

Highlights of Recent Biological Control Research in Louisiana

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Outline

- Introduction
- Citrus leafminer
- Red Imported Fire Ants
- Common salvinia
- Citrus blackfly

Nonnative Insects in U.S.

- Since 1850 # of nonnative species in U.S. has expanded 10 fold
- Over 200 have become severe pests (Examples)
- In U.S. adventive spp. make up 39% of crop pests; 27% of insect pests of forests; 7% of plant pathogens of vegetables; 73% of weeds of cultivated crops; and 41% of the weeds of pastures

Biological Control Definition

- The use of parasitoid, predator, pathogen, antagonist or competitor populations to suppress a pest population, making it less abundant and thus less damaging than it would be otherwise.
- Conservation, Augmentation and Importation



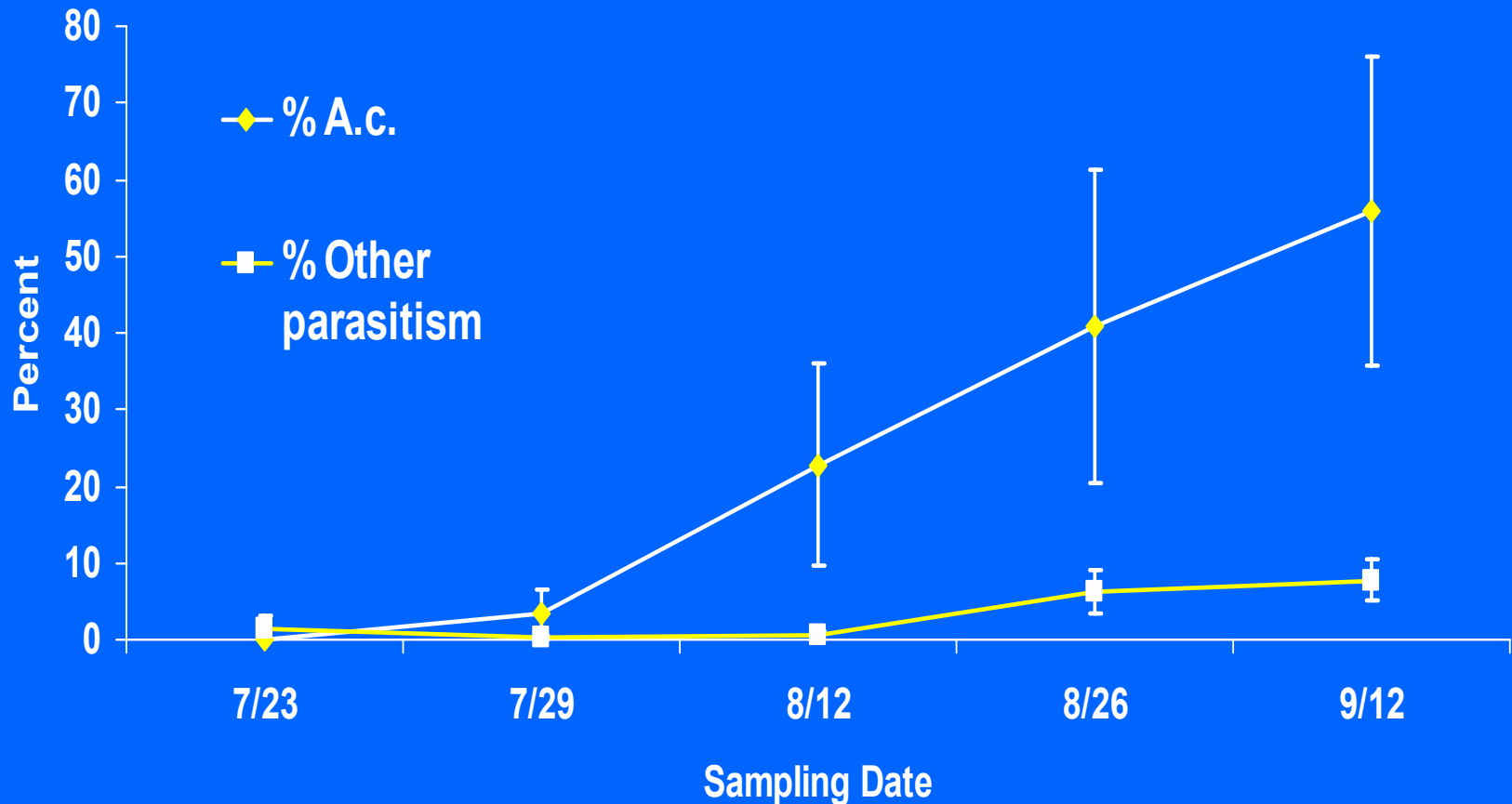
Citrus Leafminer, *Phyllocnistis citrella*



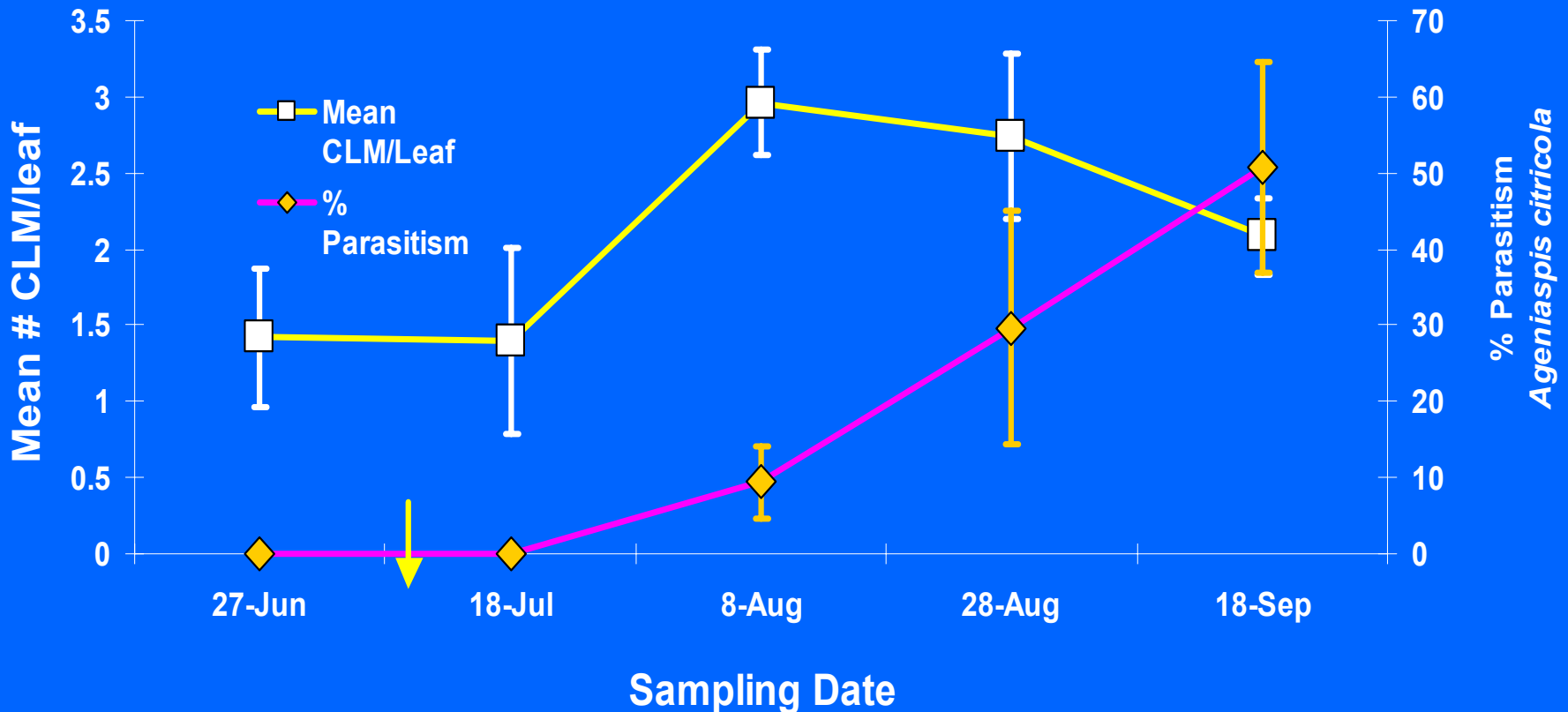




% parasitism of citrus leafminer pupae at Louisiana survey sites-1997



Citrus leafminer density and % parasitism by *Ageniaspis citricola* in Plaquemines Par. in 2002. Parasites (130) released at Citrus Station between July 12 and July 15 (indicated by arrow).

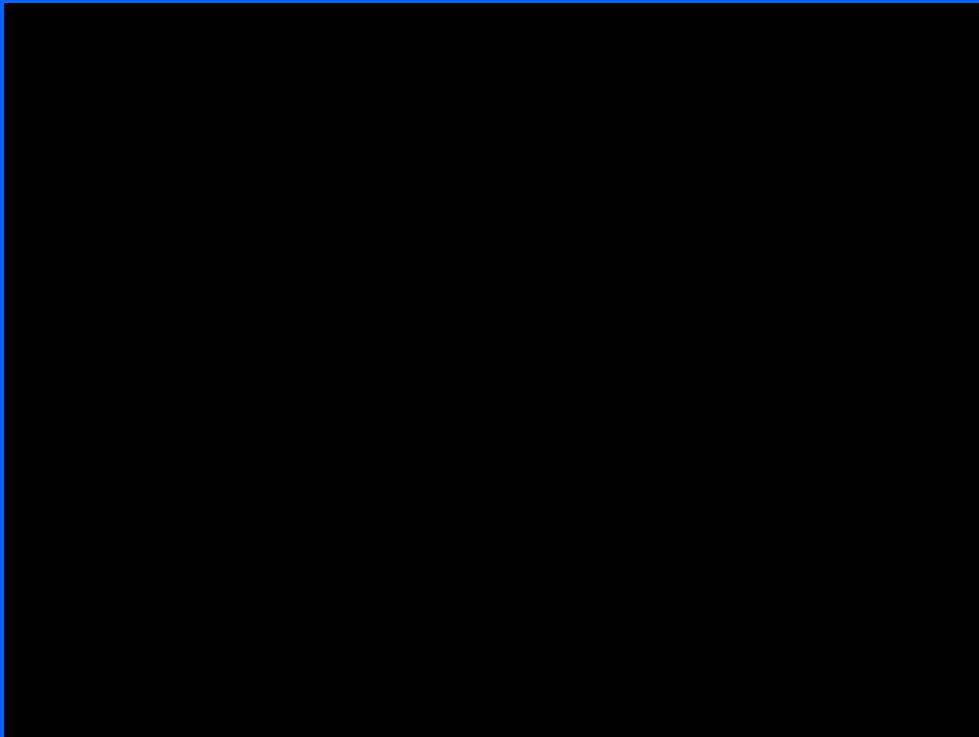




2002



Background – *Pseudacteon* decapitating flies

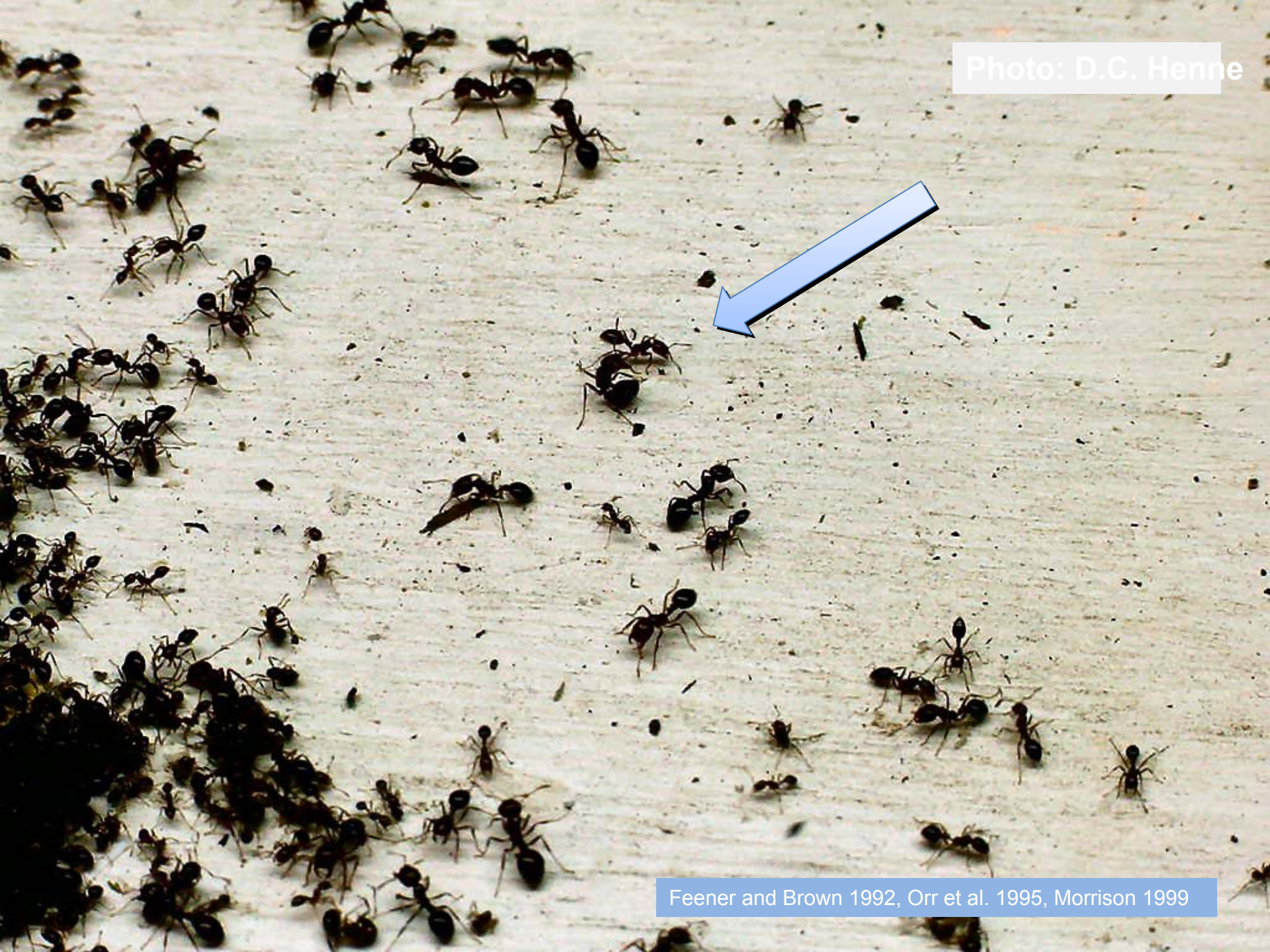


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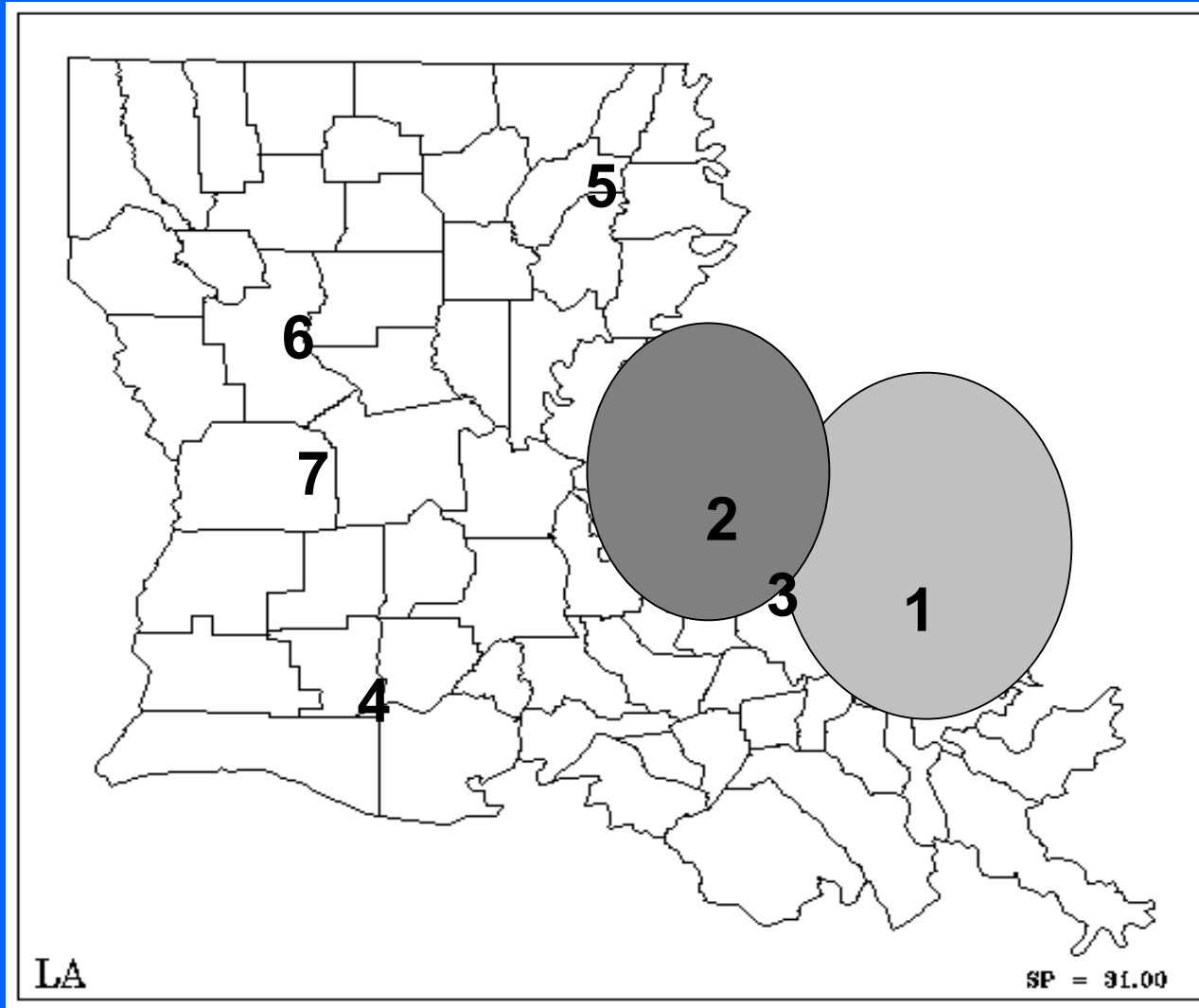
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Photo: D.C. Henne

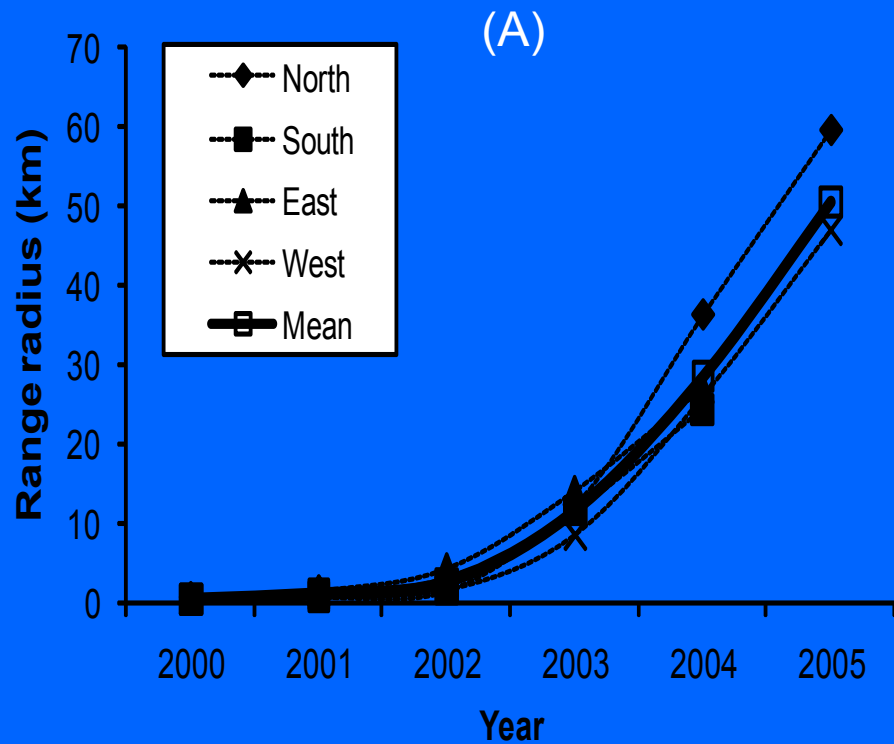


Feener and Brown 1992, Orr et al. 1995, Morrison 1999

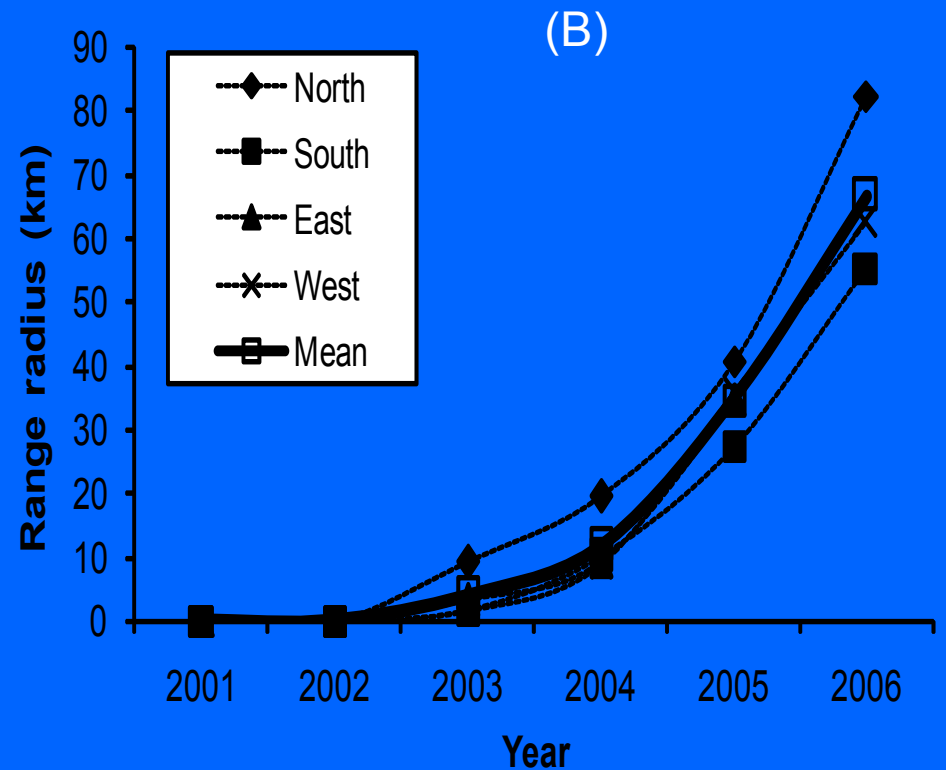
Pseudacteon tricuspis releases



Change in *Pseudacteon tricuspis* range radius (km) over time in four cardinal directions (and mean of all directions) for two release sites: Covington (A) and Norwood (B), Louisiana. Curves are derived from polynomial least-squares regression.

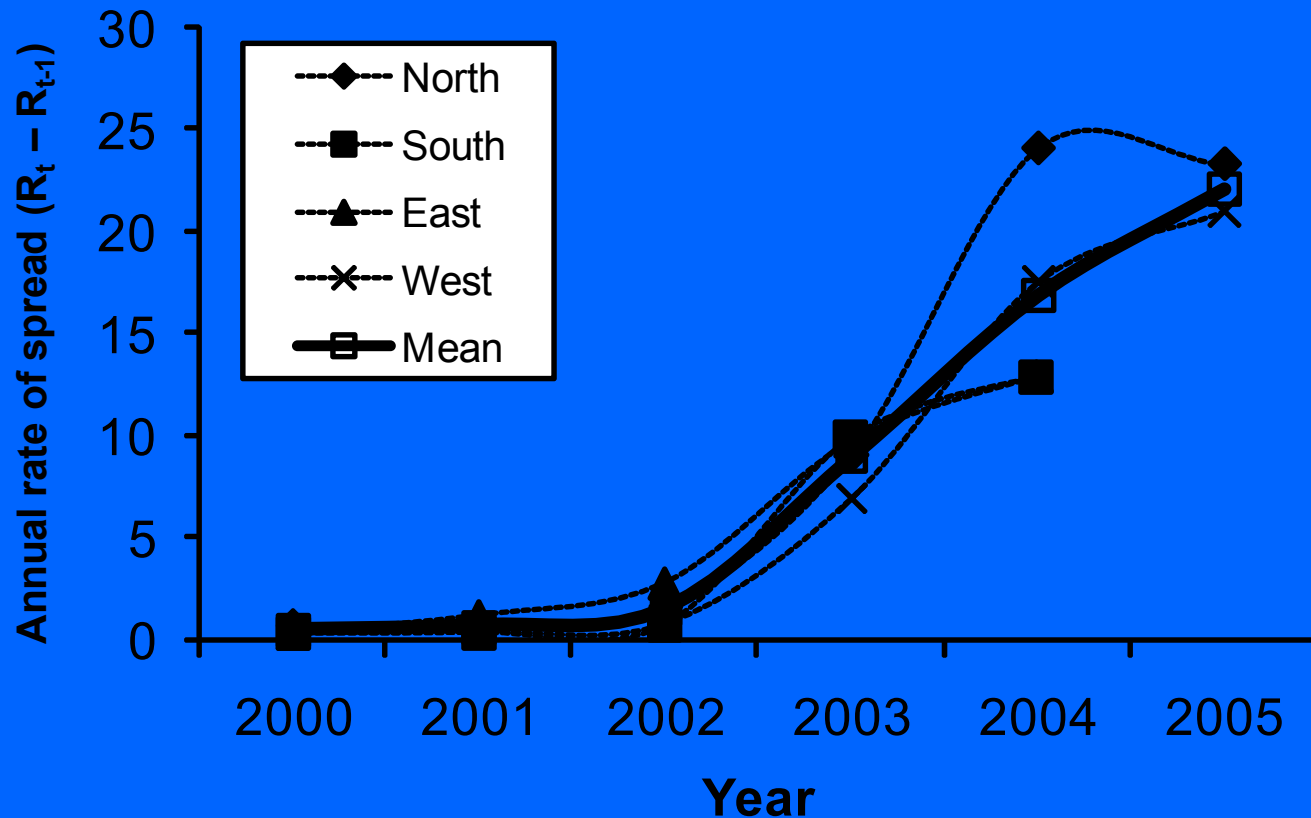


Covington $df=1,3$ ($F=164$, $P=0.001$) $y = 3x^2 - 12000x + 1.2e^{0.007}$ ($R^2=1.0$, $n=6$)



Norwood $df=1,3$ ($F=85$, $P=0.003$), $y = 4.2x^2 - 17000x + 1.7e^{0.007}$ ($R^2=0.99$, $n=6$)

Annual directional rate of spread (km/year = radius at time_t - radius at time_{t-1}) for *P. tricuspis* at the Covington release site. A logistic growth curve was fit to each individual transect and the mean of all four transects.





Baton Rouge

The image is a satellite-style map of Louisiana. Two large, overlapping yellow circles are positioned in the northern part of the state. Each circle contains a small, white, eight-pointed star marker. A blue arrow points from the text 'Baton Rouge' to a location on the Mississippi River in the western part of the state. The map shows various geographical features like rivers, lakes, and land cover.

***P. tricuspis* spread: 2006**

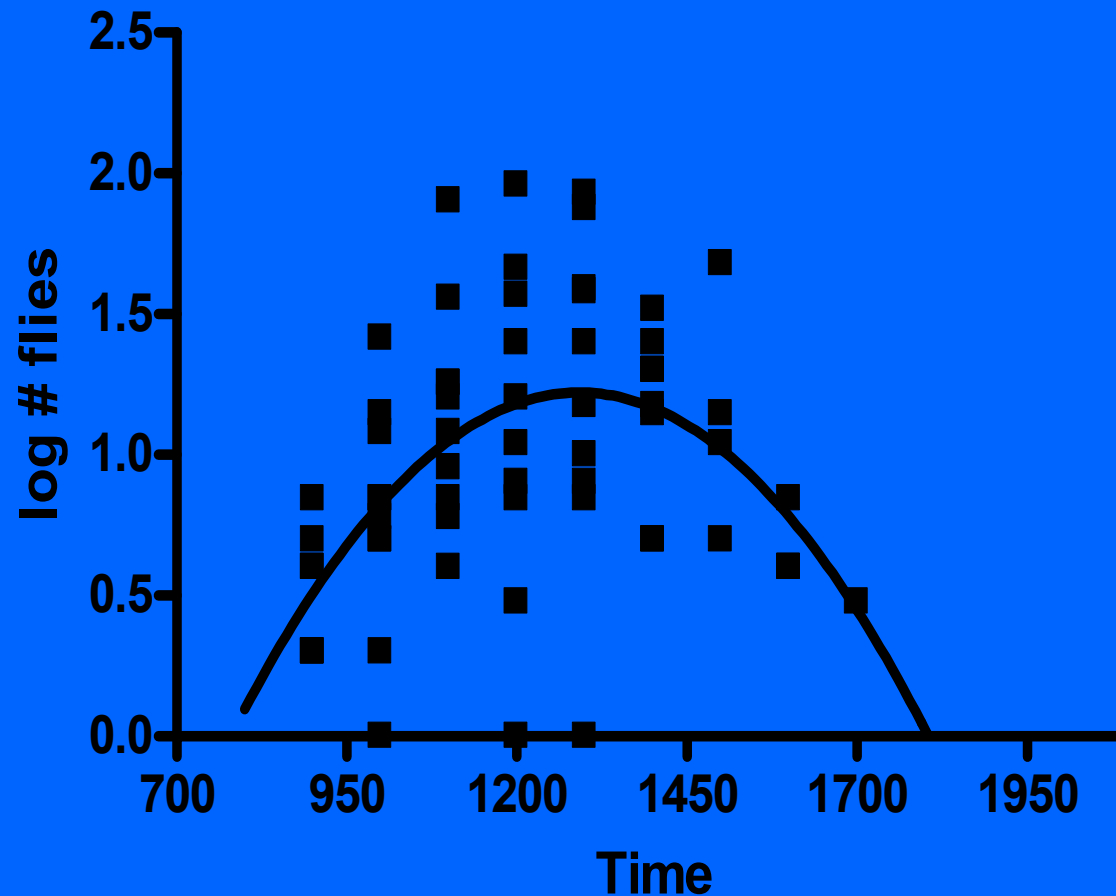
A satellite-style map of Louisiana with a large yellow circle overlaid on the eastern and central parts of the state. A blue arrow points from the text 'Baton Rouge' to the western edge of the yellow circle. The text '*P. tricuspis* spread: 2007 (estimated)' is written in yellow with a black outline at the bottom of the map. Light blue lines on the map represent state boundaries.

Baton Rouge

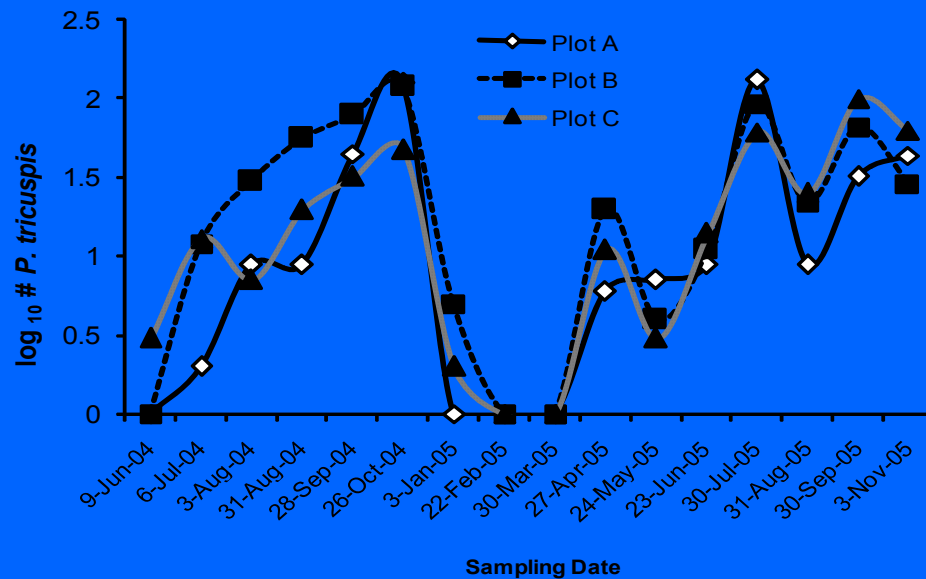
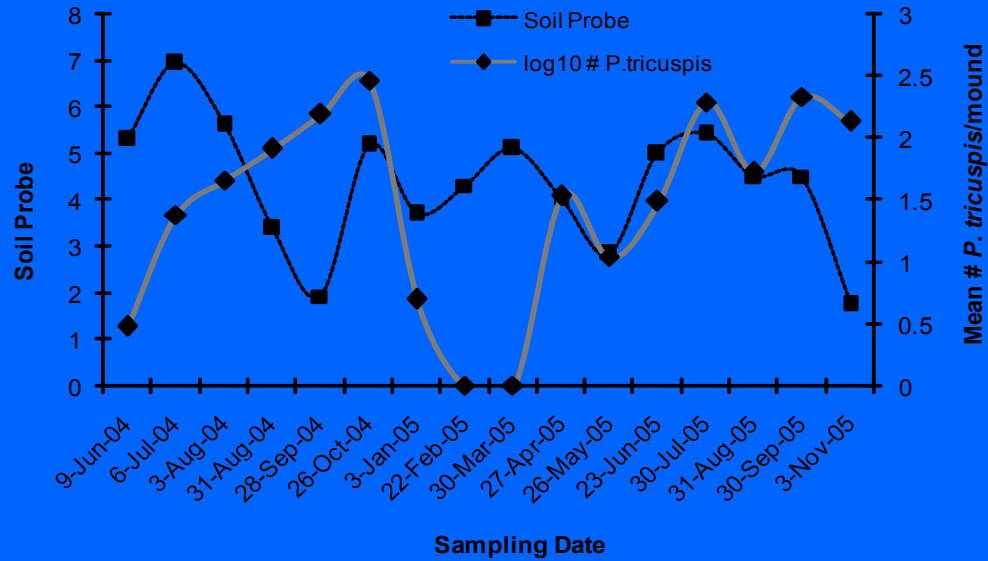
***P. tricuspis* spread: 2007
(estimated)**

Daily abundance pattern of *P. tricuspis* as a function of time of day (CST): Norwood, LA.

[$df=1,60$; $F=16.16$; $p=0.0002$), $y = -4.64e^{-0.006x^2} + 0.012x - 6.53$ ($R^2=0.25$, $n=63$)]



Time series graph of mean # *P. tricuspis*/mound and soil moisture probe readings, and plot abundances: Norwood, Louisiana 2004-2005.



COMMON SALVINIA

- Free floating aquatic fern with a horizontal rhizome.
- Native range extends from Central to South America.
- Reproduces asexually by expansion of apical and axillary buds.
- The “root” is a modified leaf that looks and functions like a root.

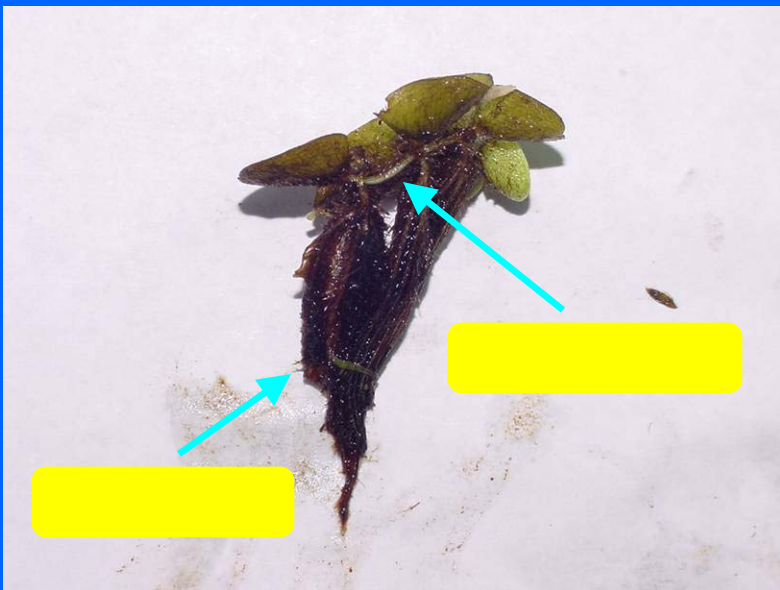
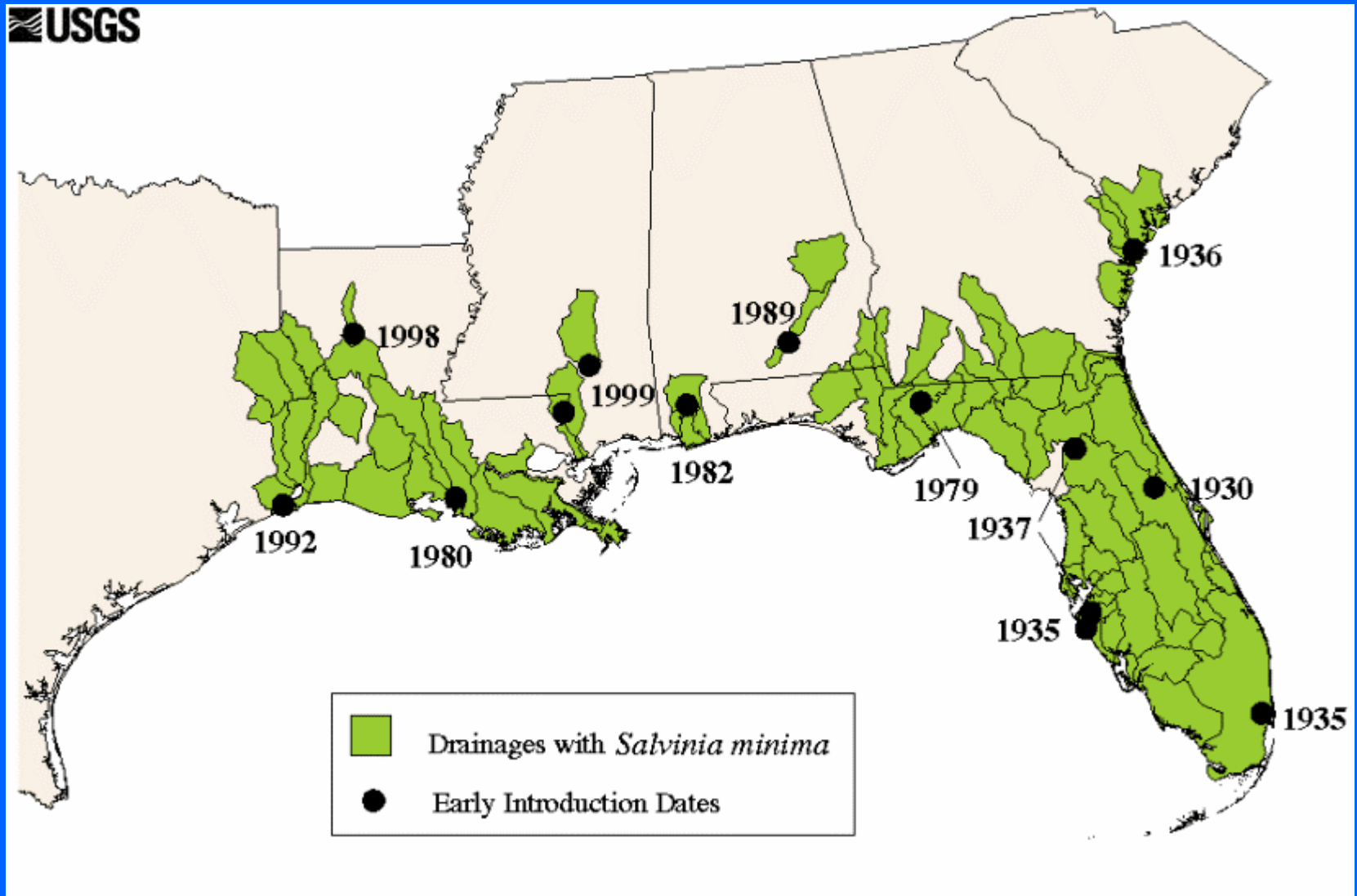


Photo: C Jacono

DISTRIBUTION OF *C. SALVINIA* IN THE US



Why Control Common Salvinia

- “Very troublesome weed” in Texas and Louisiana.
- Can form thick floating mats on the surface of water.
- Displaces native plant species (duckweed) and kills submerged plants.
- Impedes movement of boats and consequently recreational activities associated with fresh water are impacted negatively.



Water surface covered with salvinia



Barrier

Cyrtobagous salviniae

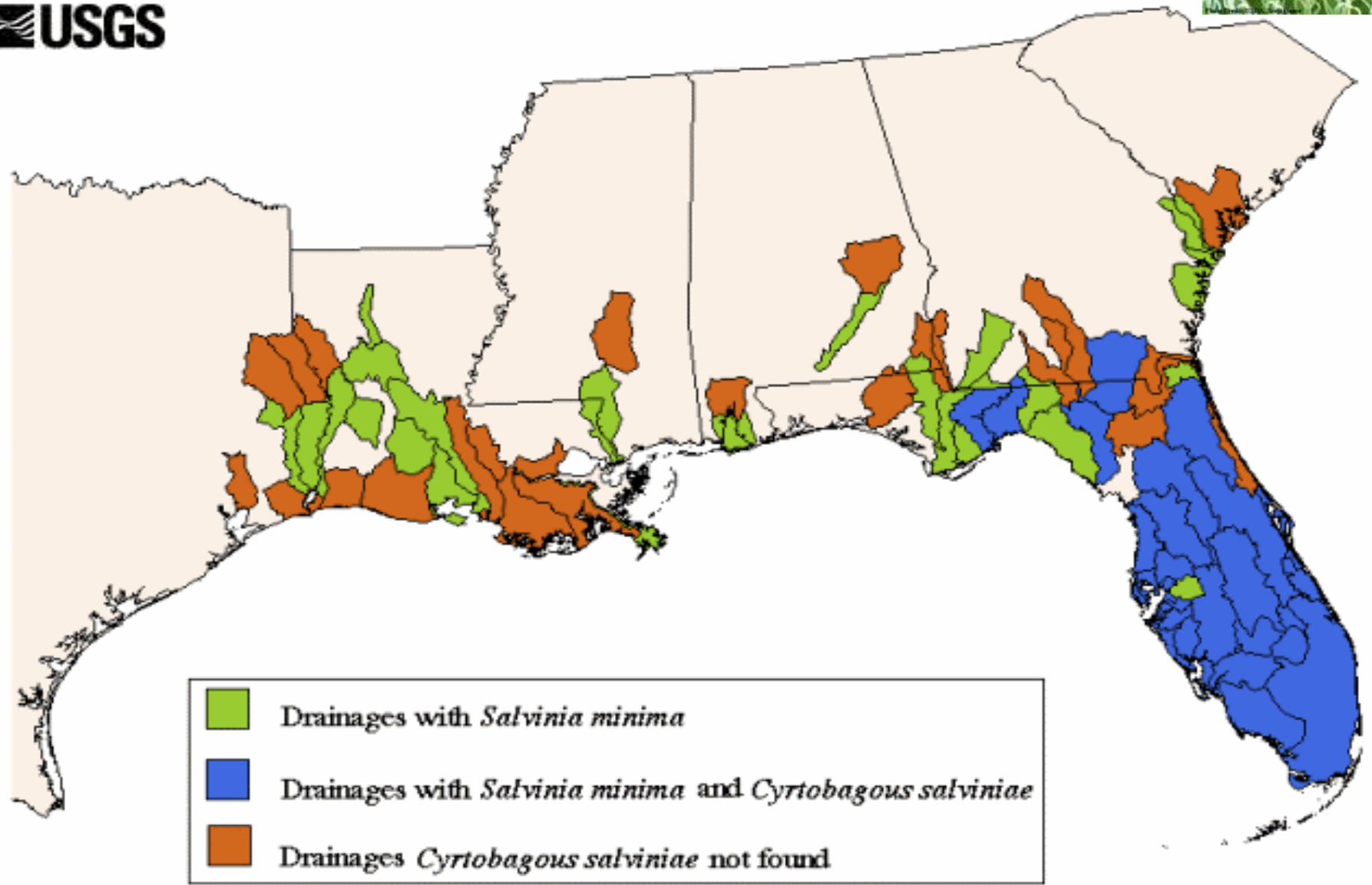
- Originated in South America.
- It is a specialist herbivore whose both larvae and adults are known to feed only on common salvinia.






DISTRIBUTION OF *C. SALVINIAE* IN THE US



USGS



-  Drainages with *Salvinia minima*
-  Drainages with *Salvinia minima* and *Cyrtobagous salviniae*
-  Drainages *Cyrtobagous salviniae* not found

Samea multiplicalis

- Originated in South America.
- It is a generalist herbivore, whose larvae can also feed on water-lettuce, water-hyacinth in addition to common salvinia.



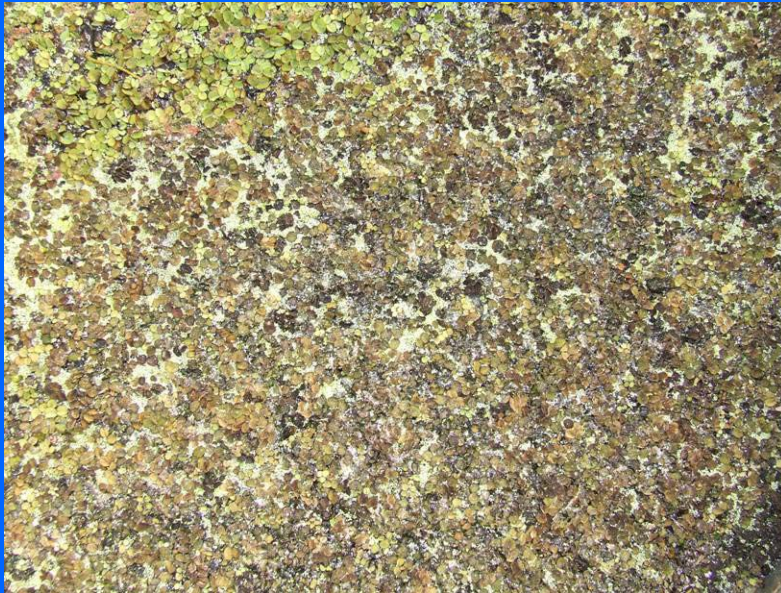


TERMINAL BUD

Photo: D. Henne



↑ WEEVIL FEEDING ↓



↑ SAMEA FEEDING ↓



Photo: K Parys

1



S. multiplicalis

2



C. salviniae



TREATMENTS & PLOTS

3



C. salviniae
S. multiplicalis

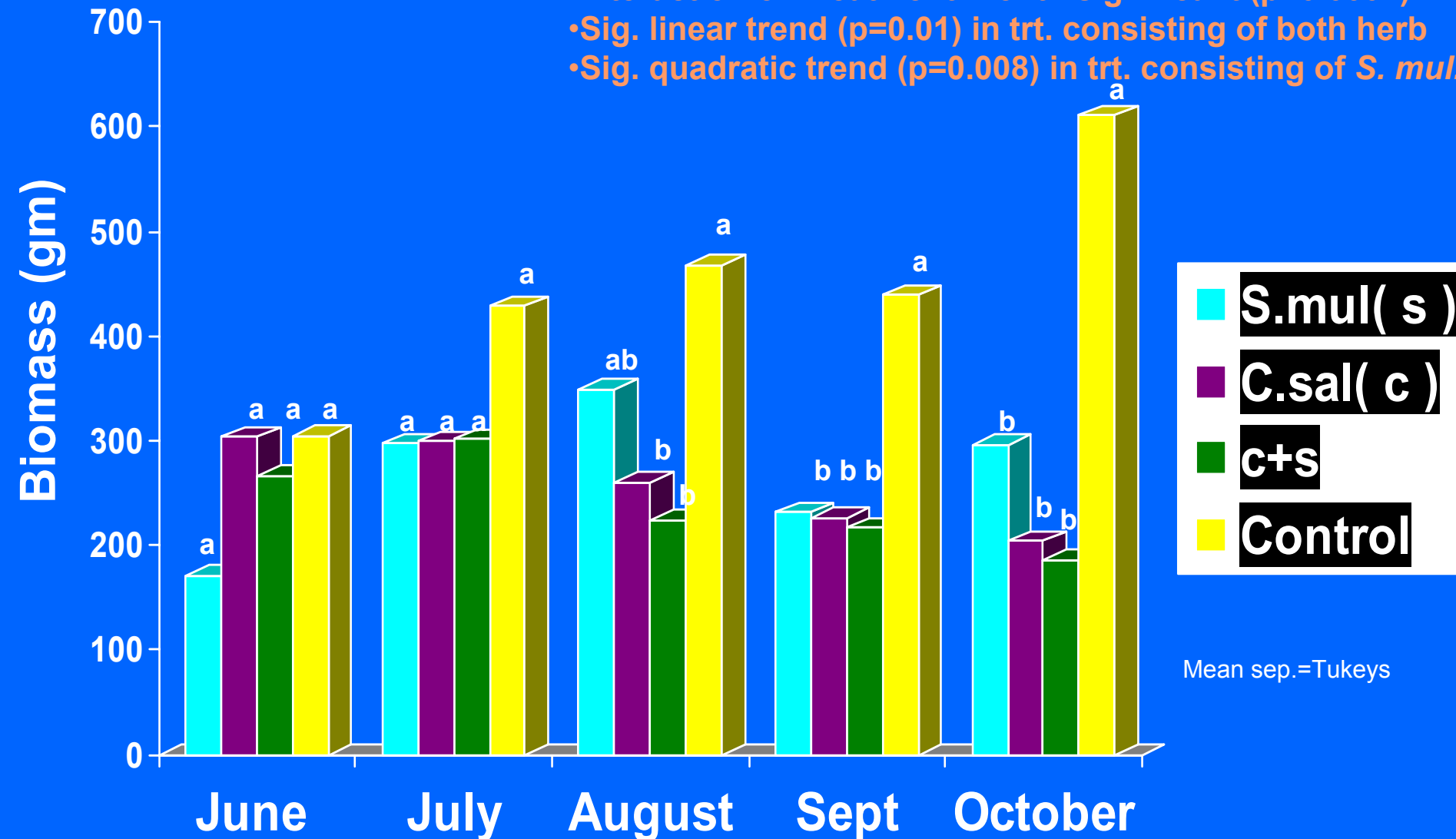
4



Control

BIOMASS-2005

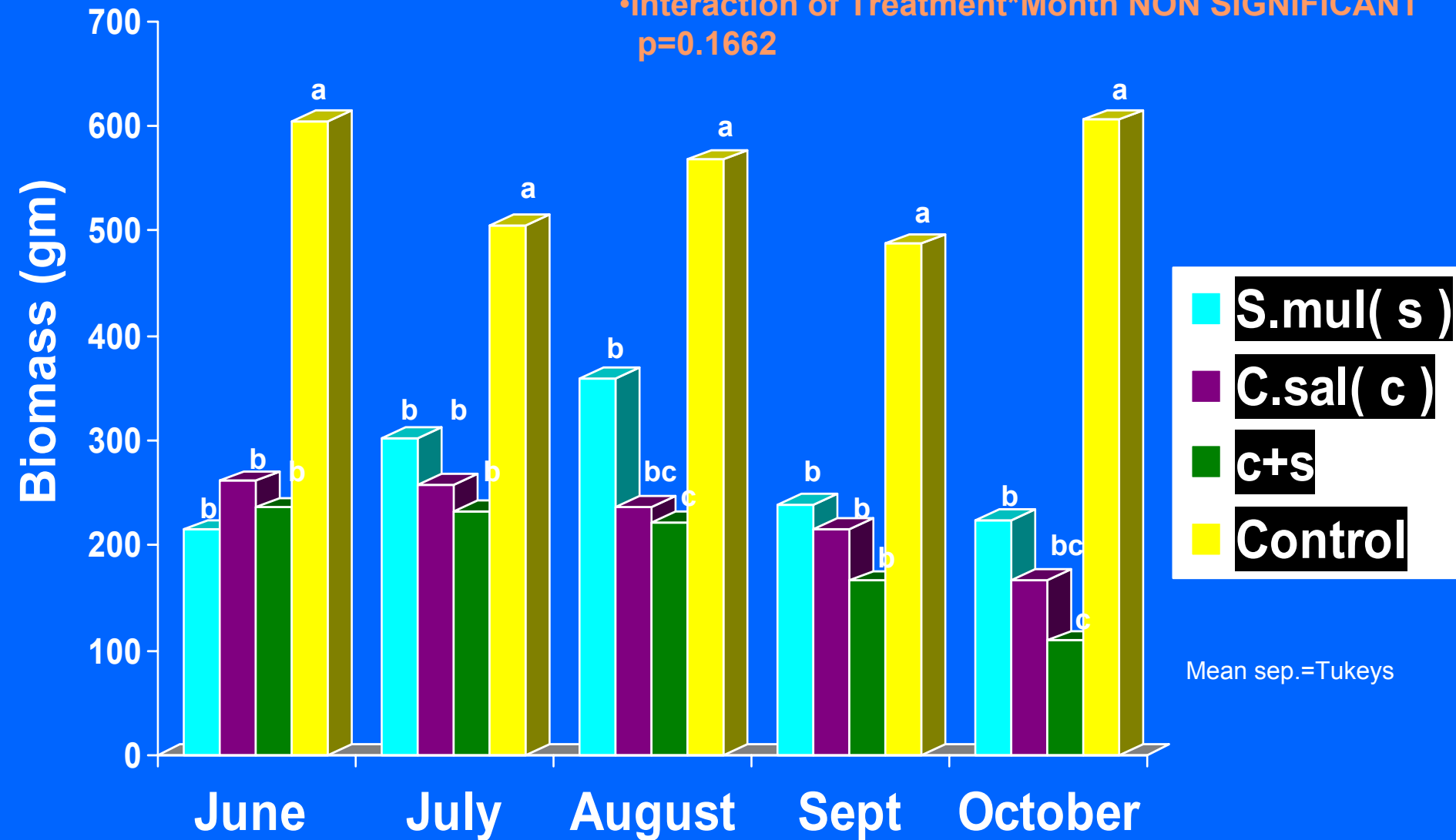
- Data subjected to ANOVA (SAS)
- Sig. treatment effect ($p=0.0017$) with biomass in control being significantly higher than other treatments
- Interaction of Treatment*Month significant ($p<0.0001$)
- Sig. linear trend ($p=0.01$) in trt. consisting of both herb
- Sig. quadratic trend ($p=0.008$) in trt. consisting of *S. mul.*



BIOMASS-2006

•Significant treatment effect with biomass in control being significantly higher than other treatments
 $p < 0.0001$

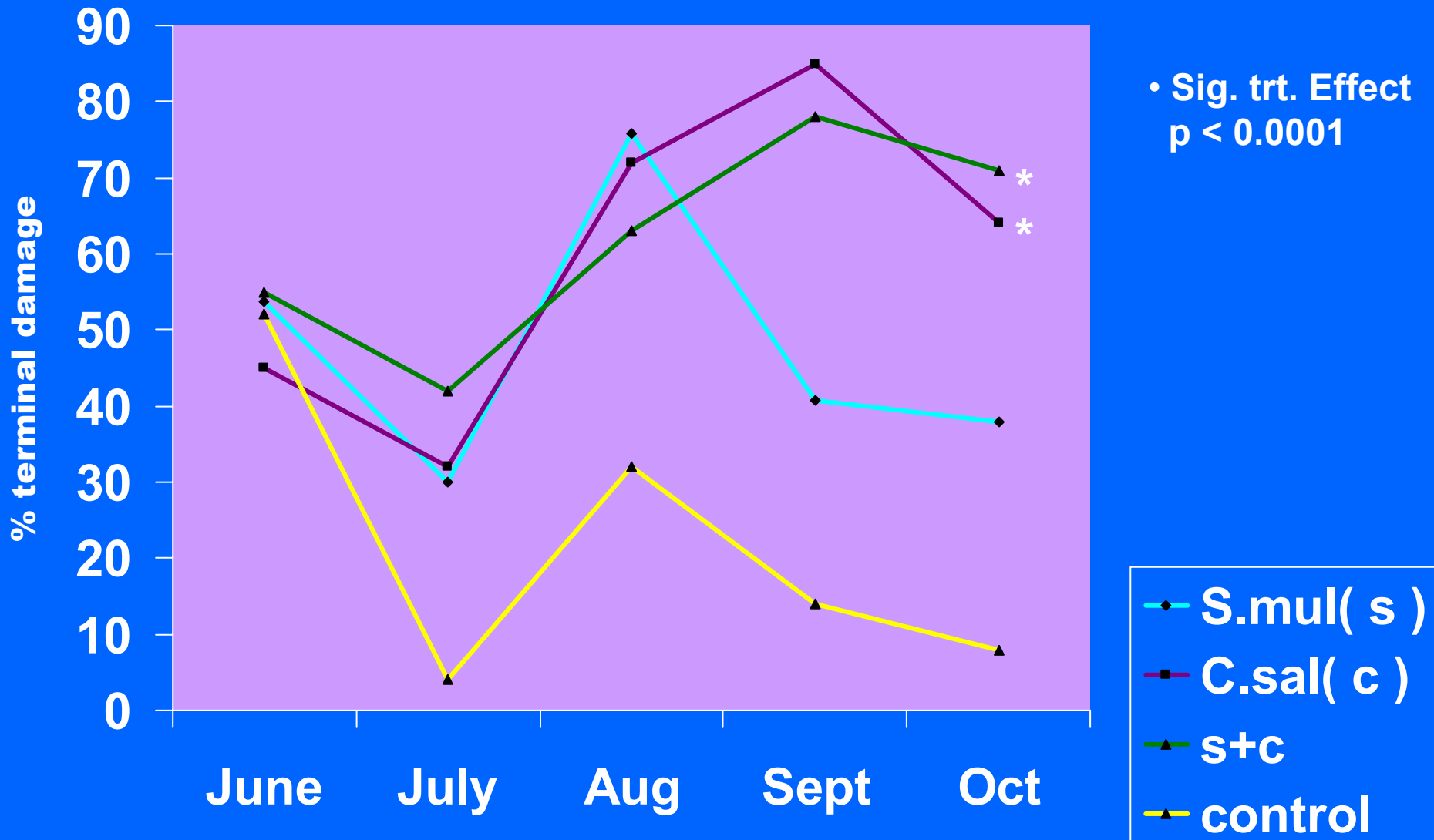
•Interaction of Treatment*Month NON SIGNIFICANT
 $p = 0.1662$



Mean sep.=Tukeys

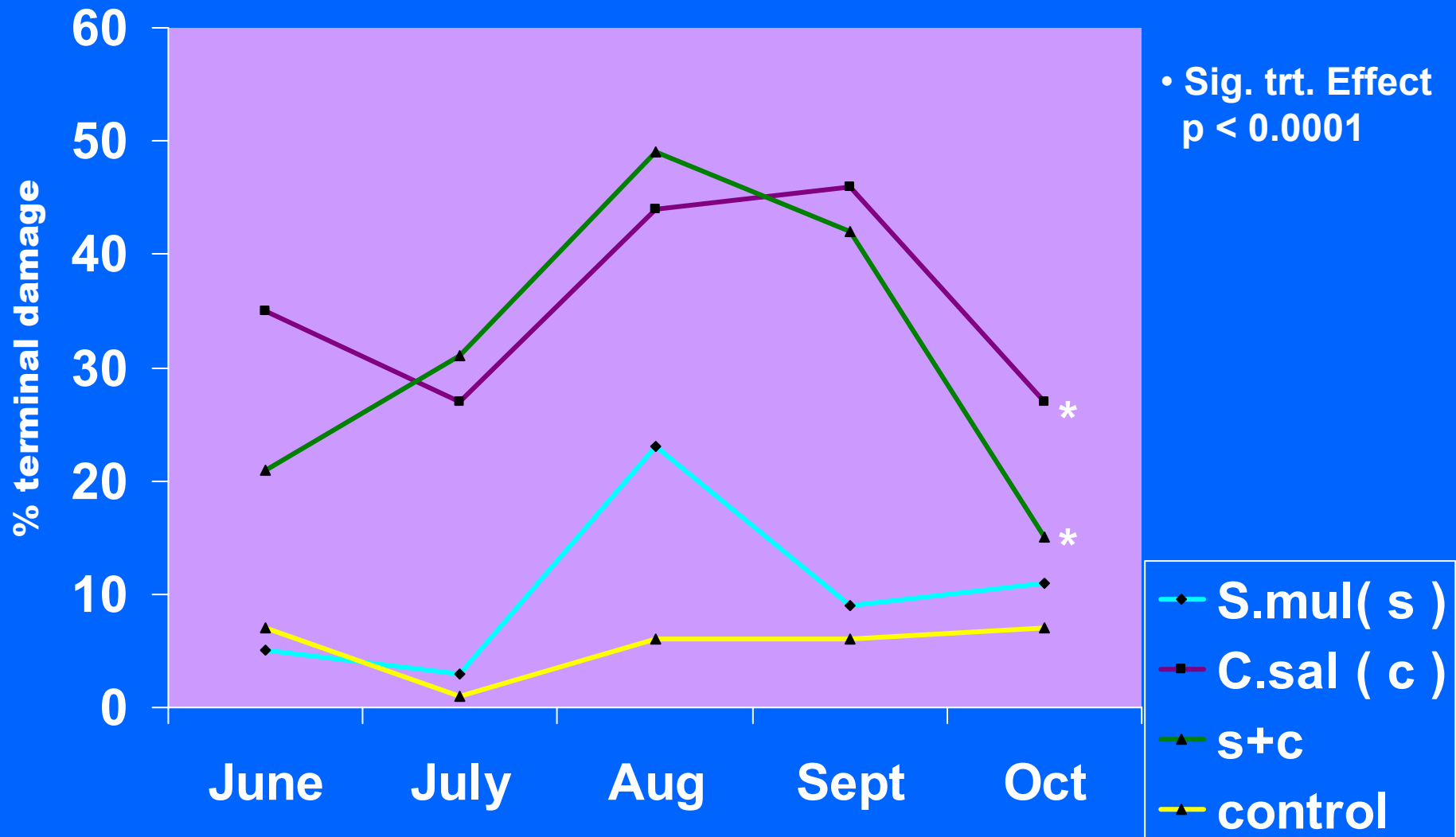
PERCENTAGE TERMINAL DAMAGE

2005



PERCENTAGE TERMINAL DAMAGE

2006



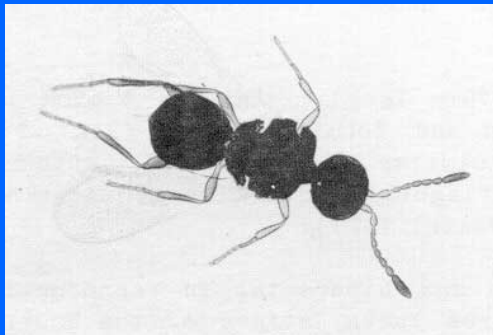






http://creatures.ifas.ufl.edu/citrus/citrus_blackfly3.htm

http://www.ctahr.hawaii.edu/nelsons/Misc/1_citrus_black_fly_1.jpg



*Amitus
hesperidum*

http://creatures.ifas.ufl.edu/beneficial/amitus_hesperidum.htm



*Encarsia
opulentum*

<http://www.plagas-agricolas.info/ve/fichas/ficha.php?hospedero=387&plaga=116>