Impacts of an invasive honeysuckle, *Lonicera maackii*, on embryonic and larval anurans and their associated invertebrate communities

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Introduction

Wetlands are vulnerable to invasion by nonnative plants[7]. Amphibians inhabit wetlands and are indicator species impacted by disturbance. Many studies have been conducted on impacts of various invasive plants on amphibians. Invasive plants have been shown to cause significant mortality and malformations in embryos[4], direct mortality in tadpoles from phenolic compounds[5], and cause shifts in adult amphibian communities[6].

Amur Honeysuckle (*Lonicera maackii*) is an invasive shrub, widespread across the eastern United States. The invaded range corresponds closely with Cope's Gray Treefrogs (*Hyla chrysoscelis*) and Northern Cricket Frogs (*Acris crepitans*). Limited research has been conducted on the interactions between these species. Watling et al.[4] found that *L. maackii* extracts do not affect survival of *H. chrysoscelis* larvae in a controlled lab environment.

I investigated impacts of *L. maackii* through hatching success, hatchling survival, hatchling size, tadpole survival, abiotic factors, invertebrate communities, and oviposition preference.

Methods

Embryo Experiment:

A. crepitans embryos were collected and placed in 15 containers with 500 mL of pond water each. Containers were assigned treatments with either native, *L. maackii*, or zero leaf litter (control). For native and honeysuckle, 1 g of respective dried leaves were used per 500 mL of water. Containers were placed in an environmental chamber (28.3°C) until hatched. Living and dead hatchlings were counted, as well as unhatched embryos. Hatchlings were euthanized and photographed to be measured in ImageJ[1,3].

Short-Term Community Impacts:

Mesocosms were treated with either native or honeysuckle (N=15 each) using 20-gal tanks. Each native tank contained 160 g of native leaves and each honeysuckle tank contained 80 g native leaves and 80 g *L. maackii* leaves. Tanks were colonized with algae, zooplankton, 10 small *H. chrysoscelis* tadpoles, and 3 dragonfly naiads.

After 20 days, tanks were sampled and broken down. Dissolved oxygen (%) and water temperature (°C) were measured in each tank. Algal samples were taken from each tank and dried. Zooplankton samples were taken from each tank and identified to order. Living tadpoles were removed from tanks, anesthetized, and preserved. Macroinvertebrates were collected and identified to the lowest useful taxonomic unit (family or order).

Long-Term Community Impacts:

Mesocosms were used from a previous study by Berta[2]. Tank treatments were native and honeysuckle (N= 15 each). For duckweed cover, a photo was taken to assess % cover using ImageJ[1,3]. Zooplankton were sampled using a single sweep with a zooplankton net and contents were identified to order. Tadpole abundance was estimated using a 30-second visual encounter. Pelagic and benthic macroinvertebrates were sampled and identified the lowest useful taxonomic unit.

Oviposition Preference

Mesocosms from both short- and long-term studies were combined (N=60). Tanks that contained eggs or tadpoles (aside from the 10 stocked *H.*

chrysoscelis tadpoles) were assigned a "1"; tanks that did not were assigned a "0".

Statistical Analyses
All analyses were performed using program R. A Welch two sample T-test was used for tadpole survival. A binomial test was used to assess oviposition preference. For all other data, MANOVA's were used with subsequent one-way ANOVA's to determine which variables were significant.

Results

Embryo Experiment:
Hatchling survival was significantly lower in honeysuckle than in control and native ($F=14.7$, $p<0.001$). Hatchling size was significantly different in all three treatments ($F=55.5$, $p<0.001$), with control having the largest hatchlings and honeysuckle having the smallest.

Short-term Community Impacts:
Dissolved oxygen and algal dry mass were both significantly lower in honeysuckle than native ($F=24.5$, $p<0.001$ and $F=27.0$, $p<0.001$, respectively). Macroinvertebrate abundance was significantly higher in native than in honeysuckle ($F=20.0$, $p<0.001$). Tadpole survival was also significantly higher in native ($t=6.2$, $p<0.001$, Fig. 1).

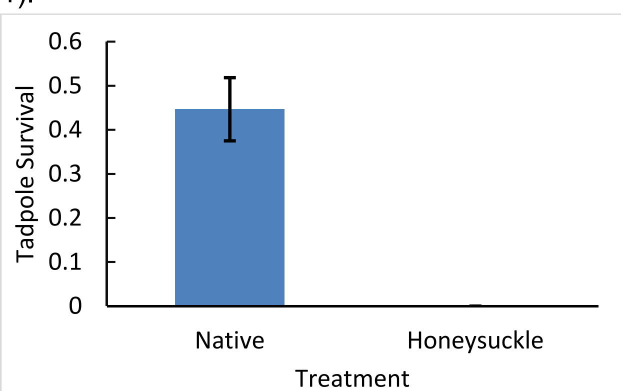

Figure 1. Effect of treatment on tadpole survival.

Long-term Community Impacts:
Duckweed cover was significantly higher in honeysuckle than it was in native ($F=11.1$, $p=0.002$).

Oviposition Preference:
Oviposition was significantly higher in native than in honeysuckle ($Z=-2.5$, $p=0.014$).

Discussion

Tadpole mortality results were in direct contrast with previous research by Watling et al.[5]. Lab studies often do not reflect environmental stochasticity. Other causes of tadpole mortality could be phenolic compounds from *L. maackii*, lack of dissolved oxygen, starvation from lack of algae, or predation. Several small tadpole remains were found in honeysuckle samples, proving that not all mortality was caused by predation. More research is needed to narrow down causes of mortality levels. Broader implications suggest controlling the spread of honeysuckle to reduce negative impacts.

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