Vineyard IPM Scouting Report for week of 9 June 2014
UW-Extension Door County and Peninsular Agricultural Research Station

Downy and Powdery Mildew

The most important component of integrated pest management is identifying the pest correctly. Often this is not a simple task since often we are looking at symptomology and not the actual pest that causes the symptoms. Two pests that can be difficult to differentiate based on symptomology are powdery and downy mildew. However learning a few basic principles about these two diseases can make the process of identification a bit easier.

Greenish-yellow oily lesions on upper leaf surface are classic symptoms of an infection caused by downy mildew.

Downy Mildew
(*Plasmopara viticola*)

Although much of the old literature refers to powdery and downy mildew as fungal diseases, only powdery mildew is caused by a fungus. Downy mildew is classified as an oomycete or “water mold. Although this may seem like a simple taxonomic classification, downy mildew shares many biological, ecological and epidemiological characteristics with fungal plant pathogens. Thinking of downy mildew as a water mold helps differentiate how these two similar looking mildews invade grape tissues.

Downy mildew overwinters as oospores in leaf debris on the vineyard floor. The oospores germinate in water and form sporangia and the sporangia liberate small swimming zoospores. The zoospores are transferred to grape tissues by rain splashes. The zoospores will enter any grape tissue that contains stomata (openings on plant tissues that are involved in gas and water vapor exchange) to start the infection process. The grape tissues need to be moist from rain or dew in order for the flagellate zoospores to move on the grape tissue to a stomate.

Often downy mildew is first noticed on grape leaves, but downy mildew can infect all green tissues that have functional stomata. Grape leaves have an abundance of stomata on the adaxial (lower) leaf surface; therefore the zoospores have a number of potential targets in which to enter leaves and initiate the infection process. Since moisture plays a critical role in the infection process, scout within the canopy where leaf tissue will have an extended wetting period from dew or rain. The first symptoms of a downy mildew infection on leaves are the appearance of yellow/green oily lesions on the upper leaf surface. As the disease progresses the lesion will expand and brown and become necrotic. On the abaxial (lower) leaf surface a white “downy” sporulation appears within the border of the lesion.

Powdery Mildew
(*Uncinula necator*)

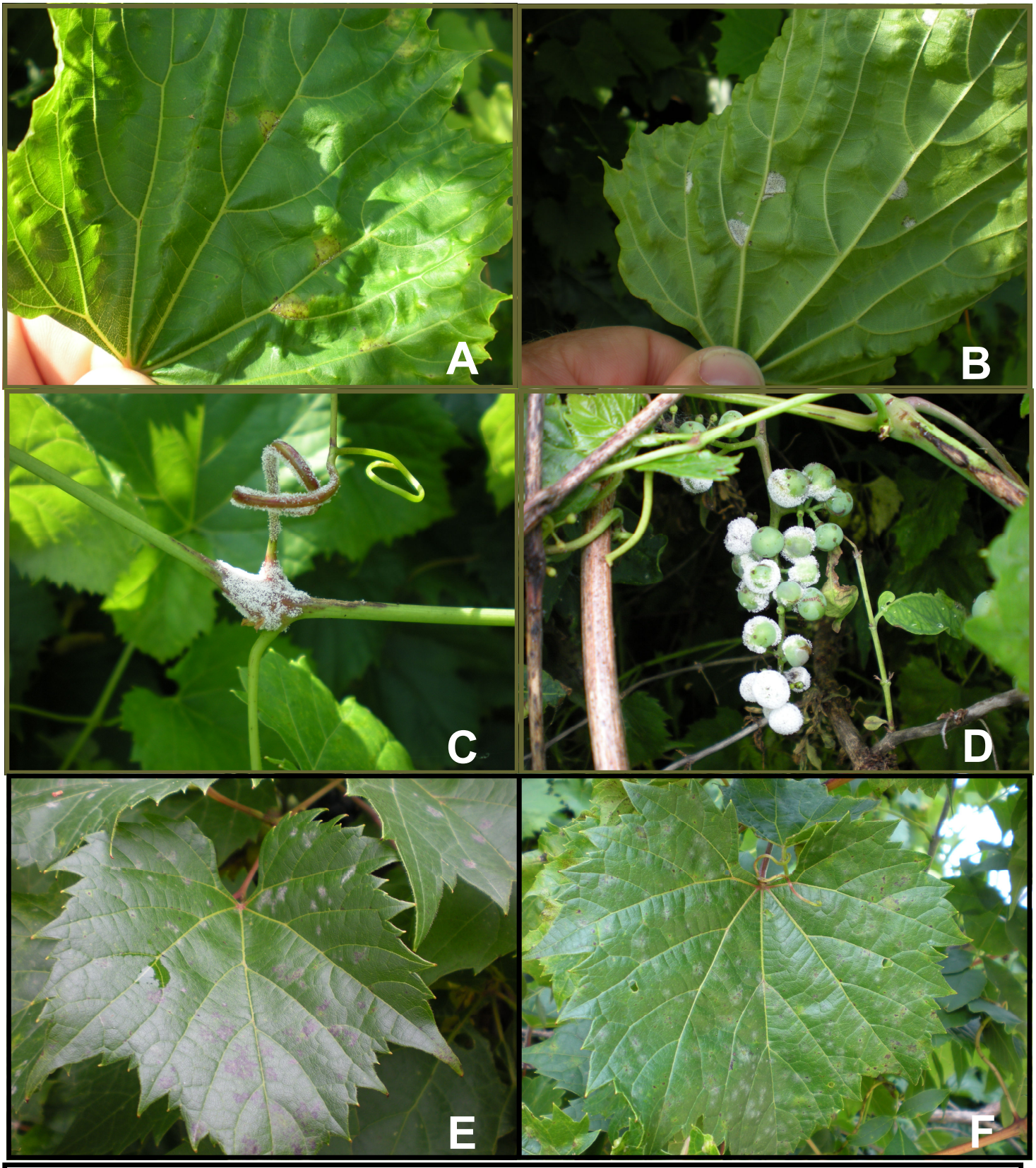
White or grayish powdery covering on upper leaf surface are classic symptoms of an infection caused by powdery mildew.

Unlike downy mildew, powdery mildew overwinters on the vine in cracks in the bark. Similar to downy mildew, powdery mildew needs water (only 0.1 inch or more) to release their spores (ascospores). The ascospores are released into the air and are disseminated by wind. These ascospores can infect all susceptible green grape tissues which starts the primary infection. The release of the ascospores is the only stage in which water is needed and the grape tissue does not need to be wet for infection to result. Though moisture is not needed for infection, powdery mildew growth is enhanced by high relative humidity (85% relative humidity being optimum). Powdery mildew fungus is sensitive to intense direct sunlight exposure.

Similar to downy mildew, powdery mildew is often first noticed on grape leaves. In contrast to downy mildew, powdery mildew can appear on both the upper and lower leaf surfaces as a white or grayish powdery coating. Scouting should focus on monitoring leaves located in the interior of the canopy where direct sunlight is filtered and relative humidity is higher.

Biological, ecological, and epidemiological characteristics of downy and powdery mildew

	Downy Mildew	Powdery Mildew
Moisture needed for initial spore release	Yes	Yes
Moisture needed for infection	Yes	No
Tissues susceptible	All green tissue with functional stomata	All green tissue
Sporulation on leaf surface	Lower	Upper and Lower
Initial disease symptoms on leaves	Greenish-yellow oily appearance on upper leaf surface	White or grayish-powdery covering
Advanced disease symptoms on leaves	Brown necrotic lesions and white downy appearance on lower leaf surface	Dull coloration and may dry out and drop from shoot
Scouting tips	Monitor leaves in the interior of canopy that remain moist from dew or rain	Monitor leaves in the interior of canopy that are shaded and out of direct sunlight



Greenish-yellow oily lesions on upper leaf surface (A), downy sporulating growth on underside of leaf (B), infected tendril and shoot (C), and infected grape cluster caused by downy mildew. Grayish-white powdery growth of powdery mildew on upper leaf surface (E & F).

Downy Mildew and Phylloxera: is there a connection?

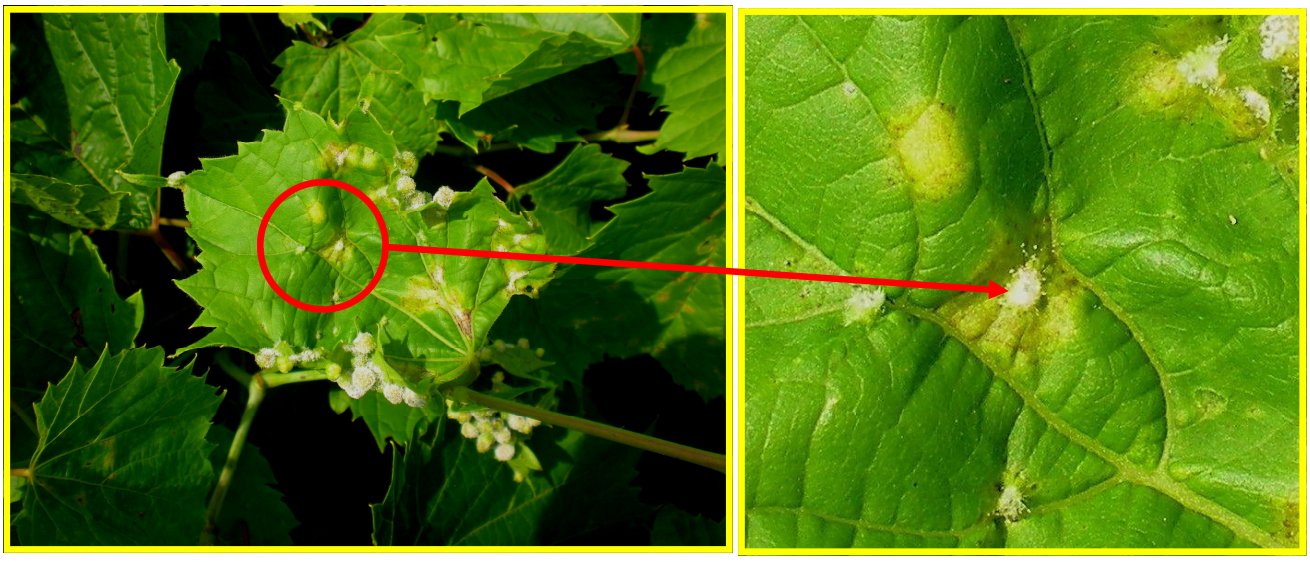
Recently I read an interesting article entitled “Leaf-galling phylloxera on grapes reprograms host metabolism and morphology” PNAS 110 (no.41) 16663-16668. One of the main findings of this research is that phylloxera leaf-galling causes the development of stomata on the adaxial (upper) leaf surface. The paper reports that in *Vitis,* stomata only occur on the abaxial (lower) leaf surface. What they found was that in *V. riparia* and a *Vitis hybrid* that had phylloxera leaf-galling resulted in the development of functional stomata on the upper leaf surface. Additionally the stomata were in greater numbers on the upper leaf surface near the gall and the density of stomata decreased as the distance increased from the developing gall.

These findings suggested to me that phylloxera leaf-galling would present greater opportunities for downy mildew zoospores to infect grape leaves that are galled. Specifically, with the development of stomata on the upper leaf surface, downy mildew zoospores could infect on the upper leaf surface.

Do I have evidence for this? Back in 2012, I remembered evaluating some wild grapes that were leaf-galled by phylloxera and also were infected with downy mildew. This was the first time I had ever observed these two pests infecting a single leaf together. Fortunately, I took a lot of pictures. The pictures below certainly suggest that downy mildew is sporulating on the upper leaf surface. I will point out that leaf-galling by phylloxera also causes trichomes to develop (small hairs).

The point being that there is the potential that downy mildew may actually develop a downy mass on the upper leaf surface on leaves that are galled by phylloxera. This could cause confusion in identifying the disease as downy or powdery mildew.

http://www.pnas.org/content/110/41/16663.full

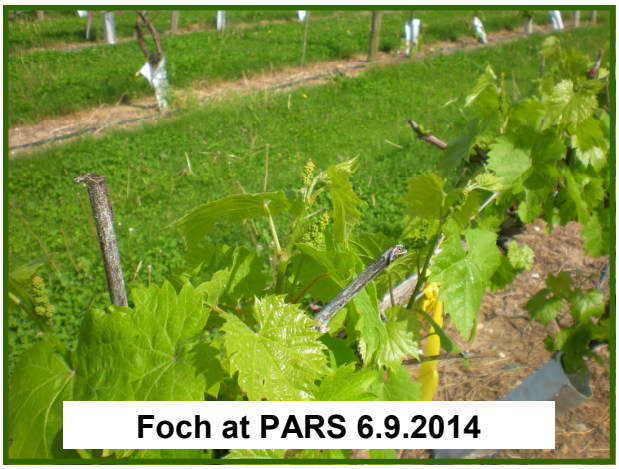


Development of wine grapes in the grape variety trials at the Peninsular Agricultural Research Station (PARS) Sturgeon Bay, WI and West Madison Agricultural Research Station (WMARS), Madison, WI

2014

Brianna at PARS 6.9.2014

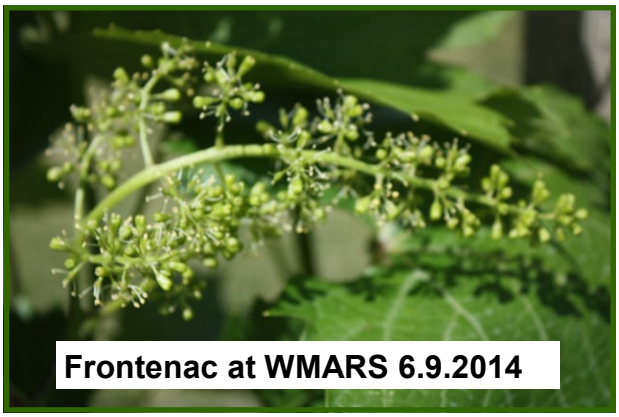
Brianna at WMARS 6.9.2014



Foch at PARS 6.9.2014

Foch at WMARS 6.9.2014

Frontenac at PARS 6.9.2014



Frontenac at WMARS 6.9.2014

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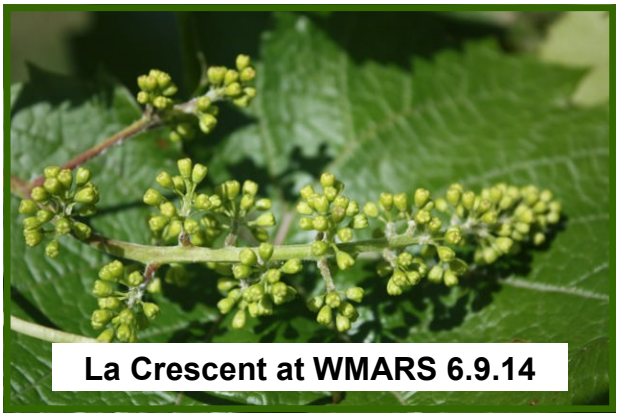
La Crescent at PARS 6.9.14

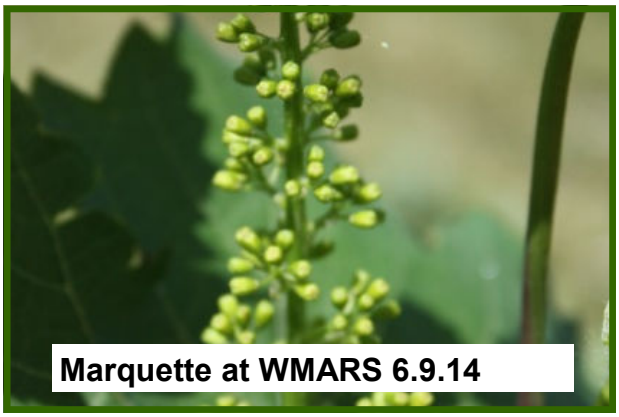


La Crescent at WMARS 6.9.14

La Crosse at PARS 6.9.14

La Crosse at WMARS 6.9.14

Marquette at PARS 6.9.14



Marquette at WMARS 6.9.14

2014

Development of wine grapes in the grape variety trials at the Peninsular Agricultural Research Station (PARS) Sturgeon Bay, WI and West Madison Agricultural Research Station (WMARS), Madison, WI

Petite Pearl at PARS 6.9.14

Petite Pearl at WMARS 6.9.14

2014

Aromella at PARS 6.9.14

Leon Millot at PARS 6.9.14

Vignoles at PARS 6.9.14

Noiret at PARS 6.9.14

Development of wine grapes in the grape variety trials at the Peninsular Agricultural Research Station (PARS) Sturgeon Bay, WI

MN 1189 at PARS 6.9.14

MN 1235 at PARS 6.9.14

2014

MN 1200 at PARS 6.9.14

MN 1258 at PARS 6.9.14

MN 1220 at PARS 6.9.14

Wild grape at PARS 6.9.14

Degree Day[1] (base 50) Accumulation from April 1 to June 1, 2014 at Peninsular Agricultural Research Station in Sturgeon Bay, WI

Date	2014	2013	5 Year Average[2]
4/1 to 6/1	261	244	308

[1]Modified method.
[2]Average from 2009 to 2013.

Degree Day[1] (base 50) Accumulation from April 1 to June 1, 2014 at West Madison

Date	2014	2013	5 Year Average[2]
4/1 to 6/1	461	458	502

[1]Modified method.
[2]Average from 2009 to 2013.

Accumulated degree days[1] (base 50) for the month of March in Sturgeon Bay and Madison, WI.

Year	Madison WI	Sturgeon Bay WI
	GDD (base 50, ceiling 86)	
2014	2[2]	nd
2013	1	0
2012	252	106
2011	13	3
2010	72	38
2009	51	12
2008	1	0
2007	90	41
2006	22	7
2005	40	9
2004	49	11

[1]Modified method.
[2]Data from http://www.doa.state.wi.us/degreedays/

Please scout your vineyards on a regularly scheduled basis in an effort to manage problem pests. This report contains information on scouting reports from specific locations and may not reflect pest problems in your vineyard. If you would like more information on IPM in grapes, please contact Dean Volenberg at (920)746-2260 or dean.volenberg@ces.uwex.edu