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Dear Editorial Board at *Functional Ecology*,

I am pleased to submit our manuscript, titled “The negative effects of an allelopathic invader on native plant photosynthesis intensify as the growth season progresses”, for consideration as a full research article in Functional Ecology. The manuscript contains 3 tables and 4 figures in the main text, with 2 tables and 2 figures included in the supplement. The manuscript is not currently in review at any other journal, but data are publicly available in a data repository.

Allelopathy has emerged as an important mechanism explaining the success of some invasive plant species. By releasing secondary compounds that negatively impact neighboring plant species and soil microbial communities, allelopathic invaders can significantly alter native plant resource acquisition and allocation to photosynthetic tissue. Alliaria petiolata, a well-studied allelopathic invader with widespread distributions in eastern North America, disrupts arbuscular mycorrhizal (AM) fungal communities that coexisting native understory plants rely on for nutrient and water provisioning to native plants. While previous studies have shown that *A. petiolata* presence is associated with decreased native plant net photosynthesis and stomatal conductance, the extent to which these effects are tied to photosynthetic capacity has not been quantified, limiting our ability to understand the physiological mechanism that drives native plant responses to allelopathic invaders. Furthermore, previous work relies on single-timepoint snapshot measures of gas exchange to make inferences about the effects of allelopathic invaders on native plant photosynthesis. While the use of such measurements are useful, they largely ignore the temporal impacts of allelopathic invaders across the growing season as soil resources shift and tree canopies close. Our work addresses this important knowledge gap by quantifying net photosynthesis, stomatal conductance, and photosynthetic capacity responses of two native understory species to *A. petiolata* presence in a long-term manipulation field experiment. Measurements were collected at two timepoints: once early in the growing season before the tree canopy closed and again later in the growing season after the tree canopy closed.

Our findings show that both native species exhibited significantly reduced net photosynthesis rates when *A. petiolata* was present. However, the mechanisms driving this response differed by species.

In Trillium spp., reductions were linked to decreased apparent photosynthetic capacity, suggesting nutrient stress, while in M. racemosum, the response was tied to reduced stomatal conductance, indicating water stress. Notably, these negative photosynthetic responses were strongest later in the growing season, underscoring the importance of considering temporal dynamics in understanding plant physiological responses to invasive species.

This study advances our understanding of plant sciences by emphasizing the importance of temporal dynamics in regulating native plant responses to allelopathic invaders. While previous research has documented reductions in net photosynthesis and stomatal conductance due to allelopathic invasion, our study is the first to show how these effects vary across the growing season. Furthermore, the species-specific mechanisms we observed suggest that allelopathy can impair nutrient provisioning (evidenced by reductions in apparent photosynthetic capacity) or water provisioning (evidenced by reduced stomatal conductance) to photosynthesis. Our study is the first to connect net photosynthesis and stomatal conductance responses with measurements of apparent photosynthetic capacity, offering nuanced insights into the mechanisms underpinning these responses. Finally, our findings caution against relying on single-timepoint measurements to make inferences about the impacts of allelopathic invasion on native plant communities, as such approaches may lead to incomplete or misleading conclusions.

Although the detrimental impacts of allelopathic invaders on native plant communities are well-documented, the dynamic nature of these impacts and their physiological mechanisms remain poorly understood. Our study shows that the negative effects of *A. petiolata* intensify as the growing season progresses, highlighting the importance of accounting for temporal dynamics when evaluating the consequences of allelopathic invasion. Moreover, we found that photosynthetic responses to *A. petiolata* align with its known effects on AM fungal communities and plant community dynamics. This suggests that the physiological impacts of allelopathic invaders could serve as keystone that links aboveground and belowground responses to allelopathic invasion, providing a novel framework for understanding how disruption of AM fungal communities due to allelopathic invasion scales up to affect plant demographic responses.

Thank you for considering this submission. We look forward to your feedback and are excited about the opportunity to contribute to *Functional Ecology*.

Sincerely,

Evan A. Perkowski, Ph.D.

*On behalf of coauthors K. Carroll, Jessie Mutz, Snehanjana Chatterjee, Xianyu Yang, Lalasia Bialic-Murphy, Stephanie N. Kivlin, Susan Kalisz, and Nicholas G. Smith*