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Detection of *Acinetobacter baumannii* in Human Lice

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ABSTRACT

Pediculus humanus humanus and *Pediculus humanus capitis* are bloodsucking human ectoparasites. Human body lice have been long known to vector several human pathogens, including *Rickettsia prowazekii*, *Bartonella quintana*, and *Borrelia recurrentis* and thus are associated with high incidences of diseases and mortality rates. In contrast, human head lice are not typically associated with the carriage of any pathogens, despite sporadic findings of *B. quintana* and *Acinetobacter baumannii* in lice collected from homeless people and children in different parts of the world. **The purpose of this project** is to assess the prevalence of *A. baumannii* in human head lice collected from school children from Madagascar and Georgia, USA, and in body lice from homeless people in Russia.

BACKGROUND

Previous studies conducted in several geographic regions have reported the detection of *Acinetobacter baumannii* from head and body lice.

Table 1. Prevalence rate of *A. baumannii* in human lice samples collected from different geographical locations.

Location	Total No. Positive	Total No. Tested	Prevalence Rate (%)
Ethiopia (Ref 3)	40	134	67%
Thailand (Ref 2)	4	275	1.45%
France (Ref 1)	95	288	33%

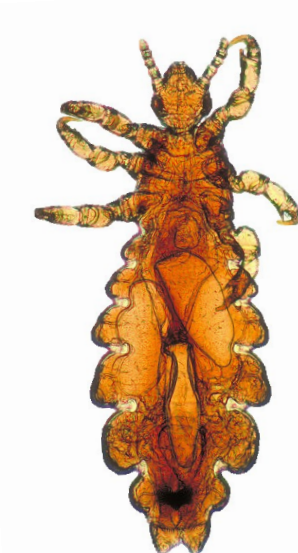
MATERIALS AND METHODS

Samples of adult human lice were obtained from Madagascar, Russia, and Georgia USA.

Each louse was identified to species and sex using taxonomic keys.



Male



Female

DNA was extracted from each louse using the Qiagen QiaAmp DNA Mini Kit protocol.

PCR was performed to optimize amplification conditions using DNA from a cultured environmental isolate of *A. baumannii*.

Louse DNA was tested using TaqMan assay targeting *rpoB* of *Acinetobacter baumannii*.

Data were analyzed using the chi-square test.

RESULTS

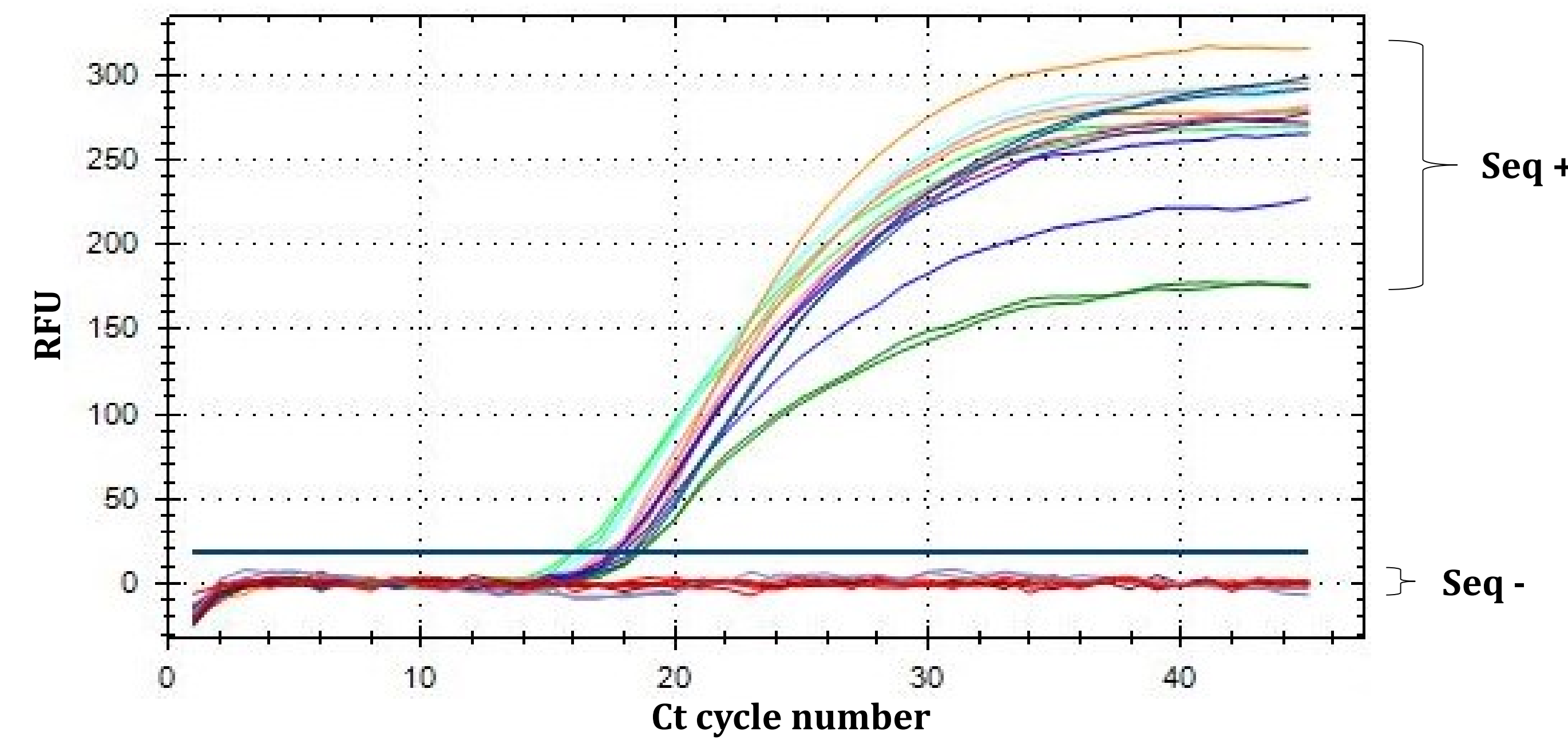


Figure 1. TaqMan detection of *rpoB* gene in environmental isolates of *Acinetobacter* species. PCR positive samples were identified as *Acinetobacter baumannii* by 16S rRNA gene sequencing.

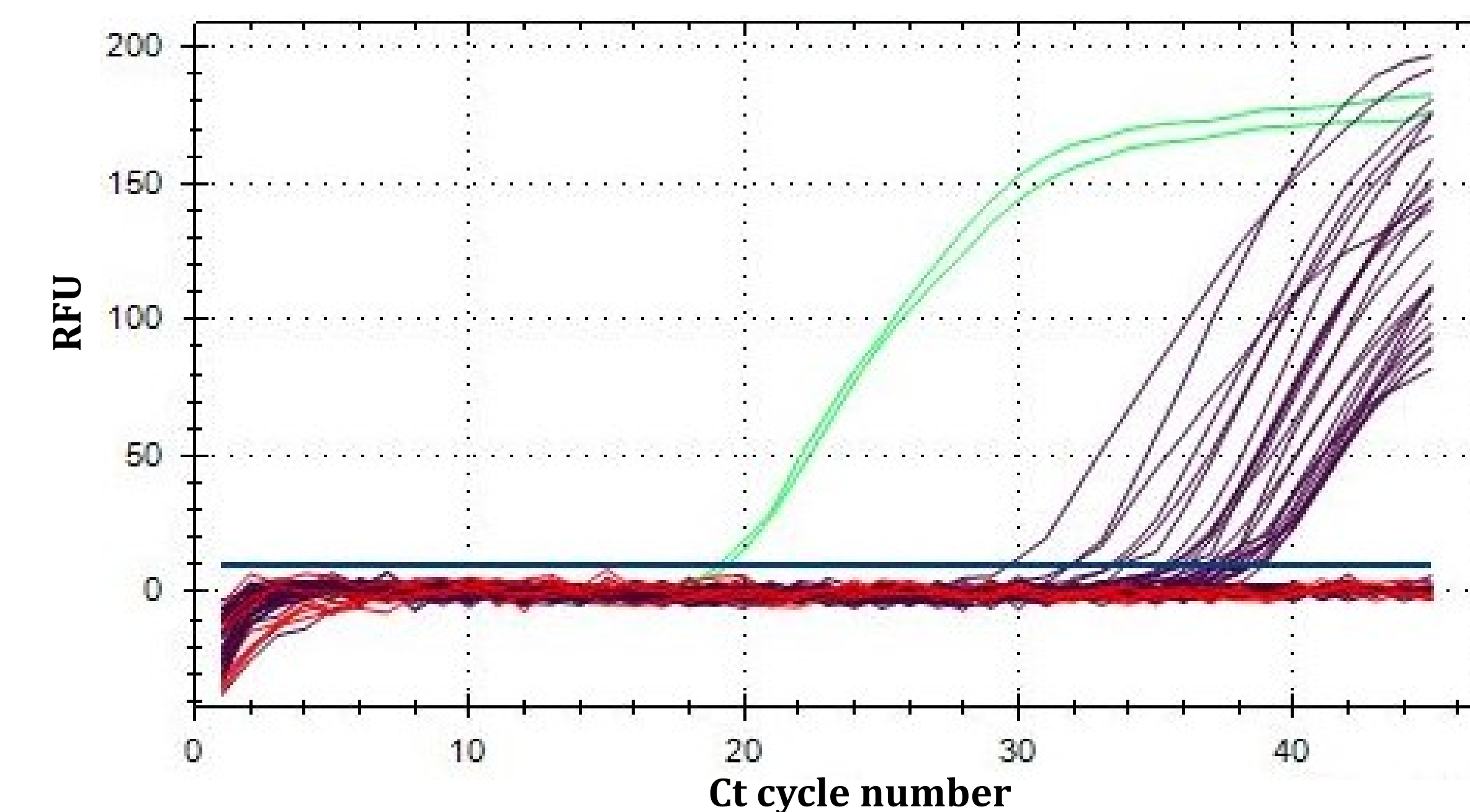
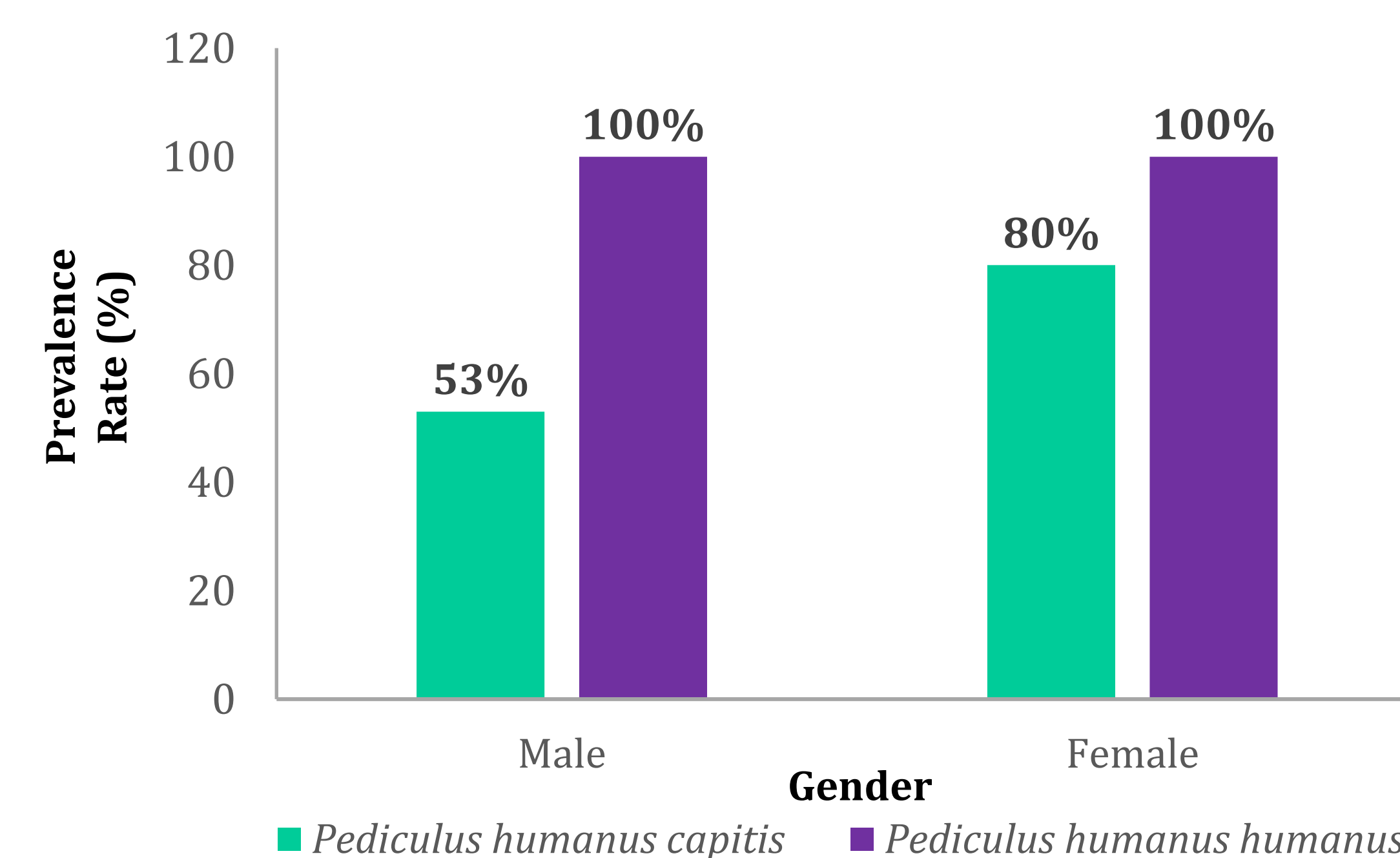


Figure 2. Detection of *A. baumannii rpoB* using TaqMan in head lice samples collected from Georgia, USA. (Green lines correspond to control positive culture, red lines correspond to negative control or no template samples.)

Table 2. Prevalence of *A. baumannii* in human lice samples collected from Madagascar, Georgia, USA, and Russia.

Location	Species	Total No. Positive	Total No. Tested	Prevalence rate (%)	Average Ct Value
Madagascar	<i>P. humanus capitis</i>	12	30	40%	34.59
Georgia, USA	<i>P. humanus capitis</i>	17	20	85%	36.73
Russia	<i>P. humanus humanus</i>	20	20	100%	31.88



■ *Pediculus humanus capitis* ■ *Pediculus humanus humanus*

Figure 3. Percentage prevalence of *A. baumannii* in male and females of head lice and body lice.

Table 3. Prevalence of *A. baumannii* in head lice and body lice.

Species	Total No. positive	Total No. Tested	Prevalence Rate (%)	Average Ct Value
<i>P. humanus capitis</i>	29	50	58%	35.84
<i>P. humanus humanus</i>	20	20	100%	31.88

SIGNIFICANCE & CONCLUSIONS

- Louse positive for *Acinetobacter baumannii* were found at each location. Among three countries tested, Russia had the greatest prevalence of 100%. Female samples collected from Madagascar and Georgia, USA had a higher prevalence rate than male samples (P=0.11, CI 95%). Male and female lice samples from Russia were all positive. Body lice has a high prevalence of carrying *A. baumannii* than head lice (P<0001, CI 95%) based on these results but samples from more locations are needed to determine if this is unique to this collection.
- The frequent presence of *A. baumannii* in association with human lice is of particular importance and concern because this otherwise opportunistic environmental microorganism harbors numerous antibiotic resistant genes and is capable of surviving in hostile environments and because louse feeding may increase its likelihood of causing infections at the bite sites.
- When lice are infected with this agent, it may lead to greater severity of pediculosis in some individuals, particularly those with weakened immune systems.
- Detection of this bacterium is crucial in monitoring louse-borne diseases and its transmission to humans.

FUTURE RESEARCH

- Clone a *rpoB* fragment of an *A. baumannii* isolate and make a recombinant plasmid which will be used as a PCR positive control for further testing of lice with the TaqMan assay.
- Conduct genetic typing of *A. baumannii* and examine the profile of its antibiotic resistance genes.
- Include in the study more geographical areas along with larger sample sizes of body and head lice.
- Understand and identify where this bacterium resides in the louse and if it is maintained vertically (transtadially, transovarially) or horizontally (co-feeding, sexual transmission) to define new strategies to reduce the carriage of this agent.
- Determine if *Acinetobacter* provides B-vitamin cofactors essential to the louse that may complement those that are produced by its endosymbiont, *Riesia pediculicola*.

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