

Final Report. Ectoparasites and bats (Chiroptera) from Acadia National Park, 2016.

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Introduction

Ectoparasite communities of bats, particularly mites, soft bodied ticks (Argasidae), and true bugs (*Cimex*), have been well documented¹⁻³. Because ectoparasites on bats are not aggressive questers, like mammalian-feeding ticks such as *Dermacentor variabilis*, they tend to spend the majority of their lives in close association with communal roosts, where the ambient humidity and temperature remain high⁴.

Recently, some studies have reported the presence of vector-borne disease agents in temperate bat species^{5,6}. While these studies have reported the genomic trace of agents such as bacteria and rickettsia in bats, the actual reservoir competence of bats for these agents remains unknown.

As part of an overall environmental and health assessment of bats on Acadia National Park (Hancock County, Maine), we identified ectoparasites removed from a small community of bats during the summer of 2016. Following species identification, we examined ectoparasites, when available, for the presence of two common tick-borne agents in Maine – *Borrelia burgdorferi*, the agent of Lyme disease, and *Anaplasma phagocytophilum*, the agent of granulocytic anaplasmosis.

Methods and Materials

Samples of ectoparasites were collected from live-captures bats on Acadia National Park from June-September 2016. Ectoparasites were removed and placed in 90% ethanol prior to identification. Specimens were identified using standardized keys⁷⁻⁹, upon arrival to the Maine Medical Center Research Institute (Scarborough, ME).

Samples were, if possible, tested by polymerase chain reaction (PCR) for the presence of two common tick-borne bacterial pathogens, *Borrelia burgdorferi* and *Anaplasma phagocytophilum*, using standardized protocols and primers¹⁰.

Results

Of the 97 individual bats sampled during this period, ectoparasites were collected from only two species, eastern small-footed bats (*Myotis leibii*) [hereafter MYLE] and northern long-eared bats (*Myotis septentrionalis*) [hereafter MYSE]. Although big brown bats (*Eptesicus fuscus*) and little brown bats (*Myotis lucifugus*) were captured during this survey, ectoparasites were not found on either species.

All the ectoparasites submitted from this survey were identified as *Ichoronyssus quadridentatus*, commonly associated with bats⁷. Among MYLE captured, 13/50 (26%) were parasitized by *I.*

quadridentatus while 4/7 (57%) MYSE were parasitized. Among individual MYLE captured, a larger number of mites were found earlier in the season, decreasing through summer (Fig.1).

When examined by PCR, no mite samples were positive for *Borrelia burgdorferi* (Fig. 2), but one sample, derived from a MYSE (#4691) tested positive for *Anaplasma phagocytophilum* (Fig. 3), indicating exposure to this rickettsia.

Conclusions

This brief survey documents the exposure of bat ectoparasites to a tick-borne agent, *A. phagocytophilum*, which is considered an emerging infection in Maine¹¹. While the PCR test indicates that genetic material of the rickettsia was present in the mites, the fact that these mites are usually one-host parasites indicates that they acquired the rickettsia from the MYSE collected. Rickettsial agents, including *A. phagocytophilum*, have previously been found in parasitic mites of *Myotis*¹², but this is the first record of such an occurrence in Maine. It is possible for these bats, during roost periods, to theoretically encounter hard ticks, such as *Ixodes scapularis*, that have fed on rodents, such as red squirrels and white-footed mice, and in seeking new hosts, encounter low roosting bats. What role bats may play in the disease ecology of tick-borne pathogens in Maine remains unknown but should be explored in future studies.

References

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Figures

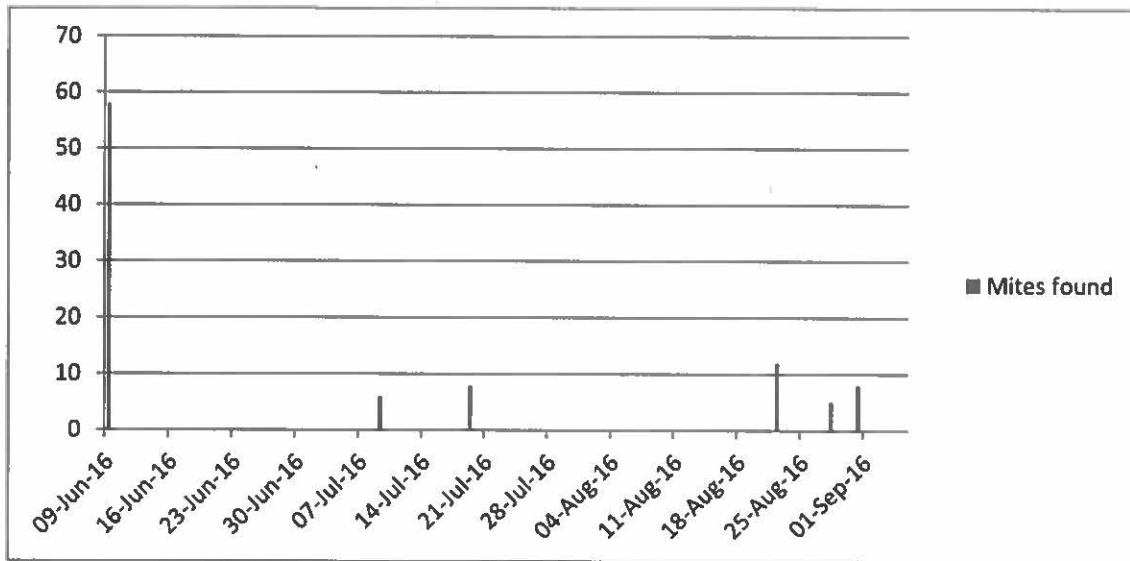


Figure 1. Numbers of *Ichoronyssus* mites found on MYLE, Acadia National Park, 2016.

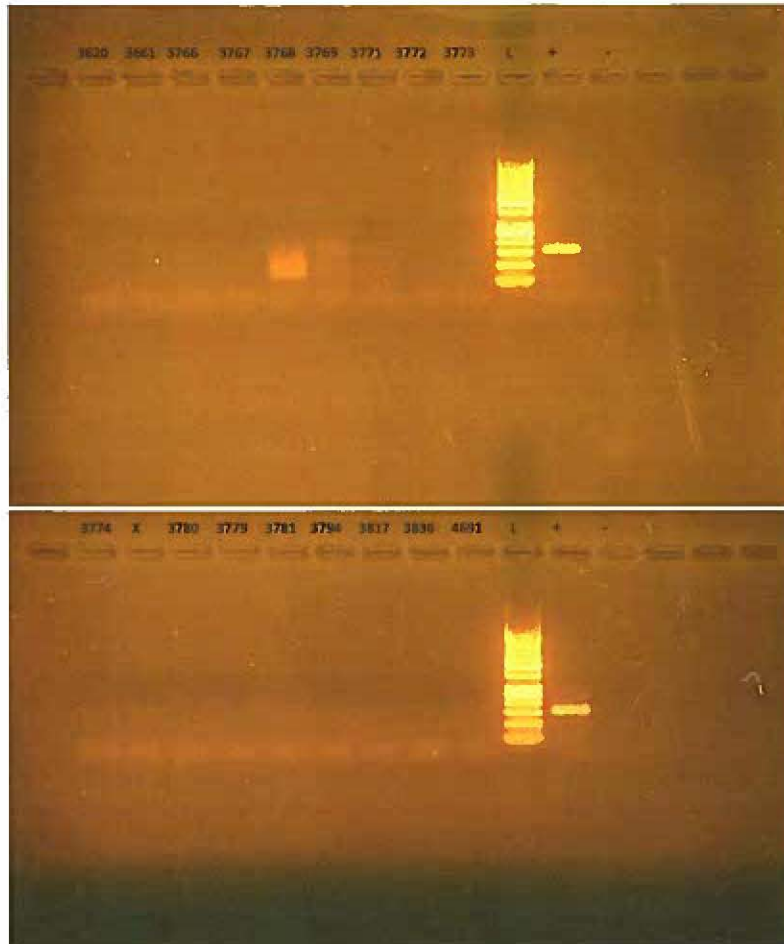


Figure 2. Gels from PCR reactions testing for *Borrelia burgdorferi*

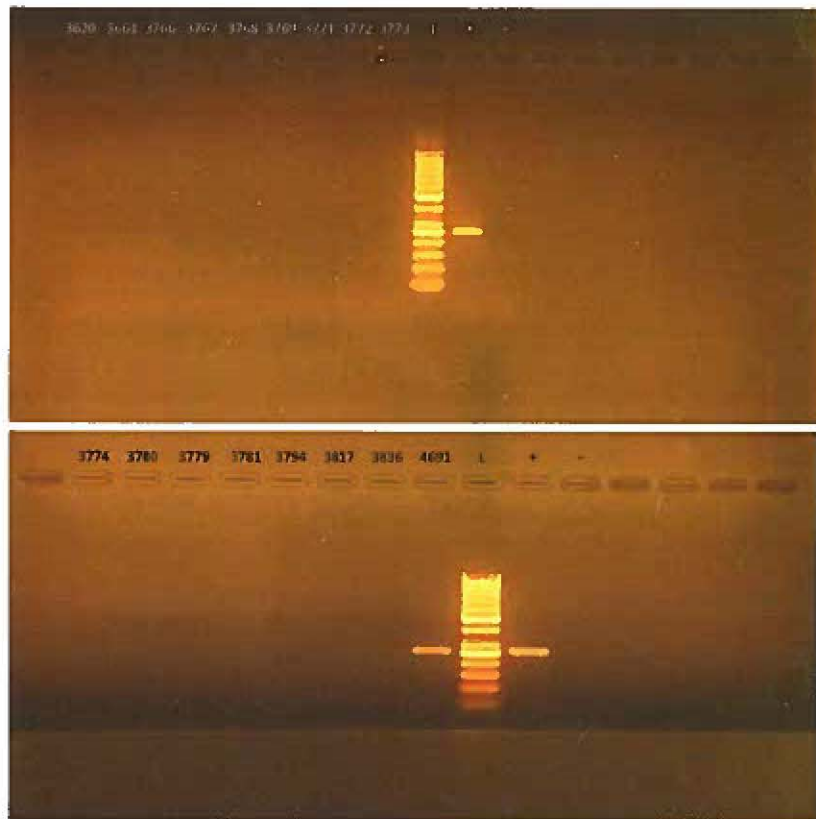


Figure 3. Gels from PCR reactions testing for *Anaplasma phagocytophilum*.