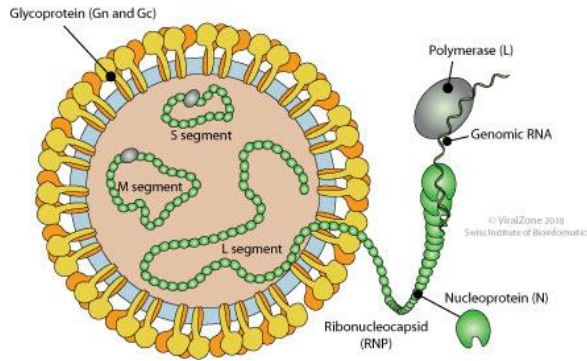
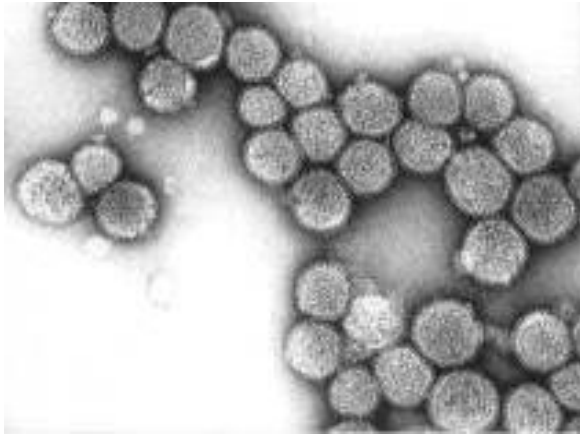




An updated in the spotted wilt virus situation

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Gilbertson Lab
Plant Pathology Department
UC Davis

Tomato spotted wilt virus (TSWV)

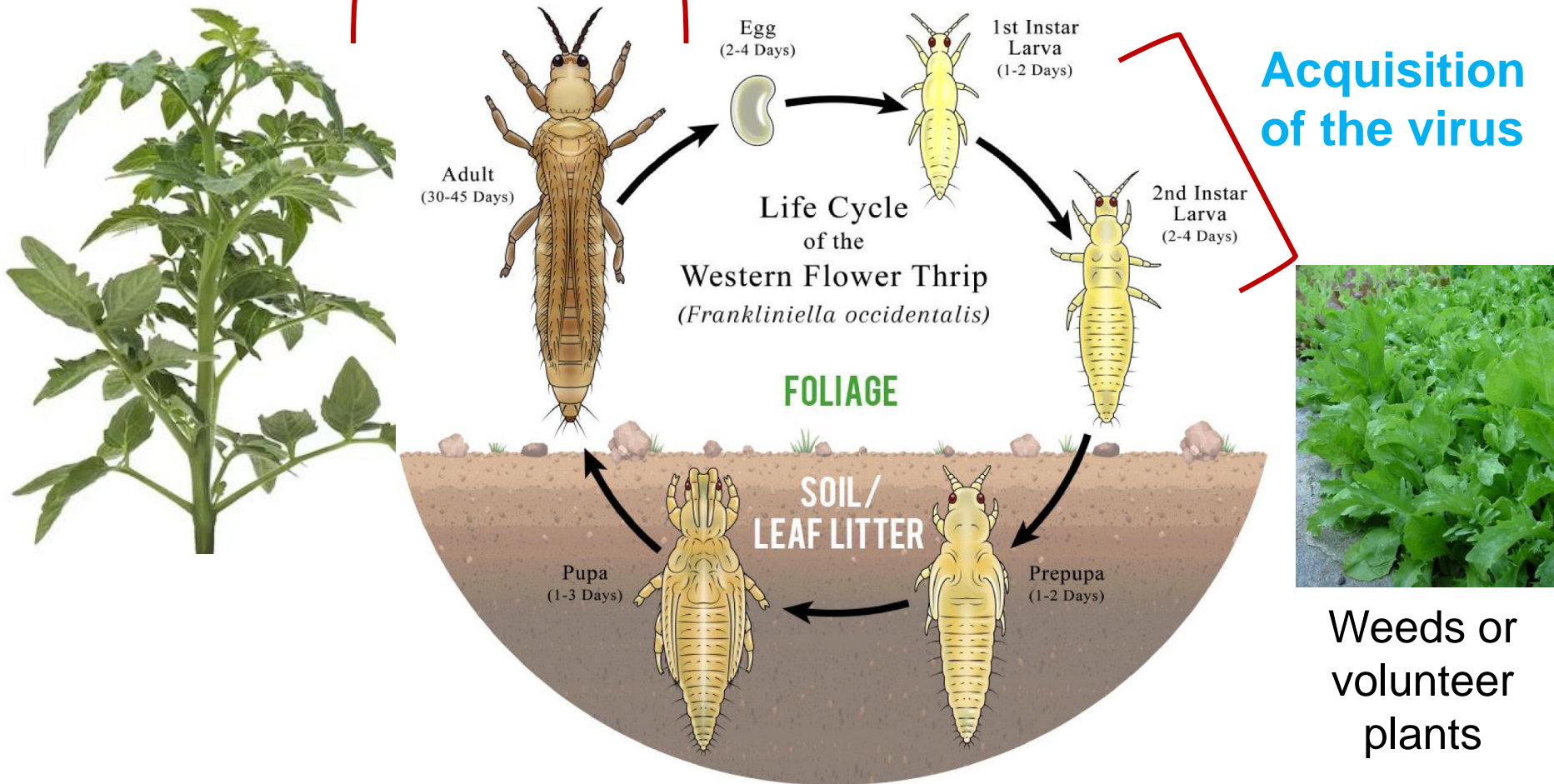


- TSWV is NOT by seed, contact, or through eggs of the thrips.
- TSWV infected all cells and is mechanically transmissible
- In CA, crops impacted by tomato spotted wilt are tomato, pepper, lettuce and radicchio
- In 2005, substantial outbreaks of spotted wilt caused losses to processing tomato production in Central California
- Collaborative project to investigate these outbreaks and make management recommendations.

Cycle of the TSWV

Transmission of the virus (only if they acquire as larvae)

Acquisition of the virus



Symptoms and impact of tospovirus infection in tomato vary depending on the age of the plant when infected

Stunting, bronzing, necrosis and yellowing of leaves and ringspots and necrosis in fruits.



Detection of resistant breaking (RB) and wild type (WT) of *Tomato spotted wilt virus* (TSWV)



total RNA extraction with the RNeasy Qiagen kit **(1 - 5 samples)** **30 min**

1 h + 30 min (synthesis of cDNA using Random primers) **Loop Mediated Isothermal Amplification (LAMP)**

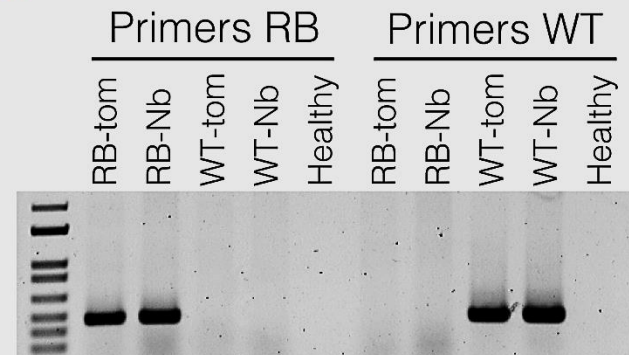
Polymerase chain reaction (PCR)

2 h

94C x 20 sec
60C x 20 sec
72C x 1:2 min **30X**

Agarose gel electrophoresis

45 min



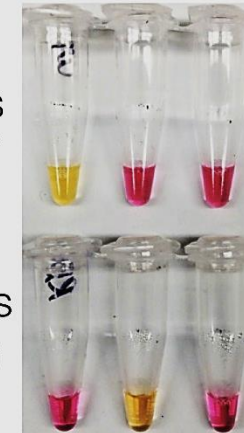
Total time: 5 hours

60 min

WT RB Healthy

Primers for WT

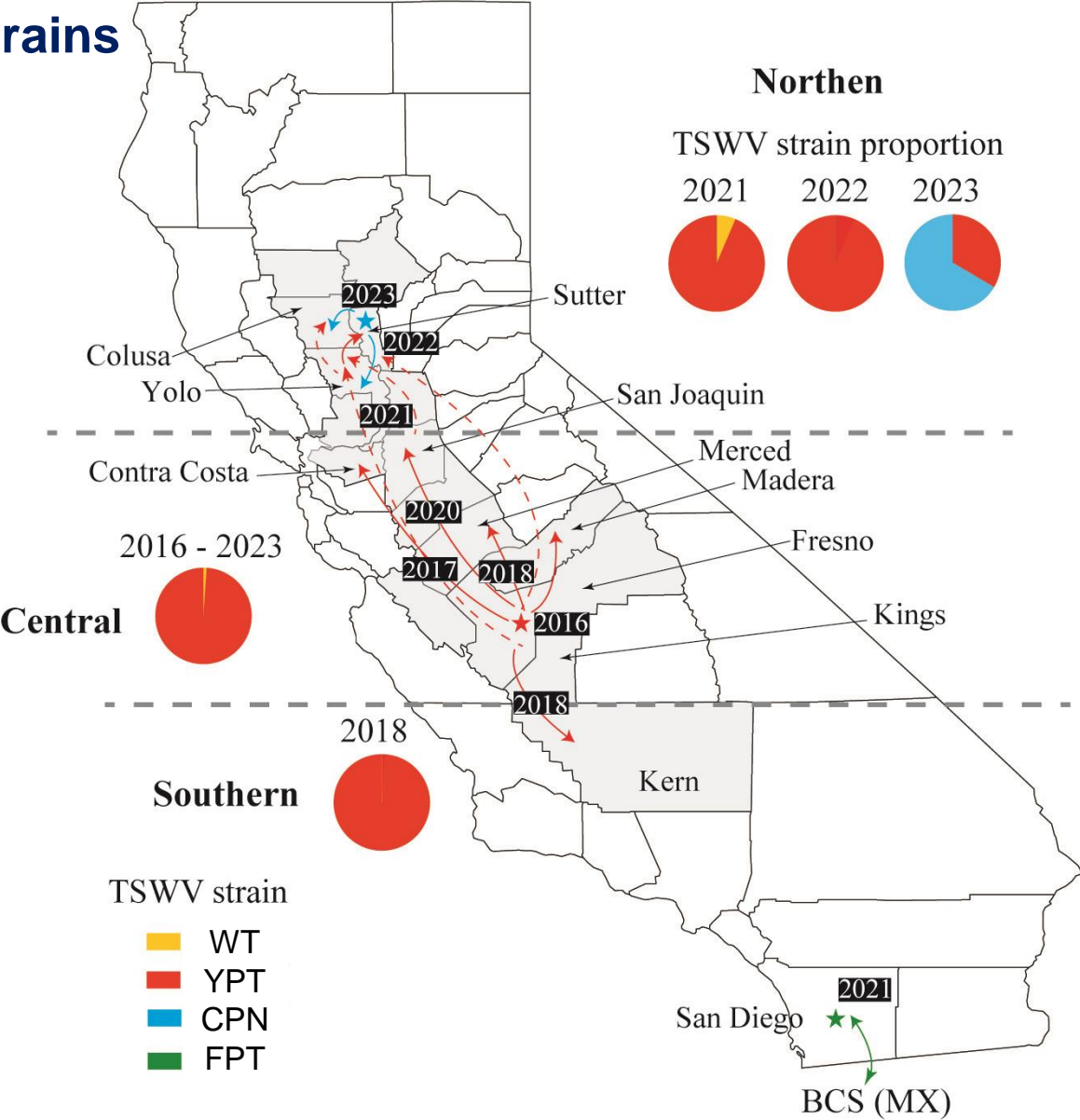
Primers for RB



67C x 50 min

Total time: 1.5 hours

Map of the state of California showing the emergence of resistance-breaking (RB strains) of tomato spotted wilt virus (TSWV).



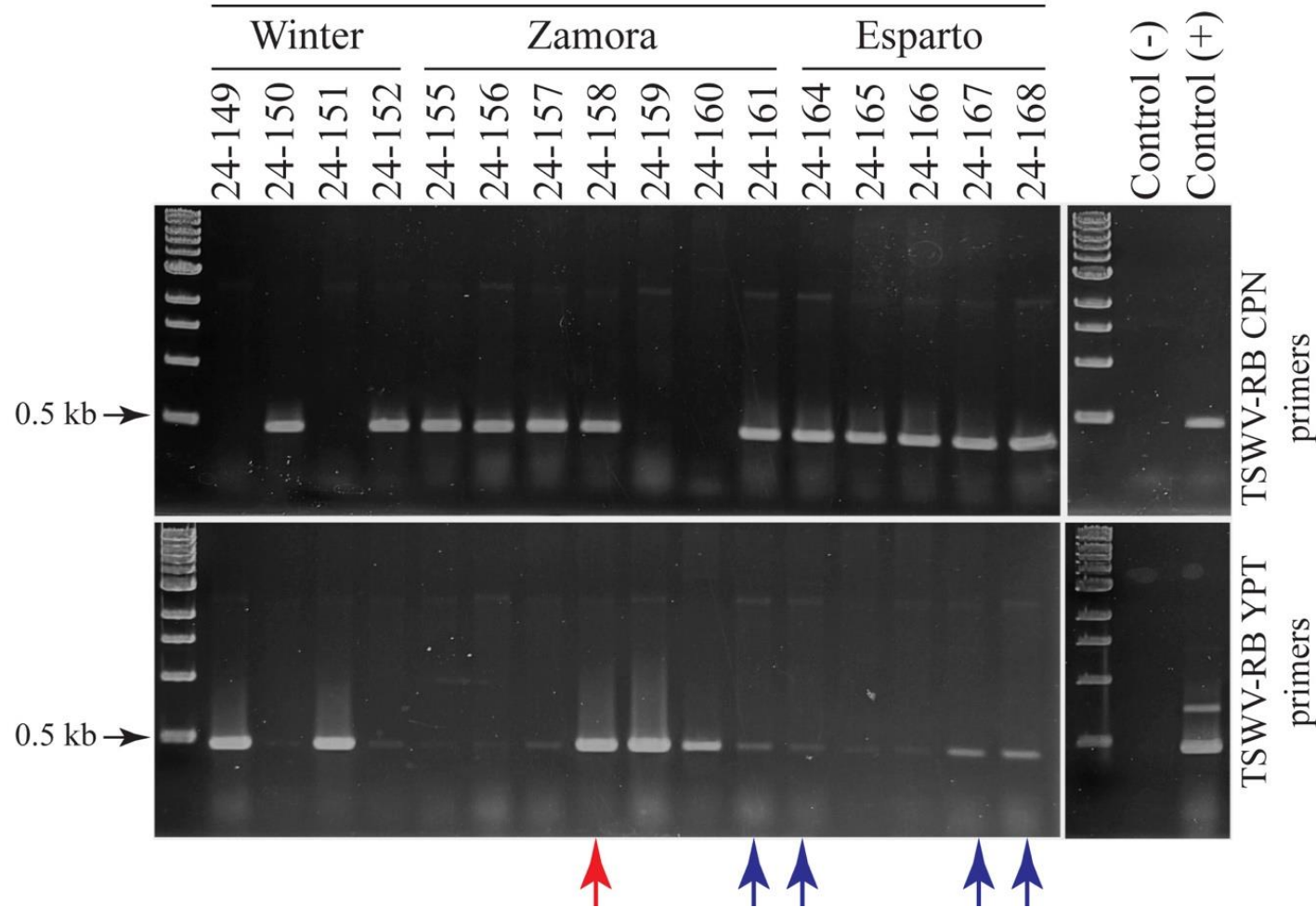
Results of RT-PCR tests for detection of tomato RB TSWV strains by county in 2024

County	TSWV-RB strains					Total samples
	CPT	FPT	YPT	CPN	MIX (YPT+CPN)	
Colusa*	0	2	4	6	0	12
Sutter*	0	0	5	19	0	24
Yolo*	0	2	28	8	45	83
Stanislaus	0	0	3	0	0	3
Fresno	0	0	44	0	0	44
Merced	0	0	8	0	0	8
Total	0	4	92	33	45	174

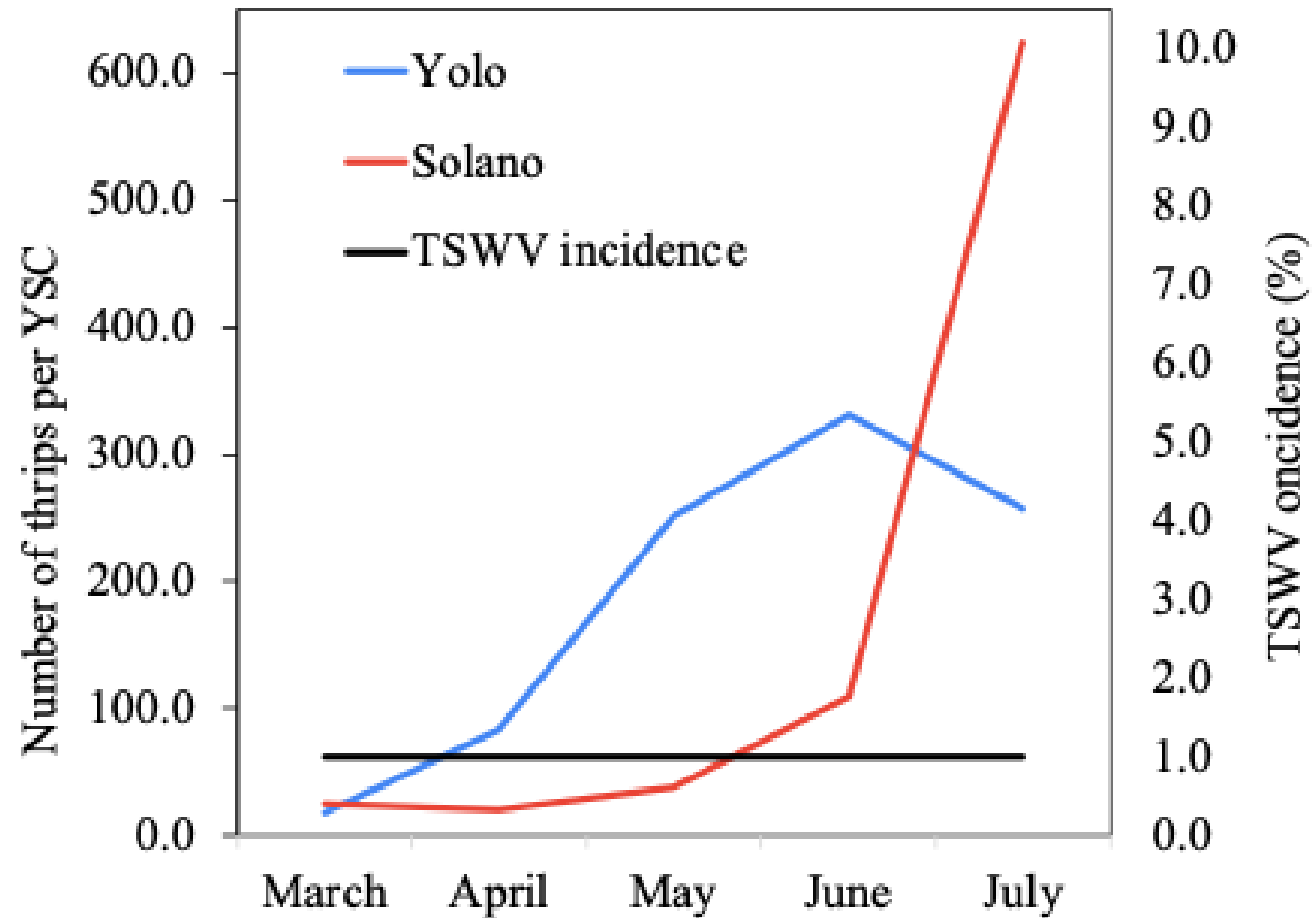
* Northern counties

RT-PCR detection of YPT and CPN strains of RB-TSWV in spotted wilt samples from Yolo

RT-PCR test with specific primers for the detection of TSWV-RB strains

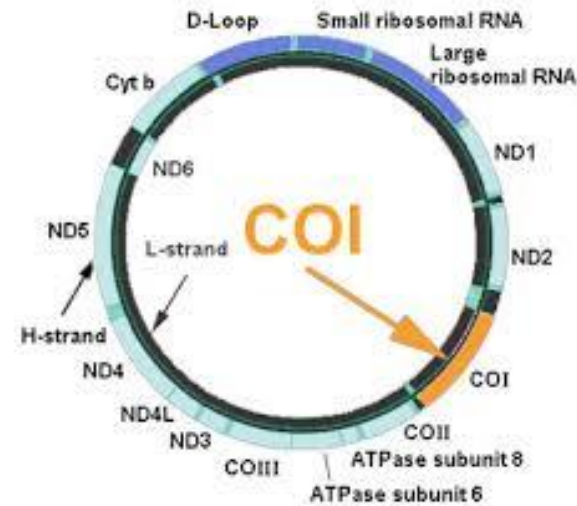


Thrips population and TSWV incidence during the tomato season 2024



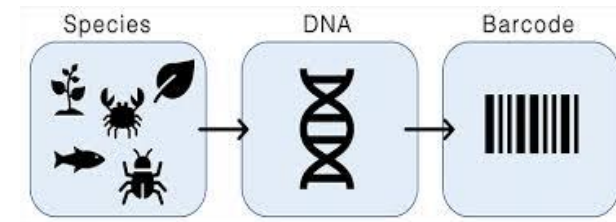
Rapid insect identification based on the mtCOI sequence

- cytochrome c oxidase subunit 1 protein (COI) located in the mitochondria.
- COI is used as a standard marker in DNA barcoding for ID different species due to its highly conserved regions across diverse organisms



- Steps:

- DNA extraction
- Amplification of mtCOI DNA fragment by PCR and degenerate mtCOI primers
- Sequence mtCOI fragment
- Compare sequence with those in database



PCR amplification of the Cytochrome C oxidase subunit 1 gene (COI) and BLAST analysis of the nucleotide sequence of selected insects

ID	Origin	Details	BLAST results		
			Scientific name	% of similarity	Accession number
SF-Ho	Hoper, DO	Sunflower, Don May	<i>Sogatella furcifera</i>	86.5%	HM160119.1
SF-In	Mirids, DO	Sunflower, Don May	<i>Reuteroscopus ornatus</i>	99.2%	KJ190451.1
Th-4	Thrips, DO	Pigeon peas, D-3, Azua	<i>Megalurothrips usitatus</i>	92.4%	MZ882425.1
Th-10	Thrips, DO	Pigeon peas, P-4, Azua	<i>Frankliniella insularis</i>	98.9%	OR136277.1
Th-16	Thrips, DO	Pigeon peas, Las Yayas, Azua	<i>Megalurothrips usitatus</i>	98.0%	MZ882425.1
WF-7	Whiteflies, DO	Collected on 08/21/24.	<i>Bemisia tabaci</i>	88.0%	OR143884.1
Esp-3	Thrips, Esparto	From Esparto (07/08/24)	<i>Thrips tabaci</i>	99.1%	OR136282.1
Esp-4	Thrips, Esparto	From Esparto (07/08/24)	<i>Thrips tabaci</i> haplotype 6	99.6%	MN036457.1
Win-3	Thrips, Winter	From Winter (07/08/24)	<i>Thrips tabaci</i> haplotype 5	87.0%	MN036456.1
24YC-1	Thrips, Fresno	From Fresno (04/12/24)	<i>Thrips tabaci</i> haplotype 8	98.6%	MN036459.

PCR amplification of the mtCOI gene and BLAST analysis of the nucleotide sequence of thrips collected from YSCs in 2024

County	Field	Date of collection	BLAST results		
			Scientific Name	% of similarity	Accession number
Yolo	Esparto	04/19/24	<i>Frankliniella occidentalis</i>	87.06%	OR136224.1
	Winter	04/19/24	<i>Thrips tabaci</i>	93.31%	OR136280.1
	Winter	05/01/24	<i>Thrips tabaci</i>	93.19%	OR136282.1
	Esparto	05/01/24	<i>Thrips tabaci</i>	98.19%	OR136280
	Esparto	05/22/24	<i>Thrips tabaci</i>	99.04%	OR136282.1
	Zamora	06/19/24	<i>Thrips tabaci</i>	93.15%	OR136282.1
	Esparto	06/19/24	<i>Thrips tabaci</i>	97.23%	LC650834.1
	Zamora	07/08/24	<i>Frankliniella occidentalis</i>	85.38%	OR136254.1
Solano	Dixon	07/08/24	<i>Frankliniella occidentalis</i>	90.88%	OR136224.1

Do onion thrips (*Thrips tabaci*) impact TSWV of processing tomato in California

- Major insect pest worldwide
 - Highly invasive
 - High rate of reproduction
 - Ability to disperse to new fields
- Direct and indirect crop damage
- Transmit tospoviruses (tomato spotted wilt viruses [TSWV] and iris yellow spot virus [IYSV])
- Exists as two cryptic species
 - **communis**-most common and a poor transmitter of TSWV
 - **tabaci**-more localized and transmits TSWV efficiently to tobacco



Hypothesis: high populations of onion thrips may explain low incidence of TSWV in processing tomatoes in the North in 2024

Conclusions

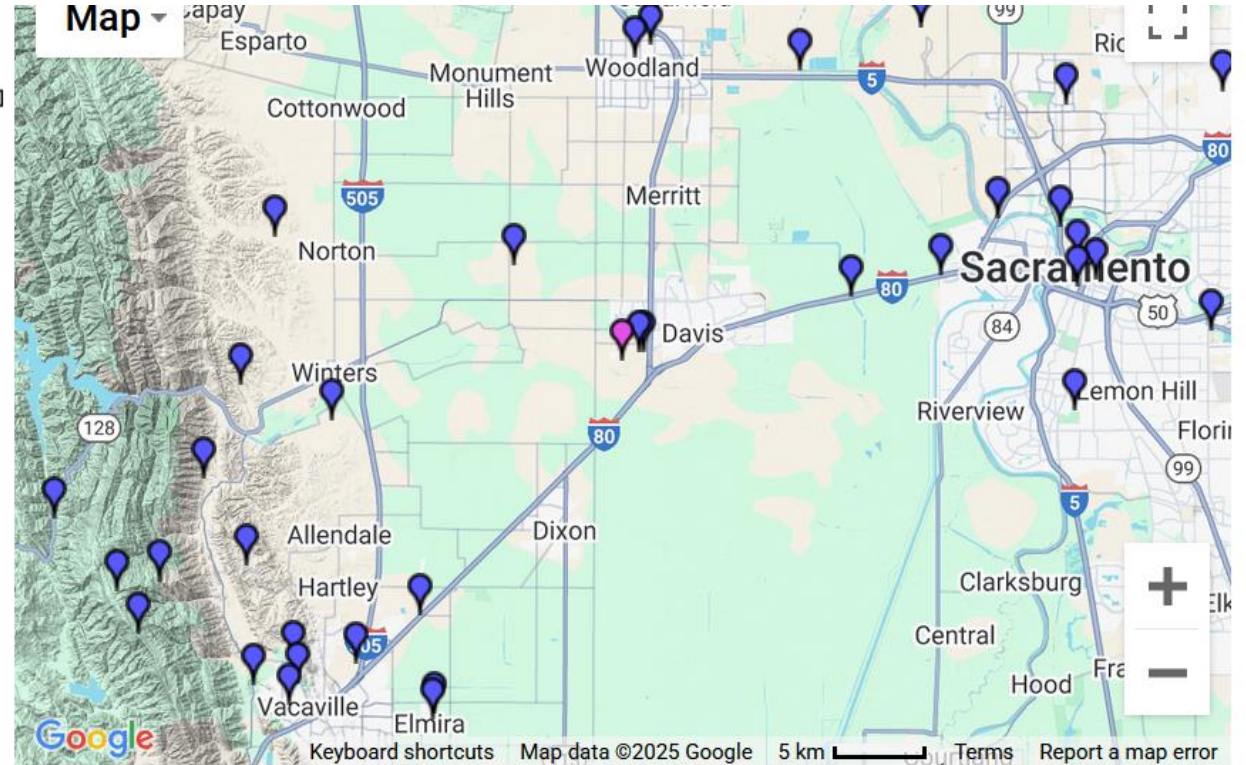
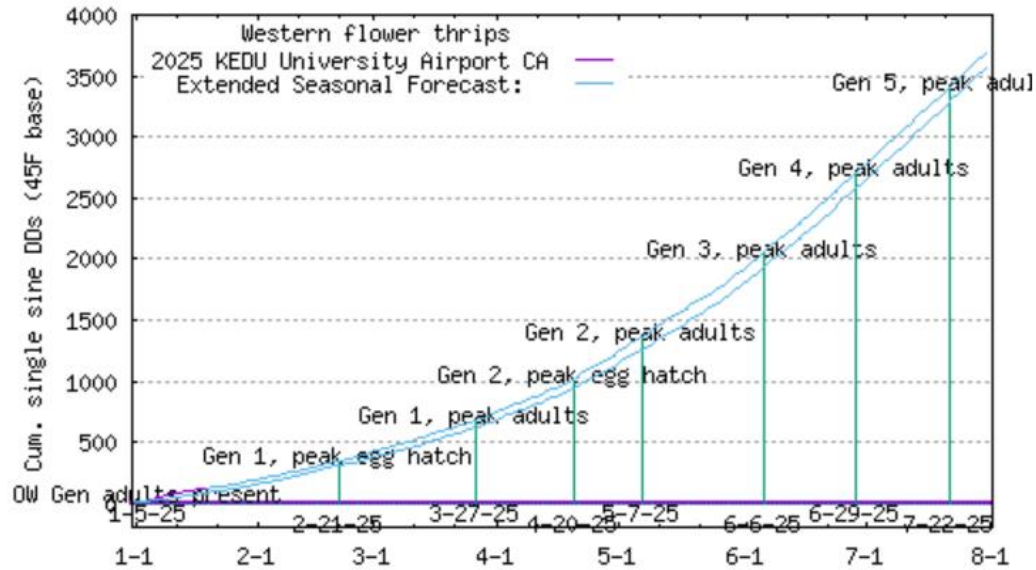
Spotted wilt

- **CPN and YPT RB-TSWV strains were detected in the North in 2024 with CPN outcompeting YPT.**
- **Failure to observe spread of TSWV may be due to the invasive onion thrips, a less effective vector of TSWV**

Curly top

- **Absence of CTD and low BLH populations in 2024 support hypothesis that outbreaks in 2021-22 were climate-driven**
- **BCTV survives in symptomless weeds and can re-emerge under favorable conditions**

Thrips growing degree day model



lat=38.35177 long=-121.84682

Uses local temperature (current & historic) to predict western flower thrips populations

KEDU METAR 38.5314 -121.7864
2025 University Airport CA elevation: 68'

Refresh - click to reset display

Display Dates

Start Date: Jan 21 2025

<https://uspest.org/risk/models>

Thrips blog: model predictions + field observations

Link: <https://ucanr.edu/blogs/ThripsTSWVYoloColusa/index.cfm>




Or google UCANR thrips blog and your county, if you're not in the south Sacramento Valley

THRIPS/TSWV STATUS IN YOLO & COLUSA

Regular update on thrips population stages in processing tomato for Yolo & Colusa

UCANR: *Safeguarding abundant and healthy food for all Californians*

2024 6th Report (May 7th)

 Author: Patricia Lazicki
Author: Neil McRoberts

Published on: May 7, 2024

General situation

Unseasonably cool weather has slowed thrips population projections slightly. However, temperatures may be into the 90s by the end of the week and we expect to see populations continue to develop.

Thrips population

Generation 2 adult thrips are peaking in the coming week. Thrips population will be predominantly nymphs through the second half of May. I've been seeing a few scattered infections in early-planted fields here in the north. There's a risk that when these Gen 3 nymphs become adults they will be able to spread the virus further. In historic hotspots, growers considering treatments should think about targeting these Gen 3 nymphs, especially if they are seeing any signs of the virus. Otherwise, generation 4 seems the more likely source for any significant chance for TSWV to spread around, and the more likely to pay off in terms of investment in thrips control.

Generation	Predicted date
Gen 2 peak egg hatch	4/25
Gen 2 peak adults	5/13
Gen 3 peak adults	6/10

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