Ailanthus altissima (Tree-of-Heaven) Control

Rachel Brooks, Scott Salom, Anton Baudoin, Tom McAvoy
Current Distribution of *Ailanthus*

(Kowarik et al. 2007)
Ailanthus in Virginia

Roadways

Forests

Urban areas

Agricultural lands

(Kasson et al 2013, Asaro et al 2009)
(Side Story: the Spotted Lanternfly)

• New Invasive:
  • PA (2014)
  • NY and DE (2017)
  • Winchester, VA (2018)

• Report sightings:
  • ask.extension.org/groups/1981/ask

Control?
Current Control Options

General “rules”:
• Combination of mechanical and chemical treatment
• Target seed-bearing trees first
• Resurvey and retreat yearly
• Costly and time consuming
The best weapon against an enemy is another enemy.

Other Options?
Biological Control

Natural enemies:
• Viruses
• Bacteria
• Fungi
• Nematodes
• Arthropods
• Vertebrates
<table>
<thead>
<tr>
<th></th>
<th>Biological Control</th>
<th>Chemical Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Cheaper</td>
<td>Expensive</td>
</tr>
<tr>
<td>Target</td>
<td>Specific</td>
<td>Broad</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>Few</td>
<td>Natural enemy can become a pest</td>
</tr>
<tr>
<td>Environmental and Human Health Hazards</td>
<td>Can accumulate or move</td>
<td></td>
</tr>
<tr>
<td>Reapplication</td>
<td>Rarely</td>
<td>Often</td>
</tr>
<tr>
<td>Removal</td>
<td>Won’t eradicate</td>
<td>Can eradicate</td>
</tr>
<tr>
<td>Resistance</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>Time</td>
<td>Slow, but long-term</td>
<td>Fast, but short-term</td>
</tr>
<tr>
<td>Location</td>
<td>Can spread</td>
<td>Can’t spread</td>
</tr>
<tr>
<td>Available</td>
<td>No guarantees</td>
<td>No guarantees</td>
</tr>
</tbody>
</table>
Biological Control History
Types of Biological Control

Origin of natural enemy:
1. Classical/importation
2. Conservation/enhancement
1. Classical Biological Control

Step 1: Survey in native range & compile literature (finished in 2004)

(Photos: T. McAvoy)
1. Classical Biological Control

Step 2: Bring potential natural enemies to quarantine lab in US (2004)
= cause severe damage & host specific

*Eucryptorrhynchus brandti* (Curculionidae)
1. Classical Biological Control

Step 3: Rearing & Host Range Testing (2004– Present)

20 taxonomically related, 10 economically important, and 5 ecological associated species

(Photos: T. McAvoy)
Step 4: Regulatory approval and release (pending)

- Still in quarantine after 13 years
- In some circumstances it does feed on corkwood (a southern tree)
- Will petition for release, ultimately our government will determine safety of release

(Photos: T. McAvoy)
2. Conservation Biological Control

Step 1: Survey invaded range and all literature

- 9 insect herbivores
- 68 fungi
2. Conservation Biological Control

Step 2: Select potential natural enemy (guess correctly or get lucky)

= cause severe damage
= host specific

(Schall and Davis 2009, Snyder et al 2013, Snyder et al 2014, Rebbeck et al 2013)
2. Conservation Biological Control

*Verticillium dahliae* (Vd)  
*Verticillium nonalfalfa* (Vn)  

(Inderbitzin et al. 2011)
2. Conservation Biological Control

Step 3: Rearing & Host Range Study (2006 – present)

PA studies are promising:

• Vn > Vd
• Spreads
• Host specific
• Inoculation method
• Inoculation timing
• Effectively removes *Ailanthus*

(Schall and Davis 2009, Kasson et al 2014, O’Neal and Davis 2015, Schall 2008)
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)

- Tree-of-heaven
- Other tree species
- Inoculated with Vn
- Inoculated with Vd
- Inoculated with Vd & Vn
- Inoculated with distilled water

37.2’ radius
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)

Bimonthly and monthly health ratings
OMPI

Control

Vd

Vn

Both
3MPI

Control

Vd

Vn

Both
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)

Vn and Both treatments are the most effective at inducing symptoms in VA.
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)

Average tree height and max temperature are significant covariates.
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)

Just *preliminary* results: Symptoms ≠ mortality
2. Conservation Biological Control

Step 3: Continued (VA Specific: Regional Efficacy)

Future:
• Restoration
• Vectors
• Long-term impact

...risk AND business!
2. Conservation Biological Control

Step 4: Regulatory approval and sale

Pesticide Registration

Requirements

Requirements for All Applicants

- Overview of Requirements for Pesticide Registration and Registrant Obligations
- Data Requirements
- Labeling
- Forms

Additional Requirements for Biopesticides

- Additional Considerations for Biopesticide Products (Chapter 3 of the Pesticide Registration Manual)
Summary: Biological controls

1. Pending!
2. Pending!
3. ?????
3. “Accidental” Biological Control?

(Hoebeke 2017, Photos: R. Rieder NJ Dept of Ag)
3. “Accidental” Biological Control?

(Hoebeke 2017, Photos: R. Rieder NJ Dept of Ag)
3. “Accidental” Biological Control?

*Agrilus smaragdifrons*

Research:
- Host range
- Impact on *Ailanthus*
- Where it is?
Biological Control Future?

Ideal natural enemy:
• Host specific
• Impacts pest
• Easy rearing/production
• Establishes well
• Spreads
• Affordable
• Easy application/use
Acknowledgements & Questions

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