AERIAL APPLICATION OF THE INSECT-KILLING FUNGUS *LECANICILLIUM MUSCARIUM* IN A MICROFACTORY FORMULATION FOR HEMLOCK WOOLLY ADELGID SUPPRESSION

Scott Costa[1], Karen Felton[2], Bradley Onken[2], Richard Reardon[3], and Rusty Rhea[2]

[1]University of Vermont, Burlington, VT 05405

[2]U.S. Forest Service, Forest Health Protection, Morgantown, WV 26505

[3]U.S. Forest Service, Forest Health Technology Enterprise Team, Morgantown, WV 26505

ABSTRACT

Forest populations of hemlock woolly adelgid (HWA) were reduced using an operational formulation of the insect-killing fungus *Lecanicillium muscarium* when it was supported by microfactory formulation technology. Mycotal is a commercial formulation of *L. muscarium* produced in The Netherlands by Koppert Biological Systems, Inc., and is registered overseas as a biological pesticide. Mycotal was tested alone and in combination with MycoMax, a formulation additive based on microfactory technology. The study design was a RCBD, and the site consisted of 12 plots of 1.25 acres on state land in Royal Blue, TN; four plots (5 total acres) were used for each experimental treatment. Co-dominant hemlock trees (10/plot) were surveyed after treatment by removing and examining foliage (5 samples/elevation) in the lower and upper (15 m) canopy and again from the lower canopy 5 weeks after treatment. Precision aerial treatments were applied via helicopter at a rate of 2.7 gallons/acre ($1x10^{12}$sp/acre) (the sticker Hyperactive and ADDIT oil were added to both fungal treatments); identical applications were made in the evening and again the following morning. USDA PPQ Permits were secured for importation, transportation, and release of Mycotal for experimental treatment of ≤ 10 acres. Treatment occurred during egg hatch (late May), when an active crawler population was developing, and a preliminary examination of efficacy was made after crawlers were settled in preparation for summer aestivation. Spores of the insect-killing fungus were delivered throughout the hemlock canopy as indicated by recovery of fungal spores from capture plates stationed in the lower canopy. Temperature, humidity, rainfall, and leaf wetness were monitored at locations across the site and were found to be favorable for fungal germination and growth. Before treatment, there were no significant (alpha=0.05) differences (ANOVA-GLM) among the treatment plots in the populations of HWA woolly masses. When the newly aestivating sisten population was examined in July, it was found that the microfactory formulation (MycoMax) tended to improve the effectiveness of the fungus (Mycotal): populations dropped from 73 percent, with fungus alone, down to 43 percent of that in non-treated control plots when the microfactory additive was included (Fig. 1). Populations of HWA will be re-examined in

spring 2010 to further evaluate population levels in the upper and lower hemlock canopy. The pilot study is being conducted through the University of Vermont in cooperation with the U.S. Forest Service and state cooperators in Tennessee. Mycotal is currently being considered for a U.S. registration.

Mycotal contains the insect-killing fungus *Lecanicillium muscarium*, which was tested alone and in combination with MycoMax, a microfactory formulation additive designed to enhance establishment and persistence of insect-killing fungi.

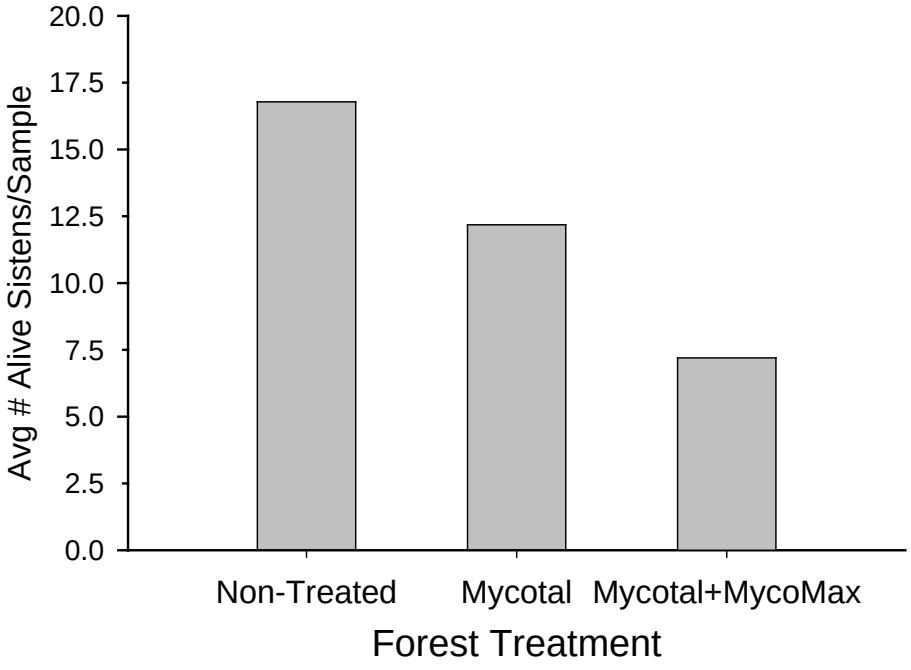

Figure 1.—HWA sisten population 5 weeks post aerial treatment with insect-killing fungus.