August 2022

Virus Management: the Heart of the NCPN Mission

I'd like to say virus *eradication* is the heart of the NCPN mission, but scientists are a precise and realistic bunch. So we carefully modulate messages, clarify expectations, and emphasize variables. But new methodologies continue to be explored and the tool kit for mitigating devastating diseases is ever expanding and improving. A new tool in development provides a single source for virus information in an online database. You can access the Beta version by searching on **NCPN Virus Database**. The site, currently hosted by Oregon State University, is still being populated with data provided by experts from each NCPN specialty crop, and the final version is expected to release later this year.

In this issue of *Network News* we highlight some of the pathogens of interest to NCPN crop groups, and provide updates on activities and efforts related to managing the viruses and virus-like pathogens that threaten the economic health of specialty crops in the United States.

NCPN-Fruit Trees: Little Cherry Virus

While there are two species of Little cherry virus, both of which can cause little cherry disease, they are generally discussed in conjunction with a third pathogen that causes X-disease, which results in similarly degraded fruit. Little cherry disease and X-disease are impacting the sweet cherry industry at epidemic levels across Washington State and northern Oregon. These two diseases are caused by Little cherry virus 1 (LChV-1), Little cherry virus 2 (LChV-2), or the X-disease phytoplasma (*Candidatus* Phytoplasma pruni), respectively.

As the name would suggest, these pathogens produce small, undersized cherries, with poor color development and flavor. Disease development occurs over several years, and severity of the disease is influenced by cultivar, climate, and rootstock. Infection of sweet cherry with LChV-1 and -2 results in small fruit with reduced sugar content with little or no flavor. Tree size and vigor are not significantly affected, and there are no reliable foliar symptoms. In contrast to the effects of the two viruses, where fruit have a bitter flavor, fruit from X-disease infected trees generally have a bland taste due to the reduction in sugar content. In addition to fruit symptoms, trees infected with X-disease will have reduced growth and extension of infected limbs, sometimes leading to crowding of leaves into dense clusters and eventual dieback.

All three pathogens are spread by grafting and propagation, including root grafting between neighboring trees. LChV-2 is also transmitted by apple and grape mealybugs. There is no known insect vector for LChV-1. The X-disease is vectored by several leafhopper species. Read More

Scouting and disease management can be difficult, but WSU has an app for help with in-field symptom and vector identification:

https://apps.apple.com/ca/app/little-cherry-virus-guide/id1564799119
https://play.google.com/store/apps/details?id=com.csekcreative.littlecherryvirusguide

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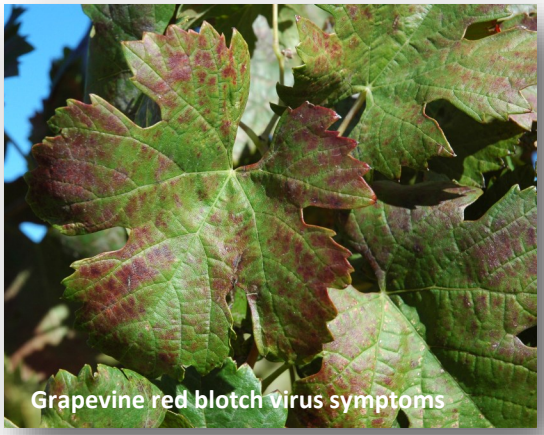
NCPN-Grapes: Grapevine Red Blotch Virus


Grapevine red blotch virus symptoms

While first detected in Napa Valley in 2008, subsequent research indicates that grapevine red blotch virus (GRBV) has been present since at least the 1940s and has been found in many wine production regions in the U.S. Costs of grapevine red blotch disease were estimated to be as high as $1,100/acre/year (2015 dollars), or about $68,548 per hectare over a 25-year lifespan of a Napa Valley, CA vineyard with high initial infection. Red Blotch symptoms vary between cultivars but are characterized by red blotchy leaves in red varietals. Like other viruses, there is no cure, but microshoot tip therapy is proving effective for producing propagative material free of the pathogen.

Red blotch disease consistently reduces sugar accumulation, increases malic acid, may delay fruit ripening and results in lower yield. It is believed that GRBV was initially spread through propagation of infected material; it now appears that the pathogen is also vectored by insects, specifically the three-cornered alfalfa hopper. For more information, read the NCPN Fact Sheet on Grapevine Red Blotch Virus

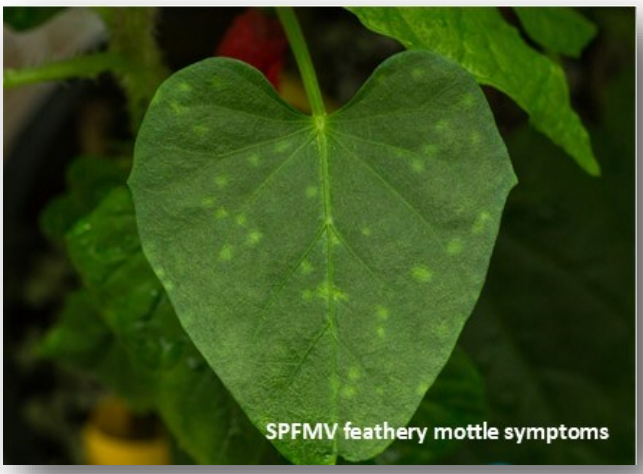
Foundation Plant Services is Building a New Greenhouse to Protect U.S. Grapevine Collection

A new, $5.25 million greenhouse is being built on the University of California, Davis, campus to safeguard the Foundation Plant Services (FPS) foundation (G1) grapevine collection from red blotch disease and other pathogens. FPS provides the grape industry with high-quality, virus-tested grapevine plant material, supplying the majority of grapevines planted in the U.S. For the grape industry, it is essential to protect this material from disease-carrying insects and guarantee fast access to clean plant material.

Read more here

NCPN-Sweetpotato: The Most Common Virus Diseases

Virus diseases are one of the most important production constraints facing sweetpotato producers. In the US, four viruses are common; each is very similar to the most common, Sweetpotato feathery mottle virus (SPFMV). Yield, skin color, shape and quality of storage roots can be greatly reduced when sweetpotatoes become infected with these viruses. Yield reductions can exceed 40%, and cracks may develop in the roots making them unmarketable. Often 100% of plants in a field are infected by the end of one growing season. Many sweetpotato viruses are vectored by aphids and whiteflies. These insects can be carried on machinery and the wind, and are responsible for spreading viruses both short and long distances.

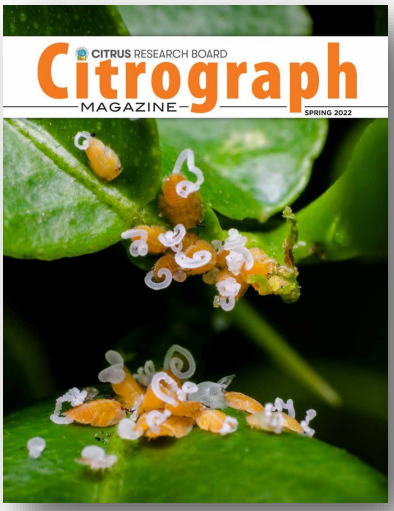

SPFMV feathery mottle symptoms

The potyvirus, Sweetpotato feathery mottle virus (SPFMV is found worldwide wherever sweetpotatoes are grown. In the 1990s, the Russet--Crack strain of SPFMV (SPFMV-RC) reduced yield up to 50% in affected fields in North Carolina.

NCPN-Citrus: Huanglongbing

Also known as citrus greening, Huanglongbing (HLB) is by far the most serious threat to the citrus industry worldwide. It is currently jeopardizing the commercial viability of the citrus industry in the United States.

HLB-infected trees become unproductive within 2 to 4 years after the onset of the disease and young trees that become infected typically do not reach a productive age. There is no cure and all types of citrus and cultivars are affected: oranges, lemons, grapefruit, mandarins, tangerines and others. At its current rate of spread and impact on the economics of citrus production, HLB could destroy the U.S. citrus industry in our lifetimes.



Like many other plant diseases, HLB is spread by humans importing plants or plant parts illegally from abroad. Once established, the disease is naturally spread by an insect known as the Asian citrus psyllid (ACP) and can also be transmitted through grafting. To prevent the spread of this, and other potentially devastating diseases, it is essential to source clean or pathogen-tested budwood for citrus tree planting and propagation.

It is also incredibly important to remove trees that have tested positive for HLB. Every infected tree has the potential to spread the disease to healthy trees, increasing the spread of the disease within and across citrus orchards and residential properties.

Read more about HLB in the latest issue of *Citrograph*

NCPN-Hops: Hop Stunt Viroid

HSVd or hop stunt viroid is a pathogen impacting yields worldwide. Not only does it stunt growth and reduce yields, but it is also easily transmissible between plants.


Hop stunt viroid symptoms

The viroid spreads when an infected plant is introduced to a field. Once there, it can infect other plants through sap transfers. Replacing all potentially infected plants is the only known way to prevent further HSVd infections as it cannot be treated.

The type and severity of symptoms produced by hop stunt viroid is dependent on the hop cultivar infected, and environmental conditions. This viroid delays or slows the growth of bines early in the growing season, and infected plants often have pale foliage. Later in the season the effect is more pronounced with the infected bines being up to 50% shorter than healthy bines, although the extent of stunting is cultivar specific and more severe in hot climates. Infected bines also have smaller cone mass and shorter lateral branches. In some cultivars, infected leaves may droop or curl downwards or show yellow speckling around the leaf veins. Symptoms may take three to five growing seasons to appear after the initial infection of mature plants, and this long latency period can lead to the propagation and distribution of infected material.

Economic benefits of HSVd-free plants, a joint NCPN-WSU effort:
https://journals.ashs.org/hortsci/view/journals/hortsci/56/12/article-p1471.xml

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NCPN-Roses: Rose Rosette Virus

While there are several known viruses that are harmful to roses, Rose rosette virus (RRV) is particularly concerning because it can spread quickly and poses a threat not only to other plants nearby, but now threatens to decimate the U.S. rose industry. RRV is transmitted by a wind-blown eriophyid mite (*Phyllocoptes fructiphilus*). Rose rosette disease (RRD) is a debilitating disease of rose plants caused by the virus. Unlike other rose diseases, RRD can result in death of rose plantings within two to three years of infection and has devastated roses in several key botanical gardens and many large public and private gardens. RRD has emerged as a major threat for U.S. rose growers, landscapers and consumers east of the Rockies.

Because there is no cure, early detection and removal of infected roses is the best way to reduce the spread and impact of this disease. When removing the infected plant, bag it before cutting the plant down or quickly place the cut plant material in a trash bag to help isolate and prevent the eriophyid mite vectors from escaping. If a plant that is affected by rose rosette disease is ignored, it can serve as a virus reservoir, allowing the disease to be transmitted to other roses.

Read more: Rose Rosette Disease Demystified

Symptoms for RRD include abnormal reddening of leaves and stems, unusual and rubbery thorns, excessive thorniness, deformed leaves, and witches' broom.

(Photo courtesy of Dr. Mark Windham, Ornamental Pathology, University of Tennessee)

NCPN-Berries: Blueberry Scorch Virus

Blueberry scorch virus (BlScV) has been detected in the U.S. in the states of Connecticut, Massachusetts, Michigan, New Jersey, New York, Oregon, and Washington.

Depending on virus strain and cultivar, symptoms vary from asymptomatic to severe blighting of flowers, young leaves and twig dieback. In addition, leaves of infected bushes on some cultivars may show marginal chlorosis or a red line pattern in late summer and fall. Plants with severe blighting bear little or no fruit and take on a scorched appearance. Virus infections can be latent for many years, depending on cultivar, and severity of expression can vary from year to year. Affected bushes of some cultivars can be productive for many years, whereas others decline quickly over a few years and eventually die. This variation in symptom expression has made field diagnosis difficult and growers are reluctant to remove infected bushes that still bear fruit.

BlScV usually spreads slowly in the field due to the inefficient nature of the virus transmission by aphids. At low levels of infection, detection combined with plant removal can greatly limit the rate of virus spread. The most important control measure is to start with BlScV-free planting stock.