

## EFFECTS OF SYSTEMIC, SUBLETHAL DOSES OF IMIDACLOPRID ON TWO PREDATORS OF HEMLOCK WOOLLY ADELGID

Brian M. Eisenback, Jeffrey G. Fidgen, Scott M. Salom and Loke T. Kok

Virginia Polytechnic Institute and State University  
Department of Entomology, 216 Price Hall, Blacksburg, VA 24061-0319

### ABSTRACT

Hemlock woolly adelgid (HWA), *Adelges tsugae* Annand, is an introduced pest of two native hemlock species, eastern hemlock (*Tsuga canadensis* (L.) Carr.), and Carolina hemlock (*T. caroliniana*). Currently, chemical control is the most effective way to control HWA infestations in accessible stands and on individual trees. Some of the most widely used pesticides against HWA are imidacloprid-based products. *Laricobius nigrinus* Fender and *Sasajiscymnus tsugae* Sasaji and McClure are two predator beetles being released in the eastern U.S. as biological control agents of HWA. As the biological control agents establish themselves in the forests and as land managers implement chemical control of the pest it will be important to understand the interactions between the two agents and how to best apply them together in forest and landscape settings. This study examines non-target effects of the systemic applications of imidacloprid on two important predators of HWA.

On April 23, 2004, 24 hemlocks on a private residence in Abingdon, Virginia, were treated by the Mauget (J.J. Mauget Co. Arcadia, California) method. There were four treatments: full, half, and quarter rates of Imicide®, and an untreated control. Five weeks after treatments, HWA-infested foliage was fed to beetles in a no choice test, and beetle survivorship and appetite were observed. To monitor HWA populations on the trees, the proportion of 200 shoots infested with at least one HWA were measured before and after treatments. To determine imidacloprid levels in the trees, branches were dried, ground, and the imidacloprid extracted with solvent and measured with an Envirologix (Portland, Maine) ELISA test kit.

Prior to treatment, the proportion of shoots infested did not differ significantly between treatment groups, but were significant six months after treatment. The change of the proportion of shoots infested before and after treatments was significant between treatments. Control and quarter proportions increased (46 and 17 percent respectively), while half and full proportions both decreased 28 percent. Half and full treatments were comparable as they both reduced HWA populations to under 10% infestation.

Differences in beetle survival rates were not statistically significant between sexes, species, or their combination, so data were pooled by sex and species. Although the mean survival rate for both predators was highest in the control treatment, means were not significant among treatments. Mean survival rate after 10 days for *L. nigrinus* was 80% and *S. tsugae* was 86%. Two possible explanations for the lack of significant differences among treatments are that imidacloprid levels were not high enough at the time of the test or that treatments may

not affect beetle feeding and mortality. Branches are being tested to determine their imidacloprid levels at the time of the tests.

The total number of adelgids eaten did not differ significantly among treatments, species, or their combination. The amount of HWA eaten was significantly different between sexes, with females eating more than males. *S. tsugae* males ate less than females but more than *L. nigrinus* males. The amount of feeding seemed unaffected by treatments, although chemical levels at the time of the tests are still to be determined. Several follow-up experiments are planned for spring 2005. Choice tests will help determine whether beetles prefer treated or untreated adelgids. To test if adelgids are a means by which the predators can be exposed, untreated branches will be cut from trees and treated with high concentrations of imidacloprid before beetles are placed on them. Also, predator eggs and larvae will be placed on treated branches to study survivorship and development. These experiments will shed more light on managing infestations and the interactions of the biological and chemical control of HWA.

### KEYWORDS

Imidacloprid, *Laricobius nigrinus*, *Sasajiscymnus tsugae*.