Linking the nutritional state of wild bees to floral resource availability in European grasslands

Clémentine Leroy, Jean-Luc Brunet, Suzanne Butschkau, Louella Buydens, Alexander Keller, Sara Diana Leonhardt, Alejandra Parreño, Guy Smagghe, Mickael Henry, C. Alaux

LINKING THE NUTRITIONAL STATES OF WILD BEES TO FLORAL RESOURCES AVAILABILITY IN EUROPEAN GRASSLANDS

Leroy, Clementine, Abeilles et Environnement, INRAE, Avignon, France
Brunet, Jean-Luc, Abeilles et Environnement, INRAE, Avignon, France
Butschkau, Susanne, Plant-Insect Interactions, Technical University of Munich (TUM University), Freising, Germany
Buydens, Louella, Department of Plants and Crops, Ghent University, Ghent, Belgium
Keller Alexander, Center for Computational and Theoretical Biology and Department of Bioinformatics, Biocenter, University of Würzburg, Würzburg, Germany
Leonhardt, Sara Diana, Plant-Insect Interactions, Technical University of Munich (TUM University), Freising, Germany
Parreno Alejandra, Plant-Insect Interactions, Technical University of Munich (TUM University), Freising, Germany
Smagghe Guy, Department of Plants and Crops, Ghent University, Ghent, Belgium
Henry Mickael, Abeilles et Environnement, INRAE, Avignon, France
Alaux Cedric, Abeilles et Environnement, INRAE, Avignon, France

All bees have in common that they rely on floral pollen and nectar for their growth, reproduction and survival. Nectar contains mainly carbohydrates that fuel the energetic demands for bees, and pollen that provides proteins, amino acids, lipids, and sterols essential for their reproduction and larval development. A decline in the diversity and abundance of floral resources in the environment is therefore expected to trigger a nutritional stress and consequently affect bee health. However, besides some studies on model species such as honeybees, little is known about the influence of floral resource abundance and diversity on the nutritional health of wild bees and thus their sensitivity to changes in floral resources at landscape-level.

To address this knowledge gap, we measured the nutritional state of bees at the community level (26 species from 4 families) collected in grasslands under different management intensities and characterized by three different floral diversity gradients in Belgium and Germany. We specifically analyzed the body content in proteins, glycogen and triglycerides since these components are essential for several life history traits (e.g. reproduction, immune functions, diapause) and their storage are expected to reflect the floral resources availability in the environment. These nutritional state indicators were then linked to landscape variables such as the floral resources density and diversity and the land use intensity.

By assessing the nutritional state of wild bee species, we can identify how different landscape change drivers, such as floral density, diversity, and management practices, affect different species. Ultimately, we aim to identify some indicator species providing early warning signals of reduced habitat quality, as well as to assess the consequences of such changes for related bee species. Our results should therefore help improving the management of floral resources in wild bee conservation programs.

Keywords: energetic metabolism, floral diversity, bee conservation