VMP 930
Veterinary Parasitology

Ticks
Tick - Anatomy

- Capitulum (Gnathostome) = “head”
  - Basis capitulum
  - Palps
  - Chelicerae
  - Hypostome
Tick - Anatomy

- **Idiosoma = “Body”**
  - Body with unsegmented abdomen
- **Legs**
  - Larvae -> 6 legs
  - Nymphs & Adults -> 8 legs
  - 1st pair of legs with Haller’s Organ
    - Sensory organ for detecting hosts

“Questing”
Ticks

General Life History

- 4 life Stages
  - Egg, larva, nymph, adult
- Ixodidae - hard ticks
  - 1 nymphal instar
  - All stages feed for a long time (2 to 14 days)
- Argasidae - soft ticks
  - 2 to 7 nymphal instars
  - Adults & nymphs feed for only minutes to hours, but feed multiple times
Ticks
Finding hosts

- Most wait immobile for host to brush against them.
- Others climb on to vegetation and actively try to detect hosts passing by.
  - Questing - Haller’s Organ
- Others emerge from cover and actively move toward their hosts
Tick - Groups

- **Family Argasidae** - soft ticks
  - Only 4 genera of Argasidae - *Argas*, *Ornithodoros*, *Otobius* (not covered) and *Carios* (not covered)

- **Family Ixodidae** - hard ticks
  - 4 main genera of Ixodidae covered because of their presence in North America - *Ixodes*, *Rhipicephalus*, *Dermacentor*, and *Amblyomma*
Argasidae - Soft Ticks

- Leathery body without plates or scutum
- Ventral capitulum (gnathostome)
- Feed on multiple individual hosts - generally live in burrows or nests and lay multiple batches of eggs
Argas spp. (Fowl ticks)

- Primarily parasites of birds
- Ecology
  - Nocturnal: feeds on birds at night
  - Lives in cracks, crevices, nests etc. during the day.
  - Egg to adult in as little as 30 days
  - Lay several clutches of 25 to 100 eggs / clutch
  - May live for up to 12 years with feeding
  - May live up to 2 years without feeding
- Gulf of Mexico & Mexican border in USA
Argas persicus
Argas spp. Pathology

- **Anemia**
  - with mortality in younger birds
- secondary infection at wound site
- Disease transmission - Fowl borreliosis (*Borrelia anserina*) in South America
- Tick paralysis in chickens
**Ornithodoros spp.**

- Feeds on rodents
- Mainly in Rocky Mountain and Pacific Coast region.
- Found in burrows, not on host.
- Nocturnal, quick feeding.
- A vector for relapsing fever in humans (*Borrelia* spp.).
Hard Ticks

- **General Arachnid characteristics**
- **Ornate or inornate scutum** covers the full dorsum of males, but only the anterior dorsum of females.
- The capitulum (gnathostome) projects anteriorly.
3-Host Tick Life Cycle

- Adults attack, mate, & feed on 3rd host
- Engorged female drops off 3rd host & lays eggs
- Nymphs drop off & molt to adults
- Eggs hatch in environment
- Larvae attack & feed on 1st host
- Nymphs attack & feed on 2nd host
- Larvae drop off & molt to nymphs
Life Cycle: 3-host tick

Important 3-host ticks (to memorize)

- *Amblyomma americanum* - Lone Star tick
- *Rhipicephalus sanguineus* - Brown Dog tick, Kennel tick
- *Dermacentor variabilis* - American Dog tick
- *Ixodes scapularis* - Black-legged tick, Deer tick
2-Host Tick Life Cycle

Ex. *Rhipicephalus evertsi*
1-Host Tick Life Cycle

- Engorged female drops off host & lays eggs
- Eggs hatch in environment
- Larvae attack host
- Larvae feed on host
- Nymphs feed on host
- Nymphs molt to nymphs on the host
- Larvae molt to nymphs on the host
- Nymphs molt to adults on the host
- Adults mate & feed on host

Ex. Rhipicephalus (Boophilus) annulatus
Which is “Easier” to control / eradicate?
Eradication of Texas Cattle Fever

*Rhipicephalus (Boophilus) annulatus* (1-host tick) vector for *Babesia bigemina*
Common Ticks to memorize

**Ixodes scapularis**
(Black-legged Tick, Deer Tick)

**Dermacentor variabilis**
(American Dog Tick)

**Amblyomma americanum**
(Lone Star Tick)

**Rhipicephalus sanguineus**
(Brown Dog Tick, Kennel Tick)
**Amblyomma americanum**

Lone Star Tick

- Wooded / outdoor habitat
- Adults attack various animals (livestock, horses, pets, and humans).
- Vector for Cytauxzoonosis - *Cytauxzoon felis*
- Heavy infestations in cattle:
  - Decreased performance, weight loss, reduced milk production
**Dermacentor variabilis**
American Dog Tick

- Wooded / outdoor habitat
- Larvae & nymphs on rodents
- Adults prefer canids but also on larger animals and humans
- Vector for Rocky Mountain Spotted Fever - *Rickettsia rickettsii*
**Ixodes scapularis**
Black-legged tick or Deer tick

- Wooden / outdoor habitat
- Adults primarily on white-tailed deer
- But also other animals: including livestock, horses, pets, and humans
- Vector for Lyme Disease - *Borrelia burgdorferi*
**Rhipicephalus sanguineus**  
Brown dog tick or Kennel tick

- Indoor habitats - kennels, residences, pet resting / bedding areas
- Primarily feed on dogs, rarely humans
- Vector for Canine babesiosis - *Babesia vogeli*
- Hardy tick - resists desiccation and 3-5 months w/o feeding.
**Haemaphysalis longicornis**

*Asian Long-horned Tick*

- **Introduced**
  - Australasian and Western Pacific Region
  - Confirmed cases in VA, WV, NJ, NY, PA, NC, MD, TN, AR, CT, KY

- **Emerging parasite problem**
  - NC bull was exsanguinated by 1000+ ticks
  - Very aggressive, “mob” a host

- **Potential vector of several viral, bacterial, and protozoan agents of livestock and human disease**

- **Ecological Success**
  - Females are parthenogenetic, and produce 2,000 clones
  - 3-host tick
*Haemaphysalis longicornis*
Haemaphysalis longicornis

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

Rhipicephalus

Haemaphysalis

Used by permission, USDA APHIS, Agriculture Handbook No. 485.
Behind mosquitoes, ticks are the second most important group of ectoparasites. Ticks are most important as a scourge to man’s domesticated animals, especially cattle.
Tick Associated Pathology

- Disease transmission
- **Blood loss** (may result in severe anemia or death)
- "Tick worry"
  - Decreased grazing, Weight loss
- Wound production
  - Secondary bacterial infection
  - Invasion sites for screwworms / blow flies
- Damage to hides
- Tick paralysis, tick toxicosis
Tick Associated Pathology

DISEASE TRANSMISSION

Protozoal diseases
- Bovine babesiosis (Ra) (Texas Cattle fever)
- Equine babesiosis
- Canine babesiosis (Rs)
- Feline cytauxzoonosis (Aa)
- Theileriosis (East Coast fever)

Rickettsial diseases
- Rocky Mountain Spotted Fever (Dv)
- Canine, equine, bovine, ovine & human ehrlichiosis
- Heartwater (Cowdria)
- Bovine anaplasmosis

Bacterial Diseases
- Lyme disease (Is)
- Tularemia (rabbit fever)
- Spirochetosis of livestock and poultry
- Brucellosis

Viral diseases
- Nairobi sheep disease
- African swine fever
Tick Associated Pathology
DISEASE TRANSMISSION

Why are Ticks Excellent Vectors?

1. Persistent feeders -- hard to dislodge

2. Slow feeders \([R. (B.)\ annulatus = 6\ to\ 8\ days]\)
   - much time for transmission of pathogen
   - geographic dispersal

3. Low host specificity -- variety of host sources = potential exposure to various pathogens

4. Longevity -- much time to acquire & transmit a pathogen throughout life
Tick Associated Pathology
DISEASE TRANSMISSION

Why are Ticks Excellent Vectors?

5. Transovarian Transmission -- Pass pathogen to next generation

6. Transstadial Transmission -- Retains pathogen throughout life stages

7. Hardy -- persists in environment

8. High fecundity (Some ticks up to 18,000 eggs per female)
Parasite in Tick Host

- **Transovarian**: Parasite moves from female tick's tissues to eggs.
- **Eggs**: Develop into larvae.
- **Larvae**: Through molting, become nymphs.
- **Nymphs**: Further molting leads to adults.
- **Adults**: Reproduce and lay eggs, completing the cycle.

*Transstadial*: As the tick develops and molts, the parasite continues in each new tick stage.

NC STATE UNIVERSITY
Nonchemical Control

- Brush or vegetation removal
  - Much labor & expensive

- Resistant cattle breeds
  - Hereford least resistant
  - Brahman most resistant

- Vaccines against ticks
  - Australian tick vaccine

- Predators and parasites
  - Naturally present but have little impact
Tick Control

- **Chemical Control**
  - Dips or dip-vat
  - Whole body spray
  - Topicals, dusts
  - Insecticide impregnated ear tags & collars
  - Injectant & acaricide boluses (systemics)
Important Points

- Know the tick life stages and the life cycles of 1-host, 2-host, & 3-host ticks.
- Know the 4 common ticks listed
  - Scientific & Common names
  - Disease & Etiological agent for which they are primary vectors
- Know name of introduced tick and its significance.
- Know tick associated pathology
- Appreciate the magnitude & diversity of DZ’s transmitted by ticks
- Know tick characteristic that make them excellent vectors
- Types of non-chemical and chemical control of ticks
Important Points

**MEMORIZE** the 4 common ticks and 1 introduced tick (scientific & common names)

- *Amblyomma americanum* - Lone Star tick
- *Rhipicephalus sanguineus* - Brown Dog tick, Kennel tick
- *Dermacentor variabilis* - American Dog tick
- *Ixodes scapularis* - Black-legged tick, Deer tick
- *Haemaphysalis longicornis* - Asian long-horned tick (introduced)