Tip Dieback in Southern Pine Nurseries

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ABSTRACT

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Dieback of terminal shoots of slash and loblolly pine seedlings was first observed in 1977 in nurseries from Texas to Florida. *Phomopsis* spp., *Diplodia gossypina*, and *Fusarium moniliforme* var. *subglutinans* were isolated from diseased tissues. Inoculations indicated that *D. gossypina* and *F. moniliforme* var. *subglutinans* were pathogenic.

In 1977, the terminal 1–5 cm of tissue on slash (*Pinus elliottii* Engelm. var. *elliottii*) and loblolly (*P. taeda* L.) pine seedlings in many southern nurseries was killed during late summer. The dead stem usually turned purplish. Pitch-soaked lesions associated with pitch canker (1) were absent. Lateral buds on affected seedlings initiated new terminal growth during the weeks following, and little damage was apparent by the time seedlings were lifted in late November or early December.

The disease was detected in many of the same nurseries in each ensuing year. Survey data indicated that less than 1% to 3% of the growing stock in individual nurseries was affected annually; the frequency varied more among seed sources within species than between slash and loblolly pines. Loblolly pine from Texas seed sources seemed particularly susceptible to the disease. Greenhouse and field tests were done to identify the causal organism(s) and determine the extent of damage caused in plantations by this disease of nursery origin.

MATERIALS AND METHODS

Potential pathogens were isolated from tissues of affected seedlings and from other sources and were grown on potato-dextrose agar (PDA). Stem pinprick inoculation of 1-yr-old loblolly pine seedlings near their terminal buds was used to test pathogenicity. A drop of comminuted fungus culture that included PDA, spores, and mycelia was placed onto the wound of each seedling. Four replicates of 25 trees were inoculated with each fungus isolate during each of four separate runs. Inoculated seedlings were incubated in a moist chamber for 72 hr and placed on a greenhouse bench for 28 days. Seedlings with dead terminals were then counted, and fungi were reisolated from these seedlings.

To study the impact of the disease on tree growth and survival, slash and loblolly pine seedlings with and without dieback from a Georgia nursery were planted in January 1978. Five 25-tree replicates were planted in a randomized complete block design.

RESULTS AND DISCUSSION

Isolations from surface-sterilized shoot tissues of affected seedlings indicated that the fungi most commonly associated with the tissues were *Pestalotia* spp., followed in order by *Fusarium* spp. (*F. moniliforme, F. oxysporum, F. solani, F. roseum*), *Phomopsis* spp., *F. moniliforme* Sheld. var. *subglutinans* Wollenw. and Reink., and *Diplodia gossypina* Cke. Other fungi, including *Penicillium* spp., *Aspergillus* spp., and *Rhizopus* spp., were also isolated but were discarded as unlikely pathogens.

F. moniliforme var. *subglutinans* was more pathogenic on loblolly pine seedlings than were most isolates of *D. gossypina* (Table 1). Both fungi can cause the tip dieback disease observed in southern forest tree nurseries (2). Of the seven isolates of *Pestalotia* spp. used in inoculation tests, only one was pathogenic on loblolly pine seedlings, and it killed only 2% of 400 seedling terminals, all of which were killed in one of the four inoculation runs. The weak pathogenicity of *Pestalotia* spp. and *Phomopsis* spp. in these tests indicates that they are not involved in the tip dieback disease. Of the *Fusarium* species isolated, only *F. moniliforme* var. *subglutinans* was pathogenic.

Numerous agents can kill terminals of slash and loblolly pine seedlings; possible causes include fertilizer and pesticide burns (phytotoxicity), insects, and any one of several wound pathogens, including the two fungi implicated in

Table 1. Pathogenicity of isolates of *Fusarium moniliforme* var. *subglutinans*, *Diplodia gossypina*, and *Phomopsis* sp. on 1-yr-old loblolly pine seedling terminals, 28 days after wound-inoculation

Fungus Isolate[y]	Source: Geographic origin	Source: Plant origin	Terminal shoots killed[z] (%)	Test fungus reisolated (%)
F. moniliforme var. *subglutinans*				
1	FL	Slash pine seedling terminal	85 fg	98
2	GA	Loblolly pine pitch canker	90 g	97
3	GA	Virginia pine pitch canker	85 fg	97
D. gossypina				
1	GA	Loblolly pine cone	95 g	100
2	FL	Slash pine seed	75 f	100
3	FL	Slash pine seedling terminal	70 ef	100
4	GA	Loblolly pine seedling terminal	80 fg	100
5	GA	Sycamore canker	50 cd	96
6	LA	Sweet potato	55 de	97
7	LA	Magnolia leaf	55 de	97
8	LA	Live oak acorn	45 cd	96
9	LA	Cotton boll	35 c	96
10	LA	Citrus	10 b	95
Phomopsis sp.				
1	MS	Slash pine seedling terminal	5 a	60
2	FL	Slash pine seedling terminal	1 a	100
3	GA	Loblolly pine seedling terminal	0 a	0
Check (uninoculated)			0 a	0

[y] T. Miller provided isolates 1 and 2 of *D. gossypina*. J. P. Jones provided isolates 6–10 of *D. gossypina*. S. J. Rowan collected all other isolates.

[z] Means followed by a common letter do not differ significantly ($P = 0.05$), according to Duncan's multiple range test. Each mean is the average of four inoculation tests of each of four 25-seedling replicates.

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these tests. In the 2-yr-old planting of slash and loblolly pine seedlings, no difference in the rate of seedling survival or growth could be attributed to the nursery tip dieback disease. Thus, the disease does not appear to be a significant concern to nursery managers.

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