DEALING WITH TICK CONTROL
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PARASITOLOGY

Beyond Borders: The Truth About Ticks

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While often the same products that are used to combat ticks are used to combat fleas, there are substantial differences between flea and tick control. One of the major differences is in the number of species that confront pets. Although one predominant flea species infests dogs in North America—the cat flea *(Ctenocephalides felis)*—at least 10 different tick species may be encountered. There can be remarkable regional variability in the number and diversity of tick species that infest dogs.[1] Practitioners in Hawaii may only deal with one tick species infesting dogs (the brown dog tick, *Rhipicephalus sanguineus*), whereas practitioners in New Mexico may encounter 3 different species, in California 6 different species and in Kansas up to 7 different tick species. This wide diversity in tick species means that ticks are active at different times of the year, are associated with different reservoir hosts and carry and transmit different diseases.

Over the past few decades, the distribution and abundance of certain tick species in North America have changed.[1-4] Two of the best documented are *Amblyomma americanum* (lone star ticks) and *Ixodes scapularis* (black-legged or deer ticks).[2-4] Because both of these ticks are important vectors of human and animal pathogens, these changes in distribution and abundance have had a marked effect on both human and animal health. Various factors have contributed to tick population movement, including agricultural practice changes; reforestation; wildlife conservation, relocation and restocking; climatic fluctuations and decreased environmental pesticide application.

CHANGES IN TICK DISTRIBUTION AND ABUNDANCE

Amblyomma americanum

Several factors have contributed to the increased range of *A. americanum*, such as increased habitat and its wide host range that includes deer, small mammals, birds and humans. This tick is found most commonly in woodland habitats with dense underbrush. Substantial reforestation over the past century in urban and rural habitats has provided increased areas of habitat for white-tailed deer, and for survival and expansion of *A. americanum*. The white-tailed deer is considered a preferred host for *A. americanum,* and all life stages will feed on white-tailed deer.

It is well recognized that before, and in the early- to mid-19th century, white-tailed deer were numerous and widespread throughout North America. But throughout the 19th century, unregulated hunting, loss of natural predators, and extensive loss of habitat decimated deer populations. By the beginning of the 20th century, only an estimated 300,000 to 500,000 deer remained

in North America.[5] Then during the early- and mid-20th century, restrictions were placed on deer hunting, a number of states began restocking efforts and, combined with an increase in natural habitat, there was a marked resurgence in deer populations to an estimated 30 million by 2015. As deer expanded their range and increased their numbers, there was a corresponding increase in tick species closely associated with deer.[5] White-tailed deer populations are so important to the long-term survival of *A. americanum* that exclusion of deer produces a profound impact on this tick species' populations. Another host that utilizes similar habitats and is an excellent host for *A. americanum* larvae and nymphs is the wild turkey.[5]

Areas with a deciduous forest canopy and high white-tailed deer and wild turkey populations can have remarkably large populations of *A. americanum.* However, many other animals can be parasitized by this aggressive tick. Immature *A. americanum* stages can be found on a variety of ground-dwelling birds and numerous mammals, such as cats, coyotes, deer, dogs, rabbits, raccoons, red foxes, squirrels and humans. Adult *A. americanum* also feed on a variety of hosts, including cats, cattle, coyotes, deer, dogs, horses, raccoons, sheep and humans.

As *A. americanum* populations expand into new areas, seasonality of ticks found on dogs and cats can change. Nymphs are found from March through September, larvae are frequently encountered in the late summer into the fall and adults are often encountered from late February through early June.[5] Because all life stages can parasitize dogs and cats, this means that *A. americanum* could potentially be encountered on our pets 8 to 9 months out of the year.

A. americanum is considered a major vector of veterinary and human pathogens, including feline cytauxzoonosis (*Cytauxzoon felis*), *Ehrlichia chaffeensis* (human monocytic ehrlichiosis), *Ehrlichia ewingii*, Heartland virus, southern tick-associated rash illness (STARI, a Lyme disease–like infection), Rocky Mountain spotted fever (*Rickettsia rickettsii*), tularemia (*Francisella tularensis*), red meat allergy in humans and Bourbon virus.

Ixodes scapularis

I. scapularis (black-legged or deer tick) is widely distributed in eastern and central North America.[5-7] Its distribution is from Florida to Nova Scotia, west into far eastern Manitoba and then south through eastern Kansas into central Texas. Reasons for its expansion are very similar to those for *A. americanum*, including increased populations of its primary reproductive host (the white-tailed deer), reforestation, and climatic fluctuations.

Seasonal activity of *I. scapularis* varies by geographic region, but larval activity is generally highest in August and September. Larvae attach to and feed on a wide variety of small mammals, including chipmunks, mice and shrews. Larvae also feed on birds and lizards. The white-footed mouse (*Peromyscus leucopus*) is of particular importance in the tick life cycle and disease transmission because it serves as a good host for larval *I. scapularis* and is a major reservoir of *Borrelia burgdorferi*.

Immature ticks typically engorge for 2 to 4 days before dropping off to molt in moist, protected areas such as under leaf litter in forested habitats. Larvae overwinter and then molt to nymphs in the spring. Nymphs will feed for 3 to 4 days on a variety of hosts, including birds, cats, chipmunks, mice, opossums, raccoons, shrews, skunks, squirrels and humans. Nymphs are found primarily from May through July in the northern US and in Canada. Adults appear most commonly from October through December. Adults that do not find a host will quest again, typically from March to May. Adults feed for 5 to 7 days, primarily on white-tailed deer, but also on bobcats, cattle, coyotes, dogs, foxes, horses, opossums, raccoons, humans and other mammals.[5]

I. scapularis is a vector for *B. burgdorferi*, *Anaplasma phagocytophilum* (human granulocytic ehrlichiosis [HGE] agent; formerly *Ehrlichia equi*) and *Babesia microti* (humans).

CONCERNS WITH CURRENT TICK CONTROL MEASURES

Although recent pharmaceutical advances have been made in flea reproduction control, such advances in the area of tick control are lacking. With the exception of the brown dog tick, *R. sanguineus,* our ability to manage tick reproduction is limited, if not almost nonexistent. In most flea infestations, we have the opportunity to control flea reproduction by either killing fleas before they can reproduce or killing flea eggs. However, it is not just because we have effective residual insecticides, insect growth regulators or insect development inhibitors that we are successful. This success is also due in large part to the fact that we can

often target the primary reproductive host: the flea-infested dog or cat. And interestingly, failures in flea control often occur when flea-infested feral pets or flea-infested urban wildlife invade the owners' yards.

But when dealing with most 3-host ticks, the problem is that the majority of the reproducing ticks are not on the dogs or cats, but on their natural wildlife hosts. Because we are limited in our ability to manage ticks on wildlife, reinfestation of pets is a common occurrence, and protracted use of acaricides as preventives is routine in many areas.

Numerous studies demonstrate the high level of efficacy of the various acaricides, but the residual activity is rarely 100%, and the efficacy of products varies between and within species, even in the same laboratory. Evaluations of acaricides under natural or field conditions further illustrate that although efficacy is good, it is not 100%.

For instance, in a field efficacy trial conducted in Kansas, an imidacloprid (8.8% w/w)-permethrin (44.0% w/w) formulation was evaluated on dogs against naturally occurring populations of *A. americanum*. When dogs were walked in a naturally tick-infested environment, the 48-hour postexposure efficacy of the imidacloprid-permethrin formulation was 93.5%, 98.9%, 94.6%, 94.1% and 96.6% on days 3, 7, 14, 21 and 28, respectively, post treatment.[8]

Variation in product efficacy also occurs. In 2 studies conducted at Kansas State University, different results were found when evaluating the efficacy of acaricides against *Dermacentor variabilis* infestations in dogs from 2 different regions of the United States.[9,10] In the first study, the efficacy of imidacloprid-permethrin and fipronil–(*S*)-methoprene formulations was evaluated against a *D. variabilis* isolate from California. The 48-hour postinfestation efficacy on day 30 post treatment was 92.0% and 83.2%, respectively, for the imidacloprid-permethrin and fipronil–(*S*)-methoprene formulations.[9] In the second study, the 48-hour postinfestation efficacy on day 30 for the imidacloprid-permethrin and fipronil–(*S*)-methoprene formulations against a *D. variabilis* isolate from Oklahoma was 17.5% and 75.7%, respectively.[10]

Recently, a new class of insecticide/acaricide has provided the first orally administered approach to tick control. Afoxolaner, fluralaner and sarolaner are members of the isoxazoline class and work by inhibiting GABA and glutamate-gated chloride channels, leading to hyperexcitation and death of insects and arachnids.[11-13]

METHODS OF COMBATTING TICKS

Understanding Tick Ecology in Your Area

Because tick control can be extremely difficult and because ticks are vectors of a variety of bacterial and protozoal diseases, veterinarians should have an understanding of the ecology of the tick(s) encountered in the area in which they practice. Veterinarians need to be educated on the various aspects of tick ecology, disease transmission and control methodologies so they can then educate their staff and pet owners. CAPC, a leading parasitic content provider, offers client and staff education resources available at capcvet.org and petsandparasites.org.

Managing Pet Owner Expectations

Because 100% tick kill is rarely achievable, perceived efficacy of acaricides may be directly related to the numbers of ticks to which dogs are exposed. If a dog is treated with one of these highly efficacious acaricides and encounters just a few ticks, it is likely that all those ticks will be killed. However, if tick exposure is considerably larger, expect a few ticks to be observed on these dogs, and pet owners may perceive a lack of efficacy. Therefore, in areas where tick populations are increasing, the perception may be that the products are not as effective as they once were.

Pet owners often view tick infestations of their pets differently than flea infestations.[12] Whether this is because of concerns about tick-transmitted diseases or simply a phobia, the presence of a couple of ticks on the pet often elicits a more pronounced negative reaction than the presence of a couple of fleas. A 95% effective flea product may provide great client satisfaction, while a similarly effective tick product may be perceived as a failure. Therefore, it is not uncommon for label-recommended application of a product to not appear to control the problem. This result may be real or perceived, based on pet owner expectations of product performance. Given pet owner concerns, a need to reduce tick-borne disease and a lack of 100% efficacy, occasionally additional control measures are needed. If additional control measures are deemed necessary, pet owners need to be educated as to why such measures are necessary and notations made in the

pet's record before extra-label uses are conducted. Finally, restricting pet access from tick-infested environments may be necessary.

Incorporating Environmental Treatment

In some situations, especially in tropical and subtropical regions and in climate-controlled kennels, brown dog ticks (*R. sanguineus*) may infest buildings, with ticks crawling up walls and curtains and throughout the home or kennel. In these situations, acaricides may need to be sprayed indoors into cracks and crevices, behind and under furniture or cages and along walls and the ceiling. To minimize toxicity problems following application, the acaricide needs to be dry before animals or humans are allowed back into the premises.

CONCLUSION

The range and local density of certain tick species has increased in many areas. Whatever the factors responsible, it must be recognized that tick infestation may be much higher—and associated tick-transmitted diseases may be more prevalent—in some locations today than in the past. The increase in tick populations means that pets are encountering ticks more frequently, pets are exposed to more ticks per encounter and clients may be seeing more ticks on their pets. Because tick products do not kill or repel all ticks instantly, clients may get the false impression that the products are not performing as well as in the past. These situations necessitate that veterinarians set client expectations for tick control, before clients set unrealistic expectations.TVP

To see the references for this article, please visit **tvpjournal.com**.

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