

Research & Reviews: Journal of Botanical Sciences

Cold Tolerance of the Medfly in Dates and in Mandarin for Adequate Quarantine Cold Treatments

Yoav Gazit*

The Israel Cohen Institute for Biological Control, Plant Production and Marketing Board, P.O. Box 235, Yehud-Monosson 5610102, Israel

Short Communication

Received date: 07/06/2016

Accepted date: 11/07/2016

Published date: 13/07/2016

*For Correspondence

Yoav Gazit, The Israel Cohen Institute for Biological Control, Plant Production and Marketing Board, P.O. Box 235, Yehud-Monosson 5610102, Israel, Tel: +972-50-7257450

E-mail: Yoav@jaffa.co.il

Keywords: *Ceratitis capitata*, Cold treatment, Postharvest, *Phoenix dactylifera*, *Citrus Unshiu*.

ABSTRACT

Low level infestations of fresh dates (*Phoenix dactylifera* L.) by the Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Medfly) are possible. A comparison of the cold-tolerance of the fly in 'Barhi' date fruits stored at 1.11 °C to that in satsuma mandarin (*Citrus unshiu*, Marcovitch), indicated that when in Barhi dates it was significantly less tolerant to the cold treatment than when in mandarin. These results demonstrated that the quarantine cold treatments taken to disinfect mandarin from Medfly, are adequate enough if applied to fresh date commodities.

INTRODUCTION

Dates are considered as a weak host of Medfly^[1]. Nevertheless, in order to export fresh dates from Israel to the US, the USDA requires that quarantine measures should be taken to assure that the dates are free of this pest. To date, the most common quarantine treatment against Medfly is cold storage^[2,3]. Since dates are tolerant to low temperatures a cold treatment is considered feasible^[4].

Medfly instars have been found to vary in their cold tolerance^[5]. Therefore, after we found that the most cold-tolerant instar of the fly was the 3rd instar, we compared its cold tolerance in Barhi dates to that in satsuma mandarin^[6]. Since the approved postharvest treatment against Medfly is 1.11 °C for 15 days (T107-a-1) (USDA-APHIS-PPQ)^[7]. This was the temperature studied.

METHODOLOGY

Inoculating the fruit with Medfly was done artificially: Dates were inoculated by drilling each fruit laterally, 2 cm deep, using drill with a 3 mm Ø bit, then Medfly eggs suspended in 0.1% agar solution were injected into the cavity using a syringe. Mandarins were injected with similar egg suspension using an automatic syringe. The inoculated dates and mandarins were incubated 10 and 8 days, respectively in order for larvae to reach the 3rd instar. Before being subjected to the cold treatment, small subsamples of each fruit were dissected and all the recovered larvae were examined by the size of the mouth hooks to verify that the 3rd instar was the dominant life stage of the fly.

The cold treatments were carried out in a cold chamber where fruit and air temperature were monitored. Part of the fruit was left untreated (control) for sufficient incubation period, allowing the larvae to develop and pupate. After 3d, 6d, 8d, 10d, 13d and 15d of treatment, 100 dates and 100 satsuma mandarins (20 from each replicate), were removed from the chamber and incubated at room temperature for at least one day, allowing the survivors to recover mobility. Then 10 fruits were dissected to detect living larvae and 10 were left for further incubation allowing the survivors to pupate. Probit analysis of the mortality was carried out and the time periods in days required to generate 50%, 90%, 95% and 99% mortality were calculated using an inverse prediction, following the fitting of the model of the mortality at the treatment temperature as a function of treatment time.

RESULTS AND DISCUSSION

When comparing the cold-tolerance of the 3rd instar larvae in date fruits to satsuma mandarins, the last viable larvae in dates and in satsuma mandarins were found after eight and 13 d, respectively (**Figure 1**). In both fruits no puparia were obtained after 10 days of treatment. It is most likely that there is a late effect of the cold storage. Larvae that were still alive 24 h to 48 h after the termination of the cold treatment (when the fruit was dissected) will die later due to that effect resulting in a fewer number of puparia formed. The determination of mortality by the recovery of larvae is the more practical and rapid method and is used in quarantine inspection.

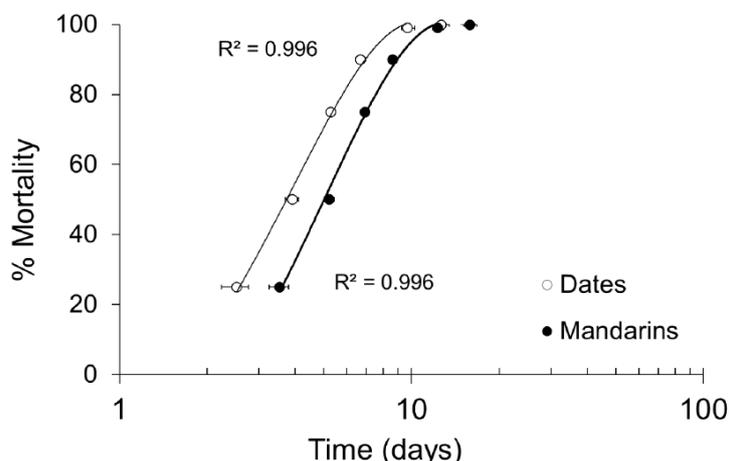


Figure 1. Probit analysis of mortality of Medfly, as determined by recovered larvae in dissected fruits of Barhi dates and satsuma mandarin, as a function of duration of cold treatment at $t \geq 1.2^\circ\text{C}$. Horizontal bars represent 95% fiducial limits.

The calculated mortality curves were significantly different. From 50% mortality to the highest mortality plotted (99%), there was no overlapping between the dates and the satsuma mandarin, indicating that Medfly when in Barhi dates were significantly less tolerant to the cold treatment than when in satsuma mandarins. Perhaps it is because dates are not a good host to begin with.

This study had clearly demonstrated that Medfly is more sensitive to cold-treatment when in dates than when in mandarin. Therefore, the quarantine measures taken to disinfest mandarin from Medfly is adequate enough if applied to fresh date commodities.

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