The Invasive Mosquito Project

Master of Public Health
Capstone Project and Field Experience Presentation

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Trotter Hall 104C
Kansas State University
November 19, 2015 8:30 a.m.
My Bio

- B.S. Biology, Kansas State University, 2012
- Started MPH Program January 2014
- Emphasis – Infectious Diseases/Zoonoses
Presentation Overview

• Introduction
• Invasive Mosquito Project
  – Overall Scope
  – Objectives
  – Materials and Methods
  – Results
  – Discussion
• Field Experience
  – Department of Public Health at Fort Riley Army Installation
  – Riley County Health Department
• Conclusion
Introduction
Epidemiologic Triad

Host

Vector

Agent

Environment

Mosquito-Borne Diseases

• Canine heartworm
• Chikungunya
• Dengue fever
• Eastern and western equine encephalitis
• Malaria
• West Nile virus
• Yellow fever
• And many more...
Chikungunya

• First locally-transmitted case confirmed in Florida in 2014\(^2\)
• 11 more local cases since then\(^2\)
• Symptoms include joint pain, fever, muscle pain, headaches, and rash\(^3\)
• Currently no medicinal treatment or vaccine\(^3\)
• Virus transmitted to people by *Aedes aegypti* and *Aedes albopictus* mosquitoes\(^4\)
Invasive Mosquito Species

**Aedes aegypti**
- Yellow fever mosquito
- Found throughout the southeastern U.S.
- Primary vector for yellow fever, dengue, and chikungunya

**Aedes albopictus**
- Asian tiger mosquito
- Prevalent in the eastern and southeastern U.S.
- Vector for dengue, chikungunya, and Eastern equine encephalitis

http://www.britannica.com/animal/Aedes-aegypti
http://entnemdept.ufl.edu/creatures/aquatic/asian_tiger.htm
Mosquito Surveillance

• Involves monitoring of adult and larval mosquito populations to support mosquito control operations

• Mosquito surveillance includes:
  – Determining what species are present
  – Tracking population fluctuations
  – Detecting mosquito-borne diseases in an area

• All of these aspects help decide what mosquito control activities should be performed
Mosquito Surveillance in Kansas

Mosquito Surveillance in Sedgwick County
Weekly Results from 9 Trap Locations

- 2015 Dates: May 19-Oct 25
- 2014 Dates: May 13-Oct 21
- 2013 Dates: May 14-Sept 24

Mosquito Surveillance Funding in the U.S.

• West Nile virus outbreak from 1999 to 2002 initiated an influx of government funding for mosquito surveillance\(^9\)

• Over time, this funding has progressively decreased (from $24 million in 2004 to $9.3 million in 2012 and 2013)\(^9\)

• Despite this fact, mosquito-borne diseases remain a major threat to public health
The Invasive Mosquito Project (IMP)
Overall Scope

• Nationwide monitoring of invasive container-breeding mosquito species in U.S.
  – Determine distributions of invasive mosquito species

• Citizen science project for high school teachers and students
  – Data collection and educational component
Objectives of IMP

• Define the geographic distribution of mosquito species
• Determine at-risk human and animal populations
• Educate citizen scientists of the risk of mosquito-borne diseases
• Create a network of potential collectors
• Build a central database to store data
My specific objectives

- Design and create a user-friendly collection form and logo
- Build a website with central database
Materials and Methods
Original Collection Form

COLLECTION RECORD FORM

Collection No. | Nearest Town | Date
---|---|---
GET NUMBER | | |

Country | Specific Locality | Time
---|---|---

Province | Latitude | Collector(s)
---|---|---

2nd Administrative District | Elevation in meters | Organization
---|---|---

COMMON FACTORS

<table>
<thead>
<tr>
<th>ENVIRONMENT</th>
<th>SHADE</th>
<th>WIND</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-info</td>
<td>No-info</td>
<td>No-info</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TERRAIN</th>
<th>SKY</th>
<th>ENVIRONMENTAL MODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-info</td>
<td>No-info</td>
<td>No-info</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TYPE: No-info</th>
<th>DISTANCE FROM HOMES</th>
<th>GROUND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-info</td>
<td>No-info</td>
<td>No-info</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEIGHT ABOVE GROUND</th>
<th>Meters</th>
<th>GROUND USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-info</td>
<td>No-info</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADULT COLLECTION</th>
<th>LARVAL COLLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tick for larval collection</td>
</tr>
</tbody>
</table>
Website and Database

• Website needed as a resource for project participants
  – Access classroom materials such as lesson plans, PowerPoint presentations, and basic information on mosquitoes and mosquito-borne diseases

• Central database needed to store data collected and submitted by students
Results
IMP Logo
# Collection Form

**Invasive Mosquito Project**

Collection Record Form

<table>
<thead>
<tr>
<th>School Name:</th>
<th>Teacher’s Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>School's Street Address:</th>
<th>Date Cup was Placed (YYYY/MM/DD):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>School District Number:</th>
<th>Date Cup was Retrieved (YYYY/MM/DD):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>City/State/Zip Code:</th>
<th>Number of Days Cup was Outside:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>County:</th>
<th>Collector Name(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How mosquito eggs, larvae, or pupae were collected (circle one or many)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
</tr>
<tr>
<td>Larvae/Pupae</td>
</tr>
<tr>
<td>Open Water</td>
</tr>
<tr>
<td>Contained Water</td>
</tr>
</tbody>
</table>
### Principal Characters for Identifying Mosquitoes of General Importance

<table>
<thead>
<tr>
<th></th>
<th>ANOPHELES</th>
<th>AEDES</th>
<th>CULEX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EGGS</strong></td>
<td>Laid singly</td>
<td>Has floats</td>
<td>Laid singly</td>
</tr>
<tr>
<td><strong>LARVAE</strong></td>
<td>Rest parallel to water surface</td>
<td>No air tube</td>
<td>Head rotated 180° when feeding</td>
</tr>
<tr>
<td><strong>PUPAE</strong></td>
<td>Pupae differ slightly</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ADULTS</strong></td>
<td>Maxillary palps as long as proboscis</td>
<td>Maxillary palp shorter than proboscis</td>
<td></td>
</tr>
</tbody>
</table>
Website

• Resource for current and prospective project participants
• Design of website created by Nolan Blankenau
• Navigate through IMP website between four pages
  – Home
  – Collection Form
  – View Data
  – Resources
Tour of Website

• [www.citizenscience.us](http://www.citizenscience.us)
Home page

Welcome!

Input Data

View Data
### School Information

Teacher's Name  
First Name  
Last Name  
Teacher's Email  
School Name  
School District Number  
City  
State  
Zip Code

### Collection Information

Please fill out whichever sections below are applicable.

- **Type of Container**  
  - e.g., cup, bowl, cup

- **Beginning of Collection**  
  - YYYY-MM-DD

- **End of Collection**  
  - YYYY-MM-DD

- **Number of Egg Rafts**  
  -

- **Number of Individual Eggs**  
  -

### Rearing Information

Mosquito Species - Number of Adults Collected

- [ ] [ ]

Other Species

If your species are not listed above, add them here.

- [ ] Add other species

Student Name

Species Identification Confirmed By

Date Confirmed  
- YYYY-MM-DD

### Comments

- [ ]

Submit
View Data page

Invasive Mosquito Project

Collected Data

Data coming soon

USDA ARS Address - 1515 College Avenue, Manhattan, KS 66502

USDA ARS Website

Contact us via email: invasive.mosquito.project@gmail.com
Resources page

Lesson 1: Egg Collection
- PowerPoint Presentation
- Presentation Information
- Introduction to Mosquitoes
  Worksheet
- Quiz A
- Quiz B

Collecting
- Collection Notes
- Egg Collection Procedures
- Collection Record Form
- Potential Collaborators/Identifiers
- North American Mosquito Project

Mosquitoes
- Chikungunya Handout
- Walter Reed Biosystematics
- American Mosquito Control Association
- United States CDC
- Mosquito Bite Prevention

Note to Teachers
Keys to the worksheets and quizzes are available by emailing us at invasive.mosquito.project@gmail.com.
Discussion
Importance of my objectives

• Logo provides visual representation for the IMP project
• New collection form offers improved organization and structure
• Website serves as user-friendly resource for project participants
• Database stores data that contributors have collected
Importance of IMP

• Mosquito species distribution data
• Multiple entities benefit
  – Students learn about:
    • Public health and safety
    • Mosquitoes and mosquito-borne diseases
    • Bite prevention and source reduction
    • Real data collection
Importance of IMP

- Teachers benefit from educational materials
- Public health departments and mosquito control agencies can:
  - Obtain distribution data for mosquitoes in their area
  - Take the opportunity to educate the public
  - Create a partnership with teachers/schools
Field Experience

https://en.wikipedia.org/wiki/Mosquito
Fort Riley Department of Public Health

Preceptor: Colonel Paul Benne
Fort Riley, Kansas
August 17 – October 1, 2015

https://www.facebook.com/FortRileyDepartmentofPublicHealth/?fref=ts
Environmental Health Section

• Worked under the supervision of Mr. Ronald Gerace, Sanitarian
• Focused on mosquito surveillance methods used on Fort Riley Army Installation
  – Mosquito trapping methods
  – Mosquito species identification
  – Mosquito control and prevention measures
Mosquito Trapping Methods

CDC Light Trap

New Jersey Light Trap

Gravid Trap
Mosquito Species Identification

**Aedes albopictus**
- Male
- Female

**Aedes aegypti**


http://entnemdept.ufl.edu/creatures/aquatic/aedes_aegypti.htm
Mosquito Control and Prevention Methods

• Fogging practiced to control adult mosquito populations
  – Contracted service through Best Pest Control of Manhattan
• B.t.i. Mosquito Briquets used to control the larval stage of mosquitoes

Riley County Health Department

Preceptor: Brenda Nickel
Manhattan, Kansas
June 1 – June 29, 2015

http://www.rileycountyks.gov/1127/About-Us
Focus Group Interview

• Conducted focus group interview with three public health professionals
  – Patti Grub - Disease Investigator for Riley County
  – Jason Orr - Public Health Emergency Preparedness Coordinator
  – Steven DeHart – Environmental Health Specialist for Riley County

• Purpose to determine if any surveillance, interventions, or guidelines related to mosquitoes are performed in Riley County
# Focus Group Questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What is your current position title and your responsibilities?</td>
</tr>
<tr>
<td>2</td>
<td>What is the information you need to know on a disease outbreak?</td>
</tr>
<tr>
<td>3</td>
<td>What information do you need to know about invasive mosquito species?</td>
</tr>
<tr>
<td>4</td>
<td>What would be your role in a situation where there is an invasive mosquito introduction or disease outbreak related to invasive mosquito species?</td>
</tr>
<tr>
<td>5</td>
<td>In regards to the previous question, what arboviral (arthropod-borne viruses) surveillance would be done, if any?</td>
</tr>
<tr>
<td>6</td>
<td>What type of interventions would be used to address this type of situation?</td>
</tr>
<tr>
<td>7</td>
<td>Is there a plan in place to monitor for mosquitoes, especially invasive mosquitoes? Are there any disease surveillance activities currently being performed in Riley County?</td>
</tr>
<tr>
<td>8</td>
<td>At what point would you let the community know about a disease outbreak related to invasive mosquitoes, like Chikungunya?</td>
</tr>
<tr>
<td>9</td>
<td>What arboviral disease related to mosquitoes are reportable?</td>
</tr>
<tr>
<td>10</td>
<td>Are there practices in place to promote protection against mosquitoes?</td>
</tr>
<tr>
<td>11</td>
<td>Who controls mosquito populations in Riley County?</td>
</tr>
<tr>
<td>12</td>
<td>Is surveillance being performed for Chikungunya in returning travelers?</td>
</tr>
</tbody>
</table>
Conclusion

- Mosquito surveillance is vital to public health
- My field experiences provided real-world knowledge of the inner workings of a public health department
References


Acknowledgements

• MPH Committee
  – Dr. Natalia Cernicchiaro
  – Dr. Lee Cohnstaedt
  – Dr. Wei-Wen Hsu
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• Barta Stevenson
• Fort Riley Department of Public Health
  – Colonel Paul Benne
  – Mr. Ronald Gerace
• Riley County Health Department
  – Ms. Brenda Nickel
• Manhattan public schools
  – Noah Busch
  – Leslie Campbell
  – Nolan Blankenau
• Ary Faraji
• Roberto Barrera
• Cory Young
Questions?