Dematiaceous Leaf Spots of *Chrysalidocarpus lutescens* and Other Palms in Florida

A. R. CHASE, Assistant Professor of Plant Pathology, University of Florida Agricultural Research Center, Apopka 32703

ABSTRACT

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Leaf spot of *Chrysalidocarpus lutescens* (areca palm) was caused by *Bipolaris* (*Helminthosporium*) *setariae*, *Exserohilum* (*Helminthosporium*) *rostratum*, and *Phaeotrichoconis crotalariae*. No obvious differences in leaf spots incited by each organism through natural or artificial infection were noted. *Caryota mitis* (fishtail palm), *Chamaedorea* spp., and *Rhapis excelsa* (rhapis palm) were also susceptible to these pathogens, while several other palm species were resistant to one or more. The distribution and isolation record of these pathogens revealed that *B. setariae* and *E. rostratum* were most important and widely distributed in Florida.

The areca palm, *Chrysalidocarpus lutescens* H. Wendl., is an ornamental palm widely grown in Florida and is important in the nursery trade. Leaf spots are persistent problems in production of this plant and are typified by red, brown, or black elliptical lesions frequently surrounded by a chlorotic halo. Under conditions of severe disease, unfurled leaves become infected and appear shredded (7) (Fig. 1). Even mild infections are important, however, because the commercial tolerance for foliar imperfections in foliage plants is low and because attempts to control leaf spots by applying chemicals have encountered difficulties. Field observations by growers and consultants and preliminary research indicate that although spread of disease to new fronds can be eliminated with some chemicals, existing leaf spots cannot be arrested in their development.

Symptoms of nutritional imbalance are confused with fungal leaf spot. *C. lutescens* shows symptoms of zinc (6) and boron (4) deficiency and of boron (4) and fluoride (C. A. Conover and R. T. Poole, *unpublished*) toxicity. Leaf spot has been difficult to control, and the occurrence of other disorders causing leaf symptoms has led to the belief that an organism is not responsible for initiation of leaf spots. *Helminthosporium* spp. (and related fungi) have long been isolated from these spots, but their low recovery rate has supported a widely shared view that they were not the primary cause of the leaf spot.

Helminthosporium spp. and related fungi have been reported as causal agents of diseases of several other ornamental plants, including flower blights and leaf spots of rose and chrysanthemum (2) caused by *Bipolaris* (*Helminthosporium*) *setariae* (Saw.) Shoemaker. *Helminthosporium* (*Exserohilum*) *rostratum* (Drechs.) Leonard & Suggs causes leaf spot of *Aechmea fasciata* (bromeliad), another foliage plant (5), and leaf spot of coconut palm has been attributed to *Drechslera incurvata* (Ch. Bernard) M. B. Ellis (1).

This research was performed to determine the etiology of leaf spots of areca palm and other palm species, the host range of any pathogen found, and the distribution of leaf spot pathogens in Florida's commercial palm nurseries.

MATERIALS AND METHODS

Isolation of the causal organism. Tissues from *C. lutescens* and other palms were collected from several nurseries throughout Florida. The most

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common symptoms encountered were elliptical necrotic lesions 1–4 mm long on leaf pinnae and petioles at all stages of development. Lesions were reddish tan to black and were frequently surrounded by a chlorotic halo.

Tissue was given one of two treatments before it was plated on fresh potato-dextrose agar medium (extract from 250 g of boiled potatoes, 20 g of agar, and 20 g of dextrose) (PDA) or fresh V-8 juice agar medium (18% V-8 juice cleared with 4.5 g of calcium carbonate and 15 g of agar) (V-8) and incubated in 12 hr of light daily (2,152 lux; fluorescent bulbs) at 24–26 C for 10–14 days. In the first treatment, tissue was surface-disinfested in 0.5% sodium hypochlorite for 2 min and rinsed in sterile, deionized water. In the second treatment, tissue was washed vigorously in tap water and rinsed in sterile, deionized water before plating.

Pathogenicity tests. Organisms that were recovered from more than one sample were included in the following pathogenicity tests. Cultures of suspected pathogens were maintained on PDA slants from either single-spore or single hyphal tip transfers from plated tissue. Inoculum was grown on V-8 plates at 24–26 C for 14–21 days (until spores were produced) with 12 hr of light daily (as described above). Spores were removed from plates by adding sterile, deionized water to the colony surface and rubbing with a sterile rubber spatula. Spore suspensions were counted with a hemacytometer and adjusted to 1×10^4 spores per milliliter by adding sterile, deionized water. Inoculum for the control treatment was prepared from a sterile V-8 plate following the same procedure.

Inoculum was sprayed onto the foliage of palm seedlings at the rate of 2 ml per plant. Plants were loosely wrapped in a polyethylene bag for 48 hr. The bags were then removed, and the plants were randomly placed on a glasshouse bench, where they received 10,760 lux of light and were watered once or twice a week, depending on the season, for the duration of each trial. All seedlings were grown in 10-cm plastic pots in steam-sterilized potting medium consisting of Canadian peat, cypress shavings, and pine bark (2:1:1, by volume) that was amended with 6 kg of Osmocote (14-14-14), 4 kg of dolomite, and 1 kg of Perk (micronutrient source, Agrico Chemical Co., Chicago, IL) per cubic meter of mix.

Ten rapidly growing (25 cm tall) areca palm seedlings were inoculated with each isolate or with the sterile medium control. Reisolation from symptomatic tissue was attempted with the same procedure used for isolating the causal organism (the second treatment). Inoculation tests were performed at least three times for each suspected pathogen.

Host range of major pathogens. The host ranges of three pathogens were tested with the following plants: *Caryota mitis* Lour. (fishtail palm), *Chamaedorea cataractarum* Mart., *Chamaedorea elegans* Mart. (parlor palm), *Chamaedorea seifrizii* Burret. (Florida hybrid palm), areca palm, *Gronophyllum* sp. Scheff. (Kentia palm), *Phoenix roebelenii* O'Brien (miniature date palm), and *Rhapis excelsa* (Thunb.) A. Henry (rhapis palm). Five to 10 seedlings of each species were grown as described above for 10 wk before inoculation. Plants were inoculated as described above with 1 ml of a spore suspension adjusted to 1×10^4 spores per milliliter of 1 ml of the sterile medium suspension. Symptoms were noted twice during the 30 days after inoculation, and reisolation was attempted as in the pathogenicity tests. Depending on the specific host-pathogen combination, the host range test was performed from two to 11 times.

Distribution of organisms in Florida. We briefly surveyed the distribution of each pathogen in Florida by collecting samples of palm leaf spots from commercial nurseries throughout the state. Recovery of organisms was attempted with the isolation procedure described above.

RESULTS

Isolation of the causal organism. Fungi from several genera were consistently isolated from palm leaf spots, including *Alternaria, Bipolaris, Curvularia, Exserohilum, Gloeosporium*, and *Phaeotrichoconis*. The most frequently isolated organisms were *Alternaria, Curvularia*, and *Gloeosporium*, which were found in nearly every leaf spot from most palms. *Bipolaris* (*Helminthosporium*) *setariae, Exserohilum* (*Helminthosporium*) *rostratum*, and *P. crotalariae* (Salam & Rao) Subram. were isolated less often than other organisms but proved to be the only pathogens of those fungi tested. Pathogens were tentatively identified (3) before confirmation by E. S. Luttrell. Treatment 2 was more efficient in terms of recovery and sporulation of the three pathogens and was adopted for use throughout the remainder of the study.

Pathogenicity tests. Several isolates each of *Alternaria, Curvularia*, and *Gloeosporium* spp. were tested for pathogenicity but proved negative. Leaf spots incited by *B. setariae, E. rostratum*, and *P. crotalariae* were indistinguishable from one another. Leaf spots appeared initially as pinpoint, water-soaked lesions, which enlarged to form elliptical reddish lesions. *B. setariae* caused streaking of the chlorotic halo (Fig. 2) similar to naturally occurring symptoms in some tests, but this was not consistent.

Although reisolation of the pathogens was successful, it resembled isolation from naturally occurring leaf spot in that recovery was usually low (one to eight of 20 possible). Only recovery of *P. crotalariae* was consistently higher (five to 15 of 20) from naturally or artificially infected tissue. Organisms that did not incite leaf spot development were not reisolated from tissue, and no pathogens were isolated from plants inoculated with the sterile medium. All isolates of the three pathogens were pathogenic on areca palm seedlings.

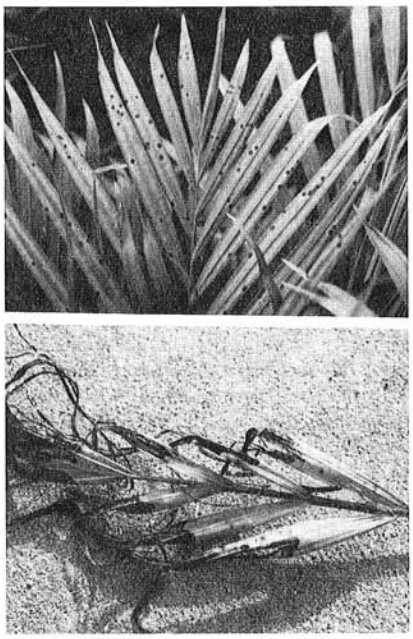

Fig. 1. Typical symptoms of palm leaf spot on *Chrysalidocarpus lutescens* (areca palm) incited by *Bipolaris* (*Helminthosporium*) *setariae, Exserohilum* (*Helminthosporium*) *rostratum*, or *Phaeotrichoconis crotalariae* (above); severe symptoms of leaf shredding (below).

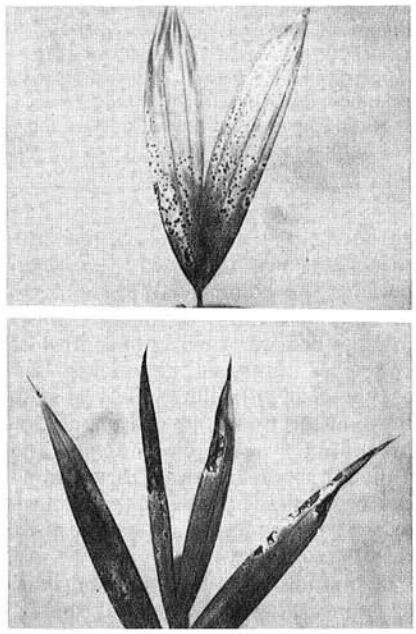

Fig. 2. Symptoms of leaf spot on a *Chrysalidocarpus lutescens* seedling incited by *Exserohilum* (*Helminthosporium*) *rostratum* (above) and *Bipolaris* (*Helminthosporium*) *setariae* (below). Note the beginning of the shredding condition (below).

Table 1. Pathogenicity of dematiaceous fungi from palm leaf spots on commercial palms in Florida

Plant	Fungal isolates[a]		
	Bipolaris setariae	*Exserohilum rostratum*	*Phaeotrichoconis crotalariae*
Areca palm	100	100	100
Cataractarum palm	0	0	0
Fishtail palm	25	100	100
Florida hybrid palm	0	5	0
Kentia palm	0	40	0
Miniature date palm	40	0	0
Parlor palm	85	70	66
Rhapis palm	0	66	40

[a] Numbers represent the percentage of plants susceptible to the fungus in all tests.

Table 2. Recovery of pathogens from palm leaf spots in Florida, by location and host

County	Pathogen[a]		
	Bipolaris setariae	*Exserohilum rostratum*	*Phaeotrichoconis crotalariae*
Broward	Florida hybrid palm (2) Areca palm Kentia palm (2)	Florida hybrid palm Rhapis palm	Areca palm
Dade	Areca palm Kentia palm (2)	Areca palm Rhapis palm	
Hillsborough		Queen palm	
Orange		Areca palm	
Palm Beach	Areca palm (5)	Areca palm (2)	Areca palm

[a] Numbers in parentheses indicate the number of isolations from that host.

Host range of the major pathogens. Certain palms were more susceptible to these pathogens than others (Table 1). Areca palms were most susceptible, which is consistent with field observations and isolation records. Fishtail palms were susceptible to all pathogens, and leaf spots frequently coalesced to form large, irregularly shaped necrotic areas. Parlor palm developed dark brown to black, elliptical or irregular lesions, taking on the appearance of shredding seen in many naturally infected areca palms. Rhapis palm also was susceptible to *E. rostratum* and *P. crotalariae* but appeared to be resistant or immune to *B. setariae* in two tests. Leaf spots on rhapis palm were slight, irregularly shaped, and black and usually mimicked those seen on naturally infected rhapis palm. Most remaining species of palms developed pinpoint chlorotic spots that did not enlarge more than 0.2 mm; no organisms were reisolated from these spots.

Distribution of pathogens in Florida. All three pathogens were isolated from at least two sources in Florida (Table 2). *B. setariae* and *E. rostratum* were most prevalent and occurred on palms other than arecas, including Florida hybrid palm, Kentia palm, *Arecastrum* sp. (Drude) Becc. (queen palm), and rhapis palm. *P. crotalariae* was isolated only twice from arecas and is apparently less important in palm leaf spots than the other two fungi.

DISCUSSION

In addition to elucidating the etiology of this disease, this research has established that three separate organisms incite leaf spot on palms in Florida. Leaf spots previously attributed to *Exosporium* sp. may have been caused by *E. rostratum*, because this organism is similar in morphology and very widespread. Other pathogens causing palm leaf spot could probably be identified by the methods described in this paper. The similarities in symptoms caused by each pathogen support this possibility, because all palm leaf spots would be diagnosed as one disease on the basis of symptomatology alone, and this study was limited.

Finally, this research has linked the pathogenic organisms that cause leaf spots of the widely grown areca palm to leaf spots of other palms grown in Florida. Because many commercial nurseries produce more than one species of palm, recognition of the potential for spread from one plant to another is important. Therefore, it is helpful to know which palms are most resistant.

Although mineral nutrition may influence the susceptibility of areca palm to leaf spot, disease symptoms are easily reproduced on plants not under stress. However, the role of host nutrition and other factors that create host stress remains unknown. In light of the difficulty encountered in chemical control of this leaf spot, as well as the current shift in disease control strategies, these factors should be investigated.

ACKNOWLEDGMENTS

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