Vineyard & Winery Management

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Water Issues

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Canker Disease Update

New Strategies Sought for Grapevine Canker Disease Management

Researchers aim to develop new tools for early detection and prevention

Common grapevine canker disease symptoms are a wedge-shaped area in a crosscut section of diseased vine wood. Photo: Ted Rieger

BY TED **RIEGER**,
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Wood canker diseases, trunk diseases and Eutypa dieback are descriptions for fungal infections of the permanent woody parts of a grapevine that lead to declines in vine production and health, and can lead to vine death. A major focus of a current research project is to develop new tools for early canker-disease detection in vineyards, and to prevent disease infection and spread in young vineyards.

Canker diseases occur in grape-growing regions worldwide, but they are bigger problems in Mediterranean climates, where the vine woody structure remains many years without freeze damage. Canker diseases can be caused by one or more fungal pathogens. More than 20 canker-disease fungal species are found in California; the five most common and aggressive species, and their diseases, are: *Eutypa lata* (Eutypa dieback); *Togninia minima* (Esca, or measles); *Phaeominiella chlamydospora* (Esca); *Neofusicossum parvum* (Botryosphaeria dieback, or Bot canker); and *Phomopsis viticola* (Phomopsis dieback).

Annual economic yield losses in California vineyards from Eutypa and Botryosphaeria are widely reported at 14% of the gross producer value. Shortened vine and vineyard lifespans result in economic losses with more frequent replacement costs.

Infection occurs primarily on pruning wounds resulting from fungal spore contact. Broken or damaged vine parts can also be infected. After wood colonization by *Eutypa lata*, a canker forms near the infected pruning wound. Cross sections of infected spurs, cordons or trunks show dark wedges or pie-shaped areas of rotted wood. Foliar infection symptoms can appear as stunted shoots with small, cupped, chlorotic and tattered leaves from late April into May. Flowers on these shoots do not develop clusters. Eutypa foliar symptoms can take a long time to develop: three to eight years after infection. Bot canker also causes wedge-shaped

cankers on cross sections, but no foliar symptoms. Bot canker is a major cause of vine arm and cordon death in California, and is prevalent in southern San Joaquin Valley.

Growers commonly wait until they see disease symptoms before initiating management, which is often too late to prevent further spread and vine loss. At this stage, management may require vine surgery: removal of dead spurs or cordons, and sometimes retraining suckers or live vine parts to maintain grape production.

Dr. Kendra Baumgartner of the USDA Agricultural Research Service at UC Davis is the lead researcher on a major project, "New Detection, Research, and Extension Tools for Managing Wood Canker Diseases," funded by a grant from the USDA Specialty Crop Research Initiative. "In the field we find mixtures of these trunk diseases and pathogens; it's rare we find just one type," she said.

Canker pathogens require rain to trigger ascospore release from fruiting bodies (perithecia) that grow on diseased wood. Research indicates that Eutypa spore production can occur in areas with annual rainfall of 13.5 inches or more. Spore release can occur with a minimum rainfall event of 0.08 inches. In Northern California, Eutypa spores are primarily produced in infected vineyards, in apricot and cherry orchards, and less commonly in pear, apple and almond orchards.

Eutypa spores can be carried by wind over long distances from diseased vineyards and orchards, or from native host plants. Spores from species that cause Esca, Bot canker, or Phomopsis dieback are splash-dispersed by rain drops and travel only a few feet when released, but wind-driven rain can carry these spores farther.

Researcher and plant pathologist Kendra Baumgartner holds a glass microscope slide used to collect fungal spores in a cabernet sauvignon vineyard in Lodi, Calif. Photo: Ted Rieger

SPORE TRAPPING STUDY

Researchers began a spore-trapping study in December 2013 at six cabernet sauvignon vineyards in Napa Valley and six in Lodi. Trapping sites represent a range of vine ages, including mature vineyards planted from 1996-2000 and younger vineyards planted from 2008-2011. "We assume any vineyard 8 years old or more will have some type of trunk disease," Baumgartner said.

Two types of spore collection tools were placed at each site. One, a low-tech but proven method, uses glass microscope slides attached to vines in the cordon area to catch fungal spores dispersed by rainwater splash. The second is a solar-powered spore trap with a spinning rod to catch airborne spores. The latter traps have proved effective for monitoring powdery mildew spores in vineyards during the growing season (*see May/June 2013 issue of V&WM, page 64*), but their use for canker spores is being tested with this study. Researchers collected sample slides and spore rods at each site (one to three times a month after a rain) from December through February, and developed high-throughput polymerase chain reaction lab analyses to identify fungal species present and track population trends.

AT A GLANCE

- Grapevine canker (or trunk) diseases occur when fungal spores infect pruning wounds.
- The diseases of most concern in California are Eutypa dieback, Esca, Botryosphaeria dieback and Phomopsis dieback.
- Grapevine canker diseases can be prevented and managed with late pruning, double pruning and applying protectants to pruning wounds.
- Researchers are testing fungal spore traps, and developing genetic-based analytical tools for early detection in vineyards.

This spore trap, set in a cabernet sauvignon vineyard in Lodi, Calif., has a solar-powered spinning rod to catch airborne Eutypa spores. Photo: Ted Rieger

"Spore traps could be useful in both young vineyards and in established vineyards to help growers decide when to start, and what years they need to use preventive practices, based on the presence of spores, to achieve the best economic management, and to maintain long-term vineyard production," Baumgartner explained.

GENETIC-BASED EARLY DETECTION

Another project goal is to develop a plant-based detection tool to analyze healthy vine leaves with no symptoms for grape genes or a molecular signature associated with fungal infection. Baumgartner said, "We're looking for the presence of genes that may produce antibodies or proteins to fight fungal disease that occur before the disease starts spreading."

Dr. Grant Cramer of the University of Nevada in Reno is working to identify genomic traits as indicators of vine infection and susceptibility that can be used for analytical testing. The reason for looking at genetic disease signatures in leaves is that they can be more easily collected by growers and ground up for lab testing than woody vine parts. "As with developing an early detection tool with spore trapping, this genetic detection tool must be technically and economically feasible for growers and for diagnostic labs," Baumgartner explained.

This tool would also benefit grapevine nurseries and clean-

stock programs that have no convenient detection tests for early-stage fungal infections, and are not required to test for fungal diseases under the California Grapevine Registration & Certification Program.

INFECTION PREVENTION

Baumgartner and UC Davis plant pathologist Dr. Doug Gubler, an expert on grapevine fungal pathogens and management, have conducted regional California grower meetings in recent months to provide updates on trunk diseases. Effective prevention management options are late pruning, double pruning and applying a fungicide/barrier on pruning cuts. Researchers advise growers to begin prevention measures early in young vineyards – when the vines are pruned for the first time – and continue these practices every year. Using vine-training systems that minimize the number of required pruning cuts is an option that can reduce the chance of infection. "The bigger the wound, the better the chance of spore infection, but it can occur on any size wound," Gubler noted.

Late dormant-season pruning can also provide benefits. "The earlier in the dormant season pruning wounds are made, the more susceptible they are to infection," he said. Most fungal species release spores following the first dormant-season rain, and after rains throughout winter and early spring. A preventive practice is to make pruning cuts at an angle (rather than horizontally flat) so moisture (and spores) drain off the wound surface instead of pooling in place.

"Later in the season (late February to early March) the vine starts to produce acids that help prevent infection," Gubler said. "Rains can occur in February and March, but vines are not as susceptible because wound healing is speeded up as temperatures increase." If late-season pruning cuts "bleed" uniformly, the chance of infection is greatly reduced.

Based on lab studies, the time period of susceptibility to infection can differ by fungal species. "After six weeks, a pruning wound is less susceptible to infection from Eutypa, but for *Botryosphaeria* it can be 10-12 weeks, and for *Phaeomoniella* it can be up to 16 weeks," Gubler said. "Decreasing susceptibility over the dormant season is real, and we can use this fact in our disease control."

Double pruning involves an early-season pruning to remove the bulk of pruning vegetation (commonly with mechanized vine-hedging in larger vineyards). This is followed later in the season with a more detailed and final hand-pruning that removes wood below the

first pruning cut that may have contacted spores.

If left in place, canker diseases move down the vine toward the trunk. This movement occurs at different rates, depending on the pathogen. Gubler said Eutypa can move up to 2 inches per year, whereas Bot can move 5-7 inches per year.

Vineyard sanitation is also important. Deadwood cut from vines and prunings that can be infected if left on the ground, should be removed so they do not harbor fruiting bodies that produce spores.

PRUNING WOUND PROTECTANTS

If a grower must start pruning in December due to large acreage or labor scheduling, applying a pruning-wound protectant right after pruning or prior to the next rain can be a good control option. "Topsim M has shown to be an effective pruning-wound fungicide over the most species," Gubler said. "We recommend a solution of Topsin M plus Rally to provide two modes of fungicidal action." One drawback of these fungicides is that they may only be effective two weeks, or until the next rain, and may need to be reapplied until the wounds heal.

A newer product registered for organic use that can protect up to three months is Safecoat VitiSeal, a water-based sealer with natural plant oils that creates a barrier to block pathogens from entering the wood. Several North Coast growers use this product, hand-applied by daubing it onto pruning wounds by a worker who follows a hand-pruning crew. VitiSeal and other wound protectants can also be applied by hand- or tractor-sprayer.

"With these diseases, you can either spend money up front, or at the end," Gubler summarized. "If you spend it up front, your vineyard will have a longer life."

Another aspect of the USDA project is an evaluation of the long-term cost-effectiveness of the different prevention practices, and the potential of early-detection tests to give growers economic information to make management decisions.

This vine shows pruning wounds and cut cordon painted with Safecoat VitiSeal, which protects pruning wounds from fungal infection. Photo: Ted Rieger

VARIETY SUSCEPTIBILITY

All grape varieties are susceptible to canker diseases, but some can be more susceptible than others. Based on anecdotal field observations, varieties considered more susceptible to Eutypa are cabernet sauvignon, syrah, pinot noir, chardonnay, riesling, sauvignon blanc and chenin blanc.

Baumgartner and other researchers looked at canker formation susceptibility in a lab and greenhouse study with cabernet franc, cabernet sauvignon, chardonnay, merlot, riesling, petite sirah, Thompson seedless and Concord from seven trunk pathogens. Thompson seedless was found to be more susceptible to Eutypa and Phomopsis; the six vinifera varieties and Concord did not vary significantly in susceptibility to Eutypa, Bot canker and Esca.

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