Causes and consequences of arthropod diversity in a tropical agroecosystem: implications for conservation biological control

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Abstract

Biological control of herbivorous pests by natural enemy diversity is a critical service to ensure sustainable crop production. In order to use this service in an agroecosystem, we need to address two main objectives.
The first objective is to characterize the effect of natural enemy diversity on biological control. Meta-analyses show that the diversity of natural enemies has generally a positive effect on suppression of arthropods herbivores. However, the impact of invasive natural enemies on this effect remains under-explored. Our study system, mango orchards on Reunion Island, was dominated by invasive omnivorous ants. Results showed that the predation rate of sentinel eggs increased with predator diversity and decreased with omnivore diversity. This negative relationship between the predation rate and omnivore diversity appeared to be caused by the most dominant invasive ant, *Pheidole megacephala*, through a reduction in the diversity of their own trophic group and predation of sentinel eggs.
The second objective is to identify drivers of trophic group diversity. Multiple factors, from the community to the landscape scale, are known to influence trophic group diversity, thus requiring a multi-scale approach. Using structural equation modelling, we examined how plant diversity, insecticide spraying and landscape complexity influence multitrophic interactions in arthropod communities in mango orchards. Results showed complex interactions between trophic groups, and effects of landscape, plant diversity and/or insecticide spraying on some trophic groups. Following the presentation of the main findings, we discuss implications for conservation biological control.

Keywords: biological invasion, ecosystem service, farming practices, landscape, multitrophic interactions, natural enemies

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