

Hemlock woolly adelgid host acceptance and predator efficacy on hemlocks with varying levels of resistance

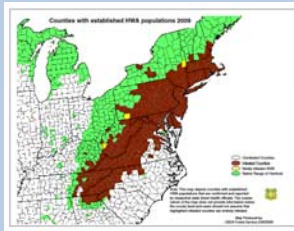
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Introduction:

Eastern hemlock

Ecologically significant foundation species, affects

- air temperature
- stream temperature and chemistry
- soil chemistry
- associated vegetation
- wildlife habitat



Hemlock woolly adelgid (HWA)

- introduced to eastern North America in 1952
- bivoltine, parthenogenic
- sessile adults produce white woolly ovisac
- extremely mobile crawlers spread by wind and wildlife
- causes needle loss, branch dieback, mortality
- highly invasive pest of eastern hemlock
- may see complete loss of eastern hemlock forest type
- different species of hemlock show varying levels of resistance to HWA



Adelges tsugae, HWA



Laricobius nigrinus

L. nigrinus

- native to Pacific Northwest
- feeds on all life stages of HWA
- life cycle synchronous with HWA
- good candidate for biological control

Objectives:

1. Investigate the suitability of five hemlock species, ranging from highly susceptible to highly resistant, for HWA crawler settlement and feeding
2. Evaluate *L. nigrinus* predation rates of HWA on the same five hemlock species

Experimental design

Five species of hemlocks growing in random block design in a common garden at Robinson Forest (Kentucky): eastern, Japanese, mountain, western, and Chinese. Seven healthy branches were selected from each tree (N=5 /species).

Most Susceptible

T. canadensis - Eastern

T. mertensiana - Mountain

T. heterophylla - Western

T. diversifolia - Northern Japanese

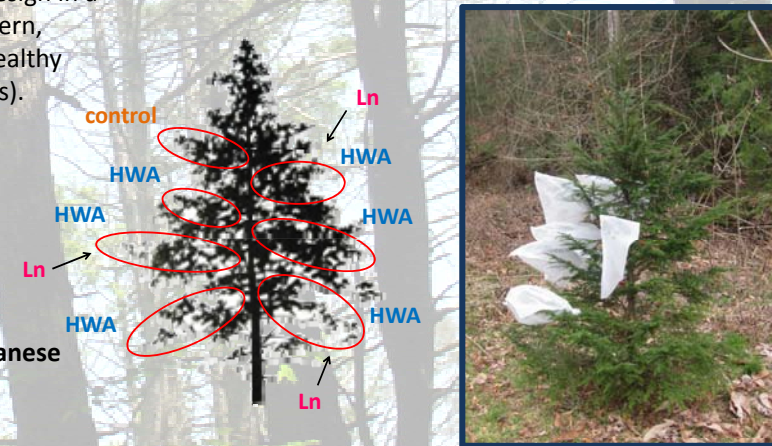
T. chinensis - Chinese

Montgomery et al. (2009) *Econ. Entomol.*

Most Resistant

Implications:

- contribute to biocontrol efforts focusing on HWA
- provide better understanding of resistance to HWA
- provide insight on how hemlock species may affect predator-adelgid interactions
- aid efforts to preserve hemlock forests in Kentucky
- contribute to the search for replacement hemlocks in the event that the eastern hemlock is lost



Methods:

Objective 1: HWA crawler settlement and feeding

HWA infestation

- six branches /tree infested with HWA April 1, 2011
- HWA infested bundles (20-25 ovisacs each) were clipped to pre-selected branches
- all branches were caged

Measurements

- HWA settlement: early June when adelgids fully developed
- HWA survival: late fall when next generation emerges
- counts will be compared across species of hemlock using ANOVA

Objective 2: *L. nigrinus* predation rates on five hemlock species

Beetle release

- 3 HWA infested branches will be chosen from each tree
- 5 mated female beetles added to each selected cage

Measurements

- *L. nigrinus* survival: beetle counts will be taken every 3-4 wks until late June, dead beetles will be replaced
- *L. nigrinus* fitness: predator reproduction will be noted
- *L. nigrinus* predation: HWA density with and without predators will be taken before and after predator release
- data will be compared across the five hemlock species using ANOVA