

Popular herbicide weakens bumblebees' color vision

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Finnish researchers found out how Roundup, a herbicide containing glyphosate, affects the learning and memory of bumblebees. Already a small dose affected their ability to learn and memorize connections

between colors and taste. The weakened fine color vision can severely impair bumblebees' foraging and nesting success.

In the study, bumblebees were exposed to an acute dose of herbicide that pollinating bumblebees might be exposed to in a sprayed field during the day. After the exposure, the bumblebees' learning and memory were tested in a 10-color discrimination task, in which the bumblebees learned to associate five specific colors with a rewarding sugar solution and another five colors with an aversive quinine solution.

Control bumblebees learned to distinguish colors associated with sweet sugar water from [colors](#) associated with a bad tasting compound and remembered what they learned after three days. Bumblebees exposed to the herbicide learned significantly less and forgot almost everything they had learned within a few days.

Individual forager bumblebees marked with a small number tag were exposed either to very low acute dose of glyphosate-based herbicide Roundup, or to sucrose (control). Thereafter, bees underwent five learning bouts in which they choose between artificial rewarding flowers (sucrose) or aversive flowers (quinine). Experimental bees were individually allowed to enter the arena with 10 different color flowers (two of each color) with a drop of sucrose or quinine.

During the five learning bouts control bees learned to differentiate between the rewarding and aversive flowers, and two days later they were able to remember all they had learned. However, learning of the Roundup exposed bees was declined within few hours from the exposure, and two days later in a memory test they had lost everything they had learned.

The researchers also found that the herbicide treatment did not affect bumblebees' performance in an easier two-color discrimination task or a

10-odor discrimination task. The results suggest that while exposure to Roundup does not make bumblebees completely color or smell blind, it does impair their fine [color vision](#).

"We focused on the cognitive traits of the bees because these traits determine the successful foraging and social behavior of social insects and therefore their fitness. I am really worried. Even one very small acute dose had a harmful effect on the bumblebees," says researcher, Associate Professor Marjo Helander from the University of Turku, Finland.

"The result is even more worrying when you take into account how much glyphosate-containing herbicides are used globally," states Helander.

"The results are quite worrying considering the importance of color vision for bumblebees. Even small disturbances in color vision can be catastrophic in terms of foraging and nesting success," says Docent Olli Loukola from the University of Oulu.

The study, "Field-realistic acute exposure to glyphosate-based [herbicide](#) impairs fine-color discrimination in [bumblebees](#)," was published in the journal *Science of the Total Environment*.

More information: Marjo Helander et al, Field-realistic acute exposure to glyphosate-based herbicide impairs fine-color discrimination in bumblebees, *Science of The Total Environment* (2022). [DOI: 10.1016/j.scitotenv.2022.159298](#)

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