

Lyme Disease in Florida¹

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What is Lyme Disease?

Lyme disease is caused by the bacterium *Borrelia burgdorferi*. This bacterium is transmitted between mammals by the black-legged tick, *Ixodes scapularis*, which is also called the deer tick (Figure 1).

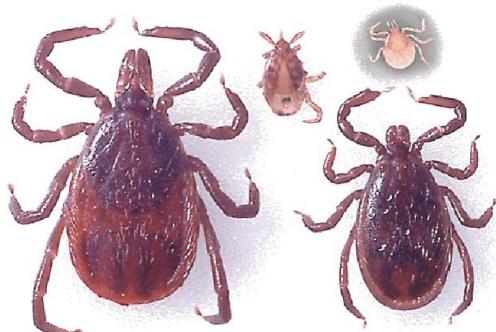


Figure 1. *Ixodes scapularis*, black-legged tick, also known as the deer tick. Female (lower left), male (lower right), nymph (upper right), larvae (upper left). Credits: Jim Newman

There have been 30-50 cases per year diagnosed in Florida in the late 1990s; about half of which can be traced to infection outside of the state. By

comparison, New York typically has 3000-5000 cases per year; clearly there is a much lower risk of infection in Florida.

The bacterium has been found in rodents in different parts of the state, but the status in the tick population is unclear. *I. scapularis* is found in most counties in the state, but the population size varies from site to site and from year to year. Little is known beyond this; there are research programs at UF-IFAS, the state Department of Health and other universities in the state investigating tick populations and pathogen distribution.

Much of the available information about Lyme disease and *I. scapularis* focuses on the Northeast and Midwest United States, the areas of highest transmission. There is concern about Lyme disease in the southeast, but the ecology of the tick is different. This changes the contact between ticks and their hosts, including humans. Contact is what determines how important the tick species is in transmitting pathogens and as a pest of humans and domestic animals. Here, we discuss the differences between northern and southern cycles of Lyme disease transmission. Further information on clinical aspects of Lyme disease, vaccination, and the northern populations of *I. scapularis* can be found at:

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<http://www.cdc.gov/ncidod/dvbid/lymeinfo.htm>
<http://www.lymenet.org/>
<http://edis.ifas.ufl.edu/VM070>
<http://edis.ifas.ufl.edu/MG204>

Life Cycle of the Vector

The black-legged tick is a 3 host tick through its entire range; an individual tick feeds on 3 separate hosts during its life (Figure 2).

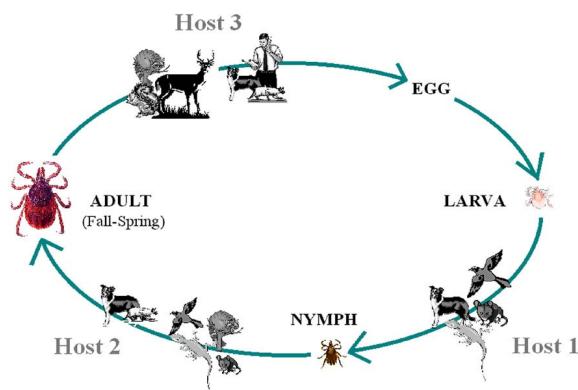


Figure 2. Life cycle of a 3-host tick. Credits: Leah Lefevre

These hosts may be of the same or different species of vertebrates. After hatching from eggs, the larvae quest, or look for hosts, on leaf litter and low vegetation. In this stage, they feed on a variety of small animals, including small mammals, birds, and, in the south, lizards. After completing the blood meal (feeding for 3-5 days), the engorged larvae drop off the host and stay in the leaf litter to develop into nymphs and molt. The subsequent nymphs feed on a similar suite of animal species, but may also feed on slightly larger mammals such as raccoons. In the north, both larvae and nymphs readily feed on humans; in the south, they rarely do. After the nymphs feed for 4-6 days, they again drop from the animal and go into the leaf litter to develop and molt. The final stage, the adults, then emerge. Adult females typically feed on larger mammals, including deer and raccoons; adult males typically do not feed but may crawl on animals looking for mates. Adult females in both the north and south extent of the species' range will readily attach to humans.

The seasonality and length of time it takes for development in each stage varies between the North and South. The cold winters in the North force some stages to diapause (a period of inactivity); this then structures the population into a 2-year life cycle with each stage being active at particular seasons (adults, fall to spring; larvae, early and late summer; nymphs, spring to early summer). The lack of cold winters in the South allows the population to be less structured. Adults are typically found from November through May, and are active all winter. The activity periods of the other stages are not well known, as they are much less likely to feed on humans and so are not attracted to our most commonly used sampling methods which rely on carbon dioxide and human disturbance of a potential tick habitat.

Three major aspects of the ecology outlined above contribute to the lower transmission of *B. burgdorferi* to humans in the Southeast: the structure of the population, the use of lizards as hosts, and the lower attack rate on humans.

Population Structure

The structured population in the Northeast amplifies the infection rate in nymphs and adults. The nymphs of a particular cohort, or generation, emerge earlier after the winter than the following cohort of larvae. These nymphs can be infected from their previous blood meal when they were larvae, and can infect the juvenile mice also emerging at the same time. These mice then can serve as hosts for the following cohort of larvae later that same summer. The larvae can pick up the bacterium from the mice. Thus in the Northeast, the nymphs serve to transmit the bacterium to mice and then to the next generation of tick larvae. This does not occur in the Southeast due to the absence of structured tick populations and diapause. This decreases the amplification of the bacterium in mice and the prevalence in ticks.

Hosts

Lizards as hosts. Some species of lizards do not become infected with *B. burgdorferi*, and therefore cannot infect ticks. Lizards are very abundant in Florida (Figure 3), and other southern states, but are less common or absent further north. As more ticks feed on lizards, fewer are feeding on infected mice

and thus the bacterium prevalence in the tick population is decreased.



Figure 3. Skink. Credits: Jim Newman

Feeding on humans. Nymphal black-legged ticks readily feed on humans in the Northeast, and are easily found on humans after walking through wooded areas in the late spring. They are small and black, and easily overlooked once attached to a person. Since nymphs may have been infected by feeding on infected mice as larvae, they are a major source of human infection. In the Southeast, however, immatures (larvae and nymphs) are rarely collected on humans. Although adults are often collected on humans, they are larger, red, and prevalent during cooler times of year when people are more heavily clothed. Overall, they are much more likely to be noticed and removed before being able to transmit the bacterium.

Symptoms of Lyme Disease

The most common early indication of Lyme disease in humans is a rash, called erythema migrans (EM), around the site of the tick bite that appears within 3 days to 3 weeks after the bite. The rash expands into a bull's eye pattern. Other symptoms include fever, flu-like symptoms, chills, headache, and extreme fatigue.

Symptoms that appear later on can include complications of :

- joints - arthritis in the knee, elbow and wrist
- nervous system - headache, stiff neck, facial paralysis
- heart - myocarditis, heart block

These may appear weeks to months after the initial symptoms.

Protection

There are a number of cases of Lyme disease in Florida each year which cannot be attributed to out-of-state travel. However, the risk of infection is much lower in the Southeast than in more northern areas due to several ecological features of the tick population. The best prevention for Lyme disease in Florida is personal protection: wear insect repellent containing DEET - concentrations at 10% - 15% are sufficient (use as directed), check yourself, children and pets thoroughly after being in a tick habitat, and remove any attached ticks promptly. Refer to "Avoiding and Repelling Mosquitoes and Other Biting Nasties" by Jonathan F. Day and "Use and Application of DEET Repellent" by P. G. Koehler for more information on products containing DEET.