Which Trees Do Mountain Pine Beetles Attack?

Gilia R. Patterson
University of Montana - Missoula, gilia.patterson@umontana.edu

Follow this and additional works at: https://scholarworks.umt.edu/umcur
Let us know how access to this document benefits you.
Which trees do pine beetles attack?

Gila Patterson
Biology, University of Montana

Raul de la Mata Pombo, Sharon Hood, Anna Sala,
Department of Biological Sciences, University of Montana

INTRODUCTION
Mountain pine beetle (MPB: *Dendroctonus ponderosae*) outbreaks are killing many trees. Outbreaks are made worse by climate change and drought.

**Questions:**
- What is the spatial pattern of MPB attacks during an outbreak?
- Does growth rate affect susceptibility to attack?
- Is there a genetic basis for susceptibility to attack?

METHODS
We used a ponderosa pine genetic trial at Lubrecht Experimental Forest in northwestern Montana.

- 204 distinct genetic families planted in 1974
- Groups of four trees per family planted in five different blocks (20 trees per family = 4080 trees)
- Height and diameter at breast height (DBH) measured in 2001 for all surviving trees
- 2480 of the original trees remained in 2013
- The trial was attacked by MPB in the mid 2000s
  - In July 2013, we recorded whether each tree had been attacked by bark beetles. We used pitch tubes to identify attacks.

RESULTS
- **MPB caused 36% mortality.**
  - Attacked trees occurred in clusters.
  - Probability of attack increased with the number of attacked neighbors.
  - Medium sized trees were most susceptible to attack.
  - Loess smooth of attack status (unattacked/attacked) vs. DBH based on 2480 trees (893 attacked).
  - There is moderate evidence of genetic variation in susceptibility to attack. Attack is also influenced by:
    - Location (block) within the stand
    - Number of neighbors attacked
    - Diameter
    - Height

<table>
<thead>
<tr>
<th>Term</th>
<th>Df</th>
<th>Deviance</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block</td>
<td>4</td>
<td>58</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Unattacked</td>
<td>1</td>
<td>359.4</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>DBH</td>
<td>1</td>
<td>179.6</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>DBH²</td>
<td>1</td>
<td>45.6</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Height</td>
<td>1</td>
<td>22.2</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Family</td>
<td>124</td>
<td>150.1</td>
<td>0.0553</td>
</tr>
</tbody>
</table>

**DISCUSSION**
Size affects probability of attack.
- Beetles may avoid small trees because small trees do not provide enough food.
- Beetles may avoid large trees because large trees are better defended.

- There is a spatial pattern of attack that must be controlled for in studies.
- Susceptibility to attack may have a genetic component.

REFERENCES

ACKNOWLEDGMENTS
Many thanks to David Patterson and Jon Graham for help with the statistical analysis.

This material is based on work supported by the National Science Foundation under Grant EPS-1101342. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.