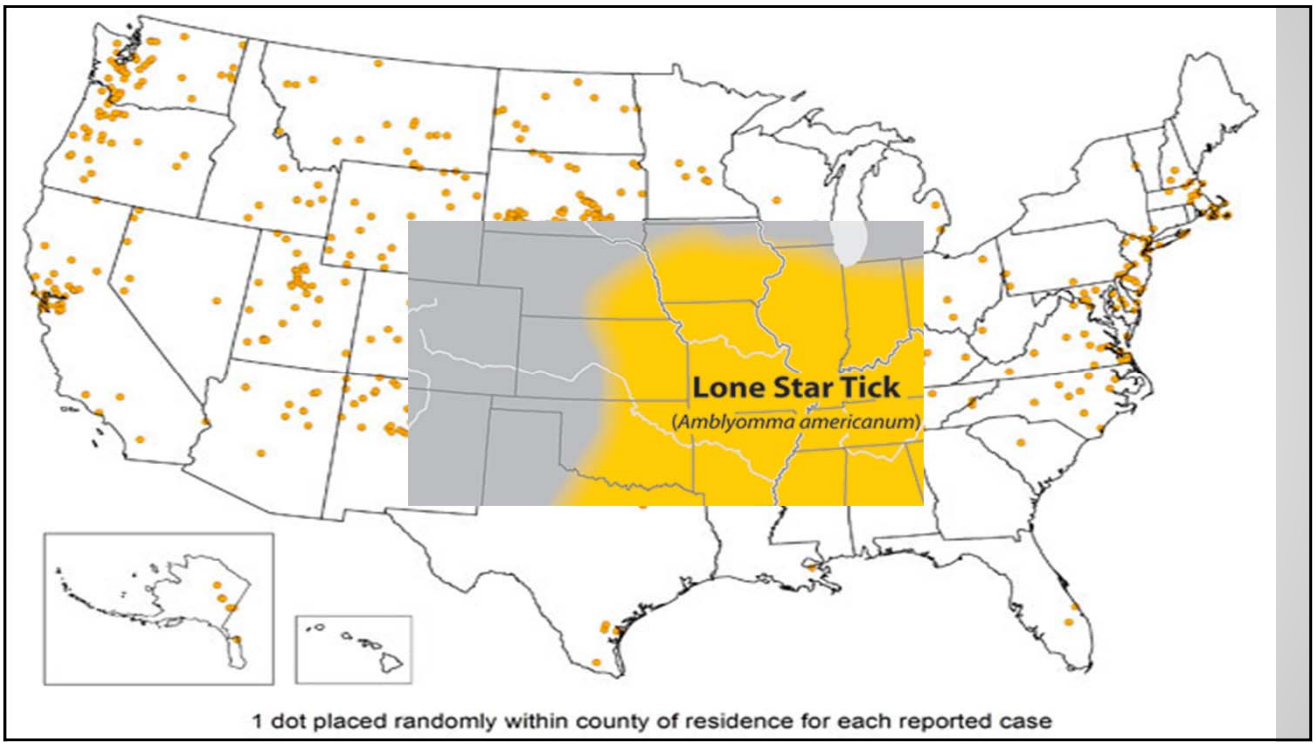
(Images from www.tickencounter.org)

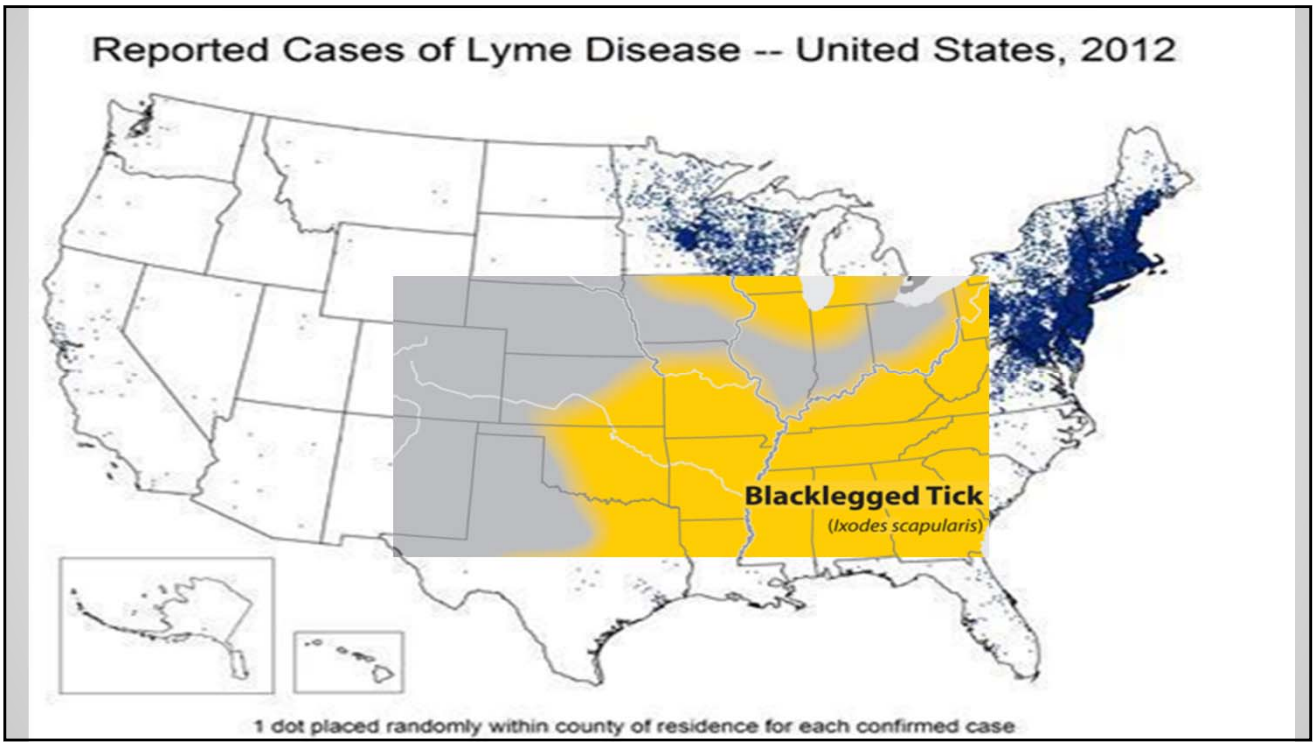
- **Brown Dog Tick (*Rhipicephalus sanguineus*)**

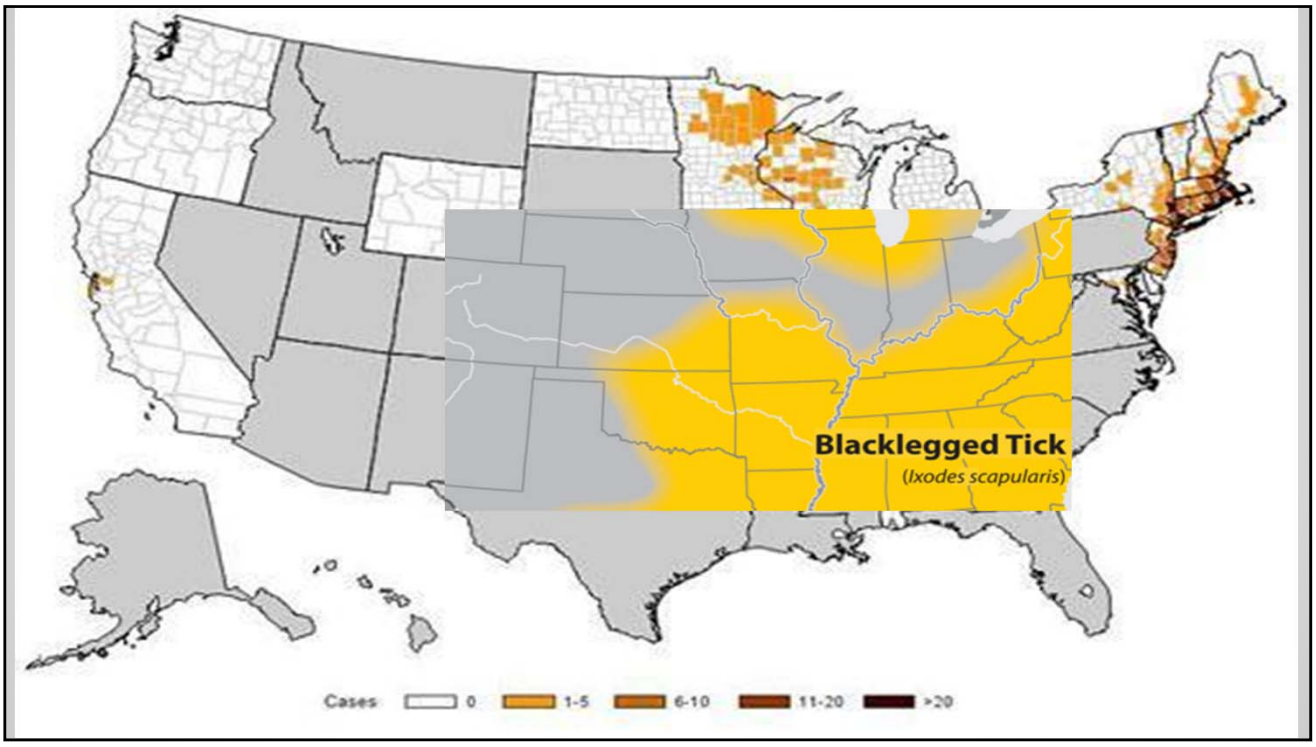
Transmits: Mostly only causes disease in dogs. Occasionally transmits RMSF to humans (along US-Mexico border and in SW US).

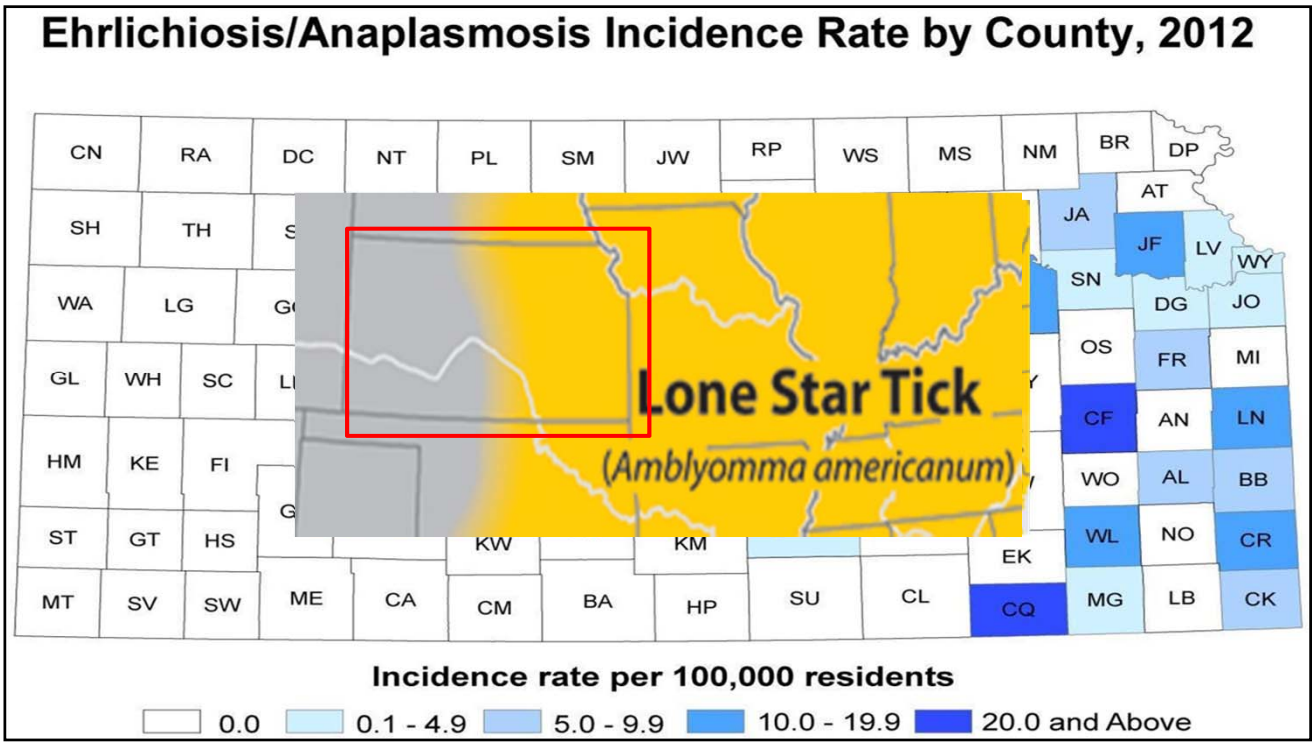
Larva Nymph Male Female Fully-fed

(Images from www.tickencounter.org)


Lone Star Tick
(Amblyomma americanum)
1 dot placed randomly within county of residence for each reported case


Reported Cases of Lyme Disease -- United States, 2012
Blacklegged Tick
(Ixodes scapularis)
1 dot placed randomly within county of residence for each confirmed case


Blacklegged Tick
(Ixodes scapularis)
Cases
0
1-5
6-10
11-20
>20


Ehrlichiosis/Anaplasmosis Incidence Rate by County, 2012
Lone Star Tick
(Amblyomma americanum)
CN
RA
DC
NT
PL
SM
JW
RP
WS
MS
NM
BR
DP
AT
JA
JF
LV
WY
SN
DG
JO
OS
FR
MI
CF
AN
LN
WO
AL
BB
WL
NO
CR
MG
LB
CK
SH
TH
WA
LG
GL
WH
SC
HM
KE
FI
ST
GT
HS
MT
SV
SW
ME
CA
CM
BA
HP
SU
CL
KW
KM
EK
CQ
Incidence rate per 100,000 residents
0.0
0.1 - 4.9
5.0 - 9.9
10.0 - 19.9
20.0 and Above

Southern Tick Associated Rash Illness (STARI)

- Bacterial
- Headache & fever
- Fatigue
- Muscle pain
- lar
- les

No map of available showing the distribution of STARI

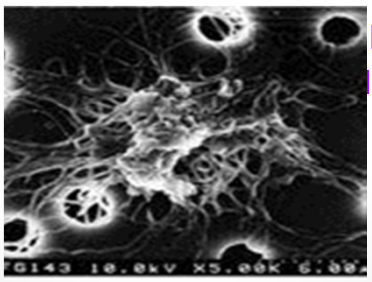
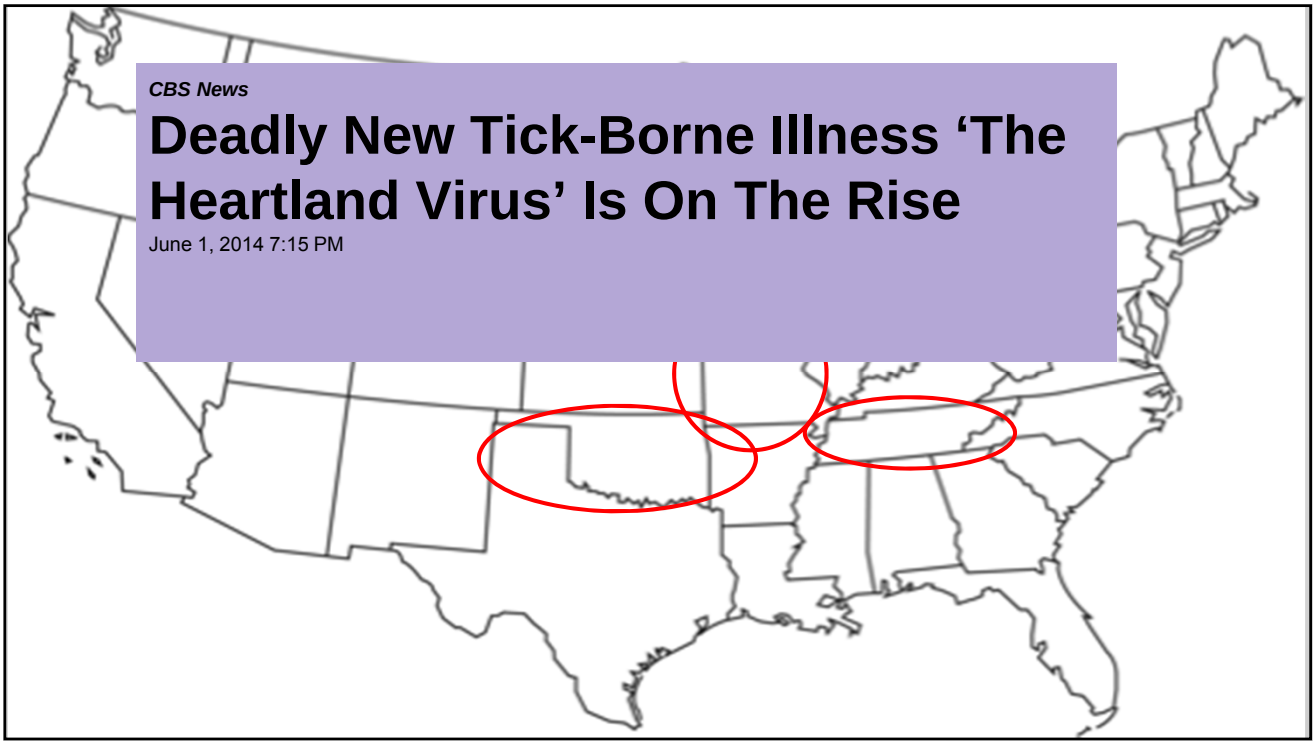


Figure 1: Researchers once hypothesized that STARI was caused by a spirochete,Borrelia lonestari, further research did not support this.

Figure 2: STARI rashes take many forms.

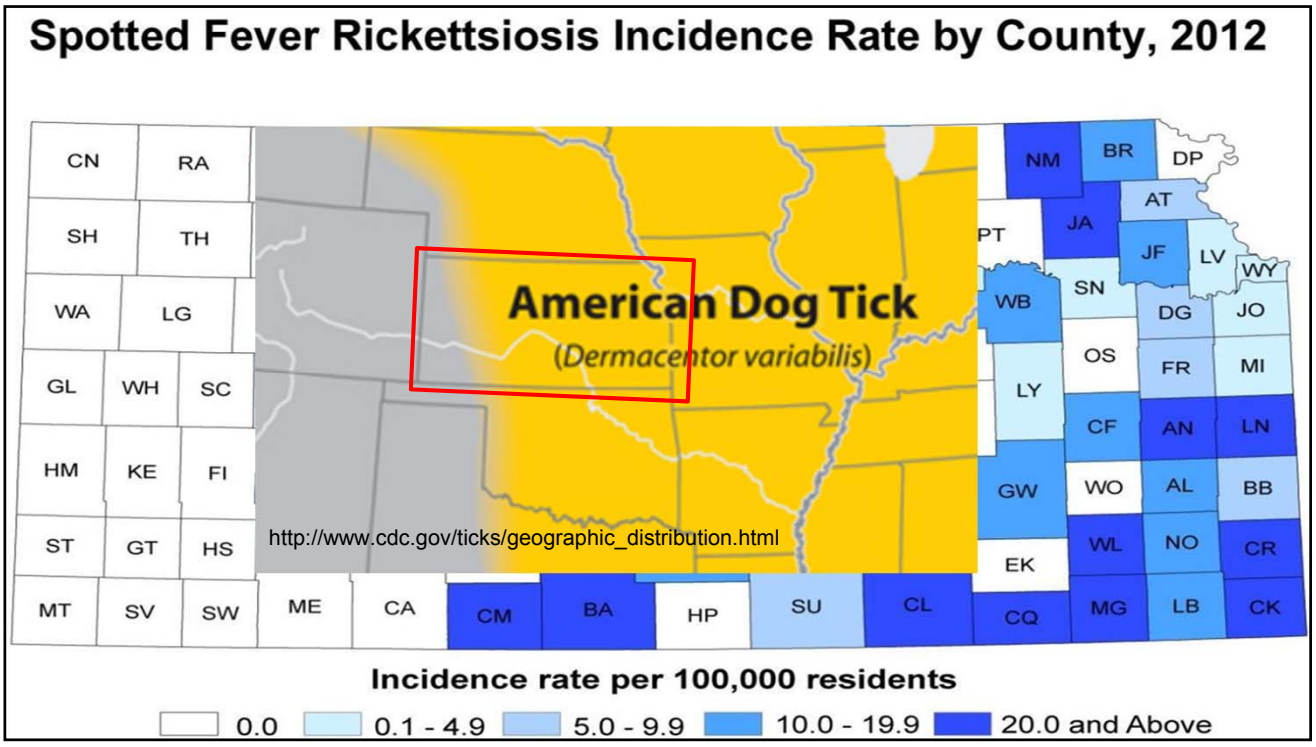
http://www.cdc.gov/stari/symptoms/



CBS News

Deadly New Tick-Borne Illness 'The Heartland Virus' Is On The Rise

June 1, 2014 7:15 PM



Canine Tick-Borne Disease Agents in the U.S.

- Lyme disease (Lyme borreliosis)
  - *Borrelia burdorferi*
- Ehrlichiosis/Anaplasmosis
  - *E.canis, E.ewingii, E.chaffeensis*
  - *A.phagocytophilum, A.platys*
- Rocky Mountain spotted fever
  - *Rickettsia rickettsia*
- Babesiosis
  - *B.canis, B.gibsoni*
- Canine hepatozoonosis
  - *Hepatozoan americanum, Hepatozoan canis*

Possible Canine Symptoms

Sentinel: to provide a guard for something or for a group of people

"Ti r

Pets are often sentinels for human disease.
A pet illness may indicate a potential concern for their owners.
http://commons.wikimedia.org/wiki/File:Border_Collie_dog.jpg

Endemic: normally found in, or native to, a region

General Symptoms of Tick-Borne Disease

- Flu-like (fever, headache, fatigue, myalgia)
- Rash
  - Lyme and STARI – erythema migrans (bull's eye rash)
  - RMSF

Exceptions:

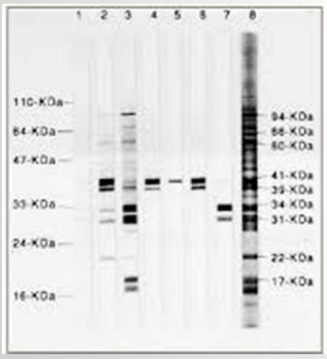
- Tularemia – fever, signs depend on route of entry
- Babesiosis – includes anemia; may recur months later
- Tick Paralysis – ascending paralysis

photos from CDC website

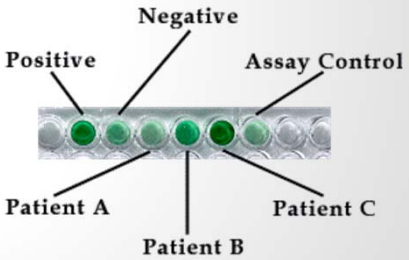
Laboratory confirmation

Indirect evidence of infection

- Measures patient antibody response to pathogen
  Western blot, ELISA, IFA
- Positive result indicates patient exposure to pathogen



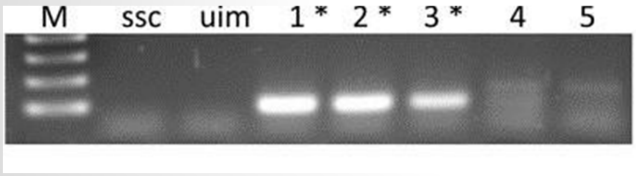
Sample Western Blot. Dark bands indicate positive results.



Sample ELISA results. Darker colors indicate higher patient titers*.

Laboratory Confirmation cont.

- **Direct evidence of infection**
  Measures presence of pathogen in patient samples (e.g. staining, live culture, PCR)



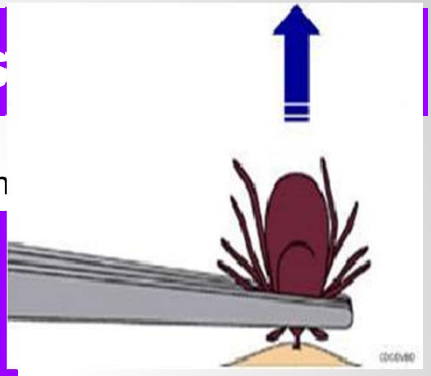
Sample PCR results. Highlighted bands indicate positive results.

Prevention: Humans

- Repel from skin using DEET (at least 20% concentration)
- Wear light colored clothing
- Treat gear and clothing with permethrin (withstands washing several times)
- Cover legs, ankles and feet (tuck pants into socks)
- Walk in the center of trails
- Check for ticks within 2hrs when coming indoors / shower. Include check of gear to prevent later attachment.

http://www.stowconservationtrust.org/deerticks.php

Prevention: Humans



- Tumble clothes in the dryer to kill remain

Do NOT put anything on the tick to make it let go as that will make it purge what it has eaten back into you, which increases chance of infection.

g alcohol, iodine scrub

olizing) or flush ticks

let)

Prevention:Pets and Property

- **For pets**, use repelling chemicals: treated collars, topical medications to prevent attachment
- Check pets for ticks regularly
- Treat with chemicals to kill ticks already attached OR remove carefully by avoiding twisting action (and safe disposal method)
- **In backyards**, clip tall grass (sunlight causes desiccation)
- Spring burning reduces populations (temporarily)
- Use chemical pesticides in problem areas (shaded areas and kennels)-- sprays and granules usually professionally applied

Tick Bite Prevention Video (Youtube)

Ticks and Ecology Connection

The abundance and distribution of *Ixodes scapularis* (Black-legged tick) and *Amblyomma americanum* (Lone Star tick) have increased and spread along with the white-tailed deer population.

- Estimated 90% of adult ticks of these two species feed on deer
- Deer are the key to the tick's reproductive success!

(source: M.Dryden video)

Increased Tick Encounters

- Reforestation
- Wildlife conservation, relocation, and restocking
- Climate fluctuations
- Migratory Birds
- Decreased environmental pesticide application
- Increased human contact with natural areas (recreation, occupation, housing into forests)
- Decreased predator populations (especially predators of small rodents)