Dynamic defence: escaping enemies at a landscape scale by shifting phenology

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Résumé

Trees suffer leaf herbivory by insect enemies, primarily during a short period after budburst. In response to this enemy pressure, shifting phenology has been identified as a defence strategy. However, previous localised studies, limited by human constraints, could only explore variations among a small number of trees. Therefore, the ecological significance of phenological shifts at a larger scale and under extreme herbivory remains unknown. Nevertheless, recent advancements in remote sensing allow investigations to extend to entire landscapes. Using satellite data, we investigated phenology and herbivory dynamics from 2017 to 2021 in oak forests spanning approximately 80 km2 in Franconia, Bavaria, Germany. Trees that experienced higher levels of herbivory in a given year showed delayed budburst in the following year, resulting in reduced herbivory pressure. These patterns remained consistent even during extreme herbivory events, such as the 2019 outbreak, and across all experimental herbivory levels. Our results indicate that at a landscape scale, trees consistently use heightened herbivory as a cue to strategically delay phenology in the following year, and this adaptive strategy helps mitigate enemy pressure. We suggest that this dynamic defence might play a crucial role in maintaining population equilibrium between the trees and their insect enemies.

Mots-Clés: Phenology, Plant defence, Herbivorery, Outbreak.

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