NACCHO Vector Summit 2019
Part 1: Basic Tick Identification
Part 2: The Asian Longhorned Tick

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Generic Hard Tick Anatomy and Key Terms (Female)

http://www.lowchensaustralia.com/pests/paralysis-tick/basic-anatomy.htm
Male Ixodid Tick

dorsal aspect
scapula
cervical groove

ventral aspect
hypostome

palp
basis capitulum

scutum

pregenital plate
epimeral plate
adanal plate
anal plate

median plate

hypostome
ventral aspect

anus

genital pore

spiracle
capitulum dorsal
capitulum ventral

legs

0.1 mm
0.5 mm
1.0 mm

0.1 mm
0.5 mm

0.1 mm
Class Arachnida
Ticks - Order: Acarina

- Hypostome
- Chelicera (dotted lines)
- Palpus

Capitulum

Courtesy CDC
Class Arachnida

Ticks
Order: Acarina
Ticks

Class Arachnida > Order: Acarina > Family: Ixodidae

Relative Length of Palpus to Length of Basis Capituli

Genera:

- Palpus is Longer than Basis Capituli: Amblyomma
- Palpus is as Long as Basis Capituli: Anocentor, Boophilus, Dermacentor, Haemaphysalis, Rhipicephalus

2nd Segment

Courtesy CDC
Ticks

Class Arachnida > Order: Acarina > Family: Ixodidae

Lateral Extension of 2nd Palpal Segment:

Genera:
- Palpus Extends Laterally: Haemaphysalis
- Palpus Does Not Extend Laterally: Anocentor, Boophilus, Dermacentor, Rhipicephalus

Courtesy CDC
Ticks
Class Arachnida > Order: Acarina > Family: Ixodidae
Genus: Amblyomma

Palpus is Longer than Basis Capituli

Dorsal View

2nd Palpal Segment
Basis Capituli

Courtesy CDC
Ticks
Class Arachnida > Order: Acarina > Family: Ixodidae
Genus: Haemaphysalis

Dorsal View

2nd Palpal Segment is Laterally Extended

Courtesy CDC
DORSAL VIEW OF THE SCUTA AND CAPITULA OF SOME FEMALE IXODIDAE (HARD TICKS), SHOWING THE CHARACTERISTICS OF THE GENERA

Rhipicephalus (Boophilus)

Rhipicephalus

Haemaphysalis

Dermacentor

Amblyomma

Ixodes

Used by permission, USDA APHIS, Agriculture Handbook No. 485.
Identification of Tick Genera

Don’ts:
1. Don’t go by general color.
2. Don’t go by size.

Do’s:
1. Identify stage/sex: larvae, nymph, adult
2. Look at key anatomical features:
   A. Ornamentation on scutum?
   B. Festoons?
   C. Shape of Basis Capitulum (BC), “head”
   D. Position of anal groove
   E. Length of mouthparts relative to BC
   F. Eyes?
Two ways to ID Ticks

1. Professional Way: The Dichotomous Key

  1. - Coxa I with 1 spur, auriculae as posteriorly directed spurs, not curved
      - Coxa I with 2 spurs

  2. - Spur on coxa I robust, its base reaching the internal coxal margin; scutum with a somewhat sinuous posterolateral margin
      - Spur on coxa I narrow, its base fusing to coxa before the internal coxal margin; scutum lacking a sinuous posterolateral margin

  3. - Coxa II with 2 spurs, the internal very small
      - Coxa II with only one spur

      2
      3
      A. triste (Fig. 26)

      4
      5
      A. tigrinum
      (Fig. 25)

2. Cheating (or Semi-professional way)
You know or have an idea what ticks you have in your area and you can narrow it down.

This does not always work...see second part of talk...
## Tick Identification 101: What stage/sex is it?

<table>
<thead>
<tr>
<th>Character</th>
<th>Found on…</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 legs</td>
<td>- larvae only (nymphs, male, female 8 legs)</td>
</tr>
<tr>
<td>Scutum entire?</td>
<td>- in males only</td>
</tr>
<tr>
<td>Genital aperture?</td>
<td>- males and females only</td>
</tr>
<tr>
<td>Porous area?</td>
<td>- females only</td>
</tr>
</tbody>
</table>

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![Diagram of tick anatomy](image1.png)

![Image of tick](image2.png)

![Image of tick](image3.png)
## Characteristics to easily separate common North American Tick Genera

### Northeast Ixodid Ticks

<table>
<thead>
<tr>
<th>Genus</th>
<th>Outline of BC</th>
<th>Festoon</th>
<th>Ornate?</th>
<th>Palps</th>
<th>Anal groove</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Amblyomma</em></td>
<td>triangular</td>
<td>yes</td>
<td>yes</td>
<td>long</td>
<td>below</td>
</tr>
<tr>
<td><em>Dermacentor</em></td>
<td>rectangular</td>
<td>yes</td>
<td>yes</td>
<td>short</td>
<td>below</td>
</tr>
<tr>
<td><em>Haemaphysalis</em></td>
<td>rectangular</td>
<td>no</td>
<td>no</td>
<td>short</td>
<td>below</td>
</tr>
<tr>
<td><em>Ixodes</em></td>
<td>rectangular</td>
<td>no</td>
<td>no</td>
<td>short male, long female</td>
<td>above</td>
</tr>
<tr>
<td><em>Rhipicephalus</em></td>
<td>hexagonal</td>
<td>yes</td>
<td>no</td>
<td>short</td>
<td>below</td>
</tr>
</tbody>
</table>
Three Most Abundant Indigenous Species in the Northeast

Blacklegged tick, *Ixodes scapularis* - Female, male, nymph

American dog tick, *Dermacentor variabilis* - Female, male

Lone star tick, *Amblyomma americanum* - Female, male nymph

Not photographed to scale, see mm ruler
Basic Tick Anatomy: *Ixodes*
Dr. Richard G. Robbins: “All male *Ixodes* have an anal groove, but because the male venter is completely covered in plates (something never seen in other ixodid genera), the anal groove simply defines the boundaries between plates.”
Basic Tick Anatomy: *Dermacentor*

Ticks of Veterinary Importance USDA-APHIS Handbook #485, m1976
Basic Tick Anatomy: *Amblyomma*

*Amblyomma americanum*

Ticks of Veterinary Importance USDA-APHIS Handbook #485, m1976
What Genus is this and why?
And why is this a trick question?
What Genus is this and why?
What genus is this and why?
Two species here....
One Species here
(and how on Earth do you ID an engorged tick)
Which tick is which?

University of Rhode Island Tick Encounter Resource
http://www.tickencounter.org/
Which Genus do these belong to?

Hint: They are engorged females and found in eastern US
Trick Questions (kinda...)
Ixodes affinis vs I. scapularis

Army Public Health Center phc.amedd.army.mil
Two Species of *Dermacentor*
Spiracular Plate:

*Dermacentor albipictis*  
*Dermacentor variabilis*
Same or Different Genus?
Part II: The Asian Longhorned Tick
This invasive tick can clone itself and suck livestock dry

In its native East Asian range, the longhorn tick spreads potentially fatal human diseases

Tick species sweeping US drains animals dry of blood and reproduces without mating

Populations of parasitic arachnid have recently arrived in suburbs of New York City

This new invasive tick just arrived in the U.S. from Asia; it kills 15 percent of its victims

BY: Deseret News Service
POSTED: 3:28 AM, Aug 9, 2018
UPDATED: 5:43 AM, Aug 9, 2018

Miyazaki officials bring tick to press conference to warn of disease spread but it gets away

KYODO
Hannah the sheep, Aug., 2017
When you hear hoof beats in Central Park...

Rabbit tick, *Haemaphysalis leporispalustris*

Asian Ionhorned tick, *H. longicornis*
Timeline to *Haemaphysalis longicornis* discovery

- 1-Aug 2017 - discovery*
- Sept-Oct - sent to Smithsonian for ID
- 7-November - barcode ID
- 9-November - morphological ID

I found it in **May** of 2017 and had specimens in my collection from 2013, but thought they were the rabbit tick.
Plan(s) of Action...

Fall/Winter 2017
- Treat the sheep
- Treat the paddock
- Survey surrounding area
  - for infested animals
  - for ticks (flagging, dry ice)
- Alert agricultural, veterinary community

Wait for spring 2018....
Haemaphysalis longicornis basics

• Three-host tick (feeds once each stage on a different host)
• Parthenogenetic (lays 800-2000 viable eggs without mating)
• Native to NE China, Korea, Japan (invasive in Australia/NZ)

female ovipositing and nymphs questing on grass
In the field...infestations on individual animals can be quite large

*H. longicornis* on sheep and in WV
Where has it been found so far?
What and where has it been found on so far?

<table>
<thead>
<tr>
<th>Animal</th>
<th>State(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>AR</td>
</tr>
<tr>
<td>White-tailed deer</td>
<td>CT</td>
</tr>
<tr>
<td>Cow</td>
<td>PA</td>
</tr>
<tr>
<td>Opossum</td>
<td>KY</td>
</tr>
<tr>
<td>Horse</td>
<td>MD</td>
</tr>
<tr>
<td>Goat</td>
<td>NC</td>
</tr>
<tr>
<td>Dog</td>
<td>NJ</td>
</tr>
<tr>
<td>Red tailed hawk</td>
<td>NY</td>
</tr>
<tr>
<td>Human</td>
<td>VA</td>
</tr>
<tr>
<td>Fox (gray and red)</td>
<td>WV</td>
</tr>
<tr>
<td>Elk</td>
<td></td>
</tr>
<tr>
<td>Cat</td>
<td></td>
</tr>
<tr>
<td>Groundhog</td>
<td></td>
</tr>
<tr>
<td>Skunk</td>
<td></td>
</tr>
<tr>
<td>Coyote</td>
<td></td>
</tr>
</tbody>
</table>
What type of environments has it been found?
Is *H. longicornis* a **vector** of any human pathogens?

*Rickettsia japonica* - Japanese spotted fever and SFTV (severe fever and thrombocytopenia virus) aka Huaiyangshan (HYS) virus

**What has *H. longicornis* been found carrying?**

(W. Nicholson CDC)

<table>
<thead>
<tr>
<th>Organism</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaplasma spp</td>
<td>China, Japan, Korea</td>
</tr>
<tr>
<td>Ehrlichia spp</td>
<td>China, Japan, Korea</td>
</tr>
<tr>
<td>Rickettsia spp</td>
<td>China, Japan, Korea</td>
</tr>
<tr>
<td>Borrelia spp</td>
<td>China, Korea</td>
</tr>
<tr>
<td>TBEV</td>
<td>Korea</td>
</tr>
<tr>
<td>Thogoto virus</td>
<td>Japan</td>
</tr>
<tr>
<td>SFTV</td>
<td>China, Japan, Korea</td>
</tr>
<tr>
<td>Babesia spp</td>
<td>China, Japan</td>
</tr>
<tr>
<td>Theileria spp</td>
<td>Australia, China</td>
</tr>
</tbody>
</table>

All samples that have been tested so far from US are negative for tick-borne bacteria and viruses (Egizi, Savage)
How and when did it enter the US?

...horses? dogs? people?

ALT was found in quarantine in NJ by the USDA on horses in the 60s and 70s.

- 2010 is the earliest confirmation (J. Mertins USDA)
- Is it spreading...or has it been introduced multiple times...?
19th century expansion

Ongoing Studies

Phenology (life cycle):
- when does each stage emerge and in what type of environments?
- are there any preferred hosts?

Vector competency studies:
- can HL acquire, maintain and transmit pathogens?

Pesticide resistance?

Establish an area-wide tick surveillance program????
Summary: This scenario teaches us the value of surveillance...

**Surveillance**: the organized and systematic sampling of ticks where data is compared from year to year.

And when warranted, data is used to formulate a public health program of education and possibly control.
Partners

- Monmouth County Mosquito Control (A. Egizi)
- Center for Vector Biology, Rutgers University (D. Fonseca)
- Department of Entomology Rutgers University (A. Toledo)
- School of Public Health, Rutgers University (W. Halperin)
- USDA-APHIS (D. Bonilla, L. Seraphin, A. Randall et al.)
- NJ Depart of Agriculture (N. Lewis, et al.)
- Hunterdon (NJ) County Health Dept. (T. Rainey)
- NJ DEP Fish and Wildlife (Jan Lovy et al.)
- SCWDAS-University of Georgia Vet School (M. Ruder et al.)
- National Veterinary Service Lab-Ames Iowa (J. Mertins, et al.)
- Walter Reed Biosystematics Unit-Smithsonian (R. Robbins)
- CDC (M Levin, H. Savage, B. Beard, W. Nicholson)
The end