

Disease Management in Muscadines and Pierce's Disease Resistant Hybrids

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2019 Southeast Regional Muscadine Grape Integrated Management Guide

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Recommendations are based on information from the manufacturer's label and performance data from research and extension field tests. Because environmental conditions and grower application methods vary widely, suggested use does not imply that performance of the pesticide will always conform to the safety and pest control standards indicated by experimental data.

This publication is intended for use only as a guide. Specific rates and application methods are on the pesticide label, and these are subject to change at any time. Always refer to and read the pesticide label before making any application! The pesticide label supersedes any information contained in this guide, and it is the legal document referenced for application standards.

Primary Southeastern Muscadine Diseases that Require Fungicide Applications

- ❖ Bitter Rot (*Greeneria uvicola*; syn. *Melanconium fuliginum*)
- ❖ Ripe Rot (*Glomerella cingulata*)
- ❖ Macrophoma Rot (*Botryosphaeria dothidea*)
- ❖ Black Rot (*Guignardia bidwellii* f. *muscadini*)
- ❖ Powdery Mildew (*Uncinula necator*)
- ❖ Angular Leaf Spot (*Mycosphaerella angulata*)

Though muscadines are not generally as susceptible to diseases as *Vinifera* grapes, disease control is very important. Producers often “get by” with minimal spray programs in dry years, only to be “hammered” in wet years. Preventive spray programs are necessary.

Percent Infected Leaves or Fruit (Carlos Variety)

	Angular Leaf Spot	Bitter Rot	Powdery Mildew (fruit)	Macrophoma Rot	Black Rot (fruit)	Black Rot (leaf)
UTC	35	10	26	1	12	22
Sprayed	11	<1	<1	<1	<1	0

W. O. Cline and B. Bloodworth; 2001 Muscadine Disease Survey

Percent Infected Leaves or Fruit (Carlos vs. Noble Varieties)

	Angular Leaf Spot	Bitter Rot	Powdery Mildew (fruit)	Macrophoma Rot	Black Rot (fruit)	Black Rot (leaf)
UTC Noble	5	3	23	0	0	0
UTC Carlos	50	8	45	<1	21	32

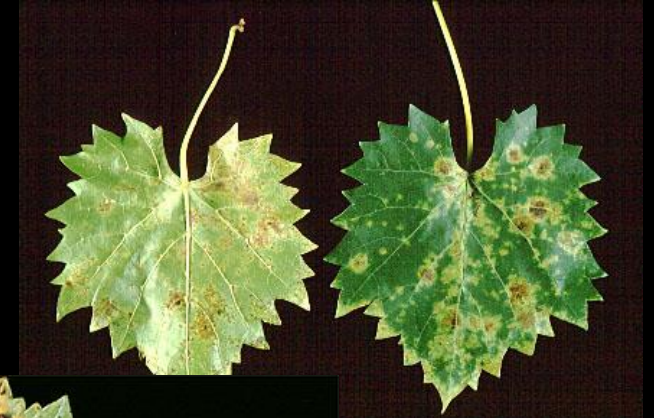


W. O. Cline and B. Bloodworth; 2001 Muscadine Disease Survey

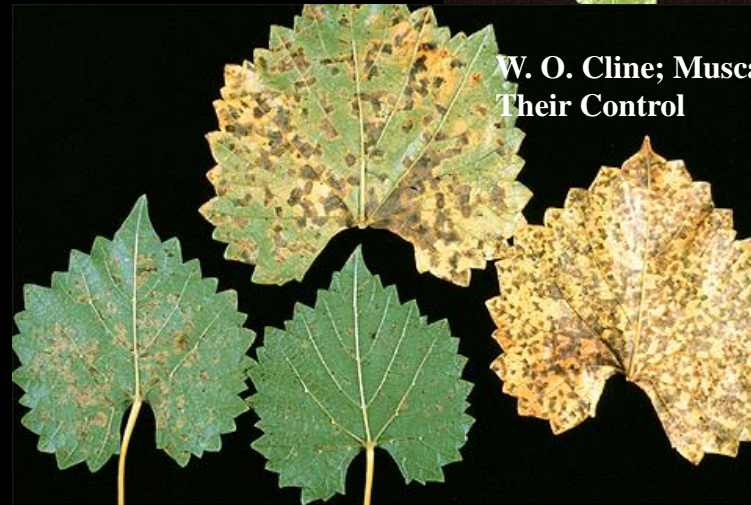
Angular Leaf Spot

(Mycosphaerella angulata or Cercospora brachypus)

- ❖ Great potential to limit yield in muscadine – not *Vinifera*.
- ❖ Defoliates the vine, and fruit development ceases (poor yield and quality).
- ❖ Mancozeb and Captan offer effective control.
- ❖ Applications made pre bloom (budbreak; some references say shoot extension) and on a 14-day schedule till late August.



W. O. Cline; Muscadine Grape Diseases and Their Control



APS Press; Diseases of Small Fruits

Bitter Rot

(*Greeneria uvicola*)

- ❖ Infection occurs at shoot extension, during or shortly after bloom in the pedicel – latent infection.
- ❖ Any tissue can be invaded, but mature, ripened fruit is most susceptible to full disease expression.
- ❖ Late season (bloom through preharvest) sprays are important. Major muscadine disease.



W. O. Cline; Muscadine Grape Diseases and Their Control



APS Press; Diseases of Small Fruits

Macrophoma Rot

(*Botryosphaeria dothidea*)

- ❖ Can be very destructive in muscadines.
- ❖ Not *Macrophoma* (*Fusicoccum aesculi*).
- ❖ Very little known about the epidemiology.
- ❖ Can be controlled by fungicide applications from bloom till harvest.



APS Press; Diseases of Small Fruits



W. O. Cline; Muscadine Grape Diseases and Their Control

Ripe Rot

(*Glomerella cingulata*)

- ❖ Can infect at any stage of fruit development.
- ❖ Rots do not show up till fruit ripens.
- ❖ Controlled through normal fungicide program for black rot.



W. O. Cline; Muscadine Grape Diseases and Their Control



APS Press; Diseases of Small Fruits

Black Rot

(Guignardia bidwellii f. muscadinii)

- ❖ Major problem in bunch grapes.
- ❖ If muscadines are sprayed with standard fungicides (i.e. Maneb and Captan), this is generally not a major problem.
- ❖ Control with early-season applications.



W. O. Cline; Muscadine
Grape Diseases and Their
Control

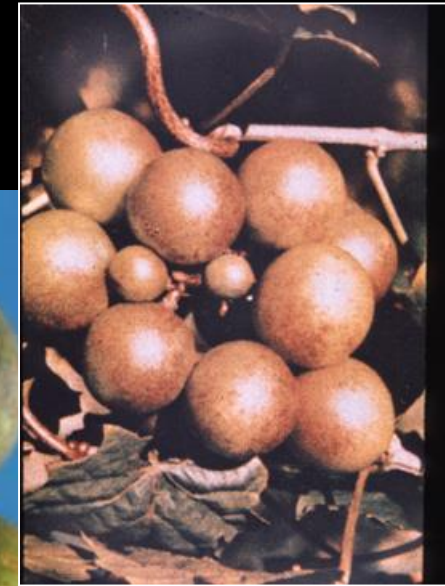


APS Press; Diseases of Small Fruits

Powdery Mildew

(*Uncinula necator*)

- ❖ Attacks leaves, cluster stem, and fruit shortly after bloom.
- ❖ Infected fruit become “russetted” and may crack.
- ❖ Can also result in fruit drop and/or reduced size.



W. O. Cline; Muscadine Grape Diseases and Their Control

Table 3 - Muscadine Grape Disease Spray Program

Application Time	Fungicide*	Amount/Acre	Remarks
First, just before bloom	Mancozeb	2 - 3 lb	
	or Captan 50WP	3 lb	
Second, just after bloom and fruit set	Nova 40W	1.2 - 2 oz	Do not omit application. Important for reducing bitter rot and other fruit infections.
	or Abound	11 - 15 oz	
Continue at 14-day intervals	Nova 40W or Abound	Above Rates	Use shorter application intervals during rainy periods. Extend application interval if conditions do not favor disease development.
Preharvest sprays beginning 6 to 8 weeks before harvest	Captan 50WP	3 lb	Necessary for berry rot control. Shorten application interval to 7 to 10 days if rainy conditions exist during berry maturation. Pay attention to days until harvest.
	or Nova 40W or Abound	Above Rates	

Minimum days from last application until harvest:
Nova – (14); Captan – (0); Mancozeb – (66); Abound – (14)

Fungicides – the short version

- Alternate Nova with Captan, apply every 2 wks from Mid-May through August
- Where ripe rot is a problem, replace Captan with Abound, Pristine or Flint
- Use enough water for adequate coverage
- ALWAYS READ AND FOLLOW THE LABEL!!

Bill Cline; NCSU

Recommended Spray Schedule for Control of Berry Diseases

Begin fungicide applications at bud break – usually early to mid-May.

Continue applications at 10 – 14 day intervals alternating among three classes of fungicides such as Nova, Abound, and Elite.

It is important to alternate between fungicides with different modes of action to prevent the pathogens from becoming resistant to the fungicides.

Apply fungicides at a 10 day interval during rainy periods and at a 14 day interval during dry periods.

Fungicide applications may be discontinued two months before harvest.

If muscadines are being grown for juice it is not necessary to apply any fungicides to most cultivars because the berry rots are not severe enough to effect their yield or quality.

Barbara Smith; USDA

Efficacy of selected fungicides against diseases of muscadine grape¹

Fungicide	PHI (Pre-Harvest Interval)	Mode-of-Action (MOA) Grouping ²	FRAC code ³	Bitter rot	Powdery mildew	Ripe rot	Macro-phoma rot	Black rot	Sooty blotch	Dead arm	Angular leaf spot
Myclobutanil (Rally)	14 days	G	3	++ ²	++++	NA	+	++++	+++	???	++++
Thiophanate-methyl (Topsin- M)	7 days	B	1	++	+++	+	+	+++	+++	++	+++
Wettable Sulfur (Microthiol and other trade names)	1 day (re-entry)	Multi-site	M 2	NA	++++	NA	NA	NA	???	NA	NA
Pyraclostrobin + boscalid (Pristine)	14 days	C	7+11	+++	++++	++++	+++++	++++	+++++	++	++++
Kresoxim-methyl (Sovran)	14 days	C	11	+++	+++	+++	++	+++	+++	++	+++
Azoxystrobin (Abound)	14 days	C	11	+++	++++	++++	++++	++++	++++	++	++++
Trifloxystrobin (Flint)	14 days	C	11	+++	++++	++++	+++++	++++	+++++	++	+++
Ziram (Ziram)	21 days	Multi-site	M 3	++	++	+++	++	+++	+++	++	+++
Captan (Captan, Captec)	0 days (72 hrs re-entry)	Multi-site	M 4	++	++	++++	+++	+++	+++	++	+++
EBDCs (includes Maneb, Manex, Penncozeb, Manzate, Dithane M-45)	66 days	Multi-site	M 3	+++	++	NA	++	+++	++	++	+++

¹ NA = no significant activity, ??? = unknown activity; + = very limited activity, ++ = limited activity, +++ = moderate activity, ++++ = good activity, +++++ = excellent activity.

² Alternation of fungicides with different modes of action helps prevent the development of pest resistance to a particular class of fungicide. There is no benefit to alternating or tank-mixing fungicides with the same mode of action. Fungicides listed as "multi-site" are the least likely to be overcome by a resistant strain of a pathogen.

³ In addition to MOA grouping, the FRAC code also indicates fungicides that can be alternated to discourage pest resistance; alternate or tank-mix only those products having different FRAC codes.

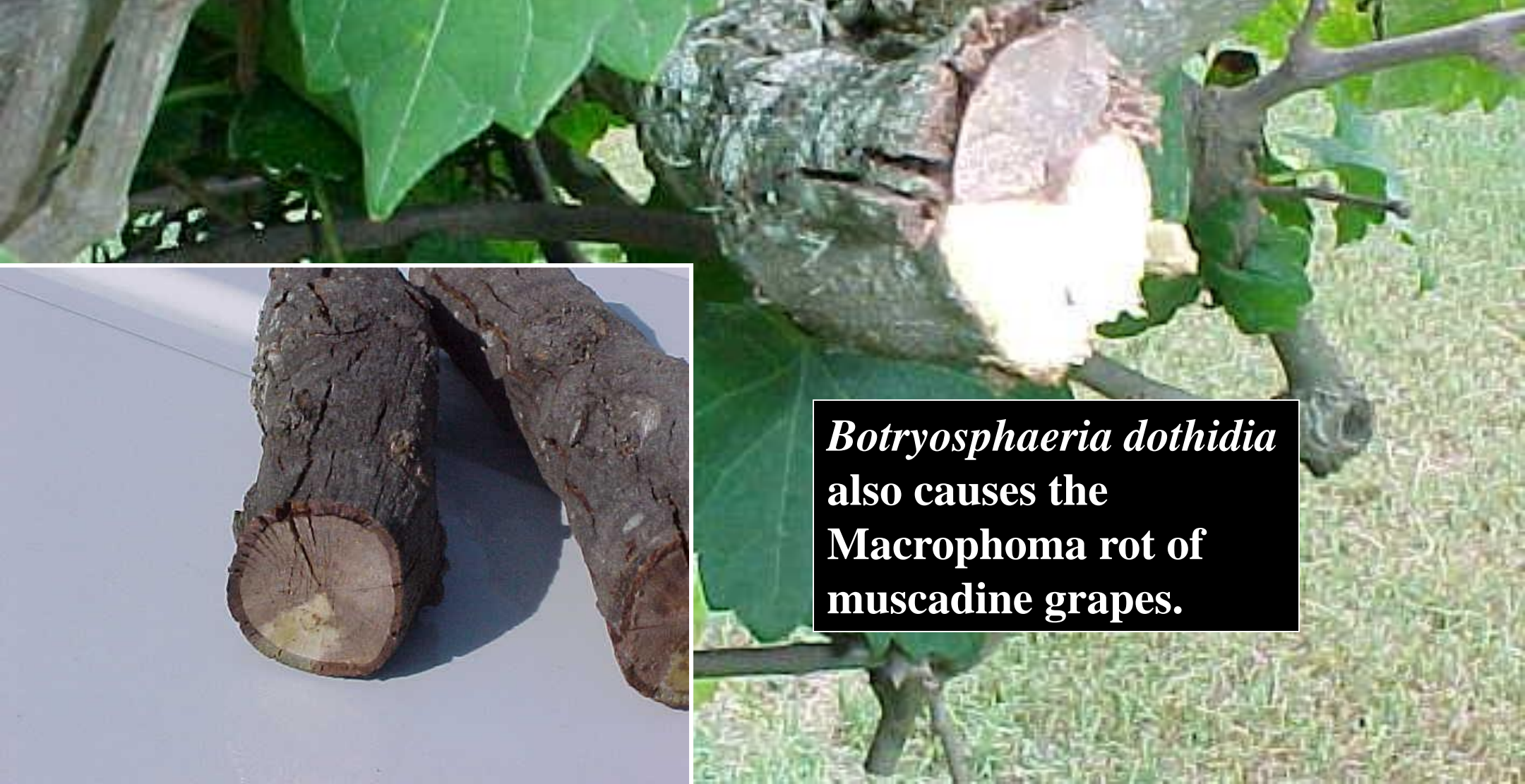
Critical Periods for Achieving Control of Muscadine Diseases

Bitter Rot	During shoot extension, through bloom, and preharvest.
Black Rot	During shoot extension, through bloom, and from fruit set until fruit is larger than ½ inch diameter.
Ripe Rot	From cap fall until harvest.
Macrophoma Rot	Last 6 weeks prior to harvest, especially 14 to 7 days before harvest, and immediately after a harvest but within the PHI before the next harvest.
Angular Leaf Spot	From fruit set through fruit ripening, and possibly after harvest.
Powdery Mildew	From fruit set through first hint of color change.

Chen et al. in Muscadine Grapes; 2001.



Pruning wound diseases are also observed in muscadine. The most prevalent dieback disease in GA is caused by *Botryosphaeria dothidia*. Generally thought to be associated with pruning cuts, wire rubs, or broken spurs.



***Botryosphaeria dothidia* also causes the Macrophoma rot of muscadine grapes.**

Stress (drought, overproduction, and/or winter injury) can allow latent infections to become major infections of muscadine. Varieties differ in susceptibility.



Current Control Measures

- ❖ **Following general pruning (Jan-Mar), spray pruning cuts with a compound such as Topsin M or Rally at the end of each day.**
- ❖ **If “dead arm” or “dieback” is observed, cut out the infected arm. Make the cut at least 8 inches below the canker. Sterilize the blades between cuts in a 10% bleach solution. Spray the cut with a fungicide.**
- ❖ **Maintain proper fertility and otherwise healthy vines.**

Postharvest Disease Control

- ❖ Largely a “black hole” with limited information.
- ❖ Low temperatures (between 0° and 3.5 °C) with saturated relative humidity are generally recommended, but saturated conditions increase rots.
- ❖ As a general rule, muscadine fruit should be moved to market in refrigerated trucks (4°C) and sold within seven days of harvest.

Pierce's Disease

- ❖ Caused by *Xylella fastidiosa*.
- ❖ Not a major problem in muscadines.
- ❖ Infected vines have minimal symptoms or issues.
- ❖ Pride cultivar is highly susceptible, and can be killed.



Leaf scorch on susceptible Carlos variety.

“Pierce’s disease is a principal factor limiting production of both *V. labrusca* and *V. vinifera* grapes in the Gulf Coastal Plains of the United States.”

Goheen and Hopkins, Compendium of Grape Diseases (1998).





Pierce's Disease Resistant Grapes

- ❖ Norton (Cynthiana)
- ❖ Black Spanish (Lenoir)
- ❖ Blanc Du Bois

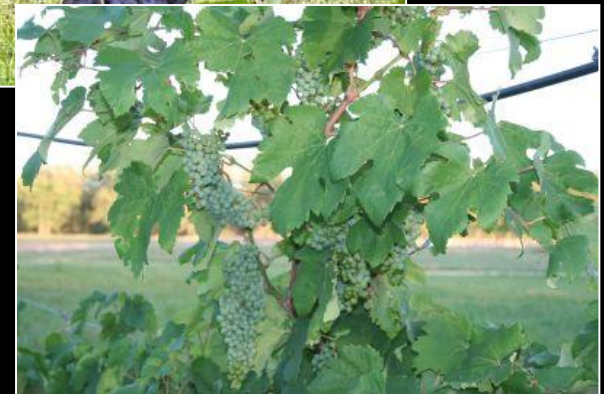
Biocontrol of Pierce's disease in various genotypes with avirulent or weakly-virulent strains of *X. fastidiosa*.

	Symptomatic vines in treatments:			
Cultivar	Control	EB92-1	Syc86-1	EB92-5
Cabernet Franc (<i>Vitis vinifera</i>)	67 %	17 %	17 %	42 %
Chambourcin (French/ American hybrid)	42 %	0 %	0 %	0 %
Cynthiana (<i>V. aestivalis</i>)	17 %	0 %	0 %	0 %

California is now testing
97% vinifera varieties
for PD resistance and
wine quality.

Black Spanish (Lenoir) and Norton (Cynthiana)

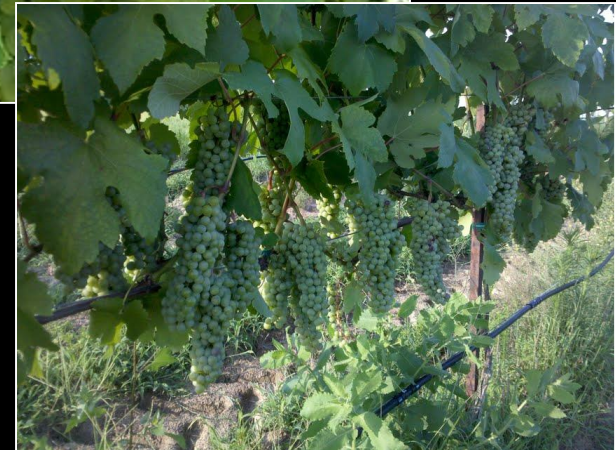
- ❖ *Vitis aestivalis*
- ❖ *Phylloxera*
resistance good
- ❖ Nematode
resistance – root
knot resistant –
dagger resistance
likely but less sure





Blanc Du Bois Hybrid

- ❖ *V. aestivalis* and muscadine in heritage
- ❖ Self rooted
- ❖ Nematode tolerant
- ❖ Needs good drainage



Primary Southeastern Bunch Grape Diseases

- ❖ Black Rot (*Guignardia bidwellii*)
- ❖ Downy Mildew (*Plasmopara viticola*)
- ❖ Powdery Mildew (*Uncinula necator*)
- ❖ Botrytis Bunch Rot (*Botrytis cinerea*)
- ❖ Phomopsis Cane and Leaf Spot (*Phomopsis viticola*)
- ❖ Anthracnose or Bird's-eye Rot (*Elsinoë ampelina*)
- ❖ Bitter Rot (*Melanconium fuliginum*)
- ❖ Ripe Rot (*Colletotrichum gloeosporioedes*)
- ❖ Sour Rot

Principal Southeastern Foliar/Fruit Diseases

	<u>Relative importance</u>		
	Norton	Lenoir	Blanc Du Bois
Downy mildew	~+	+++++	+++
Powdery mildew	~+	~+	~+
Black rot	++++	++++	+++++
Phomopsis	++++	++++	++++
Botrytis	+	+	+
Bitter rot	~+?	~+?	~+?
Ripe rot	~+?	~+?	~+?
Anthracnose or Bird's Eye Rot	++++	++++	++++
Sour rot	+++++	+++++	+++++

Anthracnose (budbreak to bloom)

Downy Mildew (immediate pre-bloom to senescence)

Phomopsis (budbreak to fruit set)

Black Rot (immediate pre-bloom to veraison)

Botrytis (rare, late season if weather conducive)

Non-specific bunch rots

Powdery Mildew

(Uncinula necator)

- ❖ Can also infect all green vine parts.
- ❖ White powdery growth
- ❖ Infected fruit may cause off flavor in wines.
- ❖ Early sprays are also required for control.
- ❖ Norton generally considered resistant. Chambourcin is susceptible.



Phomopsis Cane and Leaf Spot

(Phomopsis viticola)

- ❖ Georgia (Southeastern) climates are particularly conducive for disease development.
- ❖ Early sprays are particularly important.
- ❖ Continue applications till at least green pea stage.



Anthracnose or Bird's-eye Rot (*Elsinoë ampelina*)

- ❖ Overwinters on infected canes.
- ❖ Disease of rainy, humid regions.
- ❖ Spreads to new growth in the early spring.
- ❖ Young, tender tissue is more susceptible to attack.



APS Press; Diseases of Small Fruits

Downy Mildew

(Plasmopara viticola)

- ❖ Attacks all green parts of the vine, but leaves are particularly susceptible.
- ❖ Prebloom sprays are necessary for control.
- ❖ Somewhat limited in our late-season options.
- ❖ *Vitis vinifera* are highly susceptible, *V. aestivalis* and *V. labrusca* are less susceptible, and *V. rotundifolia* is resistant.
- ❖ Infected leaves drop, resulting in reduced sugars in the fruit and decreased hardiness of overwintering buds.



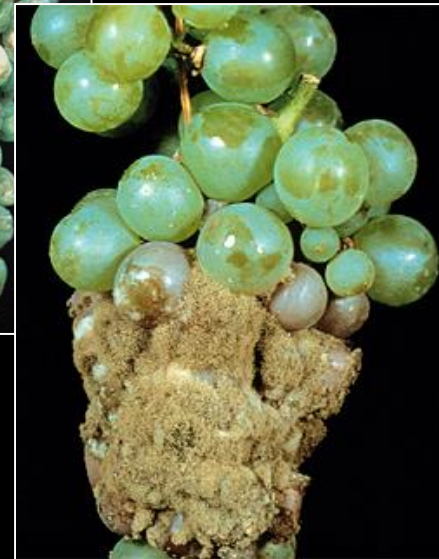




Botrytis Bunch Rot

(*Botrytis cinerea*)

- ❖ Botrytis infects primarily at bloom, killing flowers.
- ❖ Bloom sprays are essential for control of this disease.
- ❖ Also sprayed prior to bunch closing, at the beginning of fruit ripening, and prior to harvest.



APS Press; Diseases of Small Fruits

Sour Rot

- ❖ **Caused by a multitude of organisms.**
- ❖ **Infections result from wounds (insects, birds, mechanical damage, etc.) or other diseases.**
- ❖ **Fruit flies are critical to spread.**



Fritz Westover, Texas A&M

At roughly veraison (10-15 Brix), use drosophila active insecticides, and add Oxidate with each application.

