

# MAINTENANCE GUIDEBOOK VII TERMITE, INSECT, AND RODENT CONTROL

## CHAPTER FOURTEEN - TICKS

### SECTION A GENERAL

Ticks feed on the blood of only mammals, birds, reptiles, and amphibians. One way in which ticks differ from mites is that ticks are larger and have recurved teeth or ridges on the central mouthparts (called the holdfast organ). They also have, on each of the first pair of legs, a sensory pit which detects stimuli such as heat and carbon dioxide. Ticks also detect light and dark as well as shapes, shadows, and vibrations—all stimuli that help them find their hosts.

There are two types of ticks: soft and hard. Soft ticks feed on hosts that return periodically to a nest, shelter, cave, or coop. Hard ticks are found on pets, cattle, wildlife, and people. Campers, hikers, and hunters are sometimes hosts for hard ticks. Worldwide, there are over 650 species in this group.

Some ticks live their entire lives on one host, while others spend only their larval and nymphal stages on a single host, then drop off as an adult to find another host. Most ticks, however, have three hosts, one for each stage.

#### 1. LIFE CYCLE

##### a. Seed Ticks

Normally, thousands of tiny larvae hatch from a batch of eggs and crawl randomly in the surrounding area; larvae (or seed ticks) have only three pair of legs. Some attach to a small mammal or lizard, and suck blood. Their feeding (or engorgement) time lasts for hours or a day or so, since they are small. The host may distribute them while wandering away from the site of the initial encounter. When the engorged seed ticks drop off, they are still usually in or near an animal run.

##### b. Nymph

After molting, engorged nymphs, now with four pair of legs, climb grass leaves or a plant stem. Ticks climb progressively higher as they develop, so that different stages reach different layers of vegetation. Because of this, developing ticks find larger hosts than they had during the previous stage. After several days of feeding, engorged nymphs drop off the host and molt.

### c. Adult

Adults climb vegetation, stretch their front pair of legs, and wait for vibrations or a shadow announcing a nearby host. Ticks sometimes wait for months or more for a suitable host. If heat or carbon dioxide is detected (for instance, from a feeding mouse), the tick will seek it out. As the host passes by, claws located at the tips of the tick's legs grab hold of the host, and the tick moves to a place where it can engorge.

## 2. ATTACHMENT AND FEEDING

Adult female hard ticks will feed from several days to more than a week. Ticks usually grasp human hosts from a point close to the ground and crawl upwards until they reach tight clothing or the head. On wild mammals or pets, they move until they reach the highest point on the host, the head or ears.

The tick's ability to creep undetected is matched only by its ability to attach for feeding without the notice of the host; stealth keeps ticks from being scratched off by the host before they can attach. The tick slides its pair of slender teeth painlessly into the host's skin, and feeding attachment begins. Female feeding may take a week or more, or in the case of human hosts, until the tick is discovered. When feeding is complete, the engorged female drops off of the host, lays eggs, then dies. Male ticks are on the host only to mate with the female. They do not enlarge greatly or feed much. They sometimes pierce and feed on engorged females. In one species, this is the only way males feed.

## SECTION B TICK RECOGNITION

### 1. BROWN DOG TICK

The brown dog tick, *Rhipicephalus sanguineus* (Fig. 14-1), is the most urban of the pest ticks in the U.S. whose only host is dogs. It lives outdoors year round in the southern states, but in the rest of the country it cannot live outdoors in winter.

Adult ticks are about 1/8 inch long and dark red-brown, differing from the other pest ticks that have a red-and-black or white-and-brown color variation. The engorged female becomes a dark blue-gray because of her blood-stretched abdomen.

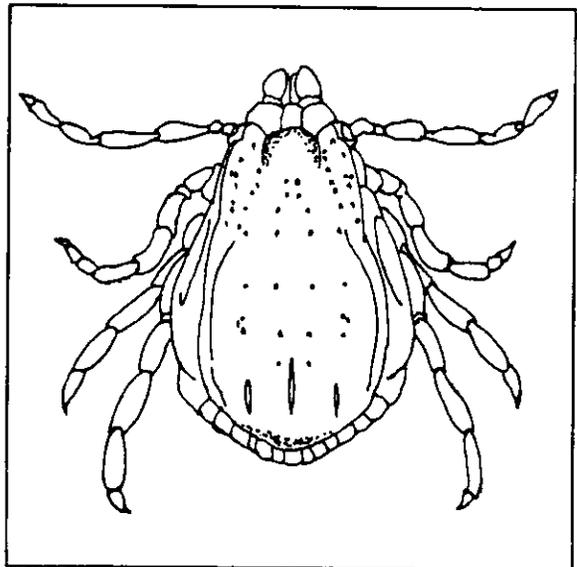


Figure 14-1

Up to 4,000 eggs can be deposited by the female. When the eggs hatch outdoors, larvae climb vegetation; inside they climb walls and furniture. The larvae, nymphs, and adults return to the dog to feed; they do not bite people. If they do not find a host, they can easily wait more than six months without feeding. After each engorgement, the tick drops and crawls to a crack where it molts. After a generation or two, ticks can be found at all stages, hiding, molting, or seeking a host. One to four generations can be produced each year, depending on the availability of hosts and temperature.

#### a. Infestation

Residences and yards can be infested by the visit of an infested dog that drops mated, engorged female ticks. Dogs can pick up ticks outdoors when taken to an infested kennel or home. Female ticks will drop off indoors, lay eggs, and their larvae will emerge in late fall. Tick infestations indoors are likely to be by brown dog ticks. Brown dog ticks usually drop off when the dog is sleeping, so its sleeping areas will most likely be infested.

## 2. AMERICAN DOG TICK

Larvae and nymphs of the American dog tick, *Dermacentor variabilis* (Fig. 14-2), prefer small rodents, especially *Microtus*, the short tailed voles, called meadow mice. The adults, which are slightly over 1/8 inch long, are found on dogs and people. The adult female is brown with a pearly light anterior dorsal shield. Males are brown-backed with pearly streaks. Both sexes have eyes, or unpigmented light-receiving areas, at the edges of the shield.

With a favorable food supply, American dog ticks can complete their life cycle in three months, with the female laying up to 6,500 eggs in late summer.

Warm springs promote early adult and larval activity and egg-laying.

Adult ticks usually contact people on the lower extremities and crawl upwards until they are stopped by constricting clothing, such as belts or underclothing. Loose clothing allows ticks to proceed as far as the head. Because of possible communication of Rocky Mountain Spotted Fever (RMSF), any tick attachment should be noted and the victim observed for symptoms.

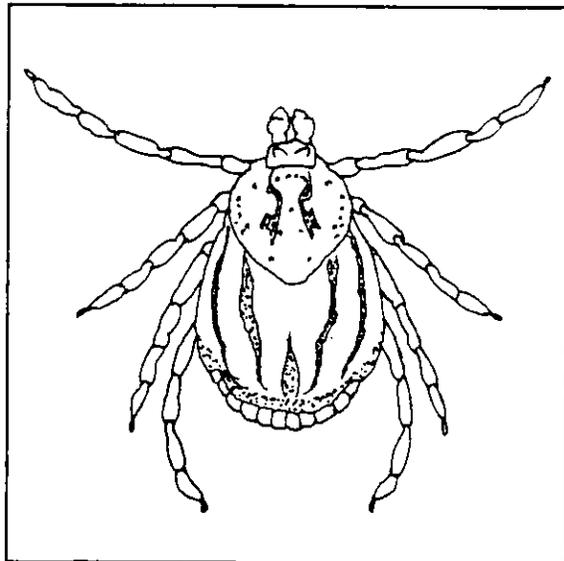


Figure 14-2

### 3. LONE STAR TICK

The Lone Star tick, *Amblyomma americanum* (Fig. 14-3), lives in the southeastern quarter of the United States, from Texas to Missouri and east to New Jersey. It attacks birds and wild and domestic mammals, as well as people.

Females are brown with a white spot in their center (the Lone Star); males are mottled brown without a white spot. Both sexes have pigmented eyes at the front lateral edges of the scutum. Females often produce more than 6,000 eggs.

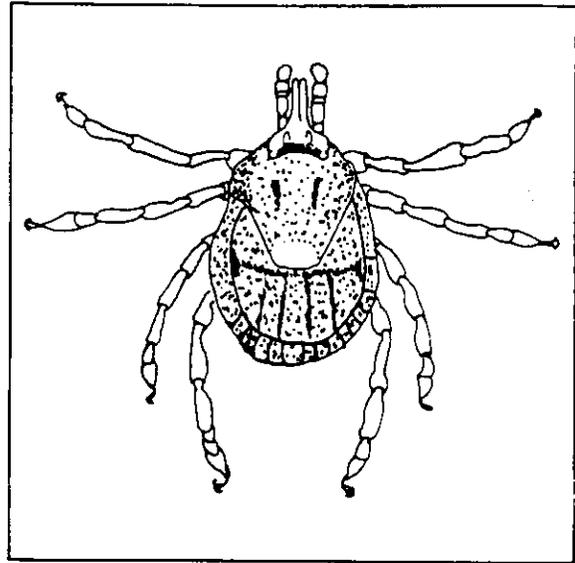


Figure 14-3

Although it is rare, people may be infested by all three stages of the Lone Star tick while inadvertently sitting or laying on an aggregation of larvae. However, the larvae do not attach, so they can be showered off. When found on people, the ticks should certainly be removed and noted in case RMSF symptoms develop.

### 4. DEER TICKS

Deer tick (*Ixodes*, Fig. 14-4) larvae are very small. Nymphs are close in size to the adult, a little less than 1/16th inch, or the size of the head of a pin. Adult deer ticks are the size of a sesame seed. Deer ticks have a two-year life cycle and utilize three different hosts.

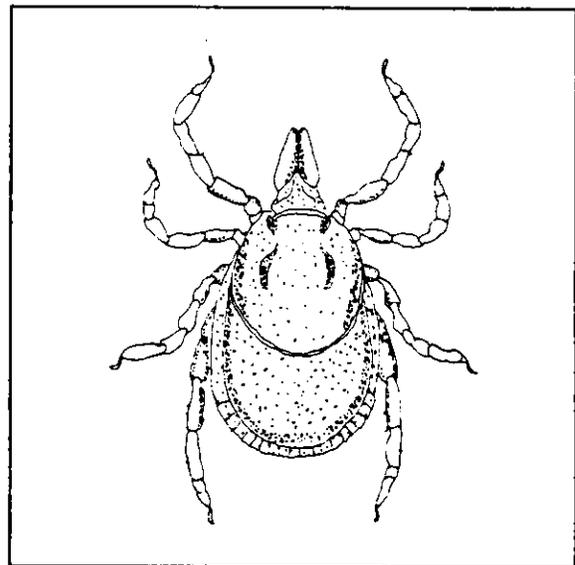


Figure 14-4

#### a. Eggs and Larvae

Eggs of the deer tick are laid in the spring by overwintering females. Tiny larvae hatch and feed on white-footed mice and other mice in the late summer. Larvae can feed on human beings, but will not transmit Lyme disease.

After overwintering, larvae molt into the nymphal stage the following spring.

## b. Nymphs

Nymphs are ready to feed in May and June. The body of the nymph is tan with black legs and a black shield (scutum) near its front. Nymphs climb vegetation and attach to passing animals such as dogs, cats, horses, cattle, raccoons, opossums, mice, migrating birds, and people.

Nymphs live in woodlands: bushy, low-shrub regions and grassy areas where they can infect animals and people. **Most human Lyme disease cases are the result of nymphal tick feeding.** The remainder is due to adult activity. Nymphs usually molt into the adult stage in late summer, although they sometimes overwinter and molt in the spring.

## c. Adults

The body of the adult female is brick red with black legs; she has a black shield (scutum) in the front. The male is entirely dark and smaller than the female. Adults feed in late fall or spring, as well as on warm days in winter. Hosts of the western blacklegged tick are dogs, cats, sheep, horses, cattle, and deer.

## SECTION C TICKS AND DISEASES

Several species of hard ticks are responsible for the spread and increase of Lyme disease and the persistence of Rocky Mountain Spotted Fever (RMSF). HA pest managers should be familiar with Lyme disease and the *Ixodes* ticks that transmit it.

The urban population in the U.S. is increasingly at risk from tick-borne diseases for the following reasons:

- Reversion of farmland to scrub vegetation;
- Continuous incorporation of rural land into urban population centers;
- Frequent travel to rural areas;
- Wildlife populations, hosts for tick-borne disease, are increasing in both rural and urban areas.

Ticks are successful parasites and transmitters of diseases because:

- They are persistent bloodsuckers; they attach and hold on.
- Long feeding periods give time for infection and extend the distribution time.
- Species have a wide host range. Initially ticks feed on small hosts, later on larger hosts; most can take three different hosts. They primarily feed on mammals, but also on birds and reptiles.
- They have a tremendous reproduction potential and lay several thousand eggs.
- Eggs of some disease-carrying ticks also carry the disease.
- They have few natural enemies. Only two species of wasps parasitize hard ticks.

## 1. LYME DISEASE

Lyme disease is caused by a spirochaete (spiral-shaped) bacteria. Symptoms vary and may resemble other diseases; many cases go undetected. The first indication of a potential infection may be the discovery of an attached tick. **Disease transmission does not occur for an estimated 10-12 hours after feeding begins; if the tick is located and removed within that time, no infection will occur.**

Usually, within seven days (from three to 32 days) after disease transmission, a rash appears which looks like a red, expanding ring with a clear spot at the center of the bite. It is not uncommon to find the rash, which is called erythema cronicum migrans (ECM), at multiple sites. It may burn or itch, but it disappears within three weeks, with the possibility of recurring.

Other skin symptoms may be hives, redness of cheeks under eyes, and swelling of eyelids with reddening of the whites of the eyes. Flu-like symptoms may accompany the skin symptoms—high fever, headache, stiff neck, fatigue, sore throat, and swollen glands.

A second set of symptoms occurs in untreated patients four to six weeks after transmission. Over half of untreated victims experience an arthritis of the large joints (primarily the knees, elbows, and wrists) intermittently or chronically.

A few experience neurological effects, including severe headache, stiff neck, facial paralysis, weakness, and possibly, pain in the chest or extremities; these symptoms may persist for weeks. In some cases, heart block may occur.

Dogs can also acquire Lyme disease, since they forage in tick habitat and become infected. Diagnosis of the disease in dogs in the area is a harbinger of human cases to follow. Symptoms in dogs include sluggishness and lameness.

### a. Responses to Lyme Disease: Education

The seriousness of this disease warrants instruction of residents by HAs that there are no easy or effective control measures, and that the following risks should be taken seriously:

- Children are at the highest risk from encountering infected ticks at play grounds, parks, and other areas where mice live. Children are not as sensitive to finding ticks on themselves as are adults.
- The second risk group consists of adults, especially grounds and outdoor maintenance workers, whose occupations place them in tick habitat.

## 2. ROCKY MOUNTAIN SPOTTED FEVER (RMSF)

RMSF is caused by a rickettsia, a disease organism related to bacteria. It is an acute infectious disease characterized by pain in muscles and joints, fever, and spotty, red skin eruptions. **At least four to six hours elapse after the American dog tick begins feeding before disease transmission begins. If ticks are removed during this noninfective period, infection will not occur.**

Rash on wrists and ankles, the most characteristic and consistent symptom of RMSF, occurs on the second to fifth day after infection. Often aching in the lower back and headaches around the head and eyes will also occur. Victims feel very tired and can run fevers of 104-106 degrees F. Less obvious symptoms may not be noticed.

## 3. TICK PARALYSIS

All species may cause tick paralysis if they feed at the base of the victim's skull for extended periods. Symptoms include paralysis of the arms and legs, followed by a general paralysis which can cause death. The victim can recover completely in a few hours, after the tick is removed. Tick paralysis is mainly reported in the western United States, but may occur wherever ticks are found.

## 4. DISEASE-CARRYING TICKS

Deer ticks, or *Ixodes*, carry Lyme disease. This genus of ticks contains the greatest number of hard tick species which transmit diseases. The northern deer tick, *Ixodes dammini*, is the carrier (called a vector) of Lyme disease in the eastern United States. Its counterpart in the South is the blacklegged tick. In the West, the common vector is *I. pacificus*. There are many other *Ixodes* in the United States.

The American dog tick, *Dermacentor variabilis*, is the vector of Rocky Mountain Spotted Fever in the eastern and central United States, and the Pacific coast. The Rocky Mountain wood tick, *Dermacentor andersoni*, which closely resembles *D. variabilis*, is found in the Rocky Mountain states, Nevada, eastern California, Oregon, and Washington. This tick was the original vector of Rocky Mountain Spotted Fever.

The Lone Star tick, *Amblyomma americanum*, ranges in the southeastern quarter of the United States from Texas to northern Missouri and east to New Jersey. The Lone Star tick can transmit Rocky Mountain Spotted Fever, but it is not as important as the previous two species of *Dermacentor*.

## **SECTION D TICK PEST MANAGEMENT**

Where pest-management services are provided to an HA development, it is important to know what kinds of ticks are present, where they are most numerous, what the disease potential in the area is, and what the host and reservoir populations are. Pest-management programs are critical for effective management of tick species that transmit Lyme disease or Rocky Mountain Spotted Fever.

### **1. INSPECTION AND MONITORING**

#### **a. Dragging**

A commonly used method of off-host sampling involves dragging a white cloth over the ground or foliage where ticks are questing for passing hosts. Ticks cling to the cloth, and can be removed for counting and identification. An easily-constructed "drag" consists of a 3 x 4 foot sheet of white muslin or flannel, hemmed on all edges, weighted at one end, and attached to a wooden pole at the other. A rope attached to each end of the pole allows the apparatus to be dragged across the desired sampling site. Selection of the sites to be sampled may have great effects on the efficiency of collection. Lone Star ticks are likely to be found in shaded areas of high humidity, while American dog ticks are most often encountered along roadways and animal runs. Sample sites should represent favored tick habitats, and sampling should be done under conditions favoring tick presence (when vegetation is not wet, and when temperatures are above 50 degrees F). All stages of ticks will attach to the flannel. A University Extension Service office, located in each county, can assist in the identification when necessary.

#### **b. Dry Ice (CO<sub>2</sub>) Collection**

This technique is nondestructive to small animals, requires no human "attractants," and appears to give more reproducible results than the drag technique. This simple technique involves placing a half-pound block of dry ice in the center of a 2 x 3 foot panel of white polyester cloth on the ground at the chosen sampling site for a predetermined period. Dry ice is available from most beverage and ice cream stores. The sampling sites should be selected in areas favoring ticks which are likely to receive heavy visitation. After one hour, ticks on the top side of the panel are collected and can be counted.

A conscientious monitoring program is the basis of effective IPM. Regular surveys should be conducted at all sites where ticks have been reported, and at other locations which appear to be favorable tick habitats. Records of sample sites and methods should be kept so that the progress of tick populations and the effect of control measures can be gauged. The records may be

supplemented by the following information:

- Local veterinarians are the first to see Lyme disease cases in an area. Positive disease diagnosis in dogs is a clear signal that human cases will follow.
- Inspect units, especially rooms where dogs sleep, under the edge of rugs, under furniture, in cracks around baseboards, window, and door frames.

## **2. HABITAT MODIFICATION**

Advise residents to:

- Check pets regularly for ticks.
- Treat pets using pesticidal dips, washes, or dusts. Do not let small children play with dogs that have been recently treated.
- Wash dog bedding frequently.
- Keep in mind that the effectiveness of flea and tick collars is variable.
- Keep grass cut short around buildings and fences. Mow on both sides of fences.
- Keep stray dogs out of the yard.

### **a. Outdoor Areas**

- Dense shrub or tree cover or tall grass provides harborage for animal hosts of ticks, and protects ticks from the loss of body fluids due to drying winds and direct sunlight. Removal of excess brush and shrubbery, and clearing of overstory trees so that approximately 50 percent of a development is exposed to direct sunlight are recommended. Grass should not be allowed to grow more than six inches high, to allow ventilation and illumination of soil. Chemical tick control is rarely needed when vegetation control is practiced.
- Inspection of the development should be performed regularly to determine when management techniques should be conducted.
- Basic principles of animal-tick management include isolation of susceptible animals from known tick populations.

### **b. Indoor Areas**

Methods of nonchemical indoor tick management include regular inspection, elimination of animal harborage areas, food- and waste-handling procedures which eliminate possible animal harborage and entry, and animal-proofing of each building. The latter includes sealing of all holes in foundations and walls, and screening with heavy-gauge metal screen above-ground windows, vents, and other openings through which animals may enter.

Recommended practices also include frequent examination of clothing (preferably by another individual) and the body (after showering), and the destruction of collected ticks.

Periodic surveys of potential or known habitats can reveal the presence of low-level tick infestations, and the need for application of management procedures (such as habitat modification described in Section D-2) to prevent or retard further population increase. A recommended action threshold is based on the CO<sub>2</sub> (dry ice) sampling technique described in Section D-1 above. A count of two ticks per three hours of CO<sub>2</sub> exposure is considered the action threshold for tick management, although this value may not be applicable to every situation. Actions should be taken (such as habitat modification) to keep tick populations below the selected action threshold.

### 3. PESTICIDE APPLICATION

A new control measure using permethrin-treated cotton balls in cardboard cylinders has been reported to reduce tick populations. White-footed mice use the pesticide-treated cotton as nesting material, and although the pesticide does not harm them, it kills their tick parasites. This device, marketed as Damminix, should be placed within the reach of female mice, to catch larvae and nymphs in an early stage of their life cycle.

The HA's pest manager can utilize these techniques:

#### **Inside:**

- Use crack-and-crevice pesticide applications where ticks hide.
- Treat under the edge of rugs, under furniture, in cracks around baseboards, windows, door frames, and in dog boxes.
- **Do not allow pets or children in the treated area until it is dry.**
- Fogging for ticks is useless.

#### **Outside:**

- Spray or dust affected areas using pesticides labeled for that treatment.
- **Do not allow pets or children into the treated area until it is dry.**

Pesticide sprays are most effective when applied to the sides of paths.

- Spray low vegetation, including low shrubs, thoroughly.
- Mow around weedy fences that provide cover for rodents moving in from nearby woodland edges. Spray at their base.
- Use herbicides to control weeds where mowing is impossible. Broad application of pesticides to mowed grass does not reduce tick populations because white-footed mice do not infest lawns.
- Dust rodent runs or burrows in areas where human traffic cannot be controlled and where there is a danger of disease transmission.

To control ticks on pets:

- Use insecticidal dips, washes, or dusts, which may be obtained at pet counters or from veterinarians. Dogs should be protected if they roam in tick habitat.
- Advise that all uncontrolled or ownerless dogs be regulated.
- Use of flea and tick collars has variable results.
- Cats do not appear to be at risk from Lyme disease nor are they hosts for RMSF vectors.

**a. Follow up**

It is important that residents know that dogs should be protected even after treatment, since eggs can take thirty days to hatch. Advise residents that brown dog ticks do not bite humans and will therefore **not transmit a disease**. The fear of Lyme disease can drive a desire for overkill; explain that the brown dog tick does not spread Lyme disease.

Continued monitoring and record-keeping is important. Tick counts should be reviewed annually to evaluate and adjust the pest-management program. Educational programs and materials for at-risk groups are vital.

**b. Precautions for At-Risk Group Members**

- Wear long pants tucked into socks while working or hiking in tick habitat.
- Use insect repellents on clothes and skin. Do not use formulations with over 20-30 percent active ingredient on skin.
- Use permethrin formulations that are labeled for use as a repellent on clothes; they withstand washing and remain effective. Those sensitive to chemicals should not use this method.
- Schedule regular body inspections for ticks at noon and at bedtime.
- Nymphal deer ticks are small, but they can be seen with close inspection. Larval deer ticks cannot be spotted easily, but they are not disease carriers.
- Only adult American dog ticks infest people or dogs.

**c. Tick Removal**

Regular inspection, location, and early removal of ticks prevents disease transmission. To remove feeding ticks, dab them with alcohol. If feeding has just started, and mouthparts are not cemented in, ticks sometimes pull their mouthparts out. If they do not release in a few minutes, take tweezers, grasp the tick at the skin level, and pull steadily until the tick is removed. Grasping the tick by the back end, or heating it, can force disease organisms into the wound. Place the tick in alcohol or otherwise keep it for identification. If the mouthparts are left in the skin, they will not

transmit the disease, but the wound should be treated with an antiseptic to prevent secondary infection. Note the date of removal to calculate the time of symptoms onset.

If the tick is identified as a deer tick, see a physician. If it is a RMSF carrier, look for symptoms within a week after exposure; if they occur, notify a physician.

**END OF CHAPTER FOURTEEN**