

Virginia Wine Board
Project #12-1982-03

***Botrytis cinerea* fungicide sensitivity evaluation in Virginia crops,
and evaluation of powdery mildew advisory**

Principal Investigator

Anton Baudoin, Associate Professor
Dept. of Plant Pathology, Physiology and Weed Science
Virginia Tech, Blacksburg, VA 24061-0331.
Tel. 540-231-5757
Fax (departmental) 540-231-7477
Email: abaudoin@vt.edu

Results, by objective

Objectives 1 and 2. Original wording:

1. Survey *Botrytis cinerea* in Virginia crops (grapes, berries, greenhouse crops, ornamentals, vegetables, apples) for sensitivity to commonly used groups of fungicides.
2. Compare sensitivity patterns and genetic similarities of *B. cinerea* from different crops to estimate rate of exchange.

The Virginia Wine Board reduced the budget of the 2012-2013 project with the apparent intent at that time of not funding the comparison with other crops. Therefore, *Botrytis* isolates from other crops have received less attention. However, in spring 2013, and in light of the approved follow-up 2013-2014 project (Proposal #13-1732-02), additional ornamental isolates have been collected (with sampling focused near vineyards) or received by mail.

Besides finishing the assay of Fall 2012 *Botrytis* from grape collections, some spring 2013 grape samples were collected and received based on collection of grape flower debris during late bloom. These are currently being tested.

With respect to Elevate (fenhexamid) resistance, this has been rare in our grape isolates, but several Elevate-resistant isolates were obtained from 2012 flower debris in a northern Virginia vineyard, and the spring 2013 cluster debris samples added an additional vineyard (Central Virginia) where fenhexamid (Elevate) resistance was detected -- further bioassay will have to determine whether this constitutes a significant proportion of the population. Fall sampling is planned in order to determine whether spring cluster debris assays have predictive value for fall *Botrytis* populations.

Several spring-collected fenhexamid-resistant isolates were tested for their sensitivity to tebuconazole. The tebuconazole sensitivity of these isolates was similar to that of *B. cinerea*, whereas a recently described new species, *B. pseudocinerea*, has been reported as distinctly *more* sensitive to this fungicide. (*B. pseudocinerea* is naturally resistant to Elevate, and thus far has been reported only from western Europe where it appears to be relatively unimportant as a grape pathogen). Confirmation by molecular identification still remains to be completed.

Table 1. Results of a resistance survey of *Botrytis cinerea* from Virginia grapes to single-site anti-Botrytis fungicides as of February 2013. Additional samples have not changed these percentages by much,

FRAC code	Fungicide	Trade names	2011-12 Resistance survey		
			Vineyards ^a	% ^b	Level
1	Thiophanate methyl	Topsin M	25/28	69%	High
2	Iprodione	Rovral, Meteor	18/28	36%	Low
7	Boscalid	Endura, component of Pristine	23/28	61%	Mod-High
7	Fluopyram	Luna Experience (2012)	0/15	0%	
9	Cyprodinil	Vangard, component of Inspire Super, Switch	19/28	NE	Various
9	Pyrimethanil	Scala	-- ^c	--	
11	Trifloxystrobin	Flint, component of Adament	25/28	84%	High
11	Azoxystrobin	Abound	-- ^c	--	
11	Kresoxim methyl	Sovran	-- ^c	--	
11	Pyraclostrobin	Component of Pristine	-- ^c	--	
12	Fludioxonil	Component of Switch	8/28	6%	Very low ^d
17	Fenhexamid	Elevate	2/28 ^e	2%	--

^a Number of vineyards with resistance present / number of vineyards tested

^b Resistance frequency: number of isolates with resistance / number of isolates tested

^c --: not tested, but performance can be estimated based on compounds in the same FRAC mode of action group

^d A recent literature report reported a somewhat higher (but still moderate) level of fludioxonil resistance in Virginia: Fernandez-Ortuno, D., Bryson, P. K., Grabke, A., and Schnabel, G. 2013. First Report of Fludioxonil Resistance in *Botrytis cinerea* from a Strawberry field in Virginia. Plant Disease 97:848.

^e These isolates are being tested for species identification, *B. cinerea* or *B. pseudocinerea*, a different species naturally resistant to Elevate and, based on literature, unlikely to be important as a grape pathogen. An additional isolate was collected in Spring 2013 from a third location.

Objective 3. Explore EBI resistance mechanisms in our powdery mildew collection other than target site mutations. Results have been reported in the January 2013 report, and have been described in L.E. Rallos's dissertation (attached). No further work on this aspect has been completed since late 2012, but we still maintain the powdery mildew isolates for possible future research.

Objective 4. Initiate evaluation of epidemiological powdery mildew infection models under Virginia conditions.

In a repeat of the 2012 procedures, potted grape plants are being grown in a greenhouse maintained at a high temperature (daily maximum above 105F) designed to prevent powdery mildew development. Fresh plants are being taken outdoors starting in early June of 2013 on an every 3- to 4-days schedule, and placed near a group of large potted grape plants heavily infected with powdery mildew. The test plants are carefully checked for powdery mildew development after 7, 10, and 14 days. Temperature, humidity, wind speed, solar radiation, and rainfall data are obtained from a VT College of Agriculture automated weather station and from the Blacksburg National Weather Service Office, and are supplemented by temperature, leaf wetness duration, rainfall, and pan evaporation data at the location where the grape plants are kept.

Like in 2012, powdery mildew infection appears to have been relatively steady in time. The spring and early summer of 2013 have not provided good conditions to test the hypothesis that infection can be related to pan evaporation, a variable that incorporates the effects of temperature, humidity, sunshine, and wind speed -- since the weather has been relatively cool, humid, and rainy, pan evaporation has been low throughout the period.

New Objectives (2013 season)

Activities described in 2013 Proposal #13-1732-02 (Botrytis and Powdery Mildew) and Proposal #13-1731-02 (Downy Mildew phosphite sensitivity) were started in the spring of 2013. An attempt was initiated to collect early-season downy mildew isolates by placing potted greenhouse-grown grapevines at several commercial vineyards to "catch" early infection. The intention is to compare such early-season isolates with isolates collected in the Fall from vineyards that have been treated several or many times with phosphite fungicides.

Publications (entire year 2012-13)

Rallos, L E. E. 2012. Characterizing resistance of the grapevine powdery mildew *Erysiphe necator* to fungicides belonging to quinone outside inhibitors and demethylation inhibitors. Ph.D. Dissertation, Virginia Tech. 135 pp. (copy attached).

Jeneylyne F. Colcol and Anton B. Baudoin. Sensitivity of *Erysiphe necator* and *Plasmopara viticola* in Virginia and nearby states to QoI fungicides, boscalid, quinoxifen, thiophanate methyl, and mefenoxam. (submitted).

Rallos, Lynn Esther E., Johnson, Nels G., Schmale David G. III, Prussin Aaron J. II, and Baudoin Anton B. 2013. Fitness of G143A-based Resistance to QoIs in *Erysiphe necator* Populations. (submitted)

Presentations (oral and posters)

Baudoin, A, 2013. Grape Disease Management: Back-to-Basics I. Powdery Mildew and Botrytis: Biology, management and research updates. Presentation at annual technical meeting of the Virginia Vineyards Association, Feb 2, 2013, Charlottesville, VA

Baudoin, A. 2013. First report of QoI and boscalid resistance of *Botrytis cinerea* in eastern US vineyards. Annual Meeting, Potomac Division, American Phytopathological Society. Abstract in *Phytopathology* 103 (Supplement): in Press.

Rallos, L and Baudoin, A. 2013. Target site mutation and *cyp51* over-expression as mechanisms of DMI resistance in *Erysiphe necator*. Annual Meeting, Potomac Division, American Phytopathological Society. Abstract in *Phytopathology* 103 (Supplement): in Press

Baudoin, A. 2013. Survey of fungicide resistance of *Botrytis cinerea* in Virginia vineyards. Annual Meeting, Potomac Division, American Phytopathological Society. *Phytopathology* 103 (Supplement 2), No. 6, S2.1