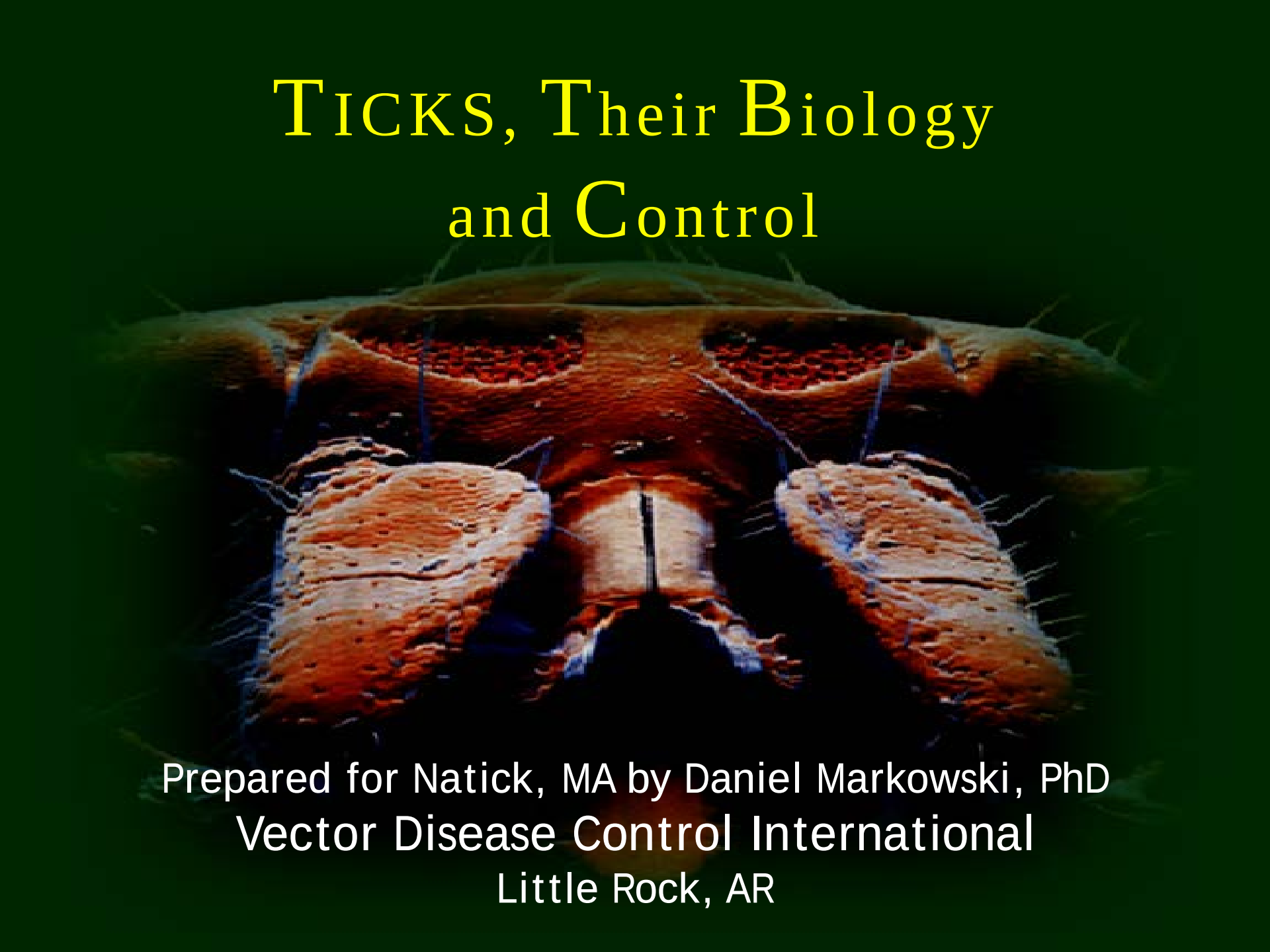
Ticks, Their Biology and Control



Prepared for Natick, MA by Daniel Markowski, PhD
Vector Disease Control International
Little Rock, AR

Three Primary Tick Species of Medical Importance

Slightly Smaller
Tear Drop Shaped
Reddish Abdomen
Solid Black Scutum

Ixodes scapularis
(Blacklegged Tick)
or
(Deer Tick)

Slightly Larger
Round in Shape
Chestnut Brown Abdomen
White Dot on Scutum

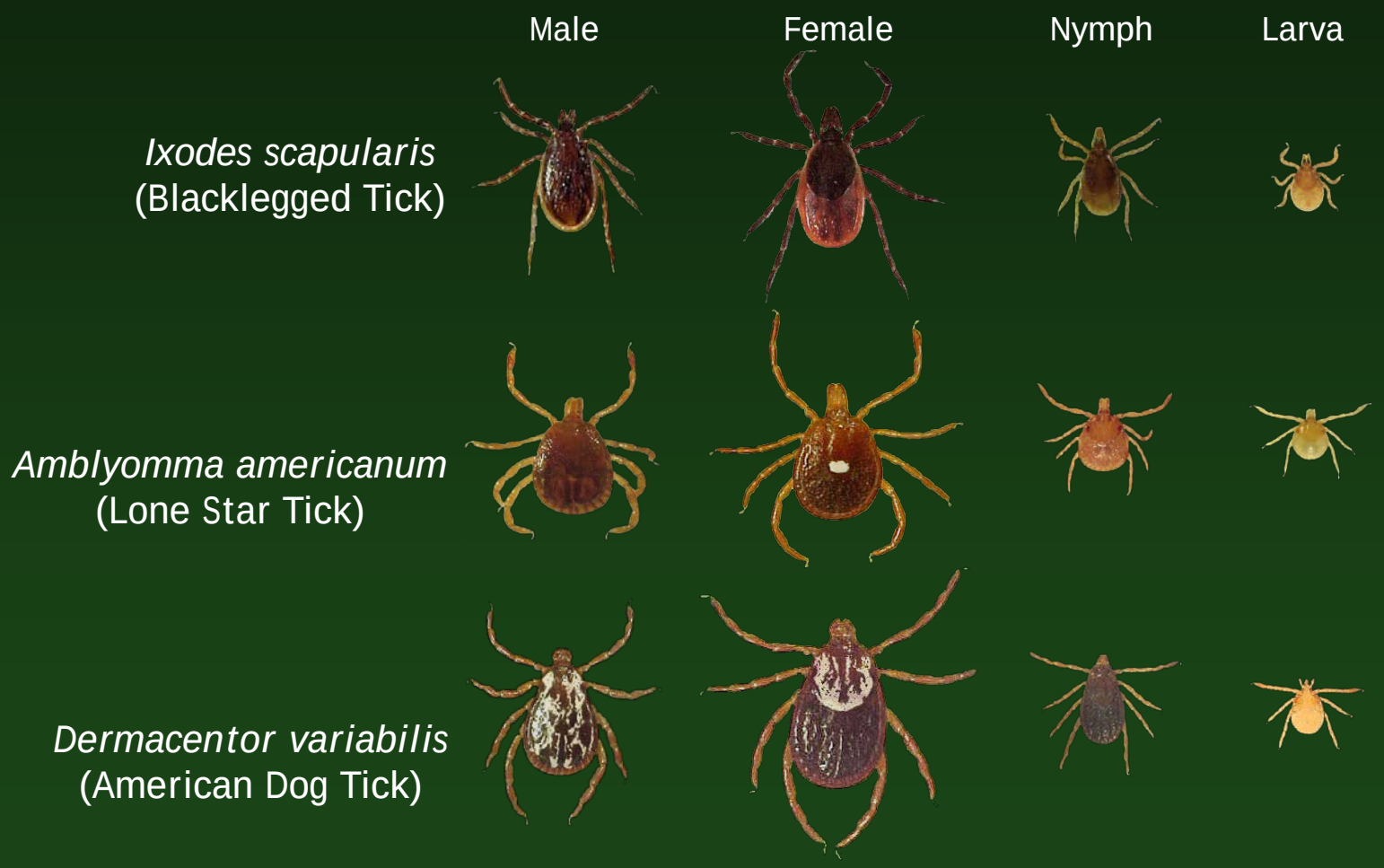
Amblyomma americanum
(Lone Star Tick)

Largest
Oblong Shaped
Dark Brown Abdomen
White Patterns on Scutum

Dermacentor variabilis
(American Dog Tick)

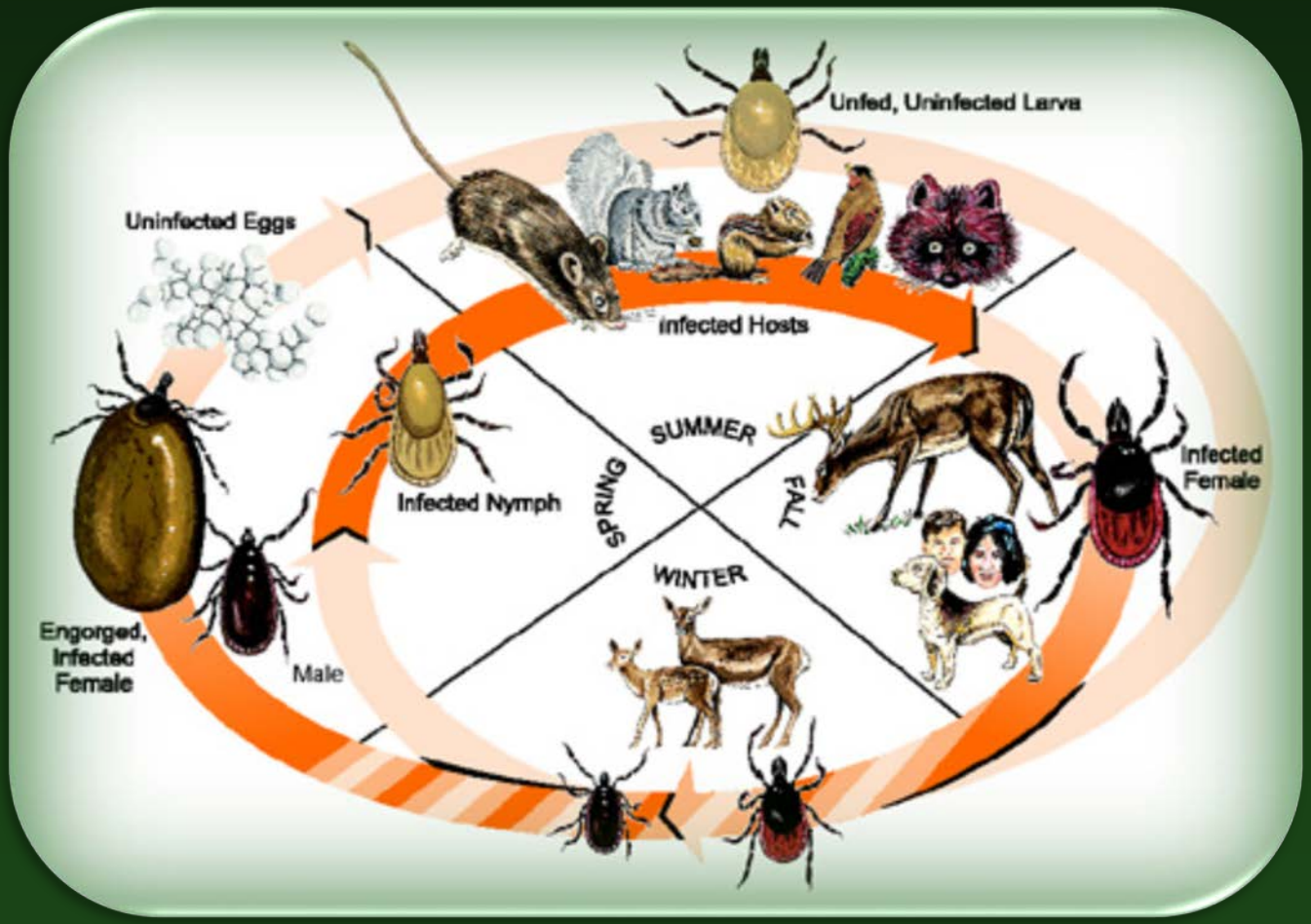
Brown Dog Ticks

Life Stages of Medically Important Tick Species



Engorged Ticks

Life Cycle of *Ixodes scapularis*



Deer ticks live for 2 years.

Larval Ticks Feed in Late Summer

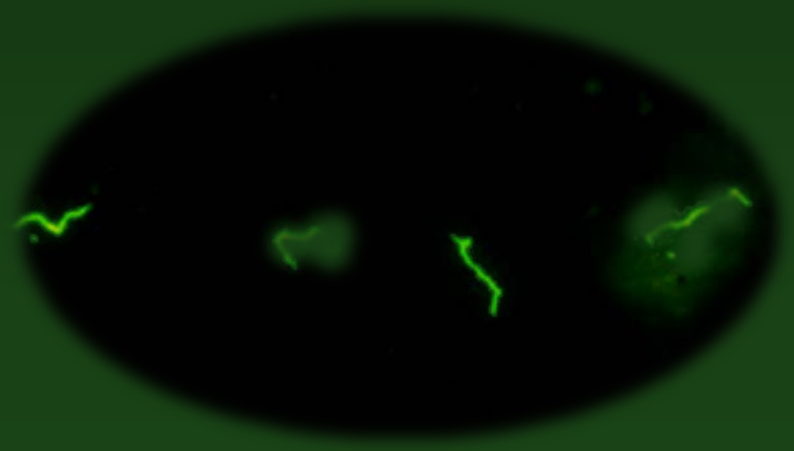
Larval Numbers Peak in August

Larvae Prefer to Feed on Small Mammals

It is during this feeding that they normally acquire the Lyme disease bacterium.

Nymphs are Active During May and June

The Lyme disease Bacterium
(Borrelia burgdorferi)



Nymphs are most Responsible for the Transmission of Lyme disease

Adults are Active from October through April

Deer are the Preferred Host for Adult Deer Ticks

Only Female Ticks Feed

Females Lay Approximately 3,000 Eggs

Females lay one batch of eggs, then die

Tick Habitat

Wooded Areas with Shade,
Leaf Litter and Brush

Tick Habitat

Tick-borne Diseases Found in the Northeast

Lyme Disease (Bacteria)

Human Granulocytic Ehrlichiosis (Rickettsia)

Human Babesiosis (Protozoan)

Human Monocytic Ehrlichiosis (Rickettsia)

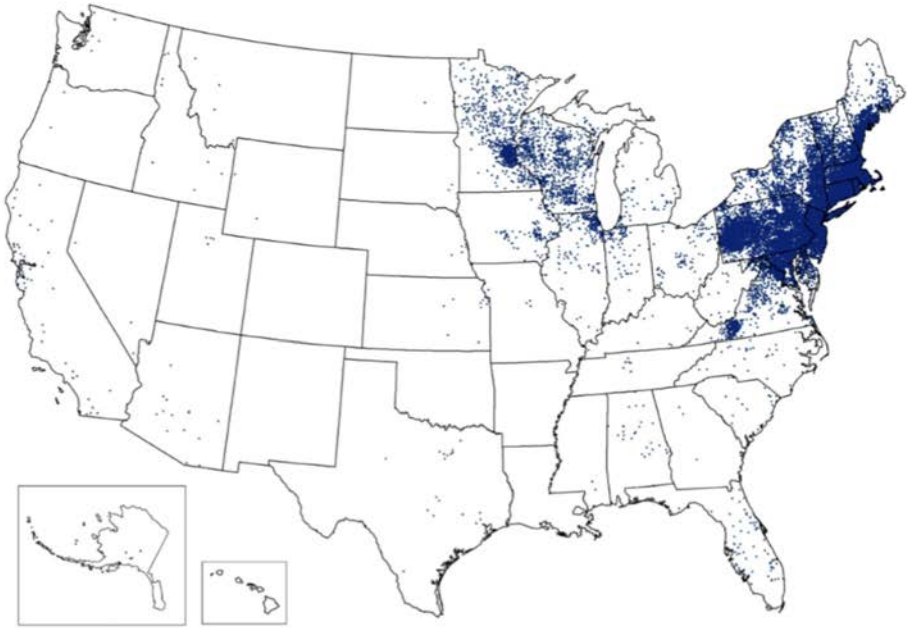
Lyme Disease - like Illness (Bacteria)

Rocky Mountain Spotted Fever (Rickettsia)

Reported Cases of Lyme Disease

Reported Cases of Lyme Disease—United States, 2014

One dot is placed randomly within the county of residence for each confirmed case. Though Lyme disease cases have been reported in nearly every state, cases are reported based on the county of residence, not necessarily the county of infection.

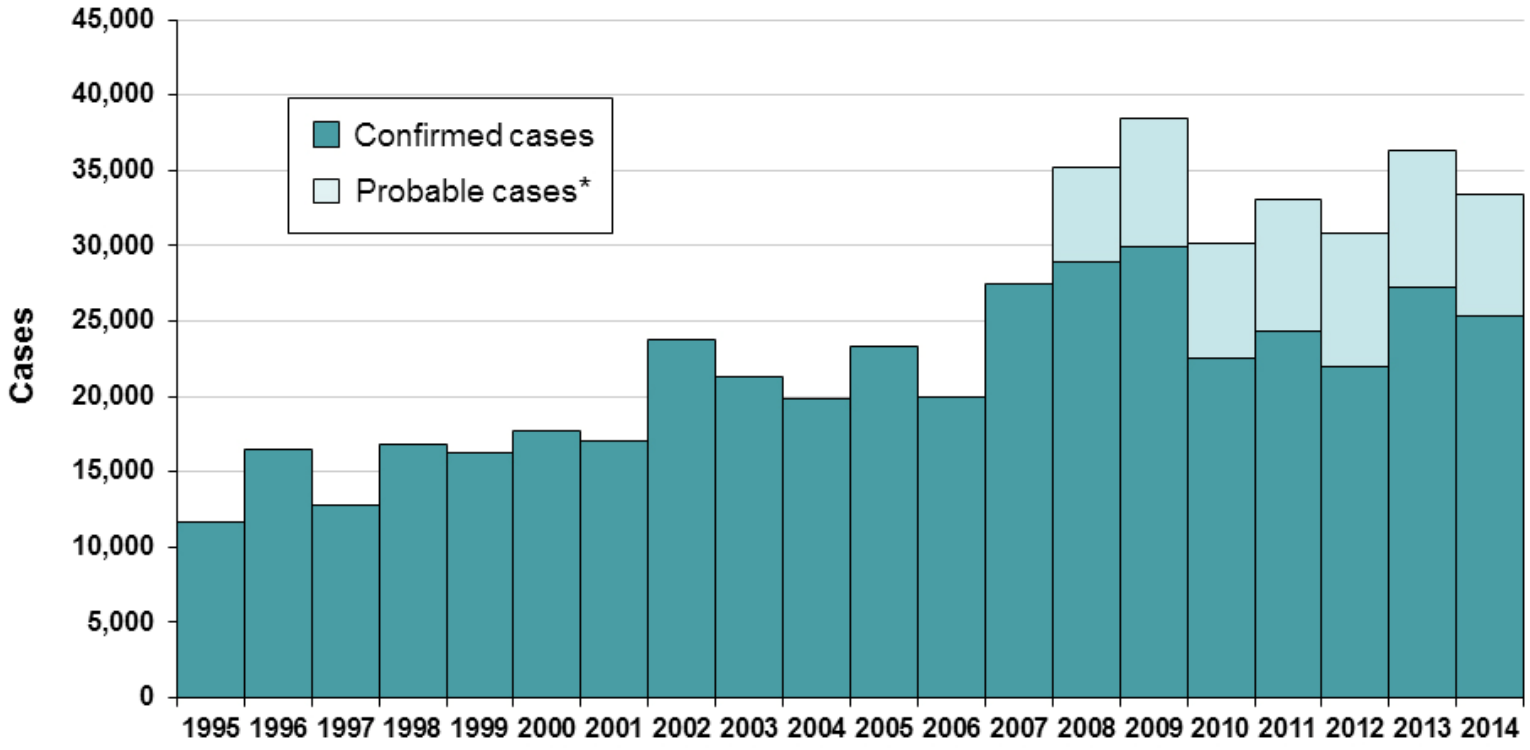


1 dot placed randomly within county of residence for each confirmed case

National Center for Emerging and Zoonotic Infectious Diseases
Division of Vector-borne Diseases | Bacterial Diseases Branch

CDC

Reported Cases of Lyme Disease by Year



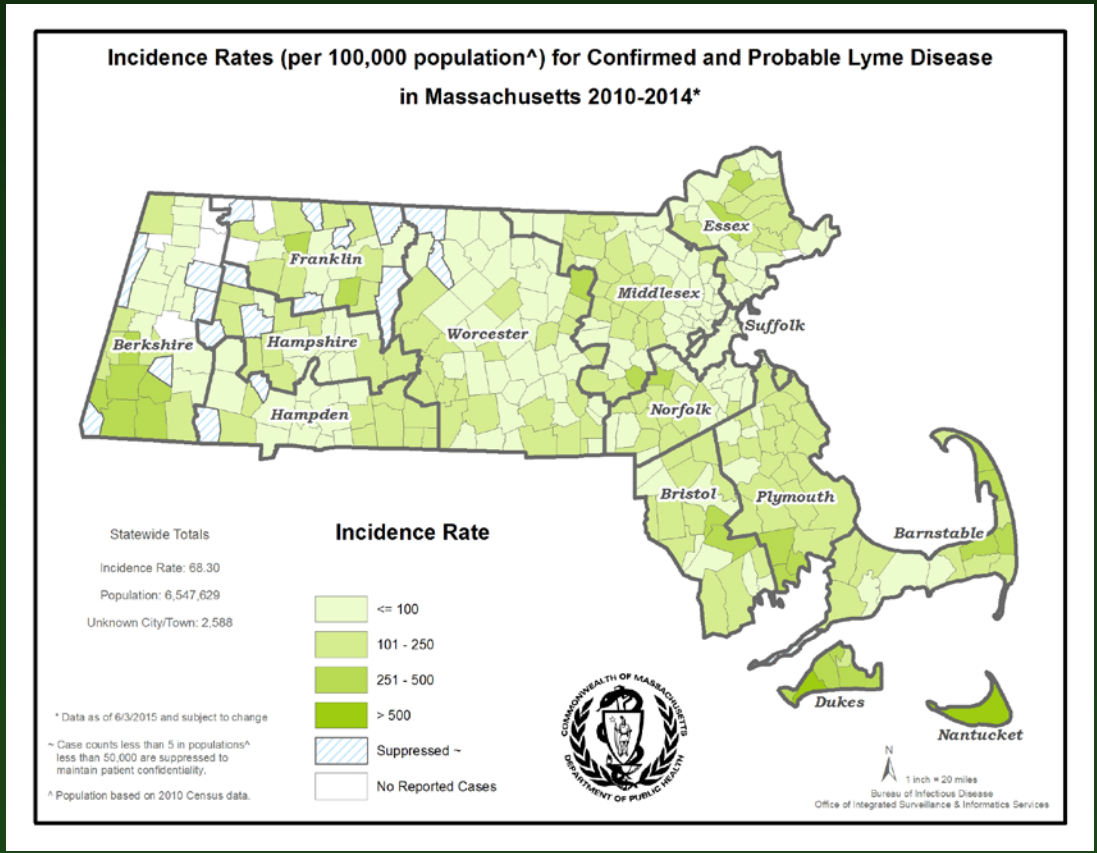
Lyme Disease Surveillance in Massachusetts, 2014
Massachusetts Department of Public Health

2014 Surveillance Highlights

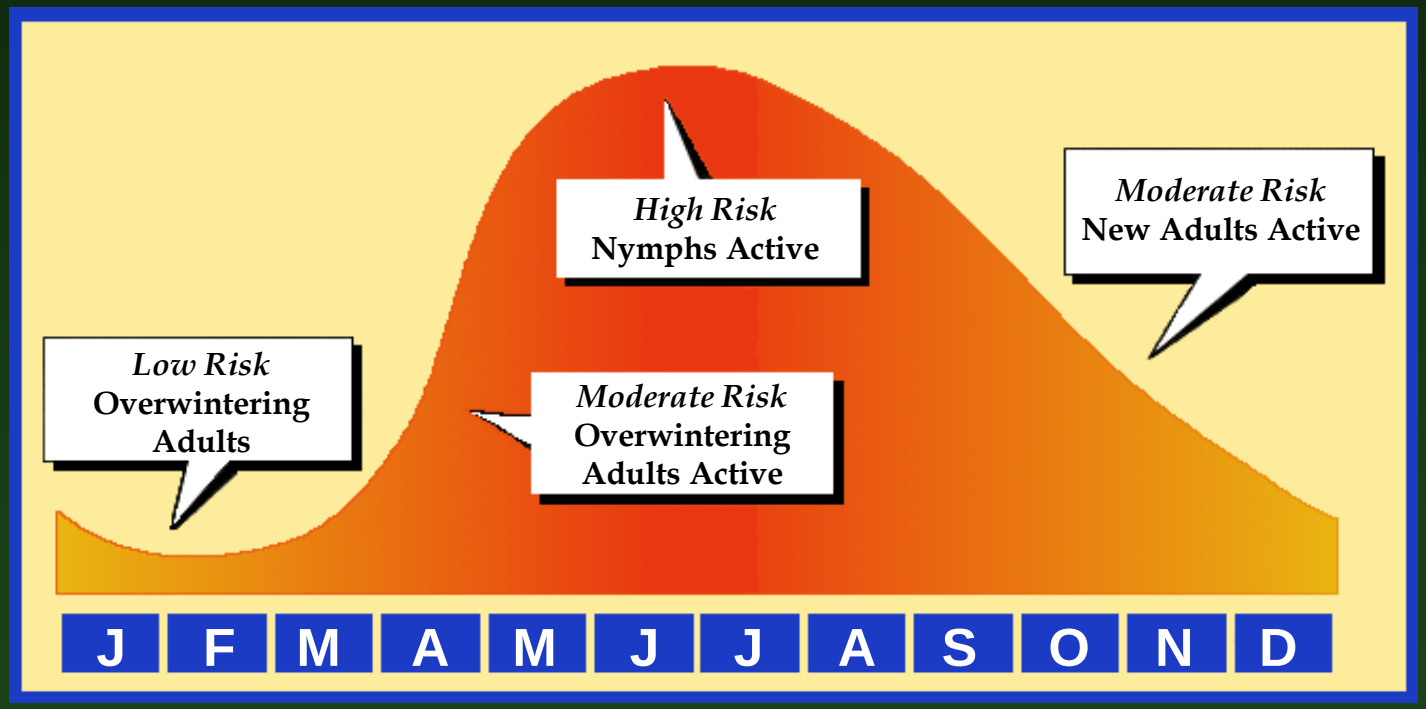
- 3,830 confirmed Lyme disease cases, and 1,770 probable cases, were reported in Massachusetts in 2014 (total = 5,600), which is a decrease of 1% from the number of confirmed and probable cases reported in 2013 (total=5,665).
- The highest incidence rates were among children aged 5-9 years and adults aged 65-74 years. The majority of cases had onsets in June, July, and August.
- 66% of confirmed cases had a reported erythema migrans (“bulls-eye”) rash.

Lyme Disease Surveillance in Massachusetts, 2014
Massachusetts Department of Public Health

- The map to the below illustrates Lyme disease incidence rates (number of cases per 100,000 residents) by city and town in Massachusetts from 2010-2014. Confirmed and probable cases are included in the rate. Darker shading represents higher incidence of Lyme disease.



Lyme Disease: *The Danger Months*



Most Lyme disease cases are acquired during the spring when nymphal ticks are active.

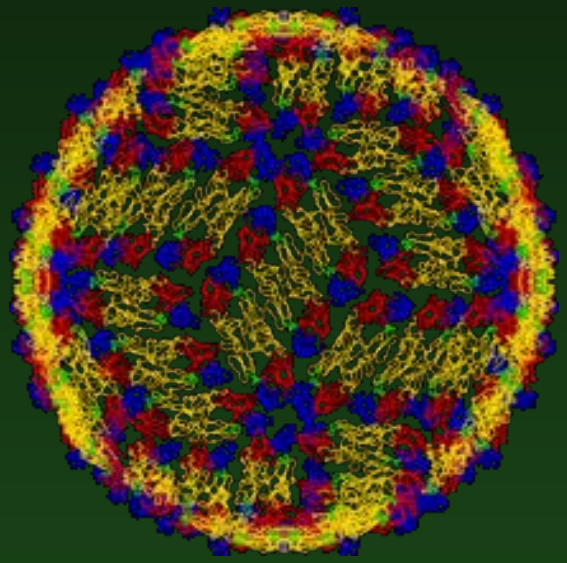
Symptoms of Lyme Disease

- Fatigue
- Chills and Fever
- Headache
- Muscle and Joint Pain
- Swollen Lymph Nodes
- Characteristic Skin Rash, *Erythema Migrans*
- Bell's Palsy

Personal Detection of Lyme Disease

- Check for Ticks and Tick Bites
- Remove Any Attached Ticks by Gently
  Pulling With Tweezers Where the Tick's
  Mouthparts Enter the Skin
- Check for Flu-like Symptoms and a Rash
- Check for Later Symptoms (1 to 8 Weeks After the Bite):
  Arthritis, Stiff Neck, Dizziness, Irregular Heartbeat, Fatigue

Treatment Of Lyme Disease



Early Lyme Disease

- Oral Antibiotics
- 3 - 5 weeks

Late Lyme Disease

- Intravenous Antibiotics
- Several Months

Tick Management Strategies

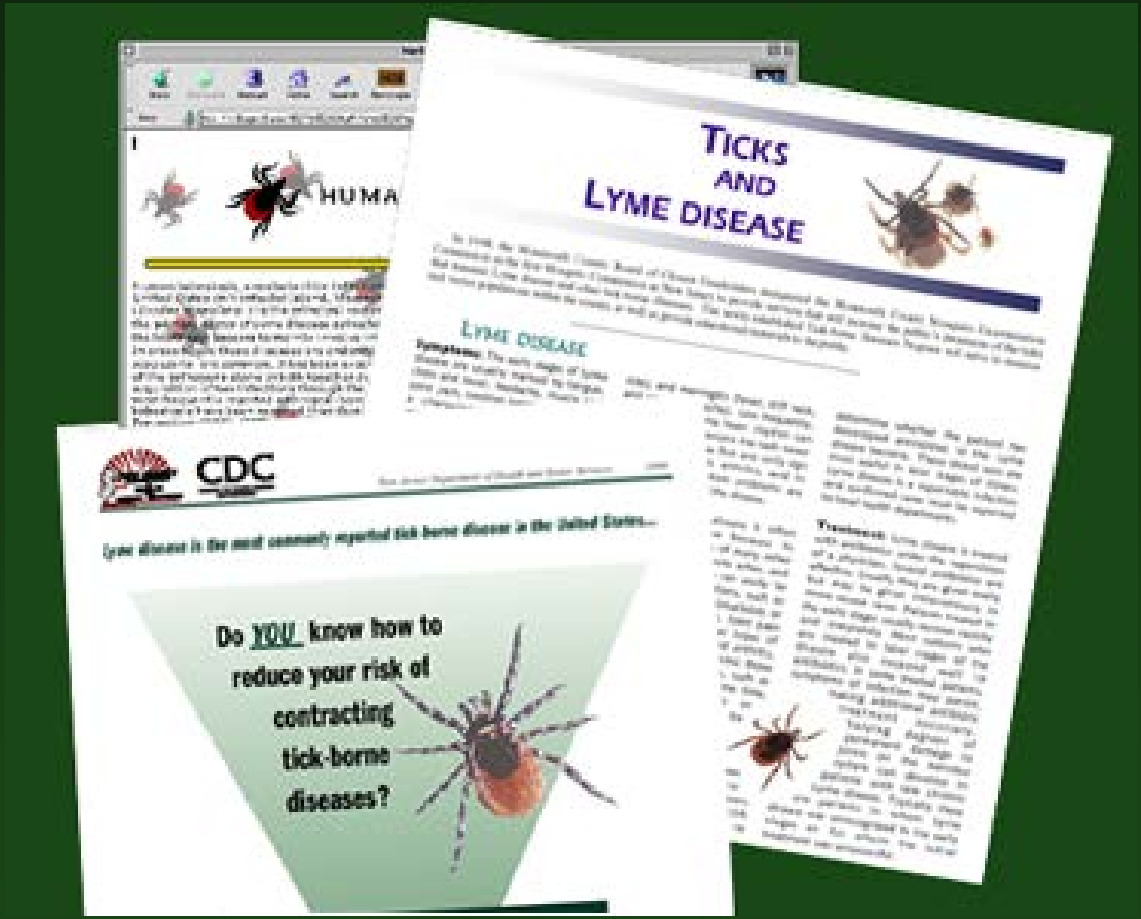
1. Increase Public Awareness
   - Post Signs
   - Distribute Informative Materials

2. Habitat Modification
   - Clear Trails
   - Restrict Access to Tick Infested Areas
   - Burning Vegetation

3. Vector-targeted and Broadcast Application of Pesticides
   - Biological
   - Chemical

4. Host-targeted measures

Distribute Educational Materials



Brochures, Posters, Internet

Stress Personal Prevention Measures

- Avoid Tick Habitats Whenever Possible
- Wear Long Pants with Cuffs Tucked into Socks
- Check Yourself and Your Pets Thoroughly for Ticks
- Use Insect Repellents Containing DEET (Less Than 30%)

Make Area Unsuitable For Ticks

- Remove Host Harborage Areas
- Trim or Remove Brush
- Use Woodchip Barriers

Tick Reduction From Habitat Modifications

Adult Reductions (MA, 1986)

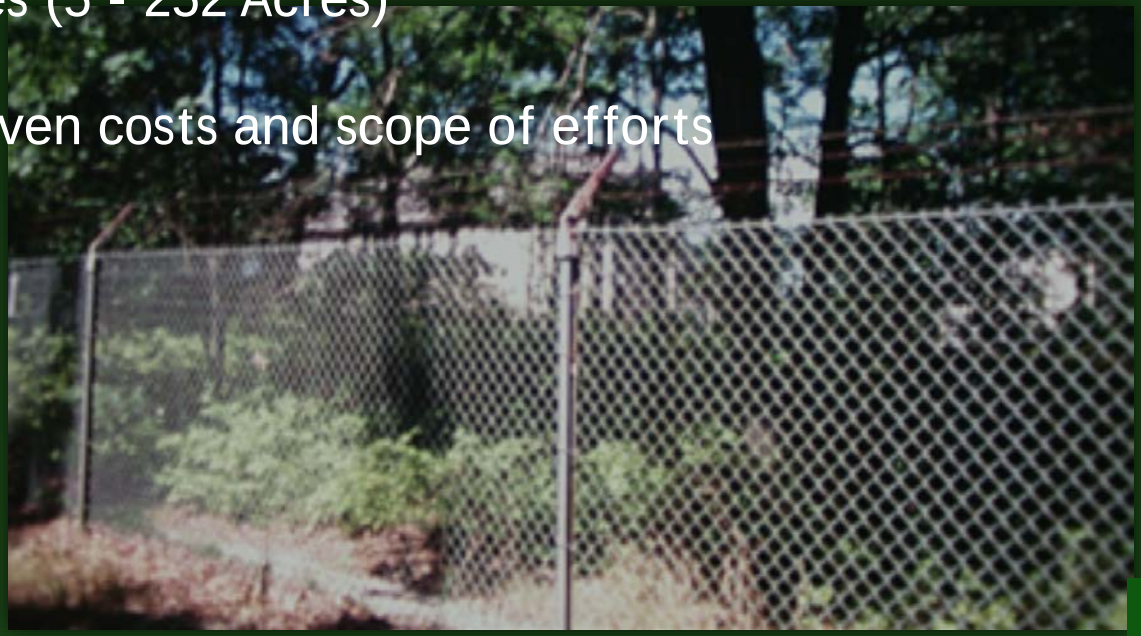
- 38% Reduction from April Burn (0.5 mo. later)
- 88% Reduction from December Burn (12 mo. later)
- 70% Reduction from April Mowing (4 mo. later)

Nymphal Reductions (NY, 1993; NJ, 1995)

- 49% Reduction from April Burn (2 mo. later)
- 74-83% Reduction from March Leaf Litter Removal (2-5 mo. later)

Tick Reduction Following Deer Fencing

- 100%, 84%, 74% Fewer Larvae, Nymphs, Adults
  In an 18 Acre Fenced Site (CT, 1993)
- 90% Fewer Larvae; 83% Fewer Nymphs
  In 5 Fenced Sites (5 - 252 Acres)
- Not practical given costs and scope of efforts



Tick Reduction using Host Applied Pesticides

- "Tick Tubes"
- Maxforce Tick Management System
- 4-Poster Designs for Deer

Other Deer Management Options:

Deer-Targeted Devices: The baited 4-Poster deer feeding station was specifically designed to kill species of ticks, primarily *I. scapularis,* that feed on white-tailed deer. The 4-poster bait station consists of a central feed bin containing corn kernels that are used as deer bait and two application/feeding stations at either end of the unit. As deer feed on the corn bait the device forces them to rub against Permethrin-laced applicator rollers. The rollers apply pesticide to the ears, neck, head, and shoulders, where the majority of the adult ticks are attached and feeding. Recent studies have shown large reductions in free-living tick populations in the years following the installation.

One station is sufficient for treating 50-70 acres of deer habitat. The unit will need to be filled with corn regularly and the amount of bait needed will be dependent on the size of the local deer population. The station will be placed a minimum of 100 yards from human dwellings and should be maintained and erected only during months when the daily mean temperature is above freezing. The initial installation of the device includes a one-year supply of pesticide and a one-year supply of application rollers.

- **Another option (that we don't offer) is a deer culling**

Tick Control Using Liquid Acaricides

Advantages:

- Lower Application Rates
- Effective Against All Active Stages
- Less Expensive Then Most Alternatives

Disadvantages:

- High Pressure Needed to Disturb Leaf Litter
- Availability of High Volume Water
- Application Equipment More Sophisticated and Expensive

Tick Control Using Granular Acaricides

Advantages:

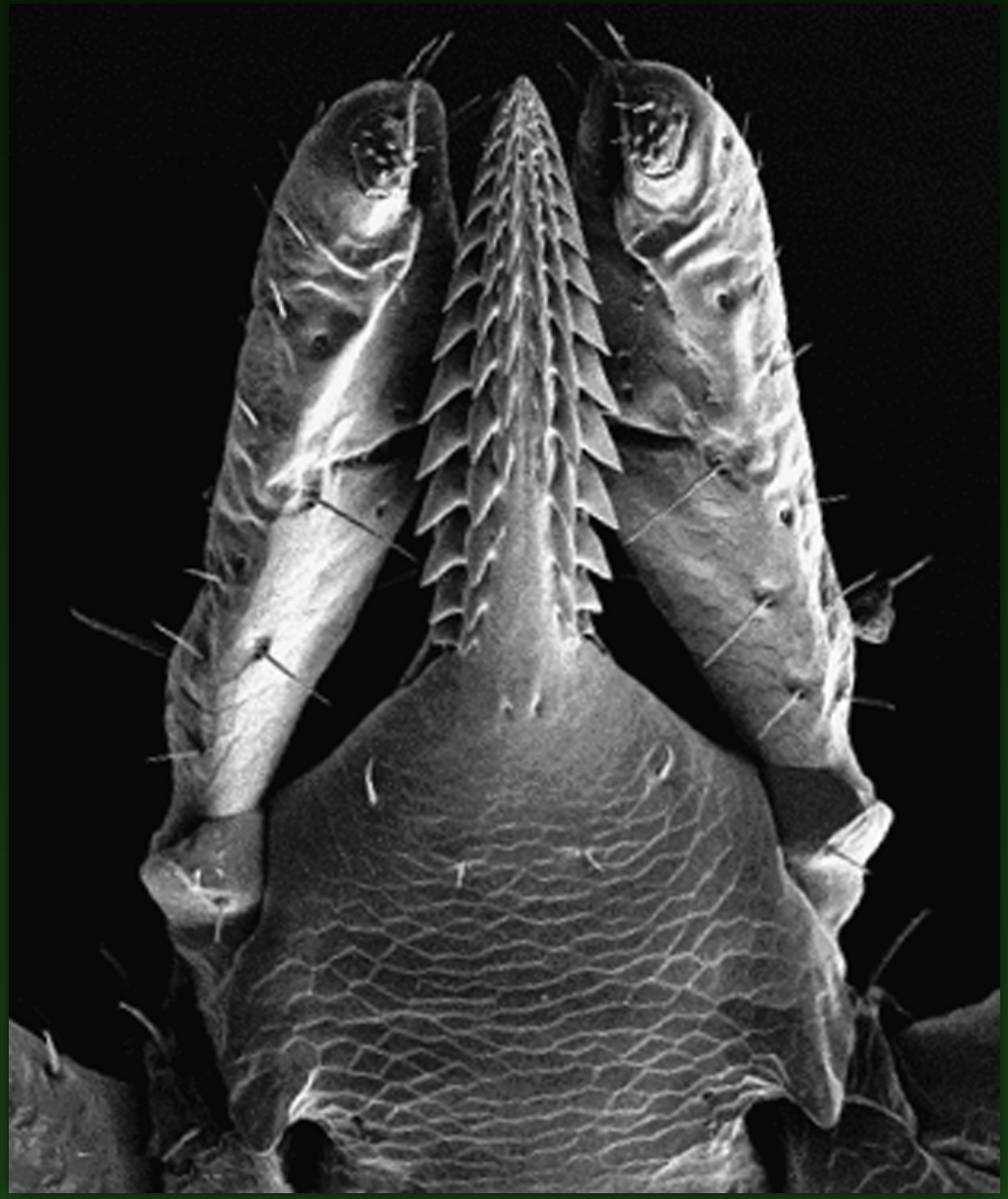
- Better Penetration of Foliage
- Easier to Apply
- Application Equipment Less Expensive

Disadvantages:

- High Application Rates
- High Volume of Material Required
- More Expensive Then Liquid Applications

New Approaches for a New Century

- Reservoir Targeted Vaccines
- Safe, Effective, Environmentally Friendly, Cost-effective



Thank You