Grapes 101

How important are grapevine trunk diseases in New York?

By Janet van Zoeren and Tim Martinson

Ed. Note: Professor José Ramón Úrbez-Torres of Agriculture and Agri-Food Canada, an expert in grapevine trunk diseases, recently presented a Northern Grapes Webinar entitled "Grapevine trunk diseases: The fungi that cause them, how they develop and spread, and how they are managed". The following article is based largely on his presentation. We would also like to thank Professor Úrbez-Torres for all of the photographs in this article.

"Dead arm" is a common symptom of some trunk diseases. Photo courtesy of José Ramón Úrbez-Torres.

While New York growers spend a great deal of time thinking about and managing the five major fungal pathogens (Powdery Mildew, Downy Mildew, Black Rot, Phomopsis, and *Botrytis*), those associated with trunk diseases have received less consistent attention. The reason for this is simple: the 'big five' foliar and fruit pathogens can destroy, reduce or render unmarketable a crop rapidly in one growing season.

Trunk diseases, on the other hand, spread slowly, are sometimes difficult to detect and result in general, non-specific symptoms like blind buds, dead cordons or 'dead arm' – or ultimately, missing vines. They do not pose an immediate threat, but over time their presence can gradually expand to rob a vineyard of its productivity.

Although grapevine trunk diseases (GTD) have been around for a long time, there has been a recent surge in the number of vineyards reported to be affected by these diseases, and a corresponding increase in research and understanding of their complexity. In 2000, 15 species of fungi from 10 genera were known to be associated with GTDs, but by 2019, researchers had identified 133 different species from 34 genera.

Grapevine trunk disease symptoms include 'dead arm' and cankers. Photo courtesy of José Ramón Úrbez-Torres.

In the Northeast, two surveys (Stewart 2004, Rolshausen & Kiyomoto 2007) identified several trunk pathogens in Pennsylvania, New York and New England vineyards. However, the extent of diseased vines and relative economic impact of GTDs in the northeast is not well understood.

Symptoms

GTDs consist of several disease complexes, each of which is caused by several to many fungal species. They affect the mature wood and vascular tissues of the vine, and often the first visual symptom is foliar die-back and general decline in vine vigor. They often form cankers within trunks and cordons that discolor discrete 'pie-shaped' sections in permanent wood. The most common GTDs found in New York include Eutypa dieback, Phomopsis canker and Botryosphaeria canker.

Eutypa foliar symptoms include yellowing and cupping leaves and short internodes. Photo courtesy of José Ramón Úrbez-Torres.

Eutypa dieback is the GTD most commonly recognized in New York state, and among the most commonly detected in the limited surveys that have been conducted. It's caused by the fungal pathogen *Eutypa lata*, along with other closely related species. Although the rate of Eutypa infection in NY is not known, in British Columbia around 10% of vines are infected. Furthermore, vineyards in Washington state with the worst severity of Eutypa had over 90% yield loss (Johnson and Lunden 1987).

Externally visible symptoms of Eutypa include leaf cupping and chlorosis (yellowing of leaf tissue), stunted deformed shoots looking somewhat like those with Roundup injury, berries ripening slowly or unevenly, dead nodes, and/or dead arms. These shoot symptoms (caused by a toxin produced by the Eutypa fungi) are diagnostic for this disease, as they are not produced by any of the other canker-forming fungi. Internally, symptoms include a wedge-shaped dark staining in areas of the wood, which is found with all of the other trunk canker diseases as well. As the disease progresses, there may be flattened cankers with no bark. See the NY state fruit IPM factsheet: "Eutypa dieback" for more information.

Phomopsis dieback (caused by the fungus *Phomopsis viticola*) was identified at Cornell in the early 1900s, and was called "dead arm" at that time. By the 1970's, research indicated that this "dead arm" disease was actually caused by the *Eutypa* fungi, with symptoms as described above. In contrast, symptoms caused by the Phomopsis fungus were then thought to be confined to lesions on current-year shoots and leaves ("cane and leaf spot", which most growers are familiar with), and in severe cases infections of cluster stems and berries, which are seen most commonly in native grape plantings. In recent years, it has been determined that the same Phomopsis fungus can also cause the collection of symptoms typical of all the canker diseases: wedge-shaped cankers and wood staining, dead canes, and dead ("blind") nodes with no growth arising from them. Not surprisingly, these Phomopsis dieback symptoms are often seen on vines with Phomopsis cane and leaf spot. See the NY state fruit IPM factsheet: "Phomopsis Cane and Leaf Spot of Grape" for more information on that phase of the disease.

Phomopsis pycnidia. Photo courtesy of José Ramón Úrbez-Torres.

***Botryosphaeria* dieback** was distinguished as being caused by different pathogens than Phomopsis or Eutypa in the 1960s, although its widespread scope of occurrence has only been recognized more recently. This single name is now given to a disease complex caused by a number of fungi in the Botryosphaeriaceae family, which are common throughout the viticultural world, including NY and surrounding regions. General symptoms are very similar to those of Phomopsis dieback, including cankers and wood staining, dead canes and missing nodes. Spore-containing fruiting bodies may emerge from infected wood.

Other Pathogens. Other diseases caused by trunk pathogens include young vine decline, Black Foot, Petri disease, and Esca.

Pathogen Biology

GTDs infect plants through any opening (most commonly through pruning wounds). Avoiding these wounds is not possible, so prevention mainly focuses on sanitation and the timing and methods of pruning.

Inoculum sources are difficult to remove altogether, since many of the GTD species are also found in nearby woody hosts (for example, *Eutypa* is found in over 80 plant species). Some of these pathogens can also be present but asymptomatic in grape vines in a vineyard, and only exhibit symptoms following stress events, such as drought, winter injury, trunk splitting, etc. Nevertheless, removal–and ideally, destruction–of dead and diseased wood is a practical means of limiting the levels of inoculum available to spread these diseases within a vineyard.

The timing of spore dispersal and how long wounds remain open to infection after pruning have been the focus of recent research. Spore dispersal and tissue infections generally happen when there is high humidity or rainfall and temperatures are above freezing. In general, wounds are most susceptible to inoculation at the time of pruning, with susceptibility decreasing over the weeks/months that follow. However, both of these factors are region and climate dependent.

For example, research in California has shown that most spores in that state are released by midwinter, with peak periods associated with winter rainfall. Late pruning can decrease infection rates by opening the wounds during the dry period in the spring and summer, when *Botrysphaeria* and *Eutypa* are unlikely to spread inoculum. Conversely, in British Columbia, early pruning decreases infection because wounds heal before spores are released in the spring.

Management

Prevention

Pruning practices. Dead tissue on cordons and trunks is a source of new inoculum, so eliminating dead tissue from cordons and trunks before they release new spores will provide some control. This is admittedly a challenge in mechanically-pruned bulk varieties. Regular, systematic trunk renewal to replace weak or diseased trunks also will limit the spread of the disease while also reducing their economic impact, by increasing the supply of healthy fruiting wood.

In our humid, cool-climate region, delayed pruning (as recommended in arid California production regions) may not be the best choice for preventing new infections. Research in Michigan's similar climate suggested that *Eutypa* spores are generally released in March through May during periods when the temperatures are above 40°F. Mid-winter pruning might provide more time for pruning wounds to heal and resist new infections.

Sanitation includes burning, burying, mulching, or composting all infected wood and pruning materials. Because even symptomless prunings can harbor the pathogens, removing and burning or composting them will prevent them from

releasing spores in the vineyard. But even chopping brush and allowing it to decompose in row middles is preferable to having dead wood within the canopy.

Pruning protectants, such as paints and pastes, are manually applied to pruning wounds at the time of dormant pruning. They can be effective, especially when combined with a fungicide. However, they are also time- and labor-intensive, and multiple applications may be required to provide control throughout the entire period of susceptibility.

More recently, pruning protectant sprays applied with standard sprayers have been shown in California and Australia to be effective against some of the pathogens responsible for GTDs. No trials have been conducted in New York, but there is currently a New York DEC-approved special local need label for the use of thiophanate-methyl (Topsin-M) for pruning paints/pastes or sprays to control *Eutypa* and *Botryosphaeria.* Mettle (tetraconaole, a Group 3 DMI fungicide) also has an EPA registration approved in most states (including NY) for post-pruning spray applications to control these diseases.

Post-infection

Trunk renewal can completely remove the infected tissue. To be effective, all wood showing any staining must be removed, including an extra 5-10 inches of apparently healthy wood below the canker. Inn Australia, a study suggested that removing all trunks in an entire vineyard block 10-15 inches above the graft union provided the most consistent long-term results.

Internal wood staining. Photo courtesy of José Ramón Úrbez-Torres.

Some factors specific to Northern climates

- Re-training due to winter injury may decrease GTD prevalence, as vines are often replaced before cankers have time to affect vine health.

- Due to the huge array of potential pathogens, ALL cultivars are susceptible to at least some of them. In our growing region, there is no cultivar that is known to be completely resistant to all trunk diseases.
- Freezing injury may make it easier for GTD pathogens to cause symptomatic infections. For example, in a study done in peaches, Cytospora (which also can be pathogenic in grapes) incidence was higher following tissue freezing. A hypothesis is that the cell destruction due to freezing allows greater pathogen colonization.
- There is a need for more studies on how winter injury interacts with GTD development, efficacy and economics of using pruning protectants, timing of infection, and on the best time to prune in our region.

The Takeaway

GTD fungal species and life cycles are complex and variable. Management options are region and climate specific – and largely untested in the northeast. It's likely that many growers – particularly those with older vineyards – are losing significant amounts of yield to dead arms and trunks associated with GTDs. Younger vineyards are less likely to be severely affected, but are posed to see an increase in symptoms and economic impact as they age. Beyond removal of infected wood, management options are limited or prohibitively expensive (manual pruning wound painting). More research is needed to define the relative importance and economic impact of these pathogens, and to test and validate improved management options for growers.

Further reading:

Gramaje, D., Úrbez-Torres, J.R., and M.R. Sosnowski. 2018. *Managing grapevine trunk diseases with respect to etiology and epidemiology: current strategies and future prospects*. Plant Disease, 102(1), 12-39.

Johnson, D.A. and J.D. Lunden. 1987. *Incidence and yield impact of Eutypa dieback of grapevine in Washington State.* Research Bulletin - Agricultural Research Center, Washington State University.

Pearson, R.C. and T.J. Burr. 1981. *Eutypa dieback*. NY state fruit IPM factsheet #1.

Pscheidt, J.W. and R.C. Pearson. 1991. *Phomopsis Cane and Leaf Spot of Grape*. NY state fruit IPM factsheet #6.

Stewart, Elwin L. and Nancy G. Wenner. 2004. Grapevine decline in Pennsylvania and New York. *Wine East* July-August:12-21,51-53.

Rohlshausen, P. and R. Kiyomoto. 2007. The Status of Grapevine Trunk Diseases in the Northeastern United States. Proceedings of the New England Vegetable and Fruit Conference. https://newenglandvfc.org/

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