CONTROL OF MEDITERRANEAN FRUIT FLY USING VACUUM OR CO_2

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Many agricultural industries currently rely on methyl bromide to disinfest commodities prior to export or sale. These commodities include fresh persimmons that are subject to quarantine treatments because of potential infestation by the Mediterranean fruit fly (MFF). In laboratory studies, we were able to show that fresh persimmons tolerate vacuum treatment and high concentrations of CO_2. We hypothesized that pests of fresh commodities such as MFF can be controlled using treatments that are effective on durable commodities. Also, we hypothesized that increasing the temperature of the commodity, the exposure time needed for the control of pests will be shortened, a prerequisite for quarantine treatments.

The flies for the tests derived from a laboratory colony of the MFF (*Ceratitis capitata* Wied). The colony was initiated from infested citrus fruits from various orchards in Israel. This colony is replenished every two to three years by introducing field-collected flies to maintain a wide range of genetic diversity. The rearing room is maintained at 24±1°C, and between 60 and 80% relative humidity. The room is illuminated with artificial fluorescent ceiling lighting from 8:00 AM to 4:00 PM.

Mature pupae are placed in cylindrical screen-cages, for the emergence of adults and oviposition. Eggs are oviposited through the screen and fall-free into a water reservoir. The eggs are collected daily and placed on larval diet consisting of sugar, brewer yeast, wheat bran, and water. The larvae grow on that diet, until they are ready to pupate. Mature larvae leave the diet and pop into trays containing fine vermiculite to pupate. Under these conditions the period of individual growth stages is as follows: egg to larva 2-3 d; larva to pupa 8-9 d; pupa to adult 8-9 d; adult to oviposition 2-3 d.

Two sets of experiments were carried out; MFF exposed to vacuum of 50 mm Hg and to 95% CO_2. The effect of vacuum was tested at 30 °, 35 °, and 42°C and the effect of CO_2 was tested at 38°C. Three developmental stages of MFF were tested: 2 day old eggs, one day old first stage larvae (Larvae I) and third stage larvae (Larvae III) before pupation.

Persimmon (*Fuyu kaki* cv. Triumph) fruits harvested in November 2001 and stored in a commercial storage room at -1°C until March 2002 were used. Prior each experiment, the persimmons were kept for 20 h to reach the test temperature. Each development stage was kept separately in 7 cm diameter Petri dishes with their food media and covered with wet paper.

MFF sensitivity to 50 mmHg absolute pressure

The three developmental stages were placed separately in Petri dishes among the persimmons and exposed to 50 mm Hg at $30^{o,}$ 35^{o} and 42^{o}C for 6, 8, 10, 16, 24, 30, 48 and 72 h. Six test chambers each of 3 L capacity containing 10 persimmons was used in these tests. The pressure of 50 mmHg was selected because it was suspected that at high temperatures in the system, the high vapor pressure due to the humidity of the persimmons, would not allow significant reduction of the absolute pressure. Additional sets of Petri dishes containing insects and persimmons were placed at the same temperatures for 16, 24, 48 and 72 h for controls.

Results show that at 30^{o}C an exposure time as long as up to 72 h would be required for the control of the MFF exposed to 50 mmHg. Whereas, when the temperature was increased to 35^{o} and 42^{o}C, complete mortality of all tested stages was obtained at an exposure of 16 h and 6 h, respectively. The third stage larvae were the most resistant to this treatment.

MFF sensitivity to 95% CO_2

Two test chambers each of 16 L capacity containing 50 persimmons were used in these tests. The atmospheric composition in the test chambers was modified to contain 95% CO_2 and 4% O_2. This was achieved by continuous supply of the same gas composition at a flow rate of 150 mL/min that also prevented accumulation of ethanol and acetaldehyde in the chamber. The test chambers with the persimmons were stored in an incubator at 38^{0}C for 6, 13 and 24 h and two additional sets at the same temperatures in air for 16 and 24 h was used as control.

The three developmental stages were placed separately in Petri dishes among the persimmons. Complete mortality of all tested stages of the MFF exposed to 95% CO_2 and 38^{o}C was achieved within less than 13 h.

Further tests would be necessary before these promising results are implemented as a possible alternative new treatment for the control of the MFF.

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