Systemic Activity of Iprodione in *Poa annua* and Postinfection Activity for *Drechslera sorokiniana* Leaf Spot Management

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ABSTRACT

Danneberger, T. K., and Vargas, J. M., Jr. 1982. Systemic activity of iprodione in *Poa annua* and postinfection activity for *Drechslera sorokiniana* leaf spot management. Plant Disease 66:914-915.

Iprodione is an effective fungicide for the control of Drechslera leaf spot of *Poa annua*. *Drechslera sorokiniana* conidia germinated in vitro in the presence of iprodione, but they proceeded to swell and burst. Iprodione was translocated basipetally and acropetally in *P. annua* but moved more efficiently basipetally. Iprodione controlled Drechslera leaf spot for 16 days and had eradicant action when applied within 48 hr of initial infection.

Drechslera leaf spot of *Poa annua* L. caused by *Drechslera sorokiniana* (Sacc.) Subram. & Jain (teleomorph: *Cochliobolus sativus* (Ito & Kurib.) Drechs. ex Dastur) is a serious disease of *P. annua* (4,5). Fungicides play an important role in disease control strategies under current golf course management practices (4). Iprodione (Chipco 26019, Rhône-Poulenc) is a contact fungicide with residual properties that is effective against several *Drechslera* spp. (1,3). Sanders et al (3) showed that iprodione is systemic, moving both acropetally and basipetally in creeping bentgrass (*Agrostis palustris* Huds.) and Kentucky bluegrass (*P. pratensis* L.) for control of *Sclerotinia homoeocarpa* F. T. Bennett. The purpose of this study was to determine whether similar systemic activity and eradicant action of iprodione occurred against *D. sorokiniana* on *P. annua*.

MATERIALS AND METHODS

Mode of action. Conidia from cultures of *D. sorokiniana* grown on potato-dextrose agar at 22 C for 10 days were pipetted (10,000/ml) on amended potato-dextrose agar with iprodione at concentrations of 1, 2, 3, 5, 10, 25, 50, 100, 200, 500, and 1,000 μg/ml. Twenty-five random conidia were observed 6, 12, 24, and 48 hr for germination and growth.

Three-month-old *P. annua* plants, established from seed, were used to determine whether iprodione has fungitoxic activity as a systemic fungicide. Plants were grown in plots measuring 11 × 11 cm in a greenhouse mix of sand, soil, and peat (1:1:1); fertilized with Hoagland's solution, and maintained at a 2.5-cm height of cut. The *P. annua* leaf tips (upper 0.5 cm) were dipped into iprodione at concentrations of 1, 5, 10, 25, 50, 100, 200, 500, and 1,000 μg/ml for 30 sec. The plants were inverted and dried for 8 hr, after which the upper 0.5-cm leaf tips were clipped off. To determine whether iprodione was translocated acropetally, the same concentrations were drenched into the root system via a funnel with 50 ml of water. The plants were then incubated for 8 hr prior to inoculation with conidia of *D. sorokiniana*.

P. annua plants were inoculated with 5 ml of distilled water containing 300,000 conidia of *D. sorokiniana* per milliliter and placed in a continuous mist chamber for 48 hr. Following removal from the mist chamber, they were placed on a greenhouse bench at 22 C ± 1 in a completely randomized fashion. Lesions per leaf were counted from 25 randomly selected leaves per pot 10 days later. Each treatment was replicated five times, and the experiment was repeated twice. Controls were uninoculated, iprodione-treated plants and inoculated plants not treated with iprodione.

Length of fungitoxic activity. *P. annua* plants used in these experiments were the same as those previously described. The effective control of Drechslera leaf spot with iprodione was determined in two experiments. In the first, iprodione was applied to *P. annua* plants in pots measuring 11 × 11 cm at the recommended rate of 0.6 g/m^2. The plants were spray inoculated with 300,000 conidia of *D. sorokiniana* per milliliter at 0, 6, 12, 24, and 48 hr after fungicide treatment. After 48 hr of continuous misting, the plants were grown in a growth chamber set at 30 C (day) and 22 C (night) for the duration of the experiment. The plants were maintained at a height of 2.5 cm by mowing every 2 days. Plants were returned to the mist chamber every 4 days for a 48-hr period and reinoculated with 60,000 conidia per milliliter to supply a constant source of inoculum. The experiment lasted 20 days.

In the second experiment, the plants were spray inoculated with 5 ml of water containing 300,000 conidia per milliliter before iprodione was applied at the recommended rate of 0.6 g/m^2 at 6, 12, 24, 48, 60, and 72 hr after inoculation. The number of lesions was counted on 25 leaves per pot 10 days after inoculation. Sporulation was induced by placing infected leaf segments on PDA. The conidia were washed with distilled water to remove any iprodione, then placed on unsprayed *P. annua* plants to determine viability. The treatments were replicated five times and each experiment was repeated twice.

RESULTS

Conidia of *D. sorokiniana* germinated at iprodione concentrations of 2–1,000 μg/ml and grew to an average length of 30.7 μm (Table 1) after 48 hr. Germ tubes were observed to swell and burst 48 hr after incubation on agar plates containing iprodione at 2–1,000 μg/ml (Fig. 1). Each of the cells of the germ tube was observed to swell and burst. An iprodione concentration of 1 μg/ml did not have an appreciable effect on conidial germination or germ tube length. Germ tubes on the control plates averaged 200 μm in length, and bursting was not observed.

Iprodione was translocated effectively both acropetally and basipetally, although the foliar treatment was more effective in controlling Drechslera leaf spot (Table 2). Neither treatment differed from the control at 1 μg/ml. The leaf dip treatment was significantly better ($P = 0.05$) than either the control or soil drench at 5 μg/ml. No lesions were observed on plants treated by leaf dip at 100–1,000 μg/ml nor on those treated by soil drench at 1,000 μg/ml. At concentrations between 5 and 200 μg/ml, lesion development was significantly lower ($P = 0.05$) for the foliar-applied iprodione than for the corresponding root-zone treatment.

Iprodione controlled lesion development for 16 days when applied before inoculation (Fig. 2). No lesions developed

Michigan Agricultural Experiment Station Journal Article 10286.

Accepted for publication 1 February 1982.

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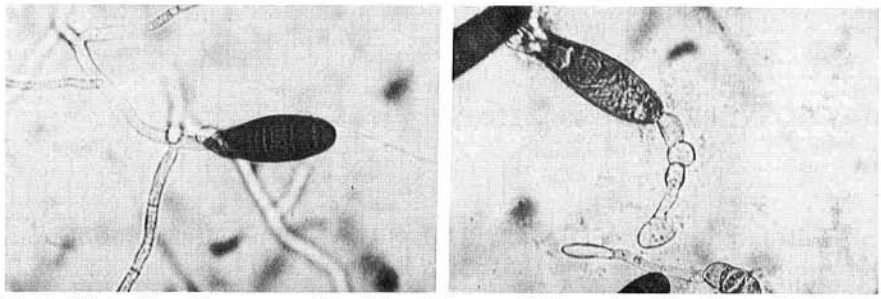

Fig. 1. Effect of iprodione on conidia of *Drechslera sorokiniana* after 48 hr. Control **(left)** with unamended potato-dextrose agar and **(right)** with agar amended with iprodione (100 μg/ml).

Table 1. Effect of various concentrations of iprodione (in amended potato-dextrose agar) on the germination of *Drechslera sorokiniana* conidia

Concentration (μg/ml)	Germ tube length (μm)			
	6 hr	12 hr	24 hr	48 hr
1	4 a[z]	40 a	135 a	200+ a
2	0 b	12 b	29 b	38 b
3	0 b	11 bc	29 b	37 b
5	0 b	6 def	15 c	28 b
10	0 b	8 cd	12 c	30 b
25	0 b	7 de	18 c	29 b
50	0 b	9 bcd	18 c	30 b
100	0 b	7 de	20 c	30 b
200	0 b	4 ef	19 c	29 b
500	0 b	4 ef	14 c	30 b
1,000	0 b	3 f	12 c	26 b
0 (control)	6 a	40 a	141 d	200+ a

[z] Numbers in a column followed by the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

when inoculation occurred immediately after iprodione application (0 hr).

No lesions developed when iprodione was applied within 24 hr of inoculation, and fewer than three lesions developed per leaf when applied within a 48-hr period (Fig. 3). Conidia that developed in lesions on leaves treated with iprodione 48 hr after inoculation were not viable. Lesions that developed on leaves treated with iprodione 60 and 72 hr after inoculation produced viable conidia.

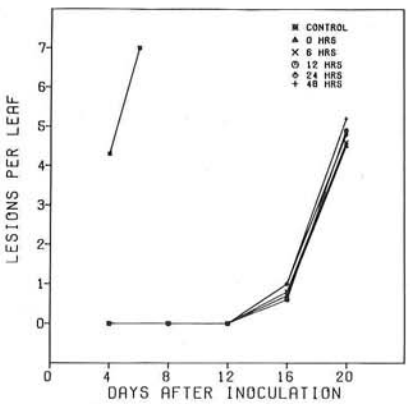

Fig. 2. Number of lesions per leaf of *Poa annua* plants inoculated with conidia of *Drechslera sorokiniana*, then treated 0, 6, 12, 24, and 48 hr later with iprodione.

DISCUSSION

Iprodione allowed the germ tube of *D. sorokiniana* conidia to germinate in culture, but the germ tube proceeded to swell and burst. Hagan and Larsen (1) reported stunted hyphal growth of *D. sorokiniana* with iprodione, but they did not mention hyphal bursting. Iprodione was translocated both acropetally and basipetally in *P. annua* and controlled Drechslera leaf spot when applied as a soil drench or foliar treatment. These results are similar to those found for *S. homoeocarpa* on creeping bentgrass (3). Basipetal movement was more effective than acropetal translocation at intermediate concentrations. This agrees with Sanders et al (3), who observed a greater control of *S. homoeocarpa* with foliar application.

Iprodione showed residual activity for up to 16 days. Control was obtained for 16 days in the presence of high inoculum levels and conditions conducive to infection. When applied immediately before inoculation, iprodione also demonstrated lethal contact properties.

Iprodione applied up to 48 hr after inoculation controlled lesion development by *D. sorokiniana* in *P. annua*. This method of control has been previously described for the ergosterol fungicides (2) and is sometimes referred to as "kickback" action. The ability of iprodione to prevent lesion development up to 2 days after the initiation of the infection process should allow iprodione to be used effectively with predictive models of disease development.

Table 2. Comparison of dip vs. drench methods on systemic activity of iprodione in 3-mo-old plants of *Poa annua* at differing concentrations for the control of *Drechslera sorokiniana*

Concentration (μg/ml)	Lesions/leaf 10 days after initial inoculation	
	Dip[x]	Drench[y]
1,000	0.0 a[z]	0.0 a
500	0.0 a	0.7 ab
200	0.0 a	1.5 c
100	0.0 a	2.7 d
50	0.5 ab	2.9 d
25	1.1 bc	5.7 e
10	2.8 d	5.6 e
5	5.5 e	7.3 f
1	7.0 f	7.3 f
0 (control)	7.5 f	7.5 f

[x] Application of iprodione by submerging leaf tips for 30 sec and allowing them to dry for 8 hr before inoculation.

[y] Application of iprodione to root zone 8 hr before inoculation.

[z] Numbers in a column followed by the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

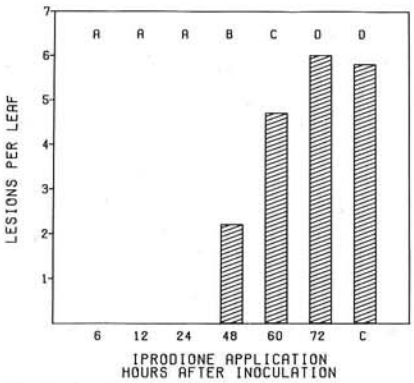

Fig. 3. Number of lesions per leaf of *Poa annua* plants treated with iprodione at different times after an initial inoculation with conidia of *Drechslera sorokiniana*. Bars with the same letters (at top of figure) are not significantly different according to Duncan's multiple range test ($P = 0.05$).

ACKNOWLEDGMENTS

We thank the Michigan Turfgrass Foundation and the Michigan State Agricultural Experiment Station for financial support.

LITERATURE CITED

1. Hagan, A., and Larsen, P. O. 1979. Effect of fungicides on conidium germination, germ tube elongation, and appressorium formation by *Bipolaris sorokiniana* on Kentucky bluegrass. Plant Dis. Rep. 63:474-478.
2. Kelley, R. D., and Jones, A. L. 1981. Evaluation of two triazole fungicides for post-infection control of apple scab. Phytopathology 71:737-742.
3. Sanders, P. L., Burpee, L. L., Cole, H., Jr., and Duich, J. M. 1978. Control of fungal pathogens of turfgrass with the experimental iprodione fungicide, RP26019. Plant Dis. Rep. 62:549-553.
4. Vargas, J. M., Jr. 1981. Management of Turfgrass Diseases. Burgess Publishing Co., Minneapolis. p. 204.
5. Weiling, J. L., Jensen, S. G., and Hamilton, R. I. 1957. *Helminthosporium sativum*, a destructive pathogen of bluegrass. Phytopathology 47:744-746.