VINE CONDITION AND *XYLELLA FASTIDIOSA* SEROLOGY FOR THREE NATIVE GRAPE SPECIES, SELECTED *VITIS VINIFERA* ON ROOTSTOCKS, AND SELECTED UNGRAFTED ROOTSTOCKS

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ABSTRACT

Three native *Vitis* species in southwest Texas rarely have even minor Pierce's disease (PD) symptoms or react to *Xylella fastidiosa (Xf)* ELISA tests. When planted next to highly susceptible *Vitis vinifera* cultivars with severe PD and a large glassy-winged sharpshooter population, *V. cinerea* var. *helleri*, *V. monticola*, and *V. mustangensis* developed PD symptoms and reacted to ELISA tests. *V. cinerea* var. *helleri* and *V. monticola* had very little iron deficiency (chlorosis). *V. mustangensis* had the lowest *Xf*-ELISA OD values. *V. cinerea* var. *helleri* and *V. monticola* had delayed leaf senescence, which may indicate delayed root senescence, a trait thought to hinder cotton root rot disease (caused by *Phymatotrichopsis omnivora*) of winegrape. *V. monticola* crosses should be included in PD and CRR breeding line tandem screening efforts.

LAYPERSON SUMMARY

In addition to Pierce's disease (PD) resistance and other pest and soil problems, we considered which native Texas grapes may have traits indicating potential parents for rootstock improvement efforts to address cotton root rot disease. Cotton root rot occurs in a large area of the PD geographical range, from Texarkana to southern Utah to central Mexico. Delayed leaf senescence in *V. monticola* suggest it may also contribute rootstock traits to help control CRR.

INTRODUCTION

Pierce's disease (PD) in the warmer regions of Texas and southwestern U.S. has caused early death of high susceptible *Vitis vinifera* cultivars for at least 300 years. Native *Vitis* species in the same area usually have no PD symptoms or serological reactions for *Xylella fastidiosa (Xf)*. These wild species continue to be used in cultivar improvement efforts for fruiting and rootstock cultivars (Covert, 2008) including PD resistance. Among the problems previously addressed with crosses involving wild grape species found in Texas and the southwestern U.S. are root pests (grape phylloxera insect, plant parasitic nematodes) and soil problems (high pH calcareous soils, poor drainage, droughty soils). As progress on PD control has increased vine longevity, incidence of cotton root rot disease has increased. The soil borne fungus *Phymatotrichopsis omnivora* causes cotton root rot disease (CRR) in most of Texas and in five other southwestern states and Mexico. High incidence of CRR has long been linked to high pH soils. Native *Vitis* species in Texas may be useful in developing rootstocks with resistance to both PD and CRR. Early publications note resistance of several Vitis sp. to CRR, including *Vitis monticola, berlandieri* and *candicans* (*mustangensis*). Plants classified as resistant developed new roots and survived in spite of the fungal infection (Taubenhaus and Ezekiel, 1936).

OBJECTIVE

1. Evaluate chlorosis, PD, and leaf condition in *V. cinerea* var. *helleri* (*V. berlandieri*), *V. monticola*, and *V. mustangensis (V. candicans)* at an irrigated high pH soil site in southwest Texas with intense PD.

RESULTS AND DISCUSSION

Vitis cinerea var. *helleri* and *V. monticola* growing in furrow-irrigated calcareous high pH soil had less iron deficiency than *V. mustangensis*. Under very intense PD, *V. mustangensis* trended toward lower mean *Xf*-ELISA optical densities than *Vitis cinerea* var. *helleri* and *V. monticola* in second leaf and third leaf, possibly indicating that mustang grape limits populations of *Xf* more than the other two species. Both *V. monticola* entries, two of six *V. mustangensis* entries, and Salt Creek rootstock always had less than 15% total leaf necrosis.

CONCLUSIONS

Three native grapes species found in southwest Texas have been used by plant breeders for many decades to address various soil insect, nematode, PD, and soil problems. In this preliminary trial, leaf chlorosis indicated less iron uptake from high pH soil, ELISA OD indicated *Xf* cell numbers, and leaf necrosis indicated cumulative effects of iron uptake, PD, and senescence. Cotton root rot disease (CRR), caused by *Phymatotrichopsis omnivora*, occurs within a large part of the PD geographic range and both pathogens have high optimal temperatures. *P. omnivora* apparently becomes more aggressive on senescing plants, and our data suggest that senescence varies among grape genotypes. In grain sorghum, plant breeders selected 'stay green' stalk and root traits separately from grain maturity date to help solve late season root and stalk diseases (Thomas and Howarth, 2000). Perhaps native *Vitis* species may be useful parents for rootstocks improvement efforts that address both PD and CRR. Entry numbers in this preliminary trial were not adequate for drawing firm conclusions. However, these data suggest that *V. monticola* crosses should be included in CRR screening efforts. Genetic resistance alone will probably never eliminate PD or CRR risk.

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Table 1. Plant conditions and *Xylella fastidiosa*-serology reactions of three *Vitis* species, selected rootstocks, and selected *V. vinifera* on rootstocks at Uvalde, TX. Green cells had the least chlorosis (rating >2.5). Blue cells had OD<0.5 (<0.3 is negative) with ELISA. Yellow cells had lowest leaf necrosis ratings (≤10%).

		Chlorosis[a]						Optical Density, *Xylella fastidiosa*-ELISA						Leaf necrosis, percent[b]					
		14Sep10		12Nov10		7Sep11		14Sep10		12Nov10		7Sep11		14Sep10		14Nov10		7Sep11	
Entry	N[c]	$\bar{x}$	SD[d]	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Vitis cinerea var. *helleri* Population 8[e]	14	3.0	0.0	2.2	0.4	2.8	0.4	1.3	0.5	0.7	0.4	0.8	0.5	0.2	0.3	33	22	6	5
V. monticola pooled	7	3.0	0.0	2.9	0.4	3.0	0.0	0.4	0.5	0.9	0.4	0.8	0.4	0.0	0.0	4	4	2	2
Population 5[e]	4	3.0	0.0	3.0	0.0	3.0	0.0	0.2	0.2	1.0	0.5	1.1	0.4	0.0	0.0	1	0	2	2
Population 7[e]	3	3.0	0.0	2.7	0.6	3.0	0.0	0.7	0.5	0.8	0.3	0.5	0.2	0.0	0.0	7	5	2	2
V. mustangensis pooled	20	1.7	0.7	1.8	0.4	1.3[f]	0.5	0.4	0.4	0.3	0.4	0.4[f]	0.3	0.7	1.6	20	26	10[f]	13
Rio Medina[g]	5	1.8	0.4	1.6	0.5	1.2	0.4	0.5	0.4	0.6	0.6	0.6	0.3	0.1	0.2	2	2	10	10
Marble Falls[g]	2	2.0	1.4	2.0	0.0	1.0	0.0	0.6	0.5	0.0	0.0	0.4	0.6	0.1	0.1	8	4	13	17
Stonewall[g]	1	1.0	.	2.0	.	1.0	.	1.1	.	0.1	.	0.0	.	0.0	.	50	.	50	.
Tow[g]	6	2.2	0.8	1.8	0.4	1.8	0.4	0.4	0.2	0.2	0.2	0.5	0.3	0.0	0.1	10	6	2	4
Uvalde[g]	1	1.0	.	1.0	.	.	.	1.0	.	0.3	.	.	.	0.0	.	99	.	.	.
Uvalde South Getty[g]	5	1.0	0.0	1.8	0.4	1.0	0.0	0.1	0.1	0.0	0.0	0.3	0.2	2.4	2.5	35	20	10	9
Champanel[h]	5	2.0	0.0	2.0	0.0	2.0	0.0	1.2	0.8	1.0	0.6	1.1	0.7	0.4	0.4	44	26	3	3
Couderc 1613 (1613C)[i]	4	1.0	0.0	2.3	0.5	1.5	0.6	1.7	0.2	1.8	0.0	1.5	0.3	37.5	11.9	83	13	89	10
Dog Ridge[j]	5	3.0	0.0	2.4	0.5	2.3[k]	1.0	0.9	0.4	0.4	0.2	0.6	0.5	0.1	0.1	8	5	14[k]	18
Harmony[l]	1	1.0	.	2.0	.	.	.	1.1	.	0.2	.	0.8	.	20.0	.	99	.	100	.
Kober 5BB[m]	2	3.0	0.0	2.0	0.0	2.5	0.7	1.1	0.5	0.7	0.0	1.1	0.4	0.4	0.2	45	0	33	39
Lenoir (Black Spanish)[n]	1	2.0	.	2.0	.	1.0	.	1.3	.	1.1	.	1.3	.	15.0	.	15	.	20	.
Salt Creek (Ramsey)[o]	4	3.0	0.0	2.5	0.6	2.0	0.0	0.3	0.2	0.4	0.2	0.4	0.1	0.4	0.4	4	1	4	1
S04[p]	5	2.6	0.5	2.2	0.4	2.0	0.0	1.1	0.7	0.7	0.3	1.2	0.2	0.3	0.4	23	12	21	2
Chardonnay/Couderc 1613	1	3.0	.	2.0	.	1.0	.	1.6	.	1.5	.	1.6	.	25.0	.	85	.	95	.
Chardonnay/Salt Creek	1	2.0	.	2.0	.	2.0	.	1.5	.	1.4	.	1.7	.	10.0	.	75	.	99	.
Chardonnay/Teleki 5C[q]	2	3.0	0.0	2.0	0.0	2.5	0.7	1.0	0.0	0.9	0.7	1.2	0.1	27.5	3.5	73	4	80	14
Merlot/Harmony	1	2.0	.	2.0	.	2.0	.	1.8	.	.	.	2.0	.	25.0	.	85	.	80	.
Merlot/Kober 5BB	3	3.0	0.0	3.0	0.0	2.7	0.6	1.4	0.1	1.3	0.2	.	0.2	11.0	3.6	78	8	67	14
Merlot/Teleki 5C	1	3.0	.	3.0	.	2.0	.	1.3	.	0.6	.	1.8	.	50.0	.	80	.	85	.

[a]Chlorosis rated as 1=chlorotic, 2=intermediate chlorosis, 3=green.

[b]Leaf necrosis due to severe iron deficiency induced by high pH soil, PD, and senescence.

[c]N=number of plants evaluated unless indicated otherwise.
[d]SD=standard deviation.
[e]Open pollinated seedlings from one parent.
[f]N=19.
[g]Rooted cuttings from one plant.
[h]*V. champinii* x *V. labrusca*.
[i]Includes *V. labrusca*, *V. riparia*, *V. vinifera*.
[j]*V.* x *champinii* (*V. candicans* and *V. rupestris*).
[k]N=4 plants.
[l]Includes *V. labrusca*, *V. riparia*, *V.* x *champinii*, *V. vinifera*.
[m]*V. berlandieri* x *V. riparia.*
[n]*V. aestivalis*, *V. cinerea*, *V. vinifera* (50%).
[o]*V.* x *champinii*.
[p]*V. berlandieri* Resseguier x *V. riparia.*
[q]*V. berlandieri* x *V. riparia*.