DESCRIPTION AND CONTROL OF THE RAPID DECAY OF SCINDAPSUS AUREUS INCITED BY ERWINIA CAROTOVORA

J. F. KNAUSS

IFAS Agricultural Research Center
Apopka
and

J. W. MILLER

FDACS, Division of Plant Industry
Gainesville

Abstract. Erwinia carotovora, a bacterium commonly associated with decays of plant storage organs, was found to produce a rapid, mushy decay of stems, leaves and petioles of Scindapsus aureus. The bacterium was isolated from diseased S. aureus tissue obtained from stock, propagation and finishing areas. Under foliage industry conditions, the most severe losses occurred during propagation, where E. carotovora combined with Pythium splendens to produce a rapid and severe cutting decay. In tests under grower conditions, pre-plant Dexon drenches (1 lb./100 gal. at 2 pt./sq. ft.) to propagation beds provided control of both pathogens. In tests conducted under controlled research conditions, Dexon applied as a dip or drench and streptomycin applied as a dip provided control of S. aureus cutting decay incited by E. carotovora.

Scindapsus aureus Engler is one of the most popular foliage plants grown in Florida for sale in northern markets. Production of *S. aureus* is often difficult because of diseases incited by the phytopathogens *Erwinia* spp. (6), *Meloidogyne* sp. (2), *Pythium splendens* Braun (3, 4, 10) and *Rhizoctonia* sp. (8).

During the Spring of 1971, a severe and rapid decay of unrooted *S. aureus* cuttings was observed to be a limiting factor in its propagation in a large Florida foliage nursery. Initial isolations from representative, diseased cuttings revealed the regular association of *P. splendens* with the decay. However, field evaluations with soil fungicides specific for the control of pythiaceous fungi provided some interesting unexpected results (4). Truban [5-ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole], found previously to be superior to Dexon [sodium-p-(dimethylamino) benzenediazosulfonate] in the protection of *S. aureus* from attack by *P. splendens* (3) and other hosts from attack by *Pythium* spp. (1, 3, 5, 7, 9), did not initially provide the same degree of disease control as Dexon (4). A search for an explanation resulted in the discovery that the bacterium *Erwinia carotovora* (L. R. Jones) Holland was also involved in the cutting decay. Preliminary tests on the control of *E. carotovora* cutting decay indicated that Dexon, known to be active against *P. splendens*, also provided some control of *E. carotovora*.

These investigations were undertaken to reproduce and describe the disease incited by *E. carotovora* and to evaluate the efficacy of Dexon in control of this bacterial plant pathogen.

Disease Description

Erwinia carotovora invades the leaves and petioles of potted plants and the stems, leaves and petioles of unrooted and rooted cuttings of *S. aureus*. Most severe disease development occurs under wet, warm to hot environments. Often, during periods conducive to optimal disease development, young emerging shoots of propagative cuttings will be completely blighted with the rot eventually progressing into the stems of cuttings.

Infection may occur through intact plant tissue but is enhanced by wounds in the plant epidermis. Infected plant tissue appears initially as a discrete water-soaked grayish green area which rapidly enlarges, becomes mushy and turns brown to black, eventually resulting in complete collapse of the affected plant propagation unit. If during leaf infection the environmental conditions become excessively dry, leaf lesions will turn a dry brownish-black, often with a yellow margin. Cuttings taken near the vine apex, and those taken from rapidly-growing vines are most susceptible to the pathogen. Infection of unrooted cuttings usually occurs through cut ends and in the area where aerial roots have been removed, with the decay eventually progressing into the petiole and lamina of the parent leaf. Complete collapse of the cutting may often occur within 2-4 days. Parent leaves of cuttings attacked by *E. carotovora* often turn a bright yellow as a result of the stem infection.

Materials and Methods

Two *E. carotovora* isolates, originally obtained

Florida Agricultural Experiment Stations Journal Series No. 4612.

from diseased *S. aureus* cuttings and designated P3 and P4, were utilized in this research. The former isolate was used in all 4 tests, the latter only in Test 4. The *S. aureus* vines from which cuttings were prepared were obtained from a foliage nursery in Apopka, Florida and were selected for uniformity of growth and apparent freedom from disease. Within each test, all treatments contained the same number of similar-aged cuttings to reduce, as far as possible, variations in susceptibility, in time of rooting and in growth of the new shoot which might arise as a result of variations in cutting age alone. Cuttings were planted, 3 per 4 inch pot, in a steam sterilized mix of 1 part German and 1 part domestic[1] peat plus 5 lbs. dolomite per cubic yd.

Inoculum used in Tests 1, 2 and 3 consisted of a 6 to 7-hr-old nutrient broth culture of isolate P3 grown at room temp (25C ± 2) on a platform shaker. Some treatments received inoculum diluted prior to infestation in various proportions with sterile tap water. In Test 4, 600 ml of the undiluted inoculum was centrifuged for 10 min., the supernatant decanted off, and the bacterial cells resuspended with sterile tap water to 1200 ml. The isolates were routinely transferred and maintained on Lima Bean Agar at 21C. Prior to each test, isolate pathogenicity was determined by spraying artifically-injured leaves of several young *S. aureus* plants with inoculum prepared as stated previously for Tests 1, 2 and 3. Inoculated plants were placed in a mist chamber (15 sec. every 30 min.) and observed 24 hr. later for disease development. Virulent cultures of the isolates caused severe and rapid leaf rot of the inoculated, injured leaves within this time period. If poor disease development occurred, the pathogen was reisolated and the process repeated until a high degree of pathogenicity was noted in the *E. carotovora* reisolated culture to be used.

Four tests were performed under glasshouse conditions (ambient temp. 21-37C) during the period encompassing 3-15-72 to 8-29-72. Each treatment contained 5 pots in Tests 1, 3, and 4, while 10 pots were employed per treatment in Test 2. The methods of infesting the planting medium with the pathogen during the research period were: pouring pre- (Tests 1, 2) or post-plant (Test 3), 45 ml of inoculum on the medium surface; and a pre-plant dip (Tests 3, 4) of unrooted cuttings in the inoculum for 5 min.

After dip inoculation of cuttings with the pathogen, the cuttings were allowed to blot on paper toweling for about 1 min. The following chemicals were applied as a post-plant soil drench (soil infested) (200 ml/4 inch pot) and/or as a post-inoculation cutting dip (dip inoculated) 5 or 10 min., for control of *S. aureus* cutting decay incited by *E. carotovora*: 2,4 diguanidino-3,5,6-trihydroxycyclohexyl-5-deoxy-2-*o*-(2-deoxy-2-methylamino-a-glucopyranosyl)-3-formyl pentofuranoside (streptomycin 17%) (strepto.) and sodium-p-(dimethylamino) benzenediazosulfonate (Dexon 35 WP) (Dex.).

After infestation and chemical treatment, the potted cuttings were placed under mist (15 sec. every 30 min.) for 7, 7, 5 and 7 days in Tests 1, 2, 3 and 4, respectively. After termination of mist, daily hand watering was initiated until conclusion of the experiment. To obtain information on the effect of the various treatments on subsequent growth of the cuttings in Test 4, the unrotted cuttings were allowed to root and weekly liquid fertilization application (2 lb. of 25-5-30 per 100 gal. water) was initiated at 21 days and continued until termination of the experiment (47 days).

Results and Discussion

Both isolates of *E. carotovora* and all methods of inoculation produced cutting stem rot symptoms (Fig. 1) identical to those observed under commercial foliage nursery conditions whereas the non-infested controls remained healthy in all tests. Dexon 35 WP, applied as either a post-plant drench (Fig. 2) or as a pre-plant dip (Fig. 3) of *E. carotovora*-infested unrooted *S. aureus* cuttings, effectively controlled the pathogen (Tables 1, 2, 3). Streptomycin employed as a pre-plant

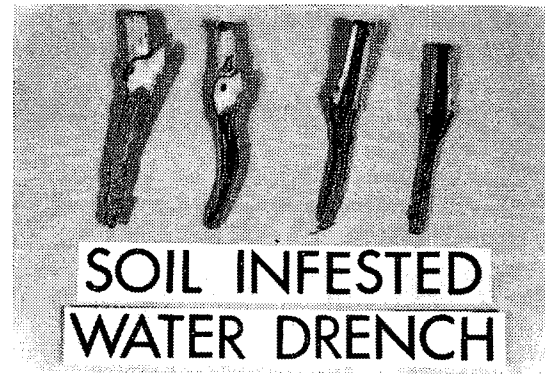

Fig. 1. Test 3. Symptoms of cutting rot of Scindapsus aureus produced 5 days after a tap water drench to unrooted cuttings previously infested with Erwinia carotovora.

[1]Peace River Peat, Bartow, Florida 33830.

Fig. 2. Test 3. Control of cutting rot of Scindapsus aureus 5 days after Dexon application to unrooted cuttings previously infested with Erwinia carotovora.

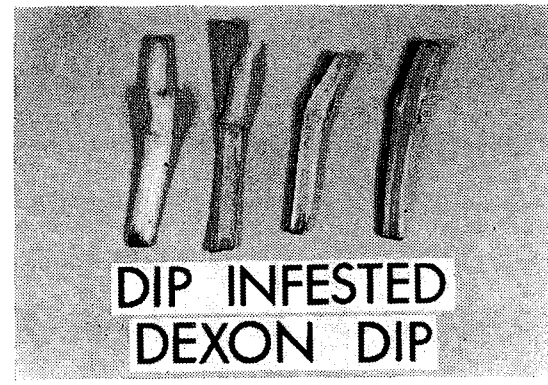

Fig. 3. Test. 3. Control of cutting rot of Scindapsus aureus 5 days after a Dexon dip prior to planting of unrooted cuttings previously dipped for 5 min. in a suspension of Erwinia carotovora.

dip also provided effective control (Table 2). Dexon, 1 lb./100 gal. water, used as a 10 min. dip of non-inoculated cuttings, did not appreciably affect rooting and subsequent growth when compared to the non-Dexon dipped, non-inoculated controls (Table 3). Since the dipping process followed soon after inoculation, Dexon might have its control effect through a simple dilution of the inoculum in these tests. This does not appear to be the case because no difference occurred between sterile tap water dipped and non-dipped infested controls (Table 2). This indicates that the activity of Dexon is strongly suggestive of being bactericidal in nature.

The data presented here indicate that in the previous research (4) on the control of *P. splendens* cutting decay of *S. aureus*, the unexpected superiority of Dexon 35 WP drenches over those employing Truban 30 WP was due to Dexon's ability to control the cutting decay caused by *P. splendens* and *E. carotovora*, both of which are often present in Florida foliage propagating areas.

Table 1. Tests 1,2. Cutting decay of Scindapsus aureus incited by Erwinia carotovora. Efficacy under Florida glasshouse conditions of Dexon drenches (1.0 lb/100 gal water at rate of 200 ml/4 inch pot) applied to previously infested unrooted cuttings.

Treatment	Inoculum dilution[y]	Avg disease rating[z] Test 1 (12 days)	Test 2 (10 days)
Infested	None	4.4	3.3
Infested : Dexon	None	2.1	2.2
Infested	1:1	2.8	3.1
Infested : Dexon	1:1	2.1	2.1
Infested	1:3	2.8	--
Infested : Dexon	1:3	1.4	--
Non-infested	--	1.1	1.4
Non-infested : Dexon	--	1.3	--

[y]Inoculum = 6 to 7-hr-old nutrient broth shake culture of isolate P3 grown at 25C ± 2. Dilutions made with sterile tap water.

[z]Avg of 15 cuttings, 3/pot, 5 pots/treatment and of 30 cuttings, 3/pot, 10 pots/treatment in Tests 1 and 2, respectively. Disease rating: 1 = no symptoms; 2 = slight pith discoloration, no stem rot; 3 = slight stem rot; 4 = moderate stem rot; and 5 = severe stem rot.

Table 2. Test 3. Cutting decay of Scindapsus aureus incited by Erwinia carotovora. Comparative efficacy of Dexon and streptomycin applied as a post-plant drench (200 ml/4 inch pot) to unrooted cuttings planted in infested soil and as a 5 min dip of previously infested unrooted cuttings.

Treatment	Conc per 100 gal water	Avg disease rating[z] (5 days)
SOIL INFESTED:CHEMICAL DRENCH		
Dexon 35 WP - infested	1.0 lb[w]	2.4
Control - infested	--	5.0
Control - noninfested	--	2.0
DIP INFESTED:CHEMICAL DIP		
Dexon 35 WP - infested	1.0 lb[w]	2.4
Streptomycin 17% - infested	200 ppm[x]	1.7
Control - infested	--	5.0
Control - infested[y]	--	5.0
Control - noninfested	--	1.9
Control - noninfested[y]	--	1.9

[w]Based on formulated product.

[x]Based on active ingredient.

[y]Followed by 5 min dip in sterile tap water.

[z]Avg of 15 cuttings, 3/pot, 5 pots/treatment. Disease rating: 1 = no symptoms; 2 = slight pith discoloration, no stem rot; 3 = slight stem rot; 4 = moderate stem rot; and 5 = severe stem rot.

Table 3. Test 4. Cutting decay of Scindapsus aureus incited by Erwinia carotovora. Effect of Dexon (1.0 lb/100 gal water) applied as a 10 min dip of unrooted cuttings previously infested with E. carotovora isolates P3 and P4 on disease control and subsequent growth of rooted cuttings.

Treatment	Conc per 100 gal	Avg disease rating[x] (7 days)	Total no rooted (47 days)	Wt new shoot (g)[y] (47 days)	Total nodes produced (47 days)
ISOLATE P3 DIP					
Dexon 35 WP	1.0 lb	2.5	14	5.5	55
Sterile Tap Water	--	4.5	3	2.4	8
ISOLATE P4 DIP					
Dexon 35 WP	1.0 lb	2.1	12	4.6	44
Sterile Tap Water	--	4.9	4	2.9	13
STW[z] DIP					
Dexon 35 WP	1.0 lb	1.9	15	6.4	66
Sterile Tap Water	--	2.0	15	7.2	65

[x]Avg of 15 cuttings, 3/pot, 5 pots/treatment. Disease rating: 1 = no stem rot; 2 = very slight rot, 1-5% of stem; 3 = slight rot, 6-25% of stem; 4 = moderate rot, 26-50% of stem; and 5 = severe stem rot, 51-100% of stem.

[y]Avg of total no cuttings rooted/treatment.

[z]STW = sterile tap water.

Although streptomycin provides adequate control of *E. carotovora*, it was shown under field conditions (4) incapable of controlling the cutting decay of *S. aureus* incited by both *E. carotovora* and *P. splendens*.

This appears to be the first report of the activity of Dexon against the bacterial plant pathogen, *E. carotovora*.

Literature Cited

1. Engelhard, Arthur W., H. N. Miller and R. T. DeNeve. 1971. Etiology and chemotherapy of **Pythium** root rot on chrysanthemums. **Plant Disease Reptr.** 55:851-855.
2. Kemp, W. G. 1953. A nematode associated with a root rot of **Scindapsus. Plant Disease Reptr.** 37;614-616.
3. Knauss, J. F. 1972. Description and control of **Pythium** root rot on two foliage plant species. **Plant Disease Reptr.** 56:211-215.
4. Knauss, J. F. 1972. Field evaluation of several soil fungicides for control of **Scindapsus aureus** cutting decay incited by **Pythium splendens** Braun. **Plant Disease Reptr.** 56:1074-1077.
5. McCain, A. H. and T. G. Byrne. 1966. Chemical control of **Pythium** root rot in ornamentals with Dexon and Terrazole. **Cal. Agr.** 20:14-15.
6. McFadden, Lorne A. 1961. Nature, cause and control of diseases of tropical foliage plants. **Fla. Agr. Expt. Sta. Ann. Rept.** 1961:356.
7. Miller, H. N. and R. T. DeNeve. 1971. Disease control of bedding plants with the use of 5-ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole. **Plant Disease Reptr.** 55:587-590.
8. Millikan, D. F. and J. E. Smith, Jr. 1955. Foot rot of pothos, a disease caused by **Rhizoctonia. Plant Disease Retpr.** 39:240-241.
9. Raabe, R. D. and J. H. Hurlimann. 1970. Fungicide mixes for poinsettia root rot control. **Cal. Agr.** 24: 9-10.
10. Tisdale, W. B. and George D. Ruehle. 1949. **Pythium** root rot of aroids and easter lilies. **Phytopathology** 39:167-170.

STEM AND LEAF ROT OF PEPEROMIA INCITED BY SCLEROTIUM ROLFSII

S. A. ALFIERI, JR.

FDACS, Division of Plant Industry
Gainesville

J. F. KNAUSS

IFAS Agricultural Research Center
University of Florida
Apopka

Abstract. **Stem and leaf rot incited by** Sclerotium rolfsii **is a previously undescribed and often serious disease of** Peperomia obtusifolia, **a foliage plant of increasing commercial importance and significant aesthetic value to the homeowner. In three separate replicated trials employing rooted and/or unrooted cuttings, the fungus** S. rolfsii **was clearly established as a causal agent producing a stem and leaf rot of** P. obtusifolia. **Of the six fungicides tested for disease control, Terraclor was most effective while Demosan, Fermate and Plantvax also provided control. All fungicides tested proved phytotoxic to** P. obtusifolia **as reflected by a reduction in top weight. Vitavax and MC-5077 were significantly more phytotoxic at the concentrations employed.**

Peperomia (*Peperomia obtusifolia* A. Dietr.), both variegated and nonvariegated, is a popular foliage plant grown in Florida. It is a member of the pepper family, Piperaceae, native to South America and is one of a few species of the genus grown as an ornamental plant (4). As a foliar ornamental, *P. obtusifolia* is enjoyed for both its beautiful succulent leaves which vary in shape and the variegation present in many of its diverse varieties. It represents nearly a quarter million dollars of Florida foliage industry's annual sales; therefore, peperomia is important economically to foliage growers and is valued by homeowers who desire plants of lasting beauty, free from disease. Relatively few serious diseases affect peperomia. These include crown rot caused by *Phytophthora parasitica* (8), edema (1, 7), ringspot (5) and Rhizoctonia rot (6). To this group can be added southern blight, a disease characterized by stem and leaf rot, often producing devastating effects.

Sclerotium rolfsii Sacc., the causal pathogen of southern blight, is well recognized as affecting an extensive number of host plants (2, 3). Southern blight is particularly destructive during vegetative propagation of *P. obtusifolia* under greenhouse conditions when the environment is hot and wet.

The purpose of this study was to reproduce the disease, describe its symptoms, and develop effective means of control with a consequent reduction of losses, coupled with minimal or no phytotoxicity.

Methods and Materials

A pure culture of *S. rolfsii* isolated from an infected plant exhibiting symptoms of stem and leaf rot indicative of southern blight was grown

Contribution No. 335, Bureau of Plant Pathology.