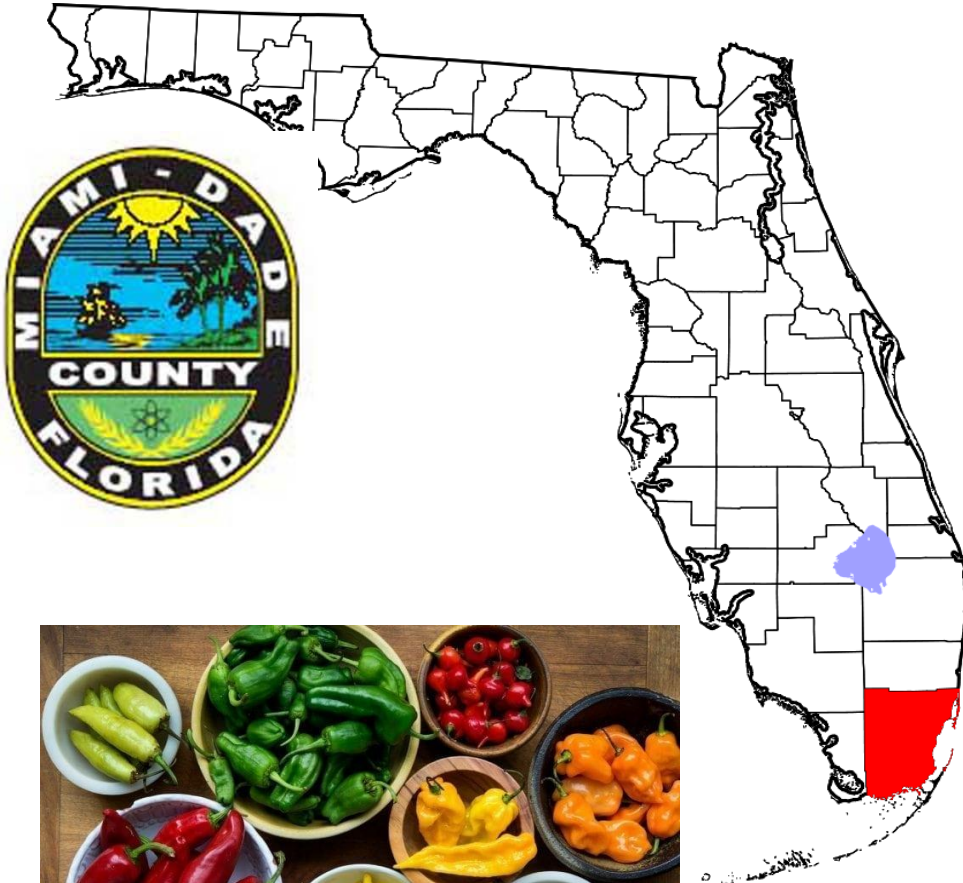


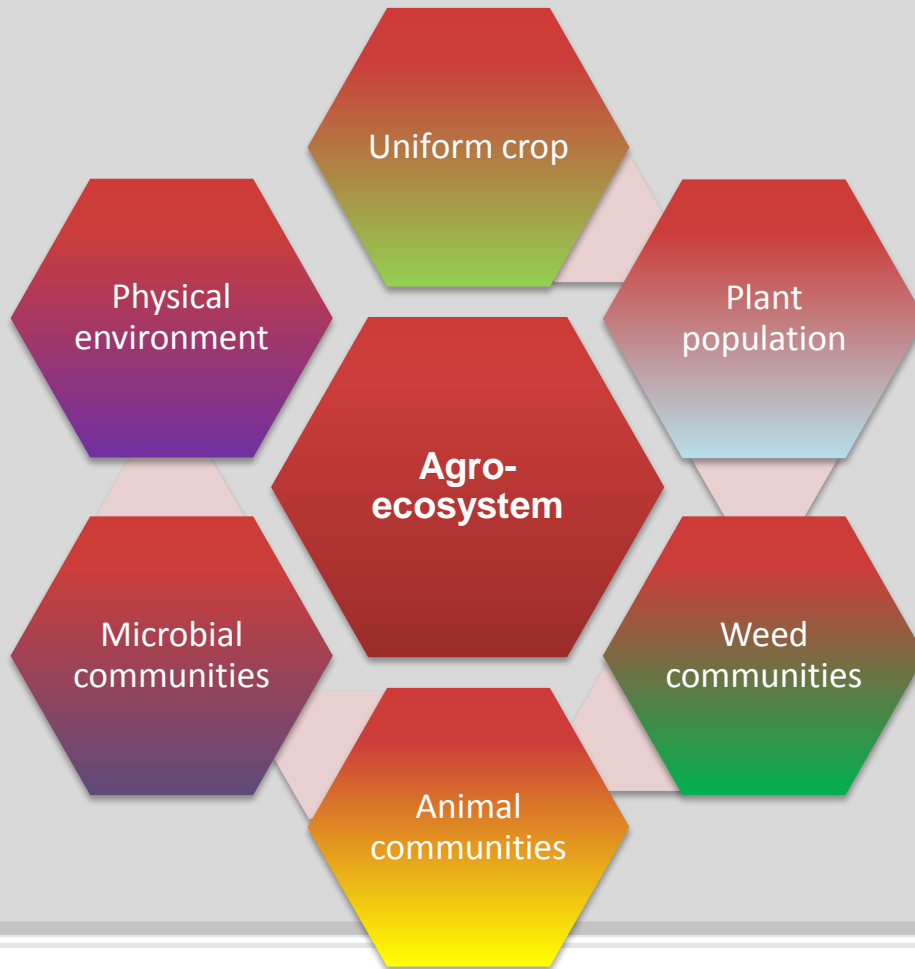
MANAGEMENT OF THRIPS, VECTOR OF TOSPOVIRUSES AFFECTING PEPPER IN SOUTH FLORIDA

Rafia A. Khan and D. R. Seal

PEPPER PRODUCTION IN MIAMI-DADE COUNTY



PEPPER AGRO-ECOSYSTEM



TOMATO CHLOROTIC SPOT VIRUS (TCSV)

- **Virus family**
Bunyaviridae
- **Genome**
Tripartite (S RNA, M RNA, and L RNA)
- **Symptoms**
Necrosis and leaf distortion
- **Hosts**
Tomato, pepper, lettuce, long beans and impatiens
- **Yield loss**
5 – 10%
- **Vector**
Thrips



TCSV infected plants



TCSV infected fruits

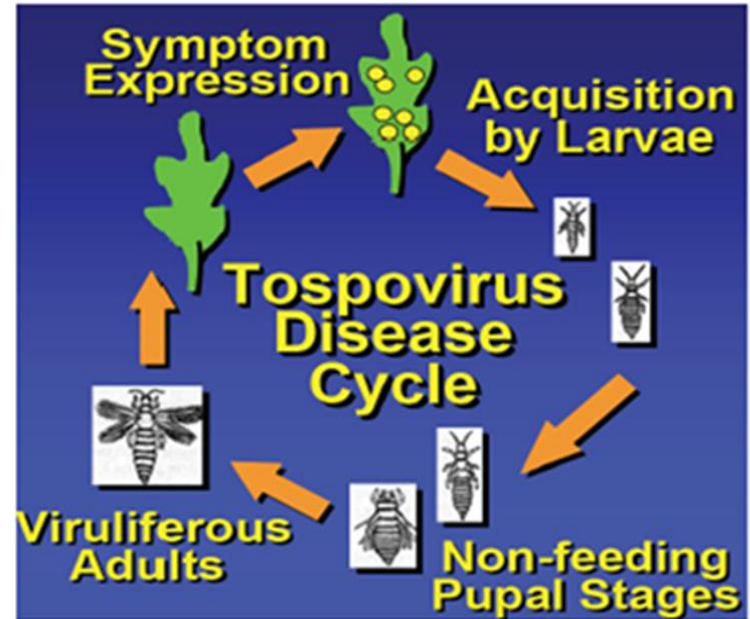
VECTORS OF TCSV



Western flower thrips
(*Frankliniella occidentalis*)



Common blossom thrips
(*Frankliniella schultzei*)



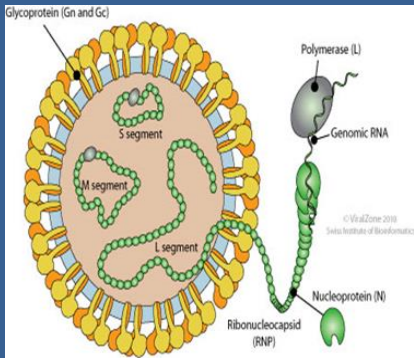
- **Transmission of tospovirus-** persistent propagative
- **Early larval instars** - acquire viruses from an infected plant parts
- **Adults-** transmit the virus into a newly non-infected plants

THRIPS AND TCSV ABUNDANCE IN AGROECOSYSTEM

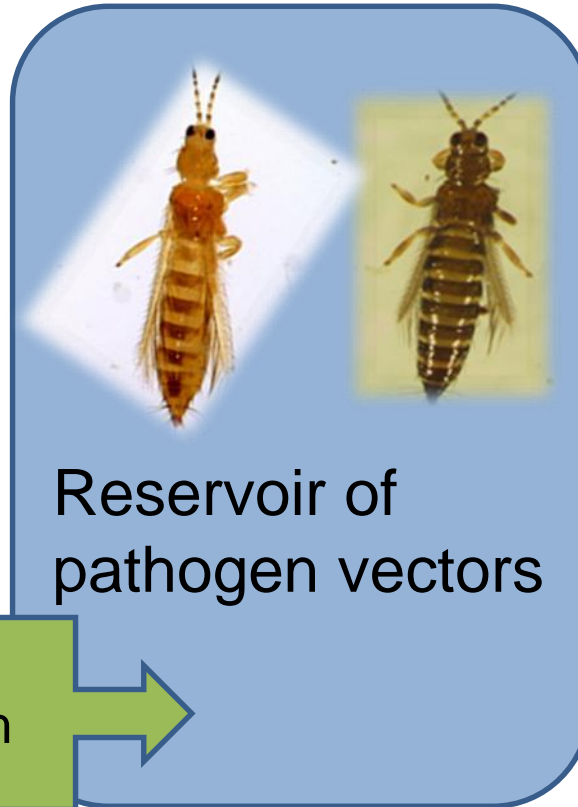
Vegetable	Western flower thrips	Common blossom thrips	Melon thrips	TCSV
Pepper	+	+	+	+
Tomato	+	+	+	+
Squash	+	+	+	-
Bean	+	+	+	-
Eggplant	+	+	+	-
Okra	+	+	+	-
Cucumber	+	+	+	-

TCSV disease started from the edge of the crop field

ALTERNATIVE HOSTS OF TCSV VECTORS



Reservoir of
Pathogen



Reservoir of
pathogen vectors

Both

OBJECTIVES

- Observe the abundance of TCSV vector thrips in some weed hosts
- Observe the abundance of TCSV vector thrips in some ornamental hosts
- Determine the effect of some ornamental plants in the incidence of TCSV in peppers
- Determine the reservoir of TCSV through molecular analysis

OBJECTIVE 1

Observe the abundance of TCSV vector thrips in some weed hosts



- **Sampling fields**
Tropical Research and Education Center (TREC) and growers field, Homestead, FL, USA
- **Sampling**
Randomly collected from each side
- **Sample size**
2 oz. of leaf and flower
- **Study period**
May, 2017-September, 2017
- **Statistical analysis**
Proc GLM (SAS institute Inc.)

SAMPLING PROCEDURE



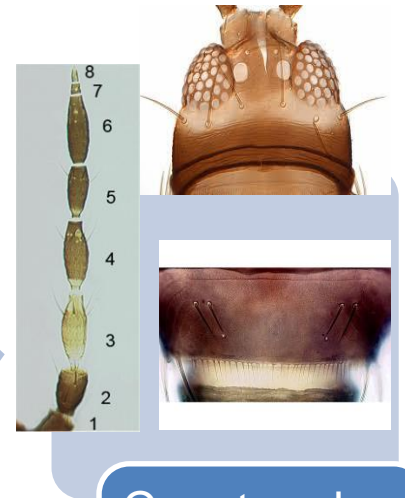
Samples are placed in a collection cup (2 pint)



Samples were shaken in 70% alcohol to dislodge thrips



Remove leaves/flowers and keep alcohol



Count and identify thrips under microscope at 40X

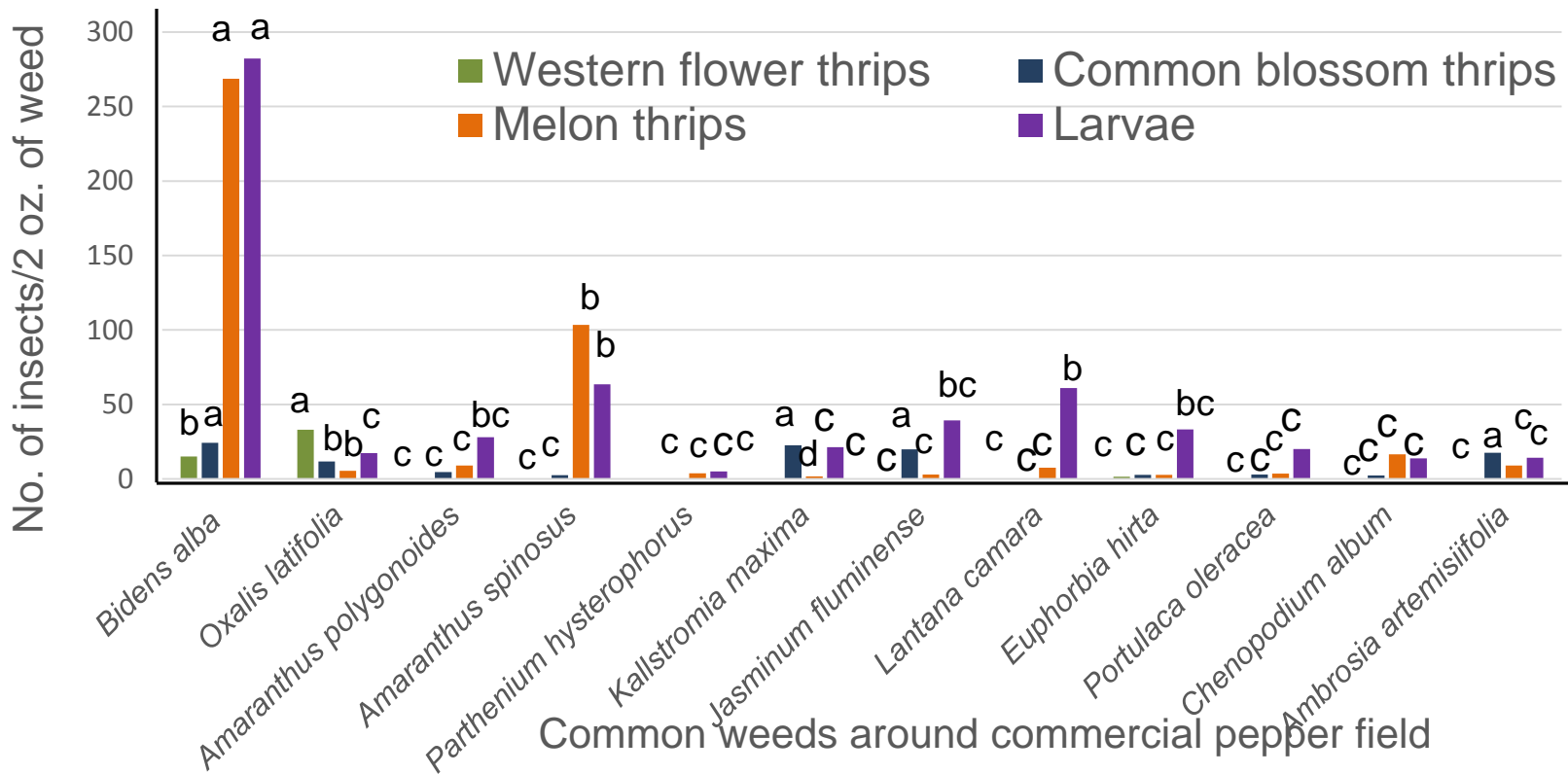
ALTERNATIVE HOSTS- WEEDS

18 families, 40 species of weeds

Family	Scientific name of weeds
Asteraceae	<i>Tridax procumbens</i> , <i>Parthenium hysterophorus</i> , <i>Bidens alba</i> , <i>Emilia fosbergii</i> , <i>Ambrosia artemisiifolia</i> , <i>Conyza canadense</i> , <i>Calyptocarpus vialis</i> , <i>Sonchus asper</i> , <i>Ageratum houstonianum</i>
Amaranthaceae	<i>Amaranthus polygonoides</i> , <i>A. spinosus</i> , <i>Chenopodium album</i>
Acanthaceae	<i>Ruellia ciliatiflora</i> , <i>Asystasia gangetica</i>
Euphorbiaceae	<i>Chamaesyce hyssopifolia</i> , <i>Euphorbia hirta</i> , <i>Acalypha alopecuroidea</i> , <i>Acalypha setosa</i> , <i>Euphorbia heterophylla</i> , <i>Phyllanthus amarus</i>
Fabaceae	<i>Desmodium incanum</i> , <i>Stylosanthes hamata</i> , <i>Rhynchosia minima</i>
Malvaceae	<i>Sida ulmifolia</i> , <i>Sida spinosa</i>
Rubiaceae	<i>Spermacoce verticillata</i> , <i>Ricardia grandiflora</i> , <i>Morinda royoc</i>

Family	Scientific name of weeds
Verbenaceae	<i>Lantana camara, Phyla nodiflora</i>
Zygophyllaceae	<i>Kallstroemia maxima</i>
Cucurbitaceae	<i>Momordica charantia</i>
Solanaceae	<i>Solanum americanum</i>
Onagraceae	<i>Oenothera laciniata</i>
Liguminosae	<i>Macroptilium lathyroides</i>
Convolvulaceae	<i>Ipomoea hederifolia, Ipomoea alba</i>
Oleaceae	<i>Jasminum fluminense</i>
Nyctaginaceae	<i>Boerhavia erecta</i>
Oxalidaceae	<i>Oxalis latifolia</i>
Portulacaceae	<i>Portulaca oleracea</i>

THRIPS ABUNDANCE IN WEEDS



Western flower thrips, $F=0.89$; $df=12,35$; $P>.5638$

Common blossom thrips, $F=2.52$, $df=12,35$; $P>0.0166$

Melon thrips, $F=6.98$; $df=12,35$; $P<.0001$

OBJECTIVE 2

Observe the abundance of TCSV vector thrips in some ornamental hosts



- **Sampling area**
Nurseries in Homestead, FL
- **Sample size**
10 flowers
- **Study period**
March, 2018-June, 2018
- **Statistical analysis**
Proc GLM (SAS institute Inc.)

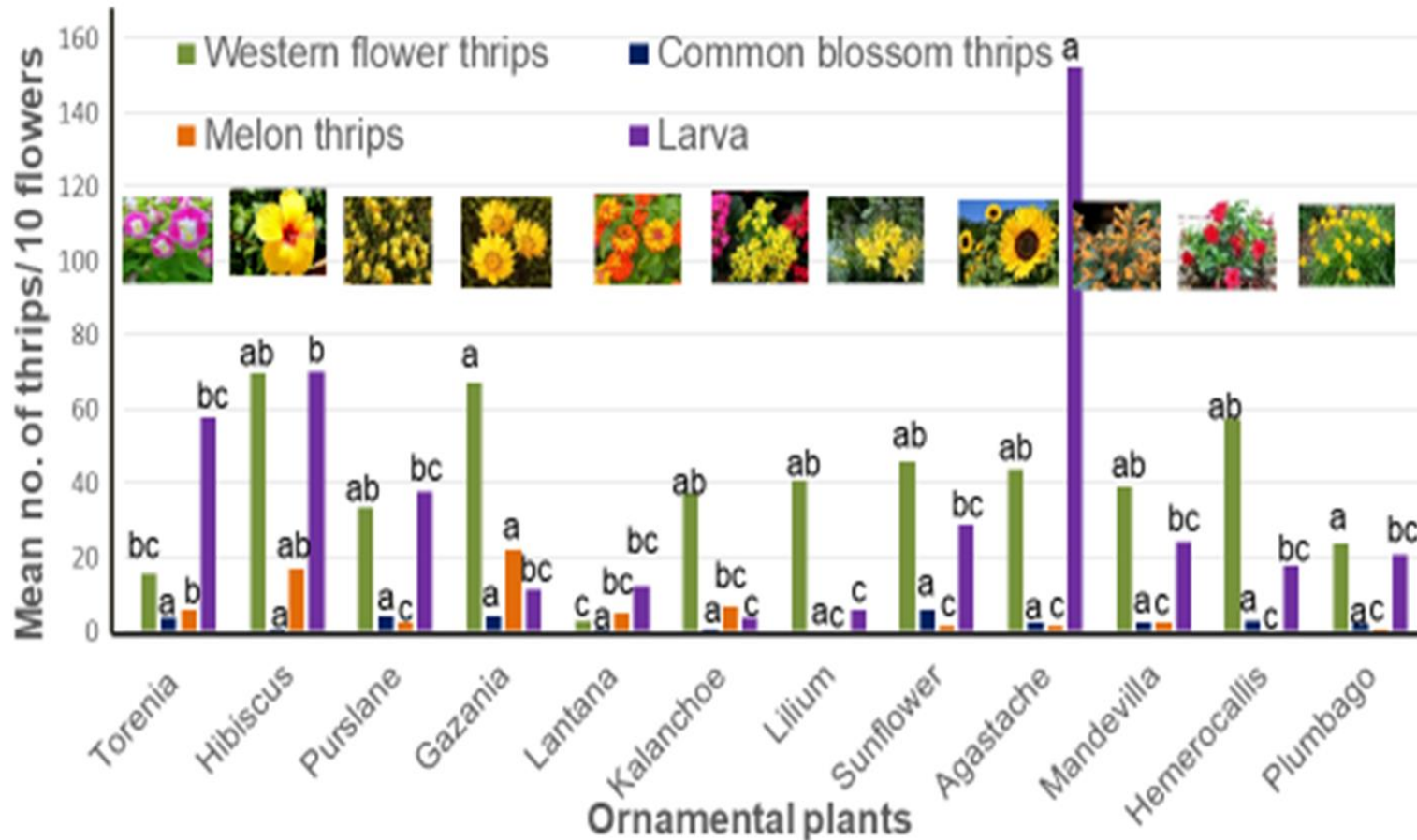
ALTERNATIVE HOSTS ORNAMENTAL PLANTS

19 plant families, 24 plant species

Family	Scientific Name	Common name
Linderniaceae	<i>Torenia spp.</i>	Wishbone flowers
Malvaceae	<i>Hibiscus spp.</i>	China rose
Onagraceae	<i>Fuchsia spp.</i>	Fuchsia
Asteraceae	<i>Ericameria arborescens</i>	Golden Fleece
Asteraceae	<i>Cosmos spp.</i>	Cosmos
Asteraceae	<i>Tagetes spp.</i>	Marigold
Asteraceae	<i>Helianthus annuus</i>	Sunflower
Asteraceae	<i>Gazania linearis</i>	Treasure flower
Asteraceae	<i>Gerbera spp.</i>	Garbers Daisy
Portulacaceae	<i>Portulaca oleracea</i>	Purslane
Rubiaceae	<i>Pentas lanceolata</i>	Egyptian starcluster
Verbenaceae	<i>Lantana camara</i>	Lantana

Family	Scientific Name	Common name
Balsaminaceae	<i>Impatiens walleriana</i>	Busy lizzy
Begoniaceae	<i>Begonia semperflorens</i>	Begonia
Crassulaceae	<i>Kalanchoe blossfeldiana</i>	Kalanchoe
Liliaceae	<i>Lilium matrix</i>	Lilium
Solanaceae	<i>Petunia spp.</i>	Petunia
Apocynaceae	<i>Catharanthus roseus</i>	Rose periwinkle
Cannaceae	<i>Canna spp.</i>	Cannatropical
Amaranthaceae	<i>Celosia argentea</i>	Plumed cockscomb
Plumbaginaceae	<i>Plumbago auriculata</i>	Blue plumbago
Lamiaceae	<i>Agastache spp.</i>	Arozona Sandstone Agastache
Asphodelaceae	<i>Hemerocallis lilioasphodelus</i>	Daylily

THRIPS ABUNDANCE IN ORNAMENTAL PLANTS



Western flower thrips, $F=1.88$; $df=11,24$; $P>.0946$

Common blossom thrips, $F=0.67$, $df=11,24$; $P>.7552$

Melon thrips, $F=6.44$; $df=11,24$; $P<.0001$

Larvae, $F=5.20$; $df=11,24$; $P>.0004$

OBJECTIVE 3

Determine the effect of some ornamental plants in the incidence of TCSV in peppers



Experimental design	Plot size	Pepper variety	Treatments	Sample size
Randomized complete block design	7' long x 6' wide with 5' long buffer	Jalapeno	1. Pepper+ Purslane 2. Pepper+Lantana 3. Pepper+Hibiscus 4. Pepper+Mandevilla 5. Pepper+Gazania 6. Pepper+Hemerocallis 7. Pepper+ Arizona Sandstone Agastache 8. Pepper (Untreated control/check)	5 flowers for all treatments

EVALUATION OF ORNAMENTAL TREATMENTS

Sampling

- Pepper (5 flowers, randomly selected from 5 plants)
- Ornamental plants (5 flowers, randomly selected from 5 plants)

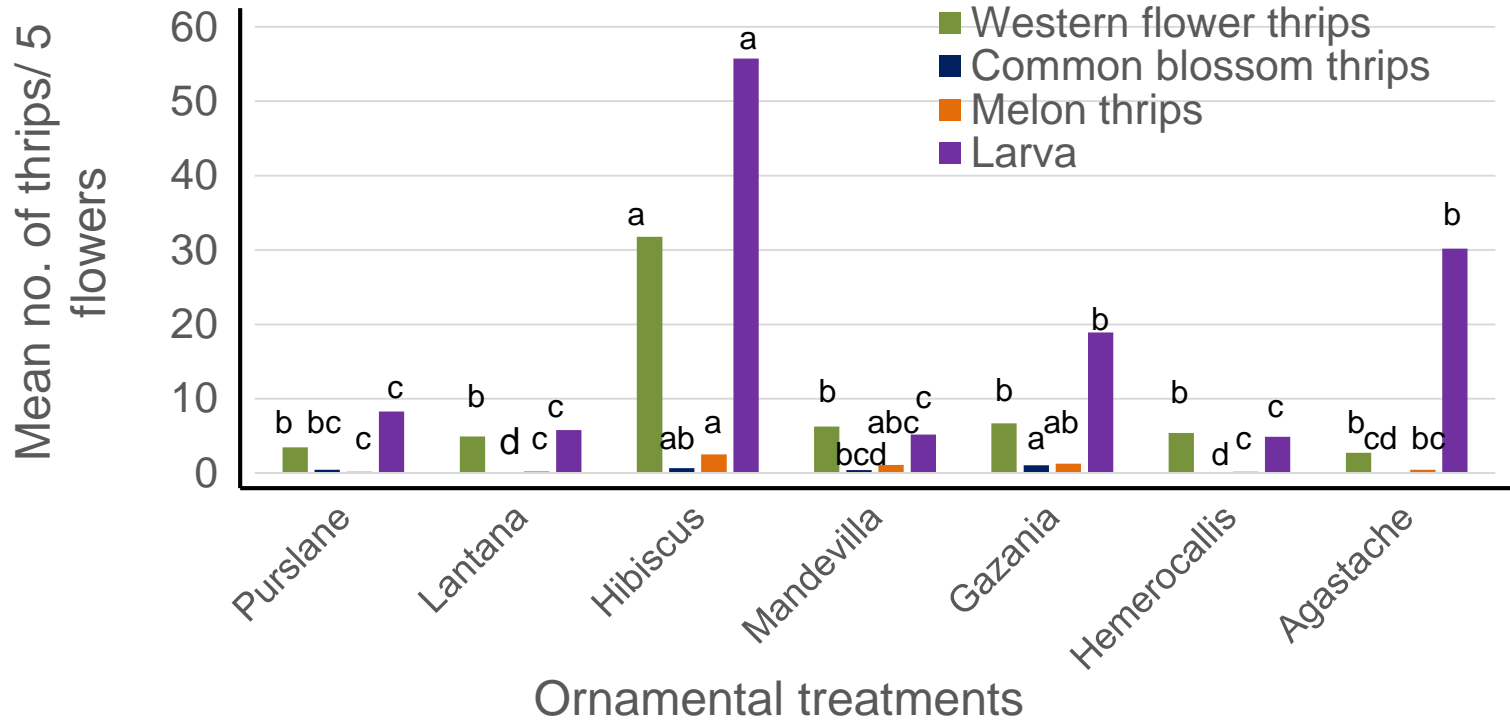


Statistical analysis

- Proc GLM Repeated Measure (SAS institute Inc.)

Experimental plots

THRIPS ABUNDANCE IN ORNAMENTAL FLOWERS



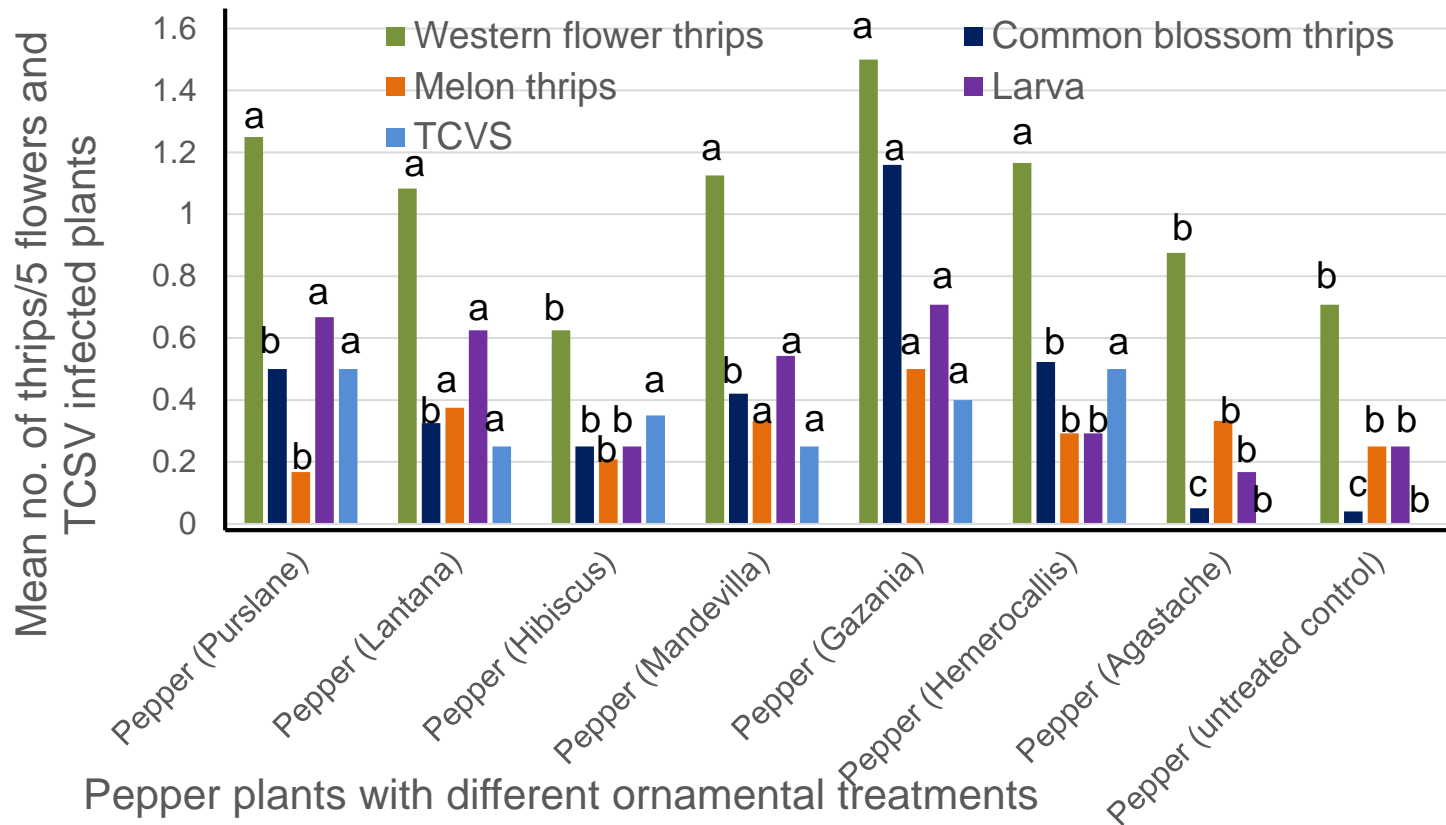
Western flower thrips, $F=12.35$; $df=6,189$; $P<.0001$

Common blossom thrips, $F=4.50$, $df=6,189$; $P>.0003$

Melon thrips, $F=4.01$; $df=6,189$; $P>.00008$

Larvae, $F=10.08$; $df=6,189$; $P<.0001$

TCSV VECTOR THRIPS ABUNDANCE IN PEPPER FLOWERS AND TCSV INCIDENCE



Western flower thrips, $F=0.41$; $df=7, 184$; $P>.8922$

Common blossom thrips, $F=0.86$, $df=7, 184$; $P>.5416$

Melon thrips, $F=0.43$ $df=7, 184$; $P>.8808$

Larvae, $F=0.70$; $df=7, 184$; $P>.6713$; TCSV, $F=1.13$; $df=7, 24$, $P>.3788$

OBJECTIVE 4

Weeds and ornamental plants as reservoir/host of TCSV



TCSV infected pepper plant
(leaf and flower)
(positive control)

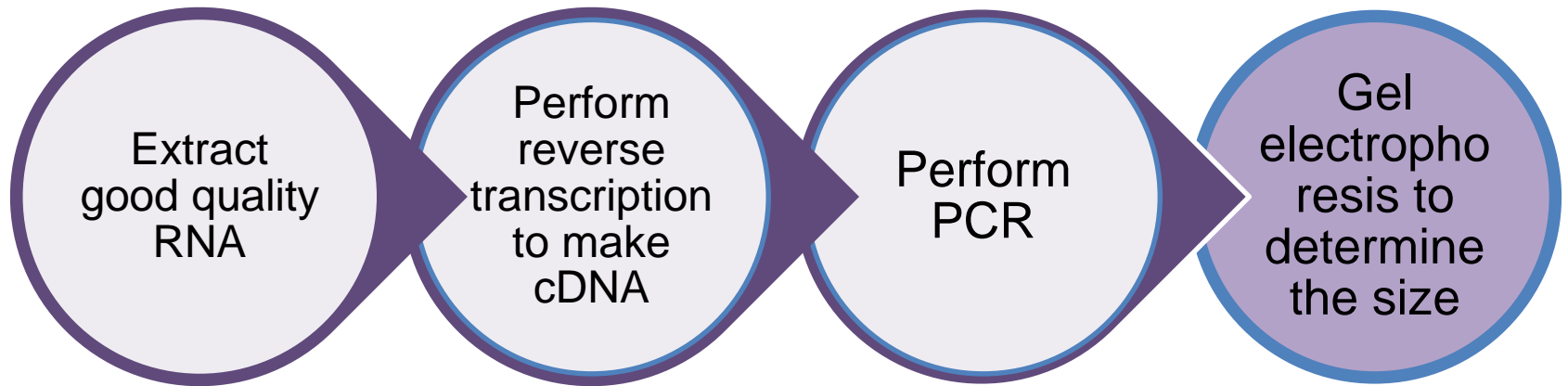


Healthy pepper plant
(leaf and flower)
(negative control)

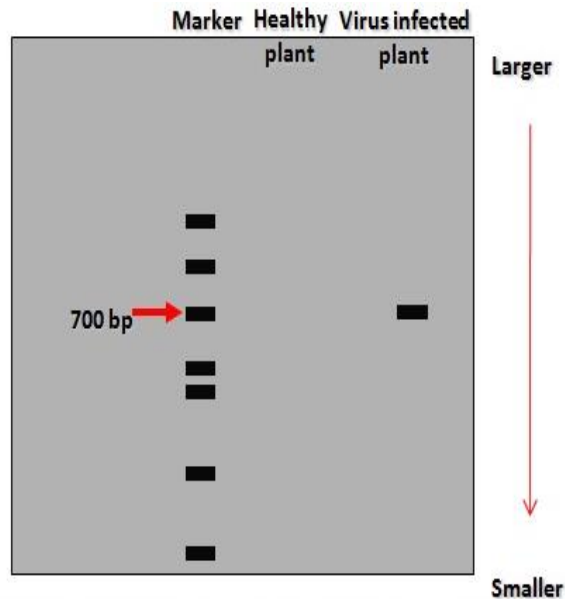


Weed and ornamental plants (Leaf and flower)
(preserved in -80°C)

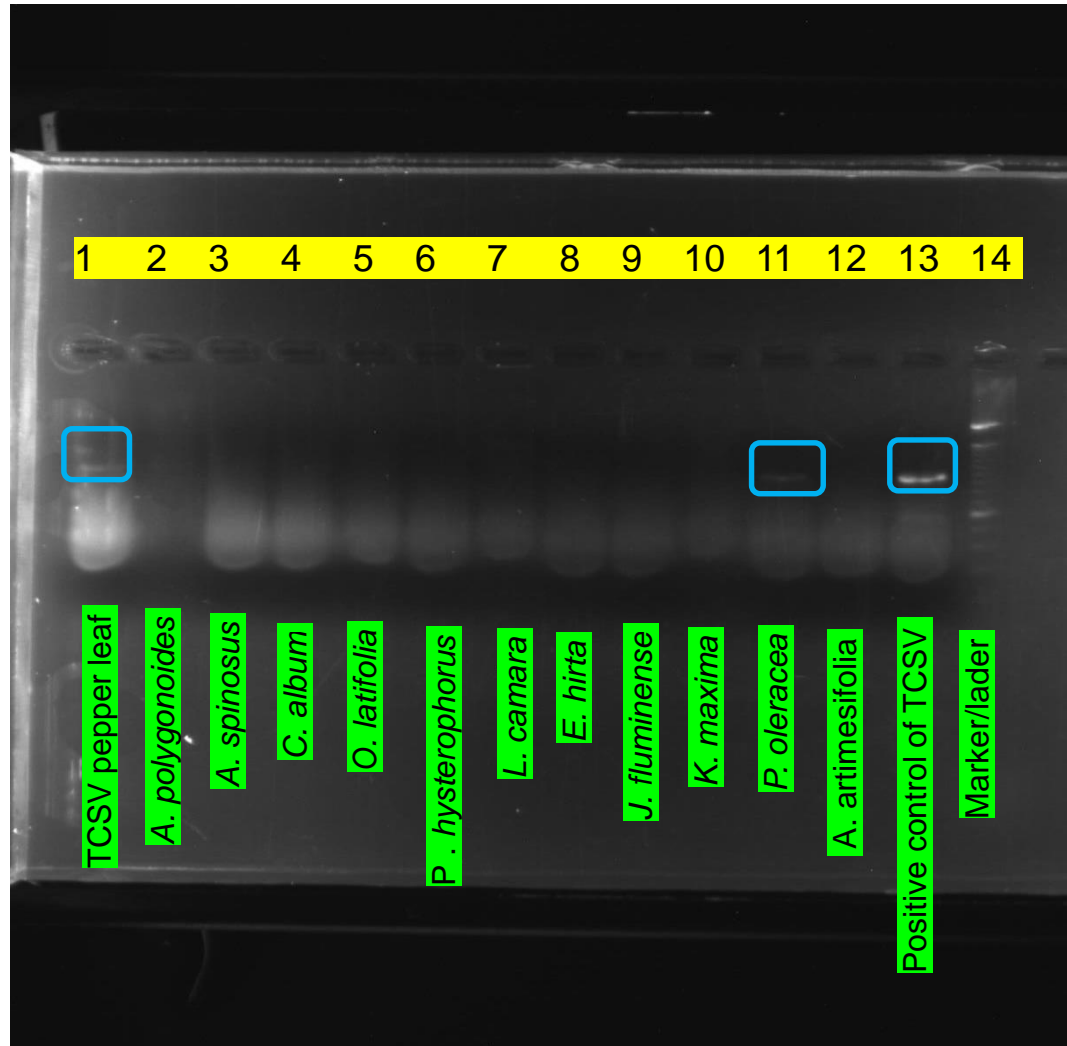
IDENTIFY RESERVOIR OF TCSV



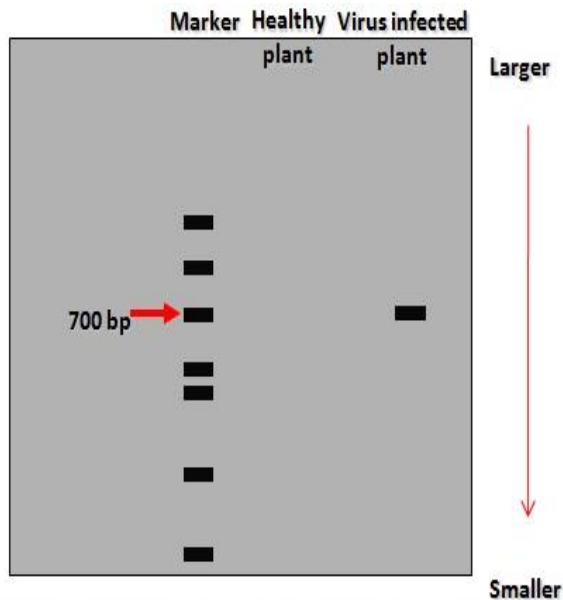
WEEDS AS RESERVIOR OF TCSV



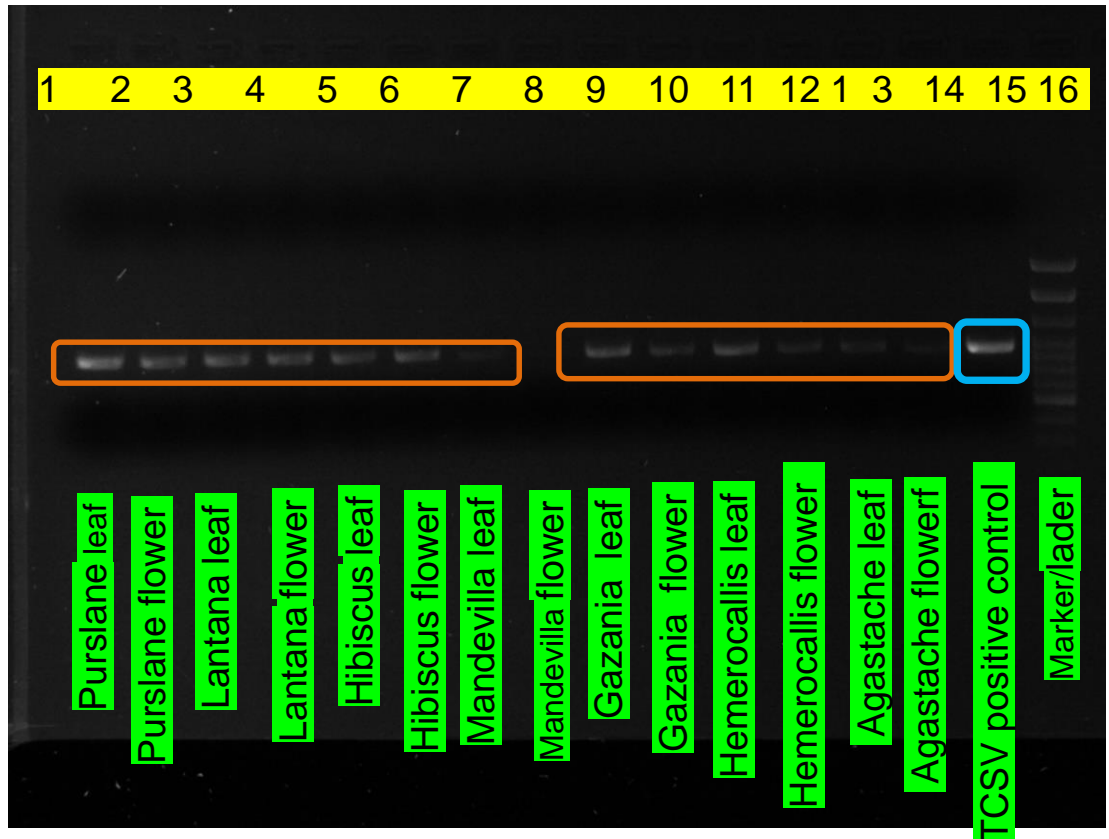
Gel electrophoresis to determine the size



ORNAMENTAL PLANTS AS RESERVIOR OF TCSV



Gel electrophoresis to determine the size



CONCLUSION

- TCSV vector thrips are abundant in some of the weeds and ornamental plants in pepper agroecosystem
- These host plants are the immediate source of TCSV infection in peppers
- Growers are recommended to maintain proper management to grow pepper and ornamental crops in close proximity
- Vector status of melon thrips (*Thrips palmi*) requires to be determined

ACKNOWLEDGEMENT

- All committee members
- Growers of commercial pepper fields
- Entomology lab members
- Tropical Research and Education Center, UF

