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4.9.P Pollinator monitoring in agroecosystems – general methods for evaluations in field studies

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Abstract

Extensive knowledge of the occurrence, condition and population changes of wild bee communities in agroecosystems is important. The knowledge is needed to understand the complexity of potential exposure routes to plant protection products in specific crops and agricultural scenarios or to evaluate possible impacts of treatments at a landscape scale taking into account other influencing parameters like the cultivation system or management practices.

Keywords: pollinator, monitoring, solitary bees, risk assessment, experimental design, non-Apis

Introduction

Pollinator monitoring studies are performed under field conditions. They focus on native bee communities occurring in agroecosystems and can be useful to make spatial and temporal comparisons in a multifaceted context to allow conclusions regarding the causes of community and development changes. They can therefore provide an important database for the design and evaluation of strategies and concrete measures to support and conserve wild bee communities in agroecosystems.

Generally, the abundance and species richness of naturally occurring pollinators in a crop and adjacent field margins will be investigated. For crops considered to be not attractive as foraging and nesting habitats for honey bees, wild bees and other pollinators, the comparison of in-field and off-crop abundance and richness can help to understand if pollinators are exposed to plant protection products or not. This might include temporal as well as spatial differences (timing of monitoring and placement of monitoring within the field and landscape).

Materials and Methods

To evaluate a wide range of pollinator species occurring in a specific crop, several methods are available. We recommend using a combination of different types of sampling techniques: non-selective and selective, because wild bees are often highly specialized in their floral choices, nesting behavior and phenology e.g., so that their populations can undergo strong spatio-temporal variations. For the non-selective methods two different types of traps might be used in combination: Vane traps and Bee bowls (pan traps). These traps can be installed at different locations (*i.e.*, in the centre of the fields; at the borders of the fields; and, outside in the adjacent field margin) and different heights adapted to the type of the crop which is investigated. As selective method, sweep netting and observation can be used via standardized or variable transect walks in a defined distance and time interval or at fixed locations.

Furthermore, the importance of the crop as a possible source for food or nesting material compared to other available sources at the time of the year can be assessed. Trap nests can be set up at different locations for hypergeic (above-ground nesting) solitary wild bee species that breed in woody cavities to assess their pollen sources by pollen identification of pollen mass samples. If required, analysis of residue levels in solitary bee provisions can be assessed additionally with samples of the stored pollen mass.

Survey activities during the field and lab phase:

Non-selective wild bee sampling

- Set up of sampling areas at different locations at the field site (centre, border, field margin and/or off crop; Fig .1.)
- Two types of different traps are used to attract wild bees in the sampling areas (bee bowls and vane traps

Selective wild bee sampling

- Sweep netting with standardized or variable transect walks in-/off the crop
- Observation plots on fixed locations (flight intensity, floral visitation behavior)

Landscape & Flowering survey

- Survey of the field site surrounding to record the abundance and diversity of crop and non-crop flower resources which are likely to be utilized by pollinators during the flowering period of the investigated crop

Pollen mass sampling from trap nests of hypergeic nesting wild bees

- Residue analysis
- Pollen source identification

Sample analysis

- Taxonomical identification of wild bee samples to species level

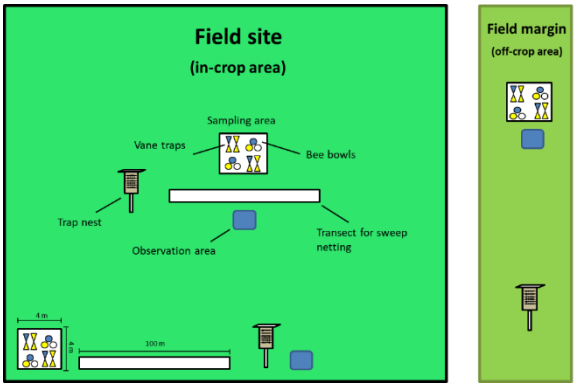

Fig. 1 Field site set-up

Results

A pollinator monitoring with selective and non-selective methods can serve as a proper way for a study design to understand pollinator-plant (crop) interactions in a risk assessment context, but can be also a useful tool to evaluate the impact of mitigation measures (*i.e.*, planting of flowering strips, cultivation management in agroecosystems *etc.*).

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