

# Genetic dissection of Natural Dry-On-Vine trait in grapevine

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# Raisins, a little of context

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- Dried grapes
- Industry of more than 100 years in California
  - Multiple uses: raw, cooking, baking, brewing
- Trend to mechanization
  - Labor up to 35% of production costs
- Specialized germplasm



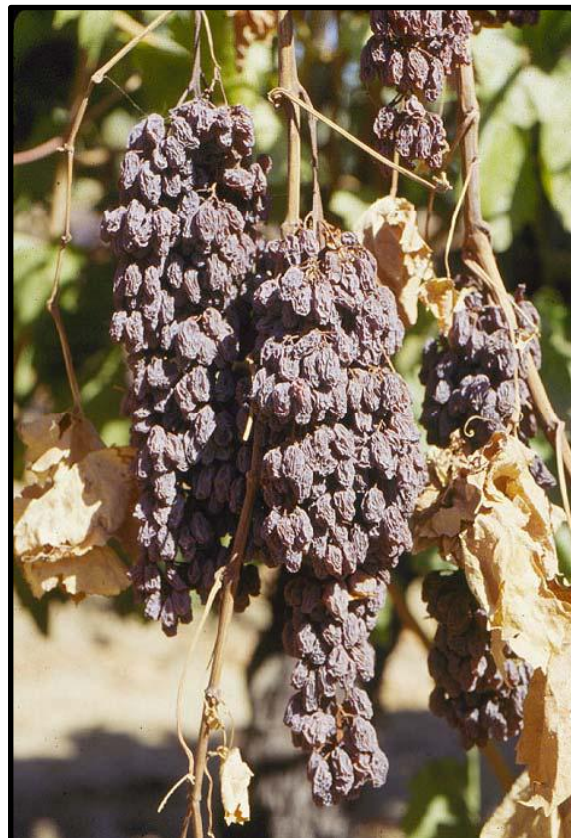


# Germplasm: traditional

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*Sultanina*

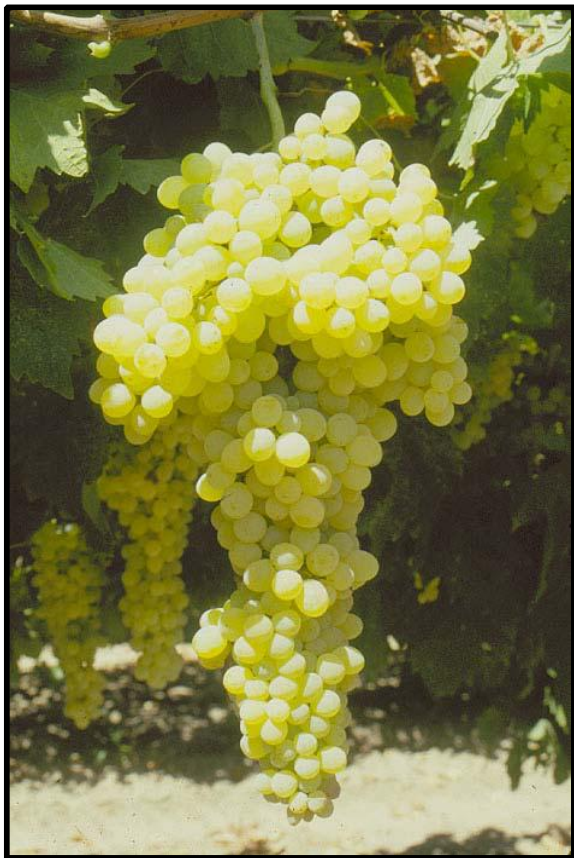


*Fiesta*



# Germplasm: DOV

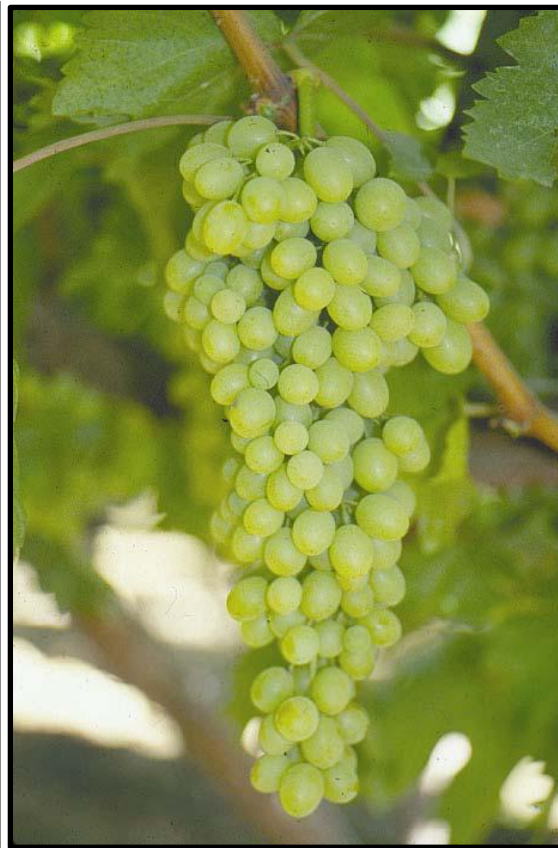
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*DOVine*



*Selma Pete*



# Germplasm: Natural Dry-On-Vine (NDOV)

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*Sunprime*  
(B82-43)



# Traditional vs NDOV

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# How to breed for NDOV raisins?

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- *Sunprime* solely source at the moment
- *VitisGen*
- Mapping of the trait
  - *C87-41* × *Sunprime*, using presence/absence = No hits!
  - *A95-27* × *Sunprime*, using % dry at three date = No hits!

# Using a different approach: candidate gene

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- Did we have a well constructed linkage map?
- Are we phenotyping the correct trait?
- Fruit drying: a reason or a consequence?
- Thinking in Vavilov: trait parallel series
  - Which other fruits dry on a vine? → wild tomatoes
- Cuticular Water Permeability 1 (*CWP1*) gene (Hovav, 2007)
  - cuticle microcracking in fruits of primitive green-fruited wild tomato species, *Solanum habrochaites*, *S. cheesmaniae* and *S. pimpinellifolium*



# Is *Cwp1* present in grapevine?

- tblastn query of *S. habrochaites* *Cpw1* on PN40024

## BLAST Results

**▼BLAST Inputs**  
**Query** ShCpw1 (269 letters)  
**Target** Vitis vinifera Genoscope.12X genome (33 sequences, 486198630 total letters)  
**Program** TBLASTN 2.3.0+

**Output Modifications**  
**Clear JBrowse** ☐ Yes ☒ No  
**View** **Target** Query  
**Allow Query Overlap** ☒ Yes ☐ No  
**Max Intron Size**   
**Download results**

**Apply**

**Hits Found 2**

	Define	Score	E	Target View [click feature to view in JBrowse]
▶	chr18	111.3	1.8E-25	<div><div>Feature scale 1000.0 </div><div>Target scale 0 29M </div></div>
▶	chr3	107.5	3.5E-24	<div><div>Feature scale 1000.0 </div><div>Target scale 0 19M </div></div>

# Collaboration with the USDA ARS San Joaquin Valley Agricultural Sciences Center

- Craig Ledbetter
  - Research Geneticist
  - Segregating populations (Tray-dry × NDOV) and phenotypic evaluation
- Steven Lee
  - Molecular Biologist
  - Gene cloning and transgenic preparation/evaluation





# Gene cloning and (simple) functional evaluation

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- Generate primer sequences based on PN40024
- *Sunprime*, *Valley Perl* and *Y308-344* (NDOV + REN4)
- Transferring into tomato (ongoing)
  - Phenotypic evaluation on microfissure density

## What about *Cpw1* in other genotypes?

[illegible]

	cov	pid	1321	.	.	:	.	.	.	.	4	.	.	.	1440
1 Cpw1_PN40024	100.0%	100.0%	GTATTAAATGCGCTCTTCCCTTGTAGGTC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
2 Cpw1_CavSavi	100.0%	99.8%	GTATTAAATGCGCTCTTCCCTTGTAGGTC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3 Cpw1_VcineB9	90.8%	96.9%	GTATTAAATGCGCTCTTCCCTTGTAGGTC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
4 Cpw1_FlamSdl	100.0%	100.0%	GTATTAAATGCGCTCTTCCCTTGTAGGTC	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
5 Cpw1_Sultana	67.0%	28.2%	CAACTTCATCCCT-CCCTCCCAATATACACA-GCCTTC	----	----	----	----	----	----	----	----	----	----	----	----
6 Cpw1_ValPerl	84.0%	31.3%	AGACCTAAATTGTT-CGGTTC	TTGGAGAGCAAGAAGAATCCCATGGAATTTGCAGAGGAAGTTATGAAGGAGGCAGATAAGTATAATGGGTTTAACTTGATAATAGCTGATCTTTGTTCCA											
7 Cpw1_Sunprem	82.5%	30.3%	AGACCTAAATTGTT-CGGTTC	TTGGAGAGCAAGAAGAATCCCATGGAATTTGCAGAGGAAGTTATGAAGGAGGCAGATAAGTATAATGGGTTTAACTTGATAATAGCTGATCTTTGTTCCA											

		cov	pid	1441	:	.	.	.	.	5	.	.	.	.	:	.	1560
1	Cpw1_PN40024	100.0%	100.0%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	CAGA
2	Cpw1_CavSavi	100.0%	99.8%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	CAGA
3	Cpw1_VcineB9	90.8%	96.9%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	CAGA
4	Cpw1_FlamSdl	100.0%	100.0%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	CAGA
5	Cpw1_Sultana	67.0%	28.2%	AA----	AGAACA	ATACAAAA	CAAAAACTA	AGGGGC	ATGGCTA	ACAATG	AAAAAT	CAGACTT	ACCT-----	GTTGTG	ATACTC	ATCTCT	--GTTGAGCAAGAGAAGAAGAGGGTA
6	Cpw1_ValPerl	84.0%	31.3%	AAACTAT	GTCTAT	ATAACCA	ACAGACCA	AGAGAAG	CTAATG	TTTCTG	TGTAGAG	TTTCACCT	GGTATT	CATGTG	CTGTCA	AATGCA	AGTTGGACTCACCTTGGCCTAAGGCACGAA
7	Cpw1_Sunprem	82.5%	30.3%	AAACTAT	GTCTAT	ATAACCA	ACAGACCA	AGAGAAG	CTAATG	TTTCTG	TGTAGAG	TTTCACCT	GGTATT	CATGTG	CTGTCA	AATGCA	AGTTGGACTCACCTTGGCCTAAGGCACGAA

	cov	pid	1681	7	1800
1 Cpw1_PN40024	100.0%	100.0%	CTCACATTTGTGCTCTTGACTGGGAGTGTGATCAAAGTTCCATTTTCAC	TGACACAGAGACAAAAATGGTATATCTTAGTGGTTTTGCAGTCTCTCTTTCAAAGAAC	TTCACAAACATTG
2 Cpw1_CavSavi	100.0%	99.8%	CTCACATTTGTGCTCTTGACTGGGAGTGTGATCAAAGTTCCATTTTCAC	TGACACAGAGACAAAAATGGTATATCTTAGTGGTTTTGCAGTCTCTCTTTCAAAGAAC	TTCACAAACATTG
3 Cpw1_VcineB9	90.8%	96.9%	CTCACATTTGTGCTCTTGACTGGGAGTGTGATCAAAGTTCCATTTTCAC	TGACACAGAGACAAAAATGGTATATCTTAGTGGTTTTGCAGTCTCTCTTTCAAAGAAC	TTCACAAACATTGA
4 Cpw1_FlamSdl	100.0%	100.0%	CTCACATTTGTGCTCTTGACTGGGAGTGTGATCAAAGTTCCATTTTCAC	TGACACAGAGACAAAAATGGTATATCTTAGTGGTTTTGCAGTCTCTCTTTCAAAGAAC	TTCACAAACATTG
5 Cpw1_Sultana	67.0%	28.2%			
6 Cpw1_ValPerl	84.0%	31.3%	CCTCCGCATCCTATCC	TCC	AGAGAGGGAACACCCAGTTA
7 Cpw1_Sunprem	82.5%	30.3%	CTCGCATCTATCCTC	C	AGAGAGGGAACA--CCAGTT



# Expectations

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- **Test the hypothesis whether or not *VviCpw1* is responsible for NDOV trait**
  - Provide a tool for the early identification of NDOV genotypes
  - Link NDOV with studies of cuticle characteristics (epidermis) in grape fruits (drying)
  - Collaborate in the selection of NDOV genotypes in a more comprehensive view
- Genotyping of available pedigree and derived germplasm from *Sunprime*
- Design of transcriptomic and phenotypic evaluations with additional functional tests



Taken from Hovav *et al.* 2007, The Plant Journal, 52(4) 627-639

# NDOV is a minute part but relevant

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Agronomic



Sensory



# Thanks for your attention!

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