

ROOTSTOCK SELECTION AND CHOICE

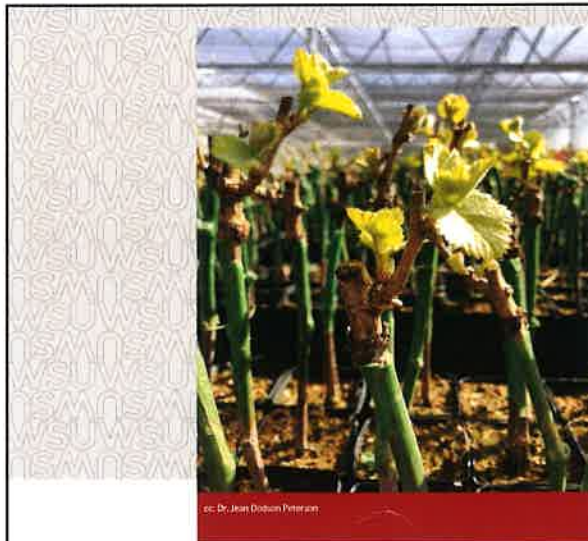
Washington Viticulture Looking Forward

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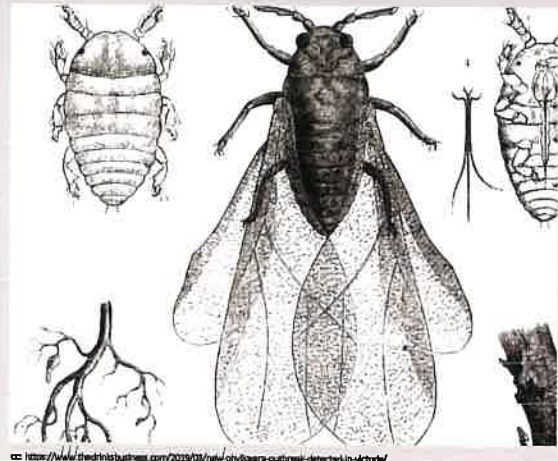
1



- European Phylloxera Crisis
- Wild Species Are Diverse
- Considerations for Rootstock Selection
- Traditional Rootstock Performance
- Rootstocks for the Future

2

European Phylloxera Crisis

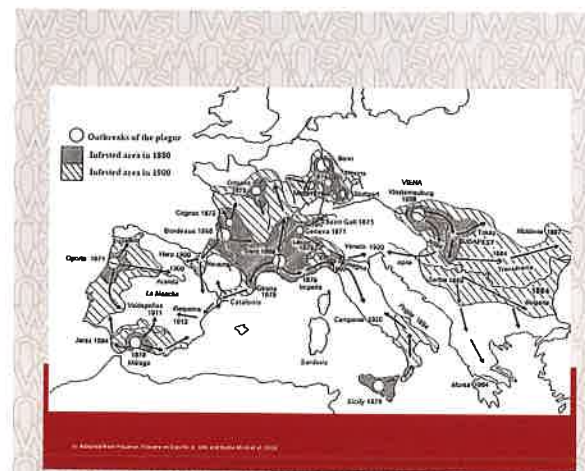


Phylloxera are aphids native to the Eastern and Southwestern United States. They feed on grapevine roots, causing damage known as tuberosities and nodosities.

3

Phylloxera: The Spread

- ➔ *Vitis vinifera* → New World
- ➔ American Wild Species and Phylloxera → Europe (1845)
- ➔ France Quickly Impacted by Phylloxera and by 1900, 75% of French Vineyards Destroyed
- ➔ Spreads Rapidly Across Europe and North Africa with Minor Exceptions



4



Phylloxera: The Initial Response

French American hybrids were among the industry's initial response but were problematic due to their chemical and sensory attributes. Additionally, any *Vitis vinifera* in the background perpetuates the risk.

5

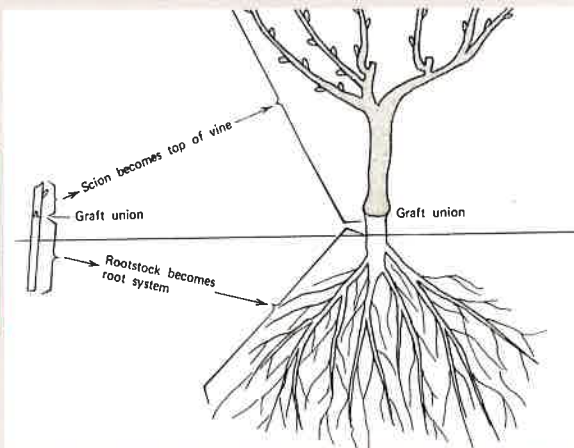
Phylloxera: The Catalyst for Grafting

Tolerant Root System → No *Vitis vinifera*

Grafted Vines → Preserve Sensory Attributes

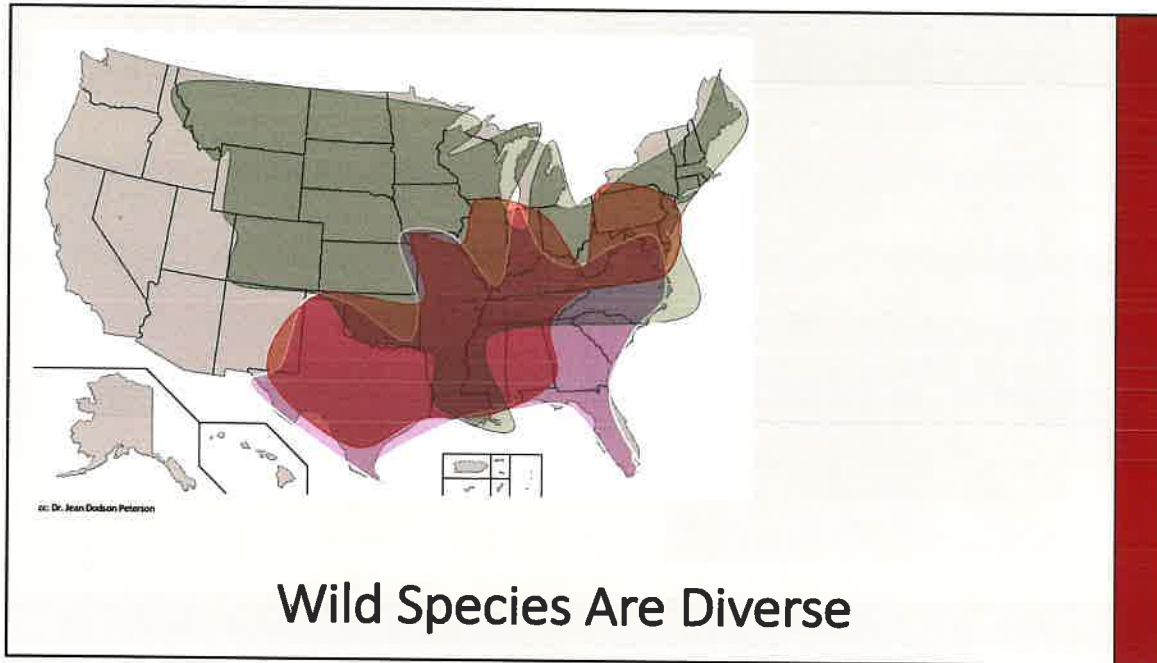
SCION - *Vitis vinifera* L. cv.

ROOTSTOCK - American species or interspecific hybrid

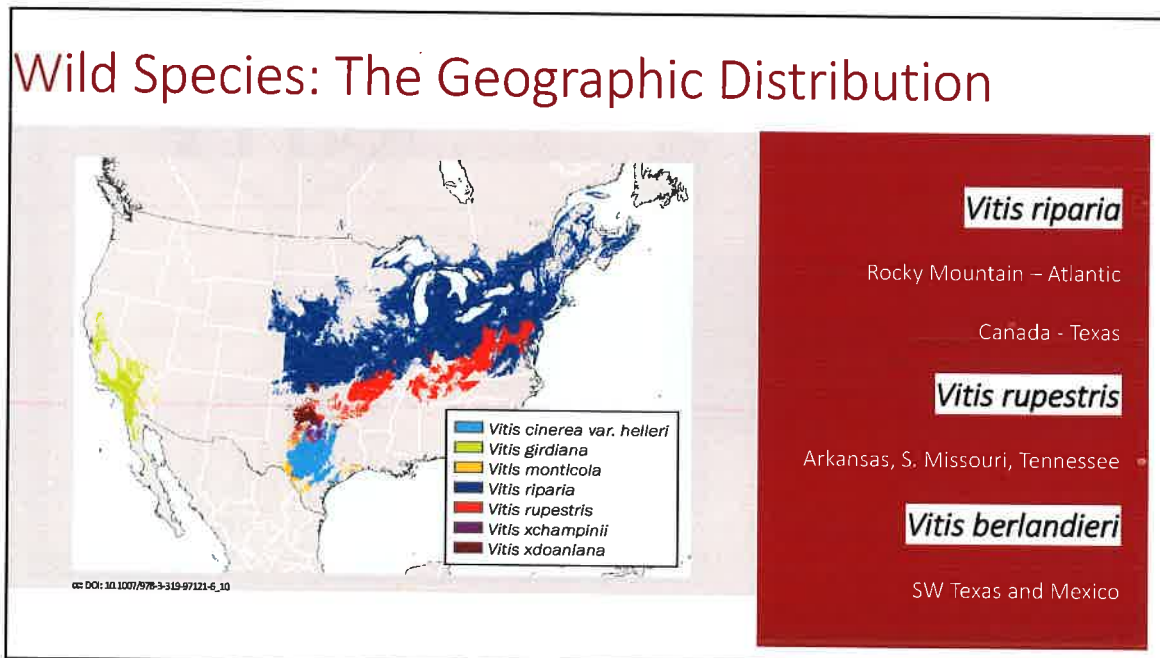


cc: Southern Oregon Wine Institute - <https://www.flicic.com/photos/47580473/6103>

6

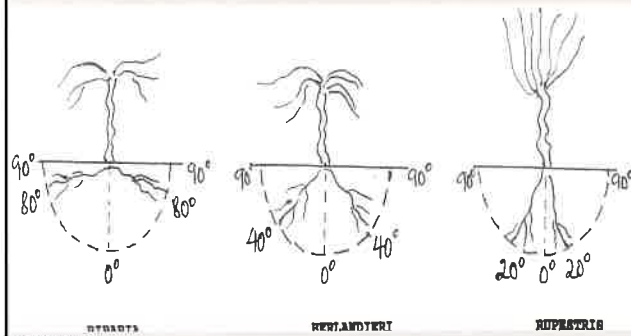


7



8

Vitis Species for Rootstocks



cc: Dr. Keith Patterson



cc: Dr. Keith Patterson

9

Vitis riparia



cc: Andy Walker

ORIGIN AND HISTORY

- Native to the United States – Riparian Habitats
- 'Riparia Gloire' Selected in Montpellier, France
- Major role in Addressing Initial Phylloxera Crisis

TRAITS

- Shallow Root System
- Not Tolerant to Lime
- Less Scion Vigor
- Roots and Grafts Well
- Hastens Maturity

10

Vitis riparia

TRADITIONAL USE

- Close Spacing
- Fertile Soils
- Water Available
- Wet Feet Situations
- Strong Phylloxera Tolerance



11

Vitis rupestris



ORIGIN AND HISTORY

- Native to the United States – Dry, Rocky Creek Beds
- ‘Rupestris du lot’ or ‘St. George’
- Long History in California Dry-farmed Vineyards

TRAITS

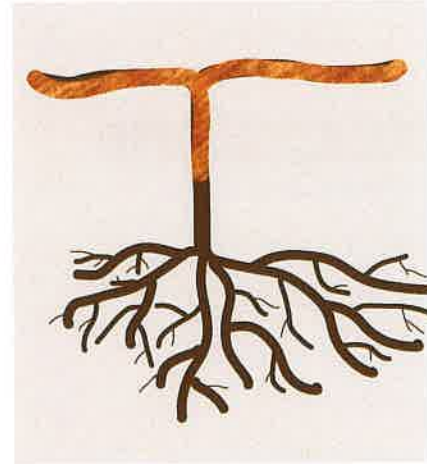
- Deep Rooted – Drought Adaptive
- Susceptible to Nematodes
- Lime Sensitive
- More Scion Vigor
- Roots and Grafts Well

12

Vitis rupestris

TRADITIONAL USE

- Dry-Farmed Sites
- Not Overly Fertile Soils
- Not Shallow Soils with Limited Water
- Not where Nematodes are Present



13

Vitis berlandieri



ORIGIN AND HISTORY

- Native to the United States – Limestone Hills of Central Texas
- Must be Hybridized with Other Species
- Imported to France – Lime

TRAITS

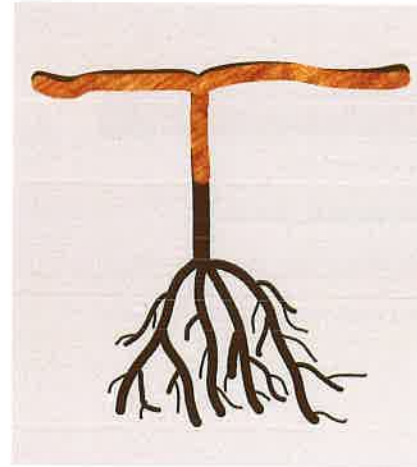
- Deep Rooted – Drought Avoidance
- Not Lime Sensitive
- More Scion Vigor
- Roots and Grafts Poorly

14

Vitis berlandieri

TRADITIONAL USE

- Drought Prone Sites
- High Lime Presence
- Moderate Phylloxera Tolerance



15



Considerations for Rootstock Selection

cc. sillydog - <https://www.flickr.com/photos/260842836/N00>

16

Rootstock
Factors to
Consider



cc: th1stforwine - <https://www.flickr.com/photos/36477441@N06>

17

Difficult to Make the Perfect Choice



cc: Ian Tyson - https://www.instagram.com/ian_tyson/?utm_source=halikudick&utm_medium=referral&utm_campaign=api-credit

18



cc: Jeremy Bishop - https://unsplash.com/@jeremybishop?utm_source=halokadeck&utm_medium=referral&utm_campaign=api-credit

Avoid Making the Clearly Wrong Decision

19



Greater Considerations

- Inverse relationship between soil and rootstock
- Water holding capacity, soil depth and overall fertility
- Interplay between climate, vine health and fruit quality
- Tons per acre required

cc: Ryan Dickey - <https://www.flickr.com/photos/96951441@N00>

20

Rootstock Specific Traits

- SOIL PESTS AND DISEASE PRESSURE**
 - Phylloxera
 - Nematodes
- VIRUS INDUCED INCOMPATIBILITIES**
 - Certified Rootstock and Scion Plant Material
 - Sometimes Desired Clones Are Not Certified
 - Virus Tested is NOT Virus Free
- ROOTSTOCK AVAILABILITY**
 - Nursery Driven
 - Timeframe for Requests
- INFLUENCE ON PHENOLOGY**
 - Length of Growing Season
 - Avoidance of Rain/Frost
 - Efficiency in Water Use

cc: Timed - <https://www.flickr.com/photos/76396780@N40/>

21

Vitis riparia x Vitis rupestris

3309C

3306C

101-14MGT

Schwarzmann

cc: N. Coedrafs, et al.

22

Vitis riparia x Vitis rupestris

MAJOR TRAITS

- Useful on fertile, non-calcareous soils
- Root system generally spreads evenly throughout the soil profile
- Nematode resistance varies by selection
- Typically at least minimally tolerant to Phylloxera
- Easy to root and graft

23

3309 Couderc
3306 Couderc



- Intolerant to virus → only use with certified wood
- Roots and grafts well
- Decent Phylloxera tolerance
- Very susceptible to nematodes (root-knot)
- Vigorous on deep fertile soils
- Induce moderate scion vigor despite shallow root system
- Good candidate for high density plantings

24

101-14MGT



- Good Phylloxera tolerance but feeding does occur on young root tips → caution on heavy clay soils prone to drought
- Good nematode tolerance (root-knot)
- Low to moderate vigor induced in scion → more vigorous than 3309C on fertile soils with water
- Tolerates wet feet
- Lime sensitive
- Not drought tolerance
- Easy to root and graft

25

Schwarzmann



- Good Phylloxera tolerance → potentially better nodosity resistance than 101-14MGT
- Good nematode tolerance (ectoparasitic) however moderate levels of root galling from *X. index* feeding
- Moderate vigor induced in scion but not tolerant of summer drought conditions
- Less commonly used → less data available
- Easy to root and graft

26

Vitis berlandieri x Vitis rupestris

110R

1103P

140Ru



27

Vitis berlandieri x Vitis rupestris

MAJOR TRAITS

- Drought and lime tolerant in warmer growing regions
- Deep root system
- Limited nematode tolerance
- Decent Phylloxera tolerance
- Difficult to root and graft

28

110R



- Good Phylloxera tolerance
- Susceptible to nematodes
- Moderate to higher vigor induced in scions
- Slow to establish when first planted but strong by years 4 – 5
- Intolerant of virus presence with graft incompatibilities → Certified material needed
- Moderate rooting and grafting
- Recommended for hillsides and dry-farmed sites where drought is common/likely
- Careful of inducing too much vigor in the scions, causing vegetative characteristics in wines and a tendency for poor bud fruitfulness
- Caution on heavy clay soils → historic reports of K deficiency

29


1103P



- Good Phylloxera tolerance
- Moderate to low nematode tolerance
- High vigor induced in scions → more than 110R but less than 140Ru
- Well suited for dry farming but can collapse under sudden drought
- Decent salt tolerance
- Widely used on low vigor sites → can induce very high vigor on scions on fertile soils with ample water
- Roots and grafts well

30

140Ru




- Good Phylloxera tolerance
- Low nematode tolerance
- Highest vigor induced in scions of this group
→ caution in deep fertile soils
- Suited for shallow, droughted and/or limestone soils
- Roots and grafts moderately well

31

Vitis berlandieri x Vitis riparia

Kober 5BB Teleki 5C SO4 420A



66:74 ucclaviv.edu

32

Vitis berlandieri x Vitis riparia

MAJOR TRAITS

- Crosses selected for Phylloxera tolerance, lime tolerance and moderate vigor
- Rooting depth between shallow and moderate
- Moderate nematode tolerance
- Most graft and root well

33

Kober 5BB



- Good Phylloxera tolerance
- Good lime tolerance
- Moderate nematode tolerance (broadly speaking)
- Very intolerant of virus → graft failure and uneven healing, must use certified wood
- Roots and grafts moderately well
- Slightly more drought tolerance than 5C or 420A but less so than 110R or St. George
- Very sensitive to Phytophthora root rot → avoid on sites with standing water in the Spring

34

Teleki 5C



- Good Phylloxera tolerance
- Moderate lime tolerance
- Moderate nematode tolerance
- Overgrown graft unions are common
- Does not tolerate deficit irrigation well
- Roots and grafts well

35

SO4



- Good Phylloxera tolerance
- Moderate lime tolerance
- Moderate nematode tolerance
- Care in older vineyards → was commonly confused with 5C until 1990
- Does not tolerate deficit irrigation well
- Roots and grafts moderately well

36

420A



- Good Phylloxera tolerance
- Moderate lime tolerance
- Low to moderate nematode tolerance → lacking sufficient field trials
- Induces lower scion vigor on most soils compared to 5C and 5BB
- K deficiency has been observed in scions

37

Miscellaneous Rootstocks

1616C

039-16


St.
George

Riparia
Gloire

©: h.vastwijk.edu

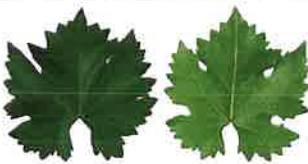
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1616C

- 
- Low to moderate tolerance of limestone soils
 - Low vigor induction in scion
 - Decent Phylloxera tolerance
 - Moderate to high nematode tolerance
 - Low drought tolerance
 - Tolerates wet feet well
 - Roots and grafts easily

39

039-16

- 
- Resists Dagger nematode feeding, allows GFLV into scion w/o major symptoms
 - Susceptible to root-knot nematodes
 - Decent resistance to Phylloxera → *V. vinifera* parentage makes this doubtful in the long-term
 - High induction of scion vigor
 - Poor limestone tolerance
 - Good response to deficit irrigation and aggressive cover crop use

40

St. George



- Susceptible to nematodes
- Supports high population of Phylloxera but no reports of failure in the field
- Typically used in dry-farmed vineyards
- Drought avoider due to extensive root system
- Does not perform well on shallow soils with limited water
- Considered high vigor rootstock with generally low-yield:pruning weight ratios (reduced fruit set)
- Generally good to avoid with small-clustered or loose clustered cultivars on fertile soils

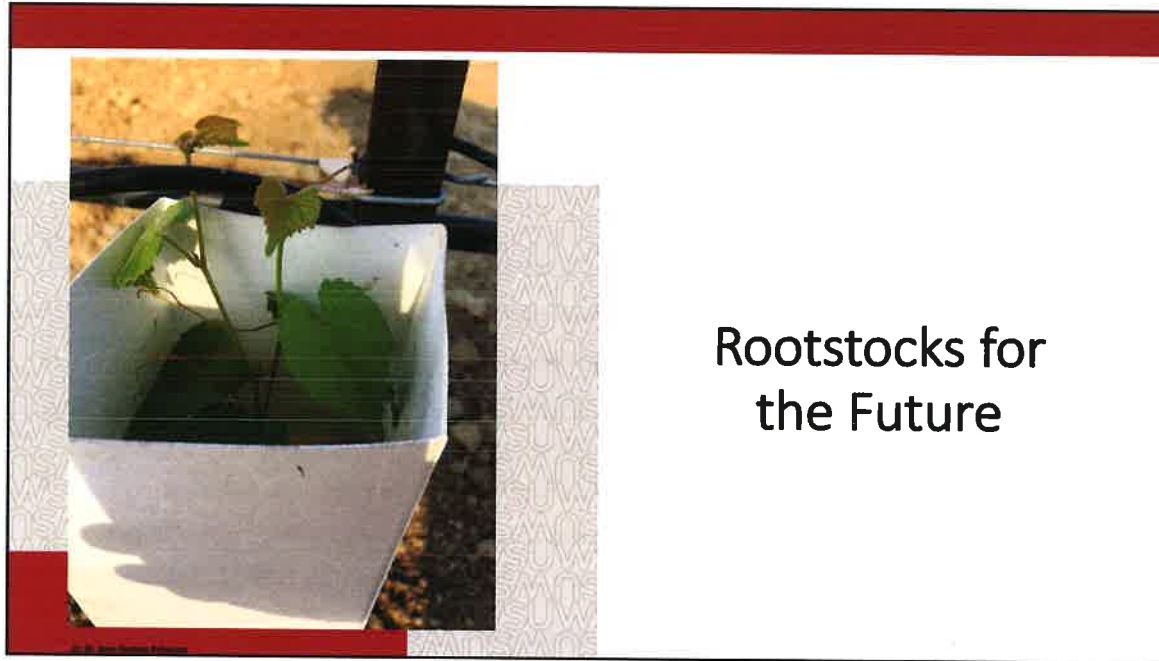
41

Riparia Gloire



- Not tolerant to limestone soils
- Strong Phylloxera tolerance
- Roots and grafts well
- Known to induce low vigor even in fertile soils → not much recent research
- Used in high density plantings with ample water
- Reported to encourage earlier ripening and maturity of scions




42



43

Rootstock: The Future

WHERE TO WE GO FROM HERE?

-  Evolving Pest Pressure, Fires, Drought, Climate Change
-  Quantitative Data, Vineyard to Bottle, Building on Past Mistakes and Successes
-  Site Specific, Production Oriented, Future Needs

44

The Rootstock is the Bridge Between the Soil and the Scion.



45



cc: CSU Cal Poly



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46

