



Characteristics of downy mildew

Viti-note Summary:

- Economic impacts
- Factors influencing grapevine susceptibility
- Lifecycle of downy mildew
- Overwintering
- Primary infection from oospores
- Secondary infection from conidia
- Conditions favouring development

Other topics in this Viti-Notes series include:

- *Characteristics of downy mildew*
- Symptoms of downy mildew
- Monitoring for downy mildew
- Managing downy mildew

Downy mildew is a major disease of grapevines caused by the fungus *Plasmopara viticola*. This species is unique to grapevines and is established in all Australian grape growing districts.

The fungus is spread by wind and water and favourable conditions for infection and disease development occur in warm wet weather, especially in late spring and early summer.

In most districts, vines are at greatest risk from 3–6 weeks after budburst until berries are pea-sized. Inadequate control of downy mildew can result in severe crop losses.

Most commercial varieties are susceptible to this disease.

Essential components for strategic management of downy mildew include prediction of infection based on weather events, monitoring the vineyard for symptoms of infection, knowing the disease cycle, and understanding how cultural management practices and available fungicides impact on disease control.

Economic impacts

Severe infection by downy mildew around flowering can lead to total crop loss if inflorescences and flowers are uniformly infected. Badly affected leaves can fall prematurely, reducing yields and berry sugar content, and expose remaining bunches to sunburn. Buds forming for next season's growth can also be less winter hardy if infected.

Factors influencing grapevine susceptibility

Downy mildew is a disease driven by very specific environmental conditions. Determining where and when to monitor requires an understanding of the conditions that favour downy mildew development.

- 10:10:24 weather conditions facilitate primary infections from resting oospores. This is when the temperature remains 10°C or more and there is at least 10 mm of precipitation over a 24 hour period.
- Suitable conditions for secondary infections to develop occur when humidity is at least 98% and the temperature is 13°C or above (optimum 20–25°C) for at least 4 hours of darkness and leaves are wet for 2-3 hours predawn. Under these conditions, the disease can spread extremely rapidly.

Vineyard conditions which increase soil and air moisture content greatly predispose vines to the potential for infection by downy mildew. Humid, sheltered areas of the vineyard are most susceptible.

All varieties of *Vitis vinifera* are susceptible to downy mildew, particularly Sultana and Pinot Noir. Less prone to infection are hybrids of *Vitis vinifera* and American species.

Overwintering

The fungus can survive for 3-5 years in vineyard soil. The resting body (oospore) originated in infected leaf, shoot or berry tissue.

Characteristics of downy mildew

Life cycle of downy mildew

An understanding of the pathogen life cycle in a grapevine helps identify when preventative action will provide the most cost-effective level of control.

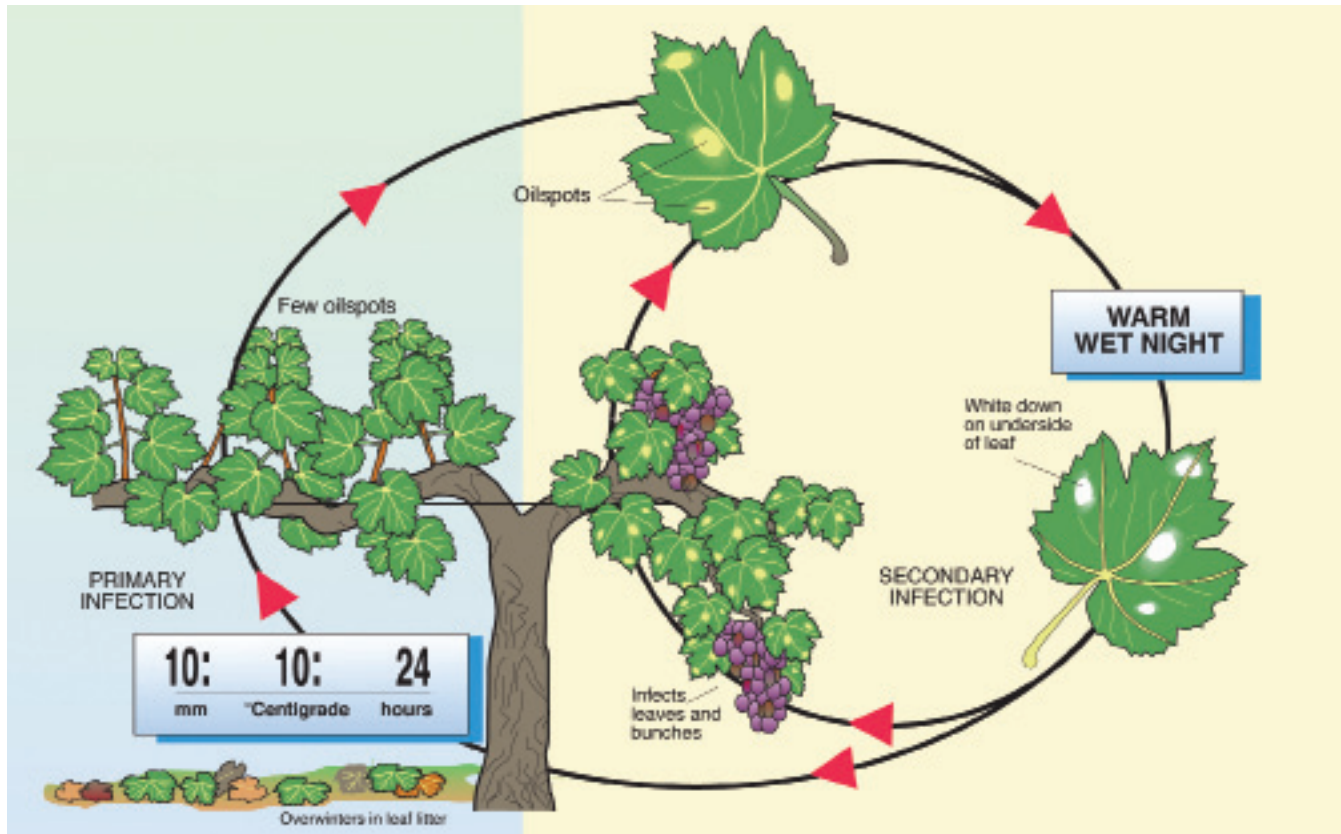


Figure 1. Life cycle of downy mildew

(Diagram courtesy of Nicholas, Magarey and Wachel, 1994, *Grape Production Series Number 1: Diseases and Pests, Winetitles*)

Primary infection from oospores

When sufficiently wetted during warm wet weather in the spring, oospores produce zoospores which are dispersed by rain-splash onto the canopy. Zoospores can move in water and if conditions are favourable, germinate and penetrate the leaf through pores called stomata. The fungus then grows within the vine tissues adjacent to the infection point. Within 4-21 days of zoospore release, characteristic 'oilspot' symptoms appear on leaves. The primary infection level is usually low with only 1-3 oilspots forming per 50 m of row.



Figure 2. Characteristic oil spot symptoms of Downy Mildew

Secondary infection from conidia

Oilspots, which are caused by growing colonies of the fungus, produce further generations of zoospores after warm humid nights. Spore-bearing structures called sporangia appear through the stomata on the undersides of leaves and other green parts of the vine. These form the characteristic 'down' which gives the disease its name. The spores borne on these sporangia are spread by wind and rain to establish new infection sites while conditions remain favourable.



Figure 3. Down-like appearance of sporangia on the underside of a grapevine leaf.

Conditions favouring development

Primary infection can occur throughout the growing season when conditions are suitable. The infection rate is generally low, resulting in around one oilspot per 50 m of vine row.

- Zoospores are released from oospores in the presence of free water once temperatures are higher than 8°C (optimum 18–22°C).
- Germination occurs when the temperature remains 10°C or more, and there is at least 10 mm of precipitation over a 24 hour period (10:10:24 conditions).
- Growth of the fungus within the vine begins near the end of the 24 hour infection period if foliage has remained wet for the last 8 hours and temperatures have been favourable.

After 4–21 days, depending on the temperature, the characteristic oilspots form. Under specific conditions these oilspots subsequently produce the spores which cause secondary infections. These conditions occur when:

- humidity is at least 98%;
- temperatures are 13°C or above (optimum 20–25°C);
- leaves are wet for 2-3 hours predawn;
- these conditions persist for at least 4 hours of darkness.

After a single warm humid night, as few as 20–50 oil-spots which may have developed from a preceding primary infection weather event, can result in the development of 100,000 secondary oil-spots in an area of 50 m radius of each initial primary oilspot. The spores from secondary infection are spread by wind and rain to establish new infection sites. This cycle continues while conditions are suitable.

Acknowledgement

The Australian Wine Research Institute would like to acknowledge:

- Cooperative Research Centre for Viticulture (CRCV) and all involved in the VitiNotes series (1996 – 2006).
- Associate Professor Peter Dry (Viticulture consultant, The Australian Wine Research Institute) in the preparation of this document.

Further information

Innovator network factsheets

Managing Downy Mildew

<http://www.gwrdc.com.au/webdata/resources/files/DownyMildewFactShee.pdf>

Training

For regional specific training in pest and disease control, the AWRI is running Research to Practice: Integrated Pest Management for changing viticultural environments.

Contact

Marcel Essling: rtp@awri.com.au for more information.

Agrochemical information

Agrochemicals registered for use in Australian Viticulture - updated annually.

Visit www.awri.com.au for the latest version.

Useful references

Nicholas, P., Magarey, P.A. and Wachtel, M. (Eds.) 1994 Diseases and pests, Grape Production Series 1, Hyde Park Press, Adelaide (a glove box edition of this book is also available).

For images of grapevine symptoms visit www.winetitles.com/diagnosis/index.asp.

Product or service information is provided to inform the viticulture sector about available resources and should not be interpreted as an endorsement.



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