SECTION 5

PATHOLOGY AND NEMATOLOGY

Dr. Alan Windham
Section Chairman and Moderator

Observations of Downy Mildew of Rose at Retail Nurseries

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Nature of Work: Hybrid tea roses (Rosa sp.) are a popular landscape plant and an important sales item for most retail nurseries in Tennessee, despite disease problems that plague this group of plants. Most nurserymen are familiar with diseases such as black spot and powdery mildew, but not downy mildew caused by Peronospora sparsa Berk. Downy mildew can be extremely destructive to roses grown in greenhouses, nurseries and outdoor plantings in warm, humid regions (1,3). In 1992, downy mildew damaged hundreds of thousands of roses and caused millions of dollars in losses in retail and wholesale nurseries along the Gulf Coast of Texas and Louisiana (Larry Barnes, Texas A & M University, personal communication). This was one of the most recent reports of downy mildew since the disease was reported on roses in Georgia in 1977 (2). In April and May 1993, the first two cases of downy mildew of rose were reported in Tennessee. This report details downy mildew epidemics at two retail nurseries.

Results and Discussion: Downy mildew was identified on hybrid tea roses from two retail nurseries in Humphreys and Dickson counties. Both nurseries received dormant, bareroot roses from wholesale nurseries in Texas in February, potted the plants and placed them in polyhouses. By late April, the majority of the roses at both nurseries had developed purplish to red irregular leaf spots and exhibited severe leaf abscission; some roses exhibited chlorotic leaves and purple stem lesions several inches in length. Sporangiophores and sporangia of P. sparsa were observed on lower leaf surfaces. Over 1000 plants of twenty cultivars exhibited symptoms of downy mildew at both nurseries (Table 1). No cultivars at either nursery were completely free of disease. Plants were unsalable due to leaf loss and cane death. At one nursery, roses in landscape plantings adjacent to the nursery were unaffected by downy mildew. Also, the Plant and Pest Diagnostic Clinic in Nashville did not receive any rose specimens with downy mildew from landscape plantings.

Significance to the Industry: Downy mildew has been reported to overwinter on dormant roses. Based on the destructiveness of this disease and the speed at which it can spread, growers at retail nurseries should apply fungicides with the advent of new growth. It appears that the environment in polyhouses, along with overhead watering create ideal conditions for epidemics to occur in mid to late Spring.

Aliette (fosetyl al) is labeled for control of downy mildew of rose. Daconil 2787 (chlorothalonil) and Fore (mancozeb) are labeled for black spot of rose and should have activity against this disease. Pace (mancozeb and metalaxyl) has received a special local need registration in Texas and may become available for use in other states. This is the first report of downy mildew of rose in Tennessee.

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Table 1. Rose cultivars exhibiting symptoms of downy mildew at retail nurseries.

Blaze	Maiden Voyage
Bonica	Olympiad
Camelot	Oregold
Chicago Peace	Paradise
Chrysler Imperial	Pink Peace
Classie Lassie	Shreveport
Climbing Joseph’s Coat	Summer Sunshine
Climbing Orchid Masterpiece	Today
Honor	Touch of Class
King’s Ransom	Tropicana

Site Parameters That Affect Dogwood Anthracnose Incidence and Severity

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Nature of Work: Dogwood anthracnose disease severity was assessed in plots (10 dogwood trees/ plot) located in either north, south, east, or west aspects (four plots/ aspect). Evaporative demand was measured in plots with southern and northern aspects with Livingston atmometers. Evaporative demand is dependent on variables such as wind speed, temperature, humidity, rainfall, and light intensity and estimates how fast water evaporates from surfaces (such as leaves).

In another study, the level of dogwood anthracnose lesion expansion was measured on the north, south, east, and west sides of dogwood tree canopies located in full sun or in full shade (4 trees/ light treatment). Lesions were categorized as either purple rimmed lesions (typical anthracnose lesions) or necrotic lesions (no colored border). Lesions were collected after six weeks and placed in moist chambers. The percentage of lesions with acervuli (fruiting bodies) and cirri (spore masses) were determined after the lesions had been incubated for 48 hours.

Results and Discussion: Dogwood anthracnose symptoms were most severe on trees growing on slopes with north aspects (Fig. 1). Trees growing on east, south, and west (E-S-W) aspects had similar levels of disease. In plots with northern aspects, water evaporated more slowly from the atmometer surface (Fig. 2) than from atmometers located on south slopes. This indicated that water evaporated more slowly on surfaces on the northern slopes and thus vegetation on northern slopes would remain wetter for longer periods of time. These observations agree with Chellemi and Britton (1) who found that increased leaf wetness was associated with increases in dogwood anthracnose severity.

For individual trees, foliage on the north side of dogwood trees displayed the most severe anthracnose symptoms and east facing foliage had the least amount of disease. Most lesions on trees located in full sun were typical anthracnose lesions with red-purple borders (Fig. 4). Necrotic lesions were the most frequently observed on tree foliage located in full-shade. Necrotic lesions were more like to have fungal fruiting bodies and spore masses. Whether the purple rimmed lesion is indicative of plant defensive responses or fungal stress (due to higher leaf temperatures or increased light intensity) is unknown. However, inoculum necessary for secondary epidemics would be reduced in environments where purple rimmed lesions were the predominant lesion type.

Significance to Industry: Dogwood anthracnose is microclimatic dependent. Trees growing on E-S-W aspects were less affected by the disease than trees growing on north aspects. In areas where dogwood anthracnose is severe, dogwood plant on the appropriate aspect (E-S-W) would fare better than trees planted on north slopes. Trees growing in full sun have fewer disease lesions in which the fungus can sporulate. This may explain why dogwoods growing in full sun are less affected by dogwood anthracnose than are trees growing in full shade.

Literature Cited:

1. Chellemi, D. O. and Britton, K.). 1992. Influence of canopy microclimate on incidence and severity of dogwood anthracnose . Can. J. Bot. 70:1093-1096.

Fig. 1. Affect of plot aspect (slope) on dogwood anthracnose disease severity. For each column, bar = standard deviation (p = 0.05) .

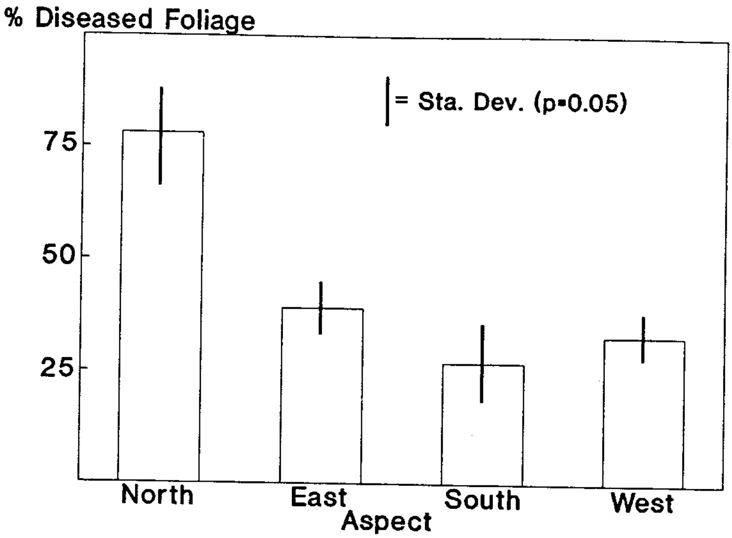


Fig. 2. Rate of water evaropation (evaporative demand) as measured by Livingston atmometers located near dogwoods growing on either southern or northern slopes. Bars = standard deviation (p= 0.05).

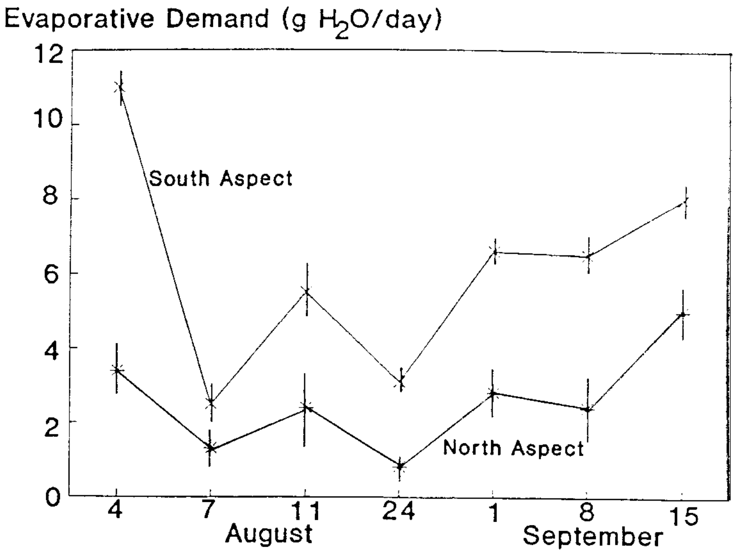
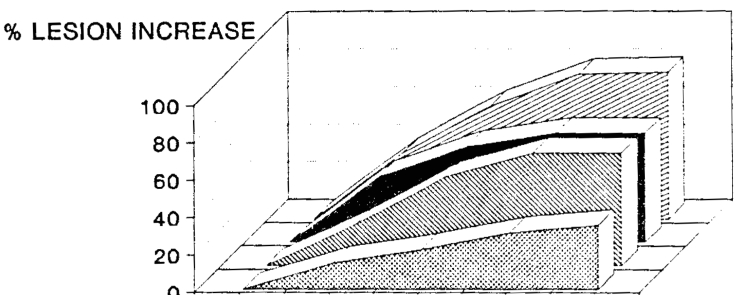
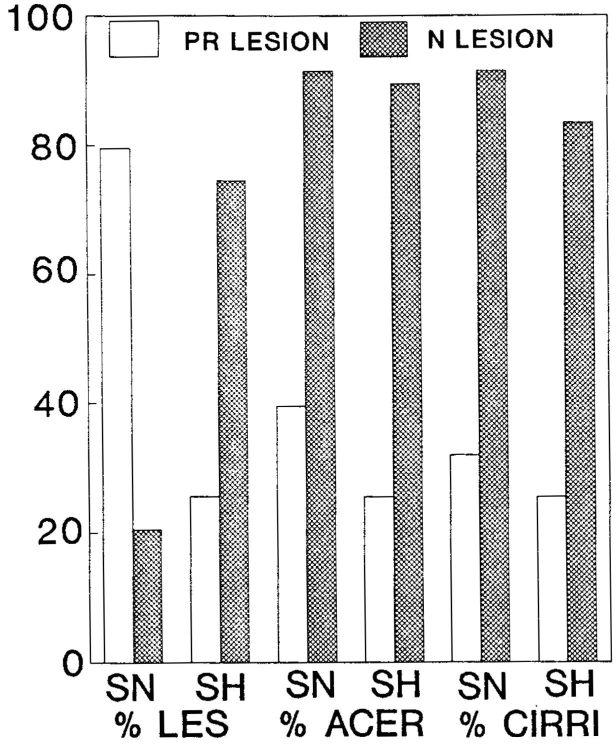


Fig. 3. The affect of tree aspect (side of tree) on dogwood anthracnose disease severity.



	5/29	6/6	6/13	6/20	7/3
NORTH	0	35	60	77	78
WEST	0	35	51	58	58
SOUTH	0	22	47	60	60
EAST	0	14	21	30	34

Fig. 4. Percent purple-rimmed (PR) and necrotic (N) lesions observed on six leaves on each of four trees growing in full sun (SN) or full shade (SH). For each lesion type, the percentage of lesions with acervuli (% acer) and with cirri (% cirri) was recorded after the leaves were harvested and placed in moist chambers for 48 hr.



Dogwood Anthracnose Resistance in Cornus Species

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Tennessee

Nature of Work: Cultivars of nine *Cornus* species were evaluated at Great Smoky Mountain National Park (GSMNP) and Ozone, TN for dogwood anthracnose resistance. Trees of *C. alba* 'Bloodgood', *C. alba* 'Elegantissma Variegata', *C. alternifolia*, *C. amomum*, *C. augustata*, *C. controversa*, *C. kousa*, *C. kous*a var. *chinensis*, *C. mas*, *C. mas* 'Golden Glory', *C. redoisier* 'Ruby', *C. sericea* 'Flaviramea', *C. sericea* 'Kelseyi', and *C. sericea* 'Isanti' were obtain from Owen Farms (Ripley, TN 38063). Trees of C. florida 'Cherokee Princess' were obtained from Commercial Nursery (Dechard, TN 37324). Trees were transplanted into five gallon containers and transported to GSMNP May 18, 1992 and to Ozone, TN May 20, 1992. These sites were selected because of the high incidence of dogwood anthracnose in native dogwood population. Trees of each species were placed under the canopies of diseased dogwoods exhibiting severe symptoms of dogwood anthracnose. At each location, trees were arranged in a randomized block design with six replications.

Disease development the test trees was assessed using a pictorial diagram of a modified Horsfall-Barratt scale (Windham and Ross). Disease severity ratings were converted to percent diseased leaf area using conversion tables developed by Redman et al. Collected data were analyzed with analysis of variance and Duncan's New Multiple Range Test. Samples of systematic leaf tissue were harvested and infections by Discula destructiva was confirmed in the laboratory.

Results and Discussion: Discula destructiva was isolated from lesions of disease foliage of all Cornus species and cultivar tested at both locations. The F test for locations was not significant and the data for the two locations were combined. Disease response could be divided into two groups: resistant (Fig. 1) and susceptible (Fig. 2). *C. controversa* was rated as susceptible in a study in the previous year at Ozone, TN (Brown et al). but was considered resistant in this studied since symptoms were observed on less than 25% of the foliage.

In addition to differences in susceptibility between *Cornus* species, differences were noted within species of *C. kousa*, *C. sericea*, and *C. alba*. *C. kousa* seedling were rated as resistant and *C. kousa* var *chinensis* were rated as susceptible. Whereas cultivars *C. alba* and *C.*

serciea were designated as susceptible cultivars but differing in severity of symptoms (Fig. 2).

Significance to Industry: Dogwood species differed in susceptibility to dogwood anthracnose. Differences were observed both at the species and cultivar levels. Therefore, species should no longer be rated as susceptible of resistant and that such terminology should be reserved for lines that have been vigorously tested under field conditions.

Figure 1. Disease severity of Cornus species that were rated susceptible (>25% foliage diseased). For each sampling date, bars with the same letter do not differ according to Duncan's New Multiple Range Test (p = 0.05). Abbreviations are C.f.= *C. flordia*, C.s.K.= *C. sericea* 'Kelseyi', C.s.F.= C. sericea 'Flaviramea', C.s.I.= *C. sericea* 'Isanti', C.k.C.= *C. kousa* var. *Chinensis*, C.a.E.= *C. alba* 'Elegantissma Variegator', C.a.B.= *C. alba* 'Bloodgood.

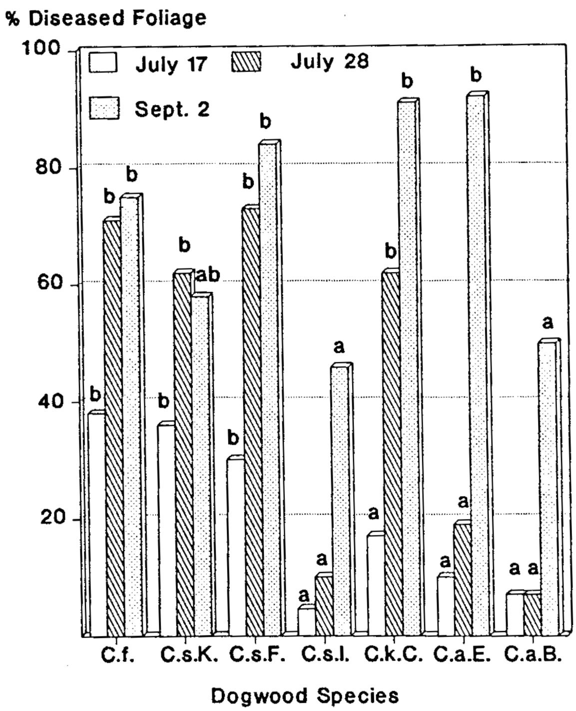
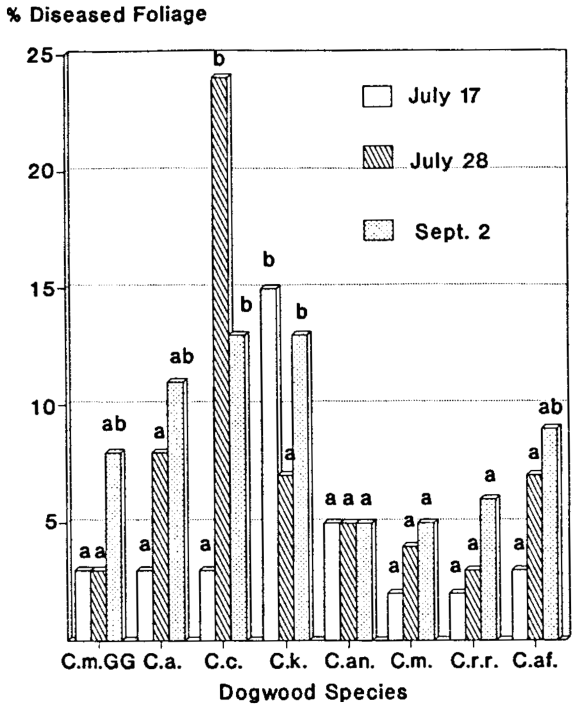


Figure 2. Disease severity of Cornus species that were rated resistant (<25% foliage diseased). For each sampling date, bars with the same letter do not differ according to Duncan's New Multiple Range Test (p = 0.05). C.m.GG= *C. mas* 'Golden Glory', C.a.=*C. amomum*, C.c.= C. *controversa*, C.,.= *C. kousa*, C.an.= *C. auqustata*, C.m.= *C. mas*, C.m.= *C. mas*, C.r.r.= *C. redoisier* 'Ruby', C.af.= *C. alternifolia*.



The Sensitivity of Bedding Plants to Southern Root-Knot Nematode, *Meloidogyne incognita,* Race 3

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Georgia

Nature of Work: Bedding plants comprise 34% of the gross sales of Georgia's $154M floricultural crops industry (4,8). The state's long growing season is conducive for excellent bedding plant development and prominent flower color. The warm temperatures, and usually adequate moisture, are conducive as well for diseases caused by various pathogens, including nematodes.

Genetic resistance is the best strategy for nematode control. However, with a few exceptions such as marigolds (1,2,3,6), limited information is available to the producer on the sensitivity of current bedding plant cultrvars to the common root-knot nematode species (g). The decreasing number of nematicides commercially available emphasizes the need for information on plant resistance to common nematodes particularly as producers and growers move toward total plant-health care or IPM programs.

The purpose of these studies was to evaluate the sensitivity of 32 bedding plant cultivars (10 species) to *Meloidogyne incognita,* Race 3.

Each cultivar, except begonia, was seeded directly in three 6-cellpacks (51/4 x 4 in., 13.5 x 9 cm) containing steam pasteurized soil: Fafard No. 3 mix (2.1). Begonia were seeded seperately in 3 in.(7cm) pots of the same mix, then transplanted to the plastic cellpacks at the 3/4 in.(2cm) seedling stage. When all plants were 1.5-2.4 in.(4-6cm) tall, nematode eggs, havested by the sodium hypochlorite method (5) from egg plant (cv. Black Knight), were added at two rates, 50 or 200 eggs per cell. The plants were watered daily and fertilized biweekly with 1/8 oz/gal. (2.5 g/l) Peters 20-20-20 water soluble fertilizer. Six to 8 weeks following infestation, plants were harvested from the cellpacks, the root systems washed well of the growing medium, and the roots examined for nematode galls. The plant fresh and dry weights were determined.

Bedding plant cultivars which did not develop any root-knot galls were classified as resistant (7), those with a mean value of l.0 or less per plant were classified as slightly susceptible, and those cultivars averaging more than 1.0 gall per plant were categorized as susceptible. Data were analyzed by analysis of variance and subjected to Duncan's multiple range test to distinguish significant differences in means ($P = 0.05$).

Results and Discussion: All cultivars of ageratum, marigold, and two cultures of salvia that we tested were classified as resistant to the Race 3 of *Meloidogyne incognita*. No galls were observed at either infestation levels after 8 weeks under greenhouse conditions. Certain cultivars of begonia, salvia, vealena, and vinca were slightly susceptible, as was the one cultivar of gerbera tested. Other cultivars of begonia, one cultivar of dianthus, three pansy and all three celosia varieties were susceptible. A list of the cultivars for each species tested with their respective ratings is provided in Table 1.

Although root-knot nematodes commonly do not stunt the growth of bedding plants in one season, the repeated planting of susceptible cutivars in the same location could increase nematode populations to damaging levels. Conversely, utilizing resistant cultivars in areas known to be infested with this common garden nematode should lower nematode populations, thereby resulting in better plant gowth.

Significance to Industry: Knowledge concerning the resistance of bedding plant species and/or cultivars to the most common plant parasitic nematodes could create greater industry awareness in this means to conkol nematodes. The findings should be useful to growers and landscape professionals in advertising potential for planting nematode resistant plants as a environmentally safe plant health care strategy, especially where altemative controls are unavailable or not economical.

We are grateful to Ball Seed Co., a Division of Geo. J. Ball, Inc., West Chicago, Illinois for providing seed for these investigations.

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Table 1. Rating of bedding plant cultivars to infection by southern root-knot nematode, *Meloidognne incognita,* Race 3 at two infestation levels.

		Rating[1] Nematode Eggs/3 cu in.(50 cm^3)	
Species	Cultivars	50	200
Agerabum	Blue Blazer	R	R
	Blue Danube	R	R
	Hawaii White	R	R
	Royal Delft	R	R
Begonia	Cocktail Gin	SS	S
	Cocktail Vodka	R	SS
	Party Love	SS	S
	Pizzazz Deep Rose	SS	S
	White Bronze	SS	S
Celosia	Apricot Beauty	S	S
	Castle Scarlet	S	S
	Cockscomb Fireglow	S	S
	Kimono Cream	S	S
Dianthus	Princess Scarlet	S	S
Gerber	Crimson	SS	SS
Marigold	French, Golden Gate	R	R
	Hybrid, Inca Gold	R	R
Pansy	Coronation Gold	SS	S
	Joker Jolly	S	S
	Padparadja	SS	S
Salvia	Carabiniere Red	R	SS
	Hotline Red	R	SS
	Hotline White	SS	SS
	Rhea	R	R
	Victoria Blue	R	R
Verbena	Deep Blue	SS	SS
	Showtime Blaze	S	S
Vinca	Carpet Dawn	SS	SS
	Cooler Grape	SS	S
	Little Blanche	SS	SS
	Little Delicata	SS	SS

Rating based on mean number of root gails recorded; R=none (resistant) SS=l.0 or less/plant (slightly susceptible), S=>1.0 (plant susceptible).

Effect of Garlic Extracts on Dogwood Anthracnose Fungi

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Nature of Work: Extracts of garlic (Allium sativum L.) are bactericidal and fungicidal against a number of plant and animal pathogens (1,3). Sprays of aqueous extracts of garlic have been effective in controlling downy mildew, scab, and angular leaf spot of cucumber; anthracnose and bacterial blight of beans; and brown rot of stone fruits in greenhouse trials (1).

Dogwood anthracnose, a serious disease of flowering dogwood (Cornus florida L.), caused by fungi in the genus Discula, is now epiphytotic in the eastern United States from New York to Alabama. The disease is believed to be spread by dissemination of conidia from infected leaves and stems. The purpose of this study was to determine the effect of garlic extracts on mycelial growth and the survival of conidia from Discula sp. associated with dogwood anthracnose.

Isolates of Discula were obtained from leaf lesions or infected twigs from flowering dogwood and were maintained on potato-dextrose agar (PDA). Conidia were harvested in distilled water from 2- to 4-week-old cultures grown on oak medium (2). PDA was used for agar plate tests and potato-dextrose broth (PDB) for tube tests.

Ten percent stock solutions of homogenized fresh garlic cloves and garlic powder (French's) were filter sterilized. The powder contained tricalcium phosphate as a free flow agent. Garlic oil (ECKERD) was obtained directly from soft-gel capsules containing oil from 1500 mg garlic bulbs per capsule.

Conidial suspensions were adjusted to 1 X 106 spores/ml. For the agar plate tests, 0.1 ml of spore suspension was spread over the plate, a sterile paper disk was placed in the center of each plate, and 100µl garlic solution (10%) or garlic oil was placed on the disk. Plates were prepared in triplicate and incubated at room temperature. Zones of inhibition were measured after 6 days. For tube tests, tubes containing 5-6 ml each of garlic solution were inoculated with 0.1 ml of the 1 X 10^6/ml spore suspension or with 6 mm round plugs from 2- to 4-week-old mycelial cultures on PDA. Samples of 0.1 ml were removed from tubes containing spore inocula immediately after mixing and at 1 hr, 2 hr, 3 hr, and 5 hr intervals and placed in tubes containing 5 ml of PDB without garlic. Mycelial plugs were removed after 5 and 24 hr and placed in PDB. All tubes were incubated at room temperature and examined for growth at 1 and 2 weeks.

Results and Discussion: With the agar plate method, 10% solutions of garlic inhibited germination of conidia from 37/37 (Table 1) isolates. Zones of inhibition averaged 5.4 cm (disk diameter = 1.3 cm) with fresh clove extract and 2.4 cm with garlic powder (14 isolates tested). The garlic oil was not effective.

Conidia from 8/8 isolates were killed following 1 min or more exposure to 5% and 10% solutions of both the clove extract and the powder in test tubes. A 1% concentration of fresh clove extract killed spores from 7/8 isolates after 5 hr exposure, but with a 1% solution of the powder, all eight isolates grew when transferred following all exposure times. Like the agar plate results, garlic oil was ineffective and growth was positive in all control tubes.

No growth of mycelial plugs from 10/10 isolates occurred following exposure to 5% or greater solutions of fresh garlic extract for 5 or more hr. Concentrations of 0.1% to 0.5% were ineffective against mycelial plugs exposed for 24 hr, but growth of plugs of 5/10 isolates was inhibited by exposure to a 1% solution of fresh garlic extract for 24 hr.

These results indicate that 5% and 10% solutions of garlic clove extracts are fungicidal and sporicidal in 5 hr for all of the Discula isolates tested. Solutions of commercially available garlic powder also were sporicidal at 5% and 10%, but were not tested against mycelial plugs. Garlic oil in commercially available softgel capsules was ineffective. Allicin, the active ingredient in garlic, is heat sensitive and may be destroyed in processing of softgel capsules.

Spores are more sensitive to garlic than hyphae. Spores from 7/8 isolates were killed after 5 hr exposure to a 1% solution of fresh garlic extract, but growth of mycelial plugs from only 1/10 isolates was inhibited under the same conditions.

Significance to Industry: Foliar sprays of garlic extracts may be useful in preventing dogwood anthracnose in nursery seedlings or in small landscape trees. Field trials using container-grown seedlings placed under naturally infected C. florida trees are now in progress.

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TABLE 1
INHIBITION OF GERMINATION OF DISCULA CONIDIA

ZONES OF INHIBITION ON PDA (CM)*
(MEAN OF THREE PLATES)

ISOLATE	ZONE	ISOLATE	ZONE
96	5.8	158	6.5
97	4.4	159	6.5
98	4.5	160	**
99	**	163	**
100	4.5	165	6.9
101	4.6	168	7.3
102	4.4	169	**
103B	4.4	174	6.5
104B	4.7	176	6.8
106	4.2	177	6.8
109	5.3	178	6.0
110A	5.3	180	5.3
110B	4.5	181	6.1
111A	4.2	183	7.1
111B	4.3	184	4.7
149	5.1	185	4.8
151	6.3	186	**
154	**	187	4.5
157	6.4		
MEAN		5.4	

* DISK DIAMETER = 1.3 CM
** NO GROWTH OR GROWTH TOO POOR TO MEASURE

Efficacy of Fluazinam for Control of Phytophthora Root Rot of Azalea Caused by *Phytophthora cinnamomi*

D. Michael Benson
North Carolina

Nature of Work: A limited number of fungicides are available for control of Phytophthora root rots on woody ornamentals. Recently, a new experimental fungicide with the common name of fluazinam (ISK Biotech, Mentor, OH) has been evaluated for disease control in ornamentals.

Hinodegiri azaleas were rooted in the greenhouse during the fall and winter months in a peat:perlite mix then transplanted in May, 1992 to 6 inch pots of pine bark: sand (3:1) at pH 5.2. Isolate 111 of *Phytophthora cinnamomi* was grown on sterilized oat grains for 30 days. Potting mix was infested the morning of June 9, 1992, by placing 30 colonized grains per pot 2 cm below the surface at the interface between potting mix and plant root ball. Plants were watered thoroughly after inoculation. In the afternoon, pots were drenched with 200 ml/pot of fluazinam (see rates below). The fungicide Subdue was used as a standard for comparison. Controls included untreated, infested potting mix as well as untreated, uninfested mix with azaleas. There were eight replications arranged in a randomized complete block design in a lath house. Azaleas were irrigated by sprinklers twice a day (0.4 inches/day). Since 1 inch of rain fell about 1 hr after the initial fungicide drench, a re-application was made the following day on June 10. Sixty days later (August 7, 1992) another application of fungicides was made.

Plant were rated for phytotoxicity and foliar symptoms of Phytophthora root rot at 28, 70, and 114 days after drenching. The rating scale was:.l = healthy plants, 2 = initial foliar symptoms (chlorosis), 3 = moderate foliar symptoms (chlorosis, poor growth), 4 = severe defoliation, stunting, and wilting. At day 114 (October 2, 1992), plant top weight was measured and root rot was assessed on a scale where 1= healthy plant, no root rot, 2 = fine roots necrotic, 3 = coarse roots necrotic, 4 = crown rot, and 5 = dead plant.

Results and Discussion: Fluazinam protected azaleas from Phytophthora root rot at all three rates tested. Plant ratings for fluazinam-treated plants were comparable to those treated with Subdue and significantly better than the untreated, infested control (Table 1). Top weight of plants treated with fluazinam at higher rates were comparable to Subdue-treated plants at final evaluation, but not as great as weights of untreated, uninfested plants (Table 1). Root rot rating was less (P=0.05) for azaleas treated with Subdue than those treated with fluazinam.

Significance to Industry: Fluazinam has the potential to protect azaleas from Phytophthora root rot. Since initial plant ratings were similar to Subdue-treated plants but long-term control was not as effective, it may be necessary to decrease the application interval of fluazinam from 60 to 30-45 days to achieve season-long disease control.

Table 1. Efficacy of fluazinam for control of Phytophthora root rot of azalea

Treatment	Rate / 100 gal	Plant rating Day 28	Plant rating Day 70	Plant rating Day 114	Top weight (g)	Root rot rating (1-5)
Fluazinam 500 F	2.8 oz	1 a	1.3 bc	1.9 b	29.0 c	1.9 b
Fluazinam 500 F	5.5 oz	1 a	1.0 c	2.0 b	33.2 bc	1.9 b
Fluazinam 500 F	8.3 oz	1 a	1.0 c	2.0 b	35.6 b	2.0 b
Subdue 2E	2.0 oz	1 a	1.4 b	1.8 b	36.3 ab	1.1 c
Infested, untreated	-	2 b	2.0 a	2.8 a	16.0 d	2.8 a
Uninfested control	-	1 a	1.0 c	1.0 c	42.5 a	1.0 c

Means within a column followed by the same letter are not significantly different according to the Waller-Duncan k-ratio test at $P = 0.05$

Chemical Control of Rhizoctonia Web blight on *Pittosporum*

A. R. Chase
Florida

Nature of Work: Web blight of woody ornamentals can be a serious problem in the Southeastern United States (4). This foliar disease is caused by either *Rhizoctonia solani* or a binucleate *Rhizoctonia* species and occurs mainly during the hot, wet summer months (1, 3). Plants with no apparent symptoms can develop 100% loss of canopy in as little as three days when conditions are optimal. Preventative treatments with fungicides may be recommended when web-blight is a continuing problem. Prior to 1991, benomyl (Benlate 50WP) was the preferred choice of fungicides for chemical control of this disease. Due to the loss of this fungicide, alternatives for control of web-blight on *Pittosporum* must be identified.

Two tests were performed using well-rooted cuttings of *Pittosporum tobira* (variegated form). They were established in Vergro potting medium in 4 inch pots and grown under 47% shade on a raised bench where they received about 1 inch of water every other day from an overhead irrigation system. Fungicide treatments were applied weekly as foliar sprays to drip. The first test received a total of 6 sprays and the second test received 4 sprays. Treatments for Test 1 were: noninoculated and inoculated controls, chloroneb (Terraneb SP, Kincaid Enterprises, Inc.) at 10, 32, and 64 oz/100 gal, thiophanate methyl (Domain FL, Grace-Sierra Plant Products) at 20 oz/100 gal, and benomyl (Benlate 50WP, E. I. Dupont Nemours, Co.) at 8 oz/100 gal. Treatments for Test 2 were: noninoculated and inoculated controls, thiophanate methyl (Topsin M, Atochem North America) at 5, 10, and 20 oz/100 gal, myclobutanil (Eagle, Rohm and Haas Company) at 2.5 oz/ 100 gal, a combination of mancozeb and systhane (RH-0611F, Rohm and Haas Company) at 32 oz/100 gal, and mancozeb (Fore FL, Rohm and Haas Company) at 38 oz/100 gal. Plants were inoculated two days after the first fungicide application with a binucleate *Rhizoctonia sp.* known to cause web blight on *Pittosporum.* The percentage of the plant foliage with symptoms of web blight was estimated on 30 September, 1992 and 29 January, 1993 for Test 1 and Test 2, respectively.

Results and Discussion: In Test 1, best disease control was achieved with applications of Domain or Benlate. Terraneb did not control Rhizoctonia web blight on *Pittosporum* in this test (Figure 1). In Test 2, optimal disease control was achieved with the combination product of mancozeb and systhane (RH-0611). The 20 oz/100 gal rate of Topsin M gave the next best control but was not statistically different from any of the other fungicide treatments except the RH-0611 (Figure 2).

The thiophanate methyl compounds gave good disease control in these tests which was as high as that achieved with Benlate. This result is not unexpected since the mode of action for thiophanate methyl is the same as that for the Benlate. In addition, since Fore FL did not give good disease control, apparently the systhane component was responsible for the high level of disease control provided by the combination product (RH-0611). Although Terraneb did not provide control of this web blight caused by a binucleate *Rhizoctonia sp.,* it was very effective in controlling a web blight of boston fern which was caused by *Rhizoctonia solani* (*2*).

S**ignificance to Industry:** The loss of Benlate for controlling web blight on *Pittosporum* made this work necessary. Direct substitution of thiophanate methyl compounds such as Domain and Topsin M gave good control of this disease. In addition, label expansions of fungicides such as systhane will give the ornamental plant producer a broader arsenal for disease control.

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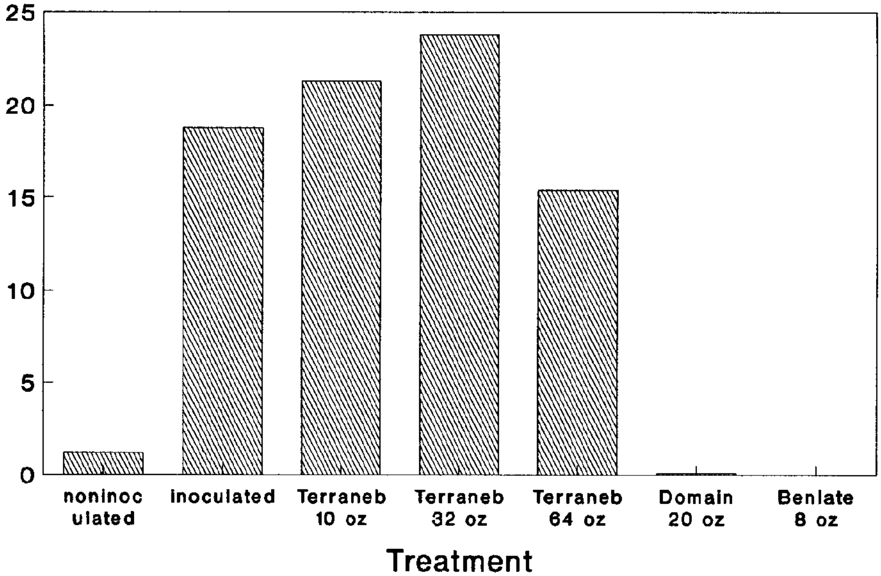
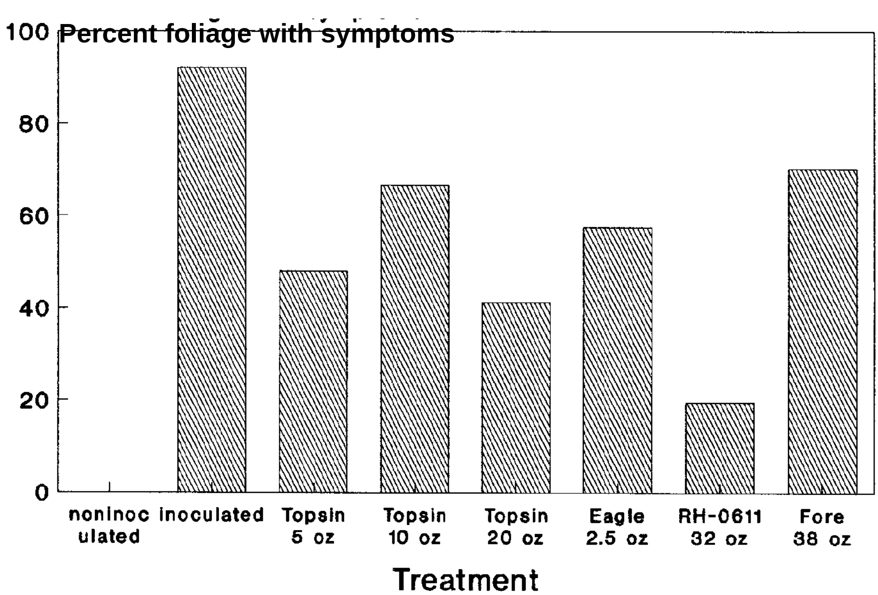
Figure 1. Efficacy of some fungicides for control of web blight on *Pittosporum, (Test* 1).



Percent foliage with symptoms

Figure 2. Efficacy of some fungicides for control of web blight on *Pittosporum,* (Test 2).



Susceptibility of Crabapple Cultivars to Fireblight in Alabama

A. K. Hagan, K. Tilt, D. Williams and J. R. Akridge
Alabama

Nature of Work: Throughout the South diseases such as fireblight, cedar-apple rust, apple scab and powdery mildew have greatly limited the use of the flowering crabapple (Malus sp.) in residential and commercial landscapes. In Alabama, fireblight and cedar-apple rust are particularly destructive, while apple scab and powdery mildew cause limited damage. Use of disease resistant crabapple cultivars, the preferred method of disease control, greatly simplifies tree maintenance by virtually eliminating costly and time consuming treatment programs. Crabapple cultivars are rated for disease susceptibility at several midwestern sites. Due to differences in regional weather patterns, tree adaptation and pathogen virulence, such disease ratings from those sites may not be applicable in the South. As part of the National Crabapple Evaluation Program, a trial has been established in a sandy soil at the Brewton Experiment Field in southwest Alabama (Zone 8a) to evaluate sixty (60) crabapple cultivars for horticultural characteristics and their reaction to common diseases. Reactions of these crabapple cultivars to fireblight in 1993 are reported here. Prior to planting, soil fertility and pH were adjusted according to soil test recommendations. The trees were planted on May 1992 on 18 ft. centers. A randomized complete block with five (5) of three plants each. In 1992 and 1993, 0.25 and 0.5 ounce of actual nitrogen (5-10-15 + minor elements) was applied, respectively, per tree. Trees were not irrigated. Weeds were controlled with directed applications of a tank mix of Gallery with Surflan and Roundup herbicide at recommended rates. Visual ratings of fireblight severity were made on April 22 and May 28, 1993 on a scale of 0-4 where 0=no disease and 4=severe limb dieback. Data on horticultural characteristics is not available yet.

Results and Discussion: In April 1993, fireblight was observed only on a few scattered trees and disease severity on all cultivars was light (data not shown). By late May, flower and shoot blight was seen on nearly all cultivars. Blighting of numerous shoots and an extensive limb dieback was also apparent on only a few cultivars. No fireblight symptoms were found on the cultivars Coral Burst, Pink Princess and *M. baccata* Jacki, (Table 1). Adams Dwarf ‘VC’, Adams FLWG 111 ‘VC’, Jewelberry, Spring Snow Dwarf, Dolgo, Liset FLWG 111, Radiant, and Velvet Pillar (bush) suffered little fireblight damage. Some fireblight damage occurred on the cultivars Liset Dwarf, Sargent Dwarf, Bob White, David, Indian Summer, Louisa, Profusion, Sargent FLWG 111, Velvet Pillar (tree), White Angel, and *M. zumi* Calocarpa. Damage on the remaining cultivars was so extensive that they would be unacceptable as landscape trees in Alabama. Cultivars suffering the most extensive fireblight damage were Snowdrift Dwarf, Red Jade Dwarf, Indian Magic, Mary Potter, Professor Sprenger, Purple Prince, Sentinel, Silver Moon, Siani Fire, and Snowdrift FLWG. Frogeye leaf spot and apple scab were noted on a few cultivars but damage was not serious.

Significance to Industry: Disease are a major factor limiting the use of crabapple in the Deep South. Chemical intensive control programs needed to protect disease-susceptible crabapple cultivars are often unsuitable for today's low maintenance landscapes. Crabapple cultivars resistant to the destructive disease fireblight have been identified. Availability of such adapted, disease resistant cultivars should greatly increase the use of crabapple in southern landscapes.

Table 1: Reactions of Selected Crabapple Cultivars to Fireblight.

Highly Resistant to Immune (Disease Rating:0-0.5)		
Adams Dwarf 'VC'	M. baccata 'Jacki'	Liset FLWG 111
Robinson Dwarf	Coral Burst	Pink Princess
Spring Snow Dwarf	Dolgo	Pink Spires
Adams FLWG 111 'VC'	Jewelberry	Radiant
Velvet Pillar (bush)		
Moderately Resistant (Disease Rating:0.5-1.0)		
Liset Dwarf	Indian Summer	Velvet Pillar (tree)
Sargent Dwarf	Louisa	White Angel
Bob White	Profusion	Sargent FLWG 111
David	M. x zumi 'Calocarpa'	
Slightly Susceptible (Disease Rating:1.0-1.5)		
Floribunda Dwarf	Beverly	Prairifire
Red Splendor Dwarf	Brandywine	Red Baron
Royalty Dwarf	Centurion	Red Jade FLWG 111
Adirondack	Donald Wyman	Strawberry Parfait
Baskatong	Tea	Hopa
Eleya		
Moderately Susceptible (Disease Rating:1.5-2.0)		
Candied Apple	Ormiston Roy	Winter Gold
Doubleblooms	Selkirk	Klehm's Imp. Bechtel

Floribunda	Snowdrift	Sugar Tyme
Golden Raindrops	Red Jade FLWG WPG 111	

Highly Susceptible (Disease Rating:2.0-3.0)

Snowdrift Dwarf	Mary Potter	Sentinel
Red Jade Dwarf	Professor Sprenger	Silver Moon
Indian Magic	Purple Prince	Siani Fire

Preliminary Observations of Needle Cast Diseases of Virginia Pine Grown for Christmas Trees in South Carolina

J. H. Blake, Walker Miller, George Ressler and Andy Boone
South Carolina

Nature of Work: Defoliation and the development of off-color and necrotic needles of Virginia pine (Pinus virginiana) grown for Christmas trees in South Carolina are limiting sales. The authors were asked to address the issue at a March 1993 meeting of the South Carolina Christmas Tree Growers Association. Other than the presence of unidentified needle cast diseases and unpublished season long observations by Boone indicating that Lophodermium spp. were present in plantations, the authors could find no documentation of these diseases on Virginia pine Christmas trees in South Carolina.

A brief review of the literature indicated that several needle diseases might occur in South Carolina (2). Potential pathogens included *Ploioderma lethale, P. hedgcockii*, *Lophodermium pinastri, L. seditiosum, Mycosphaerella dearnessii, Cyclaneusma minor*, and various *Coleosporium* spp. R. L. Doudrick (personal communication, Southern Forest Experiment Station, USDA Forest Service, Box 2008, Gulfport, MS 39503) suggested that a *Rhizosphaera* sp., probably *R. kalkhoffii*, could be the cause of a new needle and shoot blight reported in 1990 (1).

Based on a review of disease cycles of these fungi each disease would require a different spray schedule to effect control. A discussion with growers indicated that they were using many diverse spray programs but most were not sure for what specific diseases they were treating. Some were making applications once a month for the entire season. Some needle cast fungi are considered weak pathogens and should not require monthly fungicide applications, but all growers indicated they were experiencing unacceptable levels of needle cast diseases. Boone (unpublished) observed the number of spores of Lophodermium spp. caught in spore traps at various time intervals from April to October. Greased microscope slides were suspended from a stiff wire in tree rows by clothes pins about 8 inches above the ground at the drip line to trap the wind-blown ascospores. The ascospores were counted under a microscope but not identified to species. Observations were made at two-week intervals and were replicated three times.

Since comprehensive reports of needle cast problems on Virginia pine in South Carolina were absent, we decided to make systematic observations of 10 sites at approximately two-month intervals. Additional growers were encouraged to send in samples when a needle cast problem was observed. Each sample consisted of needles from under the tree and a diseased branch with mature needles from the same tree. Initial samples were also to include a soil sample and a tissue analysis sample from the site. Subsequent samples were for disease diagnosis only. Five of the 10 plantations in the study were selected for field observations.

Samples were observed immediately upon receipt at the Plant Problem Clinic. Needles were placed in moist chambers to encourage sporulation of the fungi when needed for identification. The fungi were identified based on morphological characteristics of fruiting bodies, asci, ascospores, and conidia. *Lophodermium* spp. form hysterothecia with filamentous ascospores. *L. pinastri* was distinguished from *L. seditiosum* based on the length of the asci. *Ploioderma* spp. form hysterothecia producing ovoid ascospores. *P. hedgcockii* contains four ascospores per ascus and *P. lethale* contains eight. *Rhizosphaera* sp. form rows of pycnidia emerging from stomata producing single-celled, ovoid conidia.

Results and Discussion: As of June 29, 1993, 23 samples representing 16 sites have been received. Soil analyses (9 of 9) and tissue analyses (8 of 8) indicated that all sites were under nutritional stress based on tissue analysis and soil analysis guidelines used for Virginia pine in North Carolina (personal communication, Jim Shelton, Mountain Horticultural Crops Research and Extension Center, N. C. State University, Fletcher, NC 28732). Nutrients frequently detected at lower than recommended levels were N, P, K, Ca, Zn, Fe, B and Cu. The range for the number of different nutrients found to be inadequate in a site was 2 to 7 (mean 4.3) based on tissue analyses. Interviews with growers indicated that a common practice was to lime and fertilize once in the life of a crop of trees prior to planting (once every 6-7 years). Two of the five sites visited were on poorly drained, compacted soils further contributing to tree stress.

Rhizosphaera needle cast (*Rhizosphaera* sp.) was observed in 15 of 16, Lophodermium needle cast (*Lophodermium pinastri*) in 13 of 16, and Ploioderma needle cast (*Ploioderma* sp.) in three of 16 sites (two identified as *P. lethale*). A *Colletotrichum* sp. was observed colonizing one sample of needles. Due to the cultural system and shearing practices infected needles were frequently observed suspended in the tree perhaps serving as a source of inoculum.

Boone's observation of spores of *Lophodermium* spp. revealed two peak periods of spore dispersal, one in June and one in August. The literature suggests that *L. pinastri* matures earlier than *L. seditiosum*. The bimodal response suggests that the later peak might have been *L. seditiosum* (2,3).

Significance to Industry: Depending upon the plant species attacked, *Rhizosphaera* spp. are considered weak pathogens. Similarly *L. pinastri is* considered a weak pathogen compared to *L. seditiosum*. Correct identification of the diseases present and improved management to reduce nutritional stresses may improve Virginia pine Christmas tree production with limited use of fungicides targeted against the major pathogens.

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Susceptibility of Selected Poinsettia Cultivars to Powdery Mildew

Alan S. Windham and Brian E. Corr
Tennessee

Nature of Work: Poinsettia, Euphorbia pulcherrima, is a very popular pot plant grown for the Christmas season. Approximately, 900,000 finished poinsettias are produced by greenhouses in Tennessee each year. Poinsettia has recently be found to be a host for powdery mildew caused by an Oidium spp.(4,5). The first cases of powdery mildew on poinsettias in the United States were observed in the Pacific Northwest and Pennsylvania in 1990 (4). It occurred sporadically in greenhouse ranges in the Midwest, South and East coast in 1992. In November 1992, powdery mildew was identified on ‘V-14 Glory’ poinsettia in two greenhouse ranges in Tennessee.

A test was initiated in early December 1992, to evaluate the pathogenicity of poinsettia powdery mildew on several poinsettia cultivars including: ‘V-17 Angelika White’, ‘Annette Hegg Dark Red’, ‘Freedom’, ‘V-14 Glory’, ‘Jingle Bells’, ‘Lilo Red’, ‘Red Sails’, ‘Regal Velvet’ and ‘Subjibi Red’. Conidia were brushed with a camel hair brush from leaves of a ‘V-14 Glory’ infected with powdery mildew onto the bracts of three plants of each cultivar. Inoculated plants were then placed on a greenhouse bench, bottomed watered and maintained at 75F daytime temperature and 70F nightime temperature.

Results and Discussion: All cultivars were readily infected by powdery mildew. Colonies appeared on bracts within seven days. Within 14 days, inoculated bracts of several cultivars were covered with mycelium (Figure 1).

Significance to the Industry: Powdery mildew can become epidemic on poinsettia late in the growing cycle during cooler weather. It can even continue to develop in retail establishments and at consumers’ homes. Growers should scout their crop for signs of powdery mildew throughout the growing season. Cultural and chemical controls can be used to manage this disease (1,2,3,4,5). Future studies will be directed at examining the host range of this fungus, especially other Euphorbia spp. native to Tennessee.

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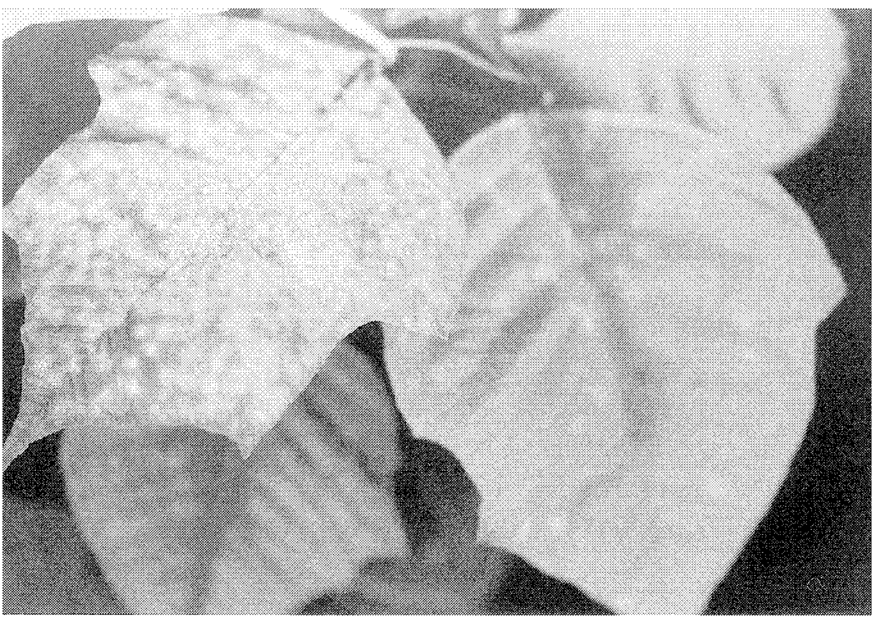

Figure 1. Powdery mildews colonies on poisettia 'Red Sails' bracts.

Evaluation of Selected Chemicals for Control of Southern Blight of Aucuba

J. W. Olive and A. K. Hagan
Alabama

Nature of Work: Southern blight is caused by the fungus Sclerotium rolfsii and it attacks many ornamental hosts. Aucuba, ajuga, and common periwinkle (Vinca minor) are among the most commonly attacked ornamentals. The fungus attacks at the soil line causing a lesion, a rotten stem and eventually wilting of the plant. Often the white mycelium is visible on the stem and soil surface, and small (1/16-1/8 inch in length) oblong to round sclerotia are produced on the soil surface and stem. These structures are able to survive for years and cause disease in subsequent crops. This accounts for the difficulty in controlling this disease.
Currently, there are few fungicides for the control of this disease on ornamental plants. These evaluations were initiated to determine the efficacy of several fungicides for the control of S. rolfsii on aucuba.

Aucuba japonica liners were potted in trade gallons in August of 1992 in a milled pine bark and peat moss medium (3:1 by volume) amended with 6 lbs limestone, 2 lbs gypsum, and 1.5 lbs Micromax per yd^3. Osmocote 17-7-12 was incorporated at the rate of 14 lbs per yd^3. Fungicides (Table 1) were applied as a heavy spray-drench on the lower 3 inches of the stem and the soil surface. Treatments were applied with a CO_2 pressurized sprayer and were applied 24 hours prior to inoculation and 2 weeks after inoculation. Inoculum was prepared by placing plugs of ten day old cultures of S. rolfsii in sterile flasks of autoclaved hydrated wheat seed. The infested seed was allowed to incubate 7 days. One gram of inoculum (approximately 20 to 25 seeds) was placed adjacent to the stem and covered with media. Plant mortality was recorded 28 days after inoculation and 60 days after inoculation.

The experiment was repeated in 1993. Plants were inoculated in July and plant mortality recorded 21 days after inoculation.

Results and Discussion: The results indicate Prostar, Fluazinam, Folicur, and Terraclor are effective in reducing disease when compared to an inoculated check (Table 1). Of these, only Terraclor is labeled for use as a drench on aucuba.

Significance to Industry: Plant mortality due to southern blight can be reduced on aucuba with applications of the labeled fungicide Terraclor.

Prostar, Fluazinam, and Folicur all control the disease and have potential for study as a control option in the future.

Table 1. Percent mortality of Aucuba inoculated with S. rolfsii and treated with selected chemicals.

Chemical	Rate/100 gal	Percent Mortality 1992	1993
Prostar 50W (Flutolanil)	8 fl oz	0	0
Fluazinam 500F	32 fl oz	0	0
Folicur 3.6F (Tebuconazole)	8 fl oz	20	0
Terraclor 75W (PCNB)	1.25 lb	30	0
Terraguard 50W (Triflumizole)	1 lb	50	10
Curalan 50DF (Vinclozolin)	8 oz	70	60
Inoculated Control	—	80	80
Uninoculated Control	—	0	0

Impatiens Necrotic Spot Virus On Woody Ornamentals in Georgia

John M. Ruter & Ron. D. Gitaitis
Georgia

Nature of Work: Impatiens Necrotic Spot Virus (formerly Tomato Spotted Wilt Virus - Impatiens strain) has been documented on bedding plants grown in south Georgia (2). Currently, Impatiens Nectrotic Spot Virus (INSV) has a large host range including more than 60 plant families. The disease, which is vectored by thrips, can infect a variety of plants. It is not currently known if woody landscape plants are infected with INSV. Therefore, this study was conducted to determine if woody landscape plants in Georgia were infected with INSV.

Non-symptomatic container-grown plants from a commercial nursery in Grady County, Georgia were randomly sampled in July, 1991. Detection of infected plants was determined by enzyme-linked immunoabsorbent assay (Agdia, Inc., Elkhart, Ind.) using replicated whole leaf tissue samples.

Results and Discussion: Plants testing positive for INSV are shown in Table 1. Approximately 16% of the total number of samples and 20% of the species evaluated tested positive for INSV. This report confirms the presence of INSV on woody landscape plants in Georgia and represents the addition of eight new plant families (Aguifoliaceae, Calycanthaceae, Caprifoliaceae, Ericaceae, Hydrangaceae, Rosaceae, Styraceae, and Theaceae) in which INSV has been found.

Significance to Industry: While the greenhouse and bedding plant industries have suffered large crop losses due to INSV in recent years, the effect of INSV on perennial woody landscape plants is not known. As stated, the plants in this study were not showing the symptoms typically associated with this virus. Weeds are known to serve as reservoir hosts for Tomato Spotted Wilt Virus (1). While woody landscape plants may not be devastated by INSV like many annual plants, they may serve as reservoir hosts for the virus. Future work may be needed to determine if woody plants are an important host for the spread of INSV to other species.

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Table 1. Plants testing positive for Impatiens Necrotic Spot Virus in south Georgia.

Aquifoliaceae	
	Ilex glabra (L.) A. Gray 'Shamrock'
Calycanthaceae	
	Calycanthus floridus L.
Caprifoliaceae	
	Abelia x grandiflora (Andre) Rehd. 'Edward Goucher'
Ericaceae	
	Oxydendrum arboreum (L.) DC.
Hydrangaceae	
	Hydrangea quercifolia Bartr.
Rosaceae	
	Photinia x fraseri Dress.
	Raphiolepsis indica (L.) Lindl. 'Clara'
Styraceae	
	Halesia carolina L.
Theaceae	
	Franklinia alatamaha Marsh.

Extension of Spray Schedule Intervals for Dogwood Anthracnose Control with Banner

M. T. Windham and A. S. Windham
Tennessee

Nature of Work: The effects of fungicide application intervals (two and four week) using Banner 1.1 E (2 oz / 100 gal and 4 oz / 100 gal) on dogwood anthracnose severity was compared with untreated controls at two locations: Roaring Fork Creek in Great Smoky Mountain National Park (GSMNP) and Ozone, TN. At each location, treatments were applied to Cornus florida 'Cherokee Princess' trees that were approximately 3 ft high and potted in 5 gal containers. Trees were placed under the canopies of naturally propagated dogwood with severe dogwood anthracnose symptoms. Treatments were arranged in a randomized complete block design with 10 replications. A spreader-sticker (Triton B-1956) was added to each fungicide solution/suspension at a rate of one drop / gal. Experiments were started at Ozone on June 9, 1992 and at GSMNP on June 11. Disease symptoms were rated with the following disease assessment scale: 5 = healthy, 4 = 1-25% diseased foliage, 3 = 26-50% diseased foliage, 2 = 51 -75% diseased foliage, and 1 = 76-100% diseased foliage, 0 = dead tree.

Results and Discussion: Fungicide treatments were equally effective in reducing dogwood anthracnose severity at both two and four week spray intervals (Table 1). Phytotoxicity symptoms were not observed with any fungicide treatment.

These data suggest that Banner could be used to control dogwood anthracnose with fewer applications than are currently recommended (currently two week applications are recommended). Such a reduction in pesticide usage would lower the cost of the chemical control measure and the amount of pesticide released into the environment. It is unknown if similar results would be obtained if surface protectants such as Daconil 2787 or Dithane M45 were used instead of a systemic sterol inhibitor such as Banner.

Significance to Industry: Banner gave good control of dogwood anthracnose when applied at 4 week spray intervals. The reduction in Banner applications (currently recommended rate is 2 wk spray interval) would reduce application and fungicide costs and reduce the amount of material released into the environment.

Table 1. Effectiveness of two rates of Banner 1.1 E when applied at either two or four week intervals at Ozone, TN and Roaring Fork Creek in GSMNP.

		Disease Severity			
		Ozone		GSMNP	
Banner rate/l00gal	Application interval	6/25	8/19	6/26	8/20
2 oz	2 wk	4.9a	4.4a	4.9a	4.2a
2 oz	4 wk	4.7a	3.9a	4.6a	3.7a
4 oz	2 wk	4.9a	4.4a	4.9a	4.3a
4 oz	4 wk	4.9a	4.2a	5.0a	3.9a
Control	-	4.2a	2.lb	4.4a	2.8b

Disease severity was estimated using Miekle-Langdon die-back scale where 5 = healthy, 4 = 1-25%, 3 = 26-50%, 2 = 51-75%, 1 76-100%, and O = dead tree. ab for each column, means followed by the same letter do not differ according to Duncan's Multiple Range Test (p= 0.05).1

Resistance to Dogwood Anthracnose in Cornus florida

M. T. Windham and E. T. Graham
Tennessee

Nature of work: Four Cornus florida trees were identified to have survived a dogwood anthracnose epidemic in Catoctin Mountain Park, MD (1). These trees were propagated as rooted cuttings in 1990 and potted in 5 gal containers in 1991. In 1992, trees of the four clones were divided into three groups: two groups were screened for dogwood anthracnose resistance and one group was kept in reserve for additional propagation. One resistance trial was at Ozone, TN using naturally occurring inoculum. Trees were arranged in a randomized control block design with three replications beneath naturally propagated dogwoods with severe dogwood anthracnose symptoms. Disease severity was rated using the following scale: 5 = healthy, 4 = 1-25% diseased foliage, 3 = 26-50% diseased foliage, 2 = 51-75% diseased foliage, 1 = 76-100% diseased foliage and 0 = dead tree.

The other resistance trial was conducted by USDA Forest Service personnel at Asheville, NC using an artificial inoculation chamber that relied on Discula destructiva conidial sprays and inocula obtained by misting water through diseased branches (2). Trees were arranged in a completely random design with three replications in June. Trees were rated in September to determine if any trees had survived.

Results and Discussion: Clones of potentially dogwood anthracnose resistant trees differed in susceptibility to dogwood anthracnose when compared to C. florida trees used as controls (Fig. 1). On July 31, all clones were significantly more resistant than the controls whereas clones 2-4 were significantly more resistant on August 27. In the USDA Forest Service test, only trees of clone 4 had survived in the chamber for the entire summer. These results were similar to those obtained at Ozone, TN where clone 4 appeared to be the most resistant clone in the test.
In addition to the clones of the four trees described in this work, five other flowering dogwoods have been identified as being potentially resistant to dogwood anthracnose. Clones of these trees and clones of the four tree used in this study will be screened for resistance in 1994 and we will attempt to identify mechanism(s) of resistance.

Significance to Industry: Dogwood anthracnose has shaken confidence in the use of flowering dogwoods in ornamental landscapes in some areas of the United States. The identification of resistant flowering dogwood may make this tree a viable choice for inclusion in landscapes in these areas.

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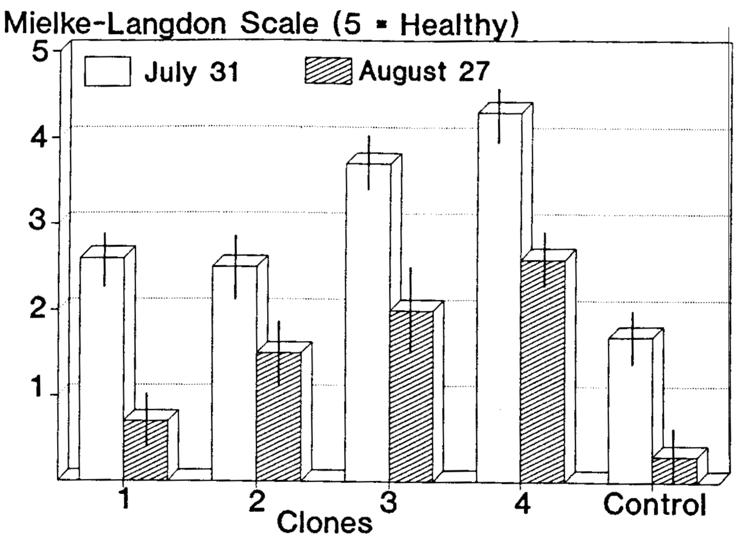
Fig. 1. Differences in dogwood anthracnose susceptibility in four Cornus florida clones and white flowering dogwood seedlings (controls) at Ozone, TN. Bars represent standard deviation.



Evaluation of Juniper Cultivars for Susceptibility to Tip Blight Caused by 'Rabatina Juniperi'

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Nature of Work: Junipers *(Juniperus spp.)* growing in eastern and central United States are subject to tip blight disease caused by the fungus *Kabatina juniperi.* The variation in susceptibility of juniper species and cultivars to Kabatina tip blight is such that some cultivars are practically immune while others are so susceptible that tip blight causes death of the entire plant. This report evaluates reactions of juniper cultivars to Kabatina tip blight disease and the effect of pruning on tip blight.

Juniper plots were established at the University of Kentucky Horticulture Research Farm in Lexington to investigate relative susceptibility of juniper cultivars to diseases and insects and to observe their cultural characteristics. Sixteen spreading and six upright container grown juniper cultivars were transplanted into separate field blocks (plot A) on May, 1991. All cultivars were replicated ten times and arranged in a randomized complete block design. [For one treatment of spreading junipers, two cultivars, *J. horizontalis (J. h.)* 'Blue Mat' and *J. conferta (J.* co.) 'Emerald Sea' occupied alternate replications.] The entire test was duplicated at the same time in another location nearby on the same farm (plot B).

Junipers were grown conventionally and mulched with wood chips. Plot *A* was pruned on a regular basis to remove all dead tips within a few weeks of their occurrence. Dead tips in plot B were removed only on November 19, 1992. The source of disease in each plot was natural inoculum. Junipers in both plots were rated for percent Kabatina tip blight on May 11 and 12, 1993. Each plant was examined visually and representative samples from each cultivar were examined microscopically for the causal agent.

Results and Discussion: There were significant differences in reactions of juniper cultivars to Kabatina tip blight (Tables 1 and 2). Many cultivars showed less disease with regular pruning, perhaps by reducing fungal inoculum, although possible variation in site qualities between plots A and B may play a role.

Significance to Industry: Nursery crop growers, garden centers, and landscapers can use this information to choose cultivars that will perform well and resist disease in the landscape.

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Table 1. Percent Kabatina tip blight of spreading junipers.

Cultivar	Plot A	Plot B
J. chinensis 'Saybrook Gold' *	0.0 a **	0.0 a
J. horizontalis 'Bar Harbor'	0.7 a	1.4 a
J. da vurica 'Expansa' ('Parsoni')	0.5 a	1.8 ab
J. horizontalis 'Wiltoni' ('Blue Rug')	0.3 a	2.2 ab
J. horizontalis 'Plumosa' (Andorra)	0.2 a	2.5 ab
J. chinensis 'Mint Julep'	0.7 a	2.6 ab
J. chinensis 'Pfitzerana'	1.7 a	1.7 ab
J. horizontalis 'Emerald Isle'	0.9 a	5.3 ab
J. chinensis var. sargentii 'Viridis'	0.5 a	7.8 abc
J. horiz. 'Plumosa Compacta Youngstown'	4.5 a	5.3 ab
J. horizontalis 'Prince of Wales'	2.7 a	10.5 abc
J. horizontalis 'Blue Chip'	2.2 a	12.1 abc
J. conferta 'Blue Pacific'	3.5 a	14.5 bc
J. squamata 'Blue Star'	16.0 b	2.1 ab
J. h. 'Blue Mat' & *J. co.* 'Emerald Sea'	0.5 a	20.0 c
J. sabina 'Broadmoor'	2.6 a	19.8 c

* Cultivar 'Saybrook Gold' showed about 10% tip dieback (about 1/2 inch on each affected tip) not attributable to Kabatina tip blight, perhaps due to physiological causes. ** Means followed by the same letter are not significantly different (DMRT, P=0.05).

Table 2. Percent Kabatina tip blight of upright junipers.

J. chinensis 'Hetzii'	0.7 a *	0.7 a
J. communis 'Hibernica'	0.5 a	1.1 a
J. chinensis 'Keteleeri'	0.8 a	1.3 a
J. chinensis 'Spartan'	2.2 a	2.3 a
J. virginiana 'Sky Rocket'	1.6 a	5.2 a
J. scopulorum 'Wichita Blue'	19.3 b	78.0 b

* Means followed by the same letter are not significantly different (DMRT, P=0.05).

Seiridium Canker on Leyland Cypress in North Carolina

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Nature of Work: Leyland Cypress (Cupressocyparis leylandii) is becoming increasingly popular as a landscape plant in North Carolina. Nursery production of this plant is increasing to meet the demand. To date, Leyland cypress has been relatively disease free in North Carolina. In other countries and other parts of the United States, canker diseases have been very damaging to this plant. The most important and damaging disease of Leyland cypress is a bleeding canker caused by several species of fungi (Seiridium cardinale, S. unicorne, and S. cupressi). Most of the literature describes the canker caused by S. cardinale. Symptoms of the disease caused by S. cardinale include an irregular sunken canker, sap frequently oozes from the canker, and dead branches with straw colored foliage.

Results and Discussion: In 1992, 7 out of 72 samples of Leyland cypress submitted to the Plant Disease and Insect Clinic were diagnosed having canker caused by S. unicorne. This was the first confirmed report of this disease in North Carolina. As of June 8, 1993, 7 of 40 samples of Leyland cypress submitted to the Plant Disease and Insect Clinic have been diagnosed as having canker caused by S. unicorne. At this time, there is no literature on the severity of canker caused by S. unicorne on Leyland cypress under North Carolina conditions. We hope to start studies on this problem in the near future.

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