13-Predictive metapopulation ecology for improving insect pest management

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Many insect pest species exploit several types of habitats in agricultural landscapes. As these habitats may export or import individuals, identifying habitats acting as sources and sinks and determining the spatial scale of their effects is critical for managing landscapes to enhance pest control. Here I describe a systematic, spatially-explicit approach that can be used to characterize and test the effects of source and sink habitats and of local factors on pest attributes. This approach was used to predict spatial variation in population dynamics in Lygus hesperus and evolution of insecticide resistance in Bemisia tabaci, suggesting that it has the potential to improve the design of landscape-level management strategies in many pests.

14-Learnings, tools and pitfalls of agroecology at landscape scale. Lessons from projects in DYNAFOR Lab

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There is a growing concern about the use of ecosystem services components (such as soil protection, conservation of water quality, pollination, biological control of pests) provided by landscape through the presence of semi-natural elements and the spatial arrangement of crop mosaic. The DYNAFOR Lab was firstly mostly involved in issues on biodiversity in small forests and rural landscape with a landscape ecology approach. Here we present our main conclusions from various projects dedicated directly or not to pest control by beneficial insects.
First, we compared aphid and hoverfly abundance in wheat fields differing in woodlot density in their vicinity, from spring 2003 to spring 2007. In addition, the rate of survival of a hoverfly species (*Episyrphus balteatus*, De Geer, 1776) after overwintering was simulated in a multi-agent model and compared to field data in spring. Simulations with the winter survival model showed higher survival rates in wooded landscapes with floral resources, but these only matched the actual spring abundance of hoverflies in 2003. Although aphids and hoverflies were both present earlier in wheat fields in wooded than in less wooded contexts, the higher ratio of hoverflies to aphids in wheat fields in wooded contexts suggests that the latter offer better potential biological control. Emergence traps in wood border showed a high variability of the abundance of overwintering beneficial insects.
The study of carabid beetle communities in emergence traps in wood edges, field borders (inside and outside fields) pointed out the drastic number of zoophagous carabid beetles overwintering in wood edges but also in field borders themselves even when ploughed.
Our global conclusion is that even if wood edges, hedges have proved their beneficial effects to support beneficial species, the field itself and its management are worth to be studied in relation to the landscape context. The temporal window at which a landscape effect could be identified is sometimes very narrow.

15- Remote sensing for spatial ecology

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