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Three-quarters of World's Honey Contain Neonicotinoids

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Since the discovery of imidacloprid in the late 1980s, neonicotinoids have become the most widely used insecticides in agricultural crop protection. Yet, in recent years there has been growing concern about the impact of these systemic pesticides on non-target organisms, especially on pollinators such as bees. Indeed, due to their physicochemical properties, neonicotinoids are translocated to all plant organs and can thus be found in pollen and nectar which are the only sources of nutrition for bees. To assess the risk posed by neonicotinoids for biodiversity and ecosystems, it is urgent to obtain a global view of their distribution in our environment.

In this study, we measured neonicotinoid concentrations in 198 honey samples collected from all around the world through a citizen science project led by the Botanical Garden of Neuchâtel. We focused on the five most commonly used neonicotinoids: acetamiprid, clothianidin, imidacloprid, thiacloprid and thiamethoxam. First, we developed and validated a stable isotope ultra-sensitive method able to quantify levels of neonicotinoids in the ppt range in honey. For this, a QuEChERS-based sample preparation followed by ultra-high performance liquid chromatography-tandem mass spectrometry was employed. Second, we determined the levels of each neonicotinoid in our honey samples. This revealed that 75% of the samples contained quantifiable amounts of at least one neonicotinoid, and that 45% contained more than one. While concentrations were in all cases below admissible limits for human consumption according to current EU and US regulations, they were in a range where significant detrimental effects on bees have been demonstrated. **Our results illustrate that advances in analytical techniques allow the detection of traces of pesticides which would have previously remained undetected, but are within the range now known to affect bees and other insects, thereby profoundly transforming our vision of ecological questions.**

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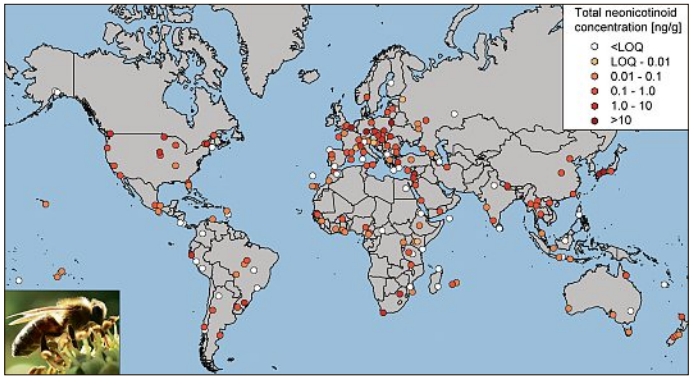
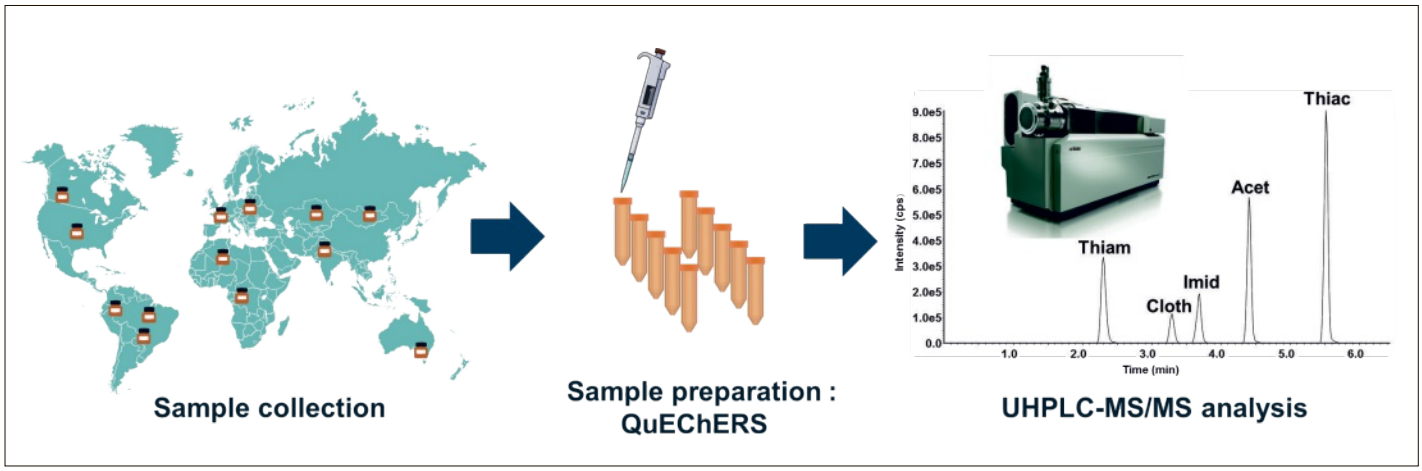


Worldwide distribution of honey contamination by neonicotinoids (reproduced from reference Mitchell *et al. Science*, **2017**, *358,* 109 with modifications). Picture of bee: Blaise Mulhauser.



Analytical workflow for the determination of neonicotinoid concentrations in honey.

Can you show us your analytical highlight?
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