Classical weed biocontrol in Canada: How do new agents happen?

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Classical Weed Biological Control

- Use of host-specific foreign organisms to control invasive alien plants
- Re-establishes ecological interaction

**Not for eradication!**
Classical Biological Control

- Self-sustaining & dispersing
- Can be very successful
- Cost-effective (e.g., Benefit:Cost of 23:1 in Australia over 100 years)
- Long-term control
Biological control often the only option available for natural areas
Biocontrol agents released against weeds in Canada

- 76 spp introduced against 24 invasive plant spp since 1951
- 73% of released established
- 33% of established successful
Stages of Weed Biocontrol

1. **Species interactions**
2. **Overseas exploration**
3. **Biology/host range studies**
4. **Petition for agent release**
5. **Propagation/field release**
6. **Establishment & impact assessment**
7. **Redistribution & long-term assessment**
Native animals

Biocontrol: Where ecological theory meets applied science

Invasive Plant

Native plants

Native animals

Introduced insects
<table>
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Toadflax Project

Ivo Tosevski

Serbian lab

Emily Barnewall

André Gassmann
CABI-Europe
Genotyping of *Mecinus* spp. populations
Eurasia & NA (based on mtDNA COII gene)

Ivo Tosevski & André Gassmann
CABI Europe 2009

ex *Linaria vulgaris*
Swiss & NA

A different *Mecinus* species in Switzerland?

ex *Linaria dalmatica* NA &
dalmatica macedonica

R. antirrhini ex vulgaris
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Testing based on degrees of relatedness

1. Same species as weed
2. Other spp in same
   - genus
   - tribe
   - family
   - order
3. Representatives of other orders and groups more distantly related
Changes in emphasis for pre-release testing

1950-60s – Economic plants
1968 – Plants closely-related to weed
1980s – Related native plants
1990s – Threatened and endangered species
>1995 – Indirect ecological effects
2000s – Pre-testing for agent efficacy
Host Range Testing

- No-choice tests
- Multiple-choice tests
  - Laboratory
  - Field
Insect Microbial Containment Facility

- AAFC, Lethbridge
- 883 m²
- Opened 2004
- For study of biocontrol agents
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Key elements of a regulatory petition for release: Science based

- Proposed action
- Target weed information
- Biocontrol agent information
- Host specificity test results
- Predicted environmental & economic impacts of release
Canadian Petition Review Process

1. Release
2. No Release
3. More research

Petitioner(s)

Petition: NAPPO Standards

CFIA - Director Plant
Biosecurity & Forestry Division

CFIA - Regulatory Entomologists

Chair, Biological Control Review Committee

USA-TAG | BCRC | Mexico

Release recommend

Scientific review
Balancing the Potential Risks and Benefits of Biological Control

Risks

• to non-targets
• other methods of control
• NO CONTROL

Benefits

There is no such thing as zero risk!
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Stolon galls
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Impact of *Aphthona* spp flea beetles on leafy spurge

**Soon after release**
- Reduced flowering stems
- Spurge mortality
Impact of *Mogulones crucifer* on houndstongue density

1999: year of release of 200 weevils

2001: few houndstongue left!
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Assessing the distribution and abundance of leafy spurge using remote sensing
Post-release population studies:
Target & non-target plants

Houndstongue weevil, *Mogulones crucifer*
on blue stickseed, *Hackelia micrantha*

Haley Catton
UBC Okanagan
Current Targets for Biocontrol & Stage

(1) *Species Interactions*: hawkweeds, Russian olive

(2) & (3) *Exploration & Host-range*: common reed, common tansy, dog-strangling vine, garlic mustard, hawkweeds, Himalayan balsam, knotweeds, ox-eye daisy, Russian olive, toadflaxes

(4) *Petitioning*: dog-strangling vine, garlic mustard, hawkweeds, hoary cress, toadflaxes
Current IP Targets for Biocontrol & Stage

(5) **Agent releases:** hawkweeds, rush skeletonweed, Russian knapweed, tansy ragwort

(6) & (7) **Establishment & Impact assessment, Redistribution:** Dalmatian toadflax, field bindweed, houndstongue, knapweeds, leafy spurge, purple loosestrife, scentless chamomile
**Summary**

**Long term development:** 10-15 yrs/weed and ca. $1-2 million to agent release

**Typically works slowly:** Takes patience!

**Success is possible:** e.g., leafy spurge, houndstongue, Dalmatian toadflax, diffuse knapweed

**New agents coming:** e.g., dog-strangling vine, hawkweeds, knotweeds, yellow toadflax

- **Hypena opulenta**
- **Aulacidea spp**
- **Aphlara itadori**
- **Rhinusa spp**