Landscape heterogeneity and pesticide reduction favor predation but also grape infestation by Lobesia botrana

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Résumé

To date, there is a consensus that biological control, benefits from landscape heterogeneity but is context-dependent. While previous studies have highlighted the potential complementarity among natural enemy guilds for biological control, none has investigated such complementarity based on the life stage of predation. Hence, we aim to investigate if predation across multiple developmental stages of *Lobesia botrana* could exhibit complementarity over time, enhancing the effectiveness of biological control.
We investigated how landscape variables but also the intensity of farming practices affected the predation of *Lobesia botrana* at different stages and associated crop damage in French vineyards. We hypothesized that both top-down and bottom-up processes are at play suggesting that landscape heterogeneity through higher amount of semi-natural habitats or with smaller vineyards favor higher levels of predation, lower pest densities and higher complementarity across time resulting in reduced pest damage. We also expected consistent effects of biodiversity-friendly practices.

Our study involved 38 vineyards-landscapes, where semi-experimental sentinel approaches were used to quantify predation rates on pupae-, egg- and caterpillar-stages. Damage caused

*Intervenant

by the larvae of first and second generations were observed.

Results showed that landscapes with average smaller vineyards promoted egg and pupae predations, while the quantity of semi-natural habitats around the vineyards favored caterpillar predation. However, no complementary effects between predation rates across pest life stages on pest abundance were found. Only high pupae predation significantly reduced spring infestation despite pesticide use intensity. Our study highlights the substantial influence of farming practices on pest infestation levels. We showed that some local practices contribute to limit pest abundance, such as higher grassy area cover that limits grape perforations whereas pesticide use intensity hampered biological control by affecting negatively predation rates at several stages but also decreased directly grape damage.

Our work reveals that landscape effects have potential to improve predation at multiple stages of development, whereas farming intensity tends to limit them. It also underlines the importance of understanding the specific stages of pest development targeted by natural enemies for effective biological control.
This highlights the importance of adopting integrated pest management strategies that account for both landscape-scale factors and local farming practices. Therefore, efforts should be increased to replace chemical pest control with other measures to mitigate reliance on chemical pesticides.

Mots-Clés: Landscape ecology, farming practices, natural pest control, Vitis vinifera, grape moth damage, Lobesia botrana