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Matthew Buchholz

Department of Biology and Center for Biodiversity Studies, Western Kentucky University,
matthew.buchholz516@topper.wku.edu

Carl Dick

Department of Biology and Center for Biodiversity Studies, Western Kentucky University, carl.dick@wku.edu

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Host-Parasite Associations of Small Mammal Communities: Implications for the Spread of Lyme Disease

Matthew J. Buchholz¹ and Carl W. Dick¹

¹ Department of Biology and Center for Biodiversity Studies, Western Kentucky University

Abstract

Many zoonotic diseases of concern to human and wildlife health are maintained in the environment by small mammal reservoirs and vectored to new hosts by ectoparasitic arthropods. While ecological relationships between small mammals and their ectoparasites are important to these dynamics, this system is poorly understood across much of North America. The goal of this study was to examine relationships between small mammals and ectoparasites across seasons and between different habitat types in South Central Kentucky and potentially provide an ecological explanation for the few human cases of Lyme disease reported in Kentucky. Small mammals were captured using Sherman live traps in three 50x200m trap grids established within Western Kentucky University's Green River Preserve (GRP). Traps were open three consecutive nights each month from November 2014-October 2015. Captured small mammals were identified to species, and standard data such as sex, age, mass, and measurements were recorded. Attached and unattached ectoparasites were removed and retained for identification. A blood sample was collected from each mammal followed by ear tagging for identification of recaptures with subsequent release at the site of capture. Blood was examined for *Borrelia burgdorferi*, the causative agent of Lyme disease in humans, by polymerase chain reaction (PCR). PCR primers used were specific to the *OspA* gene of *B. burgdorferi sensu stricto*. Home range was calculated using the minimum convex polygon method in the program Biotas, and was calculated at the daily level (multiple captures within a given month) and at the lifetime level (multiple captures spanning 2+ months). Population density was calculated using the Schnabel population estimate. Prevalence and mean intensity of ectoparasite species, and prevalence of *B. burgdorferi* DNA in collected blood and tissue, were estimated for and compared between each host species, habitat and season, and age and sex. This study found that the majority of small mammals on the GRP were not infested with ectoparasites, but infestation was affected by age, sex, habitat, and season in different parasite taxa. The study also found few specimens of *Ixodes scapularis*, the primary vector for *B. burgdorferi*, as well a low prevalence of *B. burgdorferi* compared to Lyme Disease hotspots of New York and Wisconsin. These findings provide the ecological insights into the relative lack of Lyme Disease in Kentucky.