



Characterization of tick-borne infections in cattle: Potential of direct PCR for surveillance of tick-borne pathogens

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INTRODUCTION

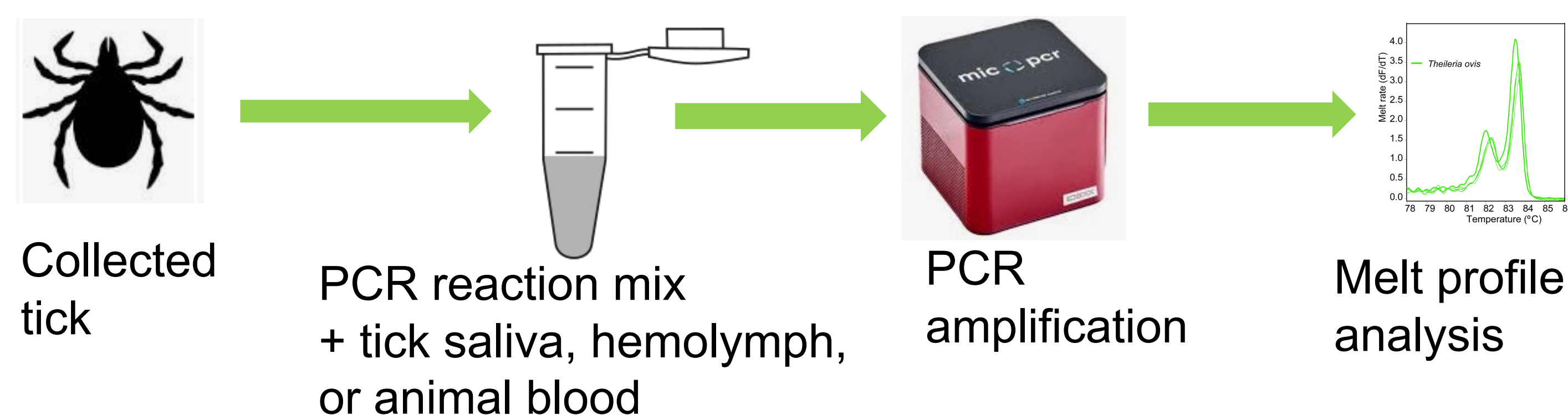
- ❖ Human health and animal health are closely linked in terms of the One Health concept by ticks and mosquitoes, among others, acting as vectors for zoonotic pathogens¹.
- ❖ Ticks are vectors of emerging infectious diseases that have been spreading in recent decades due to climate change.
- ❖ Anaplasmosis and theileriosis are some of the tick-borne diseases (TBDs) known to cause economic losses to dairy farmers in Kenya².
- ❖ Ehrlichiosis caused by *Ehrlichia ruminantium* has also been reported in Kenya. However, its economic impact has not been quantified².
- ❖ Outbreaks of Q fever (*Coxiella burnetii*) and Crimean-Congo hemorrhagic fever (CCHF) in humans have been reported in Africa and Europe³.
- ❖ Therefore, it is important to establish early warning and precautionary measures in cases of outbreaks. Developing affordable surveillance measures is the first step in assessing the risk of vector-borne epidemics.

OBJECTIVES

- ❖ To develop a direct PCR for detection of tick-borne pathogens.
- ❖ To characterize tick-borne arboviruses, bacteria, and protozoa of zoonotic importance cattle blood, ticks, and skin swabs (ears, nose, and around anal region).

METHODS

1. Direct PCR for detection of TBPs



2. Characterization of TBPs in blood, ticks and skin swab

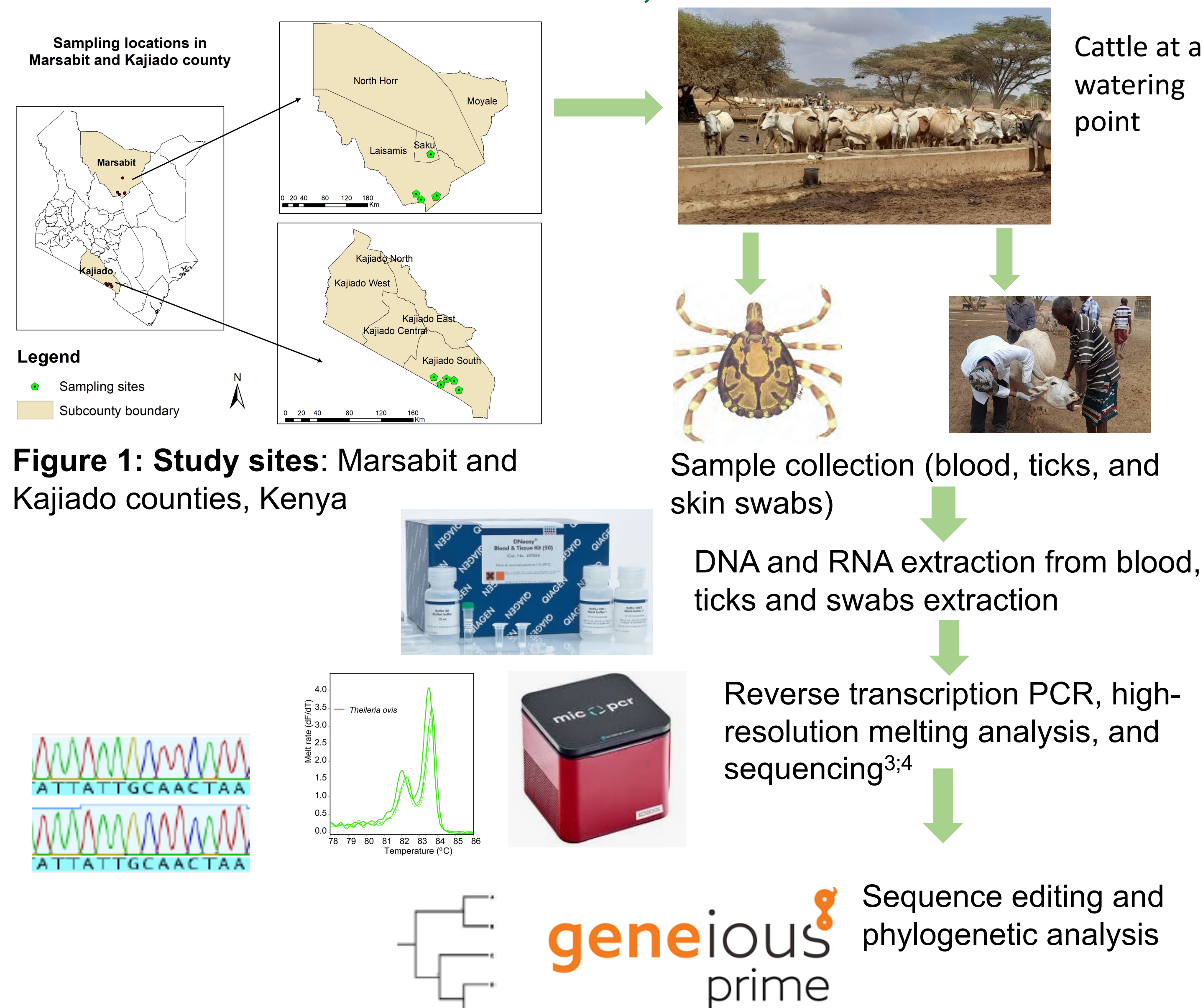


Figure 1: Study sites: Marsabit and Kajiado counties, Kenya

RESULTS

1. Optimizing direct PCR for detection of *Anaplasma* and *Ehrlichia* spp.

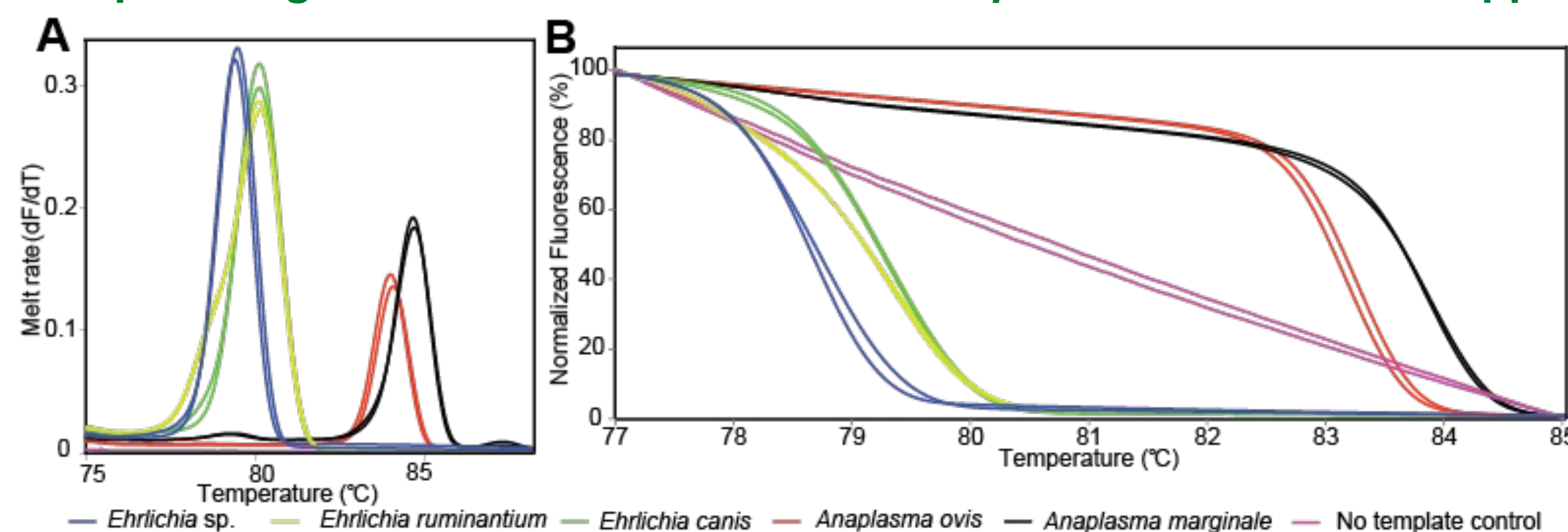


Figure 2: Distinct multiplex high resolution melting (HRM) profiles of *Ehrlichia* (*sodB*) and *Anaplasma* (*msp4*) sp. using newly developed direct PCR protocol. **A. Melt rate profiles** and **B. Normalized HRM profiles**.

2. Detection of TBPs: Can eDNA be used for surveillance of TBPs?

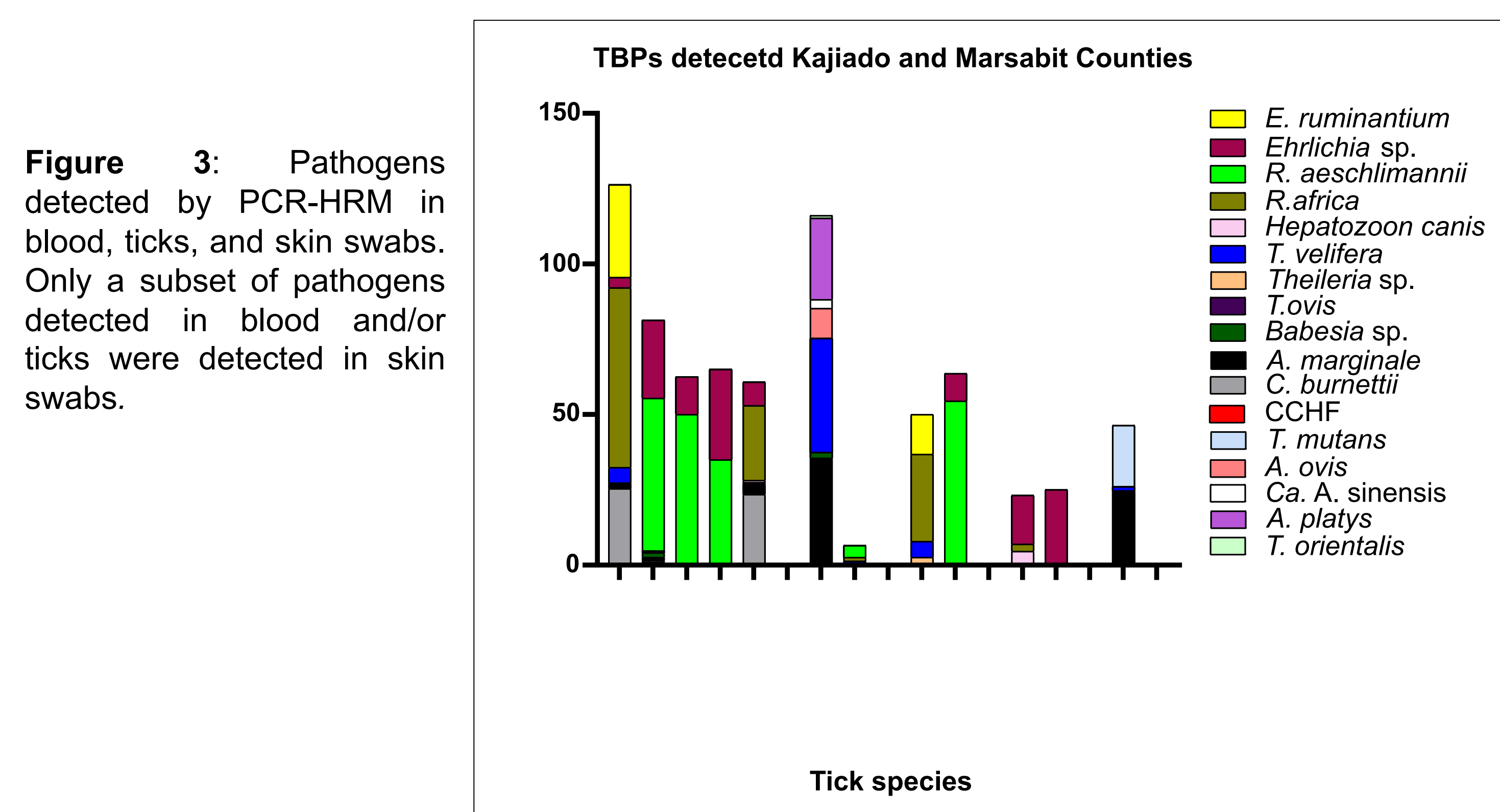


Figure 3: Pathogens detected by PCR-HRM in blood, ticks, and skin swabs. Only a subset of pathogens detected in blood and/or ticks were detected in skin swabs.

Diverse pathogens of public health and veterinary concern were detected in ticks, including the zoonotic CCHF, *C. burnetii*, and *R. africae*, further highlighting the role of ticks as vectors in their transmission.

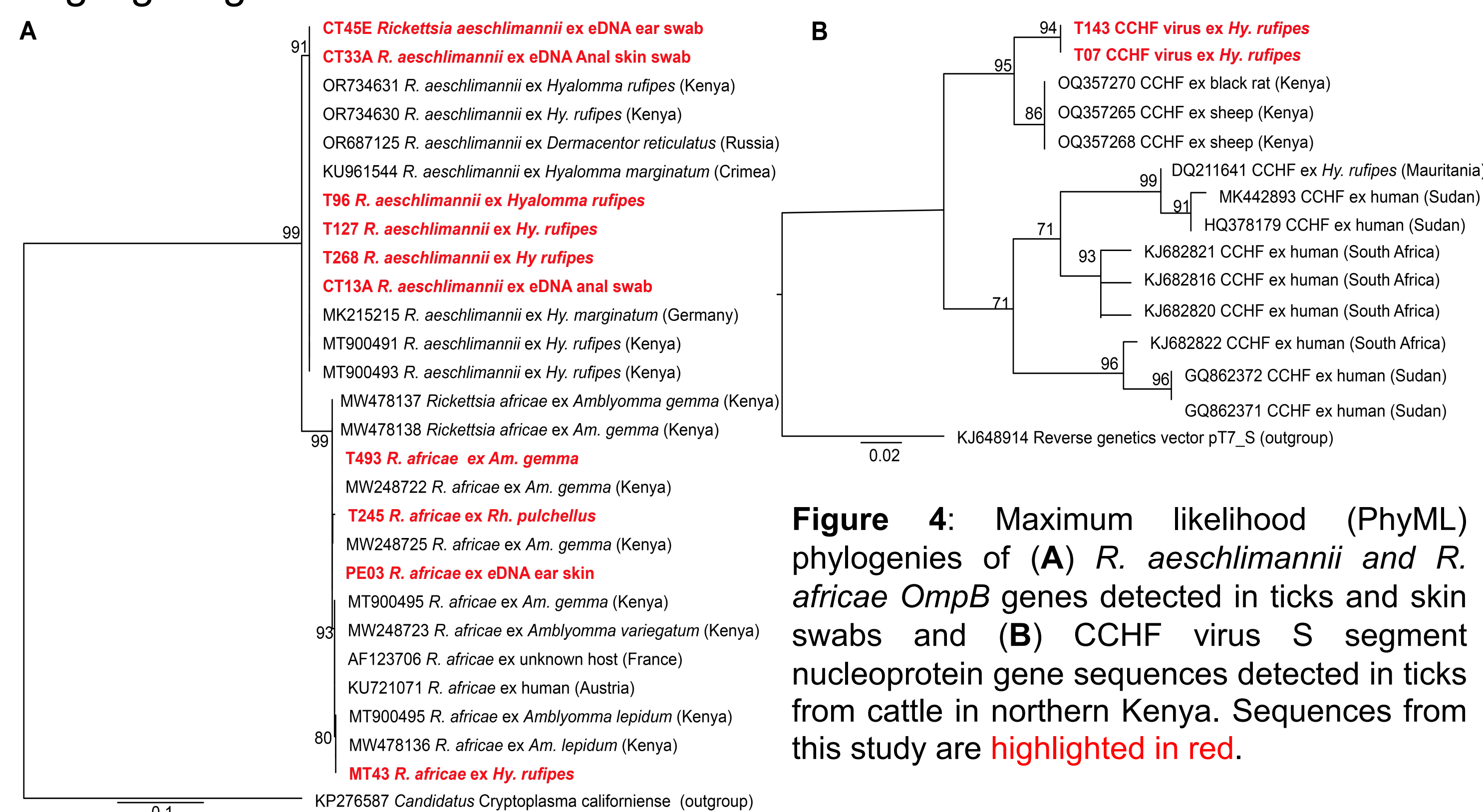


Figure 4: Maximum likelihood (PhyML) phylogenies of (A) *R. aeschlimannii* and *R. africae* *ompB* genes detected in ticks and skin swabs and (B) CCHF virus S segment nucleoprotein gene sequences detected in ticks from cattle in northern Kenya. Sequences from this study are highlighted in red.

CONCLUSIONS

- ❖ Pathogen DNA can be amplified directly from blood and tick tissue without DNA extraction.
- ❖ Presence of under-diagnosed zoonotic pathogens in ticks from cattle in northern Kenya.
- ❖ eDNA from cattle skin swabs, in combination with other tools, has the potential to be used as a faster, non-invasive, and cost-effective tool for monitoring of TBPs.

IMPACT

The findings of this study can:

- I. Guide disease control programs.
- II. Reduce the cost of screening for TBPs in animal blood, tissues, and ticks.
- III. Create awareness of the potential use of skin swabs for surveillance of TBPs, including zoonotic pathogens such as *R. africae* in livestock.

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EU Horizon 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000365.

