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First outbreaks of grapevine 'flavescence dorée' in Austrian viticulture

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Abstract

A long-term survey on the presence of phytoplasmas in Austrian viticulture was conducted from 2004 to 2010. 'Boir noir' was widespread in all Austrian vine growing areas, no other phytoplasmas could be identified until 2009. The first finding of grapevine 'flavescence dorée' (FD) was in Southeast Styria in 2009. FD was identified in *Vitis vinifera* (cv. "Müller Thurgau" and "Sämling 88"), in an American hybrid (cv. Isabella) and phytoplasmas of the same subgroup were also detected in *Clematis vitalba*. This first disease outbreak affected four different vineyards. Incidence of few newly-affected grapevines and clematis plants were observed within the infected area, however about 0.5 ha vine growing area has been uprooted until 2010. A second outbreak of FD was detected in the region of South Styria. It was an isolate disease outbreak on two single grapevines (cv. Sämling 88) and FD-related phytoplasmas were also detected in three plants of *C. vitalba.* The ribosomal group affiliation of all characterized samples from both regions indicated that the phytoplasmas belonged to the ribosomal subgroup 16SrV-C. To prevent further spreading of this quarantine pathogen *focus* zones and a buffer zones were designated in Southeast Styria and in South Styria.

Key words: Viticulture, grapevine yellows, 'flavescence dorée', *Scaphoideus titanus*.

Introduction

In Europe grapevine 'flavescence dorée' (FD) phytoplasma is listed as a quarantine pathogen (Council Directive 2000/29/EC, Annex II/AII). Its vector, the nearctic leafhopper *Scaphoideus titanus*, was introduced into Europe from North America. FD and *S. titanus* have spread from France to the eastern and southern vine-growing areas of Europe. *S. titanus* was first recorded in Austria in 2004, since then it has invaded the southeastern parts of Austria (Zeisner, 2009). The phytoplasma associated with FD belong to two strains in ribosomal group 16SrV (FD-C/16SrV-C, and FD-D/16SrV-D) (Martini *et al*., 1999; Angelini *et al*., 2001). The wild plant *Clematis vitalba,* was determined as possible host for 16SrV-C phytoplasmas (Filippin *et al*., 2009). A national survey was conducted to broadly estimate the occurrence of phytoplasmas in Austrian viticulture.

Materials and methods

The surveys were carried out on 82 locations by sampling leaves and shoots from grapevines and clematis plants over a 7-year period (2004-2010). The study sites were located in Lower Austria, Vienna, Burgenland, Styria and the vine growing areas of Carinthia. The nucleic acid extraction of the phytoplasmas from plant samples was done according to Dolye and Doyle (1990) method. A real-time PCR assay was used for screening (Angelini *et al*., 2007). The identification of the phytoplasma and the group affiliation was performed according the EPPO Diagnostic Protocol (EP7/79).

Results

All samples collected between 2004 to 2008 were infected by stolbur phytoplasmas (16SrXII) associated with 'bois noir' (BN) disease.

The first finding of FD was in the vine growing region of Southeast Styria in 2009. The phytoplasma was detected in the cultivars Isabella, Müller Thurgau and Sämling 88. In the vicinity of the infected vineyards a *C. vitalba* plant displaying leaf rolling and reddening was found to harbour also 16SrV-C phytoplasmas (figure 1).

This first disease outbreak affected four different vineyards. Due to the high disease presence about 0.5 ha vine growing area has been uprooted until 2010. In the established *focus* zone of this area, enhanced surveillance activities revealed only a few newly infected grapevines in 2010.

Several asymptomatic and symtomatic clematis plants at the border of the vineyards and outskirts of nearby forests were positive to the presence of phytoplasmas of the same ribosomal subgroup. In the investigated vineyards 'boir noir' was also present. Mixed BN and FD infections were also detected in same cases.

FD appears to be restricted to Southeast Styria, but subsequent surveys detected a second isolated disease outbreak in South Styria in 2010. Contrary to the first finding, the disease incidence was very low in that area. The phytoplasma could be detected only in two single grapevines (cv. Sämling 88) and in two clematis plants.

The ribosomal group affiliation of all characterized samples from both regions revealed that all FD strains belonged to the ribosomal subgroup 16SrV-C.

Figure 1. Reddening symptoms on *C. vitalba*, including downward leaf rolling of leaves.
(In colour at www.bulletinofinsectology.org)

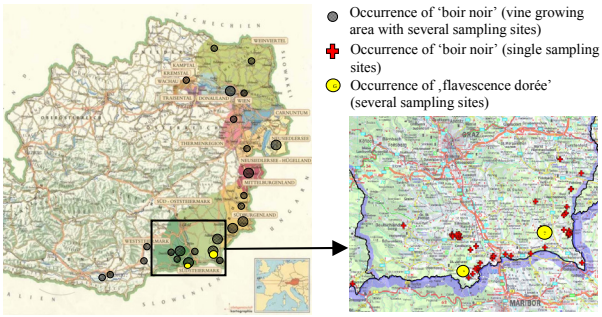

Figure 2. Current distribution of phytoplasmas in Austrian viticulture. Austrian vine growing areas are coloured.
(In colour at www.bulletinofinsectology.org)

Discussion

During the last decade, Austrian vine growers have been faced an increasing occurrence of BN disease. Besides the challenge of combating this non regulated disease of grapevine, there was a high risk of introduction of the quarantine disease FD to Austrian vine growing areas (Steffek *et al.*, 2007). Despite increased monitoring activities in the preceding years, the dimension of the first disease outbreak in Southeast Styria was considerable, and assumed to be contributed to the abundance of the vector in this area. A *focus* zone (1 km around the outbreak) and a buffer zone (5 km around the outbreak) were designated in this area to prevent further spreading of this pest. This outbreak was brought under control with uprooting of all diseased grapevines and *Clematis* plants and the combat of the vector. The vector has been established in this area since 2004. A regulation was issued to control *S. titanus* since 2009. The control has been mandatory not only for the vine growing areas of Southeast Styria but also parts of South Styria. In contrary to the first outbreak, the disease incidence in South Styria is limited to few plants, which can be contributed to the very low abundance of *S. titanus* in this area. Only few individuals of the vector were caught in this area and there is no established population. This disease outbreak support the hypothesis that clematis or other wild plants may serve as a reservoir host for FD. Transmission experiments showed that *Dictyophara europaea* is able to transmit the FD-related phytoplasma from clematis to grapevine (Filippin *et al*., 2009). Other leafhoppers, such as *Orientus ishidae* are potential vectors (Mehle *et al*., 2010). The parallel occurrence of BN and FD in the same vine growing areas may also enhance the risk that individual grapevines are hot spots for new outbreaks.

The results of this study lead to the conclusion that phytoplasmas threaten the Austrian viticulture; well-designed prospective trails may increase our understanding of control points and strategies.

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