



Grapevine yellow speckle disease



Introduction

Grapevine yellow speckle disease was first described in Australia by Taylor and Woodham (1972) in Sunraysia, north-western Victoria. They demonstrated that the disease was graft-transmissible and concluded that the causal agent might be a virus. Sixteen years later, Koltunow and Rezaian (1998) from CSIRO, Adelaide, proved that the causal agent was the viroid GYSVd-1. A similar viroid was later diagnosed and named GYSVd-2.

Viroids are smallest known infectious RNA molecules comprising a single strand of non-coding circular RNA. While viruses contain genes and can code for their essential proteins, viroids have no genes and are totally dependent on their host plant. A total of six viroids have been detected in grapevines globally, of which only Grapevine yellow speckle viroid 1 (GYSVd-1) and GYSVd-2 are symptomatic (Habibi 2017). The other viroids are Australian grapevine viroid, Hop stunt viroid, Citrus exocortis viroid and Grapevine latent viroid (GLVd, Zhang et al. 2018). All these viroids, except GLVd, have been detected in Australia. GLVd is latent in the grapevine and is rare. The full-length sequences of three grapevine viroids (AGVd, GYSV-1 and Hop stunt viroid) have been



detected in a 10-year-old bottled wine (Habibi et al. 2012). This means that wines imported into Australia may contain full-length viroid sequences, a possible cause for biosecurity concern.

Symptoms

Most grapevine varieties are infected with GYSVd-1 and test positive by PCR (Habibi 2017), but not all vines show symptoms. Severe yellow speckle symptoms occur in Australia sporadically and then only on some leaves of the vines (Salman et al. 2014). A study of 32 Chardonnay vines over five years (2009-2013) in the Alverstoke vineyard, Urrbrae, South Australia found all vines were positive for GYSVd-1 by PCR every year, but only a maximum of eight vines showed symptoms in a single year. This occurred in November 2009, when the vineyard encountered 11 consecutive days when maximum daytime temperatures were at or above 35°C (Salman et al. 2014). In the years after 2009, the number of symptomatic vines was consistently less than eight.

Yellow speckle symptoms first appear as pinpoint dots initially close to the mid-rib and then gradually progress towards the distal ends of the leaves (Figures 1 and 2). In severely affected plants, the whole leaf blade may turn bright yellow. In other countries where grapevine fanleaf virus (GFLV) is endemic, a severe symptom called vein banding appears which is the result of a synergistic reaction between viroids and viruses.

In the Adelaide Hills, young Gruner Veltliner vines growing in sleeved guard tubes showed symptoms only on the leaves growing out of the sleeves that were exposed to direct sunshine, but not on the leaves within the sleeves. When Sultana H5 leaves were subjected to dark treatment for half of the leaf blades by wrapping in aluminum foil, only the exposed halves of the leaves facing the sun showed yellow speckles. It appears that the bright sunshine in Australia combined with hot temperatures can play an important role in the expression of yellow speckle symptoms (Martelli, personal communication).

Transmission

No transmission of yellow speckle disease has been observed even after 40 years of growing healthy and infected vines next to each other and it seems that the viroid is not transmitted by seeds (Taylor and Woodham 1972). Subsequent reports from the same researchers suggest that natural spread of grapevine yellow speckle disease occurs randomly (Woodham and Krake 1982). To date, the possibility of natural spread of GYSVd is inconclusive.

Elimination of viroids from grapevines

Unlike viruses that thrive in cooler temperatures, viroids flourish in warmer temperatures, and that was why Taylor and Woodham (1972) refrained from classifying these agents as a virus. While shoot tip culture and thermotherapy can eliminate viruses from plants, viroids are resistant to hot temperature treatments. So far, there have not been any convincing reports of the elimination of viroids from grapevines.



How harmful is yellow speckle disease?

No data are available on the effect of yellow speckle disease on vine vigour, yield and wine quality. One possible reason could be that so far, no viroid-free control vines have ever been found. Overall, grapevine viroids seem to have little economic impact on fruit yield and wine quality.



Figure 1. Yellow speckle disease on Sultana clone H5 growing at the Alverstoke Orchard, Urrbrae, South Australia (photo courtesy of Tony Hoare)



Figure 2. Yellow speckle disease on Pinot Noir clone Able (photo courtesy of Tony Hoare)



References and further reading

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