Environmental, Anthropogenic, and Ecological Factors Affecting the Transmission of *Brucella suis* in Feral Swine

Veterinary Research Scholars Program
University of Missouri

Taylor Eshmont, Jeffrey J. Adamovicz

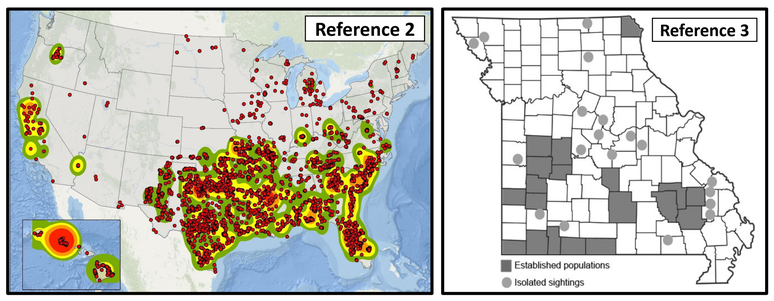
Veterinary Pathobiology, Laboratory for Infectious Disease Research, College of Veterinary Medicine, University of Missouri, Columbia, MO.

MU LIDR Laboratory for Infectious Disease Research

Veterinary Pathobiology
University of Missouri

Background

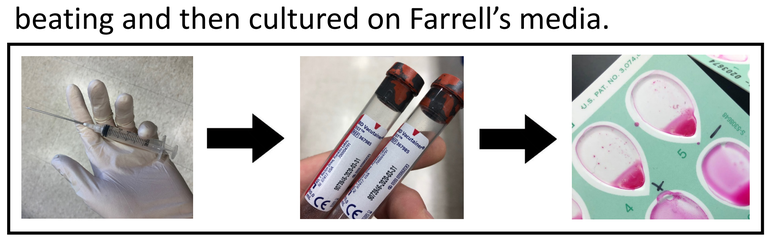
With swine production grossing approximately 900 million dollars annually in Missouri, hogs are a significant source of revenue for the state. Two pathogens of great concern in feral swine are *Brucella suis* and pseudorabies virus (PRV). In order to prevent the introduction of *B. suis* and PRV to domestic populations, we must better understand the factors supporting transmission. The overall purpose of this study is to determine (1) if pathogen prevalence is increasing in Missouri and (2) how environmental factors (elevation and hydrology), anthropogenic factors (urbanization and agriculture production), ecological factors (predation and availability of feed resources), and co-infection with PRV influence the transmission of *B. suis* in Missouri.

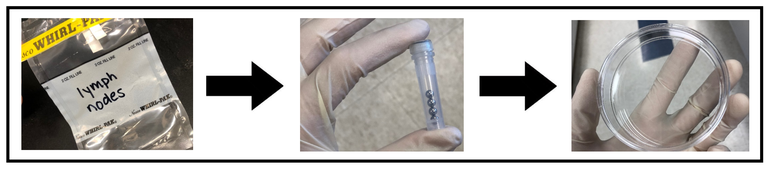


2019 Distribution of Feral Pigs in the United States (Left) and in Missouri (Right)

Laboratory Methods

To determine the current prevalence of *B. suis,* serological assays and bacterial culture will be performed. A standard card test will be run on the serum, and culture will be conducted on each tissue type: (1) lymph nodes, (2) reproductive tissue, and (3) renal tissue. Each tissue will be homogenized via bead beating and then cultured on Farrell's media.





To determine the current prevalence of PRV, ELISA will be run on collected serum.

Statistical Analysis

Disease prevalence for *B. suis* and PRV will be determined for each year since 2006. Trends regarding prevalence over time for both pathogens will be analyzed. Using linear regressions, factors will be analyzed for significance in affecting the rate of transmission of *B. suis*. Significant factors will then be used to create a mathematical model to predict the rate of transmission of *B. suis* at a county level. The following seven factors will be analyzed:

1. **Elevation**
2. **Hydrology**
3. **Urbanization**
4. **Agriculture Production**
5. **Predation**
6. **Feed Availability**
7. **Coinfection with PRV**

Field Collection

The USDA Animal and Plant Health Inspection Service (APHIS) traps and euthanizes feral swine throughout Missouri each year. These pigs act as nuisances, destroying crops, competing with wildlife, and transmitting diseases. The USDA monitors these feral populations for (1) classical swine fever, (2) *Brucella suis*, and (3) pseudorabies. Samples for this project are taken in combination with those taken by USDA APHIS.

From each adult pig approximately 20 to 40mL of blood is collected from either (1) the clavicle well, (2) orbital sinus, or (3) cardiac puncture. Serum from this blood is collected and stored in cryovials for analysis. Additionally, the following tissues are collected from each adult pig:

- **Mandibular, parotid, & retropharyngeal lymph nodes**
- **Right kidney**
- **Right testicle from boars**
- **Uterus from gilts/sows**
- **Placental tissue from pregnant sows**

Hypotheses

1) Prevalence of *B. suis* and PRV is increasing in Missouri.
2) *B. suis* has a greater rate of transmission in counties with one or more of the following: lower elevation, more water features, less urbanization, more agriculture production, less predation, greater availability of feed resources, and greater co-infection rates with PRV.

Historical Prevalence

Historical Prevalence of *B. suis*
Since 2006, USDA APHIS has tested 1091 feral pigs for *B. suis* in MO, resulting in 10 confirmed positives.

Historical Prevalence of PRV
Since 2006, USDA APHIS has tested 1428 feral pigs for PRV in MO, resulting in 50 confirmed positives.

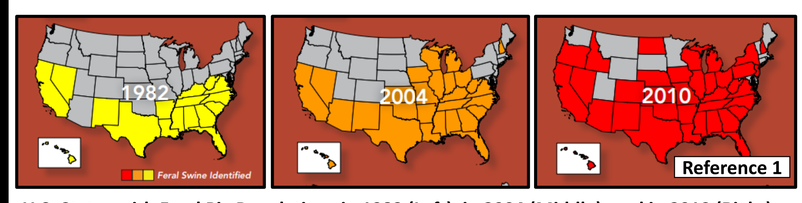
Seroprevalence of *B. suis*	Seroprevalence of PRV
0.917%	3.501%

Seroprevalence of *B. suis* and PRV in Samples Collected by USDA APHIS from Feral Pigs in MO since 2006

Discussion & Implications

Through identifying the current prevalence of *B. suis* in feral pig populations of MO and through identifying what factors correlate with an increased transmission rate, we can develop a protocol for decreasing the spread of this zoonotic pathogen, ultimately, protecting both humans and domestic populations from acquiring *B. suis.* Predictions will be made on strategies to reduce infection rates as well as suggestions for the allocation of biosecurity initiatives including the following options.

- **Traps**
- **Toxicants**
- **Fencing**
- **Harassment**
- **Contraception**
- **Vaccination**



U.S. States with Feral Pig Populations in 1982 (Left), in 2004 (Middle), and in 2010 (Right)

References

1. Animal and Plant Health Inspection Service. (2011). *Feral Swine: Damage and Disease Threats* [Brochure]. Riverdale, MD: USDA/APHIS.
2. Procedure Manual for Comprehensive Feral Swine Disease Surveillance: Wildlife Services' Comprehensive Feral Swine Disease Surveillance Procedures Manual (12th ed.). (2018). USDA APHIS.
3. University of Missouri Extension. (n.d.). Feral Hogs in Missouri: Damage Prevention and Control. Retrieved July 21, 2019, from University of Missouri Extension website: https://extension2.missouri.edu/g9457