



LYME DISEASE



PennState Extension

Lyme disease is caused by *Borrelia burgdorferi*, a member of the family of corkscrew-shaped bacteria known as spirochetes, and transmitted by blacklegged ticks (*Ixodes scapularis*).

Lyme disease was recognized in Sweden as long ago as 1908. It was first identified in the United States in 1975, after a mysterious outbreak of juvenile arthritis among the residents of Lyme, Connecticut. Since then, case numbers of Lyme disease have continually increased, and the disease has become an important health problem in some of the most populated areas of the United States.

Currently, Lyme disease is the most common vector-borne disease in the United States. Over 320,000 people are estimated to contract Lyme disease annually.



Photo courtesy of Anna Perez, Centers for Disease Control and Prevention

DISEASE TRANSMISSION

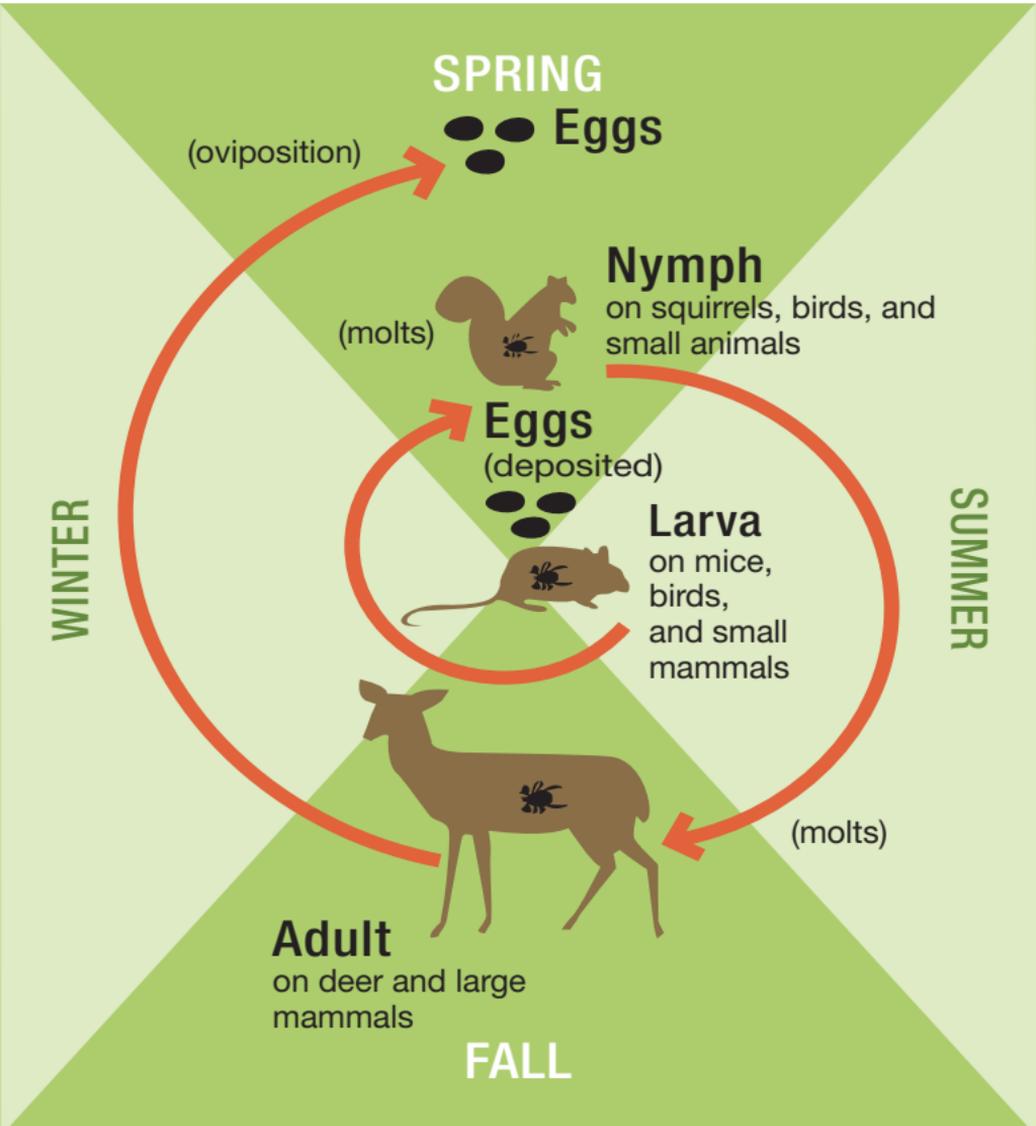
Lyme disease is transmitted by ticks infected with *Borrelia burgdorferi*. In the Northeast, the tick most commonly associated with the disease is the blacklegged tick (*Ixodes scapularis*). Closely related ticks in Washington, Oregon, and California and ticks from other parts of the world have been identified as transmitting the disease to humans. Research in the eastern United States suggests that nymphs are the most dangerous because they are rarely noticed due to their small size. Thus, the nymphs typically have ample time to feed and transmit the infection (about 24 hours is necessary to transmit the pathogen).

Wooded, brushy places are common blacklegged tick habitats. Campers, hikers, outdoor workers, sportsmen, and others who frequent such areas are at risk. Ticks search for host animals from the tips of grasses and shrubs and are transferred to animals or people that brush against vegetation. They usually attach themselves in areas that are more hidden or hairy, such as the groin, armpits, and scalp. Ticks feed on blood by inserting their mouthparts into the skin of a host animal. They are slow feeders; a complete blood meal will take several days. After more than 40 years of research, there is no convincing evidence that Lyme disease can be transmitted through means other than a tick bite.

BLACKLEGGED TICK LIFE CYCLE

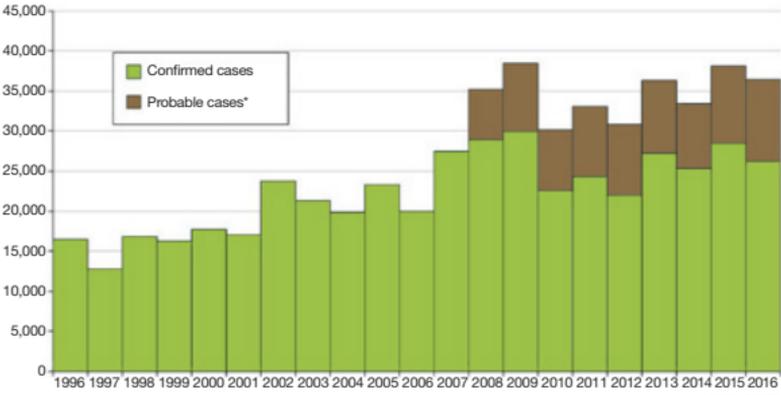
Knowing about the tick's life cycle is important for understanding the risk of acquiring Lyme disease and finding ways to prevent it. Adult female ticks lay eggs in the spring. The eggs hatch into larvae during the summer. Ticks are free of pathogens when they hatch. Larvae feed on mice, other small mammals, and birds in the summer and early fall; if they feed on an infected host, they may become infected. They then are inactive until the following spring, when they molt into nymphs.

Nymphs feed on small rodents, small mammals, and birds in late spring and summer. They seek small to medium-sized hosts, including domestic animals and people. If these nymphs fed on infected animals as larvae, they may then transmit pathogens to their second host. Nymphs are most likely to be found during the early summer months (May through July). Nymphs molt into adults in the fall and actively seek larger mammals. Adults may be found nearly year-round, particularly in the fall and early spring. Black-legged ticks are commonly called "deer ticks" because they are often found in high densities on white-tailed deer even though they feed on many large animals.



Reported Cases of Lyme Disease by Year, United States, 1996–2016

Graph courtesy of the Centers for Disease Control and Prevention



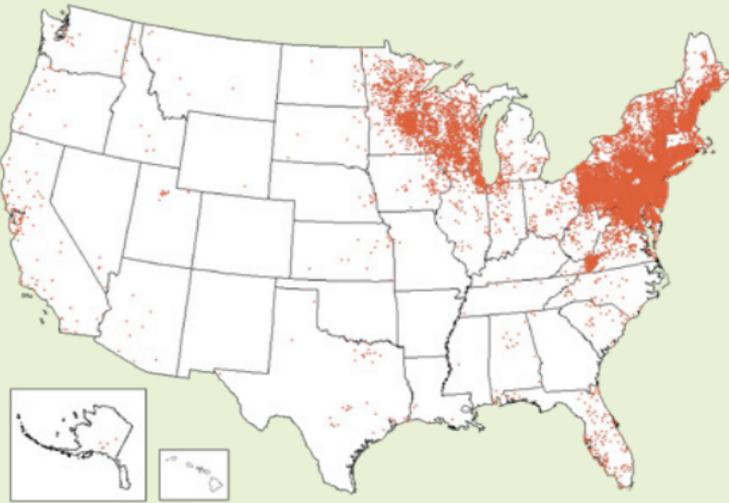
*National Surveillance case definition revised in 2008 to include probable cases.



Reported Cases of Lyme Disease, United States, 2016

Image courtesy of the Centers for Disease Control and Prevention

Each dot represents one case of Lyme disease and is placed randomly in the patient's county of residence. The presence of a dot in a state does not necessarily mean that Lyme disease was acquired in that state. People travel between states, and the place of residence is sometimes different from the place where the patient became infected.



GEOGRAPHIC DISTRIBUTION

In the United States, Lyme disease is concentrated in three areas: in the Northeast from Massachusetts to Maryland; the north-central states, especially Wisconsin and Minnesota; and the West Coast, particularly northern California. In Pennsylvania, the highest incidence of Lyme disease occurs in central and eastern counties. Lyme disease reports have indicated that Pennsylvania ranks number one in the country for Lyme disease cases and third for incidence per 100,000 people. It is important to remember that Lyme disease might be contracted in any of Pennsylvania's counties.

SYMPTOMS AND SIGNS OF LYME DISEASE

The early stage of Lyme disease is usually marked by flu-like symptoms (fatigue, chills, fever, headache, muscle and joint pain, swollen lymph nodes). A bull's-eye rash, called erythema migrans, is the most characteristic symptom of Lyme disease. It begins as a red circular patch, generally at the site of the tick bite, that appears three days to one month after the bite. The patch then expands to a diameter of 2 to 12 inches or more. Common areas for the rash to appear are the thigh, groin, trunk, and armpits. The center of the rash may clear as it enlarges, resulting in a ring-like appearance. It is usually not painful. It is important to note that 30 to 50 percent of patients may not display the rash.

In late stage Lyme disease, symptoms may occur weeks, months, or even years later. These symptoms include arthritis, migratory pain and swelling in the large joints (especially the knees), and nervous system abnormalities, including numbness, pain, Bell's palsy (paralysis of the facial muscles, usually on one side), and meningitis. Occasionally, irregularities in heart rhythm may occur.



Bite site of *Borrelia burgdorferi*-carrying tick.
Photo courtesy of Penn State Extension

DIAGNOSIS AND TREATMENT

Lyme disease is often difficult to diagnose because its symptoms mimic those of many other diseases. Diagnosis of Lyme disease should consider a history of possible exposure to ticks (especially in areas where Lyme disease is known to occur), clinical symptoms and signs, and the results of blood tests. Blood tests are most useful during the later stages of illness, but even then they may give inaccurate results. The disease is treated with antibiotics under the supervision of a physician. Patients treated in the early stages usually recover rapidly and completely. Most patients who are treated later in the disease also respond well, and full recovery is the rule. In a few patients who are treated for Lyme disease, symptoms of persisting infection may continue or recur, making additional antibiotic treatment necessary.

TICK DETECTION AND CONTROL

Sweeping or dragging your yard using a white cloth can help determine if you have a high tick population. Attach the cloth to a dowel and sweep or drag it over the vegetation, then inspect the cloth for ticks. Removing firewood and clearing leaves, brush, and tall grass from around houses and at the edges of gardens may help reduce the blacklegged tick population.

Applying acaricides (chemicals that are toxic to ticks) to gardens, lawns, and the edge of woodlands near homes may be advisable in some situations. Currently, no commercial essential oil products have demonstrated long-term effectiveness against ticks. In addition, several of the formulations may be toxic to pollinators and soil organisms.

Blacklegged ticks.

Images courtesy of the URI TickEncounter Resource Center



PROTECTING YOURSELF FROM TICK BITES

The chances of being bitten by a deer tick can be reduced with a few precautions:

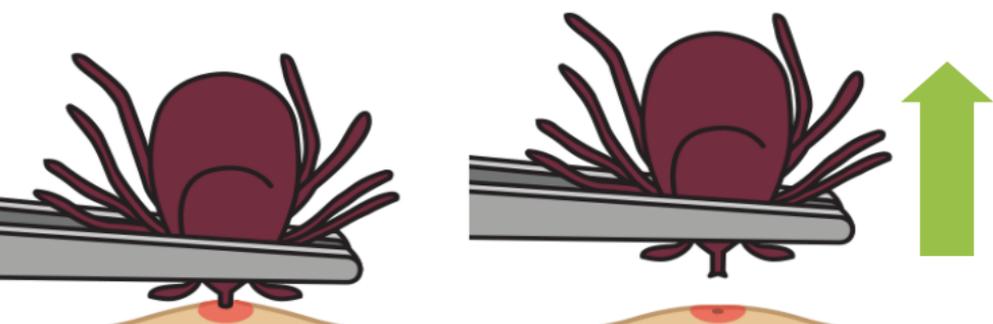
- Avoid tick-infested areas, especially in May, June, and July.
- Wear light-colored clothing so that ticks can be spotted more easily.
- Wear long-sleeved shirt and pants.
- Spray insect repellent containing DEET, picaridin, or IR3535 on clothes and exposed skin (not the face).
- After being outdoors, remove clothing and wash and dry it at a high temperature.
- Inspect yourself carefully and, if possible, shower within an hour of coming inside.

HOW TO SAFELY REMOVE ATTACHED TICKS

Use a pair of fine-tipped forceps or tweezers and grasp the tick as close to the skin surface as possible. Pull straight back with slow and steady force. Avoid crushing the tick's body. Save the tick in a plastic bag or container in the freezer. If suspicious symptoms develop, the tick can be tested for pathogens.

IF YOU'RE BITTEN BY A TICK ...

Physicians must determine if the advantages of using antibiotics outweigh the disadvantages in any instance. Antibiotic treatment to prevent Lyme disease after a known tick bite may not be warranted. If antibiotics are not used, physicians should alert patients to the symptoms of early Lyme disease and advise them to return for reevaluation if symptoms occur.



Tick removal.

Image courtesy of the Centers for Disease Control and Prevention

TICK IDENTIFICATION

Identification services are provided free of charge to Pennsylvania residents. Specimens can be taken to county Penn State Extension offices for identification. If necessary, local extension educators will forward the sample to the Insect Identification Laboratory.

SAMPLES CAN BE MAILED TO:

Insect Identification Laboratory
Department of Entomology
The Pennsylvania State University
501 Agricultural Science and Industries Building
University Park, PA 16802

Prepare specimens for mailing by placing them in a small vial filled with rubbing alcohol or alcohol-based hand sanitizer and then place the vial in a plastic sandwich bag. Please include an address, phone number, or email address as well as some information about the specimen, such as where it was found.

Revised by Erika Machtinger, assistant professor of entomology, from the brochure originally prepared by Steve Jacobs, urban entomologist and senior extension associate (retired).

All uncredited photos: Bigstock.com

extension.psu.edu

Penn State College of Agricultural Sciences research and extension programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U.S. Department of Agriculture.

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Extension is implied.

This publication is available in alternative media on request.

Penn State is an equal opportunity, affirmative action employer, and is committed to providing employment opportunities to all qualified applicants without regard to race, color, religion, age, sex, sexual orientation, gender identity, national origin, disability, or protected veteran status.

Produced by Ag Communications and Marketing

© The Pennsylvania State University 2018

Code UF006 rev2.5M010/18mpc