

DEER TICK ECOLOGY

What is a tick?

Ticks are not insects but Arachnids, a class of Arthropods, which also includes mites, spiders and scorpions. They are divided into two groups - hard bodied and soft bodied - both of which are capable of transmitting diseases in the United States.

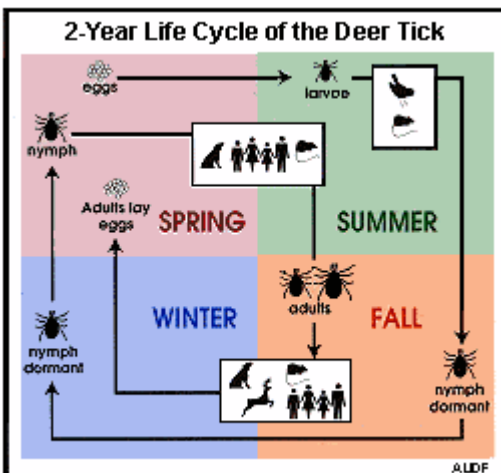
Ticks are parasites that feed by latching on to an animal host, imbedding their mouthparts into the host's skin and sucking its blood. This method of feeding makes ticks the perfect vectors (organisms that harbor and transmit disease) for a variety of pathogenic agents. Ticks are responsible for at least 9 different **known** diseases in humans in the U.S., including Lyme disease, Rocky Mountain spotted fever, babesiosis, and more recently, ehrlichiosis.

The Deer Tick Life Cycle

The deer (or black-legged) tick in the East and the related western black-legged tick are the primary (and possibly the only) **known** transmitters of true Lyme disease in the United States. Both are hard-bodied ticks with a two-year life cycle. Like all species of ticks, deer ticks and their relatives require a blood meal to progress to each successive stage in their life cycles.



The life cycle of the deer tick comprises three growth stages: the **larva**, **nymph** and **adult**. In both the northeastern and mid-western U.S., where Lyme disease has become prevalent, it takes about two years for the tick to hatch from the egg, go through all three stages, reproduce, and then die. A detailed description of this life cycle and the seasonal timing of peak activity, as they occur in these regions, is provided below.



Stage 1: Larva - As shown in the upper left corner of the life-cycle diagram above, eggs laid by an adult female deer tick in the spring hatch into larvae later in the summer. These larvae reach their peak activity in August. No bigger than a newsprinted period, a larva will wait on the ground until a small mammal or bird brushes up against it. The larva then attaches itself to its host, begins feeding, and over a few days, engorges (swells up) with blood.

If the host is already infected with the Lyme disease spirochete (a form of bacterium) from previous tick bites, the larva will likely become infected as well. In this way, infected hosts in the wild (primarily white-footed mice, which exist in large numbers in Lyme-endemic areas of the northeast and upper mid-west) serve as spirochete **reservoirs**, infecting ticks that feed upon them. Other mammals and ground-feeding birds may also serve as reservoirs.

Because deer tick larvae are not born infected, they cannot transmit Lyme disease to their human hosts. Instead, "reservoir" hosts, as mentioned above, can infect the larvae. Having already fed, an infected larva will not seek another host, human or otherwise, until after it reaches the next stage in its life cycle. Therefore, larvae do not, in themselves, pose a threat to humans or their pets.

Stage 2: Nymph - Most larvae, after feeding, drop off their hosts and molt, or transform, into nymphs in the fall. The nymphs remain inactive throughout the winter and early spring.

In May, nymphal activity begins. Host-seeking nymphs wait on vegetation near the ground for a small mammal or bird to approach. The nymph will then latch on to its host and feed for 4 or 5 days, engorging with blood and swelling to many times its original size. If previously infected during its larval stage, the nymph may transmit the Lyme disease spirochete to its host. If *not* previously infected, the nymph may *become* infected if its host carries the Lyme disease spirochete from previous infectious tick bites. In highly endemic areas of the northeast, 25% of nymphs have been found to harbor the Lyme disease spirochete.

Too often, humans are the hosts that come into contact with infected nymphs during their peak spring activity (late May through July). Although the nymphs' preferred hosts are small mammals and birds, humans and their pets are suitable substitutes. Because nymphs are about the size of a poppy seed, they often go unnoticed until fully engorged, and are therefore responsible for the majority of human Lyme disease cases.

Stage 3: Adult - Once engorged, the nymph drops off its host into the leaf litter and molts into an adult. These adults actively seek new hosts throughout the fall, waiting up to 3 feet above the ground on stalks of grass or leaf tips to latch onto deer (its preferred host) or other larger mammals (including humans, dogs, cats, horses, and other domestic animals). Peak activity for adult deer ticks occurs in late October and early November. Of adults sampled in highly endemic areas of the northeast, 50% have been found to carry the Lyme disease spirochete.



Adult deer tick questing for a host. Note the upper legs are raised in preparation for latching on to a passing animal.



Adult deer tick seeking a suitable spot to feed.

As winter closes in, adult ticks unsuccessful in finding hosts take cover under leaf litter or other surface vegetation, becoming inactive in temperatures below 40 degrees F. Generally, winters in the northeast and upper mid-west are cold enough to keep adult ticks at bay until late February or early March (an exception was the warm winter of 1997-1998) when temperatures begin to rise. At this time, they resume the quest for hosts in a last-ditch effort to obtain a blood meal allowing them to mate and reproduce. This second activity peak typically occurs in March and early April.

Adult female ticks that attach to deer, whether in the fall or spring, feed for approximately one week. Males feed only intermittently. Mating may take place on or off the host, and is required for the female's successful completion of the blood meal. The females then drop off the host, become gravid, lay their eggs underneath leaf litter in early spring, and die. Each female lays approximately 3,000 eggs. The eggs hatch later in the summer, beginning the two-year cycle anew.



For residents of regions *other than* the northeast and upper mid-west: Please note

that where the range of the deer tick (or its close relative the western black-legged tick) extends beyond the northeast or upper mid-west, the timing of peak activity for each life stage of the tick may differ from that described above. In these areas, information on peak nymphal and adult tick activity can probably be obtained from local universities and health departments.