

## CONTROL OF MEDITERRANEAN FRUIT FLY ON CITRUS WITH CATTs TECHNOLOGY

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The Mediterranean fruit fly, *Ceratitidis capitata* (Wiedmann), is a quarantine pest in many countries where it is not endemic. The accepted technology for controlling this insect on citrus fruits is a cold quarantine procedure where the fruit is held at 1° to 2°C for a period of 16 to 21 days. This method is effective but since citrus is a subtropical fruit, this extended length of time at low temperature can cause chilling injury. A high temperature thermal treatment is a shorter, more efficient method of controlling the fruit fly. By adding an element of controlled atmosphere to the high temperature, the time of exposure required can be shortened, or the temperature of exposure can be lowered.

We examined the effect of the temperatures 40°, 42° and 44°C on different developmental stages of the fruit fly, and found that the most resistant stage to high temperature was the third instar stage. The experiments were conducted on replicates of 110 fruit fly larvae in Petri dishes on moist filter paper in containers that could be both heated and have their atmosphere controlled. An experiment with anaerobic conditions showed that at 20°C an 8 h treatment of no oxygen did not impair the ability of the fruit fly to survive. However, fruit flies held at 40°C for 5 or 7 h had mortality of 83% ±7.9 and 87% ±8.3, respectively, and when nitrogen atmosphere was imposed at 40°C the percentages were 98% ±0.7 and 100%, respectively. In addition, it was found that even the third instar larvae that survived were impaired in their ability develop into mature fruit flies.

The time that was needed to control the third instar larvae at high temperature in the presence of nitrogen atmosphere was shorter as the temperature was raised (Figure 1). At 40°C the time was close to 8 h, while at 44°C the time of exposure could be reduced to less than 2 h (Figure 2). It was thought that combining a nitrogen atmosphere with increasing concentrations of carbon dioxide would be more effective than nitrogen alone. However, in testing increasing concentrations of carbon dioxide it was found that only in pure carbon dioxide was there any increased effect on the mortality of the fruit fly. Therefore, high temperature combined with nitrogen atmosphere was utilized in experiments with fruit.

Fruit heats much more slowly than insects held in Petri dishes and while the temperature is approaching the set temperature (be it 40, 42 or 44°C) there is an effect on fly viability. Therefore, it is difficult to extrapolate the response of the fruit flies in these experiments to how they would respond when inside fruit. The time it took to heat either grapefruit or pommelit fruits in an experimental CATTs machine from 25°C to 40°C in a series of 4 experiments was 121±9 minutes and to 42°C was 179±14. When third instar larvae were present in fruit heated to either 42° or 44°C in either air or nitrogen atmosphere, the time for full mortality was much shorter than the times in Petri dishes (Figure 3). In air at 42°C it took 90 minutes for full mortality, while in nitrogen atmosphere mortality was achieved after 30 minutes.

The effect of heating pommalit fruit to 40°, 42° and 44°C for 8, 6 and 4 h, respectively, in air or in nitrogen atmosphere was examined in relation to fruit quality after holding the fruit for a week of shelf life. There was no effect on fruit firmness or on the soluble solids content, ethanol or acetaldehyde in juice from the fruit. However, in 2 out of the 4 experiments there was a decrease in titratable acidity in the heated fruit. No heat damage was observed on the fruit following the treatment and shelf life. More experiments are in progress to determine sensitivity of the fruit from different growing areas and throughout the harvest season.

Figure 1. Effect of time in nitrogen atmosphere at different temperatures on mortality of third instar fruit flies.

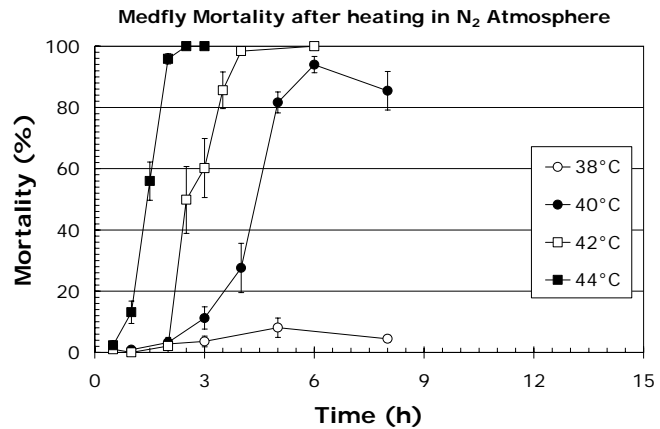


Figure 2. Predicted probit-9 for third instar fruit flies in nitrogen atmosphere at different temperatures.

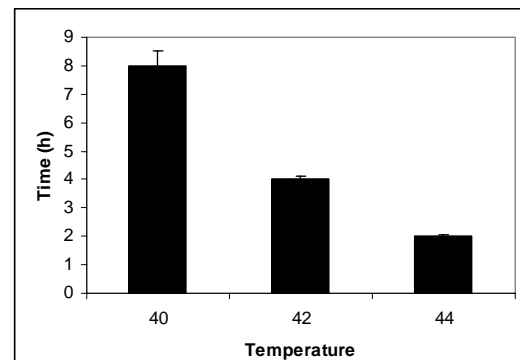


Figure 3. Mortality of third instar fruit flies after different times at 42° and 44°C in air or in nitrogen atmosphere.

