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Impact of red blotch on wine composition and quality

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Introduction

- **Grapevine red blotch-associated virus (GRBaV)**
 - First described in Cab Sauv, Zin and Cab Franc in Napa Valley (1)
 - Cornell researchers have shown that GRBaV is causal agent of red blotch diseases (2)
 - **RB disease shows symptoms similar to leafroll disease**
 - Unlike leafroll – RB show red veins on leaf undersides and no rolling

(1) Al Rwahnih et al., (2013) Phytopath. 103: 1069-1076
(2) Fuchs (2013) <http://lecture.ucanr.org/Mediasite/Play/7e6250539e5e4676ad4cd888051164c1d>

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Introduction

- **Red Blotch disease**
 - Both young and mature vines – white and red cultivars – several states
 - Suggest transmission by grafting (1)
 - Increase incidence in young healthy vines suggest vector (3)
 - Currently DNA-based PCR test available to assay for virus in plant material

(1) Al Rwahnih et al., (2013) Phytopath. 103: 1069-1076
(3) Poojaric et al. (2013) PLoS ONE 8: e64194

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RB disease – Grape composition

- ↓ **Sugar accumulation**
 - As much 4-5 °Brix less
 - Delay in ripening
- ↓ **Color development**
- ↑ **TA**
 - Current research - show not always true
 - ↑ Malic acid

(1) Al Rwahnih et al., (2013) Phytopath. 103: 1069-1076
(3) Poojaric et al. (2013) PLoS ONE 8: e64194

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RB disease – Grape composition

- **Anecdotal evidence – severely infected**
 - Some see severe color influence – pink grapes
 - Max sugar accumulation of 19°Brix
 - ↓ Total phenolics 5-30%
 - Some contracts want all infected fruit dropped or 50% dropped to help ripening??? – does it help?
 - Vineyard cultural practices?

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RB disease – Grape & Wine Composition


- **Much not known**
 - Influence of cultivar and rootstock?
 - Influence of stress?
 - No well documented influence on grape development
 - Effect on wine composition and quality?
 - Wine ageability?



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RB disease – Wine quality


- Anecdotal evidence
 - Less sugar, max 22-23°Brix
 - Tannin 0-30% less
 - Anthocyanins 0-30% less
 - Acid inconsistent
- One study UC Davis
 - What did we find??



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RB disease – Wine composition


- Study on Cab Sauv Oakville
 - Yield so low, experiment n=1
 - RB pos fruit
 - RBpos fruit according to WineXray LLC HA assay correlation
 - 30%↓ Tot Anth
 - 57%↓ Tannin
 - 18%↓ Tot Phenols
 - Wines at end of fermentation – RB pos fruit
 - 15%↓ Tot Anth
 - 15%↓ Tannin
 - 7%↓ Tot Phenols



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RB disease – Wine composition

- Study on Cab Sauv Napa Valley winery (triplicate analyses n=3)
 - RB pos fruit
 - 30%↓ Tot Anth
 - 24%↓ Tannin
 - 27%↓ Tot Phenols
 - Wines at end of fermentation – RB pos fruit
 - 5%↓ Tot Anth
 - 4%↑ Tannin
 - 9%↓ Tot Phenols



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Wine quality – Tasting notes

- RB neg
 - Red dark fruit, green pepper
 - Mouthfeel – fine emery (H), suede, medium grain, drying (M-H), general astringency (M-H), more length
- RB pos
 - More confectionary fruit, canned cherries
 - Mouthfeel – Fine emery (L), suede, finer grain tannin, drying (L-M), greener tannins, gen astringency (L-M), less integrated, less length, lack of middle palate, watery
- RB neg slightly deeper purple color

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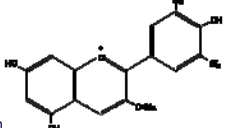
Wine quality – Tasting notes

- RB pos wines
 - Described as containing green, unripe tannins, lack of finish or length, hole in the middle palate, less texture
 - In the Cab Sauv tested there was not such a large difference in phenol content in finished wines
 - Seems it is not just the quantity of tannin – but the quality
 - Work needs to be done to determine not only difference in amounts of tannin and other phenolics, but composition of the tannin

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Background – phenols in wine

- Main phenols (flavonoids) in red wine
 - Anthocyanins responsible for red color
 - Flavan-3-ols (ex. catechin, epicatechin, epigallocatechin, epicatechingallate)
 - Oligomers and polymers of flavan-3-ols, so called proanthocyanidins (PA) or condensed tannins Fig. 1



Anthocyanin

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Figure 1: Proanthocyanidins

Procyanidin: R = H
Prodelphinidin: R = OH

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Background – phenols in wine

- **Extraction during wine making**
 - **Anthocyanins from skins**
 - Early during fermentation (3-5 days)
 - **Seed PA (mDP ~ 10), higher % galloylation**
 - **Skin PA (mDP ~ 30), also contain (epi)gallocatechin units**
 - Increase extraction with temp, % EtOH
 - Polymerization reactions between anth and PA or between PA and PA

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Sensory properties of phenols

- **Tannins or proanthocyanidins**
 - Main contributors to bitterness and astringency
 - Ratio of astringency to bitterness increase with mDP
 - 'Coarseness' and 'dryness' of astringency increase with galloylation
- **Sensory properties of pigments**
 - Anthocyanins have no taste or mouthfeel
 - Pol. Pigments add to astringency "dry", "grippy", "viscosity", "fine emery"

Gawel *et al.* (1998) *Austr. J. Grape Wine Res.* (6) 74; Vidal *et al.* (2003) *J. Sci. Food Agric.* (83) 564; Oberholster, Francis, Iland, Waters (2009) *Austr. J. Grape Wine Res.* (15) 59-69

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Wine quality

- **Thus phenol composition of final wine**
 - Important for sensory properties and thus quality
 - Anth/tannin ratio
 - Tannin composition

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Wine quality

- **Receive RB fruit**
 - Low in sugar content
 - Low in color
 - Low in tannin
- **Things to try**
 - Add red grape concentrate
 - Cofermentation
 - Fermentation with donated skins
 - Flash detente?
 - Use of commercial tannins

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Future Work – on the wine side

- **Determine what is the impact of RB on wine composition and quality**
 - Influence of cultivar?
 - Rootstock?
 - Stress?
- **Then, investigate ways to mitigate influence of RB on wine composition and quality**

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Future Work – on the wine side

- **Submitted research proposal to investigate the effect of RB disease on grape and wine composition and quality**
 - Two cultivars – Chardonnay and Cab Sauv
 - Two different vineyards
 - In total 4 different sites
- **Complete chemical analysis of grapes and wines**
- **Descriptive analysis of the wines**