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Integrated Pest Management for the Deer Tick

Ixodes scapularis = *Ixodes dammini*; Family: Ixodidae

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A complete integrated management program for the deer tick should take a multifaceted approach. This includes surveillance (the detection of tick infestations); identification and reduction of tick habitat; personal protection using light-colored clothing, checking frequently for ticks, and using repellents; behavioral considerations such as avoiding tick-infested areas, removing leaf litter in your yard, and cleaning up borders; and perhaps targeted control applications for hosts as well as tick habitat.

The Deer Tick

The deer tick, *Ixodes scapularis* (formerly named *Ixodes dammini*) is the principal vector of Lyme disease in the northeastern and north central United States. Lyme disease is an illness caused by a spirochete (a corkscrew-shaped bacterium) infection. The Lyme disease spirochete *Borrelia burgdorferi* is transmitted primarily by the deer tick, which normally feeds on mice, deer, and other small and medium-sized mammals and birds. If a human is bitten by an infected tick and consequently infected with the spirochete, the individual may develop Lyme disease.

Lyme disease is the most common tickborne disease in the United States, and is an increasing national public health problem. In 1992 Lyme disease was known to occur in 45 states, but was most prevalent in eastern coastal areas from Massachusetts to Maryland. In humans and some animals, especially dogs, *Borrelia burgdorferi* infection can produce skin, arthritic, cardiac, and neurological symptoms.

Research has shown that it usually takes 24 hours or more of feeding on a person for a nymphal-stage tick to transmit the spirochete. Adult ticks need to feed for 36 or more hours before transmitting the spirochete. Larval-stage ticks are not infected with the spirochete until they take a blood meal from an infected host animal, and thus do not transmit Lyme disease to humans.

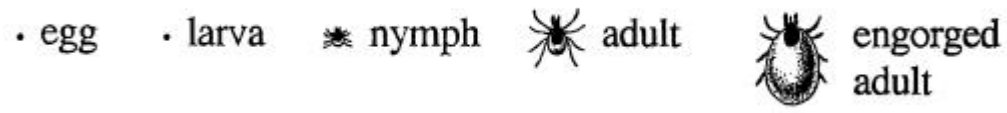
Distribution

In New York State, Lyme disease is endemic in Suffolk, Nassau, Westchester, Rockland, Putnam, Orange, Ulster, Dutchess, and Albany counties. The deer tick has been found in at least 42 counties across the state. The deer tick does not appear to be a resident of New York City, although the American dog tick (*Dermacentor variabilis*), which is the vector of Rocky Mountain spotted fever, does occur in coastal areas of the city and is common on Long Island and in downstate counties.

In infested areas, the deer tick is common wherever deer and woodland mice frequent. White-tailed deer thrive where suburban lawns adjoin woodland or open fields. Open areas provide deer grazing areas, woods offer

shelter and browse, and homeowners provide tasty ornamental plantings. People are increasingly establishing their homesites in wooded areas, raising the potential for wildlife/homeowner conflicts. In so doing, they create a habitat that attracts deer, mice, and ticks into their backyards. On Long Island, ticks are often found in beach grass near seashores, in addition to the above-mentioned areas.

Description, Life cycle, and Biology of the Tick



Relative sizes of ticks in different life stages. The actual size of an unengorged adult (shown 2nd from the right) is about the size of a sesame seed.

The deer tick passes through four life stages (egg, larva, nymph, and adult) over a period of two years. It is known as a three-host tick, which means that it feeds on three different hosts during its life cycle. All life stages besides the egg must take a blood meal to develop, and the adult female must feed to mature the eggs.

The adult deer tick is about the size of a sesame seed (2.5 mm), oval, with four pairs of legs and a flattened body. Adult deer ticks are most active in October and November and again during April arid May. They commonly attach to white-tailed deer, dogs, horses, and humans. During fall and spring the adults may be found "questing" -- waiting in ambush on vegetation from ground level to about 18 inches high (deer belly height) for a suitable host to pass by.

Unfed adult females are brick red with a small black shield on the back, and males are smaller and uniformly dark. Adults prefer to feed on deer, but will feed on other medium to large mammals including dogs, cats, and humans. Adult females feed on a host for seven to ten days, swelling to the size of a small pea, and becoming blue-black. Males feed intermittently but do not stay attached long enough to transmit infection. Female ticks may transmit Lyme disease to humans, but their larger size and longer feeding period make them easier to detect before they have an opportunity to do so.

After feeding and mating, females drop off their hosts and deposit eggs on the ground in the fall and early spring. Fall eggs overwinter, and eggs hatch into larvae in the summer.

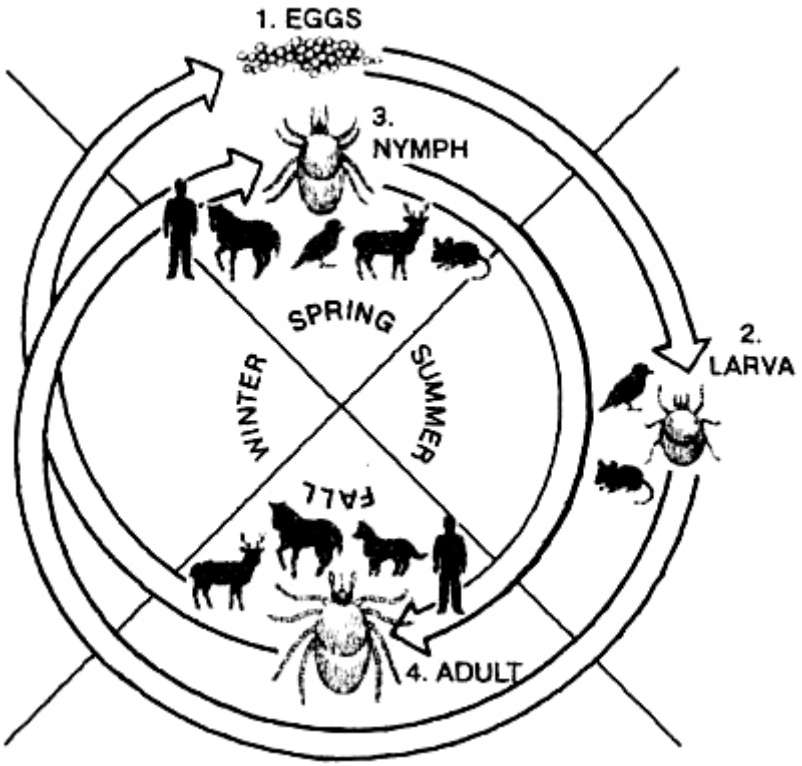
The larval deer tick that hatches from the egg in late June or July is very tiny, 0.5mm (about the size of a period). The larva has only three pairs of legs. Larvae attach to white-footed mice (*Peromyscus leucopus*) and other small and medium-sized mammals and birds, and feed for about three to five days. After feeding they drop from the host, seek a protected site under leaves or in dense vegetation, and overwinter. Larvae pick up the spirochete from infected animals (reservoir hosts). The larvae molt to the nymphal stage in the fall and remain inactive as nymphs until the following summer.

Nymphs are the most important vectors of Lyme disease to humans because they are difficult to detect (they are small and have a relatively short feeding period) and because humans are most active outdoors during the summer when nymphs are present. Nymphs occur from late May through July and are about the size of a poppy seed (1.5 mm). Nymphs may attach to humans, dogs, horses, cattle, rodents, and other small to medium-sized mammals and birds. When an infected nymph feeds on an animal, it may transmit the Lyme disease spirochete. This animal then serves as a reservoir host, capable of transmitting the spirochetes to other deer ticks.

The nymphal stage quests on vegetation and when a host brushes against vegetation, the tick clings to it and searches for a suitable feeding site. Ticks do not fly, jump, or actively pursue a host. Nymphs feed for three to five days, drop from the host, and again find shelter under leaves or other vegetation. They molt into adults in the fall.

Birds frequenting the forest floor where ticks are present may also serve as hosts for larvae and nymphs. Migrating birds are believed to contribute to the spread of the tick and to the risk of Lyme disease in endemic areas.

Deer are largely responsible for maintaining tick populations (but they are not the only animals). Deer are often present in large numbers in wooded sites and are the preferred host on which the adult ticks mate and the females acquire the necessary blood for egg development.



Life cycle of *Ixodes scapularis*

Stages of development of the tick and the most important hosts are illustrated. The deer tick has a two-year life cycle: the first year, eggs and larvae are present; the second year, nymphs and adults. Life cycles of individual ticks may overlap, meaning that all stages may occur on a particular property in one year.

Personal Protection

If you find an attached tick embedded in your skin, remove it promptly. Grasp the tick's mouthparts from the side with a finepointed tweezers or small forceps as close to the skin as possible, and pull gently but steadily upward. You want to avoid crushing the bloated abdomen of the tick which, if squeezed, might introduce the spirochetes and other body fluids into the wound in your skin. After removing the tick, disinfect the bite with rubbing alcohol or povidone iodine. Place the tick in a small container of rubbing alcohol or attach it to an index card with clear adhesive tape; write the date and the location on the body where the bite occurred, as well as the geographical site, and save these in case they should be needed later for identification. It may also be helpful to mark on a calendar the day and location of the bite.

Look for the development of a red rash, which can be an early symptom of Lyme disease. The rash, called erythema migrans, often starts as a flat or raised red area and slowly expands over several days. It may have a partial central clearing. Be aware, however, that not all infected individuals develop a rash. Other symptoms may include fatigue, headache, neck stiffness, pain or stiffness in muscles or joints, jaw discomfort, slight fever, swollen glands, or conjunctivitis. If you have a tick bite followed by a rash or any of these other symptoms, consult your physician.

Surveying for Tick Presence

Survey at appropriate times. In the vicinity of Westchester County, NY, sampling should begin in late May, and if ticks are detected, immediate steps can be taken to minimize the risk of infection before early summer when people spend more time outdoors. Survey again weekly throughout June. The best time to survey is on calm days in early morning just after the dew has dried or on slightly overcast days. In general, ticks are not active on rainy days, and activity appears to drop off just before a storm, so avoid surveying then. Survey for adults weekly from mid-October to mid-November.

Dragging and flagging are two techniques used by researchers to find ticks in an area. The dragging technique may be used by individuals to survey for tick presence on home lawns. A drag consists of a one-yard-square piece of white or light-colored sturdy flannel cloth, such as corduroy, attached to a pole. Rope is attached to both ends of the pole to enable the user to pull the drag across a lawn or other area of low vegetation. The cloth is dragged behind the surveyor. This technique works well for nymphs and adults which quest for a host animal. The drag is kept low to the ground -- it must brush across the top of the lawn or leaf litter. Drag cloths should be inspected about every 30 seconds for ticks. Suspect ticks are grasped with a forceps and placed in alcohol or a pre-moistened sample vial for later examination.

Flagging is similar, but in this case a smaller cloth, the flag, is attached to one end of a pole with the other end used as a handle. The flag is pushed ahead of the collector, and it is primarily used in areas of higher vegetation such as thick understory in wooded areas and brush and shrubs in open areas, or in edge habitats and along property borders where vegetation is thicker. Ticks are usually found within 18 inches of the ground.

When surveying always wear protective clothing. Tuck in everything, including pants into socks or boots, to help keep ticks, if present, on the outside of the clothing.

If you find deer ticks, you need to decide what to do. Continued surveying will help you determine if the tick was an isolated individual or if you have a larger population in the area.

Drag or flag sampling will collect only approximately one of every ten ticks inhabiting an area. Repeated sampling at different times will increase the likelihood of finding a tick.

Landscape Management

Studies on residential properties show that deer ticks are more likely to be found in certain habitats. Deer ticks require high humidity; therefore, they seek out habitats that offer this condition. Heavily shaded, damp (but not flooded) areas covered with leaf litter are ideal. Sites where host animal activity is concentrated are also important. Deer ticks, therefore, are often found in woodlots or wooded areas between yards, along edge habitats, and especially in unmaintained borders. High-risk areas are also found along rock walls, woodpiles, or brushpiles. All stages are rare on maintained lawn, and deer ticks are rarely found in open, sunny areas.

Landscapes may be managed to manipulate wildlife activity patterns, to lower the humidity in habitats where ticks are likely to be found, and to push back the "danger zone" where tick exposure is likely to occur by manipulating edging and mulching borders.

Where possible, keep deer away by reducing deer habitat or fencing them out. Studies show that immature ticks are most abundant in areas where deer are abundant.

Mice, the principal reservoir host of the spirochete, and other small mammals can be kept away by reducing cover and thereby having more open areas in the lawn, along walls, and along borders so that mice are less likely to find cover. If possible, eliminate wooded brush-covered habitat or fence it off so people and pets do not have ready access to it. Vegetative screens between properties may harbor all types of animal activity and therefore provide a potential habitat for ticks. Pruning off the lower branches of a vegetative screen will help reduce habitat but still will provide a screen. Using a light mulch, one to two inches deep, or bare soil around shrubbery also helps reduce habitat. When mowing along edge habitat, direct the mower discharge into

shrubbery rather than onto the lawn. Clean up storage areas, woodpiles, and junk piles. If you feed birds, position the bird feeders away from rodent habitat, clean up loose seed, and stop feeding by April and do not resume again until after larval tick activity has decreased in October or November. Removing leaf litter and planting grass under shade trees will help reduce tick abundance.

Behavioral Considerations

If you can conduct major activities involving tick habitat at tick-free times of the year, you may avoid the ticks. For example, cutting wood might be done in the winter rather than in the early fall when adult ticks are most active. If you need to be in tick-infested areas, try to plan activities there during the driest part of the day.

Restrict children's activities to managed areas, those less likely to harbor ticks. If necessary, fence off areas for children to play in.

Keep pets either entirely inside or entirely outside during tick season. Use pet products to reduce tick exposure (check with your veterinarian). Adjust your habits regarding pets; for example, keep them out of human living or sleeping areas, or both. Groom and make a tick check of animals after each possible tick exposure.

Get into the habit of checking people for ticks right after ending outdoor activities. In infested areas it may be best to remove clothes before entering the living area and seal them in a plastic bag until they are laundered or put into a clothes dryer.

Ticks cannot survive a 20-minute tumble in dry heat, in a clothes dryer.

Discovery and prompt removal (within 24 hours) of attached ticks can minimize the risk of infection. The longer you wait to remove an attached tick, the more you increase the chances of infection.

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