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*Mathematical insights into mechanisms leading to coexistence and competitive exclusion among mutualist guilds*

Mutualistic interactions are gaining increasing attention in the scientific literature, especially as pollination and plant-microbe symbioses play a key role in agricultural productivity. In particular, the widespread symbiosis between plants and arbuscular mycorrhizal (AM) fungi, offers a promising sustainable alternative for maintaining productivity in farmland. Despite the potential benefits for soil quality and crop yield associated with the use of AM fungi, experiments assessing the effective establishment of the fungi in the field have given inconsistent results. Additionally, it is not clear whether the introduction of commercial AM fungi could lead to a biodiversity loss in the native fungal community, and ultimately have a negative impact on plant growth. We developed a series of mathematical models for plant and AM fungal growth to assess the establishment, spread and impact of an introduced species of AM fungi on the native fungal community and on plant productivity. Our models provide a theoretical framework to determine the circumstances under which the inoculated fungal species can coexist with the native fungal community and effectively boost productivity, versus when inoculation constitutes a biodiversity risk and, ultimately, a detriment to crop yield. Overall, our results show that diversity within mutualistic communities promotes productivity and reduces the risk of invasion and biodiversity loss posed by the introduction of a less mutualistic, or even parasitic, species. Although my analysis focuses on plant-fungal interactions, my findings provide valuable criteria to assess the impact of species introduction in mutualistic communities in general, such as other beneficial microbes or pollinator communities.