Development of quarantine insect control systems for tropical fruits using controlled atmospheres

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The application of a quarantine treatment for many crops in different parts of the world is a requirement, not only for export markets, but even for some national markets. Currently very few quarantine systems are developed and used. For example, the most important and commonly used system in Mexico 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 disadvantages. This presentation will summarize our work developed over a period of about 8 years on the possible use of controlled atmosphere (CA) as a quarantine control system for some tropical 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 ºC) and relative humidity (RH) was tested on the tolerance of several fruits including different cultivars of mango, avocados, 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* is 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 pKa 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 avocado and guava. Papaya has an intermediate tolerance. The basis for tolerance/sensitivity to insecticidal CA will be discussed.