Assessing the in natura effects of pesticide use on flower visitors in France using citizen science

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Résumé

Agricultural practices have intensified (landscape simplification, quantity and diversity of pesticides) and this impacts biodiversity. Although pesticides antagonistic effects have been demonstrated under lab conditions for some flower-visitors' species, studies are lacking regarding *in natura* effects, often encountered at sublethal doses and in cocktails. Here, we aim at developing indicators of responses of flower-visitors to pesticides use on a national scale.

We used data from a monitoring scheme of flower visitors across France based on citizen science (Spipoll) and related occurrences to pesticides indicators derived from the French database on pesticide purchases: i) a total pesticide hazard ratio integrating quantity, toxicity and degradability of 269 active substances, and ii) the diversity of pesticides purchased locally. We also included covariables such as arable land proportion, landscape heterogeneity, weather conditions, etc. We assessed responses to pesticides for ca. 40 separate species and major flower visitors' guilds (bumblebees, solitary bees, hoverflies, butterflies, and beetles).

Preliminary results highlight diverse responses at species level to pesticides (both the total hazard ratio and substances diversity). At guild level, we detected a significant negative association between pesticide diversity (cocktail effect) and bumblebee diversity. Additionally, diversity of solitary bees was negatively associated with the total pesticide hazard ratio but only the mostly agricultural landscapes.

Perspectives for these first results are i) to understand which species traits explain the various responses to pesticides, and ii) delve into the potential associations with individual active substances, which could help change pesticide use toward less harmful substances.

Mots-Clés: Agriculture, Citizen science, Indicators, Flower visitors, Pollinators, Pesticides

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