

COLD TOLERANCE AND HOST RANGE COMPARISONS BETWEEN COASTAL AND INLAND WESTERN UNITED STATES POPULATIONS OF *LARICOBIOUS NIGRINUS*

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ABSTRACT

A fundamental difficulty in classical biological control is to ensure that natural enemy releases have appropriate genetic quality, which, if lacking, may reduce the species' adaptability to the new environment resulting in lowered impact or even failure. "Biotypes" of *Laricobius nigrinus* (Coleoptera: Derodontidae), a predator of *Adelges tsugae* (Hemiptera: Adelgidae), may provide an example of this phenomenon. This predator, first collected for biological control use from the coastal city of Victoria, British Columbia, Canada, established at high rates in warmer parts of the invaded range of *A. tsugae* but consistently failed to establish in cold areas (e.g. northeastern United States), making a cold tolerant biotype desirable. Exploration in the northern Rocky Mountains confirmed the presence there of a geographically isolated *L. nigrinus* population adapted to a climate much colder than that experienced by the coastal population of this predator. To support planned releases in the northeastern United States of this rediscovered inland population, we compared the host range and cold tolerance of inland (northern Idaho) and coastal (Seattle, WA) populations of this species. Host acceptance and suitability tests with *A. tsugae*

and a nontarget adelgid, *Pineus strobi*, indicated that inland *L. nigrinus* also has a narrow host range, as was previously documented for the coastal population. The inland population of *L. nigrinus* was found to be more cold tolerant than the coastal population, based on the super-cooling points of adult *L. nigrinus* from Seattle, WA (-16.9 °C), Coeur d'Alene, ID (-19.2 °C), and Moscow, ID (-18.6 °C) and differential survival rates among populations in a 1 month field cage study during winter in Massachusetts [Seattle, WA (49 percent survival), Coeur d'Alene, ID (90 percent), and Moscow, ID (90 percent)]. Last, comparisons of Seattle, WA and Coeur d'Alene, ID collection locations via CLIMEX v.2 confirmed that the optimal release locations in the eastern United States for the coastal *L. nigrinus* population is the mid- to southern Appalachians and warm coastal areas, while that of the inland population would be the northeastern and Great Lake region (an area of expected *A. tsugae* spread). As such, we recommend release of the coastal *L. nigrinus* population in USDA plant hardiness zones 6a,b and higher; while in zones 5a,b and lower, the inland *L. nigrinus* is preferred.