Recovery phenomena in Japanese plum trees grafted with apricot that stably recovered from European stone fruit yellows

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Abstract

European stone fruit yellows (ESFY) is the most destructive phytoplasmas disease of apricot and Japanese plum in Europe. All conventional preventive defence strategies have been ineffective in the past, however it has been demonstrated that individual plants can recover from the disease, behaving as completely tolerant to ESFY. The status of tolerance is transmissible by grafting, so investigations about the possibility to transmit this status from visually recovered apricot to Japanese plums in the field, under high ESFY-infection pressure were carried out.

Keywords: Japanese plum, recovery, graft transmission

Introduction

'Candidatus Phytoplasma prunorum' is associated with the quarantine phytoplasma European stone fruit yellows (ESFY). The ESFY disease generally induces typical symptoms such as early bud break, plum leptonecrosis and leaf rolling of apricot (*Prunus armeniaca*), Japanese plum (*Prunus salicina*) and other cultivated *Prunus* species in Europe (Poggi Pollini *et al.*, 2012). To date, all approaches applied to phytoplasma infected plants did not reduce the incidence of these epidemic diseases (Osler *et al.*, 2014). A great relevance has been recently attributed to the recovery, a long-time known phenomenon consisting in the spontaneous remission of symptoms in diseased plants. Despite the physiological basis of this recovery is not completely understood spontaneous and stabile recovery can occur in a low numbers of ESFY-diseased apricot plants (Osler *et al.*, 2014, Poggi Pollini *et al.*, 2012). The long-lasting recovered plants behave in the fields as tolerant to ESFY and this acquired tolerance resulted transmissible by grafting, with a very high efficiency to successive generations of apricot (Osler *et al*., 2014). The aim of this work was to investigate the possibility to transmit this status of acquired tolerance from recovered apricot plants to Japanese plum plants and to verify how long this status can be maintained under natural conditions.

Materials and Methods

Apricot plants 12 years-old naturally recovered form ESFY symptoms and detected in 2015 in the province of Trento, were employed together with plants, located in Friuli Venezia Giulia kindly provided by the University of Udine, with acquired tolerance (Osler *et al*., 2014) These plants did not show disease symptoms but were positive for the presence of the 'Ca. P. prunorum' by RT-qPCR detection (Minguzzi *et al.*, 2016, Ratti *et al.*, 2019). Two-years old Japanese plum of several cultivar grafted on myrobalan 29C rootstocks, were grafted by chip-budding with tolerant apricot plants (4 plants per cultivar plus one ungrafted control) (Table 1). Three months later a second chip-budding was performed with ESFY-infected material collected form symptomatic Japanese plum cultivar Santa Rosa. The plants were visually inspected since June 2017, at least three times a year to monitor the presence of the typical symptoms. All the plants were tested annually using of 1 g of phloem from woody shoots of the plum trees, placed in extraction bags (Bioreba) using reported procedures (Minguzzi *et al.*, 2016, Ratti *et al.*, 2019).

Results

The results of field observations showed that the grafting combinations can be divided into 2 groups. Many Japanese plums (4 groups out of 7) showed off season growth, severe foliar symptoms, fruit deformation, progressive decline and sometimes total die-back in the last three years (2017-2019). On the contrary in the remaining 3 combinations most of the plants (Bergeron B/Obilnaja, Bergeron TO/ TC Sun and Harcot n°5/Larry Ann) did never shown symptoms (Table 1). Moreover, in the last group no undersized fruits were noticed and a good production was achieved.

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Table 1. Results of grafting tests on Japanese plums.

Japanese plums grafted	Mother plants (apricots)	Symptomatic plants*	ESFY-positive plants*
Black Sunrise	Bulida SP 3/25	4/4	4/4
Friar	Reale di Imola n° 15	4/4	4/4
Larry Ann	Harcot n° 11	4/4	4/4
Larry Ann	Harcot n° 5	1/4	4/4
Obilnaja	Bergeron B**	0/4	4/4
Ozark Premier	Reale di Imola n° 8	4/4	4/4
TC Sun	Bergeron TO**	0/4	4/4

*Control plants were symptomatic and positive in RTq-PCR in all thesis. **Kindly provided by Fondazione Edmund Mach, Italy.

Specific amplification was obtained from positive controls as well as from all grafted plants. No phytoplasmas were detected in any of the healthy plants used as controls.

Discussion

The potential epidemic threat posed by '*Ca*. P. prunorum' in apricot and Japanese plum orchards is confirmed by the dramatic increase in the number of infected trees, especially when highly susceptible cultivar, like most of the available stone fruit cultivars, are grown under high European stone fruit yellows infection pressure (Poggi Pollini *et al.*, 2012). Like other phytoplasmas, direct protection of the trees from '*Ca*. P. prunorum' cannot be achieved by chemical control measures. Moreover, all preventive measures employed to prevent ESFY spread as sanitary selection, use of clean propagation material, removal of the infected plants and vector control with insecticide treatments have not reduced the progression of the disease in Italy so far (Poggi Pollini *et al.*, 2007). The results presented showed that spontaneous recovery can occur of ESFY-diseased Japanese plums grafted with apricots with acquired tolerance in natural condition. Similar results were observed earlier (Osler *et al.*, 2014) Our findings may have a significance after future studies to confirm that the acquired tolerance and/or resistance would be maintained in phytoplasma infected plants by grafting procedures.

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