Leaf and Crown Rot of *Liriope muscari*[1]

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INTRODUCTION: *Liriope muscari* (Decne.) L.H. Bailey, a member of the Liliaceae family, is native to southeast Asia. This grass-like perennial is used in landscapes, along borders or planted *en masse* as a ground cover. The dark green color, spikes of lavender-colored flowers and low maintenance have made *L. muscari* a popular choice for many landscapes in the southeastern United States. 'Ever-green Giant' is by far the most commonly used variety of *L. muscari* used in Florida landscapes (Gilman 1999).

In the past few years. a serious leaf and crown rot disease has led to significant losses of 'Evergreen Giant' in nurseries and landscapes. Control of this disease must be addressed during the production and maintenance of'Evergreen Giant' if it is to retain its popular status in the landscape industry.

PATHOGENS AND FACTORS INITIATING DISEASE: Several fungi, and at times certain cultural conditions, can be associated with leaf and crown rot of *L. muscari. Phytophthora* spp., *Fusarium oxysporum* Schlechtend.:Fr and *Rhizoctonia solani* Kuhn are commonly recovered from rotted crown and basal leaf tissue as well as from associated necrotic roots. Strandberg (2001) suggests that *Phytophthora* spp., predominately *P. palmivora* (E. J. Butler) E.J. Butler, are the primary pathogens initiating this disease. *Fusarium oxysporum* and *R. solani* may represent secondary or opportunistic pathogens in this disease syndrome as research indicates that applications of fungicides targeting these potential pathogens provided little or no control of leaf and crown rot. Poor landscape installation by planting liriope too deep, burying the crowns, and mulching too heavily can predispose plants to infection by *Phytophthora* spp. The practice of broadcasting granular fertilizer or herbicide can injure tender crown and basal leaf tissue if the granules become wedged between leaves. This phytotoxic injury can predispose leaf tissues to fungal infection. Also, overwatering and overfertilization can alter host physiology and create adverse environmental conditions that do direct damage to plants, and can be conducive to biotic disease development. In many infected plants, root knot nematodes *(Meloidogyne* sp.) have also been found. It is not known if these nematodes aid in the development of this disease, for no damage threshhold has been identified for root knot on *L. muscari.*

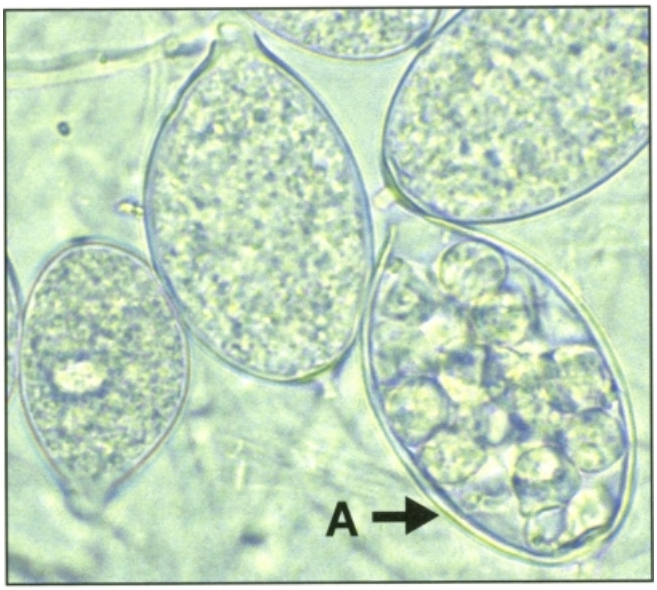

Fig 1. Caducous sporangia *of Phytophthora palmivora.* **(A)** Zoospores forming within sporangia (bottom right). Zoospores are discharged from sporangia through the papillate apex.

Crown and leaf rot disease can be increased easily through the liriope propagation process. Crowns of liriope are divided and leaves and roots are trimmed down to create a single plantlet referred to as a bib. These bibs are produced domestically by a growing industry based on the harvest and division of established landscape liriope, and also by offshore production nurseries or by nurseries that divide liriope for use in their own facility. Increased demand for liriope (especially `Evergreen Giant'), use of propagative plant material harboring *Phytophthora* inoculum, poor sanitation practices during propagation and crowded nursery conditions with overhead irrigation have led to greater disease incidence in nurseries and subsequent poor performance and decline of liriope in the landscape.

Members of the genus *Phytophthora,* commonly identified as water molds, produce asexual sporangia which in turn produce motile zoospores capable of moving in irrigation water or splashing rain between susceptible host plants where they encyst, penetrate host tissue and cause infection (Fig. l). Sexual reproduction culminates with the development of oospores which aid in the survival of *Phytophthora* spp. during adverse environmental conditions.

Historically, *Phytophthora nicotianae* Breda de Haan and *P. palmivora* have been isolated from liriope exhibiting leaf, crown and root rot symptoms. In the past few years, *P. palmivora* has been the most commonly isolated species associated with this disease, and can be identified by the production of caducous sporangia (sporangia which fall off

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Fig. 2. Typical leaf and crown rot symptoms.

sporangiophores at maturity) and retain a short pedicel (5 microns) at the attachment end. These sporangia are mostly elliptical to ovoid in shape, 40-60 microns long and 25-35 microns wide on average, and have a papillate apex (Erwin and Ribeiro 1996).

SYMPTOMS: The first symptom of leaf and crown rot can be observed as yellow flagging of interior foliage. As the infection progresses, necrotic basal leaf tissue may extend 2-3 inches up from the crown. Infected leaves typically lodge and can be easily separated from the diseased plant (Fig. 2). Initially, infected plants may remain symptomless above ground, even though a significant number of roots are infected with *Phytophthora.* When suspect plants are removed from the soil, discolored and sloughing roots are usually present. Crown and leaf rot symptoms will appear as the disease continues to develop.

CONTROL: The most important factor in controlling leaf and crown rot of liriope is using disease-free propagation material. Any new or unproven source of propagative bibs should be evaluated cautiously and the plant material checked closely for signs of rot or necrotic tissue. Keep clean propagation material away from production areas, and don't handle bibs until hands are washed or cleaned with an appropriate disinfectant. This will help avoid inoculation. Containerized liriope grown in nurseries should be kept on a preventative fungicidal regime. Eliminate crowding between pots and do not overwater.

Nurseries have a variety of chemical fungicides to choose from that may provide control of *Phytophthora* and improve disease management. The following products are currently registered for use on liriope. Fungicide registrations are subject to change and product labels should be consulted to determine legal uses. Mefenoxam (Subdue MAXX® 2MC, l%GR, 2X WSP), propamocarb (Banol® 66.5MC), and propamocarb + chlothalonil [Lesco Par® T/O (6L)] are applied as a soil and root drench. Fosetyl aluminum (Aliette® 80 WDG, Aliette® T&O 80 WDG, Prodigy® 80 DG) is applied as a foliar spray and is systemic downward in the target plant (Simone *et at.* 2000).

Control of *Fusarium* and *Rhizoctonia* spp. may also improve management of leaf and crown rot in nurseries and landscapes. Fungicides effective against these secondary or opportunistic pathogens include thiophanate methyl [Cleary's® 3336 (5OWP, 46.2F, 2G), Fungo® flo(46.2), Fungo® 5OWSB, SysTec® 1998 (46.2F, 85WSG),or chlorothalonil + thiophanate methyl (Spectro® 90 WDG)] (Simone *et* al.2000).

Provided that disease-free liriope plants are used in landscapes, occurrence of leaf and crown rot should be kept at a minimum. Fungicidal treatment of newly planted liriope may be an effective prophylactic strategy against infection by *Phytophthora* spp. and other potential pathogens. Symptomatic landscape liriope plants should be rogued and destroyed as quickly as possible after their discovery to minimize spread of the disease. The remaining symptomless liriope should be treated with the appropriate fungicides.

SURVEY AND DETECTION: Containerized liriope plants or landscape specimens exhibiting poor color or chlorotic new growth may be infected with *Phytophthora* spp. Necrotic basal leaf tissue may be observed on symptomatic leaves as infected foliage falls away from the crown as the disease progresses. Roots of diseased liriope plants may appear healthy, but close examination usually reveals a number of light brown necrotic roots from which *Phytophthora* spp. may be isolated.

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