

EFFECTS OF PARTIAL CUTTING ON THE INCIDENCES OF TREE WOUNDING MICROBIAL SUCCESSION AND TREE MORTALITY

INTRODUCTION:

One of the challenges of partial cutting operations is minimizing damage to residual trees. In these types of cuts, large pieces of forestry equipment must be manoeuvred in somewhat confined spaces. Unavoidable wounds to residual trees ultimately result. Tree wounding initiates the complex mechanisms involved in decay. Affected trees are prone to blowdown and breakage at the wound site, and if they survive to rotation age, their end values are diminished due to decay in the wood.

The ability of a microbe to function and sustain itself depends on several factors, such as suitable substrates, water, oxygen, other gases and temperature. When trees are wounded, a series of events occur that will determine the mycofloral component of the wound face and the conditions of succession

that ultimately result in stain and decay. There are three stages to decay. The first includes physiological reactions of the host caused by the wound. The second stage of succession occurs when pioneer invaders, primarily bacteria, yeasts and deuteromycetes, invade the area and overcome the physiological and chemical barriers of the host. These pioneering fungi are capable of modifying the substances produced by the tree in response



Wounds on a spruce resulting from partial cutting operations.

to the wound. The final step in the microbial succession is invasion by decay fungi. For the majority of decay fungi, this is the mode of infection; however, there are fungi such as *Haemostereum sanguinolentum*, that do not need to have the wound sites preconditioned by other microbes. However, wounding of coniferous wood enhances the invasion of bacteria. The present study was undertaken to determine the

influence of temperature effects on the microbial diversity colonizing wounds of spruce, and their abilities to inhibit *H. sanguinolentum*.

LOCATION/SITES:

The study area is located approximately 120 kilometres north-east of Thunder Bay, Ontario, within the Black Sturgeon Forest.

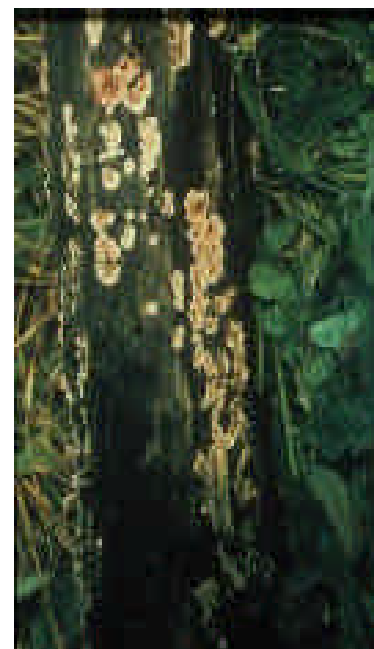
RESULTS:

Partial cuttings were done by either a feller-buncher with a grapple skidder or by manual felling with a cable skidder. Wounds were sampled on black and white spruce trees in two stands.

- Stand 1: wounding after winter freeze up (post freeze up)
- Stand 2: wounding before freeze up (pre-freeze up).

Wounds were very variable in size. All had bare wood exposed. Mortality rates were high for both species.

Identification using plasmalemma fatty acid analysis indicated that there was a complex of bacteria capable of living on wound surfaces one week after they occurred. Species of *Pseudomonas* comprised the highest proportion of the mycoflora. Pre-freeze up wounds had the greatest diversity of microbes. Microbes inhabiting the wounds inflicted prior to freeze up had a very high bacteria component. *Bacillus sphaeficus* isolated from the pre-freeze up wounds, demonstrated the



Fruiting bodies of *H. sanguinolentum*.

highest antagonism to *H. sanguinolentum*. Yeast numbers and diversity were highest on wounds incurred during the post freeze up period. *Cryptococcus albidus* var. *albidus* was the most frequently isolated yeast. The inhibitory test demonstrated that all yeasts were ineffective at inhibiting growth of *H. sanguinolentum*. Filamentous fungi were more prevalent on the pre-freeze up wounds. There was no apparent diversity amongst the fungi isolated at the different times, however, there was a high proportion of fungi that failed to form fruiting structures and could not be identified. There were approximately twice as many fungi isolated from the pre-freeze up wounds and a high incidence of *T. polysporum* on pre-freeze up wounds. Inhibition tests demonstrated that only a small proportion of the population was capable of inhibiting *H. sanguinolentum*. The *Penicillium* species were the most inhibitory by producing distinct inhibition zones between the cultures whereas the *Trichoderma* species overgrew the *H. sanguinolentum* colony and eventually digested the mycelia. White spruce wounded in the pre-freeze up period had the lowest mortality rate after 2 years, however, 5 year evaluations showed that the mortality rate was very high regardless of tree species or wounding period.

CONCLUSION:

High levels of mortality resulted from wounding. Inhibitory bacteria likely contributed to lower mortality in white spruce wounded pre-freeze up. The effects of wounding may be accelerated if wounding occurs after freeze-up.

MANAGEMENT IMPLICATIONS:

To lessen the impacts, wounding should be avoided wherever possible. Particular care should be taken in winter operations, as wounds at this time have a greater opportunity to cause decay.

SOURCES OF RELEVANT INFORMATION:

McLaughlin, J.A.; Dumas, M.T. 1996. Pathological implications of partial cutting Boreal Mixedwood stands. pp. 167-169 In: C.R. Smith and G.W. Crook compilers., Advancing Boreal Mixedwood management in Ontario: Proceedings of a Workshop. Natural Resources Canada, Canadian Forest Service & Ontario Ministry of Natural Resources, Sault Ste. Marie, Ontario, 239 p.

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