**“Negative effects of an allelopathic invader on native plant species’ carbon assimilation are driven by species-specific mechanisms”**

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**Abstract**

Invasive plants exploit strategies that maximize their competitive success for establishment in novel ecosystems. Allelopathy, a ‘novel weapon’ defined as a secondary compound produced by a plant that negatively impacts neighboring plant species and soil microbial communities, has gained traction as a mechanism to explain the widespread success of invasive plant species. Previous work estimates that ~72% of invasive plant species can produce and release allelopathic compounds into the environment, resulting in detrimental effects of allelopathic plant invasion on neighboring native plant performance and soil microbial community composition. Specifically, allelopathy-mediated plant invasion reorganizes belowground arbuscular mycorrhizal (AM) fungal communities, which may cause detrimental consequences for native plant species’ resource provisioning, uptake, and allocation to organs that support primary productivity and reproduction. Despite this, our understanding of the mechanisms that drive the negative effects of allelopathic invasion on native species’ photosynthesis processes remains in its infancy, limiting our ability to make inferences about the long-term consequences of allelopathic invasion on primary productivity and its downstream effects on broader levels of ecological organization.

Here, we show that Alliaria petiolata, an allelopathic invader that reorganizes AM fungal communities by secreting glucosinolates belowground, negatively affected leaf gas exchange in two native understory AM-associating plant species (Maianthemum racemosum and Trillium spp.) growing in a long-term A. petiolata field manipulation experiment. Alliaria petiolata presence decreased M. racemosum net photosynthesis and stomatal conductance and increased stomatal limitation of net photosynthesis. The positive effect of *A. petiolata* presence on *M. racemosum* stomatal limitation only occurred after the tree canopy closed and soil nitrogen availability decreased. In contrast, A. petiolata presence decreased maximum rates of Rubisco carboxylation and electron transport for RuBP regeneration in Trillium spp., but this pattern only occurred after the tree canopy closed and soil nitrogen availability decreased. Reduced photosynthetic capacity in Trillium spp. was associated with null effects of A. petiolata presence on net photosynthesis or stomatal conductance. Overall, results indicate that mechanisms that drove the negative effects of A. petiolata presence on native plant physiology were species-specific. Net photosynthesis responses to *A. petiolata* presence in M. racemosum may have been due to changes in water use that increased stomatal limitation, while photosynthetic capacity responses to *A. petiolata* presence in Trillium spp. may have been due to reduced nitrogen uptake and nitrogen allocation to photosynthetic leaf tissue.