FORCED HOT AIR FOR CONTROL OF ARTHROPODS IN HARVESTED CHRYSANTHEMUM CUTTINGS

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Introduction

Effective, non-damaging treatments for postharvest insect control in floricultural and ornamental plant materials are essential to allow for interstate and international marketing. Methyl bromide fumigation provides such a treatment for some commodities, but causes phytotoxicity to others. The impending loss of methyl bromide in 2005 for all uses other than quarantine treatments has generated increased interest in developing alternatives. Heat treatments, both vapor heat and hot water, have been developed and are used commercially for disinfesting various tropical and subtropical fruits. However, these treatments have not been fully explored for floricultural and ornamental commodities. A physical treatment, such as a heat treatment, would be desirable due to its potential longevity as a treatment and safety for workers and the environment.

The objective of this research is to develop an alternative disinfestation treatment for harvested chrysanthemum cuttings. The key pests of field grown chrysanthemums are melon aphid (*Aphis gossypii* Glover), silverleaf whitefly (*Bemisia argentifolii*), and the agromyzid leafminer, *Liriomyza trifolii* (Burgess). In addition, two-spotted spider mites (*Tetranychus urticae* Koch) and western flower thrips [*Frankliniella occidentalis* (Pergande)] can be incidental pests. We are currently testing various temperatures and exposure times in an effort to develop a heat treatment which can control all lifestages of these pests.

Materials and methods

- Chrysanthemum tip cuttings and target pests were exposed to forced hot air in a self-contained, computer-controlled atmosphere and temperature treatment system (CATTS)
- Temperatures tested ranged from 118ºF (48ºC) to 126ºF (52ºC) with exposure times from 20 to 120 minutes
- Mean percent mortality was determined for target pests, and tip cuttings were evaluated for visible phytotoxicity

Results and discussion

- Melon aphids and western flower thrips were completely controlled at temperatures and exposure times well within the tolerance of mum cuttings (Tables 1, 2, and 3).
- Two-spotted spider mites are more resistant to the treatments, with mortality well below that of the other pests tested (data not shown).
- Preliminary data indicates that adult whiteflies and leafminers can be controlled by forced hot air, however, the immature stages could be more resistant to the treatments. Preliminary tests with leafminer larvae indicate that significant mortality can be achieved with 122ºF (50ºC) or 126ºF (52ºC) at 80 and 40 minutes, respectively. However, temperatures and exposures necessary for complete control may exceed mum tolerance (data not shown).
- Further work is needed to explore the effects of temperature and exposure time on the various lifestages of these target pests. Controlled atmospheres may also be explored in combination with the heat treatment.

Table 1. Mortality for melon aphids exposed to 48, 50, and 52°C. For treatment, infested cuttings were placed along with mum cuttings, inside ventilated plastic shipping bags.

Exposure Time (minutes)	Temperature					
	48ºC (118ºF)		50ºC (122ºF)		52ºC (126ºF)	
	% mortality (SD)	N	% mortality (SD)	N	% mortality (SD)	N
20	62 (7.2)	684	98 (1.7)	483	61 (3.4)	1033
40	72 (18.5)	450	100 (0.0)	274	100 (0.0)	655
80	99 (0.6)	325	100 (0.0)	485	-	-
100	100 (0.0)	582	-	-	-	-
120	100 (0.0)	578	-	-	-	-
Control mortality	56 (2.9)	1741				

Table 2. Mortality for western flower thrips exposed to 48, 50, and 52°C. For treatment, thrips were placed in small plastic cups along with mum cuttings inside ventilated plastic shipping bags.

Exposure Time (minutes)	Temperature					
	48ºC (118ºF)		50ºC (122ºF)		52ºC (126ºF)	
	% mortality (SD)	N	% mortality (SD)	N	% mortality (SD)	N
20	21 (2.4)	633	14 (0.2)	522	19 (0.9)	646
40	21 (0.6)	443	100 (0.1)	431	100 (0.0)	472
80	100 (0.)	497	100 (0.0)	471	-	-
100	100 (0.0)	449	-	-	-	-
120	100 (0.0)	370	-	-	-	-
Control mortality	8 (2.0)	1149				

Table 3. Damage (SD) to chrysanthemum cuttings exposed to forced hot air. Cuttings were packed in ventilated plastic shipping bags and exposed to 48, 50, and 52°C. Damage was rated as 1 (no damage), 2 (slight damage), 3 (moderate damage), and 4 (severe damage).

Exposure Time (minutes)	Temperature		
	48ºC (118ºF)	50ºC (122ºF)	52ºC (126ºF)
untreated	1.0 (0.0)	1.0 (0.0)	1.1 (0.3)
20	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
40	1.0 (0.0)	1.0 (0.0)	1.0 (0.2)
80	1.0 (0.0)	1.0 (0.0)	3.2 (0.8)
100	1.0 (0.0)	1.0 (0.0)	4.0 (0.0)
120	1.0 (0.0)	1.3 (0.5)	4.0 (0.0)