

PRELIMINARY ASSESSMENT OF THE COLD TOLERANCE OF *LARICOBIVS NIGRINUS*, A WINTER-ACTIVE PREDATOR OF THE HEMLOCK WOOLLY ADELGID FROM WESTERN CANADA

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Abstract

Laricobius nigrinus Fender is a winter active predator of the hemlock woolly adelgid (HWA), *Adelges tusgae* Annand, native to the Pacific northwest of North America. Adults appear in the foliage of infested hemlocks as the overwintering HWA sistens generation develops (Oct. - Dec.) and begin oviposition in the ovisacs of HWA soon after adelgid oviposition begins in January. Thus, multiple life stages of the predator are present during the coldest periods of the Pacific Northwest winter. As *L. nigrinus* is being evaluated as a biological control agent against HWA in the eastern U.S., where winter climates can be more severe than those of its native range, it is important to understand the cold tolerance of the life stages of the predator present during the winter months.

We assessed the cold tolerance of adults, eggs and larvae of *L. nigrinus* through evaluations of the supercooling points (SCPs) of field-collected adults and laboratory reared (at 5 °C) eggs and larvae. Freezing was fatal to all life stages. The mean SCPs of adults ranged between -16 °C and -19 °C, while those of overwintering one day and five day old eggs were -27.5 °C and -26.9 °C,

respectively. Newly eclosed first instar larvae (L1) that had not yet begun to feed, supercooled to -24 °C, while their supercooling capacity both diminished slightly (0 = -22.1 °C) once feeding was initiated. Supercooling capacity diminished with each successive instar, with the SCPs of the L₂, L₃ and L₄ being -17 °C, -15 °C and -13 °C respectively.

Survival of eggs and adults after exposure to sub-zero temperatures above their mean SCPs (-10 °C and -20 °C for eggs; -10 °C and -15 °C for adults) for increasing durations (to a maximum of 8 h) was also evaluated. Survivorship was highest for eggs and adults exposed to -10 °C. Survival of eggs declined with decreasing temperature and increasing duration of exposure. Survival of eggs exposed to -20 °C for 1h was 45%, with no survival evident at longer durations. Increasing durations of exposure of adults to -15 °C (1 °C above mean adult SCPs) resulted in reduced adult survival. However, 40% of the adults tested survived 8h exposure to -15 °C. These results indicate that both the duration and extent of extreme winter minima may be determinants of the range of *L. nigrinus* in eastern North America.