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► To cite this version:

Benoit Ricci, Claire Lavigne, Audrey Alignier, Stéphanie Aviron, Luc Biju-Duval, et al.. Efficiency of conservation biological control depends on interaction effects between landscape and pesticide use intensity. Sfécologie-2018, International Conference of Ecological Sciences, Oct 2018, Rennes, France. hal-02734940

HAL Id: hal-02734940

<https://hal.inrae.fr/hal-02734940v1>

Submitted on 2 Jun 2020

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Efficiency of conservation biological control depends on interaction effects between landscape and pesticide use intensity

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Abstract

Control of crop pests by their natural enemies provides a valuable but poorly quantified ecosystem service. Many studies have addressed the multiple scale drivers of pest control but results from such studies appear variable, if not equivocal. The variability of landscape responses can result from its modulation factors by local practices, among which pesticide use intensity which affects pests and natural enemies and could be a major driver of natural pest control. In this study, we examine the relative contribution of pesticide use and landscape on biological control along a double gradient of pesticide use and landscape simplification. Eighty commercial fields were monitored during three years in four contrasted regions in France. Biocontrol in each field was estimated using three different types of sentinel preys (*Ephestia kuehniella* eggs, *Acyrtosiphon pisum* aphids and *Viola arvensis* seeds). For each one, the interaction effects of landscape variables with the intensity of pesticide use on predation patterns were analyzed.

The predation of weed seeds was negatively influenced by both pesticide use and landscape

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simplification, without interaction between the two scales. The predation of *Ephestia* was negatively influenced by landscape simplification only in case of low pesticide use intensity whereas the effect was positive in case of high pesticide use intensity. There was a significant interaction between pesticide use and the length of interfaces between crops and woods on the predation aphids. These landscape variables had a positive effects on the predation of aphids in case of low or medium pesticide use intensity but a negative effect in case of high pesticide use intensity. These results could indicate that in fields with low local pesticide use, landscape complexity enhance biological control whereas in intensive fields, the presence of semi-natural habitat could be unsuitable for natural enemies adapted to intensive situations.