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**Impact of Fungicide Inputs on the Severity of Entomosporium Leaf Spot
on Selected Cultivars of Indian Hawthorn**

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Introduction

Indian hawthorn (*Rhaphiolepis umbellata* (Thunb.), an evergreen shrub with lustrous dark-green foliage, mounded canopy, and typically a compact growth habit, is well adapted for use in mass, hedge, and foundation plantings in commercial and residential landscapes from the Birmingham area to the Gulf Coast of Alabama (2). While the majority of Indian hawthorn cultivars are dwarf-type plants, a few selections are large shrubs with an open canopy and upright growth habit.

Entomosporium leaf spot, which is caused by the fungus *Entomosporium mespili*, is the most widespread and damaging disease found in the nursery and landscape on Indian hawthorn (4). Container-grown Indian hawthorn that suffer heavy leaf spot damage are unsalable and must be discarded. Unlike photinia, loquat, and other hosts of *E. mespili*, disease development on Indian hawthorn typically begins in late fall and continues through late spring until all but the youngest leaves at the shoot tips are shed. During this time frame, disease spread is rapid, particularly during extended periods of wet, overcast weather. Little if any spread of Entomosporium leaf spot occurs during the summer and early fall.

In a production nursery, blocks of container-grown Indian hawthorn are highly vulnerable to Entomosporium leaf spot. Two of the major components of a leaf spot control program are the production of resistant cultivars and/or the use of protective fungicides. In a 1980 Georgia trial, Corley (1) noted that several cultivars had high levels of disease resistance, while several others suffered from heavy leaf spot-related defoliation and spotting of the leaves. Recent field studies in Alabama (4), Louisiana (5), and Georgia (6) have shown that Olivia™ and several other recent Indian hawthorn releases have good resistance to this disease. As a result, production has shifted, particularly in the Southeast, from Entomosporium leaf spot-susceptible cultivars to those possessing a high degree of resistance to this disease.

While fungicides have been recommended for the control of *Entomosporium* leaf spot on Indian hawthorn, little specific information is available concerning their value in a disease control program. On the leaf spot susceptible cultivar Becky Lynn®, Daconil Ultrex, when applied at 2-week intervals gave, complete protection from this disease (3). However, the response of other leaf spot resistant and susceptible cultivars of Indian hawthorn to fungicide inputs in a nursery or landscape setting is unknown.

The objective of this multi-year field study was to determine the susceptibility of selected cultivars of Indian hawthorn to *Entomosporium* leaf spot and to assess the impact of fungicide inputs on the level of disease-related damage on each of those cultivars.

Materials and Methods

Prior to planting, soil fertility and pH of a Benndale (A) fine sandy loam soil were adjusted according to the results of a soil fertility assay conducted at the Auburn Soil Testing Laboratory. In March 1994, selected cultivars of dwarf Indian hawthorn were established on 5 foot centers spaced in rows 6 foot apart on the Brewton Experiment Field in Brewton, AL (USDA Plant Hardiness Zone 8a). In March 1995 and March 1996, 'Snow White' and Bay Breeze, respectively, were planted. A drip irrigation system was installed immediately after planting, and the plants were watered as needed. Beds were mulched periodically with 1 to 2 in of aged pine bark. Twice each spring, approximately 3 ounces of 16N-4P₂O₅-K₂O fertilizer was uniformly distributed around each plant. Directed applications of 1 lb/A of Gallery™ DF and 2 qt/A of Surflan T/O™ were made early each spring to control annual weeds. Hand weeding and spot applications of recommended rates of the herbicides Roundup™ or 912 Herbicide 6S (monosodium acid methanearsonate [MSMA]) were used to control escape weeds and encroaching centipede grass. The centipede grass alleys between the rows were mowed periodically.

This study consisted of a split plot consisting of 6 replications with dwarf Indian hawthorn cultivars as the main plot and fungicide treatment as the split-plot. Daconil 2787 4F (chlorothalonil) was applied at a rate of 2 pt/100 gal of spray volume at 2- and 4-week intervals to randomly selected plants in each plot. One untreated plant in each plot was included as the negative control. Applications were made to run-off with a CO₂-pressurized backpack sprayer from February 21 to June 4, 1997; January 21 until May 5, 1998; and from January 6 until May 17, 1999.

Before fungicide applications began in 1997, *Entomosporium* leaf spot was well established on the susceptible cultivars of Indian hawthorn. Visual ratings of *Entomosporium* leaf spot were made on 13 cultivars of Indian hawthorn on a scale of 1 to 5 where 1 = no disease, 2 = 1 to 25%, 3 = 26 to 50%, 4 = 51 to 75%, and 5 = 76 to 100% of leaves diseased or prematurely shed. In 1997, disease ratings were logged on March 6, April 20, May 19, June 29, and September 8. The following year, severity ratings for *Entomosporium* leaf spot were recorded on January 16, February 27, April 8, June 13, August 5, October 16, and December 3, 1998. For the 1999-growing season, disease ratings were taken on March 10, April 16, May 27, July 12, September 10, and November 17. The average disease rating for each year was calculated by totaling the *Entomosporium* leaf spot ratings recorded for each sub-plot and then dividing by the total number of disease observations made in that year. Significance of fungicide treatment effects was tested by analysis of variance, and means for each treatment on cultivars of Indian hawthorn were

compared with Fisher's protected least significance difference (LSD) test with a level of significance at $P = 0.05$.

Results

In 1997, the least season-long Entomosporium leaf spot-related damage on the unsprayed control plants was noted on Olivia™ and Eleanor Tabor™ (Table 1). On both of these cultivars, symptoms were limited to light spotting of the leaves. Other dwarf Indian hawthorn cultivars that also suffered relatively light leaf spotting and defoliation included Indian Princess®, 'Snow White' and 'Clara'. In contrast, considerable defoliation and heavy spotting of the remaining leaves was observed on 'Heather,' Springtime®, Enchantress®, 'Harbinger of Spring,' 'Pinkie,' Spring Rapture®, Bay Breeze®, and White Enchantress®.

On 10 of the 13 dwarf Indian hawthorn cultivars listed, the severity of Entomosporium leaf spot was significantly lower on plants treated with Daconil 2787 at 2 and 4 week intervals than on the unsprayed plants (Table 1). In contrast, disease severity on the unsprayed Olivia™, Eleanor Tabor™, and Indian Princess® Indian hawthorn, which suffered light spotting of the leaves and premature leaf loss, were similar to the ratings recorded for those plants sprayed with Daconil 2787 at 2 and 4-week intervals. As expected, Daconil 2787 often gave better protection from Entomosporium leaf spot when applied at 2 week than at 4-week intervals. When treated at 2-week intervals, disease ratings were significantly lower on Spring Rapture®, Springtime®, 'Pinkie,' Bay Breeze® and 'Heather' but not on White Enchantress®, Enchantress®, 'Snow White,' 'Clara,' and 'Harbinger of Spring.' As indicated by disease ratings of 2.9 or above, the above cultivars treated at 2-week intervals still suffered from moderate leaf spotting and some defoliation. Leaf spotting and defoliation levels observed on Spring Rapture®, White Enchantress®, Enchantress®, Bay Breeze®, and 'Heather' treated monthly with Daconil 2787 were similar to those logged for the untreated controls.

During the 1998-growing season, the intensity of Entomosporium leaf spot, particularly on the susceptible cultivars, was lower than in the previous year (Table 1). As observed in the previous year, light leaf spotting and minimal leaf shed was seen on the cultivars Olivia™, Eleanor Tabor™, Indian Princess®, 'Snow White,' and 'Clara.' In contrast, moderate to heavy spotting of the leaves along with noticeable defoliation was noted on the remaining 8 cultivars of Indian hawthorn.

In 1998, the severity of Entomosporium leaf spot on all 13 Indian hawthorn cultivars treated with Daconil 2787 at 2-week intervals was significantly lower when compared to levels on the untreated controls (Table 1). In addition, leaf spot severity was lower on most of the cultivars treated with Daconil 2787 at 2 week than at 4 week intervals. With the exception of White Enchantress®, 'Pinkie,' Olivia™, and Indian Princess®, Entomosporium leaf spot severity was lower on cultivars treated with Daconil 2787 every 4 weeks than on the unsprayed controls.

For the 1999 growing season, light to moderate leaf spotting, as well as some premature leaf loss, was noted on untreated Olivia™, Eleanor Tabor™, 'Snow White,' 'Clara,' and Indian Princess® (Table 1). Extensive leaf spotting and premature leaf shed was observed on the unsprayed Spring Rapture®, Springtime®, White Enchantress®, Enchantress®, Bay Breeze®, 'Harbinger of Spring,' 'Heather,' and 'Pinkie.'

As noted in the previous two years, Daconil 2787, when applied at 2 and often 4-week intervals significantly reduced the severity of Entomosporium leaf spot on Indian hawthorn (Table 1). On Spring Rapture®, 'Heather,' Olivia™, and Indian Princess®, however, similar severity ratings were, observed on plants sprayed with Daconil 2787 at 4-week intervals and those left unsprayed. The disease ratings for Spring Rapture®, White Enchantress®, 'Snow White,' Enchantress®, 'Heather,' 'Harbinger of Spring,' 'Pinkie,' Bay Breeze®, and Indian Princess® Indian hawthorn that were treated with Daconil 2787 at 2-weeks were significantly lower than those recorded on the same cultivars receiving monthly sprays of the same fungicide.

Summary

Substantial differences in the sensitivity of cultivars of Indian hawthorn to Entomosporium leaf spot have been reported in field studies conducted in Alabama (4), Georgia (1,6) and Louisiana (5). As noted in Alabama (4), Corely (1) observed in 1980 that 'Snow White' suffered less damage than the susceptible cultivars Springtime® and Enchantress®. In a recent field study in Georgia, Ruter (6) noted that disease severity was higher on 'Snow White' and 'Clara' Indian hawthorn than had been logged. The recently released cultivars Olivia™ and Eleanor Tabor™ have consistently demonstrated a high level of resistance to Entomosporium leaf spot (4,5,6).

In all three years, significant reductions in symptom severity were observed on the fungicide-treated Indian Princess®, 'Clara,' 'Snow White,' Olivia™, and Eleanor Tabor™ compared to the untreated controls. With few exceptions, disease severity was lower on the plants treated at 2 than at 4 week intervals. However, the need of bimonthly or monthly applications of Daconil 2787 to protect the above cultivars from Entomosporium leaf spot, particularly in landscape plantings, was limited. Symptoms on the unsprayed plants of Indian Princess®, 'Clara,' 'Snow White,' Olivia™, and Eleanor Tabor™ were often limited to light, unobtrusive spotting of the leaves in the lower canopy with little or, in some cases, no defoliation. Reductions in disease severity obtained with the fungicide treatments were often restricted to a reduction in the number of symptomatic leaves in the lower canopy. Such reductions would, however, often be hard for someone without a trained eye to detect, particularly in a well-managed landscape.

In contrast to the above cultivars, routine bimonthly or monthly applications of Daconil 2787 applied over a five month period were needed to protect Spring Rapture®, White Enchantress®, 'Snow White,' Enchantress®, 'Heather,' 'Harbinger of Spring,' 'Pinkie,' and Bay Breeze® Indian hawthorn from Entomosporium leaf spot. On the above cultivars, bimonthly fungicide applications usually provided better disease control than did the monthly treatment regime. When left unprotected, extensive leaf spotting and heavy defoliation was consistently seen in all three years on Spring Rapture®, White Enchantress®, 'Snow White,' Enchantress®, 'Heather,' 'Harbinger of Spring®, 'Pinkie,' and Bay Breeze®. As expected, bimonthly fungicide treatments provided better disease control than the monthly applications of Daconil 2787. With the exception of 1997, symptoms on the above leaf spot-susceptible cultivars sprayed bimonthly with Daconil 2787 were usually restricted to leaf spotting in the lower canopy and light defoliation. However, symptom severity on the above cultivars, when treated bimonthly with Daconil 2787, was similar and in 1997 numerically higher, than the disease ratings recorded for the leaf spot-resistant Indian Princess®, 'Clara,' 'Snow White,' Olivia™, and Eleanor Tabor™ Indian hawthorn.

In summary, establishment of resistant cultivars is the key component of a sustainable program for preventing outbreaks of *Entomosporium* leaf spot in residential and commercial landscape plantings of Indian hawthorn. An attractive landscape planting of leaf spot resistant cultivars Indian Princess®, 'Clara,' 'Snow White,' Olivia™, and Eleanor Tabor™ Indian hawthorn can be maintained without protective fungicide treatments and would be excellent choices for low-maintenance landscapes. On the other hand, Spring Rapture®, White Enchantress®, 'Snow White,' Enchantress®, 'Heather,' 'Harbinger of Spring,' 'Pinkie,' and Bay Breeze® were too susceptible to *Entomosporium* leaf spot for use in landscapes in Gulf Coast region of Alabama and other areas with a relatively wet climate. The 5-month program of bimonthly fungicide applications, which was required to maintain attractive and relatively spot-free plants, would prove far too costly in terms of time and money to justify fungicide use in the nursery or landscape.

Literature Cited

1. Corley, W. L. 1980. Leafspot ratings of ten *Raphiolepis* cultivars. Proc. SNA Res. Conf. 25:140-141.
2. Dirr, M. A. 1998. Manual of Woody Landscape Plants, 5th Ed., Stipes Publishing Co. Champaign, IL, 1187 pp.
3. Hagan, A. K., J. W. Olive, L. C. Parrott, Jr., and M. Rivas-Davila. 2000. Compass screened for the control of *Entomosporium* leaf spot on photinia and Indian hawthorn. SNA Res. Conf. 45:221-224.
4. Hagan, A. K., J. R. Akridge, K. L. Bowen, J. W. Olive, and K. M. Tilt. 2001. Resistance of selected cultivars of Indian hawthorn to *Entomosporium* leaf spot, fireblight, and anthracnose in Alabama. J. Environ. Hort. 19:43-46.
5. Holcomb, G. E. 1998. Reaction of Indian hawthorn cultivars to *Entomosporium* leaf spot, 1997. Biol. Cult. Test Cont. Plant Dis. 13:39.
6. Ruter, J. M. 1999. Susceptibility of 13 Indian hawthorn cultivars to *Entomosporium* leaf spot, 1998. Biol. Cult. Test Cont. Plant Dis. 14:63.

Table 1. Impact of fungicide inputs on the severity of Entomosporium leaf spot on selected cultivars of Indian hawthorn, 1997 to 1999.

Cultivar	1997 Treatment Interval ^x				1998 Treatment Interval ^x				1999 Treatment Interval ^x			
	2 week	4 week	UTC ^y	LSD ^z	2 week	4 week	UTC ^y	LSD ^z	2 week	4 week	UTC ^y	LSD ^z
Spring Rapture®	3.1	3.8	4.0	0.5	2.2	2.9	3.3	0.4	2.2	3.1	3.6	1.2
Springtime®	3.3	4.0	4.4	0.3	2.3	3.0	3.7	0.2	2.0	2.7	3.8	0.3
White Enchantress®	3.2	3.5	3.9	0.6	2.2	2.9	3.4	0.6	2.2	2.9	3.9	0.8
Enchantress®	3.5	3.9	4.2	0.5	2.4	3.1	3.6	0.3	2.0	3.0	3.8	0.4
'Snow White'	2.0	2.1	2.9	0.5	1.4	1.7	2.6	0.2	1.1	1.3	2.0	0.3
'Clara'	2.1	2.4	2.9	0.4	1.7	2.0	2.8	0.3	1.1	1.4	2.1	0.2
'Pinkie'	3.1	3.7	4.1	0.3	2.7	3.2	3.5	0.4	2.1	2.8	3.7	0.5
Bay Breeze®	2.5	3.2	3.4	0.4	2.0	2.3	3.2	0.3	1.7	2.2	3.4	0.2
Harbinger of Spring®	2.9	3.4	4.2	0.7	2.3	2.4	3.5	0.5	2.1	2.5	3.6	0.6
'Heather'	2.9	3.4	3.5	0.4	2.4	2.8	3.6	0.3	2.5	3.2	3.5	0.5
Olivia®	1.8	1.8	1.9	0.3	1.6	1.8	2.0	0.3	1.4	1.8	1.9	0.5
Eleanor Tabor®	2.0	1.9	2.2	0.3	1.4	1.7	2.0	0.3	1.3	1.5	2.1	0.3
Indian Princess®	2.0	2.4	2.4	0.5	1.8	2.1	2.2	0.3	1.9	2.5	2.6	0.4
LSD ($P=0.05$) ^z	0.4	0.5	0.4	--	0.3	0.3	0.4	--	0.3	0.5	0.4	--

^xDaconil 2787™ at a rate of 2.0 pt/100 gal of spray volume was applied at 2 and 4 week intervals from February 21 to June 4, 1997; January 21 to May 5, 1998; and January 6 to May 17, 1999.

^yUTC = untreated control.

^zMean separation within rows and columns was according to Fisher's protected least significance test ($P=0.05$).