Pepper Viruses: Survey Update

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INTRODUCTION

California is host to many pepper viruses that continue to create difficulties for growers. They seem to go through cycles of high presence, viral infection, and yield losses alternating with cycles of low-level impact. Growing seasons 2004 and 2005 are among those years where the central coast production area witnessed a high level of virus presence.

The following report is based on a two-year field survey we undertook in the fall of 2004 and 2005 to assess the presence and identify the many viruses infecting fields in Santa Clara and San Benito counties. We focused our effort on the Gilroy and surrounding areas. Gilroy has historically exhibited a variable but sustained presence of viruses over the past two decades.

SURVEY—

The survey included 14 pepper production fields in 2004 and 2005. They included bell and varied chili pepper fields. We collected 29 in 2004 and 50 in 2005.

The sampling was based on selecting symptomatic plants, i.e., those exhibiting some viral symptoms, either on the foliage or/and on the fruit. All samples were catalogued and submitted to a local diagnostic lab for virus identification.

SURVEY RESULTS

Based on visual rating, infection by viruses varied from light (about 5%) to heavy (more than 75%). It varied from field to field and within given fields.

A few fields were severely attacked that it looked very little harvest may have been realized. Some of these may have been infested early in the season (late June early July, 2004). Other fields had patches of severe infection. Every sample collected was infected (sampled only affected plants).

By far tomato spotted wilt virus (TSWV) and cucumber mosaic virus (CMV) were the dominant viruses. In 2004 TSWV was found in 50% of the samples and CMV in 38%. Low-level incidence was recorded for Potato Y Virus, PYV, (5%), and Tobacco Etch Virus, TEV, and Pepper Mottle Virus.

Table 1. Virus Incidence in the surveyed atea, Fall 2004 & 2005

		TMV	TSWV	CMV	PepMoV	PYV	TEV	Total
2004	**#**	1	21	16	1	2	1	42
2004	**%**	2.4%	50.0%	38.1%	2.4%	4.8%	2.4%	--
2005	**#**	--	29	21	--	--	--	50
2005	**%**	--	52.0%	38.0%	--	--	--	

In 2005, similar trends were observed. However, CMV was limited to two locations, while TSWV was found in every location sampled. Of the 50 sub-samples analyzed, TSWV showed up in 52% of the cases. Please consult Table 1 for comparative statistics. The two viruses overlapped in half of the sub-samples where they were both present.

CUCUMOVIRUS – CMV: Cucumber mosaic virus (38% & 32% presence)

Symptoms

Symptoms on plants affected with CMV vary:

- Plants show an overall lighter color with mosaic patterns (alternating light and dark green areas) especially on the younger leaves.
  Often, the main leaf vein is distorted and somewhat zigzag in appearance.

Generally, plants show stunting, leaf curling, and mosaic, and oak leaf patterns.

- Fruit may be malformed and can exhibit conspicuous concentric rings or spots.

Transmission

CMV is transmitted by more than 60 species of aphids. It can also be transmitted by mechanical inoculation and seed.

- Aphid retains virus for only a short time, minutes to hour, a non-persistent manner
- In general, field spread is related to overall aphid activity, not to the presence of colonizing aphids.

Host range

The host range is extensive and covers several crops (beans, beets, carrots, celery, peas, cucurbits, spinach, tomato and pepper), ornamentals (calendula, periwinkle, and petunia), and weed species (chickweed, mustards, nightshade, and pigweed).

Management

No good sources of cucumber mosaic cucumovirus resistance in peppers are currently available. Efforts are underway to develop resistant cultivars that also have commercial fruit quality.

TOSPOVIRUS—TSWV: Tomato spotted wilt virus (50% presence)

For years, TSWV was encountered in the fields in the vicinity of Gilroy, but was secondary to CMV in impact on California pepper industry. Over the last two decades, TSWV presence has been recorded in increasing incidences in the pepper fields in California. In 2004-2005 surveys, over 55% of the samples indicated the presence of this virus.

Pepper fruit with TSWV symptoms (left) and free of symptoms (right).

Symptoms

Infected plants with tomato spotted wilt virus are overall yellowing (chlorosis), stunted with dead (necrotic) spots on leaves or terminal shoots.

Fruits show chlorotic spots, red and/or green areas surrounded by yellow halos, concentric rings that may become necrotic.

Transmission
Tomato spotted wilt tospovirus is transmitted by various species of thrips, Western flower thrips *(Franklinella occidentalis),* and Onion thrips *(Thrips tabaci),* and chili thrips *(Scirtothrips dorsalis).*
Tomato spotted wilt tospovirus also infects the thrips vector.
It is one of the few plant viruses whose host range includes broadleaf and monocot plants (such as onions).

Host range
Tomato spotted wilt tospovirus has an extremely wide host range among plants, including many crops (celery, Cole crops, lettuce, spinach, tomato, and pepper), ornamental (calendula, gerbera, sunflower, petunia, and nasturtium), and weed plants (chickweed, malva, shepherd's purse, purslane. Bindweed, and pigweed) including several greenhouse plants.

Virus Management
No completely effective control strategies are currently available in California. No resistant cultivars are available, but sources of resistance have been identified and may be introduced soon.
TSWV remains a big problem in greenhouse crops
Virus management requires multipoint strategy that would include (a) regular field scouting, (b) weed suppression, (c) sanitation, (d) isolation of production fields, (e) management of insects, (f), and careful use of pesticides to avoid vector resistance buildup. Breeding for resistance is underway, but plants with desirable horticultural traits are not available yet.
Overall, it will take the cooperative efforts of industry, researchers, and enforcement agencies on a regional scale to coordinate vector management and suppression.

Table 2. Viruses Affecting Pepper Plants in California

Virus name	Acronym	Group	Transmission/vector
Alfalfa mosaic virus	AMV	Alfamovirus	Aphid
Cucumber mosaic virus	CMV	Cucumovirus	Aphid
Pepper mild mottle virus	PMMoV	Tobamovirus	See, mechanical
Pepper mottle potyvirus	PeMV	Potyvirus	Aphid
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
Beet western yellows	BWYV	Luteovirus	Aphid (persistent)
Potato leafroll virus	PLRV	Luteovirus	Aphid (persistent)