Grape Powdery Mildew

Guide H-329

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SYMPTOMS

Powdery mildew, caused by the fungus *Erysiphe necator* (syn. *Uncinula necator*), is one of the most prevalent and easily recognized plant diseases afflicting grape vines in New Mexico. It appears as a dusty white-gray or greenish-white coating on leaf surfaces or other above-ground plant parts. The disease is most commonly observed on the upper surfaces of leaves (Figure 1), but can also affect the lower leaf surface, young stems, buds (Figure 2), flowers, canes, and young fruit. Severely infected leaves may exhibit mottling or deformity, including leaf curling and withering. Infected fruit turn grayish-white at first and ultimately exhibit a brown russeted appearance. Infected fruit may crack, shrivel, or drop from clusters (Figure 3).

LIFE CYCLE

The powdery mildew fungus overwinters as hyphae inside dormant buds, or as chasmothecia (spore-bearing structures) in bark or on canes, leftover fruit, and leaves on the ground. When hyphae from dormant buds serve as the primary inoculum, the new tissue is infected when the bud breaks dormancy. When chasmothecia provide the primary inoculum, plants are infected in the spring when ascospores (sexual spores) are released from the overwintering structures. Ascospores shoot up into the air currents and are wind-blown to susceptible plants, where new infections begin. During the growing season, the fungus produces conidia (asexual spores) that increase the severity of the disease on infected plants and may spread the fungus from one plant to another.

CONDITIONS FOR DISEASE

In New Mexico, powdery mildew is favored by warm temperatures (43-95°F, with optimum temperatures of 68-80°F) and high humidity (40-99% relative humidity). Low light also favors disease development. For this reason, powdery mildew infections are often found in dense canopies where low light conditions and low air circulation prevail.

MANAGEMENT

Planting locations with good airflow are preferable; canopies at these locations will dry faster. There are also several different management practices that can help reduce or prevent powdery mildew. Such practices increase light penetration and reduce relative humidity in the plant canopy. Do not crowd the plants together when planting or training vines. A high canopy designed with air ventilation in mind will be preferable to a canopy that has low ventilation and high leaf density. Airflow and ventilation will discourage mildew growth. Selectively pruning overcrowded plantings and removing leaves are recommended cultural practices to increase light penetration and the circulation of air; this also decreases relative humidity infection. Do not compost infected plant debris. Avoid nitrogen fertilizer applications in the late summer to limit the production of succulent tissue. Water early in the morning to let the tissue and soil dry as quickly as possible. Avoid overhead watering to reduce relative humidity.

Fungicides may be used for managing powdery mildew. For best results, fungicide treatments should begin before the overwintering fungus can infect new growth. The first few treatments are the most important and should be applied at appropriate intervals, starting at bud break or early shoot growth. A powdery mildew index (PMI) model may be used to determine appropriate treatment intervals because frequency will depend upon weather conditions and choice of fungicide. For more information on calculating PMI, please see the University of California's Agriculture and Natural Resources statewide integrated pest management program at

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***Figure 1*. Infected leaf (Yuan-Min Shen, Taichung District Agricultural Research and Extension Station, Bugwood.org).** (To view color versions of these photographs, visit http://aces.nmsu.edu/pubs/_h/H-329.pdf)

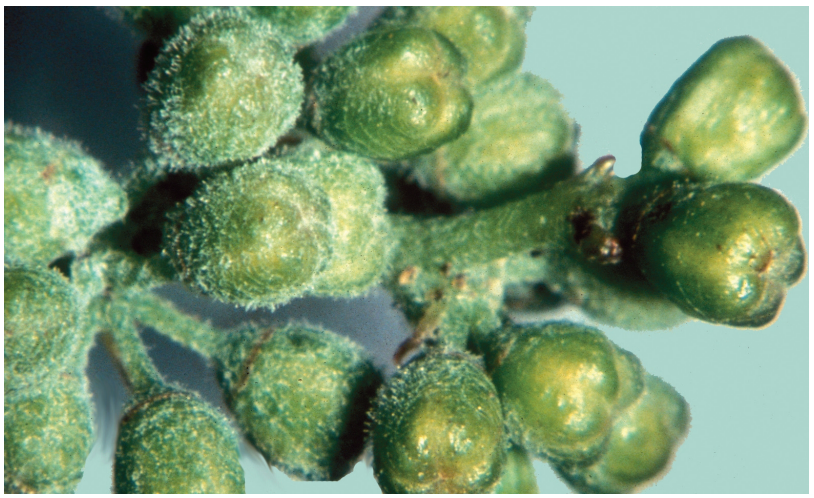

***Figure 2*. Infected flower bud (University of Georgia Plant Pathology Archive, University of Georgia, Bugwood.org).**

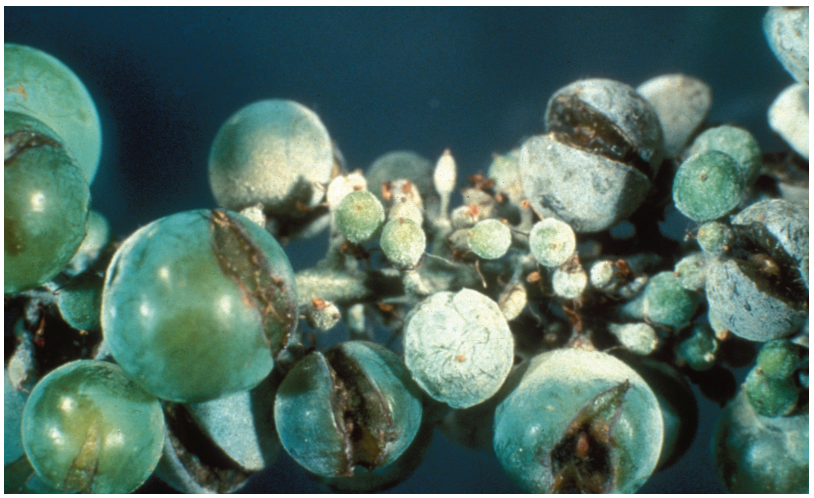

***Figure 3*. Infected berries (University of Georgia Plant Pathology Archive, University of Georgia, Bugwood.org).**

www.ipm.ucdavis.edu. Mildew fungicides are commonly divided into different groups. These groups are classified by their mode of action: amino acids and protein synthesis, glucan synthesis, mitosis and cell division, respiration, signal transduction (quinolines), sterol inhibitor, multi-site activity, biologicals, unknown mode of action, host plant defense induction, and products with mixed modes of action.

See Table 1 for fungicides currently registered for use on grapes to help manage powdery mildew in New Mexico. This table lists fungicides by modes of action. Rotating fungicides with different modes of action is important in resistance management (delaying or preventing the development of fungicide resistance in pathogens).

DISCLAIMER

The recommendations in this publication are provided only as a guide. The authors and New Mexico State University assume no liability resulting from their use. Brand names appearing in publications are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.

Please be aware that pesticide labels and registration can change at any time; by law, it is the applicator's responsibility to use pesticides ONLY according to the directions on the current label. Use pesticides selectively and carefully and follow recommended procedures for the safe storage and disposal of surplus pesticides and containers.

Table 1. Fungicide Use on Grapes Against Powdery Mildew in New Mexico

Mode of Action	Common Name	Trade Name
Amino acids and protein synthesis	cyprodinil	Vangard WG
Glucan synthesis	polyoxin D zinc salt	Ph-D WDG
Mitosis and cell division	thiophanate-methyl	T-Methyl 70W WSB T-Methyl E-AG 70 WSB Thiophanate-Methyl 85 WDG Topsin M 70 WDG
Respiration		
Carboxamides	boscalid	Endura
Strobilurin (QoI)	azoxystrobin	Abound Amistar
	trifloxystrobin	Flint
	kresoxim-methyl	Sovran
Signal transduction (quinolines)	quinoxyfen	Quintec
Sterol inhibitor	fenarimol	Rubigan E.C.
	tebuconazole	Amtide Tebuconazole 45WDG Elite 45 DF Orius 45 DF Orius R 20 AQ
	myclobutanil	Eagle 20EW Myclobutanil 40 Nova 40W Rally 40W Spectracide Immunox
	triflumizole	Procure 480SC Procure 50WS
Multi-site activity	copper ammonium complex	Liqui-Cop
	copper hydroxide	Champ DP Champ Formula 2 Champ WG Kocide 101 Kocide 2000 Kocide 3000 Kocide 4.5 LF Kocide DF Kocide LF Kentan DF Nu-Cop 3L Nu-Cop HB Nu-Cop 50 DF
	copper salts of fatty acids	Camelot Brand Fungicide Tenn-Cop 5E
	copper soap	Copper Soap Liquid Fungicide Cueva Copper Soap Liquid Copper Soap
	copper sulfate	Copper Sulfate Crystals Crystal Blue Copper Sulfate Crystals Cuprofix Disperss Cuprofix MZ Disperss Cuprofix Ultra 40 Disperss Phyton 27

Table 1. Fungicide Use on Grapes Against Powdery Mildew in New Mexico (continued)

Mode of Action	Common Name	Trade Name
Multi-site activity (continued)	mancozeb + copper hydroxide	Mankocide
	sulfur	Kumulus DF
		Sulfur Dust
		Liquid Sulfur Six
		Microthiol Disperss
		Sulfur 6L
		THAT Flowable Sulfur
		Thiolux Jet
	potassium salts of fatty acids + sulfur	3-in-1 sprays
Biologicals (mode of action unknown)	*Streptomyces lydicus*	Actinovate
	Bacillus pumilus	Ballard Plus
		Sonata
	Bacillus subtilis	Serenade ASO
		Serenade Max
Unknown mode of action	hydrogen dioxide	Oxidate
		StorOx
	potassium bicarbonate	Amicarb 100
		Milstop Foliar Fungicide
	petrolium oil	BioCover MLT
		Brandt Saf-T-Side
		Purespray Green
		Suffoil-X
	neem oil	70% Neem Oil
		Bonide Bon-Neem
		Concern FTE
		Green Light Neem Concentrate
		Triact 70
		Triology
	phosphonates	Fosphite
		Fungi-phite
		Rampart
	potassium salts of fatty acids	M-Pede
	plant extracts	Regalia SC
Host plant defense induction	Harpin protein	Messenger

Products with Mixed Modes of Action	Common Name	Trade Name
Strobilurin + sterol inhibitor	trifloxystrobin + tebuconazole	Adament 50 WG
Multi-site activity + sterol inhibitor	mancozeb + myclobutanil	Clevis
Strobilurin + carboxamide	pyraclostrobin + boscalid	Pristine