

## **EXHIBIT D**

# Minimizing tick bite exposure: tick biology, management and personal protection

# Arkansas Ticks

## Hard Ticks (Ixodidae)

- Lone star tick - *Amblyomma americanum*
- Gulf Coast tick - *Amblyomma maculatum*
- American dog tick - *Dermacentor variabilis*
- Winter tick - *Dermacentor albipictus*
- Black-legged tick - *Ixodes scapularis*
- Brown dog tick - *Rhipicephalus sanguineus*

## Soft Ticks (Argasidae)

- Fowl tick - *Argus persicus*
- Spinose ear tick - *Otobius megnini*

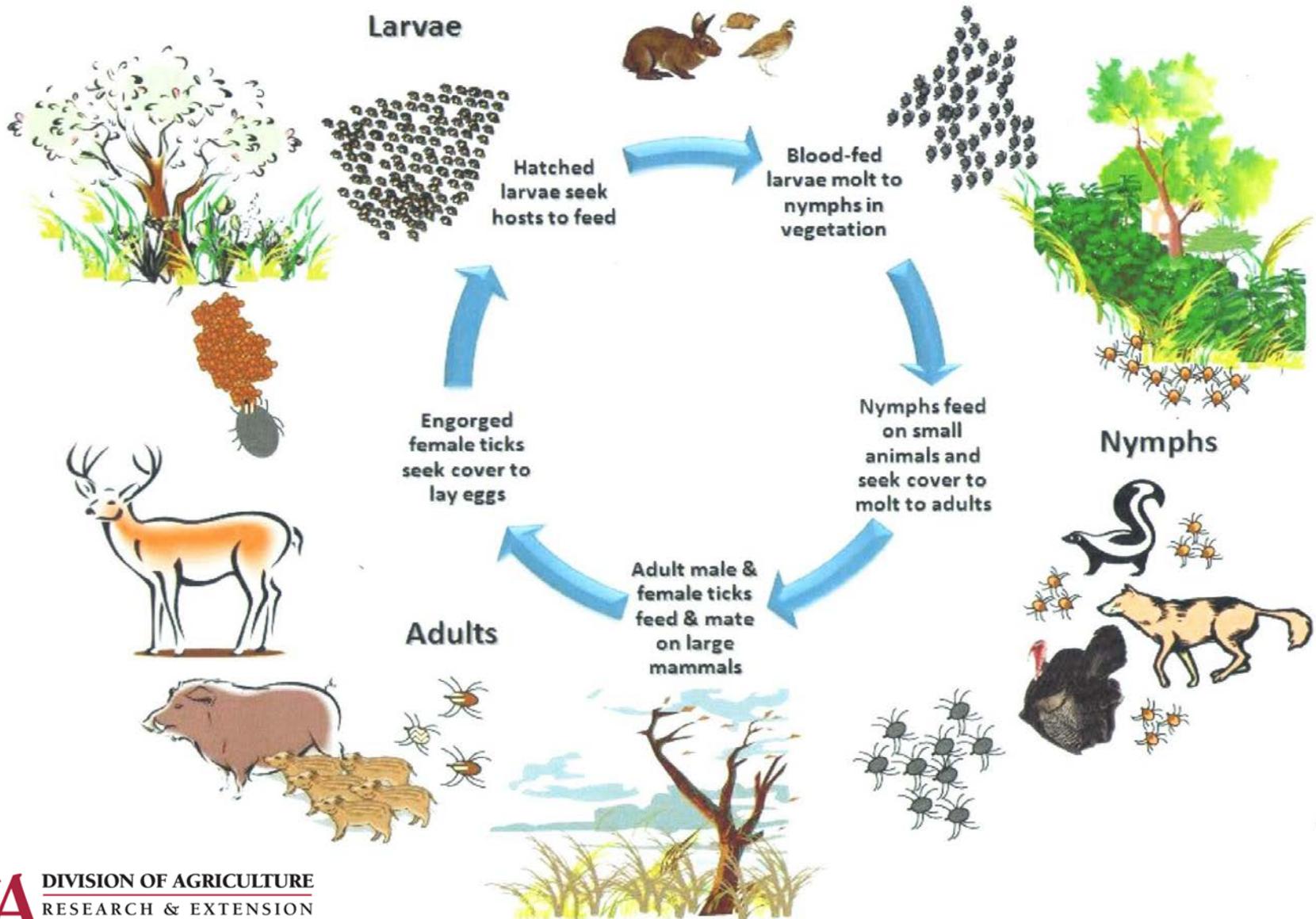


**Hard tick**



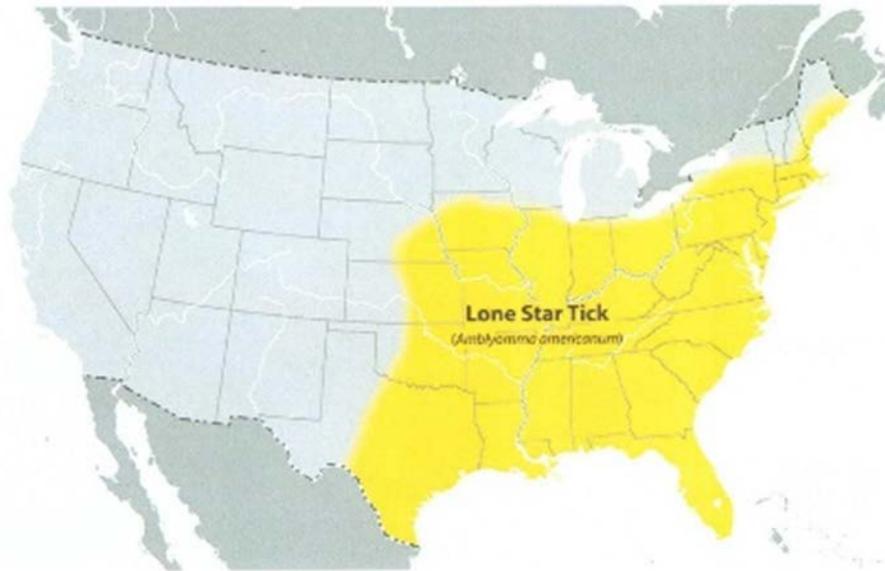
**Soft tick**

# Three-host tick life cycle



# Lone star tick, *Amblyomma americanum*

## Distribution



- From Texas throughout south-central and south-eastern US.
- Range has expanded
- Abundance in an area is influenced by habitat, host availability and other factors (natural enemies)

# Lone Star Tick

- Very abundant in AR, aggressive feeder, readily bites humans
- Woodlands and woodland edges
- Three-host tick; 1 year life cycle
- Adults most abundant in May, June, July; appear in March
- Nymphs abundant in April or May and August
- Larva (seed) ticks abundant in late summer
- **Alpha-gal allergy**, ehrlichiosis, STARI (southern tick associated rash illness - *Borrelia*), **Heartland virus**, **Rickettsia parkeri**, and tularemia; cytauxzoonosis (bobcat fever) in domestic cats



# Engorgement of adult female lone star through time



# How important are white-tailed deer as tick hosts?

- Lone star and black-legged tick populations are expanding geographically and in density, especially in areas with increasing deer herds
- Other ticks species do use deer as hosts but not at the frequency of the lone star and black-legged ticks; lone star larvae, nymphs and adults readily feed on white tailed deer



# Gulf Coast Tick

- Now established in Arkansas
- Three-host tick
- Long host list: large and small mammals, birds
- Diseases – Heartwater disease in Africa (*Cowdria ruminantium*), also transmits *Rickettsia parkeri* (a newly described spotted fever); *Hepatozoon americanum* (American canine hepatozoonosis – dog ingests infected tick)



# American dog tick, *Dermacentor variabilis* Distribution



- Along the Atlantic coast, New England to Florida, west to Montana and west Texas
- Was once more common than the lone star tick

# American Dog Tick

- Three-host tick, 1-2 year life cycle, depending on conditions
- Bites occasionally cause tick paralysis
- Diseases: Rocky Mountain spotted fever, tularemia, anaplasmosis in cattle, possibly cytauxzoonosis (bobcat fever) in domestic cats
- Once more commonly encountered than the lone star tick



# Black-legged tick, *Ixodes scapularis*

## Distribution



- Eastern North America, Atlantic coast, mid-west and Gulf coast region

# Black-legged Tick

- Three-host tick, 1 year life cycle in Arkansas
- Adults feed on deer cattle, horses, etc.
- Immature ticks feed on birds, small mammals and lizards
- Vector of Anaplasmosis, Babesiosis, and Lyme disease (Northeast, northcentral and mid-Atlantic)
- Readily feed on deer



# Brown dog tick, *Rhipicephalus sanguineus*

## Distribution



- Global occurrence between 50 degrees North and 30 degrees South
- Preferred host – dog, opportunistic on other animals



# Minimizing Tick Bite Exposure

- Avoid Tick Infested Areas
- Wear Proper Clothing
- Use Tick Repellents
- Routine Self-Checking
- Controlling Ticks in the Environment
- Controlling Ticks on Hosts

# Repellents

- Clothing repellents (permethrin)
- Skin repellents (DEET)
- Effective non-DEET clothing and skin repellents are available (Ex. BioUD (biopesticide isolated from wild tomato) has shown repellent efficacy against lone star and American dog ticks)

# Clothing and Self-Checking

- Wear light –colored clothing, tuck in shirt tail and pants into socks
- Inspect yourself frequently for ticks (at least twice daily), examine clothing and body twice daily when in infested areas
- Prompt removal of ticks, the longer a tick is attached, the greater the chance of it transmitting a pathogen (6-24 hrs.)
- If you are bitten, record the date of the tick bite

# Tick removal

- Grasp the tick with tweezers
- Pull upward with steady pressure, do not jerk or twist the tick.
- If mouthparts remain in the skin, remove them with a sterilized needle (similar to removing a splinter).
- Write down the date of the tick bite. Removed ticks can be preserved in a vial with alcohol
- Wash hands and bite area thoroughly with soapy water then apply an antiseptic such as alcohol



# Tick Control in the Environment

- Broadcast application of insecticides/acaricides
  - not feasible for large areas, used in yards and public use areas
  - shorter-term management option
- Control weeds and brush, keep lawn mowed, remove debris and leaf litter around the yard, especially near woods line
  - reduces humidity of microclimate lowering tick survival
  - reduces harborage for wildlife that bring ticks into the area
- Exclude wildlife from yard (fencing out deer – not easy)
- Tick control on pests
  - can reduce tick abundance in yards
- Controlled burns – can reduce lone star tick populations, may take a couple of years for reduction to become apparent

# Tick Control on Important Hosts

- Deer self-application device – “4-poster” feeder station
  - Deer contact acaricide treated paint rollers when consuming corn, treats ears, head and neck
  - Studies in the NE show black-legged tick reductions
  - Tennessee study showed a reduction in lone star ticks; the cost per station was about \$20 per month; one station would cover 40-50 acres
- Feeding systemic insecticides to deer
  - Feeding ivermectin-treated corn to deer reduced lone star tick abundance (TX and TN studies). Also effective against cattle fever ticks

