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ORAL PRESENTATION

MANAGING LANDSCAPES FOR PROMOTING THE WEED SEED REGULATION SERVICE IN AGRICULTURE

Sandrine PETIT¹ – Sarah LABRUYERE¹ – Orla MCLAUGHLIN¹ – Benoit RICCI¹ – Dave BOHAN¹

¹ INRA, UMR 1347 Agroécologie, 17 rue Sully, 21000 Dijon, FRANCE, david.bohan@dijon.inra.fr, sarah.labruyere@dijon.inra.fr, oral.mclaughlin@dijon.inra.fr, benoit.ricci@dijon.inra.fr, sandrine.petit2@dijon.inra.fr,

Introduction

A major challenge for the future of agriculture is to manage ecological, pest control services in place of current pesticides with little or no additional risk to productivity and food security. Among natural enemies, carabid beetles consume substantial amounts of weed seeds in arable fields and the abundance of seed-eating carabids has been linked to the amount of weed seed bank regulation, suggesting that weed seed predation might partly substitute for chemical weed control and could be employed as an ecosystem service in agriculture (Bohan et al., 2011). However, empirical evidence for landscape management supporting this weed seed regulation service is still relatively scarce (Trichard et al., 2013). We present here the findings of two surveys analyzing the effects of the spatial organization of the mosaics of crop types, crop management and semi-natural habitats on the abundances of seed-eating carabids and on the levels of weed seed predation levels in arable fields.

Identifying key agricultural habitats within the land mosaics

To date, most landscape ecological studies have focused on the contribution of semi-natural habitats to carabid diversity, with findings of limited use for designing land management strategies aimed at enhancing weed regulation services. Here, we investigated the impact of the cover specific agricultural land use types in the landscape on the abundance of nine common seed-feeding carabid species. We used data collected in 161 arable fields and four crop types across the UK (Firbank et al., 2003). We detected a general positive effect of the cover of grassland and of oilseed rape crops in the surrounding of fields on in-field carabid abundance (Labruyere et al., 2016). Following this survey, an experimental study was set up in northern-eastern France to assess the role of oilseed rape for 3 abundant seed-eating carabid species, with estimations of activity-density of each species and of the nutritional status of individuals for each species. Our results show that during spring, oilseed rape crops shelter more and better-fed individuals than winter cereals fields and grassy field margins, suggesting that oilseed rape is a key land-use for the population dynamics of seed-eating carabids in agricultural mosaics. Our result also show that the nutritional status of individuals tended to decrease when pesticide use increased in this crop type.

Acknowledging that local and landscape scale management act in interaction

One difficulty in analyzing the impact of the spatial organization of the land mosaics is the common occurrence of interactive (conditional) effects, i.e. in-field management can have an effect conditional to the landscape context of fields or vice-versa. Using data from 67 arable fields in northern-eastern France, we examined whether in-field management -conservation agricultural (CA) practices of no-tillage and cover planting- and landscape management - the amount of arable agriculture sown and of perennial grassland - affected the in-field abundance of seed-eating carabid beetles and the level of weed seed predation. We found that CA practice enhanced in-field carabid abundance and weed seed predation, but only after a period of four years of adoption. Prior to this, carabid abundance and weed seed predation were mostly responding to the landscape context of arable fields and were enhanced by high cover of annual arable crops and high cover of perennial grassland. Adopting management to maintain a high cover of either of these two habitats during the early, three-year phase of CA adoption would thus represent a lever to maintain seed-eating carabid numbers in arable fields.

Conclusion

In-field carabid abundance and levels of weed seed predation respond to the spatial distribution of agricultural land-use at various spatial scales and some crop types and crop management options affect weed seed predation levels both locally and at the landscape scale. This suggests that there is a diversity of management options, at different scales that could be used to enhance the service of weed seed regulation in agriculture.

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