PEER REVIEWED

DEFEATING TICKS

Practical Tips for Preventing Tick-Borne Disease in Pets

Lindsay Starkey, DVM, and Susan Little, DVM, PhD, Diplomate ACVIM (Parasitology)

Veterinary practices nationwide have seen an increase in tick infestations in recent years. A number of environmental factors can conspire to result in a tick infestation surge, including higher populations of wildlife hosts, better habitat, and more supportive climate.[1-4] Veterinarians need to provide solutions that improve the welfare of infested pets and secure peace of mind for their owners.

OVERVIEW

Geographic Distribution

Practitioners in the upper Midwest and Northeast United States have been battling *Ixodes scapularis* for decades,[5-8] while those on the West Coast are well acquainted with *Ixodes pacificus*.[5,9] The south central and southeastern regions are ideal tick habitats for *Amblyomma americanum* and *Dermacentor variabilis* as well as *Ixodes scapularis*.[5,10-14] No region is free from *Rhipicephalus sanguineus*; this tick, commonly known as the brown dog tick, is seen nationwide.[5,15]

Hosts

Ticks require a blood meal from a host to continue their development. This, in turn, means they are vectors of a variety of viral, bacterial, and protozoal organisms that can cause morbidity and mortality in both pets and people. Wildlife hosts are the most common source of blood for many species of ticks, with the notable exception of *R sanguineus*, which feeds on dogs.[16] However, most ticks will readily feed on a pet or human.

Signs of Infestation

Attached ticks incite a local inflammatory response, causing pruritus, which can lead to irritation and, potentially, secondary bacterial infections. In addition, blood loss from ticks can become significant during heavy infestations. A few ticks feeding to capacity do not pose a threat to the host's blood volume. However, in environments with intense tick populations, an individual animal may acquire hundreds or thousands of ticks, and severe blood loss may result.[17] As with other forms of arthropod-induced anemia, such as flea anemia, smaller, younger animals are at a higher risk for mortality, but adult, immune-competent animals can also develop anemia if there are substantial numbers of ticks feeding simultaneously.

TICK SPECIES & HABITATS

A number of different tick species infest and transmit disease to dogs and cats in North America (**Figure 1**). Most of the tick species common in U.S. pets are ticks of wildlife that pets acquire when they enter habitats frequented by the hosts of the immature or adult stages.

Amblyomma americanum

Amblyomma americanum, the lone star tick, is commonly found on deer throughout the eastern two-thirds of the U.S. Larval, nymphal, and adult ticks that are actively seeking hosts, or questing, are present in wooded habitats frequented by deer and other wildlife hosts; pets or humans that enter these habitats during times of peak activity will encounter a virtually inexhaustible supply of these ticks.[18]

Ixodes scapularis

The black-legged tick or deer tick, *Ixodes scapularis*, has a similarly immense population in wooded regions; in areas where this tick dominates, nymphs and adults can sometimes be found on virtually every piece of vegetation. Rodents serve as the primary host for immature *Ixodes* species in many areas, but deer are a cornerstone species for the reproductively active adult ticks and support the overall population.[17]

Dermacentor variabilis

The American dog tick, *Dermacentor variabilis*, is very commonly encountered in natural outdoor environments, but prefers grassy, overgrown meadows or taller vegetation along trails. Because immature *D variabilis* feed on rodents while adults feed on medium-sized mammals, brush piles, agricultural structures, or other habitats that attract nesting rodents and hosts for the adults, such as raccoons, coyotes, or foxes, will see increased tick populations.[17]

Amblyomma maculatum

The Gulf Coast tick, *Amblyomma maculatum*, tends to feed on ground dwelling birds and rodents when immature; these ticks are often found in more open habitats than the wooded habitats of *A americanum*.

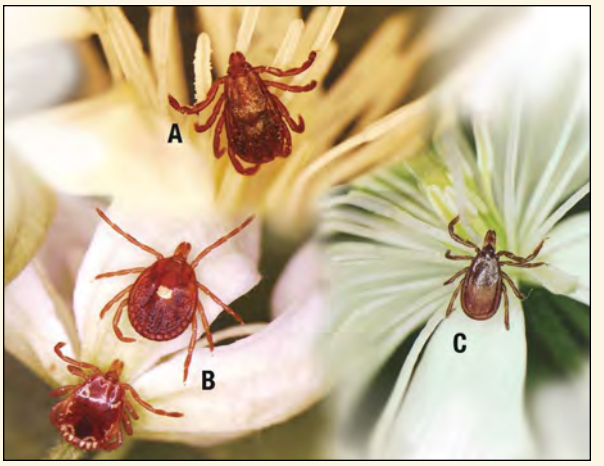

Figure 1. *Adult* Rhipicephalus sanguineus ***(A),*** Amblyomma americanum ***(B), and*** Ixodes scapularis ***(C)*** *ticks commonly attach to and feed on dogs not protected with an acaricide.*

Adult *A maculatum* prefer larger mammals, such as cattle, horses, or deer, but will feed on a dog or person if the opportunity arises.[19]

Rhipicephalus sanguineus

One notable exception to the rule of ticks being supported by wildlife hosts and acquired from natural habitats is the brown dog tick, *Rhipicephalus sanguineus*. This tick, also commonly known as the kennel tick, has the unique ability to thrive in the relatively low humidity found in most indoor environments.[15]

All life stages of *R sanguineus* have a strong preference for dogs, which means that infestations are invariably associated with the presence of dogs and

TICK SPECIES: LOCATION, HABITAT, & INFECTIOUS DISEASE

	U.S. Location	Habitat	Major Infectious Diseases
American Dog Tick *Dermacentor variabilis*	South central & southeastern regions	Grassy, overgrown meadows, taller vegetation, & brush piles/agricultural structures	Ehrlichiosis Spotted fever
Black-Legged/ Deer Tick *Ixodes scapularis*	Midwest, Northeast, south central, & southeastern regions	Wooded habitats with deer & rodents	Anaplasmosis Lyme Disease
Brown Dog Tick *Rhipicephalus sanguineus*	Nationwide	Indoor environments & areas frequented by dogs	Babesiosis Ehrlichiosis Hepatozoonosis Spotted fever
Gulf Coast Tick *Amblyomma maculatum*	Southeastern region	Open habitats with ground dwelling birds & rodents	Hepatozoonosis Spotted fever
Lone Star Tick *Amblyomma americanum*	South central & southeastern regions	Wooded habitats with deer & other wildlife hosts	Cytauxzoonosis Ehrlichiosis Spotted fever

CLINICAL SIGNS

Tick Infestation

- Pruritus
- Anemia

Tick-Borne Disease

- Lethargy
- Fever
- Myalgia
- Decreased appetite
- Discharge from nares or eyes
- Lameness
- Hematologic abnormalities
- Thrombocytopenia (rickettsial infections)
- Neutrophilia (canine hepatozoonosis)

absence of an effective, consistent tick control program. Because these ticks are found inside the home as well as outside in areas where dogs frequent, there is constant exposure risk and overwhelming infestations often ensue.[20]

Although *R sanguineus* prefers dogs, when home infestations exist, people are often bitten as well, resulting in potential disease transmission.[21]

INFECTIOUS DISEASE RISKS

Infectious Disease by Species

Ticks serve as vectors of potentially fatal pathogens.

- **Anaplasmosis & Lyme disease:** Both *Borrelia burgdorferi*, the causative agent of Lyme disease, and *Anaplasma phagocytophilum*, the cause of granulocytic anaplasmosis, are spread by *Ixodes* species ticks.[22]
- **Rocky Mountain spotted fever:** Spotted-fever group *Rickettsia* species, including *R rickettsii* (Rocky Mountain spotted fever), are vectored by numerous tick species, including those within the genera *Dermacentor*, *Amblyomma*, and *Rhipicephalus*.[23]
- **Babesiosis & hepatozoonosis:** Canine hepatozoonosis is spread by *A maculatum* and *R sanguineus*, the latter of which can also transmit the organisms responsible for babesiosis.[15,24]
- **Ehrlichiosis:** Several *Ehrlichia* species are transmitted by *A americanum*, *D variabilis*, and *R sanguineus*; novel Ehrlichia species have also been associated with *Ixodes* species.[23,25]
- **Cytauxzoonosis:** Cats are also susceptible to tick-borne diseases, with *A americanum* and *D variabilis* linked to transmission of *Cytauxzoon felis*.[26]

Clinical Signs & Disease

Tick-borne diseases often manifest with similar clinical signs regardless of the infectious organisms involved.

- Lethargy, fever, myalgia, and decreased appetite are common. Discharge from the nares or eyes, lameness, and hematologic abnormalities may also be seen.
- Thrombocytopenia is common with rickettsial infections, including those caused by *Rickettsia*, *Ehrlichia*, and *Anaplasma* species; profound neutrophilia is present in dogs with American canine hepatozoonosis.[23,24,27]
- The majority of tick-borne disease agents cause mild to moderate illness in infected hosts, but several, including *R rickettsii, C felis, E canis, A phagocytophilum,* and *B burgdorferi* can be fatal in pets, while *R rickettsii, A phagocytophilum,* and *E chaffeensis* are potentially fatal in humans.[23,26,28,29]
- Because ticks transmit multiple pathogens and dogs are often infested with numerous ticks, co-infection with multiple tick-borne disease agents is commonly seen and can result in more severe disease.[30,31]
- Vaccines are only available for *B burgdorferi* in dogs; preventing infection with other pathogens depends on strict attention to tick control.

PREVENTING TICKS & TICK-BORNE DISEASE

Ticks are a constant threat to pets and humans; however, effective strategies to combat ticks exist.

1. Acaricide Use

The first tier of tick control is routine acaricide use.

- To be effective, acaricides must be applied to the pets well before exposure to ticks.
- At present, all persistent acaricides available in the U.S. are topical formulations consisting of either solutions or collars formulated to allow slow release after application; efficacy may last for 30 days (topical liquids) or several months (collars).
- A number of approved acaricide or acaricide/repellent products for pets exist with proven efficacy

HOW TO PREVENT TICKS & TICK-BORNE DISEASE

1. **Acaricide use in pets well before tick exposure.**
   - Topical solutions
   - Collars
2. **Follow protocols for tick habitats.**
   - Apply repellents to humans.
   - Wear protective clothing.
   - Avoid areas heavily populated with ticks, if possible.
3. **Remove ticks promptly to prevent disease transmission.**
4. **Protect the home environment.**
   - Alter environment to make it less conducive to tick survival.
   - Have licensed pest control operators apply environmental sprays.

against a range of tick species.[32]
- Pyrethroid-based tick control products (eg, cyphenothrin, deltamethrin, permethrin, etc) have the added benefit of repelling ticks as well as killing them.[33]

2. Protocols for Tick Habitats

Repellents

People are advised to use repellents when in areas with questing ticks; recommended products include those containing DEET (N,N-Diethyl-meta-toluamide) and permethrin.[34]

Tick Habitat Avoidance

Recognizing areas to avoid, whenever possible, will decrease the overall number of ticks that have the opportunity to attach and feed. As discussed previously, some tick species prefer wooded areas, while others are found in more open surroundings. Tick numbers are often greater along deer trails and other areas frequented by wildlife hosts, and in areas where deer bed down.

Protective Clothing

When in an environment with a high tick population, light-colored long pants and sleeves are protective and allow ticks to be more readily seen. Tucking pant legs into boots and taping the juncture will limit tick access to skin, as will taping the waistband and cuffs of sleeves.

3. Prompt Removal

Even when repellents and protective clothing are used, people should check themselves and their pets for ticks frequently, especially after venturing into prime tick habitat, to insure attached ticks are promptly removed (see **Tick Removal Advice**).[35] The longer a tick is attached, the greater the chance for transmission of an infectious agent to the host.

4. Tick Control at Home

Control of ticks in the environment involves restricting habitat, limiting wildlife, and, in some cases, judicious application of environmental acaricides. Due to the intense management required, often these strategies are only employed in the area immediately surrounding the home and not on large acreages.

Tick-Scaping

Limiting the amount of ideal tick habitat involves tick-scaping, or altering the habitat to make it less conducive to tick survival.[36]
- Most ticks are very susceptible to desiccation; removing ground vegetation and leaf litter where ticks gather to maintain water balance will reduce the numbers that survive.[17]
- Edging the yard with rocks or gravel can also decrease the number of ticks that cross into the yard from adjacent wooded areas.[36]
- Exclusion of wildlife from the area immediately surrounding the home, where feasible, may limit the numbers of ticks that are seeded into the environment by natural hosts.
- Treatment of wildlife hosts can also be pursued: permethrin-treated cotton can be distributed to reduce tick numbers on rodent populations and 4-poster bait stations that apply acaricides to deer have been shown to reduce, albeit not eliminate, tick populations in limited areas.[36]

Environmental Sprays

Environmental sprays are also available and are best applied in a targeted fashion to an infested premise, focusing on the perimeter for ticks entering from the surrounding area or, in the case of *R sanguineus*, on specific locations where dogs spend most of their time. Due to potential toxicity associated with premise sprays, application by a licensed pest control operator is recommended when the interior of a home requires treatment.[36]

IN SUMMARY

Even when all methods discussed in this article are applied, complete eradication of ticks, particularly species that are commonly found on wildlife, is likely not achievable. Nonetheless, it is possible to reduce tick numbers to a manageable level, particularly if

TICK REMOVAL ADVICE

To remove a tick safely and with the least risk of injury or infection to yourself or the animal, use forceps or a tick tool to grasp the tick mouthparts as close to the skin as possible and apply steady, rearward traction.[35]

Once removed, save the intact tick for identification in a vial with ethanol or well-trapped in a piece of tape that is then placed in the freezer. If the person or animal develops signs of a tick-borne disease in the next few weeks, having this tick record may assist with prompt diagnosis and appropriate treatment.

When a dog presents with a large number of attached ticks, chemical removal using acaricides is likely the best option; complete manual removal in these cases is difficult to achieve, time consuming, and can be traumatic for the patient.

DO NOT

- To avoid breaking the mouthparts, do not quickly jerk or twist the tick out of the skin.
- Do not apply a lit match or harsh chemical to the tick in an attempt to encourage it to release as this can induce regurgitation in the tick, hastening transmission of pathogens.
- Do not crush the tick as this may result in exposure of people and pets to infectious material.

the pet owner employs a multimodal approach that focuses on routine treatment of animals, reduction of exposure, and habitat management. ■

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***Lindsay Starkey**, DVM, currently serves as the Bayer Resident in Veterinary Parasitology through the National Center for Veterinary Parasitology at Oklahoma State University. In 2012, Dr. Starkey received the AAVP/CAPC Graduate Student Award in Zoonotic Disease from the American Association of Veterinary Parasitologists, for her dissertational research, which focuses on ticks and tick-borne diseases. She received her DVM from Oklahoma State University.*

***Susan Little,** DVM, PhD, Diplomate ACVIM (Parasitology), is the Director of the National Center for Veterinary Parasitology at Oklahoma State University's Center for Veterinary Health Sciences, where she serves as Regents Professor and the Krull-Ewing Chair in Veterinary Parasitology. Her research focuses on zoonotic parasites and tick-borne diseases. She has been recognized for teaching excellence through the Pfizer (Norden) Distinguished Teaching Award (1999 and 2010) and the national Student AVMA Excellence in Teaching Award (1998 and 2005), and for her outstanding research through the Pfizer Award for Research Excellence (2012). Dr. Little received her DVM from Virginia Tech.*