Two Vexing Problems: Symphylans & Tomato Spotted Wilt Virus

Aziz Baameur

UC Cooperative Extension

Santa Clara County

SF Workgroup meeting

6/11-12/2008

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

Phone: 408-282-3127

Email: azbaameur@ucdavis.edu

Garden Symphylan

Symphylans (Garden Centipedes)

- **Small (1/4 inch) white soft-bodied -- ‘centipede-like’ animals**
- **Eyeless**
- **Sense the world with antennae**
- **15 body segments**
- **12 pairs of legs**
- **paired spinnerets**
- **“Nervous” movement, running!!**

Symphylans

Class: Symphyla NOT INSECTS

Long lived (5+ years in the lab)

1 generation per year…2 or 3 possible

Eggs laid in groups in the soil and tended

Newly emerged nymphs have 6 pairs of legs

Molt throughout life; do not feed during molting

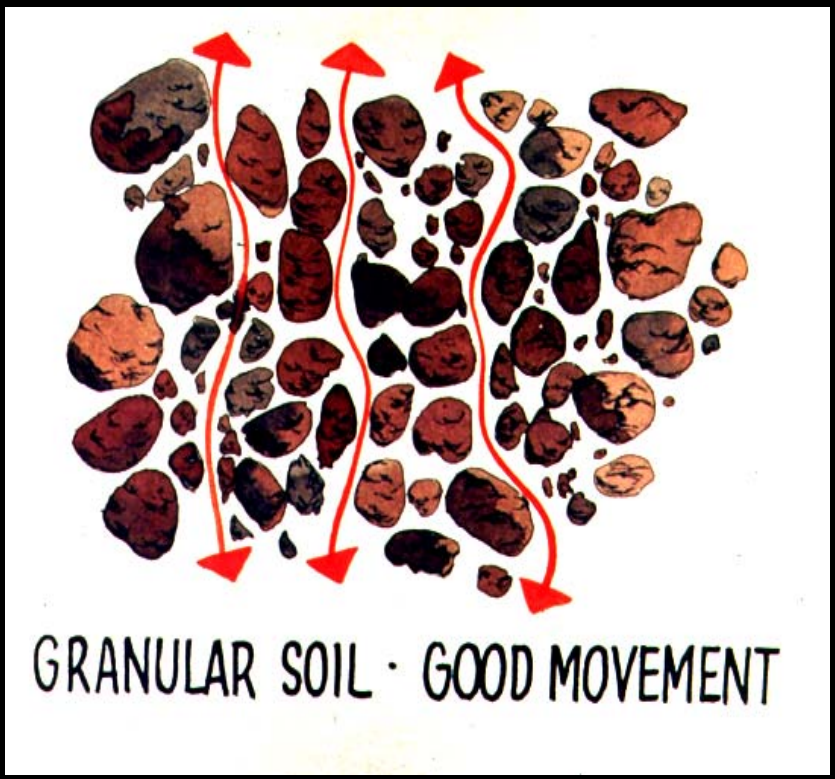
Life Cycle

- Nymphs and adults become active in the spring and can be found in increasing numbers in the upper 6 inches of soil during the spring and summer months.
- egg to adult is about
  - 160 days at 50°F
  - 87 days at 68°F
  - 53 days at 77°F

Symphylans

- **Generalist feeders but with a preference for the tissues of higher plants**
- **May eat 3-15 times their own weight per day**
- **Tend to avoid light, but will feed above ground**

Symphylans



Move in soil pores…fast and far

– More than 10 feet per day.

Diurnal movements…up and down in the soil profile

Host Range & Control

Hosts: plant roots, most vegetables, beans, corn, peas, potatoes, strawberries, Cole crops

cultural control methods: flooding
physical control methods:
sterilize soil,
compact soil,
deep cultivation when they are near the surface

notes: may allow entrance of pathogens into roots (Fusarium). migrates deep into soil cracks.

Field damage

Symphylans Damage in Cucumber Field 2004

Symphylans Damage in Sweet Corn Field 2004

Damage in Green Beans

Greenhouse Damage

Greenhouse Application





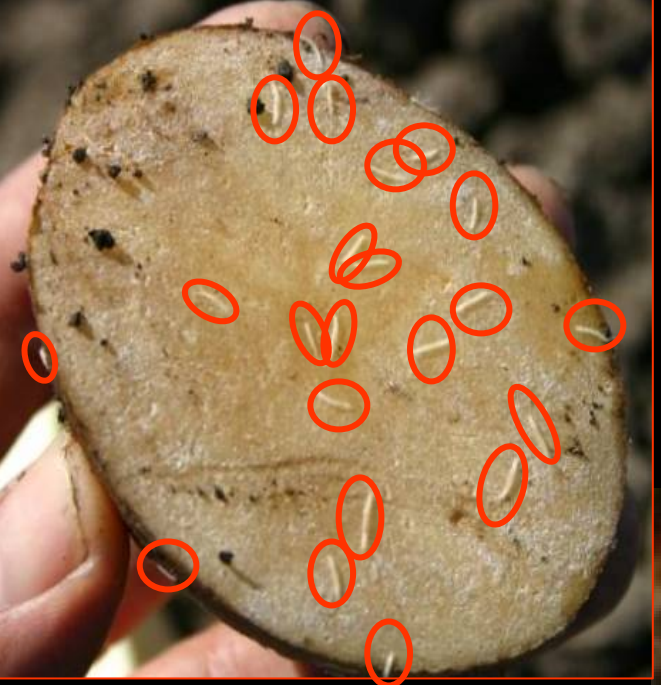

Post Treatment

Green Beans

Organic Materials Used

- Feather Tea--a Chinese product at 2.6 gal/Acre
- Jennifer--12.5 gals/acre
- Neemex 4.5--30 Oz/ Acre
- Microlife--10 gals/ Acre
- Ecotrol-24 #/A
- And Control-no chemical applied but 28 gals/Acre water


Field Application



Symphylan Count

22 symphylans
Average= 25

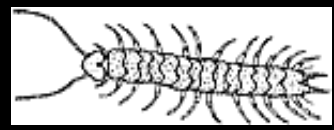

100
Lightly infested
34
Heavily infested

Conclusions

- Soil injection may not be as efficient as chemigation
- Water deeper movement enhances product efficacy
- Need to try materials in greenhouse
- Will expand trial in field next year with more chemicals.

Symphylan

Control Ideas



hosts: plant roots, most vegetables, beans, corn, peas, potatoes, strawberries, Cole crops
cultural control methods: flooding
physical control methods: sterilize soil, compact soil, deep cultivation when they are near the surface
notes: may allow entrance of pathogens into roots (Fusarium). migrates deep into soil cracks. molts. past adult. a little sexual dimorphism, these creatures molt continuously throughout life. Advisor frequent visits

Acknowledgments & Thanks

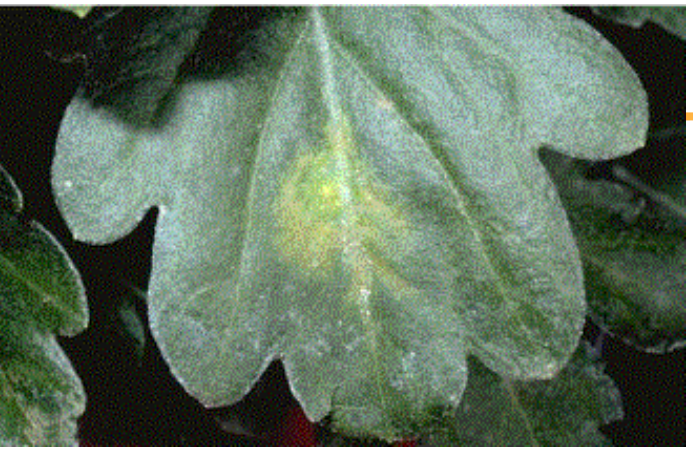
- Frankie Lam, former FA, Plant Entomology, Monterey County
- Bill Chaney, FA emeritus, Plant Entomology, Monterey County
- Local growers
- SFP

Pepper Virus in Central Coast Survey, 2004-2005

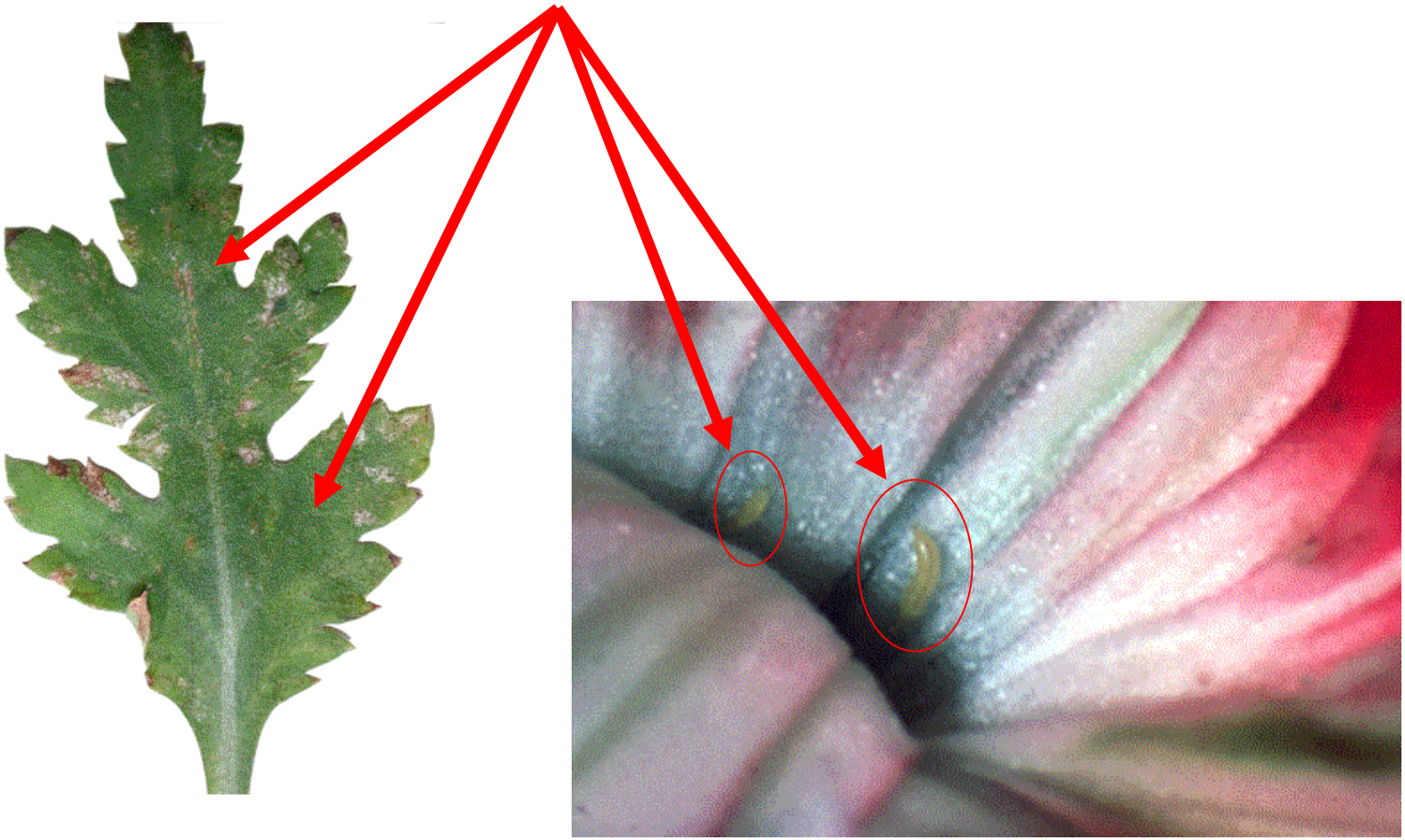
TSWV Stem Necrosis on Mum Plants

1994
Found
In mums.
Mild to severe stem necrosis, wilting of leaves and stems, and chlorotic and/or necrotic spots and rings on some of the leaves

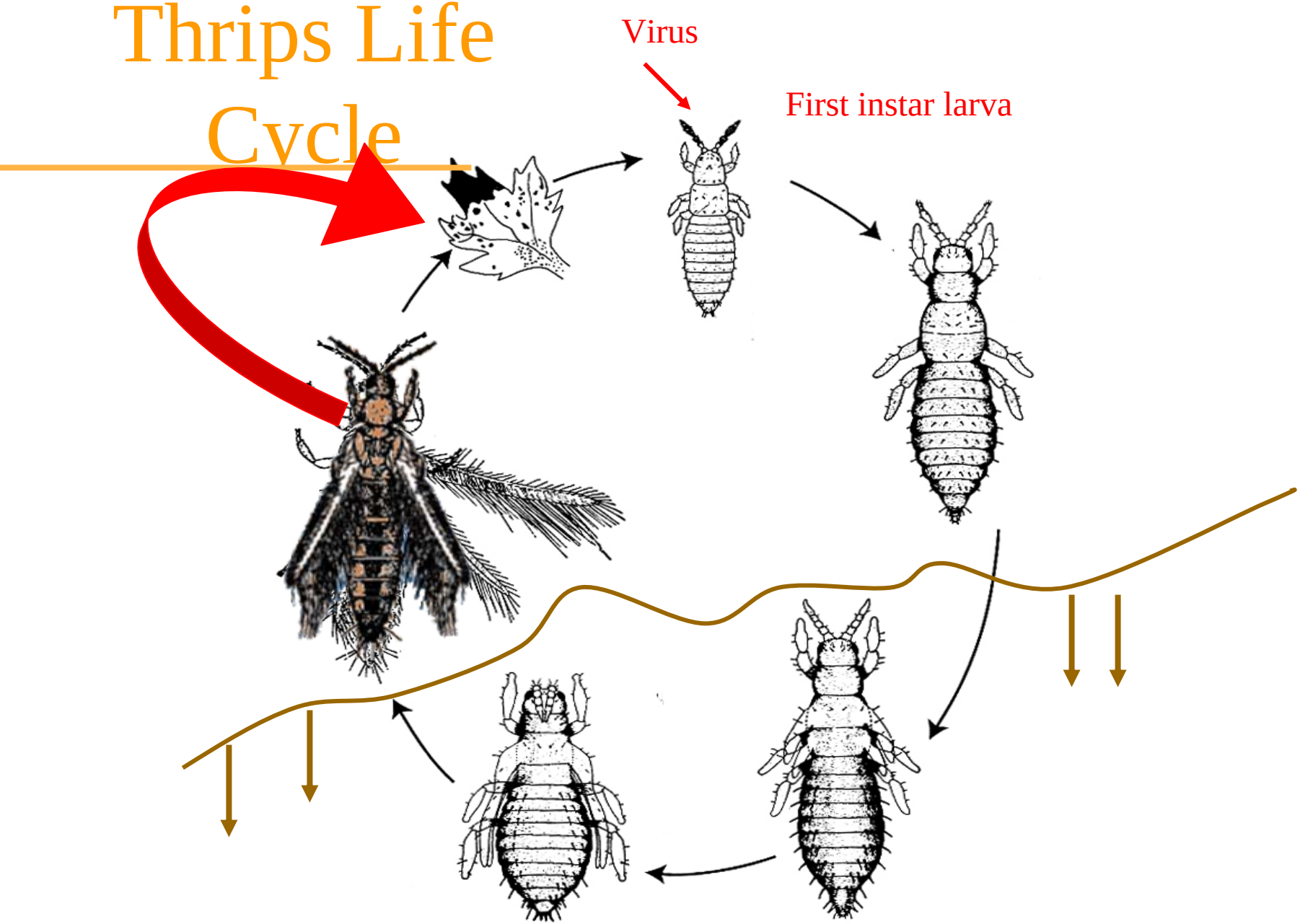
TSWV Foliage Necrosis on Mum Plants



Thrips Damage to Foliage
Hide in Flower Parts



Thrips Life Cycle



Pepper in California is subject to many virus pathogens. The incidence and severity of the various virus diseases can vary greatly from year to year

Pepper Diseases-Central Coast

Bacterial	Fungal	Viral
Bacterial spot	Phytophthora	*Cucumber mosaic virus*
	Powdery mildew	*Tomato spotted wilt virus*
	Southern blight	*Tobacco etch virus*
	Verticillium wilt	*Potato virus Y*
	Gray mold	Alfalfa mosaic virus
	Downy mildew	Tobacco mosaic virus
		Pepper mottle virus

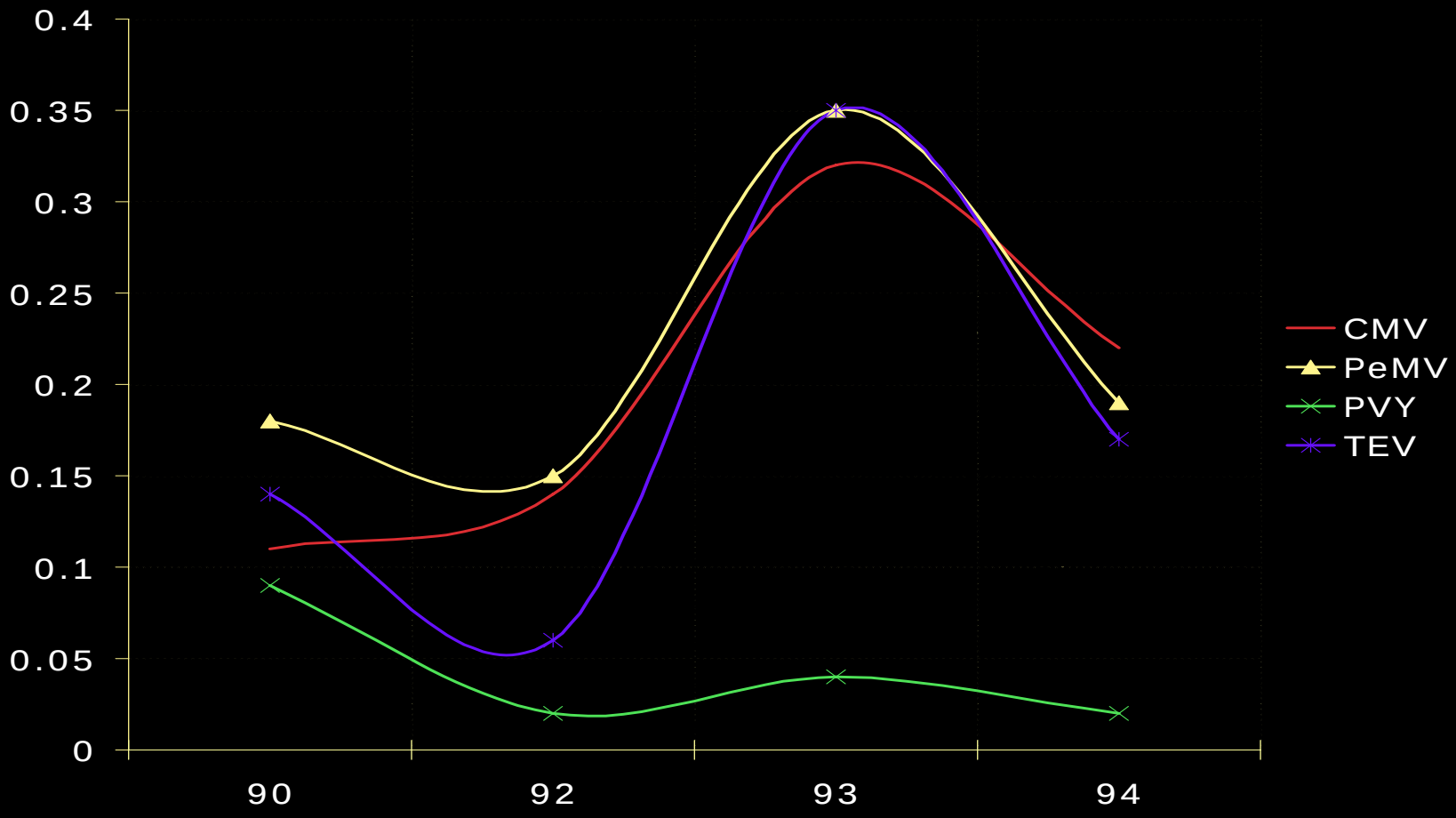
Common Pepper Viruses in California

Pathogen	Acronym	Group	Transmission
Alfalfa mosaic virus	AMV	Alfamovirus	Aphid
Cucumber mosaic virus	CMV	Cucumovirus	Aphid
Pepper mild mottle virus	PMMoV	Tobamovirus	Seed, mechanical
Tobacco mosaic virus	TMV	Tobamovirus	Seed, mechanical
Tomato mosaic virus	ToMV	Tobamovirus	Seed, mechanical
Pepper mottle virus	PepMoV	Potyvirus	Aphid
Potato virus Y	PVY	Potyvirus	Aphid
Tobacco Etch virus	TEV	Potyvirus	Aphid
Tomato spotted wilt virus	TSWV	Tospovirus	Thrips
Beet curly top virus	BCTV	Geminivirus	leafhopper

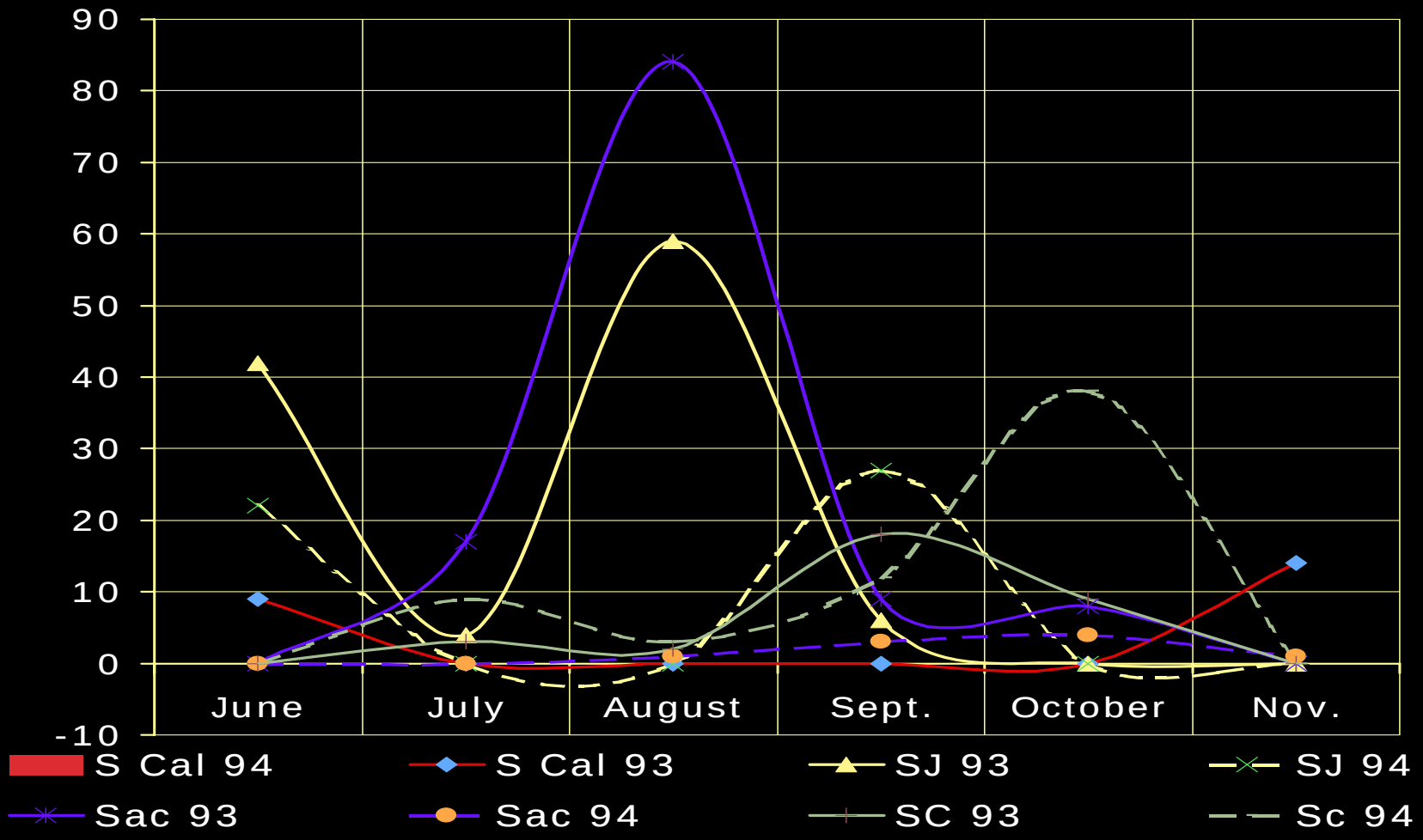
1991-95 Virus Study

Tomato spotted wilt tospovirus (TSWV) occurs worldwide and in many different crops and weeds. TSWV is of great concern in many crops in different locations, but so far its incidence in California peppers seems to be limited. We don't know why this is, but we have encountered TSWV each year, but primarily only near the Gilroy area.

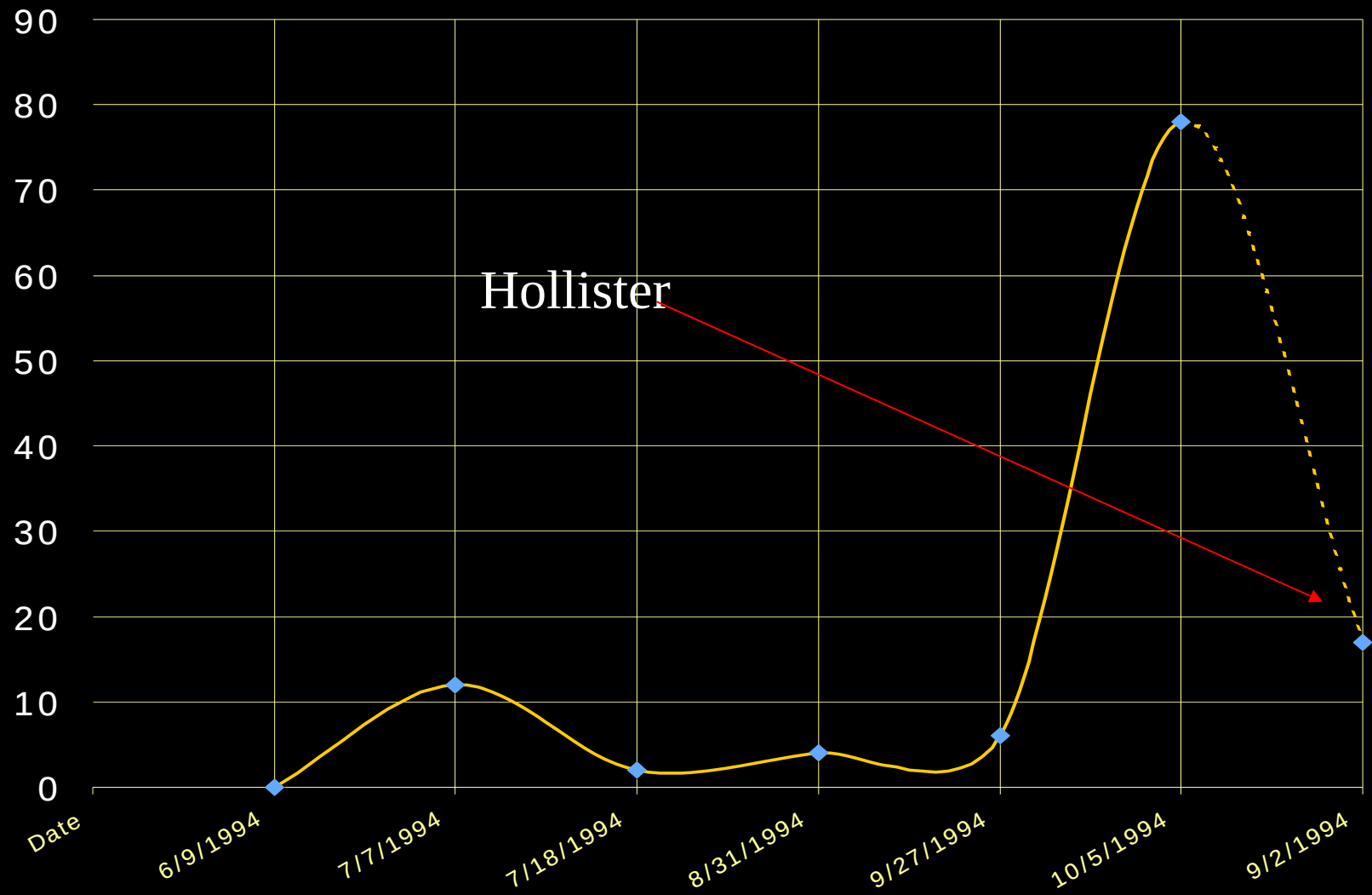
Virus Study in CA 1990-94



Virus Presence by region in 93 & 94 Positive Samples



Virus Frequency in Gilroy Area ‘94



Virus Symptoms

It is difficult to distinguish single or multiple virus infections in the field. Most of these viruses induce degrees of mosaic, mottle, vein banding, and plant stunting. Malformation, leaf cupping, and fruit distortion and/or discoloration may also be encountered. Accurate diagnosis is dependent on laboratory tests involving serology or viral inclusion examination

- In 2004, all collected plants tested positive for one or more viruses.
- 62% of the samples were infected with a single virus and 38% had mixed infections
- TSWV and CMV were the dominant viruses 41% CMV 17%
- For multiple infections, TSWV and CMV accounted for 31% of the cases

’05: 50% of the samples infected

- only two viruses were detected: TSWV and CMV
- single infections accounted for 99% of infections

Other Viruses-2004

- PYV was found in7%
- TEV and PeMV were detected in 3% of the plants.

Common Pepper Viruses in California

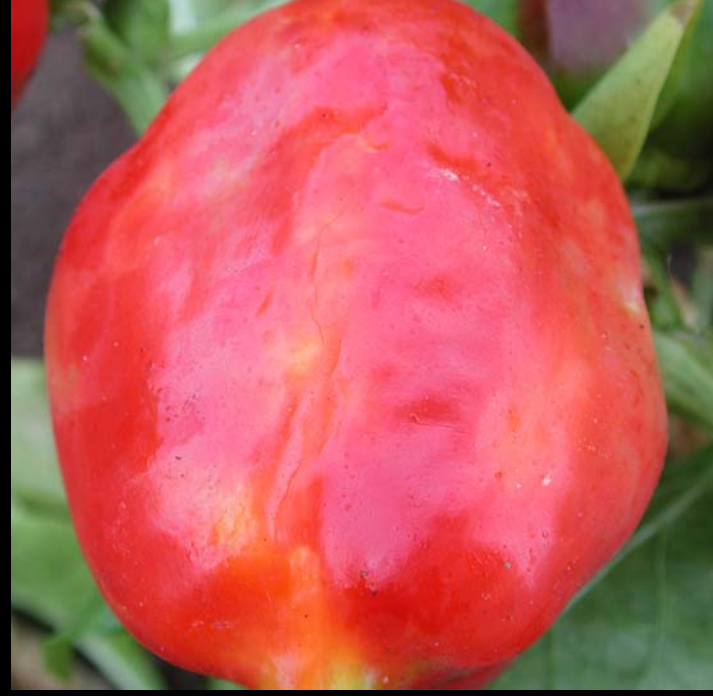
Pathogen	Acronym	Group	Transmission
Alfalfa mosaic virus	AMV	Alfamovirus	Aphid
Cucumber mosaic virus	CMV	Cucumovirus	Aphid
Pepper mild mottle virus	PMMoV	Tobamovirus	Seed, mechanical
Tobacco mosaic virus	TMV	Tobamovirus	Seed, mechanical
Tomato mosaic virus	ToMV	Tobamovirus	Seed, mechanical
Pepper mottle virus	PepMoV	Potyvirus	Aphid
Potato virus Y	PVY	Potyvirus	Aphid
Tobacco Etch virus	TEV	Potyvirus	Aphid
Tomato spotted wilt virus	TSWV	Tospovirus	Thrips
Beet curly top virus	BCTV	Geminivirus	leafhopper

Single Vs. Mixed Infections Central Coast Survey

Season	Single	Mixed	Total	Mixed infections %
2004	18	11	29	38%
2005	50	1	51	1%

Tomato Spotted Wilt Virus-TSWV

Symptoms



–Disfigured fruit

–Raised bumps on chili fruit

Tomato Spotted Wilt Virus-TSWV

Symptoms

- All growth stages affected
  - Stunting
  - Mosaic symptoms: leaf/fruit
  - Sudden Necrosis
  - Stunting
  - Small fruit
  - Fruits show chlorotic spots
  - red and/or green areas surrounded by yellow halos
  - Disfigured fruit
  - Raised bumps on chili fruit

Cucumber Mosaic Virus--CMV

Transmission & Control

Transmission

- Green peach & melon aphids (polyphagous-feed on many plants)
- Mechanical-less than TMV
- Seeds of some weed species

Control

- Sanitation
- Isolation
- Aphid control
- Use of Silver reflective mulch

Weeds susceptible To Cucumber Mosaic

Burr Clover	Chickweed	Clovers (many species)
Groundsel	Lambs Quarter	Mustard, Field
Mustard, Indian	Nettleleaf Goosefoot	Nightshade, Black
Redroot Pigweed and other pig weed species	Shepherd's Purse	Sow Thistle
Sweet Clovers		

Crops/ornamental Hosts of Cucumber Mosaic Virus—CMV 1200 plant species

Beans, Fava	Beans, Snap	Beets
Calendula	Carrot	Celery
Cucurbits	Peas	Peppers
Periwinkle	Petunia	
Radish	Spinach	Tomato
Vetch		

Tomato Spotted Wilt Virus-TSWV

Symptoms

–Disfigured fruit

–Raised bumps on chili fruit

What can be done

- Coordinate actions for vector control-region?
- Scout field frequently
- Test suspects!!
- Sanitation: removal of infected plants
- Alternate control strategies and pesticides
- Avoid resistance induced practices:
  - Avoid mixes
  - Avoid mixes of products w/ similar modes of action
  - Rotate pesticide classes
  - If it works don’t overuse it
- Isolation when possible

Biological Control Anyone?

Thanks!