



Bulletin 648
June 2002
Alabama Agricultural Experiment Station
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DISEASE RESISTANCE OF SELECTED CULTIVARS OF INDIAN HAWTHORN IN ALABAMA



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First Printing 1M, June 2002

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DISEASE RESISTANCE OF SELECTED CULTIVARS OF INDIAN HAWTHORN IN ALABAMA

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INTRODUCTION

Indian hawthorn (*Raphiolepis umbellata*), with its dark-green evergreen foliage, mounded canopy, and compact growth habit, has long been a fixture in residential and commercial landscapes across the southeast (2). While most cultivars of Indian hawthorn are dwarf plants with a tight canopy, a few selections such as Rosalinda™ and Majestic Beauty® are large shrubs with an open canopy and an upright growth habit.

In both the nursery and the landscape, Entomosporium leaf spot, which is caused by the fungus *Entomosporium mespili*, is the most common and damaging disease of Indian hawthorn (1,8,10). In Alabama and surrounding states, spotting of the leaves typically begins in late fall to early winter. At early stages of this disease, the leaf spots are bright red [Figure 1]. Depending on the Indian hawthorn cultivar, a red [Figure 2] to maroon [Figure 3] halo or blotch appears around the ash-brown to gray center of each leaf spot. On highly susceptible cultivars, the leaf spotting and defoliation begins at the base of the plant [Figure 4] and often continues throughout the spring until all but the youngest leaves at the shoot tips have been shed [Figure 5] (4). Disease spread on Indian hawthorn is especially rapid following several days of mild, cloudy, and wet winter or early spring weather. Unlike photinia, little if any spread of Entomosporium leaf spot occurs on Indian hawthorn during the summer and early fall, particularly during extended periods of hot, dry weather.

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Cultivars of Indian hawthorn and related *Rhaphiolepis* taxa are known to differ in their susceptibility to Entomosporium leaf spot (5,6,7,9). Corely (1) reported that Majestic Beauty®, ‘Snow White’, ‘Pink Lady’, and *R. x delacourii* had high levels of disease resistance. However, ‘Jack Evans’, Springtime®, ‘Fascination’, and Enchantress® suffered heavy leaf spot-related damage (1). In recent studies in Georgia (9) and Louisiana (5), several newly released cultivars of Indian hawthorn such as Olivia™ also demonstrated good resistance to Entomosporium leaf spot. Tilt *et al.* (12) noted that cultivars of Indian hawthorn with good leaf spot resistance also had superior aesthetic ratings in the landscape.

Entomosporium leaf spot is not the only damaging disease that occurs on Indian hawthorn. In Alabama, outbreaks of fire blight, a bacterial disease caused by *Erwinia amylovora*, have occasionally been seen on Indian hawthorn in landscape plantings and on container stock in the nursery. Wilting and discoloration of one or more shoot tips is usually the earliest symptom of fire blight on Indian hawthorn [Figure 6]. Within a few weeks, the leaves on the dying shoot tip turn brown, curl downward, and remain attached to the dead shoot [Figure 7]. Damage may be so extensive that susceptible cultivars may succumb to fire blight. Surviving fire blight-damaged Indian hawthorn are unmarketable and unattractive. Holcomb (6) recently reported that an entire field planting of Olivia™ succumbed to this disease, while the remaining cultivars of Indian hawthorn in a Louisiana study were not damaged. Overall, the susceptibility of the most commercially available Indian hawthorn cultivars to fire blight is unknown.

The fungus *Colletotrichum gloeosporioides* causes a leaf spot, leaf blight, and dieback disease called anthracnose on a wide range of annual, perennial, and woody landscape plants (11). On Indian hawthorn, 1 to 2 inch circular leaf spots are typically light brown in color with alternating light and dark concentric rings, which gives the spots a distinct ‘target spot’ appearance [Figure 8]. While Indian hawthorn is reported as a host of *C. gloeosporioides* (3), little information is available concerning the occurrence of anthracnose in landscape plantings or the sensitivity of specific cultivars to this potentially damaging disease.

The objective of this study was to determine the susceptibility of Indian hawthorn (*R. umbellata* and hybrid *R. x delacourii*) cultivars to Entomosporium leaf spot, fire blight, and anthracnose in a simulated landscape planting.

MATERIALS AND METHODS

Before planting, soil fertility and pH of a Benndale (A) fine sandy loam soil at the Brewton Experiment Field in Brewton, Alabama, (USDA Hardiness Zone 8a) were adjusted according to the results of a soil fertility assay done by the

Auburn University Soil Testing Laboratory. In March 1994, the initial planting of dwarf cultivars of Indian hawthorn and the upright selection Majestic Beauty® was established on 5-foot centers spaced 6 feet apart. In March 1995, 'Snow White' and Rosalinda™, which are dwarf and upright forms, respectively, were added. The dwarf Indian hawthorn Bay Breeze® was planted in March 1996. The majority of Indian hawthorn cultivars were transplanted from trade gallon containers.

The experimental design was a randomized complete block with six three-plant replications. A drip irrigation system was installed immediately after planting, and the block of plants was watered as needed. Beds were mulched as needed with 1 to 2 inches of aged pine bark. Twice each spring, approximately 3 ounces of 16N-4P-8K analysis fertilizer was uniformly distributed around each plant. Directed applications of 1 pound per acre of Gallery™ DF and 2 quarts per acre of Surflan™ T/O were made early each spring in the mulched beds to control annual weeds. Hand weeding and spot applications of recommended rates of the herbicides Roundup™ or 912 Herbicide 6S™ (monosodium acid methanearsonate [MSMA]) was used to control escape weeds and invading centipede grass. The centipede grass alleys between the rows were periodically mowed.

Within the first year, Entomosporium leaf spot was well established on the susceptible cultivars of Indian hawthorn. Beginning in 1995, visual ratings of Entomosporium leaf spot were made on a scale of 1 to 5 where 1 = no disease, 2 = 1 to 25%, 3 = 25 to 50%, 4 = 50 to 75%, and 5 = 75 to 100% of leaves diseased or prematurely shed. Entomosporium leaf spot ratings were taken on May 24, 1995; May 29, 1996; May 19, 1997; and May 13, 1998. On June 29, 1997 and August 5, 1998, fire blight severity was assessed on a scale of 0 to 4 where 0 = no disease, 1 = one or a few blighted shoot tips, 2 = numerous shoot tips blighted and a few scaffold branches killed, 3 = major portion of the shrub killed, and 4 = plant dead. Anthracnose damage was assessed on June 29, 1997 and August 5, 1998 using the scale previously described for Entomosporium leaf spot.

RESULTS

Entomosporium Leaf Spot

Entomosporium leaf spot, which was the most common disease observed, was noted on all cultivars of Indian hawthorn. However, sizable differences in the level of disease-related spotting of the foliage and leaf shed were seen among those cultivars evaluated from 1995 through 1998 for their reaction to this often damaging disease (Table 1). Over the four-year test period, Olivia™ and Indian

TABLE 1. SEVERITY OF ENTOMOSPORIUM LEAF SPOT ON CULTIVARS OF INDIAN HAWTHORN AT THE BREWTON EXPERIMENT FIELD, 1995 TO 1998

Cultivar	Disease Severity Ratings ¹			
	1995	1996	1997	1998
Gulf Green™	1.0	1.0	2.8	3.5
Indian Princess®	1.1	1.1	2.3	2.7
Olivia™	1.1	1.1	2.0	2.2
<i>R. x delacourii</i> ²	1.4	—	—	—
‘Snow White’ ³	1.6	1.7	3.2	3.3
‘Janice’	1.9	1.9	2.6	—
Majestic Beauty®	2.0	2.0	3.0	3.5
Eleanor Tabor™	2.2	2.2	2.5	3.3
‘Jack Evans’	2.2	2.2	3.0	—
‘Clara’	2.3	2.3	4.0	3.5
Rosalinda™ ³	2.5	2.5	3.0	3.3
Bay Breeze® ⁴	—	—	3.6	4.8
Spring Rapture®	3.2	3.2	4.0	4.5
Enchantress®	3.3	3.3	4.5	4.3
‘Heather’	3.5	3.5	4.0	4.8
‘Pinkie’	3.5	3.5	4.2	4.5
Harbinger of Spring®	3.6	3.6	4.6	4.4
White Enchantress®	3.6	3.6	4.6	4.0
Springtime®	3.9	3.9	4.7	4.0

¹Entomosporium leaf spot severity was assessed 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 defoliated.

²All *R. delacourii* died by the early winter of 1996.

³Rosalinda™ and ‘Snow White’ were planted in March 1995.

⁴Bay Breeze® was established in March 1996, but disease ratings were not taken until the following year.

Princess® suffered the least leaf spotting and premature leaf shed (Table 1). In each year, damage on Olivia™ was limited to light spotting of the leaves at the base of the plant and no premature leaf shed. Although Indian Princess® was largely free from Entomosporium leaf spot in the first three years of this trial, noticeable spotting of the leaves was seen in 1998. In 1995, light and unobtrusive leaf spotting was noted on the hybrid *R. x delacourii*. However, the entire stand of this cultivar died simultaneously in the fall 1995 shortly after two hurricanes drenched the Brewton site.

In the first three years of this study, Entomosporium leaf spot severity on Gulf Green™, ‘Janice’, and Eleanor Tabor™ was quite similar to that seen on Olivia™ and Indian Princess® (Table 1). However, the level of leaf spotting and premature leaf shed seen in 1998 was significantly higher on Gulf Green™ and

Eleanor Tabor™, as compared with Olivia™ and Indian Princess®. Since the entire stand of 'Janice' succumbed to fire blight in 1998, no Entomosporium leaf spot ratings were collected that year. Other cultivars that suffered from light leaf spotting as well as a low level of premature leaf shed in 1995 and 1996 included 'Clara', 'Jack Evans', and Majestic Beauty®. In 1996, low levels of Entomosporium leaf spot were also noted on 'Snow White' and, to a lesser extent, on Rosalinda®. In 1997 and 1998, Entomosporium leaf spot severity intensified on 'Clara', Majestic Beauty®, 'Snow White', and Rosalinda® to the point that objectionable spotting of the leaves and leaf shed was seen. Overall, leaf spot damage was heavier in 1997 and 1998 than in the previous two years.

Indian hawthorn selections most susceptible to Entomosporium leaf spot were Bay Breeze®, Spring Rapture®, Springtime®, White Enchantress®, 'Heather', Enchantress®, Harbinger of Spring®, and 'Pinkie'. Although the disease severity ratings for these cultivars did significantly differ in one or more years, all of the above cultivars generally suffered from heavy spotting of the foliage and premature leaf shed (Table 1). As indicated by disease ratings of 4.0 or above, the majority of these Indian hawthorn cultivars were almost completely defoliated by the May 1997 and May 1998 rating dates. Despite such severe damage over a two- to four-year period, none of these cultivars succumbed to Entomosporium leaf spot (data not shown). Previously, Corley (1) also noted that Springtime® and Enchantress® were highly susceptible to Entomosporium leaf spot. Due to the intensive and costly fungicide spray programs required to maintain their health and appearance, the production and establishment of the above cultivars should be avoided in Alabama and neighboring southern states where Entomosporium leaf spot is prevalent.

Although a number of Indian hawthorn cultivars were moderately to highly susceptible to Entomosporium leaf spot, Olivia™ and Indian Princess® consistently demonstrated a high level of resistance to this disease over the four year test period. With the notable exception of 1998, the disease severity ratings for Eleanor Tabor™ and Gulf Green™ usually did not differ significantly from those recorded for Olivia™ and Indian Princess®. Recently, Holcomb (5) and Ruter (9) have also rated Olivia™ as being among the most leaf spot-resistant cultivars of Indian hawthorn. As previously noted (1,4), *R. x delacourii* demonstrated good disease resistance but did not survive through the 1995 growing season.

In a recent Louisiana study (5), damage on Eleanor Tabor™ was limited to light spotting of the leaves, but heavy leaf spot damage was seen on this cultivar in a 1999 Georgia study (9), the same year that serious damage was noted in our study. Over the test period, disease intensity gradually increased on Majestic Beauty®, 'Clara', 'Jack Evans', 'Snow White', Rosalinda™ and Bay Breeze® to the point that the damage was objectionable. Ruter (9) reported much heavier leaf spot damage on 'Snow White' and 'Clara' than was noted in this study. In



Figure 1, left. Typical leaf spots with bright red halo on leaves of Indian hawthorn.

Figures 2 and 3, below. The center of the leaf spots eventually turns tan to ash-brown in color but retains the red to maroon halo. The pinhead-sized black pustules in the center of the leaf spot are the fruiting bodies of the fungus *E. mespili*.

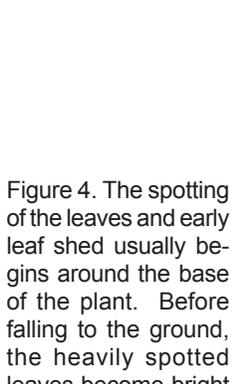


Figure 4. The spotting of the leaves and early leaf shed usually begins around the base of the plant. Before falling to the ground, the heavily spotted leaves become bright red to maroon in color.





Figure 5. A heavily defoliated Springtime™ Indian hawthorn (left) next to another plant of the same cultivar (right) that was protected from *Entomosporium* leaf spot with a fungicide.



Figure 6. Shoot dieback phase of fire blight on 'Janice' Indian hawthorn.

Figure 7. Shoot dieback phase of fire blight on Olivia™ Indian hawthorn.



Figure 8. Anthracnose on Majestic Beauty® Indian hawthorn. Note the concentric ring or 'target spot' pattern that is the characteristic symptom of anthracnose on Indian hawthorn.



TABLE 2. DISEASE RATINGS OF FIRE BLIGHT AND ANTHRACNOSE ON CULTIVARS OF INDIAN HAWTHORN AT THE BREWTON EXPERIMENT FIELD, 1997 AND 1998

Cultivar	—Fire blight ¹ —		Anthracnose ²
	1997	1998	1997
GulfGreen™	0	0	1.0
‘Snow White’	0	0.1	1.0
White Enchantress®	0	0.1	1.0
Spring Rapture®	0	0.3	1.0
Rosalinda™	0.1	0	1.3
‘Clara’	0.1	0	1.0
Springtime®	0.1	0	1.0
Harbinger of Spring®	0.1	0.1	1.0
‘Pinkie’	0.1	0.1	1.0
Eleanor Tabor™	0.2	0	1.0
‘Heather’	0.2	0.1	1.0
Indian Princess®	0.2	0.1	1.0
Enchantress®	0.3	0	1.0
Majestic Beauty®	0.6	0	2.7
Olivia™	0.7	1.0	1.0
‘Janice’ ³	3.7	—	—
‘Jack Evans’ ³	4.0	—	—

¹Fire blight was rated on June 29, 1997 using a scale of 0 to 4 where 0 = no disease, 1 = one to several spurs or shoot tips dead, 2 = numerous shoot tips blighted and a few scaffold limbs killed, 3 = major portion of bush killed, and 4 = bush dead.

²Anthracnose damage was assessed on June 29, 1997 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.

³‘Jack Evans’ and ‘Janice’ succumbed to fire blight in June 1997. No anthracnose ratings were taken.

contrast, Corley (1) reported that ‘Jack Evans’ was highly susceptible to *Entomosporium* leaf spot, while Majestic Beauty® and ‘Snow White’ suffered only light leaf spotting.

Fire Blight

In 1997, characteristic fire blight symptoms such as blossom blight and shoot dieback first appeared on selected cultivars of Indian hawthorn between the April 20 and May 19 rating dates. As indicated by fire blight ratings of 2.2 and 2.3, respectively, numerous blossom clusters and shoot tips, as well as several scaffold limbs on ‘Janice’ and ‘Jack Evans’, had died by May 19. By June 29, all the ‘Jack Evans’ and all but one of the ‘Janice’ Indian hawthorn had died. Between the May and June rating dates, some intensification of fire blight was noted on Majestic Beauty® and Olivia™ (data not shown). Although light blighting of the blooms and shoot tips was seen on nine additional cultivars, the

disease ratings for these plants did not significantly differ from those of the fireblight-free cultivars (Table 2). The following year, blighting on one to a few bloom clusters and shoot tips was seen only on the Olivia™ Indian hawthorn (Table 2). Insignificant fire blight damage was seen on eight additional cultivars of Indian hawthorn. In 1997 and 1998, Gulf Green™ was the only cultivar to remain free of fire blight. Throughout the 2001 growing season, fire blight continued to worsen on Olivia™ while the remaining cultivars have remained free of this disease.

Overall, fire blight severity was higher in this study than had been noted in previous Indian hawthorn screening trials (1,5,9). In 1997, ‘Janice’ and ‘Jack Evans’ Indian hawthorn, which were not known to be susceptible to fire blight, were eradicated. The Indian hawthorn Olivia™, which has consistently suffered moderate but objectionable blossom blight and shoot dieback, was heavily damaged by fire blight in a recent Louisiana study (6).

Anthracnose

In 1997, anthracnose appeared on the leaves of the upright cultivars Majestic Beauty® and Rosalinda™ between the May and June rating dates (Table 2). Numerous diseased leaves on Majestic Beauty® were prematurely shed, and the level of anthracnose-induced defoliation was noticeable. Throughout the remainder of 1997, anthracnose levels on neither cultivar intensified. Minor anthracnose damage was also seen on these two cultivars in the summer of 2000 and 2001. Symptoms of anthracnose have never been observed on the leaves of any of the dwarf-type cultivars of Indian hawthorn.

DISCUSSION

As expected, *Entomosporium* leaf spot was the most common and damaging disease observed in this simulated landscape planting of Indian hawthorn. The dwarf-type cultivars Indian Princess® and Olivia™ showed a consistently high level of resistance to this common and often damaging disease. Two additional cultivars, Eleanor Tabor™ and Gulf Green™, suffered noticeable damage only when heavy winter and spring rains favored disease development. In 2000 and 2001, however, severe defoliation due to *Cercospora* leaf spot and a unattractive upright growth habit greatly reduced the landscape value of Gulf Green™. The Indian hawthorn selections Spring Rapture®, Springtime®, White Enchantress®, ‘Heather’, Enchantress®, Harbinger of Spring®, and ‘Pinkie’ proved so susceptible to *Entomosporium* leaf spot that their production and use in southeastern landscapes should cease. With the right weather patterns, damaging outbreaks of this disease may also occur in nursery and landscape plantings of

‘Clara’, Majestic Beauty®, ‘Snow White’, and Rosalinda®. While the leaf spot-damaged selections were unsightly, none succumbed to this disease.

On the other hand, stands of the cultivars ‘Janice’ and ‘Jack Evans’ were eradicated by fire blight. In 1997 or 1998, unobtrusive blighting of one or more bloom clusters was seen on the majority of cultivars screened. In particular, the sensitivity of Olivia™ to fire blight seen in this and a recent Louisiana study (6) raises serious questions concerning the production and use of this otherwise superior cultivar of Indian hawthorn in Alabama landscapes.

Anthrachnose proved more of a nuisance than a serious threat to the health of Indian hawthorn. Blighting of the leaves and premature leaf shed due to anthracnose was limited to the upright cultivars Majestic Beauty® and Rosalinda™. Of these two cultivars, Rosalinda™ is much more attractive. All of the dwarf Indian hawthorns remained free of the symptoms of anthracnose. Overall, Indian Princess® and Eleanor Tabor™ demonstrated the highest level of overall disease resistance, and both are attractive landscape plants.

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