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New tool to map pollinator exposure to pesticides

As bee populations decline, exposure of pollinators to pesticides is of increasing concern. Italian research has now demonstrated that an index of exposure which accounts for insect behaviour, as well as pesticide application, provides a valuable tool for assessing the realistic risk of pesticides to pollinators.

Assessing the environmental impact of pesticides requires not only an understanding of their toxicity, but also accurate estimates of how insects are exposed to them. Current risk assessments are often based on a ratio between the amount of pesticide applied and the concentration of pesticide above which there are toxic effects to the insect. However, this is likely to be over-simplistic, since exposure to pesticides can vary with many factors, such as the presence and attractiveness of flowers.

In this study, partly conducted under the EU ALARM project[1], experiments on agricultural land were conducted to test a new index which predicts the pesticide exposure to insects by accounting for the behaviour of honeybees.

For permanent crops, such as vineyards or orchards, where pesticide is not applied during flowering, the main sources of exposure for insects are likely to be non-crop plants that surround the intensively managed areas. The index therefore calculates exposure as average concentration in plant parts as the amount of pesticide drifting onto non-crop plants, divided by the area over which pollinators forage.

The researchers tested the index on two 4 x 4 km plots in a grape-growing region of North-East Italy. The first plot contained an intensively managed vineyard (25% of the area). In the second, a control plot , vineyards covered less than 2% of the area and insecticide input was minimal. In order to test the index's predictions, the researchers measured the levels of an organophosphate insecticide, chlorpyrifos (CHL), in non-crop plant samples collected from 16 locations in each plot.

Finally, the researchers were concerned that a lack of detailed land use data would affect the accuracy of the index's predictions. Therefore they tested the index's performance using data at three different resolutions; 1 x 1 km, 2 x2 km and 4 x 4 km.

The index's predicted concentrations for the intensive site were generally close to the measured samples from the sites. Predictions for the control site, where CHL levels were low, were less accurate, but the researchers stress that results did confirm generally low pesticide levels in the area, which remains valuable information for risk assessments.

The results also demonstrated that the index was more accurate when more detailed data were available. At the largest scale (4 x 4 km), predictions were much less accurate. However, researchers note that if data are only available on large scales, dividing the crop area into average field sizes can substantially increase accuracy.

The researchers conclude that the index provides a more realistic assessment of pollinator pesticide exposure than previous methods; it may be especially valuable since it can be adapted for other insects and can be used in risk assessment methods to estimate the combined effects of different pesticides. However, they do emphasise that the index needs to be further validated so that levels of uncertainty can be assessed.

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