Altered nutrient cycling as a novel non-target effect of weed biocontrol

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Invasive weeds have been shown to alter decomposition rates and nutrient cycling in invaded systems. However, little attention has been paid to the role of introduced biological control agents in influencing nutrient cycling. Alligator weed (Alternanthera philoxeroides) invades waterways in northern New Zealand. It is partially controlled in these environments by the alligator weed flea beetle, Agasicles hygrophila, which was introduced as a biological control agent in the early 1980s and has since become widespread. Annual biomass dynamics and litter decomposition rates of alligator weed were compared with those of two native sedges, Schoenoplectus tabernaemontani and Isolepis prolifer, in a New Zealand lake. Herbivory by the alligator weed flea beetle caused a 75% decrease in alligator weed above-ground biomass over a 3-month period in late spring and early summer. This contrasted in both timing and magnitude of litter input by either native plant species. In addition, alligator weed litter decomposed significantly faster than the litter of either native species. This combination is likely to alter the annual availability of nutrients within this ecosystem, with potential flow on effects including facilitation of further weed invasion.

Interactions of plant quality and predation affect the success of purple loosestrife biocontrol programme

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Biocontrol of purple loosestrife (Lythrum salicaria) in North America is generally considered highly successful. Yet, at certain sites, biocontrol agents fail to control their host plant. Field observations indicate that leaf-feeding biocontrol agents Galerucella pusilla and Galerucella calmariensis are more abundant in flooded than in dry sites. We tested two hypotheses: (1) leaf beetles suffer increased predation in dry areas and (2) superior plant quality in flooded areas results in improved leaf beetle performance. To test Hypothesis 1, we conducted predator exclusion experiments at multiple sites. We found marginal effects of exposure to predation on leaf beetle survival, but survival was always higher under flooded conditions. To test Hypothesis 2, we conducted a common garden experiment where we grew L. salicaria plants under three water levels. We measured several plant traits that are potentially related to plant quality and leaf beetle performance. Plants grown in flooded treatments had higher water content and lower tannic acid concentration. All other traits were not significant. Consistent with field observations, leaf beetle fertility and survival were higher on flooded plants. Our data suggest that the relative effects of top–down (predation) vs. bottom–up forces (plant quality) vary along a water level gradient and may further interact with abiotic conditions.