

Cheatgrass facilitates spillover of a seed bank pathogen onto native grass species

Julie Beckstead^{1*}, Susan E. Meyer², Brian M. Connolly¹, Michael B. Huck¹ and Laura E. Street¹

¹Department of Biology, Gonzaga University, Spokane, WA 99258, USA; and ²US Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory, Provo, UT 84606, USA

Summary

1. Pathogen spillover occurs when disease levels for a given population are driven by transmission from a reservoir species that carries a high pathogen load. Pathogen spillover is widely documented in crop systems, but has been little studied in natural plant communities.

2. The abundant seed production of weedy species may create a scenario where spillover of a generalist seed pathogen onto less abundant seeds of native hosts is possible. The invasive annual weed cheatgrass (*Bromus tectorum*) is a potential reservoir species for *Pyrenophora semeniperda*, a multiple-host fungal seed pathogen that naturally occurs in the semi-arid western United States.

3. To investigate potential community-level consequences of spillover by this pathogen in plant communities invaded by cheatgrass, we first used artificial inoculation studies to determine the relative susceptibility of seeds of cheatgrass and five co-occurring native grasses to *P. semeniperda*. Secondly, we quantified the pathogen reservoir (density of pathogen-killed seeds) in the spring seed bank for cheatgrass monoculture, cheatgrass-invaded native grass, and uninvaded native grass patches. Thirdly, potential pathogen spillover onto co-occurring native grasses was quantified by planting native grass seeds into field-collected seed-zone samples from each vegetation patch type and scoring subsequent seed mortality.

4. All species tested were susceptible to infection by *P. semeniperda*, but their vulnerability to seed death varied as a function of germination time and degree of susceptibility.

5. Seed bank samples from cheatgrass-dominated patches contained seed densities over four times higher than samples from uninvaded native grass patches, and *P. semeniperda*-killed seeds were also present at much higher densities, indicating that cheatgrass can function as a reservoir for *P. semeniperda*. Native seeds planted into seed-zone samples from cheatgrass-dominated patches were more likely to be killed by *P. semeniperda* than those planted into samples from uninvaded native patches. Seed mortality also varied across years, sites and host species.

6. Synthesis. Pathogen spillover onto native seeds is likely to operate within seed banks of semi-arid communities invaded by cheatgrass, and perhaps other weeds, and may have broad consequences for community structure. Our findings also demonstrate the ecological significance of multiple-host pathosystems that operate at the seed stage.

Key-words: apparent competition, *Bromus tectorum*, *Drechslera campanulata*, multiple-host pathogen, pathogen spillover, *Pyrenophora semeniperda*, seed pathogen