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Postharvest Control of Thrips on Harvested *Dendrobium* Orchids

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BACKGROUND

Two of the most serious pests of the Hawaii orchid industry are western flower thrips (WFT) [*Frankliniella occidentalis* (Pergande)] and melon thrips (*Thrips palmi* Karny). Both insects are quarantine pests and vectors of *Tospovirus*. Orchids shipped to the mainland United States from Hawaii are rejected if melon thrips and/or western flower thrips are detected. Current methods of post-harvest disinfestation for floral commodities consist mainly of aerosol/fog products, controlled atmosphere treatments, chemical fumigation, insecticidal dips, irradiation and low or high temperature treatments. Each of these treatments has advantages and disadvantages. Many result in decreased vase or market life of the commodity. Our objective was to determine the response of WFT and *Dendrobium* orchids to a series of treatments using combinations of controlled atmosphere (CA), warm air,

and chemical fumigants designated as GRAS (generally recognized as safe).

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MATERIALS AND METHODS

Dendrobium orchid (Jaquelyn Thomas 'Uniwai princess') inflorescences were obtained from the Beaumont Agricultural Research Center at the University of Hawaii.

For all treatments, inflorescences were placed in plastic sleeves (4-5 per sleeve) and held in 5.6 Gallon PVC tubes (1 sleeve per tube) that had been modified for use as airtight treatment chambers. Inlet and outlet ports in each tube allowed warm air, chemical fumigants, CA or a combination thereof to be introduced and/or sampled. After the treatment, orchids were held at a constant temperature of 68°F, 60% RH and 8 hour photoperiod. Orchids remained under these conditions during evaluation.

For chemical fumigation, precooled 35°F (2°C) liquid ethyl formate (EF), methyl formate (MF), or acetaldehyde (Aa) was injected through a rubber septum on a small inlet port into the treatment chamber and onto filter paper. Acetaldehyde was applied at a rate of 0.5, 1.0 or 1.5%, EF at 0.7 or 1.4%, and MF at 1.0 or 2.0%, with an exposure time of 1 hour at 75°F (24°C) for all chemicals.

For exposure to warm air or controlled atmospheres and warm air, treatment chambers were placed in a room heated to 95°F (35°C). A flow through system was used to deliver humidified (90 to 95% RH) air, 55% CO_2, or 1.5% O_2 to the treatment chambers. During treatment, CA mixtures were monitored using rapid gas analyzers. Some treatments consisted of a pretreatment with Aa, followed by a treatment of 1.5% O_2 or air at 95°F (35°C). For these treatments, inflorescences were removed from treatment chambers after Aa fumigation and held at 68°F (20°C) in ambient air for 1 h before being exposed to any follow up treatments.

Phytotoxicity was evaluated based on a numerical scale of 1 (no injury) to 9 (severe injury). The marketable life was terminated when the average rating of inflorescences for a given treatment reached scale 3 (10% of flowers wilted, discolored, or damaged). Vase life was terminated when the average rating reached scale 6 (50% of flowers wilted, discolored or dam-aged). Common types of damage seen were burned pollinia; water soaking, i.e., browning or discoloration of petals; petal wilt or curl; and pitting of petals (small brown areas).

Western flower thrips were reared on fresh green beans at a constant temperature of 75°F (24°C) and 12 hour photoperiod. A section of orchid stem containing 5-6 flowers was placed in a silkscreen bag (1 per treatment per replication) and artificially infested with 250-450 second instar WFT. Bags were then sealed and placed in treatment chambers (PVC tubes) and exposed to treatments described above. After treatment, bags containing orchids and thrips were held at 68°F (20°C) for 48 h, at which time thrips were assessed for mortality.

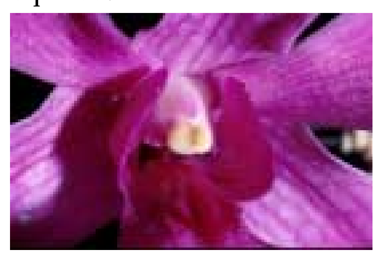
Results/Conclusions

Exposure to EF or MF significantly reduced market and vase life at both concentrations tested (data not shown). Although insect mortality was high with both EF and MF, the loss of market and vase life due to burned pollen caps eliminated these chemicals from being effective disinfestation treatments.

Although exposure to air at 95°F (35°C) increased WFT mortality over that of air at 70°F (21°C), mortality was still relatively low, even at the longest exposure times. Exposure to 55% CO_2 at 95°F (35°C) required 12 hours for complete WFT mortality; however, orchids exhibited a drastic loss in vase and market life when exposed to this gas mixture, even at the shortest exposure time (8 h). Orchids were tolerant of exposure to 1.5% O_2 at 35°C, with little market or vase life reduction with exposures up to 48 h. However, complete WFT mortality did not occur until 60 h of exposure to this treatment.

Impact to the Industry

Effective, non-damaging treatments for postharvest insect control in floricultural and ornamental plant materials are essential to allow for interstate and international marketing. The impending loss of methyl bromide in 2005 for all uses other than quarantine treatments has increased interest in developing alternatives. In addition, the potential for further regulation makes the future of methyl bromide for quarantine uses uncertain. A physical treatment, such as a heat treatment or controlled atmosphere treatment would be desirable due to the potential longevity as a treatment and safety for workers and the environment. GRAS fumigants, such as Aa, have shown potential for insect control and would be a safer alternative to methyl bromide fumigation. A single cultural method for complete insect control on many floral commodities does not appear feasible and combined treatments will likely be required.



At present, the industry is in need of a safe, effective treatment that does not detrimentally affect the quality of *Dendrobium* orchids. Our results may be beneficial in the development of insect control treatments for additional floral products. Our preliminary studies indicate that further research is needed to develop a treatment that provides quarantine level security with little impact on the product.