Oregon’s New Challenges: The Gypsy Moth and Japanese Beetle

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Asian Gypsy Moth and European Gypsy Moth

• Morphologically (appearance) identical

• AGM females can fly, increasing its dispersal ability

• AGM has broader host range and readily feeds on evergreen trees

• EGM studies indicate phenotypic plasticity—the ability to adapt rapidly to new environmental conditions and diets, including leaves containing tannin and secondary plant metabolites
Risks

• Economic
• Ecological
• Human Health
Oregon Potential Economic Costs

- Costs of quarantines to nursery ($803 million; 85% exported) and Christmas tree industries ($100 million; 90% exported)
- Forestry production (hardwoods and fir)
- Increased pesticide use by private landowners (urban, nurseries, and private forests)
Northwestern forests: Douglas fir (most common), firs, maples, dogwood, alder, red cedar, pines, oaks, willows
In Oregon, forests comprise 30 million acres of state’s 63 million acre land mass (48%) 30 species of conifers and 37 species of hardwoods
Potential ecological risks

Watersheds and streams: Higher temperatures, lower oxygen, increased organic load (affects fish and other aquatic organisms)
Defoliation, in conjunction with climate change, may increase fire risks
Competition/displacement of native species

European Gypsy Moth

Northern tiger swallowtail

Redman and Scriber 2000
Human Health

Each caterpillar sheds its bristly skin four or five times as it grows, and the skins pile up. The bristles may become airborne and irritate human eyes, skin and respiratory systems. In fact, many people develop a rash if they come into contact with the bristles. It becomes extremely unpleasant to work or play outdoors; the caterpillars will also crawl on houses and may get inside.
Oregon’s GM catches in 2016

No AGMs caught in Forest Park eradication area

2 EGMs: Along the McKenzie River approximately 22 miles east of Eugene

4 EGMs: NW of Grants Pass
2015

2 AGMs caught near St. Johns and Forest Park (and 5 EGMs, including Washington and Multnomah Counties)
Proposed treatment area was 8600 acres

Actual treatment excluded water and T & E nests
(3 horned lark, 7 active bald eagle nests)

7923 acres
Sentinel GM egg mass monitoring
Treatment dates

- April 16, 17, 18
- April 25, 26
- May 1, 2
Ground Operations
Not a perfect beginning:

Two spills on 2\textsuperscript{nd} day of 1\textsuperscript{st} application

• A bolt broke - 250 gallons of Foray 48B were dumped on an empty gravel parking lot adjacent to the Willamette River

• A new bolt was installed, but it broke again, and another 250 gallons were dumped in an open grass field
Response to the spills

- Project personnel visited the sites and property owners the same day
- Photos and samples taken
- DEQ and FAA notified within 24 hours
- News release the same day
In the end, we had a very successful spray program
2016

Planned Delimitation Trapping Post treatment

- 49 traps/sq mi
- 36 traps/sq mi
- 25 traps/sq mi
Oregon Department of Agriculture: 2016 GM and AGM Traps

http://geo.maps.arcgis.com/home/webmap/viewer.html?webmap=14c97650fb13453b9974dfa41c52f236

2016 Actual trap Placement 3,086 Delimitation traps
NW Grants Pass

Catches over the past few years from 2013-2016 have followed a southwestern trajectory.

2017-Continue delimitation trapping
Gypsy moth caught near Grants Pass vs. GM caught along McKenzie River
What is happening with the Japanese beetle in Oregon?
Japanese Beetle in Oregon

The larva is a whitish “c-shaped” grub

Major cause of turf damage

A major pest of fruit trees, roses, grapes (over 300 species of plants)

Heavy damage to private yards, nursery stock, golf courses, and other landscapes

Impact on native plants
Japanese Beetle Distribution in the Continental US

Legend:
- Red = well established
- Orange = establishing
- Yellow = Occurrences
- White = No occurrences
- Labelled = Samples used for analysis

Q = Quarantine
Japanese beetle mini RA 2016

Economic Risk Analysis: Oregon and the Japanese Beetle (Popillia japonica) Newman

Name: Japanese Beetle, *Popillia japonica* (Newman)
Origin, biology, hosts: Native to Japan, first found in the U.S. in 1916 (New Jersey); now in most eastern states; one generation per year; larvae feed on grass roots; adults feed on over 300 species of plants (e.g., roses, fruit trees, grapes)

**RISK RATING SUMMARY**
Relative Risk rating: VERY HIGH
Numerical Score: 9 (on a 1-9 scale)
Uncertainty: LOW

**RISK RATING DETAILS**
- **Establishment Potential: HIGH**
  Oregon’s climate and host plant distribution are ideal for Japanese beetle establishment.
- **Spread Potential: HIGH**
  Since 1916, Japanese beetles have become established in half of the 48 contiguous states. Nursery stock, commercial cargo airplanes, and long haul trucks are major pathways of introduction.
- **Environmental Impact Potential: LOW**
  Many Japanese beetle hosts occur in Oregon’s natural environment. Himalayan blackberry, a known favorite host plant, is abundant. Potential impacts to native species such as bigleaf maple, salmonberry, and native grasses are difficult to predict, but could be significant.
- **Economic Impact Potential: HIGH**
  Oregon has a number of susceptible hosts that are of economic significance (see Table):

<table>
<thead>
<tr>
<th>Oregon Crop/Commodity</th>
<th>Harvested/Acreage</th>
<th>Production Value</th>
<th>Estimated Crop Damage Costs</th>
<th>Estimated Quarantine Costs</th>
<th>Total Economic Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurseries (B &amp; B, Container, Greenhouse)</td>
<td>61,099*</td>
<td>805,000,000*</td>
<td>12,880,000</td>
<td>3,477,600</td>
<td>16,357,600</td>
</tr>
<tr>
<td>Grapes</td>
<td>19,000</td>
<td>118,320,000</td>
<td>1,893,120</td>
<td>151,450</td>
<td>2,044,570</td>
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<tr>
<td>Hops</td>
<td>5,410</td>
<td>35,679,900</td>
<td>570,864</td>
<td>45,660</td>
<td>616,534</td>
</tr>
<tr>
<td>Cannabis</td>
<td>7</td>
<td>363,000,000</td>
<td>5,776,000</td>
<td>Not Applicable</td>
<td>5,776,000</td>
</tr>
<tr>
<td>Canaberries</td>
<td>9,000</td>
<td>70,789,000</td>
<td>1,132,610</td>
<td>90,310</td>
<td>1,223,920</td>
</tr>
<tr>
<td>Blueberries</td>
<td>9,000</td>
<td>102,325,000</td>
<td>1,637,200</td>
<td>130,910</td>
<td>1,768,110</td>
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<tr>
<td>Pears (all varieties)</td>
<td>34,400</td>
<td>127,378,000</td>
<td>2,528,212</td>
<td>163,800</td>
<td>2,692,012</td>
</tr>
<tr>
<td>Sweet cherries</td>
<td>32,500</td>
<td>82,709,000</td>
<td>1,323,444</td>
<td>105,870</td>
<td>1,429,314</td>
</tr>
<tr>
<td>Apples</td>
<td>5,100</td>
<td>43,269,000</td>
<td>692,304</td>
<td>55,384</td>
<td>747,688</td>
</tr>
<tr>
<td>Snap beans/process</td>
<td>8,500</td>
<td>13,940,000</td>
<td>273,040</td>
<td>17,843</td>
<td>240,883</td>
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<tr>
<td>Grasses (turf)</td>
<td>418,550</td>
<td>449,018,000</td>
<td>7,184,288</td>
<td>57,413</td>
<td>7,725,001</td>
</tr>
<tr>
<td>Golf Courses</td>
<td>8,500</td>
<td>386,400,000</td>
<td>5,382,400</td>
<td>Not Applicable</td>
<td>5,382,400</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>571,109</strong></td>
<td><strong>2,545,840,000</strong></td>
<td><strong>34,957,456</strong></td>
<td><strong>4,812,204</strong></td>
<td><strong>45,546,660</strong></td>
</tr>
</tbody>
</table>

1. product of production value multiplied by 2016 (damage estimate from Fowler et al. 2017)
2. ODA 2016
3. based on 191st golf course in OR and average of 45 acres of grass planted per 18 hole golf course
4. 2016 reported 156,628 pounds; Oregon internal market, sold at average of $3/channel
5. The Oregon Golf Economy (final report) 2013
6. product of estimated crop damage costs, multiplied by 0.24 (estimated proportion of products that would be quarantined based on destination—western states and Canada)
7. product of estimated crop damage costs, multiplied by 0.08 (estimated proportion of quarantine costs (Fowler et al. 2017))

**TAKE HOME MESSAGE**
If the Japanese beetle is not eradicated in NW Portland and spreads throughout the state, the economic impact to all crops, commodities, and other related businesses could be approximately $45.5 million.
Typical life cycle of the Japanese beetle
Number of traps placed and Japanese beetles caught around PDX since 1991
What are stable isotopes?

- Isotopes are atoms of the same element (e.g., C, N, S, O, H) that differ in the number of neutrons

- Plant tissue hydrogen isotope composition is a reflection of local precipitation

- Hydrogen in animal tissue comes from ingested hydrogen (e.g., from plants and prey)
Portland Airport and Japanese beetles in the Midwest have a similar Hydrogen isotope ($\delta^2$H) values
Hydrogen isotope values from all regions

**Western**

**Midwest-East**
Analysis of the isotopic composition of beetles can be used to identify recent arrivals.

Our research shows that Japanese beetles come into Oregon each year at Portland Airport, and beetles can be brought in multiple times within a single season.
Number of JB Traps Placed Between 1988 and 2015

- 1988: 1,424
- 1989: 3,632
- 1990: 5,974
- 1991: 5,824
- 1992: 5,567
- 1993: 5,161
- 1994: 4,848
- 1995: 4,839
- 1996: 5,030
- 1997: 4,608
- 1998: 4,611
- 1999: 5,126
- 2000: 5,408
- 2001: 4,810
- 2002: 4,773
- 2003: 4,645
- 2004: 5,126
- 2005: 5,408
- 2006: 5,126
- 2007: 5,408
- 2008: 4,533
- 2009: 3,731
- 2010: 2,641
- 2011: 2,516
- 2012: 2,410
- 2013: 2,215
- 2014: 2,360
- 2015: 2,990
Trapping effort has decreased over the years, but risks of introduction have increased

1990-1992 ~ 9000 traps

1993-2006 ~ 5000 traps

2007-2016 ~ 3000 traps
402 Japanese beetles caught between 1988-2015; 2016 catches are 91% of the total for the past 27 years combined!
Japanese beetles in the neighborhood

Chomping on roses

Chewed leaves

A trap catch

Nice new housing area
Buffers around Japanese beetle catches
2017

Proposed treatment

1,000 Acres

2,459 Properties
Mitigation Proposal

- Use Acelepryn G Insecticide (Group 28 Reduced Risk)
- Treat entire infested area according to label
- Treatment time ~April / May
- Delimit trap densities (200-300 / sq. mi.)

- Duration: 4-5 years
- Cost: ~ $1.2 Million
Reduced Risk Status of Acelepryn™ insecticide

- No Signal Word Required
  A Signal Word is required for all registered pesticide products unless the pesticide product is below toxicological exposure limits.

- Limited Precautionary Statement
  Does not present hazard to humans or domestic animals.

- Limited Protective Equipment Needed
  Shirt, pants, socks, and shoes.
Reduced Risk Pesticide
Term used by the EPA to designate a pesticide with the following properties:

- **Low impact on human health**
  
  Low mammalian toxicity, reduced exposure to applicators, handlers & workers

- **Low toxicity to non-target organisms**
  
  Birds, fish, honey bees, parasites & predators

- **Low potential for water contamination**
  
  Ground water, surface water, low water solubility & high affinity for organic matter

- **Low amount of product needed to be efficacious**
  
  Low amount of active ingredient/area and few applications

- **Low potential for development of pest resistance**
  
  New mode of action
New Jersey Acelepryn™ Turf Dissipation Study Results

(Dupont)

A plot shows the dissipation of Acelepryn over time in different environments:
- **Grass**
- **Thatch**
- **Soil**

The graph indicates that:
- **Grass** has a rapid initial decrease followed by a slower decline.
- **Thatch** shows a similar pattern but with a slight delay.
- **Soil** has a delayed peak followed by a slower decline.

Key observations:
- Approximately 90 days to reach max level in soil.
Chlorantraniliprole (Acelepryn), represents a relatively new class of insecticides called anthranilic diamides. It does not adversely affect bee colonies even when the workers forage on flowering clover that had been directly sprayed.

J Larson and D Potter. 2013. Bee-friendly lawn care. Landscape Management (landscapemanagement.net)
Actions and Consequences

- Permission from home owners
- Multiple years of treatment
- Need grassroots community engagement to be successful
- Temporary quarantine area needs to be established
- Changes in green waste management within eradication boundaries
- Considerations for small farms and nurseries in this area
- Failure will result in decreased quality of life, increased pesticide use, costly quarantines, potential decrease in property values
Legislative Days in Salem: September 21

Japanese Beetle Display on the Capitol Steps

Host plant display, including Cannabis
Conclusion

The Oregon Department of Agriculture is planning to eradicate the Japanese beetle in Northwest Portland beginning in Spring 2017.