# Update on recent biological control releases against invasive plants by the USDA-ARS in California

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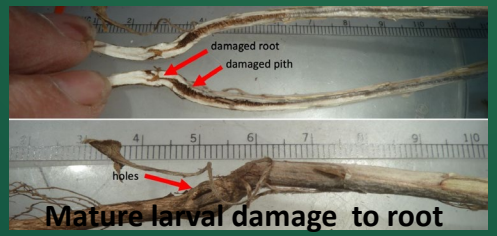
**First new agent in over 20 years released against yellow starthistle**

# Newly-Released Biological Control Agent on Yellow Starthistle 2020-2022

## The rosette weevil *Ceratapion basicorne.*
## First new insect agent released against yellow starthistle in over 20 years.
## First agent that feeds on the root and rosette of immature plants.






- Introduced from yelllow starthistle's native range in northern Greece.
- Among 53 plant spp. tested in lab, 8 received damage.
- In field, only yellow starthistle damaged.


Smith, L. 2007. Physiological host range of *Ceratapion basicorne*, a prospective biological control agent of *Centaurea solstitialis* (Asteraceae). Biol. Control 41: 120-133.
Cristofaro, M., De Biase, A., Smith, L. 2013. Field release of a prospective biological control agent of weeds, Ceratapion basicorne, to evaluate potential risk to a nontarget crop. Biol. Control 64: 305-314.

# Innovations in rearing and technology transfer
# Yellow starthistle root weevil *Ceratapion basicorne*

**This weevil naturally has only one generation per year.**

- Hormone treatment: induce egg-laying-multiple generations per year in lab.

- Cold treatment: Simulate winter conditions and stimulate mating and egg-laying any time of year in lab.

**Insect naturally lays eggs on leaves.**

- Determine optimum placement of females on leaves.
- Transfer larvae rather than females-more efficient.

**Over 1,000 weevils reared at USDA-ARS**

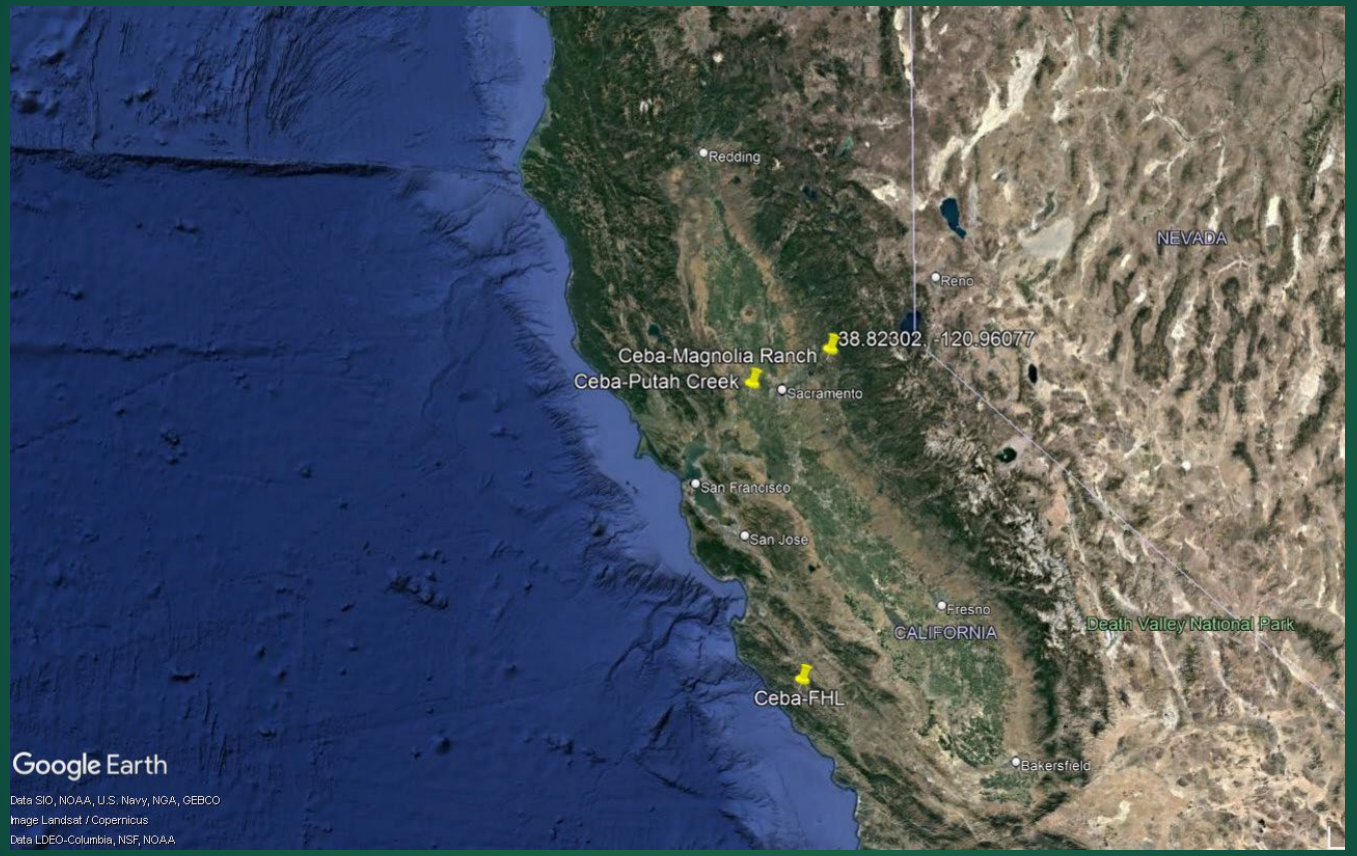
**Rearing manual written.**

**Successful rearing at four cooperating laboratories:**

- **CDFA, Sacramento**
- **CO Dept of Agriculture**
- **Idaho-Nez Perce Tribe**
- **Idaho-Univ. of Idaho**

# Field Release of the Rosette/Root Weevil *Ceratapion basicorne* 2020-2022

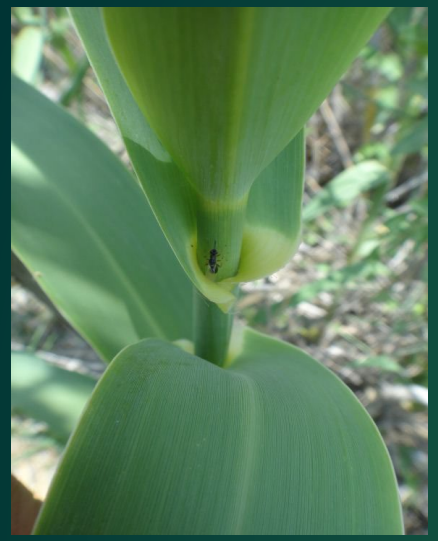


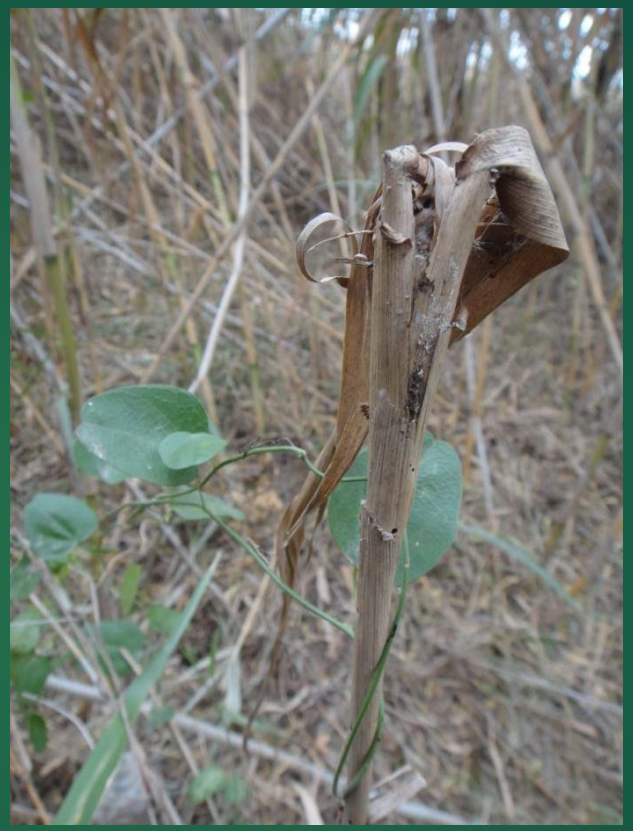



2020-Central Valley: Putah Creek Ecosystem Reserve (UC Davis), Yolo County
2021-Sierra foothills: Magnolia Ranch/BLM land, El Dorado County
2022-Coastal mountains: Fort Hunter-Liggett (US Army installation), Monterey County

# Arundo shoot tip-galling wasp established in the Central Valley

# Impact of the arundo wasp *Tetramesa romana*



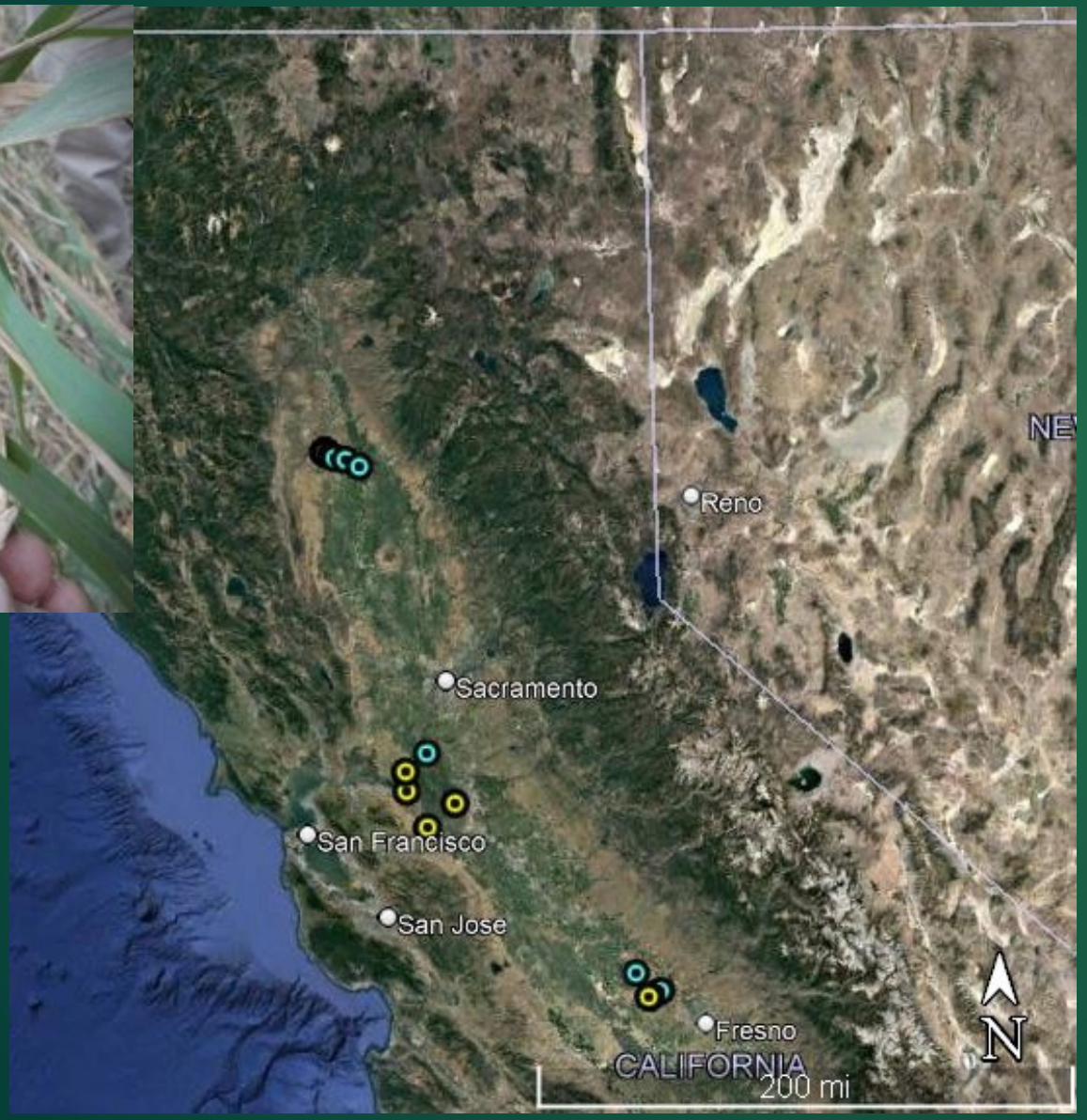


Original releases in the Lower Rio Grande Basin of Texas and Mexico (2009-2012)

- Reduced live biomass by 44%
- Increased mortality of side shoots.
- Two to three-fold increase in diversity of other plants

- About 13,000 adults released in northern California since 2010, establishment being verified.

# 2022 update (5 years post-release)

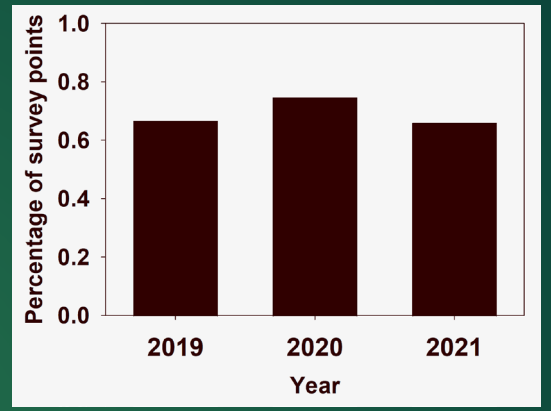


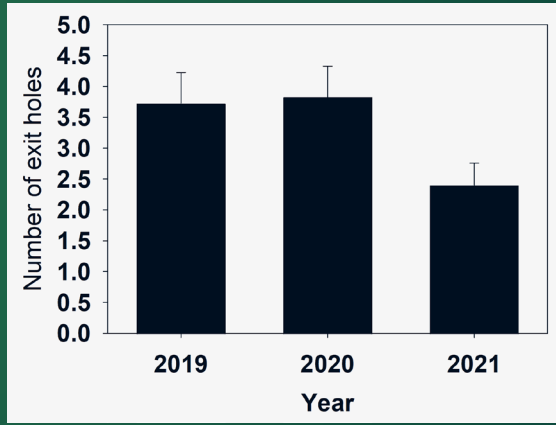

Survey technique: Two-minute counts of exit holes and immature galls.

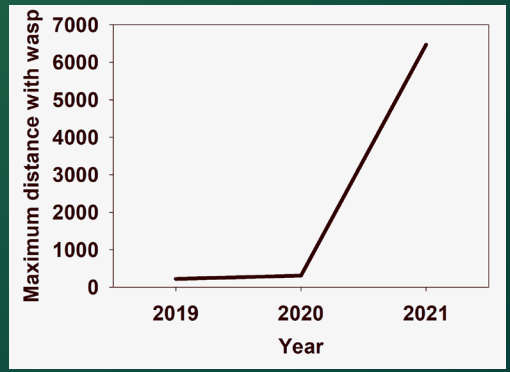
Yellow=wasp present
Blue=wasp absent

Multi-year evidence of establishment: 6 of 11 sites.

# 2019-2021 surveys-arundo shoot-galling wasp
# Established-Stony Creek in northern Sacramento River watershed

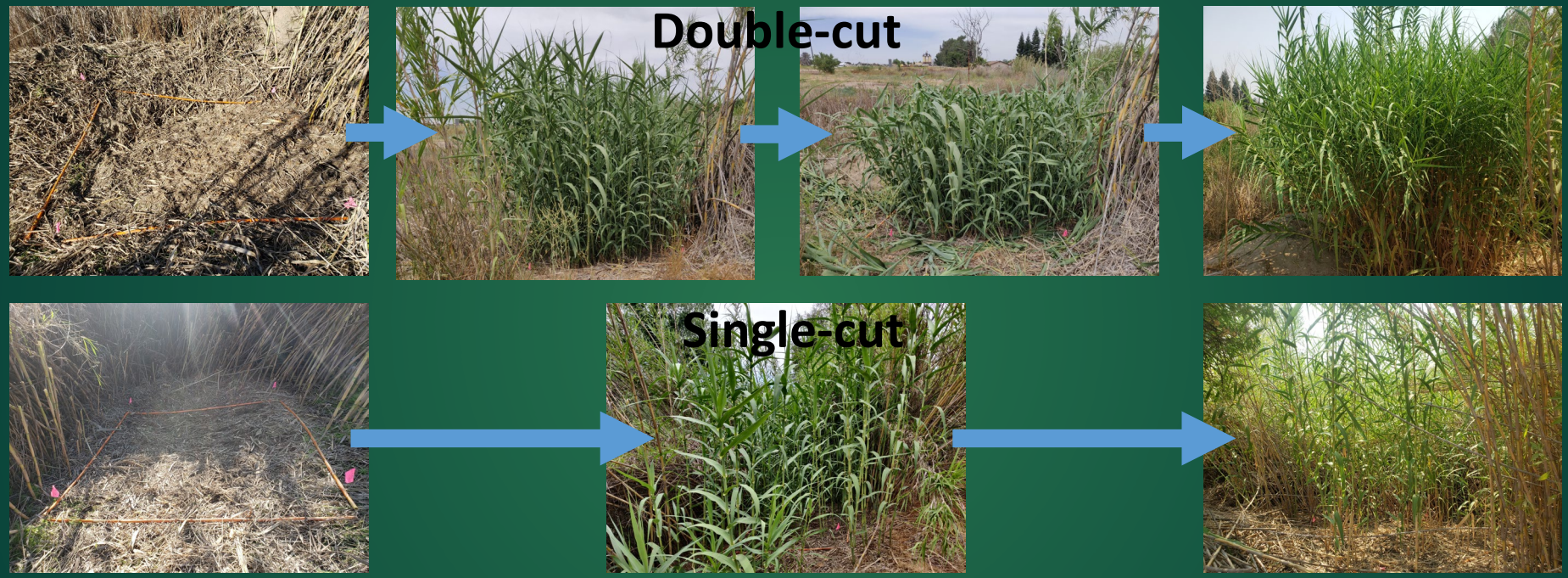




- 99 points surveyed each year.
- Over 60% of points had at least one exit hole/ gall.
- Exit hole abundance decreased by 37% in 2021 compared to 2020.
- 21-fold greater dispersal distance in 2021 v. 2020.
- 6.4 km dispersal in 2021.
- Two other sites downstream-no wasps in 2021.

# Physical control of arundo of release plots improves wasp establishment




- Double-cut: Ground cut April 2020, then top regrowth to ca. 1.5 m height June-July 2020.
- Single cut: Ground cut April 2020, regrowth, no subsequent topping.
- Wasp release in all plots Sept-Nov 2020 (130 per plot). N=3 plots per treatment per site.
- Mark and examine 10 shoots per plot Nov 2020-Sept 2021; also two-minute plot surveys.
- Collect marked shoots Sept. 2021 and measure/dissect side shoots.

# Integrated chemical-biological control of arundo in the Delta-2017-2022







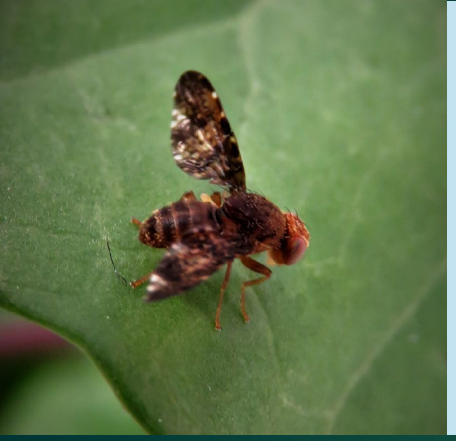
- Examining wasp density on original (2017) biocontrol plots and in post-herbicide regrowth.
- Preliminary results suggest higher wasp abundance in regrowth.

Some images provided by the Sonoma Ecology Center and Sacramento-San Joaquin Delta Conservancy

**Arundo rhizome- and shoot-feeding armored scale established at 7 sites in the Central Valley (in release plots only)**

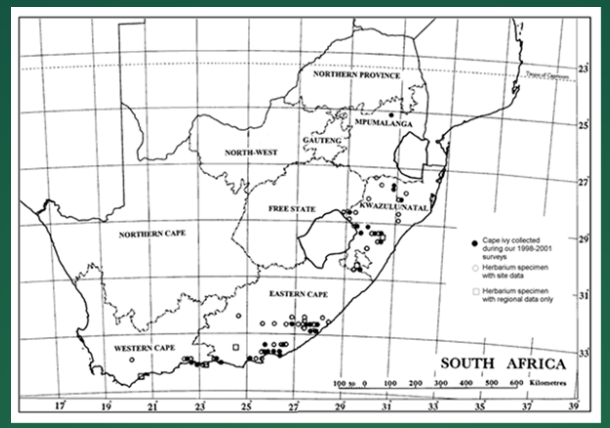
# Cape-ivy shoot tip-galling fly established along the California coast

# Cape-ivy shoot tip-galling fly



*Parafreutreta regalis* (Tephritidae)

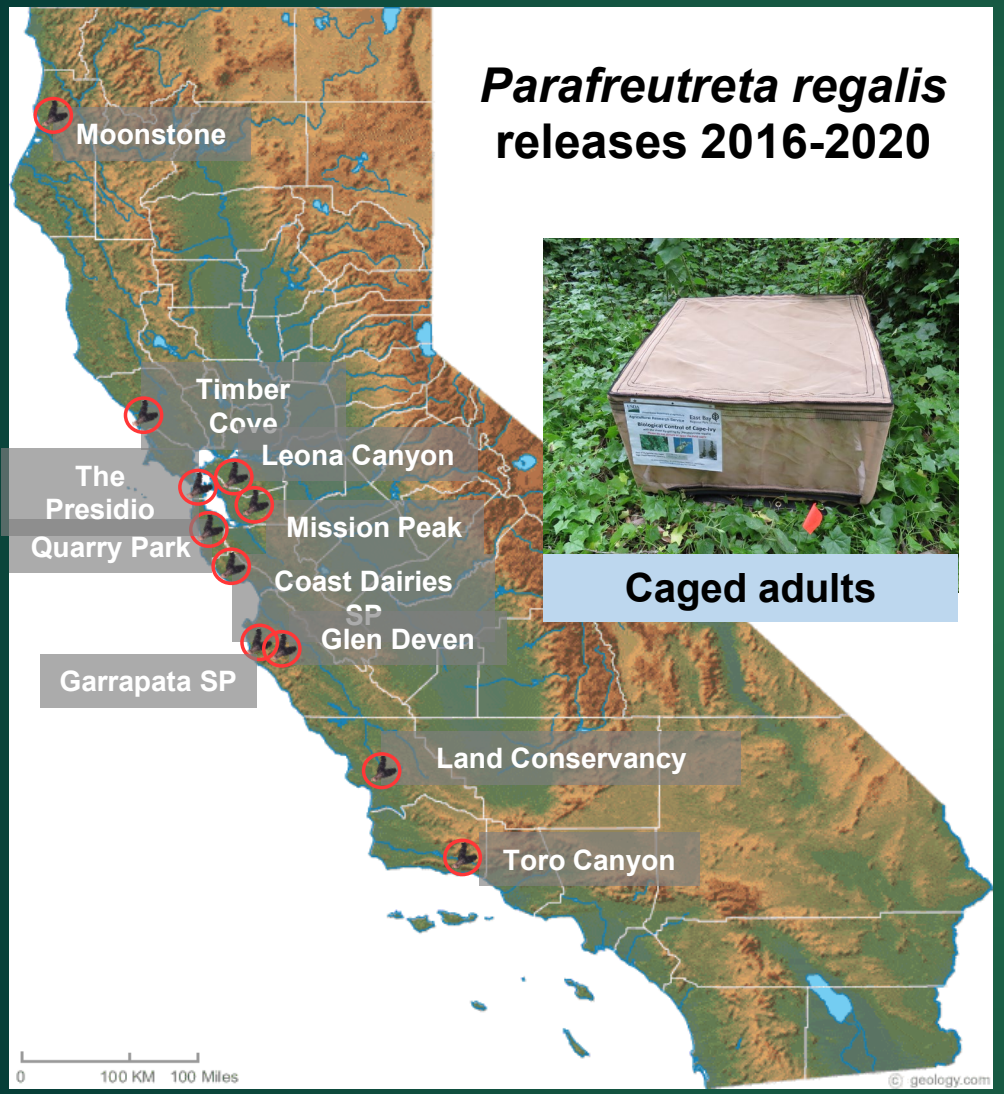
- Lays eggs in shoot tips
- Shoot tip develops ‘tumor’ (gall)




galled plant vs. healthy plant



# Releases of caged fly adults 2016-2020





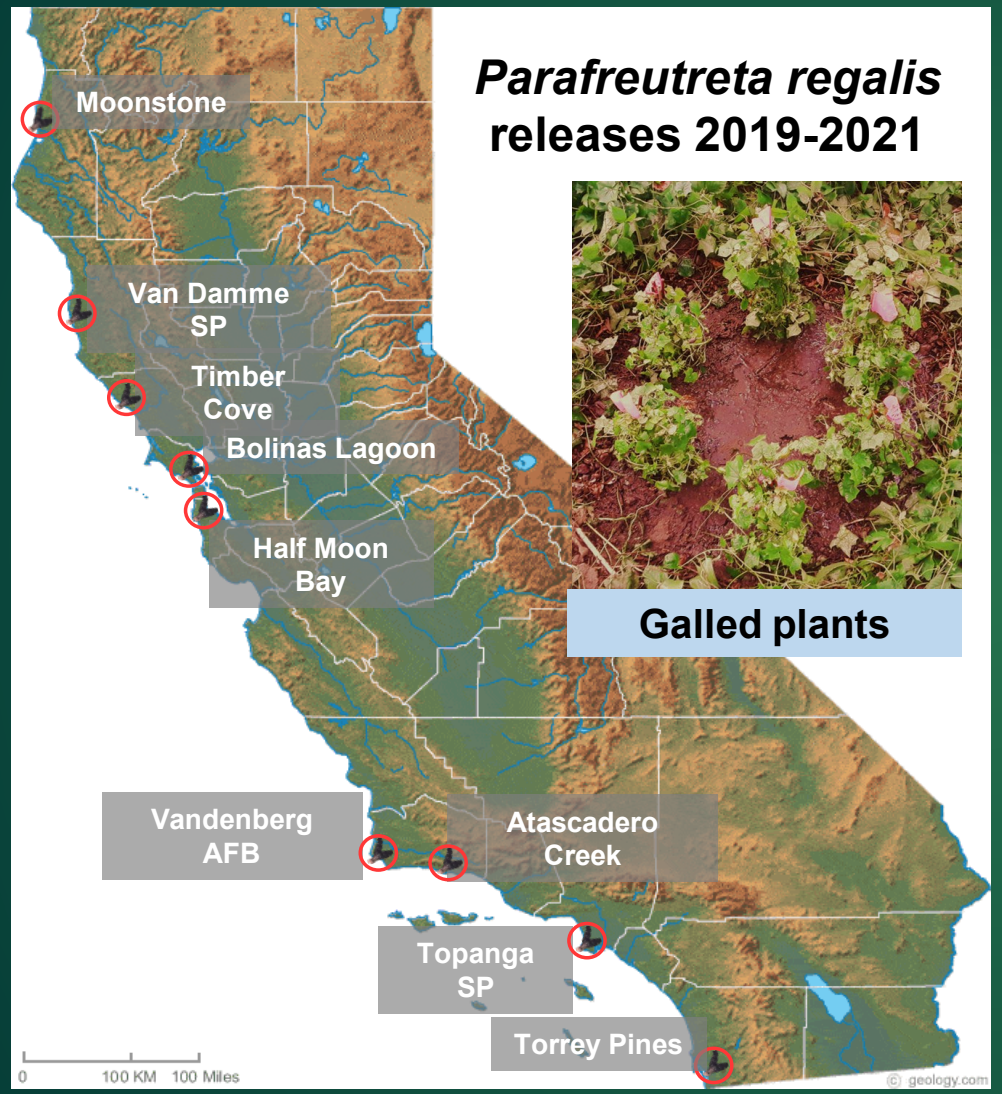

Caged adults

Moonstone Beach – Humboldt Co.
1 release (2017) not established
Timber Cove – Sonoma Co.
3 releases (2016-17) not established
The Presidio (2 sites) – San Francisco Co.
21 releases (2017-20) not established*
Leona Canyon – Alameda Co.
2 releases (2016-17) not established*
Mission Peak – Alameda Co.
21 releases (2016-20) ?
Quarry Park – San Mateo Co.
7 releases (2017-19) not established
Coast Dairies SP – Santa Cruz Co.
7 releases (2017-19) *established
Garrapata SP – Monterey Co.
7 release (2018-19) *established
Glen Deven Ranch – Monterey Co.
12 releases (2016-19) *established
Land Conservancy – San Luis Obispo Co.
1 release (2017) *established
Toro Canyon – Santa Barbara Co.
5 releases (2017, 2020) not established

**11 sites, 86 total release events 2016-2020**

* = major site/plot disturbance

# Releases of galled plants 2019-2022




**9 sites, 30 total release events 2019-2022**

Moonstone-Humboldt County
1 release-2022-?

Van Damme SP – Mendocino Co.
4 releases (444 galls, 2020), incl. 1 in 2022-this week ?

Timber Cove – Sonoma Co.
6 releases (626 galls, 2019-20) established

Bolinas Lagoon – Marin Co.
3 releases (512 galls, 2020) established

Half Moon Bay – San Mateo Co.
8 releases (724 galls, 2019-20) not established

Vandenberg AFB – Santa Barbara Co.
2 releases (79 galls, 2021) ?

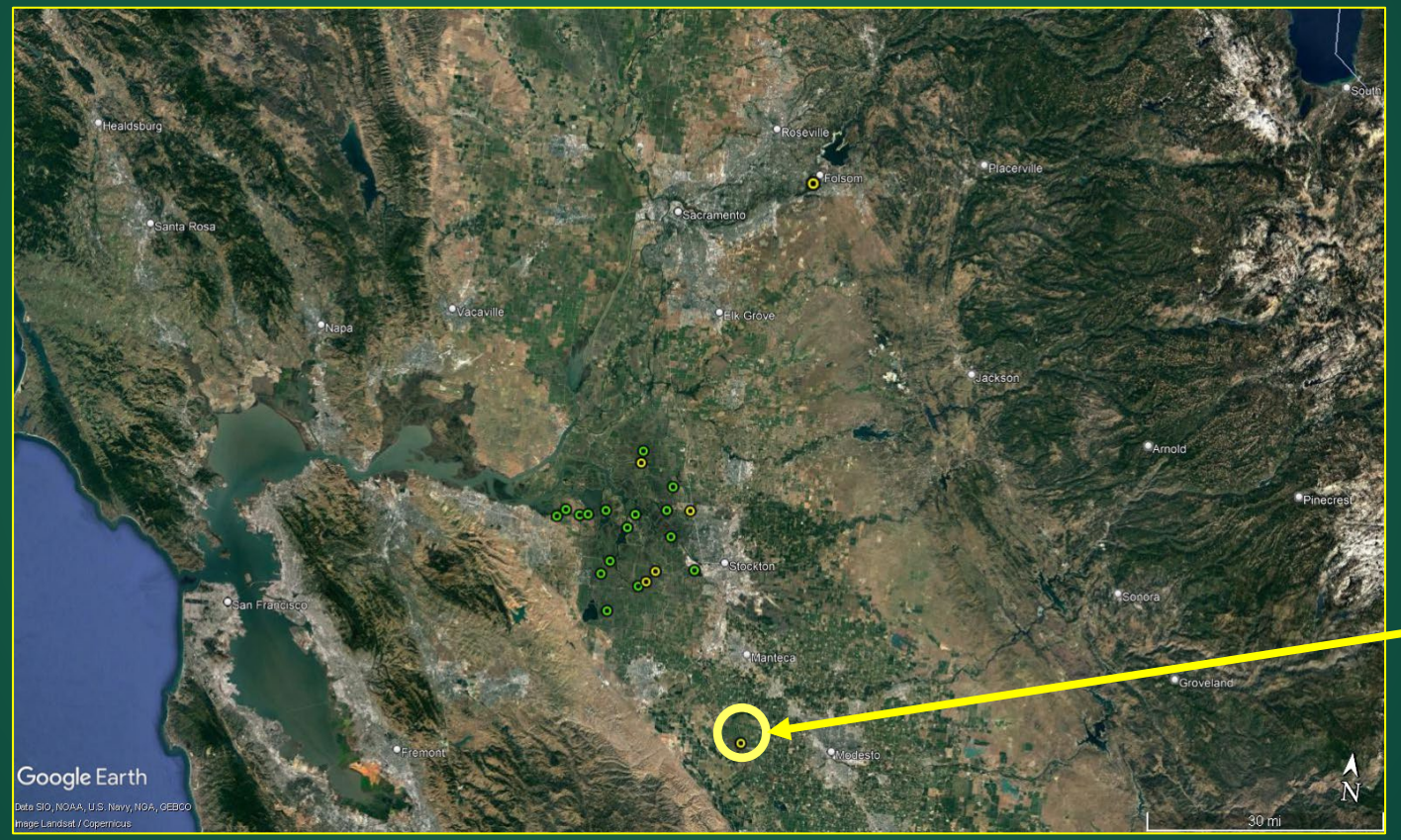
Atascadero Creek and Coyote Creek – Santa Barbara
3 releases (111 galls, 2021) established-2 sites

Topanga SP – Los Angeles Co.
1 releases (109 galls, 2021) established

Torrey Pines – San Diego Co.
2 releases (379 galls, 2020, 2022), established

# Water hyacinth planthopper weakly established in the Sacramento-San Joaquin Delta

# The planthopper *Megamelus scutellaris* released for biological control of water hyacinth in northern California 490,000 released at 20 sites in the Delta-2018 to 2020 + more outside Delta

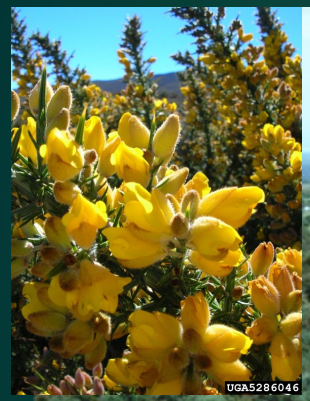




- Established at four sites in the Sacramento-San Joaquin Delta (yellow).
- Not established at 16 other sites in the Delta (green).
- Surprise establishment south of the Delta on the SJ River-closest release sites is about 70 river-miles upstream, or downstream in Delta.

# New agent against gorse released in northern California

# New (since 2019) biological control of weeds agent released in California: the gorse thrips *Seriocothrips staphylinus*

Eric Coombs



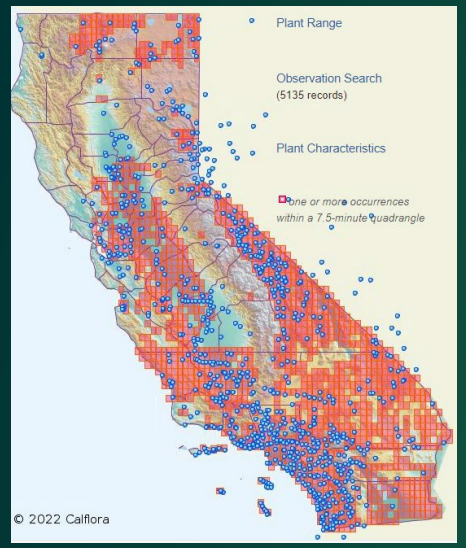





- Agent studied and permit obtained at Oregon State University-135 plant species tested.
- Releases made by USDA-ARS at six sites in 2020 in northern California-coastal mountains.
- In 2022, one thrips recovered at each of two of the six sites.

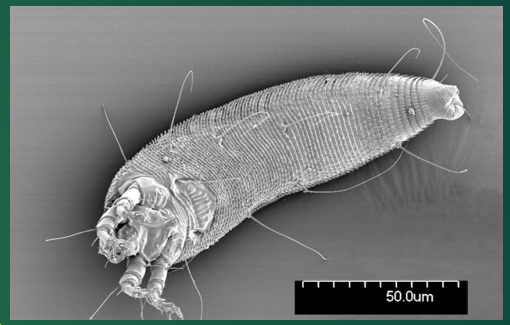
# Potential future agents

# Russian thistle (*Salsola tragus, S. kali, S. paulsenii, S. australis* ) (Chenopodiaceae)




Widespread invader in rangelands, along roadsides

## New agents-in quarantine




Stem tip-feeding mite-*Aceria salsolae*

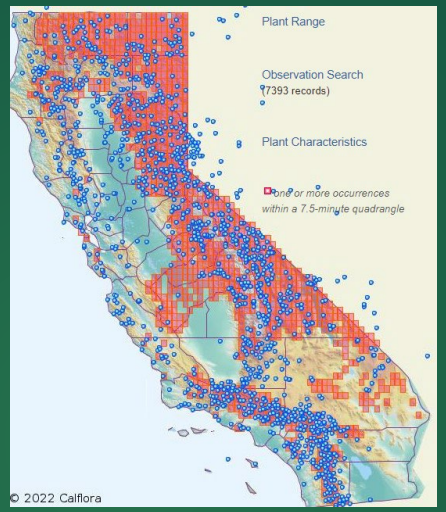
## Old agents-both limited by parasitism

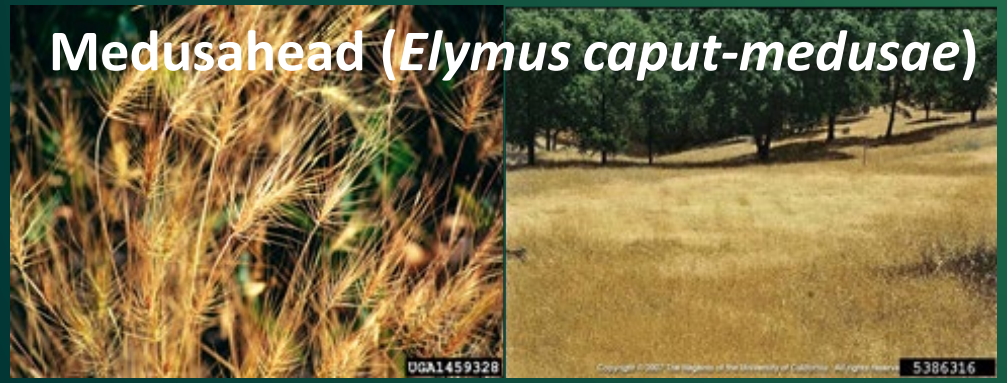
*Coleophora klimeschiella*

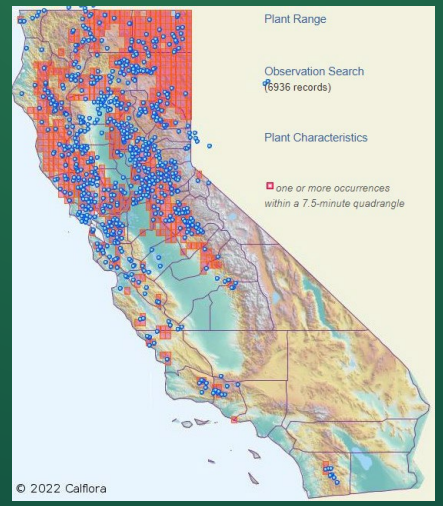
*Coleophora parthenica*

Shoot-boring moth-*Gymnancyla canella*

# New (since 2020) focus for the USDA-ARS in Albany: Invasive annual grasses


**Two new scientists hired:**

**Research Microbiologist:**
Determine the 'microbiome' of roots; isolate inhibitory bacteria and fungi as biological control agents.

**Research Entomologist:**
Discover, characterize and seek release permits for mites and insects as biological control agents.