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Genetic Control Suggested in Compartmentalization of Discolored Wood Associated with Tree Wounds

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ABSTRACT. Nine trees in three clones of *Populus deltoides* × *P. trichocarpa* compartmentalized effectively the discolored wood associated with wounds: after 6 months only small columns of discolored wood were associated with the 14 experimentally inflicted wounds per tree. Eighteen trees in six other clones compartmentalized poorly the discolored wood associated with wounds: after 6 months large columns of discolored wood were associated with the wounds. Wound closure and tree diameter were not related to percentage of stem that was discolored. The results suggest that compartmentalization of discolored wood associated with wounds may be under genetic control. FOREST SCI. 23: 179–182.

ADDITIONAL KEY WORDS. Wood decomposition, tree wound reaction, hybrid poplar.

HEALING OF WOUNDS on higher plants has been described in detail by many investigators. Healing has been generally considered as wound closure (Swarbrick 1926, Block 1941, McQuilkin 1950, Crowdy 1953, Neely 1970). Recent research suggests that some trees are able to withstand the constant stress of wounding by internally walling off—compartmentalizing—their infected tissues (Shigo 1975, 1976, Shigo and Wilson 1976).

This research led to further experiments on clones of hybrid poplars to determine whether trees of different genotypes respond differently to wounding.

Sixty trees representing nine hybrid clones of *Populus deltoides* Marsh × *P. trichocarpa* Hook grown on the Massabesic Experimental Forest at Alfred, Maine, were

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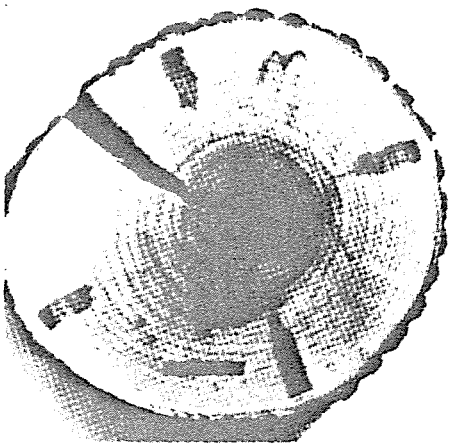

FIGURE 1. Strong compartmentalization—only tissues injured by the drill bit were discolored vertically. There was no lateral spread of discolored wood away from the drill wounds. The black bar is 5 cm.

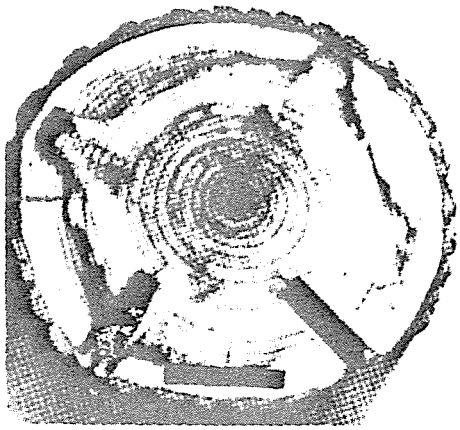

FIGURE 2. Weak compartmentalization—discoloration associated with the drill wounds spread vertically and laterally. The drill holes were closed. The black bar is 5 cm.

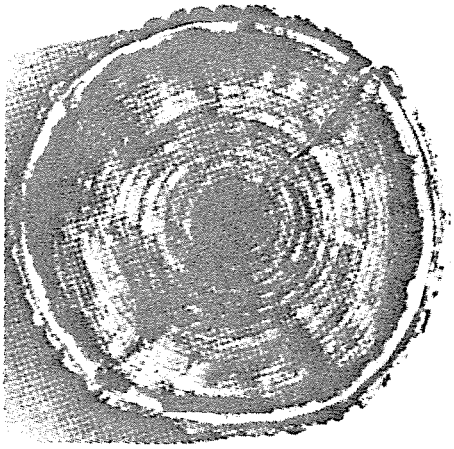

FIGURE 3. Very weak compartmentalization—discoloration associated with the wounds spread vertically and laterally very rapidly. The black bar is 5 cm.

wounded in 1975. The trees were 25 years old, 10 to 20 m in height, 15 to 35 cm in diameter at 1.4 m above ground, and all in the same planting. Each tree received 14 wounds. Wounds were made 5 cm deep with a drill bit 1.43 cm in diameter. On 27 March each tree received six wounds; two each at about 0.5, 1.5, and 2.5 m above ground. On 2 May each tree received two wounds at 3 m above ground and on 3 June six additional wounds at the same heights as the March wounds.

Wounds in each whorl were oriented approximately 90 degrees from each other (Fig. 1).

In August, the number of wounds still open was determined (Table 1).

In October, three trees per clone were selected at random, felled, and cut into disks 5 cm thick, from 20 cm below the lowest wound to 20 cm above the highest. The volume of infected discolored wood in each disk was calculated as a percentage of total volume, and averaged for all disks per tree.

Nine trees from three clones (251, 211, 212; Table 1) compartmentalized effectively the injured and infected tissues associated with the wounds. The discolored wood associated with the wounds did not spread laterally away from the drill holes (Fig. 1).

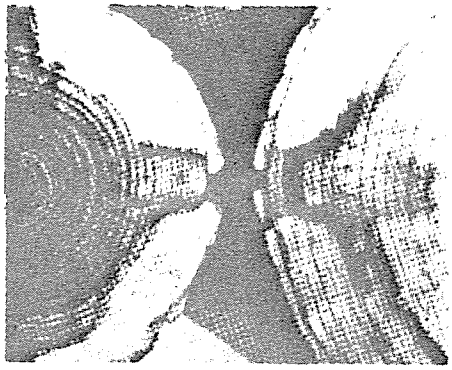

FIGURE 4. The tree on the left was 12 cm in diameter. The drill holes were still open in August, but the discolored wood associated with the holes did not spread laterally—very strong compartmentalization. The tree on the right was 25 cm in diameter. All holes were closed in August but the discolored wood associated with the wounds spread laterally—weak compartmentalization.

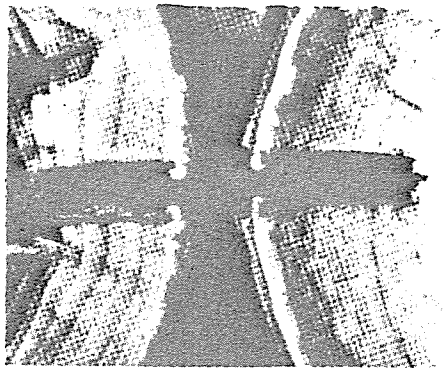

FIGURE 5. The tree on the left was growing rapidly until the last three years. The hole was still open in August, but discoloration did not spread laterally away from the hole—strong compartmentalization. The tree on the right was also growing rapidly until the last three years. The hole was still open in August, but discoloration spread laterally very rapidly—very weak compartmentalization.

Fifteen trees from five clones (208, 250, 256, 205, 207; Table 1) compartmentalized poorly the discolored wood associated with the drill holes. The discolored wood spread laterally away from the drill holes (Fig. 2).

Three trees from one clone (210; Table 1) had very poor compartmentalization. Most of the stem was discolored (Fig. 3).

Volume of discolored wood associated with the wounds differed significantly among clones (Table 1). Tree diameter did not differ significantly among clones (Table 1).

TABLE 1. Relationship of volume of discolored wood in 27 trees from 9 clones of hybrid poplars to tree diameter and wound closure.

Clone	Mean[a] volume of discolored wood	Mean[b] dbh	Holes closed in August from total of 18[c]	
			March wounds	June wounds
	Percent	*cm*	*Number*	*Number*
251	38	22	17	8
211	39	22	18	15
212	42	24	18	13
208	57	19	15	3
250	58	21	14	1
256	59	22	18	16
205	63	18	11	12
207	63	16	11	3
210	81	21	7	0

[a] Three trees per clone, LSD ($P < 0.01$) = 14.4.

[b] Three trees per clone. No significant difference among clones ($F = 1.77$).

[c] Three trees per clone, each tree received 6 wounds in March and 6 additional wounds in June.

Trees in some clones had small diameters and open holes in August. There was no lateral spread of discolored wood away from the wounds—strong compartmentalization (Fig. 4). Trees in some clones had large diameters and closed holes. The discolored wood spread laterally away from the wounds—weak compartmentalization (Fig. 4). Some trees had rapid growth until the last three years. The wounds were still open, but in some clones compartmentalization was strong, and in other clones compartmentalization was weak (Fig. 5). These results suggest that wound closure is a separate process from compartmentalization (Table 1). Wound closure has been shown to be related to current growth rate (Block 1941).

We consider wound closure as a minor part of the wound response. Closure does not appear to determine the extent of internal discoloration initiated by wounding.

The results of this research suggest that compartmentalization of discolored wood associated with wounds may be under genetic control. If this is so for other species, then it may be possible to select trees that develop small columns of internal defect associated with wounds.

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