Grapevine rootstock stem lesion and other putative viral induced rootstock markings

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Introduction. With the demise of rootstock AXR#1, a Vitis vinifera x V. rupestris hybrid, to phylloxera (1985-2000), vineyards devoted to wine production were re-planted onto several phylloxera resistant rootstocks; comprised largely of interspecific Vitis species developed in France and the USA. However, unlike AXR#1, which is tolerant to several graft transmissible agents (GTAs aka latent viruses), a few hybrid rootstocks responded differently whereby some GTAs caused graft-incompatibility and early death in young grapevines. During December 1995, we initiated a program on grapevine wood marking disorders, which followed a conversation with Don Luvisi (retired UCCE farm advisor, Kern County). He had earlier planted replicated trials of Redglobe table grape grafted on nine hybrid rootstocks and every plant on rootstocks 3309C, 5BB, 5C, and 1103P grew poorly and then died. Even though all components were Foundation or certified sources, involvement of hypersensitive rootstock response to an unknown virus was strongly suspected. The certification program serves as assurance in which propagation materials have met a set of guidelines, e.g., testing free of known harmful viruses, and represent the best sources available. However, there are grapevine viruses yet to be discovered. To clearly demonstrate presence of lethal GTAs, we proceeded to make healthy plants sick (see below for procedure). In the course of our investigations, we have identified several new diseases and GTAs, a few of which were lethal on hybrid rootstocks. The current status of our research is presented herein.

Materials and Methods. Indicator plants consisted of green-grafted scions of cv. Cabernet Sauvignon (occasionally cv. Chardonnay was used) on various hybrid rootstocks (a range of 6 to 18 rootstocks per trial were used and comprised of 50 plants per scion-rootstock combination). These were planted into the field, trained onto individual stakes, and grown for a year. In July-August (second leaf stage), buds taken from cane collections from diseased (minimum of three) and normal (one or two) grapevines per commercial vineyard were chip-budded onto the scion trunks with three to six chip-buds per test plant per rootstock per collection. After 30 days, the bud chips were scored as alive or dead. Following 12-month post-inoculation, test plants were scored for red leaf with Cabernet Sauvignon or chlorotic leaf curl with Chardonnay. Surviving symptomatic plants were sacrificed after 24 months, trunk unions autoclaved, bark stripped to expose the woody cylinder and read for stem markings.

Results and Discussion. Rootstock stem lesion appears as necrosis (1-2 mm deep) on the woody cylinder of reacting rootstocks. Lesion area varied from small, discrete ones to those extending down the rootstock (Fig. 1). Lesion size is dependent upon the interaction between the GTA and rootstock genotype. Infected grapevines succumb in two-three years. Based on differential rootstock responses, to date six diseased sources and five lethal GTAs were identified. One LGTA in cv. Redglobe (RG) was molecularly characterized as a variant of Grapevine leaf roll associated virus 2 (GLRaV-2); designated GLRaV-2RG. It was lethal on five of 18 rootstocks, namely 3309C (riparia x rupestris), 1616C (solonis x riparia), 1103P, 5BB, and 5CC (all berlandieri x riparia) (see Uyemoto & Rowhani 2003). The asymptomatic test plants on 13 other rootstocks were positive for GLRaV-2RG via RT-PCR assays. Another two diseased sources impacted three rootstocks: 3309C, 101-14Mtg (riparia x rupestris), and Freedom [solonis x rupestris (1616 x St. George) x champinii] and suggests a common LGTA. Virus infections in both sets of asymptomatic test plants on 15 rootstocks were confirmed when back-assayed on test plants Chardonnay/3309C. Also included in the 18-rootstock trial, diseased sources #4 & #5 impacted, respectively, 5BB, 1616C, and Harmony (parentage as Freedom) or only 5BB. Disease source #6 assayed in a separate trial (which did not have test plants on 1616C and Harmony) impacted only 5BB. Back assays of the latter three sources were not attempted.

Rootstock necrosis and distortion symptoms have only been observed in two locations planted to Pinot Noir on 3309C. Affected rootstocks develop necrotic longitudinal grooves interspersed with non-necrotic longitudinal ‘raised’ woody tissues (Fig. 1). Initially the canopy is solid red color but chronically infected grapevines develop smaller, green leaves and stunted shoots. Diseased grapevines persisted longer than those afflicted with rootstock stem lesion.
**Grapevine necrotic union** disease, induced on rootstock 110R, involves several clones of Pinot noir (Pommard = UCD#4, UCD2A, 777, and 667). Initial canopy symptoms consist of solid red leaves on an otherwise dense canopy and full grape clusters (acute phase), which later progresses to stunted shoots with small, uneven grape clusters or vine death (chronic phase). Woody cylinders of diseased grapevines exhibited necrosis along the scion-rootstock junction (Fig. 1). In one Pommard block, disease incidence increased nearly 4X in two growing seasons and indicative of secondary spread.

**1103P stem pitting** disease was first observed in bench grafted plants of 10 year old Cabernet Sauvignon on 1103P but not with Cabernet Sauvignon on St. George planted in the same block. The canopies appear normal in leaf color and vegetative growth compared to Cabernet Sauvignon on other rootstocks in the planting. The disease does not appear to be lethal.

Pathogenicity tests to demonstrate the infectious nature for the latter three diseases: rootstock necrosis and distortion, grapevine necrotic union, and 1103P stem pitting are in progress.

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**References**


Figure 1. Rootstocks with wood markings of (left to right): stem lesion, necrosis-distortion, necrotic union and stem pitting.