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Ticks and Tick-Borne Diseases

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Ticks are blood-feeding parasites that can significantly impact the quality of life and health of humans and pets. Most importantly, some species of ticks may infect the host with any of several different diseases, which can result in mild to serious illness or death. Proper protection from ticks and prompt removal are crucial to preventing infection.

Three tick species in Ohio are medically important because they are disease vectors: the American dog tick, the blacklegged tick (commonly called the deer tick), and the lone star tick. The brown dog tick, although uncommon, is the only tick that can become established indoors in homes with dogs and kennels. This fact sheet provides information on these four species. Other tick species are rarely encountered in Ohio.

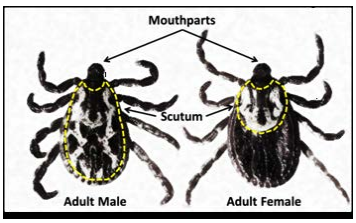

Figure 1. The scutum is outlined in yellow on the upper surface of an adult male and female hard tick.

Many of the species in Ohio, including the three of medical importance and the brown dog tick, are hard ticks. They are called hard ticks because they possess a scutum (hard plate) on their upper surface just behind the mouthparts (see Figure 1). The scutum covers almost the entire upper surface of the adult male whereas it covers only the front portion of the female. Soft ticks lack a scutum. In Ohio, soft ticks are not pests of humans.

Life Cycle and Habits

Ticks have a life cycle that includes the egg and three stages: six-legged larva, eight-legged nymph, and eight-legged adult. Adult ticks often have distinct characteristics and markings, but immature stages (larvae and nymphs) are entirely tan or brown and difficult to identify to species. All stages are round to oval shaped.

Ticks must consume blood at every stage to develop. Most species feed on a different type of host during the adult stage, with larvae and nymphs preferring smaller hosts. Nymphs become engorged, but they are much smaller than the adults. Adult female ticks greatly increase in size during feeding but adult males do not.

Important Tick Species in Ohio

AMERICAN DOG TICK (DERMACENTOR VARIABILIS)

The American dog tick is the most commonly encountered species throughout Ohio.

Figure 2. Adult forms of the American dog tick. From left to right: male, unfed female, and engorged female. *Photo by Jeffery Alfred, used with permission from Iowa State University Extension.*

Identification: Adults typically are brownish with light grey mottling on the scutum. Immatures are very small and rarely observed. The adult American dog tick is the largest tick in Ohio at approximately 3/16 of an inch (unfed females, fed, and unfed males). After feeding, the female is much larger (~5/8 of an inch long) and mostly gray.

Biology: American dog ticks prefer grassy areas along roads and paths, particularly next to woody or shrubby habitats. The immature stages of this species feed on rodents and other small mammals. Adult ticks feed on a wide variety of medium to large size mammals such as opossums, raccoons, groundhogs, dogs, and humans. Adults are most commonly encountered by humans and pets.

Adults are active during spring and summer, but they are most abundant from mid-April to mid-July. The adult tick waits on grass and weeds for a suitable host to brush against the vegetation. It then clings to the host's fur or clothing and crawls upward seeking a

place to attach and feed. Attached American dog ticks are frequently found on the scalp and hairline at the back of the neck.

Males obtain a small blood meal then mate with the female while she is attached to the host. The female feeds for seven to 11 days then drops to the ground and remains there for several days before laying approximately 6,000 eggs then dying shortly thereafter. The male remains on the host and continues to feed and mate for the remainder of the season until his death.

Diseases: The American dog tick is the primary transmitter of Rocky Mountain spotted fever (RMSF). This species may also transmit tularemia. Toxins in the tick's injected saliva have been known to cause tick paralysis in dogs and humans. Immediate tick removal usually results in a quick recovery.

BLACKLEGGED TICK OR DEER TICK (IXODES SCAPULARIS)

The blacklegged tick recently has emerged as a serious pest in Ohio. This species has become much more common in the state since 2010, particularly in regions with the tick's favored forest habitat. Maps showing Ohio counties with the blacklegged tick are available at **odh.ohio.gov/**.

Identification: The larval stage of the blacklegged tick is extremely tiny and nearly translucent, which makes it extremely difficult to see. The nymphal stage is translucent to slightly gray or brown. Adult males are slightly more than 1/16 inch long; unfed females are larger (~3/32-inch long). Both sexes are dark chocolate brown, but the rear half of the adult female is red or orange. Engorged adult females may appear gray. All comparable stages of the blacklegged tick are relatively smaller than other medically important ticks.

Biology: Blacklegged ticks are found mostly in or near forested areas. The immature stages feed on a wide range of hosts that occur in their woodland habitats. Adult blacklegged ticks feed on large mammals, most commonly white-tailed deer. Hence, some people call them "deer ticks." Mating can occur on or off of a host. The female deposits approximately 2,000 eggs, all in one location.

All stages may attach to humans. They have no site attachment preference and will attach almost immediately upon encountering bare human skin.

One or more life stages may be active during every month of the year (Figure 4), depending on temperature. Because of this year-long activity, preventative measures should be taken outdoors where the tick occurs, even during autumn and winter.

Diseases: The blacklegged tick is the only vector of Lyme disease in the eastern and Midwestern United States. It is also the principal vector of human granulocytic anaplasmosis and babesiosis. This tick species may be co-infected with several disease agents, and some ticks may simultaneously infect a host with two or more of these diseases.

Figure 3. Various stages of the blacklegged tick, clockwise from left to right: unfed larva, unfed nymph, fed nymph, adult male, adult female, partly fed female, and fully engorged female. For size reference, the center dot is approximately 0.8 mm diameter. *Photo by Jeffery Alfred, used with permission from Iowa State University Extension.*

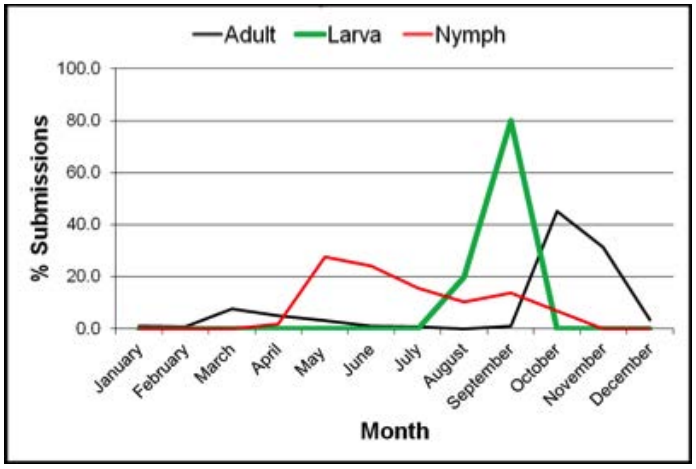

Figure 4. Seasonal abundance of the blacklegged tick as evidenced by samples submitted to the Ohio Department of Health. Blacklegged tick adults are active during spring, fall, and winter; nymphs are active during spring and summer; and larvae are active during late summer.

LONE STAR TICK (AMBLYOMMA AMERICANUM)

Lone star ticks recently have emerged as a serious pest, especially in southern Ohio.

Identification: The unfed adult female is about 3/16-inch long, brown, with a distinctive silvery spot on the upper surface of the scutum (hence the name 'lone star'.). Once fed, the female is almost circular in shape and ~7/16-inch long. The male tick is about 3/16-inch long, brown, with whitish markings along the rear edge.

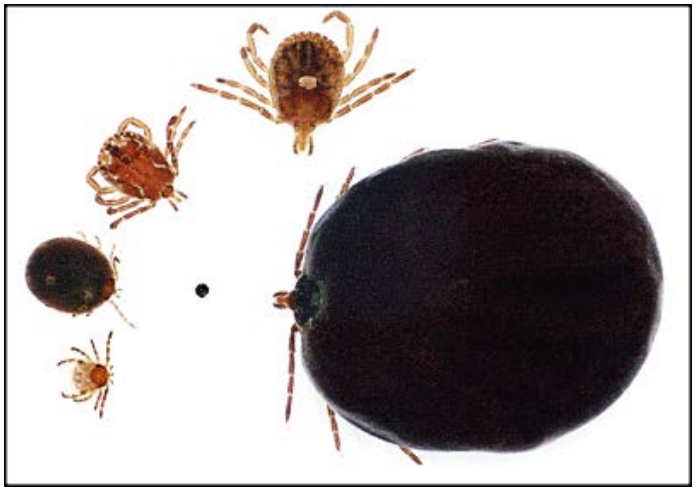

Figure 5. Nymphal and adult forms of the lone star tick. Clockwise, from bottom left: unfed nymph, engorged nymph, adult male, unfed adult female, and engorged adult female. For size reference, the center dot is approximately 0.8 mm diameter. *Photo by Jeffery Alfred, used with permission from Iowa State University Extension.*

Biology: Lone star ticks are most commonly found in southern Ohio, but they are dispersed by migratory birds and therefore are reported in most Ohio counties. All stages readily feed on almost any bird or mammal, including humans. All stages can be found throughout the warm months of the year.

Shade is an important environmental factor for this species, which typically occurs in shady locations along roadsides and meadows and in grassy and shrubby habitats. All stages crawl to the tip of low growing vegetation and wait for a host to pass by. Larval lone star ticks, commonly referred to as seed ticks, may congregate in large numbers on vegetation. A person or pet unlucky enough to brush against this vegetation may become host to hundreds of larval ticks. The sticky side of masking tape can be used to collect crawling immatures.

Diseases: Lone star ticks are the primary transmitter of human monocytic ehrlichiosis and southern tick-associated rash illness (STARI). They also may transmit tularemia and Q-fever.

BROWN DOG TICK (RHIPICEPHALUS SANGUINEUS)

The brown dog tick, although very uncommon in Ohio, is the only tick that can become established indoors in homes with dogs and in kennels.

Figure 6. Brown dog tick adult male (left) and female (right). *Photo by J. F. Butler, courtesy of University of Florida.*

Identification: The adult brown dog tick is reddish brown and lacks markings. Unfed adults are about 1/8 inch long. After feeding, the female is much larger (~a 1/2-inch long) and bluish gray.

Biology: Unlike other tick species, the brown dog tick can complete its entire life cycle indoors. It is well adapted to survive in the warm, dry conditions inside and outside home environments. These ticks do not thrive in wooded areas. Nonetheless, they may occur in grassy and bushy areas adjacent to homes and kennels, roadsides, and footpaths.

Brown dog ticks rarely feed on humans. Rather, dogs are their preferred host. All stages of the brown dog tick feed on dogs and they may attach anywhere on a dog's body. However, adult ticks typically attach on the dog's ears and between its toes, whereas larvae and nymphs typically attach on the dog's back. After feeding, they drop off the host but do not travel far. Brown dog ticks can complete a generation in approximately 60 days with optimal temperatures and readily available dog hosts.

Diseases: In Ohio, the brown dog tick has not been implicated in human disease transmission. However, this tick species has been identified as a transmitter of RMSF to humans in the southwestern United States and along the U.S.-Mexico border. It currently is not known if the brown dog tick serves as a vector of RMSF in other parts of the United States.

Nationwide, the brown dog tick is an important, but uncommon, transmitter of RMSF and several other disease organisms to dogs.

Management: For most tick species, outdoor chemical control is largely ineffective because of their wide distribution and movement, but the brown dog tick is an exception because of its close proximity to human habitation. Treatment of the premises outside the home should include grassy and brushy areas around outbuildings and kennels, sites

where the dog rests, and underneath doghouses where ticks may reside during off-host periods.

Pesticide treatments should be preceded by sanitation efforts such as vacuuming and cleaning to remove debris and as many ticks as possible; this also allows increased penetration of an insecticide into cracks and crevices. Pesticide application indoors should target areas frequented by the dog, particularly its sleeping and resting sites where ticks are likely to have dropped off. Because ticks hide in secluded places to molt, it also is critical to treat cracks and crevices in the floor and walls, baseboards, window frames, and doorframes; around wall molding and hangings; and under carpet edges.

The dog should be treated for ticks, preferably by a veterinarian, at the same time as the premises, outdoors or indoors, are being treated. A variety of pesticide products are labeled for indoor and outdoor treatment of ticks.

Tick-Borne Diseases in Ohio

Tick feeding often results in inflammation, swelling, irritation, and the potential for secondary bacterial infection at the feeding site. However, infection by tick-borne disease agents during feeding is of primary concern. Humans and pets can become infected with causal agents of RMSF, Lyme disease, human granulocytic anaplasmosis, human monocytic ehrlichiosis, tularemia, and babesiosis among others.

If you experience fever or flu-like symptoms following a tick bite, immediately contact your healthcare professional and emphasize that you recently were bitten by a tick. Save the tick in some type of container and take it with you to the healthcare professional. It is very important to receive the appropriate antibiotics as soon as possible.

Pets, especially dogs that become infected with a tick-borne disease, may become lethargic and anemic. They may quit eating and lose weight, and they sometimes become lame. Any pet with such symptoms should be examined by a veterinarian. When heavily infested with ticks, excessive blood loss can result in the pet's death. Dogs should be routinely tested for exposure to tick-borne diseases at annual checkups, but immediately if symptoms occur.

ROCKY MOUNTAIN SPOTTED FEVER

RMSF is not confined to the Rocky Mountain range, despite the name of the disease, and cases are reported in Ohio each year. This disease is transmitted by adult American dog ticks. Less than 2 percent of these ticks carry the causative bacterial agent, *Rickettsia rickettsii*, hence, relatively few people are infected. Furthermore, an infected tick must be attached for at least a day for transmission to occur.

Symptoms of RMSF appear three to 12 days after tick feeding and typically include sudden high fever, headache and aching muscles. On the second or third day of the fever, a non-itchy rash may develop on the wrists and ankles. The rash soon spreads to other parts of the body including the torso, palms, and soles. This disease rapidly progresses and can cause death if not treated with the appropriate antibiotics. Early treatment of RMSF typically results in rapid recovery. Most fatalities, although rare, can be attributed to a delay in seeking medical attention.

LYME DISEASE

Lyme disease is transmitted by the blacklegged tick and is the most prevalent tick-borne disease of humans in Ohio and the United States. This bacterial disease is named after Lyme, Connecticut, where cases were first reported in 1975. The nymphal stage of the blacklegged tick is usually responsible for transmitting Lyme disease, which is caused by the bacterium, *Borrelia burgdorferi*.

Symptoms may include a bull's-eye rash developing at the site of a tick bite within two to 32 days. This rash is diagnostic for Lyme disease. However, up to 40 percent of infected humans do not develop a ring-rash, which is almost always more than 2 to 3 inches across. Fever, headache, fatigue, or joint pain also may be symptoms of Lyme disease. Immediate antibiotic therapy for Lyme disease reduces the risk of neurological, arthritic, or cardiac complications developing days to years later.

Dogs are susceptible to Lyme disease. Precautions should be taken to protect them from tick exposure. Although cats are not susceptible to Lyme disease, they are particularly likely to pick up blacklegged ticks and transport them into the home environment. Before using any over-the-counter product, it is recommended that you consult your veterinarian.

HUMAN GRANULOCYTIC ANAPLASMOSIS (ANAPLASMOSIS)

Anaplasmosis is transmitted by blacklegged tick nymphs and adults and is less commonly reported than Lyme disease in Ohio. This disease is caused by the bacterium,

Anaplasma phagocytophilum.

Onset of symptoms may begin up to three weeks after a blacklegged tick bite. Initial symptoms may include fever, headache, and muscle aches. Other symptoms may include nausea, joint pain, chills, confusion, and sometimes a rash. Anaplasmosis may cause severe illness, especially if left untreated, and 50 percent of all infected individuals require hospitalization.

HUMAN MONOCYTIC EHRLICHIOSIS (EHRLICHIOSIS)

Ehrlichiosis is transmitted by lone star tick nymphs and adults. Several species of *Ehrlichia* bacteria cause ehrlichiosis.

The symptoms of ehrlichiosis are the same as for anaplasmosis (see above).

Tick Identification

Ticks can be submitted for species identification to the C. Wayne Ellett Plant and Pest Diagnostic Clinic (PPDC) at The Ohio State University. Information detailing how to submit a specimen can be obtained from the PPDC website at ppdc.osu.edu, your local county Extension office, or by contacting the PPDC: phone (614-292-5006), fax (614-466-9754), email (ppdc@cfaes.osu.edu).

Disease Testing of Ticks

Some private labs conduct disease testing of ticks, but there is no state agency in Ohio that provides this service. Treatment should not depend on tick testing.

Integrated Pest Management Strategies

PREVENTION OF TICK BITES

HUMANS

- Apply a tick repellent, making sure to follow the manufacturer's instructions. Note that DEET formulations of at least 25 percent are needed to repel ticks. Repellents containing permethrin should be applied to clothing only; do not apply directly to exposed skin.
- Wear light-colored clothing to make it easier to find crawling ticks.
- Wear long-sleeved shirts and long pants. Tuck pants into socks, and tuck shirt into pants.
- Perform tick checks frequently.

- Remove ticks immediately.
- Avoid tall grass and weedy areas; stay on paths.

PETS

- Protect pets with a reputable anti-tick product.
- Lyme disease vaccination of dogs in Ohio should be considered as infection risk increases.
- Keep dogs confined to your yard or home; do not allow them to roam freely.
- Keep dogs on a leash during walks, and inspect them for ticks afterwards.
- Avoid tall grass and weedy areas; stay on paths.

HABITAT MODIFICATION

Habitat management is essential for controlling tick populations. Keep your yard mowed, and do not allow brush or leaf litter to accumulate. Remove brush, tall weeds, and grass in order to eliminate the habitat of rodents and other small mammals, which serve as hosts for ticks.

HOST REMOVAL

It is helpful to remove rodents harboring inside or near one's house by using traps or rodenticides.

INSECTICIDE TREATMENT OF PETS

Dogs may be treated for ticks, and products are available from your veterinarian. Before using any over-the-counter product, it is recommended that you consult your veterinarian.

Tick Removal (Grasp, Pull, Disinfect, and Save)

- Prompt removal of an attached tick reduces the chance of infection. Tick attachment of several hours or more is often required for disease transmission.
- Take care not to crush or puncture the tick during removal. Diseases may be acquired from infected tick body fluids that contact broken skin, the mouth, or eyes. Do NOT use a hot match or cigarette to remove a tick as this may cause the tick to burst.
- Do NOT apply solvents or other materials to the tick to "stimulate" the tick to detach;

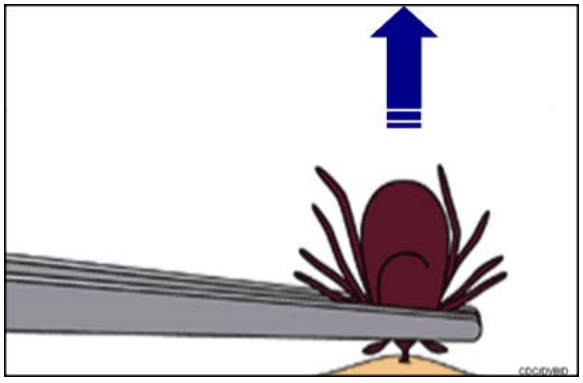

Figure 7. Position tweezers near the embedded tick's mouthparts

solvents are ineffective and delay removal. Such treatments may result in increased risk of disease transmission.

- Avoid touching a tick with your bare hands. Shield your fingers with a paper towel, wear rubber gloves, or use tweezers.

and as close to your skin as possible. Then, use steady pressure to pull the tick straight out without twisting or jerking.

- Use tweezers (or preferably a tick removal tool) to **grasp** an embedded tick as close to your skin as possible and near the tick's mouthparts (see Figure 7). Use steady pressure to **pull** it straight out. Do not twist or jerk the tick, as its mouthparts may be left in the skin, but that should not be a major concern because removing the tick is the main goal. Do not try to dig out broken off mouthparts as this may lead to secondary bacterial infections. Instead, proceed to the next step. Your body should be able to deal with broken mouthparts as foreign objects (similar to your body dealing with a splinter). If concerned, consult your healthcare professional.
- After tick removal, thoroughly **disinfect** the bite site, and wash your hands with soap and water. The attachment site should be treated with a topical antibiotic to prevent secondary bacterial infection.
- **Save** the tick for identification. It is useful to place the tick in a container with hand sanitizer or rubbing alcohol; or wrap the tick inside an alcohol wipe before placing it into a container. The alcohol helps preserve the specimen. Take the tick with you to a healthcare professional if you develop flu-like symptoms.

Websites for Additional Information on Ticks

- **tickencounter.org**
- **tickapp.tamu.edu**
- **extension.iastate.edu/publications/pm2036.pdf**
- **cdc.gov/ticks/**

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