



Local Prevalence of Ticks Carrying the Lyme Disease Bacterium

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Abstract

Our ongoing study has been to survey local deer tick populations in a 50-150 mile radius of Eau Claire for the presence of *Borrelia burgdorferi* bacteria. This bacterium, which is transmitted by a tick bite, is responsible for Lyme disease in humans and other animals. Students in Biology 306 (Infectious Disease Ecology) and faculty in the Biology Department have collected ticks over the past 3 years by sweeping methods or visual detection on clothing. This past year DNA was extracted from individual ticks and processed by a real-time polymerase chain reaction (qPCR) to detect the *B. burgdorferi* *rec A* gene. Ticks positive for the bacteria were identified by the presence of a 222 base pair DNA product with a melting temperature (T_m) of 82°C. The DNA size was verified by gel electrophoresis. To date, among the 120 assayed ticks, we have observed approximately 26% of the ticks carrying the bacterium. Local areas of interest with carrier ticks included: Putnam woods, Lowes Creek Park, and the Downsville area.

Background

Lyme disease is a bacterial infection transmitted to humans through a deer tick bite. The most common indication of an infection is a red bulls-eye shaped rash, referred to as *Erythema migrans*, although this is absent in 25% of infections. Later symptoms include fever, chills, fatigue, muscle and joint aches. If left untreated, chronic arthritis and/or neurological problem can develop.¹

As the number of Lyme disease cases increases, it is important to understand the ecology of the disease.² Surveys have been conducted in other countries and regions of the United States. For example, studies conducted in Germany and in New Jersey found 35% and 43% of ticks, respectively, to be carriers of the bacteria.^{3,4,5} However, few to no reported studies have been conducted in Wisconsin.

Our survey was conducted using ticks collected between spring and early fall in 2010, 2011 and 2012 (Fig 1). To determine if a tick was carrying the bacterium, we performed DNA extraction and qPCR to amplify the *rec A* gene DNA. Ticks containing DNA with a T_m of 82°C were presumed positive and verified through agarose gel-electrophoresis by the presence of a 222bp DNA fragment representing the amplified region of the *rec A* gene (Fig 2-6).

Materials & Methods

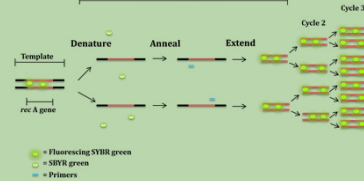


Fig 2. A female deer tick <http://bugguide.net>

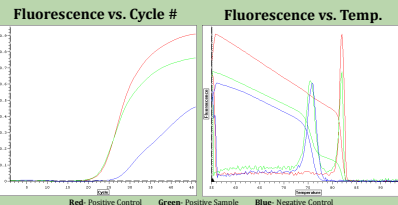
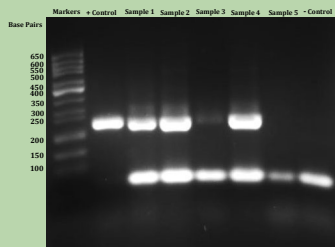
DNA Extraction

1. Tick homogenization:
 - Buffer
 - SDS
 - Proteinase K
2. DNA extraction:
 - Phenol
 - Chloroform
3. Ethanol precipitation

DNA Amplification qPCR Cycle



Agarose Gel-Electrophoresis



Results

Carrier Tick Prevalence

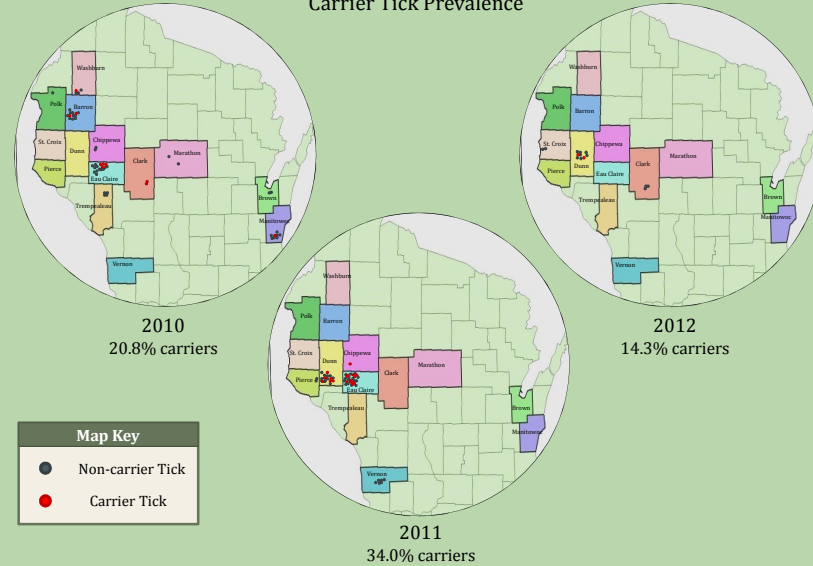


Fig 1. Maps indicating locations of tick samples from 2010, 2011, and 2012.

Analysis

We conducted a **Pearson's Chi-squared test with Yates' continuity correction** to determine whether or not there was significant difference in the percentage of carrier ticks in Eau Claire county between 2010 and 2011. There was no significant difference in the percentage of carrier ticks from year to year ($p=0.5049$).

Conclusions & Future Studies

- The average prevalence of ticks carrying the *B. burgdorferi* bacteria from the years 2010 to 2012 was 26%.
- More ticks will need to be assayed for a more comprehensive view of the prevalence.
- Presumptive positive ticks should be verified with additional primers.
- Sequencing of the 222 base pair product should be performed for confirmation.

References

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