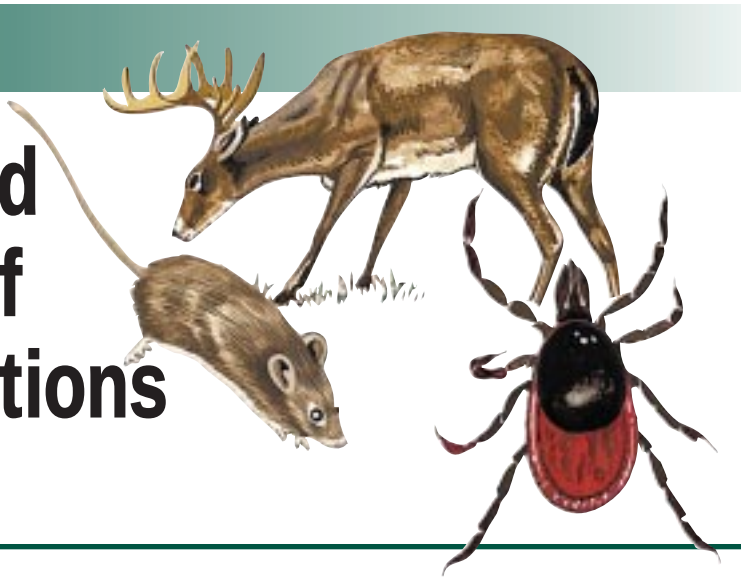
A Homeowner's Guide To:

Assessment and Management of Vector Tick Populations in New Jersey



INTRODUCTION

Tick-borne diseases, particularly Lyme disease, have become a significant public health issue during the last decade. The following **Homeowner's Guide** provides a summary of published research on managing exposure to ticks. It includes information on tick biology, ecology, and behavior, because an understanding of these factors is helpful in avoiding exposure to ticks, and in developing a successful tick reduction program.

The black-legged or deer tick, *Ixodes scapularis*, because of its importance in the transmission of Lyme disease, human granulocytic ehrlichiosis (HGE), and babesiosis, is the focus of this pamphlet. Vectors of other known tick-borne diseases, the American dog tick (Rocky Mountain spotted fever [RMSF]) and the lone star tick (human monocytic ehrlichiosis [HME]), are also covered.

BACKGROUND

Ticks pass through four stages of development: egg, larva, nymph and adult. Larvae, nymphs and adults must obtain a bloodmeal from three different hosts in order to complete the life cycle ***(FIGURE 1)***.

After feeding and mating in the fall or early spring, the female black-legged tick drops off the host and deposits several thousand eggs. In late July and early August, the eggs hatch into larvae, which usually feed on small animals. After feeding for several days, larvae drop off the host and spend the winter protected beneath leaves and other plant debris. They emerge as eight-legged nymphs the following spring.

The nymphs, which fed on infected hosts as larvae, carry the Lyme disease spirochete, *Borrelia burgdorferi*, through the molt and now can transmit the infection to the next host. After feeding for a period of 3-4 days, nymphs drop off the host and molt to adults in the fall. Larvae and nymphs are generally found at ground level. Adult black-legged ticks climb on low-lying vegetation and shrubs and, by doing so, generally encounter larger mammals.

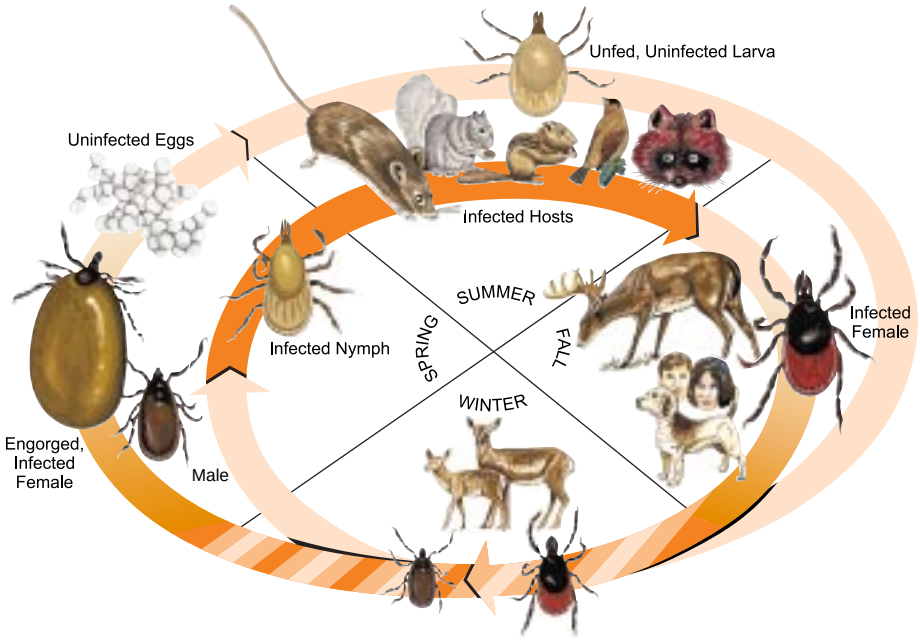


FIGURE 1: Black-legged ticks and the Lyme disease transmission cycle (darker orange denotes higher risk of transmission).

The lone star tick is also found in wooded areas and behaves in much the same way as the black-legged tick, except that all active stages may be found on shrub layer vegetation.

The American dog tick is most commonly found in open field habitats.

Peak Activity Periods

The peak activity period of adult black-legged ticks in New Jersey is between mid-October and early December. Those adults unable to find hosts in the fall will become inactive as the temperature declines and resume activity the following spring from mid-March through April. Unlike other tick species, adult black-legged ticks will become active in winter during periods of warming. Although nymphs may be observed from late April through July, the peak activity period is between late May and

early June. Larvae are most abundant in late July and August.

The activity periods of lone star ticks are somewhat similar, except that they do not have a fall activity period. Adult lone star ticks are abundant during April and May, while nymphs are active between May and July. Larvae are most abundant in August and September. American dog tick adults appear in May and again in September, while larvae and nymphs are most prevalent in May-June and July-August, respectively. The medically important ticks of New Jersey are shown in ***FIGURE 2***.

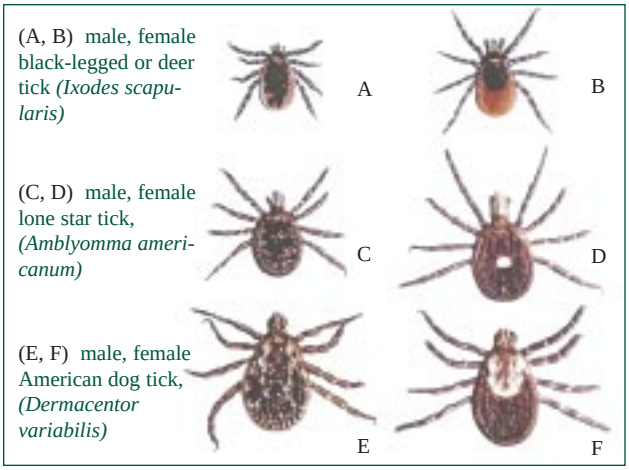


FIGURE 2: Ticks of medical importance in New Jersey.

Hosts

In the study of tick-borne diseases there are two types of hosts. Animals which provide a bloodmeal only are called maintenance hosts, while those that provide a bloodmeal and a source of disease organisms are referred to as reservoir hosts.

The principal reservoir host for Lyme disease, HGE, and babesiosis is the white-footed mouse. The reservoir for RMSF is the meadow vole. Ticks that carry pathogens from one stage to the next are also considered reservoirs.

New Jersey's medically important ticks feed on a wide variety of animals. Host selection is largely influenced by questing (host-seeking) behavior. For example, by questing in the leaf litter in forested habitats, black-legged tick larvae and nymphs frequently encounter small woodland mammals, such as white-footed mice, chipmunks, and squirrels, as well as a variety of birds. By questing on shrub layer vegetation, adult black-legged ticks more often feed on larger mammals, such as raccoons, opossums or white-tailed deer. However, when ticks are active they will feed on any available host, including domestic animals and humans. American dog ticks feed on animals which are generally found in field habitats and woodland edge. The lone star tick is more often found on larger mammals.

FIGURE 3: Wooded residential property showing areas of high (woodland and wooded edge), moderate (landscaping), and low (lawn) risk.

Transmission

Ticks require an extended period of time to insert their mouthparts and begin feeding. Generally, black-legged ticks must be attached for 24 hours before transmission of the Lyme disease spirochete occurs, with the likelihood of transmission increasing over time. The importance of prompt removal of ticks to reduce the risk of acquiring tick-borne diseases cannot be overstated.

In New Jersey, 40-45% of adult black-legged ticks are infected with Lyme disease spirochetes, while nymphs are infected at about one-half that rate. Larvae are rarely infected. The infection rates for other disease agents have not been determined.

Tick Ecology

Black-legged ticks are generally found in wooded rural and suburban areas throughout New Jersey. Lone star ticks are found in similar habitats, but their range seems to be limited to the southern one-half of the State. American dog ticks are more common in field habitats, including those in many urban areas.

Black-legged ticks are most often found in upland forests with well developed shrub layers. Unfavorable habitats include open sunny areas such as lawns, athletic fields and other recreational areas, croplands, and wetlands. Most cases of Lyme disease are the result of exposure to infected ticks at or near one's home. In wooded residential areas, black-legged ticks will be found in wooded areas and along woodland edge ***(FIGURE 3)***. However, landscaped areas with dense ground cover plants also provide a suitable habitat for black-legged ticks. Dense shrub layer, leaf litter, and other plant debris play an important role in the survival of both larvae and nymphs by maintaining conditions of high humidity. Woodpiles and brush piles, landscaping ties, stone walls, and similar structures provide refuge and nesting sites for rodents. Lawns immediately adjacent to woodland edge may support low numbers of ticks.

Lone star ticks are most commonly found in forested areas. American dog ticks are associated with field habitats. All three species may be encountered along woodland edge.

TICK MANAGEMENT

Avoidance and Personal Protection

Avoiding tick-infested areas is the principal means of preventing exposure to ticks and potential transmission of disease. If this proves impractical, modify your behavior when entering tick habitat:

- **Wear light-colored clothing, making it easier to see ticks.**
- **Tuck pant legs into socks and shirts into pants. Ticks will be forced to crawl on the outside of clothing, where they can be more easily seen and removed.**
- **Use personal repellents which contain DEET or clothing repellents containing permethrin. Read label directions carefully.**
- **Frequently inspect yourself and family members for ticks.**

Tape or lint removal rollers are useful in removing unattached ticks. Because ticks must be attached for extended periods before transmission occurs, the prompt removal of attached ticks is essential. Never use petroleum jelly, noxious chemicals or heat sources, as these methods do not work and may actually enhance transmission. To properly remove ticks, use fine-pointed tweezers, grasp the tick as close to the skin as possible and exert steady backward pressure ***(FIGURE 4)***.

FIGURE 4: Recommended tick removal method.

Protect pets by limiting their exposure to tick-infested areas and use tick collars or sprays. Consult your veterinarian.

By following these recommendations, the likelihood of being bitten by infected ticks is dramatically reduced. Tick control should be considered as a final alternative to the preventive measures above, and only after the presence of ticks has been documented.

Suppressing Tick Populations

The decision to implement a tick control program is based on the belief that there is some unacceptable impact to human well-being. Low to moderate tick numbers and low infection rates may not justify widespread tick control, which is often difficult, too costly, and viewed as causing unacceptable environmental impacts. The emergence of Lyme disease as a significant public health threat may provide the exception.

Principal tick control strategies:

- **Reduction of hosts**
- **Use of predators and parasites (biological control)**
- **Modification of habitats**
- **Use of pesticides (chemical control)**

Used in various combinations, these strategies form the basis of an integrated pest management (IPM) program. Effective biological control and host reduction techniques designed to reduce tick abundance have not been developed. However, parasitic wasps, nematodes, and fungi are biological control agents currently under evaluation. In residential settings, habitat modification and use of pesticides provide the only practical means of managing tick populations.

Habitat Modification

Reduce potential exposure to ticks by making environments unattractive to hosts and unsuitable for tick survival. Some habitat modification techniques, such as controlled burning, are impractical in residential settings. Physical destruction of vegetation by mowing and trimming back overhanging shrubs, along with the removal of leaf litter and plant debris in wooded and landscaped areas, will make these areas more unsuitable for ticks. Removal of woodpiles, brush piles, fallen trees and stumps, and other harborages and limiting the use of birdfeeders to the winter will tend to keep rodent populations to a minimum. Deer can be discouraged from entering yards by thinning vegetation near woodlands to reduce cover. Use of ornamental plants which are less attractive as a food source, use of deer repellents, and construction of fences may also help keep deer away from residential areas.

Chemical Control

Acaricides are pesticides that kill ticks and related organisms. Using acaricides to control black-legged ticks has been attempted in two ways:

1. Host-targeted

Tubes containing permethrin-treated cotton are dispersed in wooded and landscaped areas. The treated cotton, marketed commercially as Damminix®, is intended to be collected by white-footed mice for nesting material. Larvae and nymphs exposed to this nesting material will be killed. Some studies suggest the effectiveness of this method is unpredictable.

2. Habitat-targeted

Acaricides are applied directly to tick habitats. Adult black-legged ticks are the easiest stage to control. They quest on shrub layer vegetation in the fall and spring. Applying liquid acaricide during this period can result in control exceeding 95%.

Controlling black-legged tick nymphs is crucial, but more difficult since they are most active when foliage is present. Successful control of nymphs has been achieved using either granular or liquid formulations of a variety of acaricides. Granular acaricides can be applied with a chest-mounted cyclone spreader using gravity to penetrate foliage. Liquid formulations should be applied with sufficient pressure to penetrate foliage and physically disturb leaf litter. Although control exceeding 90% can be achieved, these applications, made in late May to early June, *will not* prevent the emergence of larvae in the summer or the appearance of adults in the fall. Further, these applications appear to be less effective on lone star nymphs and adults, which may coexist in the treated area. Control of black-legged tick larvae is generally not recommended because this stage is not infected with the Lyme disease spirochete.

Acaricide Selection

Many acaricides available for tick control can be purchased and applied by the general public. Alternative acaricides include soaps and desiccants. Specific acaricides, formulations, and methods of application may be restricted to certain target areas. Users are cautioned to carefully read the acaricide labeling to ensure that the proposed application is not in violation of federal and State pesticide control laws. Contact Rutgers Cooperative Extension, your County Agricultural Agent, or pesticide dealer for recommendations.

Granular and liquid formulations have various advantages and disadvantages. Generally, granular formulations are easier to apply by the homeowner. Application of liquid formulations requires access to large amounts of water and sophisticated equipment. However, less acaricide is required to achieve adequate control. Consideration should be given to hiring a professional pest control firm, which has the necessary experience and equipment to perform tick control.

Funded, in part, under Cooperative Agreement (U50/CCU 206567-06) from the Centers for Disease Control and Prevention

Quick Reference

Prevention is the best way to reduce your risk of contracting tick-borne diseases...

- **Avoid potential tick-infested areas (woodland, wooded edges and landscaped areas with dense ground cover, leaf litter and shrubs).**
- **Wear appropriate clothing and use repellents when entering high risk habitats. Be sure to conduct frequent self-examinations after any type of exposure.**
- **Monitor children carefully and limit their activity to low risk areas.**
- **Protect pets by limiting their exposure to tick-infested areas and use tick collars or sprays.**
- **Learn to recognize the medically important ticks of New Jersey.**

Where avoidance is impractical, chemical control may provide an alternative...

Acaricides should only be used if avoidance of tick-infested areas is not an option and ticks are known to occur in the area to be treated. **Since no tick control method is 100% effective, personal protection should always be practiced.** If symptoms consistent with tick-borne illness develop, contact your physician.

Host reduction, habitat modification, biological control, and use of host-targeted acaricides have limited or unpredictable success in reducing black-legged tick populations when used alone, particularly in residential settings. Research has demonstrated the effectiveness of properly timed acaricide applications. Applications of either liquid acaricides, using high pressure hydraulic sprayers, or granular formulations, directed against black-legged tick nymphs in late May to early June appear to have the greatest impact on the tick population, thereby reducing transmission. Single applications consistently resulted in control of greater than 90% of nymphs. However, the effectiveness of a single control attempt directed solely against adult or nymphal ticks in small areas will be temporary and limited only to that stage. Adult black-legged ticks are most easily controlled, but reduction of the adult population does not offer the same public health benefits as the control of nymphs, the life stage responsible for the majority of disease transmission.

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