Pesticide combination affects bees' ability to learn

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A honey bee robs a comb. Photo by Lynn Ketchum

Two new studies have highlighted a negative impact on bees' ability to learn following exposure to a combination of pesticides commonly used in agriculture. The researchers found that the pesticides, used in the research at levels shown to occur in the wild, could interfere with the learning circuits in the bee's brain. They also found that bees exposed to combined pesticides were slower to learn or completely forgot important associations between floral scent and food rewards.

In the study published today (March 27, 2013) in *Nature Communications*, the University of Dundee's Dr Christopher Connolly and his team investigated the impact on bees' brains of two common pesticides: pesticides used on crops called neonicotinoid pesticides, and

another type of pesticide, coumaphos, that is used in honeybee hives to kill the *Varroa* mite, a parasitic mite that attacks the honey bee.

The intact bees' brains were exposed to pesticides in the lab at levels predicted to occur following exposure in the wild and brain activity was recorded. They found that both types of pesticide target the same area of the bee brain involved in learning, causing a loss of function. If both pesticides were used in combination, the effect was greater.

The study is the first to show that these pesticides have a direct impact on pollinator brain physiology. It was prompted by the work of collaborators Dr Geraldine Wright and Dr Sally Williamson at Newcastle University who found that combinations of these same pesticides affected learning and memory in bees. Their studies established that when bees had been exposed to combinations of these pesticides for 4 days, as many as 30% of honeybees failed to learn or performed poorly in memory tests. Again, the experiments mimicked levels that could be seen in the wild, this time by feeding a sugar solution mixed with appropriate levels of pesticides.

Dr Geraldine Wright said: "Pollinators perform sophisticated behaviours while foraging that require them to learn and remember floral traits associated with food. Disruption in this important function has profound implications for honeybee colony survival, because bees that cannot learn will not be able to find food."

Together the researchers expressed concerns about the use of pesticides that target the same area of the brain of insects and the potential risk of toxicity to non-target insects. Moreover, they said that exposure to different combinations of pesticides that act at this site may increase this risk.

Dr Christopher Connolly said: "Much discussion of the risks posed by

the neonicotinoid insecticides has raised important questions of their suitability for use in our environment. However, little consideration has been given to the miticidal pesticides introduced directly into honeybee hives to protect the bees from the *Varroa* mite. We find that both have negative impact on honeybee brain function."

"Together, these studies highlight potential dangers to pollinators of continued exposure to pesticides that target the insect nervous system and the importance of identifying combinations of pesticides that could profoundly impact pollinator survival."

More information: 'Cholinergic pesticides cause mushroom body neuronal inactivation in honeybees'. *Nature Communications*.dx.doi.org/10.1038/ncomms2648

'Exposure to multiple cholinergic pesticides impairs olfactory learning and memory in honeybees.' J Exp Biol Advance Online Articles. 7 February 2013 as doi:10.1242/jeb.083931

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