What’s New in Weed Biocontrol in California

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Classical Weed Biological Control

• A method of weed control where natural enemies from a weed’s native range are introduced into the exotic range where the weed has become invasive.
• The objective is for the exotic natural enemy to become self-sustaining members of the herbivore community in the new area of infestation.
• Most common biological control method used against weeds
THEORY OF BIOLOGICAL CONTROL:
Density dependent mortality lowers the average density of the weed population.
Musk Thistle (*Carduus nutans*)
Siskiyou County

Photos by CDFA
Musk Thistle Control Agent

Seed Head Weevil

Adult

Larval Damage

Photos by CDFA
What’s New for California?

Newly Approved BC Agents

- **Giant reed, Arundo donax**
  - Tetramesa romana (gall wasp)
  - Rhizaspidiotus donacis (scale insect)
- **Russian knapweed, Acroptilon repens**
  - Jaapiella ivannikovi (gall fly)
  - Aulacidea acroptilonica (gall wasp)
- **Canada thistle, Cirsium arvense**
  - Ceutorhynchus litura (root weevil)
- **Rush skeletonweed, Chondrilla juncea**
  - Bradyrrhoa gilveolella (root moth)
- **Water Hyacinth, Eichhornia crassipes**
  - Megamelus scutellaris (plant hopper)
- **Klamath weed, Hypericum perforatum**
  - Aplocera plagiata (leaf moth)

Patrick Moran USDA-ARS
- released 2010
- released 2013

Jodi Aceves (Siskiyou Co) & CDFA
- released 2011
- released 2013

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- released 2013

Patrick Moran USDA-ARS
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Jodi Aceves (Siskiyou Co) & CDFA
- released 2011
Arundo along the Rio Grande River in Texas

Photo by John Goolsby, USDA-ARS
Biological Control Agents

- **Tetramesa romana**
  - Arundo wasp
  - Hymenoptera: Eurytomidae
  - Larvae feed on stems & side shoots (adult stingless)
  - *Released in CA in 2010*

- **Rhizaspidiotus donacis**
  - Arundo scale
  - Homoptera: Diaspididae
  - Scale insects feed on roots and side shoots
  - *Released in CA in 2013*

- **Lasioptera donacis**
  - Arundo leafminer
  - Diptera: Cecidomyiidae
  - Larvae are leaf sheath miners causing defoliation
  - *Under evaluation*

- **Cryptonevra spp.**
  - Arundo fly
  - Diptera: Chloropidae
  - Fly larvae feed on new stem shoots
  - *Testing in Europe*

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Slide provided by John Goolsby, USDA-ARS
USDA-ARS Scientists working on *Arundo* biocontrol
**Tetramesa romana** (Hymenoptera: Eurytomidae)

- Adult females live 4-5 days and reproduce via parthenogenesis.
- One female produces an avg. of 26 new adults; max of 66.
- Larvae develop inside cane in 30-35 days.
- Almost all (90%) of egg-laying and feeding occur at shoot tip.
- Growth of plant stunted by gall.
- Host specific to *Arundo donax*.


Arundo wasp damage Lower Rio Grande Valley

Photos by John Goolsby, USDA-ARS
Giant reed
*Arundo donax*

**Tetramesa romana**
Accidently introduced – found in Southern California

Map of 2007 survey
Dudley et al. (2007)

Current efforts by USDA-ARS using known biotypes and releases directed at sites in Northern CA
Rhizaspidiotus donacis, Arundo scale

- Feeds on roots and stems, host specific to Arundo
- Sex ratio (Female:Male) in adults: 0.88 ± 0.094 (n = 37 plants)
- Adult female survival (on plant until reproductive maturity): 203 days
- Average crawler production by individual female: 85 to 300, 50-80% of females are reproductive
- Highly significant impact on A. donax in Europe


Arundo scale damage – Del Rio, TX

Arundo stand in plot is thinning. 24% of stems dead

High densities of large, robust, mature F2 females

Mature rhizomes infested with scale at each node and bud

Many new buds are dead from scale feeding
Effects of human disturbance and climate on arundo scale impacts on *Arundo donax* in Europe

A. Undisturbed
No freeze
Hot summer
Dry soil

B. Disturbed (mowing)
No freeze
Hot summer
Dry soil

C. Disturbed (irrigation)
No freeze
Hot summer
Wet soil

D. Undisturbed
Light freeze
Warm summer
Dry soil

E. Undisturbed
Deep freeze
Mild summer
Dry soil


Slide provided by John Goolsby, USDA-ARS
Lasioptera donacis, Arundo leafminer

- Larvae feed in leafsheath channels
- Causes rapid leaf death and defoliation
- Defoliator needed to open plant canopy to allow for native vegetation to compete
- Adult fly places spores of saprophytic fungi (*Arthrinium arundinis*) on leafsheath to start infection
- *A. arundinis* found worldwide, Texas accession to be used for release on Rio Grande

Slide provided by John Goolsby, USDA-ARS
Arundo leafminer

Fly larva feeds on leaf sheath causing defoliation

Photos by John Goolsby, USDA-ARS
What’s New for California?

Accidental introductions into California

• Scotch broom, *Cytisus scoparius*
  – *Aceria genistae* (gall mite)
  – *Asphondylia pilosa* (flower bud gall fly)

• Dalmatian toadflax, *Linaria genistifolia ssp. dalmatica*
  – *Mecinus janthiniformis* (stem weevil)

• Canada thistle, *Cirsium arvense*
  – *Larinus planus* (seed head weevil)

• Musk thistle, *Carduus nutans*
  – *Cheilosia corydon* (root & stem fly)
Scotch broom natural enemy

*Aceria genistae* - broom gall mite

Photos provided by Jennifer Andreas, Washington State University
Scotch broom natural enemy

*Aceria genistae* - broom gall mite

Galls stunt growth and can result in plant mortality

Photos from Eric Coombs, Oregon Dept. of Agriculture
Scotch broom natural enemy

*Aceria genistae* - broom gall mite

Photos from Eric Coombs, Oregon Dept. of Agriculture
Dalmation toadflax

- Family Scrophulariaceae (snapdragon family)
- Perennial
- Invades and dominates rangelands
- *Mecinus janthiniformis* – a stem weevil
- Accidental introduction in Northern CA

Photos by Baldo Villegas, CDFA
Dalmation toadflax

*Mecinus janthiniformis* larval damage

Photos by Baldo Villegas, CDFA
Dalmation toadflax

- Issues with native Scrophulariaceae esp. *Sairocarpus (= Antirrhinum) virga*
- 13 sp. of *Antirrhinum* in CA – highest diversity in North America
USDA-APHIS Permitting of Weed BC Agents

• Petitioner submits permit request to APHIS; this includes the host testing results
• APHIS sends document to Technical Advisory Group (TAG) for review
• If TAG recommends approval, APHIS sends document to USFWS (T & E issues) & Indian Tribes for review
• If USFWS & Indian Tribes concur, then EA written and submitted to 30 public comment period.
• If no serious negative comments, EA approved, FONSI written, and permit issued.
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What’s on the Horizon for California?

Agents recommended for approval by TAG

Review by USFWS & Indian Tribes pending

• Cape ivy, *Delairea odorata* (Patrick Moran, USDA-ARS)
  – *Digitivalva delaireae* (stem boring moth)
  – *Parafreutreta regalis* (stem gall fly)

• Hoary cress, *Lepidium draba* (Montana State University)
  – *Aceria drabae* (gall mite)
Cape Ivy (*Delairea odorata*)
Patrick Moran, USDA-ARS
(lead scientist)

*Digitivalva delaireae*
(stem boring moth)

Photos by Joe Balciunas, USDA-ARS
Cape Ivy (*Delairea odorata*)
Patrick Moran, USDA-ARS
(lead scientist)

*Parafreutreta regalis* (stem gall fly)
Hoary cress (*Lepidium draba*)  
*Aceria drabae* (gall mite)
Aceria salsolae (Russian thistle mite)

On human eyelash

scanning electron micrograph

Photos by Lincoln Smith, USDA-ARS
Potential biocontrol agents for hoary cress

- **Aceria drabae**: TAG recommended release!
- **Ceutorhynchus turbatus**: TAG requested additional tests
- **Ceutorhynchus cardariae**: 
- **Psylliodes wrasei**: 
- **Ceutorhynchus assimilis**: 
- **Melanobans sp. pr. semistriata**: 

Slide provided by Harriet Hinz, CABI Switzerland
What’s on the Horizon?

Agents being tested for safety – petitions to be written

Perennial pepperweed (*Lepidium latifolium*) CABI
Dyer’s woad (*Isatis tinctoria*) CABI
Hoary Cress (*Lepidium draba*) CABI
Scotch thistle (*Onopordum acanthium*) USDA - ARS
Common crupina (*Crupina vulgaris*) USDA - ARS
Oxeye daisy (*Leucanthemum vulgare*) CABI
Common tansy (*Tanacetum parthenium*) CABI
Russian thistle (*Salsola tragus*) USDA - ARS
Yellow starthistle (*Centaurea solstitialis*) USDA - ARS