TRANSMISSION OF *CERATOCYSTIS ULMI* ON PRUNING SAWS

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Abstract. Transmission of *Ceratocystis ulmi* from infected wood to healthy elms was accomplished by use of a pruning saw. Sawdust from infected wood was shown to contain the DED pathogen. Because of transmission of this fungus on pruning saws, workers involved in the pruning of elms should consider equipment sterilization between trees.

The spread of Dutch elm disease by beetles through feeding wounds is well documented (1). Therefore, it seems plausible that transmission from diseased to healthy trees by pruning tools may also occur. Thus, it was surprising that Holmes (2) reported nontransmission of *Ceratocystis ulmi* (Buisman) *C. Moreau* from diseased to healthy American elms when using a chainsaw technique. However, numerous reports indicate that susceptibility of elm trees are dependent on the environment (3,5,7,4), which may explain Holmes' lack of success. While it may seem logical to prune elms in the winter, when elm bark beetles are inactive and would not be attracted to pruning wounds (6), the possibility of mechanical transmission by contaminated equipment should not be completely ruled out.

This work was undertaken to establish whether Dutch elm disease can be transmitted from diseased to healthy trees by pruning tools.

Materials and Methods

To provide a uniform and virulent inoculum as a positive control, a single spored isolate of C. ulmi stored in a soil tube at 5 °C (12) was used to inoculate sterile plates of elm extract agar. After two to three weeks, spore suspensions were made with 10 ml of sterile distilled water. Spore suspensions were used to inoculate Chinese elm (*Ulmus parvifolia* var Drake) in two ways. Three separate sites on three trees at approximately 20 cm distance along the trunk were inoculated with the spore suspension using a tuberculin syringe. A check using sterile distilled water was likewise injected into three trees. Three separate sites on three trees were also wounded at 20 cm spacings with a pruning saw after the blade was dipped in a spore suspension.

Since the spread of disease under natural conditions could take place from a natural source of disease, a wood sample with typical streaking and a known healthy wood sample submitted to the Dutch elm disease laboratory in Sonoma, CA., was also used as a inoculum source. These wood samples were immediately evaluated by plating representative wood chips on elm extract agar to confirm the presence or absence of the pathogen in each sample. When making inoculation from wood samples, sterile pruning saws were initially used to cut into the sample wood and then used to wound the trunks of trees at 20 cm spacing. In addition, sterile saws were used to produce approximately .5g of sawdust from each wood sample and 5 individual sites on 3 elm extract agar plates were inoculated by placing sawdust particles on the plates at each site.

After incubation from March 15 to August 15 in a screened cage at Sanoma CA., the inoculation sites were evaluated by pealing back the bark and looking for vascular streaking. In addition, five pieces of tissue were removed from areas 1 to 3 cm adjacent to each of the original inoculation sites and plated on elm extract agar to confirm the presence of *C. ulmi* at the original inoculation sites.

Results

When the syringe inoculation technique was evaluated all sites inoculated with *C. ulmi* spores showed good symptoms of streaking. The pathogen was recovered from all inoculation sites. Syringe inoculation with sterile water showed no vascular streaking and there was no recovery of

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C. ulmi from inoculation sites.

When the saw cut inoculation using the *C. ulmi* spore suspension was evaluated, all 9 inoculation sites showed atypical light streaking and 3 of 9 were positive for recovery of the pathogen. Saw cut inoculation with infected wood had good streaking in 7 of 9 sites, slight streaking at one site and no visible streaking at one site. However, at all sites inoculated by this method, tissue pieces when cultured with the saw cut method using noninfected wood showed no vascular streaking and there was no recovery of *C. ulmi.*

In addition, the sawdust plated on EEA was positive in all cases for *C. ulmi* when taken from infected wood and negative in all cases when taken from noninfected wood.

Table 1. Symptoms of streaking and recovery of *C. ulmi* from inoculation sites on *Ulmus parvifolia* var Drake, 5 months after needle or saw cut inoculations.

	Tree	Vascular streaking	*C. ulmi* recovery
Needle inoculation			
	A	+	+
C. ulmi suspension	B	+	+
	C	+	+
	A	−	−
Sterile water	B	−	−
	C	−	−
Saw cut inoculation			
	A	±	−
C. ulmi suspension [z]	B	±	−
	C	±	+
	A	±	+
Infected wood	B	+	+
	C	+	+
	A	−	−
Non-infected wood	B	−	−
	C	−	−

[z] Vascular streaking was very light and atypical in all cases.

Discussion

This paper presents evidence that *C. ulmi* can be transmitted from infected to healthy elm trees by using contaminated pruning saws. While the plausibilty of such transmission has previously been considered, no previous work has been able to demonstrate such transmission. The success of our transmission using pruning saws may have been due to several factors: Inoculation was made during a time of the year when the trees were most susceptible to the disease, since the xylem elements are largest during the spring. Container grown trees were used and may have been more susceptible due to their age or the inherent stress of being cultivated in a container. Although Chinese elm (*Ulmus parvifolia*) is not believed to be particularly susceptible to Dutch elm disease, our method of inoculation and transmission was successful.

This was the second season that transmission of *C. ulmi* was obtained using infected wood as an inoculum source with the saw cut technique. Because of transmission on contaminated pruning saws, many workers involved in pruning operations on *Ulmus* spp. should seriously consider sterilization of equipment before going on to another tree. Equipment sterilization may prove helpful in the containment of DED, especially in light of the evidence presented in the paper.

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