Mosquito circadian rhythms related to host use

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Lazzari, C.R., Minoli, S.A. & Barrozzo, R.B. 2004


Survey revealed that most studies of host attraction do not report time of day, which can influence vector sensitivity.
Circadian rhythms

Influence daily patterns
  Flight activity
  Nectaring (males and females)
  Blood seeking (females)
  Reproduction

Differ by mosquito species
  Crepuscular or nocturnal
  Diurnal
Circannual rhythms

Influence seasonal patterns of activity
  Diapause (as egg or adult)
  Reproduction
Differ by mosquito species
  Species overwinter as egg or adult
  Species differ in longevity
Hypotheses

1) Mosquitoes should be most sensitive to host odors at specific times of day

2) Mosquitoes should vary in sensitivity to host odors related to the time of year

3) Males and females should differ in response to host odors but not floral odors
Methods

• Olfactometer
• Mosquito cultures
• Assays
Olfactometer
Olfactometer

- Dual-port y tube design
- Custom made to Bernadette’s specifications
- Created from recycled glass pipe from chemical labs
Culex restuans

- Continuous cultures maintained in laboratory
- Egg rafts oviposited in hay-infusion water
- Rafts transferred to deionized water
- Larvae fed flake fish food
- Adults free to emerge and mate in cage
Culex restuans cultures

- Incubator #1, DD = constant darkness
- Incubator #3, 16L/8D = reverse summer (lights on 6pm, off at 10am)
- Incubator #4, 12L/12D = reverse fall or spring (lights on 10pm, off at 10am)
- Incubator #5, LL = constant light
Table incubators
Mosquito cage
Olfactometer assays

• “Air” trials to control for north/south port preference
• Flowers (oregano, mountain mint, fennel, Clethra)
• Carbon dioxide
• Lactic acid
• Acetone
• Octenol
Air trials

• Created air flow from a single source across both ports as a control for port preference
• Tested mosquitoes from all four light regimes (DD, 16L/8D, 12L/12D, LL)
• Mosquitoes showed no preference for a specific port
Treatment or control chamber
Measure room temperature, humidity and light levels.
Assay

- Air flow 90ml/min directs air to both ports
- Chemical in treatment port (north or south)
- Air flows down treatment and control ports
- Air streams meet where arms join tube
- Insect follows tube to y and chooses treatment arm or control arm
Carbon dioxide assay

- 3-5 trials (separate days) for each light regime (DD, 16L/8, 12L/12D, LL)
- Each trial remove 10-20 mosquitoes from incubator and place in releasing chamber
- Choose females that approach hand
- Record behavior for several hours and note final locations at end of day
Gabe monitoring mosquito activity
Results

• Different responses by male and female mosquitoes to carbon dioxide

• Light regime had minor influence in response by females
Male mosquitoes in Treatment (carbon dioxide) or Control Chambers

Mean ± SE number of mosquitoes

<table>
<thead>
<tr>
<th>Light regime</th>
<th>Control (C)</th>
<th>Treatment (T)</th>
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<tbody>
<tr>
<td>DD</td>
<td>1 ± 0.5</td>
<td>1 ± 0.5</td>
</tr>
<tr>
<td>16L8D</td>
<td>2 ± 0.2</td>
<td>3 ± 0.3</td>
</tr>
<tr>
<td>12L12D</td>
<td>1 ± 0.1</td>
<td>1 ± 0.1</td>
</tr>
<tr>
<td>LL</td>
<td>1 ± 0.3</td>
<td>2 ± 0.4</td>
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</tbody>
</table>
Female mosquitoes in treatment (carbon dioxide) or control chambers

Mean + SE number of mosquitoes

Light regime

DD 16L8D 12L12D LL

T C T C T C T C T C
Conclusions

• Male mosquitoes did not respond to carbon dioxide
• Males did not differ according to light regime
• Female mosquitoes responded more strongly to carbon dioxide than to control
• Female response strongest from those cultured under highest light conditions
Future directions

• Repeat experiments with *Aedes albopictus*

• Assay more plant volatiles and chemical blends