Living on the edge: the narrow genetic base of the rootstocks is a serious threat

Daniel Pap GBG2018
VITIS ROOTSTOCK - Narrow genetic base?

Gloire de M., Rességier 2, du Lot contribution to the total genetic background is 40%

Chloroplast haplotype diversity limited – few mother lines

In California: minimal requirements are: Root-knot nematode resistance, Phylloxera resistance
Root-Knot Nematode Resistance and Pathotypes

<table>
<thead>
<tr>
<th>Pathotype ID</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race3</td>
<td><em>M. incognita</em></td>
</tr>
<tr>
<td>Harmony-C</td>
<td><em>M. incognita</em></td>
</tr>
<tr>
<td>Harmony-A</td>
<td><em>M. arenaria</em></td>
</tr>
</tbody>
</table>

**Based on Ferris et al 2012**

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Parentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCD GRN1</td>
<td><em>V. rupestris</em> cv A. de Serres, <em>M. rotundifolia</em> cv Cowart</td>
</tr>
<tr>
<td>UCD GRN2</td>
<td><em>V. rufotomentosa</em>, <em>V. champinii</em> cv Dog Ridge, <em>V. riparia</em> cv Riparia Gloire</td>
</tr>
<tr>
<td>UCD GRN3</td>
<td><em>V. rufotomentosa</em>, <em>V. champinii</em> cv Dog Ridge), <em>V. champinii</em> cv c9038, <em>V. riparia</em> cv Riparia Gloire</td>
</tr>
<tr>
<td>UCD GRN4</td>
<td><em>V. rufotomentosa</em>, <em>V. champinii</em> cv Dog Ridge), <em>V. champinii</em> cv c9038, <em>V. riparia</em> cv Riparia Gloire</td>
</tr>
<tr>
<td>UCD GRN5</td>
<td><em>V. champinii</em> cv Ramsey, <em>V. champinii</em> cv c9021), <em>V. riparia</em> cv Riparia Gloire</td>
</tr>
</tbody>
</table>

**Resistance to Race3**
- Teleki 5 C
- SO4
- Kober 5 BB
- Glorie de Mpt.
- Schwarzmann
- 99R
- 1103P
- St. George
- 110R
- 140Ru
- Börner
- Dog Ridge
- Ramsey
- Freedom
- 1613C
- Harmony
- 101-14
- 3309C
- 44-53
- 420A
- 1616C

**Susceptible (some level)**
- 101
- 420A

**Based on Ferris et al 2012**
Nematode mapping efforts (on going)

• Resistance on Chr 18 (GRN2 / GRN4 / GRN5)  
  (based on Bulk Segregate Analysis)

• MJR1 – Chr18 - *M. javanica* (Smith et al. 2018)  
  *V. cinerea* accession

• Expanded mapping populations:  
  GRN2/GRN4/GRN5

• New mapping populations  
  *V. cinerea / V. arizonica*: b41-23, b45-26

RKN screen in the greenhouse
**Phylloxera Biotypes – and Resistances?**

Astrid Forneck et al 2016  AJEV  
Biotype differentiation according to host performance

<table>
<thead>
<tr>
<th>Biotype</th>
<th>V. vinifera</th>
<th>Hybrids</th>
<th>American Sp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>TUB.</td>
<td>NOD.</td>
<td>LEAF</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Granett et al. 1985, King and Rilling 1985  
Granett et al. 1985  

- AXR#1 break down in California (B biotype)
- Teleki 5C virulent phylloxera in EU
- Quick spread of New – leaf feeding from in CA
Resistance to B biotype

*V. vinifera* F2-35 × *V. arizonica-girdiana* b42-26

RDV2 identified on Chr18

Map generated for Pierce’s Disease R mapping

Excercised roots in Petri dishes

Greenhouse evaluation in perlite filled bins
Californian Foliar Phylloxera

• This biotype feeds on roots (for e.g. 1103P roots)

• V. vinifera F2-35 × V. berlandieri 9031

• Segregates 1:1 for (pseudo)Tuberosity in excised root assays

Trait: not feeding through the cortex of the root, but allows feeding on root tips, callus tissue (Nodosity)
Summary

• Narrow genetic base of the existing rootstock is a threat
• Need for new resistance sources
• Need for understanding genetics of resistances
• Establish marker assisted selection
• Need to keep up with the everchanging pest
• We should not forget to look below ground
Acknowledgement

Summaira Riaz
Nina Romero
Rebecca Wheeler-Dykes
M. Andrew Walker
Karl Lund
Astrid Forneck

Funding Sources

California Grape Rootstock Improvement Commission
California Grapevine Rootstock Research Foundation
CDFA Improvement Advisory Board
California Table Grape Commission
Louis P. Martini Endowed Chair funds