Comparing species richness of Geometrid moths between Riverine and Primary Forests in Wanang III

http://lepidoptera.butterflyhouse.com

Ivana Matejickova  Bradley Gewa  Markus Manumbor
Lepidoptera: *Geometridae*

- From Latin *geometra* (geometer/earth measurer) after characteristic larvae locomotion

- One of the three most species rich moth families: > 21000 species described worldwide

- Important model group for environmental studies in tropics (Holloway et al. 1992)

- Suitable study group for forestry practice effects as they have weak flight ability and high habitat fidelity (Thomas 2002)
Lepidoptera: *Geometridae*

- Caterpillar - loop-like movement
  - also called Inch worms, Spanworms or Loopers
- Adults- intricate camouflaging or wavy wing patterns
  - slender abdomen, broad wings
  - typical resting position with wings held flat, hind wings visible
- popular subfamily: *Geometrinae* (Emerald Moths)

http://lepidoptera.butterflyhouse.com
Hypothesis

$H_A =$ There is a difference in the number of individuals and species richness of Geometrid moths between riverine and primary forest.

$H_0 =$ There is no difference in the number of individuals and species richness of Geometrid moths between riverine and primary forest.
Study Site

- Wanang Ill Lowland rainforest, Wanang Conservation Area, Madang
Study Site

1. Open Riverine Vegetation (5 sites)
   - on sandbanks near water
   - mostly grasses, shrubs and successional regrowth
     \((Dendrocnide, Melanolepis, \text{etc.})\) from flood disturbances
   (light also exposed to primary vegetation near water edge)

2. Closed Primary Vegetation (4 sites)
   - 90-100\% canopy cover
   - mostly undisturbed lowland primary forest vegetation
     (buttress trees, lianas, fairly dense undergrowth with shrubs)
Method- Light trapping

- 18.00 - 22.00 (4 hours) peak moth activity time (Brehm 1999)
- Collection/Sorting/ ID
- Creation of Wanang III Geometrid Reference Collection for morphotype assignment and counts
- References: Moths of Borneo (Holloway 1993/96/97): BRC Lepidoptera Database
Most common species found in both riverine and primary forest

- Scopula parvimacula
- Zythos turbata
- Hyposidra talaca
- Cleora sp.
- Albinospila syntyche

http://lepidoptera.butterflyhouse.com
## Results

<table>
<thead>
<tr>
<th></th>
<th>River 1</th>
<th>River 2</th>
<th>River 3</th>
<th>River 4</th>
<th>River 5</th>
<th>Primary 1</th>
<th>Primary 2</th>
<th>Primary 3</th>
<th>Primary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUM individuals</strong></td>
<td>54</td>
<td>45</td>
<td>45</td>
<td>38</td>
<td>21</td>
<td>256</td>
<td>150</td>
<td>169</td>
<td>177</td>
</tr>
<tr>
<td><strong>SUM sp.</strong></td>
<td>32</td>
<td>22</td>
<td>23</td>
<td>27</td>
<td>14</td>
<td>109</td>
<td>56</td>
<td>60</td>
<td>58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Shared</th>
<th>Riverine</th>
<th>Primary</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUM individuals</strong></td>
<td>203</td>
<td>752</td>
<td>955</td>
<td></td>
</tr>
<tr>
<td><strong>SUM sp.</strong></td>
<td>32</td>
<td>44</td>
<td>130</td>
<td>206</td>
</tr>
</tbody>
</table>
# T-test results

<table>
<thead>
<tr>
<th></th>
<th>T value</th>
<th>Mean Riverine</th>
<th>Mean Primary</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals</td>
<td>-7.40001</td>
<td>1.588164</td>
<td>2.265048</td>
<td>0.000149</td>
</tr>
<tr>
<td>Species</td>
<td>-5.20978</td>
<td>1.357358</td>
<td>1.831798</td>
<td>0.001240</td>
</tr>
</tbody>
</table>

- There is a significant difference in the number of individuals and species richness of Geometrid moths between riverine and primary forest.
Difference in number of individuals

Box & Whisker Plot: \( \text{lonin} = \log_{10}(\text{indiv}) \)

<table>
<thead>
<tr>
<th>Habitat type</th>
<th>Log. of individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riverine</td>
<td>1.4</td>
</tr>
<tr>
<td>Primary</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Mean ± SE
Mean ± 1.96 * SE
Difference in number of species

Box & Whisker Plot: \( \log_{10}(nsp) \)

- Riverine
- Primary

- Mean
- Mean ± SE
- Mean ± 1.96*SE

Log. of species
Simpson index - species diversity index

<table>
<thead>
<tr>
<th></th>
<th>T value</th>
<th>Mean Riverine</th>
<th>Mean Primary</th>
<th>Df</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simpson index</td>
<td>0.070134</td>
<td>0.034345</td>
<td>3.170594</td>
<td>7</td>
<td>0.015695</td>
</tr>
</tbody>
</table>

P value < 0.05, there is a significant difference in species diversity between habitats
Comparison of study sites

- CANOCO
- Method: DCA
Species composition between localities

P value < 0.05, there is a significant difference in species composition between habitats
Summary

Difference caused by:

- Riverine forest is disturbed with less host plants-moth diversity decreases with disturbance (Holloway et al. 1992, Kitching et al. 2000)
- Increasing phase of the moon had a negative effect on number of samples.

<table>
<thead>
<tr>
<th></th>
<th>River 1</th>
<th>River 2</th>
<th>River 3</th>
<th>River 4</th>
<th>River 5</th>
<th>Primary 1</th>
<th>Primary 2</th>
<th>Primary 3</th>
<th>Primary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUM individuals</td>
<td>54</td>
<td>45</td>
<td>45</td>
<td>38</td>
<td>21</td>
<td>256</td>
<td>150</td>
<td>169</td>
<td>177</td>
</tr>
<tr>
<td>SUM sp.</td>
<td>32</td>
<td>22</td>
<td>23</td>
<td>27</td>
<td>14</td>
<td>109</td>
<td>56</td>
<td>60</td>
<td>58</td>
</tr>
</tbody>
</table>
Acknowledgements

Instructors:
Prof. RNDr. Vojtech Novotny CSc.
Prof. RNDr. Jan Suspa Leps
Kipiro Damas (senior botanist, FRI)
Kenneth Molem (senior botanist, BRC)

Institutions:
Binatang Research Center
The University of South Bohemia

Others:
Czech and PNG course participants
Elvis and Cliffson for final geometrid identification
Wanang community (for pig and singsing 😊)
Nen Dolly (for gutpela kaikai 😊)
Literature Cited

• Holloway J. D., Kirk-Springgs A. H., Chey V. K. 1992: The response of some rain forest insect groups to logging and conversion to plantation. Philosophical Transactions of the Royal Society (B) 335, 425-436.
• Binatang Research Centre Lepidoptera Database
• http://www.entropy.cas.cz/png/caterpillars/parataxoweb.html
• http://lepidoptera.butterflyhouse.com