Bulletin of Insectology ***60*** *(2): 311-312, 2007*
ISSN 1721-8861

Hot water treatment and field coverage of mother plant vineyards to prevent propagation material from phytoplasma infections

Franco MANNINI
Istituto Virologia Vegetale CNR – Unità di Grugliasco (TO), Italy

Abstract

Phytoplasma may be transmitted by the propagation of scions and/or cuttings collected from diseased plant during a period of symptom latency. Although propagation itself usually results in a strong reduction of the infection in the progeny, some infected plants may survive bringing the pathogen in a new vineyard. These aspects are particularly important in the production of grapevine "base" material (i.e. the source of clonal material to establish commercial nursery mother plant vineyards). Hot water treatment of propagation material and a insect-proof coverage of mother plant vineyards could strongly prevent from this danger. The experiences recently achieved on the matter in Piedmont (north west Italy) are reported in this paper.

Key words: grape, propagation, mother plant vineyards, phytoplasmas, hot water treatment, insect-proof coverage.

Introduction

"Flavescence dorée" (FD) and "bois noir" (BN) are serious grapevine diseases caused by two genetically distinct phytoplasmas, although showing an identical symptom expression. FD is associated with an elm yellows-type phytoplasma transmitted by the leafhopper *Scaphoideus titanus*, while BN is associated with a stolbur-type phytoplasma transmitted by the leafhopper *Hyalesthes obsoletus*. FD and BN diffusion in the commercial vineyards is mainly due to the vectors, however the propagation of infected plants by nurseries may also contribute to worsen the problem. Although propagation itself usually results in a strong reduction of the infection in the progeny, some infected plants may survive bringing the disease in a viticultural area previously free. In this respect the role played by propagation is not of minor interest, particularly in the production of the "base" material (i.e. the source of clonal material to establish commercial nursery mother plant vineyards).

Hot water treatment (HWT) has been proposed since 1966 by Caudwell to cure dormant woody plant material from phytoplasmas. Afterward other works showed the effectiveness of the treatment against these pathogens (Caudwell *et al*., 1990; Tassart-Subirats *et al*., 2003), although some other experiences indicate the BN more difficult to be completely eradicated than FD (Borgo *et al*., 1999; Bianco *et al.,* 2000; Mannini and Marzachì, 2007).

HWT, however, must be carefully applied because may interfere with the vitality of woody propagation material. This is one the main reasons why HWT did not meet the favour of nurseries, especially in Italy, where some experiments carried out in the past gave unclear results on this respect showing a strong variability in the plant survival rate depending on the variety and on the type of material (Frausin *et al*., 1999; Moretti *et al*., 2002). Not so in France where HWT is considered a reliable technique and it is compulsory for the "base" propagation material. Recent experiences carried out in Piedmont (Mannini and Marzachì, 2007) confirmed the reliability of HWT when done with a proper equipment.

The other fundamental aspect in terms of prevention from FD and BN is the protection of the mother plant vineyards (MPV) from the vectors. Despite the insecticide sprays in fact, some infected insects coming from the surroundings may survive introducing the disease in the mother vine source block. The isolation of mother plants from the outside would be the only way to minimize this possibility.

Materials and methods

In recent time the Grapevine Premultiplication Centre of Piedmont has set a new approach in the production of clonal "base" material, introducing the complete isolation of the MPV from ground (except roots) and the outside and the HWT of the dormant wood during the propagation. The attempt is the prevention at the highest level from any possible virus and phytoplasma infection in the propagated material.

The healthy clonal "primary sources" are kept individually potted inside a screen-house. Each clone is represented by three plants (on its own roots). The isolation from the soil and from the outside, thanks to a double insect-proof net, safeguards the original sanitary status of the clones from both virus and phytoplasma. According to the national regulations, the so-called "initial material" is collected from those mother plants to establish the MPV suitable for the production of "base" material. The new technique consists in planting in the field the MPV under a cover of an insect-proof tunnel provided with a double room entrance and with the complete plastic mulching of the ground. The tunnels are 2.70 m high and 3.00 m wide at the base and 1.50 m wide at the top. Each plant row is isolated from the others. Along the rows a metallic structure is designed to support the net coverage as well as the wire sets to uphold the plant

canopy. In the upper part of the tunnels a plastic pipe runs with sprinklers for fungicide and insecticide sprays. The chemicals for spraying are poured in the pipe from the outside. Another plastic pipe for water supply is located under the mulching. Vineyard management (i.e. the entry of workers inside the tunnels) is limited to green and winter pruning, and to routine sanitary inspections. The soil on which MPV are planted is sandy and *Xiphinema index*-free.

The own rooted plants of the different clones are distributed along the rows in five-vines plots separated from each others by a five meters of empty row. This to prevent possible mistakes during winter wood collection (i.e. blending of the wood from different clones) and the movement of grape mealy bugs, known as virus vectors, from one plot to another, in case they were incidentally present under the tunnels. In addition to insecticide sprays, the insect-proof net prevents plants from possible contact with vector insects coming from the outside, as well as the mulching stops the growth of weeds, possible hosts of *Hyalesthes obsoletus* Signoret or other BN vectors.

The woody propagation materials collected from the covered MPV are then processed by HWT at a minimum of 50 °C x 45' before grafting or, alternatively, at the final stage of the propagation as graftings (grafted and rooted vines) before the distribution to the commercial nurseries. The HWT at 52 °C x 45' may also be used to increase the prevention from BN, in this case however a reduction of the take rates in the propagation should be expected.

Results and discussion

In the first year, the vines of MPV under the tunnels developed vigorously, showing no water stress or phytosanitary problems (such as powdery or downy mildew). As expected, no dangerous insects were found in the chromotropic traps and no weeds developed through the mulching. The HWT, carried out with a specific equipment, had no or slight negative effect on the vitality of propagation material. After three years of HWT experience, the reduction of vine take compared to the untreated control, ranged from 0 to a maximum of 20% when using higher temperatures (52 °C x 45'), confirming the reliability of HWT.

This new strategy for the production of clonal "base" material, first example at national level, is an attempt to prevent at the highest degree the propagation material from any possible virus and phytoplasma infection. In this scheme, the material remains always protected from the outside being originated initially from the screenhouse and then from the field covered MPV. As a final guarantee of safety, the woody material undergoes to HWT during propagation processing.

In order to prevent clonal plants from virus infection, the MPV for the production of "base" material are often located in non viticultural areas, environments quite susceptible to BN for the large presence of weeds, possible host of vectors. There are reports of MPV removed few years after planting due to the high number of BN infected plants. In these situations the coverage of MPV and the HWT applied to propagation material may result very advisable.

The proposed scheme is strongly suggested for the production of "base" material, however it could also be very useful for the production of "certified" material when the MPV of commercial nurseries are located in areas with a high rate of the disease or for cultivar very sensitive to FD and BN (Chardonnay, Barbera, etc.).

Acknowledgements

The author thanks the Regione Piemonte for the economical support to the Premultiplication Centre and to HWT researches, the Nurseries of Vignaioli Piemontesi for economically supporting the construction of HWT equipments, the Phytopathology Service of Regione Piemonte, L. Nervo of Vivalb, N. Argamante and F. Ghilino of IVV-CNR for technical collaboration.

References

CAUDWELL A., 1966.- L'inhibition *in vivo* du virus de la "flavescence dorée" par la chaleur. Etudes de virologie.- *Annales des Epiphyties,* 17*:* 61-66.

CAUDWELL A., LARRUE J., VALAT C., GRENAN S., 1990.- Les traitaments a l'eau chaude des bois de vigne atteints de la "flavescence dorée".- *Progrès Agricole et Viticole*, 107 (12): 281-286.

BIANCO P. A., FORTUSINI A., SCATTINI G., CASATI P., CARRARO S., TORRESIN G. C., 2000.- Prove di risanamento di materiale viticolo affetto da flavescenza dorata mediante termoterapia.- *Informatore Fitopatologico*, 50 (4): 43-49.

BORGO M., MURARI E., SARTORI S., ZANZOTTO A., SANCASSANI G. P., BERTACCINI A., 1999.- Termoterapia per eliminare i fitoplasmi da vite.- *Informatore Agrario*, 55 (24): 47-51.

FRAUSIN C., GREGORIS A., ANACLERIO F., 1999.- Verifica di pratica utilizzazione della tecnica di termoterapia in acqua calda per il risanamento di talee di vite affette da giallume (GY), pp. 85-50.- In: *Proceedings of Convegno 'Flavescenza dorata e legno nero della vite in Friuli-Venezia Giulia,* (regione Autonoma Friuli-Venezia Giulia, eds), Gorizia, 5 November 1999, Italy.

MANNINI F., MARZACHÌ C., 2007.- Termoterapia in acqua contro i fitoplasmi della vite.- *Informatore Agrario*, 63 (24): 62-65.

MORETTI G., ANACLERIO F., GARDIMAN M., LOVAT L., 2002.- Trattamento con acqua calda su legno di marze e su radici di barbatelle innestate di alcuni vitigni (*Vitis vinifera* L.) - II. Effetti sull'innesto e sulla ripresa delle barbatelle.- *Vignevini,* 29 (9): 84-91.

TASSART-SUBIRATS V., CLAIR D., GRENAN S., BOUDON-PADIEU E., LARRUE J., 2003.- Hot water treatment: curing efficiency for phytoplasmas infection and effect on plant multiplication material, pp. 69-70. In: *Extended Abstracts 14° ICVG Conference*, Locorotondo (BA), 12-17 September 2003, Italy.

Corresponding author: Franco MANNINI (e-mail: f.mannini@ivv.cnr.it), Istituto Virologia Vegetale - CNR, Unità di Grugliasco, via Leonardo da Vinci 44, 10095 Grugliasco (TO), Italy.