

## Nymphal ticks at various stages of feeding

The following clip shows microscopic views of nymphal black-legged ticks (*Ixodes scapularis*). The first is an extreme close up followed by a wider camera angle showing nymphal black-legged ticks at various stages of feeding in one shot.

As the camera pans from left to right, you see ticks at various stages of feeding (0, 12, 24, 48, 72, and 96 hr) from unfed (on the far left) to fully engorged (about 96 hours) on the far right. Black-legged ticks transmit Lyme disease, anaplasmosis, and babesiosis.

Lyme disease is transmitted by the bite of infected *Ixodes scapularis* ticks. Most cases of Lyme disease result from the bite of the nymphal tick because of their small size. They are about the size of a poppy seed, so they can go unnoticed while biting people. In areas of the U.S. where Lyme is commonly found, the infection rate in these ticks averages about 20%.

## Life stages of ticks

The following clip shows nymphal black-legged ticks (***Ixodes scapularis***).

The clip shows a close up of adult male ticks (smaller and all black) and adult female ticks (larger with a reddish-brown body), larvae and nymphs

The clip shows close ups of ticks in three of the four life stages; from smallest to largest are larvae, nymphs, and adult ticks (the egg stage is not shown). Scientist uses forceps to pick up an adult tick and move it closer to the group.

Ticks live in soil and leaf litter and when conditions are favorable; they will look for a host by climbing up and onto low-lying vegetation. They then lie in wait and will attach to animals or people who walk by.

## Life stages of ticks

The following clips are extreme close ups showing three of the four life stages of ***Ixodes scapularis*** ticks on human skin in order to illustrate the size of the various tick life stages (larvae, nymphs, and adults).

Scientist with larval ticks on his finger illustrating the extremely small size. Ticks are housed in incubators where the relative humidity and temperature are controlled. This colony of non-infectious ticks has been housed in ideal rearing conditions at the CDC Fort Collins insectary. An insectary is a specialized laboratory where insects such as ticks are bred and raised.

This is followed by an extreme close up of nymphal ticks crawling on the finger followed by an extreme close up of adult ticks, then another extreme close up of an adult female black-legged tick crawling on human skin.

The following clips demonstrates a laboratory test used to determine the effectiveness of repellents against nymphal black-legged ticks.

As a control, a filter paper disc is treated with a compound that is known NOT to repel ticks. Notice how ticks travel freely all over the disc. This is followed by treatment of a filter paper disc with a test compound to determine its ability to repel ticks. A scientist applying (pipetting) a natural repellent onto filter paper followed by an extreme close up of the procedure. Notice he is applying the natural repellent inside the second circle (treatment zone) drawn on the filter paper.

The clip shows a diagram of a horizontal repellent test set up with the experiment zones labeled. The large inner circle is the introduction zone, the second circle is the treatment zone, followed by the outside circle or untreated zone.

Using forceps, the scientists places nymphal ticks in the introduction zone of the horizontal repellent test. The following clips show ticks placed on the control assay without any repellent applied to the treatment zone, followed by ticks placed on the experimental assay where a repellent was applied within the second circle (treatment zone). This test illustrates a test compound that does NOT repel ticks followed by a test compound that effectively repels ticks. The segment is shown at normal speed followed by time lapsed speed.

This clip shows a scientist applying repellent to his finger followed by test segments of his finger inside the circle with the ticks NOT crossing upward past the red line on the finger. The ticks are not harmed during the process.

This clip shows an extreme close up of his repellent-treated finger with ticks not crossing the boundary.

The Select Tick Control System (TCS) is a device to reduce host-seeking ticks in residential and public areas. The bait boxes work by luring in small mammals, such as mice and chipmunks, with a non-toxic bait. These small mammals serve as reservoirs for tick-borne diseases. Once the animal enters the bait box, it rubs against a wick and is passively treated with a chemical that kills ticks. A single visit kills ticks on these small mammals for up to 8 weeks. This device is an environmentally friendly approach to tick control. These devices have been demonstrated to reduce ticks on properties by >90%.

The scientist removes the outer steel protective cover and then removes the black plastic lid of the bait box. With his gloved fingers, the scientist shows the small mammal (mice, chipmunks, etc.) entry points into the bait box. By removing the wick assembly you can see how the rodents can get to the non-toxic bait.

Scientist shows the size and shape of bait enclosed in the bait boxes and how it works. Oil infused with a tick-killing chemical is transferred onto the rodents' bodies each time they enter a bait box. This passive action can protect rodents that enter the bait boxes from ticks and fleas and other external parasites that land on them for up to 8 weeks.

Scientist moistens the wick with denatured alcohol to reactivate it.

The following clip shows a scientist opening an incubator door and removing a large covered glass container (desiccator) that contains ticks, and then placing it on a workbench.

The scientist removes a tick vial and removes adult ticks one-by-one with forceps.

Extreme close up of same thing, glass tick vials covered with mesh lids. Black-legged ticks spread Lyme disease, anaplasmosis, and babesiosis.