Biological Control of Aquatic Weeds

Shon Schooler

CSIRO Entomology, Long Pocket Laboratories, Indooroopilly QLD 4068
Management of invasive aquatic plants

1) chemical control (restricted around water)

2) physical control (can spread fragments)

3) biological control
Aquatic weed species
Salvinia
Water hyacinth
Alligator weed
Cabomba
Mistflower
Effective biological control:
water hyacinth
salvinia

and, in aquatic habitats
alligator weed
Salvinia
(Salvinia molesta)
Biological control of salvinia

The salvinia weevil, *Cyrtobagous salviniae*

Jabiluka Billabong
Kakadu National Park
Biological control of salvinia

Lake Moondarra, Mt Isa

The salvinia weevil, *Cyrtobagous salviniae*

Similar results in other countries in Africa, Asia, Pacific
Water hyacinth

(*Eichhornia crassipes*)
Historical problems with water hyacinth

Bremer River, tributary of the Brisbane River, Ipswich, 1928

Brisbane River city reaches, 1909

Brisbane River city reaches, 1909

Brisbane River city reaches, 1909
Tambali Lagoon, Sepik River, PNG

Water hyacinth
Biological control

before

Neochetina weevils

after
Current projects:

alligator weed (Alternanthera philoxeroides)
cabomba (Cabomba caroliniana)
Alligator weed (Alternanthera philoxeroides)

Management problems:

1) resistant to herbicides

2) physical methods ineffective, fragmentation leads to increased spread

3) finding suitable biocontrols for all habitats
Worldwide distribution of *A. philoxeroides*

From Julien et al 1996, Journal Aquatic Plant Manage

- **☆ introduced range**
- **★ native range**
Current distribution of alligator weed in Australia

Data compiled by Aquatic WONS coordinator, Andrew Petroeschevsky
Biological Control

Agasicles hygrophila
Chipping Norton Ponds (Sydney, 1977-1981)
Problem:

These insects are not effective in terrestrial habitats or in cooler climates.

Aim of the current biological control project

To identify and introduce herbivores to help manage alligator weed growing in terrestrial habitats and cool climates.
Steps in a Biological Control Program

Goal: A safe and sustainable method to manage invasive plant species.

1) Identify where the plant is from
2) Find potential biological control agents
3) Test the host range (specificity) in quarantine
4) Release agents
5) Monitor agent and weed populations
Alligator weed native range surveys
Alligator weed: potential host plants
Alligator weed: host testing in quarantine
Host Testing in Quarantine

Photo: Richard Chan
Thrips, *Amynothrips andersoni*

Feeds on native *Alternanthera* species so it is not safe for introduction.
Flea beetle, *Disonycha argentinensis*

Also feeds on native *Alternanthera* species
Stem galling fly: *Clinodiplosis alternantherae*

Also feeds on native *Alternanthera* species
## Related species in Australia

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternanthera philoxeroides</td>
<td>exotic</td>
</tr>
<tr>
<td>Alternanthera nodiflora</td>
<td>native</td>
</tr>
<tr>
<td>Alternanthera sessilis</td>
<td>exotic</td>
</tr>
<tr>
<td>Alternanthera denticulata (A, large green leaf)</td>
<td>native</td>
</tr>
<tr>
<td>Alternanthera denticulata (C, reddish leaf)</td>
<td>native</td>
</tr>
<tr>
<td>Alternanthera denticulata (D, small leaf)</td>
<td>native</td>
</tr>
<tr>
<td>Alternanthera pungens</td>
<td>exotic</td>
</tr>
<tr>
<td>Alternanthera dentata</td>
<td>exotic</td>
</tr>
<tr>
<td>Alternanthera nana</td>
<td>native</td>
</tr>
</tbody>
</table>
What’s next?

Flea beetle: *Systena nitentula*

Leaf mining fly, *Ophiomyia alternantherae*
Cabomba (Cabomba caroliniana)

Management difficulties:

1) submerged plant in potable water supplies

2) physical methods ineffective, fragmentation increases spread
Worldwide distribution of *Cabomba caroliniana*

- **Introduced range**
- **Native range**

May 2007
Lago Iberá, Argentina

Sudd – floating vegetation islands
Cabomba in Australia (Oct 2007)

Data compiled by WoNS coordinator, Andrew Petroeschevsky
Native range surveys

Photo: Ricardo Segura
Potential for Biological Control

Weevil (*Hydrotimetes natans* Kolbe: Curculionidae) larva feeds within stem.

Preliminary testing indicates that it is host specific.
Host Specificity Testing straightforward

No natives in genus

One native in family

Watershield

*Brasenia schreberi*
Future projects:
mistflower (Ageratina riparia)
mistflower in Lamington NP, QLD (July 2006)

mistflower distribution in Australia (herbarium records)
Why mistflower?

1) negative impacts on plant diversity
2) widespread in eastern Australia but no control options
3) have a proven effective and safe biological control agent
4) CSIRO has expertise on this agent to do the research
5) already an approved target for biological control
Impacts on diversity and ecosystem function

1) data from New Zealand

2) Included in 10 worst environmental weeds in NSW (Coutts-Smith & Downy 2006)

- moist cliff faces (endemic diversity hotspot)
- stream channel
- mistflower in Springbrook NP, QLD
Proven safe and effective biological control agent

white smut fungus (*Entyloma ageratinae*)

1) Hawaii (total control 8 months wet areas and in 3-8 years in dry areas)

2) New Zealand (total control resulting in increased plant diversity within 4 years)
Entyloma on mistflower in Hawaii

before

after

Photos: E. Trujillo
Stay tuned!

We have a stakeholder group assembled.

Several potential funding options will become available within the next year.

Hopefully we will get funding to complete this project in the near future.
Conclusions

Biological control is an effective management tool for the control of aquatic weeds.

Finding host specific agents is sometimes difficult, but necessary for reducing risk to non-target organisms.

Technology transfer has advantages because the probability of success is greater and the research time (and cost) is reduced.
Thank you

alligator weed in China
Acknowledgements

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Lake Macdonald Catchment Care Group
Cabomba Stakeholder Group
Burnet Mary Regional Group (BMRG)
# Biological control of salvinia

## Rearing facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Operator</th>
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<tbody>
<tr>
<td>Grafton, NSW</td>
<td>Department of Primary Industries</td>
</tr>
<tr>
<td>Brisbane</td>
<td>Brisbane City Council</td>
</tr>
<tr>
<td>Bundaberg</td>
<td>Bundaberg Regional Council</td>
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<tr>
<td>Darwin</td>
<td>Department of Natural Resources, Environment and the Arts</td>
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<td>Mirriam vale</td>
<td>Gladstone Regional Council</td>
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<td>Yeppoon</td>
<td>Rockhampton Regional Council</td>
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<td>Conservation Volunteers Australia</td>
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<td>Malanda</td>
<td>Queensland Parks and Wildlife Service</td>
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<tr>
<td>Gympie</td>
<td>Gympie Regional Council</td>
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