



PESTS

That Affect Human Health

Entomology 363

Ticks and Tick-borne Diseases



Ticks are slow-crawling, wingless, eight-legged parasites that burrow their mouth parts into the skin of people and animals to suck blood. Once firmly attached, they are difficult to remove.

Ticks feed exclusively on the blood of animals (mammals, birds and reptiles). Ticks receive no sustenance from plants. However, habitats such as forest edges with mixed trees, grasses and other woody and non-woody plants often are heavily infested with ticks—such habitats offer food and cover for many kinds of animal hosts and favor tick survival by providing increased humidity and protection from direct sunlight.

Hard Ticks

Hard ticks are the group of ticks most Kansans are familiar with and readily recognize.

The entire body covering of the male hard tick is hardened. Juveniles and females have hardened plates only on the foreparts of their bodies and can swell to several times their original size during feeding. Some species have pale markings on the hardened parts of their bodies and on their legs. There are no contrasting color markings on juveniles of any species found in Kansas.

Hard ticks have four developmental stages: egg, larva, nymph and adult. They feed only once in each post-hatching stage, requiring five to 10 days to become engorged. Under natural conditions, a complete life cycle of the species found in Kansas requires at least one year. Adults of most species mate while the female is attached to the host animal. After mating and engorgement, females detach from the host, fall to the ground, digest the blood and produce several thousand eggs. The egg masses are deposited beneath soil debris. A few weeks later, tiny six-legged larvae hatch from the eggs and crawl onto vegetation and upward to await a passing host. People who come in contact with this vegetation can be infested by hundreds of the larval ticks (also called seed ticks).

After feeding on a host, the larvae descend to the soil where they metabolize their first meal, molt and become pinhead-sized, eight-legged nymphs. In most species, nymphs resemble adult females except for their small size and lack of contrasting

color markings. Nymphs again seek a host, feed, drop to the ground, molt and become adults.

Following is information on the tick species with implications for human health problems in Kansas.

American Dog Tick (*Dermacentor variabilis*)

American dog ticks are abundant throughout most of Kansas and the United States. Larvae and nymphs feed mostly on field rodents; adults parasitize many species of wild and domestic animals and humans. Adults are active from March through September. American dog ticks are vectors of Rocky Mountain spotted fever, tularemia and Q fever.

Lone Star Tick (*Amblyomma americanum*)

The species is named for the single, bright spot on the female's back. Lone star ticks, common throughout the eastern one-third of Kansas, are most abundant near brushy and wooded sites. All feeding stages suck blood from many kinds of wild and domestic animals, birds and humans. Their mouth parts are longer than those of the American dog tick—they feed more deeply and commonly cause more host skin reaction. Immediate (one- to four-day) localized inflammation should not be mistaken for the more delayed erythema migrans (bull's eye rash) that is a diagnostic sign of Lyme disease.

Lone star tick nymphs and adults are active from March through October. The larvae are present in Kansas from mid-June through early September. Adults and nymphs are vectors of tularemia, human monocytic ehrlichiosis and Q fever. Although there is controversy on the issue, evidence suggests that Lyme disease (or Lyme-like disease) in Kansas and southern states may be transmitted by lone star ticks.

Some populations of lone star ticks harbor rickettsiae that look like Rocky Mountain spotted fever (RMSF) rickettsiae but are a benign form. Further studies may determine whether some populations of lone star ticks harbor and transmit RMSF.

Brown Dog Tick (*Rhipicephalus sanguineus*)

The brown dog tick, native to Africa, has become well established in the United States. The American strain of brown dog tick has an almost exclusive host preference for dogs, but they sometimes bite people who are in close contact with infested dogs or who live in infested homes.

Brown dog ticks can transmit Rocky Mountain spotted fever and tularemia and are vectors of canine ehrlichiosis among dogs.

Unlike other hard ticks, brown dog ticks may become established as indoor pests. They commonly survive on outdoor dogs only as far north as central Kansas, although they occur in homes and well-protected kennels throughout the United States. Indoor infestations usually are not noticed until winter or early spring when large numbers of tiny ticks hatch from eggs laid indoors during the summer. Engorged females seek crevices in low sites in which to lay their eggs. Larvae and nymphs may crawl upward on walls and across ceilings.

Blacklegged Tick (*Ixodes scapularis*)

This species has no pale markings. It is present in wooded areas from eastern Texas to eastern Minnesota and eastward. A northern subpopulation of *I. scapularis* was described in 1979 as a new species, *Ixodes dammini*, commonly called the deer tick. Later, research proved *I. dammini* was the same as the well-known blacklegged tick, *I. scapularis*. Blacklegged ticks require high humidity and are closely associated with forests and dense plant life. The larvae and nymphs feed on many species of small mammals, birds, lizards and skinks. These juveniles are active mostly in May through mid-July. Adults seek hosts in September through November and are found on many animals but are most numerous on deer, cattle and horses. This species is abundant in only a few Kansas communities and seldom has been collected west of a line from Winfield (Cowley County) through Topeka and Atchison.

Blacklegged ticks are vectors of Lyme disease, Rocky Mountain spotted fever, human babesiosis and human granulocytic ehrlichiosis (HGE). The latter two diseases have not been diagnosed in Kansas.

Soft Ticks

Soft ticks, having almost no hardened areas on their bodies, resemble miniature bean bags. Most species reside in burrows or nests of their vertebrate hosts and often are associated with present or past structural infestation by bats, roof rats, wood rats (packrats) or pigeons. Unlike hard ticks, they feed several times in each life stage, feeding for a few minutes or hours while the host is at rest, then returning to the nest. A life cycle includes the egg, larva, several nymphal stages, and the adult. All stages of soft ticks may be present simultaneously, regardless of season.

Spinose Ear Tick (*Otobius megnini*)

This soft tick lives in arid regions of the western states including south central and the western one-third of Kansas. Larvae creep into the ear canals of their hosts and remain there through the nymphal stages. They are covered with spines, making them difficult to dislodge. The most common hosts are hooved animals but dogs and humans are occasionally infested. Spinose ear ticks are not known to transmit disease to humans, but they cause great pain and secondary infections of the bite site are common. Adults live on the ground and do not feed.

Other Soft Ticks (*Ornithodoros* species)

Ornithodoros turicata, the relapsing fever tick, ordinarily feeds on burrow-dwelling rodents, land turtles and rattlesnakes in the dry parts of southern Kansas. They sometimes bite humans, causing considerable pain and skin reaction, and may transmit relapsing fever.

Ornithodoros talaje has been collected from widespread sites within Kansas, usually in old buildings. This species feeds on rodents, bats, birds, snakes and humans. *O. talaje* is capable of transmitting relapsing fever, but it is not known to do so in Kansas.

O. kelleyi, normally a parasite of bats, occurs in Kansas and eastward. Occasionally, it bites people who live and work in bat-infested structures—especially if the bats have been excluded or eradicated and the ticks wander from the bat roost in search of a host. *O. kelleyi* has not been shown to transmit agents of human disease.

Tick-borne Human Diseases

Only a few dozen cases of all the tick-borne diseases combined occur in Kansas each year. However, all can be very serious and should be considered in diagnosing illnesses that show appropriate symptoms. Symptoms often are complex and some are shared by several diseases. This publication does not cover definitive diagnostic criteria.

Contrary to its name, **Rocky Mountain spotted fever** (RMSF) has been contracted in nearly every state of the United States. American dog ticks, blacklegged ticks and possibly other species transmit RMSF. The disease develops rapidly. From 3 to 5 percent of cases are fatal; fatalities usually are associated with delay in diagnosis and treatment.

Lyme disease in Kansas is most common in the eastern one-third of the state. Evidence suggests that Lyme disease in Kansas may be contracted not only from bites of the blacklegged tick (the primary vector in most of the United States) but also from lone star ticks. Many lone star ticks harbor spirochetes known as *Borrelia lonestari* that look like *Borrelia burgdorferi*, the species that causes Lyme disease. This newly named species may be the cause of Lyme disease in Kansas and southern states.

Lyme disease sometimes causes severe chronic debilitation but has rarely been fatal.

Relapsing fever is caused by any one of several other species of *Borrelia* spirochetes. It is vectored by various soft ticks but probably only by *Ornithodoros turicata* in Kansas. Only people who work or camp near dryland turtle or rodent burrows are likely to be bitten by this species. Bites from other vector species usually occur in relation to working or sleeping in caves or old buildings that have been infested by rodents or bats.

Tularemia is a bacterial disease that occurs throughout most of the world. Most hard ticks, some species of deer flies, and possibly other blood-sucking arthropods are capable of transmitting tularemia. The disease also may be contracted

through bites, scratches, or exposure to the blood of infected wild animals, cats and dogs. Incubation time, prognosis and fatality rates are similar to those for Rocky Mountain spotted fever.

Q fever rickettsiae are harbored by many species of ticks. Q fever is contracted through exposure to filth and dust contaminated by excreta of infected ticks, and via raw milk of infected cows or goats. People risk contracting Q fever in confined spaces infested by soft ticks or when handling pelts of animals that have been heavily infested with hard ticks.

Human monocytic ehrlichiosis (HME) destroys white blood cells known as monocytes. Lone star ticks are the primary vectors. Sometimes fatal, HME occurs mostly in southeastern and south central states, including Kansas.

Human granulocytic ehrlichiosis (HGE) attacks white blood cells called granulocytes and also may be fatal. Blacklegged ticks are the primary vectors. Most common in the northern Midwest and northeastern states, no cases of HGE have been diagnosed in Kansas.

Tick paralysis is caused by neurotoxins in tick saliva. Many species of hard ticks and soft ticks can cause tick paralysis. It is associated with prolonged attachment of ticks, especially along the spine or near the base of the skull. One tick can cause paralysis, but parasitism by more ticks increases the likelihood of paralysis. Small animals and children are more susceptible than large animals and adult humans. Recovery is usually rapid upon timely removal of the ticks, but death may result if paralysis progresses too far.

Tick Control Methods

Tick control is difficult and requires a combination of strategies.

Cultural Prevention

Keeping grassy and weedy areas clipped short exposes ticks to direct sunlight and drying, thus reducing tick survival. Short vegetation provides ticks with less opportunity to climb onto someone. Reduced cover reduces the number of rodents that juvenile ticks depend on, which also reduces tick numbers. In recreation areas, twigs and branches should be pruned back from trails so that they do not brush against hikers.

Spring burning of grasslands reduces rodent habitat and tick populations.

Pesticides Applied to Outdoor Areas

Pesticides that kill mites and ticks are referred to as acaricides. Outdoor tick control can be implemented on recreation sites, lawns and non-cropland. Be sure the specific situation for tick control matches the wording on the pesticide label. Do not treat pastures with acaricides. Keep spray or drift from contaminating food crops or grazing areas.

Acaricidal use is most successful when integrated with cultural control methods. Choose acaricides with lasting re-

sidual activity but that do not cause danger to human users of the site. Apply treatments when other people are not present; allow reentry only after the acaricide has dried. Do not treat areas that shed runoff into streams or lakes. Acaricides for outdoor tick control include carbaryl (Sevin), diazinon, chlorpyrifos (Dursban) and propoxur (Baygon). Additional products may be used by certified commercial pest control personnel.

Pesticides for Dog Sleeping Quarters and Kennels

Tick infestations often are present near the favored resting sites of pets, in dog houses, and on or under porches. Treat all cracks and crevices, high and low. Compounds registered for use in kennels include diazinon, DDVP, carbaryl, malathion, propoxur, pyrethrins and the pyrethroids: allethrin, cyfluthrin, cypermethrin, permethrin and resmethrin. Other products are available only to certified commercial pesticide applicators.

Pesticides Applied to Indoor Areas

For indoor infestations of brown dog ticks, treat along baseboards, window and door frames, and other such sites where these pests may be concealed. Eggs of brown dog ticks may hatch over a period of several months, so more than one treatment may be necessary. Products listed under “Pesticides for Dog Sleeping Quarters and Kennels,” plus several insecticides commonly used for control of cockroaches and indoor fleas, are registered for brown dog tick control indoors.

Pesticides Applied to Dogs and Cats

This group includes dips, shampoos, dusts and sprays of many of the chemicals listed in the previous paragraphs. Only use products with specific label directions for application to the animal species being treated. Dips containing amitraz (Mitaban) or permethrin (many trade names) are effective; a unique new chemical, fipronil (Frontline TopSpot) kills ticks on pets for up to a month after treatment. As with fleas, if tick control indoors and outdoors is to be effective it must be correlated with treatment of the pets.

Tick repellents for use on pets include pyrethrins and some permethrin products. Tick repellents and tick-killing collars seldom do a complete job. Daily hand-picking of ticks from your cat or dog is important if the animal frequents infested environments. Keeping ticks from becoming engorged on pets reduces the number of ticks close to home the following season.

Personal Protection

Behavioral Avoidance

Avoid unnecessary trips into tall grass, weeds and brushy and forested areas. Also, restrict pets from such areas. In tick-infested areas, seek open areas and trails. For resting, choose bare ground in a sunlit area.

Clothing as a Barrier

Long-sleeved shirts, close-fitting cuffs, high necklines and long trousers make it more difficult for ticks to reach bare skin. Once on your clothing, ticks climb upward, so upper clothing should be tucked into lower clothing—shirt into trousers, trousers into long stockings or boot tops. Increase protection by taping sock tops over pantlegs with wide tape and apply a second layer of tape with the sticky side out to trap crawling ticks. Light-colored clothing helps you see and intercept ticks before they reach skin.

Repellents for Use on People

Repellents should not be used on young children. Do not allow repellents to be inhaled or come in contact with eyes, nostrils or mouth. Apply repellent to clothing from the ankles to the knees and around the beltline. The active ingredient in most commercial repellents is N, N diethyl-meta-toluamide, often called Deet. Deet repels ticks for only a few hours. Repellents containing 0.5 percent permethrin (e.g., Permanone Tick Repellent, Coulston's Duranon Tick Repellent, Cutter Outdoor Gear Guard Insect Repellent) can be sprayed outdoors onto clothing and allowed to dry outdoors before wearing. Treated clothing is a repellent to ticks through three or more ordinary launderings. Permethrin-based repellents should not be applied to skin, but they are recommended for outer clothing of people who must spend a lot of time in tick-infested sites. Dusting sulfur is effective but messy and, with perspiration, causes an undesirable odor.

Personal Inspection

After coming from tick infested areas, remove your clothes and inspect yourself for ticks. Children need help searching themselves. Larval and nymphal ticks may be mistaken for freckles or small scabs, so look carefully. Family members, even infants, who have not been outdoors are sometimes bitten by ticks carried in by others; so they, too, should be checked for ticks. Ticks that are removed within a few hours are unlikely to have transmitted disease.

Inspect the clothing or immediately wash it so ticks can't crawl out of it onto other clothing, furniture or carpets. Leave camping gear and bedrolls outside until well inspected.

Tick Removal

To remove an embedded tick, place fine-tipped tweezers close to the skin, grasp its "head" and pull (gently and patiently) directly away from the skin surface. Never twist or pull sideways. **Do not** try to make the tick back out with heat, petroleum jelly or irritants. Such methods only work when the tick is not securely attached. A deeply attached tick is anchored not only with a mouthpart that has microscopic, recurved teeth, but also with a cement-like substance. Only when the tick is full does it produce a salivary component that dissolves the cement and allows it to withdraw. Irritants or smothering agents may cause a tick to regurgitate, which increases the likelihood of disease transmission and secondary infection. **Do not** squeeze the tick's body, as you may squeeze its gut contents into the skin, causing infection.

Disinfect the tick bite. Save ticks removed from humans in alcohol with the date and the victim's name on the container. Use a different container for each person and for each bite occasion. Be especially watchful for flu-like illness, headache, lack of balance, nausea, extreme fatigue, skin rashes or fever for the first 10 to 14 days after the tick-bite incident. If such symptoms develop, see a physician and take the tick(s) with you to the appointment. The identity of the tick may help determine which diseases should be considered in making a diagnosis. The doctor may identify the tick, or you can take it to your local K-State Research and Extension office and have it sent to the K-State Insect Diagnostic Laboratory.

Acknowledgments

Helpful suggestions were made by manuscript reviewers, Richard A. Miller, Johnson County Extension Director; Jack F. Cully, Jr., K-State Wildlife Biologist; and Patsy E. Mock, the author's patient wife. Special appreciation is expressed for the work of Anna Barrett, K-State Research and Extension Editor.

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

Publications from Kansas State University are available on the World Wide Web at: <http://www.oznet.ksu.edu>

Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. In each case, credit Donald Mock, Ticks and Tick-borne Diseases, Kansas State University, April 1998.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

MF-2335

April 1998

It is the policy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service that all persons shall have equal opportunity and access to its educational programs, services, activities, and materials without regard to race, color, religion, national origin, sex, age or disability. Kansas State University is an equal opportunity organization. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, Marc A. Johnson, Director.

File code: Entomology—4

4-98—6M