FIVE QUESTIONS

ON GLYPHOSATE

FOR MARTIN KALTENPOTH

Mr Kaltenpoth, in your study, you showed that glyphosate causes harm to saw-toothed grain beetles. Another study showed that the substance had an adverse effect on honeybees. What other insects might be affected?

MARTIN KALTENPOTH We are still not exactly sure. But glyphosate could be harmful to many insects that rely on symbiotic bacteria. These include species that feed on plant saps, such as aphids, cicadas or heteropterans. However, many beetle, bee, and ant species also host symbionts and could be affected by glyphosate.

Glyphosate was thought to be nothing more than a herbicide. Why does it also affect insects?

It inhibits the shikimate pathway, which plants use to produce aromatic amino acids, among other things. But, in addition to plants, certain bacteria and fungi also use this metabolic pathway. Insects that cannot meet their demand for aromatic amino acids, such as tyrosine, from their food host bacteria in special organs for amino acid production. They live in symbiosis with these bacteria. Glyphosate acts on these microbes like an antibiotic: once the insects have absorbed the toxin through their food, it spreads throughout their bodies and kills the bacteria living in the cells of the symbiotic organs. Without their partners, the insects lack the tyrosine they need to form their exoskeleton, which causes them to dry out faster and makes them more vulnerable to predation. In the case of bees, the toxin damages bacteria in the intestinal flora rather than in symbiotic organs, which renders them more susceptible to pathogens.

Glyphosate has been on the market for decades: what should one be on the lookout for in the future during the approval process for pesticides to identify adverse effects on other organisms at an early stage?

We should test the effect of future pesticides on a larger number of different species. Not all insects are the same – and what one species tolerates can be harmful to another. We now know that focusing on the median lethal dose – the concentration at which half of the test organisms die – is not sufficient. Pesticide manufacturers need to take greater account of effects that do not directly cause death. Fortunately, this realization is playing an increasing role in risk assessment.

Microorganisms are also vitally important for us humans. What consequences could residues of the pesticide have for our intestinal flora?

Some bacteria in the human intestine also use shikimate metabolism, and so they could certainly be harmed by glyphosate. Studies have shown that the product can affect the intestinal flora of mice and rats at concentrations that are assumed to be acceptable for humans. It remains unclear whether a glyphosate-induced change in intestinal flora could also potentially affect humans – and, if so, how.

Until now, it has been assumed that glyphosate had, at most, an indirect effect on insects – for example, by destroying the plants they feed on. In light of the new findings, could the product be partly responsible for the widespread decline in insect populations?

There are undoubtedly various causes for the decline in insect populations. What is clear, however, is that many insects need symbiotic bacteria to survive. I therefore fear that glyphosate could be contributing to the decline in insect numbers, and so I believe its continued use is cause for concern. However, if we want to reduce the use of pesticides, then we need to discuss alternatives such as the use of genetically modified plants. Unfortunately, rational discussions on the alternatives are currently rare.

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ILLUSTRATION: SOPHIE KETTERER FOR MPG