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

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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.

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

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.

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 and PRV in Samples Collected by USDA APHIS from Feral Pigs in MO since 2006

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<tr>
<th>Seroprevalence of B. suis</th>
<th>Seroprevalence of PRV</th>
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<td>0.917%</td>
<td>3.501%</td>
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Discussion & Implications

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

References


Historical Prevalence of PRV

Seroprevalence 3.501%

Statistical Analysis

