Predator-Prey Dynamics and Intraguild Predation: Implications for Coexistence

Francisco Martinez*[1,2], Meriem Sahraoui[1], Anne Xuereb[1], Apostolos Pekas[3], and Enric Frago[1,2]

[1]Centre de Biologie pour la Gestion des Populations – CBGP, INRAE, CIRAD, IRD, Institute Agro, University of Montpellier, Montpellier, France – France

[2]Centre de Coopération Internationale en Recherche Agronomique pour le Développement – Agricultural Research Centre for International Development (CIRAD) – France

[3]Biobest Group – Belgique

Résumé

Trophic levels are not always strictly defined, and many species show omnivory by feeding on species belonging to different trophic levels. Intraguild predation, a prevalent form of omnivory, occurs when two competing consumers that share a resource also predate each other. In terrestrial ecosystems, intraguild predation is a common interaction between arthropod natural enemies, and may significantly regulate prey suppression and biocontrol services. Early theory on intraguild predation suggests limited conditions under which species engaging in this interaction may coexist. When intraguild predation is asymmetrical (i.e., one predator feeds on another but not vice-versa) often the dominant predator persists, leading to the competitive exclusion of the weaker competitor. Despite decades of research, understanding at the experimental level the mechanisms of coexistence in communities with intraguild predation remains a challenge. In this study we coupled an experiment in microcosm cages with behavioral tests to understand the population dynamics of three species: the ladybird *Adalia bipunctata*, the brown lacewing *Micromus angulatus* and the parasitic wasp *Aphidius colemani*, all of them feeding on the aphid *Myzus persicae*. The ladybug and the lacewing were the dominant predators because they feed on both aphids and parasitoid larvae living within aphid hosts. As expected, the parasitoids were victims of intraguild predation, had smaller population sizes and become extinct faster in the presence of the dominant predators. Unexpectedly however, the presence of the parasitoid had a negative impact on lacewing population growth, an effect that we did not observe on the ladybird. A further behavioral experiment provided insights into these findings, and revealed that ladybirds consumed aphids more rapidly than lacewings, but despite being dominant predators they both avoided parasitized aphids when they reached the mummy stage. I will discuss the importance of long-term multigenerational experiments to identify the factors that may allow the coexistence of predators engaging in intraguild predation. I will also discuss the implications of our study to better understand the population dynamics of complex arthropod communities and its relevance to future biocontrol strategies.

Mots-Clés: Intraguild predation, population dynamics, coexistence, omnivory, trophic levels

*Intervenant