

Influence of Season on Organisms Infecting Untreated Southern Pine Stakes

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ABSTRACT

Untreated southern pine stakes were planted in soil in the fall, winter, spring, and summer, and isolations were made from them each month for 11 months after planting, and at the end of the test 24, 21, 18, and 15 months after planting the fall, winter, spring, and summer series, respectively. Bacteria and *Trichoderma viride* were the most prevalent organ-

isms isolated from the belowground parts of stakes planted in the fall, spring, and summer, but were recovered less frequently from stakes planted in the winter. Bacteria were isolated most frequently from the aboveground parts of the stakes. Soft rot and wood rot fungi were isolated occasionally. Phytopathology 61:1013-1014.

Additional key words: *Pinus* sp., *Chaetomium globosum*, *Lenzites saepparia*, *Schizophyllum commune*.

Studies on the initial colonization of wood by microorganisms and the relationship of these organisms to subsequent decay have rarely considered the effect that season of planting might have on the colonizing organisms. Merrill & French (3) studied the colonization by fungi of untreated pine stakes planted in June 1963 by sampling at weekly intervals from June into September, and other workers have also used only one exposure period (1, 2, 5). Shigo (4) gives a detailed review of the subject of succession of organisms in discoloration and decay of wood. This study was made to determine the natural succession of organisms on untreated pine stakes planted on one test site during each of the four seasons.

MATERIALS AND METHODS.—The experimental material consisted of 144 untreated southern pine sapwood stakes 5 × 10 × 45 cm. The stakes were air-dried to a moisture content of 15%, divided into four sets, numbered, randomized, and planted in an experimental plot. Stakes were placed 22.5 cm in the ground in an upright position and spaced 60 × 90 cm. The plot was on loam soil in a former pasture area on the campus of Mississippi State University, State College, Miss. One set of stakes was planted in October 1968, the second set in January 1969, the third set in April 1969, and the fourth set in July 1969. The experimental plot was mowed at regular intervals to control the growth of grass.

Each month for the first 11 months after planting, three stakes were removed randomly from each season's set for culturing. The final samples from the October planting were removed after 24 months in the ground, from the January planting after 21 months, from the April planting after 18 months, and from the July planting after 15 months.

After removal from the ground, loose soil was brushed from the stakes and they were sawn in half longitudinally leaving a piece 2.5 × 10 × 45 cm. Nine 5-mm chips were removed from the fresh sawn surface of the aboveground portion of the stake after flaming in alcohol, 9 from the belowground portion, and all 18 placed on 2% malt agar.

The plates were incubated at 30 C for at least 3 weeks, and all organisms recovered were classified as

follows: bacteria, molds, stainers, soft rotters, and wood rotters.

RESULTS.—The results of the isolations are summarized in Tables 1 & 2. No termite damage was observed throughout the study. Identifications of bacteria were not made.

TABLE 1. Per cent of untreated pine stakes yielding organisms from belowground parts at intervals after planting^a

Identity	Months after planting						
	1	6	11	15	18	21	24
	<i>Planted October 1968 (Fall)</i>						
Bacteria	0	30	30				46
<i>Trichoderma viride</i>	85	100	98				83
Other molds	0	0	0				0
Stainers	0	0	0				0
Soft rotters	0	0	0				0
Wood rotters	0	0	0				0
Sterile	15	0	0				0
	<i>Planted January 1969 (Winter)</i>						
Bacteria	63	65	22				60
<i>Trichoderma viride</i>	0	11	7				22
Other molds	11	11	42				7
Stainers	0	7	15				26
Soft rotters	0	0	0				0
Wood rotters	0	0	0				0
Sterile	30	0	14				0
	<i>Planted April 1969 (Spring)</i>						
Bacteria	63	51	22				15
<i>Trichoderma viride</i>	26	33	85				66
Other molds	17	18	18				3
Stainers	0	26	3				26
Soft rotters	0	0	0				0
Wood rotters	0	0	0				0
Sterile	0	0	0				0
	<i>Planted July 1969 (Summer)</i>						
Bacteria	26	3	0				0
<i>Trichoderma viride</i>	48	77	96				85
Other molds	14	15	7				22
Stainers	0	0	0				0
Soft rotters	0	0	0				0
Wood rotters	0	0	0				0
Sterile	12	5	0				0

^a Each figure based on an average of nine isolation points on each of three stakes. Totals for some months are over 100% where more than one organism was isolated from any one point.

TABLE 2. Per cent of untreated pine stakes yielding organisms from aboveground parts at intervals after planting^a

Identity	Months after planting						
	1	6	11	15	18	21	24
<i>Planted October 1968 (Fall)</i>							
Bacteria	11	33	38				26
<i>Trichoderma viride</i>	3	27	3				55
Other molds	3	18	13				10
Stainers	0	22	13				37
Soft rotters	0	0	33				0
Wood rotters	0	0	0				0 ^b
Sterile	82	7	15				11
<i>Planted January 1969 (Winter)</i>							
Bacteria	88	45	33				26
<i>Trichoderma viride</i>	0	0	7				3
Other molds	7	12	17				7
Stainers	0	7	17				26
Soft rotters	0	0	3				0
Wood rotters	0	0	7				15 ^b
Sterile	11	36	16				33
<i>Planted April 1969 (Spring)</i>							
Bacteria	40	22	40		29		
<i>Trichoderma viride</i>	3	7	3		3		
Other molds	3	61	3		10		
Stainers	0	11	28		13		
Soft rotters	0	0	0		3		
Wood rotters	0	0	0		0 ^c		
Sterile	54	11	26		42		
<i>Planted July 1969 (Summer)</i>							
Bacteria	62	40	3	11			
<i>Trichoderma viride</i>	0	3	7	29			
Other molds	6	3	44	14			
Stainers	3	15	9	20			
Soft rotters	0	0	0	20			
Wood rotters	0	0	0	0 ^c			
Sterile	29	44	37	26			

^a Each figure based on an average of nine isolation points on each of three stakes. Totals for some months are over 100% where more than one organism was isolated from any one point.

^b *Lenzites saepparia* rot pockets present on all three stakes.

^c *Lenzites saepparia* rot pockets present on two of the three stakes.

Trichoderma viride Pers. was the mold fungus most commonly isolated. Other molds isolated belonged to species of *Fusarium*, *Aspergillus*, *Mucor*, *Rhizopus*, *Penicillium*, and *Cephalosporium*. Stainers isolated included species of *Alternaria*, *Ceratocystis*, *Pullularia*, *Hormiscum*, *Torula*, and *Nigrospora*.

Chaetomium globosum Kunze was the only soft rotter identified. The two wood rotters identified were *Schizophyllum commune* Fr. and *Lenzites saepparia* (Wulf.) Fr.

Bacteria and *T. viride* were the dominant organisms isolated from the belowground portions of the stakes regardless of planting season. *Trichoderma viride* was present in over 90% of the isolations made from fall-planted stakes, but was recovered from only 8% of the stakes planted in the winter. Spring- and summer-

planted stakes yielded this fungus from 71 and 84% of the belowground isolation points. In the winter planting, where *T. viride* isolations were low, bacteria were dominant (Table 1). In contrast to the belowground results, bacteria were isolated more frequently than any other organism from the aboveground parts of the stakes for all of the four planting periods, and *T. viride* was often outnumbered by other molds and stainers (Table 2).

Some chip samples remained sterile even after 3 weeks' incubation. These were more common aboveground and in stakes that had been planted for only a few months. Stakes planted in the winter had the most sterile samples (Tables 1, 2).

Chaetomium globosum, the only soft rot fungus identified, was isolated from the aboveground parts of stakes planted at all four seasons, but only from the belowground parts of stakes planted in the winter. The number of isolations were too few to show any differences among seasons (Tables 1, 2).

Wood rot fungi were isolated occasionally from both above- and belowground parts of stakes (Tables 1, 2).

DISCUSSION.—On many sites, rot fungi can appear much earlier in the succession than was found in this study. For example, in a home garden within a few miles of the test site, sporophores of *L. saepparia* were observed at the ground line of 46% of 24 untreated pine tomato stakes 4 months after planting in June 1970.

The pronounced differences in early colonization of these stakes with season of planting is probably due to temperature and moisture conditions at planting time. The organisms that are dominant in the soil and air at any planting time will infect first, and are not likely to be displaced readily at a later time when they may not dominate in the environment as long as the wood media is suitable for their development. It is not known what effect these differences in early colonization with season of planting have on final decay, but season of planting should be considered in successional studies.

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