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Control of *Ralstonia solanacearum* in tomato potting medium by the use of a solar collector

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Abstract. A solar collector was used to disinfest potting medium inoculated with *Ralstonia solanacearum*. Tomato plantlets grown in the potting medium treated in the solar collector for one full day had no symptoms of bacterial wilt.

Ralstonia solanacearum, a widespread and destructive bacterial plant pathogen, limits production of many important crops, including the solanaceous species potato, tomato and pepper. This pathogen can also infect other herbaceous and woody plants and its control is difficult (Hayward 1994). Disinfestation of container medium is particularly important for the growth of disease-free seedlings and prevention of pathogen dissemination.

A solar collector was developed by Ghini (1993) with the aim of disinfesting container medium using solar radiation. This equipment was shown to be very efficient in controlling several fungal soilborne plant pathogens, including species of *Fusarium*, *Pythium*, *Rhizoctonia*, *Sclerotium*, *Sclerotinia* and *Phytophthora*, as well as nematodes such as *Meloydogyne* (Ghini 1993; Ghini *et al*. 1998). The purpose of this work was to determine the efficacy of the solar collector for the control of bacterial wilt caused by *R. solanacearum*.

As previously described (Ghini 1993), the solar collector comprises six aluminum tubes (15-cm diameter) placed in parallel rows in a wooden box (1.5 m × 1.0 m × 0.3 m), covered with transparent plastic (Fig. 1). Potting medium is placed inside the tubes for solar treatment.

In the experiments, which were conducted during autumn and spring (April and December 2005) in Jaguariúna, São Paulo (22°42′S, 46°59′W), 2 kg of potting medium (moisture content of ~70% of field capacity) was mixed with 7 mL of a bacterial suspension (~8×10^6 cfu/mL) of *Ralstonia solanacearum* (biovar I) strain IBSBF 32 (IBSBF = Phytobacteria Culture Collection of Instituto Biologico, Caixa Postal 70, Campinas, SP 13001-970, Brazil), isolated from tomato. Inoculum was

Fig. 1. Solar collector for substrate disinfestations.

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prepared from the virulent fluidal wild-type colonies selected on TZC medium (Kelman 1954).

The mixture was placed in the solar collector and treated for 1, 2, 3 and 4 days under full sunlight. Average day temperatures over the treatment period were 23°C in April and 25°C in December. Temperatures of the potting medium inside the solar collector were measured with a digital temperature multi-sensor, at intervals of 1 h. The sensor was placed along the middle of the tubes. Controls with infested and non-infested potting medium were kept at room temperature during the solarisation treatment.

Subsequently, potting medium from all the different treatments was placed in 2-L pots and five 30-day-old tomato seedlings, cv. Santa Clara, were transplanted to each pot, with eight replications per treatment. The plants were maintained in a greenhouse (25–30°C) and examined daily for the development of wilt symptoms. Reisolations were made on TZC medium from vascular tissues showing bacterial exudates.

Potting medium temperature inside the solar collector was higher than 60°C for at least 5 h during the day. Maximum temperature reached was 78.8°C. There were no wilted plants in the treatments solarised for 1–4 days, as well as in the control without the pathogen in both trials, while 60 and 70% of tomato plants showed wilt symptoms in the non-solarised infested potting medium from the experiments carried out in April and December, respectively (Fig. 2). The control of the disease was observed in two different periods of the year, as verified for other pathosystems (May-de Mio *et al*. 2002).

The results described by Ghini (1993) demonstrated that temperatures obtained in the solar collectors are sufficient to control soilborne plant pathogens but do not completely sterilise the potting medium, even after a prolonged treatment of 7 days. It does not create a 'biological vacuum' to the same extent as do other disinfestation methods, such as treatment with methyl bromide, soil steaming or autoclaving. Reinfestation is more likely to occur in a soil with a 'biological vacuum' because antagonistic organisms are also removed. A prolonged solar treatment of 7 days also did not alter the nutrient contents of the soil (Ghini 1993). Randig *et al*. (2002) observed a decrease in an indigenous community of arbuscular mycorrhizal fungi, but a higher weight of dry plants of maize was verified on treated substrate.

Fig. 2. Tomato plants growing on substrate infested with *Ralstonia solanacearum* and (1) not treated; (2) treated for 1 day, (3) 2 days, (4) 3 days, and (5) 4 days with solar radiation from a collector; (6) not infested and not treated; and (7) not infested and treated on solar collector.

A comparative economic evaluation was performed for solar and methyl bromide soil disinfestation, based on actual cost data from a commercial nursery (Ghini *et al*. 2000). The yearly cost per cubic meter of soil ranged from US$0.42 to US$0.52 in favour of methyl bromide disinfestations. However, the evaluation does not take into consideration the occupational health and environmental benefits, which greatly favour solar over chemical control. Moreover, methyl bromide is being prohibited worldwide for soil and potting medium treatment.

This study showed that the solar collector is an efficient method to treat potting medium infested with *R. solanacearum*. This equipment has started to be used by many growers, nurseries and research institutions in Brazil as an alternative method of control in view of the methyl bromide crisis. It can be used during the whole year and over the entire country. The ease of construction and operation of the solar collector offers a low-cost, efficient and safe system for the production of healthy seedlings.

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