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# Trophic interactions in the rhizosphere: applying chemical ecology to develop novel strategies for root pest control

Ted Turlings<sup>\*†1</sup>

<sup>1</sup>University of Neuchatel (UniNe) – Fundamental and Applied Research in Chemical Ecology, Rue Emile Argand 11, CH-2000 Neuchatel, Switzerland

## Abstract

Root exudates can serve various functions to control abiotic and biotic processes. Particularly intriguing are root exudates that control mutualistic interactions with soil-dwelling organisms. These mutually beneficial plant-mediated signals are not only of fundamental ecological interest, but the root-produced signals may also be exploited for crop improvement and protection. This is illustrated by our work on root-feeding larvae of the beetle *Diabrotica virgifera virgifera* (Western corn rootworm), which cause tremendous losses to maize growers in the USA and Europe. Entomopathogenic nematodes (EPN) are a possible solution to fight this pest. These tiny parasitic worms kill the rootworm larvae within days and we have found that they are attracted to *E*-( $\beta$ )-caryophyllene, a sesquiterpene that is specifically emitted from maize roots after rootworm attack. American maize lines have lost the ability to emit this signal. Using genetic transformation we restored caryophyllene emission in one such line and in field trials this was shown to result in enhanced EPN attraction and better protection against rootworm damage. Using our knowledge of these rhizosphere interactions, we are currently developing new strategies for the application of entomopathogenic nematodes to control rootworms and other soil pests. These strategies involved: 1) the selection for highly effective nematode strains, 2) the application of nematodes in beads that can be planted with maize seeds, and 3) increasing the "shelf life" of nematodes with the use of a plant-derived compound that puts them in a state of quiescence.

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\*Speaker

†Corresponding author: ted.turlings@unine.ch