ARPHA Conference Abstracts 9: e202845
doi: 10.3897/aca.9.e202845

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Conference Abstract

Interactive effects of mycorrhizal mutualists and insect enemies on invasive plant success

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Received: 04 Jun 2026 | Published: 05 Jun 2026

Citation: Taneja Y, Lekberg Y, Meagher RL, Hahn P, Rosche C, Nagy DU, Flory SL (2026) Interactive effects of mycorrhizal mutualists and insect enemies on invasive plant success. ARPHA Conference Abstracts 9: e202845. https://doi.org/10.3897/aca.9.e202845

Abstract

Plant invasion success emerges from simultaneous interactions with multiple biotic partners, yet invasion ecology has largely relied on isolated, pairwise hypotheses such as Enemy Release or Enhanced Mutualism. Enemies and mutualists often co-occur and generate non-additive effects where one interaction modifies the strength or direction of another. Such interaction modifications may produce plant performance outcomes that cannot be inferred from pairwise hypotheses.

Arbuscular mycorrhizal (AM) fungi and herbivores exemplify this complexity. AM fungi can enhance nutrient uptake and growth, but they may also alter plant nutrient quality, induce defensive traits, or create carbon-allocation trade-offs that influence herbivore impacts. During invasion, species experience turnover in mutualists and enemies across biogeographic ranges, potentially reshaping cost-benefit dynamics among partners. Thus, AM fungi may modify herbivory differently in native versus non-native ranges, but whether these shifts contribute to invasion success remains unresolved.

We asked whether AM fungi alter effects of herbivory, if these effects differ between native and non-native populations, and what mechanisms may underlie enhanced performance

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in the non-native range. We predicted that AM fungi would modify plant-herbivore interactions differently in the non-native range, where populations may better balance herbivore resistance and mutualistic benefits through allocation strategies, plasticity or pre-adaptation.

We tested these predictions using *Erigeron canadensis*, fast-growing annual herb native to North America and invading much of Eurasia. Seeds were collected from 30 populations (15 native, 15 non-native) spanning broad latitudinal and climatic gradients. In a fully factorial greenhouse experiment, we manipulated AMF inoculation (MycoBloom) and generalist herbivore soyabean looper *Chrysodeixis includens*. After two months of mycorrhizal establishment, plants were treated with two herbivory bouts of one-week followed by a three-week recovery period.

We found that AM-associated plants from the non-native range exhibited a ~50% reduction in the odds of leaf damage (OR=0.52), with damage declining from ~14% to ~7%, and insect survival decreasing from 66% to 36%. A significant range × treatment interaction indicates AMF-mediated increases in resistance in non-native populations, whereas AM fungi did not alter resistance in native populations. Ongoing analyses of resistance traits, nutrient chemistry, and belowground allocation will clarify underlying mechanisms.

Together, these results provide some of the first experimental evidence that interactions among multiple biotic partners jointly shape invasion success and highlight the limitations of relying solely on pairwise hypotheses to predict invasion outcomes. Finally, we present a framework to incorporate non-additive effects among mutualists and enemies into invasion research.

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Presented at

Neobiota 2026, the 14th International Conference on Biological Invasions

Conflicts of interest

The authors have declared that no competing interests exist.