The effect of water mites on Diptera of human pathological importance in metro Detroit

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Why Water Mites?

Parasite
Predator
Prey
Research in the Great Lakes

- Biodiversity in an Urban Watershed
- Habitats within an Area of Concern
- A paradigm shift in viewing Biodiversity
- Great Lakes is an important resource
Context

- Detroit is one of the top mosquito problem cities in the US (Detroit News 2018).
- Mosquito-borne diseases are a global concern and a recent report by the UN Intergovernmental Panel on Climate Change has reported that changing temperatures may allow new pests and diseases to invade new habitats and become established poses new threats to human health (UN Intergovernmental Panel on Climate Change 2018).
- Most dangerous animal on earth is the mosquito, killing an estimated 800,000 humans yearly (BBC news: https://www.bbc.com/news/world-36320744).
### Previous Work

Water mite feeding on midge (chironomid) larvae

<table>
<thead>
<tr>
<th>Predator</th>
<th>Prey</th>
<th>Match of DNA product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lebertia</td>
<td>C. pipiens</td>
<td>C. pipiens</td>
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<tr>
<td>Lebertia</td>
<td>Chironomid</td>
<td>Chironomidae sp.</td>
</tr>
<tr>
<td>Lebertia</td>
<td>Chironomid</td>
<td>Cricotopus sp.</td>
</tr>
</tbody>
</table>
Current Work

Field Sites with Laboratories
1. Lake St. Clair Metropark Research Laboratory
2. Great Lakes Water Authority Research Laboratory
3. Belle Isle Aquarium Research Laboratory
Mesocosms set up across Field Sites
## Results

<table>
<thead>
<tr>
<th>Mesocosm Identifier</th>
<th>Date Water Mite Added</th>
<th>Date Monitoring Mosquito Larvae</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSCMP#3</td>
<td><em>L. quinquemaculosa</em> 08/09/18</td>
<td>No larvae 08/23/18</td>
</tr>
<tr>
<td>LSCMP#2</td>
<td><em>Hydrachna</em> 08/31/18</td>
<td>Larvae 09/07/18</td>
</tr>
<tr>
<td>LSCMP#6</td>
<td><em>L. quinquemaculosa</em> 10/11/18</td>
<td>No larvae 10/19/18</td>
</tr>
<tr>
<td>WSU#6</td>
<td><em>L. quinquemaculosa</em> 09/15/18 &amp; 10/17/18</td>
<td>Pupae 10/22/18</td>
</tr>
</tbody>
</table>
Results

• In laboratory experiments I have shown that Lebertia quinquemaculosa water mites predate mosquito larvae and molecular analysis of water mite gut contents collected from the field corroborate this observation.

• My preliminary work on water mite diets and on predation of mosquitoes in mesocosm systems in urban parks have shown that water mites may be able to mitigate mosquito presence in urban habitats.
Impact of Biodiversity on Public Health

Dr. Adrian Vasquez sampling ponds at Lk. St. Clair Metropark.

Working Hypothesis: A habitat with healthy biodiversity results in a healthier environment which in turn is important for human health. The increase in biodiversity would mean that there is better control of pest species like mosquitoes.

Present Concerns in Detroit

Major flood in 2014 led to submerged neighborhoods. Damaged personal property due to extreme weather events. Negative consequences due to aging infrastructure and poverty.

Flooding of residential basements and backyards can lead to habitats for pest Dipterans such as mosquitoes and midge flies. This in turn can lead to an uptick in disease such as Asthma outbreaks.
Research, Outreach and Training
Acknowledgments

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Questions?

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