

Picky pathogens help non-native tree species invade

July 24 2019



Boxelder maple trees, *Acer negundo* (left) and Norway maple trees, *Acer platanoides* (right) are different species from the same genus: *Acer*. Boxelders are native to North America, however, and are invasive in Central Europe where they were introduced as park trees and spread quickly in new places, competing with the Norway maple and other natives. Credit: Jean-Pol Grandmont (left) and James St. John (right).

Walk into a forest comprising only native trees, and you probably notice many different tree species around you, with no one species dominating the ecosystem. Such biodiversity—the variety of life and species in the forest—ensures that each species gets a role to play in the ecosystem, boosting forest health and productivity. However, when non-native trees invade, they form dense groups of a single species of tree. This bucks

conventional wisdom because, in theory, pathogens—microscopic disease-causing organisms—should prevent this from happening.

Trees have many natural enemies, such as herbivores and insects that nibble on their leaves. But their main foes are invisible to the naked eye. In older forests especially, [fungal pathogens](#) evolve to attack the seedlings of certain tree [species](#) and, over time, accumulate in the soils around the adults, hindering the growth of their seeds. Seeds that fall far away from their parent typically survive better. The pathogens thus help dictate where native trees can grow and prevent some species from dominating others.

This effect is part of the Janzen-Connell hypothesis, a widely accepted explanation for the promotion of biodiversity in forests. The theory was developed in the 1970s by ecologists Daniel Janzen and Joseph Connell, who said that species-specific herbivores, pathogens, or other [natural enemies](#) make the areas near a tree inhospitable for the survival of its seedlings. If one species becomes too abundant, there will be few safe places for its seedlings to survive, thus promoting the growth of other plant species within one area.

Why, then, do introduced tree species often invade, outcompete, and displace native [trees](#), even those of the same genus? The subject is the focus of a new study published in the Ecological Society of America's journal *Ecosphere*.



Northern red oak trees, *Quercus rubra* (left) and pendunculate oak trees, *Quercus robur* (right) are different species from the same genus: *Quercus*. Northern reds are native to North America, and are the fourth-most significant invasive species in western and central Europe. Credit: Katja Schulz (left) and Mehmet Karatay (right).

Aleksandra Wróbel, a Ph.D. candidate in the Department of Systematic Zoology at Adam Mickiewicz University in Poland, says that the relationship between [native trees](#) and their enemy pathogens is a tightly co-evolved one; so tight, in fact, that pathogens may not be able to recognize or attack even closely-related introduced tree species. "Enemy-release" theory states that because introduced species are new to the ecosystem, they do not have enemies yet in the soil, and their seeds can fall densely and thrive, becoming invasive. This relaxation of the Janzen-Connell effect, says Wróbel, "gives non-native species a big competitive advantage over native species."

To test how the intensity of the effect differs between tree species of a same genus, Wróbel and colleagues use greenhouse and field

experiments to study two pairs of invasive and native tree species in Central Europe: boxelder (*Acer negundo*) vs. Norway maple (*Acer platanoides*), and Northern red oak (*Quercus rubra*) vs. pedunculate oak (*Quercus robur*). They also conduct surveys of natural forests containing populations of all four species to investigate their survival in an uncontrolled environment.

Under controlled conditions, the invasive species of both pairs fare better than their respective native cousins, avoiding attack by soil [pathogens](#); they are released from the Janzen-Connell effect, giving them the survival advantage. However, under natural conditions, one genus pair (*Acer*) followed the expected pattern, with non-native seedlings escaping pathogen attack, while the other pair (*Quercus*) did not. Wróbel chalks this up to the complexity of interactions with other plants and animals that tree seedlings experience in the wild.

This study indicates that freedom from disease partially explains why non-native tree species dominate in areas where they are introduced. Improving understanding of the role that plant-soil interactions play in the establishment and spread of invasive plants is critical for developing effective management and control strategies.

"Figuring out why invasive species are able to proliferate so readily in new areas is one of the most important issues in ecology and nature protection," concludes Wróbel, "and the results of our research provide additional insight into the factors responsible for the success of certain non-native species."

More information: Aleksandra Wróbel et al, Differential impacts of soil microbes on native and co-occurring invasive tree species, *Ecosphere* (2019). [DOI: 10.1002/ecs2.2802](https://doi.org/10.1002/ecs2.2802)

Provided by Ecological Society of America

Citation: Picky pathogens help non-native tree species invade (2019, July 24) retrieved 24 April 2024 from <https://phys.org/news/2019-07-picky-pathogens-non-native-tree-species.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.