Influence of Irrigation Method on Severity of Selected Fungal Leaf Spots of Foliage Plants

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ABSTRACT

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Overhead sprinkler irrigation that resulted in wetting of foliage was an important influence in severity of Alternaria leaf spot of schefflera, Fusarium leaf spot of dracaena, and Exserohilum (Helminthosporium) leaf spot of areca palm. Disease severity was decreased as much as 100% when individual plants were irrigated by hand in a manner that kept the foliage dry. During a 6-wk rating period, disease development diminished to undetectable levels on hand-irrigated plants but remained high on those irrigated overhead. Disease spread to uninfected plants only under overhead sprinkler irrigation.

Foliar fungal diseases of tropical foliage plants comprise the largest group of diseases of these plants (1,2) and cause serious losses in plant quality. Traditionally, fungal leaf spot control has been by fungicide sprays on either a preventive or therapeutic basis (2). The importance of maintaining dry foliage in the prevention and minimization of foliar diseases of foliage plants has been stressed in Florida for many years, although little research has been conducted to demonstrate the efficacy of this cultural control. The ability to control diseases in the absence of chemicals is important under certain conditions. Foliage plants such as *Brassaia actinophylla* Endl. (schefflera) are especially susceptible to phytotoxic response to chemicals (3). In addition, as costs of purchasing and applying pesticides increase, the need for cultural controls will also increase.

Alternaria leaf spot, caused by *Alternaria* sp., commonly occurs on scheffleras and under wet conditions results in defoliation and loss in plant quality (5,6) even when sprayed regularly. Another serious disease is Fusarium leaf spot of *Dracaena marginata* Lam. and other dracaenas, which is caused by *Fusarium moniliforme* Sheld. (7). This disease is controlled successfully with chemical sprays when they are applied on a 10- to 14-day schedule. Finally, Helminthosporium leaf spot of *Chrysalidocarpus lutescens* H. Wendl. (areca palm), which is caused by numerous dematiaceous fungi (4) including *Exserohilum rostratum* (Drechs.) Leonard & Suggs (Chase, *unpublished data*), occurs throughout Florida on plants exposed to rainfall or overhead irrigation. Control of palm leaf spot is difficult; it depends partially upon removal of infected leaves, which can be a time-consuming and expensive process (Chase, *unpublished data*).

Although cultural control through reduction or elimination of foliar wetting of these leaf spots has been recommended in the past, there has been no research on foliage plants to support this recommendation. The present research demonstrates the effect of foliar wetting on severity of three leaf spot diseases in the absence of chemical controls.

MATERIALS AND METHODS

The influence of overhead irrigation was tested with respect to each of the following pathogen-suscept combinations: *F. moniliforme-D. marginata, Alternaria* sp.-*B. actinophylla,* and *E. rostratum-C. lutescens.* The test procedure was the same for each combination. Plants free of leaf spot were obtained from commercial growers or produced from seed and were grown in a glasshouse (10,760 lux) for at least 3 mo prior to the initiation of the test to ensure the absence of both leaf spots and chemical residue on leaves. Plants were potted in 15-cm pots in steam-sterilized potting medium consisting of Canadian peat, cypress shavings, and pine bark (2:1:1 by volume), which was amended with 6 kg of Osmocote (14:14:14), 4 kg of dolomite, and 1 kg of Perk (micronutrient source manufactured by Estech, Inc., Chicago, IL) per cubic meter of mix.

Fifteen plants were used in each of the following treatments for each test: 1) overhead irrigation, uninoculated; 2) overhead irrigation, inoculated with the pathogen; 3) hand irrigation, uninoculated; and 4) hand irrigation, inoculated with the pathogen. Plants in treatments 1 and 2 were watered two or three times a week by sprinkler irrigation set to deliver 2.5 cm of water to the soil surface over a 2-hr period between 1400 and 1700 hr. Sprinkler irrigation was reduced if rainfall occurred such that total water was the same as on days without rainfall. Plants in treatments 3 and 4 were irrigated individually by hand, with care taken to maintain dry foliage; they received the same amount of water on the same day as the other treatments. All plants were maintained in a shadehouse under 47% shade for the duration of the test. Plants in treatments 3 and 4 were in a wood-framed structure covered with 2-mil polyethylene to protect them from rainfall and irrigation water.

Prior to initiation of the test, the temperatures in the midst of each group of plants were recorded six times daily for 3 days; it was found that temperatures under the polyethylene structures did not vary by more than 1 C from those outside the structures. The 15 plants in each treatment were divided into three blocks separated by empty space for the duration of the test.

Isolates of the three pathogens were obtained from naturally infected plants by single-spore transfer to fresh potato-dextrose agar medium (filtered extract from 250 g of boiled potatoes, 20 g of agar, and 20 g of dextrose). Inoculum for each test was grown either on potato-dextrose agar (*F. moniliforme*) or V-8 juice agar medium (18% V-8 juice, cleared with calcium carbonate and centrifugation; *Alternaria* sp. and *E. rostratum*) under 8 hr of light a day (2,152 lux) at 24–26 C for 2 wk prior to use.

A spore suspension was made by adding 10 ml of sterile deionized water to the plate and gently rubbing the surface with a sterile glass rod. Inoculum was adjusted to 1×10^6 (*F. moniliforme*), 2×10^3 (*Alternaria* sp.), or 1×10^4 spores per milliliter (*E. rostratum*). One milliliter of the appropriate spore suspension was added to the whorl of each dracaena by pipette or was sprayed onto the foliage of each palm or schefflera. Each control plant was inoculated with 1 ml of sterile deionized water.

All plants were placed in polyethylene bags for 48 hr immediately following inoculation. Plants were randomized within the three blocks such that treatments 1 and 2 were mixed and

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Table 1. Effect of irrigation method on Exserohilum (Helminthosporium) leaf spot of *Chrysalidocarpus lutescens*

Irrigation method[x]	Inoculation	Leaf spot severity rating[y]	Leaves with spots (%)
OSI	Water	2.2 b[z]	53.3 b
OSI	Spores	3.0 c	92.0 c
IPI	Water	1.3 a	2.7 a
IPI	Spores	2.5 b	69.3 b

[x]OSI = overhead sprinkler irrigation, IPI = individual pot irrigation.
[y]Numbers represent the average rating for 15 plants. The rating scale was as follows: 1 = no lesions, 2 = 1–10 lesions per leaf, 3 = 11–100 lesions, 4 = more than 100 lesions, and 5 = leaf shredding.
[z]Numbers followed by the same letter in the same column are not significantly different at the 5% level using Duncan's multiple range test.

Table 2. Effect of irrigation method on Fusarium leaf spot severity of *Dracaena marginata*

Irrigation method[x]	Inoculation	Leaf spot severity rating[y]		
		30-3-81	14-4-81	4-5-81
OSI	Water	1.3 a[z]	1.3 a	1.6 b
OSI	Spores	3.5 c	2.9 b	2.6 c
IPI	Water	1.1 a	1.0 a	1.0 a
IPI	Spores	2.1 b	1.1 a	1.0 a

[x]OSI = overhead sprinkler irrigation, IPI = individual pot irrigation.
[y]Numbers represent the average rating for 15 plants. The rating scale was as follows: 1 = no lesions, healthy; 2 = slight lesions, less that 11 per plant; 3 = moderate lesions, 11–100; 4 = severe deformity of new leaves; and 5 = bud rot, dieback of the shoot.
[z]Numbers followed by the same letter in any column are not significantly different at the 5% level using Duncan's multiple range test.

treatments 3 and 4 were mixed. Disease incidence and severity were recorded during a 4- to 6-wk period using a 1–5 rating scale or by counting infected leaves. Although the severity rating scale differed slightly for each pathogen-suscept combination, a rating of 1 was given for no disease and 5 for a maximum level of disease. The severity rating was made for the total plant in both arecas and scheffleras, but dracaenas were rated only for infection in new leaves. The test was performed once with Exserohilum leaf spot, twice with Fusarium leaf spot, and three times with Alternaria leaf spot.

RESULTS AND DISCUSSION

The block effect was not statistically significant in any experiment, and data were combined for analysis. Exserohilum leaf spot of areca palm was greatly affected by water on leaves (Table 1). The percentage of infected leaves and disease severity were greatest for inoculated plants receiving overhead irrigation and least in uninoculated plants receiving individual pot irrigation. Spread of the disease to uninoculated plants occurred most frequently in plants watered overhead, and disease was as severe in individually pot-watered, inoculated plants as in the overhead irrigated, uninoculated plants.

Results were the same for the dracaenas inoculated with *F. moniliforme*. Disease was significantly increased in overhead irrigation treatments compared with the individual pot irrigation (Table 2). Inoculated plants with dry foliage were rated free of disease on new leaves within 6 wk. In contrast, new leaves of inoculated plants receiving overhead irrigation had leaf spot, and the disease spread to uninoculated plants by splashing water. Results are given for the first test but were similar in the second test.

The response of scheffleras inoculated with *Alternaria* sp. was much the same as for the other two pathogen-suscept combinations tested. Disease was more severe in plants grown under overhead sprinkler irrigation than when water was delivered to the soil alone (Table 3). The trends in disease severity were the same as those in Fusarium leaf spot. Disease of individually pot-watered, inoculated plants decreased as plants grew, but it continued at a high level for inoculated plants that were irrigated overhead. Results are given for the first test but were similar in the other two.

The importance of watering method in

Table 3. Effect of irrigation method on Alternaria leaf spot severity of *Brassaia actinophylla*

Irrigation method[x]	Inoculation	Leaf spot severity rating[y]
OSI	Water	1.0 a[z]
OSI	Spores	3.0 c
IPI	Water	1.1 a
IPI	Spores	1.9 b

[x]OSI = overhead sprinkler irrigation, IPI = individual pot irrigation.
[y]Numbers represent the average rating for 15 plants. The rating scale was as follows: 1 = no lesions, healthy; 2 = slight lesions, 1–10 per plant; 3 = moderate lesions, 11–100; 4 = severe, defoliation of leaves; and 5 = plant death.
[z]Numbers followed by the same letter are not significantly different at the 5% level using Duncan's multiple range test.

severity of these leaf spot diseases was demonstrated. The need for free water on the leaf surface for the infection process to occur is well known. These studies have shown that water on leaves is also needed if disease development is to continue. Spread from infected plants to healthy plants occurs through use of a watering method that allows splashing of spores and provides the water necessary for infection to occur on the plant. Most important, this research has established that leaf spots can be controlled through a culturing system that maintains dry leaves and is effective in halting the development of some diseases because infections of the new leaves cannot occur.

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