Title Development of quarantine insect control systems in Mexico using controlled atmospheres

Author E.M. Yahia

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Abstract

The application of quarantine treatments for some crops in Mexico is a requirement, not only for export markets, but also for some national markets in states free from fruit flies. Currently very few quarantine systems are developed and used. The most important and commonly used system in the country is hot water treatment developed for mango in 1988. Unfortunately, although this system has been used since then in several countries, it is still limited to mango and has several problems. This presentation will summarize our work developed over a period of about 10 years on the possible use of CA as a quarantine control system for fruits. Several fruits were investigated, but only mango was sufficiently tolerant for this treatment. Insecticidal CA ($\leq$0.5 kPa O_2 + $\geq$50 kPa CO_2) at different temperatures (from 20 to 55°C) and relative humidity (RH) was tested on the tolerance of several fruits including different cultivars of mango, avocados, pears, guavas and papayas, and on the mortality of different stages of the two most important fruit flies in Mexico (*Anastrepha ludens* and *A. oblique*). Insecticidal CA, especially at high temperatures increased the mortality of different stages of the fruit flies. Insecticidal CA at 43°C and 50% RH for 160 minutes achieved insect mortality in mango (probit 9) without causing negative effects on the fruit. The in vivo morality was faster than the in vitro mortality in both insects. Eggs were more tolerant than other stages of the insects. *A. obliqua* was slightly more tolerant than *A. ludens*. The mean estimated temperatures for 50%, 99% and 99.9968% in vitro mortality ($LT_{50}S$, $LT_{99}S$, and $LT_{99.9968}S$) of eggs of *A. obliqua* exposed to 0 kPa O_2 + 50 kPa CO_2 at 51, 54 and 55°C for 240 min were 49.4, 54.8 and 60.9°C, respectively. Other fruits that were investigated but were found to be very sensitive to these atmospheres included pears, avocado and guava. The sensitivity of these fruits to insecticidal CA seems to be due to changes in pH that inactivates aerobic enzymes, activates anaerobic enzymes and stimulates the accumulation of toxic metabolites. Trehalose may play an important role in the tolerance of fruits and vegetables to stress.