

Scientific Name: *Laricobius osakensis*

Family: Derodontidae

Order: Coleoptera

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***Laricobius osakensis* (L.o.)** is a predatory beetle that feeds on hemlock woolly adelgid (HWA), *Adelges tsugae* Annand. This beetle is the primary predator of HWA in its native range in Japan and the two species have co-evolved life-cycles as a result of this shared environment. It was first discovered in Japan in 2005 from a systematic sampling effort on *Tsuga sieboldii*. In March 2006, beetles were brought back to the Beneficial Insects Quarantine Lab at Virginia Tech and after rigorous testing, a FONSI was issued in 2010 allowing these beetles to be released in the U.S.

Identification: Adult *L.o.* are between 2-3 mm in length and are dorsally convex and ventrally flattened. Their antennae have eleven segments with a three segmented club, elytra are seriate or striate and the abdomen has five visible sternites. Lack of ocelli is the primary way to distinguish *L.o.* from other *Laricobius* species. Adult *L.o.* have two color morphs to help distinguish between sexes. Beetles with reddish elytra and glossy in appearance are females while those that are nearly black with no gloss are males (Fig 1 & 2).

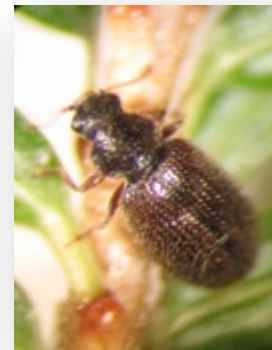


Fig 1 & 2. Female *L.o.* on left and male *L.o.* on right



Fig 3. *L.o.* egg in HWA ovisac

Fig 4. *L.o.* Larva



Fig 5. *L.o.* adult on HWA infested branch

Biology: In late December, adults begin laying eggs in synchrony with HWA oviposition. Eggs are laid in the woolly ovisacs of the adelgid. Larvae hatch and feed on the eggs of HWA. Once feeding is complete, mature larvae drop to the soil to pupate. Adults remain in the soil for an aestival diapause period over the summer and emerge in the fall the same time the aestivating nymphs of HWA systems resume development (Figs 3-6). *Laricobius osakensis* shows promise as a biological control agent due to its synchronous life cycle with HWA and its voracious feeding behavior compared with other species of *Laricobius*.

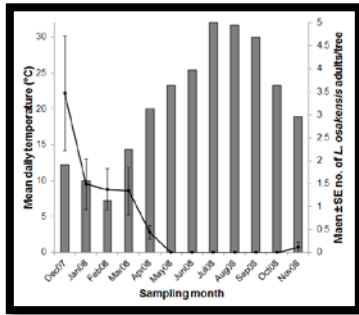


Fig 6. Abundance of *L.o.* adults in relation to month and temperature

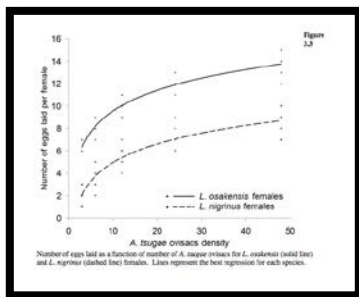


Fig 7. Numerical response of *Laricobius* spp. predators on HWA

Both larvae and adults feed on all stages of HWA. In predation studies, *L.o.* adults fed on more ovisacs than *L. rubidus* and *L. nigrinus* did. In addition to feeding on complete ovisacs, *L.o.* larvae consumed ovisacs in half the time of *L. nigrinus*. Female *L.o.* also showed a higher numerical response, laying more eggs than *L. nigrinus* females (Fig 7). Since the *L.o.* lifecycle is synchronized with HWA, it is not surprising that in laboratory studies it could only complete development to the adult stage when feeding on HWA. It has also been determined that there is no evidence of hybridization occurring between *L.o.* and other species of *Laricobius*. Lab studies show that eggs produced by copulation of *L.o.* and *L. nigrinus* are likely sterile due to lack of fluorescence in the nuclei of eggs produced.

Current Activities: This beetle has been released in the field to monitor their colonization and reproduction in the eastern U.S. In the fall of 2012, *L.o.* was released in the field for the first time in Summersville, West Virginia and Giles County in southwest Virginia. Two more releases were made in 2013 in Goshen and Saltville, Virginia. Release of adults occurs in the fall and egg releases have been made in the spring (Figs 8 & 9). Colonization will be monitored by monthly beat sheet sampling in the fall for adults. Reproduction is monitored by branch clipping in the spring where clipped branches are brought back to the lab at Virginia Tech and the larvae that drop are tested for species I.D. All beetles released thus far were reared in the Insectary at Virginia Tech. The goal is for highly successful release sites to serve as field insectaries in the future.



Fig 8. Release of adult *L.o.* on HWA infested foliage



Fig 9. Release of *L.o.* eggs of HWA infested foliage.

Resources:

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