2005 Evaluation of Phytotoxicity to Herbaceous Ornamental Plants with Applications of Mogeton 25WP (quinoclamine)

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Methods: The trial was established in cooperation with Nevin Smith at SunCrest Nursery in Watsonville, California. Thirty six 1-gallon container plants of each test species were arranged into three blocks each containing three plants treated with four concentrations of Mogeton (Table 1).

Table 1. List of ornamental used in the evaluation

No.	Latin Name	Cultivar	Growing Conditions
1	*Helleborus orientalis*		Shade house
2	*Iris douglasiana*		Shade house
3	*Liriope muscari*	Big blue	Shade house
4	*Athyrium nipponicum Var. pictum*		Shade house
5	*Echinacea purpurea*	White swan	Field Grown
6	*Heuchera sangunea*	Firefly	Field Grown
7	*Coreopsis auriculata*	Nana	Field Grown
8	*Aster chilensis*		Field Grown
9	*Miscanthus sinensis*	Grazillimus	Field Grown
10	*Lavender angustifulia*		Field Grown
11	*Achillea millefolium*	Yarrow	Field Grown
12	*Agastache mexicana*		Field Grown
13	*Aquilegia sp.*	Blue star	Field Grown

Plants were arranged in a 10 foot by 10 foot area (100 ft^2) and sprayed. Treatments were applied with a CO_2 backpack sprayer using a one nozzle wand with an 8008E tip at 30 psi (Table 2). All treatments were applied in 1892 mls (2 quarts) applying the equivalent of 218 gallons of water per acre as per the IR4 Ornamental Protocol #05-004. No adjuvant was applied with the treatments. Treatments were applied on June 1 and 29. The applications were made in the morning and no overhead irrigation water was applied until the following morning.

Table 2. Mogeton Treatments (applied at the rate of 2 quarts/100 $ft^{2)}$
1) untreated control
2) 2 oz/gallon;
3) 4 oz/gallon
4) 8 oz/gallon

Following treatment the plants were moved to a common area (either in the open nursery or under a shade structure – see table 1) and randomized. Evaluations for phytotoxicity were made on June 10, June 17, June 29, July 28 and August 26 which was 1, 2, 4, 8 and 12 weeks following the initial application, respectively (Table 3). Ratings included phytotoxicity ratings on a scale of 0 to 10 (0 = no phytotoxicity to 10 = crop completely killed). Comments were also made on the type of phytotoxicity observed (Table 4) and photographs were taken of phytotoxicity. Liverworts infested the Helleborus pots and

were rated for weed control on a scale of 0 to 10 (0 = no control to 10 complete liverwort control) (Table 5).

Results: The phytotoxicity ratings of the test species broke into three categories: 1) species with no damage; 2) species with slight damage; and 3) species damaged by quinoclamine (Table 3). The species with no damage from quinoclamine treatments included: *Echinacea purpurea, Heuchera sanguinea, Coreopsis auriculata, Lavendula angustifolia,* and *Achillea millefolium*. We did not detect phytotoxicity symptoms on these species on any evaluation date and at any of the rates tested. Species with slight damage included: *Helleborus orientalis, Iris douglasiana, Aster chilensis, Agastache mexicana. H. orientalis* and *I. douglasiana* exhibited slight damage on the third evaluation date. *A. mexicana* exhibited some weakened stems on the fifth evaluation date, but it probably was not associated with the treatment. Species damaged by quinoclamine included: *Liriope muscari, Athyrium nipponicum, Miscanthus sinensis* and *Aguilegia sp. L. muscari* and *M. sinensis* both had burns that occurred at the base of the leaves in the region of the intercalary meristem. The burned tissue moved higher up on the plant as the leaves expanded. The damage was obvious at first, but less so as time passed as new leaves emerged making it more difficult to find the scarred tissue. *M. sinensis* was only affected at the higher rates. *Aguilegia sp.* developed chlorotic to necrotic symptoms along the margins of the leaves following application of quinoclamine. These symptoms also tended to diminish over time due to dilution of the affected tissue. *A. nipponicum* was the most severely affected of the species tested. There was initial confusion whether some of the damage was caused by transplant shock. The later evaluations clearly indicate that *A. nipponicum* was adversely affected by applications of quinoclamine. Table 4 includes the comments from our data sheets on the observations that we made regarding the damage observed while conducting the phytotoxicity ratings. Table 5 contains the liverwort control data from the pots of *Helleborus orientalis*. The data indicates excellent control of liverworts by all rate of quinoclamine.

Table 3. Phytotoxicity rating of the test species on five evaluation dates

Plant Species	Evaluation Date	Rate Treatment (oz.) 0	2	4	8	LSD (0.05)
Helleborus orientalis	June 10	0.0	0.0	0.0	0.0	N/A[1]
	June 17	0.0	0.0	0.0	0.3	NS[2]
	June 29	0.3	1.3	1.3	2.3	NS
	July 28	Not rated due to severe die back				
	August 26	No rating; plants removed by grower				
Iris douglasiana	June 10	0.0	0.0	0.0	0.0	N/A
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	1.7	3.0	3.0	NS
	July 28	Not rated; leaf spot present				
	August 26	Not rated; plants removed by grower				
Liriope muscari 'Big Blue'	June 10	0.0	4.0	4.7	6.0	1.0
	June 17	0.0	3.3	5.3	6.0	0.9
	June 29	0.3	1.0	0.7	4.3	1.1
	July 28	0.3	1.0	0.7	4.3	1.1
	August 26	Not rated; plants removed by grower				
Athyrium nipponicum var. *pictum*	June 10	Not rated due to transplant shock				
	June 17	1.3	4.7	4.3	3.7	NS
	June 29	0.3	3.3	3.0	4.7	NS
	July 28	1.0	6.0	4.0	5.7	2.3
	August 26	Not rated; plants removed by grower				
Echinacea purpurea 'White Swan'	June 10	0.0	0.0	0.0	0.0	N/A
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	0.0	0.0	0.0	0.0	N/A
Heuchera sanguinea 'Firefly'	June 10	0.0	0.0	0.0	0.0	N/A
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	0.0	0.0	0.0	0.0	N/A
Coreopsis auriculata 'Nana'	June 10	0.0	0.0	0.3	0.7	NS
	June 17	0.0	0.0	0.0	1.0	NS
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	0.0	0.0	0.0	0.0	N/A

Table 3 continued. Phytotoxicity rating of the test species on five evaluation dates

Plant Species	Evaluation Date	Rate Treatment (oz.) 0	2	4	8	LSD (0.05)
Aster chilensis	June 10	0.3	0.7	0.3	1.3	NS
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	0.0	0.0	0.0	0.0	N/A
Miscanthus sinensis 'Grazillimus'	June 10	0.3	0.0	1.7	3.3	1.5
	June 17	0.0	0.0	1.7	3.3	1.6
	June 29	0.0	0.0	2.0	2.3	1.0
	July 28	0.0	0.3	1.0	2.0	1.0
	August 26	0.0	0.0	1.0	1.7	1.1
Lavandula angustifolia	June 10	0.0	0.0	0.0	0.0	N/A
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	0.0	0.0	0.0	0.0	N/A
Achillea millefolium	June 10	0.0	0.0	0.0	0.0	N/A
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	0.0	0.0	0.0	0.0	N/A
Agastache mexicana	June 10	0.0	0.0	0.3	0.3	NS
	June 17	0.0	0.0	0.0	0.0	N/A
	June 29	0.0	0.0	0.0	0.0	N/A
	July 28	0.0	0.0	0.0	0.0	N/A
	August 26	1.7	1.7	1.7	2.3	NS
Aguilegia 'Blue Star'	June 10	0.1	1.1	1.1	1.5	0.1
	June 17	0.0	3.7	3.7	5.0	0.9
	June 29	0.0	1.0	1.3	2.0	1.0
	July 28	1.0	2.3	2.7	4.0	1.5
	August 26	0.0	0.0	0.0	0.0	N/A

1 – Not able to subject data to statistical analysis because of too many zeros. But the trend clearly suggests no damage.
2 – Not statistically significant.

Table 4. Comments of the phytotoxity observed over the course of the trial

Latin Name	Cultivar	Comments
Helleborus orientalis		Blackened tips on third evaluation date, unsure if due to treatment
Iris douglasiana		Burned leaf tip on 3rd evaluation date at 8 oz rate. Not sure if caused by spray
Liriope muscari	Big blue	Chlorosis and necrosis at base of leaves. The chlorosis and necrosis moved from base as plant elongated. Followed dose response.
Athyrium nipponicum Var. *pictum*		Confusion on this species as to whether observed necrosis was due to transplant shock or treatments.
Echinacea purpurea	White swan	Chlorosis at 3rd evaluation date at 8 oz rate.
Heuchera sangunea	Firefly	Chlorosis and spotting at 3rd evaluation date, but probably not associated with treatments
Coreopsis auriculata	Nana	Some interveinal chlorosis observed on all treatments
Aster chilensis		Purpling on leaves on 3rd evaluation date at 8 oz rate, but not consistent
Miscanthus sinensis	Grazillimus	Necrosis observed at 1st evaluation date at the base of leaves. This necrosis moved up due to elongation of the leaves.
Lavender angustifulia		No comments.
Achillea millefolium	Yarrow	No comments.
Agastache mexicana		Weakened stems observed on 5th evaluation date
Aquilegia sp.	Blue star	Chlorosis observed at the edges of the leaves on the 1st evaluation date. Chlorosis was being hidden by new growth on the 3rd evaluation date. Bacterial disease obscured chlorosis.

Table 5. Liverwort control ratings[1] in Helleborus.

Sampling Date	Rate Treatment (oz.)				LSD (0.05)
	0	2	4	8	
10-Jun-05	1.0	7.7	9.0	9.0	0.6
17-Jun-05	1.0	8.0	10.0	10.0	N/A[2]
29-Jun-05	0.0	7.0	9.7	10.0	1.0
28-Jul-05	1.7	10.0	10.0	10.0	1.5
26-Aug-05	Not rated; plants removed by grower				

1 – (0 = no control, 10 = complete kill); 2 – not able to subject to statistical analysis due to no variation among the replicates, but the magnitude of difference among the means indicate clear differences.