Exotic Ticks

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Exotic Ticks

Amblyomma variegatum
Amblyomma hebraeum
Rhipicephalus microplus
Rhipicephalus annulatus
Rhipicephalus appendiculatus
Ixodes ricinus

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Overview

- Organisms
- Importance
- Disease Risks
- Life Cycle
- Identification
- Geographic Distribution
- Prevention and Control
- Recommended Actions

In today’s presentation we will cover information regarding exotic ticks and the diseases they can transmit. We will also talk about how to identify exotic ticks, and the impact these ticks have had in the past and could have in the future. Additionally, we will talk about how exotic ticks are transmitted and the species they affect. Finally, we will address prevention and control measures, as well as actions to take if exotic ticks are suspected.

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Exotic Tick Species

Tick
Amblyomma hebraeum (bont tick)
Amblyomma variegatum (tropical bont tick)
Ixodes ricinus (the castor bean tick)

Exotic ticks are ticks that are not found in the United States. These Important tick species (and the diseases they carry) are a risk for introduction into the U.S. These ticks include Amblyomma hebraeum, the bont tick (Source: forestryimages.org), Amblyomma variegatum, the tropical bont tick (Source: Wikimedia Commons), Ixodes ricinus, the castor bean tick (Source: sciencedaily.com).... (continued on next slide)

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Exotic Tick Species

Tick
Rhipicephalus (formerly Boophilus) annulatus (American cattle tick)
Rhipicephalus (formerly Boophilus) microplus (Southern cattle tick)
Rhipicephalus appendiculatus (brown ear tick)

Rhipicephalus (formerly Boophilus) annulatus, the American cattle tick (Source: tickapp.tamu.edu), Rhipicephalus (formerly Boophilus) microplus, the Southern cattle tick (Source: tickapp.tamu.edu), and Rhipicephalus appendiculatus, the brown ear tick (Source: Wikimedia Commons).

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Importance

- Tick bites
  - Irritating, painful
  - Secondary infection, infestation
  - Hide damage, anemia
- Exotic disease agents
  - May be carried by exotic ticks
  - Biological vector
  - Mechanical vector

Tick bites can be irritating and/or painful. They also provide entry points for secondary bacterial invaders or screwworms. Heavy infestations can damage hides and may cause anemia, particularly when the animal is in poor condition. Rhipicephalus appendiculatus, the brown ear tick, damages the ears of cattle and other livestock, and some species of ticks cause tick paralysis. However, the most important risk with the introduction of exotic ticks is that they may carry the agents of exotic diseases. The greatest danger is when the tick acts as a biological vector, but pathogens carried mechanically can be introduced if they survive long enough.
Exotic Ticks

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Disease Risks
- A. variegatum, A. hebraeum
  - Ehrlichia ruminantium
  - Rickettsia africae
- I. ricinus
  - Babesia divergens, louping ill, tick-borne encephalitis virus
- R. appendiculatus
  - Theileria parva (East Coast fever)
  - Nairobi sheep disease

A. variegatum and A. hebraeum can transmit Ehrlichia ruminantium (formerly Cowdria ruminantium), the agent of heartwater. These ticks can also carry *Rickettsia africae*, which causes African tick-bite fever, and other disease agents. *I. ricinus* transmits a number of pathogens including *Babesia divergens* (babesiosis), louping ill virus and tick-borne encephalitis virus, which are exotic to the Americas. *Rhipicephalus appendiculatus* can carry *Theileria parva*, the cause of East Coast fever, as well as Nairobi sheep disease virus and other disease agents.

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Disease Risks
- R. microplus, R. annulatus
  - Babesiosis
  - Babesia bigemina
  - Babesia bovis
  - Anaplasmosis
  - Anaplasma marginale

R. microplus and R. annulatus are particularly important in transmitting babesiosis, which is caused by *Babesia bigemina* and *Babesia bovis*, and anaplasmosis, caused by *Anaplasma marginale*. Babesiosis or “cattle fever” was eradicated from the United States between 1906 and 1943, by eliminating these vectors. *R. annulatus* and *R. microplus* still exist in Mexico and further south, and a permanent quarantine zone is maintained along the U.S./Mexican border to prevent their reintroduction. This image shows the permanent quarantine “buffer” zone between Texas and Mexico—a country where these ticks remain well established. Today, this buffer zone extends over 500 miles from Del Rio, Texas, to the Gulf of Mexico. [Image: USDA APHIS].

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Life Cycle

Ticks pass through four life cycle stages. Although ticks have host preferences, which may vary with the life stage, most species will feed on a wide variety of wild and domesticated animals, as well as humans.

[Photo: Morphologic features associated with the four life cycle stages through which a tick passes on its way to adulthood. Source: CDC Public Health Image Library.]

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Three-Host Ticks
- Found on host during feeding
- Develop to next stage on ground
- Larvae, nymphs, adults
  - All require blood meal
- Eggs deposited in environment
- Host species
  - Immature ticks: small mammals, birds
  - Adult ticks: large mammals

*Amblyomma variegatum*, *A. hebraeum*, *I. ricinus* and *R. appendiculatus* are 3-host ticks. Three-host ticks can be found on the host while they feed, then they drop to the ground to develop to the next stage. Larvae, nymphs and adults all require a blood meal. Once the adult female has fed and mated, she deposits her eggs in the environment. The life cycle for *Amblyomma variegatum*, *A. hebraeum* and *I. ricinus* usually takes more than a year, and up to a few years, to complete. Immature *Amblyomma* spp. and *I. ricinus* tend to be found on smaller mammals, birds and reptiles, while the adult stages usually feed on large mammals including livestock and wildlife. *R. appendiculatus* can complete one to three life cycles in a year, depending on the environment. This tick mainly infests cattle, buffalo and large antelope, but it can occur on other species including sheep and goats. Immature ticks may also be seen on small antelope, carnivores, hares and other species. Adult *R. appendiculatus* prefer to feed in the ears, but some are found on the head. Immature stages feed in the ears, on the head, and on the legs. Large numbers of ticks may be found on an animal, and heavy infestations can damage the ears.
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**One-Host Ticks**

- All stages spent on single animal
- Eggs hatch in environment
- Developmental stages
  - All require blood meal
- Life cycle completed in 3-4 weeks
  - Heavy tick burden possible
- Host species
  - Cattle, other mammals

*Rhipicephalus microplus* and *R. annulatus* are one-host ticks: all stages are spent on a single animal. The eggs hatch in the environment and the larvae crawl up plants to find a host. Newly attached larvae (“seed ticks”) are usually found on the underside of the animal, particularly on the softer skin inside the thigh, flanks and forelegs. After feeding, the larvae molt twice, to become nymphs and then adults. Each developmental stage (larva, nymph and adult) feeds only once, but the feeding takes places over several days. Adult male ticks become sexually mature after feeding, and mate with feeding females. An adult female tick that has fed and mated detaches from the host and deposits a single batch of eggs in the environment. *R. microplus* and *R. annulatus* have a life cycle than can be completed in 3 to 4 weeks. This characteristic can result in a heavy tick burden on animals.

Cattle are the preferred hosts for *R. annulatus*. This tick is also found occasionally on other mammals, particularly large animals but also capybaras and other species. It rarely feeds on sheep and goats. *R. microplus* mainly infests cattle, deer and buffalo, but it can also be found on many other hosts including horses, donkeys, goats, sheep, pigs, dogs and wild animals.

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**Identification**

- Hard ticks
  - Family Ixodidae
  - Dorsal scutum, mouthparts protrude
- *Amblyomma*
  - Large, ornate, variegated
- *Rhipicephalus, Ixodes*
  - No ornamentation
- Submit ticks for identification

*A. variegatum, A. hebraeum, R. microplus, R. annulatus, R. appendiculatus and I. ricinus* are all members of the family Ixodidae (hard ticks). Hard ticks have a dorsal shield (scutum) and their mouthparts (capitulum) protrude forward when they are seen from above. *Amblyomma variegatum* and *A. hebraeum* are large, ornate, variegated ticks with long, strong mouthparts. The bodies of female *A. variegatum* are brown, but the males are brightly ornamented with orange. When they are engorged, adult female *A. variegatum* are about the size of a nutmeg.

*Rhipicephalus* spp. and *Ixodes* spp. have no ornamentation and are less distinctive, but they may be identified at least to the genus level using tick keys. Tick identification to the species level can be difficult, and ticks should be submitted to an expert for identification or confirmation. Ticks that are submitted in 70% ethanol can be examined morphologically, and if necessary, tested by PCR. Both male and female ticks, and ticks from different life stages, should be submitted if they can be found.

[Photo: This drawing depicts an Ixodidae hard tick from the dorsal and ventral perspectives revealing its morphologic features. Source: CDC Public Health Image Library.]
**Geographic Distribution**

- **Tropics and subtropics**
  - A. variegatum, A. hebraeum
  - R. annulatus, R. microplus
  - R. appendiculatus
- **Widely distributed**
  - R. annulatus, R. microplus
- **Cool, humid areas (Europe)**
  - I. ricinus

**R. microplus** and **R. annulatus**, which are one-host ticks, have been successfully eliminated from some countries. Eradication programs are based on animal identification and periodic acaricide treatment of livestock, as well as public education, surveillance, quarantines and movement restrictions. In the U.S., 

**Prevention and Control**

- Exclude exotic ticks
  - Pre-export inspection of animals
  - Animals certified-free of ectoparasites
  - Quarantine upon entry
- Acaricide treatment
- Three-host ticks
  - Difficult to eradicate
  - Environmental control

*Photo: Feedlot cattle. Source: Renee Dewell/CFSPH.*
Exotic Ticks

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Prevention and Control
- Treatment options
  - Dip cattle
  - Intervals for 9 months
  - Treat until "tick free"
- Two consecutive acaricide treatments
- Remove animals from infected pastures
- Pasture must remain free of livestock for 6 to 9 months

A single acaricide treatment can destroy all of the ticks on an animal, but will not prevent reinfection. There are two options for treating infested and exposed cattle. These animals may be dipped at regular intervals for nine months. Alternatively, they may be treated until they are “tick free” before two consecutive acaricide treatments, then removed from the infected pasture. The infested pasture must remain free of all livestock for 6 to 9 months or longer, to break the tick life cycle. [Photo: Cow walking through acaricide dip. Source: Scott Bauer/USDA]

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Prevention and Control
- In endemic areas
  - Acaricide treatment
  - Does not prevent reinfestation
  - Pasture rotation
  - Environment modification
  - Biologic and chemical control strategies
  - Resistant breeds

In regions where A. variegatum, A. hebraeum, R. microplus, R. annulatus, R. appendiculatus or I. ricinus are already endemic, control methods include acaricide treatment, pasture rotation, environmental modification, and integrated biologic and chemical control strategies. Acaricides can eliminate the ticks from the animal, but they do not prevent reinfection and must be repeated periodically. Ticks can become resistant to these chemicals. The use of resistant breeds is an important means of tick control in some countries. European (Bos taurus) breeds of cattle usually remain fairly susceptible to ixodid ticks, even after multiple exposures. However, some cattle such as zebu (Bos indicus) or zebu crosses can become resistant to B. microplus after exposure. Vaccines against R. microplus may be available in other countries. [Photo: Cattle. Source: Megan Smith/CFSPH]

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Recommended Actions
- IMMEDIATELY notify authorities
- Federal
  - Area Veterinarian in Charge (AVIC)
    http://www.aphis.usda.gov/animal_health/area_offices/
- State
  - State veterinarian
    http://www.usaha.org/stateanimalhealthofficials.aspx
- Quarantine

If you suspect exotic ticks, state or federal authorities should be notified immediately. Animals suspected infested with exotic ticks should be isolated, and the farm should be quarantined until definitive diagnosis is determined.

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Additional Resources
- Center for Food Security and Public Health
  - www.cfsph.iastate.edu
- USAHA Foreign Animal Diseases ("The Gray Book")

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