Frontline EXPRESS

Canadian Forest Service, Great Lakes Forestry Centre

Bulletin No. 5

BIOLOGICAL CONTROL OF FOREST PESTS AND ELUCIDATION OF THEIR INTERACTIVE PROCESSES

INTRODUCTION:

Canada loses 65 million cubic metres of wood annually due to tree disease, with the majority of this loss attributable to decay fungi. Currently, control measures for these pathogens are nonexistent or relatively ineffective. Isolation of antagonists from ecosystems containing these naturally occurring pathogens will increase the likelihood of finding successful biocontrol organisms. The efficacy of the biocontrol method can be enhanced by integrating it with complimentary cultural and environmental conditions inhibitory to the pathogen. This study will characterize the virulence of pathogens and develop environmentally safe and long-lasting control measures for these diseases through the isolation, testing and development of inoculation methods, and manipulation of the pathogen environments, to increase populations and biodiversity of the mycoflora under various conditions. The mode of action of the control agents will also be elucidated. Impacts that global warming may have on increases or decreases in plant susceptibility to decay fungi such as *Armillaria ostoyae*, will be examined from the perspective of host physiological condition and influence on the carbon balance. Other research will work on the problem of vegetation control in forestry. Specifically, the potential of bacterial and fungal pathogens and the phytotoxins they produce will be evaluated as environmentally compatible methods to control the major weeds, primarily aspen species, fireweed, Rubus species, and alder, which are affecting the regenerating capabilities and sustainability of our forests.

LOCATION/SITE:

Work has been carried in the laboratory and field settings. Control of aspen stump sprouting was investigated on sites north of Thessalon, Ontario. Efficacy of *Chondrostereum purpureum* as a biocontrol agent on aspen and red maple, was assessed on sites north of Fredericton, New Brunswick and north of Iron Bridge and Thessalon, Ontario. Field work examining control of fungal pathogens has been carried out in tree nurseries in Kemptville, Ontario.

RESULTS:

One area of research assessed efficacy of *Chondrostereum pupureum*, an indigenous fungus, as a biocontrol agent for control of speckled alder, red maple, and trembling aspen sprouting. Two formulations of the fungus were used and compared against a control site mechanically cut with stumps treated with triclopyr. The species most affected by the fungal treatments was speckled alder, which incurred a 72% decrease in stem volume index and 19% more clump mortality than untreated sites.

Aspen resprout killed by Chondrostereum purpureum. Fruiting bodies appear white.

Another area of research evaluated the feasibility of using steam as a method to reduce inocula of *Cylindrocladium floridanum*, a root disease pathogen, to determine its effect on the populations of other specific soil microbes and to determine its effect on first year growth of white pine seedlings. Results indicated that steam treatments killed microsclerotia of *C. floridanum* at 5 and 10 cm depths in one bareroot nursery. Populations of *Trichoderma* and fluorescent pseudomonads were reduced at 10 and 20 cm depths respectively. Density of white pine seedlings in steamed beds was higher, and height, root collar diameter, and shoot and root weight were all significantly greater in steamed beds as compared with untreated control beds. Results from other biocontrol investigations have been obtained within this

study and may be made available in future publications.

CONCLUSIONS:

Agrobacterium rubi infecting raspberry (Rubis spp.)

Efficacy varied among the *C. purpureum* isolates and the target species discussed above, and formulation was found to be less important. Generally, effectiveness of *C. purpureum* paled next to the results of the control herbicide treatment used. Steam treatments of tree nursery soils appeared to have a positive effect on white pine seedling growth and survival. Steam temperatures appeared sufficient to eliminate *C. floridanum* from the upper soil layers, and were low enough to limit release of toxic amounts of manganese into the soil.

MANAGEMENT INTERPRETATIONS:

Although the *C. purpureum* was not as effective as the triclopyr against the species discussed above, they may offer a viable, socially acceptable alternative where herbicide use is restricted. Steam treatment of nursery soils appears to be effective for controlling *C. floridanum* for first year growth of seedlings. This type of site preparation could be enhanced further by integration with a biological control procedure.

SOURCES OF RELEVANT INFORMATION:

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