

Ilyonectria macrodidyma (Halleen, Schroers & Crous) and *I. liriodendri* (Halleen, Schroers & Crous)



Fig. Symptoms of grapevine black foot disease a) diseased young Chardonnay on Ramsey rootstock with very short shoots; b) black discolouration of the trunk base wood; c) internal necrosis extending from the pith to the bark; d) roots sloughed away in heavy, wet, poorly drained soil.

Disease: grapevine (*Vitis spp*) black foot disease. Causal agent: *Ilyonectria macrodidyma* (Halleen, Schroers & Crous; formerly *Cylindrocarpon macrodidymum*); *Ilyonectria liriodendri* (Halleen, Rego & Crous, formerly *Cylindrocarpon liriodendri*). Classification: Fungi ; Ascomycota; Pezizomycotina; Sordariomycetes; Hypocreomycetidae; Hypocreales.

Grapevine black foot disease is a root fungal disease of grapevines caused by *Ilyonectria* spp. (principally by *I. macrodidyma* and *I. liriodendri*). In NSW, Australia, we have shown that the disease initiates in the grapevine nursery field soil and is spread to new locations through planting of diseased grapevines in vineyards, leading to young vine decline, especially when the plants are co-infected with Botryosphaeriaceae fungi. Infected vineyards show many declining grapevines with slow growth, reduced vigour, retarded sprouting, shortened internodes, sparse and chlorotic foliage. The disease results frequently in plant death, forcing growers to uproot and replant (Cabral *et al.* 2012).

Biology and Ecology: In Australia the disease usually initiates in the grapevine nursery field soil after callused cuttings are planted. At that stage, undifferentiated callus tissue and uncovered pith at the base of the cutting are vulnerable to infection. The callus and young roots are fragile and can break during planting, resulting in infection-susceptible wounds. Infection starts mainly through the basal stem although hyphae can also enter the roots via root hairs. The hyphae kills the invaded root cortical cells and spreads.

The symptoms include black discolouration of the trunk base wood and black streaks in the vascular system, with internal necrosis extending from the bark to the pith. The xylem vessels become occluded with fungal tissue, gums and tyloses and the infected roots show black, sunken, necrotic lesions, and can rot away completely.

Distribution: The disease was first reported from the NSW Hunter region Australia in 2007 (Whitelaw-Weckert *et al.* 2007) and from the NSW Riverina Australia in 2013 (Whitelaw-Weckert *et al.* 2013). It is now present in most wine producing countries of the world (Cabral *et al.* 2012).

Further Reading:

Bleach CM, Jones EE, Jaspers MV, 2009. Biofumigation with brassica spp. for the control of *Cylindrocarpon* black foot disease of grapevines. *New Zealand Plant Protection* 62, 396.

Cabral A, Rego C, Nascimento T, Oliveira H, Groenewald JZ, Crous PW, 2012. Multi-gene analysis and morphology reveal novel *Ilyonectria* species associated with black foot disease of grapevines. *Fungal Biology* 116, 62–80.

Whitelaw-Weckert MA, Rahman L, Appleby LM, Hall A, Clark AC, Hardie WJ, Waite HL, 2013. Co-infection by *Botryosphaeriaceae* and *Ilyonectria* spp. fungi during propagation causes decline of young grafted grapevines. *Plant Pathology* 62, 1226-1237.

Whitelaw-Weckert MA, Nair NG, Lamont R, Alonso M, Priest MJ, Huang R (2007) Root infection of *Vitis vinifera* by *Cylindrocarpon liriodendri* in Australia. *Australasian Plant Pathology* 36, 403-406.

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Host Range: In addition to grapevines, *Ilyonectria macrodidyma* and *I. liriodendri* attack many other plant species including almond, apple, avocado, azalea, beech, cherry, cyclamen, Douglas fir, ginseng, kiwi fruit, liriodendron, Liliium, magnolia, peach, oak, olive, peach, plum, Scots pine, spruce, strawberry and weeds in vineyards. These alternate host plants may act as reservoirs for the grapevine black foot disease species.

Disease Management: Currently there are no proven methods to control or eradicate the disease from infected vineyards.

After the removal of infected plants, the pathogens can survive for many years in soil as chlamydospores, so it is important to treat the infected planting holes. Possible future treatments might include biofumigation using mustard crops or seed meals (Bleach *et al.*, 2009). Heavy, wet and poorly drained soils contribute to disease severity and significant crop losses so site selection is important.

Disease prevention: Hot water treatment (HWT) of dormant nursery plants before planting out in the vineyard will prevent the spread of this disease. Contact Helen Waite (hwaite@csu.edu.au) for advice regarding HWT.