



## Outdoor Worker Safety Tick and Mosquito Bite Prevention

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## Outline of Presentation

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Overview of the MDH Vectorborne Diseases Unit  
Tickborne Diseases of MN  
Mosquito-borne Diseases of MN  
Prevention Summary



## MDH Vectorborne Diseases Unit

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**Agency Organization**

- Health Protection Bureau
  - Infectious Disease Epidemiology, Prevention, & Control Division

**Responsibilities**

- Conduct surveillance for vectorborne diseases in MN
  - Diseases transmitted primarily by ticks and mosquitoes
  - Blood transfusion associated infections also

**Activities**

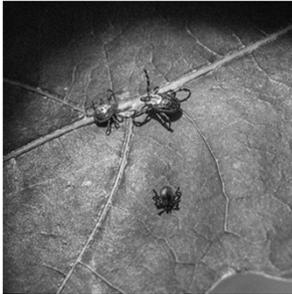
- Disease Surveillance
  - Humans, animals, vectors
- Research
  - TickNET
- Community Outreach
  - Health Care Providers
  - Occupational Health Professionals





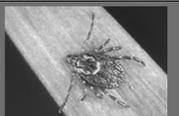
## Tickborne Diseases of MN

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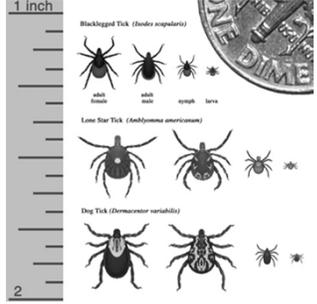


### 3 Ticks of Public Health Concern in MN

		
<b>Blacklegged (Deer) Tick</b>	<b>American Dog (Wood) Tick</b>	<b>Lone Star Tick</b>
Lyme disease Human anaplasmosis Babesiosis Ehrlichiosis ( <i>E. muris</i> -like) Powassan virus	Rocky Mountain Spotted Fever Tularemia	Ehrlichiosis Tularemia STARI
		

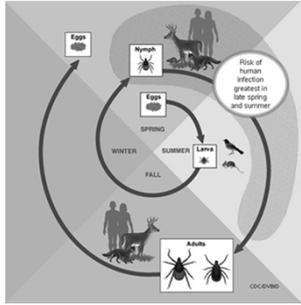


### Tick Life Stages



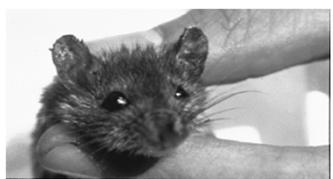


### Blacklegged Tick Life Cycle





### Blacklegged Tick Larvae



- Very, very small
- Size of a period at end of sentence
- Not known to transmit disease agents to humans
- Acquire disease agents during first blood meal



## Blacklegged Tick Nymphs



- Very Small
  - Size of a poppy seed
- Transmit most cases of human disease
  - Difficult to detect!



## Blacklegged Tick Adults



- Small
  - Size of a sesame seed when unfed
  - Size of a watermelon seed when engorged
- Feed and mate in the early spring or fall



## Blacklegged Tick Habitat



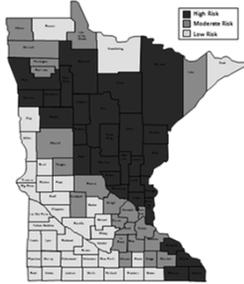
## Minnesota Biomes



Image Modified from Minnesota DNR, <http://www.dnr.state.mn.us/biomes/index.html>



## Minnesota Tickborne Disease Risk



**Tickborne disease risk is confined to forested areas throughout the state.**

**Take precautions to prevent tickborne disease when visiting these areas.**



## Blacklegged Tick Questing

What they do:

- Live on forest floor, in leaf litter
- Search for a host from the tips of low-growing vegetation
- Sense biochemical cues
  - CO<sub>2</sub>, body heat, vibrations, etc.
- Climb onto a person/animal near ground level



What they don't do:

- See
- Jump
- Fly
- Fall from treetops



## Blacklegged Tick Disease Transmission

- In order for a tick to spread disease:
  1. The tick must be able to transmit a disease agent during feeding
    - Nymphs and Adult Females = Highest Risk
  2. The tick must be infected with a disease agent
    - A high proportion of ticks are infected with a disease agent, but not all
  3. The tick must be attached for a certain amount of time
    - Lyme disease: 24-48 hours
    - Anaplasmosis: 12-24 hours
    - Babesiosis: >24 hours
    - Powassan: Possibly <15 minutes (in mice studies)



**Bottom Line: Remember to check yourself for ticks at least once a day !**



## Blacklegged Tick Average Infection Prevalence\*

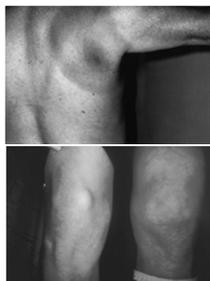
Disease Agent	Adults	Nymphs
<i>Borrelia burgdorferi</i>	34.4%	17.3%
<i>Anaplasma phagocytophilum</i>	6.5%	6.1%
<i>Babesia microti</i>	7.7%	5.4%
<i>Ehrlichia muris</i> -like agent	2.5%	3.6%

\*These are preliminary results based on test results from the collection of blacklegged ticks from various sites in Minnesota from 2006-2011.



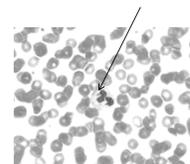
## Lyme Disease

- *Borrelia burgdorferi*
- Symptoms (3-30 days after tick bite)
  - Characteristic Rash
  - Fever
  - Muscle and joint pain
  - Fatigue
  - Pain and swelling in large joints
- Diagnosis
  - Exposure to ticks or wooded areas
  - Physical examination
  - Laboratory tests: bloodwork, joint tap
- Treatment
  - Antibiotics



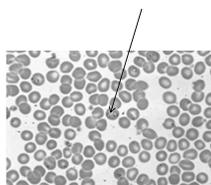
## Human Anaplasmosis & Ehrlichiosis (EML)

- Closely related diseases
  - *Anaplasma phagocytophilum*: Human anaplasmosis endemic to MN
  - *Ehrlichia chaffeensis* & *E. ewingii*: Human ehrlichiosis uncommon in MN
    - 2009 - detection of new pathogen unique to MN and WI: *Ehrlichia muris-like* agent
- Symptoms (3-21 days after tick bite)
  - Many cases have no symptoms
  - Fever
  - Severe headache
  - Muscle aches
  - Severe complications and death possible
- Diagnosis
  - Laboratory tests: bloodwork
- Treatment
  - Antibiotics



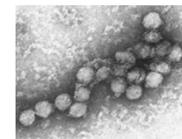
## Babesiosis

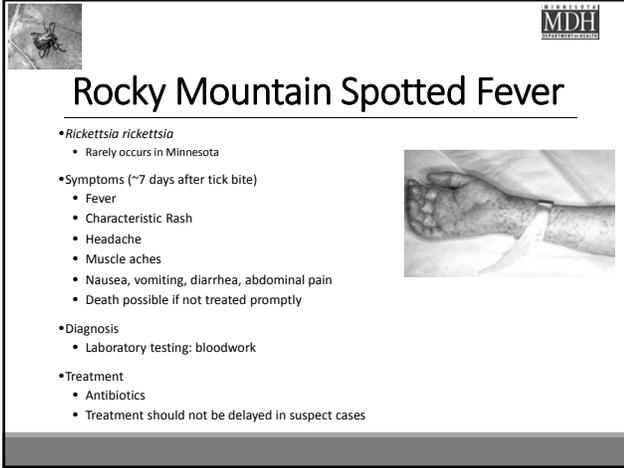
- *Babesia microti*
- Symptoms (3-60+ days after tick bite)
  - Most cases have no symptoms
  - Fever
  - Headache
  - Fatigue
  - Muscle and joint aches
  - Loss of appetite and nausea
  - Severe complications and death possible
- Diagnosis
  - Laboratory testing: bloodwork
- Treatment
  - Combination of anti-protozoal and antibiotic



## Powassan Virus Disease

- Powassan virus
  - Flavivirus closely related to West Nile Virus
- Symptoms (7-30 days after tick bite)
  - Clinical spectrum not fully known
  - Some cases may have no symptoms or only a mild fever
  - Severe cases: encephalitis/meningitis
    - Long-term neurologic problems may occur
    - Death possible
- Diagnosis
  - Laboratory testing: bloodwork/spinal tap
- Treatment
  - No specific anti-viral medication
  - Supportive care for severe cases





**Rocky Mountain Spotted Fever**

*Rickettsia rickettsia*

- Rarely occurs in Minnesota

**Symptoms** (~7 days after tick bite)

- Fever
- Characteristic Rash
- Headache
- Muscle aches
- Nausea, vomiting, diarrhea, abdominal pain
- Death possible if not treated promptly

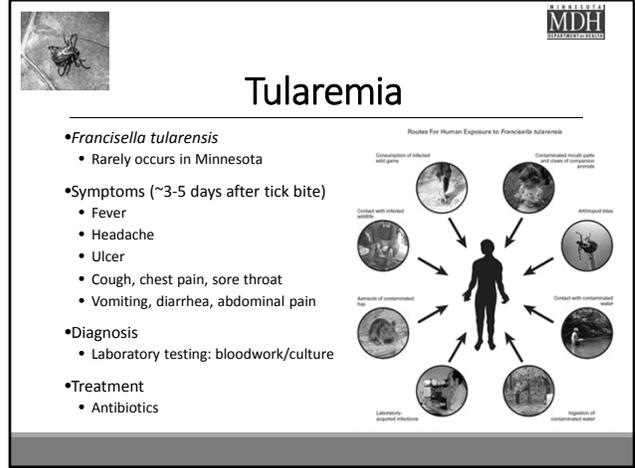


**Diagnosis**

- Laboratory testing: bloodwork

**Treatment**

- Antibiotics
- Treatment should not be delayed in suspect cases



**Tularemia**

*Francisella tularensis*

- Rarely occurs in Minnesota

**Symptoms** (~3-5 days after tick bite)

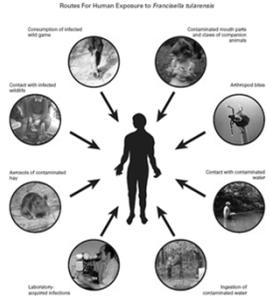
- Fever
- Headache
- Ulcer
- Cough, chest pain, sore throat
- Vomiting, diarrhea, abdominal pain

**Diagnosis**

- Laboratory testing: bloodwork/culture

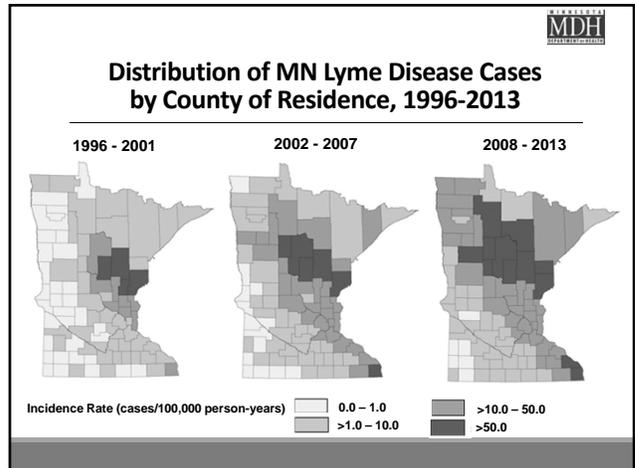
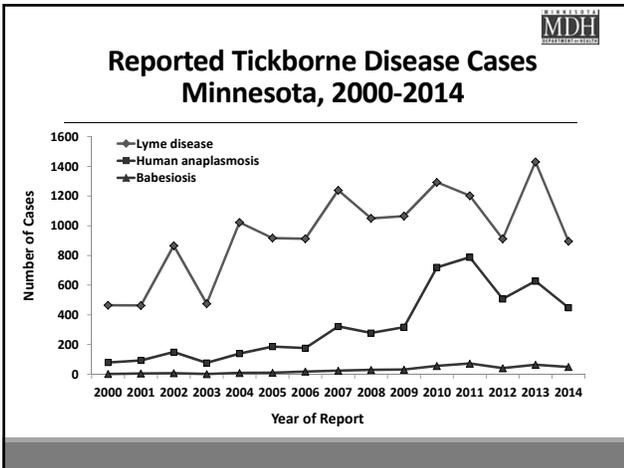
**Treatment**

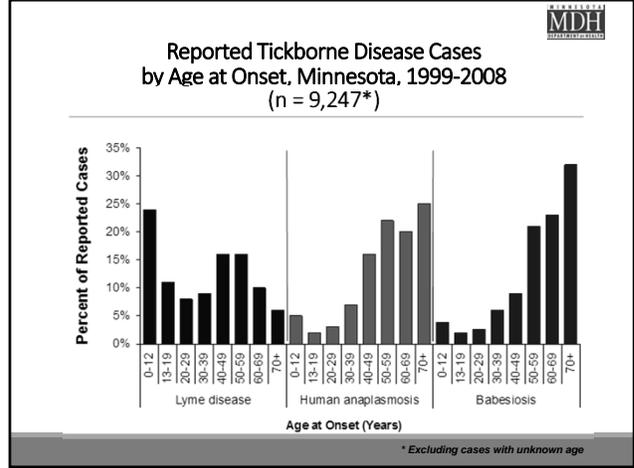
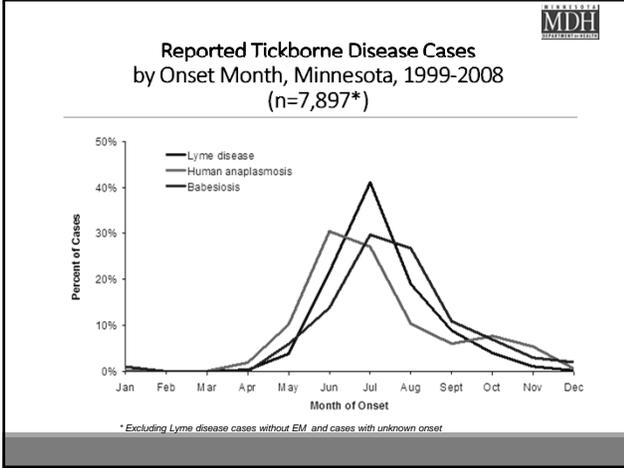
- Antibiotics



**Routes For Human Exposure to *Francisella tularensis***

- Concentration of rabbit antigens
- Compromised mouth parts and nose of companion animals
- Amphibian bites
- Contact with compromised deer
- Ingestion of contaminated water
- Laboratory exposed infections
- Arms of compromised birds
- Contact with infected





## Protect Yourself from Tickborne Diseases

- Know when and where you're at risk**
  - Primarily Mid-May through mid-July
  - Wooded and brushy areas
- Wear tick repellent**
  - DEET 20-30% on skin or clothing
  - Permethrin 0.5% on clothing
- Check yourself for ticks**
  - At least once a day
  - Remove ticks ASAP!

**Tick removal**

If you find a tick on yourself, remove the tick promptly.

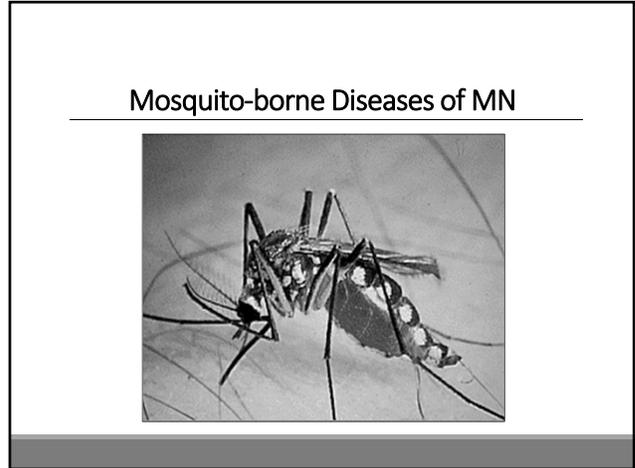
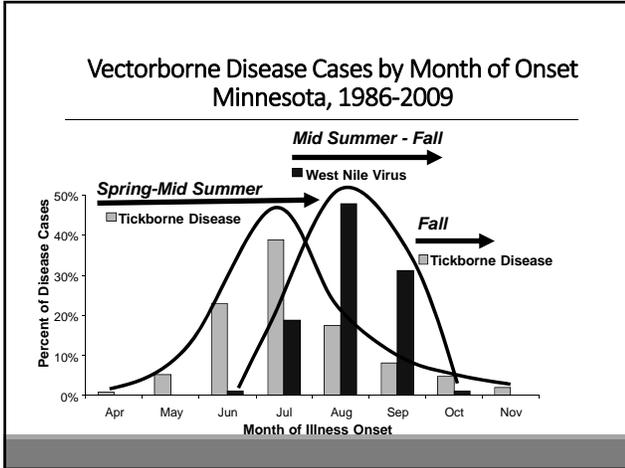
- Prompt tick removal is important.
- If possible, use a pair of tweezers to grasp the tick by the head.
- Hold the tick close to the skin.
- Pull the tick outward slowly, gently, and steadily.
- Do not squeeze the tick.
- Use an antiseptic on the bite.

Avoid tick remedies like Vaseline®, nail polish remover or burning matches - they are not a safe or effective way to remove ticks.

Watch this 1 minute video showing you how to remove a tick.

## Other ways to reduce your risk of tick encounters

- Keep trails mowed short
- Remove leaf litter and brush
- Create a barrier between your yard and woods
- Apply pesticide to high traffic/high risk areas
- Talk with your vet about tick preventatives for your pets



### Minnesota's Endemic Mosquito-borne Diseases

MINNESOTA MDH

- West Nile virus disease
  - *Culex tarsalis*
- La Crosse encephalitis
  - *Aedes triseriatus* ('tree-hole' mosquito)
- Jamestown Canyon virus disease
  - *Aedes* genus ('snow-melt' mosquitoes)

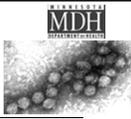
### Non-Endemic Mosquito-borne Diseases in Minnesota

MINNESOTA MDH

- Malaria
- Dengue fever
- Chikungunya
- Zika virus

*Anopheles gambiae*      *Aedes albopictus*      *Aedes aegypti*

## West Nile Virus



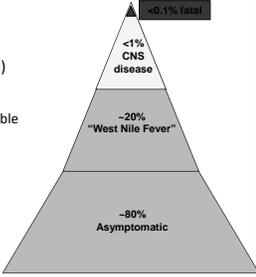
Virus first identified in US in 1999  
 ◦ First case in MN in 2002

Vector: *Culex tarsalis*

Symptoms (most severe in elderly population)  
 ◦ Most cases have no symptoms  
 ◦ Fever, headache, fatigue, rash  
 ◦ Meningitis or encephalitis, death rare but possible

Diagnosis  
 ◦ Laboratory testing: bloodwork/spinal tap

Treatment  
 ◦ No specific anti-viral medication  
 ◦ Supportive care  
 ◦ Hospitalization for severe cases

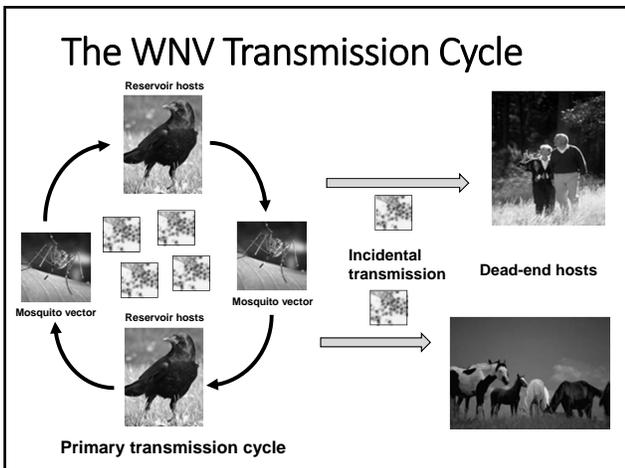


## *Culex tarsalis*

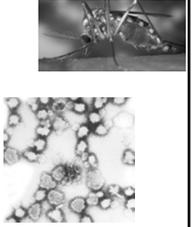


Widely distributed in Western US  
 Temporary/semi-permanent bodies of water  
 Feed on wide range of species  
 ◦ prefer birds  
 Most active at dusk and dawn





## La Crosse Encephalitis



• First identified in a MN resident, a child who died in a La Crosse, WI hospital, in the early 1960's

• Vector: *Aedes triseriatus* ('tree-hole' mosquito)

• Symptoms (most severe in children < 16 yrs)  
 ◦ Many cases have no symptoms  
 ◦ Fever, headache, nausea, vomiting, fatigue  
 ◦ Encephalitis, often accompanied by seizures  
 ◦ Coma, paralysis, and death possible

• Diagnosis  
 ◦ Laboratory testing: bloodwork/spinal tap

• Treatment  
 ◦ No specific anti-viral medication  
 ◦ Supportive care with hospitalization

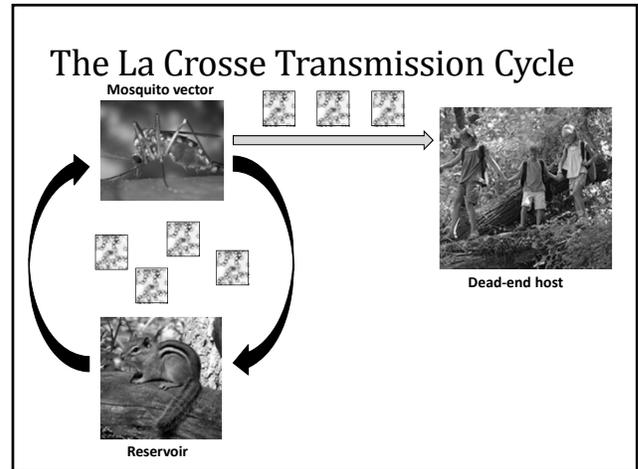
## Aedes triseriatus

Found in the Eastern US  
 ◦ SE corner of MN

Forest-dwelling mosquito  
 ◦ small water-holding containers

Feed on a variety of species  
 ◦ prefer chipmunks/squirrels

Daytime feeders



## Jamestown Canyon Virus

- First isolated from a mosquito in Colorado in 1961
- Reportable in US since 2004
  - Very rare
- Vector: *Aedes* genus ('Snow-melt' mosquitoes)
- Likely widely distributed in Minnesota
- Deer thought to maintain virus in nature
- Symptoms
  - Clinical spectrum is unclear
  - Fever, headache, flu-like illness
  - Encephalitis and meningitis
- Diagnosis
  - Laboratory testing: bloodwork/spinal tap
- Treatment
  - Supportive care

## Protect Yourself from Mosquito-borne Diseases

- 1) Know when and where you're at risk
  - Primarily Mid-July through mid-September
  - Western agricultural areas of the state
- 2) Avoid mosquito bites
  - Avoid outdoor activities from dusk to dawn
  - Wear long-sleeved shirts and long pants
  - light-colored, loose-fitting clothing works best
  - Install and repair door/window screens
- 3) Wear mosquito repellent
  - DEET 20-30% on skin or clothing
  - Permethrin 0.5% on clothing
  - Others: picaridin, IR3535, and oil of lemon eucalyptus



**Protect Your Environment from Mosquito-breeding Habitat:**  
Can you find 5 ways to reduce standing water in these pictures?





**Vectorborne Disease Prevention**

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**Take-Home Prevention Messages**

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5. Know when and where you are at risk for tickborne diseases:
  - Wooded or brushy areas – don't forget about the edges of the woods too!
  - Primarily mid-May through mid-July
4. Mosquitoes may seem bad early in the summer but these are mainly just pest species; be aware of mosquito-borne diseases later in the summer, even though the mosquitoes aren't as bothersome.
3. Blacklegged ticks are small and hard to detect but you can significantly reduce your risk of tickborne disease by performing tick checks frequently and removing ticks as soon as possible.
2. If you spend time outdoors in tick or mosquito habitat, wear appropriate clothing & use repellent!
  - DEET-based repellents (20-30%) can be applied to clothing or skin
  - Permethrin-based products can be applied to clothing/gear (NOT skin)
1. Not everyone knows when they have been bitten by a tick/mosquito so watch yourself for signs of illness (fever, rash, headache, muscle aches, fatigue, etc.) and contact your doctor if you become sick.



**For More Information**

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<http://www.health.state.mn.us/divs/idepc/dtopics/vectorborne/index.html>

