ZINNIA (*Zinnia elegans* 'Magellan Orange')
Powdery mildew; *Golovinomyces cichoracearum*

B.R. Harlan, M.C. Buitrago
and M.K. Hausbeck,
Department of Plant, Soil
and Microbial Sciences
Michigan State University
East Lansing, MI 48824

Evaluation of a biocontrol, biorational products and experimental fungicides for the control of powdery mildew of zinnia in the greenhouse, 2021.

Zinnias ('Magellan Orange') were seeded in 128-cell flats on 22 Jul. The zinnia seedlings were transplanted into 6-in pots containing a soilless media (Suremix MI Grower Products Inc, Galesburg MI) on 21 Aug. Plants were maintained in a research greenhouse and fertilized three times weekly with 200 ppm Peters 20-20-20 water-soluble fertilizer (ICL Fertilizers, Columbia, MO). Greenhouse temperatures averaged 76.5°F during the experiment with a high of 101.9°F and a low of 63.3°F. Five replicates per treatment were arranged in a complete randomized design. Treatments were applied to the plants with a hand-pressurized sprayer until the foliage was visibly wet, on the dates for each treatment listed in the table below. Powdery mildew was not present on any of the plants at the initiation of the treatments. Zinnia plants with actively sporulating *Golovinomyces cichoracearum* were placed between the replicated blocks on 21 Sep. The total number of powdery mildew colonies present on each plant were counted on the 12, 21, and 28 Oct. Data were analyzed in R (v. 4.1.2) using Kruskal Wallis test and statistical differences were obtained using Pairwise Wilcoxon Rank Sum Tests (P=0.05, p adjust method "BH").

Disease pressure was severe in this trial with the untreated control plants averaging 74.8 powdery mildew colonies on the final rating date (28 Oct). All treatments, with the exception of TDA-NC-1, MBI-121 (96 fl oz) and EcoSwing, significantly reduced powdery mildew colonies compared to the untreated control by the final rating date. Although not statistically significant, it should be noted that the higher rate of MBI-121 (128 fl oz) resulted in just 21% of the powdery mildew colonies compared with plants treated with the lower rate (96 fl oz). SP2700 was highly efficacious; the lower application rate (11 oz) significantly reduced colonies of powdery mildew compared to the untreated control at all rating dates and at a higher rate (22 oz) resulted in powdery mildew free plants 17 days after the final application. Both the high and low rates of experimental product SP2478 and non-registered Gatten were highly effective and limited powdery mildew colonies to <1.0 per plants were observed at all rating dates. EcoSwing showed moderate efficacy against *G. cichoracearum* in this trial, limiting the number of colonies by 41.7% compared to the untreated control, although colony counts were not statistically different from those of the untreated control. Experimental product XDE-659 was highly effective in this trial and resulted in disease free plants at all rating dates. Newly registered Broadform SC and industry standard Eagle 20EW effectively controlled powdery mildew and are often used by growers in their control programs. No obvious signs of phytotoxicity were observed on the treated plants in this study.

Treatment and rate/100 gal;	Application dates*	Avg. # of powdery mildew colonies per plant		
		12 Oct	21 Oct	28 Oct
Untreated control	-	45.4 a**	63.4 a	74.8 a
MBI-121 96 fl oz	1,4,6	4.6 b	8.0 bc	23.4 ab
MBI-121 128 fl oz	1,4,6	0.8 bc	2.0 b	4.8 bcd
SP2700 11 oz	1,3,5	0.0 c	0.2 b	6.4 bc
SP2700 22 oz	1,3,5	0.0 c	0.0 b	0.0 d
TDA-NC-1 570 g + NIS 0.125%	1,2,3,4,5	27.8 ab	61.2 ac	91.8 a
TDA-NC-1 570 g + NIS 0.125%	1,3,5	39.6 a	65.6 a	83.0 a
SP2478 1.6 fl oz	2,4,6	0.0 c	0.0 b	0.0 d
SP2478 3.1 fl oz	2,4,6	0.0 c	0.0 b	0.2 d
Gatten 6.4 fl oz	2,4,6	0.2 bc	0.4 b	0.2 d
Gatten 25.4 fl oz	2,4,6	0.0 c	0.0 b	0.0 d
EcoSwing 32 fl oz	1,4,6	12.6 ab	27.8 abc	43.6 ab
Eagle 20EW	2,6	0.0 c	0.0 b	0.0 d
XDE-659 20.6 fl oz	2,4,6	0.0 c	0.0 b	0.0 d
Broadform SC 4 fl oz	2,6	0.8 c	0.8 b	0.8 cd

*Application dates are coded as follow 1=17 Sep, 2=20 Sep, 3=24 Sep, 4=27 Sep, 5=30 Sep, 6=4 Oct.
**Column means with a letter in common are not significantly different using Pairwise Wilcoxon Rank Sum Tests; $P \leq 0.05$.