Arbovirus Co-Infections in Wisconsin Tick Populations

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INTRODUCTION:
Health care providers commonly encounter patients who present with a clinical syndrome resembling a “tick borne illness.” Powassan/Deer Tick Virus (POWV/DTV) is closely related to tick-borne encephalitis virus (TBEV), a virus that causes neurological disease in 20-30% of infected patients in Europe. The studies described here reveal the prevalence and geographic distribution of Wisconsin ticks carrying POWV/DTV and the rate of co-infection with Borrelia, the causative agent of Lyme disease.

METHODS: Questing ticks were collected during three time frames: Harvest 1: Fall 2011-Spring 2012; Harvest 2: Spring 2013; Harvest 3: Fall 2013.

Prevalence of Tick-Associated Infectious Agents by Species in Northern Wisconsin

**Harvest 1: Endemic Zone**
- Collection area same as described by Ebel et al., 1999: NW quadrant of Wisconsin
- Historically highest density of Ixodes ticks carrying Borrelia
- Also highest reported frequency for Lyme Disease

**Harvest 2: Geographic Survey**
- 33 counties across Wisconsin
- >2000 ticks collected during Spring 2014 harvest
- Ticks used to survey prevalence of agents across Wisconsin

**Harvest 3: Hyper-Endemic Zone**
- Bayfield County in NW quadrant of Wisconsin
- 100 ticks collected from the same dog
- Collected within a 2 week span in Fall of 2013

Case Study - Assessment of Individual Ticks for Transmissible Agents in Localized, Hyper-Endemic Region

**Prevalence of Borrelia and POWV/DTV by Tick Genus Across Wisconsin**

**CONCLUSIONS:**
1. Both Ixodes and Dermacentor ticks infected with Borrelia are found across Wisconsin
2. POWV/DTV infection seen only in Ixodes ticks; distribution across Wisconsin
3. An individual can acquire multiple tick associated pathogens simultaneously:
   - Study 1: A single tick carrying more than one agent
   - Study 2: Multiple ticks carrying one agent in a single exposure
   - Study 3: Localized “hot spots” with high frequency of both single agent and co-infected ticks
4. POWV/DTV found in a significant percentage of Ixodes ticks in all studies
5. Infection with POWV/DTV may be under diagnosed and the virus may contribute to the acute and/or persistent symptoms often associated with Lyme disease diagnosis.