

Pesticides detected in pollen and nectar may pose a long-term hazard for pollinators

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Graphical abstract. Credit: *Science of The Total Environment* (2023). DOI: 10.1016/j.scitotenv.2023.162971

Pesticides have been detected in flowers not targeted with the chemicals that could be an additional, underestimated threat to pollinators

according to new findings by Trinity and DCU, published in the *Science of the Total Environment*.

"This is the first time that a multi-field survey of pollen and nectar from crops and [wild plants](#) has been undertaken in Ireland and is critical to our understanding of [pesticide residues](#) in the Irish context," says Prof. Jane Stout, School of Natural Sciences, Trinity, who co-led the research with Prof. Blánaid White, School of Chemical Sciences, DCU.

The researchers looked for pesticide residues in the nectar and pollen of crop and non-target hedgerow plants. They evaluated the fungicides azoxystrobin, boscalid and prothioconazole and the herbicides fluroxypyr and glyphosate, which are among the most applied [pesticides](#) in Ireland.

They also looked for the neonicotinoid insecticides acetamiprid, clothianidin, imidacloprid, thiacloprid, and thiamethoxam. Some of these chemicals have not been recently applied in Ireland, indeed, their approval has expired (e.g., clothianidin, imidacloprid, thiamethoxam and thiacloprid), but may stay in the environment for long periods of time.

They recorded several compound detections, the majority of which originated from fields where there was no recent application of the specific compound(s). The combination of azoxystrobin, boscalid and clothianidin residues in pollen and nectar of both oilseed rape and non-target bramble flowers, was the most common, with clothianidin appearing to linger for several years after its application on the sampled sites.

"The research takes place in the context of Ireland reaching the ambitious European Commission target in the Farm to Fork Strategy of reducing the use and risk of chemical pesticides by 50%," says Prof. White.

Pesticides are widely used in modern agriculture to maximize food production by preventing [crop damage](#) and disease.

The most widely applied pesticide categories in Ireland are herbicides, fungicides and insecticides. Crops attractive to [pollinators](#), like the oilseed rape, are likely to receive a pesticide input from all these categories.

"Application of various pesticide compounds from different pesticide categories, at multiple time intervals throughout the cropping period, increases the risk of pollinator exposure to pesticide mixtures through pollen and nectar with unknown consequences in pollinator's health," says Ph.D. student Elena Zioga, Trinity.

"Our findings can help us to understand which are the more hazardous pesticides in an Irish context, and also help us to understand what the risks associated with the different chemical pesticides are, so that we can more effectively reduce the risk associated with them," said Prof. White.

Doctoral student Elena Zioga, who was jointly supervised by Prof. White and Prof. Stout, collected thousands of flowers from agricultural fields across Ireland, and carried out her chemical analysis work at the DCU Water Institute.

The findings of certain neonicotinoids, which are known to threaten pollinators, still lingering despite a 2018 ban by the European Commission "is a worry" said Ms. Zioga, who would like to know the extent of their presence in the environment, and at what concentrations.

"We found clothianidin residues in pollen and nectar of both plant species even though it hasn't been applied for years. The fact that it remains present in pollinators' food sources for so long is a concern."

The researchers also found mixtures of pesticides more often than single compound detections, and this means it is important to understand the impact of these mixes on pollinators and other non-target organisms.

"We don't know the full impact on pollinators of consuming foods contaminated with multiple pesticides, and most of what is known is compound specific," said Prof. White. "Moreover, the toxicity of single compounds is mainly being tested on honey bees, while we have scarce toxicity data on other wild bee species like [bumble bees](#) and solitary bees," added Ms. Zioga.

Bees and other pollinators can benefit from food sources provided by certain crops, however exposure to multiple pesticides applied on those crops, is of concern for bee health and for the sustainable delivery of pollination services, which consequently may have significant implications for ecosystem function, crop production, and human health.

"We need to understand how different compounds move through the environment, and the rate at which these compounds degrade, so that we can understand the extent of their persistence," said Prof. White. "And we need to know what their long-term effects are on pollinators and other organisms" added Prof. Stout.

More information: Elena Zioga et al, Pesticide mixtures detected in crop and non-target wild plant pollen and nectar, *Science of The Total Environment* (2023). [DOI: 10.1016/j.scitotenv.2023.162971](https://doi.org/10.1016/j.scitotenv.2023.162971)

Provided by Trinity College Dublin

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