Seed Dormancy and Germination of Japanese hops (*Humulus japonicus*): A Cold Case

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Cold Stratification

- Seeds need to be exposed to a period of colder temperatures in order to break seed dormancy and begin germination.
- Examples: tulips, lavender, and sweet peas
Japanese hops (*Humulus japonicus*)

- Invasive species found near rivers and streams of the Eastern United States.
- Introduced from Asia as a source of tea.
- Invasive species: a plant or animal that is not native to a specific location
  - Spreading
  - Can cause damage to the environment
- Examples: Asian carp and zebra mussels
Japanese hops (*Humulus japonicus*)

- Japanese hops are in the same genus as beer hops, but are NOT used for beer.
  - Lacking lupulin – oils and flavor.
- Is an annual vine that can grow up to 35 feet in one season.
- Competes with native species for sunlight and nutrients.
  - Overtops herbaceous vegetation and small trees.
Why is this research important?

- **Purpose:** Determine the key factors that break the physiological dormancy of the seeds.
- **Finding** what environmental conditions are conducive to the germination of *H. japonicus* seeds can help determine where *H. japonicus* may thrive.
- **Understanding** the ecological role of *H. japonicus* is necessary to implement a management plan.
National Distribution of Japanese hops

Floristic Synthesis of NA © 2009 BONAP

Humulus japonicus
Hypotheses

- Cold stratification is possible factor in breaking dormancy.
- Field experiment:
  - Prolonged exposure to natural conditions will lead to an increase in germination.
- Controlled indoor experiment:
  - Predict an interaction between time exposure, moisture levels and temperature.
Materials & Methods

- Collected seeds in November, 2014 near Independence Creek
  - Total sorted: 2,620 seeds
- Field experiment:
  - Seeds were buried in sand
  - Exposure to ambient conditions for 1, 2, 3 or 4 months
  - Compared to a control (zero exposure)
  - Four replications of each treatment
  - Each replication = 50 seeds
Materials & Methods

- Indoor experiment:
  - Exposure to varying levels of temperature and moisture for different time periods
Germination

- All of the seeds were stored and germinated at room temperature in petri dishes.
- Distilled water and filter paper were used to keep the environment moist.
- Germination was recorded daily.
Results: Field Experiment

Seed Germination Rates After Exposure to Natural Ambient Conditions

- One-way ANOVA
- Significance is <0.001 which means that time exposure is significant!

Average Percentage of Seeds Germinated vs. Treatments - Length of Exposure
## Results: Indoor Experiment

### Average Percentage of Germinated Seeds After Exposure to the Treatments (Temperature, Moisture, & Time)

<table>
<thead>
<tr>
<th></th>
<th>1 Month</th>
<th>2 Months</th>
<th>3 Months</th>
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<tbody>
<tr>
<td><strong>Damp</strong></td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Dry</strong></td>
<td>3</td>
<td>0</td>
<td>3</td>
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<tr>
<td><strong>23.5°C Room</strong></td>
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<td>0</td>
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<tr>
<td><strong>10.5°C Fridge</strong></td>
<td>13</td>
<td>21</td>
<td>44</td>
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<tr>
<td><strong>-20.0°C Freezer</strong></td>
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</tbody>
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- Three-way ANOVA
- Significance = 0.036 for an interaction between temperature, time exposure, and moisture
Discussion

- Our results indicate that seed dormancy is broken by cold stratification.
- Fluctuation of temperature and moisture.
- Seed germination occurs rapidly – important role in control.
Discussion
Management Practices

- Will thrive in areas where cold and wet conditions are present.
- Possible Management Options:
  - Chemical methods such as spraying
  - Cultural control such as cover crops
  - Mechanical methods such as hand-pulling
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National Park Service http://www.nps.gov/plants/alien/pubs/midatlantic/huja.htm
Natural Resources Conservation Services http://plants.usda.gov/core/profile?symbol=HUJA
Wisconsin Department of Natural Resources http://dnr.wi.gov/news/mediakits/mk_carpcontrol.asp
Questions?