

DRACAENA DECLINE AND ROOT ROT

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Introduction

The genus *Dracaena* includes about 40 species of tropical treelike shrubby plants, many of which are popular prized species used for interior and exterior landscaping. In Hawaii, cultivars of *D. fragrans*, *D. deremensis*, *D. marginata*, *D. reflexa*, and *D. sanderana* are important for landscaping as well as for export. *Dracaena surculosa* and *D. goldieana* are also grown for indoor use.

In recent years, severe root rot and poor growth of *Dracaena* have occurred at commercial nurseries on Oahu and Hawaii. Commonly, diseased plants were *D. deremensis* 'Warneckii' and 'Janet Craig', *D. fragrans* 'Massangeana', and *D. marginata*. This study was undertaken to determine the cause of this serious problem, and early findings are presented here.

Disease and Symptoms

In pots, diseased *Dracaena* is typified by stunted yellow leaves, wilted green leaves, or excessive numbers of dead lower leaves. Frequently, new leaves are small and affected plants fail to thrive months after planting. Potted plants also die or exhibit poor vigor, making removal necessary. Loss of a single cane in a pot disturbs the planting design and symmetry, thereby devaluing the pot, and reduces total production. In the field, affected stock plants also grow poorly, although dead plants are found less frequently.

Diseased root systems of potted *Dracaena* are reduced, brown, and necrotic. Larger roots with varying degrees of necrosis are frequently present, but smaller healthy, fibrous roots are few or absent. In severe cases, all roots are necrotic and no functional roots remain.

A cane rot has also been associated with plants exhibiting severe root rot. Frequently, the green epidermal layers at the base of the plant are killed and the cane becomes off-white to light brown internally.

Microscopic examination of the diseased roots revealed spherical fungal oospores, or

sexual spores (Fig. 1); inflated, lobate fungal growth resembling sporangia, or asexual spores (Fig. 2); and hyaline (colorless), narrow fungal threads, or hyphae, the vegetative stage of fungi. Diseased roots and cane specimens were washed, trimmed, and plated on sterile agar to isolate possible fungal pathogens. An examination for parasitic nematodes was also made, but only occasional root-knot nematode larvae were observed.

Causal Organism and Spread

A large number of fungal species was isolated from various disease samples collected from different nurseries. These organisms included *Thielaviopsis paradoxa*, *Fusarium* spp., *Cylindrocladium* sp., *Pythium splendens*, *P. graminicola*, other *Pythium* spp., *Phytophthora palmivora*, *Colletotrichum* sp., *Gliocladium* sp., and *Kutilakesopsis* sp. Pure cultures of all fungi isolated were established, and pathogenicity tests were initiated with some of these isolates.

Healthy 'Massangeana' plants were used for these tests. Plants were established from tip cuttings rooted in vermiculite, grown in a 1:1 mixture of vermiculite plus Sunshine Blend[®] 4, fertilized periodically with Osmocote[®] 14-14-14, and maintained in a glasshouse.

Fungi were individually tested by applying spore suspensions or macerated agar cultures to the root system. Plants were monitored for symptom development for two to three months. These tests demonstrated that six isolates of *Fusarium*, two isolates of *P. palmivora*, two isolates of *Pythium* spp., and one isolate of *Cylindrocladium* sp. were nonpathogenic. Root systems of plants inoculated with the above fungi remained healthy, as did the control plants, which received no fungi.

The single isolate of *P. splendens* tested was also nonpathogenic, but further testing of other isolates is required. *Pythium splendens* was isolated in high numbers from declining *Dracaena*. It commonly occurs in soil and is a serious root pathogen of several economic crops,



Figure 1. Photomicrograph of spherical, thick-walled *Pythium* oospore within infected *Dracaena* root cell.



Figure 2. Photomicrograph of lobate structures resembling *Pythium* sporangia within root cells of *Dracaena*.



Figure 3. Representative root systems of inoculated (left) and uninoculated (right) *Dracaena* plants.

such as papaya, cucumber, and certain ornamental plants. Pathogenicity tests of other *P. splendens* isolates collected from *Dracaena* are needed before this fungus can be discounted as a factor in *Dracaena* decline.

Thielaviopsis paradoxa caused slight vascular cane discoloration extending from the cut end of the rooted *Dracaena* cane, indicating that it is a weak wound pathogen. This fungus is known to cause severe rots of sugarcane and pineapple seed pieces.

Severe root rot developed on plants inoculated with *P. graminicola* (Fig. 3). Two months after inoculation, roots were in advanced stages of rot with 70 to 100 percent of the root system necrotic or lost. Infected roots were soft and fell apart easily. Above-ground decline symptoms were also evident, with inoculated plants producing small, stunted new leaves. The older leaves on inoculated plants were moderately chlorotic, dull green, slightly flaccid, or wilted.

Pythium graminicola has been difficult to isolate from diseased *Dracaena* and is frequently overrun by fungi such as *P. splendens*, *Fusarium* spp., and bacteria in isolation plates. The common occurrence of *P. splendens* and other *Pythium* spp. in diseased *Dracaena* has been particularly troublesome in these studies. These fungi grow aggressively in isolation plates, making slower growing pathogens difficult to isolate or observe. Many *Pythium* spp. occur regularly in soil and are saprophytic or nonparasitic. These organisms quickly invade plant tissue that has been destroyed or weakened by other pathogens. Efforts are continuing to improve detection of *P. graminicola* within diseased tissue and to readily distinguish it from *P. splendens* and other *Pythium* spp.

Control and Spread

Little is known about *Pythium graminicola* in Hawaii. It is known to cause root rot of corn and has also been reported on sugarcane. Its pathogenicity to *Dracaena* is a new record. Growth, multiplication, and spread of this fungus is favored by high moisture and temperatures of 24–30°C (75–86°F). Motile zoospores are produced in the presence of free water, although typical laboratory procedures to consistently produce abundant zoospores in axenic (sterile) cultures have been unsuccessful.

Until more is known about specific control measures, adherence to certain general principles will be necessary to manage this disease. With respect to fungal root diseases, the first principle of control is to reduce or eliminate inoculum or fungal spore levels. Movement of fungal spores spreads disease. Spore germination is rapid with free moisture and is quickly followed by fungal penetration of the host, resulting in disease establishment.

Lobate structures resembling *Pythium* sporangia are formed in large numbers in roots of inoculated plants. In water, these sporangia are known to release motile zoospores that are attracted to and infect roots. Oospores are also commonly formed in roots of diseased plants and tolerate a wide range of environmental conditions, enabling the fungus to survive for long periods in soil without the host. Their presence necessitates destruction of diseased plants by incineration or removal of these plants from the nursery. Avoid reusing media from pots with diseased plants without pasteurization or sterilization. Oospores will quickly germinate and repeat the disease cycle when plants are grown in contaminated media.

The second principle is the production of healthy plants through selection and protection of new clean cuttings. *Pythium* is a soil inhabitant, and the diseases it causes are mostly root rots or diseases of tissue and organs in contact with soil.

Stock plants inevitably will have some soil adhering to stems and leaves. In problem fields, these soil particles are likely to harbor spores of pathogenic fungi such as *Pythium*. Taking

cuttings as high above the soil line as feasible will minimize introducing infective propagules into the propagation area. If cuttings must be harvested close to the soil, *Pythium* contamination can be reduced or eliminated by scrubbing the lower cane surface to remove the dirt, then spraying with a dilute disinfectant such as a 10 percent solution of common household bleach. Dipping is not recommended, as it promotes bacterial diseases of the cane and foliage.

Cleaning and disinfecting knives, saws, or other cane-harvesting tools and keeping them off the ground during harvesting will reduce contamination. Harvested canes must be protected from direct contact with the soil surface in problem fields; a clean plastic tarpaulin may be useful for this purpose.

In the greenhouse, removal or isolation of diseased *Dracaena* plants will minimize disease spread to newly established plants. Since *Pythium* spreads through water movement, good field and bench drainage are critical. Avoid benches that drain horizontally, as fungal spores and bacteria can be easily spread from plant to plant. Snails and slugs also contribute to the movement of *Pythium* spores by ingesting diseased plant tissue with fungal spores and excreting the spores. The germination of these excreted spores is also known to be enhanced by passage through snails.

More studies are needed to resolve the *Dracaena* decline problem. Pathogenicity studies of other fungi such as *Gliocladium* and other *Pythium* species obtained from *Dracaena* must be continued, and pathogenicity to *Dracaena* of *P. graminicola* from other hosts such as corn must be determined. The occurrence of *P. graminicola* in fields adjacent to *Dracaena* is also important to the epidemiology and control of this disease. Studies are also continuing on chemical control and growth and reproductive requirements of *P. graminicola*.

This research was supported in part by the U.S. Department of Agriculture under CSRS Special Grant No. 89-34199-4430. Reference to a company or product name does not imply approval or recommendation of the product by the College of Tropical Agriculture and Human Resources, University of Hawaii, or the U.S. Department of Agriculture to the exclusion of others that may be suitable.