Historical occurrence of Grapevine Red Blotch-Associated Virus

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Novel grapevine viruses discovered by NGS

- 2009 Al Rwahnih et al.: Description of Grapevine Syrah virus 1 (California, USA)
- 2011 Giampetruzzi et al.: Description of Grapevine Pinot gris-associated virus (Italy)
- 2011 Zhang et al.: Description of Grapevine vein clearing virus (Midwest US), the first DNA virus found in *Vitis*.)
- 2012 Al Rwahnih et al.: Description of Grapevine virus F (California, USA)
- 2012 Al Rwahnih et al.: Identification of Grapevine red blotch-associated virus (California, USA). (Same as Grapevine Cabernet franc-associated virus: New York. Krenz et al., 2012)
- 2013 Al Rwahnih et al.: Identification of plant virus satellite. (California, USA)
- 2014 Maliogka and Katis: A putative badnavirus identified in vines affected by Roditis leaf discoloration (Greece)
- 2015 Al Rwahnih et al.: A putative reovirus identified in Cabernet Sauvignon vines (California, USA)

Grapevine red blotch-associated virus Is Widespread in the United States

B. Krenz, J. R. Thompson, H. L. McLane, M. Fuchs, and K. L. Perry

***Grapevine red blotch-associated virus* is widespread in California and U.S. vineyards.**

M. R. SUDARSHANA (1), A. Gonzalez (1), A. Dave (1), A. Wei (2), R. Smith (3), M. M. Anderson (3), A. M. Walker (3)

Detection and genetic diversity of Grapevine red blotch-associated virus isolates in table grape accessions in the National Clonal Germplasm Repository in California

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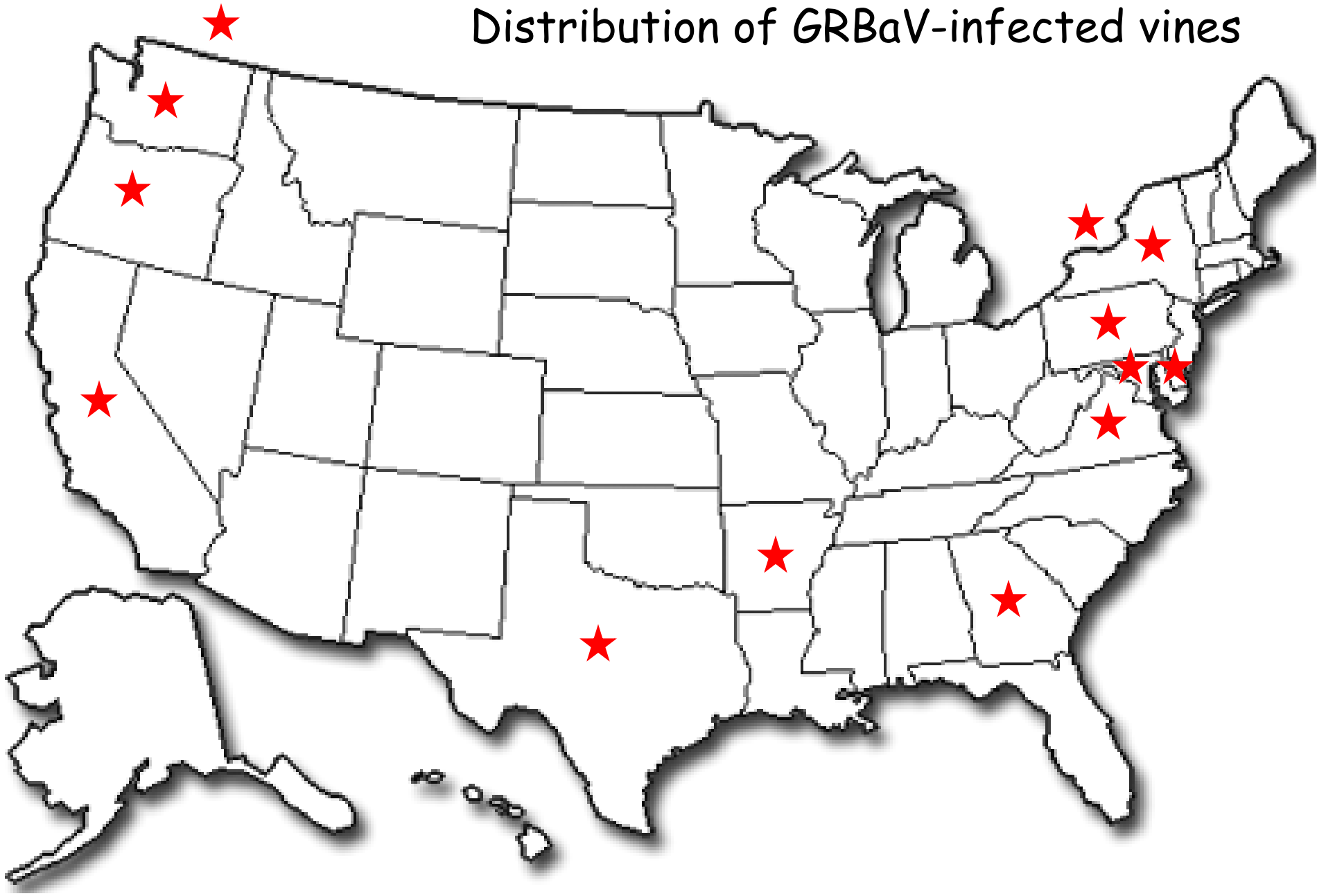
Grapevine Red Blotch-Associated Virus, an Emerging Threat to the Grapevine Industry

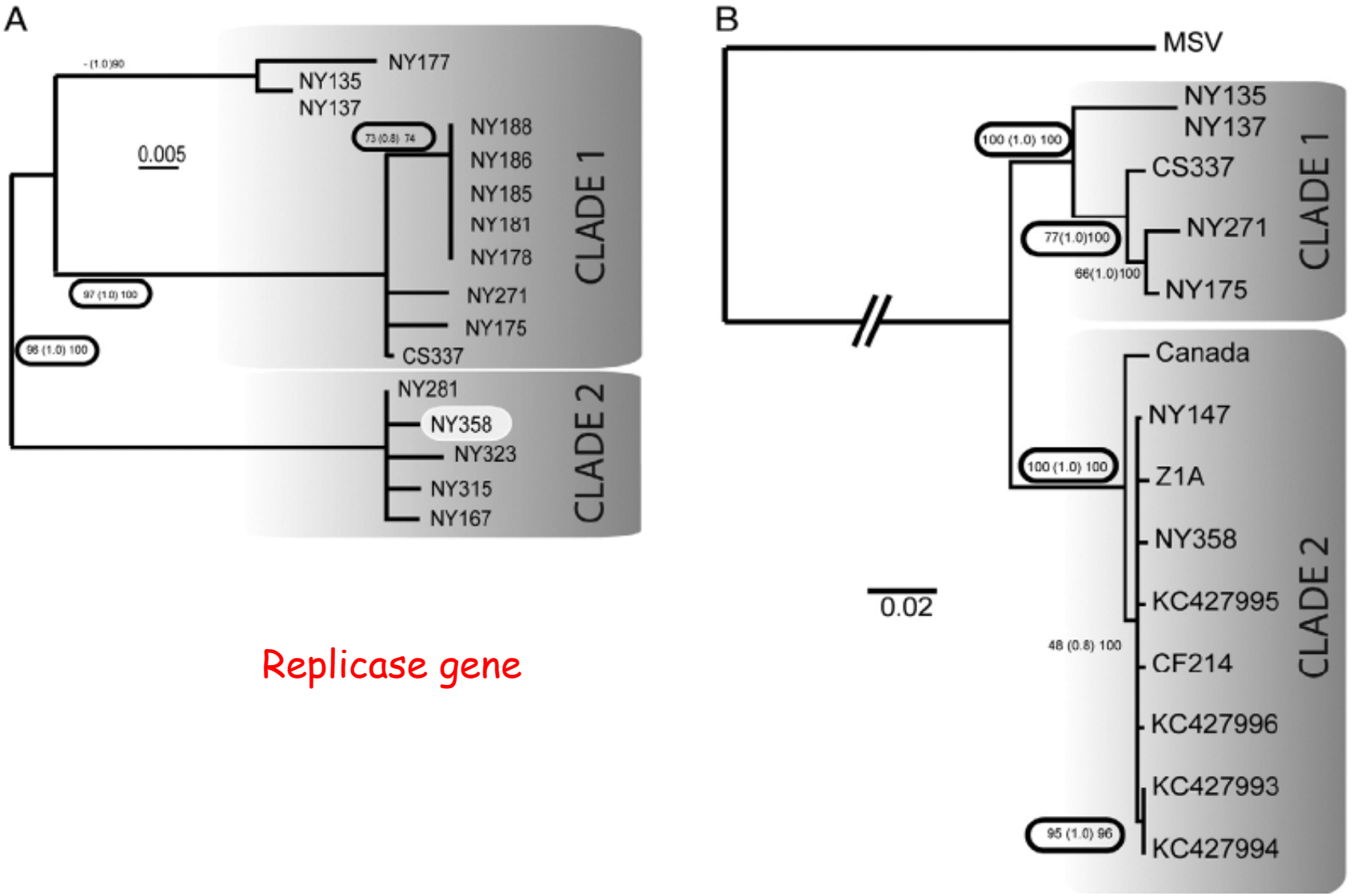
Mysore R. Sudarshana, Keith L. Perry, and Marc F. Fuchs

Distribution of GRBaV-infected vines



Courtesy of Dr. Marc Fuchs

Molecular variability



Replicase gene

complete genome.

Krenz et al., 2014, Phytopathology

Is Red Blotch a novel disease? Is it caused by an invasive introduction?

UC Davis Center for Plant Diversity/Herbarium

- The Herbarium archives contain over 300,000 dried specimens.
- Each specimen is labeled and mounted on archival paper.
- Specimen data includes species, cultivar, place and date of origin, and the collector's name.

The herbarium also maintains a few un-mounted grape samples from Yolo County.

Example of a specimen records

Consortium of California Herbaria

Participants News Search About Help

UC Davis

Accession Detail Results

UCD is the home institution for this record

Please cite data retrieved from this page: Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/; Fri Oct 31 15:16:31 2014).

Records are made available under the CCH Data Use Terms.

Specimen number	UCD17955
Determination	*Vitis vinifera* More information: Jepson Online Interchange
Collector, number, date	H. Olmo, s.n., 08 11 1940
County	Fresno
Locality	Wahtoke Vineyard in Sanger
Coordinates	36.7042 -119.5553 BerkeleyMapper [or without layers, here]
Datum	WGS84; ER = 3.612 km
Coordinate source	Geolocate (copied from UCD17950)
Annotations and/or curatorial actions	Vitis vinifera L. cv. Murocain 2010-10-06 Original determination

Sample collection

- Fifty six grapevine specimens were collected (Approximately 0.5 g of leaf/petiole tissue).
- 23 *Vitis vinifera* and 33 American hybrid samples
- specimens were harvested and pressed between 1937-1950.
- Pieces of foil containing each sample were placed in individual Ziplock bags to prevent cross contamination.
- The 56 sample bags were transported to a lab in which research on grapevine had NOT previously been conducted.

List of samples: Vitis cultivars from Napa or Sonoma County

Sample #	Herbarium ID#	Variety/cultivar	Location (County)	Year of collection	Collector	Tissue
1	DAV202170	Vitis vinifera L. cultivar Early Burgundy	Sonoma	1940	H. Olmo	Leaves
2	DAV202866	Vitis vinifera L. cultivar aff. Napa Gamay	Napa	1939-1940	H. Olmo	Leaves
3	DAV202172	Vitis vinifera L. cultivar Petite Bouschet	Sonoma	1937	H. Olmo	Leaves
4	DAV202202	Vitis vinifera L. cultivar Rosetta	Sonoma	1938?	H. Olmo	Leaves and petioles
5	DAV202196	Vitis vinifera L. cultivar Zinfandel	Napa	1935	H. Olmo	Leaves and petioles
6	DAV202174	Vitis vinifera L. cultivar Black Malvoisie	Sonoma	1935	H. Olmo	Leaves and petioles
7	DAV202201	Vitis vinifera L. cultivar Burger	Napa	1935	H. Olmo	Leaves and petioles
8	DAV202171	Vitis vinifera L. cultivar Carignane	Sonoma	1937	H. Olmo	Leaves and petioles
9	DAV202870	Vitis vinifera L. cultivar aff. Merlot	Napa	1939-1940	H. Olmo	Leaves and petioles;
10	DAV202872	Vitis vinifera L. cultivar aff. Gamay	Sonoma	1939-1940	H. Olmo	Leaves and petioles
11	DAV202227	Vitis vinifera L. cultivar Grey Riesling	Sonoma	1938	H. Olmo	Leaves and petioles
12	DAV202860	Vitis vinifera L. cultivar Early Burgundy	Napa	1939-1940	H. Olmo	Leaves and petioles

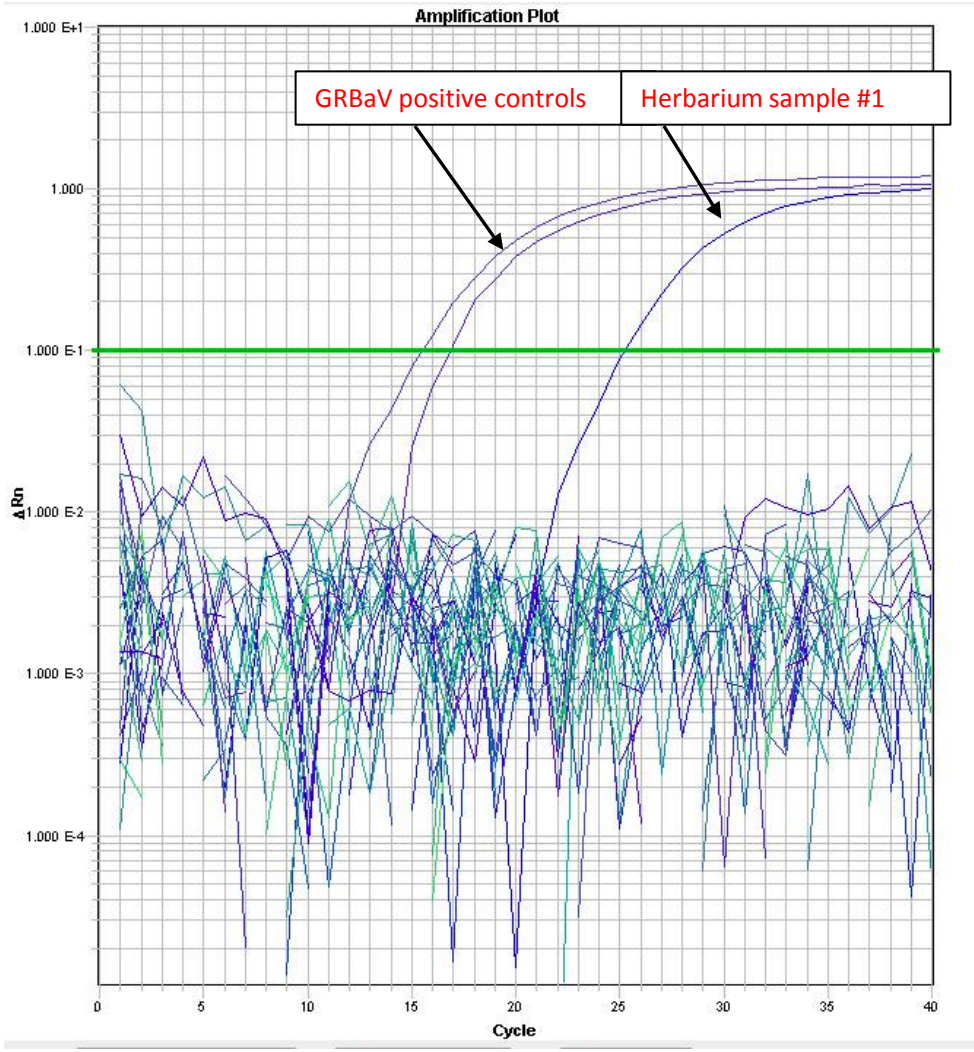
Precautions to prevent cross-contamination

- Extractions were conducted in an isolated lab (The Michelmore Lab)
- Samples processed with ALL new materials and reagents.

GRBaV PCR Results

- All herbarium samples were tested for GRBaV using both conventional and Quantitative PCR assays.

- Only one sample was found to be positive for GRBaV (sample #1).



Sample #1

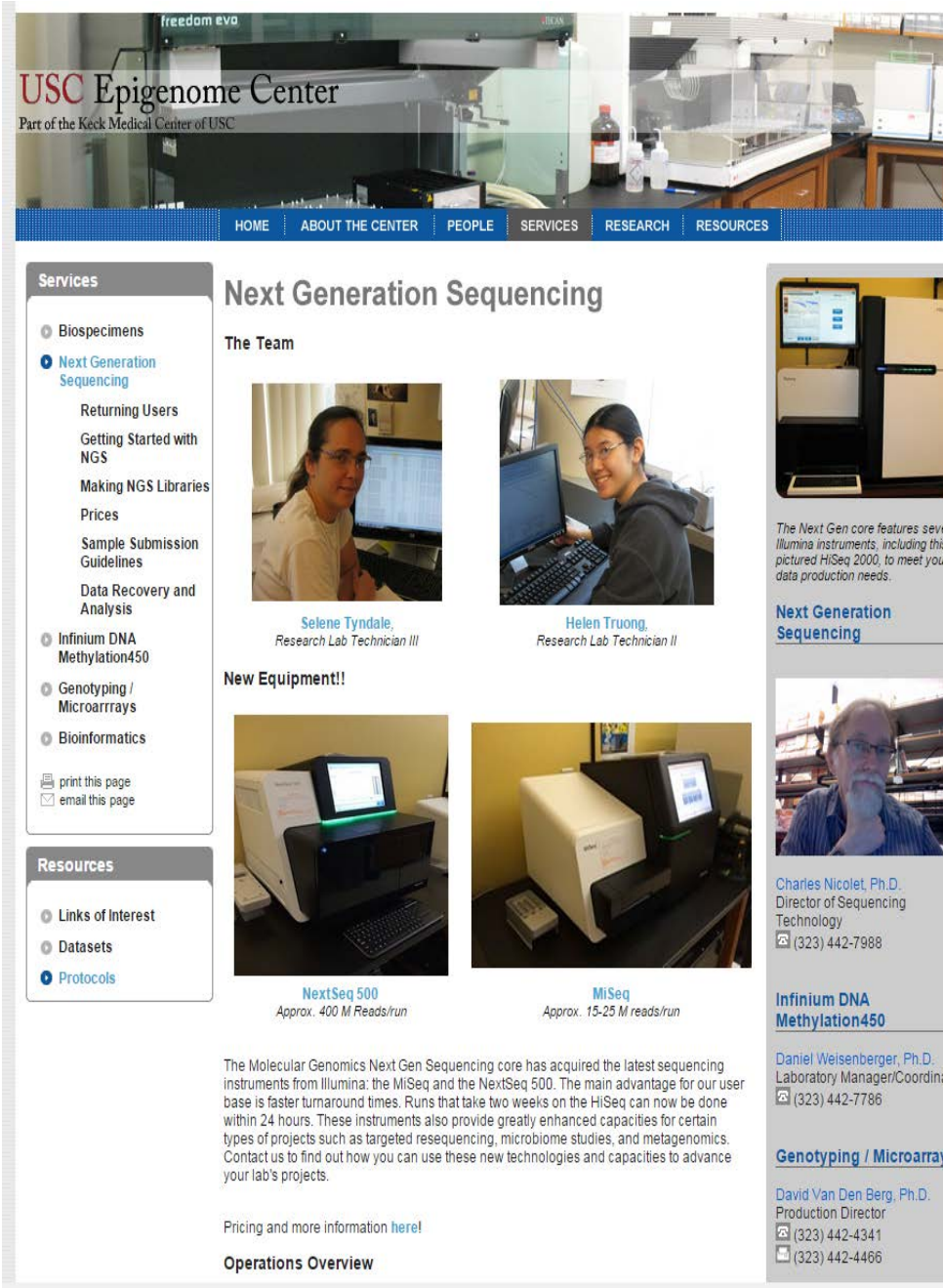
Cultivar: Early Burgundy
Location: Sonoma
Collector: H. Olmo
Year of collection: 1940

What is Next: Genomic analysis

Obtain the full genome sequence of GRBaV herbarium isolate and compare it with the recently sequenced GRBaV isolates.

Confirmation by NGS

- 0.1g of tissue was collected from the original specimen
- Total nucleic acid was extracted in an isolated lab and sent to the sequencing facility at the University of Southern California. (That lab has never worked with grapevine material)
- Next Generation Sequencing generated about 88 million Illumina reads
- More than 92,000 reads mapped specifically against the GRBaV genome



Blast Results

- The full genome sequence of this herbarium isolate (Accession No. KP221559) shared 92-99% nucleotide identity with other GenBank isolates.

- The virus was a member of a mixed infection with GLRaV-2 and GVB.

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DISEASE NOTES

First Report of Grapevine red blotch-associated virus in Archival Grapevine Material From Sonoma County, California

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FPS Research Shows Red Blotch in Calif. Since 1940?

FPS Meeting Provides Update on CDFA Grapevine Certification Program Revision Plan

*Posted by **Ted Rieger** on November 21, 2014*

Based on recent tests performed with dead grapevine leaf material on file in the University of California Davis (UCD) Plant Herbarium, UCD Foundation Plant Services (FPS) director Deborah Golino stated, "Red blotch has been present in the Sonoma County winegrape growing area for at least 74 years." Golino announced the finding at the annual FPS meeting held November 20 in Davis to update nursery industry representatives on FPS activities.

The study used currently available laboratory testing technology for Grapevine Red Blotch-associated Virus (GLRaV) on 56 different grapevine specimens placed in the UCD herbarium from 1937-1950. Only one specimen tested positive--a sample of the cultivar Early Burgundy collected by UCD viticulture professor emeritus Dr. Harold Olmo from a Sonoma County vineyard in 1940.

Thank you