

Grape Phylloxera



Daktulosphaira vitifoliae Fitch
Phylloxeridae, Hemiptera

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Acknowledgements

- California Grape Rootstock Improvement Commission / California Grape Rootstock Research Foundation
- CDFA NT, FT, GV Improvement Advisory Board
- California Table Grape Commission
- American Vineyard Foundation
- E&J Gallo Winery
- Louis P. Martini Endowed Chair in Viticulture



Testing of control methods developed on Caribbean islands



**1st instars
(crawlers)**



**Adult &
eggs**

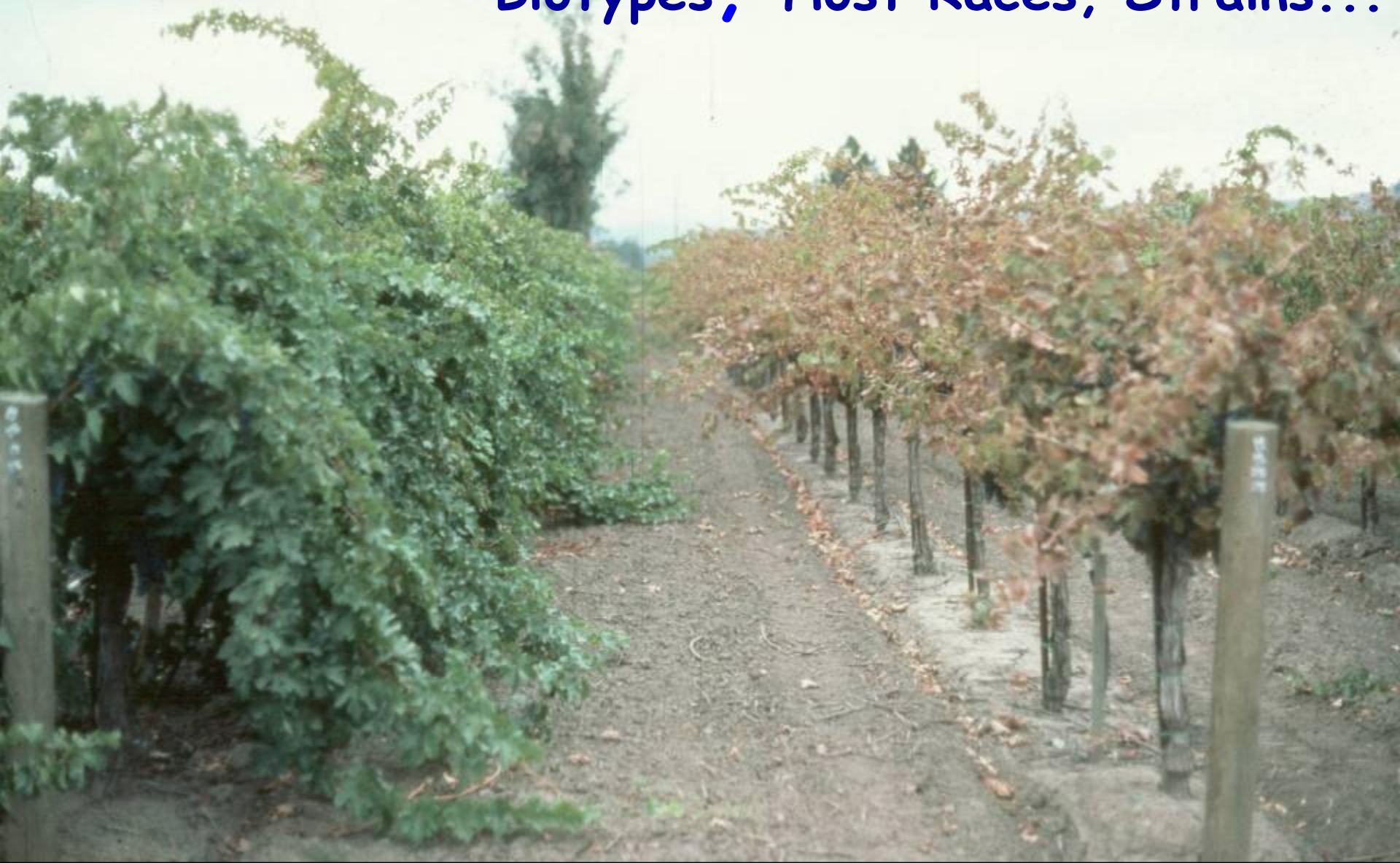


Nodosities on primary roots

Leaf galls



Biotypes, Host Races, Strains...



Resistant rootstock

AXR#1

Aerial photo



Infra red
Epicenter
Wind movement
Satellite infestations

History

± 1860s: Phylloxera → Europe → damage

1870s debates

Cause or result of damage

Control

- Insecticides
- Hybrid direct producers
- Rootstocks

Christy Campbell

The botanist and the vintner: How wine was saved for the world; Phylloxera

George Ordish

The Great Wine Blight

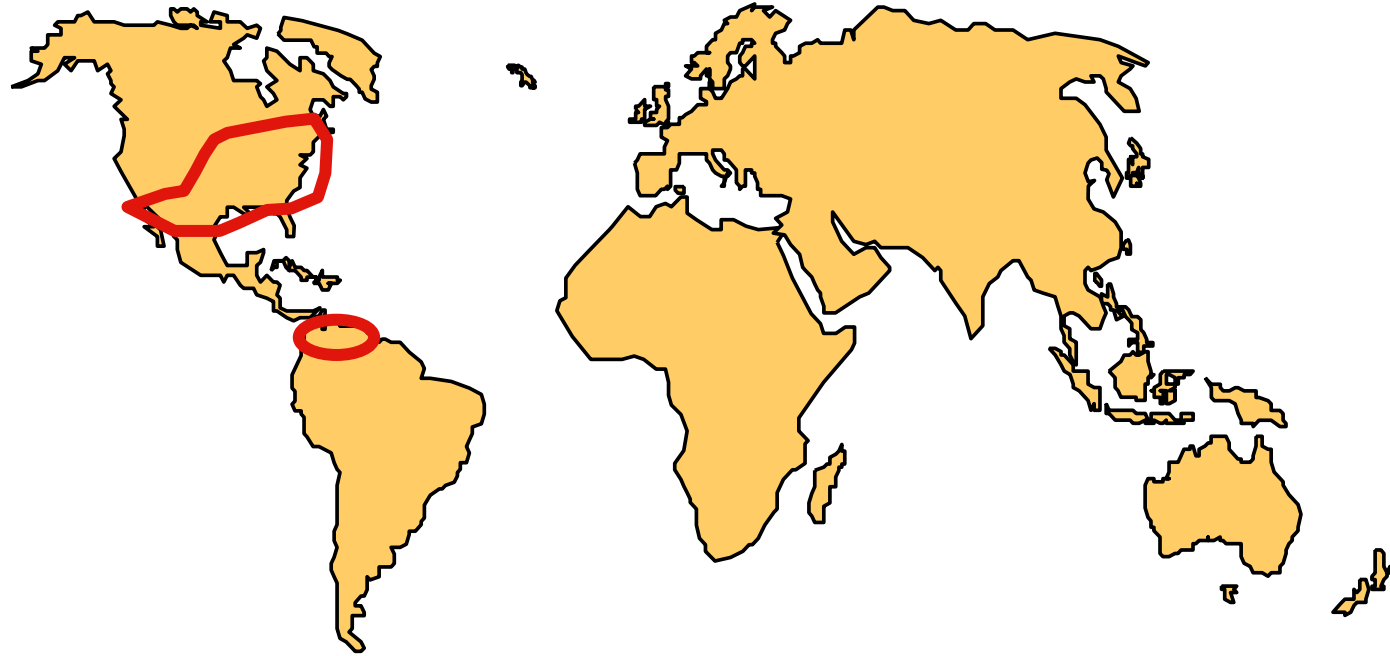
Breeding and use of resistant rootstocks

Durability of strong resistance

Failure of some American *Vitis* x *V. vinifera* hybrids

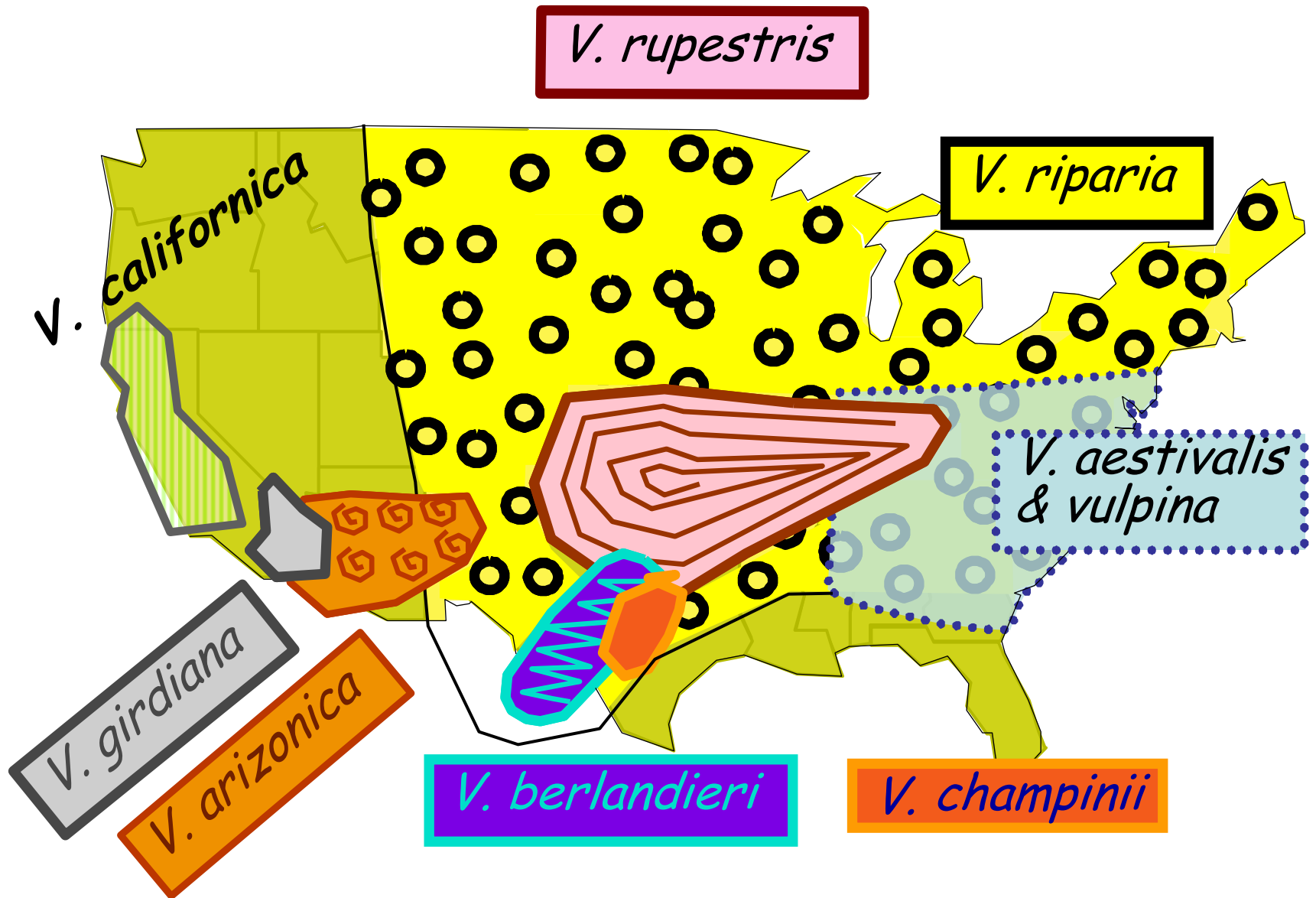
Origin

Native geographical range



Plant Range—American *Vitis* sp. — Leaf galls
— Primary roots

Native hosts

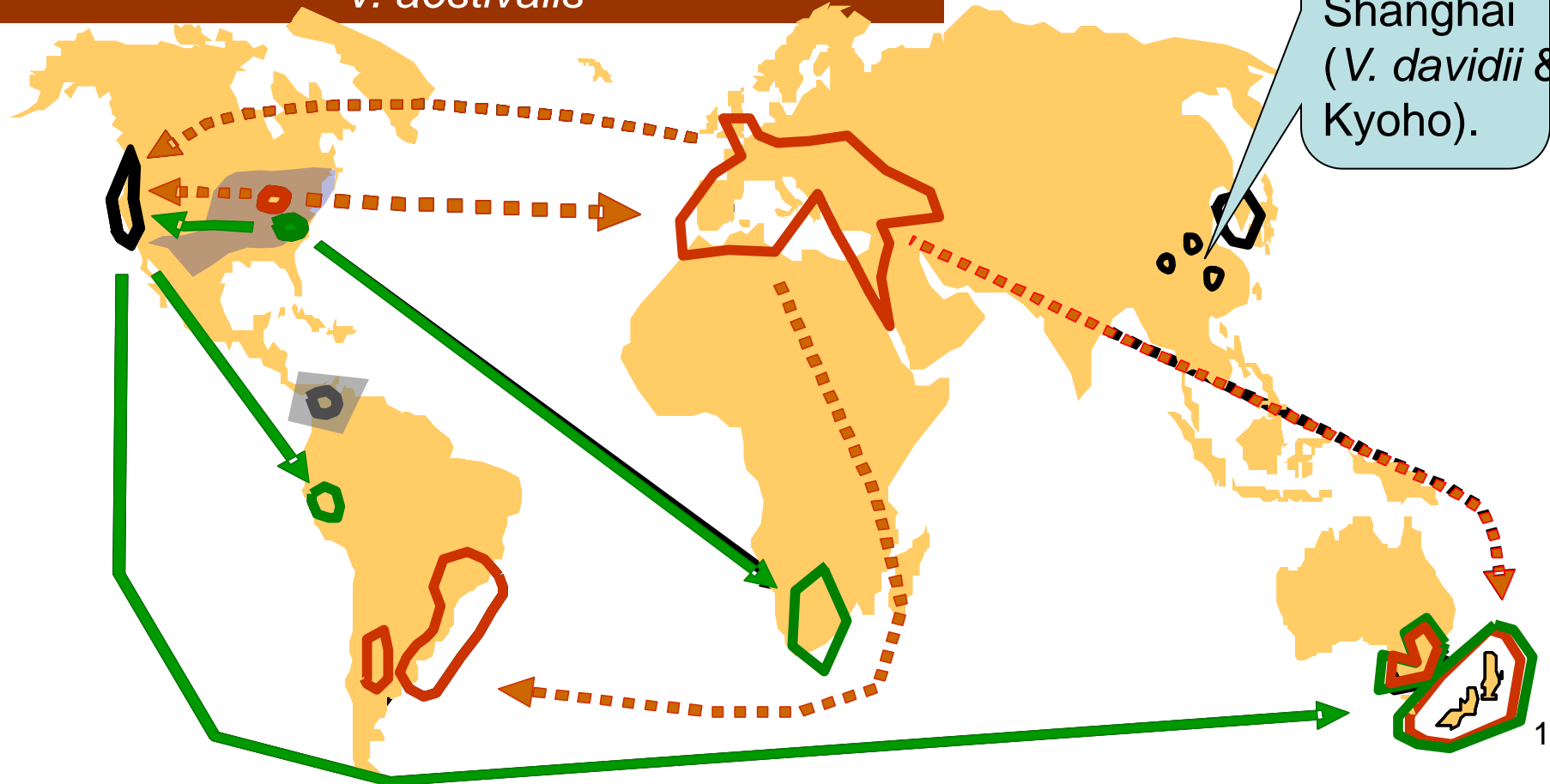


Spread

Lin; Downie;
Fornek; Corrie;
Du

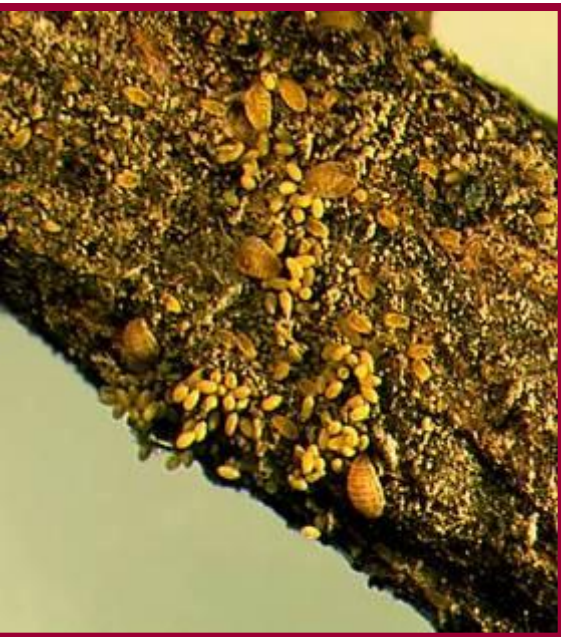
Phylloxera origin	Original host	New host
US Northeast	<i>V. riparia</i>	<i>V. vinifera</i>
US Southeast	<i>V. vulpina</i> <i>V. aestivalis</i>	<i>V. vinifera</i>

2006:
Hunan,
Shaanxi,
Shanghai
(*V. davidii* &
Kyoho).



Expectations

Vine parentage	Galls	Damage
<i>V. vinifera</i>	Root galls <u>Tuberousities</u> Nodosities Very rare leaf galls	Root loss → Yield loss Vine death



Tuberousities (suberized roots)



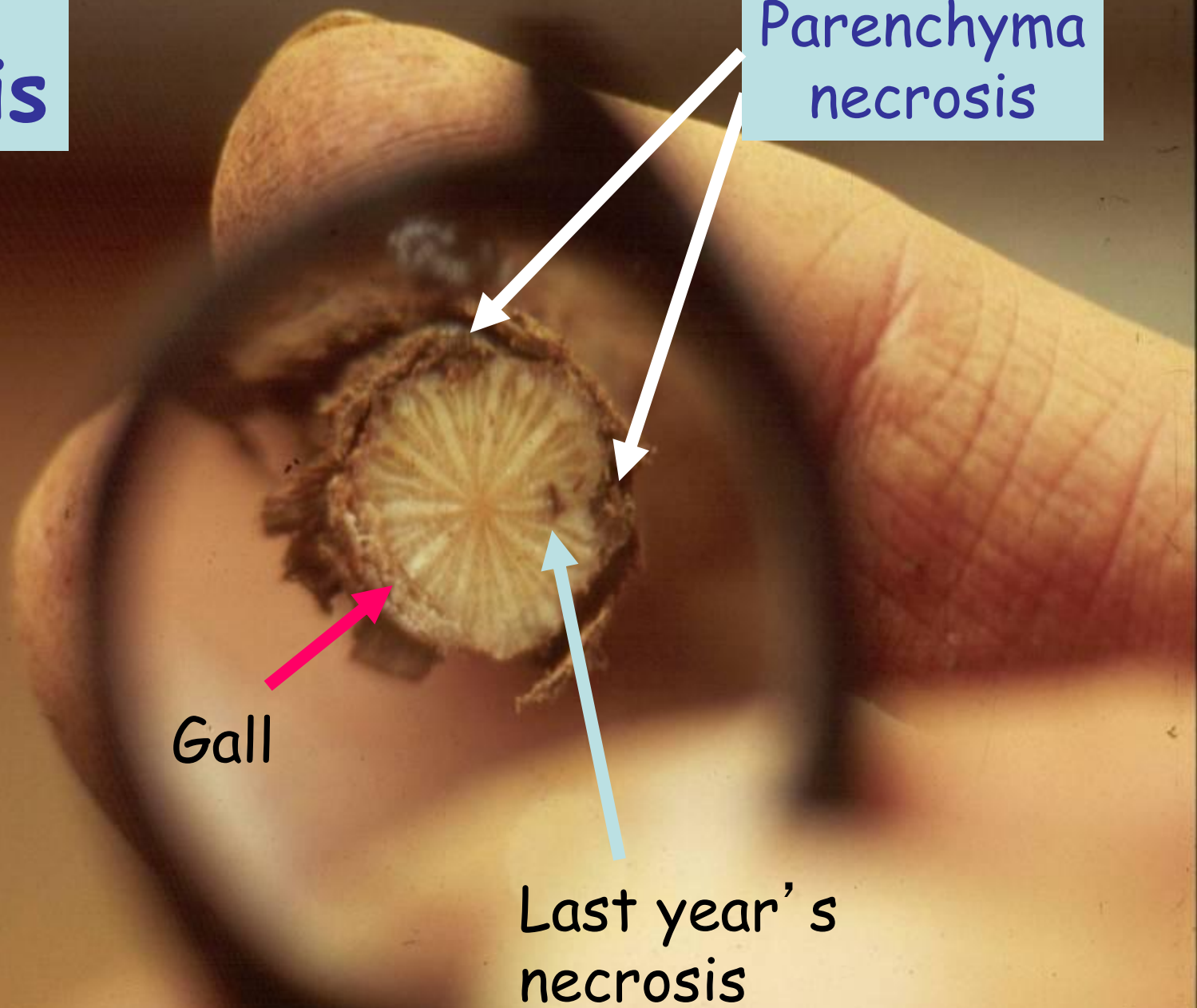
Nodosities
(primary and secondary roots)

**Root
necrosis**

**Parenchyma
necrosis**

Gall

Last year's
necrosis





Pythium
Fusarium
Alternaria
Rhizoctonia
Trichoderma
Macrophominia
Phaeoacremonium

Expectations

Vine parentage	Galls	Damage
American <i>Vitis sp.</i>	Leaf galls → nodosities →	Low-severe Varies. (?)



Expectations

Vine parentage	Galls	Damage
Amer. <i>Vitis</i> spp. <u>roots</u>	Few nodosities	None
<i>V. vinifera</i> <u>scion</u>	No leaf galls	None
Amer. <i>Vitis</i> sp. x <i>V. vinifera</i> <u>roots</u> AXR#1, O43-43, Harmony, Freedom Host specific strains	nodosities tuberosities	Severe

Other Control Tactics

Slowing of damage

Quarantine

Sandy soil

Flooding

Organic management

Colder soils

Issues

Site specificity

Long term carry through

Scientific support

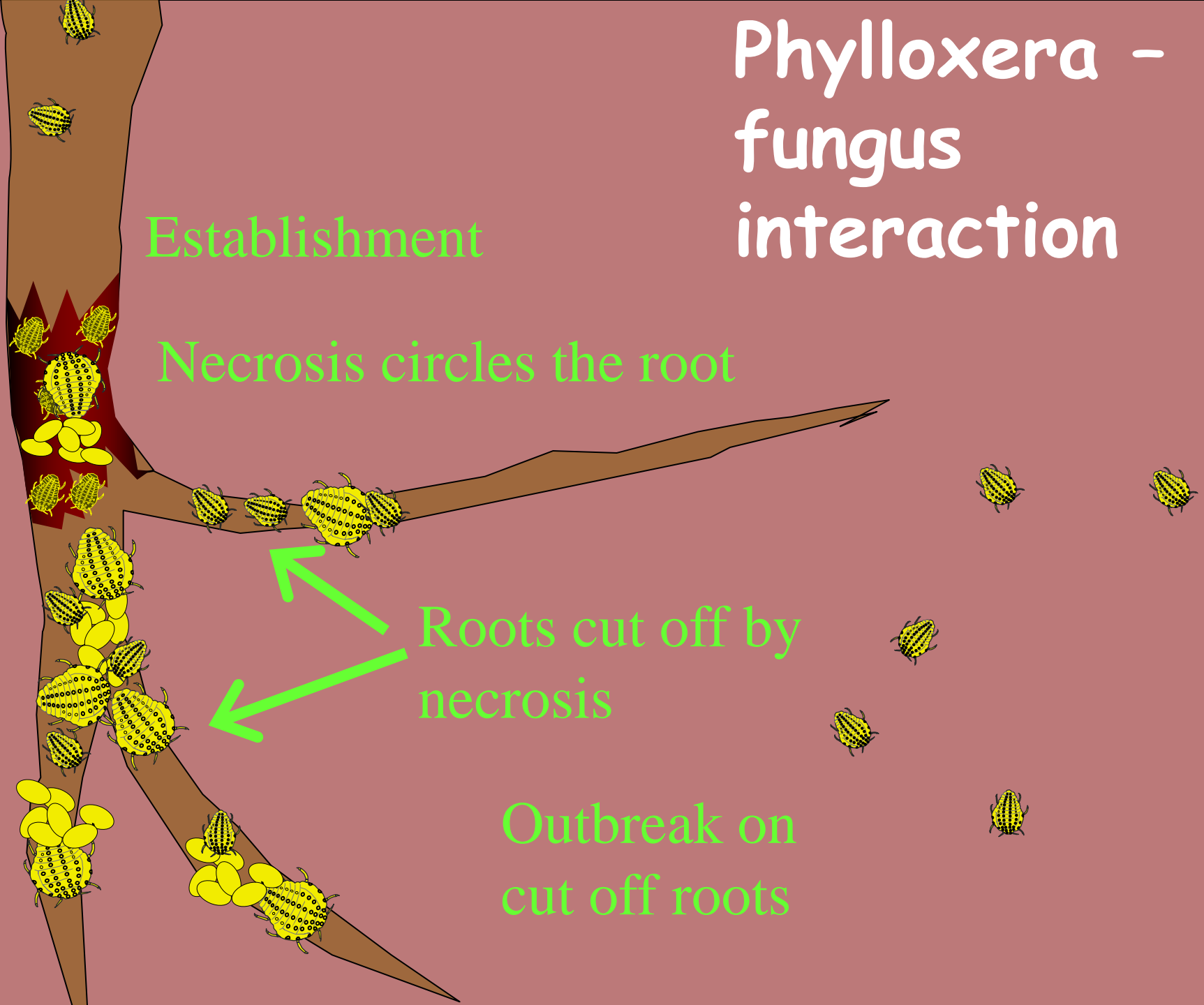
Phylloxera - fungus interaction

Establishment

Necrosis circles the root

Roots cut off by
necrosis

Outbreak on
cut off roots



Phylloxera – Karl Lund

- Characterized new strains
- Leaf gall forms
- Strains adapting to rootstocks –101-14Mgt and others
- National diversity assessment – over 450 isolates from US



Phylloxera Strains



- VIN R1
 - Collected from Chardonnay roots in UCD vineyard
- AXR R1
 - Collected from AxR #1 roots in Mendocino County
- 101 R1
 - Collected from 101-14 roots in Healdsburg, CA
- 101 R2
 - Collected from 101-14 roots in Geyserville, CA
- 101 L1
 - Collected from 101-14 leaves in Dunnigan, CA
- STG L1
 - Collected from St. George leaves in Winters, CA

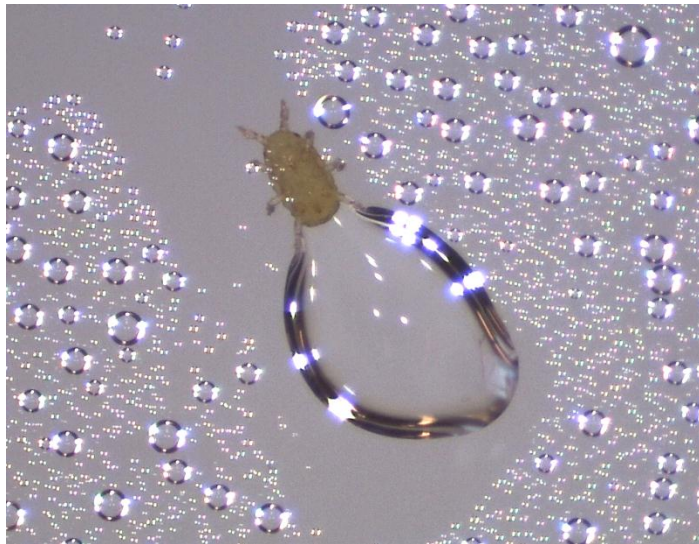
Phylloxera Phenotyping

- VIN R1 (Chardonnay)
 - Limited range of hosts
 - Very aggressive on Colombard
 - Unable to reproduce consistently on AxR #1
- AXR R1
 - Increased host range as compared to 101-14 strains
 - Also aggressive on Colombard
 - Able to reproduce well on AxR#1



Phylloxera Phenotyping

- 101 R1 and 101 R2
 - Widest host range
 - Only strains able to reproduce on Riparia Gloire
 - Also able to reproduce on AxR1
 - Reproduce slowly on Colombard



Phylloxera Phenotyping



- 101 L1
 - Reduced host range compared to other 101-14 strains
 - Able to reproduce on both Colombard and AXR #1
 - Only strain to have any success on Ber 9031
- STG L1
 - Reduced host range compared to 101 L1
 - Better reproduction on Colombard than 101-14 strains, but not as good as VIN R1 or AXR R1

Phylloxera Phenotyping

- Host Range (narrow to wide)
 - VIN R1; AXR R1; STG L1; 101 L1; 101 R1 & R2
- Reproduction on Colombard (aggressive to weak)
 - Same as above
- None of the strains fed on Trayshed
- *V. berlandieri* 9031 very resistant



101-14 Strains

- Strains collected on 101-14 have better reproductive capacity on 101-14
- 101-14 Strains can:
 - Reproduce in less than 2 weeks
 - Adults can produce more than a dozen eggs a day
- Lead to extremely large populations on 101-14
- May lead to reduced fitness of 101-14 during heavy infestation

1103P Phenotyping

- All strains reproduce on 1103P
- VIN R1 and AXR R1 did poorly
- A few tuberosity like galls formed



101-14Mgt and Phylloxera

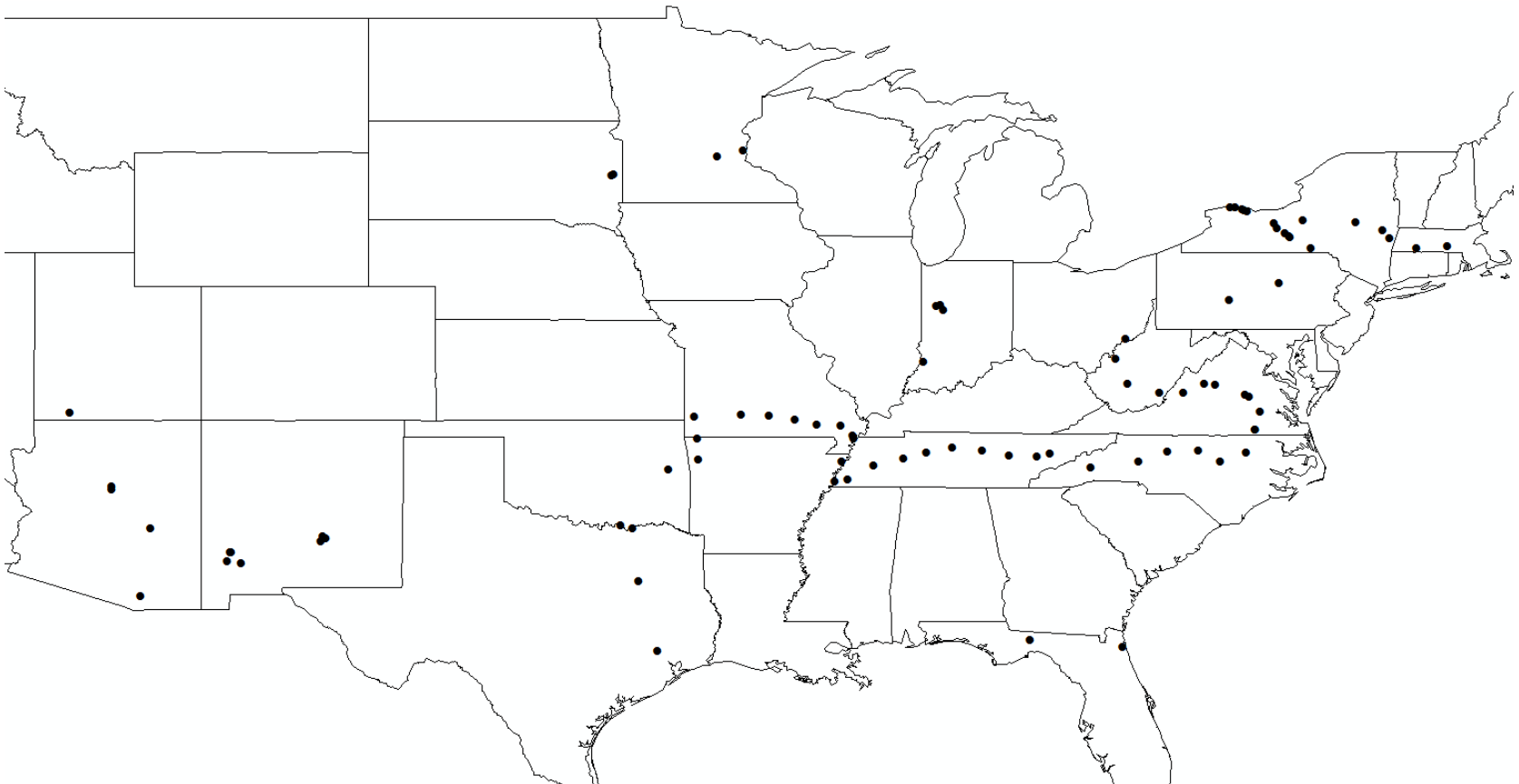
- Heavy clay soils — too wet in the Spring and cracking in Summer
- 101-14's predominantly horizontal and thin roots
- Poor 1^o root regeneration – not well adapted to deficit irrigation
- Better adapted phylloxera strains also found on 3309C, 1103P, Teleki 5C and St. George

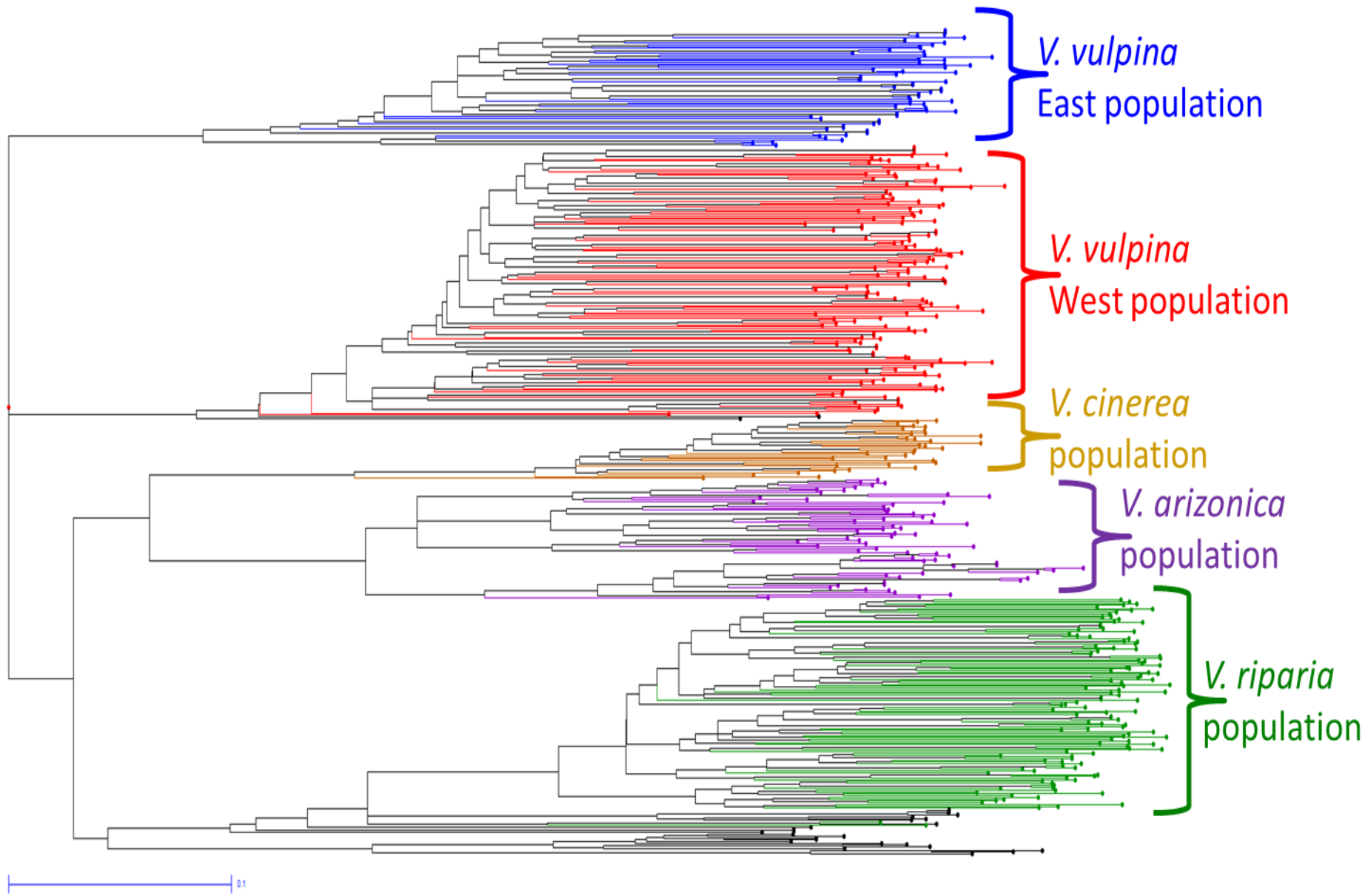


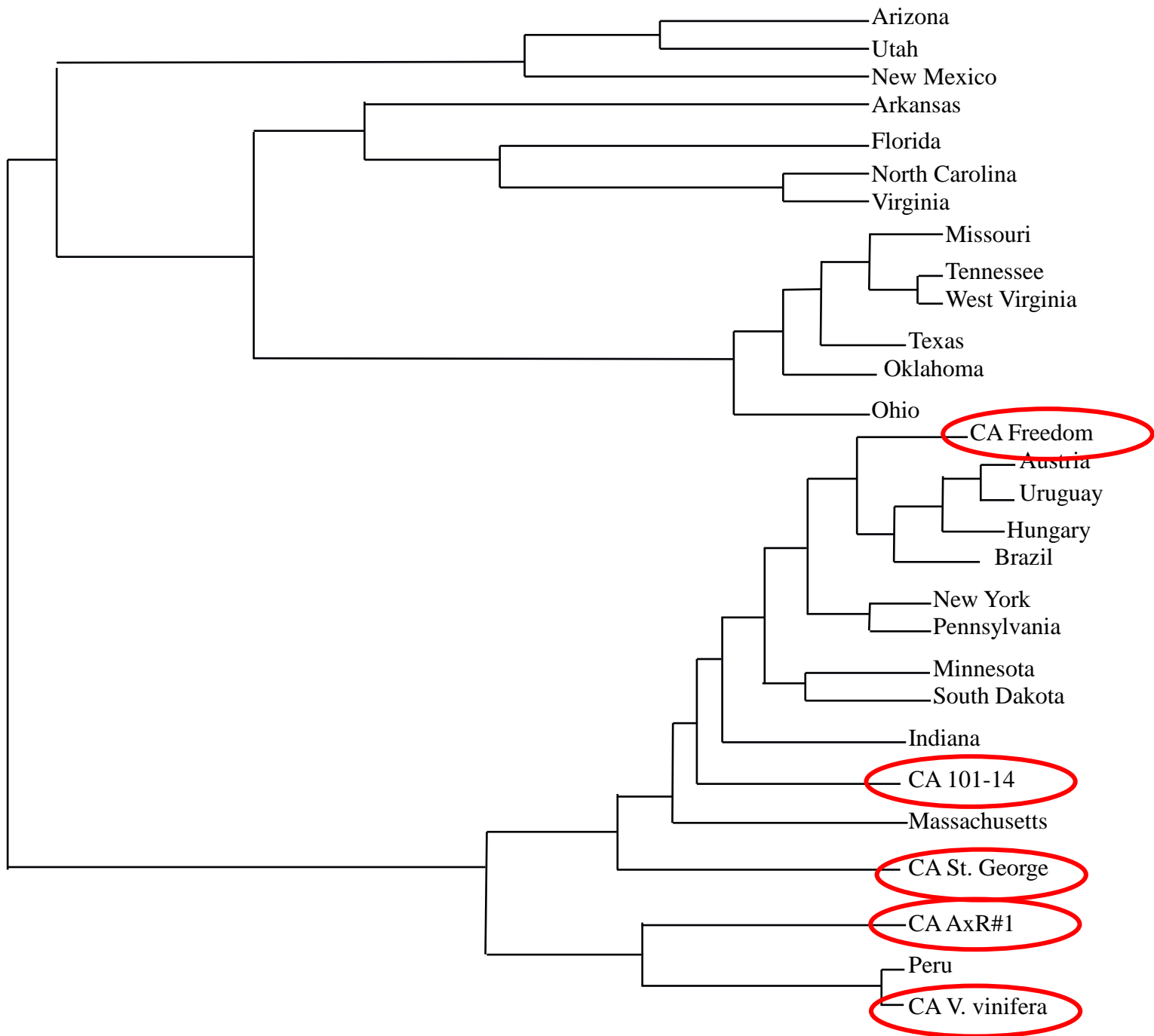
Sample Collection

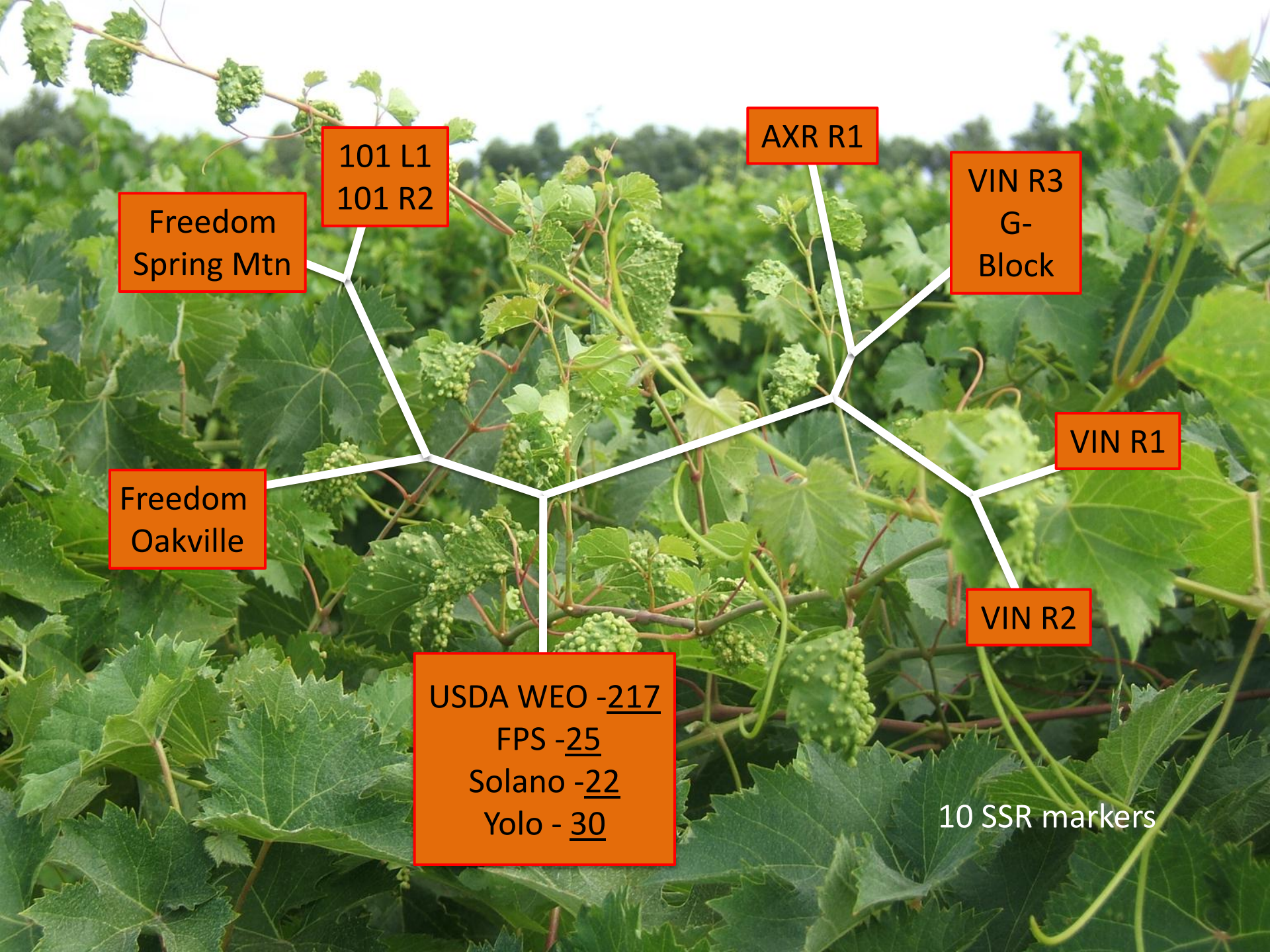
- 468 Samples, 149 Plants, 85 Sites, 19 States

7 samples from California; 7 samples from Austria; 8 samples from Hungary; 2 samples from Argentina; 3 samples from Brazil; 3 samples from Peru; 4 samples from Uruguay









Freedom
Spring Mtn

101 L1
101 R2

Freedom
Oakville

USDA WEO -217
FPS -25
Solano -22
Yolo - 30

AXR R1

VIN R3
G-
Block

VIN R1

VIN R2

10 SSR markers



A
GUSTAVE FOEX

Thanks!