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Conference Abstract

Invasive plant drives pathogen spillover from natural to agricultural systems

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Abstract

Pathogen spillover between host species is a major driver of pathogen emergence in humans, animals, crops, and natural ecosystems. Many human pathogens reflect spillover from wild animal hosts to humans; forest pathogens have spilled over from ornamental plants; and novel crop pathogens have emerged via spillover from wild hosts. However, the mechanisms and eco-evolutionary dynamics of spillover, especially among plant hosts, are poorly understood. Invasive species might exacerbate spillover events because they provide physical linkages across ecosystems boundaries; they disrupt natural areas, and they establish within disturbed ecosystems. We hypothesize that invasive plants, with dense populations at ecosystem boundaries, facilitate the eco-evolutionary dynamics of pathogen transmission between ecosystems. To examine this possibility, we focused on a natural-agricultural ecosystem boundary with a recent emergence of a novel fungal pathogen of industrial hemp. The fungus *Bipolaris gigantea* has caused widespread epidemics on the invasive grass *Microstegium vimineum* in eastern US forests for over 20 years. After legalization of hemp cultivation in 2014, there were massive outbreaks of the same pathogen on hemp in the same region as diseased

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M. vimineum. Utilizing this system, we aimed to quantify the ecological drivers of pathogen transmission between ecosystems. To identify ecological components of disease severity and transmission to hemp, we conducted:

1. field surveys to quantify the occurrence and severity of disease on experimental sentinel hemp plants placed in transects at multiple distances from *Microstegium* stands, and
2. a field experiment manipulating invasion, moisture (i.e., irrigation), nutrition (i.e., fertilizer), and endophyte inoculation.

In both circumstances, we found that the severity of disease on hemp was best predicted by significant interactions between hemp biomass and *Microstegium* disease severity. In the field experiment, we also found that disease severity on hemp was predicted by a significant interaction between fertilizer addition and endophyte inoculation. Fertilizer increased hemp disease severity intuitively through increased hemp growth; however, endophyte inoculation reduced disease severity but only in the presence of fertilizer. This effect was not driven by interactive effects of fertilizer and endophyte inoculation on hemp size. Together, these results provide substantial support for cross-boundary transmission of a pathogen mediated by an invasive species. These data are also poised to validate future theoretical dynamical and eco-evolutionary models by our group.

Keywords

Microstegium vimineum, *Bipolaris gigantea*, ecosystem boundaries, plant-pathogen dynamics, eco-evolutionary models

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Conflicts of interest

The authors have declared that no competing interests exist.