Everyone seems to have a better mosquito trap: Making sense of mosquito trapping

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Thank you

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Objectives

• Introduction
• History
• Review
• Goals
• Better traps
• Local needs
From the beginning

- Adequate sampling
- History local work
- Nullified
- “Failure” explained
- Problem found
- Weaknesses

TJ Headlee (on rt) on Atlantic County meadow ca 1916

Intelligent sampling
Many human collectors
We call this surveillance

- Webster’s
  - To watch over
  - Close watch kept over someone
  - Constant observation of a place or process
  - Supervision or inspection

Mosquito surveillance

J S Riker, Sussex County NJ
Monitoring

• Time consuming
  – Collect, rear, ID
• Information important
• Provides foundation
• Justifies intervention
• Yr to yr comparisons

G. Nemeth, Sussex County
Philosophy

• Measure populations

• Prioritize intervention

• Measure effectiveness of abatement

• Target pest and/or habitat specifically in financially efficient & environmentally friendly manner

Mosquito surveillance program drives process
Program components

- Rainfall & tides
- Survey & mapping
- Larval sampling
  - w/ traps
- Adult collections
- Identification
- Virus testing
- Complaints

W. Crans Rutgers & V. DeSerio Bergen County NJ
Finding larval habitat

- Surveys
- Inspectors
  - On foot, bicycles, horses
- Discover habitats
  - Temporarily treat
  - Eliminate

Adult collections used to evaluate efforts
Adult mosquitoes find you

- Nightly collections
- Mosquito fighters
- Drawback
  - Honesty
  - Attractiveness
  - Skill
  - Variation
- 1927 remove human factor

Mechanical means sought to collect adult mosquitoes
Sugar can trap

- Tin sugar can
- Inverted screen funnel
- Light
- Portable
- 4’ off ground
- Killing agent

Cost $1.5 to build, battery was 30 cents more & ran for 72 hrs
Man against machine

- No light, no catch
- Large opening on bottom, better
- Dusk to dawn, similar to human collector
- Abundant mosquitoes, composition good

Further testing indicated
- Mosquitoes scarce, trap failed
- Practical experience indicated it did not meet the need!

Note: All traps, unless specially designated as “bottom-open traps,” are cylindrical sugar cans about 12 inches by 10 inches with 6 inlet ports. Traps designated as “bottom-open traps” are likewise cylindrical sugar cans of same dimension, but with entire bottom forming an inlet port.

Table 1—Record of Trap Nests

<table>
<thead>
<tr>
<th>Date</th>
<th>Number of Traps</th>
<th>Captured</th>
<th>Sollicitas</th>
<th>Sylvestris</th>
<th>Compendiaceum</th>
<th>Spinulosa</th>
<th>Pipiens</th>
<th>Trisobius</th>
<th>Total</th>
<th>Average per Trap</th>
<th>Greatest Number</th>
<th>Smallest Number</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/15-9/23</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4</td>
<td>5</td>
<td>0</td>
<td>63</td>
<td>61</td>
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<tr>
<td>9/22-9/23</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>1.8</td>
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<td>0</td>
<td>66</td>
<td>55</td>
</tr>
<tr>
<td>9/26-9/27</td>
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<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>1.0</td>
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<td>0</td>
<td>59</td>
<td>57</td>
</tr>
<tr>
<td>9/28-9/29</td>
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<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>1.1</td>
<td>3</td>
<td>0</td>
<td>61</td>
<td>58</td>
</tr>
<tr>
<td>9/30-9/31</td>
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<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>2.0</td>
<td>2</td>
<td>0</td>
<td>82</td>
<td>62</td>
</tr>
</tbody>
</table>

Remarks

- Lighted (electric)
- Lighted (electric)
- With lights
- Without lights
- Electric lights
- Kerosene lights
- Blinded—lighted (electric)
- Bottom-open trap
- Lighted (electric)
- Bottom-open trap
- Unlighted
- Lighted (electric)
- Lighted (electric)
- Bottom-open trap

The object here is to check human collector against trap.
3 years later

- Electric
- Light (different colors)
- Fan
- Net
- Outperformed human collector 2:1
- Representative
- White light better
- Flight activity & temp
1931-1932 statewide system w/ type C trap

- 35 traps running
- $25/trap (high)
- Bulky design
  - Transportation, shipping & servicing
- Cyanide jar flooded
- Electric parts corroded
- Vibration & noise
- Light failure

Improvement needed
Model 50 trap

- All new traps 1933 (41)
- Vertical trap (w/ light above)
- Funnel 16x16-mesh copper wire screen
- Half-pint cyanide jar
- 3 legs
- Conical roof (white, 360°)
- Rubber light mount
- Cost less ($17.50 w/ timer)

Note: Human collectors still working

This one was a keeper!
Adult surveillance methodology

- Complaints
- Landing counts
- Light trap
- CO$_2$
- Oviposition/ gravid
- Animal-baited
- Resting boxes
- Visual
- Propane driven
- Etc…
Attractants & trapping

- Built in bias
- Species differences
  - Some traps are better
  - Species & regional differences (same traps)
- Trap placement
- Incorporate several methods
- *Aedes japonicus* example
  - Initially nothing worked well
New Jersey light traps

- Standard
- Light is attractant
- Established sites
- Run May – October
  - Dusk to dawn
  - Timers and photo cells
- Collect d, 3 or 1 x wk
- Electric ($$$)
- Records date to 1930’s

Variety of insects, male’s
Important to calibrate all traps

C. White, Sussex County NJ
Commonly found in NJLT

- Aedes vexans, cinereus, canadensis, atropalpus, cantator, taeniorhynchus, grossbecki, stimulans, excrucians, fitchii, atlanticus, trivittatus, abserratus, sticticus, triseriatus, sollicitans

- Anopheles punctipennis, bradleyi, crucians, walkeri, quadrimaculatus

- Coquillettidia perturbans

- Culiseta morsitans, inornata, melanura

- Culex territans, pipiens, restuans, salinarius

- Psorophora howardii, ciliata, ferox, columbiae

- Uranotaenia sapphirina
• “Things” attracted to light
• Underrepresented sp.
  – *Aedes trivittatus*
  – *Ae. sticticus*
  – *Ae. fitchii*
  – *Ae. abserratus*
  – *Ae. aurifer*
  – *Ae. stimulans*
  – *Ae. aegypti*
  – *Ae. albopictus*
  – *Ae. japonicus*
  – Etc.
CO$_2$ baited traps

CDC/EVS/ABC/MMX...

- Light & CO$_2$
- Portable traps
- Placed as needed
- Easily elevate traps
- Nightly collections
- Host seeking

EVS Trap
CDC/EVS/ABC/MMX traps…

- Require CO₂
- Light optional
- Set early evening
- Picked up the next morning
- Fresh / living specimens
CO₂ baited traps

- Good indicator
- Greater diversity
- Fill void
- Labor intensive

ABC Trap
Mosquito Magnet®

- Heat, $\text{CO}_2$ & $\text{H}_2\text{O}$
  - No light
- Don’t need electric
- Counterflow tech
- Ad attractant
  - Biting adults

$\text{$$ but similar to NJLT from labor – cost for gas}$

Propane combustion

Reduce nuisance?
Attractants

- Added to all traps
- Improve collections
- Cost
- Shelf life

Home made
Animal baited trap

Ehrenberg pigeon trap

- Bird attractant
  - Ornithophilic species
- Set late
  - Check hourly/nightly
- Keep bird alive
- Knock down mosquitoes
- Preserve on ice
- Release pigeon
- Maintain flock
Truck Trap

- No attractant
- Sample taken over a distance
- Flight activity (behavior)
- Not selective w/ respect to sex or host seeking status
- Under utilized

But

- Open areas (roads) and sampling height bias

From Chamberlin and Lawson 1945

Florida Keys MCD
- Cool dark place
- Live engorged mosquitoes
  - Arbovirus
- Very selective
- Passive
- Inexpensive
- Research tool
Representative data

- 7k – 14k specimens June / September
- Host preference studies
- Collected 16 NJ species
  - Aedes cinereus, Ae. vexans, Ae. atropalpus, Ae. canadensis, Ae. thibaulti, Ae. triseriatus, Anopheles punctipennis, An. bradleyi, An. quadrimaculatus, Culiseta melanura, Culex erraticus, Cx. pipiens, Cx. restuans, Cx. salinarius, Cx. territans, Psorophora ferox
Resting box trap Morris County NJ
• No light, dark object
• Fan draws insects in
• Are more mosquitoes better?
  – Population estimates
  – Low #s just as useful
  – Sampling pest species
  – Consistent effort
• Adjust intervention thresholds
Gravid traps

• Oviposition substrate
• Blood fed mosquitoes trying to lay eggs
• Fresh samples
• Arbovirus surveillance
• Exotic *Aedes* & male mosquitoes

Collects *Cxulex* sp. by the 1000s
Ovitraps

• Oviposition substrate
• Gravid mosquitoes
  – Containers
• Exotic Aedes
• Detect introduction
  – Ports (air & sea), railways, interstate stops
  – Boarder of range

Easier than searching for small containers
Exotic *Aedes* • Contrasting colors • Movement • Commercial options • Combined with lures

Adding another method to gain a better picture of the mosquito population
Emergence traps

- Bias is trap placement
- Check habitat or system
- Catch basins

Coquillettidia & Mansonia

I. Rochlin, catch basin trap, Suffolk County NY

M. Romanowski, basin trap w/ 4 night sample Ocean County NJ
Choosing the right trap

- Depends on goals
- What are you trying to accomplish?
- Data use
- Monitor populations
- Arbovirus surveillance
- Control

York County PA, WNV surveillance trap set 2012
Monitoring populations

- Requires consistency over time
- Select reliable trap
- Simple is better
  - Reduce variables
  - Use same trap type throughout
  - Calibrate often
  - Understand trap bias
- Have backup supply
Change in effort

• Evaluating new system?
  
  • Run both
    – Keep the old system going
    – Establish correlation
    – Thoroughly test
    – Preserve data integrity
  
  • Problems take time
Landing rates

- Very selective
  - Host seeking

- Simple & quick
  - Count mosquitoes
  - Record time & temp

- Intervention need

- Willing participant

- Variability

J. Brock, Horry County Mosquito Control, by August Dittbenner
Surveillance programs evolve (to meet local needs)

- Local resources determine program support
- There is no one size fits all
- Research vs. operational level data
- Using data generated to adapt program is a continual process
- Sometimes there is a better trap
- An invasive species & WNV changed how we do things
Biology waits for no one

• What is it?
• Where are they?
• How many are there?
• Are they a problem?
• Where are they coming from?
• What are you going to do about it?

Inspectors, ID Specialists / Biologists / Pilots / Administrators
Act well your part, there all the honor lies

Alexander Pope

To forget one’s purpose is the commonest form of stupidity

Friedrich Nietzsche
Questions & contact info

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