

Scouting for Grape Powdery Mildew

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Powdery mildew (*Erysiphe necator*) is a microscopic fungus that can threaten your business and get ahead of your vineyard management tactics before you even realize it is there. Scouting for powdery mildew should be an important part of your overall management plan. Finding the first occurrence of this disease can help you start or adjust your fungicide program and determine where to concentrate your resources. When scouting for powdery mildew, there are several important factors to consider, depending on your management style, vineyard situation, and canopy management.

Management tactics

There are several tactics used to manage powdery mildew, including fungicides and methods of canopy management.

Fungicide use

Finding the first signs of powdery mildew can determine when to initiate your fungicide program. Rather than starting too early and wasting unnecessary applications, you can simply wait until disease is found and then begin your spray program. This is a tactic often used in other cropping systems, such as ornamental plants susceptible to powdery mildews in the greenhouse. To make this tactic work, you have to be thorough and vigilant to find those first few powdery spots (called colonies). This can be risky since fungicides work best when applied before this fungus gets started in your vineyard. Therefore, this tactic is more suited for smaller vineyards or vineyard blocks that can be thoroughly scouted.

Even after your fungicide program is started, finding that first powdery mildew colony can help you make important adjustments to your management plan. You can begin to use stronger fungicides, higher rates, slower sprayer speeds, shorter application intervals, or

a combination of these tactics. Powdery mildew may indicate problems in your application system, such as poor sprayer calibration or vine coverage.

Canopy management

Finding powdery mildew can help focus your limited resources where and when they are needed. Powdery mildew is often first found in high-vigor areas of your vineyard or in shaded riparian areas. Making that first find of disease can allow you to make timely adjustments in prebloom shoot thinning, sucker removal, shoot positioning, or fruit-zone leaf removal. You can combine these practices to reduce canopy density, allow better spray penetration, and increase air circulation, all of which will aid in your management success.

Knowing where powdery mildew was out of control last year also can help you change your overall management or determine methods to limit vine vigor. Adjustments can be made at pruning to alter bud number or to make changes to your fertility program.

Taking quick action

Under favorable conditions, powdery mildew may reproduce in as little as 5 days. Once powdery mildew gets ahead of your management plan, it may be impossible to control. Frequent scouting and quick management decisions, followed by timely action, are required.

Effective scouting

Finding a handful of millimeter-sized colonies somewhere in several acres of vineyard can be a daunting task. However, knowing something about the fungus itself can help limit the search to a few key places and times.

Weather conditions

Generally, the powdery mildew fungus overwinters as small black bodies (cleistothecia) on the exfoliating bark of the vine (Figure 1). Cleistothecia release sexual ascospores during rainy weather above 40°F from budbreak through bloom, but infection generally does not occur until daily averages are above 50°F (Figure 2). This warmer weather also favors infection that results in individual colonies on the surface of leaves growing close to the bark.

Location of symptoms

During the early stages of epidemics, symptomatic leaves are often confined to the canopy interior, close to trunks or cordons. Knowing this, you can focus your search on leaves that are closest to trunks, cordons, and head regions of the vine (Figure 3). A quick stop in a high-vigor area of your vineyard to search basal leaves may be all that is needed. Go straight to the head region



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Figure 3. Trunk and cordon with exfoliating bark where cleistothecia of powdery mildew overwinter.

and turn over a few leaves that are in tight groups close to the bark. Repeat this process for several vines in the area, and you may catch the start of the epidemic.

Visibility of symptoms

The first colonies will appear as whitish or grayish patches on leaves when observed with the naked eye (Figure 4). There may or may not be an effect or symptom of the infection on the other side of the leaf. Typically, the first colonies occur on the underside of a leaf since the ascospores are coming from the bark below. Some pathologists have also described the first colonies as tiny red-to-brown areas on the bottom of basal leaves. Colonies are more easily detected in full sunlight with the sun over your shoulder. Searching midmorning or midafternoon will increase your chances of finding the first colonies.

Leaf discoloration

The side of the leaf opposite the colony may have no symptoms or may be discolored. Typically, a diffuse yellowing (chlorosis) may be seen. Some people are overly focused on any yellow spot on a leaf. Scattered bright yellow spots on leaves in vineyards (due to a variety of other problems) are not unusual early in the growing season. A close look with a hand lens will help distinguish these problems from powdery mildew.

Flower inspection

Flower clusters before, during, and after bloom can be infected as well. Be sure to look at a few emerging flower clusters while scouting for this disease. The



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Figure 1. Cleistothecia of grape powdery mildew on the surface of a leaf.



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Figure 2. Cleistothecium squashed open to show several asci with ascospores.

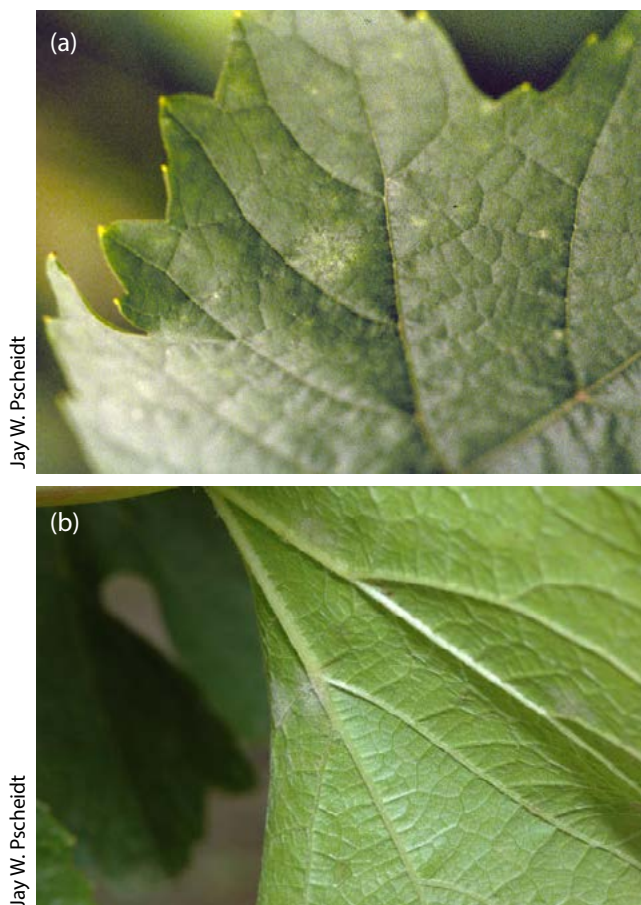


Figure 4. Individual colonies of powdery mildew on the top surface (a) and bottom side (b) of the leaf.

flower buds, rachis, or pedicel of the berry can all be infected and may show symptoms.

Magnification

The confirmation of the earliest stages of powdery mildew requires the use of a hand lens. Most of the powdery mildew fungus remains on the outside of leaves or stems. The threads of the fungus (hyphae) remain close to the surface on the epidermal plant cells until sporulation. New hyphae, called conidiophores, grow up from the surface and bear the asexual dispersal spores of the fungus. These spores are barrel-shaped and form in chains at the tip of these conidiophores.

A low magnification of the colony will show a fine network of small threads (mycelia) on the surface of the leaf. The presence of upright threads with chains of spores confirms the identification of this fungus. Under the right lighting, these look like a row of tiny droplets of water or a short string of tiny pearls

(Figure 5). Beware: Young leaves will have natural hairs (trichomes) on the surface. These trichomes are more numerous on younger leaves and could be mistaken for the fungus. Trichomes are much larger, have thick cell walls, and taper to a point. The fungal mycelia will not have these characteristics.

Flag shoots

In high-disease situations, powdery mildew can also overwinter as hyphae inside the vine's dormant buds. Buds on new shoots can be infected 4 to 6 weeks after shoots start growing but not after bud scales mature. The fungus remains inactive in these newly infected buds until the next growing season. Shortly after budbreak, the fungus becomes active and covers the emergent shoot with a white mass of mycelia (flag shoots). Flag shoots have rarely been observed in western Oregon, or eastern Washington and Oregon.

Flag shoots are difficult to find. They may be covered with a large white mass of mycelia or only a hint of thin threads on the shoot (Figure 6). Shoots generally are delayed in budbreak and appear stunted and somewhat yellowed compared to healthy shoots.

Flag shoots may be found well before you plan to start your fungicide program. This is a serious situation requiring quick action. Remove the shoot and either bury it on site or place it in a sealable plastic bag so you do not spread spores to other areas of the vineyard. Removal of the flag shoot is good, but spores may have been distributed already, and infections may have started that are not yet visible. For this reason,



Figure 5. Look for chains of conidia with your hand lens to confirm powdery mildew. Note that the mycelium is very sparse in this colony.

it is important to get your fungicide program started immediately, concentrating on the area where flag shoots were found. Keep watch for continued disease development in this area.

Infected green shoots and canes

When green shoots and canes are infected, the affected tissues appear dark brown to black in feathery patches (Figure 7). Patches later appear reddish-brown to black on the surface of dormant canes. You can scout for powdery mildew while dormant pruning by looking for these symptoms (Figure 8). It will indicate where in the vineyard you need to concentrate scouting and control efforts in the coming year.

Conclusion

When you are scouting, keep in mind that you are looking for something different or unusual. Keying in on every spot or leaf blemish can be time consuming and frustrating. It takes some experience and training to efficiently find early powdery mildew colonies. Your persistence will be rewarded when you do find the disease and can take swift action. The payoff is an improved powdery mildew management program.

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Figure 6. Flag shoots of powdery mildew soon after bud break in the spring.



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Figure 7. Colonies on stems look like dark feathery spots or stains.



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Figure 8. Shoots heavily infected by powdery mildew during the growing season can still be seen in the dormant season as dark canes. The set of vines in the middle of this row were not sprayed for powdery mildew the year before.

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