

Host Suitability and Preference of *Laricobius nigrinus* (Fender) (Coleoptera: Derodontidae): A Predatory Beetle for Potential Biological Control of *Adelges tsugae* (Annand) (Homoptera: Adelgidae)

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Abstract

Laricobius nigrinus (Coleoptera: Derodontidae) is being evaluated as a potential biological control agent of hemlock woolly adelgid (HWA), *Adelges tsugae* (Homoptera: Adelgidae) Annand in eastern North America. HWA is not considered a pest on western species of hemlock (McClure *et al.* 1996). A combination of natural enemies and host resistance likely play an important role in maintaining levels of HWA below economic thresholds. We are studying *L. nigrinus* because it may play a role in regulating HWA abundance.

L. nigrinus develops and reproduces successfully on a diet of HWA. Host preference tests are being conducted. In no choice tests, *L. nigrinus* lay significantly more eggs on *A. tsugae* than on *Pineus strobi* or *A. lariciatus*. In paired choice tests, *L. nigrinus* lay significantly more eggs on *A. tsugae* than on *P. strobi*. The expected results from these studies will indicate host range of *L. nigrinus* which is a key requirement for determining its suitability for release in the eastern U.S.

Biology of *L. nigrinus* has not been previously reported in the literature. Our laboratory studies indicate that mating occurs readily between February and April. Males lie lateral to females when copulating. Females lay eggs singly within the woolly ovisacs of HWA. The beginning of egg laying by *L. nigrinus* appears to be synchronized with egg laying by HWA in the spring. This is being confirmed with our field sampling. The eggs appear to be deposited with a sticky secretion on the surface to aid in adhering to the wool. Eggs are bright yellow when first laid, oblong in shape and smooth surfaced. The egg undergoes a color change as it develops, changing from bright yellow to pale greenish-yellow. A few days before hatch, black compound eyes can be seen through the

chorion. The ovipositional period lasts from February to late April. Four instars were determined from head capsule measurements. All life stages of *L. nigrinus* feed on HWA. Early instars feed within the woolly sacs and can only be found by picking open the wool. Later instars feed within the wool but are also active on the stem in search of prey. Larvae appear to have well developed mandibles, which they use to grasp prey and suck out body fluids. Mature fourth instars migrate to the soil and remain in a prepupal state for about 10 days before pupating. Pupation period is between 10 and 14 days. Mean development time (\pm SD) from egg hatch to adult is 56.8 ± 2.61 and 44.2 ± 2.55 at 15 and 18°C, respectively. Emergent adults remain in the soil and aestivate, resuming activity in early October.

Biology of *L. nigrinus* described from laboratory observations is similar to biology described by Franz (1958) for *L. erichsonii*, a European species. However, Franz (1958) reports that emergent adults feed prior to undergoing aestivation from August to October. This was not observed for *L. nigrinus* under laboratory conditions. Aestivation for *L. nigrinus* occurred from May to October in the laboratory.

We are currently sampling *L. nigrinus* and HWA in western hemlock seed orchards in western North America (where *L. nigrinus* is native) to determine its seasonal abundance and synchrony with HWA. Temperature requirements are also being determined to compare HWA phenology and to help streamline our rearing efforts.

References

- Franz, J. M. 1958. **Studies on *Laricobius erichsonii* Rosenh. (Coleoptera: Derodontidae) a predator on chermesids Part I, distribution, life-history, and ecology.** Entomophaga. 3: 109-164.
- McClure, M. S.; Salom, S. M.; Shields, K. S. 1996. **Hemlock Woolly Adelgid.** FHTET 96-35. U.S. Department of Agriculture, Forest Service.

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