

GRAPEVINE CANKER DISEASES:

Causal organisms, infections and current management strategies

Grapevine fungal pathogens

Several unrelated groups of Ascomycete fungi cause trunk diseases in grapevines. These include: (i) Species in the Diatrypaceae family including *Eutypa lata* the causal agent of **Eutypa dieback**; (ii) Species in the Botryosphaeriaceae including *Botryosphaeria dothidea*, *Lasiodiplodia theobromae*, *Diplodia seriata*, *D. mutila*, *D. corticola*, *Dothiorella iberica*, *D. viticola*, *Neofusicoccum parvum*, *N. australe*, *N. luteum*, *N. vitifusiforme*, and *N. viticlavatum*. Species of Botryosphaeriaceae have been reported to cause different grapevine diseases including **Bot canker**, **black dead arm**, and **Macrophoma rot**; (iii) Species in the Togniniaceae including *Togninia minima*, *Phaeacremonium angustius* (*Pm. angustius*), *Pm. mortoniae*, *Pm. viticola*, and *Pm. parasiticum*; (iv) One species in the Herpotrichiellaceae, *Phaeoconiella chlamydospora* (*Pa. chlamydospora*); and (v) One species in the Pleurostomataceae *Pleurostromophora richardsiae* (*Pl. richardsiae*). *Pa. chlamydospora*, *T. minima* and many species of *Phaeoacremonium* are the causal agents of **esca** or **black measles** and **Petri disease**. This list of fungi is certainly not exhaustive as additional species are continually being associated with wood cankers and branch dieback worldwide.

Grapevine Infections

Infection of grapevines by fungal pathogens primarily **occurs through pruning wounds**. Fungal spores (sexual and asexual) become airborne during and following rain and come in contact and colonize exposed wood vessels. Grapevines have the highest risk of infection during the pruning period, from late fall to early spring, due to the high number of wounds made on a single grapevine, and the number of rain events that occur during that period of time.

Grapevine **wounds remain susceptible** to infection by these fungi **for several weeks**. Plugging of the xylem and phloem elements and decay of the wood follows infection, impairing movement of water and nutrients, and leading to the decline of the grapevine. **Each grapevine can become infected multiple times with one or more pathogens** and it is common to isolate several pathogens from old cankers. Therefore, trunk diseases should be regarded as a complex of pathogens. For these reasons, **it is sometimes difficult to associate one type of symptom with a single pathogen**. **Esca symptoms** include the presence of brown to black spots or streaks in the xylem vessels, 'tiger-striped' chlorotic and necrotic patterns on leaves and the formation of necrotic spots or 'measles' on the berries. **Wood symptoms of Eutypa dieback and Bot canker** are difficult to distinguish as both diseases exhibit wedge-shape cankers in cross section of infected cordons. *Eutypa dieback* foliar symptoms typically include the development of stunted shoots and chlorotic and tattered leaves in the spring (Figure 1). Foliar symptoms have not been identified for **Bot canker** and no characteristic symptoms have been described or identified for the other taxa associated with trunk diseases. Symptom expression also varies

from year to year and among grape varieties partly because of variability in susceptibility making it even more problematic to identify characteristic disease symptoms.

Economic impact

Grapevine trunk diseases are commonly a significant problem of older vineyards (over 10 years old) in every California grape growing regions. However, young grapevine decline, also called **Petri disease** or **young Esca**, has been observed in newly planted vineyards. Moreover, **Bot canker** was observed in Californian vineyards younger than ten-years-old. Once symptoms are observed, the affected grapevines usually continue a steady decline over time until death occurs. Infected vineyards display decreased yields and quality. In addition, the labor involved in removing infected wood, retraining dead/dying vines and replanting adds to the overall production costs. When the affected vineyards are no longer economically sustainable to maintain, growers have no alternative but to replant and vineyard longevity decreased significantly. It is difficult to accurately measure the economic impact on grape production of trunk diseases because of the slow movement and the long incubating time of some of these fungi. However, in 1999 losses were estimated at \$260 million per annum in California wine grape production. No data are available for table grape or raisin productions.

Management of grapevine canker diseases

Complete control of canker diseases is virtually impossible due to the number of wounds made on an individual grapevine annually and the extended period of wound susceptibility. Disease pressure is always high in areas where inoculum reservoirs occur on grapevines and on alternate plant hosts. Once the pathogens become established, **surgical removal of the diseased wood parts is critical to reduce inoculum levels**. Proper sanitation and cultural practices are essential to delay the establishment and minimize the impact of these diseases. Pruning grapevines in dry weather is critical because fungal airborne inoculum is nearly non-existent at this time. **Pruning near bud-break is strongly recommended due to more rapid wound healing later in the season**. In this regard, double-pruning, which consists of mechanical pruning in the winter followed by hand-pruning before bud-break, is a viable technique to complete pruning in large vineyard acreages. **Protection of new wounds is also highly recommended to achieve good disease control**. However, available commercial products that protect pruning wounds from canker disease fungi are limited. Most products were initially developed and field-tested for the control of *E. lata*. The two main challenges for registered treatments are: 1) To protect pruning wounds against a broad range of fungi causing grapevine cankers, and 2) To provide protection during the entire period of susceptibility without being washed off with rain. There are three products that growers can apply on pruning wounds as preventive control treatments; Topsin M (United Phosphorus, Inc.), Rally (DowAgrosciences), and B-Lock (Nutrient Technologies, Inc.)

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Rolshausen P.E. et al. 2010. Evaluation of Pruning Wound Susceptibility and Protection Against Fungi Associated with Grapevine Trunk Diseases. *American Journal of Enology and Viticulture* 61:113-119.



Fig.1: Disease symptoms caused by wood decay fungi in grapevine. **A**, grapevine cordon dieback with infected spur positions. **B**, spotting or 'measles' on grape berries characteristic of Esca disease. **C**, cross section of the cordon of a grapevine showing wedge-shape canker characteristic of *Eutypa* dieback or Bot canker. **D**, cross section of the cordon of a grapevine showing dark vascular streaking characteristic of Esca disease. **E**, stunted shoots and leaves of grapevine characteristic of *Eutypa* dieback foliar symptom. **F**, 'tiger-striped' patterns on leaves of grapevine cv. Cabernet Sauvignon characteristic of Esca disease.