SCIENTIFIC REPORT IN RESPONSE TO THE COMMENTS OF THE WORKING GROUP ON THE REVISION OF THE EU EMERGENCY MEASURES ON

Xylella fastidiosa

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Objective of the report: technical guidelines for hot water treatment for the safe movement of grapevine germplasm.

Content:

- Scientific background
- Technical guidelines
1. Scientific background

Hot water treatment (HWT) has been used successfully to disinfest plant material, including seeds and storage organs, since the 19th century (Waite and Morton, 2007) and remains the only effective means of controlling a number of important pests and pathogens in grapevine propagating and planting material for which there are no other practical chemical or biological controls.

It has been widely applied to cuttings as well as 1-year-old rooted vines to control and prevent the dissemination of Pierce’s disease (Goheen et al., 1973), phytophthora (Von Broembsen and Marais, 1978), crown gall (Burr et al., 1989; Ophel et al., 1990; Bazzi et al., 1991; Burr et al., 1996), phytoplasmas (Caudwell et al., 1997, Mannini and Marzachi, 1997, Eppo, 2012), mealy bug (Haviland et al., 2005) and endogenous fungal pathogens including Phaeomoniella chlamydospora (Crous et al., 2001; Laukart et al., 2001; Fourie and Halleen, 2004) in planting material.

It is essential to remark that (i) propagating material with obvious signs of disease should not be used (Anonymous, 1998); (ii) care should also be taken to ensure that material to be HWT is fully dormant.

Hot water treatment is a significant stress and can result in the loss of treated material if not applied correctly. Precautions should be taken prior to, during and after the treatment as described below.

Treatment conditions for Pierce’s Disease sanitation of dormant grapevines cuttings are at 45°C for 3 h or 50°C for 45 min (Goheen et al., 1973).

While early research (Lear and Lider, 1959; Meagher, 1960; Goheen et al., 1973; Goussard 1977; Burr et al., 1989) demonstrated that HWT is a safe and effective treatment for the control of pests and pathogens in cuttings and rooted vines, the application of the technique to commercial industry practice has not always been successful and problems with design, temperature control and monitoring in some early HWT plants allowed the development of hot and cold spots during treatment.
The design of HWT plant and equipment varies, but usually consists of one or more hydrating tanks that are used to pre-soak material in cold water before treatment, an insulated HWT tank with a heat source and a pump to circulate the water, and one or more cool-down tanks for plunging treated material to facilitate rapid cooling. Material that is to be treated is packed in mesh baskets for insertion into the tanks, usually by means of a forklift or block and tackle. Baskets are slightly smaller than the tanks to allow a 300 mm gap between the walls and floor of the tank to facilitate water circulation in the HWT tank. Tanks and baskets are normally constructed of stainless or galvanized steel to prevent rust. Baskets are packed with cuttings and rooted vines in bundles of 100 laid in the direction of the water flow to facilitate even heat distribution allowing 500 ml of water for each cutting and 1 l for each rooted vine (Anonymous, 1998). Bundles tied too tightly and wrapping of bundles in hessian or similar materials and over packing dipping baskets impedes the flow of water and results in the development of hot and cold spots.

2. Technical guidelines

2.1 – Pre-treatment and quality of vegetal material

Canes and plants to be treated have to:

- contain the best possible amount of reserves, i.e.: a total lignification of material, grafts and cuttings originating from non-overloaded mother-vines, plants having completed their vegetative cycle at the moment of uprooting
- be kept at best conditions of temperature and hygrometry after cutting or uprooting, with a special attention to possible desiccation or loss of reserves due to excessive high outdoor temperatures. Storage in refrigerating hammers below 5°C with high hygrometry is strongly recommended. Any vegetal material, with an insufficient reserves level or not looking fresh enough, might be altered by the Hot Water Treatment.
2.2 - Pre-treatment
Grapevine plant material should be taken out of cold storage 12–24 h prior to treatment and stored at room temperature in a humid and aerated chamber. Although it used to be common practice, soaking the material in cold water is no longer recommended as it creates a risk of spreading pathogens (Waite & Morton, 2007). The roots should be washed prior to treatment. Canes should not be cut or treated with fungicides just before treatment.

2.3 - Treatment conditions
The hot water treatment should be done on fully dormant materials at the end of the storage period. A treatment before or during storage in the refrigerating chamber is strongly inadvisable. After treatment, a long storage might cause not only superficial mould and also a delay in the vegetative revival.

2.4 Precautions during the Hot Water Treatment
- The temperature (50°C) after immersion and the treatment duration (45 minutes) should be respected (alternatively treatment conditions could be 45° for 3 hours).
- No fungicide should be added to the soaking water.
- The water has to be changed regularly (every day).

2.5 Precautions after the Hot Water Treatment
After treatment, the plant material should be left to set back to room temperature (avoid direct contact with cold water) during 12 to 24 hours in a humid and aerated atmosphere before storage in a cold chamber for a short time, or before grafting.

2.6 Precautions during transport
The treated material needs to be placed for transport in aerated containers with water supply (providing a good hydration). If the external temperature rises (risks of fermentation or desiccation) it may be necessary to place containers in a refrigerated compartment during transport.
2.7 Treatment device (Fig. 1):
To satisfy the expected physical and technical requirements, the equipment device has to fulfill precise fabrication standards regarding heating capacity, thermal isolation of the soaking recipient, constant maintenance of the exact temperature and homogeneity inside the material through an efficient system for permanent mixing.

Notes:
A non-respect of the order of procedures and precautions could lead to an important loss of plant material, even when the treatment as such was conducted as indicated. These advises might be subjected to changes and improvements.
REFERENCE CITED


Figura 1. Example of devise used for hot water treatment.