

MULTIGENERATIONAL DISPERSAL OF AN INTRODUCED AND NATIVE *LARICOBIOUS* SPECIES WITHIN EIGHT HEMLOCK WOOLLY ADELGID INFESTED HEMLOCK STANDS

Gina A. Davis, Scott M. Salom, and Loke T. Kok

Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

ABSTRACT

Laricobius nigrinus (Fender), introduced from the Pacific Northwest, continues to show promise as a biological control agent for hemlock woolly adelgid (HWA), *Adelges tsugae* (Annand), in the eastern United States. A complicating factor for evaluating *L. nigrinus* is that a native predator of pine bark adelgid, *Laricobius rubidus* (LeConte), shows evidence of adaptation and exploitation of abundant HWA populations. An added challenge in studying the introduced agent is that the congener larvae are morphologically indistinguishable, necessitating identification of collected specimens through molecular diagnostic assays. For 2 years, HWA-infested trees have been sampled to assess dispersal of *L. nigrinus* following their release. This sampling has taken place at four sites confirmed to have established *L. nigrinus* populations. Larvae of both *Laricobius* spp. were recovered in spring 2007 and 2008, representing the F2-F3 and F3-F4 *L. nigrinus* generations, respectively. Sampling involved removing a cluster of branches from 16 eastern hemlock, (*Tsuga canadensis* L. (Carr.), trees located 50 to 900 m from the central release areas. In addition, four new *L. nigrinus* release sites were sampled (2 to 7 months post-release) in 2008, at 10, 30, 50, and 100 m from the release areas to monitor dispersal of the parent

generation. We found that the parent generation did not disperse much more than 10 m. The F2-F3 and F3-F4 generations were recovered at approximately 100 and 300 m, respectively, from the release areas. In stands that include eastern white pine (*Pinus strobus* L.), *L. rubidus* are commonly found on HWA infested hemlocks. In hemlock stands lacking white pine, *L. rubidus* appears to be less abundant. Our 2007 and 2008 data from the four established sites show that *Laricobius* population density per branch cluster (mean $\pm$ SD, 20.6 ± 35.4 ; $n=131$) was positively correlated ($r=0.394$, $p=0.0001$) with HWA population density per branch cluster (mean $\pm$ SD, 0.76 ± 0.79 ; $n=131$). This relationship suggests that the predator is able to find its prey and perhaps respond numerically to it. At this early stage it appears that adults do not move far away from the site of their release but that subsequent generations begin to disperse in earnest. For this biological control agent to have a large-scale impact, dispersal to new areas where releases have not taken place will be needed. The frequent recovery of *L. rubidus* on HWA infested hemlocks supports the importance of ongoing research of *Laricobius* spp. interactions.