Allelopathic potential of woody non-natives in a young forest community

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Introduction

❑ Non-native plant species have been known to be more successful within introduced areas when compared to their natural ranges.

❑ Allelopathy has been suggested as a mechanism for the success of non-native plants because they frequently establish monocultures.

❑ Our goal was to conduct a survey of a suite of non-native forest invaders to determine whether they have allelopathic potential.

❑ By using a standard methodology we directly compared the strength of allelopathy among species.

Collection Site

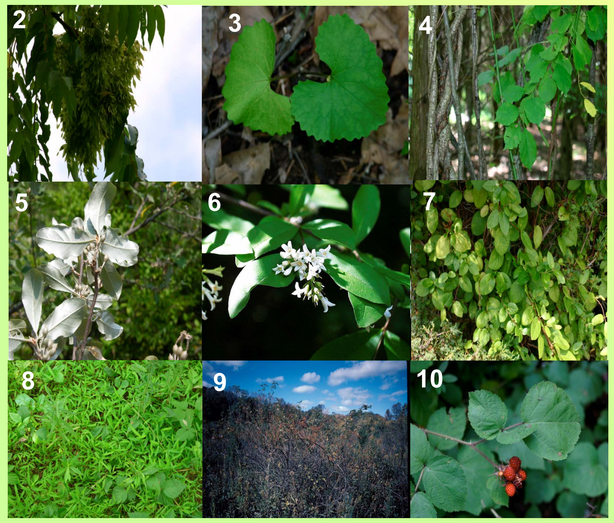
The Buell-Small Succession Study (BSS) within the Hutcheson Memorial Forest (HMF) on former agricultural land in the Piedmont region of New Jersey, (40□30´ N, 74□34´ W). The forest is approximately 50 years old.

Scientific name

1 *Acer platanoides*
2 *Ailanthus altissima*
3 *Alliaria petiolata*
4 *Celastrus orbiculatus*
5 *Elaeagnus angustifolia*
6 *Ligustrum vulgare*
7 *Lonicera japonica*
8 *Microstegium vimineum*
9 *Rosa multiflora*
10 *Rubus phoenocolasius*

Common Name

Norway maple
Tree of heaven
Garlic mustard
Oriental bittersweet
Russian olive
European privet
Japanese honeysuckle
Japanese stiltgrass
Multiflora rosa
Wine berry

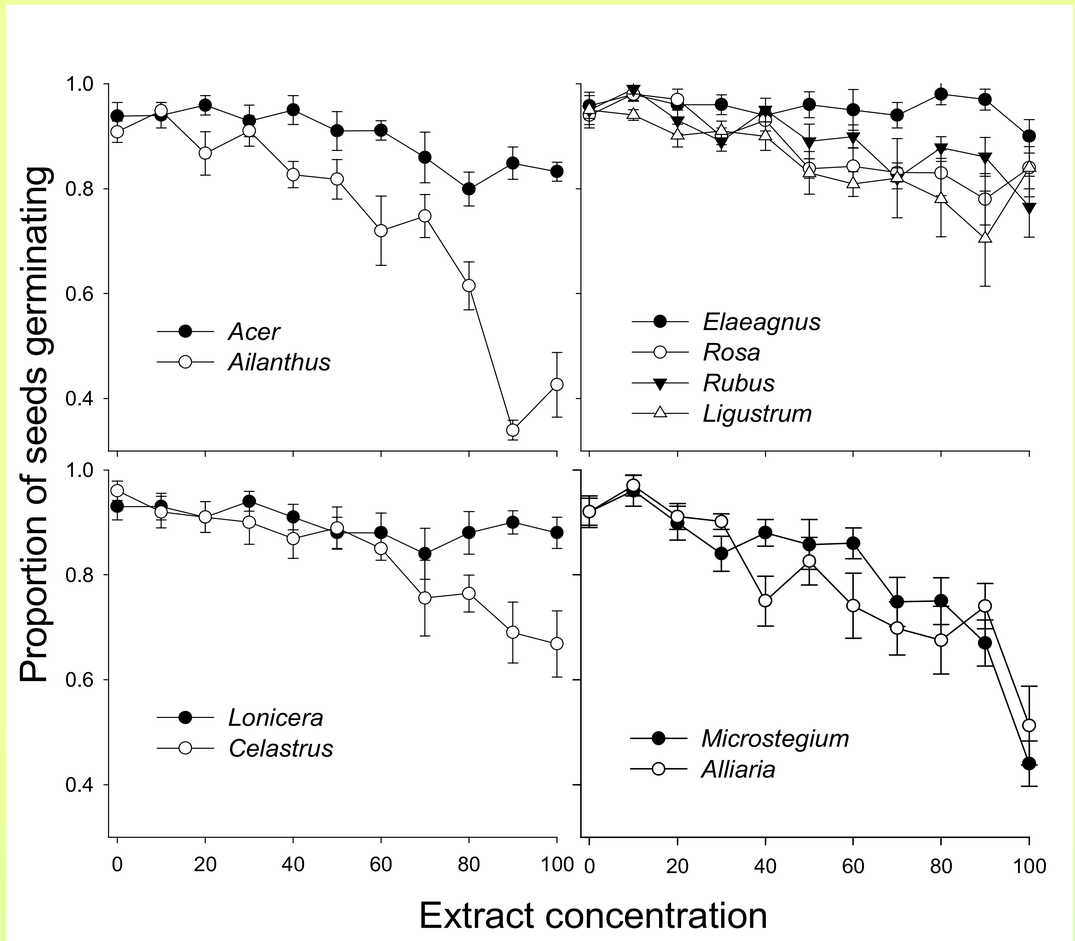


Pictures 1 and 6 provided by the Herbarium of Missouri State University

Laboratory Bioassay Methods

Leaves of each species were collected separately from HMF and air dried for 2 days. An aqueous extract was made from 12.5 g of the dried leaf tissue and mixed with 500 ml of DI water. Dilutions of each extract were made ranging from 0% to 100% in 10% increments.

4 mL of extract was added to each plate containing 20 target seeds (radish). Each dilution was replicated 5 times (55 plates total). Plates were incubated at 25 □C for 4 days. Germinated seedlings were then counted. Regressions were run to quantify the strength of allelopathy for each non-native species.



Results

❑ At low leaf extract concentrations species had minimal reduction in seedling germination.

❑ At higher concentrations, germination proportions differentiated among all species.

❑ *Ailanthus* exhibited the most allelopathic potential out of all non-natives (and for trees).

❑ Shrubs had much smaller effects on seed germination overall.

❑ For lianas, *Celastrus* was moderately toxic, *Lonicera* was mildly toxic.

❑ The herbaceous species had consistently high allelopathic potential.

Table 1.—Regression coefficients of the relationship between extract concentration and germination to quantify the strength of allelopathy for each of the non-native species. Ranking: 10 is the most toxic and 1 is the least toxic species. Bolding indicates a significant *P*-value.

Species	Rank	*β*	*P*-value
Ailanthus	10	-0.55	**<0.0001**
Microstegium	9	-0.38	**<0.0001**
Alliaria	8	-0.37	**<0.0001**
Celastrus	7	-0.28	**<0.0001**
Ligustrum	6	-0.19	**<0.0001**
Rosa	5	-0.18	**<0.0001**
Rubus	4	-0.16	**<0.0001**
Acer	3	-0.14	**<0.0001**
Lonicera	2	-0.06	**0.0326**
Elaeagnus	1	-0.03	0.2216

Discussion/Conclusions

❑ All species had some allelopathic capability except for *Elaeagnus*.

❑ Herbs and shrubs were consistent in allelopathic responses whereas trees and lianas were not.

❑ *Ailanthus*, *Alliaria*, and *Microstegium* were the most allelopathic— therefore allelopathy may enhance their competitiveness.

❑ Allelopathy may be more important in certain species rather than vary consistently across life forms.

❑ The mixture of allelopathic levels in lianas and trees suggest that there is limited utility of plant life form in predicting the strength of allelopathy.

Future Research

A broad suite of native species should be tested to determine the importance of allelopathy in structuring communities and to develop predictions of which species have a strong potential for allelopathy.

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