Poster

Nutritional stress exacerbates impact of a novel insecticide on solitary bees' behaviour, reproduction and survival

Knauer, Anina C.[1]*; Alaux, Cédric[2]; Allan, Matthew[3]; Dean, Robin[4]; Dievart, Virginie[2]; Glauser, Gaétan[5]; Kiljanek, Tomasz[6]; Michez, Denis[7]; Schwarz, Janine M.[1]; Tamburini, Giovanni[8]; Wintermantel, Dimitry[9]; Klein, Alexandra Maria[9]; Albrecht, Matthias[1]

[1]Agroecology and Environment, Agroscope, Zurich, Switzerland
[2]UR406 Abeilles & Environnement, Site Agroparc, INRAE, Avignon, France
[3]Atlantic Pollination Ltd, Eastleigh, United Kingdom
[4]Red Beehive Company, Bishops Waltham, United Kingdom
[5]Neuchâtel Platform of Analytical Chemistry, University of Neuchâtel, Neuchâtel, Switzerland
[6]Department of Pharmacology and Toxicology, National Veterinary Research Institute, Pulawy, Poland
[7]Institute for Biosciences, University of Mons, Mons, Belgium
[8]Department of Soil, Plant and Food Sciences (DiSSPA - Entomology), University of Bari, Bari, Italy
[9]Nature Conservation and Landscape Ecology, University of Freiburg, Freiburg, Germany
*email: anina.knauer@agroscope.admin.ch

Abstract

Pesticide exposure and food stress are major threats to bees, but their potential synergistic impacts under field-realistic conditions remain poorly understood and are not considered in current pesticide risk assessments. We conducted a semi-field experiment to examine the single and interactive effects of the novel insecticide flupyradifurone (FPF) and nutritional stress on fitness proxies in the solitary bee *Osmia bicornis*. Individually marked bees were released into flight cages with monocultures of either buckwheat, wild mustard or purple tansy, which were assigned to an insecticide treatment (FPF or control) in a crossed design. Nutritional stress, which was high in bees foraging on buckwheat, intermediate on wild mustard and low on purple tansy, modulated the impact of insecticide exposure. Within the first day after application of FPF, mortality of bees feeding on buckwheat was 29 times higher compared to control treatments, while mortality of FPF exposed and control bees was similar in the other two plant species. Moreover, we found negative synergistic impacts of FPF and nutritional stress on offspring production, flight activity, flight duration, and flower visitation frequency. These results reveal that environmental policies and risk assessment schemes that ignore interactions among anthropogenic stressors will fail to adequately protect bees and the pollination services they provide.

Keywords: bee health, foraging, nectar, pesticide, pollen, reproduction