Scott Adkins

U.S. Horticultural Research Laboratory
Fort Pierce, Florida

Acknowledgements

Carrie Vanderspool
Lisa Rouse
Jennifer Ikerd
Greg Hess
Jeff Smith
Ken Sims
Christina Thompson
Danny Cook
Rod Systma

Growers

UF-IFAS Extension

Scouts
Glades Crop Care
Red Gator

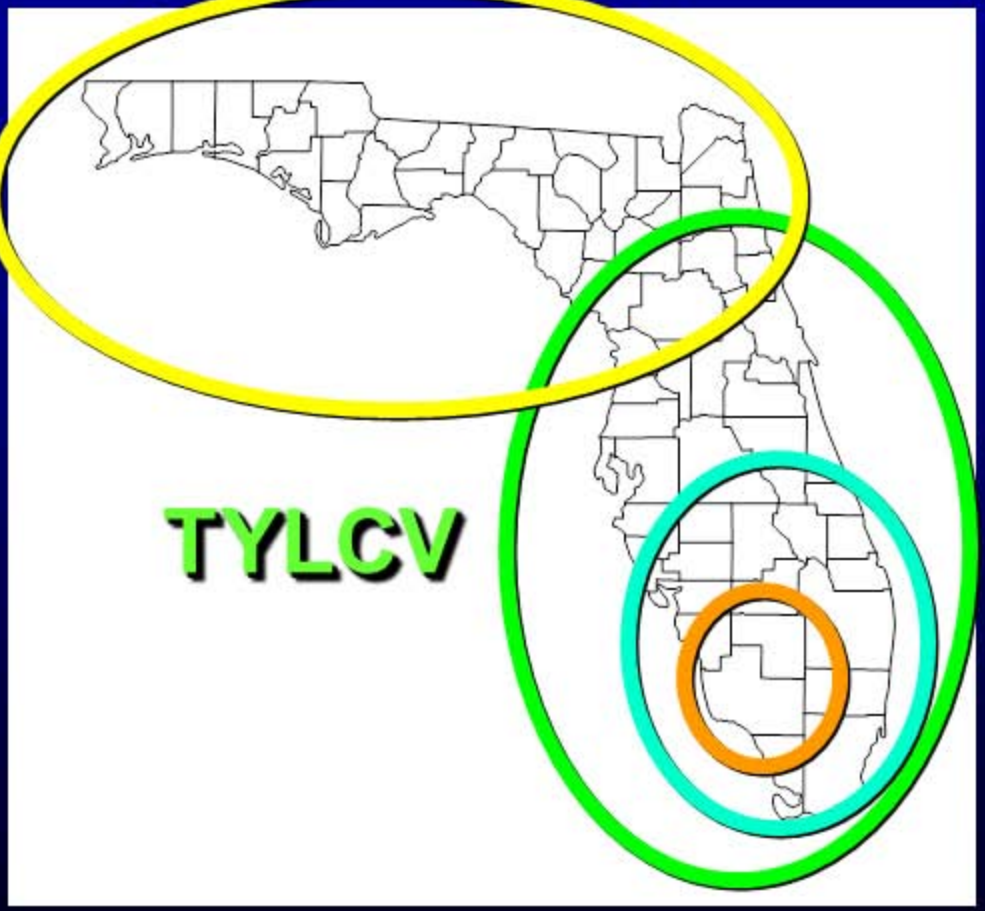
Seed Companies

NWA, FL WA
FSCF, FFVA, FTC

USDA-SCRI
USDA-Critical Issues
FDACS-SCBG
ZedX – Joe Russo

Tomato viruses in Florida

TSWV



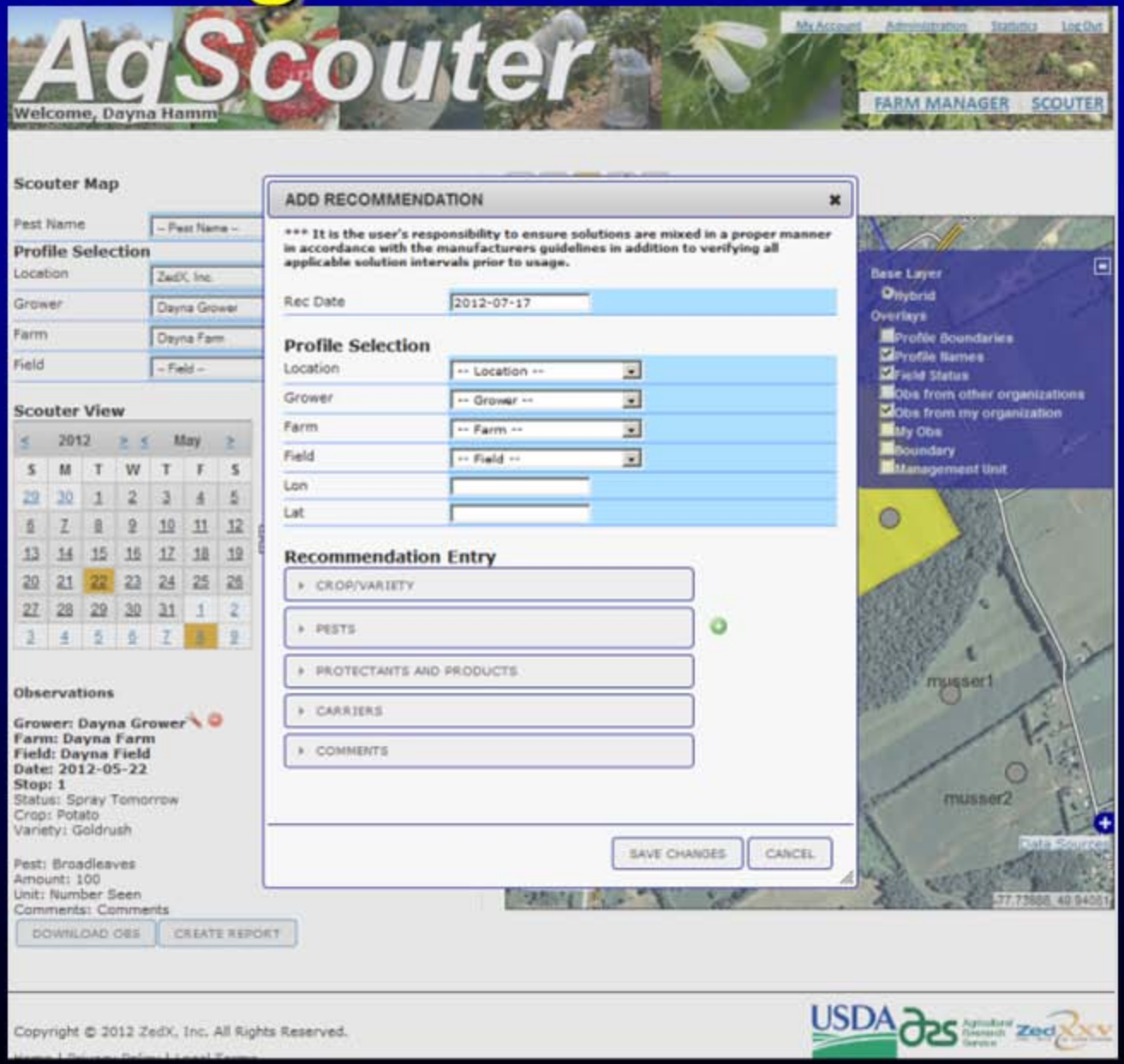
2012

Tospoviruses on the move

Online scouting and decision support system

- Provide real time status of viruses & their vectors; yours & neighbors
- Help identify hotspots for viruses & their vectors; visualize regional pest pressure
- Being validated now
- Cooperative, area-wide management in the future

Adding a recommendation

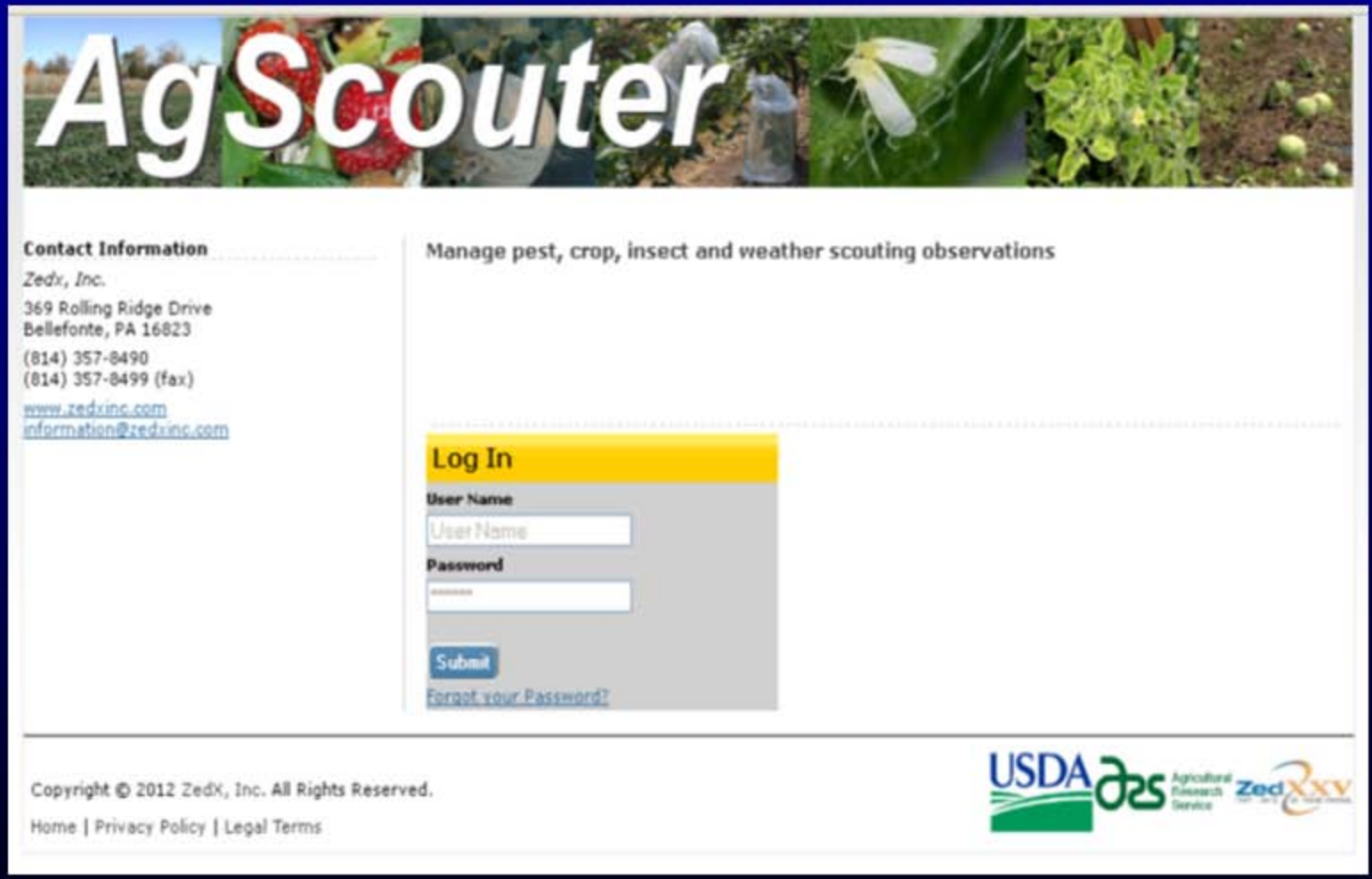


Bill, ZedX

Pest intensity of an observation

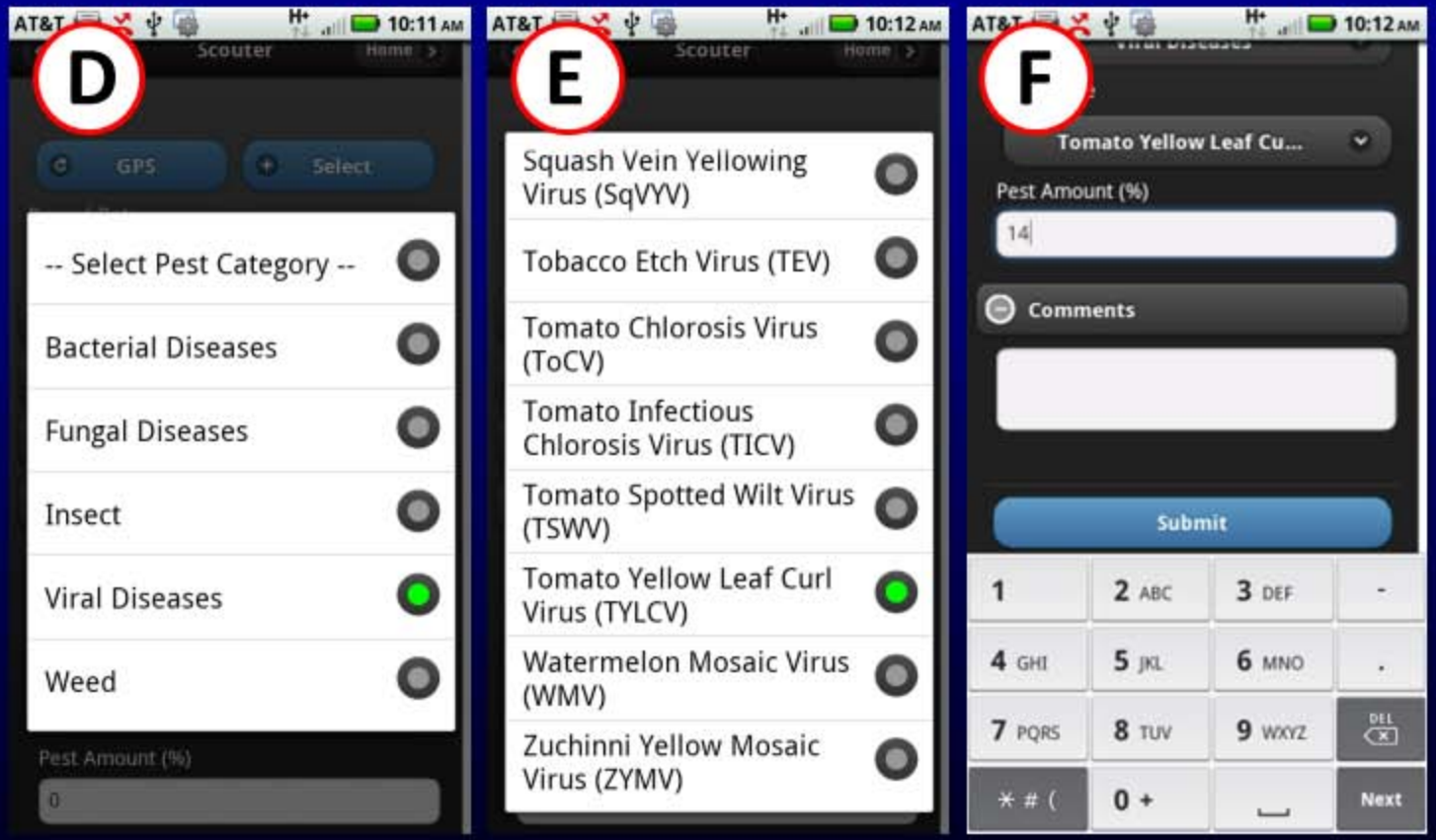
Bill, ZedX

Online scouting and decision support system



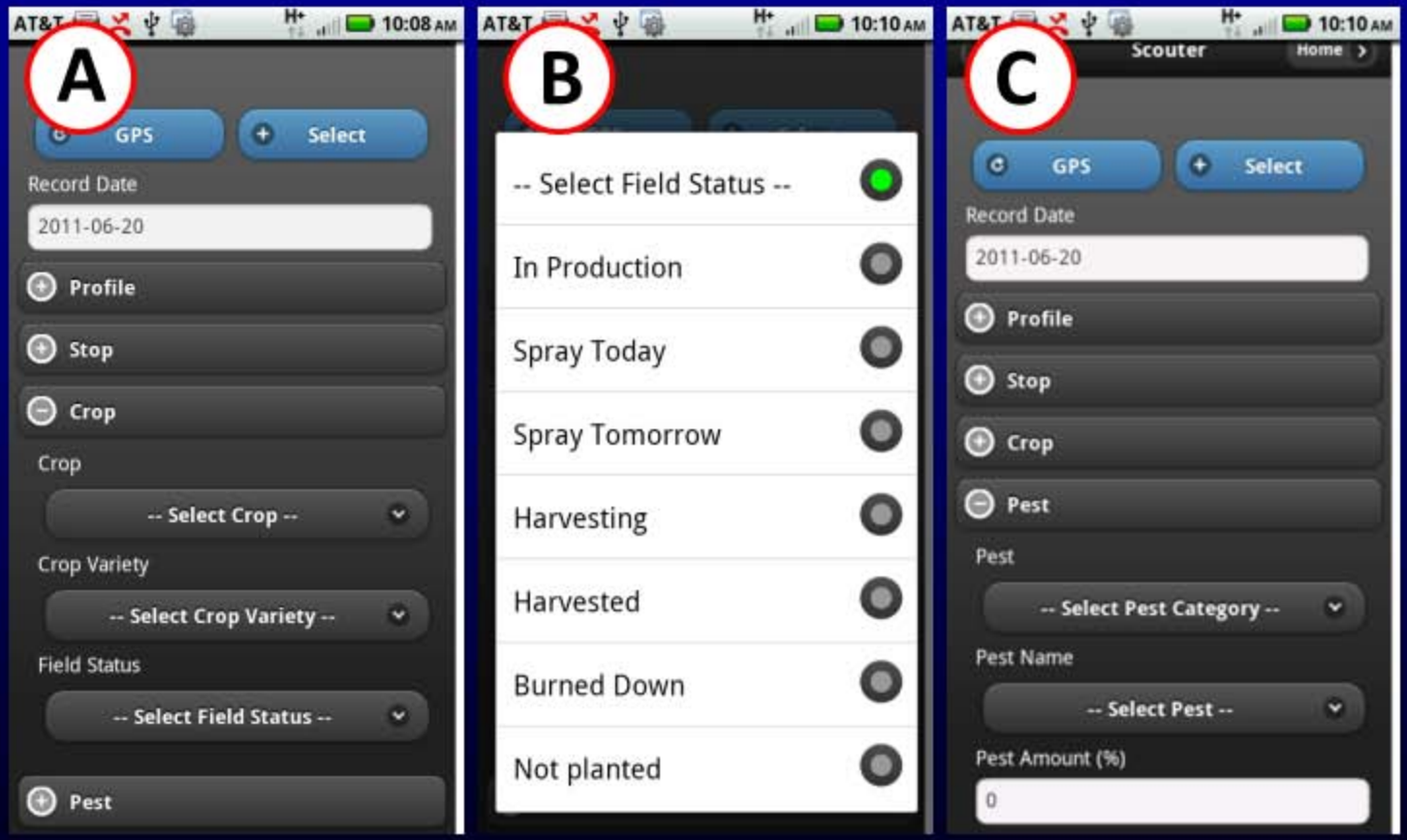
Bill, ZedX

Online scouting and decision support system



Bill, ZedX

Online scouting and decision support system



Bill, ZedX

How can we deal with emerging viruses like GRSV and TCSV?

- Online scouting/decision support system

Bill Turechek

How can we deal with emerging viruses like GRSV and TCSV?

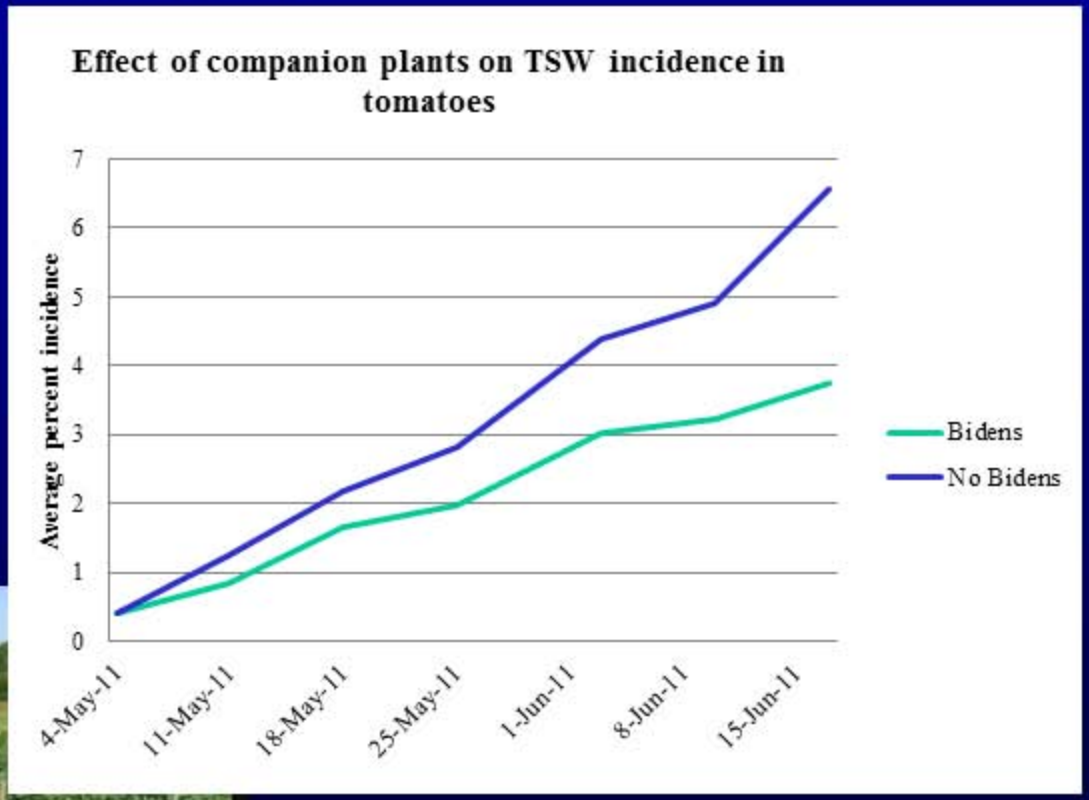
GRSV and TSWV resistance

TSWV
R gene: *Tsw*

GRSV and TSWV resistance

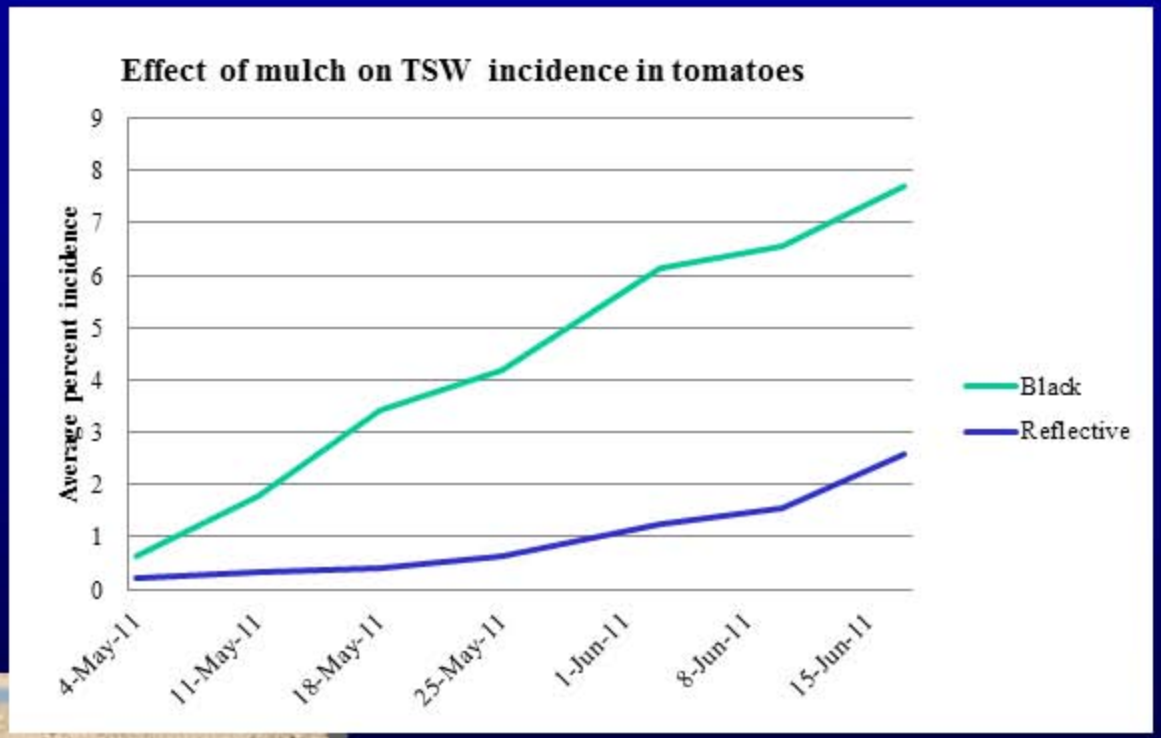
TSWV R gene: - *Sw5* *Sw5*

Vector control



Kara Tyler-Julian &
Joe Funderburk

Vector control



Kara Tyler-Julian &
Joe Funderburk

Vector control

UF UNIVERSITY of FLORIDA
IFAS Extension

ENY859

Managing Thrips and Tospoviruses in Tomato[1]

Joe Funderburk, Stuart Reitz, Steve Olson, Phil Stansly, Hugh Smith, Gene McAvoy, Ozan Demirozer, Crystal Snodgrass, Mathews Paret, and Norm Leppla[2]

Several invasive species of thrips have established in Florida and are causing serious economic losses to vegetable, ornamental, and agronomic crops. Damage to crops results from thrips feeding and egg-laying injury, by the thrips vectoring of plant diseases, the cost of using control tactics, and the loss of pesticides due to resistance. Western flower thrips (*Frankliniella occidentalis*), which was introduced and became established in northern Florida in the early 1980s, is the major thrips pest of tomatoes. The western flower thrips did not become an economic problem in central and southern Florida until 2005 (Frantz and Mellinger 2009). Two other invasive species, melon thrips, *Thrips palmi*, and chilli thrips, *Scirtothrips dorsalis*, are not damaging pests of tomato.

review information on the situation in Florida (Funderburk 2009, Frantz and Mellinger 2009, Weiss et al. 2009).

The western flower thrips is the most efficient vector of *tomato spotted wilt virus* (TSWV). This virus is one of about twenty known species of tospoviruses (Sherwood et al. 2001a, b). Epidemics of tomato spotted wilt (TSW) occur frequently in numerous crops in northern Florida. Until recently, it was thought that TSW occurred sporadically in central and southern Florida. Most infections were confined to a few isolated plants in a field, transplants, mainly pepper, which originated from planthouses in Georgia. Secondary spread (i.e., within the field) away from the initial site of infection was rarely, if ever, seen. Recently,

Vector control

- UV reflective mulch
- Companion plants
- “Gentle” insecticides

- Suppress vector species but encourage non-vector species and predators

Joe Funderburk, Galen Frantz, Stuart Reitz

Vector control

- UV reflective mulch
- Companion plants
- “Gentle” insecticides

GRSV hosts in Florida

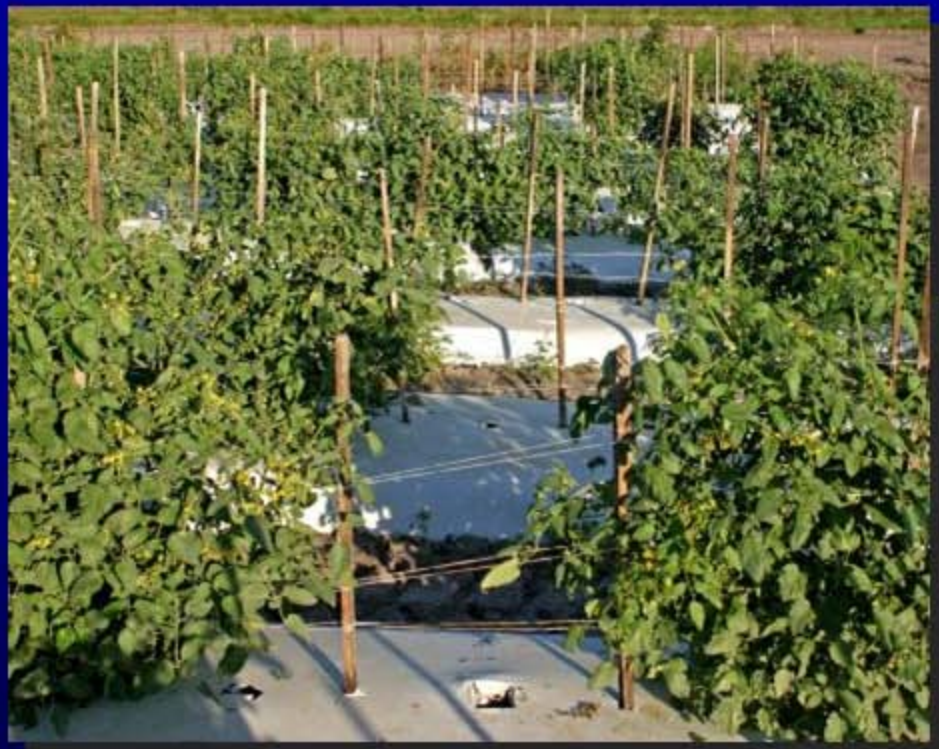
Cutleaf groundcherry

American black nightshade

Reservoir control

- Weed, volunteer crop hosts
- Crop itself
  - Continuous cropping
  - Overlapping seasons

GRSV-infected tomato plants rogued from Florida field



December 2010

Sanitation, roguing

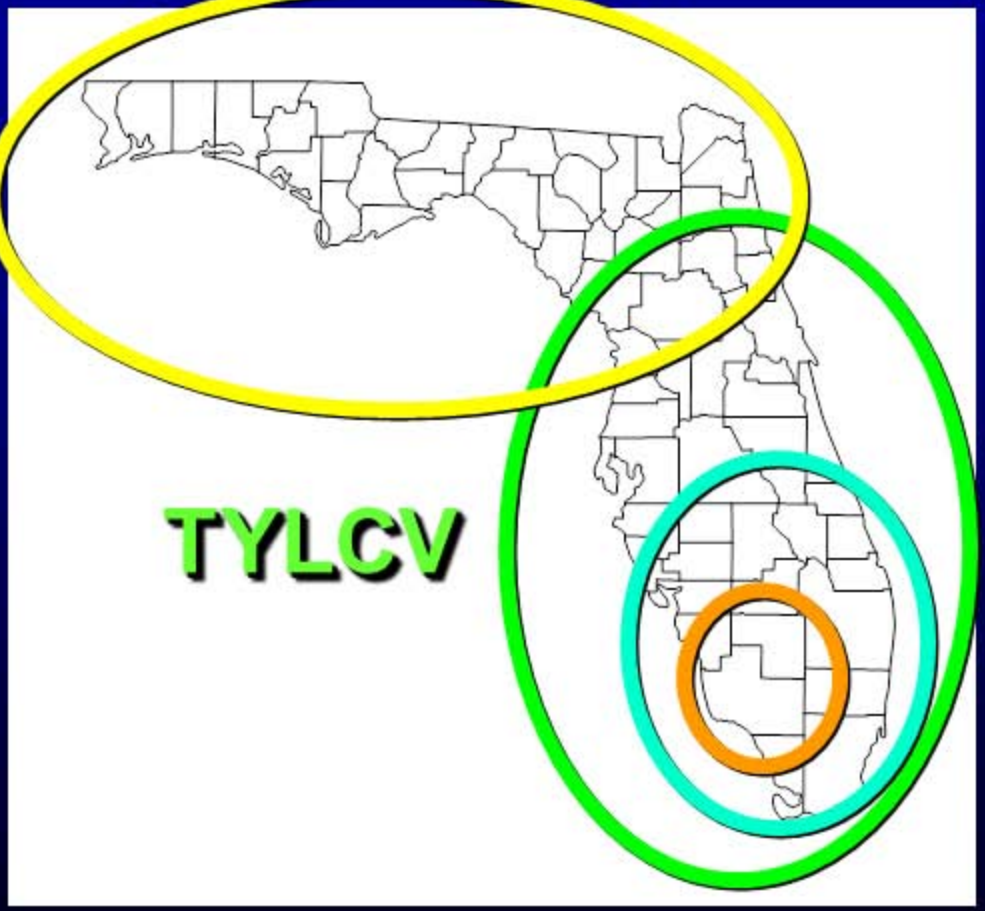
- Use virus-free transplants
- Rogue infected transplants and field plants

Tospovirus management

- Sanitation, roguing
- Reservoir control
- Thrips vector control
- Resistance
- Decision support system

Tomato viruses in Florida

TSWV

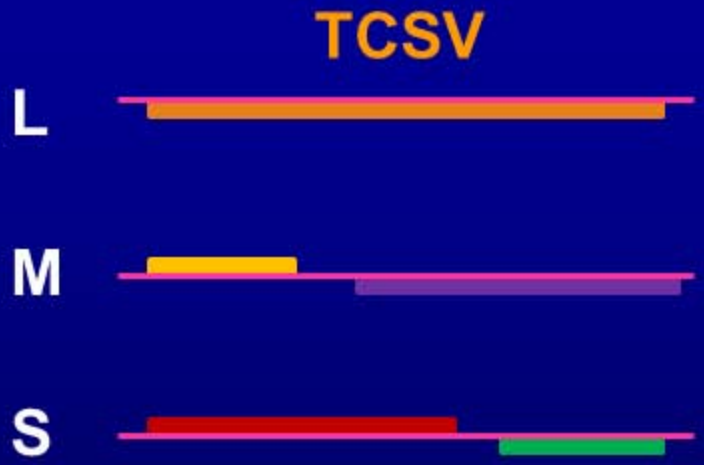


2012

Tospoviruses in U.S., 2012

- *Tomato spotted wilt virus* (TSWV)
- *Impatiens necrotic spot virus* (INSV)
- *Chrysanthemum stem necrosis virus*
- *Peanut bud necrosis virus*
- *Groundnut ringspot virus* (GRSV)
- "GRSV" = GRSV/TCSV reassortant
- *Watermelon silver mottle virus*
- *Zucchini lethal chlorosis virus*
- *Iris yellow spot virus* (IYSV)
- *Tomato chlorotic spot virus* (TCSV)
- Capsicum chlorosis virus

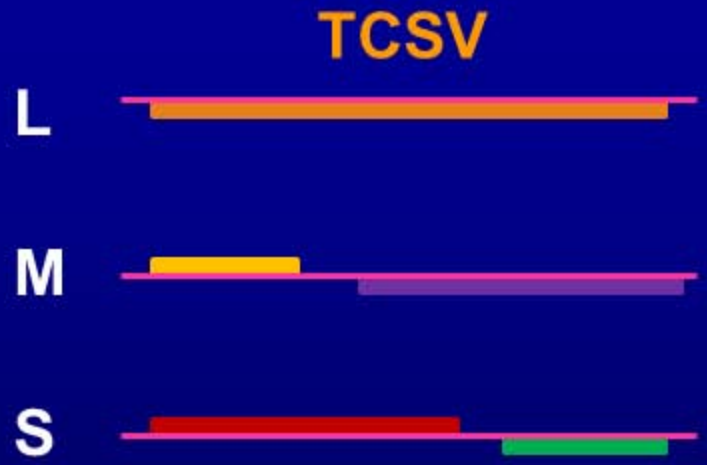
Tospoviruses on the move



- TCSV detected (one parent of GRSV/TCSV reassortant)

- GRSV/TCSV reassortant behaved like its parent species (GRSV and TCSV)
- For simplicity, we decided to call the reassortant GRSV

Tospoviruses on the move



- TCSV detected (one parent of GRSV/TCSV reassortant)

Tospoviruses on the move

- Since March 2012 multiple tomato samples tested with atypical GRSV results – Collier and Hendry Counties

Leon Lucas

Tospoviruses on the move

Summary

- GRSV host and geographic range expanding in Florida; remains at low incidence generally
- Common blossom thrips and Western flower thrips transmit GRSV in Florida
- All Florida GRSV has same genotype (chromosome swap) with >99% nucleotide identity
- First interspecies chromosome swap

Role of common blossom thrips in GRSV transmission in Florida

- Historically a minor species
- GRSV generally in low incidence
- One exceptional field with high thrips population and high GRSV incidence (Galen Frantz)
- GRSV and TCSV vector in South America

Thrips in tomato flowers in Miami-Dade County 1997-2011

- Florida flower thrips (~49%)
- Melon thrips (~30%)
- Western flower thrips (~14%)
- Common blossom thrips (~3%)

Galen Frantz, Glades Crop Care

GRSV transmission

Thrips species	Acquisition	Transmission
Western flower	7%	12%
Florida flower	4%	0%
Tobacco	0%	0%
Common blossom	41%	26%

- Common blossom thrips was most efficient GRSV vector, although Western flower thrips also transmitted to tomato
- Florida flower thrips acquired GRSV but did not transmit

Is GRSV transmitted by other Florida thrips species?

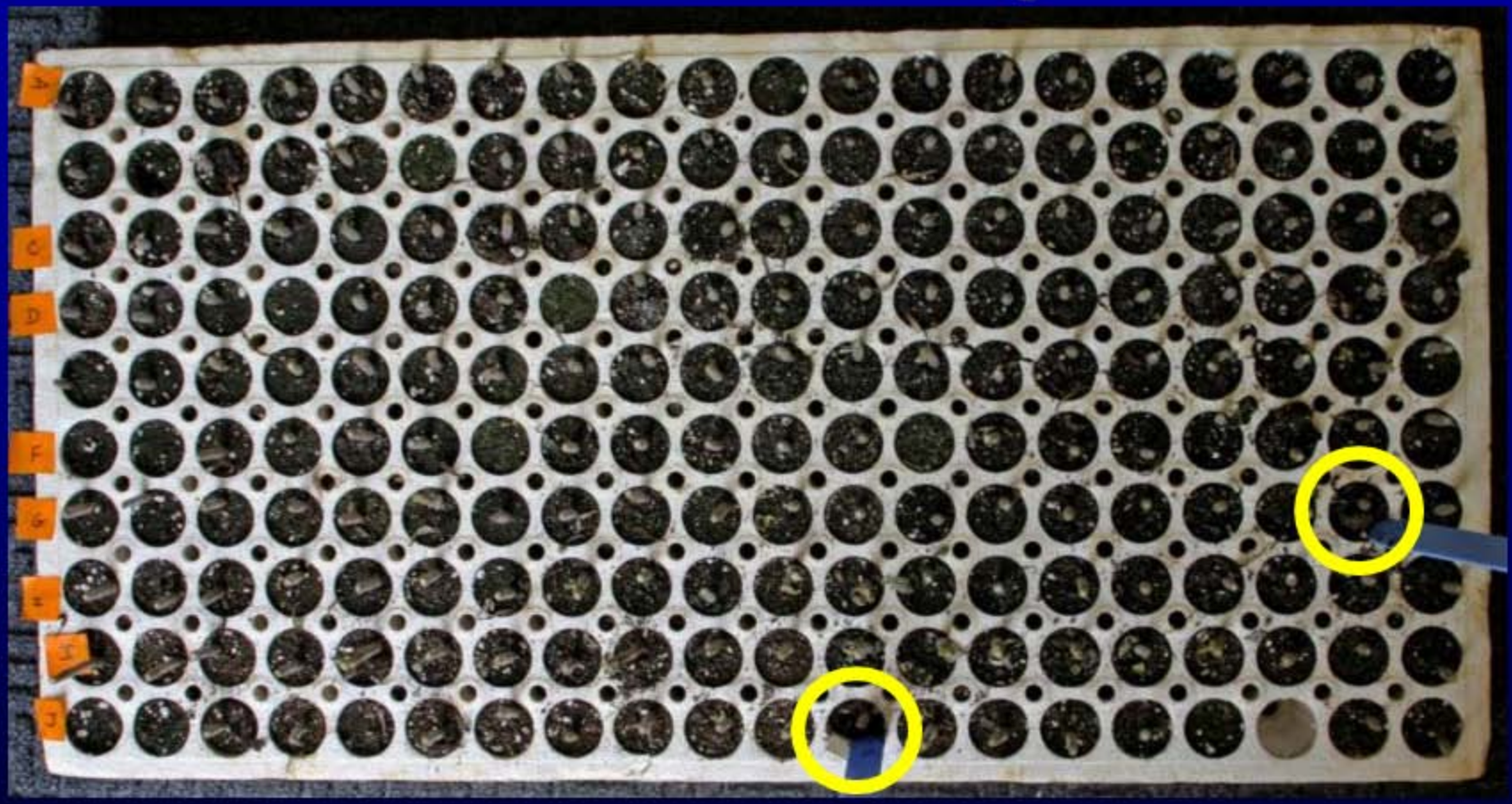
- Florida flower thrips (*F. bispinosa*)
- Tobacco thrips (*F. fusca*)
- Common blossom thrips (*F. schultzei*)

Craig Webster, Stuart Reitz and Galen Frantz

GRSV is transmitted by Western flower thrips

Stuart Reitz

GRSV-infected transplants



GRSV detected in symptomatic transplants only

GRSV-infected transplants

GRSV-infected transplants

mid-August 2010 to present

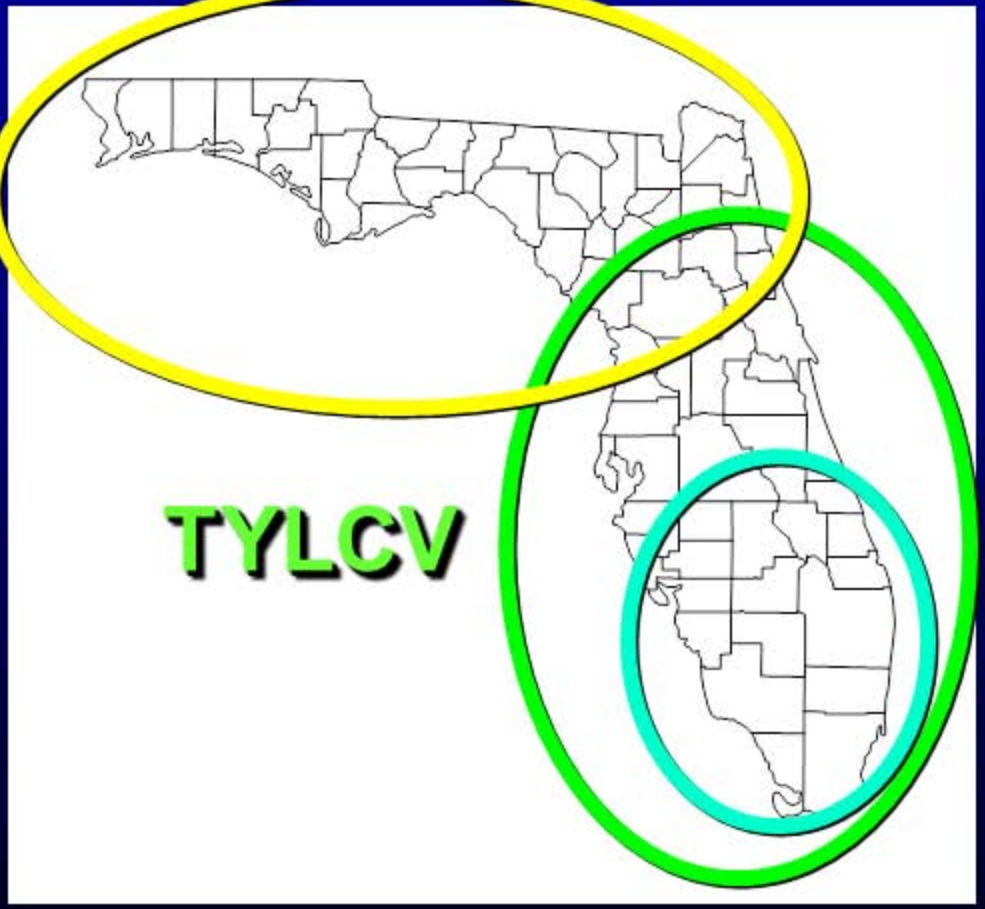
Leon Lucas, Glades Crop Care

GRSV field survey

- Only TSWV detected in peanuts
- GRSV only detected in solanaceous plants

Galen Frantz, Gene McAvoy

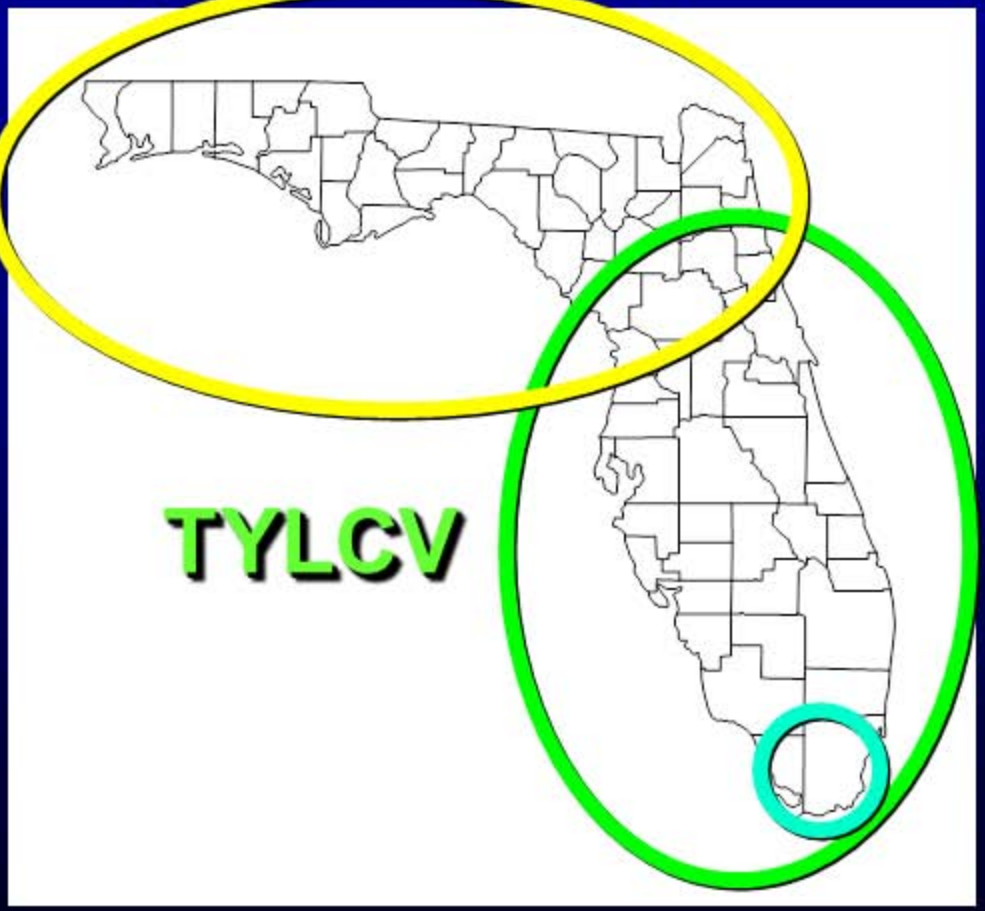
Tomato viruses in Florida



2012

Tomato viruses in Florida

TSWV



2009

GRSV detection in Florida

- Miami-Dade (November 2009)
- Collier
- Hendry
- Martin
- Lee
- Palm Beach
- Manatee
- St. Lucie
- Charlotte (March 2012)

GRSV field survey

- Only TSWV detected in samples from outside of Florida
- GRSV only detected in Florida

GRSV field survey

- Southeastern U.S. vegetable production (focused on tomato)
- Plants with typical tospovirus symptoms (>500 to date)

Glades Crop Care

GRSV experimental host range

- Only solanaceous plants infected
- No legume hosts

GRSV experimental host range

GRSV hosts in Florida

Cutleaf groundcherry
(*Physalis angulata*)
St. Lucie County
(November 2011)

GRSV hosts in Florida

American black nightshade (June 2011)

GRSV hosts in Florida

eggplant (March 2011)

GRSV hosts in Florida

tomatillo (November-December 2010)

GRSV hosts in Florida

pepper (December 2010)

GRSV-infected tomato fruits

May 2011

April 2012

GRSV-infected tomatoes in field

April/May, Martin County

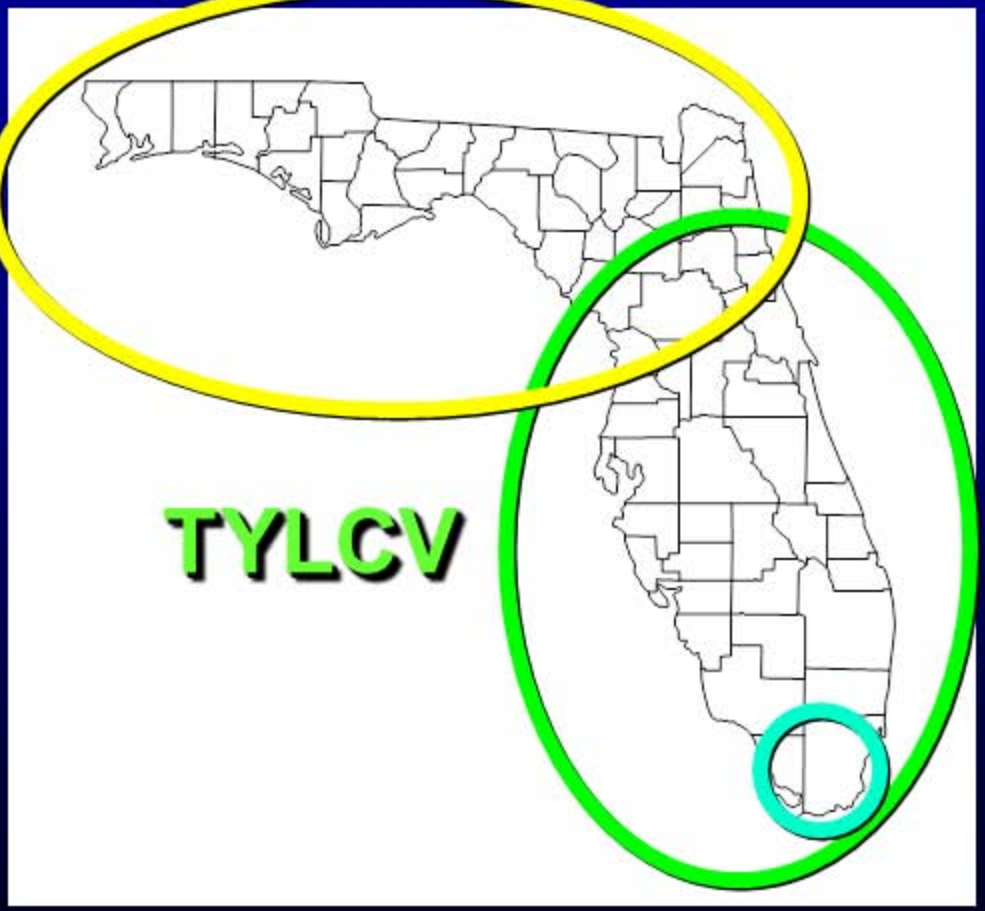
2010

2012

Glades Crop Care

Tomato viruses in Florida

TSWV



2009

Genome reassortment

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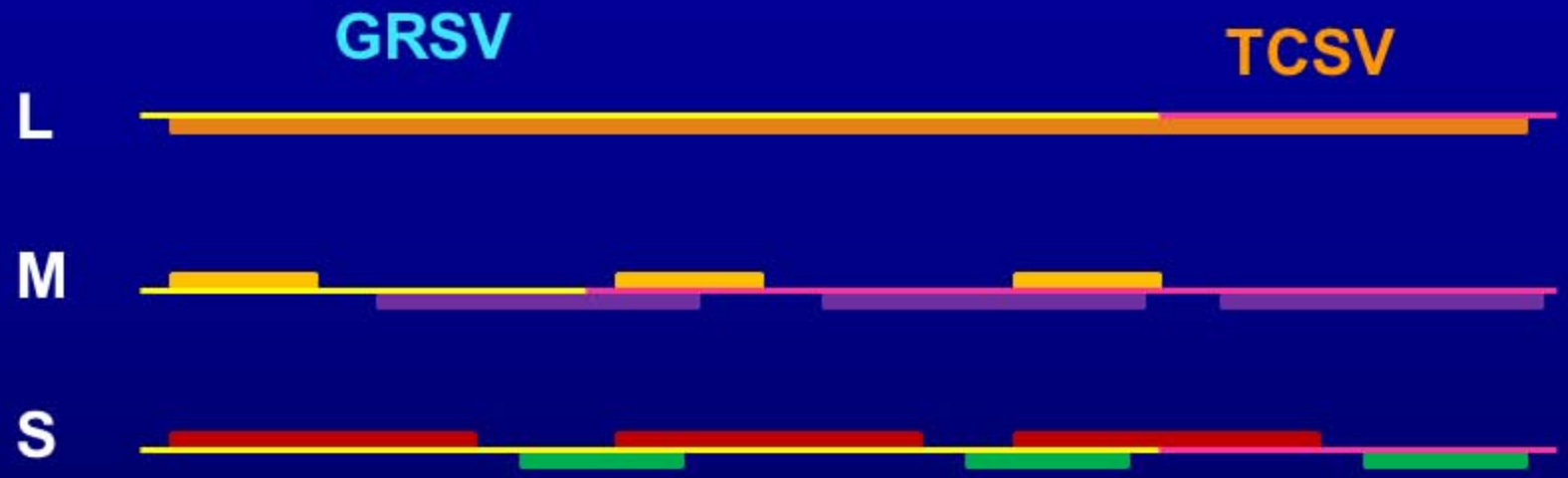
Genome reassortment



- S and L RNAs from GRSV whereas M RNA from *Tomato chlorotic spot virus* (TCSV) = a chromsome swap
- Represents an emerging virus with unique combination of genes from parent species (GRSV and TCSV)

First report of *Groundnut ringspot virus* in Florida

December 2009

One genome segment (chromosome) is from *Tomato chlorotic spot virus*!

First report of *Groundnut ringspot virus* in Florida

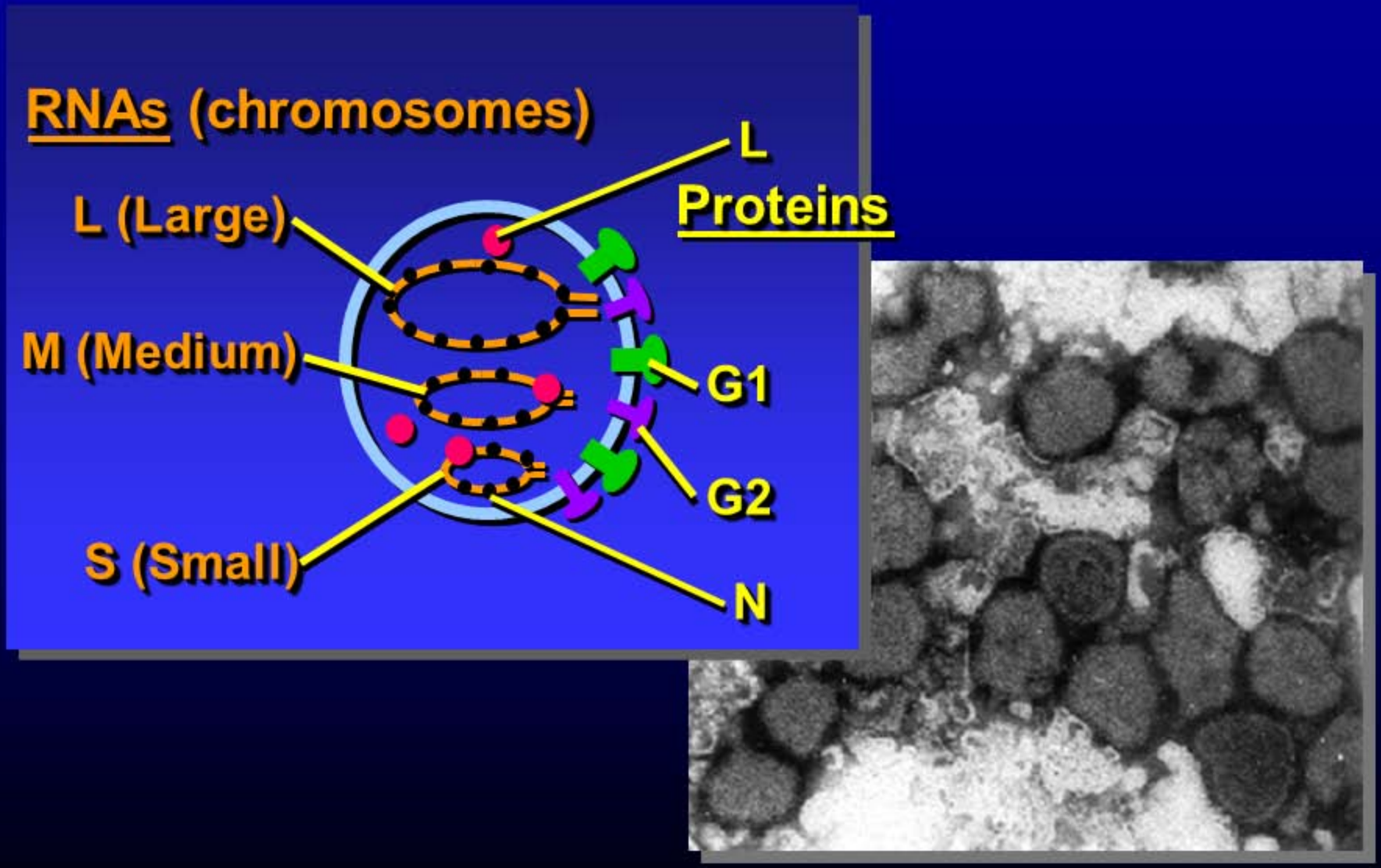
December 2009

Tospoviruses on the move

December 2009

Glades Crop Care

Tospovirus particles

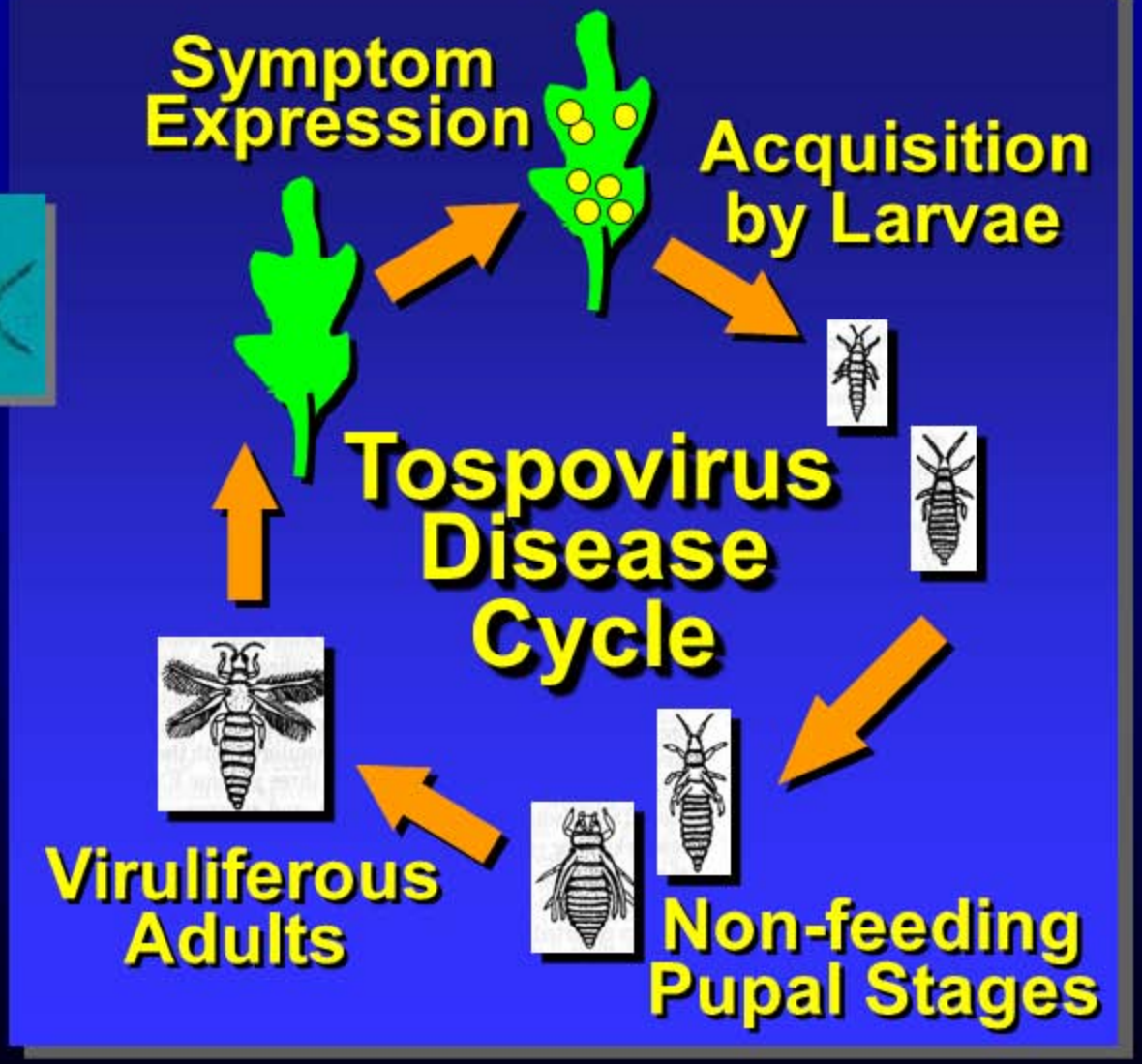


Thrips transmit tospoviruses

Western flower thrips

Tobacco thrips

Melon thrips



No seed transmission of tospoviruses

Why care about Tospoviruses?

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Tospoviruses in U.S., 2009

- *Tomato spotted wilt virus* (TSWV)
- *Impatiens necrotic spot virus* (INSV)
- *Chrysanthemum stem necrosis virus*
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Tospoviruses

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What's a Tospovirus?

Groundnut ringspot virus and *Tomato spotted wilt virus* - Tospoviruses in Florida

Scott Adkins, Craig G. Webster, H. Charles Mellinger, Galen Frantz, William W. Turechek, Eugene McAvoy, Stuart R. Reitz and Joe Funderburk

USDA-ARS, Glades Crop Care, UF Extension and University of Florida