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Final Report

Do Soils Suppressive of Phylloxera Exist?

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Objectives

Long-term:

1. To develop a substantive hypothesis of the mechanisms of the vineyard soils which suppress phylloxera damage.

2. To determine vineyard management methods to make practical use of the knowledge of which soils suppress phylloxera to control damage.

Short-term:

1. To test the hypothesis that vineyard soils exist which are suppressive or tolerant of phylloxera growth in areas where the decline of the vineyard would be expected.

2. To determine whether suppressiveness is due to increased vine tolerance, inhibition of phylloxera population growth, or inhibition of secondary pathogen infection of wound sites.

Summary

Root samples were taken from organically and conventionally managed phylloxera-infested vineyards in northern California. Roots infested with phylloxera from organically managed vineyards showed significantly less root rot (11.8%) than phylloxerated roots from conventionally managed vineyards (27.1%). Incidence of fungal rot was significantly correlated with phylloxera populations in conventionally managed vineyards, whereas it was not in organically managed vineyards. Fungal cultures of necrotic feeding sites on roots showed no differences in pathogen species composition, however, occurrence of the pathogen antagonist *Trichoderma* was more prevalent in the cultures from roots from organically managed vineyards.

The importance of "feeding the soil" with organic matter is underscored in this research. Organic matter is important not only in nutrient retention and release but in the regulation of microbial populations for optimal root health as well. Damage from phylloxera feeding is less severe in soils managed with high organic matter inputs, possibly due to the facilitation of growth of pathogen antagonist microbes such as *Trichoderma*. The decoupling of phylloxera numbers and root damage, possibly mediated by pathogen antagonists in the rhizosphere, may be a fruitful area of study in other crop/pest systems.

Phylloxera infested vineyards have a soil ecosystem that is characterized by continual wounding of perennial plant roots. This creates an ongoing and long term dynamic between 1) root pathogens, 2) pathogen antagonists, if present, 3) soil organic matter serving as a microbe energy and plant nutrient source, and 4) the plant.

Recently discovered susceptibility to phylloxera of current "resistant" rootstocks in Germany, the 5C rootstock in particular, lends urgency to the task of developing alternative strategies for phylloxera. While no major rootstock with 100 percent North American heritage has been shown to be susceptible to phylloxera damage in California despite extensive testing, there is no guarantee of rootstock invincibility. California may be at the stage of phylloxera infestation Germany was 40 years ago, with "resistant" rootstocks such as 5C beginning to show nodosities but lacking damage (Porten 1997). German vines have developed phylloxera damage in the last two decades on these rootstocks, which are currently being used as phylloxera-resistant replanting stock in California. However we should note that the climate in Germany favors midsummer nodosities which seem to be the cause of their damage, while these would not occur in California as readily. Some systems of replanting vineyards in California are optimal for selection for phylloxera virulence; if growers continue to replant into infested vineyards where infested roots intertwine with the newly planted roots, virulence may become more common.

The complete report of this project is available on SAREP's Web page at:
www.sarep.ucdavis.edu/grants/Reports

Resources

Lotter, D.W., Granett, J., and Omer, A.P. 1999. Differences in Grape Phylloxera Relation, Grapevine Root Damage in Organic and Conventional Managed Vineyards in California. *Hort Science* 34:1108-1111.