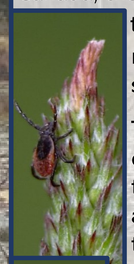
Tick-Talk: Quantifying Dawn and Dusk Questing Behaviour and Pathogen Presence in *Ixodes* Ticks

Author: Shantelle March
Supervisors: Dr. Tatiana Rossolimo, James Kho (PhD candidate)

Introduction

Ticks are ectoparasites who feed by a sit-and-wait strategy known as questing. Ticks pursue their potential hosts indiscriminately and insidiously, making them difficult to detect on a host. In Canada, there are over forty species of ticks who pose significant health risks to humans by being vectors of many harmful, sometimes fatal, pathogens.



This project sought to determine if *Ixodes* ticks quest preferentially during dawn or dusk, and if there is any statistical significance in which bacteria and viruses are found at these times of day when ticks are questing.

It is hypothesized that there is no preference for time-of-day questing in *Ixodes* genera (H_0) and also that there is no correlation between pathogen presence and time-of-day questing behaviours (H_0).

Materials & Methods

- Ticks were collected at dawn and dusk from Sept to Dec 2023 at three locations across HRM (Fig.1).
- Ticks collected using "flag and drag" method.
- DNA & RNA were extracted from specimens, and PCR & gel electrophoresis were performed in order to determine pathogenic load.
- Tested for Lyme, Bartonella, Babesia, *Anaplasma phagocytophilum*, and Powassan virus.

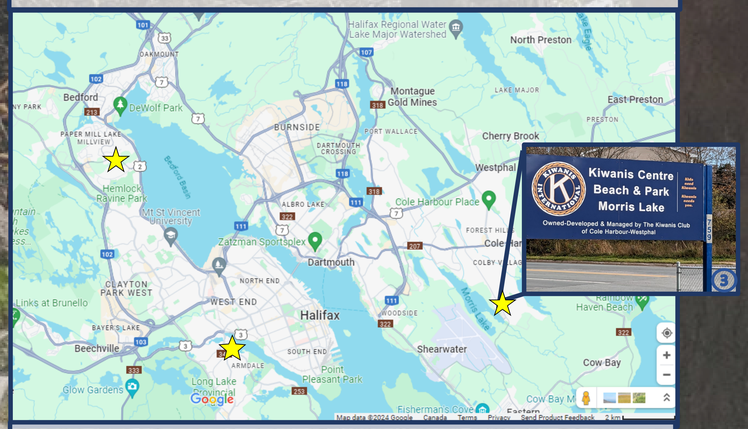


Figure 1 Three locations where tick collection was affected. From L to R: Bedford South hiking trails, Frog Pond, and Morris Lake Kiwanis park. Map source: Google Maps, 04 Feb 2024.

Results

Preliminary results indicate that there may be preference for morning questing activity over evening questing (Fig. 3). Of 518 specimens, 75% were found to be questing in the morning.
A sample of ticks (Fig. 4; n=44) were tested for Bartonella infections from which 75% tested positive. This represents 47% of the sample which quested during the morning.

Figure 2 Two *Ixodes* tick specimens. The left specimen was collected using flag & drag method. The right specimen is a nymph shown under a microscope at 4X magnification.

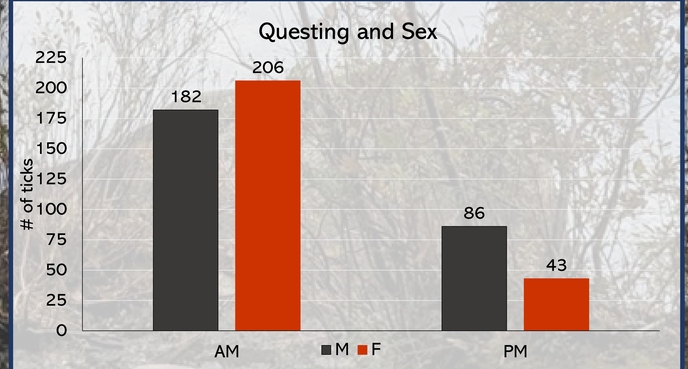


Figure 3 *Ixodes* ticks questing at morning versus evening (n=518).

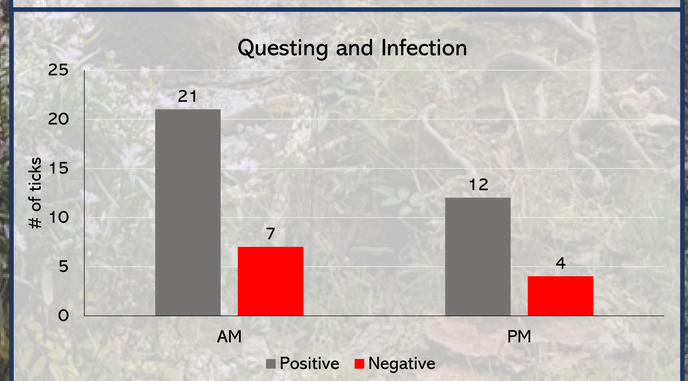


Figure 4 A sample of *Ixodes* ticks were tested for Bartonella (n=44), from which 75% tested positive and 47% of which were collected during morning questing.

Discussion

A parasite will pursue a host when it is more likely to be successful in obtaining one, so long as it does not pose any danger to itself. The susceptibility of *Ixodes* ticks to desiccation from the heat of midday largely limits questing activity to morning and evenings. Time of day questing preference in tick species may also be linked to the host's own preferences for foraging, perhaps indicating a co-evolution in these species.

The absence of ticks questing at a time of day may be indicative of questing success in the opposite time of day.

Future Research

Future research may want to focus on longer periods of field collection that could span multiple seasons or years. This would provide better insight into tick abundance in specific locations in HRM and NS. Additionally, more lab-based projects might be pursued that can institute controls such as timed light intervals and set environmental controls in order to better describe the physiological boundaries across *Ixodes* genera within which ticks quest for hosts. Finally, analyses into the foraging behaviours and daily routines of common *Ixodes* hosts may help to direct future tick-related research efforts, especially those that overlap with Public Health tick awareness campaigns at both the municipal as well as provincial levels.

References

Photos:

1. Jarle Tryti Nordeide, Wikimedia Commons, 18 July 2020.
2. Michael Apel, Wikimedia Commons, 02 June 2007.
3-4. Shantelle March, 2023.
Background image: Shantelle March, 2023.

Content:

Acknowledgements

Dalhousie University is located on the unceded and ancestral territory of the Mi'Kmaq people, who are the traditional custodians of the land known as Kjipuktuk.
My heartfelt gratitude goes out to my two supervisors, Dr. Tatiana Rossolimo and James Kho for their guidance throughout this research project. Additional thanks to all the volunteers in the Rossolimo Tick Lab, who provided vital assistance in tick collection and analysis. A final and most special thank you to Kees and Scout, two top notch albeit unintentional tick collectors on my team.

DALHOUSIE UNIVERSITY