



Kentucky Tick Surveillance

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INTRODUCTION

Tick-borne diseases are the second most vectored disease in humans outcompeting mosquito-borne disease in North America. However, tick and tick-borne disease distribution is not well understood in Kentucky. The three most common tick-borne diseases seen in Kentucky are Spotted fever rickettsiosis, Human monocytic ehrlichiosis and Lyme disease—all of which are increasing not only in Kentucky but nationwide. This may be explained, in part, by the range expansion and increased population densities of their tick vectors—particularly that of *Ixodes scapularis* that transmits Lyme disease. Three species of tick are considered main vectors of human disease pathogens—*Amblyomma americanum* as the primary vector of monocytic ehrlichiosis and a secondary vector of Spotted fever rickettsiosis, *Dermacentor variabilis* as the primary vector of Spotted fever rickettsiosis and *Ixodes scapularis* as the only vector of Lyme disease.

A strong surveillance system is crucial to providing the knowledge necessary to develop a useful understanding of the relationships between ticks and One Health. Working with the Kentucky Department of Public Health, we conducted a state-wide surveillance of tick distribution at county level and pathogen testing using PCR for detection of *Rickettsia rickettsii*, *Ehrlichia chaffeensis* and *Borrelia burgdorferi*. Preliminary data supports the presence of established *Amblyomma americanum*, *Dermacentor variabilis* and *Ixodes scapularis* tick populations infected with *Ehrlichia chaffeensis*, *Rickettsia rickettsii* and *Borrelia burgdorferi* pathogens, respectively, which suggests that Kentuckians are at risk for these tick-borne diseases.

OBJECTIVES AND METHODS

Objective 1: What is the county distribution of *Amblyomma americanum*, *Dermacentor variabilis*, and *Ixodes scapularis* populations in Kentucky?

Ticks commonly inhabit areas of forest, brush and field—particularly areas that contain substantial amounts of leaf litter as this is used for molting, mating and questing habitat. Ticks respond positively to increasing humidity, becoming more active and aggressive. Because of this, they are often found in deciduous forests, which makes up 47% of Kentucky’s total land area¹. It is expected that every species will be found throughout the state especially in counties that contain more deciduous forest land cover, such as those containing Daniel Boone National Forest and Land Between the Lakes. Field collection of ticks is conducted via drag cloth sampling and flagging in the types of areas mentioned above. Additionally, ticks are collected through the Kentucky Veterinarian

Tick Submission Program wherein veterinarian offices in Kentucky send in, via mail, any ticks collected off patients. Ticks are taxonomically identified and then stored in vials containing 70% ethanol.



Figure 1a: *Dermacentor variabilis* female (left) and male (right)



Figure 1b: *Amblyomma americanum* female (left) and male (right)



Figure 1c: *Ixodes scapularis* female (left) and male (right)

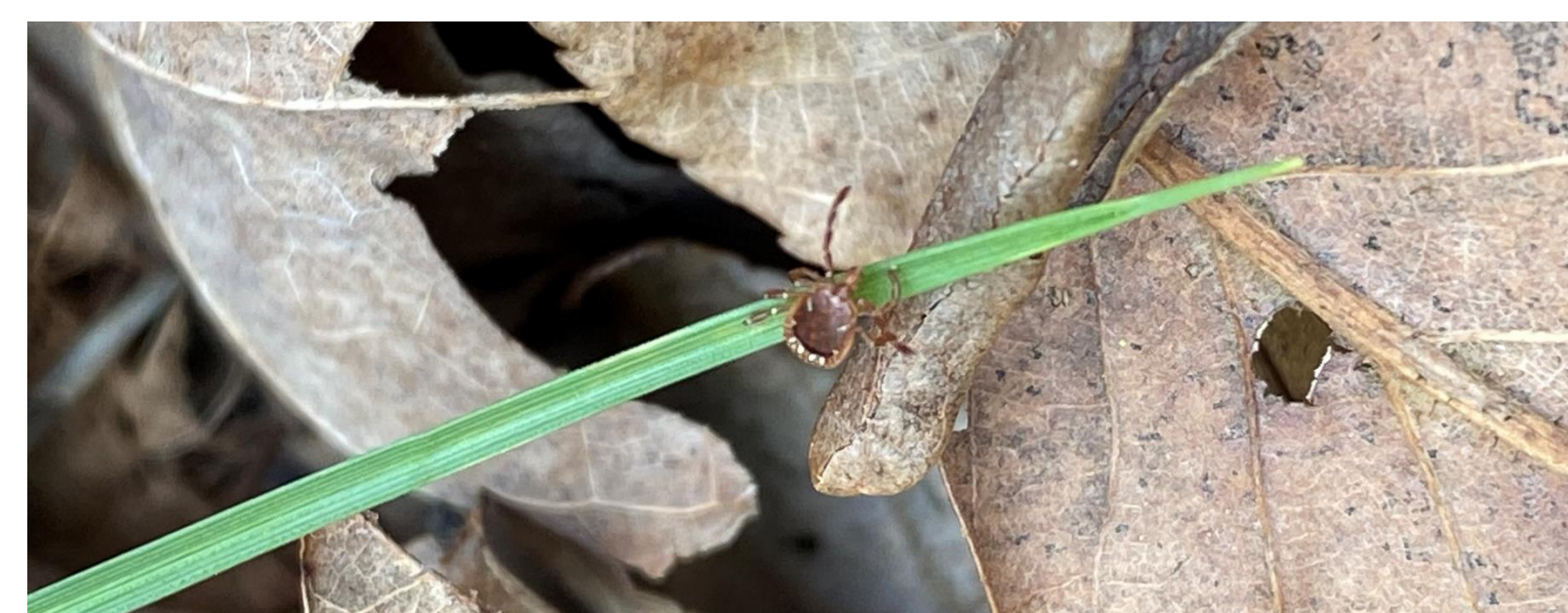


Figure 2: *Amblyomma americanum* male questing on a blade of grass.



Figure 3: Sampling with drag net in ideal tick habitat.

Objective 2: What is the prevalence of *Rickettsia rickettsii*, *Ehrlichia chaffeensis*, and *Borrelia burgdorferi* in ticks collected?

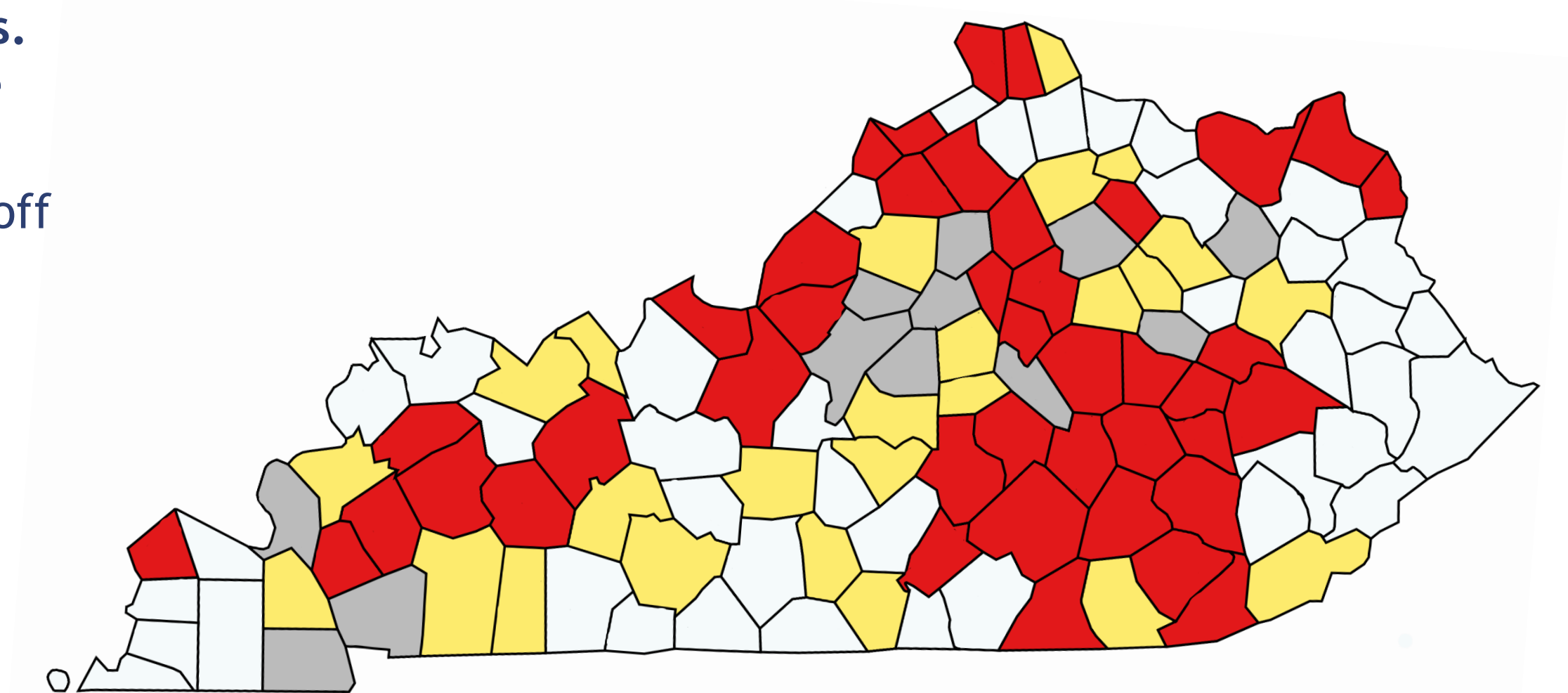
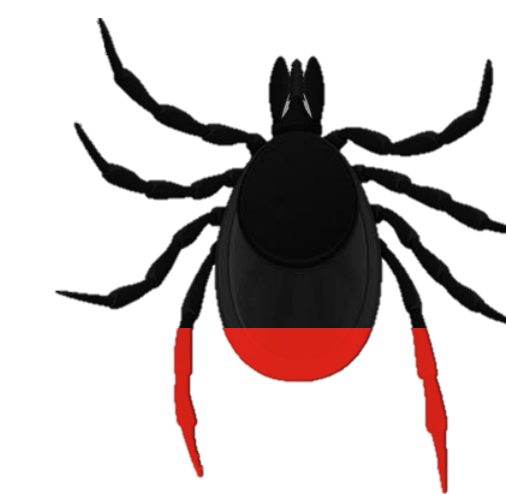
A polymerase chain reaction (PCR) test was used for pathogen detection. Ticks were first homogenized in lysis solution, then the DNA was extracted. The DNA and primers targeting select genes in pathogens were used to amplify fragments of *Rickettsia rickettsii* in *D. variabilis*, *Ehrlichia chaffeensis* and *Rickettsia rickettsii* in *A. americanum* and *Borrelia burgdorferi* in *I. scapularis*. The PCR products were run and agarose gels to identify presence/absence of target gene fragment.

RESULTS & DISCUSSION

Previous surveys reported the presence of *I. scapularis* in about 30% of KY counties. Our survey efforts increased data on populations for *A. americanum*, *D. variabilis* and *I. scapularis* to 80% of counties in KY. Our surveys found that the distributions of *A. americanum*, *D. variabilis* and *I. scapularis*. Populations seem to be scattered throughout the state, suggesting that public in all regions of KY may be at risk for developing tick-borne diseases from a tick bite. Counties in red represent established populations of the respective species defined as 6 or more specimen or 2 specimen of separate life stages of that species were collected within a 12-month period. Counties in yellow represent reported populations defined as less than 6 specimen of the same life stage and species with a 12-month period. Counties colored in grey represent counties where sampling was performed but no ticks of that species were collected while counties in white represent counties that were not dragged and had no data.

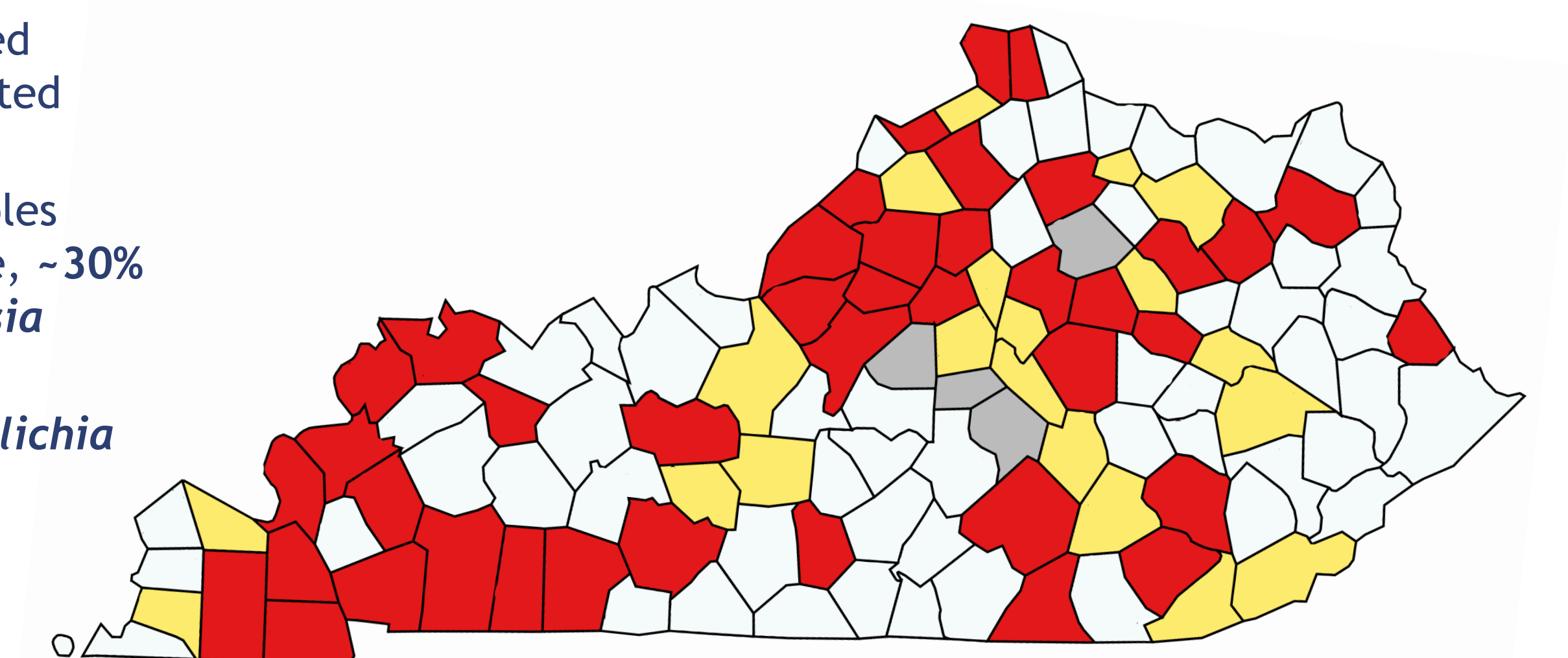
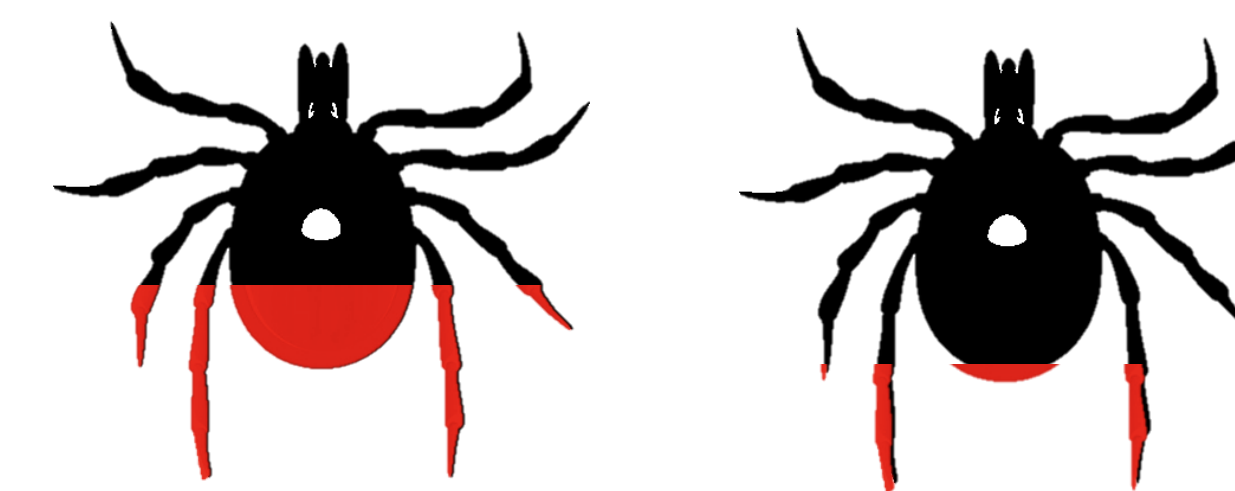
Ixodes scapularis

- 66 counties have data on *I. scapularis* populations. 18 counties contained established populations while another 18 contained reported populations.
- A total of 96 ticks were tested in 24 samples based off of collection site and date. Of these, ~20% of the samples tested positive for a *Borrelia burgdorferi* infection.



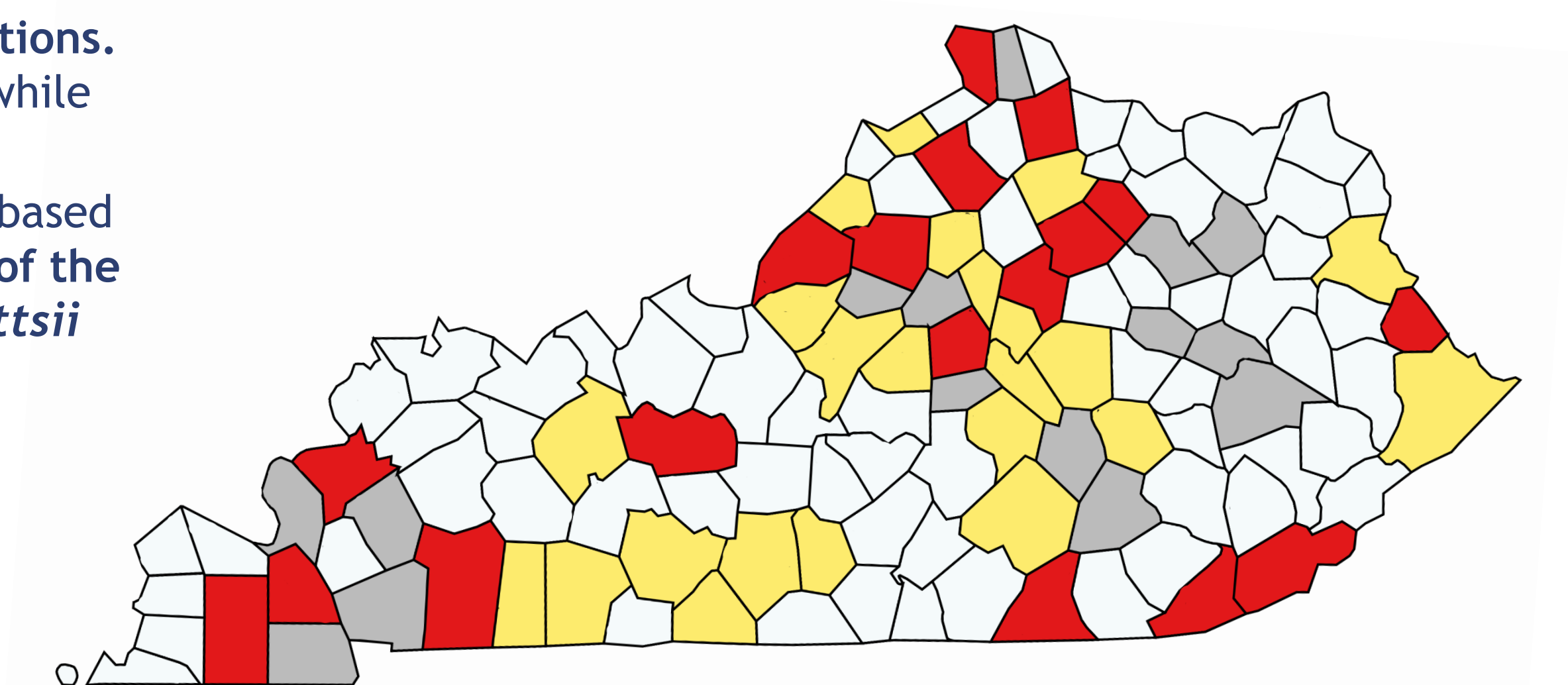
Amblyomma americanum

- 63 counties have data on *A. americanum* populations. 42 counties contained established populations while another 21 contained reported populations.
- A total of 2,404 ticks were tested in 195 samples based off of collection site and date. Of these, ~30% of the samples tested positive for a *Rickettsia rickettsii* infection.
- 2% of the samples tested positive for an *Ehrlichia chaffeensis* infection.



Dermacentor variabilis

- 42 counties have data on *D. variabilis* populations. 18 counties contained established populations while another 24 contained reported populations.
- A total of 218 ticks were tested in 108 samples based off of collection site and date. Of these, ~30% of the samples tested positive for a *Rickettsia rickettsii* infection.



THANKS TO

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REFERENCES

1. "Main Navigation." *Forest Facts - Kentucky Energy and Environment Cabinet*, eec.ky.gov/Natural-Resources/Forestry/Pages/Forest-Facts.aspx.

All pictures, figures, and graphs were taken and/or created by the authors.