The Man with the Plan: Developing an affordable and efficient surveillance assay for *Rickettsia sp.*

Tick-transmitted diseases are of major concern in the United States. Oklahoma in particular is a crossroad-state for ticks, having a high variety of tick populations spread throughout the state. Rocky Mountain Spotted Fever (*Rickettsia rickettsii*) is concerning to many members of the public, though other Spotted Fever Group *Rickettsia* *sp.* should also concern them as well. According to Oklahoma State University’s Medical and Veterinary Entomologist, Dr. Bruce Noden, the Rocky Mountain Spotted Fever that we used to know is no longer the only concern. “There are many different species of Rickettsial diseases now, with various different side effects that make them difficult to identify.”

Dr. Bruce Noden is an assistant professor within the Department of Entomology and Plant Pathology. His research interests include studying the influence of ecological and environmental factors on arthropod populations of disease vectors and their pathogens. More recently, he has focused on ticks and mosquitoes, including research on Spotted fever group Rickettsia, including Rocky Mountain spotted fever.

Dr. Noden has lived an interesting life, having grown up in Africa and participated in education and research programs in Africa and the United States. He received his Ph.D. in Immunology and Infectious Diseases from the Johns Hopkins Bloomberg School of Public Health. He first arrived to OSU as an assistant professor in 2013, and has since been tackling Spotted fever group (SFG) Rickettsia , Ehrlichia, West Nile virus, Zika virus, Murine typhus and canine heartworm.

Part of his research includes the development of low-cost molecular diagnostic tools for vector-borne diseases. I specifically reached out to Dr. Noden for his work on “Development of a loop-mediated isothermal amplification (LAMP) assay for rapid screening of ticks and fleas for spotted fever group rickettsia,” and he was eager to discuss it with me (Noden *et. al,* 2018). As he put it, “this research was a kernel from my long-term passion for aiding under-developed countries. This study was truly representative of why I got into science.”

When asked about his reasons for focusing on cheaper disease detection assays, Dr. Noden became very invigorated. “The problem with surveillance in developing countries is that they have to be dependent on a ‘brother nation.’ Funding for disease research in these countries is most often provided to research on major human diseases such as Malaria and HIV, rather than those affecting the wealth of the common man.” According to Dr. Noden, wealth in developing countries is more often determined by their land or livestock, rather than currency. With Rickettsial diseases, people of developing countries are losing their entire livelihood due to a lack of ability for these countries to afford surveillance and control.

The LAMP assay is an alternative molecular diagnostic tool to the end-point polymerase chain reaction (PCR) assay and quantitative PCR (qPCR) assay. The primary differences are that LAMP is able to amplify DNA in partially processed samples and is less likely to be altered by interfering inhibitors common in tick samples. Dr. Noden and his team specifically sought to develop a LAMP assay to detect SFG rickettsia DNA from field-collected ticks *and* fleas, comparing it to the results of established end-point PCR assays.

From the field-collected ticks, both assays identified the same infected tick pools, but for the flea pools LAMP detected two additional positives. This study is considered to be the first study to develop a functional LAMP assay for spotted fever group and transitional group (TRG) rickettsiae in field-collected ticks and fleas. “As far as we know, our LAMP assay has been the only one successful in detecting *Rickettsia* *sp.* Even LAMP assays for Rickettsia in human or animal hosts have not been successful yet.”

However, Dr. Noden also mentioned that there are some issues to address with the LAMP assay before it can begin to be used for field applications. “LAMP assays are very sensitive, contain more components than PCR, and are easily contaminated, therefore a kit would have to be developed to ease delivery. There’s also the issue of color-related assessment dueto color-blindness, which we had never considered before until a student of mine explained later he couldn’t differentiate the blue-purple color indicators for the test.”

Dr. Noden believes that their LAMP assay could eventually be used as a field-based surveillance tool for rickettsial pathogens in ticks and fleas, especially for resource-challenged countries. “The LAMP assay is not necessarily important for countries such as ours where we can afford current disease detection services,” explained Dr. Noden, “but we hope that it can aid with Rickettsial detection in countries that need it.” This not only gives these countries a means by which to monitor the vector populations, but also helps with integration into control programs. Hopefully with this LAMP assay, other countries will also be able to enjoy the luxury of better protection for their communities and livelihoods.

**References**

Noden BH, Martin J, Carrillo Y, Talley JL, Ochoa-Corona FM (2018) Development of a loop-mediated isothermal amplification (LAMP) assay for rapid screening of ticks and fleas for spotted fever group rickettsia. PLoS ONE 13(2): e0192331. https://doi.org/10.1371/journal.pone.0192331