

## **The Next Generation of Tick-borne Infections: emerging ticks and tick-borne diseases in dogs and cats**

Susan E. Little, DVM, PhD, DACVM-Parasit.

College of Veterinary Medicine

Oklahoma State University

The list of tick-borne diseases affecting dogs and cats is extensive and growing. Lyme disease, anaplasmosis, ehrlichiosis, Rocky Mountain spotted fever, babesiosis, hepatozoonosis, and cytauxzoonosis are all transmitted to pets by ticks; novel species of *Borrelia*, *Ehrlichia*, *Rickettsia*, and *Babesia* have been reported in recent years. In addition, a new tick (*Haemaphysalis longicornis*) has become established in the eastern US. This presentation will review the habits and biology of the most common ticks found on pets in the northeastern United States, explain disease associated with recently recognized pathogens, and describe effective control strategies to limit both tick infestations on pets and transmission of the growing number of tick-borne disease agents.

### **Tick Biology**

***Life cycle and development.*** All common ticks of dogs and cats in North America have a three-host life cycle with distinct larval, nymphal, and adult stages that feed on different individual animals. Feeding times vary for each stage and species of tick, but the same general pattern is evident. Larvae hatch from the egg clutch in the environment and then seek a host on which to feed. After feeding for 3-5 days, larvae detach and molt to nymphs in the environment. The nymphs seek a second host, often after a period of several weeks or months in the environment, and feed for approximately 5-7 days before detaching and molting to the adult male or female tick. Adult ticks will then seek a third host on which to feed and mate; unfed adults can also survive in the environment for several months. Adult feeding takes longer, with females staying attached for 5-14 days depending on the species, and males often remaining on the host much longer, feeding and mating intermittently.

***Important species.*** Several important tick species are present in North America and both diversity and intensity of infestations vary, sometimes dramatically, with geographic location and time of year. For example, the brown dog tick, *Rhipicephalus sanguineus*, is most common in the southern states but can be found on any premise with dogs. Severe, life threatening infestations can develop due to high populations of brown dog ticks in homes and kennels. Brown dog ticks live indoors and, in warmer areas, immediately outside kennels and homes with dogs.

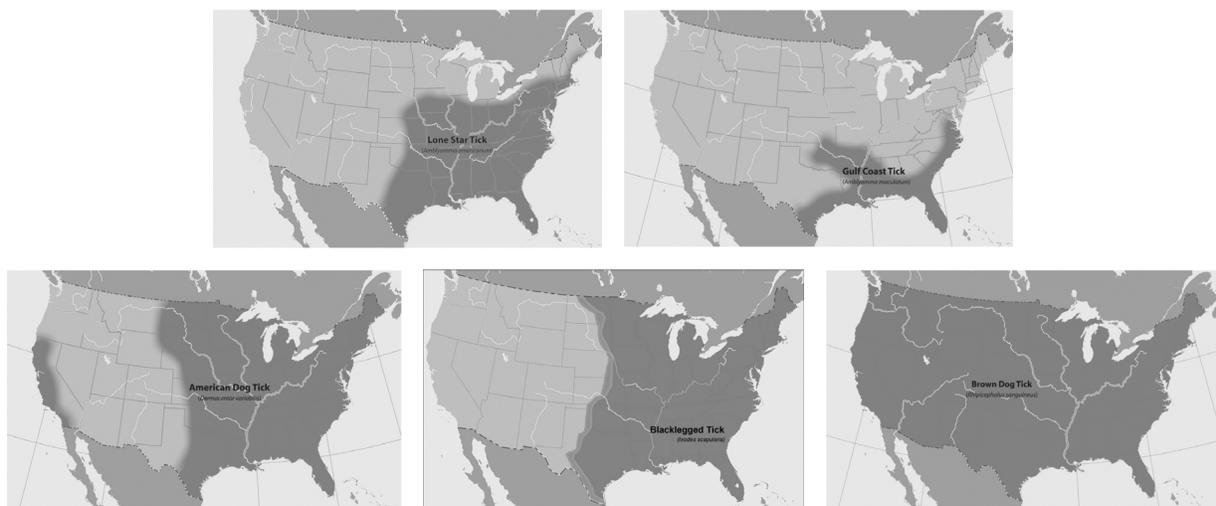
In contrast, the other tick species that commonly infest pets are found outside, sustained on wildlife hosts, and only incidentally infest dogs and cats. In open, grassy areas pets are more likely to encounter and become infested with *Dermacentor variabilis*, the American dog tick. Wooded areas often harbor *Ixodes scapularis*, the deer tick, or *Amblyomma americanum*, the lone star tick. In recent years, *Haemaphysalis longicornis*, the Asian longhorned tick, has become established on wildlife and domestic ruminants in several eastern states. Dogs that

travel with their owners may also present infested with other species, acquired days earlier in the western or central United States. Table 1 provides an overview of tick species important in the eastern United States.

**Timing of activity.** Ticks are active throughout the year, whenever temperature and humidity supports questing behavior of the different species and stages. Although ticks are commonly known to infest pets in spring and summer, adult *Ixodes scapularis* activity peaks in the fall and continues throughout the winter months; nymphs and larvae follow in spring and summer, respectively. *Amblyomma americanum* adults emerge early in the spring, as soon as weather begins to warm, with nymphs and larvae more commonly found in summer and early fall. *Dermacentor variabilis* adults begin questing late spring through summer. Immature *D. variabilis* prefer to feed on rodents and are rarely recovered from pets, but the winter tick (*D. albipictus*) has been increasingly reported domestic animals. *Haemaphysalis longicornis* is found March through October, with peak infestations usually described in May and June. Brown dog ticks can be found throughout the year; temperate populations peak in summer and tropical populations in fall.

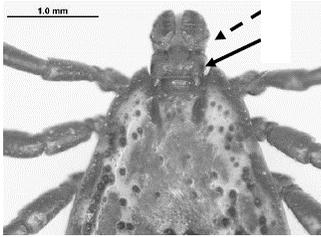
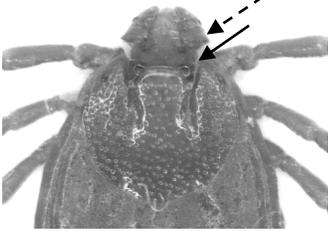
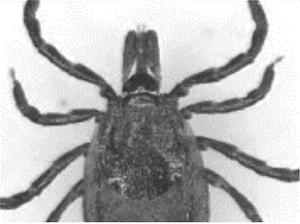
### Expanding geographic distribution

Tick populations vary by geography and are very responsive to environmental conditions. Due to ongoing shifts in habitat, reservoir host populations, and climate, as well as occasional point-source introductions, tick distribution is also changing and many species are now found thriving in areas where they were not previously recognized.



**Figure 1.** Distribution of common ticks of dogs and cats in the United States. From CDC.gov ([https://www.cdc.gov/ticks/geographic\\_distribution.html](https://www.cdc.gov/ticks/geographic_distribution.html)).

**Table 1.** Common tick species of dogs and cats in the northeastern United States.

| Tick species   | Habitat   | Diseases transmits   | Morphology  |
|--|---|--|---|
| <i>Amblyomma americanum</i><br>Lone star tick              | Wooded habitats with deer and ground-dwelling birds                                     | Cytauxzoonosis<br>Ehrlichiosis<br>Tularemia<br>Rocky Mountain spotted fever<br>Novel spotted fever<br>rickettsioses                                |    |
| <i>Amblyomma maculatum</i><br>Gulf Coast tick              | Open areas under tree canopy<br>Overgrown pastures                                      | Hepatozoonosis<br>Ehrlichiosis<br>Novel spotted fever<br>rickettsioses   |     |
| <i>Dermacentor variabilis</i><br>American dog tick         | Grassy, overgrown meadows, taller vegetation, & brush piles/<br>agricultural structures | Rocky Mountain spotted fever<br>Novel spotted fever<br>rickettsioses<br>Tularemia  |    |
| <i>Haemaphysalis longicornis</i><br>Asian longhorned tick  | Survive various habitats, including grassy areas and paddocks with high humidity        | None known in the USA  |   |
| <i>Ixodes scapularis</i><br>Deer tick,<br>blacklegged tick | Wooded habitats with deer & small vertebrates   | Lyme disease<br>Novel <i>Borrelia</i> spp.<br>Anaplasmosis<br>Powassan virus*<br>Babesiosis*   |   |
| <i>Rhipicephalus sanguineus</i><br>Brown dog tick          | Indoor environments & areas frequented by dogs, especially kennels and shelters         | Anaplasmosis<br>Canine babesiosis<br>Canine ehrlichiosis<br>Hepatozoonosis<br>Rocky Mountain spotted fever<br>Novel spotted fever<br>rickettsioses |  |

Arrow, basis capitulum. Dashed arrow, second palpal segment.

\*Clinical disease due to this pathogen from this tick only described in humans.

## The “new tick” — *Haemaphysalis longicornis*

In 2017, veterinarians and other scientists in the eastern United States recognized for the first time that the longhorned tick, *Haemaphysalis longicornis*, had become established in several eastern states. Historically found in Asia, and established in Australia and New Zealand, as of February 1, 2021, *H. longicornis* has now been identified from 124 counties in 15 eastern and Midwestern US states. Although this tick species is a serious pest of livestock and horses, to date, the tick has been most commonly reported from dogs, and travel of dogs with their owners provides a direct route of spread for the tick. The tick has also been found feeding on several cats. *Haemaphysalis longicornis* is unusual in that it can reproduce by parthenogenesis, a factor that may enhance establishment of new populations as introduction of a single tick can lead to large numbers of ticks in the environment in a short period of time.



**Figure 2.** Hosts infested with *Haemaphysalis longicornis* and current distribution of longhorned ticks in North America. From USDA Situation Report, February 3, 2021.

## Strategies to limit ticks and tick-borne infections

**Tick control products.** Administration of tick control products remains the cornerstone of protecting pets from ticks. A number of different tick control options are available for dogs and cats, including spot-on topical or transdermal formulations, long-lasting collars, and oral products. All are very effective at limiting the number of ticks acquired by pets, and several have been shown to dramatically reduce the risk of disease transmission (Table 2). A key factor predicting success with tick control is routine administration to the pet by the calendar regardless of whether or not ticks have been seen actively infesting the pet. Once ticks attach and feed, transmission of disease agents may have already occurred. Protecting pets with diligent attention to tick control also serves a public health role in that treated pets are much less likely to introduce ticks into the home.

**Tick habitat avoidance.** Recognizing areas to avoid, whenever possible, will decrease the overall number of ticks that have the opportunity to attach and feed. *Ixodes scapularis* and *A. americanum* prefer wooded areas, while *D. variabilis* and *H. longicornis* are found in more open surroundings and *R. sanguineus* often infests homes and kennels (see Table 1). For wildlife-associated ticks, the numbers are often greater along trails and other areas frequented by wildlife hosts, and in areas where deer or other wildlife bed down.

**Table 2.** Examples of tick control products shown to limit transmission of disease agents.

| Pathogen                         | Tick Vector                     | Host | Acaracide   |
|----------------------------------|---------------------------------|------|---|
| <i>Anaplasma phagocytophilum</i> | <i>Ixodes scapularis</i>        | Dog  | Sarolaner<br>Flumethrin / imidacloprid<br>Permethrin / imidacloprid                                   |
| <i>Babesia canis</i>             | <i>Dermacentor reticulatus</i>  | Dog  | Afoxolaner, fluralaner,<br>lotilaner, sarolaner<br>Flumethrin / imidacloprid<br>Permethrin / fipronil |
| <i>Borrelia burgdorferi</i>      | <i>Ixodes scapularis</i>        | Dog  | Afoxolaner, sarolaner<br>Flumethrin / imidacloprid<br>Permethrin / imidacloprid                       |
| <i>Cytauxzoon felis</i>          | <i>Amblyomma americanum</i>     | Cat  | Sarolaner / selamectin<br>Flumethrin / imidacloprid   |
| <i>Ehrlichia canis</i>           | <i>Rhipicephalus sanguineus</i> | Dog  | Fipronil<br>Flumethrin / imidacloprid<br>Permethrin / fipronil<br>Permethrin / imidacloprid           |

**Prompt removal of ticks.** Even when tick control products are used, owners should check their pets for ticks frequently, especially after venturing into prime tick habitat, to insure attached ticks are promptly removed. The longer a tick is attached, the greater the chance for transmission of an infectious agent to the host. Systemic products like the isoxazolines require ticks to feed to acquire the compound and so attached ticks are expected to be found although they will usually be dead.

To remove a tick, using forceps or a tick tool, grasp the tick mouthparts as close to the skin as possible and apply steady, rearward traction. Once removed, the intact tick should be saved or submitted 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. Ticks can be identified for no charge at Oklahoma State University ([www.ShowUsYourTicks.org](http://www.ShowUsYourTicks.org)).

### Suggested Reading

1. Saleh MN, Sundstrom KD, Duncan KT, Ientile MM, Jordy J, Ghosh P, Little SE. 2019. Show us your ticks: a survey of ticks infesting dogs and cats across the USA. <https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-019-3847-3>
2. Starkey LA, Little SE. 2012. Defeating ticks: practical tips for preventing tick-borne diseases in pets. Today Vet Pract Sept/Oct 40-44. <https://todaysveterinarypractice.com/defeating-ticks-practical-tips-for-preventing-tick-borne-disease-in-pets/>
3. Little SE, Braff J, Place J, Buch J, Kulasooriya B, Knupp A, Beall M. 2021. Canine infection with *Dirofilaria immitis*, *Borrelia burgdorferi*, *Anaplasma* spp., and *Ehrlichia* spp. in the United States, 2013–2019. Parasit Vector. 14:10. <https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-020-04514-3>