Grape Downy Mildew: Identification, Symptoms and Control

UCCE Sonoma County Grape Day
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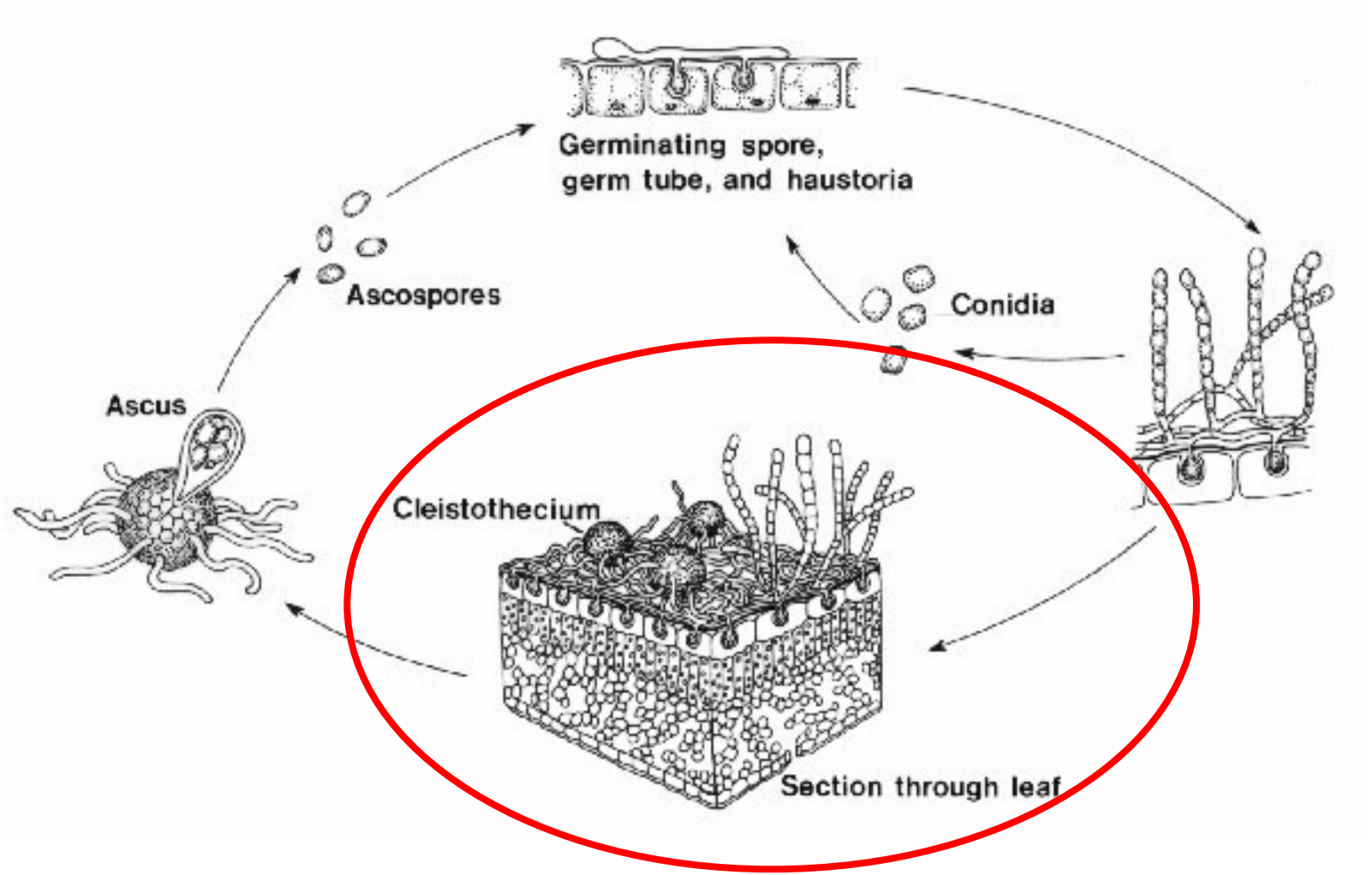
Grape downy mildew

Plasmopara viticola

- Oomycetes – water molds
- Infects all green tissue in grapevines (obligate parasite)
- All *Vitis vinifera* cultivars are highly susceptible
- It invades green tissue and hyphae develop between cells **inside** green tissue
- The vine's cell walls are penetrated and haustoria (feeding pegs) invaginate the cell membrane.

***Uncinula necator,* the causal agent of Grapevine Powdery Mildew grows predominately on the leaf surface**



Generalized Life Cycle of Powdery Mildews, American Phytopathological Society
https://www.apsnet.org/edcenter/disandpath/fungalasco/labexercises/PowderyMildew/Pages/PowderyMildewsLifeCycle.aspx

Pinot noir, August 13, 2019, Sebastopol

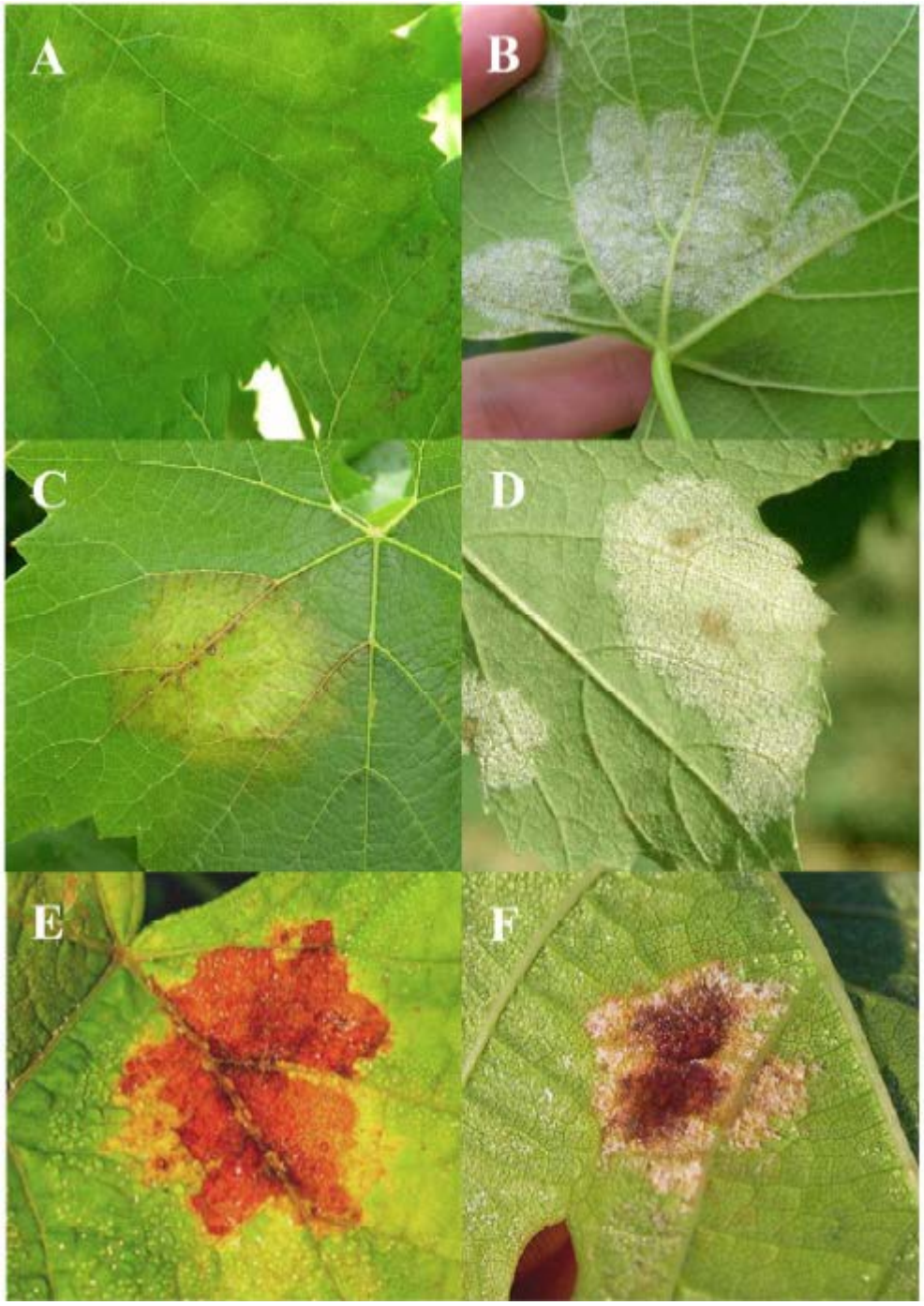
Pinot noir, August 13, 2019, Sebastopol

Oil spots on leaf blades

The primary infections occur on the underside of the leaf.
Hyphae invade the tissue and oil spots appear on the upper side of the leaf.

Wet soil is required:
--allows for the release of overwintering oospores
--rainfall
-- at least 52^0F

Chardonnay, August 13, 2019, Sebastopol



Sequence of lesion development and sporulation of *Plasmopara viticola* on grapevine leaves

From: Kennelly, M.M., et al. 2007. Phytopathology, 97:512-522.

Downy mildew of grapevines

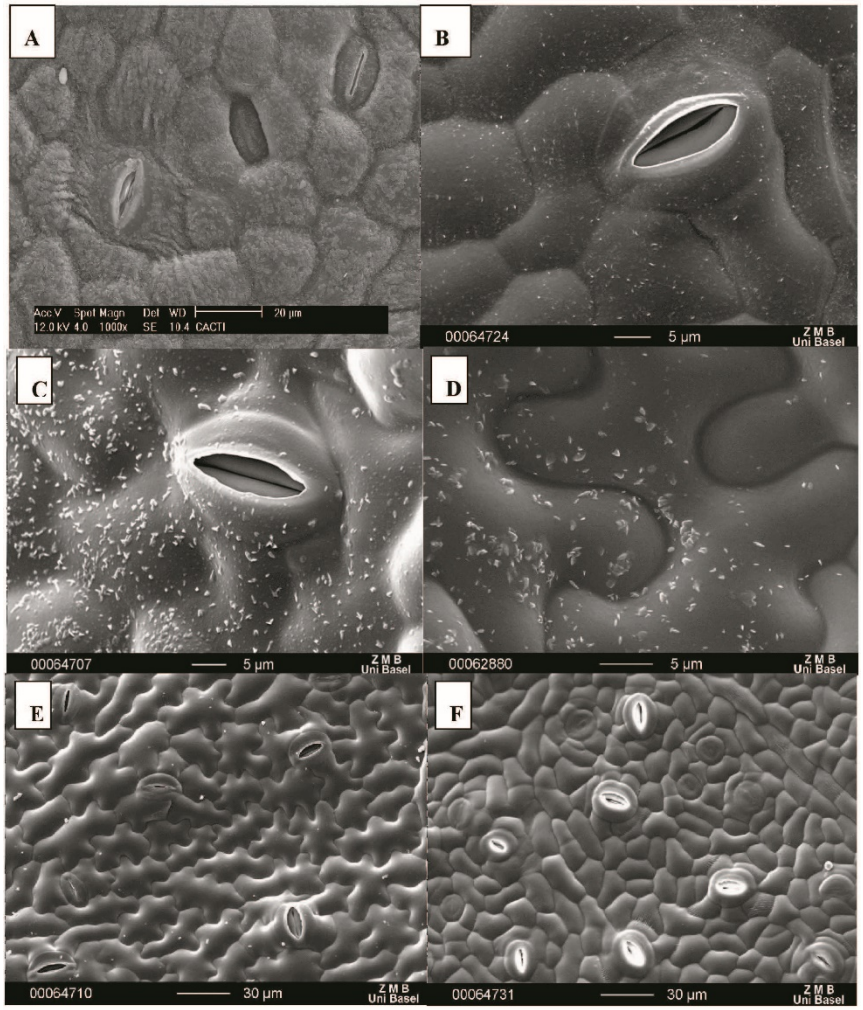
Source URL: https://www.agric.wa.gov.au/table-grapes/downy-mildew-grapevines

The original document was last revised at Tue, 14/05/2019 - 1:09pm

Figure 8 Infection on mature leaves will be yellow-brown and remain small, confined by the leaf veins forming a mosaic pattern

Older leaves

Stomata on grapevine leaf blades and other green issue provide the entry for infection



From: Boso, S. et al. 2014. Vitis, Vol 49(1)

Stomata lignify on older, unripe berries and cannot be infected. Pedicels have stomata and are still susceptible.

Bruce Watt, University of Maine, Bugwood.org

Touriga Nacional

Photo: L. Varela, July 28 2018, Portugal

Chardonnay

Photo: May 11, 2017, Santa Maria, CA

https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=24099

Chardonnay

Photo: May 11, 2017, Santa Maria, CA

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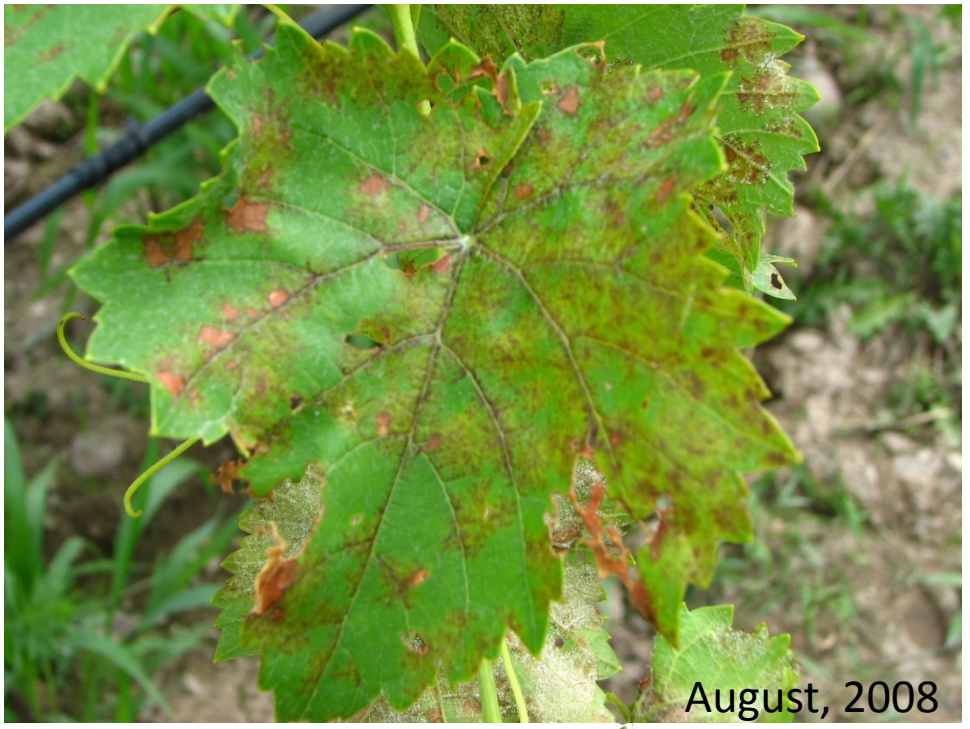
Photos: H. Walter-Peterson, Downy mildew on Chancellor

Photo: M. Moyer, July 8, 2019, New York

Touriga Nacional infected with *Plasmopara viticola*

Photo: L. Varela

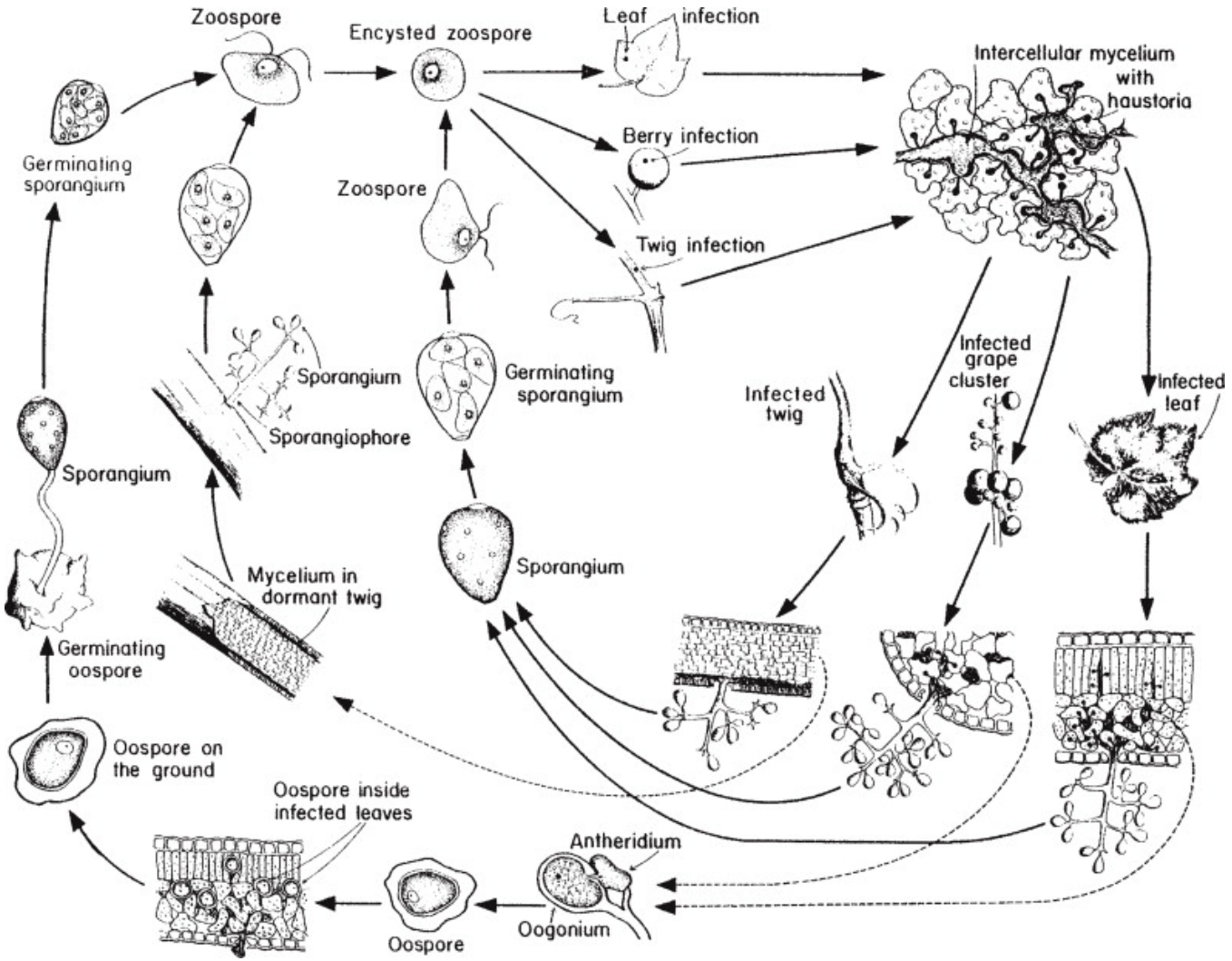
Photo: M. Moyer



Early leaf drop due to severe late season disease will reduce cold hardiness resulting winter injury or kill

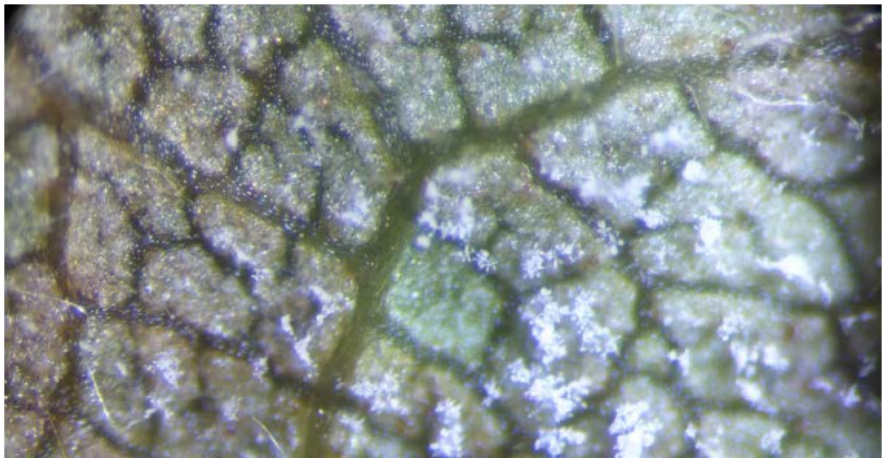
Photos: H. Walter-Peterson, Cornell

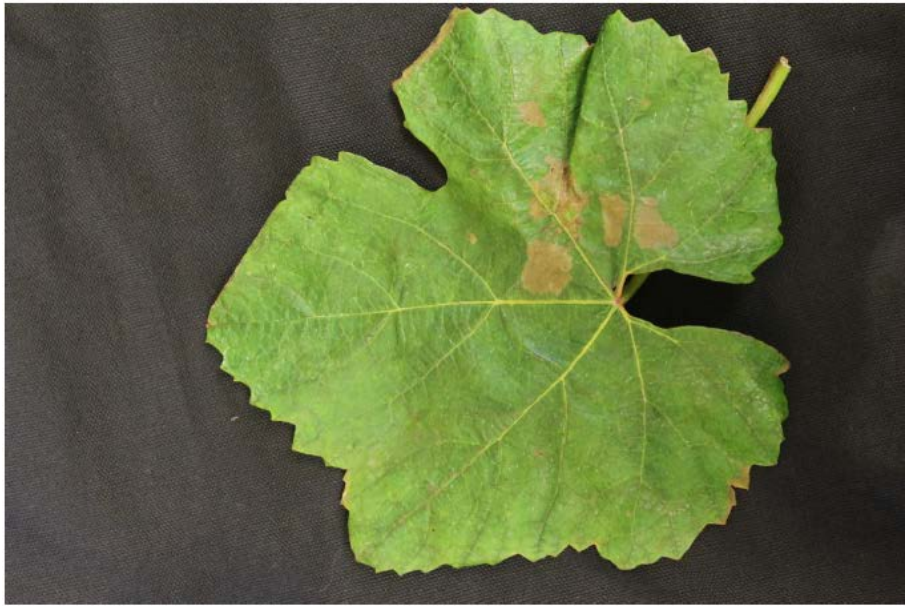
Life cycle of *Plasmopara viticola* - the causal agent of grapevine downy mildew



From: Ronald S. Jackson PhD, in Wine Science, Principles and Applications. Book. (Third Edition), 2008. https://www.sciencedirect.com/book/9780123736468/wine-science

6/6/19: Specimen collected by a PCA between River Rd and Guerneville Rd. Submitted to the Eskalen Lab, UC Davis





FUNGICIDES, BACTERICIDES, AND BIOLOGICALS FOR DECIDUOUS TREE FRUIT, NUT, STRAWBERRY, AND VINE CROPS 2017

ALMOND	***PEAR***
APPLE	***PISTACHIO***
APRICOT	***PLUM***
CHERRY	***POMEGRANATE***
GRAPE	***PRUNE***
KIWIFRUIT	***STRAWBERRY***
PEACH/NECTARINE	***WALNUT***

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UC Kearney Agricultural Research and Extension Center
kare.ucanr.edu/programs/Plant_Pathology

Statewide IPM Program
ipm.ucanr.edu

http://ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf

General Properties of Registered and Experimental Fungicides Used on Deciduous Tree Fruit, Nut, Strawberry, and Vine Crops in the United States‡

Single active ingredient	Trade name	Class (FRAC number)[1]	Systemic action	Mode of action	Resistance potential
copper[9]	various	Inorganic (M1)	No	multi-site	low
sulfur	various	Inorganic (M2)	No	multi-site	low
mancozeb	Dithane,Manzate, Penncozeb	Carbamate (EBDC)[2] (M3)	No	multi-site	low
thiram	Thiram	Carbamate (DMDC)[3] (M3)	No	multi-site	low
ziram	Ziram	Carbamate (DMDC)[3] (M3)	No	multi-site	low
captan	Captan	Phthalimide (M4)	No	multi-site	low

PHENYLAMIDES (FG 4)‡

Trade name	Common name	Company	Activity
Mefenoxam	mefenoxam	ADAMA Agricultural Solutions Ltd., FarmSaver,	contact, systemic
Ridomil Gold	mefenoxam	Syngenta Crop Protection	contact, systemic

‡ Some of the active ingredients or products listed in this table may not be registered as pesticides or may have had their registration withdrawn. Check with your state pesticide regulatory agency to verify that applications are made in accordance with state and federal laws and regulations.

Mode of action: FRAC[1] Group 4; interferes with activity of a nuclear RNA polymerase I

Resistance risk: high; to reduce the risk of resistance development start treatments with a fungicide with a multi-site mode of action; rotate or mix fungicides with different mode of action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications/season.

Growth effects: inhibits mycelial growth, sporangial development, and zoospore viability

Sporulation: reduces

PHOSPHONATES (FG 33)‡

Trade name	Common name	Company	Activity
Aliette	fosetyl-aluminum	Bayer CropScience	systemic
Fungi-Phite	potassium phosphite	Plant Protectants, LLC	systemic
K-Phite	polyphosphite	Plant Food Systems, Inc.	systemic
Legion	fosetyl-aluminum	ADAMA Agricultural Solutions Ltd.	systemic
Linebacker	fosetyl-aluminum	Tessenderlo Kerley, Inc. (NovaSource)	systemic
ProPhyt	potassium phosphite	Helena Chemical Company	systemic

‡ Some of the active ingredients or products listed in this table may not be registered as pesticides or may have had their registration withdrawn. Check with your state pesticide regulatory agency to verify that applications are made in accordance with state and federal laws and regulations.

Mode of action: FRAC[1] Group 33; reports indicate variable effects on both plant and organism physiology.

Resistance risk: medium (resistance detected in some crops)

Growth effects: may inhibit phosphorus deficiency signaling in the plant and fungus; direct toxicity in inhibiting mycelial growth.

Sporulation: suppresses sporulation of *Phytophthora* spp.

UNIVERSITY OF CALIFORNIA AGRICULTURE & NATURAL RESOURCES

UC IPM

Statewide Integrated Pest Management Program

http://ipm.ucanr.edu/PMG/r302101111.html

How to Manage Pests

UC Pest Management Guidelines

| All grape pests | All crops | About guidelines |

Grape

Downy Mildew

Pathogen: *Plasmopara viticola*

(Reviewed 12/14)

In this Guideline:

SYMPTOMS

The fungus attacks all green parts of the vines, particularly the leaves. Depending on the incubation period and leaf age, lesions are yellowish and oily or angular, yellow to reddish and brown and limited by the veins. Sporulation of the fungus appears as a delicate, dense, white, cottony growth in the lesions. Infected shoot tips thicken, curl ("Shepherd's Crook") and become white with sporulation. They eventually turn brown and die. Similar symptoms are seen on petioles, tendrils and young inflorescences, which, if attacked early enough, ultimately turn brown, dry up and drop. The young berries are highly susceptible. They appear grayish when infected (gray rot) and become covered with a downy felt of fungus sporulation. Berries become less susceptible as they mature, but rachis infections can spread into older berries (brown rot, no sporulation). Infected berries of white cultivars may turn dull gray-green, while those of black cultivars turn pinkish red. Infected berries remain firm, compared to ripening healthy berries, and drop easily. Portions of the rachis or the entire cluster also may drop.

COMMENTS ON THE DISEASE

Grape downy mildew occurs mainly in regions where it is warm and wet during the vegetative growth of the vine. Limited rainfall in spring and summer generally limits the spread of the disease in California. Surviving inoculum may be present in California at low levels and initially may have been introduced on plant material from outside of California. In most regions the fungus survives the winter mainly as oospores in fallen leaves. However, in California's generally mild winters, survival of the fungus in buds, shoot tips, and persistent leaves may be more important than in other grape-growing regions.

The pathogen is dispersed by splashing rain and wind. The infection process can take less than 90 minutes. Infection generally occurs in the morning and the incubation period is about 4 days. Downy mildew is favored by all factors that increase the moisture content of soil, air and host plant. Rain and irrigation practices are principal factors in promoting epidemics. The optimum temperature for development of the disease is 68° to 77°F (20° to 25°C) with extremes ranging from 50° to 86°F (10° to 29°C). In California the greatest potential for disease development exists when a wet winter is followed by late spring rains. The potential is high as well in the event of early fall rains.

MANAGEMENT

Preventive management consists of effective soil drainage and reduction of sources of overwintering inoculum. In a vineyard that depends on sprinkler irrigation, extend the interval between irrigations as long as possible.

Fungicides for use against downy mildew can be categorized as either preventive or curative. The preventive fungicides must be applied before an infection period begins. New growth following application will not be protected. Include a spreader/sticker agent to prevent the material from washing off with rain. In vineyards with a history of downy mildew, apply early season copper sprays as part of a preventive program, especially during wet springs.

Common name (Example trade name)	Amount per acre**	R.E.I.‡ (hours)	P.H.I.‡ (days)

UPDATED: 12/14

Compare treatments | Calculate emissions | Protect bees

UC IPM Grape Downy Mildew guidelines lists five materials. Restricted Entry Intervals range from 4 to 48 hours and Preharvest intervals range from 14 to 42 days.

Crop and Pest Management Guidelines
A Cornell Cooperative Extension Publication

Cornell Cooperative Extension

Page Contents

2019 New York and Pennsylvania Pest Management Guidelines for Grapes

Cornell Cooperative Extension

PennState Extension

These guidelines are not a substitute for pesticide labeling. Always read and understand the product label before using any pesticide.

https://cropandpestguides.cce.cornell.edu/Guidelines/2019/Grapes/index1.aspx

Tables in

"2019 New York and Pennsylvania Pest Management Guidelines for Grapes" *and selected materials*

Table 3.2.1 Physical modes of action of and resistance risk of fungicides used in management of grape diseases[1].

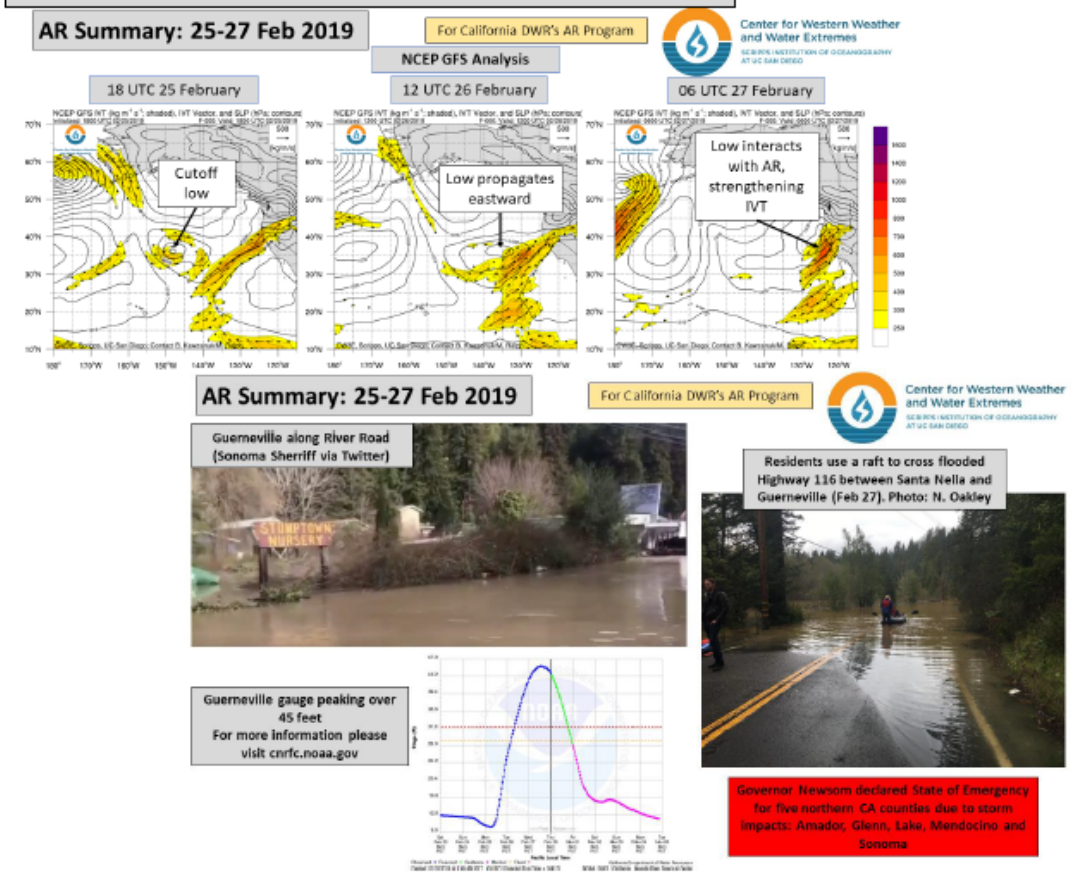
Fungicide	Protectant[a]	Post-infection[b]	Anti-sporulant[c]	Eradicant[d]	Resistance risk	Resistance group
captan (Captan, Captec)	+	-	-	-	L	N/A[j]
copper (several formulations)	+	-[i]	-	-	L	N/A[j]

Table 3.2.2 Effectiveness of fungicides for management of grape diseases[1].

Fungicide	Phomopsis cane and leaf spot	Black rot	Downy mildew	Powdery mildew	Botrytis bunch rot
captan (Captan, Captec)	++++	+	+++	0	+
copper (several formulations) [c]	+	+	+++	++	0

https://cropandpestguides.cce.cornell.edu/Guidelines/2019/Grapes/index1.aspx

Water Year 2019 Highlight



Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

- Six ARs impacted California during February 2019
- The AR that impacted Northern California between 25 and 27 February produced an impressive 21.36 inches of precipitation over Venado, CA
- The large precipitation accumulations associated with this late February AR combined with the moist conditions created by numerous ARs that impacted the region in the previous weeks caused the Russian River in Guerneville, CA to rise to 45 feet, 4.5 ft. below the flood of record
- Visit https://cw3e.ucsd.edu/cw3e-ar-update-25-27-february-post-event-summary/ for a full summary on the event

CW3E
Center for Western Weather and Water Extremes

https://cw3e.ucsd.edu/distribution-of-landfalling-atmospheric-rivers-over-the-u-s-west-coast-during-water-year-2019-end-of-water-year-summary/